

# Equipment for Special Machines WF 721/WF 723 A/WF 723 B/WF 723 C Positioning Modules

Planning Instructions

Edition 06.98

Hardware Description



WF 721/WF 723 A/  
WF 723 B/WF 723 C  
Positioning Modules

Planning Instructions  
Hardware Description

Valid for object version:

WF 721 A00

WF 723 A A01

WF 723 B A03

WF 723 C A00

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**Note**

*Because of clear arrangement, this documentation does not inform about all details of all types of the product. Therefore, it cannot take into account all possible cases of installation, operation and maintenance.*

*If you require additional information or have special questions, please seek further particulars from your local SIEMENS office.*

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# 1 Preface

**What informaton is to be found in this manual ?**

In the hardware description directions for using the WF 721/WF 723 A/WF 723 B/WF 723 C modules in SIMATIC Controllers and connection conditions are fixed. The software is described in separate manual. Applications, contents and target groups of the complete documentation are shown at the end of this manual.

**For whom is this manual intended ?**

The hardware description is meant for planning engineers who decide to use the WF 721/WF 723 A/WF 723 B/WF 723 C components and must observe the corresponding. A second target group is the commissioning and service personnel controlling the correct execution of the given directions and removing faults.

Both target groups must be qualified according to the definitions given on pages 1-2.

**What prior knowledge is of needed ?**

Beside the planning instruction, the EMC recommendations, all general safety regulations, regulations of the VDE and the national safety rules must be observed.

The installation instructions of the SIMATIC must be observed carefully. These can be taken from the relevant manuals.

**How is the manual divided ?**

The manual is divided into three parts:

- Interface Description
- Hardware Properties
- Component Selection

Index and abbreviations can be found in the appendix.

**Do you want improvements?**

Please inform us, if you don't like something in this documentation. Let us know your suggestions of improvements; for this use the form at the end of the manuel. We shall try to consider your suggestions in the next edition.

## Definitions/ terminology

### *Qualified personnel*

Persons who are experienced in setting up, assembling, commissioning and operating the product and whose qualifications are commensurate with their activity, for example:

- Training and authorization to switch power to electrical circuits and equipment according to the recognized standards, to earth such equipment and to mark up the cables on such equipment,
- Training in the maintenance and use of safety devices according to the recognized standards,
- First aid training.

### *Attention*



## ATTENTION

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*Slight injury or damage to property **may occur** if the prescribed precautionary measures are not observed.*

### *Caution*



## CAUTION

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*Death, grievous bodily harm or considerable damage to property **may occur** if the prescribed precautionary measures are not observed.*

### *Danger*



## DANGER

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*Death, grievous bodily harm or considerable damage to property **will occur** if the prescribed precautionary measures are not observed.*

### *Notes*



*This symbol draws your attention to important and useful information.*

### *Cross references*

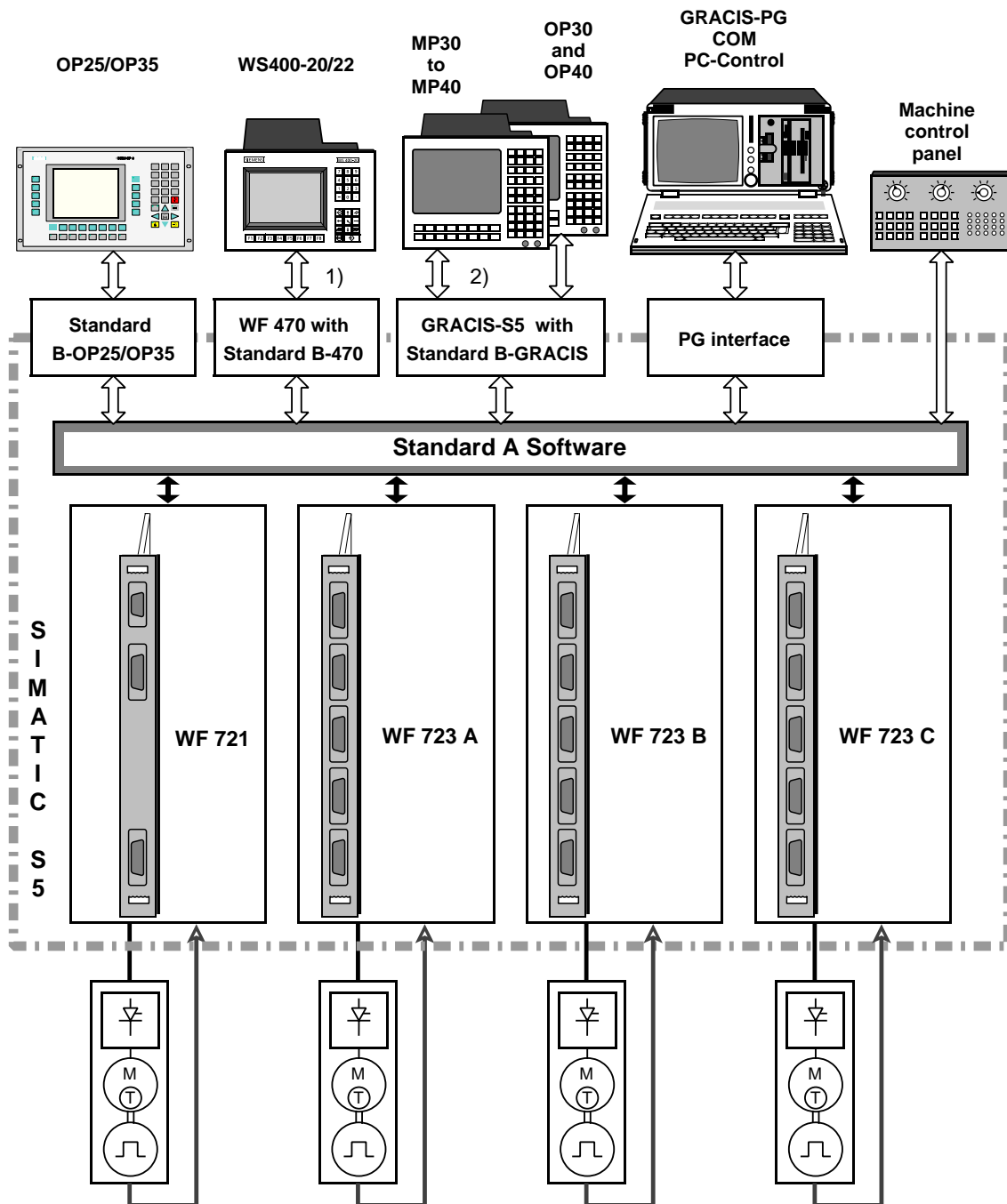


*This symbol refers you to certain information in a manual.*



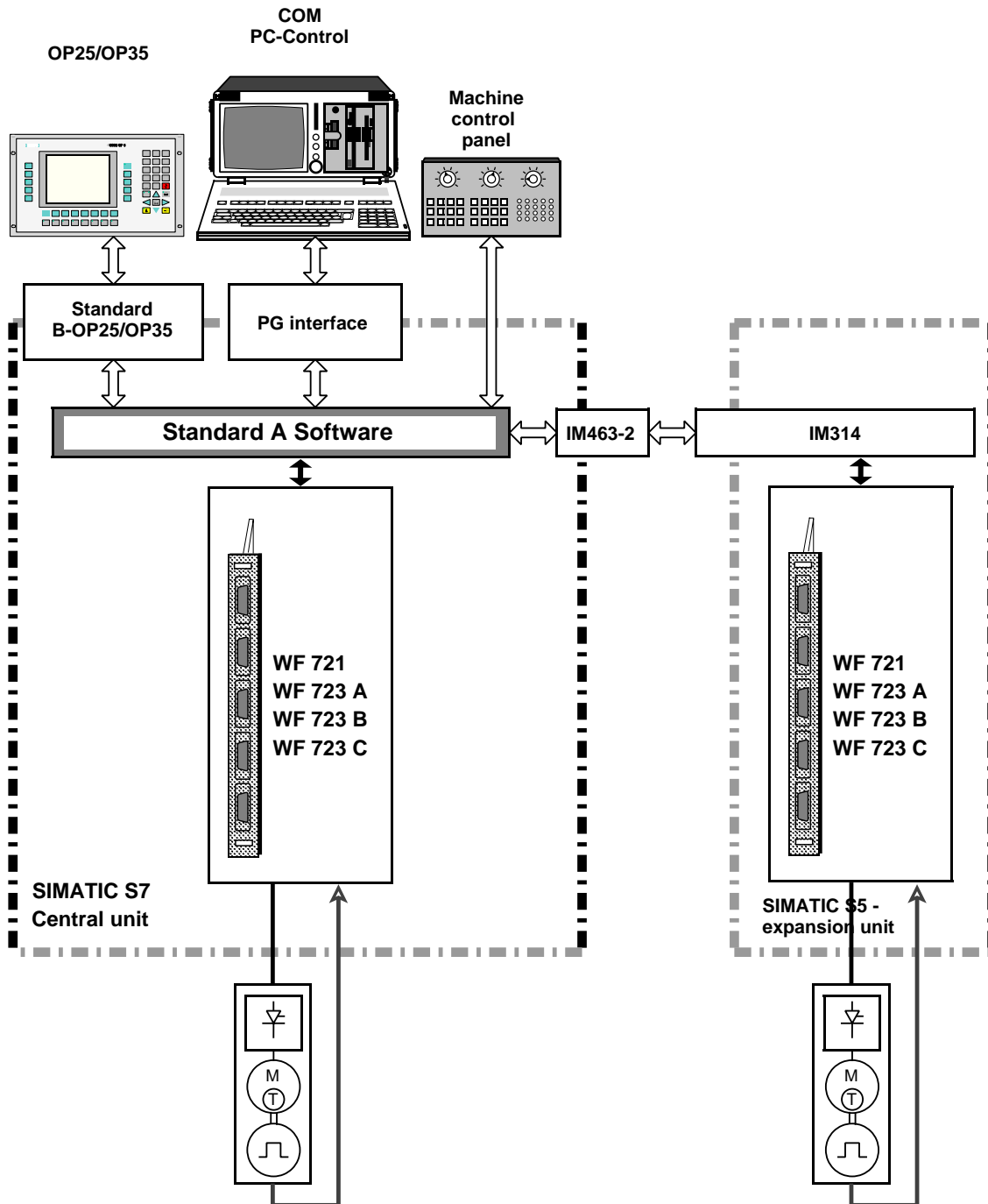
# 2 Overview of Cable and Hardware Structure

## 2.1 Overview of Hardware and Software with SIMATIC S5

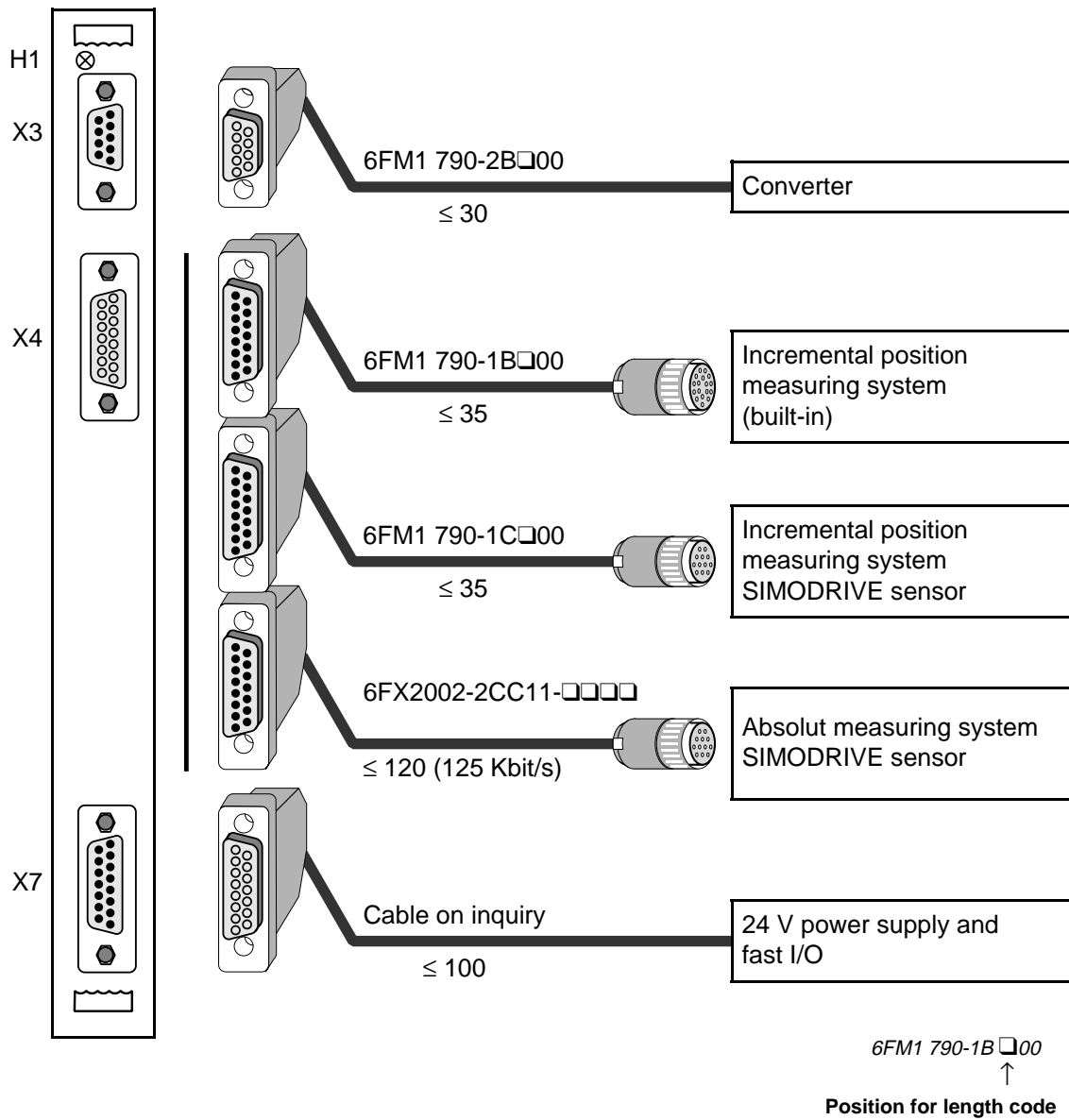


- 1) for WF 723B/WF 723 C no operating masks for Standard B-470 are available
- 2) for WF 723 C no operating masks for Standard B-GRACIS are available

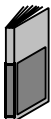
## 2.2 Overview of Hardware and Software with SIMATIC S7



## 2.3 Overview: WF 721

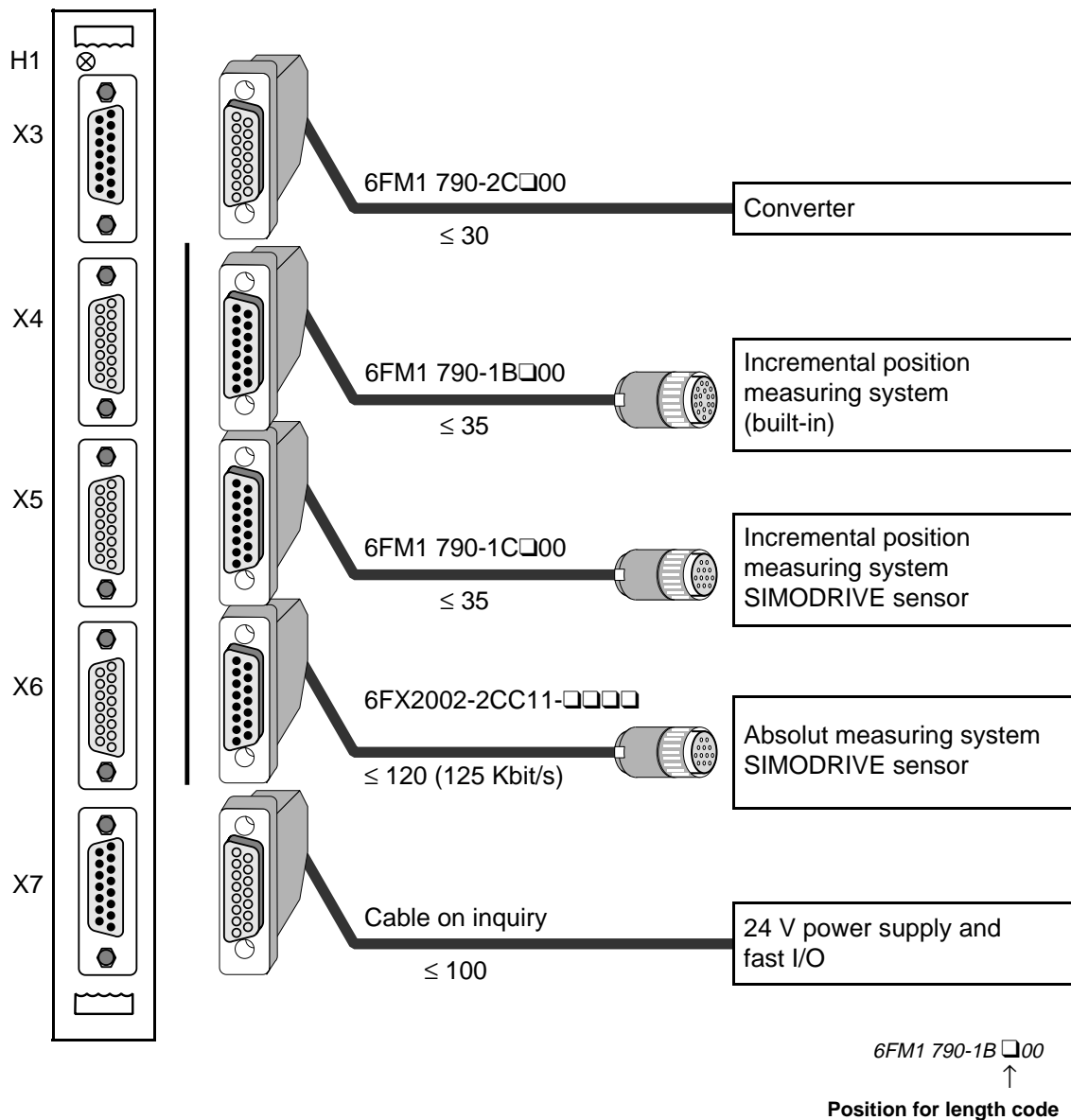


**The LED H1 will be selected if a WF traversing error message which has to be acknowledged by reset is pending in the axis.**



**For connector and cable details refer to section 8.**

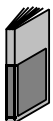
## 2.4 Overview: WF 723 A, WF 723 B, WF 723 C



Connector	Designation	WF 723 B: Utilization as
X4	Hardware axis A	Feed axis
X5	Hardware axis B	Feed axis
X6	Hardware axis C	Feed axis or spindle



**The LED H1 will be selected if a WF traversing error message which has to be acknowledged by reset is pending in the axis.**



**For connector and cable details refer to section 8.**

## 2.5 Length Code for Standard Cables

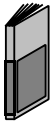
Length/m	6FM1 ...-..□ ..
2.00	A
5.00	B
10.00	C
18.00	D

Special lengths upon request



# 3 Module Locations in the SIMATIC Rack and Current Consumption

The positioning modules WF 721/WF 723 A/WF 723 B/WF 723 C run with the SIMATIC racks listed below. For the module racks of the SIMATIC S5-115U and the SIMATIC S7-400, adaptor casings are an indispensable condition for the pluggability of the WF modules. The module width with adaptor casing is represented by a dotted line, the bus connector of the WF module, by a small grey rectangle. A WF module has to be inserted into a SIMATIC rack so that the grey rectangle faces a module location marked in grey. WF modules can operated without fan.



*For the module locations of WF 470 and GRACIS-S5 in a SIMATIC S5, refer to catalog AR 10.*



*WF-data is buffered by the SIMATIC buffer battery.*

## 3.1 SIMATIC S5

### 3.1.1 Admitted CPU Types

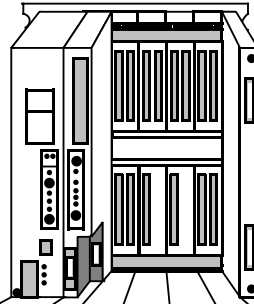
Automation unit	CPU type	Order No.
<b>S5-115U</b>	941B	6ES5 941-7UB11
	942B	6ES5 942-7UB11
	943B	6ES5 943-7UB11
	943B	6ES5 943-7UB21
	944B	6ES5 944-7UB11
	944B	6ES5 944-7UB21
	945	6ES5 945-7UA13
	945	6ES5 945-7UA23
<b>S5-135U</b>	928A	6ES5 928-3UA21
	928B	6ES5 928-3UB21
<b>S5-155U</b>	928A	6ES5 928-3UA21
	928B	6ES5 928-3UB21
	948	6ES5 948-3UA12
	948	6ES5 948-3UA22

### 3.1.2 Central Controller SIMATIC S5-115U

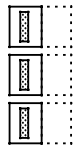
#### 3.1.2.1 Module Rack CR 700-0LB



*It is no coupling possible to the expansion unit ER 701-3 with the module rack CR 700-0LB.*



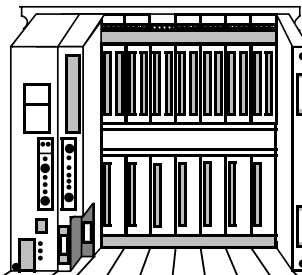
Width and max. current consumption per module



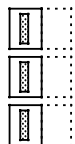
1.0 / 1.3 A  
1.4 A  
1.4 A

	PS	CPU	Slot designation				IM
			0	1	2	3	
Current supply (min. 7 A)	Shaded						
Central controller		Shaded					
WF 721 / WF 723 A			Shaded	Shaded	Shaded		
WF 723 B			Shaded	Shaded	Shaded		
WF 723 C			Shaded	Shaded	Shaded		

#### 3.1.2.2 Module Rack CR 700-2



Width and max. current consumption per module

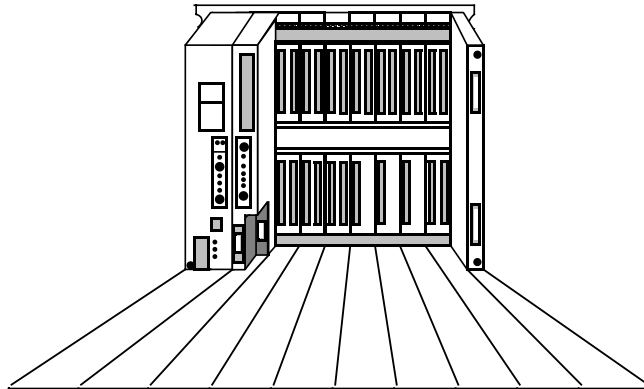


1.0 / 1.3 A  
1.4 A  
1.4 A




	PS	CPU	Slot designation							IM
			0	1	2	3	4	5	6	
Current supply (min. 7 A)	Shaded									
Central controller		Shaded								
IM304									Shaded	
WF 721 / WF 723 A			Shaded	Shaded	Shaded	Shaded	Shaded	Shaded		
WF 723 B			Shaded	Shaded	Shaded	Shaded	Shaded	Shaded		
WF 723 C			Shaded	Shaded	Shaded	Shaded	Shaded	Shaded		



### 3.1.2.3 Module Rack CR 700-3

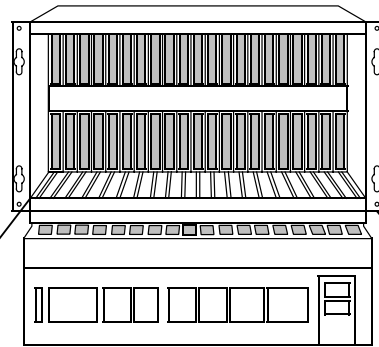


Width and max. current consumption per module




	1.0 / 1.3 A
	1.4 A
	1.4 A

	PS	CPU	Slot designation								IM
			0	1	2	3	4	5	6		
Current supply (min. 7 A)											
Central controller											
IM304											
WF 721 / WF 723 A											
WF 723 B											
WF 723 C											

### 3.1.3 Central Controller SIMATIC S5-135U/155U

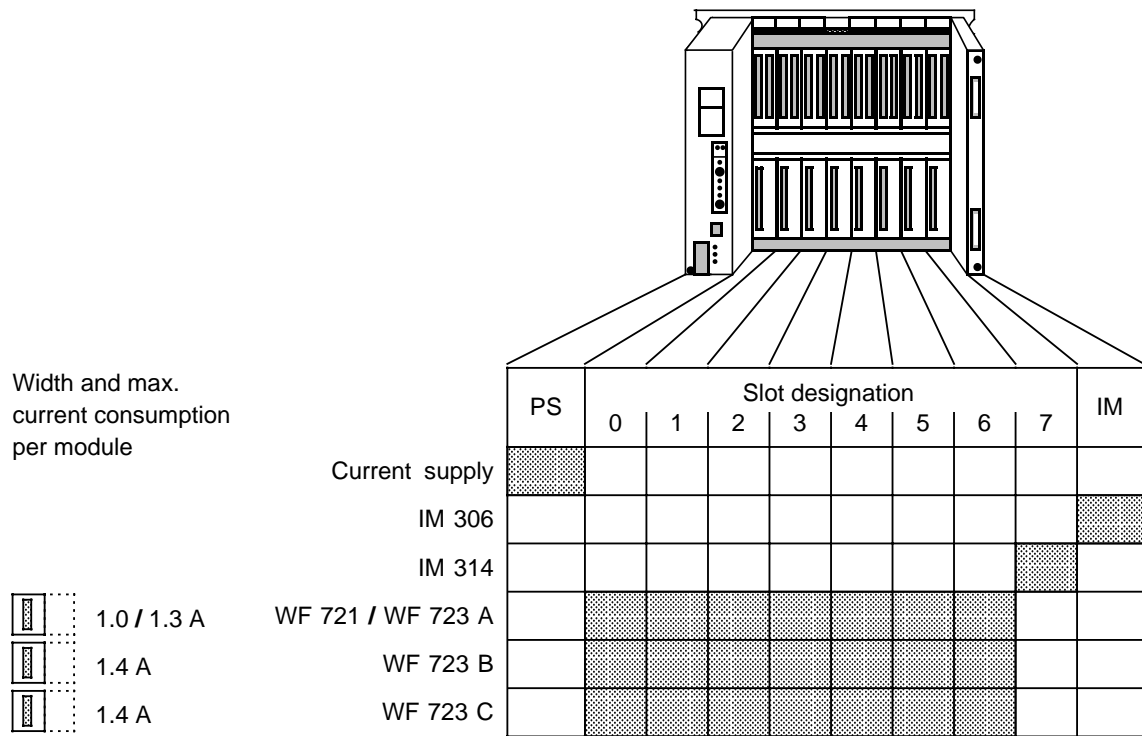


Width and max. current consumption per module

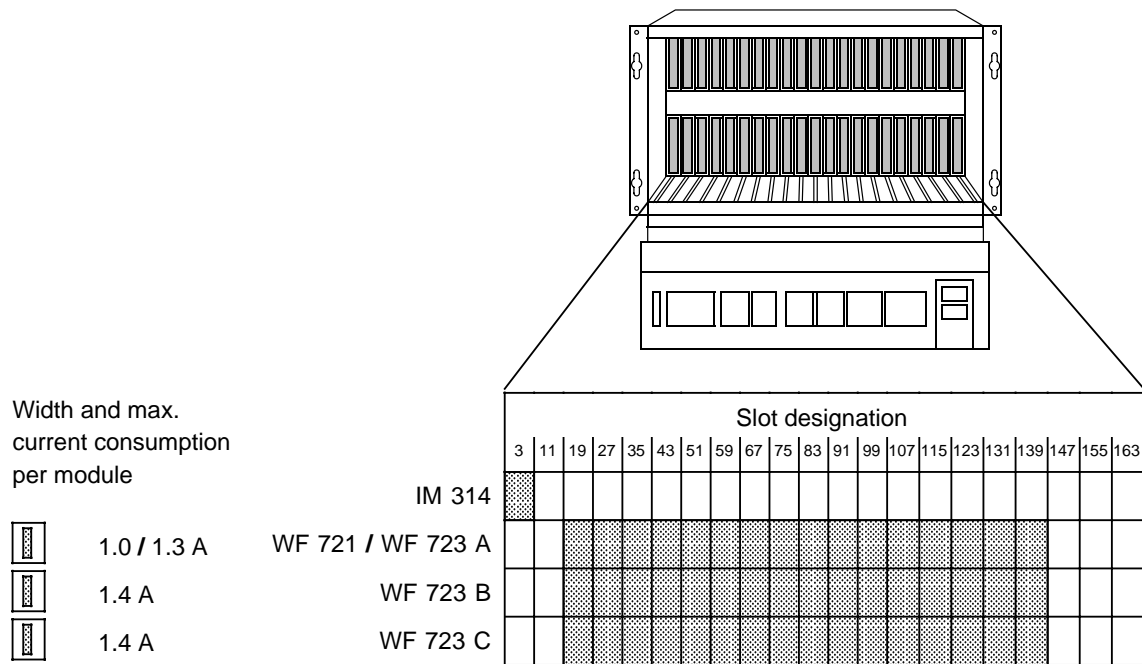
	1.0 / 1.3 A
	1.4 A
	1.4 A

	Slot designation																					
	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163	
CPU 928A/B																						
CPU 948																						
IM 304																						
WF 721 / WF 723 A																						
WF 723 B																						
WF 723 C																						

### 3.1.4 Expansion Unit ER 701-3



### 3.1.5 Expansion Unit SIMATIC S5-185U



## 3.2 SIMATIC S7-400

The positioning modules WF 721/WF 723 A/WF 723 B/WF 723 C can be used in the SIMATIC S7-400 in different ways:

- in the SIMATIC S7-400 central controller in the SIMATIC S7 adaptor casing,
- in a SIMATIC S5 expansion unit coupled with the central controller of the SIMATIC S7-400 via the interfaces IM463-2 (S7) and IM314.

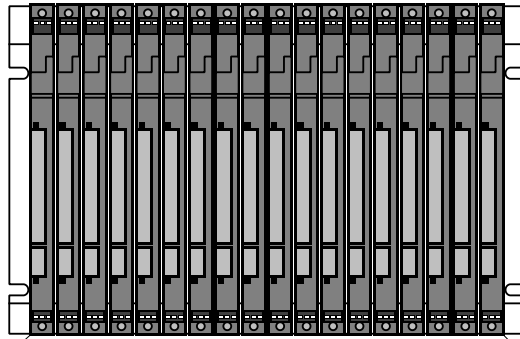


***For the module racks of the SIMATIC S7-400, adaptor casings are an indispensable condition for the pluggability of the WF modules. The module width with SIMATIC S7 adaptor casing is two slots.***

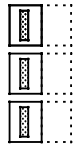
### 3.2.1 Admitted CPU types

Automation unit	CPU type	Order No.
<b>S7-400</b>	412-1	6ES7 412-1XF02-0AB0
	413-1	6ES7 413-1XG02-0AB0
	413-2DP	6ES7 413-2XG02-0AB0
	414-1	6ES7 414-1XG02-0AB0
	414-2DP	6ES7 414-2XG02-0AB0
		6ES7 414-2XJ01-0AB0
	416-1	6ES7 416-1XJ02-0AB0
	416-2DP	6ES7 416-2XK01-0AB0
		6ES7 416-2XL01-0AB0

### 3.2.2 Module Rack UR1



Width and max. current consumption per module



1.0 / 1.3 A

WF721/WF723A in AK

1,4 A

WF723B in AK

1,4 A

WF723C in AK

IM463-2

		Slot designation																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
PS		■	■	■															
CPU		■	■																
		■	■																
		■	■																
		■	■																
		■	■																

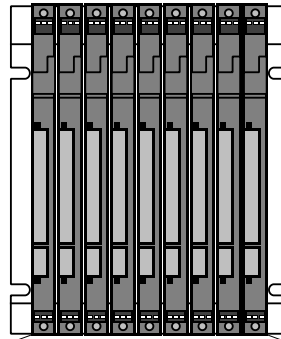
PS: Depending on the model, the current supply unit occupies 1, 2 or 3 slots

CPU: 1 or 2 slots, depending on the model

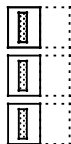
AK: The adaptor casing occupies 2 slots (max. 8 units can be plugged)

IM463-2: Occupies 1 slot (max. 4 units can be plugged)

### 3.2.3 Module Rack UR2



Width and max.  
current consumption  
per module

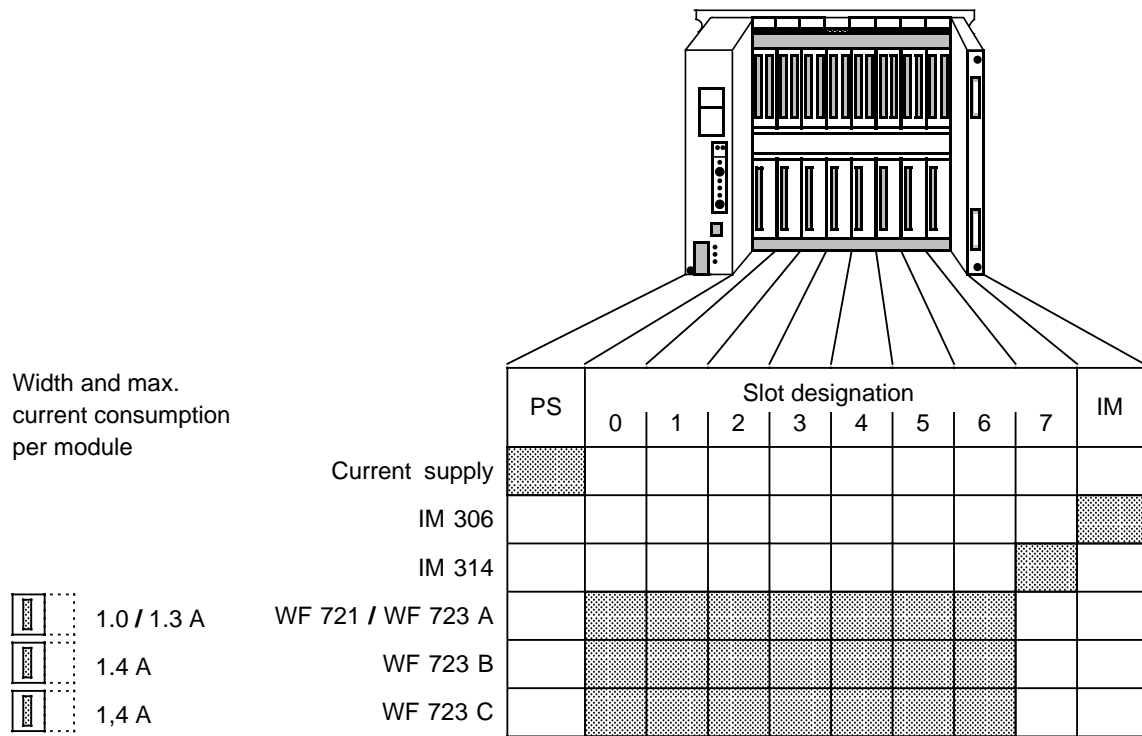


1.0 / 1.3 A	WF721/WF723A in AK
1.4 A	WF723B in AK
1.4 A	WF723C in AK
	IM463-2

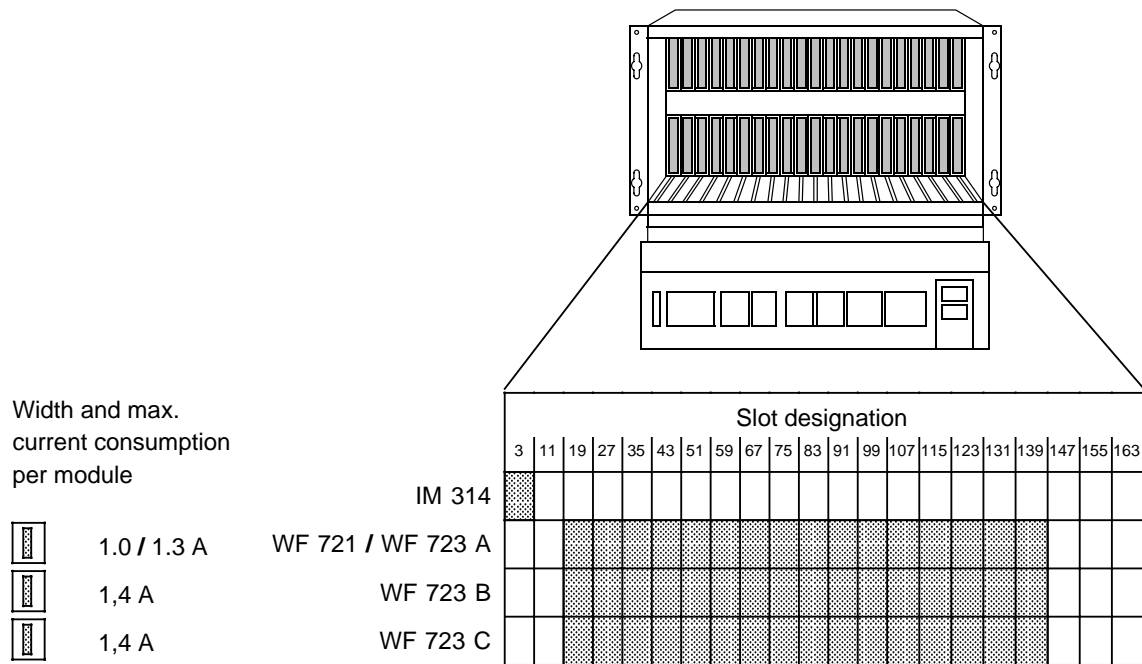
	Slot designation								
	1	2	3	4	5	6	7	8	9
PS									
CPU									

- PS: Depending on the model, the current supply unit occupies 1, 2 or 3 slots  
 CPU: 1 or 2 slots, depending on the model  
 AK: The adaptor casing occupies 2 slots (max. 3 units can be plugged)  
 IM463-2: Occupies 1 slot (max. 4 units can be plugged)

### 3.2.4 Expansion unit ER 701-3

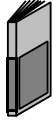


### 3.2.5 Expansion unit EG 185



# 4 Connection Conditions and Installation Directions

Die SIMATIC S5 und die SIMATIC S7 unterscheiden sich in ihren allgemeinen technischen Daten, insbesondere in den Umgebungsbedingungen. Wenn Sie eine WF-Baugruppe in einer S7-400 einsetzen, sind für den Gesamtaufbau die jeweils strengeren Umgebungsbedingungen einzuhalten.



***For connection and installation, the EMC recommendations for WF modules (refer to documentation summary on the inner cover), and the installation directions for SIMATIC S5/S7 are of particular relevance.***

## 4.1 Installation Directions

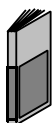
### 4.1.1 Potential Equalization Lines and Earthing

#### General Principle

For an interference free operating, all controlling units (PLC, EU, drive controller, etc.) connected by signaling cables must be connected by potential equalization lines as well.

Exception: Components connected via optical waveguide are excepted from the above direction.

Huge network systems using potential equalization lines must conform to the EMC recommendations.



***Please refer to section 4.3.1***

#### Earthing



#### ATTENTION

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***For correct operation careful earthing is needed to avoid external interference. Be sure of earthing without loops. Only use cables with required diameter.***

## 4.1.2 Safety Regulations

During the planning phase of flow diagrams, general regulations, especially those according to the DIN-standards 407000 to 40719, must be attended.

Particular safety equipment as emergency shutdown, axis limit stop detection, etc. must conform to the DIN standard VDE 0113 part 1. "Protection in case of fault" must be realized by selfswitching and redundand electric circuit design.



### DANGER

---

***Activating a system using drives must be realized with hardware components as well as the emergency shutdown circuit. Reactions caused by the emergency shutdown circuit must be controlled by software and by hardware !***

Here are some important notes to give maximum protection when using drives that may cause uncontrolled and dangerous movements in case of fault:

- In case of emergency shutdown slow down drives in the best possible way.
- Protection against unintentional reactivation after an emergency shutdown.
- System state saving after de-activation.
- Detection of the first fault.
- Protection against use of defective machines.

Safety equipment such as protective gratings and relevant switch-off devices must be taken into account during the planning phase.

## 4.2 Handling Directions

### 4.2.1 Handling - General



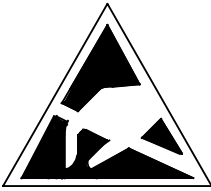
### ATTENTION

---

***Modules, cables and power supply lines may only be plugged or unplugged when the controllers or the plant are switched off. Interface signaling lines and power supply lines may only be alive when the modules are plugged. Nonobservance may lead to the destruction of modules.***



## 4.2.2 Electrostatically Endangered Components (EEC)



Try to avoid physical contact with any module as far as possible. If this is unavoidable because of work to be performed on them, the human body must be discharged before touching the modules. This can be done by simply touching a conductive grounded object (e.g. bright metal cabinet parts, electrical socket protective ground contact).

Avoid physical contact of modules with highly insulating materials such as plastic film, plastic-laminated desk tops and clothing made out of synthetic fibre. Place modules only onto conductive surfaces. When soldering on modules, the soldering iron tip must be grounded.

Modules and electronic components must be stored or dispatched in conductive packagings, such as metalized plastic boxes or metal bushings. If packagings are non-conductive, enclose the modules in conductive material before packaging. The use of conductive foam rubber or household aluminium foil may be appropriate.

The necessary protective measures for electrostatically endangered components are illustrated below.

a = Conductive flooring  
b = EEC table  
c = EEC shoes

d = Protective clothing of 100% cotton  
e = EEC chain  
f = Ground connection of cabinets

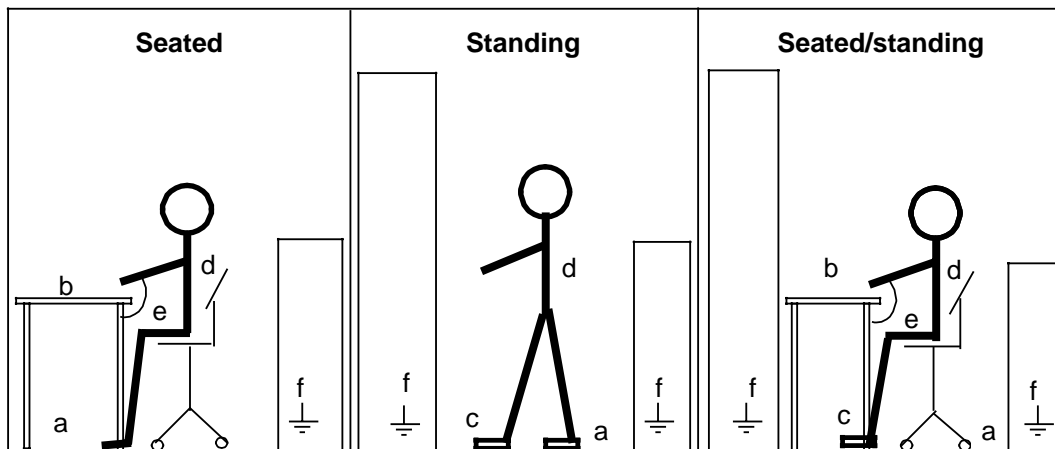


Figure 4.1 EEC-protective measures of safety for a workplace



### ATTENTION

**Never touch plugs, tracks or elements of a module before discharging your body at an earthed part of the system.**

Carpets made out of synthetic fibre as well as plastic soles may cause electrostatic charge up to several kilo-volts. Integrated circuits are extremely sensitive against such high voltage discharges. Therefore, it is absolutely necessary to make sure that potential equalization is done.

## 4.3 Examples for SIMATIC - WF - Drive - Encoder - Connection

### 4.3.1 Potential Equalization Concept

In order to guarantee fault-free operation, all components of the system connected via signaling cables must be connected by potential equalization lines as well. Potential equalization lines prevent from exceeding potential differences between system components. High potential differences cause a compensating current running through the signaling cable that may lead to faulty data transmission.

For satisfying results make sure that the cable cross section is not less than 10 mm<sup>2</sup> for the potential equalization line and the resulting surface area for interference distraction. For maximum conductor surface area, only flexible conductors should be used. Solid conductors must be avoided.

Potential equalization lines have to be arranged radially. The potential equalization busbar must be mounted as close as possible to the WF module. Therefore, several WF modules should be concentrated in one rack (central controller, expansion unit) at a central system location and not be spread over several expansion units.

Today's modern analog controller components, such as converters and transistorized controllers, work with very high clock frequencies. In connection with the high intermediate-circuit voltages, the drive represents a very high interference potential that must be prevented by an appropriate earthing concept.

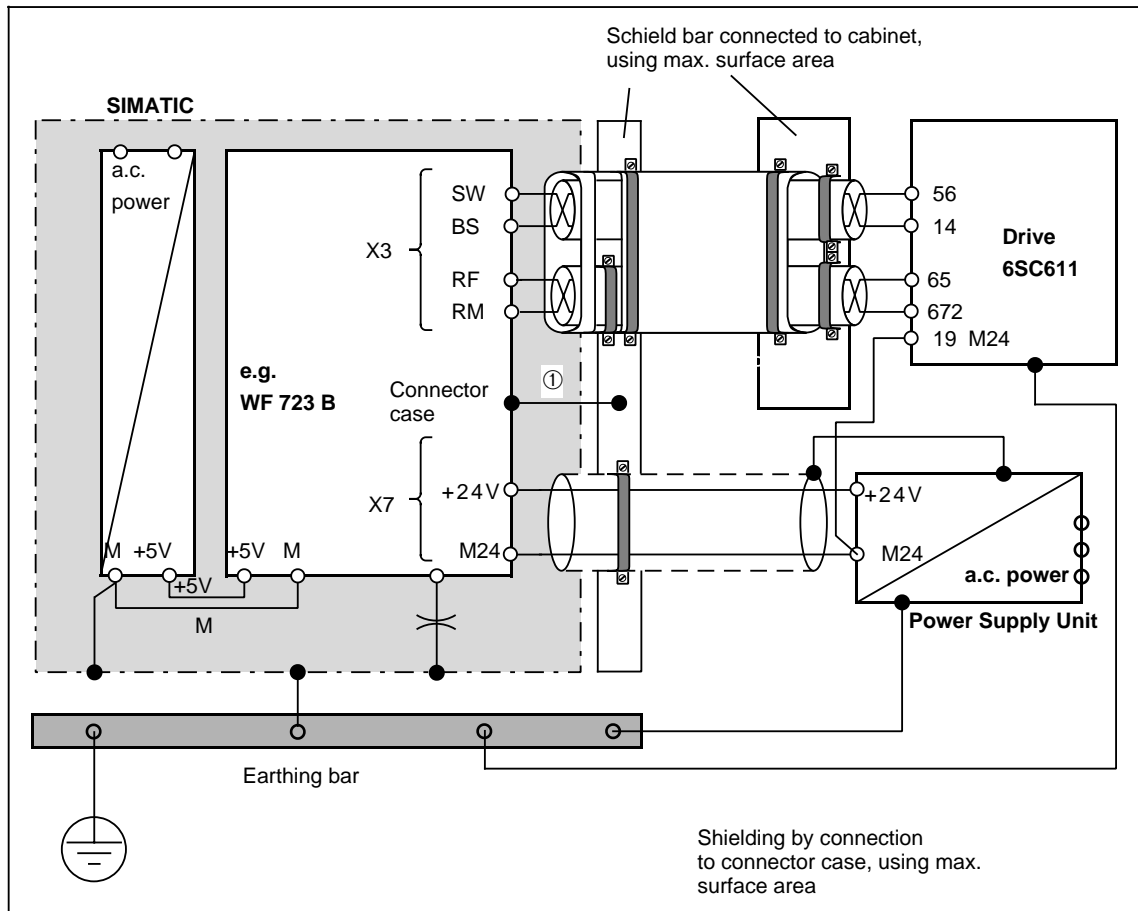
Drive and WF module have to be connected with a separate potential equalization line (minimum cross section 10 mm<sup>2</sup>, Cu). The distance between the rack containing the WF module and the potential equalization busbar must not be bigger than 0.5 meters. The cross section of the cable used between the potential equalization busbar and the earthing bar must be min. 10 mm<sup>2</sup>, Cu. The cable used should be as short as possible.



***Do not use equalization busbars made of cadmium-plated steel. Do not use protective conductors as potential equalization lines.***

## 4.3.2 Shielding Connection Concept

### 4.3.2.1 Command Value Interface



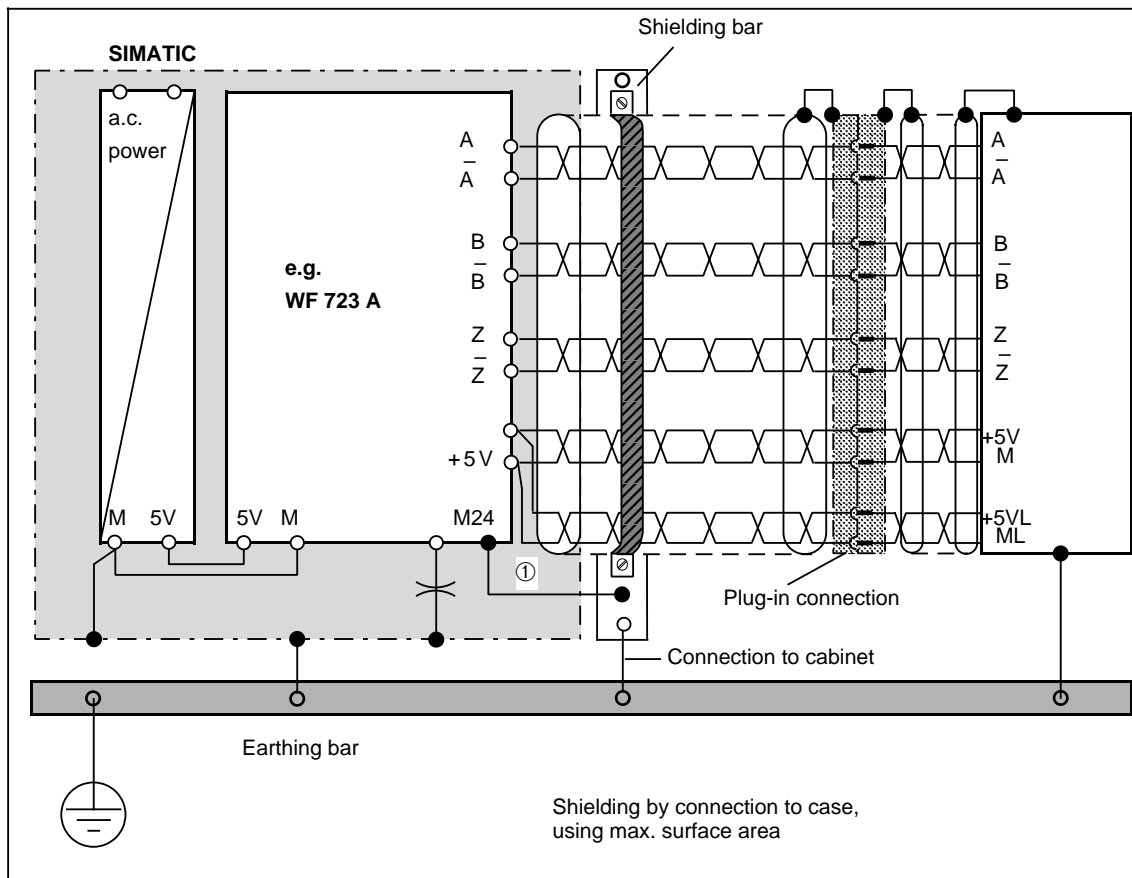
To guarantee proper signal transmission use shielded cable for signaling lines. The shield must be connected properly to destroy interference immediately.

As the command-value cable of the WF 721/WF 723 A/WF 723 B/WF 723 C contains analog as well as digital signal lines, use a cable with multiple shielding. The shields of the digital lines, just like the outer shield, have to be connected at both ends. Connect the shield of the command-value cable only on the side of the drive (receiver), using maximum surface area.

In order to generate control enable, the WF module must be powered by 24 V externally. The used cable must be shielded and the shield conductor should be connected to the components at both ends.

Take care to prevent potential differences between the M24-connection of the drive and the M24-connection of the power supply unit. In case of interference the control enable of the WF-axis would work only sporadically or not at all.

### 4.3.2.2 Connection of Incremental Position Encoders



Connect the position encoders very carefully. This signaling line carries the information about the position of the corresponding WF axis, so that the WF axis is able to position with a maximum accuracy of  $1\mu\text{m}$  and to traverse the axis with closed-loop control at a speed of 500 m/min (with a resolution of  $10\mu\text{m}$ ). The transmission frequencies in the measuring circuit cable amount to up to 250 kHz. Therefore, measuring circuit wires must be shielded. Make sure to use exclusively twisted pair wires. Avoid excessive wire pairs by careful cable selection. If this is impossible for certain reasons, connect the unused pairs to a signal potential (e.g. +5 V and M), making sure that the signals are reciprocal. Do not carry A and B in the same pair, but use A and  $\bar{A}$  or +5 V and M or only M.

Lead the shield of the line through the encoder plug (connect it to case or plug). If there is a potential difference between position encoder case and shielding bar of the WF-axis, connect a separate potential equalization line to the position encoder.

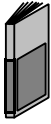
Avoid interruptions of the encoder line, e.g. through intermediate plugs or flat connectors.

### 4.3.2.3 Input Circuit Connection

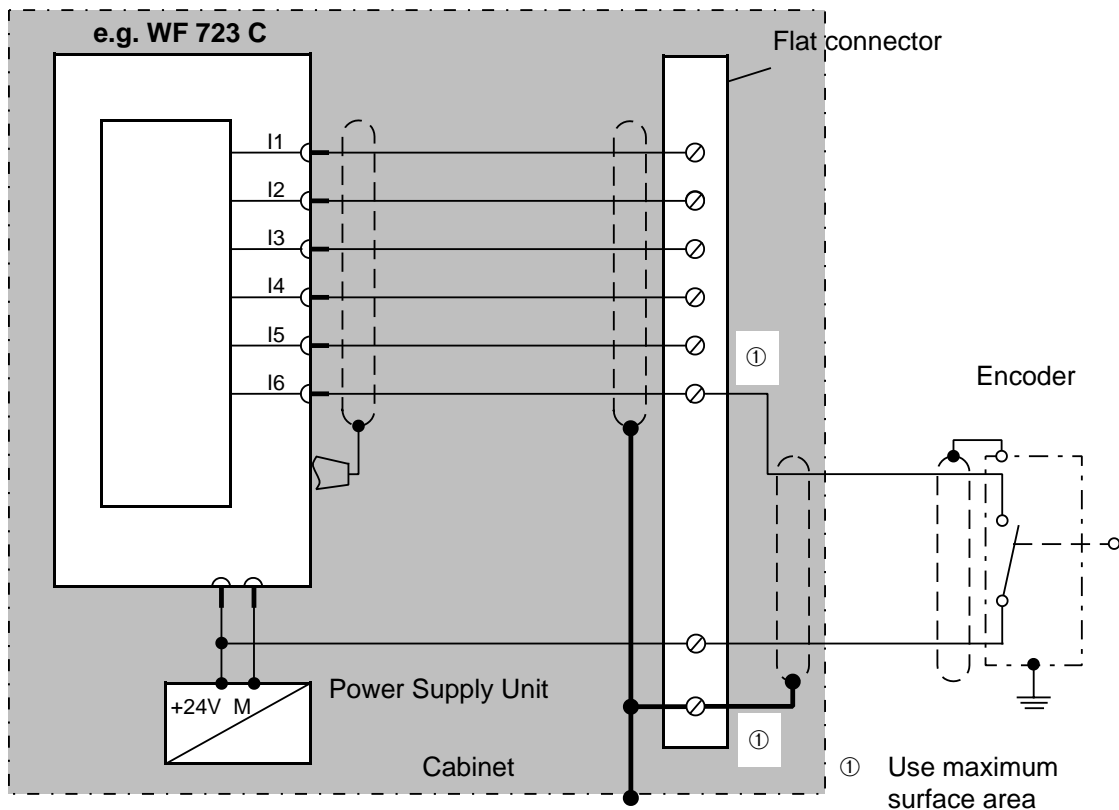
The WF 723 A/WF 723 B/WF 723 C uses 9 inputs, respectively the WF 721 uses 7 inputs. 3 controller feedback signals ("ready") from the drive can be plugged on connector X3, respectively at the WF 721 one feedback signal and 6 further input circuits on connector X7.

The function of the inputs can be selected by machine data setting (MD 15).

Some connection conditions must be fulfilled.



**The voltage and current limits mentioned in section 5 must be observed.**

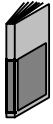


As the WF-module inputs are interrupt inputs, the encoders must be connected by shielded cable. The shield conductor must be connected to the cabinet shielding bar using maximum surface area.

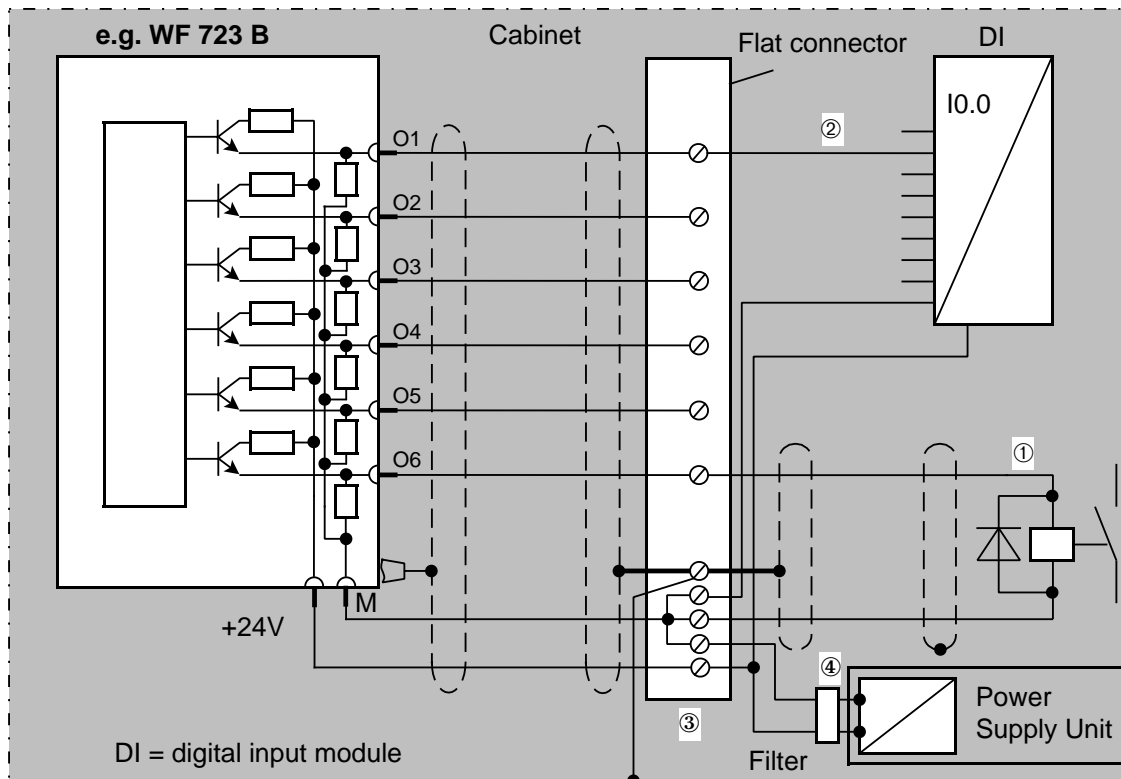
Make sure that the switching contact is bounce-free. Unused inputs must remain unconnected. Therefore, avoid superfluous wires when selecting the cables. Signals processed as an interrupt (e.g. flying actual-value setting) have to be pending for at least 50  $\mu$ s. Signals not processed as an interrupt (e.g. external block change) have to be pending for at least one WF cycle.

### 4.3.2.4 Output Circuit Connection

The 9 outputs of the WF 723 A/WF 723 B/WF 723 C, respectively the 7 outputs of the WF 721, are located similar to the inputs on the connectors. 3 outputs used for control enable, respectively one output at the WF721. This outputs must be plugged on connector X3 and 6 further outputs are plugged on connector X7. The function of the outputs (X7) can be selected by machine data setting (MD 16).



**The voltage and current limits mentioned in section 5 must be observed.**



- ① The cables used for relays or electromagnetic valves must be shielded. The unshielded part of the cable must be kept as short as possible. Coils must be de-jammed.
- ② When connecting an output to a digital input of the PLC make sure that the relevant return circuit is laid very close to the hot wire. At distances > 3 m or when laying wires parallel to other signaling lines use shielded cable.
- ③ The shield conductors must be connected to the shielding bar or the cabinet by maximum surface area. Wires or clamps must not be used.
- ④ If the power supply unit is mounted externally to the module cabinet, the supply voltage has to be filtered when entering the cabinet (the same applies to mains voltages).

When re-energizing the WF-modules, a hardware circuit provides that the outputs are in low state.

# 5 Technical Data

In addition to national and international recommendations, various Siemens standards (SN) are valid. The applicable standards are indicated in the corresponding sub-sections.

## 5.1 Electrical Data

<b>Internal Power Supply</b>	
The modules are powered via the corresponding SIMATIC bus. Regulated d.c. power supply SN 26555 part 9.	
Nominal voltage	+5 V
Voltage limits/static	+4.85 V to +5.25 V
Current consumption (without encoder) – WF 721 – WF 723 A – WF 723 B – WF 723 C	1.0 A 1.3 A 1.4 A 1.4 A
Admissible current consumption per encoder	max. 0.3 A

<b>External Power Supply</b>	
For digital outputs of the module, +24 V and M is needed for connector X7. Regulated d.c. power supply SN 26555 part 9.	
Nominal voltage	+24 V
Voltage limits/static	+20 V to +30 V
Voltage limits/dynamic – lower limit      voltage duration recovery time – upper limit      voltage duration recovery time	+14.25 V 5 ms 10 s +35 V 500 ms 50 s

<b>Signal Voltages</b>	
<b>Analog</b> d.c. signal voltages SN 26555 part 1 or DIN IEC 381, part 2	
Nominal analog output voltage range	– 10 V to +10 V
Permitted load current	0 mA to 2 mA

<b>Signal Voltages</b>	
<b>Binary</b> d.c. signal voltages SN 26555 part 3	
High level – nominal voltage range – permitted voltage range for inputs outputs – permitted current range for inputs outputs Permitted inductive load	+24 V  +13 V to +33 V +15 V to +33 V  0 mA to 5 mA 0 mA to 500 mA damping necessary with recovery diode or RC-circuit
Low level – nominal voltage – permitted voltage range for inputs outputs	+0 V  – 2 V to +4.5 V 0 V to +2.5 V
Frequency limits/ baud rate for encoder input – incremental – serial	250 kHz 125 kBit/s
Required input current Encoder signals – incremental – serial	10 mA 7 mA

## 5.2 Reliability

<b>Temperature</b>	<b>MTBF (mean time between failure)</b>
25 °C – WF 721 – WF 723 A – WF 723 B – WF 723 C	6.65 years 5.7 years 6.18 years 6.18 years
55 °C – WF 721 – WF 723 A – WF 723 B – WF 723 C	2.47 years 1.8 years 2.34 years 2.34 years



### 5.3 Mechanical Data

Vibrating stress during operation (DIN IEC 68-2-6; SN29010-1, class 12)	10 Hz to 58 Hz: 0.075 mm excursion 58 Hz to 500 Hz: 9.81 m/s <sup>2</sup> (=1g)
Vibrating stress when module packed ready for dispatch (DIN IEC 68-2-6; SN29010-2, class 22)	5 Hz to 9 Hz: 3.5 mm excursion 9 Hz to 500 Hz: 9.81 m/s <sup>2</sup> (=1g)
Toppling over of unpacked module (DIN IEC 68-2-31)	Height of fall 50 mm
Rolling test of packed module (DIN IEC 68-2-31)	
Weight – WF 721 – WF 723 A, WF 723 B, WF 723 C	approx. 0.6 kg approx. 0.7 kg

### 5.4 Climatic Environmental Conditions

Ambient temperature (DIN IEC 68-2-1 cold; DIN IEC 68-2-2 dry heat; DIN IEC 68-2-3 humid heat) – operating temperature (SN26551-1, assignment B) – storage temperature (SN26556-2, assignment C)	0 °C to +55 °C $\Delta T \leq 10$ K/h – 40 °C to +70 °C $\Delta T \leq 20$ K/h
Air pressure – during operation  – storage	min. 860 hPa (below, restricted refrigerating capacity) max. 1060 hPa min. 660 hPa max. 1060 hPa

### 5.5 Chemical Stress

Protect the system against influence of chemically aggressive gas by corresponding measures during system installation.

Operation-Endangering Dust or Gas	
Type of ventilization	Self-ventilated
Class of protection	VDE0106-1(IEC536) class III
Protection against water and foreign substances (DIN40050; IEC529) – module plugged into the SIMATIC S5 rack – module withdrawn	IP20 IP10

## 5.6 Electromagnetic Compatibility

### 5.6.1 Interference Suppression



*The system operator is responsible that interference suppression of the entire system (controllers, drivers, machines, etc.) is guaranteed.*

The WF 721/WF 723 A/WF 723 B/WF 723 C complies with the limiting-value class A (DIN VDE 0871 part 1 and 2) for frequencies higher than 10 kHz.

### 5.6.2 Resistance to Jamming (According to Standards: IEC 801-2, 3 and 4)

<b>Resistance against cable disturbance (tests according to IEC 801-4)</b>	
D.C. power supply cable – testing voltage – test duration	3 kV 1 min
Signaling cable (leaving the module) – testing voltage – test duration	2.5 kV 1 min

<b>Resistance against electrostatic discharge (tests according to IEC 801-2)</b>	
– testing voltage – test duration	8 kV 10 discharges (at a rate of 1 disch./sec.)

<b>Resistance against high frequency interference (tests according to IEC 801-3)</b>	
– testing field intensity – test duration	10 V/m (27 MHz to 500 MHz) 11 min per frequency decade

## 5.7 Data Securing

The WF-module data is stored in RAM that is buffered by the SIMATIC power supply.



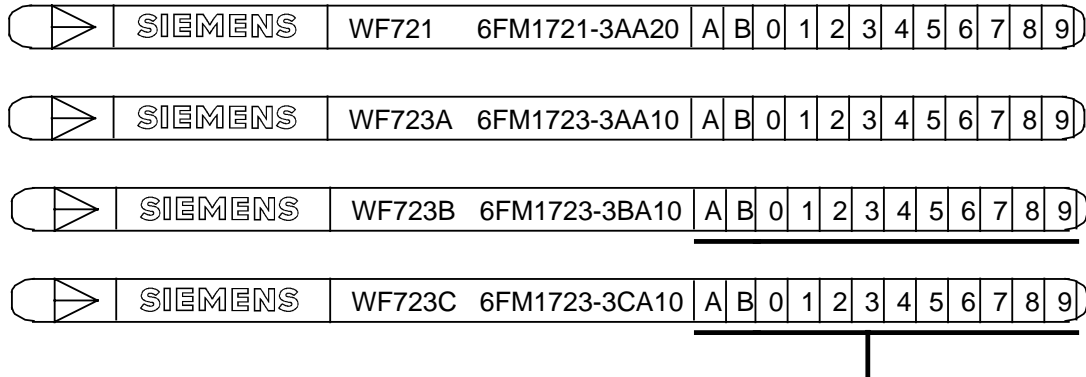
### ATTENTION

*When withdrawing WF-modules, data is lost. Therefore, it is necessary to save the data centrally or to make a data copy before withdrawing the module.*

# 6 Hardware Description

## 6.1 Labels

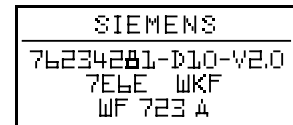
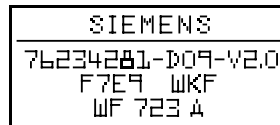
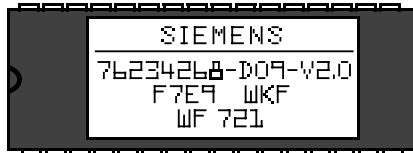
- The following label is attached to the front panel of the module:



Object version (= coding of hardware and firmware version)

The current object version is made known by means of revision notes. Please contact your Siemens branch office.

- EPROM label (WF 721/WF 723 A only)



socket-no. (D09)  
software version (V2.0)  
check sum (F7E9)

- FEPROM label (WF 723 B/WF 723 C only)  
The labels mark the version of the loadable firmware on delivery of the module and have therefore no special meaning.



**The WF 723 B, order number 6FM1 723-3BA10, has FEPROM label (order number 6FM1 723-3BA00 has EPROM label).**

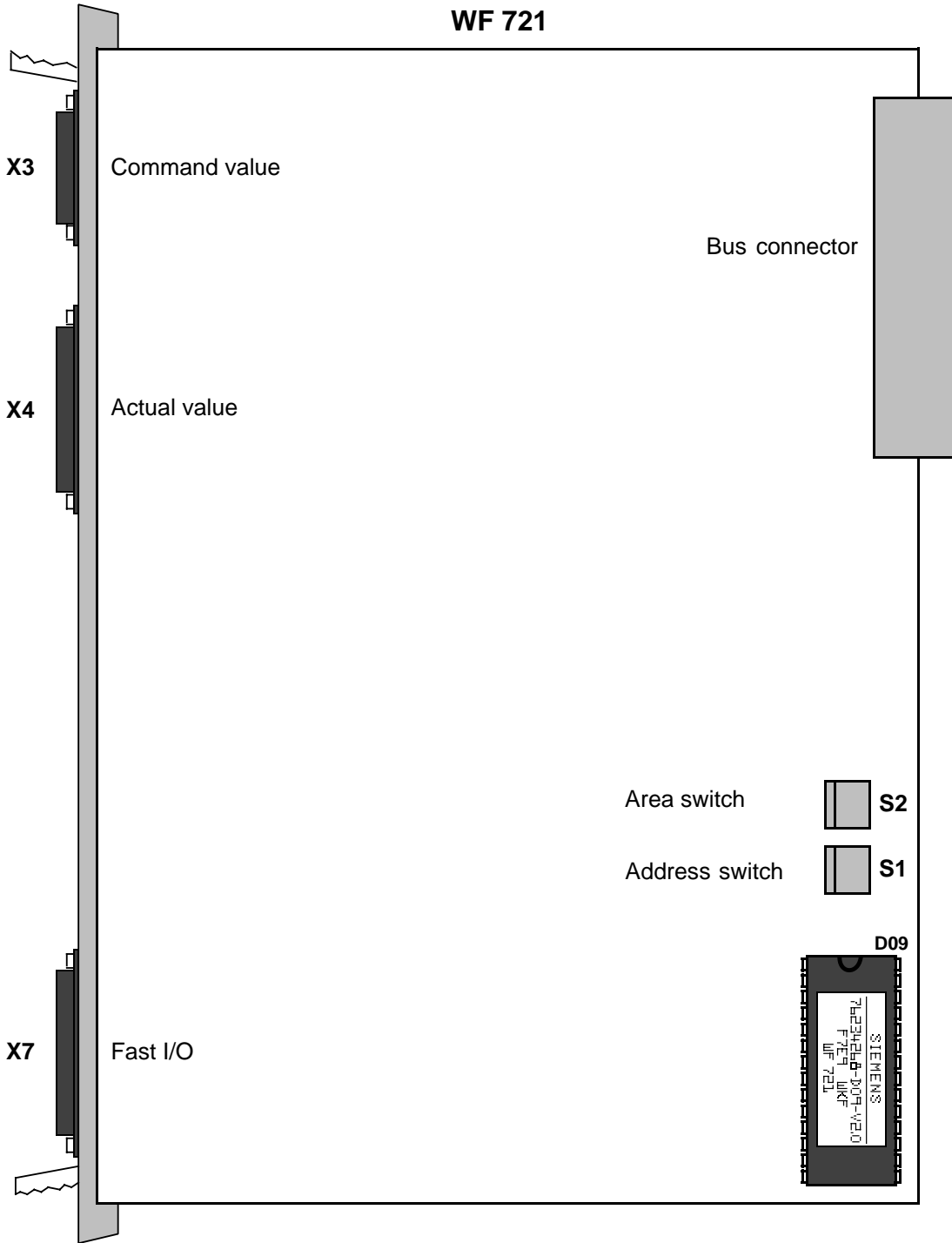


Fig. 6.1 WF 721 – socket location of the EPROM

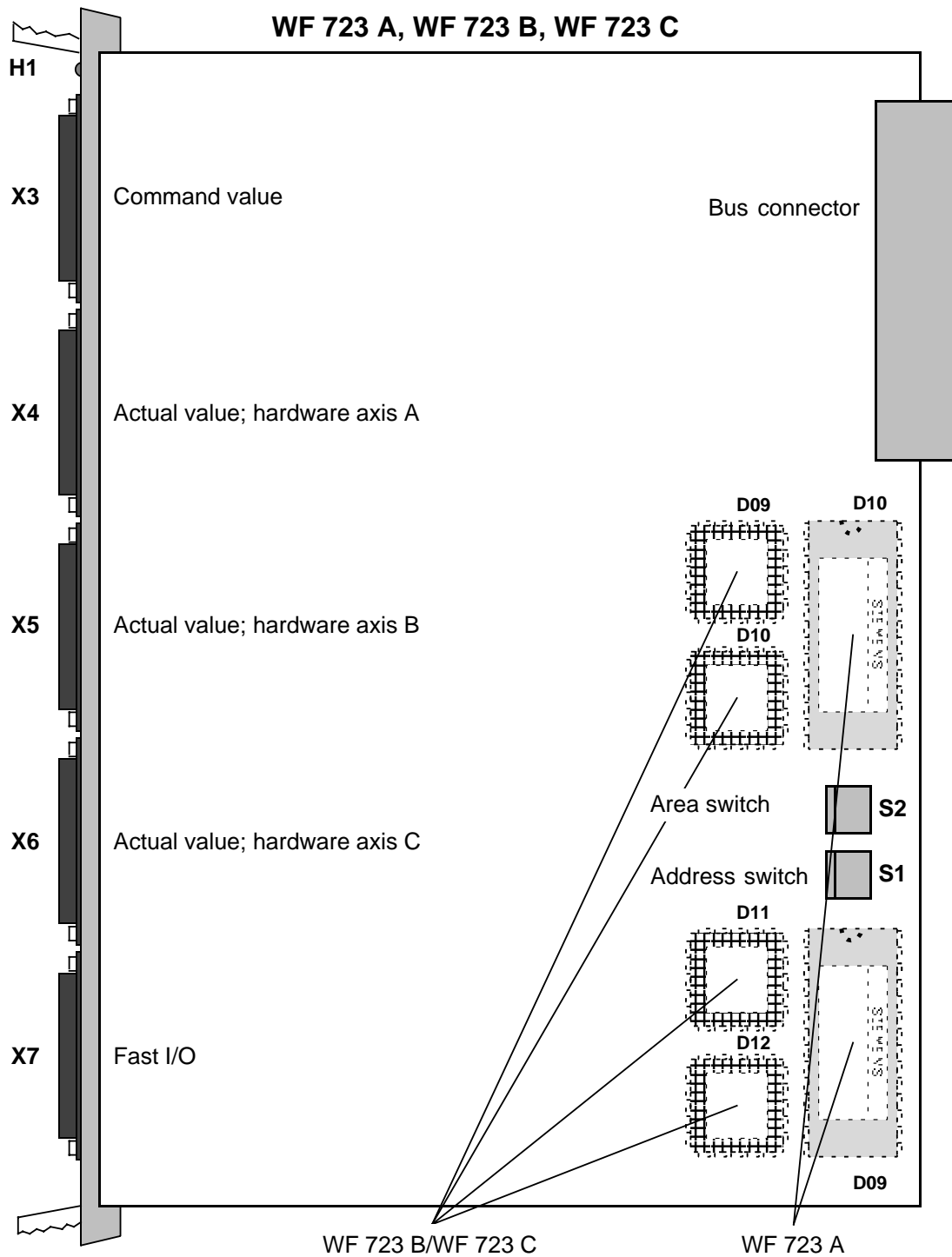


Fig. 6.2 WF 723 A, WF 723 B, WF 723 C – socket locations of the EPROM / FEPR0M

## 6.2 Addressing the WF-module as a SIMATIC S5 Periphery

The respective addressing range is set both on the module and on the IM314 interface (refer to device and periphery manual).

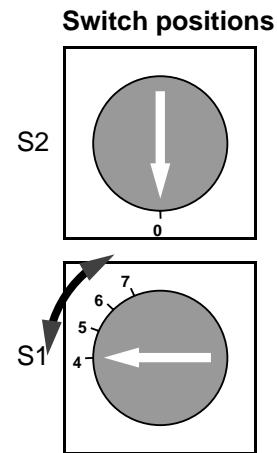
### 6.2.1 Normal Periphery (P area)

Set the starting address of the WF modules by means of the rotary switches S1/S2. Each WF module occupies in the addressing area of the SIMATIC S5 an area of 32 bytes. The WF module is addressed as a digital peripheral module. The area of the process picture is reserved for digital peripheral input/output modules.

For this reason, the peripheral address has been fixed as the first address that can be set. Therefore, up to 4 modules can be addressed in the normal peripheral area.

Addressing as normal periphery

Starting address	WF No.	Switch position	
		S1	S2
P 128	1	4	0
P 160	2	5	0
P 192	3	6	0
P 224	4	7	0



Modules in the normal peripheral area are situated on the absolute hardware addresses of F000-F0FF (S5-115U and S5-135U) or FF000-FF0FF (S5-155U). If the WF modules are plugged in the expansion unit, the latter must be addressed as P periphery.

### 6.2.2 Extended Periphery (Q area)

The automation units S5-115, S5-135U and S5-155U offer the possibility to use further peripheral modules in the Q area. Through this extended peripheral area, up to 8 WF modules can be used.

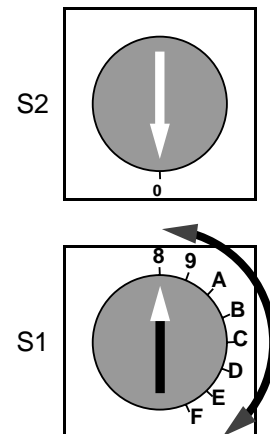
With S5-115U automation units, WF modules addressed in the Q area may only be plugged in the expansion unit.

If the modules are plugged in the expansion unit, the latter must be addressed as Q periphery.

## Addressing as Q periphery

Starting address	WF No.	Switch position	
		S1	S2
Q 0	5	8	0
Q 32	6	9	0
Q 64	7	A	0
Q 96	8	B	0
Q 128	9	C	0
Q 160	10	D	0
Q 192	11	E	0
Q 224	12	F	0

### Switch positions



Please note that in the central controller only modules may be used which decode the Q periphery addresses themselves. All other modules, e.g. all digital peripheral modules, must be accommodated in expansion units.

### 6.2.3 Addressing in the IM3/IM4 area

Through a corresponding setting of switches S1 and S2, it is possible to address the WF modules in the so-called IM3 or IM4 area. The starting addresses are in the absolute addressing area FC00-FCFF or FD00-FDFF (for S5-155U, FFC00-FFCFF and FFD00-FFDFF).

When making use of the two addressing areas IM3/IM4, another 8 WF modules each can be used in the SIMATIC S5.

When using the digital peripheral modules and positioning modules together in one expansion unit, the addresses must not overlap.

No digital I/O modules in the central controller of the S5-135U and S5-155U may be addressed if the address is used once more in another area. In the S5-155U automation unit, modules addressed as IM3 or IM4 must be plugged exclusively in the expansion unit.

#### Recommendation:

The necessary digital I/O modules can be addressed in an expansion unit in the P area. In this case, the IM314 interface will prevent any address overlaps with modules in other devices, e.g. central controller.

If the WF modules are plugged in the expansion unit, the latter must be addressed as IM3 or IM4 area.

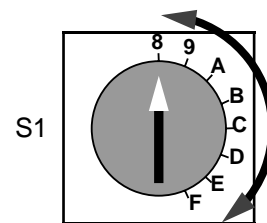
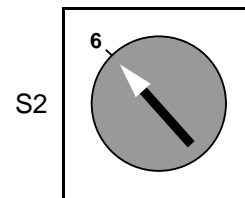
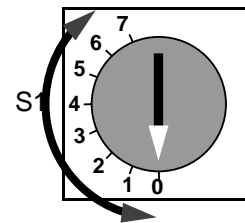
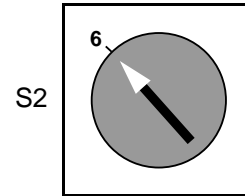
Therefore results for the automation units S5-115U, S5-135U and S5-155U the maximum possible number of 28 WF modules.



**When additionally utilizing the IM3/IM4 area, use Standard A version 2.0 (for 28 modules).**

Starting address	WF No.	Switch position	
		S1	S2
IM3 0	13	0	6
IM3 32	14	1	6
IM3 64	15	2	6
IM3 96	16	3	6
IM3 128	17	4	6
IM3 160	18	5	6
IM3 192	19	6	6
IM3 224	20	7	6
<hr/>			
IM4 0	21	8	6
IM4 32	22	9	6
IM4 64	23	A	6
IM4 96	24	B	6
IM4 128	25	C	6
IM4 160	26	D	6
IM4 192	27	E	6
IM4 224	28	F	6

**Switch positions**



Please note that in the central controllers S5-135U and S5-155U, only modules may be used which effect the extended decoding themselves. All other modules, e.g. all digital peripheral moduels, must be accommodated in expansion units.



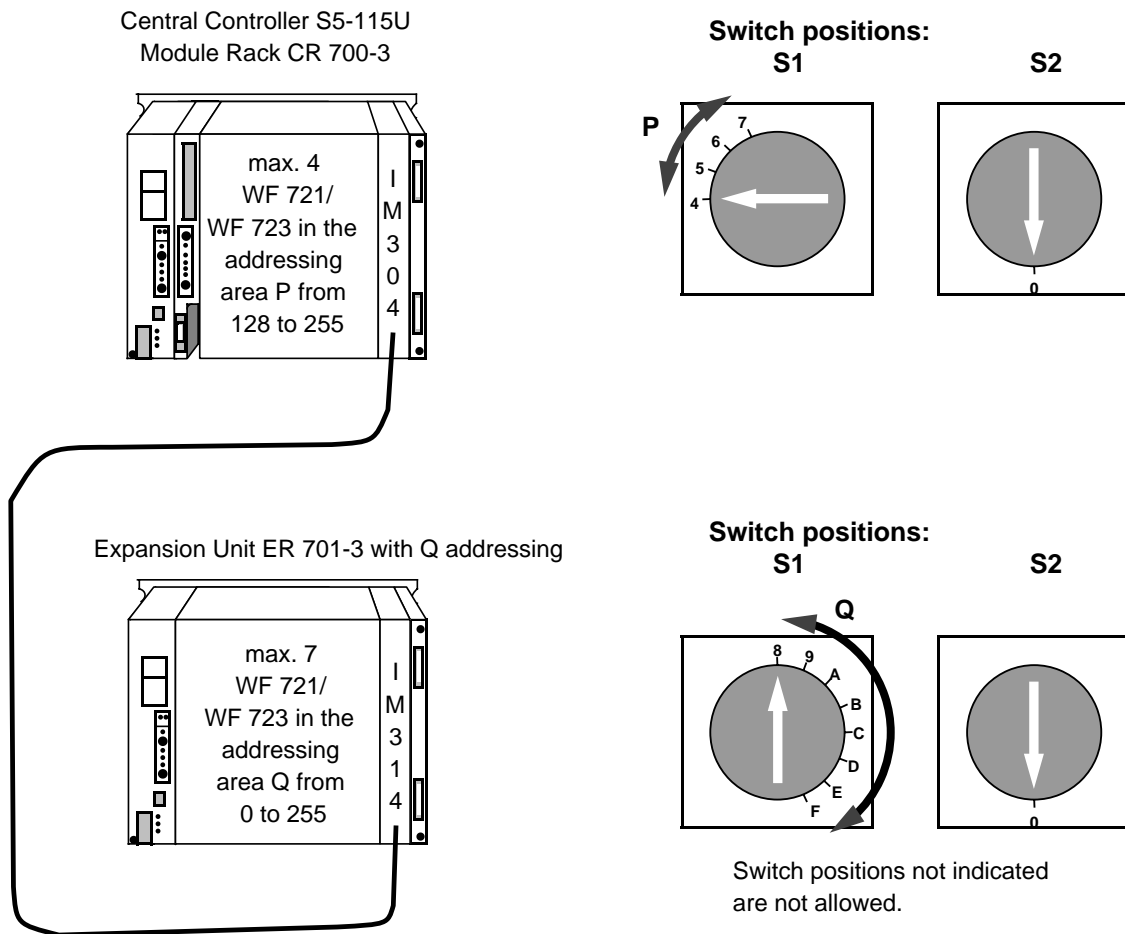
## 6.2.4 Module Location Variants and Addressing Area

Addressing area	Automation Unit						Switch position	
	S5-115U		S5-135U		S5-155U		S1	S2
	ZG	EG	ZG	EG	ZG	EG		
P	X	X <sup>1)</sup>	X	X <sup>1)</sup>	X	X <sup>1)</sup>	4 to 7	0
Q	—	X <sup>2)</sup>	X	X <sup>2)</sup>	X	X <sup>2)</sup>	8 to F	0
IM3	—	X <sup>3)</sup>	X	X <sup>3)</sup>	X	X <sup>3)</sup>	0 to 7	6
IM4	—	X <sup>4)</sup>	X	X <sup>4)</sup>	X	X <sup>4)</sup>	8 to F	6

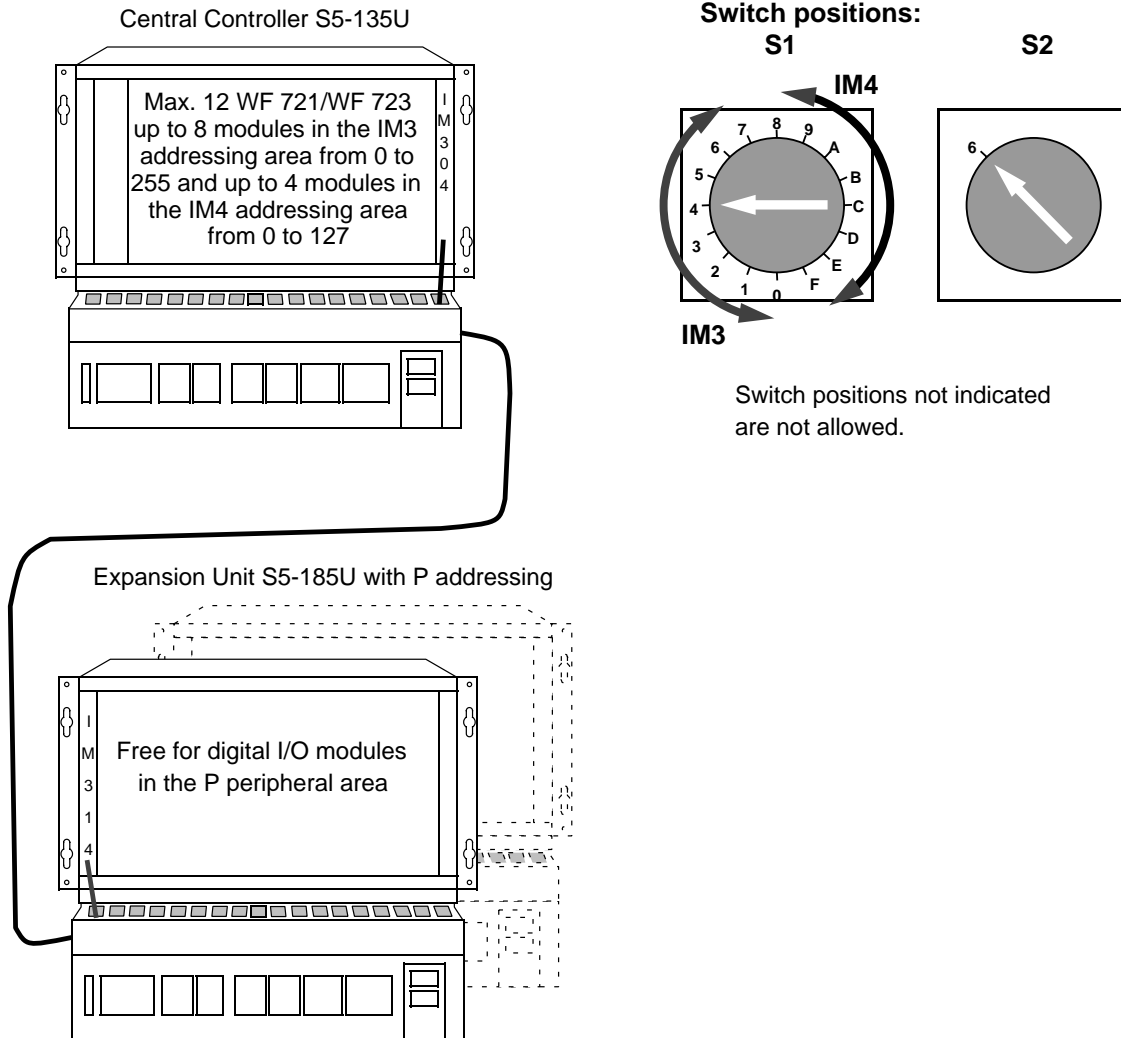
- 1) The IM314 interface must be addressed as P area.
- 2) The IM314 interface must be addressed as Q area.
- 3) The IM314 interface must be addressed as IM3 area.
- 4) The IM314 interface must be addressed as IM4 area.

## 6.2.5 Addressing Examples

### 6.2.5.1 Addressing Area P in the Central Controller and Area Q in the Expansion Unit



## 6.2.5.2 Addressing area IM3/IM4 in the Central Controller



## 6.3 Addressing the WF-module as a SIMATIC S7-400 Periphery

The WF-modules can be used in the SIMATIC S7-400 in different ways:

- in the SIMATIC S7-400 central controller by means of a SIMATIC S7 adaptor casing,
- in the SIMATIC S5 expansion unit by means of the interfaces IM463-2 (S7) and IM314 (S5).

In the SIMATIC S7-400 central controller, max. 8 adaptor casings, i.e. max. 8 WF-modules can be plugged. In the SIMATIC S7-400 central controller, max. 4 IM463-2 can be plugged and each IM463-2 can be coupled with max. 32 WF-modules can be addressed.

For configuring the adaptor casing and the IM463-2 interface, you need the STEP7-Tool HWKonfig (hardware configuration).

The following settings have to be made:

- **Entry:** Only one WF module can be operated in one adaptor casing. Therefore, only one entry per casing is admissible. For the IM463-2 interface, an entry for each WF module must be generated. As several S5 expansion units can be coupled via one IM463-2, the entries refer to the total number of all modules.
- **S7 address:** The address under which the WF module shall be addressed in the S7 program (Standard A). The S7 addresses begin at 512.



***This address must be indicated in the DBZU as "S7 address".***

- **S5 address:** The WF module address set by the addressing switches S1 and S2, the area being indicated separately.
- **Length:** The modules WF 721/WF 723 A/WF 723 B/WF 723 C have a fixed length of 32 bytes.



***The next S7 address must be at least 32 bytes higher.***

- **Part PA:** For WF modules, 0 must be set.
- **Area:** In the adaptor casing, only the P area is admissible. Via the IM463-2 interface, the areas P, Q, IM3 and IM4 can be selected.



***The corresponding areas must also be set on the IM314.***



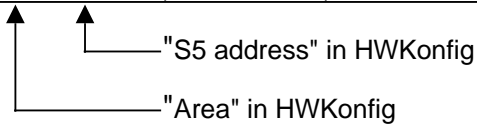
***Make sure that neither S7 addresses nor S5 addresses overlap.***

### 6.3.1 Normal Periphery (P area)

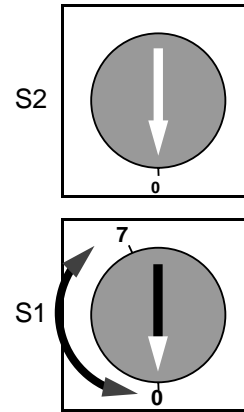
It can be used with adaptor casing and IM463-2 interface.

Addressing as normal periphery

Starting address	WF No.	Switch position	
		S1	S2
P 0	1	0	0
P 32	2	1	0
P 64	3	2	0
P 96	4	3	0
P 128	5	4	0
P 160	6	5	0
P 192	7	6	0
P 224	8	7	0



Switch positions



***If the WF modules are operated in the S5 expansion unit, set the P area on the IM314.***

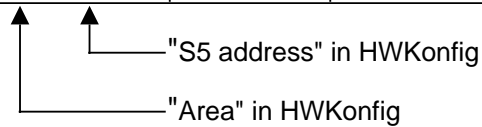
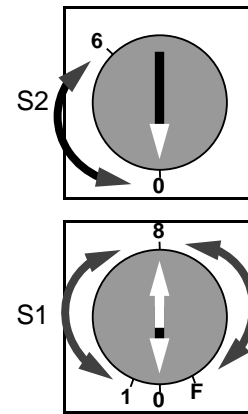
### 6.3.2 Extended Periphery (Q-, IM3-, IM4 area)

It can be only be used in the S5 expansion unit with IM463-2 interface.

Addressing as extended periphery

Starting address	WF No.	Switch position	
		S1	S2
Q 0	9	8	0
Q 32	10	9	0
Q 64	11	A	0
Q 96	12	B	0
Q 128	13	C	0
Q 160	14	D	0
Q 192	15	E	0
Q 224	16	F	0
IM3 0	17	0	6
IM3 32	18	1	6
IM3 64	19	2	6
IM3 96	20	3	6
IM3 128	21	4	6
IM3 160	22	5	6
IM3 192	23	6	6
IM3 224	24	7	6
IM4 0	25	8	6
IM4 32	26	9	6
IM4 64	27	A	6
IM4 96	28	B	6
IM4 128	29	C	6
IM4 160	30	D	6
IM4 192	31	E	6
IM4 224	32	F	6

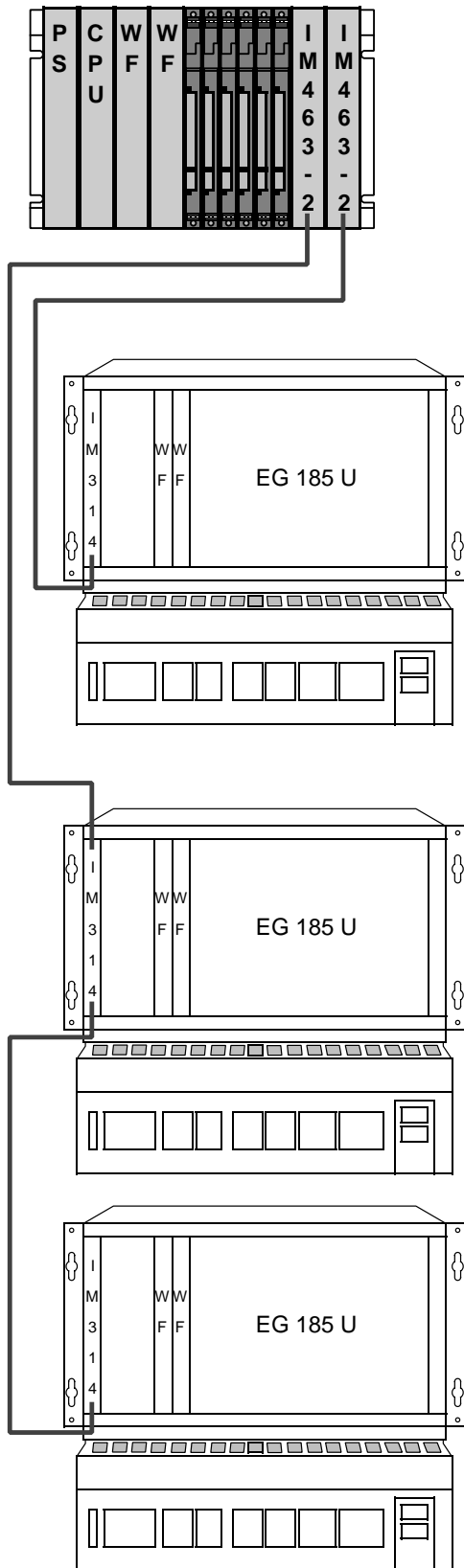
Switch positions



**Set the Q, IM3 or IM4 area on the IM314.**

### 6.3.3 Addressing Example

SIMATIC S7-400

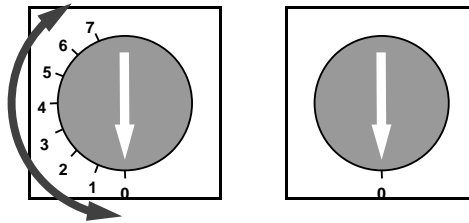


Switch positions:

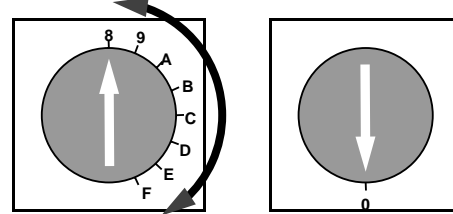
S1

S2

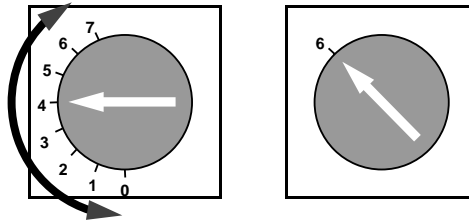
exclusively P area



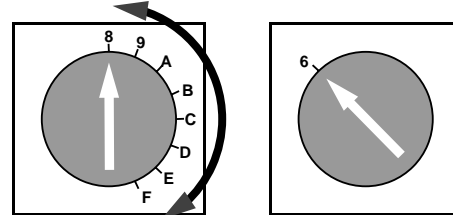
e.g. Q area



e.g. IM3 area



e.g. IM4 area



Switch positions not indicated are not allowed.

# 7 Peripheral Equipment

## 7.1 Selection of the Final Control Elements

### 7.1.1 General

The selection of final control elements must be done according to the needs that are expected of the positioning system, with closed-loop position control:

- The programmed positions must be reached with extreme precision and in a minimum of time.
- Given speeds must be kept exactly and with minimum tolerances, even if the mechanic loads acting upon the axis are changing.
- At standstill, the axis must have a high rigidity, to prevent leaving the position through machining forces.
- It must be possible to freely select the speeds of the axes over a large range.

To fulfill all these requirements, the selection of the final control element is of decisive importance.

### 7.1.2 Final Control Element

The final control element is the part of the closed-loop controller that moves the mechanics by an analog command value. This value is transmitted by the WF module.

The final control element is built out of one (or several) control loops that are cascade-controlled by the closed-loop controller.

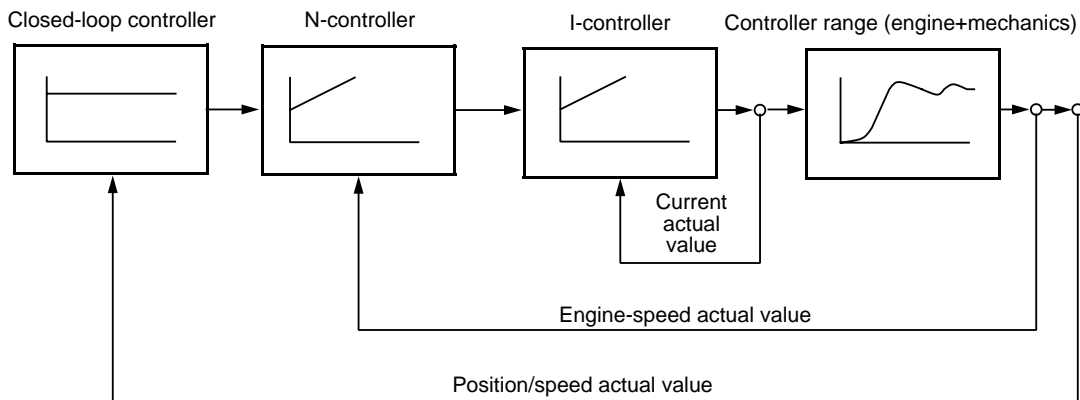


Fig. 7.1 Final control element

For the final control element of the WF-axis, d.c.-powered as well as three-phase-powered servodrives can be used. Both types of drive are equipped with the necessary PI controller that moves the axis completely up to the programmed end position.

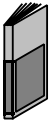
Electrohydraulic relay valves are also used that move the mechanics by hydraulic pressure instead of electromagnetic forces (electric motors).



***If there is no cascaded speed or engine-speed control loop, there will be losses in dynamics and positioning precision.***

All these drives or final control elements must not only fulfill the requirements regarding dynamics and control range, but it must also be possible to operate them in all 4 torque/engine-speed quadrants. That means that the drive must be able to accelerate or decelerate in both directions of rotation. Single-quadrant or two-quadrant drives cannot be used.

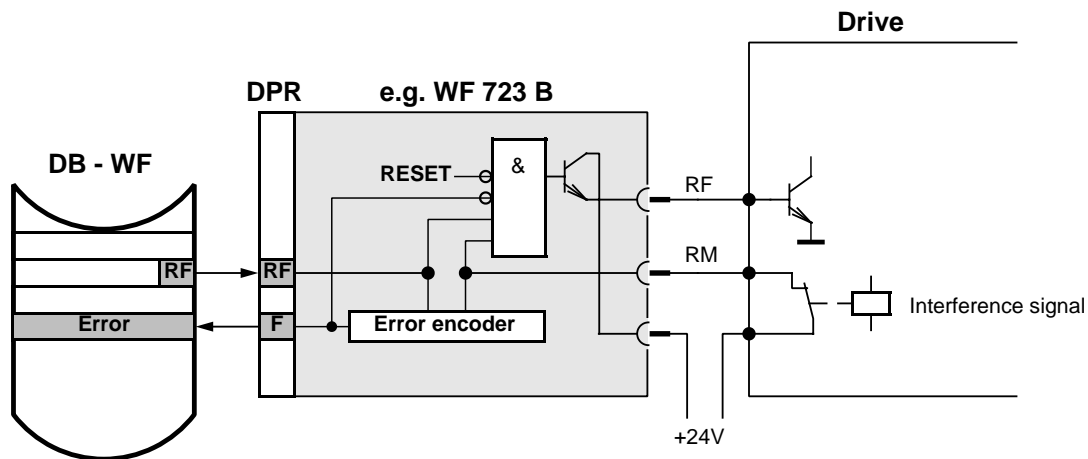
### 7.1.3 Drives



***Refer to the SIMODRIVE-catalogs NC 60.1 and NC 60.2***



## 7.1.4 Controller Enable and Ready Signal of the Drive



DPR . . . dual-port RAM  
 RF . . . controller enable  
 RM . . . controller ready  
 F . . . error bit

The user can control the "controller enable" signal transmitted to the drive by the control interface in the DBWF.

If the RF bit is set via the user software, the WF axis output will be selected when the following conditions are fulfilled:

- No RESET
- No error
- Drive ready

If the drive controller used is not able to output a direct "ready" message, supply the RM input with +24 V.

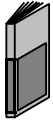
If the controller needs for "controller enable" another signal voltage than +24 V, the "controller enable" output has to be decoupled by means of a relay, taking into account by all means the maximum current load. Otherwise the module might be destroyed.

If a suspended axis without weight compensation is controlled by the WF module, the selection of the stop brake must be connected with the output "controller enable" signal.



***The outputs for the command values are in undefined state when on-powering. Therefore, the controller enable output must be jumpered.***

## 7.2 Position Encoders



*For further information on position encoders, refer to the sections on incremental encoders, serial encoders and closed-loop position control in the Description of Functions.*

### 7.2.1 Admitted Position Encoders

Via PRODOK and "Equipment for Special-Purpose Machines - User Information", the admitted encoders will be made known and updated.

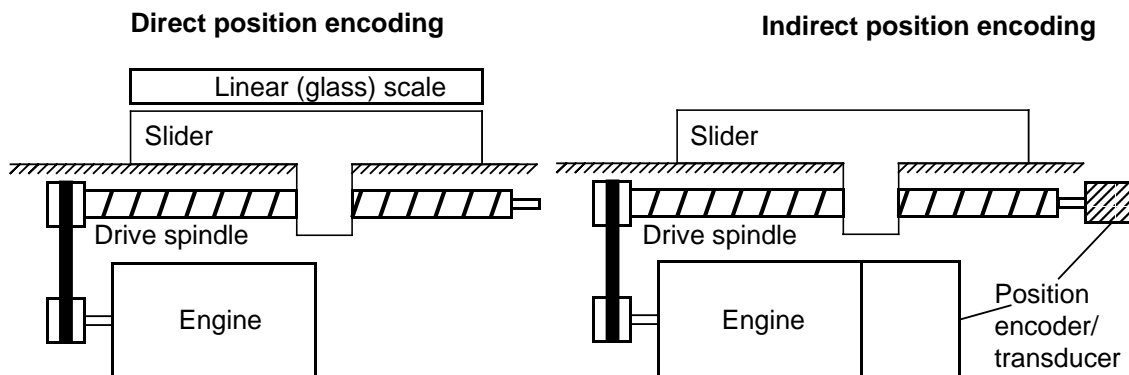
### 7.2.2 Serial Position Encoders

The WF modules offers the possibility to connect on plugs X4, X5 and X6 at choice a serial position encoder instead of an incremental encoder.

Serial position encoders are only admitted with 13, 21, 25-bit data format and Gray code and +24 V power supply.

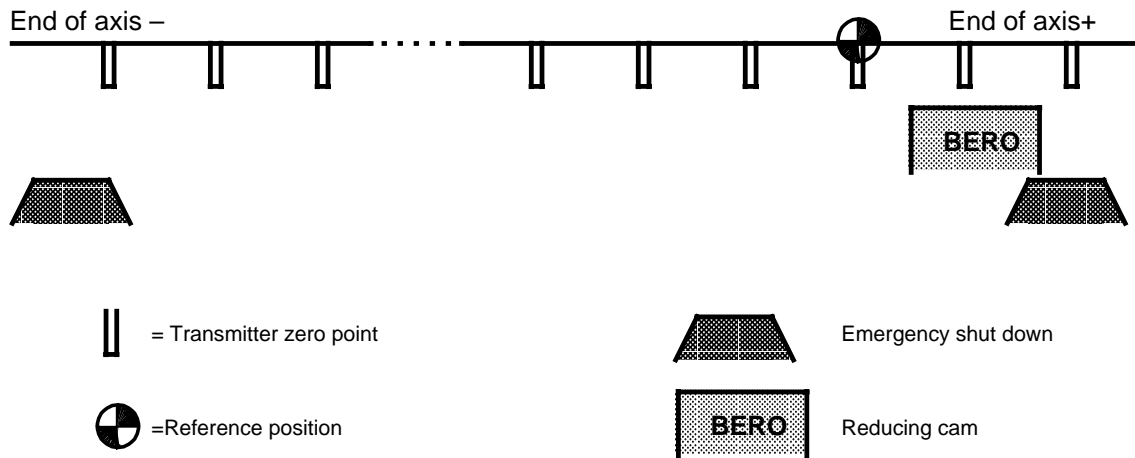
### 7.2.3 Incremental Position Encoders

The position encoding of the WF axis can be done by incremental rotatory encoders as well as with a glass scale using external pulse shaping circuits (EXE). In many cases the rotatory encoder is mounted onto the engine (indirect position encoding), whereas the glass scale measures the position directly at the table.

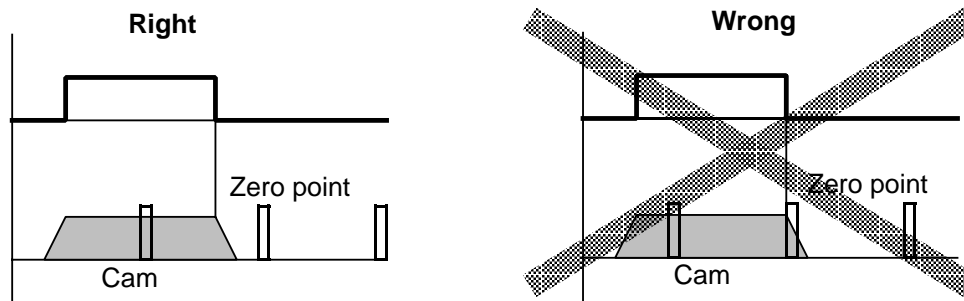


## 7.2.4 Reducing Cam for Reference Position Traversing

To synchronize the control with the mechanics, the reference points must, in case of incremental position encoders, be approached without collision. The software limit switches are not yet effective before synchronization. Therefore, it is recommendable to arrange the reducing cams at the end of the traversing range.



The length of the reducing cam must be at least as long as the deceleration distance when approaching the cam. The switching moment of the cam should be set in such a way that the zero point signal is output some millimeters after passing the switching position.



Switching tolerances due to temperature changes of the reducing cam may in case of setting errors lead to faulty synchronization (risk of collision). Make sure, by a corresponding selection of the position encoders, that the physical distance between zero points is not too small, as this might lead to adjusting problems.

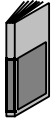
When selecting the reducing cam, observe the following:

- The switch must work with +24 V. The voltage must electrically be connected with the a.c. voltage (refer to "technical data").
- The current load of the switch is very low (< 5 mA), so that the contact in some switches is not sufficient.
- When connecting a BERO to the WF-axis, the signal must be free of clock frequencies (also check in damped mode).
- Bear in mind the switching hysteresis (time delay).
- As the reducing cams are connected to interrupt inputs of the WF axis, a shielded cable must be used for connection (refer to section 4).

## 7.2.5 Position Encoder Extension

The position encoder transmits the position as well as the traversing speed to the WF axis. Therefore, the encoder has to be mounted very carefully.

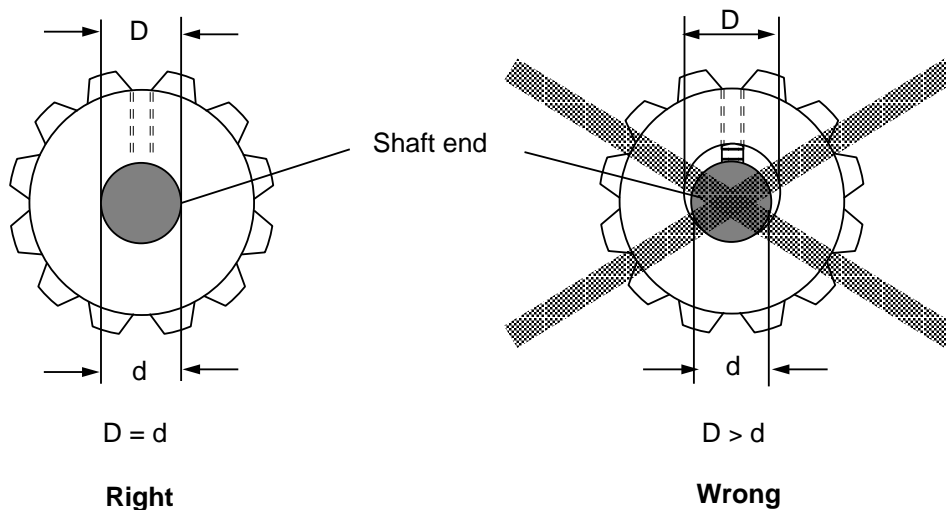
Position encoders have different shaft diameters. By means of a coupling element, a rigid connection between encoder and engine or measuring pinion is effected. Beside spring washer couplings, corrugated-pipe couplings are used for connecting the position encoder.



*For technical data and order numbers of the coupling elements, refer to catalog NC 90 for incremental position encoders, or the SIMODRIVE or manufacturer documentation for serial position encoders.*

### Example:

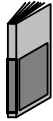
If the encoder is connected with the mechanics by a pinion (and a toothed belt, make sure that the shaft end fits tightly in the adaption hole.



If this is not observed, the toothed belt might vibrate and skip one or several teeth (risk of collision). Furthermore, the run of the axis will be very bumpy, due to the varying actual value. The resulting shocks might lead to frequent failure of the position encoder.

Make sure that the couplings fit tightly, that the encoder is mounted centrally and at the correct angle, and that the screws are firmly tightened. Loose screws may lead to slipping of the couplings and thus to positioning errors.

## 7.3 High-Load Power Supply Units



**Recommended devices: 6EV1 with 20 A or 40 A output current. For detailed information, refer to catalog ET 8.**

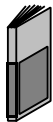
When using other devices, the following minimum requirements have to be observed:

- Rotary-current bridge circuit (400 V primary)
- Filter capacitor with 200  $\mu\text{F}$  per 1 Ampere current

## 7.4 Admitted Operation Components

		COM 723	PC-Steu.	B-470	B-GRACIS	B-OP25/ OP35
WF721/WF723A in SIMATIC	S5	•	•	•	•	•
	S7	•	•	—	—	•
WF723B in SIMATIC	S5	•	•	—	•	•
	S7	•	•	—	—	•
WF723C in SIMATIC	S5	•	•	—	—	•
	S7	•	•	—	—	•

- Operation possible
- Operation not possible



**For more detailed information and order number, also for further accessories, refer to catalog AR10 (order No. E86060-K6310-A101-A5-7600).**

### 7.4.1 PG (PC) with COM 723/PC-Control

The COM 723 and PC-Control software packages run on a programmer or an industrial-standard PC IBM under Windows.

In large systems, often an AG interface cable is used for connection of the switch cabinet and the main control desk. This cable must be laid separate from power cables. Near the cabinet entry, connect the shielding conductor to an equalization busbar using maximum surface area. The same applies to the entry to the main control desk.

## 7.4.2 WF 470 with Standard B-470

The display module WF 470 is an operation component which permanently remains connected with the automation unit. The display monitor is supplied with an RGB signal from the module. The keyboard can be connected at choice in parallel via an input module, or serially to the WF 470. Screen masks are stored in the RAM or EPROM of the WF 470 and called via Standard B-470 and the WF 470 linking software. Standard B-470 fetches or transmits the WF 721/WF 723 A data to the Standard A software.

### Connectable operator panels:

- WS 400-20
- WS 400-22
- WS 400-30/WS 400-50
- Compact operator panel

## 7.4.3 GRACIS with Standard B-GRACIS

Standard B-GRACIS runs on GRACIS version 1.4 and the admitted GRACIS hardware.

The GRACIS visualization system is available in various forms:

- Integrated in the SIMATIC S5 (GRACIS-S5)
- Integrated in the programmer (GRACIS-PG)
- Integrated in the operator panel (GRACIS-OP)

## 7.4.4 OP25 or OP35 with Standard B-OP25/OP35

Standard B-OP25/OP35 serves for visualization with the Operator Panels OP25 or OP35. Configured standard masks are stored on the OP and can be modified and extended with PROTOOL.

For operating Standard B-OP25/OP35, the following hardware is needed:

- Automation unit which admissible CPU module
- WF 721, WF 723 A, WF 723 B or WF 723 C
- Operator Panel OP25 or OP35
- Connection line between OP and automation unit
- Connection line between PC/PG and OP

# 8 Cable Diagrams

## 8.1 Command Value Cable

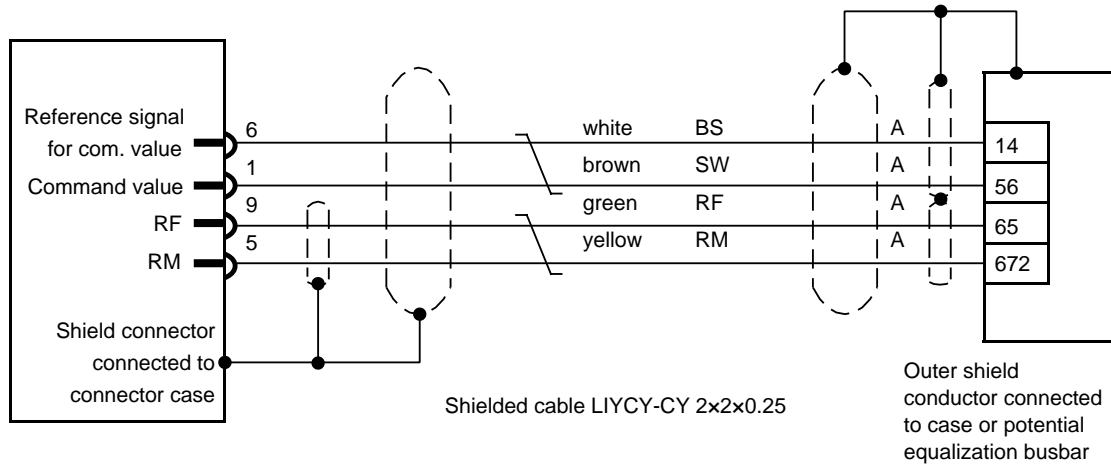
### 8.1.1 WF 721

**Cable from command value output connector to servodrive**  
**Order No.: 6FM1 790-2B□00**

**WF 721**

**6SC611**

Front panel connector X3



**Connector**  
 Sub-D,  
 9 pin, female  
 6FM1 790-8LA00  
**Solder side**

**Wire ends stripped**  
 Pin-type cable  
 socket labeled

## 8.1.2 WF 723 A/WF 723 B/WF 723 C

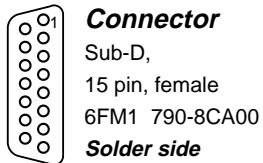
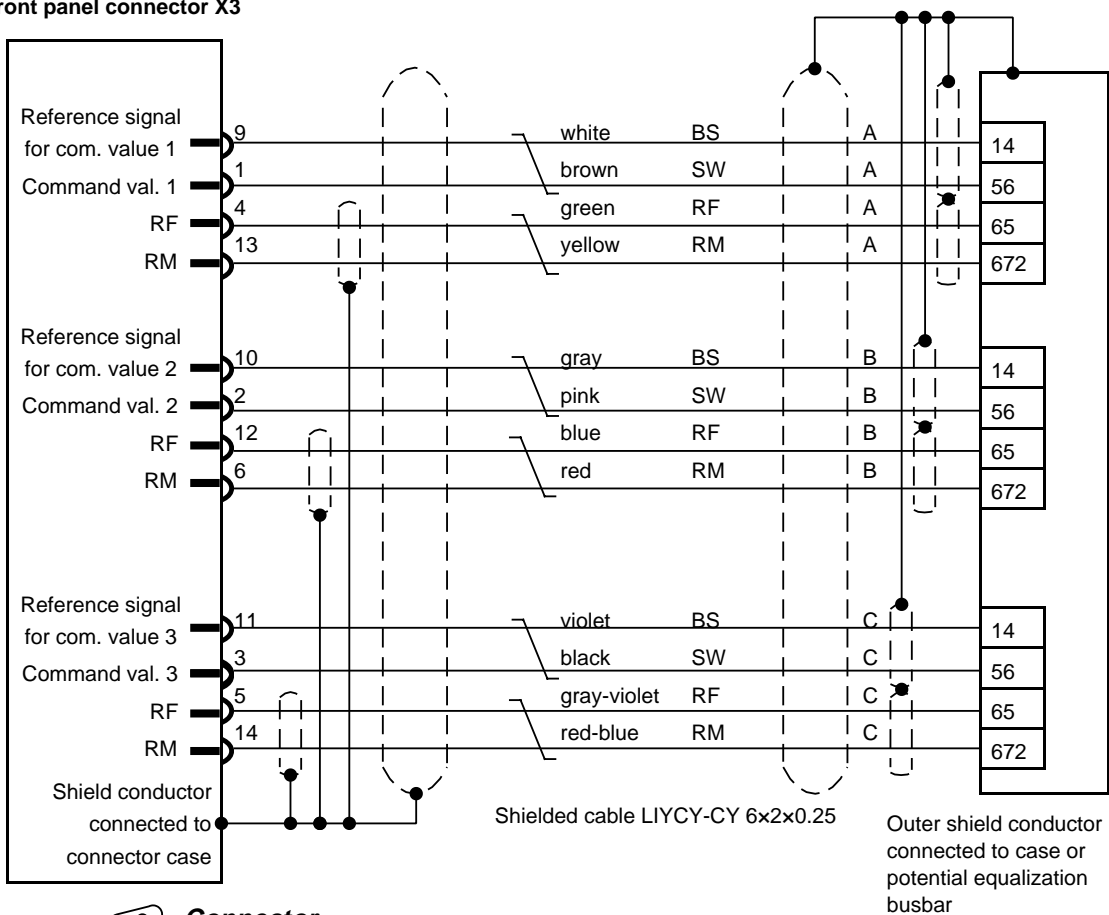
### Cable from command value output connector to servodrive

Order No.: 6FM1 790-2C□00

WF 723 A/WF 723 B/WF 723 C

6SC611

Front panel connector X3



### Wire ends stripped

Pin-typ cable  
socket labeled

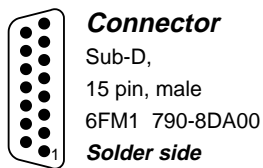
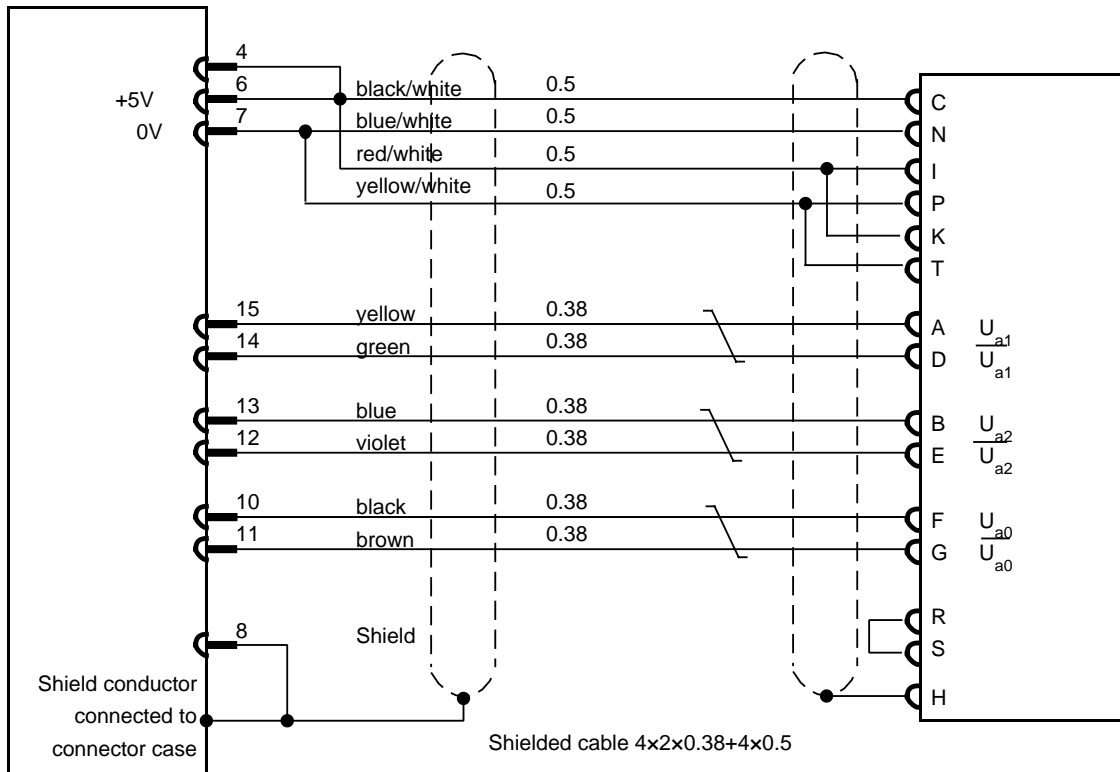


## 8.2 Cable for Measuring System

**Cable from actual value connectors to ROD 320 rotary encoder**  
**Order No.: 6FM1 790-1B□00**

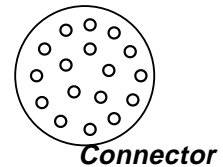
**WF 721/WF 723 A/WF 723 B/WF 723 C**  
 Front panel connector X4, X5, X6

**Measuring-system connector**



**Round connector**

17 pin, female  
 6FC9 348-7AV01  
**Solder side**



**PIN 4 and PIN 8 are not used.**

# Cable from actual value connectors to Siemens digital rotary encoder

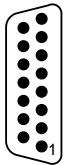
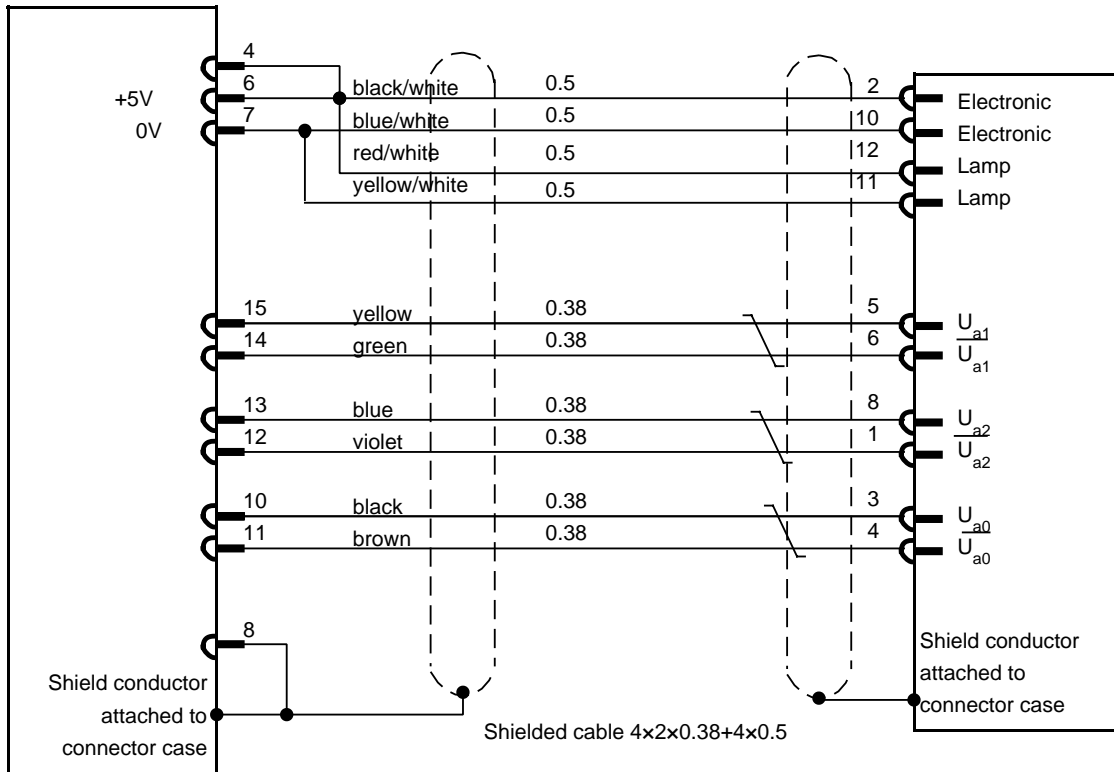
Order No.: 6FM1 790-1C□□00

WF 721/WF 723 A/WF 723 B/WF 723 C

Measuring-system SIMODRIVE Sensor

Front panel connector X4, X5, X6

6FX2 001-2□□□□

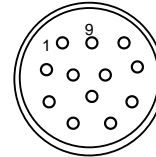


**Connector**

Sub-D,  
15 pin, male  
6FM1 790-8DA00  
**Solder side**

**Round connector**

12 pin, female  
6FX2 003-0CE12  
**Solder side**



**PIN 4 and PIN 8 are not used.**

# Cable from serial interface connector to serial encoder

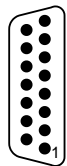
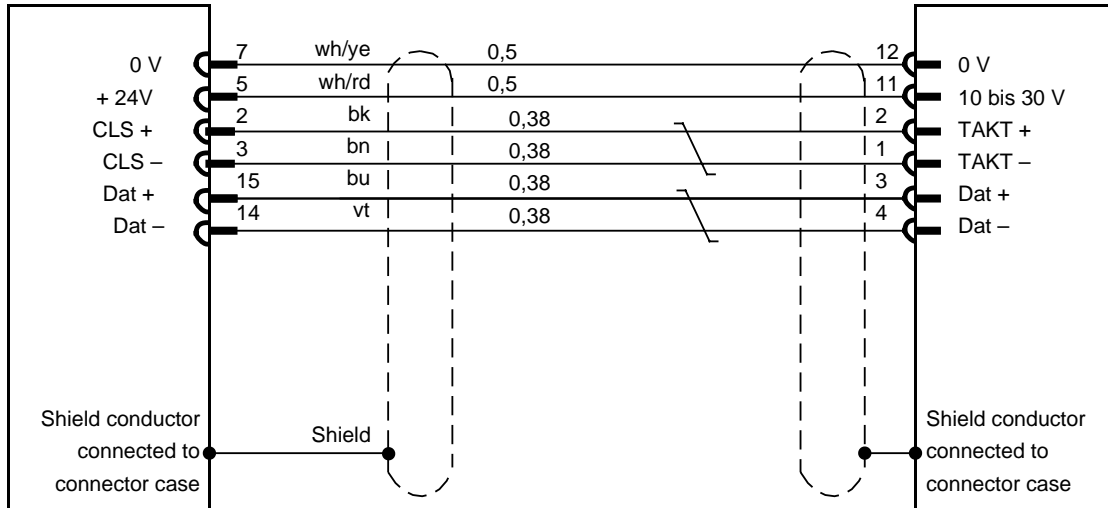
Order No.: 6FX2002-2CC11-□□□□

**WF721/WF 723 A/WF723 B/WF723 C**

**Measuring-system SIMODRIVE Sensor**

Front panel connector X4, X5, X6

6FX2 001-2□□□□

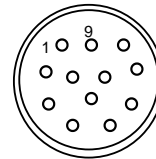


**Connector**  
Sub-D,  
15 pin, male  
6FM1 790-8DA00  
**Solder side**

**Round connector**

12 pin, female  
6FX2 003-0CE12

**Solder side**

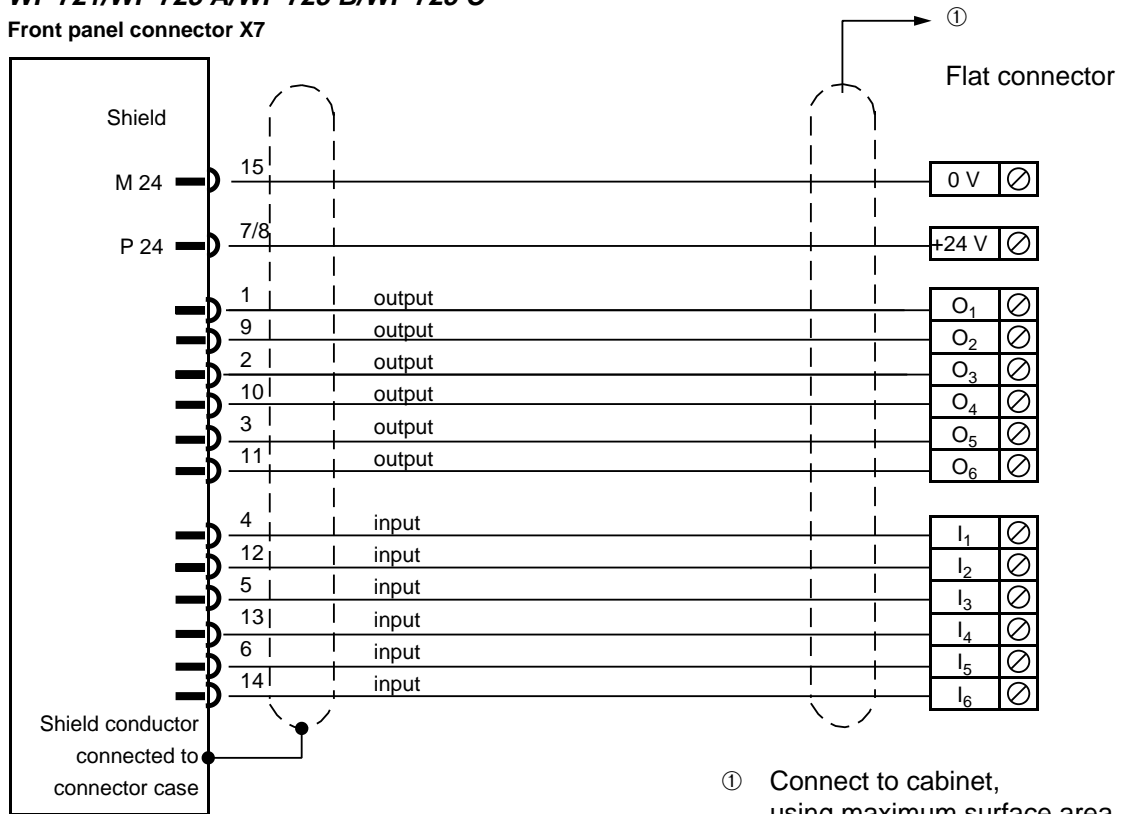


### 8.3 Cables for Fast I/O Connection

## Cables for 24 V current supply and fast inputs/outputs

**WF 721/WF 723 A/WF 723 B/WF 723 C**

Front panel connector X7



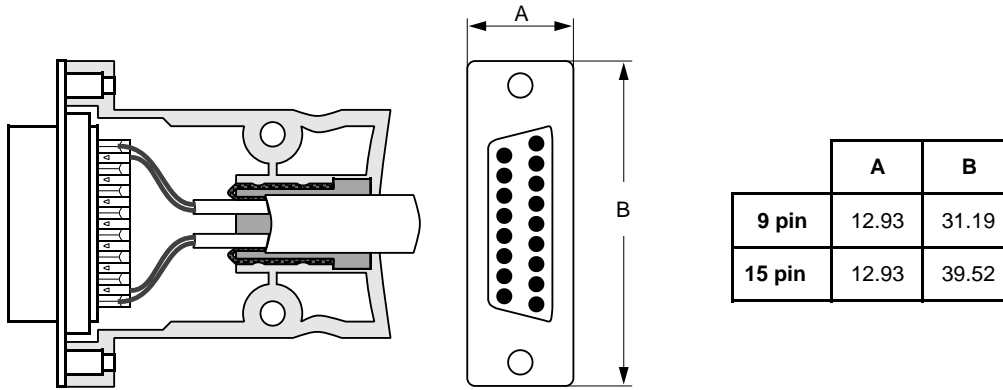
① Connect to cabinet, using maximum surface area, or connect shield to potential equalization busbar

**Connector**  
 Sub-D,  
 15 pin, female  
 6FM1 790-8CA00  
**Solder side**



**The functions of the inputs and outputs are parameterized via machine data. The inputs I<sub>1</sub> to I<sub>6</sub> behave like SIMATIC S5 inputs. They must remain open if no function is desired.**

## 8.4 Sub-Miniature Connector (Connection to WF module)





# 9 Appendix

## 9.1 Abbreviations

<b>AG</b>	Automation unit
<b>BS</b>	Reference signal
<b>CPU</b>	Central processing unit
<b>CR</b>	Central rack
<b>DIN</b>	Deutsche Industrie Norm (German industry standards)
<b>DMA</b>	Direct memory access
<b>DPR</b>	Dual-port RAM
<b>EG</b>	Expansion Unit
<b>EEC</b>	Electrostatically endangered components
<b>EMC</b>	Electromagnetic compatibility
<b>EPROM</b>	Erasable programmable read only memory
<b>ER</b>	Expansion rack
<b>F</b>	Error bit
<b>I</b>	Input
<b>IEC</b>	International electrotechnical commission
<b>IM</b>	Interface
<b>IP</b>	Type of protection according to standards
<b>M</b>	Mass
<b>MD</b>	Machine data
<b>MP</b>	Monitor panel
<b>MTBF</b>	Mean time between failure
<b>NC</b>	Numerical control
<b>NM</b>	Zero point
<b>O</b>	Output
<b>OP</b>	Operator Panel
<b>PG</b>	Programmer
<b>PLC</b>	Programmable logic controller
<b>PRODOK</b>	Documentation of products
<b>PS</b>	Power supply
<b>RAM</b>	Random access memory
<b>RF</b>	Controller enable
<b>RGB</b>	Red/green/blue (monitor connection)
<b>RM</b>	Controller ready
<b>SCH</b>	Shield
<b>SEP</b>	Standard slot
<b>SN</b>	Siemens Standards
<b>SSI</b>	Serial interface with synchronous clock
<b>SW</b>	Command value
<b>VDE</b>	Verband Deutscher Elektrotechniker (German electronic commission)
<b>WF</b>	Flat module for machine tools
<b>WS</b>	Machine tool controller
<b>ZG</b>	Central controller

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If you find any printing errors when reading this publication, please let us know, using this form. We also welcome any suggestions to improve the manual.

**Suggestions and/or corrections**

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