SIEMENS

SIMATIC

**C7-626 / C7-626 DP
Control Systems**

**Volume 1
Installation, Assembly, Wiring**

Manual

C79000-G7076-C626-01

Safety Guidelines

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:

Danger

indicates that death, severe personal injury or substantial property damage will result if proper precautions are not taken.

Warning

indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.

Caution

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

Note

draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

The device/system may only be set up and operated in conjunction with this manual.

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground, and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:

Warning

This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

Trademarks

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Disclaimer of Liability

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

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Siemens Aktiengesellschaft   Order No. C79000-G7076-C626

Preface

Purpose

The information in this manual will enable you to do the following:

- Install and wire a C7-626 or C7-626 DP (Volume 1).

- Assign parameters to the CPU of the C7-626 or C7-626 DP, load a user program into this CPU and run the program (Volume 2).

- Put the C7-626 and C7-626 DP into operation and use the operator interface (O/I) functions (Volume 2).

Audience

The manual is divided to take into account two different types of reader:

- Volume 1:
  Users who carry out the mechanical and electrical installation of the C7 at the location of use and who bring the C7 to a state of readiness for immediate use.

- Volume 2:
  Users who create control programs and O/I configurations, load them into the C7, and print out screen displays and messages.

Contents of This Manual

This manual describes the hardware and software of the C7-626 and C7-626 DP. It consists of two volumes.

Volume 1 of the manual covers the following topics:

- Installation and preparation of the C7-626 or C7-626 DP

- Networking the C7-626 or C7-626 DP with programming devices (PGs) and other devices

- Connecting the digital and analog I/Os

- Connecting the I/Os to the universal inputs

- Connecting the IM361 interface module

- Connecting a printer to the C7

Volume 2 of the manual covers the following topics:

- Starting up the C7

- Controlling with the C7 CPU

- Addressing and assigning parameters to the C7 I/O

- C7 diagnostics

- Using the O/I functions of the C7

Conventions Concerning C7

To make the manual easier to read, the device type description C7-626 or C7-626 DP will be referred to throughout the manual as **C7**.

Scope of This Manual

This manual is valid for the following C7s:

C7	Order Number
C7-626	6ES7626-1AG00-0AE3
C7-626 DP	6ES7626-2AG00-0AE3

C7 Manual

This manual is available under order number 6ES7626-1AE00-8BA0.

Other Pertinent Manuals

This manual describes the C7-626 and C7-626 DP. For programming, expanding and configuring a C7, you also require the following manuals:
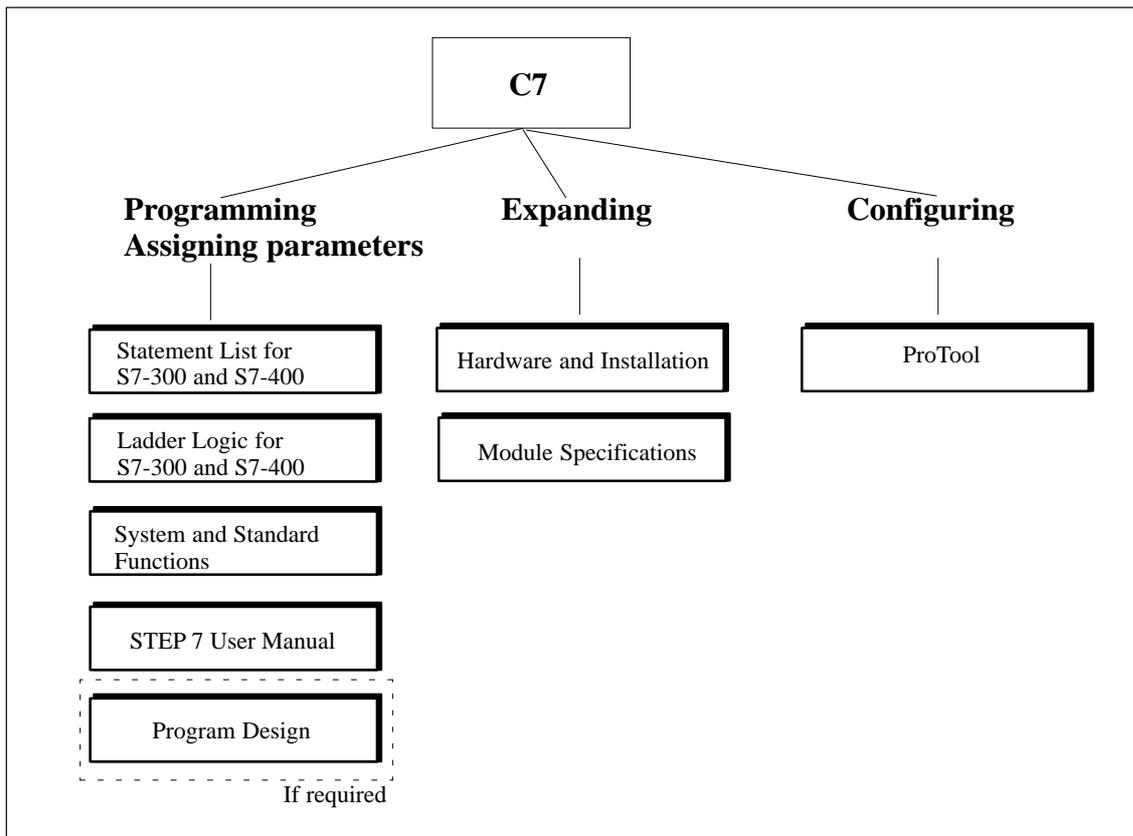
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                              ┌──────────┐
                              │    C7    │
                              └──────────┘
             ┌───────────────────┼───────────────────┐

      Programming            Expanding            Configuring
   Assigning parameters

   ┌─────────────────┐     ┌─────────────────┐   ┌─────────────────┐
   │ Statement List for│   │ Hardware and     │   │    ProTool       │
   │ S7-300 and S7-400 │   │ Installation     │   │                  │
   └─────────────────┘     └─────────────────┘   └─────────────────┘

   ┌─────────────────┐     ┌─────────────────┐
   │ Ladder Logic for │    │ Module           │
   │ S7-300 and S7-400│    │ Specifications   │
   └─────────────────┘     └─────────────────┘

   ┌─────────────────┐
   │ System and Standard│
   │ Functions        │
   └─────────────────┘

   ┌─────────────────┐
   │ STEP 7 User Manual│
   └─────────────────┘

   ┌─────────────────┐
   │ Program Design   │
   └─────────────────┘
          If required
```

Table 1-1   STEP 7 Documentation Package

Manual	Contents

Standard Software for S7 and M7
STEP 7 User Manual
	Provides information on working with the STEP 7 tools
	• Installing and starting up STEP 7 on a programming device/PC
	• Handling tools with the following contents:
	   – Managing projects and files
	   – Configuring and assigning parameters to the S7-300
	   – Assigning symbolic names for the user program
	   – Creating and testing the user program in STL/LAD
	   – Creating data blocks
	   – Configuring communications between several CPUs
	   – Loading, storing and deleting the user program in the programming device/CPU
	   – Monitoring and controlling the user program (for example, variables)
	   – Monitoring and controlling the CPU (for example, operating mode, memory reset, memory compression, protection levels)

Statement List for S7-300/S7-400 Programming Manual or *Ladder Logic for S7-300/S7-400 Programming Manual*	Reference manual for programming with STL or LAD: • Basics for working with STL/LAD (for example, structure of STL/LAD, number formats, syntax) • Description of all operations in STEP 7 (with programming examples) • Description of the different addressing possibilities in STEP 7 (with examples) • Description of all integral functions of the CPUs • Description of the CPU-internal registers
System Software for S7-300/S7-400 System and Standard Functions Reference Manual	Detailed description of • all standard functions (FCs) integrated into STEP 7 • all system functions (SFCs) integrated into the operating system of a CPU
Standard Software for S7 *Converting S5 Programs Manual*	Provides information on converting STEP 5 programs to STEP 7: • Working with the S5/S7 Converter • Rules for conversion • Using converted STEP 5 standard function blocks in STEP 7
Master Index	• Master index for all the manuals in the documentation package.

Other References   You will find a list of further information sources on the subject of the
S7-300 and other programmable controllers in Appendix D of Volume 2 of
this manual.

Table 1-2   Additional Manuals

Manual	Contents
System Software for S7-300 and S7-400 Program Design Programming Manual	Provides basic information on designing STEP 7 programs: • Instructions for the efficient solution of programming tasks with the programming device/PC and STEP 7 • How the CPUs operate (for example, memory concept, I/O access, addressing, blocks, data types, data management) • Description of STEP 7 data management • Using STEP 7 data types • Using linear and structured programming (with programming examples) • Using block call operations • Overview of how to use the STEP 7 applications for developing projects (with detailed examples) • Using the test and diagnostic functions of the CPUs in the user program (for example, error OBs, status word)
S7-300 Programmable Controller Installation and Hardware	Describes the hardware of the S7-300: • Electrical configuration of the S7-300 • Installing the S7-300 • Wiring and preparing the S7-300 for operation • Characteristics and technical specifications of the S7-300 modules
S7-300/M7-300 Programmable Controllers Module Specifications Reference Manual	Describes the hardware of the S7-300 modules: • Analog modules • Digital modules • Interface modules • Characteristics and technical specifications of the S7-300 modules
S7-300 Programmable Controller CPU 312 / CPU 314/ CPU 315 / CPU 315 DP, Instruction List	Describes the instruction set of the CPU 312, CPU 314, CPU 315 and CPU 315 DP, including the execution times of all operations.
PG 7xx	Describes the programming device (PG) hardware: • Assembling and starting up the programming device • Expansion possibilities • Configuring • Error diagnostics
COROS ProTool	Manual for creating configurations: • Using ProTool • Configuring • Displays and messages • Loading the configuration into the C7

Structure of This Manual

This manual has the following aids to help you find specific information:

- At the beginning of the two volumes, you will find a complete directory of contents.

- In each chapter, you will find information in the left-hand column of every page giving you an overview of the contents of that section.

- After the Appendices, there is a Glossary containing important technical terms used in the manual.

- At the end of the manual, there is a detailed index.

Standards

The C7 control system conforms to standards as described in Appendix A.1.

Queries

If you have any questions concerning the C7 control system, please contact your local Siemens representative.

You will find a list of Siemens representatives worldwide in Volume 2 of the manual, Appendix E.

If you have any questions or remarks concerning the manual, please fill in and return the Suggestions/Corrections form at the back of Volume 2.

Contents

Product Overview

1

Overview

This chapter contains general information concerning the C7-626 and C7-626 DP. A brief overview of the performance range provides you with a first impression of the two units.

This chapter also tells you which additional components you can connect to a C7 device.

Accessories for Operating the C7

To operate the C7, you require the following accessories:

- Programming device (PG) or PC with a multipoint interface and programming device cable.

- You must load the following on to the programming device or PC

    – the STEP 7 applications

    – ProTool.

Introduction   The C7 systems are available in two variants:

C7-626   With a graphics display, digital and analog inputs and outputs, multipoint
                          interface and IM360 interface module.

C7-626 DP   The C7-626 DP is identical to the C7-626, but has the additional feature of a
                          PROFIBUS-DP interface module.

Figure 1-1 C7-626 or C7-626 DP

Performance Range

With the C7 devices you can:

- Load and run user programs on the C7 CPU.

- Connect the C7-626 DP to the PROFIBUS DP via an integrated DP interface.

- Process digital and analog signals using the integrated I/Os of the C7.

- Use interrupt inputs and counters (for frequency measurement, period duration measurement, etc.).

- Load and use O/I applications that you have created using the "ProTool" configuring tool.

- Use these configurations to monitor and intervene in the process you are controlling with the user program.

- Output data to a printer.

C7 Units

The C7 has two units that work independently of each other and can communicate with each other via the internally-looped C7 multipoint interface (MPI).

- C7 CPU

- C7 OP

These components will be referred to explicitly in the manuals as required.

Connectable Components of a C7

In addition to the connections to the process, you can also connect different components to the C7. The most important components and their functions are listed in Table 1-1:

Table 1-1　　Connectable Components of a C7

Components	Function	Illustration
Interface module (IM361)	...connects a C7 with an expansion rack for S7-300 modules	
Signal modules (SMs) (digital input modules, digital output modules, analog input modules, analog output modules, analog input/output modules)	...pass different process signal levels on to the C7 CPU. They can be connected to the C7 via an IM361.	
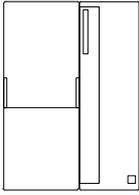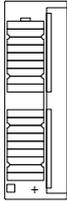
Table 1-1   Connectable Components of a C7

Components	Function	Illustration
Function modules (FMs)	...for time-critical and memory-intensive process signal handling tasks, for example, positioning or closed-loop control.	
Communications processors (CP)	...offloads the CPU of communications tasks, for example, CP 342-5 DP for linking to SINEC L2-DP.	
S7-300 (CPU)	...communicates via the MPI with the C7 and/or other nodes on an MPI network.	
S7-400 (CPU)	...communicates via the MPI with the C7 and/or other nodes on an MPI network.	
Operator Panels (OP)	...executes operator interface functions and communicates with the C7 via the multipoint interface.	
PROFIBUS bus cable with bus connector	...connects nodes on an MPI network or L2-DP network with each other.	
Programming device cable	...connects a programming device/PC with a C7.	
Printer	...prints out O/I messages of the C7.	
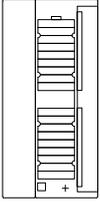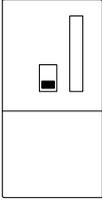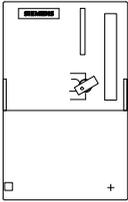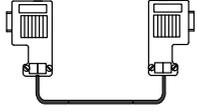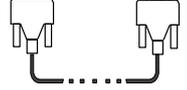
Table 1-1   Connectable Components of a C7

Components	Function	Illustration
Programming device (PG) or PC with the STEP 7 and ProTool software packages	...configures, assigns parameters, programs and tests the C7	
RS 485 repeater	...for amplifying the signals in an MPI network or L2-DP network, and for linking segments of an MPI or L2-DP network.	
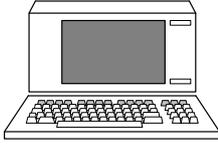
Example

Figure 1-2 shows some possible connections to other devices and the connection of signal inputs.
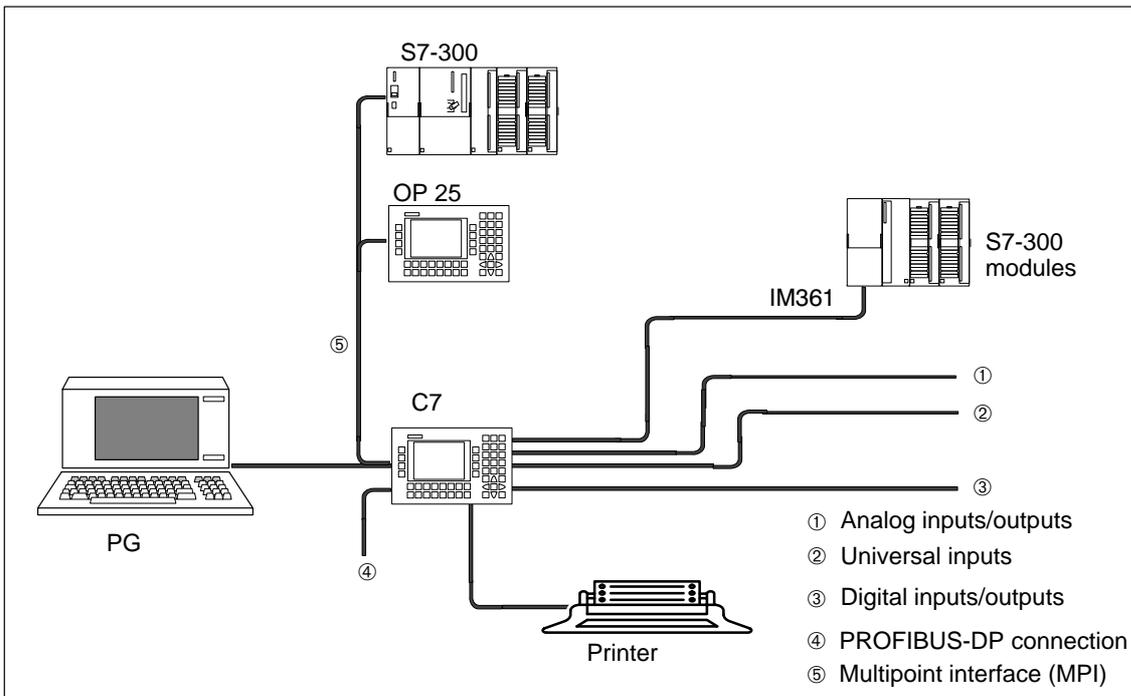
Figure 1-2 Some C7 Connection Possibilities

Installing and Preparing the C7

2

Summary of Sections

2.1 Scope of Supply and C7 Accessories

Parts Supplied

The following components are included in the scope of supply of the C7-626 or C7-626 DP:

- C7-626 or C7-626 DP

- A set of labeling strips (for function keys and softkeys)

- Battery

- A grounding bar

- 6 shielding clips

- 1 seal and 4 brackets

- Product Information

Spare Parts

The following components can be ordered as **spare parts for the C7:**

- Labeling strips for function keys and softkeys 6ES7 623-1AE00-1AA0

- Service package (seal and 4 brackets) 6ES7 623-1AE00-3AA0

- Back-up battery 6ES7 623-1AE00-5AA0

Accessories

The following components can be ordered as **C7-specific accessories:**

- *C7-626/C7-626 DP Control Systems* manual comprising two volumes in the languages:
  German: 6ES7 626-1AE00-8AA0
  English: 6ES7 626-1AE00-8BA0
  French: 6ES7 626-1AE00-8CA0
  Spanish: 6ES7 626-1AE00-8DA0
  Italian: 6ES7 626-1AE00-8EA0

- Plug connectors for C7 I/O with coding keys and coding sliders
  6ES7 623-1AE00-4AA0.

The following components can be ordered as important **standard accessories** for the C7:

- Programming device cable 6ES7 901-0BF00-0AA0 (for connecting the C7 to the programming device)

- PC/MPI cable, 5 m 6ES7 901-2BF00-0AA0

- IM cable (for connecting additional modules)

IM cable, 1 m	6ES7 368-3BB00-0AA0
IM cable, 2.5 m	6ES7 368-3BC51-0AA0
IM cable, 5 m	6ES7 368-3BF00-0AA0
IM cable, 10 m	6ES7 368-3CB00-0AA0

- Printer cable (for V.24 serial interface) 6XV 1440-2C... (max. 16 m)
- Serial cable (PG-C7) 6XV 1440-2K...

   The following applies for the length key of both cables:

                                                            6XV1440-2C☐☐☐

Multiplier	0.01 m	E
	0.1 m	H
	1.0 m	N
	10.0 m	T
	100.0 m	U
Length digit	10	1 0
	12	1 2
	15	1 5
	16	1 6
	20	2 0
	25	2 5
	32	3 2
	40	4 0
	50	5 0
	60	6 0
	63	6 3
	80	8 0

2

2.2   Inserting the Labeling Strips

Labeling Strips

The function keys and softkeys are labeled using labeling strips which are inserted into the keypad from the side.

When shipped, the function keys of the C7 are labeled with K1....K10 and the softkeys with F1....F14.

Plant Specific Labeling

A set of blank labeling strips is enclosed with the C7. They can be used for plant-specific labeling of the C7.

> **Caution**
>
> The writing on the strips must be wipe-resistant before inserting. A keypad membrane soiled on the inside cannot be cleaned and can only be replaced in the factory.

A sheet with plant-specific labeling strips is also provided. The strips must be cut off exactly along the marked line. If the labeling strips are too large, they cannot be inserted into the keyboard.

Labeling strips can only be changed when the C7 is not installed. The sealing ring should be replaced. Proceed as follows:

Step	Action
1.	Cut off the corners of the labeling strip that are marked with a ① C7–626 K1...K10 ①
2.	If possible, hold the labeling strip at the end you want to insert in the slit. Hold the strip horizontally. Hold the strip by touching both surface areas rather than the edges to facilitate insertion.
3.	Slide the strips into the slits provided. The location of the slits is shown in Figure 2-1. The strips are slid over the existing labeling.
4.	To avoid bending the strip as you insert it, move it backwards and forwards several times ↑ ↓.
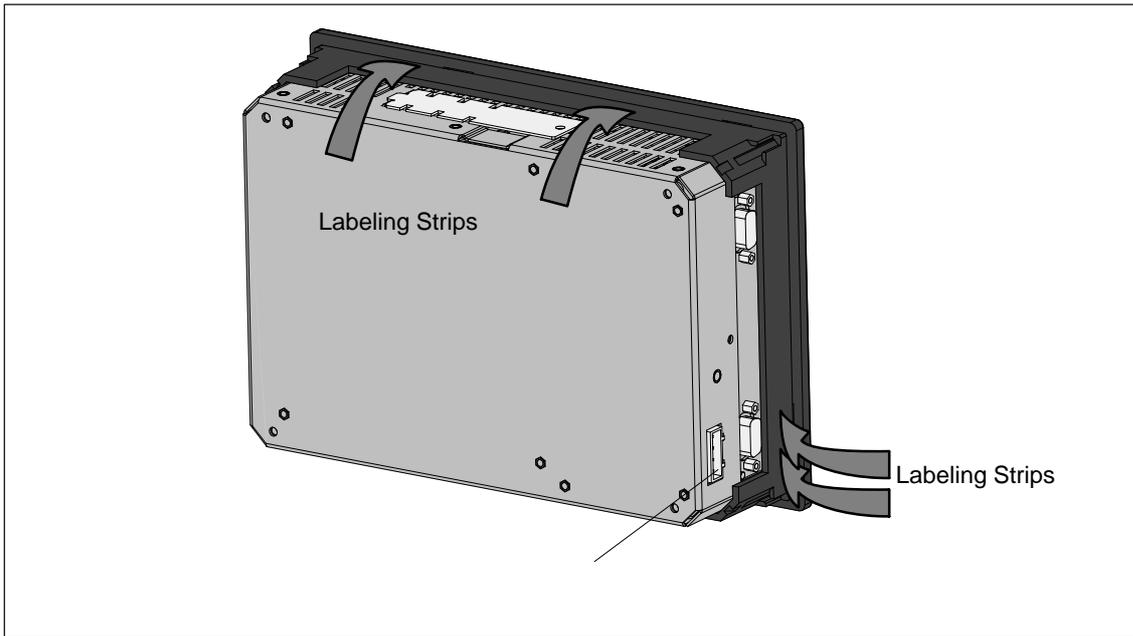
Figure 2-1   Inserting Labeling Strips

2.3　Installing a C7

Installation　　The C7 has been prepared for fixed installation in a control panel or cabinet door. Proceed as follows:

Step	Action
1.	Make a standard cutout in the control panel in accordance with DIN 43700 (dimensions 23.5 x 158.5 mm).
2.	Insert the enclosed sealing ring behind the front panel (see Figure 2-2).
3.	Insert the C7 in the cutout in the control panel.
4.	Insert the four fixing brackets (see Figure 2-4 ①) into the guides provided. Push the fixing brackets in until the spring engages.
5.	Screw the four fixing screws enclosed with the C7 into the four fixing brackets enclosed (see Figure 2-5) (approximately two to three turns).
6.	Tighten the four screws with a screwdriver.

Insert sealing ring here
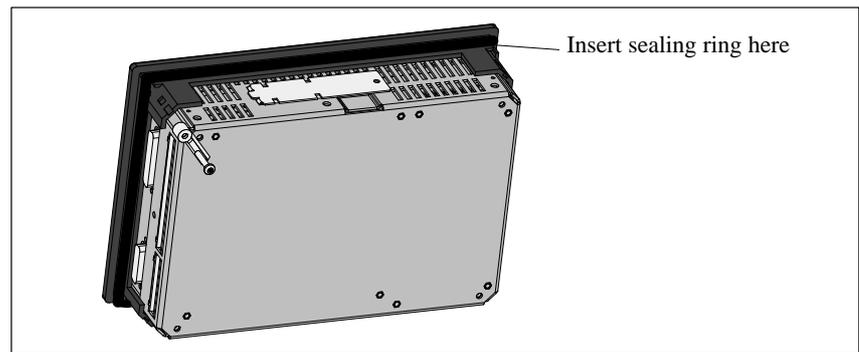
Figure 2-2　　Inserting the Sealing Ring

Cutout in front panel
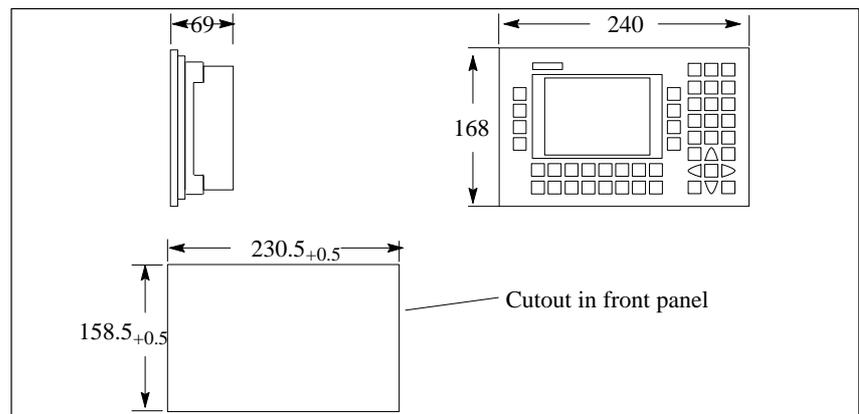
Figure 2-3　　Dimensions for the C7

**Fixing Bracket
Before Engaging**
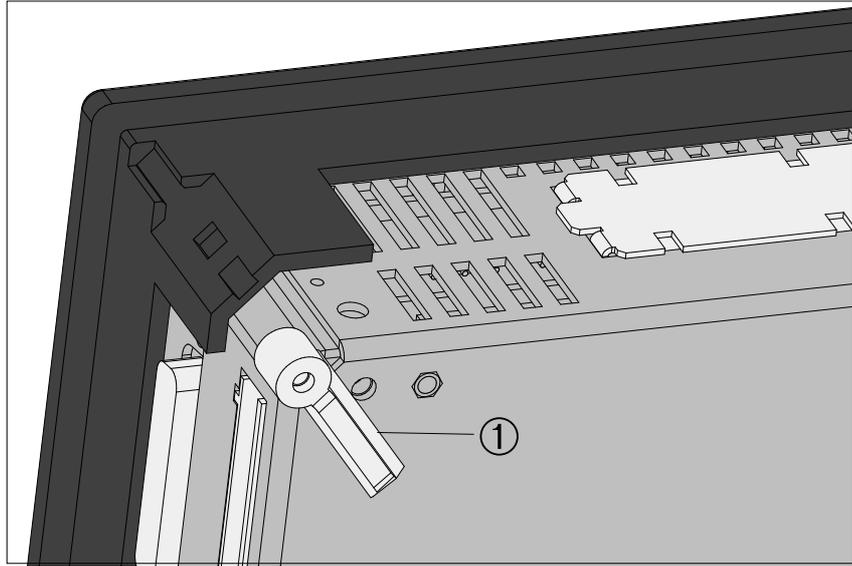
Figure 2-4   Fixing Bracket Before Engaging

**Fixing Bracket
Engaged**
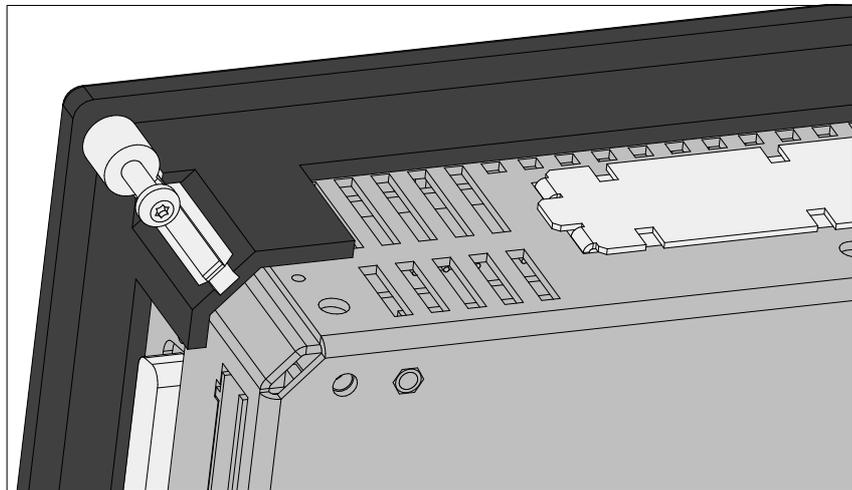
Figure 2-5   Fixing Bracket Engaged, with Screw

Loosening the Fixing Bracket

Proceed as follows when loosening the fixing bracket:

Step	Action
1.	Loosen screw.
2.	Lift fixing bracket (① in Figure 2-6).
3.	Push fixing bracket out of guide (② in Figure 2-6).
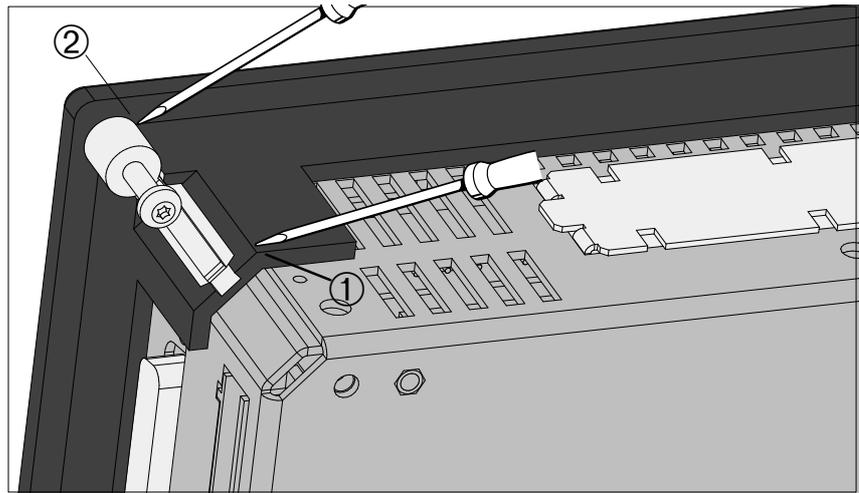
Figure 2-6   Loosening the Fixing Bracket

2.4   Arranging the C7 in the Mechanical Environment

Arranging the C7   When installing a C7, please note the following:

- The control panel may be 1 to 4 mm thick. Make sure the sealing ring fits tightly in all places.

- A gap of 50 to 70 mm from a housing wall must be observed on the sides of the C7 as shown in Figure 2-7.

- The sealing ring on the frontplate must sit perfectly.

- The tabs of the insertion strips must not be caught.

- The C7 must be protected from direct sunlight.
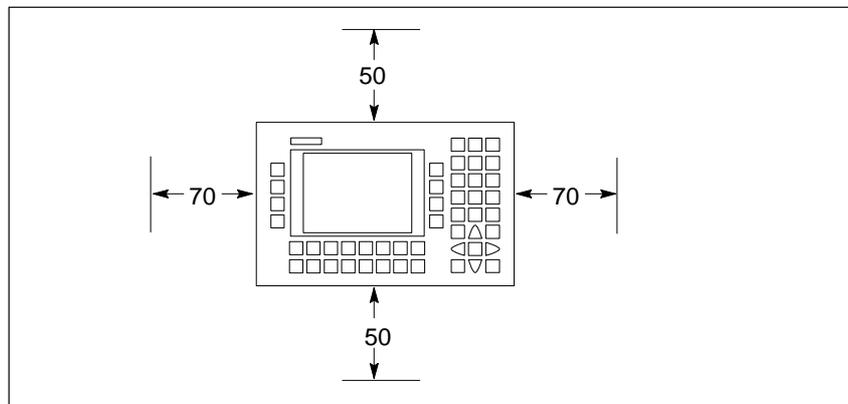
Figure 2-7   Gap Dimensions to be Observed when Installing the C7

2.5   Electrical Installation and Connector Pin Assignment

Introduction   The plug and socket connectors (interfaces) required for connecting the various inputs and outputs of the C7 are provided.
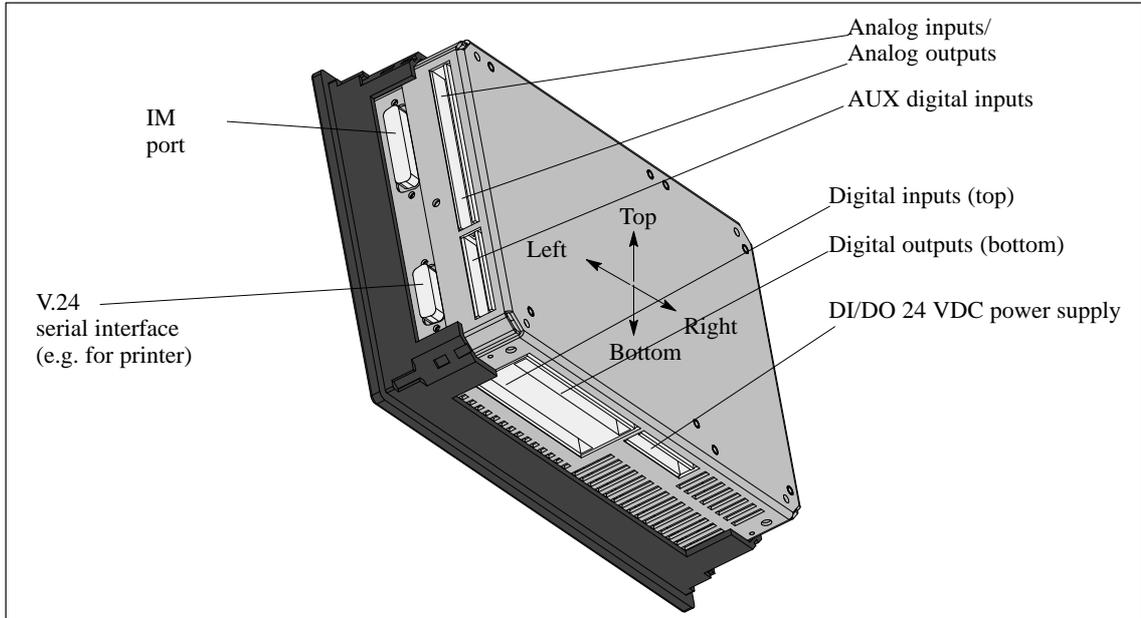
Figure 2-8   A View of the C7 with External I/O Interfaces

C7 Pin Assignments   Tables 2-1 to 2-6 show the pin assignments for the following C7 connectors.

Digital Inputs

Table 2-1   Pin Assignments of the Digital Inputs

Pin No.	Signal	Explanation
0.0	I0.0	Digital input 0
0.1	I0.1	Digital input 1
0.2	I0.2	Digital input 2
0.3	I0.3	Digital input 3
0.4	I0.4	Digital input 4
0.5	I0.5	Digital input 5
0.6	I0.6	Digital input 6
0.7	I0.7	Digital input 7
1.0	I1.0	Digital input 8
1.1	I1.1	Digital input 9

Table 2-1   Pin Assignments of the Digital Inputs

Pin No.	Signal	Explanation
1.2	I1.2	Digital input 10
1.3	I1.3	Digital input 11
1.4	I1.4	Digital input 12
1.5	I1.5	Digital input 13
1.6	I1.6	Digital input 14
1.7	I1.7	Digital input 15

2

Digital Outputs

Table 2-2   Pin Assignments of the Digital Outputs

Pin No.	Signal	Explanation
0.0	Q0.0	Digital output 0
0.1	Q0.1	Digital output 1
0.2	Q0.2	Digital output 2
0.3	Q0.3	Digital output 3
0.4	Q0.4	Digital output 4
0.5	Q0.5	Digital output 5
0.6	Q0.6	Digital output 6
0.7	Q0.7	Digital output 7
1.0	Q1.0	Digital output 8
1.1	Q1.1	Digital output 9
1.2	Q1.2	Digital output 10
1.3	Q1.3	Digital output 11
1.4	Q1.4	Digital output 12
1.5	Q1.5	Digital output 13
1.6	Q1.6	Digital output 14
1.7	Q1.7	Digital output 15

**Analog Inputs/
Outputs**

Table 2-3   Pin Assignments of the Analog Inputs/Outputs

Pin No.	Explanation
AI1-U	Analog input 1, signal input for voltage
AI1-I	Analog input 1, signal input for current
AI1-M	Analog input 1, reference potential
AI2-U	Analog input 2, signal input for voltage
AI2-I	Analog input 2, signal input for current
AI2-M	Analog input 2, reference potential
AI3-U	Analog input 3, signal input for voltage
AI3-I	Analog input 3, signal input for current
AI3-M	Analog input 3, reference potential
AI4-U	Analog input 4, signal input for voltage
AI4-I	Analog input 4, signal input for current
AI4-M	Analog input 4, reference potential
M_{ANA}	Reference potential of analog measuring circuit
AO-U	Analog output, signal output for voltage
AO-I	Analog output, signal output for current
AO-M	Analog output, reference potential

**AUX Digital Inputs
(Universal Inputs)**

Table 2-4   Pin Assignments of the Universal Inputs

Pin No.	Explanation
M	Relevant ground
DI-X1	Universal input 1 (digital input, interrupt input or counter input)
DI-X2	Universal input 2 (digital input, interrupt input or counter input)
DI-X3	Universal input 3 (digital input, interrupt frequency or period duration counter input)
DI-X4	Universal input 4 (interrupt input or digital input)
–	Not connected
–	Not connected
–	Not connected

**DI/DO 24 VDC
Power Supply**

Table 2-5 Pin Assignments of the DI/DO Power Supply

Pin No.	Explanation
1L+	24-volt supply for DI 0.0...1.7
1M	Relevant ground for DI 0.0...1.7
2L+	24-volt supply for DO 0.0...DQ0.7 (approx. 2 A)
2L+	24-volt supply for DO 0.0...DQ0.7 (approx. 2 A)
2M	Relevant ground for DO 0.0...DQ0.7
3L+	24-volt supply for DO 1.0...DQ1.7 (approx. 2 A)
3L+	24-volt supply for DO 1.0...DQ1.7 (approx. 2 A)
3M	Relevant ground for DO 1.0...DQ1.7

**V.24 Serial
Interface**

Table 2-6 Pin Assignments for the V.24 Serial Interface (for printer, etc.)

Pin No.	Explanation
1	C7-M (reference potential)
2	--
3	RxD
4	TxD
5	CTS
6	--
7	--
8	C7-M (reference potential)
9	--
10	RTS
11	--
12	C7-M (reference potential)
13	--
14	--
15	C7-M (reference potential)
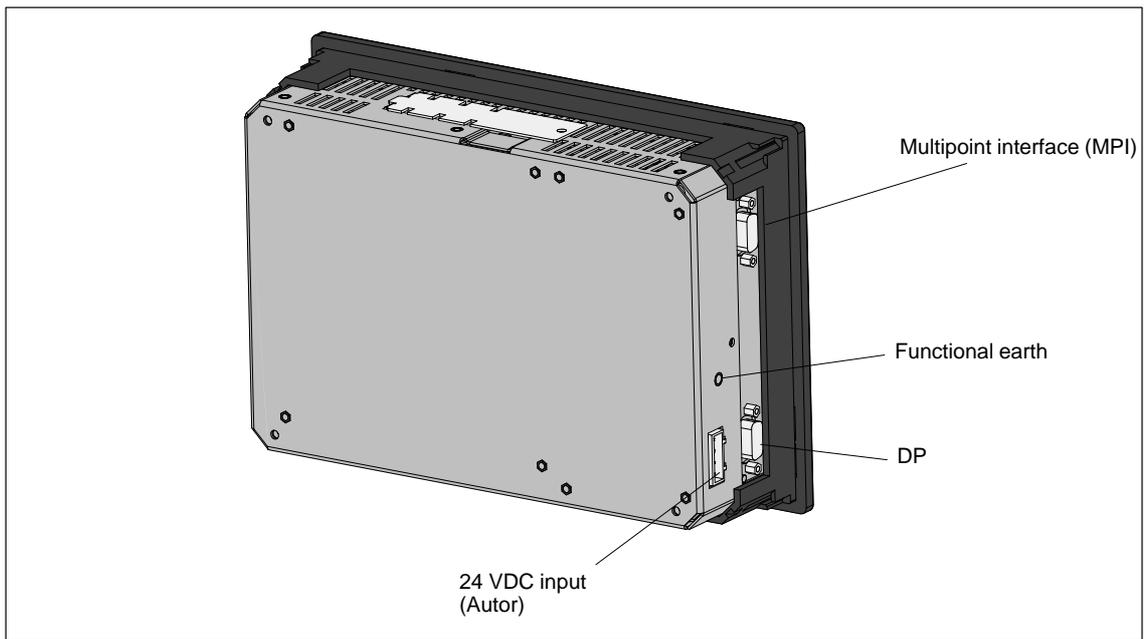
Figure 2-9   C7-626 DP: View with MPI, DP and C7 Power Supply

MPI / PROFIBUS DP Interface

Pin No.	Explanation
1	NC
2	M24V
3	RS485 line B
4	RTSAS
5	M5V
6	P5V
7	P24V
8	RS485 line A
9	NC

24 VDC input (C7 power supply)

Pin No.	Explanation
1	L+
2	M (ground M24V)
3	A+ (authorization input)
4	AE (authorization input) ground

Functional Earth   Connect the functional earth terminal ⏚ (see Figure 2-9) to the cabinet
ground taking the shortest route and using a cable lug and a cable with a
minimum cross-section of 4 mm.

C7 Device Connections   You can use the following cables for connecting the C7 to other devices:

Table 2-7   Cables for Connecting to the C7

Connecting Cable	Length	Special Features	Illustration	Connection Between ...
MPI				
Programming device cable	5 m	–		C7 ↔ PG/PC C7 ↔ OP C7 ↔ S7-300 C7 ↔ S7-400
PROFIBUS bus cable interior cable direct-buried cable and bus connectors without PG-type connector, with PG-type connector and PROFIBUS bus terminal RS 485, with 1.5 m cable, with 3 m cable, with PG-type connector and 1.5 m cable	–	User must make own cable		C7 ↔ PG/PC C7 ↔ OP C7 ↔ C7 C7 ↔ S7-300 C7 ↔ S7-400
V.24 serial interface				
Serial interface (printer cable) For Siemens printers DR210/211/2303/231-N		See Catalog ST80.1		C7 → Printer C7 ↔ PG/PC
IM361				
IM361 cable		–		C7 ↔ additional I/O (S7-300)
C7 I/O connections				
Connectors for C7 I/O		16 pin 8 pin 4 pin		C7 ↔ external sensors
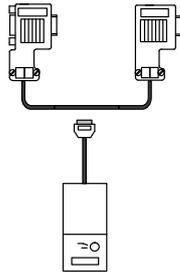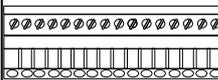
2.6   Setup Guidelines for Interference-Proof Installation

Introduction

An automation system must be shielded to prevent interference.

When a system is poorly grounded or not shielded, low-frequency and high-frequency interference signals can penetrate the internal bus of the PLC and cause malfunctions.

Interference signals can also be caused when relays or contactors switch (very rapid changes in current or voltage; high-frequency interference signals) or when two parts of a system have different grounding potentials (low-frequency signals).

Use and Installation of Interference-Proof Cables

Use only shielded cables for all data lines, analog signal lines, and connections to universal inputs.

* Ground cable shields on both sides.

   The standard cables specified in the *ST80.1* and *ST70* catalogs meet these requirements.

* Screw down or lock all plug connections.

* Do not install data lines or signal lines parallel to power lines. Use a separate cable duct located at least 50 cm from power lines.

Interference-Proof Hardware Setup

The basis of trouble-free operation is the hardware setup of the control system. Any interference signals resulting from the process should be kept away from the hardware setup where possible.

Cabinet Setup

Devices which could bring in interference signals from outside should be installed at the bottom of the cabinet. Place the grounding rail directly at the cabinet entrance so that cables which could be carrying interference signals can be placed directly on the grounding potential. Place all shielded lines with their shielding here. With double-shielded signal lines, place only the outer shield on the grounding potential.

Install long signal lines along the cabinet walls. Setting up the cabinet in accordance with EMC guidelines is an important factor in the reduction of interference. All grounding connections in the cabinet must have large cable cross-sections and be laid over a large surface.

Insulate analog devices in the switching cabinet and ground them to a single point in the cabinet using copper tape.

Always use equivalent metals for the materials. Never use aluminum (danger of oxidation).

Connect all doors and metal parts (sides, back and cover) of the cabinet at least three times to the cabinet frame (short, paint-free, large-area connections).

Note

If your system generates high electrostatic voltages (for example, textile machines and special construction machines), run the grounding lines of the machine parts carrying interference signals to a separate operating ground isolated from the central grounding point of the cabinet (surface grounding with housing construction, reinforcement).

Protection Against Overvoltage

To protect your device from overvoltage and lightning, please observe the guidelines in **/70/** Section 4.11.

For routing wires within buildings, please observe the guidelines in **/70/** Section 4.8.

2

2.7   Connecting Shielded Cables

Overview

This section describes how to connect the shield of shielded signal lines to ground. The ground connection is made by directly connecting the shield with the ground terminal of the C7.

Procedure

Proceed as follows to install the grounding bar and shielding clips supplied with the C7:

1. Unfasten the two screws on the C7 as shown in Figure 2-10.

2. Position the grounding bar as shown in Figure 2-10 and fix this in place with the previously removed screw.

3. Affix the shielding clips to the grounding bar as shown in Figure 2-10.

4. Press the insulated cable into these shielding clips in such a way as to achieve optimal contact of the cable shield.
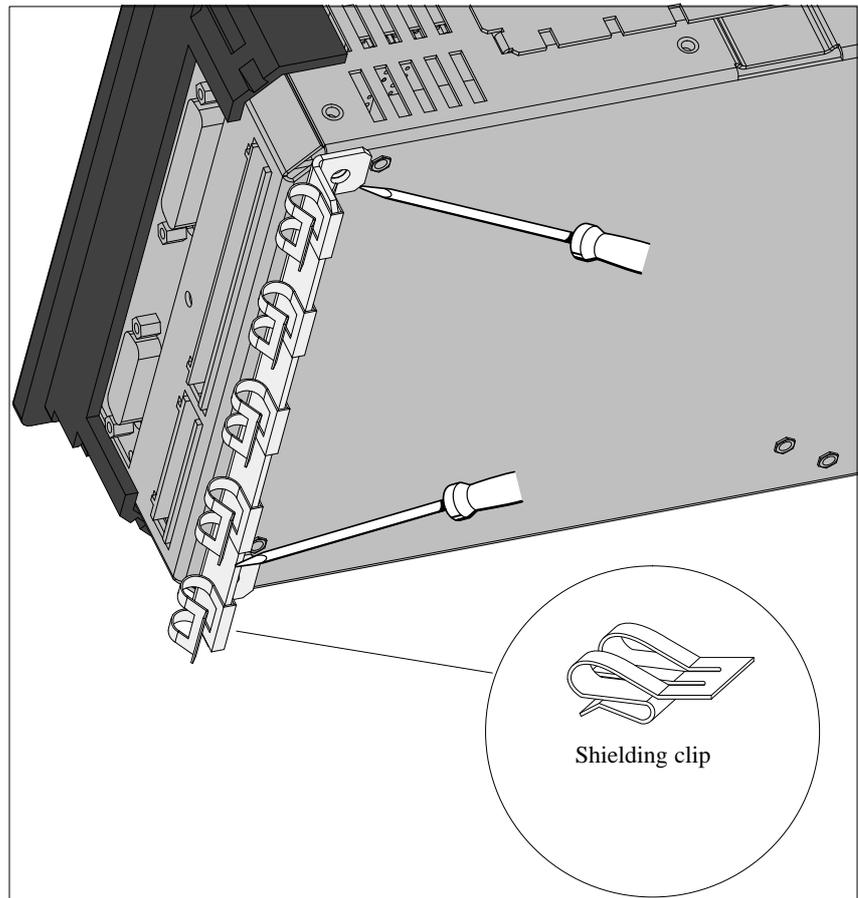
Shielding clip

Figure 2-10   C7 with Grounding Bar and Shielding Clips

2.8   Keying Connectors

Overview

A set of connectors with solid and profiled coding keys can be ordered as C7 accessories (see Section 2.1 under Accessories). This section describes how to key the connectors.

Keying Connectors

The solid coding keys ① and profiled coding keys ② (see Figure 2-11) prevent a connector from being confused with another without polarity reversal.

Proceed as follows:

1. Insert the solid coding key ① into the notches provided on the connector part ❶.

2. Insert the profiled coding key ② into the respective cutouts on the housing part ❷.

Solid and profiled coding keys that face each other prevent the connector from being plugged in.

The connector can be plugged in if solid and profiled coding keys do not face each other.
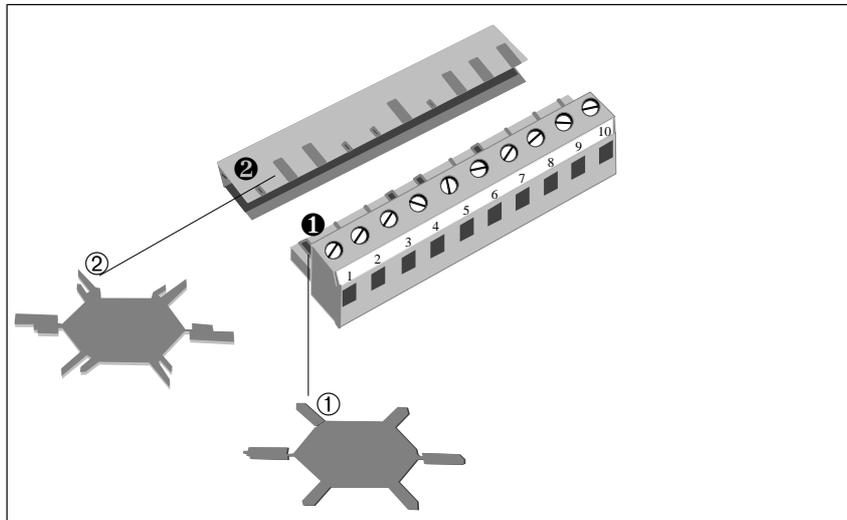
Figure 2-11   How to Key Connectors

⚠ **Warning**

If you confuse the connectors, the device may be destroyed.

2.9   Arrangement of Additional S7-300 Modules

Additional S7-300 Modules

You can connect further S7-300 modules to the C7 via the IM 360 interface of the C7.

The manual **/70/** describes how to install S7-300 modules.

Prerequisite

An IM 361 module of the S7-300 system must be connected to the C7.

Connecting Additional I/Os

You can connect an additional I/O as follows:

1. Install the additional I/O as described for racks 1 to 3 in the manual **/70/**.

2. Connect the C7 to the IM 361 via the IM standard cable (see also Figure 2-8 for connecting the C7).

When the C7 is first started up, it detects any additional connected modules.

IM 360 Interface Module

The C7 has an integral IM 360 interface module for I/O expansion with an external S7 standard I/O. This interface module is characterized by the following features:

*   Data transmission from the IM 360 to the IM 361 of the first rack expansion via a 368 connecting cable.

*   Maximum distance between IM 360 and IM 361: 10 m

You can expand your C7 by up to three mounting racks using the IM 360 interface module.

2
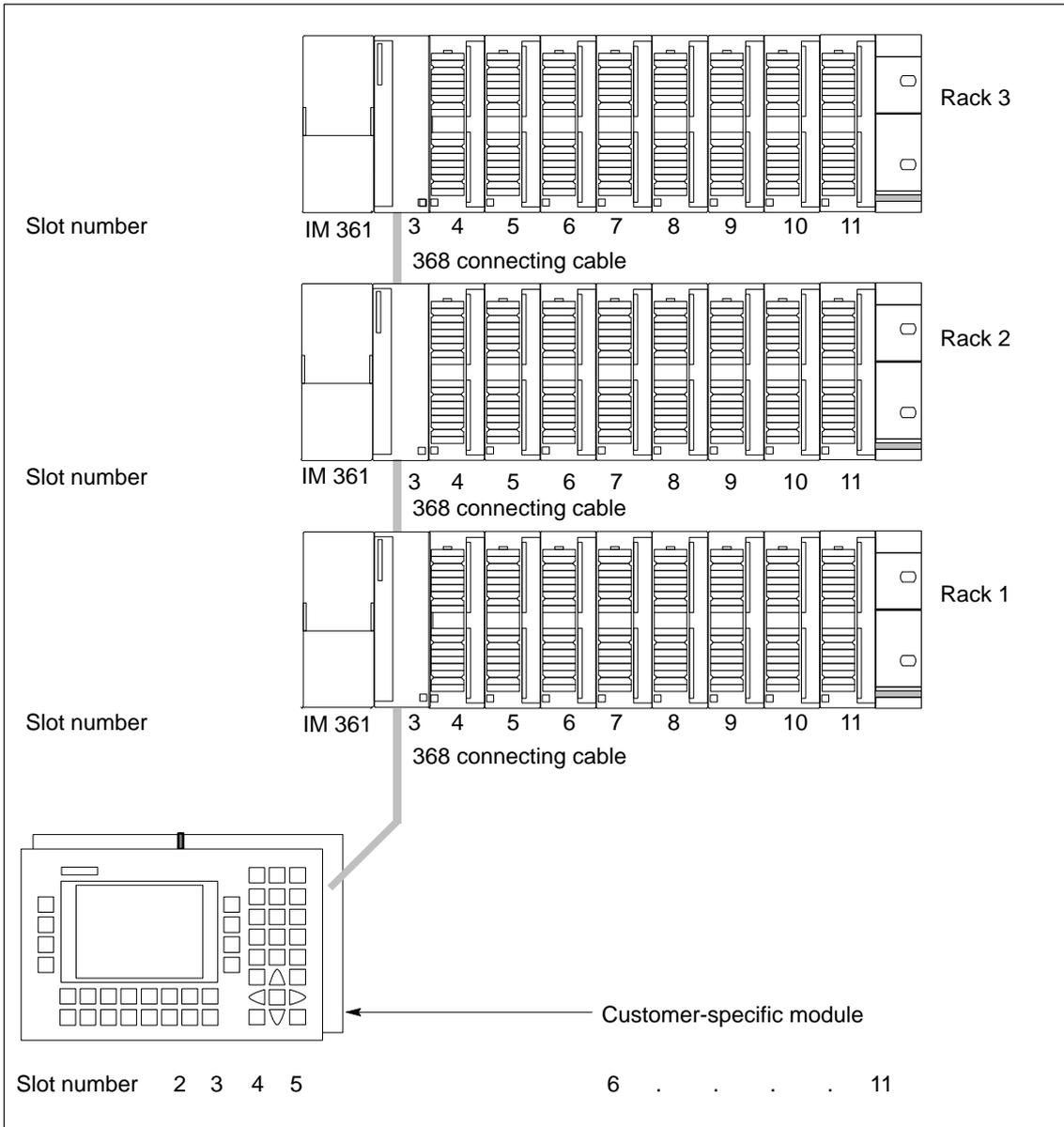
Figure 2-12   Maximum Configuration of the Slots of a C7

2.10 C7 Clocks

Overview

A C7 system has two clocks:

- One clock in the C7 CPU
- One clock in the C7 OP

**Clock in the
C7 CPU**

The clock in the C7 CPU is an integral "real-time clock" (hardware clock). This clock is independent of the clock in the C7 OP.

**Setting the C7 CPU
Clock**

The clock is supplied with the following value set:
DT#1994-01-01-00:00:00.

Master Clock

As an integrated clock, the C7 CPU clock can also function as the master clock within the C7 I/O configuration (see also Section 3.4.6 in Volume 2).

**Setting and
Reading the Clock
in the Control
Section**

You can set and read the clock in the following ways:

- With the programming device (PG) using STEP 7

  or

- In the user program with SFC0 "SET_CLK". With SFC1 "READ_CLK", you can read the current time of day (see the reference manual **/235/**).

**Clock During
Power Off**

The C7 must always be backed up with a battery. The clocks in the C7 continue to run during power off.

**Clock in the C7 OP
Section**

The clock in the C7 OP is independent of the clock in the C7 CPU.

**Setting the O/I
Clock**

The clock is supplied with the following value set:
01.01.94 -00:00.

**Setting and
Reading the Clock
in the C7 OP
Section**

The clock time can be set:

- Via the user program and interface block, or
- On-line by operator input if the special display "Clock Time/Date" has been configured and selected (see Volume 2, Section 6.7.1).

Run-Time Meter   The C7 CPU provides you with a run-time meter.

You can use this meter to keep count of the operating hours of the C7 CPU or of any controlled equipment.

You program the run-time meter in the user program with the SFCs 2 "SET_RTM", 3 "CTRL_RTM" and 4 "READ_RTM" (see the reference manual **/235/**).

2

2.11 Starting Up

Overview
The C7 comes supplied with a preloaded configuration. You can therefore carry out a startup with the **existing configuration**.

However, if the configuration no longer exists (for example, after a reset), you must carry out a startup **without** any configuration.

This section explains how to proceed in these cases.

2.11.1   With a Loaded Configuration in the C7 OP

Starting Up   After applying the power supply the C7 carries out a self-test. The test checks the functionality of the most important device components and displays the results of the test via the LED status and the display screen. The following startup will be carried out:

1. The C7 carries out a self test after power on.

2. The C7 carries out an operating system test for both parts (C7 CPU and C7 OP).

3. During the start-up phase (1 and 2) the C7 CPU remains in STOP mode.

    Once the C7 OP has been started up, the following basic screen will be displayed:
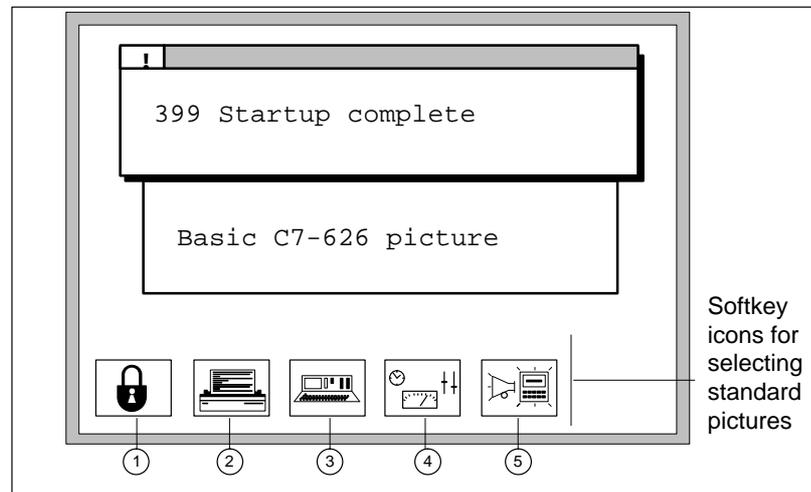
Figure 2-13   Basic C7 Picture (Example)

4. Confirm the displayed message by pressing ⌐ ESC .

2.11.2   Without a Loaded Configuration in the C7 OP

Loading the Configuration

Load the basic configuration so that the explanations in this manual relate to this configuration.

Note

When starting up without a configuration, you must load a configuration via the V.24 serial interface.

Proceed as follows:

1. Connect the V.24 serial interface of the C7 OP (see Figure 2-8) to the programming device/PC via a programming device/PC standard cable.

2. Switch on the C7 power supply.

    As no configuration is loaded, the C7 automatically goes into transfer mode and waits for a data transfer.

3. Transfer the configuration from the programming device/PC to the C7 OP.

    The firmware of the C7 OP is automatically transferred as well.

After a successful transfer, the C7 OP is restarted.

*   Message 339 Startup complete can be removed by pressing ⌐ ESC

    and the basic screen is then displayed.

339 Startup complete

Basic C7-626 picture
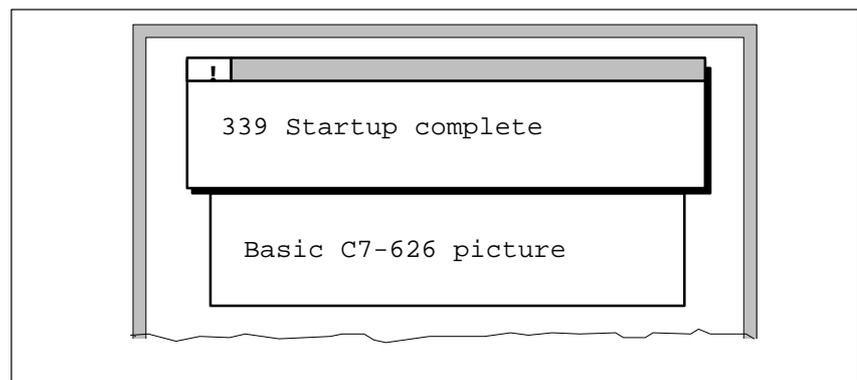
Figure 2-14   Basic C7 Picture with Message 339

Setting the C7 CPU Operating Modes Menu

In the **C7 CPU Operating Modes** menu, you can select either the RUN-P, RUN, STOP or MRES function by pressing [▱↔▱] [HELP] simultaneously.

This operation is only necessary if the basic configuration has been loaded.

2

```
        DI: 00000000 0.7-0.0
            00000000 1.7-1.0

        DO: 11001000 0.7-0.0
            10101000 1.7-1.0

     CPU-MODE:  RUN


     RUN-P    RUN    STOP    MRES         ESC

  K1    F9    F10    F11    F12    F13    F14    K2
```
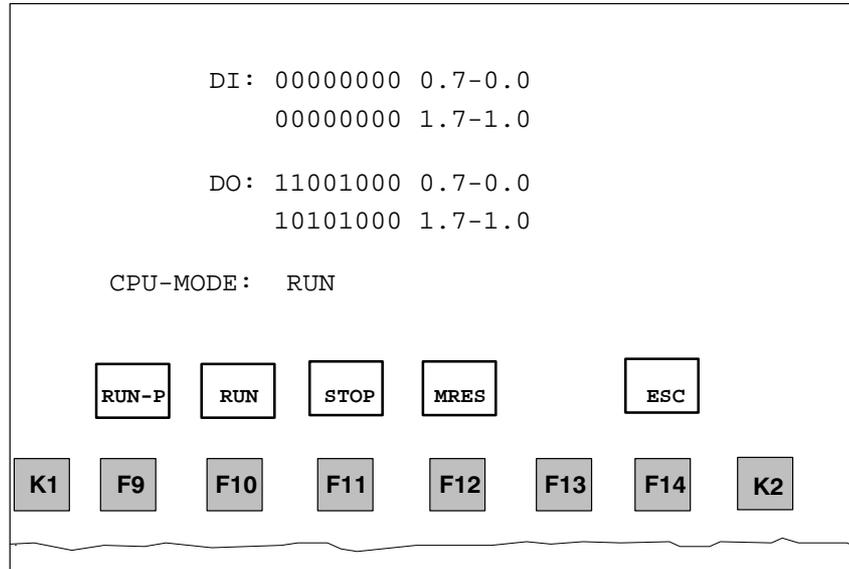
Figure 2-15   C7 CPU Operating Modes Menu with Corresponding Function Keys

Choosing a C7 CPU Operating Mode

With the softkeys F9...F14, you can select one of the C7 CPU operating modes displayed on the screen.

2.12 Status and Error LEDs on the C7

Status and Error LEDs

The C7-626 / C7-626 DP has the following status and error LEDs:

```
                              ▭ SF
                              ▭ BAF
                              ▭ DC5V
                              ▭ FRCE
                              ▭ RUN
                              ▭ STOP
```
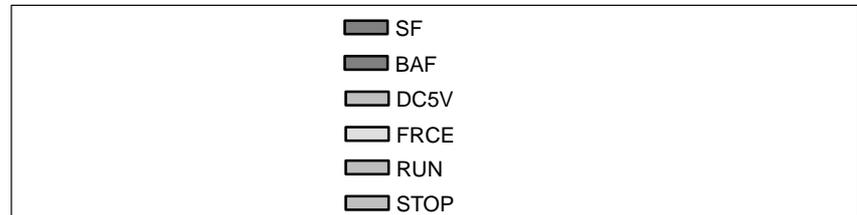
Figure 2-16   Status and Fault LEDs of the C7-626 / C7-626 DP

Meaning of the Status and Error LEDs

The status and error LEDs are explained in the order in which they are arranged on the C7.

Display	Meaning	Explanation
SF (red)	C7 CPU group error	**Lights up** in the event of • Hardware faults • Firmware errors • Programming errors • Parameter assignment errors • Arithmetic errors • Timer errors • Defective internal memory • Battery failure or no backup during power on • I/O fault/error in the internal I/O functions You must use a programming device and display the contents of the diagnostic buffer to determine the exact nature of the error/fault.
BAF (red)	Battery fault	**Lights up** if the battery • has too little voltage • is defective • is missing.
DC5V (green)	5 VDC supply for C7	**Lights up** if the internal 5 V voltage is O.K.
FRCE (yellow)	Reserved	–
RUN (green)	Operating mode of the C7 CPU	**Lights up** if the C7 is executing a user program. **Flashes** (2 Hz) during C7 startup (the STOP LED also lights up; after the STOP LED goes out, the outputs are enabled).
STOP (yellow)	Operating mode of the C7 CPU	**Lights up** if the C7 is not executing a user program. **Flashes** at 1-second intervals if the CPU requests a memory reset.

Configuring MPI Networks and PROFIBUS-DP Networks

3

MPI/PROFIBUS DP

You can

- integrate the C7-626 via the MPI into an MPI network.

- integrate the C7-626 DP via the MPI into an MPI network or set up a PROFIBUS-DP network via the PROFIBUS-DP interface.

SINEC-L2 DP = PROFIBUS DP

SINEC-L2 DP is the PROFIBUS DP for SIEMENS devices.

The Same Setup

The setup of an MPI network is basically the same as the setup of a PROFIBUS-DP network. That is, the same setup rules apply, and you use the same components for setting up both networks. There are only exceptions if you set a transmission rate > 1.5 Mbps in the PROFIBUS-DP network. In this case, you require special components which will be referred to in the relevant section.

Since the setup of an MPI network does not differ from that of a PROFIBUS-DP network, this section will simply refer to setting up a network.

Setting up the Communication

You must assign MPI/L2 addresses to the individual nodes of an MPI or PROFIBUS-DP network to enable them to communicate with each other. How you assign these addresses and what rules you must observe are described in the *STEP 7 manuals*.

Summary of Sections

In Section	You Will Find	On Page
3.1	Setting Up a Network	3-2
3.2	Rules for Configuring a Network	3-5
3.3	Cable Lengths	3-12
3.4	Network Components	3-15
3.5	Bus Connectors	3-17
3.5.1	PROFIBUS Bus Connector	3-18
3.5.2	Bus Connector 6ES7 972-0B.20-0XA0	3-19
3.5.3	Bus Connector 6ES7 972-0B.10-0XA0	3-22
3.5.4	Plugging the Bus Connector into the Module	3-24
3.6	Starting Up the PROFIBUS DP	3-25

3.1 Setting Up a Network

**Definition:
Multipoint
Interface (MPI)**

The interface of the C7 for connecting, for example, programming devices, is called a multipoint interface since several devices can communicate with the C7 via this interface (that is, communication can take place from several points).

**MPI Transmission
Rate**

The MPI transmission rate of the C7-626 and C7-626 DP is fixed at 187.5 Kbps.

**Definition:
PROFIBUS DP**

Digital, analog and intelligent modules, as well as a wide range of field devices according to DIN E 19245 Part 3 such as drives or valve islands, are stored locally from the automation system to the process – up to a distance of 23 km.

The modules and field devices are thus connected to the automation system via the field bus PROFIBUS DP and addressed as local I/Os.

**DP Transmission
Rate**

The DP transmission rate of the C7-626 DP can be set up to 12 Mbps.

**Connectable
Nodes**

The following table shows which nodes you can use to set up a network.

MPI	PROFIBUS DP (only with C7-626 DP)
Programming devices (PG/PC)	Programming device (PG/PC)
Operator interface devices (OP)	Operator interface devices (OP)
S7-300/M7-300	DP masters (C7-CPU DP)
S7-400/M7-400	Additional DP masters
Additional C7 devices	DP slaves
FMs, CPs	

Device / Node

Convention: all devices that you connect in an MPI network are called nodes. Note that the C7 occupies two MPI addresses and therefore already consists internally of two nodes.

Segment

A segment is a bus line between two terminating resistances. A segment can contain up to 32 nodes.

Number of Nodes   You can connect up to 126 (addressable) nodes via the MPI.

MPI/L2 Addresses   To enable all nodes to communicate with each other, you must assign them an address:

- In an MPI network, an "MPI address" and a "highest MPI address".

- In a PROFIBUS-DP network, an "L2 address" and a "highest L2 address".

You must assign these MPI/L2 addresses to each node individually with the programming device **before** networking (also, with some PROFIBUS-DP slaves, by using the switch on the slave).

Note

The RS 485 repeater has no "MPI/L2 address".

Table 3-1 contains all permissible MPI/L2 addresses.

Table 3-1   Permissible MPI/L2 Addresses

MPI Addresses	L2 Addresses
0 to 126	0 to 125
of which reserved:	of which reserved:
0 for programming device	0 for programming device
1 for C7 OP	
2 for C7 CPU	

Default MPI Addresses on the C7   The following table shows the default MPI addresses with which the C7 devices are supplied.

Node (Device)	Default MPI Address	Highest Default MPI Adress
Programming device	0	15
C7 OP	1	15
C7 CPU	2	15

Rules for the MPI/L2 Addresses

Please observe the following rules before assigning MPI/L2 addresses:

- All MPI/L2 addresses in a network must be different

- The highest possible MPI/L2 address must be ≥ the largest actual address and must be the same for all nodes. (Exception: connecting a programming device to several nodes; see Chapter 4).

Special Features of CPs and FMs

CPs and FMs (as customized modules or in expansion racks) with their own MPI address have the following special feature: their MPI address is determined automatically by the C7 and assigned according to the following system:
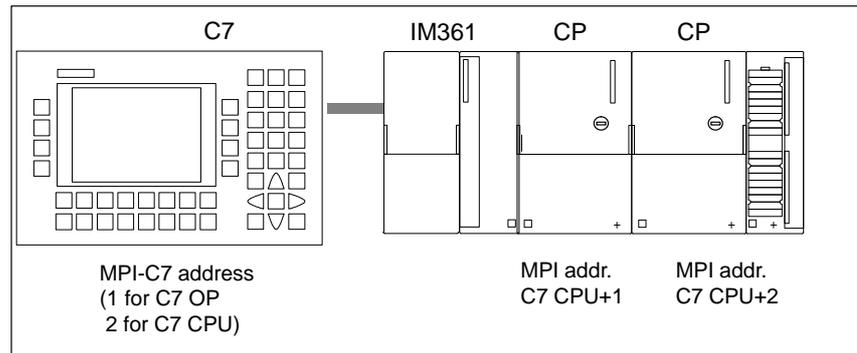
Figure 3-1   Automatic Assignment of MPI Addresses for CPs and FMs

Data Packets in the MPI Network

Please note the following characteristics in the MPI network:

Warning

Loss of data packets in the MPI network.

If you connect another CPU to the MPI network during operation, you may lose GD packets and increase the scan cycle time.

Remedy:

1. Switch off the node to be connected.
2. Connect the node to the MPI network.
3. Switch on the node.

CPU to CPU Communication

A C7 CPU can communicate with up to four further CPUs. They can exchange global data. For detailed information on global data, please refer to **/231/**.

GD Circle

Sending and receiving global data occurs in GD circles. Each C7 CPU may participate in up to four different GD circles.

3.2   Rules for Configuring a Network

Overview   In this section you will be shown

- how to configure an MPI network
- which rules you must observe.

The rules for an MPI network and an L2 network are identical.

Rules   You must observe the following rules when connecting the nodes of a network:

- **Before** you interconnect the individual nodes of the network, you must assign the MPI address and the highest MPI address or the L2 address and the highest L2 address for each node (with the exception of the RS 485 repeater).

  Tip: Mark all nodes in a network with the address on their housings. In this way, you can always see which node has been assigned which address in your system.

- Connect all nodes in the network as shown in Figure 3-5; that is, integrate the stationary programming devices and OPs directly into the network.

Note

For 3 Mbps and above, you may only use bus connectors with the order numbers 6ES7 972-0B.**1**0-0XA0 or 6ES7 972-0B.**2**0-0XA0 for connecting nodes.

Connect only those programming devices/OPs that are required for startup or maintenance via spur lines to the network.

Note

For 3 Mbps and above, you may only use the programming device connecting cable with the order number 6ES7 901-4BD00-0XA0 to connect the programming device.

- If you are operating more than 32 nodes in a network, you must link the bus segments via RS 485 repeaters.

  In a PROFIBUS-DP network, all of the bus segments **together** must have at least one DP master and one DP slave.

- Ungrounded bus segments and grounded bus segments are connected via RS 485 repeaters.

- Each RS 485 repeater used reduces the maximum number of nodes per bus segment. This means, if there is an RS 485 repeater in a bus segment, there can then only be a maximum of 31 further nodes in the bus segment. The number of RS 485 repeaters has **no** effect on the maximum number of nodes on the bus.

  There can be up to 10 segments in one row.

- Switch the terminating resistance on at the geographical end point of the network (see Section 3.3).

- **Before** you insert a new node into the network, you must switch off the supply voltage.

Recommendation for MPI Addresses in the Network

The MPI addresses set at the factory should not be assigned as fixed node addresses since, otherwise, address conflicts (double MPI addresses) can arise when devices are replaced or the network is expanded.

- Reserve the MPI address "0" for a service programming device.

- Reserve the address "1" for the C7 OP.

- Reserve the address "2" for the C7 CPU.

This avoids double assignment of MPI addresses after installing a further preset C7 or S7-300 in the MPI network (for example, when replacing a C7).

Recommendation for PROFIBUS Addresses

Reserve the L2 address "0" for a service programming device which may be temporarily connected to the L2-DP network at a later stage if required. You should therefore assign other L2 addresses to the programming devices included in the L2-DP network.

Components

You connect the individual nodes via the bus connectors and the PROFIBUS bus cable. Remember to provide for the nodes a bus connector with programming device socket to which a programming device can be connected if required (see also Section 3.5).

Use the RS 485 repeater for connections between segments or for extending cables.

Using the RS 485 Repeater

See the reference manual **/71/** for details of how to install and use a repeater.

Terminating Resistance

A cable must be terminated with a surge impedance. To do this, switch on the terminating resistance at the first and last node of the network.

At least one of these two nodes must be supplied with power.

Terminating Resistance On Bus Connector

Figure 3-2 shows you where to connect the terminating resistance on the bus connector.
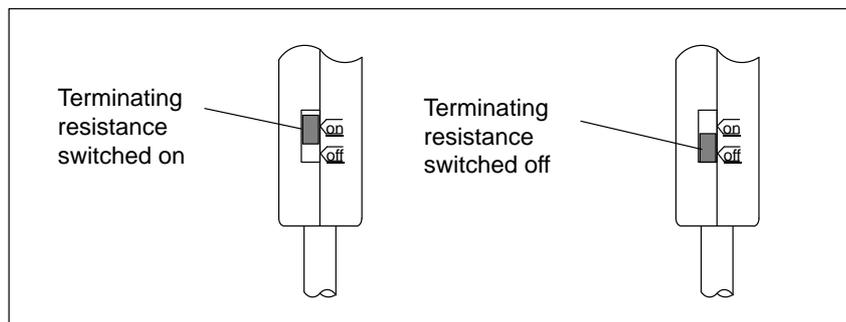
Figure 3-2   Terminating Resistance on the Bus Connector

Terminating Resistance On RS 485 Repeater

Figure 3-3 shows you where to connect the terminating resistance on the RS 485 repeater.
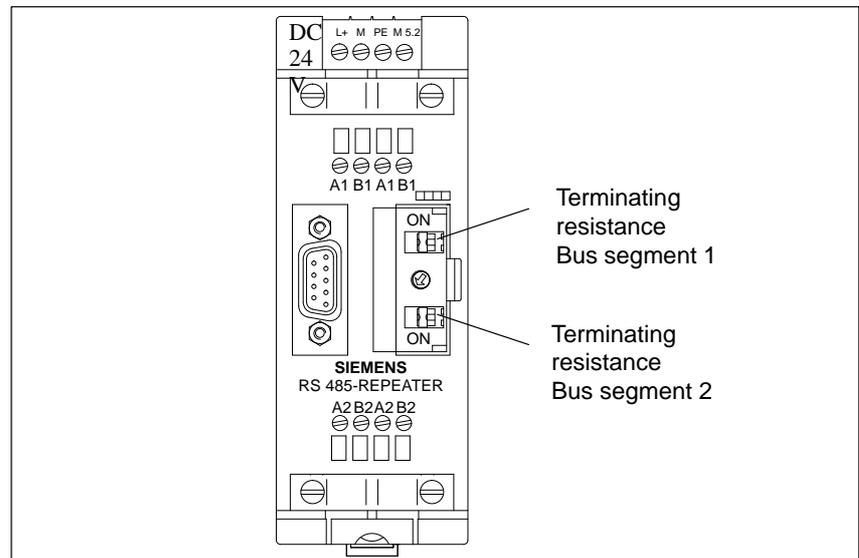
Figure 3-3   Terminating Resistance on the RS 485 Repeater

Example of Terminating Resistance in the MPI Network

Using a possible MPI network configuration, Figure 3-4 shows where you must connect the terminating resistance.

*   Only connected via spur line at startup or during service work

①   Terminating resistance switched on
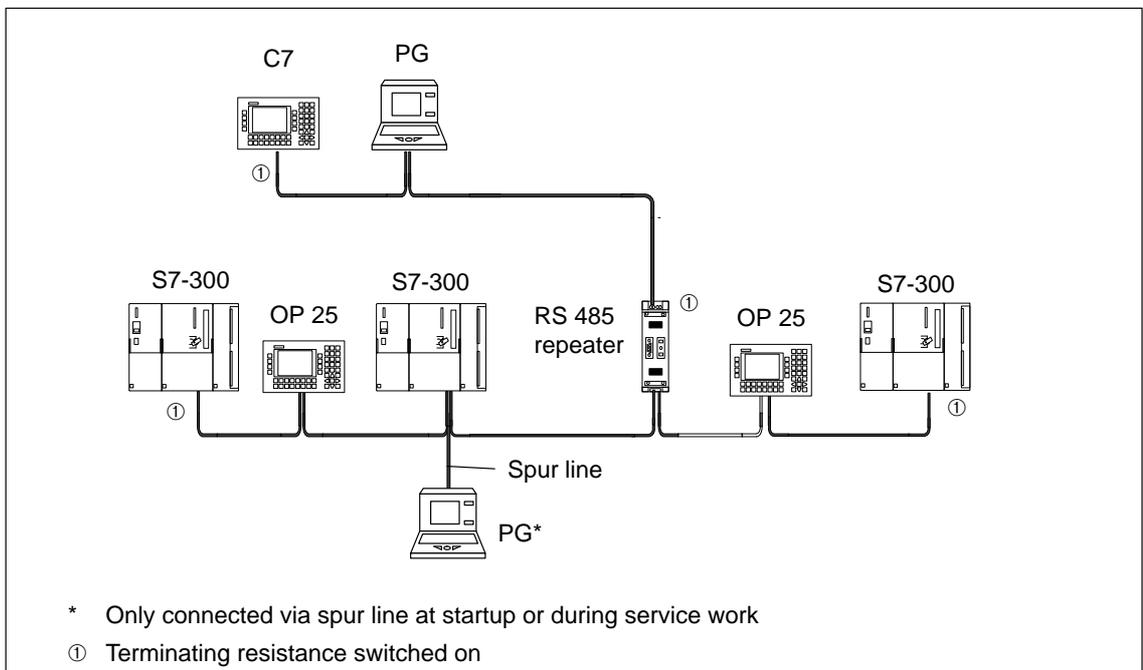
Figure 3-4   Switching Terminating Resistances in an MPI Network

Example of an MPI Network   Figure 3-5 shows the main setup of an MPI network according to the rules listed above.
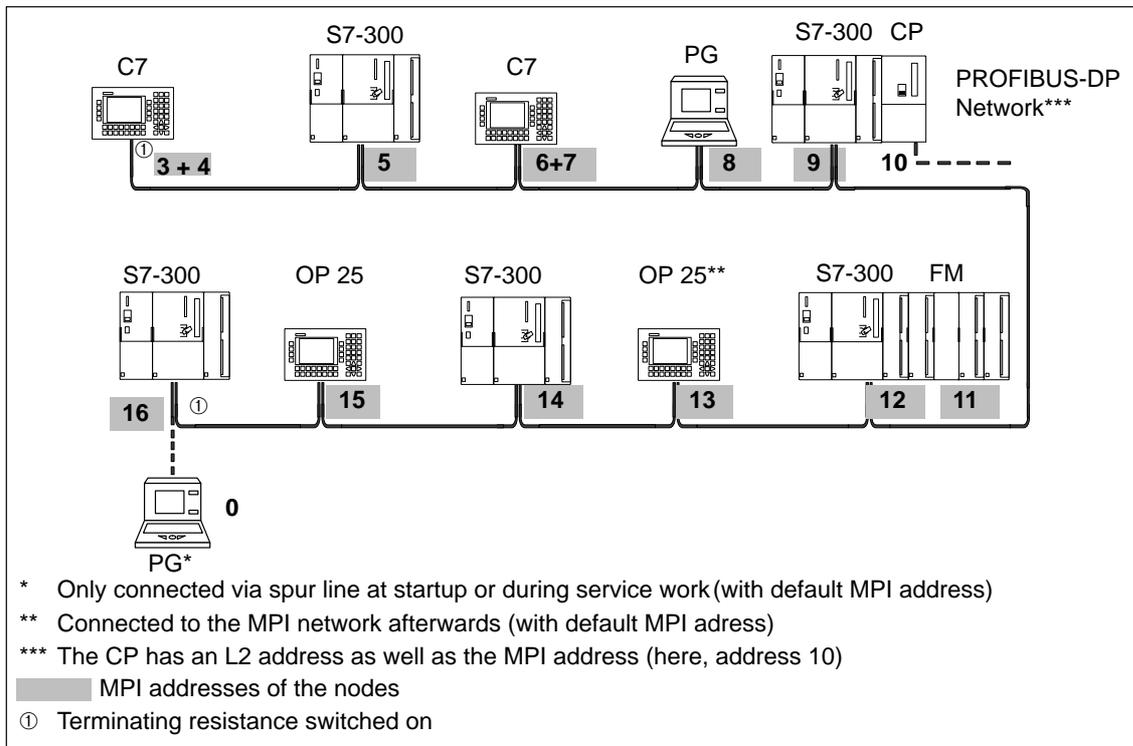
Figure 3-5   Example of an MPI Network

Example of a PROFIBUS-DP Network

Figure 3-6 shows the main setup of a PROFIBUS-DP network according to the rules listed above.

1 = Default L2 address for DP master

* Only connected to MPI via spur line at startup or during service work (with MPI address = 0)

0 ... x L2 addresses of the nodes

0 ... x MPI addresses of the nodes

① Terminating resistance switched on

Figure 3-6   Example of a PROFIBUS-DP Network

Example with C7-626 DP   Figure 3-7 shows an example of a setup with the C7-626 DP, which is integrated in an MPI network and at the same time used as a DP master in a PROFIBUS-DP network.

Figure 3-7   Example of a Setup with the C7-626 DP in the MPI and PROFIBUS-DP Networks

3.3 Cable Lengths

Segment in an MPI Network

You can implement cable lengths up to 50 m in a segment of an MPI network. The 50 m applies from the first node to the last node of the segment.

Table 3-2   Permissible Cable Length of a Segment in an MPI Network

Transmission Rate	Max. Cable Length of a Segment (in m)
187.5 Kbps	50*

*with non-isolated interface

Segment in a PROFIBUS-DP Network

In a segment of a PROFIBUS-DP network, the cable length depends on the transmission rate (see Table 3-3).

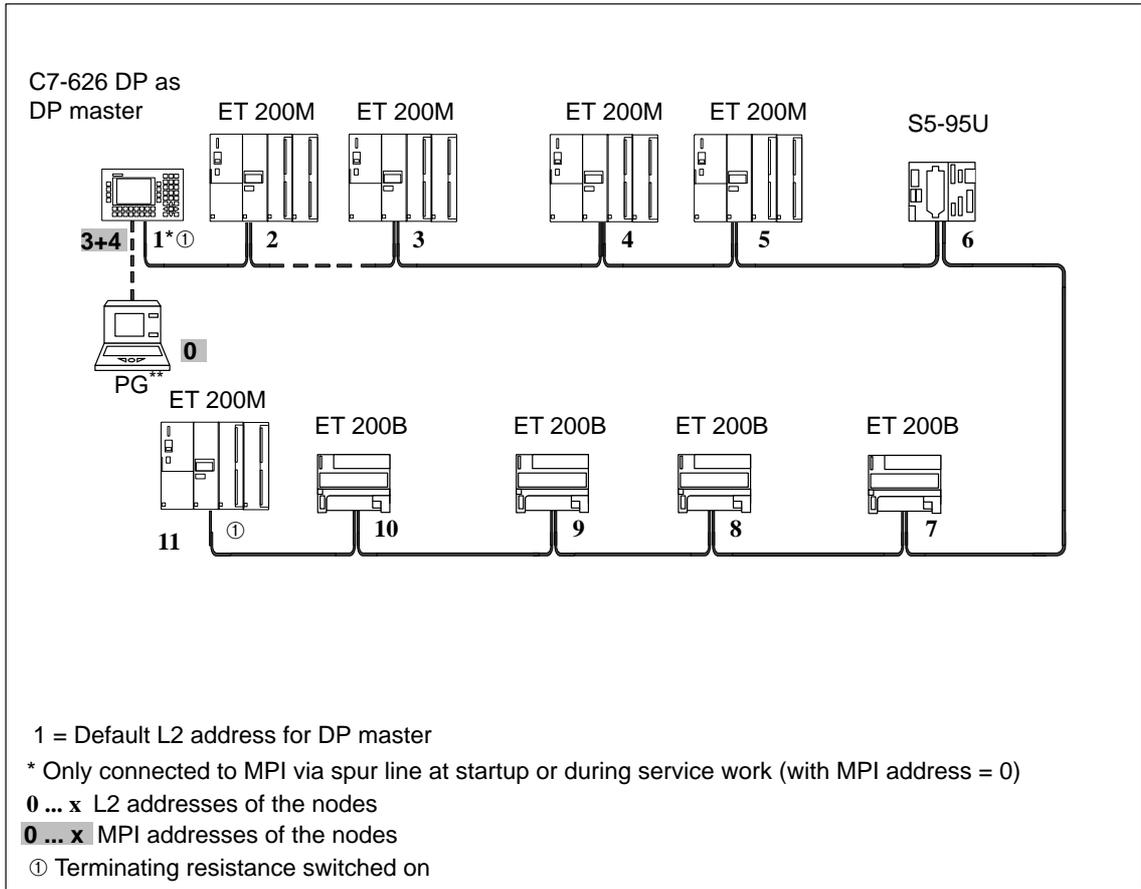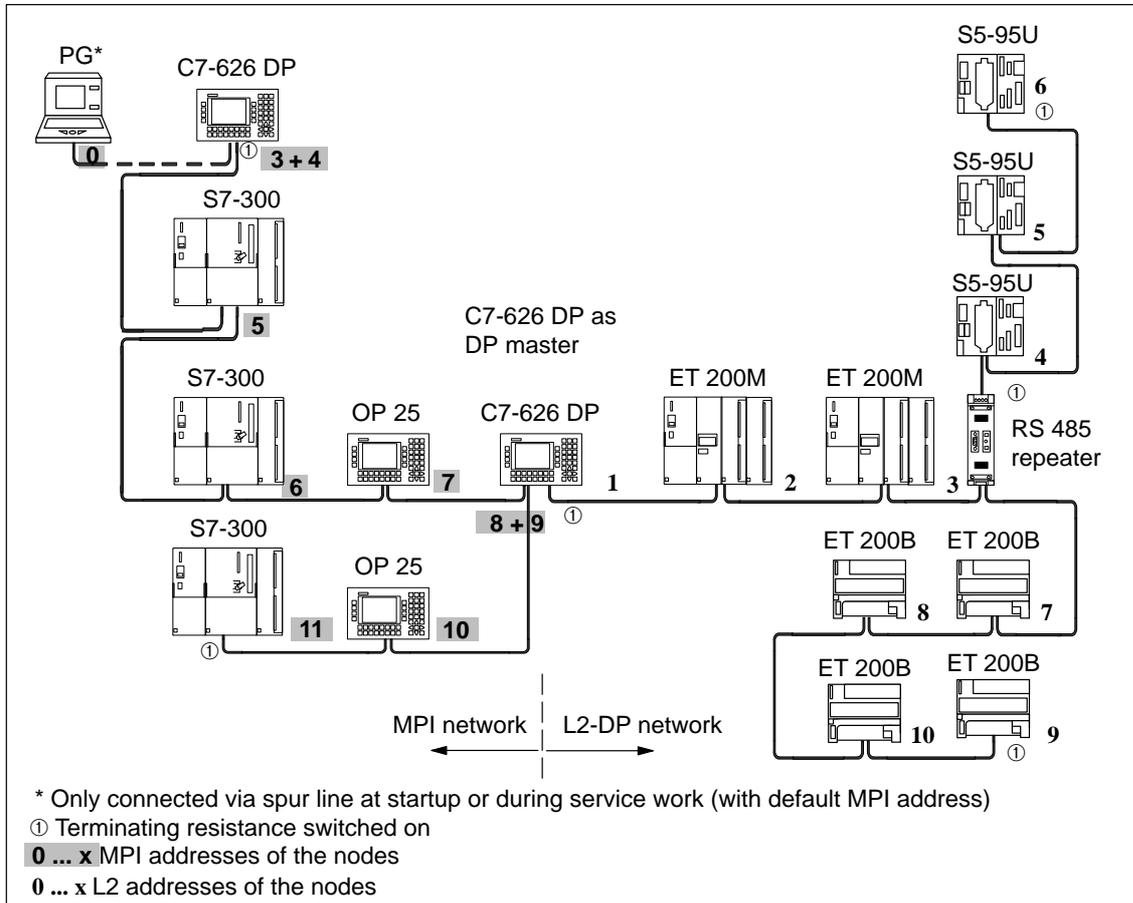Table 3-3   Permissible Cable Length of a Segment in a PROFIBUS-DP Network Depending on the Transmission Rate

Transmission Rate	Max. Cable Length of a Segment (in m)
9.6 to 187.5 Kbps	1000*
500 Kbps	400
1.5 Mbps	200
3 to 12 Mbps	100

*with isolated interface

Longer Cable Lengths

If you implement longer cable lengths than those permissible in one segment, you must use RS 485 repeaters. The maximum possible lengths between two RS 485 repeaters correspond to the cable length of a segment. However, when using these maximum cable lengths, note that there must be **no** other node (remote segment) between the two RS 485 repeaters. You can connect up to nine RS 485 repeaters in series.

When calculating the total number of nodes to be connected, note that an RS 485 repeater counts as a node of the network, even if it has not been assigned its own MPI/L2 address.

Figure 3-8 illustrates the principle of "cable extension" with RS 485 repeaters for the MPI.
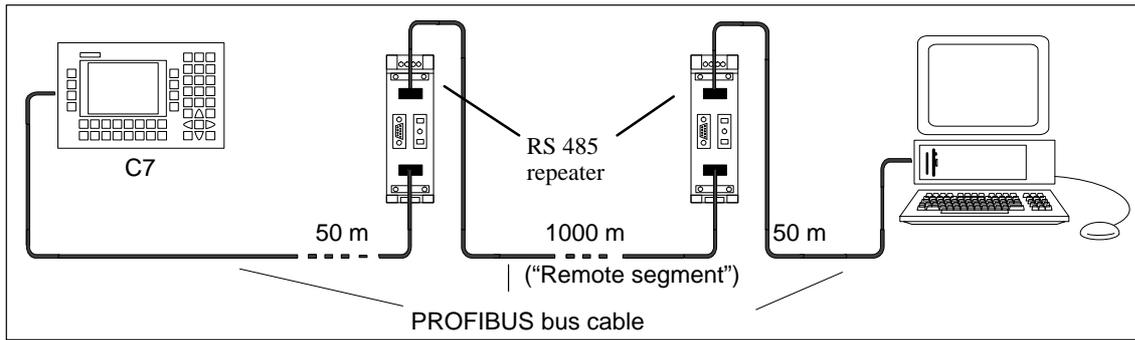
Figure 3-8   Maximum Cable Length Between Two RS 485 Repeaters

3

Length of Spur Lines

If you do not assemble the bus cable directly onto the bus connector (for example, when using an L2 bus terminal), you must take into account the maximum possible spur line length.

The following table shows which maximum lengths of spur lines are permitted per bus segment:

For 3 Mbps and above, use the programming device connecting cable with order number 6ES7 901-4BD00-0XA0 to connect the programming device or PC. You can use several programming device connecting cables with this order number in one bus setup. Other spur lines are not permitted.

Table 3-4   Length of the Spur Lines per Segment

Transmission Rate	Max. Length of Spur Line per Segment	Number of Nodes with a Spur Line Length of ...	
		1.5 m or 1.6 m	**3 m**
9.6 to 93.75 Kbps	96 m	32	32
187.5 Kbps	75 m	32	25
500 Kbps	30 m	20	10
1.5 Mbps	10 m	6	3
3 to 12 Mbps	–	–	–

Example   Figure 3-9 shows a possible MPI network configuration. The example indicates the maximum possible distances in an MPI network.

Figure 3-9   Cable Lengths in an MPI Network

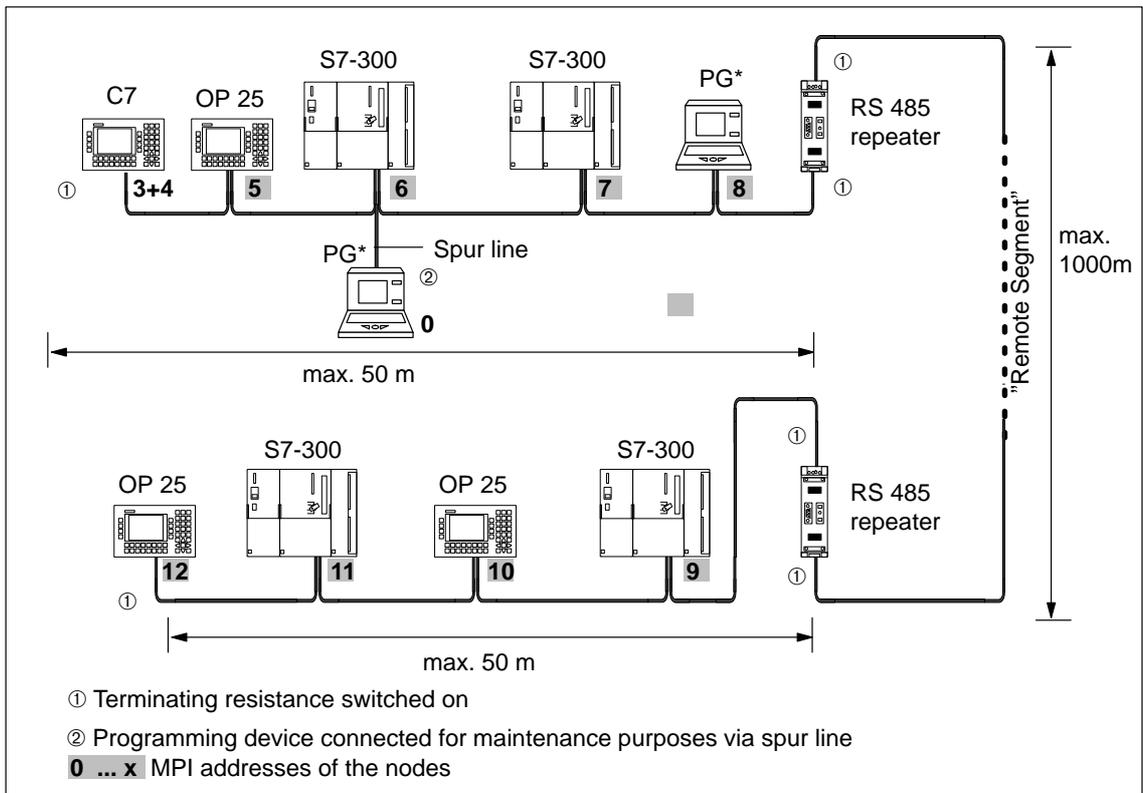## 3.4   Network Components

Purpose   You require network components...

Table 3-5   Network Components

Purpose	Component
... for setting up a network	PROFIBUS bus cable
... for connecting a node to the network	Bus connector
... for amplifying the signal ... for linking segments	RS 485 repeater
... for converting the signal to fiber-optic transmission (PROFIBUS DP network only)	Optical Link Module
... for connecting programming devices/OPs to the network	Programming device cables (spur lines)

PROFIBUS Bus Cable   We offer the following PROFIBUS bus cables:

Table 3-6   Bus Cables

PROFIBUS bus cable
PROFIBUS direct-buried cable
PROFIBUS drum cable
PROFIBUS bus cable with PE sheath (for food and drinks industry)
PROFIBUS bus cable for festooning

Characteristics of the PROFIBUS Bus Cable   The PROFIBUS bus cable is a two-core, twisted and shielded cable with the following characteristics:

Table 3-7   Characteristics of the PROFIBUS Bus Cable

Features	Values
Surge impedance	Approx. 135 to 160 Ω (f = 3 to 20 MHz)
Loop resistance	$\leq$ 115 Ω/km
Operating capacitance	30 nF/km
Attenuation	0.9 dB/100 m (f = 200 kHz)
Permissible core cross-section	0.3 mm^2 to 0.5 mm^2
Permissible cable diameter	8 mm $\pm$ 0.5 mm

Rules for Cable Laying

When laying the PROFIBUS bus cable, you must **not**

- twist it,

- stretch it or

- press it.

In addition, when laying the interior bus cable, you must observe the following boundary conditions (d_A = outer diameter of the cable):

Table 3-8   Boundary Conditions when Laying the Interior Bus Cable

Features	Edge Conditions
Bending radius when bent once	$\geq$ 80 mm ($10 \times d_A$)
Bending radius when bent several times	$\geq$ 160 mm ($20 \times d_A$)
Permissible temperature range when laying	$-$ 5 $°$C to $+$ 50 $°$C
Storage and stationary operating temperature	$-$ 30 $°$C to $+$ 65 $°$C

3.5   Bus Connectors

Purpose of the Bus Connector

The bus connector is used for connecting the PROFIBUS bus cable to the MPI. This is how the connection to further nodes is established.

There are five different bus connectors:

- Up to 12 Mbps PROFIBUS bus connector (6GK1500-0EA00)
- Up to 12 Mbps
    – Without PG-type connector (6ES7 972-0BA10-0XA0)
    – With PG-type connector (6ES7 972-0BB10-0XA0)
- Up to 12 Mbps, optionally with vertical or angular outgoing cable
    – Without PG-type connector (6ES7 972-0BA20-0XA0)
    – With PG-type connector (6ES7 972-0BB20-0XA0)

No Application

The bus connectors are **not** required for the RS 485 repeater.

3.5.1   PROFIBUS Bus Connector

**Appearance
(6GK15000-0EA00)**

Figure 3-10 shows the PROFIBUS bus connector 6GK1500-0EA00.

Diagram II:

Bus connection for the first and last stations on the PROFIBUS BUS. The cable can be connected on the left or the right.

① Switch position to "ON" for the first and last stations on the PROFIBUS: "ON" (terminating resistance switched on).

② Cable shielding must lie bare on the metal guide.

Diagram III:

① Terminating resistance switched off.

② Cable shielding must lie bare on the metal guide.
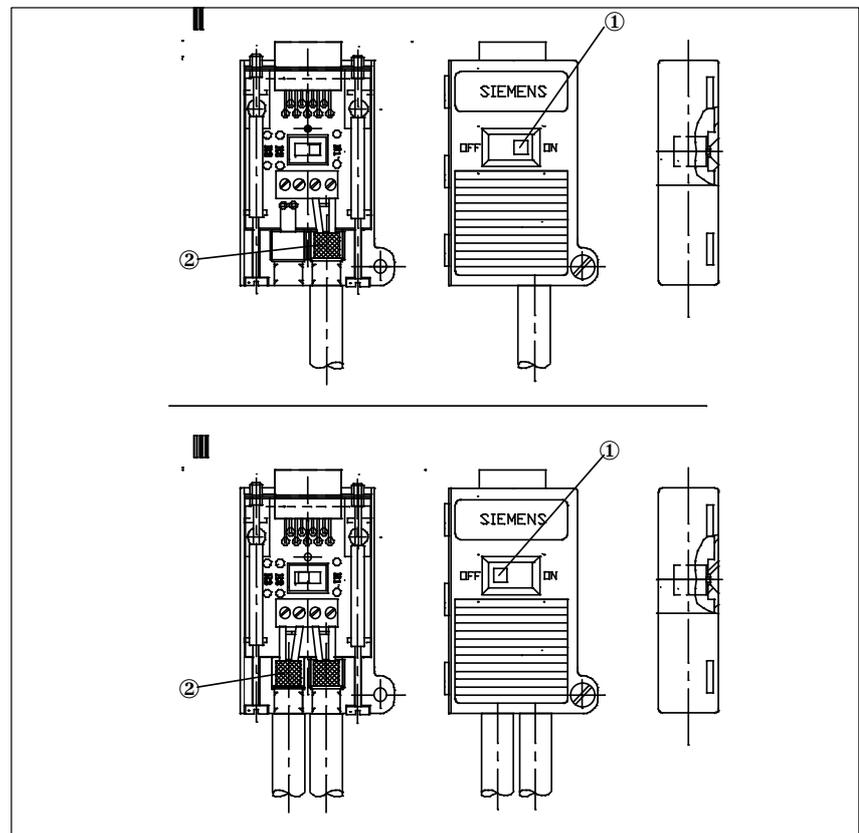
Figure 3-11   PROFIBUS Bus Connector

Assembling the Bus Cable

Connect the bus cable to the PROFIBUS bus connector with the order number 6CGK1500-0EA00 as follows:

1. Strip the insulation off the cable.

2. Insert the green and red wires into the screw-type terminal block.

3. Press the cable sheath between both sides of the screw-type terminal.

4. Screw the green and red wires tightly into the screw-type terminal.

Figure 3-12   Connecting the PROFIBUS Bus Cable to the Screw-Type Terminal Block

3.5.2   Bus Connector 6ES7 972-0B.20-0XA0

Appearance (6ES7-972-0B.20 ...)

Figure 3-13 shows the bus connector 6ES7 972-0B.20 ...:
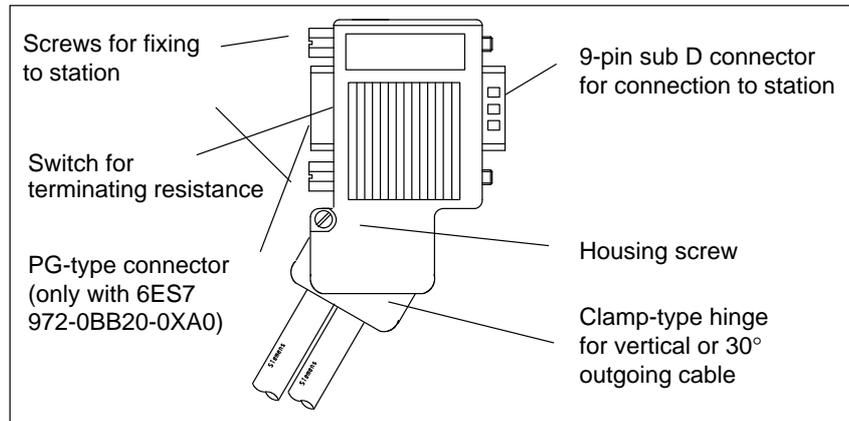
Figure 3-13   Bus Connector (Order Number 6ES7 972-0B.20 ...)

Assembling the Bus Cable

Connect the bus cable to the bus connector 6ES7 972-0B.20 ... as follows:

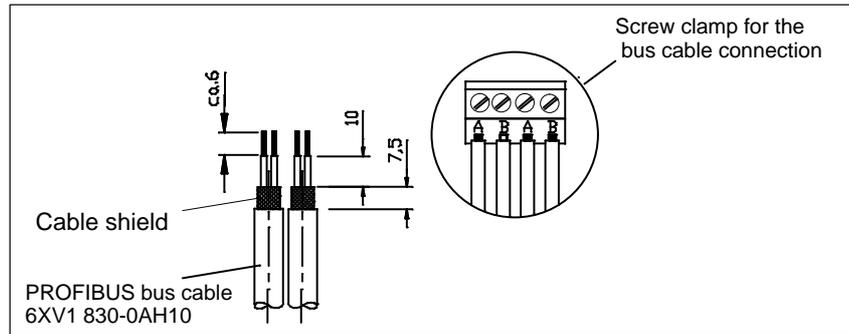1. Strip the insulation off the bus cable as shown in Figure 3-14.
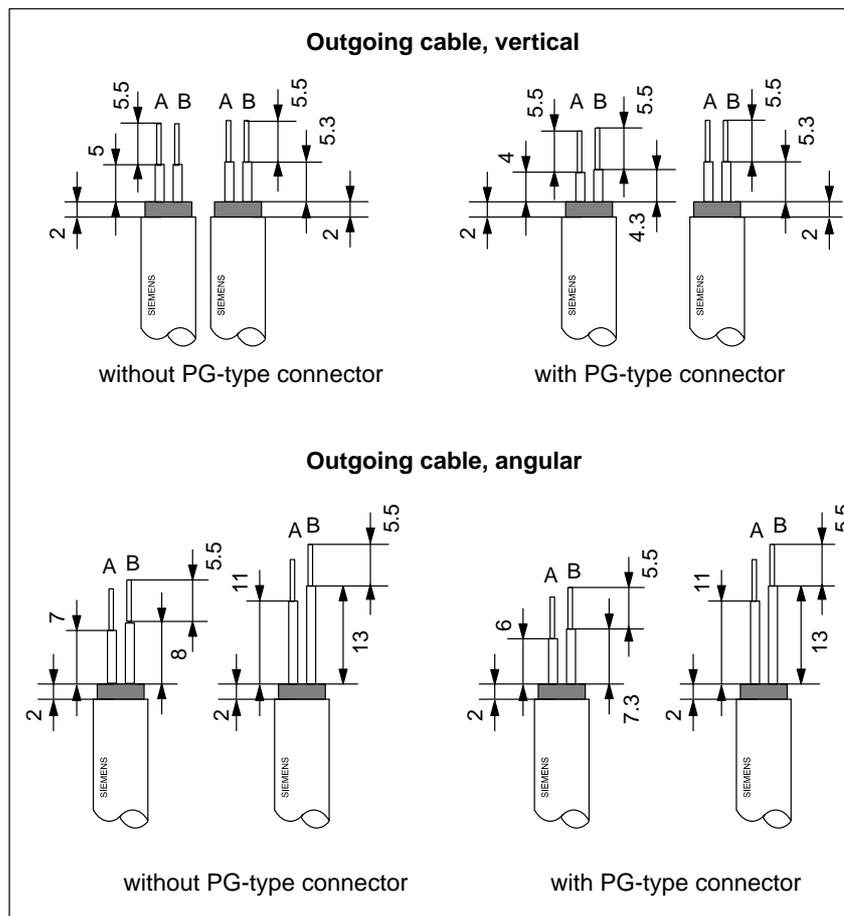
Figure 3-14   Length of Stripped Insulation for Connecting to the Bus Connector 6ES7 972-0B.20 ...

2. Open the housing of the bus connector by loosening the housing screw and swinging the cover upward.

3. Remove the clamp-type hinge cover.

4. The bus connector 6ES7 972-0B.20 is supplied for an angular outgoing cable.

    If a vertical outgoing cable arrangement is required:

    – Loosen the screw at the left side of the hinge.

    – Slightly lift the hinge.

    – Turn the hinge inward.

    – To fix the hinge, tighten the screw on the left.

5. Insert the green and red wires into the screw-type terminal block as shown in Figure 3-15.

   Make sure that you always connect the same wires at the same terminal, A or B (for example, always connect the green wire to terminal A and the red wire to terminal B).

1 The bus cable can be connected on the right or on the left

Figure 3-15   Connecting the Bus Cable to the Bus Connector (6ES7 972-0B.20 ...)

6. Screw tight the clamp-type hinge cover.

   Make sure that the cable shielding is bare under the shielding clip.

7. Tighten the green and red wires in the screw-type terminal.

8. Close the cover of the bus connector and

9. Screw the housing back on.

3.5.3   Bus Connector 6ES7 972-0B.10-0XA0

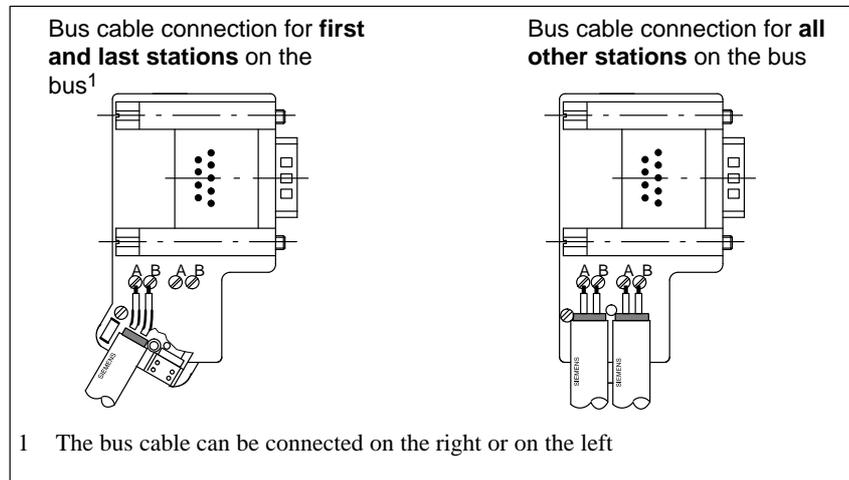**Appearance**   Table 3-9 shows the bus connectors 6ES7 972-0B.10-0XA0.

Table 3-9   Description and Function of the Bus Connectors 6ES7 972-0B.10-0XA0

Appearance of the Bus Connectors		No.	Function
with PG-type connector	without PG-type connector	①	Connection to the MPI, PROFIBUS-DP interface (9-pin sub D connector)
		②	Connection for the PROFIBUS bus cable
		③	Terminating resistance
		④	Interface for PG/OP
		⑤	Screws for fixing to the node

Assembling the PROFIBUS Bus Cable for Bus Connectors

Proceed as follows to connect the PROFIBUS bus cable to the bus connector 6ES7 972-0B.10-0XA0:

1. Cut the bus cable to the desired length.

2. Insulate the bus cable according to Figure 3-16.
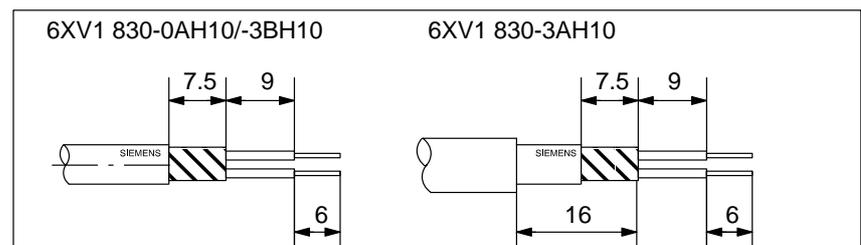
Figure 3-16   Length of Bared Wire for Connecting to the Bus Connector

3. Open the housing of the bus connector by loosening the housing screws.

4. Remove the cover.

5. Insert the green and red wires into the screw-type terminal block as shown in Figure 3-17.

   Make sure that you always connect the same wires at the same terminal, A or B (for example, always connect the green wire to terminal A and the red wire to terminal B).

6. Press the cable sheath between both sides of the screw-type terminal block. This will hold it in place.

7. Screw the green and red wires tightly into the screw-type terminal block.

Figure 3-17   Connecting the Bus Cable to the Bus Connector
                (6ES7 972-0B.10-0XA0)

8. Screw the housing back on.

   Make sure that the cable shielding is bare under the shielding clip.

3.5.4   Plugging the Bus Connector into the Module

Connecting the Bus Connector

Proceed as follows to connect the bus connector:

1. Plug the bus connector into the module.

2. Screw the bus connector to the module.

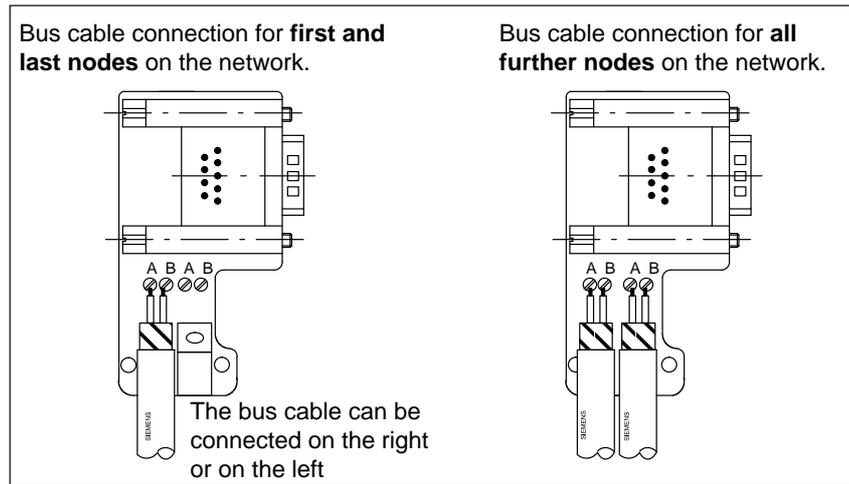3. If the bus connector (order number 6ES7 ...) is at the start or end of a segment, you must switch on the terminating resistance (switch position "ON") (see Figure 3-18).

Make sure that the stations with the terminating resistance are always supplied with power during power up and during operation.

Terminating resistance switched on

Terminating resistance **not** switched on
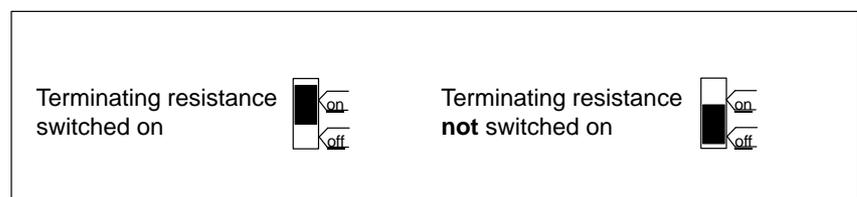
Figure 3-18   Bus Connectors (6ES7 ...): Terminating Resistance Switched On and Not Switched On

Removing the Bus Connector

You can remove the bus connector with a **looped-through bus cable** from the PROFIBUS-DP interface at any time without interrupting data traffic on the bus.

!

Warning

Possibility of interrupting data traffic on the bus!

A bus segment must always be terminated at both ends by the terminating resistance. This is not the case if the last slave with bus connector is not supplied with power. Since the bus connector draws its power from the node, the terminating resistance is ineffective.

Make sure that the stations at which the terminating resistance is switched on are always supplied with power.

3.6   Starting Up the PROFIBUS DP

Introduction

In this section, you are shown how to proceed when starting up a PROFIBUS-DP network with a C7-626 DP as a DP master.

Prerequisites

Before you can start up the PROFIBUS DP network, the following steps must be carried out:

- The PROFIBUS-DP network must be set up (see Section 3.1).

- Using *STEP 7,* you must have configured the PROFIBUS-DP network and assigned all nodes an L2 address and an address space (see **/70/**). Note that with some DP slaves a PROFIBUS address switch must be set (see description of the relevant DP slaves).

Starting Up

Start up the PROFIBUS DP network as follows:

1. Using *STEP 7*, load the configuration of the PROFIBUS-DP network (setpoint configuration) using the programming device into the C7-DP CPU. This is described in **/70/**.

2. Switch on all DP slaves.

3. Switch the C7-DP CPU from STOP to RUN.

Behavior of the C7 DP CPU on Startup

On startup, the C7-DP CPU checks the setpoint configuration with the actual configuration. You can adjust the length of the check with *STEP 7* in the parameter block "Start-Up Characteristics" with the parameter "Module Time Limits".

If the setpoint configuration = actual configuration, then the C7-DP CPU goes to RUN mode.

If the setpoint configuration $\neq$ actual configuration, then the behavior of the C7-DP CPU depends on the parameter setting "Startup at setpoint $\neq$ Actual configuration":

Startup at setpoint $\neq$ Actual configuration = yes (default setting)	Startup at setpoint $\neq$ Actual configuration = no
C7-DP CPU goes into RUN mode	C7-DP CPU remains in STOP mode and after the time set in the parameter "Module Time Limits" has elapsed, the BUSF LED flashes.
	The flashing of the BUSF LED shows that at least one DP slave cannot be addressed. In this case, check whether all the DP slaves are switched on and that it matches the established configuration, or display the diagnostic buffer with *STEP 7*.

To set the parameters in the parameter block "Start-Up Characteristics", see Section 10.11.2 in **/70/** and also the *STEP 7* on-line help.

Connecting a Programming Device / PC to a C7

4

Summary of Sections

4.1 Connecting a Programming Device/PC to a C7

Possibilities

This chapter explains how you can connect a programming device or PC to the C7 via a multipoint interface.

Connecting a Programming Device/PC to a C7

You can connect a programming device or PC with the MPI of the C7 using a prefabricated programming device cable.

Alternatively, you can make up the connecting cable yourself using the PROFIBUS bus cable and bus connectors (see Section 3.5).

Figure 4-1 shows the components for connecting a programming device/PC to a C7.
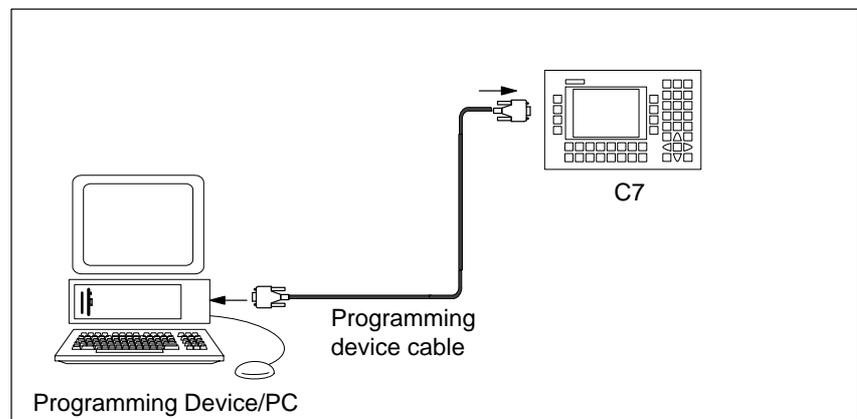
Figure 4-1   Connecting a Programming Device/PC to a C7

4.2 Connecting a Programming Device/PC to Several Nodes

Possibilities

This chapter shows you how to connect a programming device or PC to several networked nodes via the MPI.

Two Installation Variants

When you connect a programming device/PC to several nodes, you must differentiate between two installation variants:

- Fixed installation of the programming device/PC in the MPI network

- Programming device/PC connected for startup and maintenance purposes.

Depending on this, you connect the programming device/PC with the other nodes as follows (see also Section 3.2):

Installation Variant	Connection
Fixed installation of the programming device/PC in the MPI network	The programming device/PC is linked directly into the MPI network
Programming device/PC connected for startup and maintenance purposes	The programming device/PC is connected to one node via a spur line

4

Fixed Installation of Programming Device/PC

With fixed installation of a programming device/PC in the MPI network, you connect the programming device/PC via a bus connector directly with the other nodes of the MPI network in accordance with the rules listed in Section 3.2.

Figure 4-2 shows a C7 network with two C7s. Both C7s are connected to each other via the PROFIBUS bus cable.
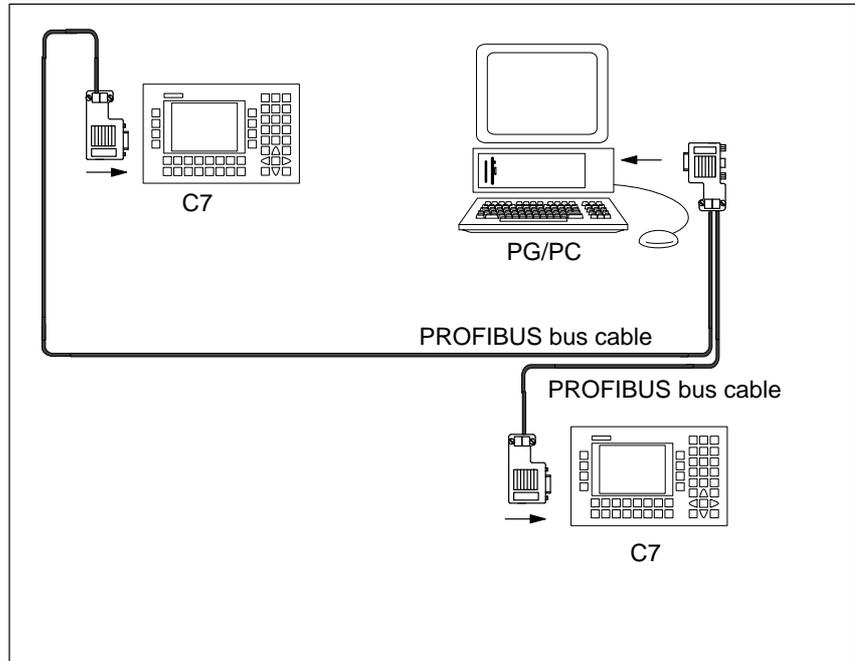
Figure 4-2   Connecting a Programming Device to Several C7s

Connecting the Programming Device/PC for Service Purposes

If there is no stationary programming device/PC available, we recommend the following:

In order to connect a programming device/PC for service purposes to an MPI network with "unknown" node addresses, we recommend that you set the following address on the service programming device/PC:

- MPI address: 0

- Highest MPI address: 126.

Then find out the highest MPI address in the MPI network using the STEP 7 application *Hardware Configuration* and adjust the highest MPI address on the programming device/PC to match that of the MPI network.

**Programming
Device/PC for
Startup or
Maintenance**

For startup or maintenance purposes, connect the programming device/PC via a spur line to a node of the MPI network. The bus connector of this node must possess a PG-type connector for this purpose (see also Section 3.5).

Figure 4-3 shows two networked C7s to which a programming device/PC is connected.
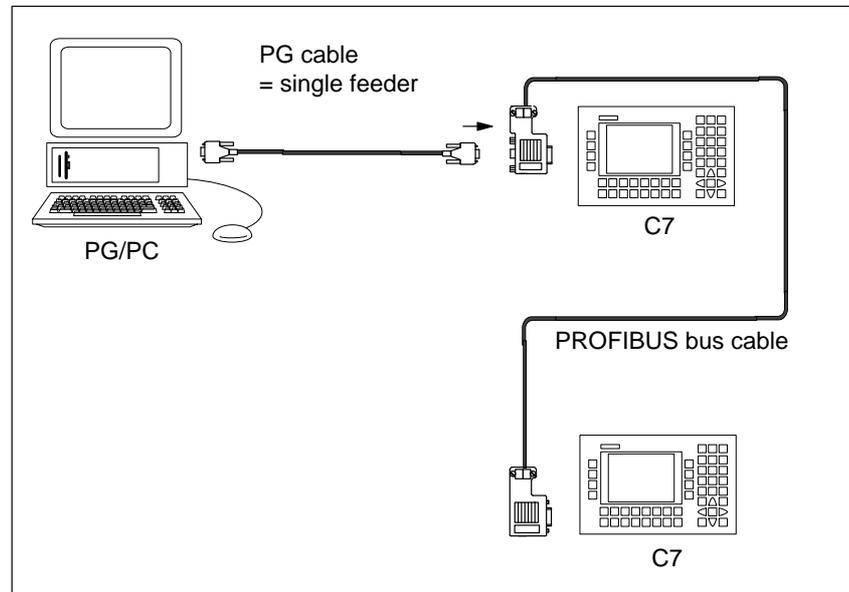
Figure 4-3   Connecting a Programming Device/PC to an MPI Network

4

C7 Digital Input/Output

5

5.1 Digital Input Function

Characteristics

The digital input function has the following characteristics:

- 16 inputs, isolated as a group

- Nominal input voltage: 24 VDC

- Suitable for switches and 2-wire proximity switches (BEROs), for example.

Terminal Connection and Block Diagram

Figure 5-1 shows the terminal connection and the block diagram of the digital input function.
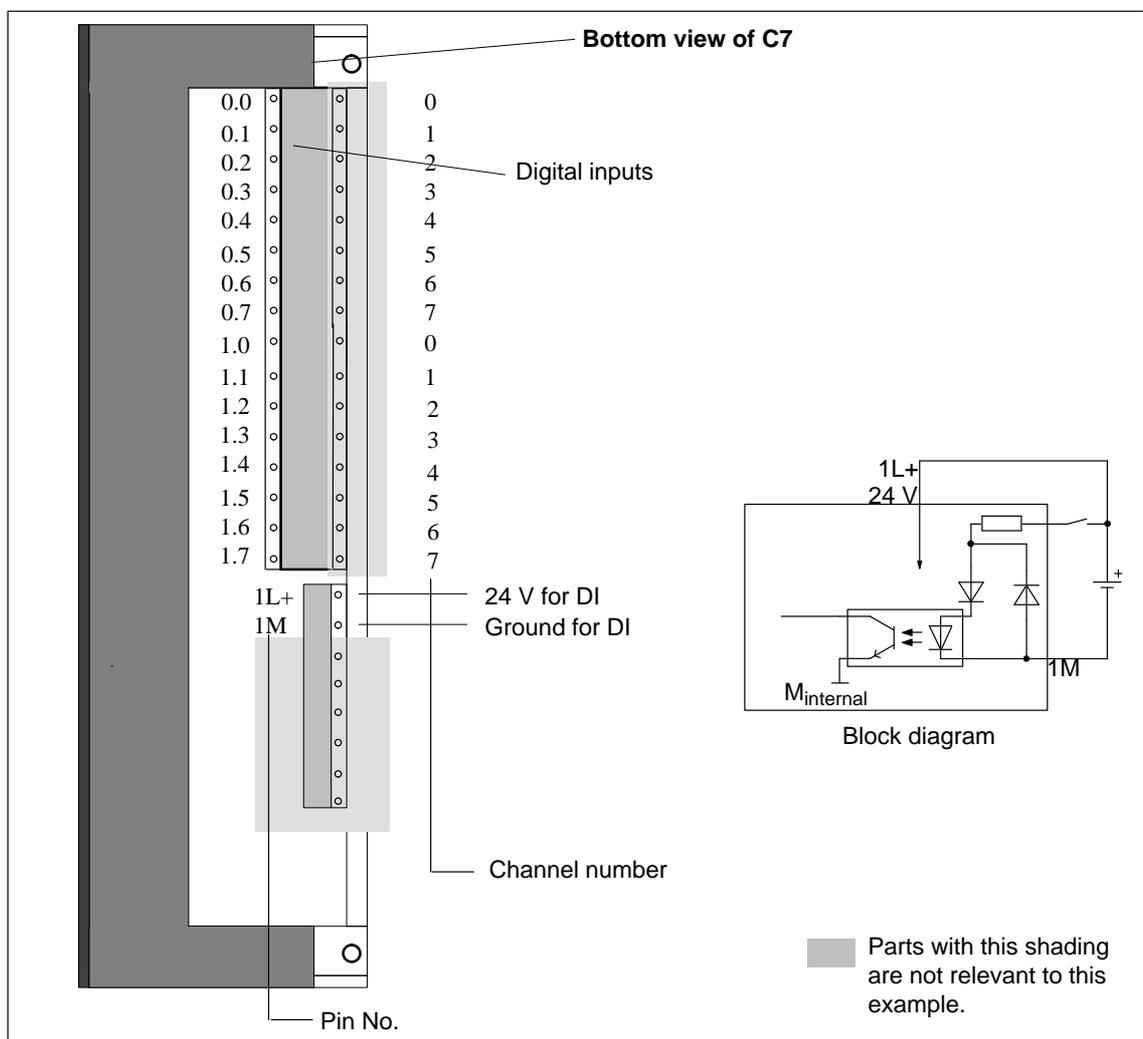
Figure 5-1   Terminal Connection and Block Diagram of the Digital Input Function

Specific Data of the Digital Input Function	
Number of inputs	16
Cable length	
• Unshielded	600 m
Voltages, Currents, Potentials	
Nominal load voltage L +	24 VDC
Number of simultaneously energizable inputs	16
Galvanic isolation	Yes (optocoupler)
• In groups of	16
Permissible potential difference	
• Between the M terminals of the groups	–
• Insulation resistance	500 VDC
Status, Interrupts, Diagnostics	
Interrupts	No
Diagnostic functions	No

Data for Selecting a Sensor	
Input voltage	
• Nominal voltage	24 VDC
• For "1" signal	from 11 to 30 V
• For "0" signal	from -3 to 5 V
Input current	
• For "1" signal	from 6 to 11.5 mA
Input delay time	
• Programmable	No
• At "0" to "1"	from 1.2 to 4.8 ms
• At "1" to "0"	from 1.2 to 4.8 ms
Input characteristic	In accordance with DIN EN 61131-2 (IEC 1131, Part 2)
Type of input in accordance with IEC 1131	Type 2
Connection of 2-wire BEROs	Possible
• Permissible quiescent current	≤ 2 mA

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5.2   Digital Output Function

Characteristics   The digital output function has the following characteristics:

- 16 outputs, isolated.

- Output current: 0.5 A

- Nominal load voltage: 24 VDC

- Suitable for solenoid valves and d.c. contactors.

Special Feature   The digital outputs may be briefly activated under the following conditions:

- Applying the DI/DO power supply (independently of the 24V/GND wiring)

- Applying the 24V/GND, if the DI/DO power supply is already wired.

A pulse can be approximately 50 μs within the permissible output voltage range. You must observe this when using digital outputs in conjunction with high speed counters.

Terminal Connection and Block Diagram

Figure 5-2 shows the terminal connection and the block diagram of the digital outputs.
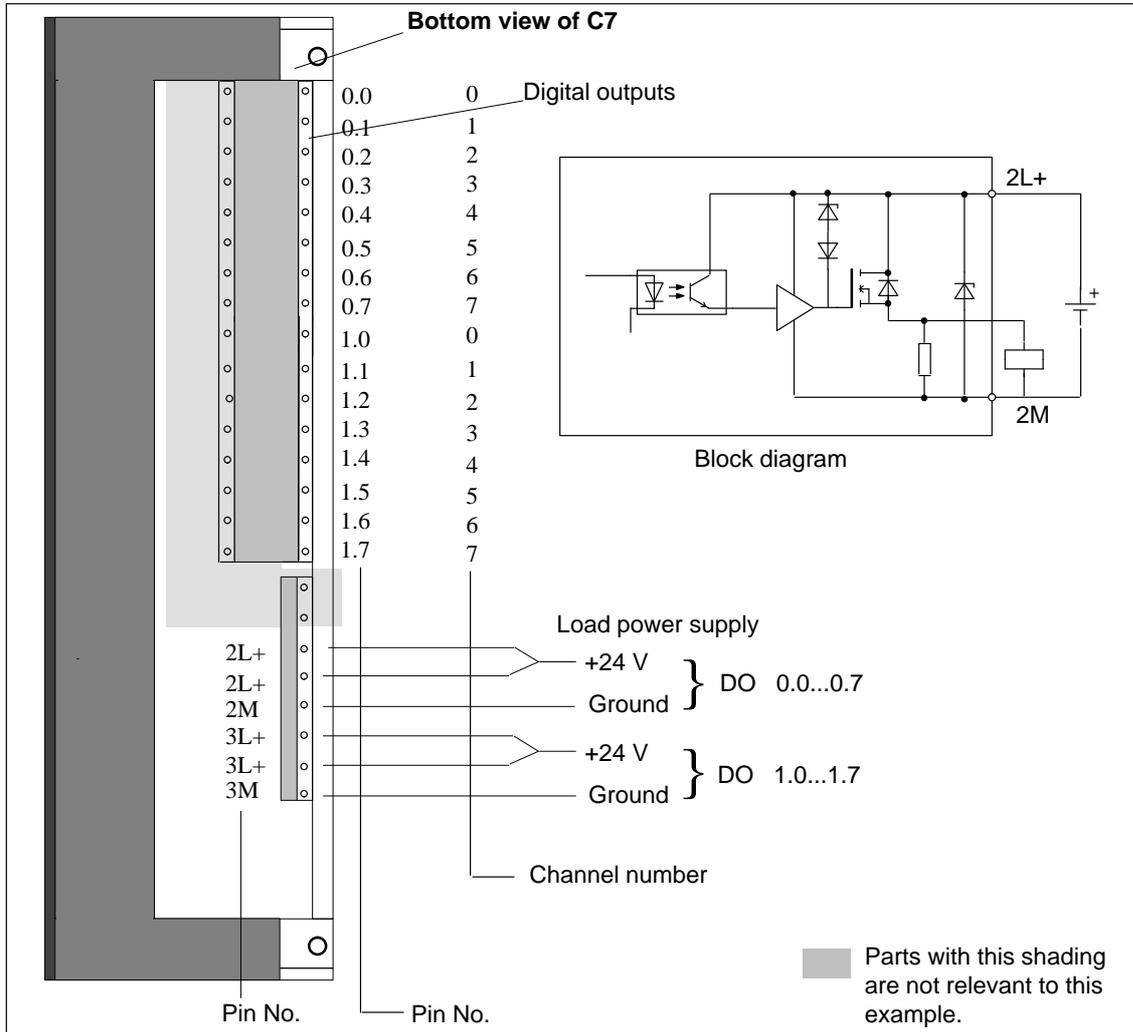

Figure 5-2   Terminal Connection and Block Diagram of the Digital Outputs

Connection of Load Power Supply

If the maximum permissible current is utilized for the load power supply, both pins should be wired to avoid overloading of the contacts. For relatively low currents, wiring of only one +24 V pin is sufficient.

Specific Data of the Digital Output Function	
Number of outputs	16
Cable length	
• Unshielded	600 m
Voltages, Currents, Potentials	
Nominal load voltage L +	24 VDC / 0.5 A
Total current of the outputs (per group)	2 A
Galvanic isolation	Yes (optocoupler)
• In groups of	8
Insulation resistance	500 VDC
Status, Interrupts, Diagnostics	
Interrupts	No
Diagnostic functions	No

Data for Selecting an Actuator	
Output voltage	
• At "1" signal	L + (– 0.8 V)
Output current	
• At "1" signal nominal value	0.5 A
Permissible range	5 mA..0.5 mA
• At "0" signal (quiescent current)	max. 0.5 mA
Lamp load	max. 5 W
Parallel switching of 2 outputs	
• For logic operations	Possible (outputs of the same group only)
• For enhancing performance	Not possible
Activating a digital input	Yes
Max. switching frequency	
• With resistive load/lamp load	100 Hz
• With inductive load	0.5 Hz
Inductive cutoff voltage limited (internally) to	L + (– 48 V)
Short-circuit protection of the outputs	Yes, electronically timed
• Operating point	1 A

5.3   Status Bits of the DI/DO

Overview

The process image of the digital I/O can be displayed using a C7 system function. There are two different states:

- Inputs are read directly from the process and are displayed in BIN format.

- Outputs are read from the process image (PIQ) and are displayed in BIN format.

In STOP mode, the real process status for the outputs = 0. The process image displayed may differ from this; it is the last thing to be set by the control program.

Selecting the DI/ DO Status Display

You do not require any server password level to select the DI/DO status display. You can select the function by pressing [AZ] [HELP] simultaneously.
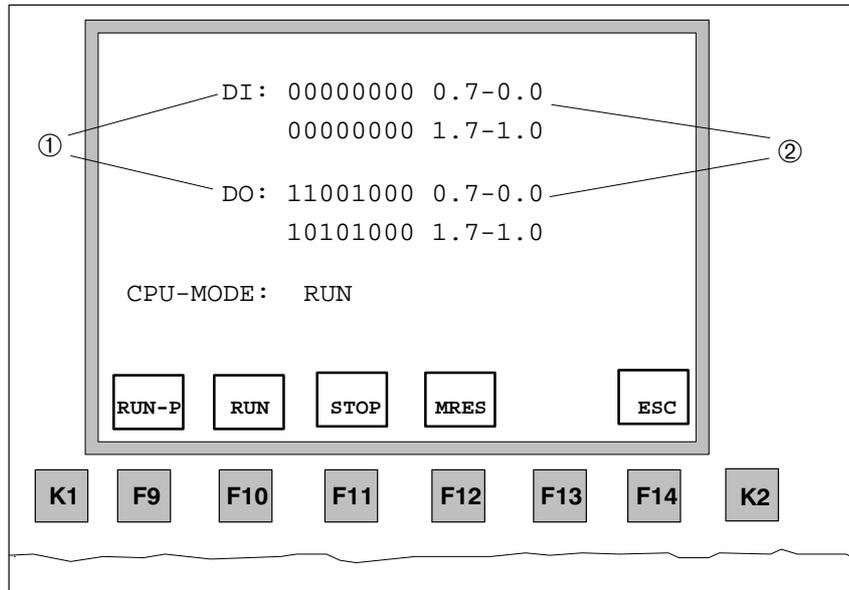
Figure 5-3   DI/DO Status Bits in a C7

Table 5-1   Explanation of the DI/DO Display in Figure 5-3

Point	Explanation
①	Signal state of the DI/DO • 1 DI/DO set • 0 DI/DO reset
②	Pin number from - to. See also connector pin assignment in Section 2.5.

Note

The values of the DI/DO are read and displayed every 500 ms (default value). Changes which occur between these times are not displayed.

Exiting the DI/DO Status Display

Exit the DI/DO status display by pressing F14 .

C7 Analog Input/Output

6

Ungrounded Configuration

The C7 cannot be installed in an ungrounded configuration.

6.1 Connecting Transducers to Analog Inputs

Overview

You can connect various types of transducers to the analog inputs:

- Voltage transducers
- Current transducers

Cables for Analog Signals

To reduce electrical interference, you should use twisted-pair shielded cables for the analog signals. The shield of the analog signal cables should be grounded at both cable ends. If there are potential differences between the cable ends, an equipotential bonding current can flow over the shield. This can interfere with the analog signals. In such a case, you should ground the shield at one end of the cable only.

Isolated Analog Input

The analog input is isolated and so there is no electrical connection between the reference point of the measuring circuit M_{ANA} and the M terminal of the C7 power supply (see Figure 6-1).

A potential difference V_{ISO} can occur between the reference point of the measuring circuit M_{ANA} and the M terminal of the C7. Make sure that V_{ISO} does not exceed the permissible value. Where it is possible that the permissible value might be exceeded (see technical specifications), establish a connection between the M_{ANA} terminal and the M terminal of the C7.

Connecting Transducers to Analog Inputs

A potential difference V_{CM} (common mode voltage) may occur between the measuring line AIx-M of the input channels and the reference point of the measuring circuit M_{ANA}. However, this potential difference must not exceed the permissible value. Where it is possible that the permissible value for V_{CM} might be exceeded, or where you cannot determine the difference in potential accurately, you must connect AIx-M to M_{ANA}. Please observe this also for the unused inputs.

Abbreviations

The abbreviations used in Figures 6-1 to 6-3 have the following meanings:

AIx-X:	Measuring line AIx-U or AIx-I
AIx-M:	Reference potential of the measuring line
M_{ANA}:	Reference potential of the analog measuring circuit
M:	Ground terminal of the C7
V_{CM}:	Potential difference between inputs and M_{ANA}
V_{ISO}:	Potential difference between M_{ANA} and the M terminal of the C7

Isolated Transducers

The isolated transducers are not connected with the local ground potential. They can be operated free of potential. Local conditions or interference can cause potential differences V_{CM} (static or dynamic) to occur between the measuring lines M of the input channels and the reference point of the measuring circuit M_{ANA}. However, this potential difference must not exceed the permissible value. Where it is possible that the permissible value for V_{CM} might be exceeded, or where you cannot determine the difference in potential accurately, you must connect AIx-M to M_{ANA}.

Figure 6-1 shows the principle of connecting isolated transducers to an isolated analog input module.

Figure 6-1   Connecting Isolated Transducers to an Isolated Analog Input Module

Non-Isolated Transducers

The non-isolated transducers are connected on-site with the ground potential. Depending on local conditions or interference, potential differences (static or dynamic) can occur between the locally distributed measuring points. To prevent these potential differences, you must provide equipotential bonding conductors between the measured value points.

In addition, potential differences V_{CM} (static or dynamic) can arise between the measuring lines AIx-M of the input channels and the reference point of the measuring circuit M_{ANA}. However, these potential differences must not exceed the permitted value. Where it is possible that the permissible value for V_{CM} might be exceeded, or where you cannot determine the difference in potential accurately, you must connect AIx-M to M_{ANA}.

Figure 6-2 shows the principle of connecting non-isolated transducers to an isolated analog input module.
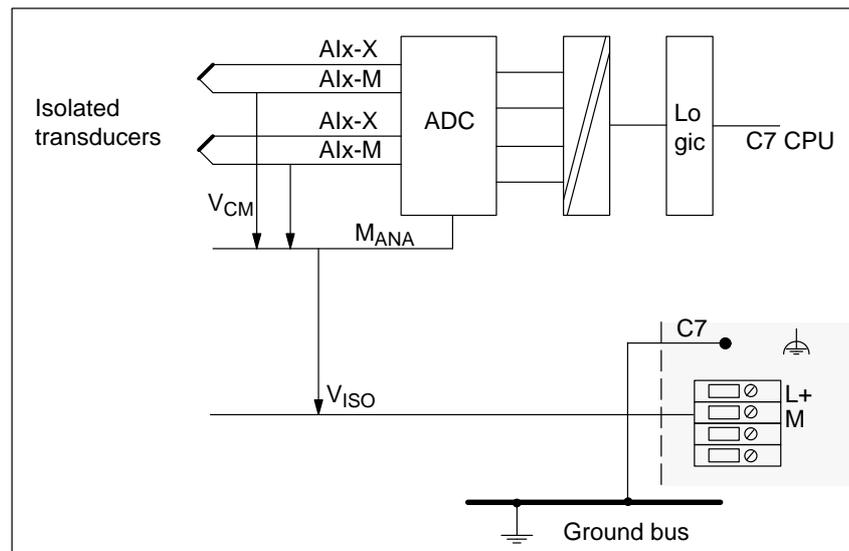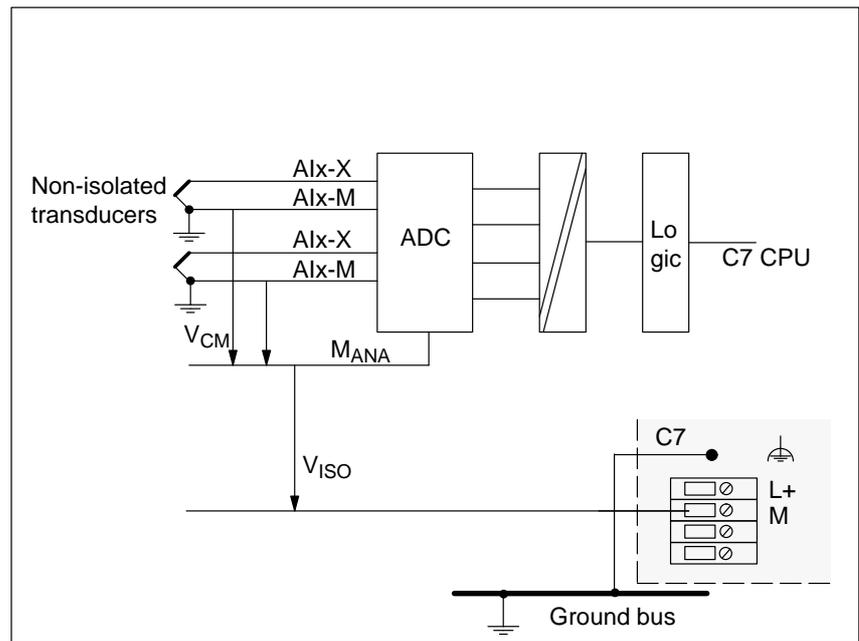
Figure 6-2   Connection of Non-Isolated Transducers to an Analog Input Module

6.1.1   Connecting Voltage and Current Transducers

Abbreviations and Mnemonics

The abbreviations and mnemonics used in Figures 6-3 to 6-4 have the following meanings:

AIx-X: Measuring line AIx-I or AIx-U

AIx-M: Reference potential of the measuring line

M_{ANA}:   Reference potential of the analog measuring circuit

Connecting Voltage Transducers

Figure 6-3 shows the connection of voltage transducers to an isolated analog input.
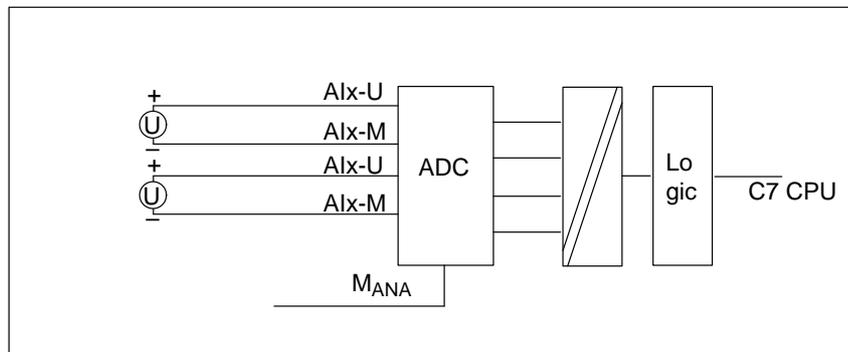
Figure 6-3   Connecting Voltage Transducers to an Isolated Analog Input

Connecting Current Transducers as 4-Wire Transducers

4-wire transducers possess a separate voltage supply. Figure 6-4 shows the connection of current transducers as 4-wire transducers to a non-isolated analog input module.
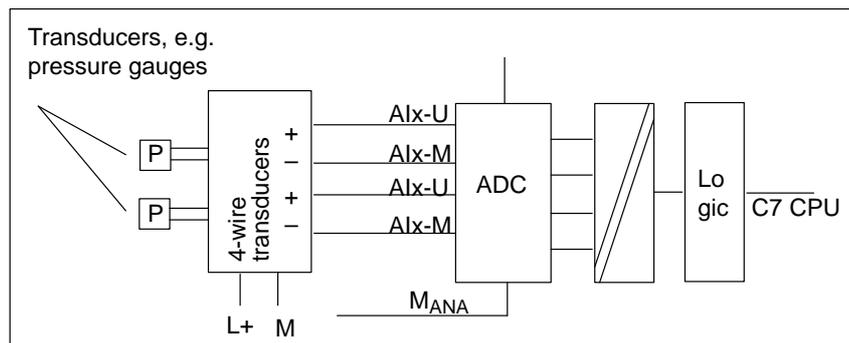
Figure 6-4   Connecting 4-Wire Transducers to a Non-Isolated Analog Input Module

6.2   Connecting Loads/Actuators to the Analog Output

Overview

You can provide loads/actuators with current or voltage using the analog output.

Cables for Analog Signals

To reduce electrical interference, you should use twisted-pair shielded cables for the analog signals. The shield of the analog signal cables should be grounded at both cable ends. If there are potential differences between the cable ends, an equipotential bonding current can flow over the shield. This can interfere with the analog signals. In such a case, you should ground the shield at one end of the cable only.

Isolated Analog Output

The analog output is isolated and so there is no electrical connection between the reference point of the AO-M analog circuit and the M terminal of the C7.

A potential difference V_{ISO} can occur between the reference point of the analog circuit M_{ANA} and the M terminal of the C7. Make sure that V_{ISO} does not exceed the permissible value. Where it is possible that the permissible value might be exceeded (see technical specifications), establish a connection between the AO-M terminal and the M terminal of the C7.

Abbreviations and Mnemonics

The abbreviations and mnemonics in the Figures 6-5 to 6-6 have the following meanings:

AO-I:	Analog output: current
AO-U:	Analog output: voltage
R_L:	Load/actuator
AO-M :	Ground terminal (reference potential of the analog output)
L+:	Terminal for 24 VDC supply voltage
M_{ISO}:	Potential difference between M_{ANA} and the M terminal of the C7.

Figures 6-5 to 6-6 show you how to connect loads/actuators to the current and/or voltage outputs of the analog output module.

Connecting Loads to a Current Output

You must connect loads to a current output at Q_I and the reference point of the analog circuit M_{ANA}

Figure 6-5 shows the principle of connecting loads to a current output of an isolated analog output module.

Figure 6-5   Connecting Loads to a Current Output of an Isolated Analog Output Module

6

Connecting Loads to a Voltage Output

Connection of loads to a voltage output is only possible in 2-wire circuits as there is only one output.

2-Wire Connection   2-wire connection of loads to a voltage output is carried out at terminal Q_V and the reference point of the measuring circuit M_{ANA}.

Figure 6-6 shows the principle of connecting loads to a voltage output of a non-isolated analog output module with 2-wire connection.
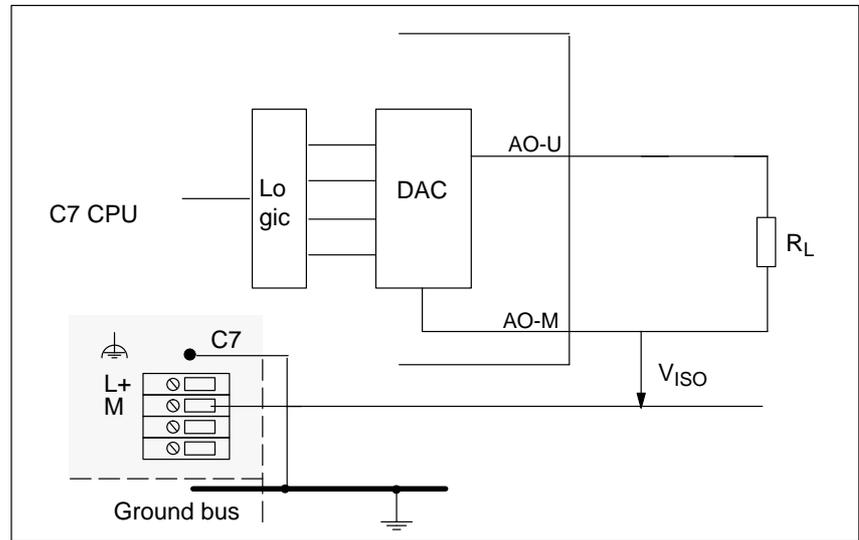
Figure 6-6   2-Wire Connection of Loads to a Voltage Output of an Analog Output Module

6.3   Analog Input Function

Overview

This section contains

- The characteristics of the analog input module

- The technical specifications of the analog input module

You will learn

- How to start up the analog input module

- The measuring ranges provided by the analog input module

- The parameters you can use to influence the characteristics of the analog input module.

Available Measurement Types

The following measurement types are available on the analog input module:

- Voltage measurement

- Current measurement

Measuring Ranges

The measuring ranges are:

- Voltage: ± 10 V

- Current: ± 20 mA, 4 to 20 mA

Wire Break Check

For the current range 4 to 20 mA, a current of < 1.6 mA is interpreted per software as a wire break (see Volume 2, Section 5.2).

Measuring Ranges for 4-Wire Transducers

Measuring ranges for current measurement with 4-wire transducers:

- ± 20 mA

- 4 to 20 mA

6.3.1 Characteristics and Technical Specifications of the Analog Input Module

Characteristics
The analog input module has the following characteristics:

- 4 inputs

- Measured value resolution

    – 12 bits including sign

- Measurement type selectable:

    – Voltage

    – Current

- Choice of measuring range per input

- Diagnostics which can be assigned parameters

- An interrupt which can be assigned parameters

- An interrupt cycle which can be assigned parameters

- Isolated

Terminal Connection Diagram

Figure 6-7 shows the terminal connection diagram of the analog inputs.
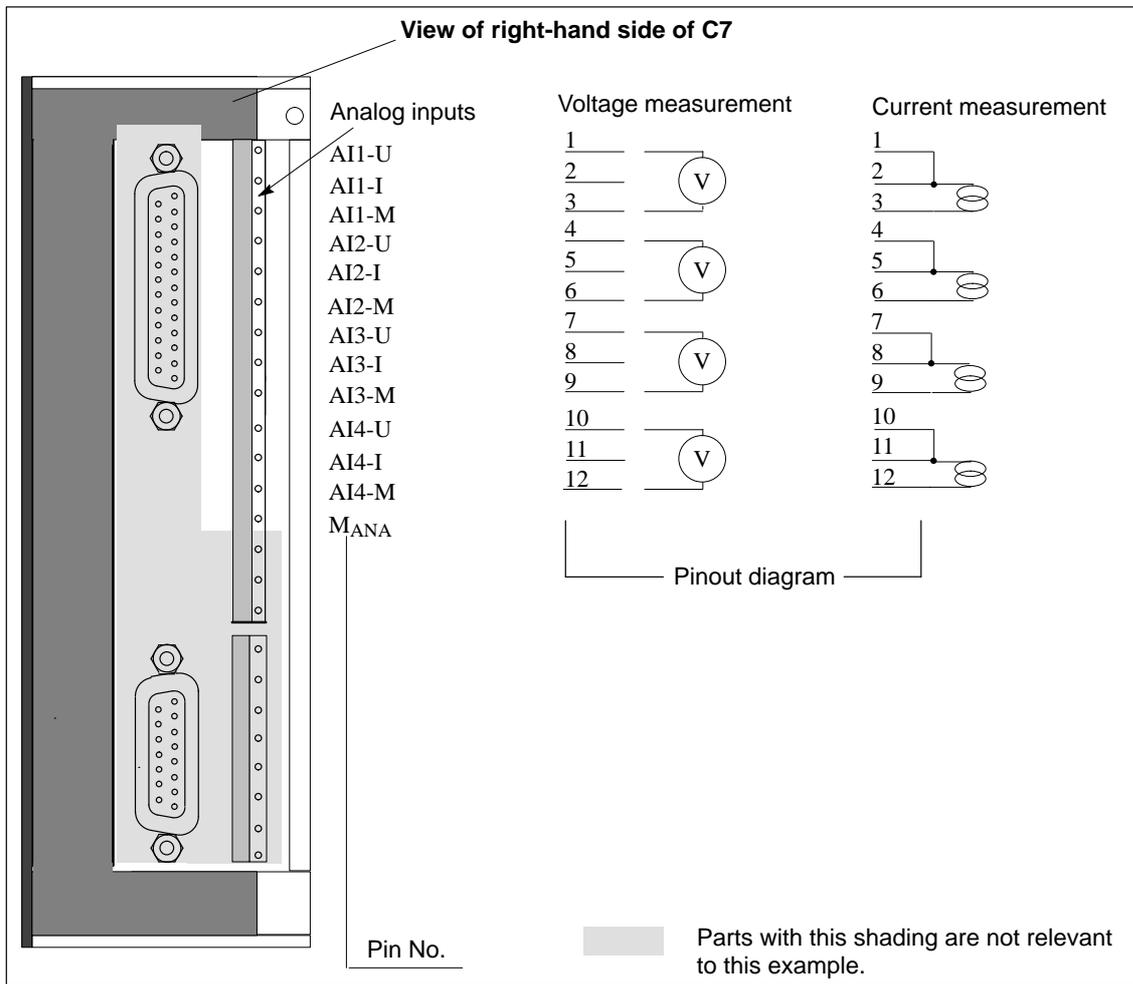
Figure 6-7   Terminal Connection Diagram of the Analog Inputs

⚠️ **Caution**

The jumper between pins $1 + 2$, $4 + 5$, $7 + 8$, $10 + 11$ must also be wired in the case of current measurement.

Channels   Three pins are combined to form a channel.

Table 6-1   Channels of the Analog Input Module

Pin No.	Value	Channel
AI1–U	Voltage input	Channel 1 (AI1)
AI1–I	Current input	
AI1–M	Reference potential	
AI2–U	Voltage input	Channel 2 (AI2)
AI2–I	Current input	
AI2–M	Reference potential	
AI3–U	Voltage input	Channel 3 (AI3)
AI3–I	Current input	
AI3–M	Reference potential	
AI4–U	Voltage input	Channel 4 (AI4)
AI4–I	Current input	
AI4–M	Reference potential	

Connection of an   Only one analog sensor can be connected to an analog input channel.
Analog Input
Voltage Measurement

Figure 6-8   Connection of a Channel for Voltage Measurement

Current Measurement

When connecting a current measurement channel, the voltage pin and the current pin are to be jumpered.
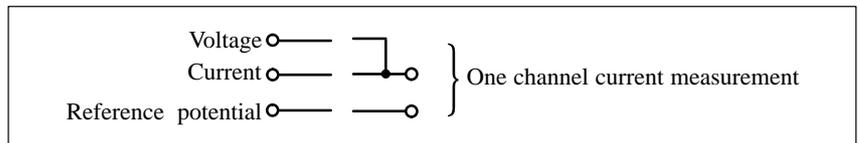
Figure 6-9   Connection of a Channel for Current Measurement

Block Diagram   Figure 6-10 shows the block diagram of the analog input module. The input resistances are 140 Ω / 125 mW. You will find detailed technical specifications of the analog input module below.
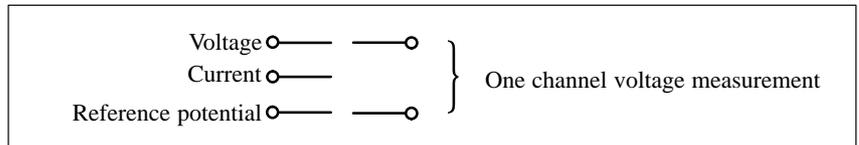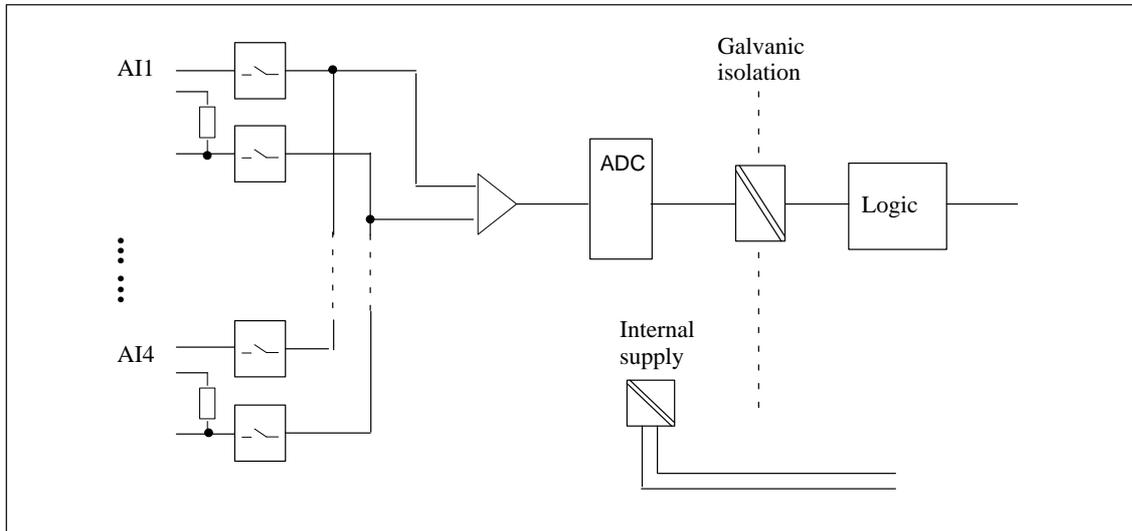

Figure 6-10   Block Diagram of the Analog Input Module

Technical Specifications

Specific Data of the Analog Input Function	
Number of inputs	4
Cable length, shielded	200 m
Voltages, Currents, Potentials	
Nominal load voltage L +	24 VDC
• Polarity reversal protection	Yes
Voltage supply to the transducers	
• Short circuit protection	Yes
Galvanic isolation (analog I/O to electronics)	Yes
Permissible potential difference	
• Between reference potential of inputs and M_{ANA} (V_{CM}) if signal = 0 V	2.5 VDC
• Insulation resistance	500 VDC

Analog Value Generation	
Measurement principle	Momentary value
• Basic conversion time	2.5 ms
• Resolution in bit incl. sign (incl. overrange)	12
• Transition frequency input filter	132 kHz
Measurement ranges: Voltage Current	V/A at different pins –> no coding pin –10...10 V –20...20 mA, 4...20 mA
Measurement tolerance	± 1% of the end value

6

Interference Suppression, Error Limits	
Interference voltage suppression for f = n × (f1 ± 1 %), (f1 = interference frequencies)	> 70 dB
• Common mode interference (V_{PP} < 2.5 V)	> 40 dB
• Series-mode interference (peak value of interference < nominal value of input range)	
Cross-talk between the inputs	
• At 50 Hz	50 dB
• At 60 Hz	50 dB
Basic error limit (operational limit at 25 °C)	1%

Data for Selecting a Sensor		
Input ranges (nominal values) / input resistance		
• Voltage	± 10 V;	/100 kΩ
• Current	± 20 mA;	<250 Ω
	4 to 20 mA;	<250 Ω
Permissible input voltage for voltage input (destruction limit)	18 V	
Permissible input current for current input (destruction limit)	30 mA	
Connection of signal sensors		
• for voltage measurement	Possible	
• for current measurement as 4-wire transducer	Possible	
Temperature compensation	Balanced by continuous on-line calibration	

Status, Interrupts, Diagnostics	
Interrupts	
• Interrupt cycle	Yes, can be assigned parameters
• Diagnostic interrupt	Yes, can be assigned parameters
Diagnostic functions	Yes, can be assigned parameters
• Diagnostic information can be read	Yes
Time intervals	Yes, can be assigned parameters
Wire break detection	Can be assigned parameters (using software) at measuring range 4 to 20 mA

6.4   Analog Output Function

Overview

This section contains

- The characteristics of the analog output function

- The technical specifications of the analog output function

You will learn

- How to start up the analog output function

- The various ranges of the analog output function

- The parameters you can use to influence the characteristics of the analog output function

- The technical specifications of the analog output function.

Characteristics

The output function has the following characteristics:

- 1 output

- The output can be selected either as

    – Voltage output or

    – Current output

- Resolution 12 bits including sign

- Diagnostics which can be assigned parameters

- Isolated

6

Note

If you modify the output ranges during operation of the analog output function, intermediate values can arise at the output!

Terminal Connection Diagram

Figure 6-11 shows the terminal connection diagram of the analog output function.
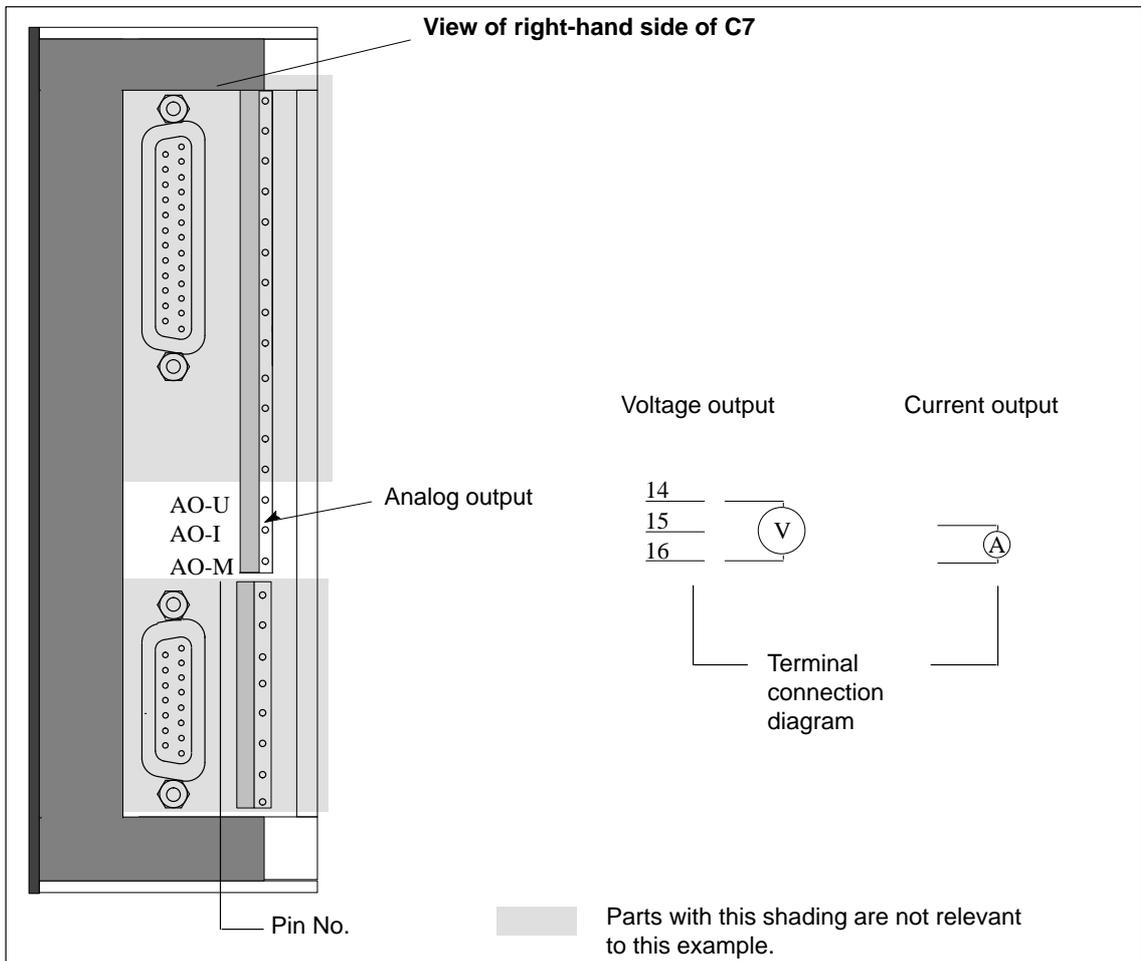
Figure 6-11   Terminal Connection Diagram of the Analog Output Function

Block Diagram

Figure 6-12 shows the block diagram of the analog output module. You will find detailed technical specifications of the analog output module on the following pages.
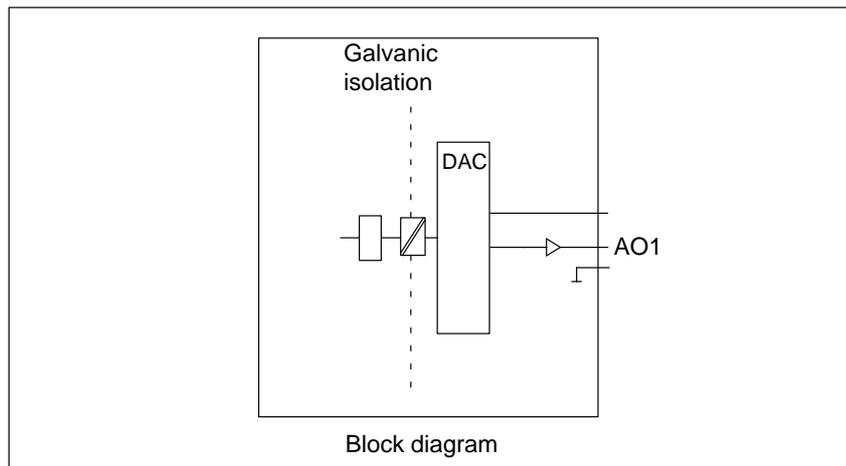
Figure 6-12   Block Diagram of the Analog Output Function

Technical Specifications

Specific Data of the Analog Output	
Number of outputs	1
Cable length, shielded	200 m
Voltages, Currents, Potentials	
Galvanic isolation	Yes
Insulation resistance	500 VDC
Measurement ranges:	V/A at different pins –> no coding pin
Voltage	± 10 V
Current	± 20 mA, 4...20 mA
Analog Value Generation	
Resolution (including overrange)	
• ± 10 V; ± 20 mA; 4 to 20 mA	12 bits incl. sign
Conversion time	max. 0.8 ms
Settling time	
• For resistive load	0.1 ms
• For capacitive load	3.3 ms
• For inductive load	0.5 ms
Substitute value injectable	Yes, can be assigned parameters

Interference Suppression, Error Limits	
Measuring tolerance	$\pm 1\%$ of end value
Basic error limit (operational limit at 25 °C, referred to output range)	
• Voltage	$\pm 1\%$
• Current	$\pm 1\%$
Output ripple (referred to output range)	$\pm 0.05\%$
Status, Interrupts, Diagnostics	
Interrupts	
• Diagnostic interrupt	Yes, can be assigned parameters
Diagnostic functions	Yes, can be assigned parameters
• Diagnostic information can be read	Yes, group error/fault

6

Data for Selecting an Actuator	
Output ranges (nominal values)	± 10 V ± 20 mA from 4 to 20 mA
Load resistance	
• At voltage outputs	min. 2 k Ω
• At current outputs	max. 500 Ω
• Capacitive Load	max. 1 µF
• Inductive Load	max. 1 mH
Voltage output	
• Short-circuit protection	Yes (countervoltage-proof)
• Short-circuit current	max. 25 mA
Current output	
• Idle voltage	min. ± 15 V
Connection of actuators	
• For voltage output 2-wire connection	Possible
• For current output 2-wire connection	Possible
Supply of sensors	External (not via C7)

Universal Inputs

7

Universal Inputs This chapter describes the technical specifications and characteristics of the universal inputs for the C7.

Overview

The C7 has four digital universal inputs that provide the following functionality:

- Interrupt input
- Counter input
- Frequency/period duration counter input
- Digital input

These input functions can be set by assigning them parameters.

Terminal Connection Diagram

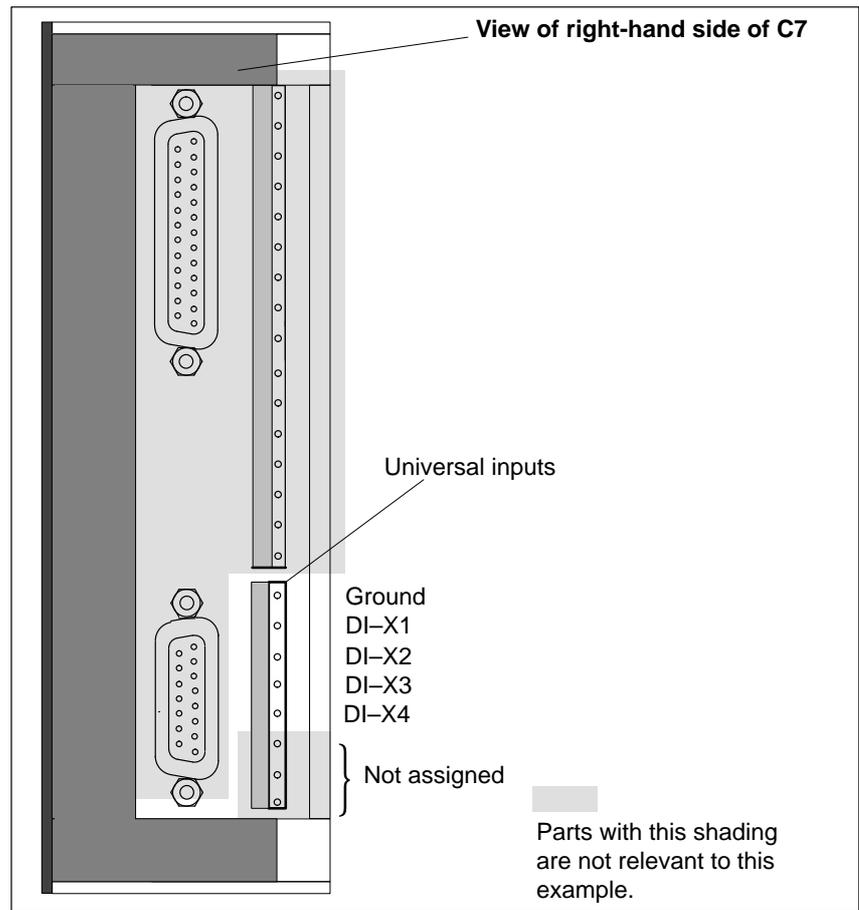Figure 7-1 shows the pin assignments of the universal inputs.

Figure 7-1   Pin Assignments of the Universal Inputs

Pin Assignments of the Universal Inputs

The pin assignments of the universal inputs are as follows:

Table 7-1   Assignments of the Universal Inputs

Pin No.	Function
M	Relevant ground
DI–X1	Universal input 1 (interrupt input, digital input, or counter input)
DI–X2	Universal input 2 (interrupt input, digital input, or counter input)
DI–X3	Universal input 3 (interrupt input, digital input, counter input, frequency counter input or period duration counter input)
DI–X4	Universal input 4 (interrupt or digital input)
	Not connected
	Not connected
	Not connected

Assigning Parameters to the Inputs

The universal inputs are set with the software. This is done using the STEP 7 application *Hardware Configuration*. You use this application to determine which function the individual input is to execute (see Table 7-1).

Interrupt Input

If this function is set, the input responds like a normal interrupt input, that is, a hardware interrupt is triggered in the C7 CPU as a response to the edge with assigned parameters.

Digital Input

If this function is set, the input responds like a normal digital input (see Section 5.2). The only difference here is that the current process signal is not automatically fed to the control program but must first be read in from the I/O.

Counter Input

These universal inputs enable you to capture counter pulses up to a frequency of 10 kHz. The counter can count either up or down.

Frequency Counter

This enables you to count pulses within a programmed length of time. From this you can calculate a frequency ≤ 10 kHz.

Period Duration Counter

This function enables you to count fixed timer ticks between two equal edges. From this you can calculate the duration of an interval period.

7

Technical Specifications of the Universal Inputs

Specific Data of the Universal Inputs	
Number of inputs	4
Cable length, shielded	1000 m
unshielded	600 m
Voltages, Currents, Potentials	
Nominal load voltage L +	24 VDC
Number of simultaneously energizable inputs	4
Galvanic isolation	No
Function, Interrupts, Diagnostics	
Interrupts	Can be assigned parameters
Counter functions	Can be assigned parameters
Max. counter frequency	10 kHz Module standard diagnostics in conjunction with analog I/O. No channel-specific diagnostics
Counters	Max. 3
• Principle	Edge counting
• Counter range	up 0 to 65535 down 65535 to 0
• Limit value (setpoint) specification	1 value per counter
• Counter interrupt of up counter	When limit value is reached
• Counter interrupt of down counter	When "0" is reached
• Enable	In the program
Period Duration Counter	Max. 1
• Principle	Counting between fixed time units from two positive edges
• Counter range	0 to 16777215
• Max. period duration	8.395 s or 0.119 Hz
Frequency Counter	Max. 1
• Principle	Counting of pulses within a time period
• Counter range	0 to 16777215
• Gate width	0, 1s, 10s (can be set)
• Max. frequency	10 kHz; limited by input filter

Data for Selecting a Sensor	
Input voltage	
• Nominal voltage	24 VDC
• For "1" signal	from 11 to 30 V
• For "0" signal	from –3 to 5 V
Input current	
• At "1" signal	from 2 to 8 mA
Input delay time	
• Programmable	No
• At "0" to "1"	approx. 0.01 ms
• At "1" to "0"	approx. 0.01 ms
Input characteristic	In accordance with IEC 1131, Part 2
Type of input in accordance with IEC 1131	Type 2
Input current	
• At "1" signal	From 6 to 11.5 mA

Maintenance

8

8.1 Changing and Disposing of the Back-Up Battery

**Change During
Power On Only**

You must always change the back-up battery during power on. This prevents any data loss in the internal user memory while changing the battery.

**Changing the
Back-Up Battery in
the C7**

Note

The data in the internal user memory will be lost if you change the back-up battery during power off!

Change the back-up battery during power on only.

Proceed as follows to change the back-up battery:

Step	Action
1.	Unscrew the cover of the C7 battery compartment (see Figure 8-1).
2.	Lift the cover up and to the right (see Figure 8-2). Make sure you raise the cover only as far as the battery connections allow.
3.	Remove the battery connector of the old back-up battery.
4.	Loosen the cable binders with which the back-up battery is attached to the cover (see Figure 8-3).
5.	Attach the new back-up battery with the cable binders to the cover.
6.	Plug the battery connector of the new back-up battery into the relevant socket in the battery compartment of the C7. The notch on the battery connector must point to the left (see Figure 8-3).
7.	Close the battery cover with the springs to the left onto the C7 and screw the cover tight again.

Note

Do not touch any interior components of the C7 with your hands or a metal part (screwdriver). Electrical components and printed circuit boards are not sufficiently protected for this purpose. Please observe ESD guidelines.
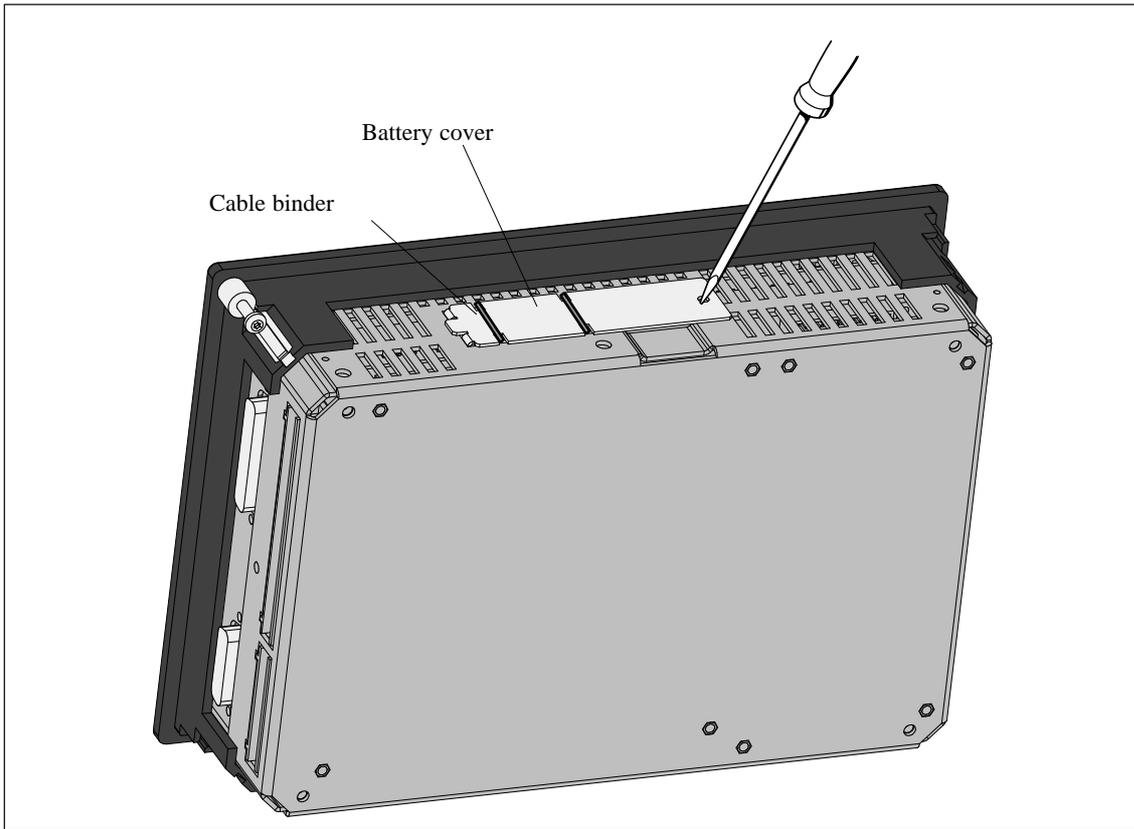
Figure 8-1   Battery Cover Before Opening
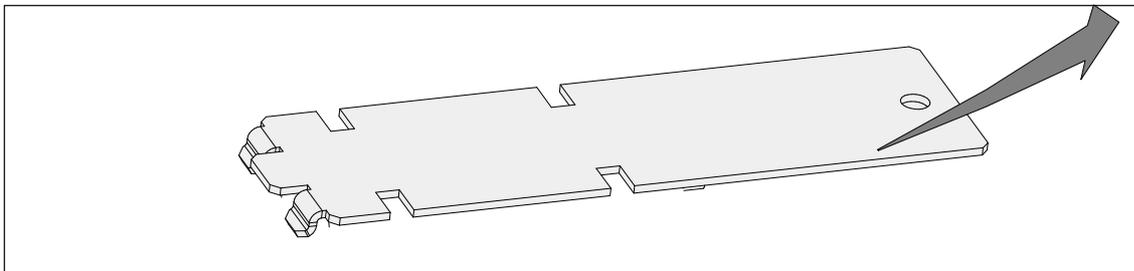
Figure 8-2   Battery Cover
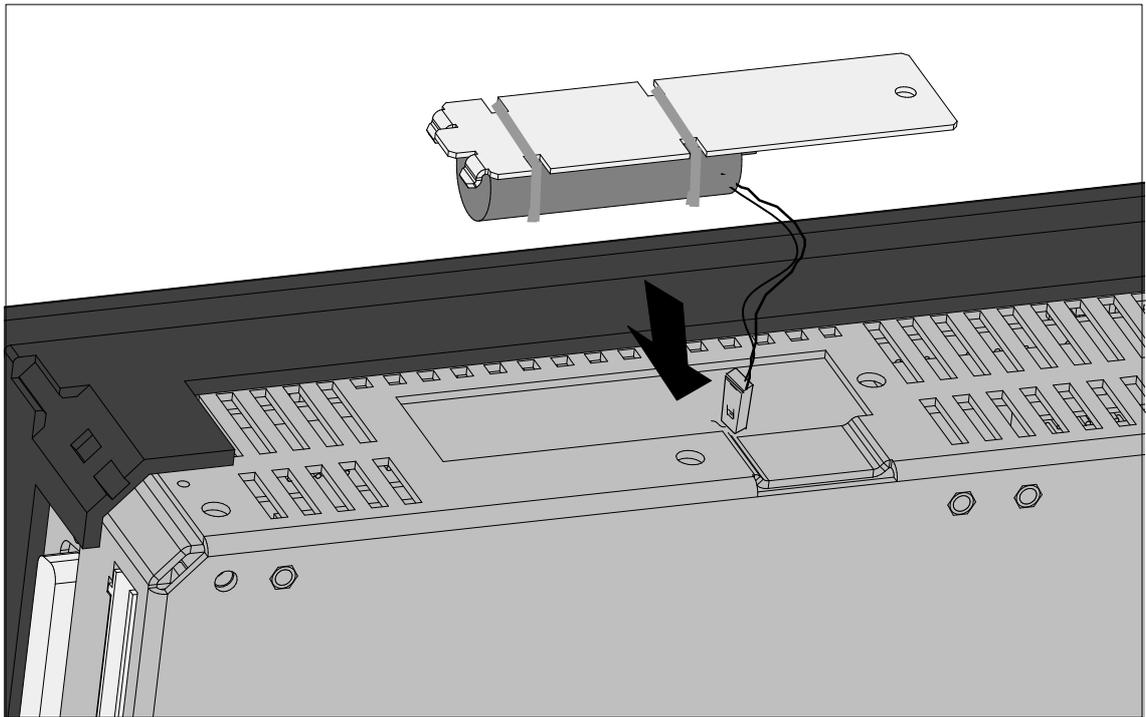
Figure 8-3   Inserting the Back-Up Battery

How Often Should You Change the Battery?   We recommend that you change the battery every year.

Disposal   Please observe national regulations/guidelines concerning the disposal of back-up batteries.

Storage of Back-Up Batteries   Store back-up batteries in a cool, dry place.

Back-up batteries can be stored for up to five years.

⚠   **Warning**

Back-up batteries can ignite or explode and constitute a serious fire hazard if they are heated or damaged!

Store back-up batteries in a cool, dry place.

Rules for Handling and Using Back-Up Batteries

To prevent hazards when using back-up batteries, you must observe the following rules:

⚠️ **Warning**

The use of back-up batteries may result in injury and damage.

Wrongly handled back-up batteries can explode or cause serious burns.

Do not
- recharge
- heat
- burn
- drill
- crush
- short-circuit

back-up batteries.

8

8.2 Replacing the C7

Introduction   On-site repair of the C7 has not been provided for. For this reason, a defective C7 must be replaced.

Prerequisite   The following prerequisites must be met for replacing a C7:

Hardware

- Programming device/PC with MPI interface module

- PG/PC cable or PC/MPI cable

Development tools

- STEP 7

- ProTool

User software (stored outside the C7)

- User configuration

- User control program (if data from the C7 CPU can no longer be read).

Removal   Proceed as follows:

- Mechanical removal takes place in the opposite order to the installation.

- Connect a programming device/PC to the MPI.

- Use STEP 7 to transfer the user program stored in the C7 CPU to a programming device/PC.
  If the C7 CPU is defective and the user program can no longer be displayed, remove the C7 without any further safety measures.

- The configuration loaded onto the C7 cannot be displayed. It must be available on a programming device/PC.

Installation   As soon as you have a new C7, install it as follows:

1. The mechanical and electrical installation is as described in the manual.

2. Connect a programming device/PC to the MPI.

3. Perform a memory reset of the C7 as described.

4. Transfer the previously saved user program from the programming device/PC with the relevant data to the C7 CPU (using STEP 7).

5. Load your configuration with ProTool into the C7.

6. Start the user program.

General Technical Specifications

A

What Are General Technical Specifications?

This chapter lists the general technical specifications of the C7.

These general technical specifications contain the standards and test values that the C7 conforms to, or the criteria against which the C7 has been tested.

Summary of Sections

In Section	You Will Find	On Page
A.1	Technical Specifications	A-2
A.2	Notes on the CE Marking	A-5
A.3	Notes for the Machine Manufacturer	A-6
A.4	Transport and Storage Conditions for Back-Up Batteries	A-7

A.1 Technical Specifications

The table contains the technical specifications of the overall unit. The data for the I/O can be found in the relevant chapters.

Table A-1   Technical Specifications of the C7

Criterion	Technical Specifications
C7-626 C7-626 DP	
Order number	C7-626 : 6ES7626-1AG00-0AE3 C7-626 DP : 6ES7626-2AG00-0AE3
Dimensions: C7 mounting dimensions	240 x 168 x 69 mm (H x W x D) 231 x 159 mm
Weight	C7-626: 1350g C7-626 DP: 1390g
C7-626, C7-626 DP display	FSTN display, graphics capacity, 360 x 240 Pixel, CCFL back-lighting
Keyboard	Membrane keyboard with metal domes, 48 keys, 28 integrated LEDs
Serial interface	V.24 (printer)
Multipoint interface	Standard MPI
Back-up battery	Back-up time approx. 1 year
C7 OP	
Flash memory (configuration memory)	C7-626: 128 Kbytes
Work memory	128 Kbytes
Power supply	
Supply voltage (V_{CM})	24V DC; (20.4 to 30.2V DC; safety extra-low voltage) The C7-626 and C7-626 DP have no internal protection against high-energy surge pulses in the μs range. For information on protection regulations, consult the manual **/70/**, Chapter 4.
• Polarized input voltage connection	Yes
• Voltage interruption (can be jumpered)	$\geq 20\text{ms}$
Current consumption (I_N)	1000 mA max.
Load current power supply	
Supply voltage (V_{CM})	24 VDC; (20.4...30 DC, 2V, safety extra-low voltage SELV) The C7-626 and C7-626 DP have no integrated protection against high-energy surge pulses in the μs range. For information on protection regulations, consult the manual **/70/**, Chapter 4.
• Input voltage Protected against polarity reversal	Yes ≥ 20 ms

Table A-1   Technical Specifications of the C7

Criterion	Technical Specifications
Safety	
Standardization	DIN EN 61131-2 ≙ IEC 1131-2
Foreign bodies and water protection • Device front • Device housing	IP 65 to IEC 529 IP 20 to IEC 529
Electromagnetic compatibility (EMC)	
Emitted interference Limit value class	B in accordance with EN 55022≙ CISPR 22
Conducted interference on AC voltage supply lines	±2kV (in accordance with IEC 801-4/IEC 1000-4-4; burst) ±1kV (in accordance with IEC 801-5/IEC 1000-4-5; μs pulse / line to line)* ±2kV (in accordance with IEC 801-5/IEC 1000-4-5; μs pulse / line to ground)* * With protective element lightning conductor KT type AD 24 V from the Dehn company.
Noise immunity on signal lines	±2kV (in accordance with IEC 801-4/IEC 1000-4-4; burst) ±1kV (in accordance with IEC 801-5/IEC 1000-4-5; μs pulse / line to line)* ±2kV (in accordance with IEC 801-5/IEC 1000-4-5; μs pulse / line to ground)* * With unshielded signal lines with protective element lightning conductor KT type AD 24 V from the Dehn company.
Noise immunity against discharge	±6kV, discharge on contact (in accordance with IEC 801-2/IEC 1000-4-2; ESD) ±8kV, atmospheric discharge (in accordance with IEC 801-2/IEC 1000-4-2; ESD)
Immunity to high-frequency radiation	10V/m with 80% amplitude modulation with 1 kHz, 10kHz-80MHz (in accordance with EN 50 141) 10V/m with 80% amplitude modulation with 1 kHz, 80kHz-1GHz (in accordance with EN 50 140) 10V/m, pulse-modulated, 50 % c.d.f. with 900 MHz (to EN 50 140)
Climatic conditions	

Temperature
     Operating
 	
     Non-operating
	Tested in accordance with DIN IEC 68-2-1, DIN IEC 68-2-2
	± 0°C to +45°C for horizontal installation
	± 0°C to +50°C for vertical installation
	          Note:
	          With forced air ventilation, a maximum of 45°C can be obtained
	          if installed horizontally.
	
	–20°C to +70°C

Relative humidity
     Operating
     Non-operating
	Tested in accordance with DIN IEC 68-2-3
	5% to 95% at 25°C (no condensation)
	5% to 95% at 25°C (no condensation)

Atmospheric pressure
     Operating
     Non-operating
	
	1080–795 hPa ≙ –1000m to +2000 m)
	1080–660 hPa ≙ –1000m to +3500 m)

A

Table A-1 Technical Specifications of the C7

Criterion	Technical Specifications
Mechanical environmental conditions	
Vibration	Tested in accordance with DIN IEC 68-2-6
Operating	10 to 58 Hz, amplitude 0.075 mm
	58 to 500 Hz, acceleration 9.8 m/s^2
Non-operating	5 to 9 Hz, amplitude 3.5 mm
	9 to 500 Hz, acceleration 9.8 m/s^2
Shock	Tested in accordance with DIN IEC 68-2-29
Operating	Semi-sinusoidal: 100 m/s^2 (10 g), 16 ms, 100 shocks
Non-operating	250 m/s^2 (25 g), 6 ms, 1000 shocks

24 V DC Power Supply

The entire 24 VDC power supply for the C7-626 and C7-626 DP (operating voltage, load voltage, relay power supply, etc.) must be provided in the form of safety extra-low voltage (SELV).

Warning

Personal injury and damage to property can occur.

If you do not provide the correct 24 VDC power supply for your C7-626 or C7-626 DP, this may result in damage to components of your programmable controller and personal injury.

Use only safety extra-low voltage (SELV) for the 24 VDC power supply to your C7-626 or C7-626 DP.

Relevant for the U.S.A. and Canada

The following markings are used to show the relevant approval:

Underwriters Laboratories (UL) to UL 508 standard

UL recognition mark

Canadian Standard Association (CSA) to standard C 22.2. No 142

FM APPROVED   FM Standards No. 3611, 3600, 3810 APPROVED for use in Class I, Division 2, Group A, B, C, D indoor hazardous locations.

A.2   Notes on the CE Marking

EC EMC Directive 89/336/EEC

CE

Products bearing the CE marking meet the requirements of the EU directive 89/336/EEC on "Electromagnetic Compatibility".

In accordance with the above-mentioned EU directive, Article 10 (1), the EU declarations of conformity and the relevant documentation are held at the disposal of the competent authorities at the address below:

> Siemens Aktiengesellschaft
> Bereich Automatisierungstechnik
> AUT E 14
> Postfach 1963
> D-92209 Amberg
> Federal Republic of Germany

Area of Application

The C7-626 and C7-626 DP control systems have been designed for use in the following areas in accordance with their CE marking:

Area of Application	Requirements:	
	Emitted Interference	**Immunity**
Industrial and office area	EN 50081-2: 1993	EN 50082-2: 1995
Household, business and trade area, small plants	EN 50081-1: 1992	EN 50082-1: 1992

Observing the Installation Guidelines

The installation guidelines and safety instructions described in the manual must be observed when installing and operating the device.

A

A.3 Notes for the Machine Manufacturer

Introduction

The SIMATIC programmable controller system is not a machine as defined in the EU Machinery Directive. There is therefore no declaration of conformity for SIMATIC with regard to the EU Machinery Directive 89/392/EEC.

EU Machinery Directive 89/392/EEC

The EU Machinery Directive 89/392/EEC regulates requirements relating to machinery. A machine is defined here as an assembly of linked parts or components (see also EN 292-1, Paragraph 3.1).

SIMATIC is part of the electrical equipment of a machine and must therefore be included by the machine manufacturer in the declaration of conformity procedure.

Electrical Equipment of Machinery in Accordance with EN 60204

The EN 60204-1 standard (Safety of Machinery, Electrical Equipment of Machines, Part 1, Specification for General Requirements) applies for electrical equipment of machinery.

The table below is designed to help you with the declaration of conformity and to show which criteria apply to SIMATIC according to EN 60204-1 (as of June 1993).

EN 60204-1	Subject/Criterion	Remarks
Paragraph 4	General requirements	Requirements are met if the devices are mounted/installed in accordance with the installation guidelines. Please observe the explanations on the previous pages.
Paragraph 11.2	Digital input/output interfaces	Requirements are met.
Paragraph 12.3	Programmable equipment	Requirements are met if the devices for protection of memory contents against change by unauthorized persons are installed in locked cabinets.
Paragraph 20.4	Voltage tests	Requirements are met.

A.4   Transport and Storage Conditions for Back-Up Batteries

**Transport of
Back-Up Batteries**

Transport back-up batteries where possible in their original packaging.
Observe the regulations for the transport of dangerous goods and substances.
The back-up battery contains approximately 0.25 g of lithium.

Note: According to air freight transport regulations, the back-up battery is in
Hazardous Goods Class 9.

**Storage of
Back-Up Batteries**

Store back-up batteries in a cool, dry place.

Back-up batteries can be stored for up to 5 years.

Warning

Back-up batteries can ignite or explode and constitute a serious fire hazard if
they are heated or damaged!

Store back-up batteries in a cool, dry place.

**Rules for Handling
and Using
Back-Up Batteries**

To prevent hazards when using back-up batteries, you must observe the
following rules:

Do not

- recharge

- heat

- burn

- drill

- crush

- short-circuit

back-up batteries.

A

Guidelines for Handling Electrostatically Sensitive Devices (ESD)

B

Summary of Sections

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B.1 What is ESD?

Definition   All electronic modules are equipped with large-scale integrated ICs or components. Due to their design, these electronic elements are very sensitive to overvoltages and thus to any electrostatic discharge.

These **E**lectrostatically **S**ensitive **D**evices are commonly referred to by the abbreviation **ESD**.

Electrostatically sensitive devices are labelled with the following symbol:
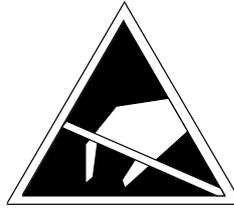
Caution

Electrostatically sensitive devices are subject to voltages that are far below the voltage values that can still be perceived by human beings. These voltages are present if you touch a component or module without previously being electrostatically discharged. In most cases, the damage caused by an overvoltage is not immediately noticeable and results in total damage only after a prolonged period of operation.

B.2 Electrostatic Charging of Objects and Persons

Electrostatic Charging

Any object with no conductive connection to the electrical potential of its surroundings can be charged electrostatically. In this way, voltages up to 15 000 V can build up whereas minor charges; that is, up to 100 V, are not relevant.

Examples:

• Plastic covers	up to 5 000 V
• Plastic cups	up to 5 000 V
• Plastic-bound books and notebooks	up to 8 000 V
• Desoldering device with plastic parts	up to 8 000 V
• Walking on plastic flooring	up to 12 000 V
• Sitting on a padded chair	up to 15 000 V
• Walking on a carpet (synthetic)	up to 15 000 V

Limits for Perceiving Electrostatic Discharges

An electrostatic discharge is

• perceptible from 3500 V

• audible from 4500 V

• visible from 5000 V

A fraction of these voltages is capable of destroying or damaging electronic devices.

Carefully note and apply the protective measures described below to protect and prolong the life of your modules and components.

B

B.3   General Protective Measures Against Electrostatic Discharge Damage

Keep Plastics Away

Keep plastics away from sensitive devices. Most plastic materials have a tendency to build up electrostatic charges easily.

Provide Sufficient Grounding

Make sure that the personnel, working surfaces and packaging are sufficiently grounded when handling electrostatically sensitive devices.

Avoid any Contact

If possible, avoid any contact with electrostatically sensitive devices. Hold modules without touching the pins of components or printed conductors. In this way, the discharged energy cannot affect the sensitive devices.
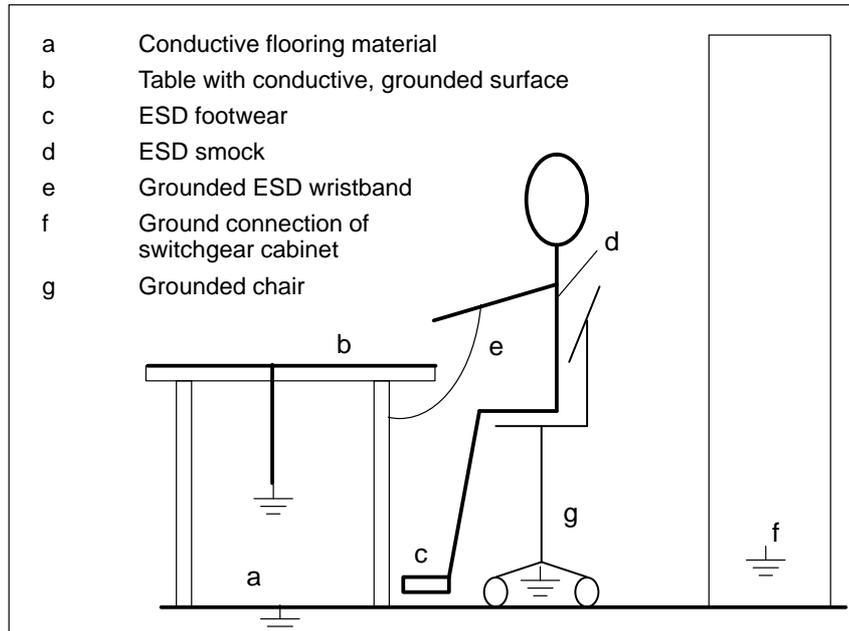
Additional Precautions for Modules without Housing

Note the following measures that have to be taken for modules that are not protected against accidental contact:

- Touch electrostatically sensitive devices only
    - if you wear a wristband complying with ESD specifications or
    - if you use special ESD footwear or ground straps when walking on an ESD floor.
- Persons working on electronic devices should first discharge their bodies by touching grounded metallic parts (for example, bare metal parts of switchgear cabinets, water pipes, etc.).
- Protect the modules against contact with chargeable and highly insulating materials, such as plastic foils, insulating table tops or clothes made of plastic fibers.
- Place electrostatically sensitive devices only on conductive surfaces:
    - Tables with ESD surface
    - Conductive ESD foam plastic (ESD foam plastic is mostly colored black)
    - ESD bags
- Avoid direct contact of electrostatically sensitive devices with visual display units, monitors or TV sets (minimum distance to screen > 10 cm).

ESD Precautions The following figure again illustrates the precautions for handling electrostatically sensitive devices.

a	Conductive flooring material
b	Table with conductive, grounded surface
c	ESD footwear
d	ESD smock
e	Grounded ESD wristband
f	Ground connection of switchgear cabinet
g	Grounded chair

B.4 Taking Measurements and Working on ESD Modules

Use Grounded Measuring Devices Only

Measurements may be taken on electrostatically sensitive devices only if

- the measuring device is grounded (for example via protective conductor) or

- the tip of the isolated measuring device has previously been discharged (for example, by briefly touching grounded metal parts).

B.5 Packing Electrostatically Sensitive Devices

Using Conductive Material for Packing Modules without Casing

Generally use conductive materials for packing modules without casing and components. You may also use metal-clad plastic boxes or metal containers. Always store ESD modules in conductive packing material.

Cover Batteries

When packing modules incorporating batteries, cover the battery connections with insulating tape or insulating material to avoid short-circuiting of the battery. Remove the battery if possible.

Glossary

A

Analog I/O
The analog I/O converts analog process values (for example, temperature) into digital values that can be processed by the C7 CPU or converts digital values into analog manipulated variables.

Assigning Parameters
Assigning parameters means setting the operating characteristics of a module.

Automation System
An automation system is a → programmable logic controller in the SIMATIC S7 range.

B

Back-Up Battery
The back-up battery guarantees that the → user program in the → C7 CPU is stored safe from power failures and that data areas, bit memory, timers and counters remain retentive.

Back-Up Memory
The back-up memory backs up memory areas of the → C7-620 without the need for a back-up battery. The memory backs up a programmable number of timers, counters, bit memory and data bytes, the → retentive timers, counters, bit memory and data bytes.

Bus
A bus is a transfer medium that connects two or more nodes with each other. Data transfer can be serial or parallel, via electrical conductors or fiber optic cable.

C

C7-620
The C7-620 control system integrates an S7-300 CPU, a COROS OP, the I/O and an IM 360 interface module in one single unit.

C7 CPU	The C7 CPU is a central processing unit of the C7 range, complete with processor, arithmetic unit, memory, operating system and interfaces for programming devices. The C7 CPU is independent of the → C7 OP. The C7 CPU has its own MPI address and is connected to the C7 OP via the MPI (multipoint interface).
C7 I/O	The C7 I/O (→ signal module) forms the interface between the process and the programmable controller. There are digital input and outputs as well as analog inputs and outputs. The integral universal inputs have special functions in the C7 (interrupt/counter inputs).
C7 OP	The C7 OP handles the OP functions of the C7 control system. It is independent of the → C7 CPU and continues to operate, for example, if the C7 CPU enters the STOP mode. The C7 OP has its own MPI address and is connected to the C7 CPU via this interface. It is via the MPI that the C7 OP is connected to a configuring computer (programming device/PC).
CP	→ Communications Processor
Communications Processor (CP)	Communications processors are intelligent modules with their own processor. They form an important group within the components of a programmable controller. A distinction can be made between various types of communications processors according to their tasks. For example, CPs for messages and logging, for point-to-point connection, for operator interfacing (COROS), for bus connections (SINEC), for diagnostics and mass storage applications.
Complete Restart	When a CPU starts up (for example, when the mode selector is moved from STOP to RUN or when power is turned on), before cyclic program processing starts (OB1), the organization block OB100 (complete restart) is processed first. In a complete restart, the process-image input table is read in and the STEP 7 user program processed starting with the first statement in OB1.
Configuration	The assignment of modules to racks/slots and addresses (for example, signal modules).
Configuration Memory	The configuration memory is a flash memory integrated in the C7 OP. It is used for storing the configuration data.
Cyclic Interrupt	A cyclic interrupt is generated periodically by the C7 CPU according to a time grid which can be assigned parameters. It triggers execution of the relevant organization block.

D

Diagnostics → Diagnostic Functions, → System Diagnostics

Diagnostic Buffer The diagnostic buffer is a buffered memory area in the C7 CPU in which diagnostic events are stored in order of occurrence.

Diagnostic Events Diagnostic events include errors in a digital function in the C7, system faults in the C7 caused, for example, by programming errors or operating mode transitions.

Diagnostic Functions The diagnostic functions comprise the complete scope of system diagnostics and the detection, evaluation and signaling of faults within the C7.

Diagnostic Interrupt Modules with diagnostics capability signal system errors to the → C7 CPU by means of diagnostic interrupts.

E

Equipotential Bonding Electrical connection (equipotential bonding conductor) that brings the bodies of electrical resources to the same or approximately the same potential as foreign conducting bodies in order to prevent interference or hazardous voltages arising between the bodies.

Error Display The error display is one of the possible responses of the operating system to a run-time error. The other possible responses are: → error response in the user program, STOP mode of the C7 CPU.

F

Flash EPROM With regard to their characteristic to retain data in the case of a power failure, FEPROMs correspond to the electrically erasable EEPROMs, but can be erased much faster (FEPROM = Flash Erasable Programmable Read Only Memory).

The following data can be held in flash memory without being affected by a power failure:

- The → user program

- The → parameters that determine the characteristics of the → C7 CPU and the I/O functionality of the C7.

Flash Memory	→ Flash EPROM
Function Grounding	Grounding with the sole purpose of ensuring the intended purpose of the electrical resources. Function grounding has the effect of short-circuiting interference voltages that would otherwise have an impermissible influence on the resources.
Function Module (FM)	A function module is a module that offloads the CPU of the S7-300 and S7-400 programmable controllers of time-critical or memory-intensive process signal handling tasks. FMs generally use the internal bus for high-speed data exchange with the CPU. Examples of FM applications include counting, positioning, closed-loop control.

G

Ground	Conductive ground whose electrical potential at any point can be taken as zero.
	In the area of grounding electrodes, the ground can have a potential other than zero. This is frequently referred to as the "reference ground".
Ground (verb)	To connect an electrically conductive part with the grounding electrode (one or more conductive parts that have very good contact to ground) by means of a grounding point.

H

Hardware Interrupt	A hardware interrupt is triggered by interrupt-triggering modules as the result of certain events in the process. The hardware interrupt is signaled to the C7 CPU. Depending on the priority of the interrupt, the corresponding organization block is then executed.

I

Information Function	The information functions of STEP 7 permit the display of status information on the programming device via one or more C7 systems during the various startup phases and during operation of a programmable controller.

Interrupt The → operating system of the C7 CPU recognizes 10 different priority classes governing execution of the user program. Interrupts such as hardware interrupts belong to these priority classes. When an interrupt occurs, the operating system automatically calls an assigned organization block in which the user can program the desired response (for example, in an FB).

Isolated In isolated input/output modules, the reference potentials of the control circuit and the load circuit are galvanically isolated by, for example, optocouplers, relay contactors or transformers. Input/output circuits can be connected to common potential.

L

Load Memory The load memory is a component part of the C7 CPU. It contains objects (load objects) created by the programming device. It is implemented as a fixed integrated memory.

M

Memory Reset When clearing the → **C7 CPU**, the following memories are deleted:

- The → work memory
- The read/write memory area of the → load memory
- The → system memory
- The → back-up memory

and the user program is reloaded from the → flash memory.

When clearing the → **C7 OP**, the following memories are deleted:

- The → work memory
- The → configuration memory

The C7 OP then does not contain a user configuration.

MPI → Multipoint Interface

MPI Network A network is a connection of several C7s and/or S7-300s and further terminals, such as a programming device, via a → connecting cable. Data are exchanged between the connected devices over the network.

Multipoint Interface (MPI)

The multipoint interface is the programming device interface in SIMATIC S7. It allows a number of programmable modules, text display operator panels, and operator panels to be accessed from a central unit. The nodes on the MPI can communicate with each other. Each node is identified by an address (MPI address).

N

Node Number

The node number represents the "access address" of a C7 CPU, C7 OP or a programming or other intelligent I/O module when it communicates with other nodes via an → MPI network. The node number is assigned to the C7 CPU, C7 OP and programming device.

Non-Isolated

In non-isolated I/O modules, the reference potentials of the control circuit and the load circuit are electrically connected.

O

Operating System of the C7 CPU

The operating system of the C7 CPU organizes all functions and processes of the C7 which are not linked to a special control task.

P

Parameters

1. A parameter is a variable of a STEP 7 logic block
2. A variable for setting the behavior of a module
(one or more per module)

Every configurable module has a basic parameter setting when it is supplied from the factory, but this can be changed using STEP 7.

There are two types of parameter: static and dynamic parameters.
(→ Parameters, Dynamic or → Parameters, Static)

Parameters, Dynamic

Dynamic parameters of modules, in contrast to static parameters, can be changed by the user program during operation by calling an SFC; for example, limit values of an analog signal input module.

Parameters, Static

Static parameters of modules, in contrast to dynamic parameters, cannot be changed by the user program, but only using STEP 7; for example, the input delay of a digital signal input module.

PG → Programming Device

PLC → Programmable Logic Controllers

Process Image The signal states of the digital inputs and outputs are stored in the C7 CPU in a process image. A distinction can be made between the process-image input table (PII) and the process-image output table (PIQ).

The process-image input table is read by the input modules before execution of the user program.

The process-image output table is transferred to the output modules by the operating system at the end of the user program.

Programmable Logic Controllers Programmable logic controllers (PLCs) are electronic controllers whose function is stored in the control device as a program. The setup and wiring of the device are therefore not dependent on the function of the controller. A programmable controller has the structure of a computer; it consists of a CPU with memory, I/O modules, and an internal bus system. The I/O and the programming language are set up according to the requirements of control engineering.

Programming Device Programming devices are essentially personal computers that are compact and portable and suitable for industrial use. They are characterized by being equipped with special hardware and software for SIMATIC programmable controllers.

R

RAM The Random Access Memory or RAM is a read/write memory in which each memory location can be addressed individually and have its contents changed. RAM is used as a memory for data and programs.

Reference Ground The reference ground is the total of all connected inactive parts of an operating resource that cannot carry a hazardous touch voltage even in the event of a fault.

Reference Potential Potential from which the voltages of the connected circuits are considered and/or measured.

S

Scan Cycle Time   The scan cycle time is the time required by the → C7 to execute the → user program once.

Signal Module   Signal modules (C7 I/O) form the interface between the process and the C7. There are digital input and output modules and analog input and output modules.

STEP 7   Programming software for creating user programs for SIMATIC S7 programmable controllers.

STEP 7 Application   A STEP 7 application is a tool of → STEP 7, which is tailored to a specific task.

Substitute Value   Substitute values are values which are output to the process in the case of faulty signal output modules or which are used in the user program instead of a process variable in the case of faulty signal input modules. The substitute values can be specified in advance by the user (for example, maintain old value).

System Diagnostics   System diagnostics comprises the recognition, evaluation and signalling of errors which occur within the programmable controller. Examples of such errors include: program errors or module failures. System errors can be indicated via LEDs or via STEP 7.

System Memory   The system memory is integrated in the CPU and executed in the form of RAM. The address areas (for example, timers, counters, bit memory) and data areas required internally by the →   operating system (for example, backup for communication) are stored in the system memory.

T

Time-Delay Interrupt   The time-of-day interrupt belongs to one of the priority classes in the program execution of the C7 CPU. It is generated at a specific date (or day) and time (for example, 9:50 or every hour or every minute). A corresponding organization block is then executed.

Time-Of-Day Interrupt   The time-delay interrupt belongs to one of the priority classes in SIMATIC S7 program execution. It is generated when a timer has expired in the user program. A corresponding organization block is then executed.

Tool → STEP 7 Application

Total Current Sum of the currents of all output channels of a digital output module.

Transmission Rate Data transmission rate (bit/s).

U

Ungrounded Without galvanic connection to → ground.

User Memory The user memory contains → logic blocks and → data blocks of the user program. The user memory is integrated in the C7 CPU as flash memory. In general, however, the user program is executed from the → work memory of the C7 CPU.

User Program The user program contains all the statements and declarations and the data required for signal processing to control a plant or a process. The program is linked to a programmable module (for example, C7 CPU, FM) and can be structured in the form of smaller units (blocks).

V

Varistor Voltage-dependent resistor.

W

Work Memory (RAM) The work memory is a RAM in the → C7 620 which the processor accesses while executing the program.

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