

Equipment for Machine Tools

WF 715

Cam Controller

Planning Instructions

Edition 05.93

Part 1
Hardware Interface Description

Equipment for Machine Tools

WF 715 Cam Controller

Planning Guide, Part 1 Hardware Interface Description

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Overview of Cables and
Accessories 2

Cable Diagrams 3

Module Locations and
Address Areas in the
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Note

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1 System Configuration

The electronic cam controller WF 715 has been designed to control movement sequences, depending on the angle of the crankshaft. The control is done with the output of cams.

Additional WF modules can be used, in the SIMATIC S5, if the machine control requires functions like tool management, positioning of material handling equipment or positioning of auxiliary axes.

Individual functions require the following components:

- **Operation**

The hardware configuration of the operator interface depends upon application. There are two basic configurations available:

Configuration with programmer and machine control panel

Machine control panel, equipped with controls according to the machine requirements, is used for operation. The programming and commissioning of the system is done using PG 675 or PG 685 Programmer. This configuration utilizes Software Package Standard I-WF 715.

Configuration with WS 400 CRT Operator Interface and Keyboard

The WS 400 CRT Operator Interface, consisting of WF 470 CRT Interface Module, Monitor with Keyboard, or Compact Operator Panel, is used for operating and data entry. This configuration utilizes Software Package Standard I-WF 715, Software Package Standard III- WF 715 and SIMATIC S5 Standard Software for WF 470.

- **Tool data management**

The WS 400 CRT Operator Interface is a prerequisite to this application.

Hardware components:

WF 463S External Memory Device

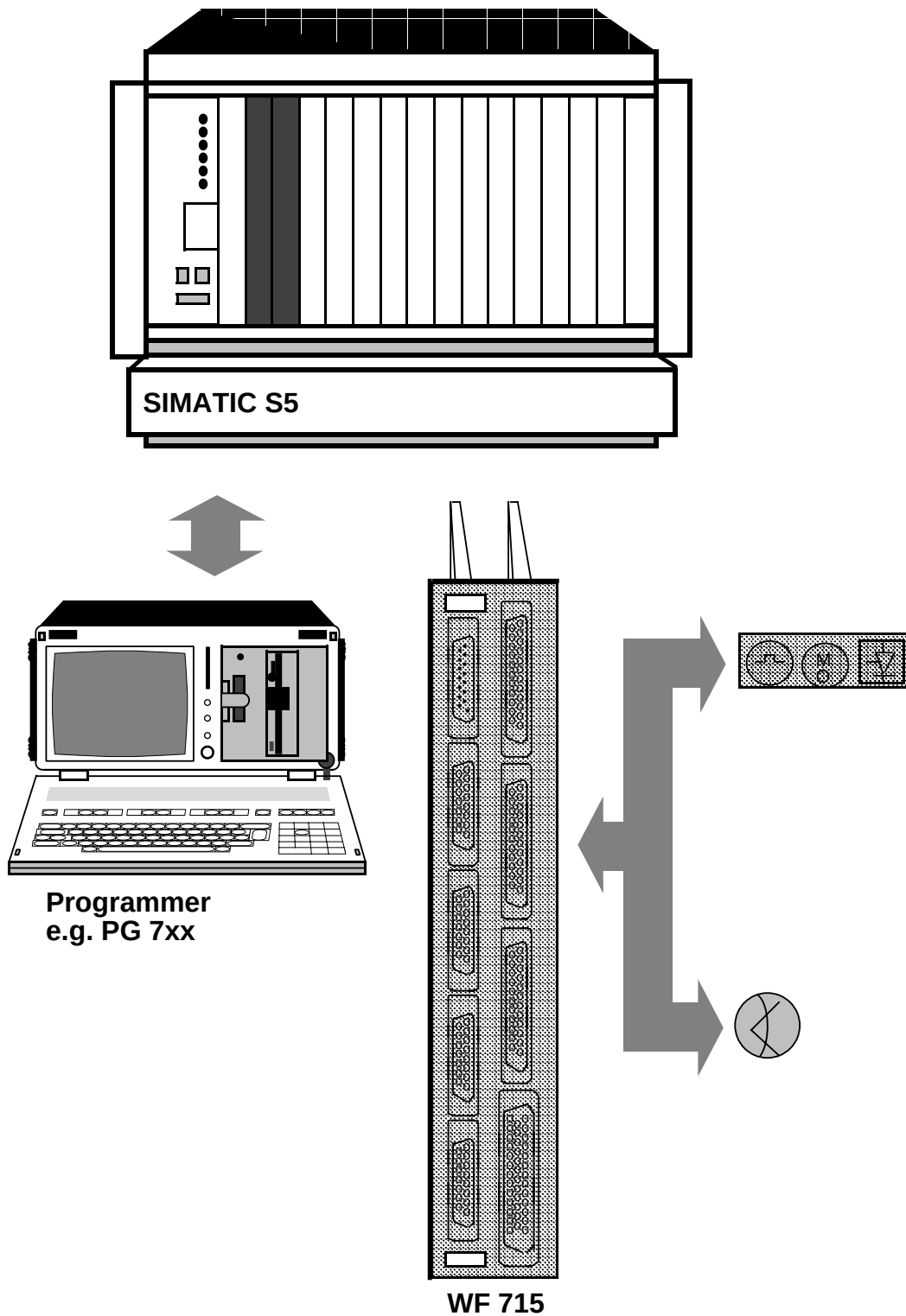
Software Package:

Standard III-WF 715

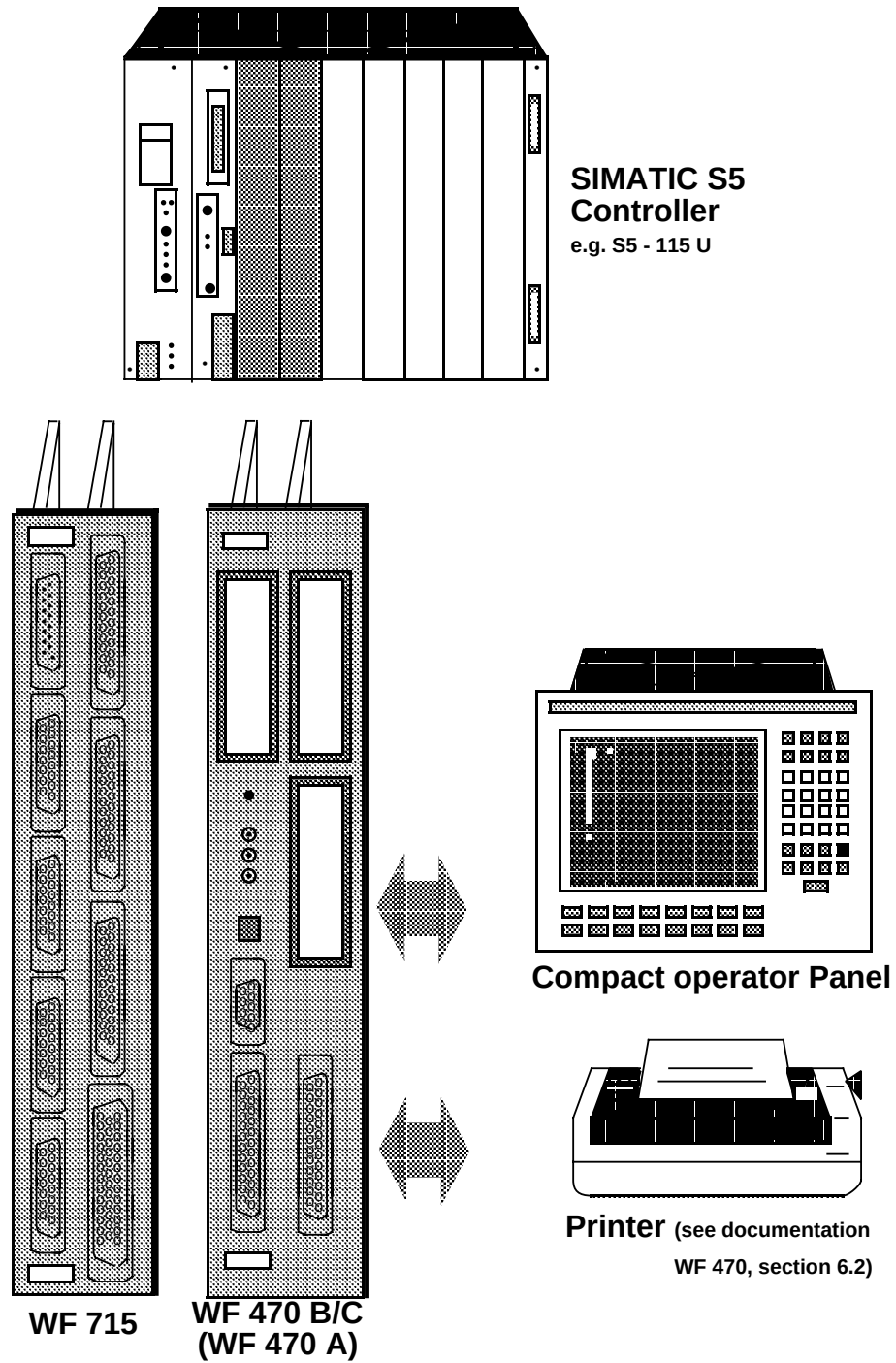
SIMATIC S5 Standard Software for WF 463S

1.1 Hardware Structure

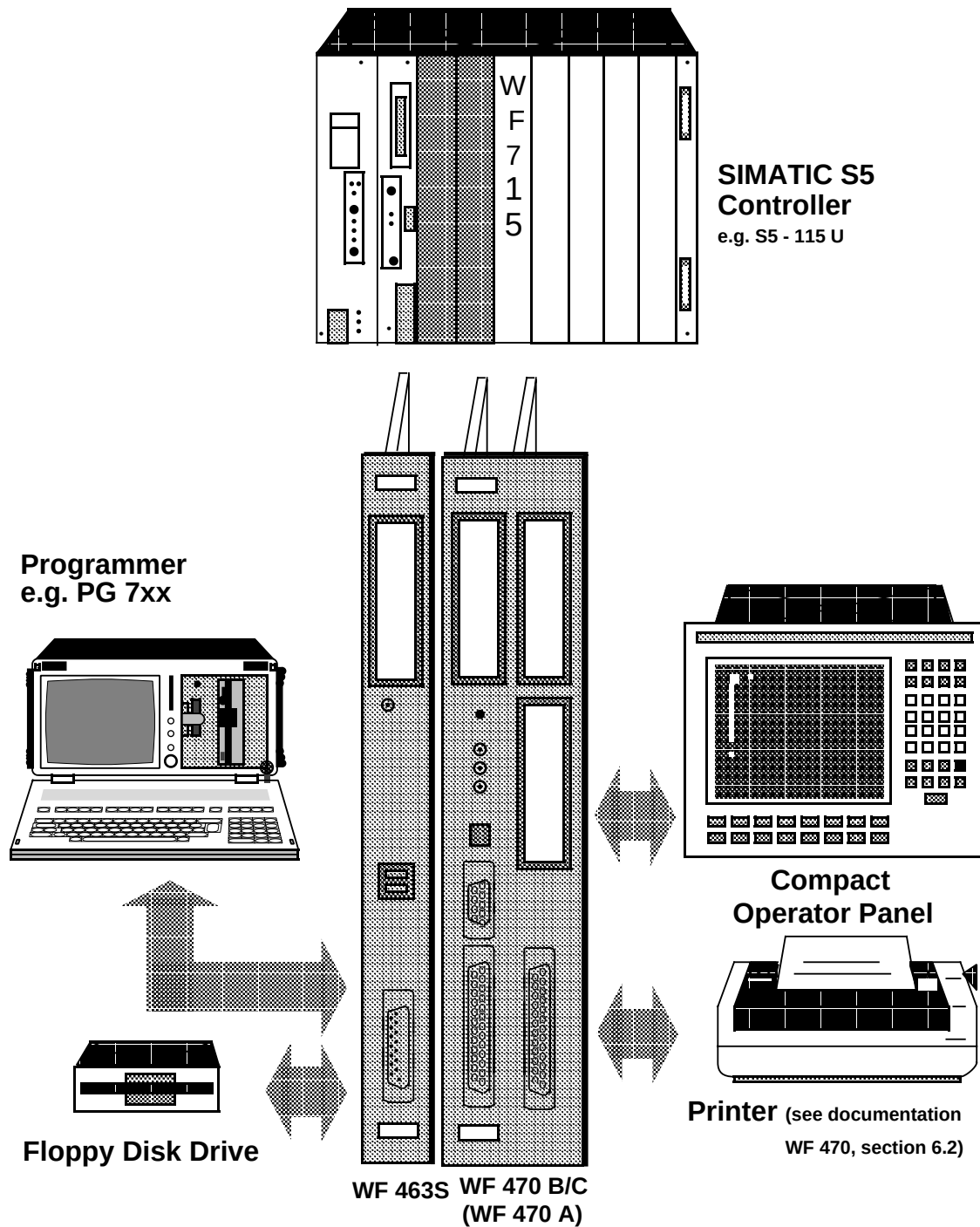
1.1.1 Hardware Structure of the Standard I -715



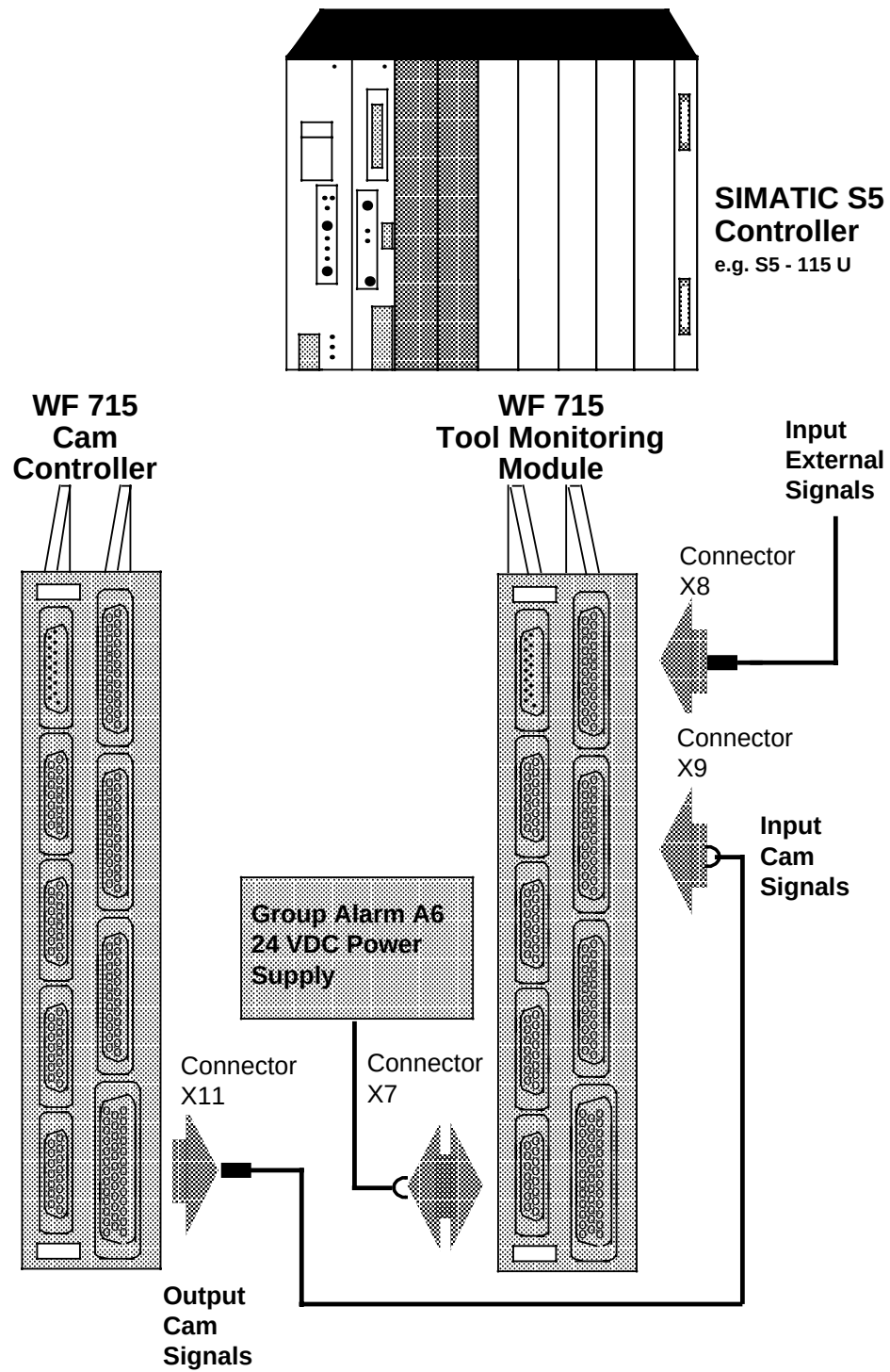
1.1.2 Hardware Structure of the Standard III-715 with WS 400 CRT Operator Interface



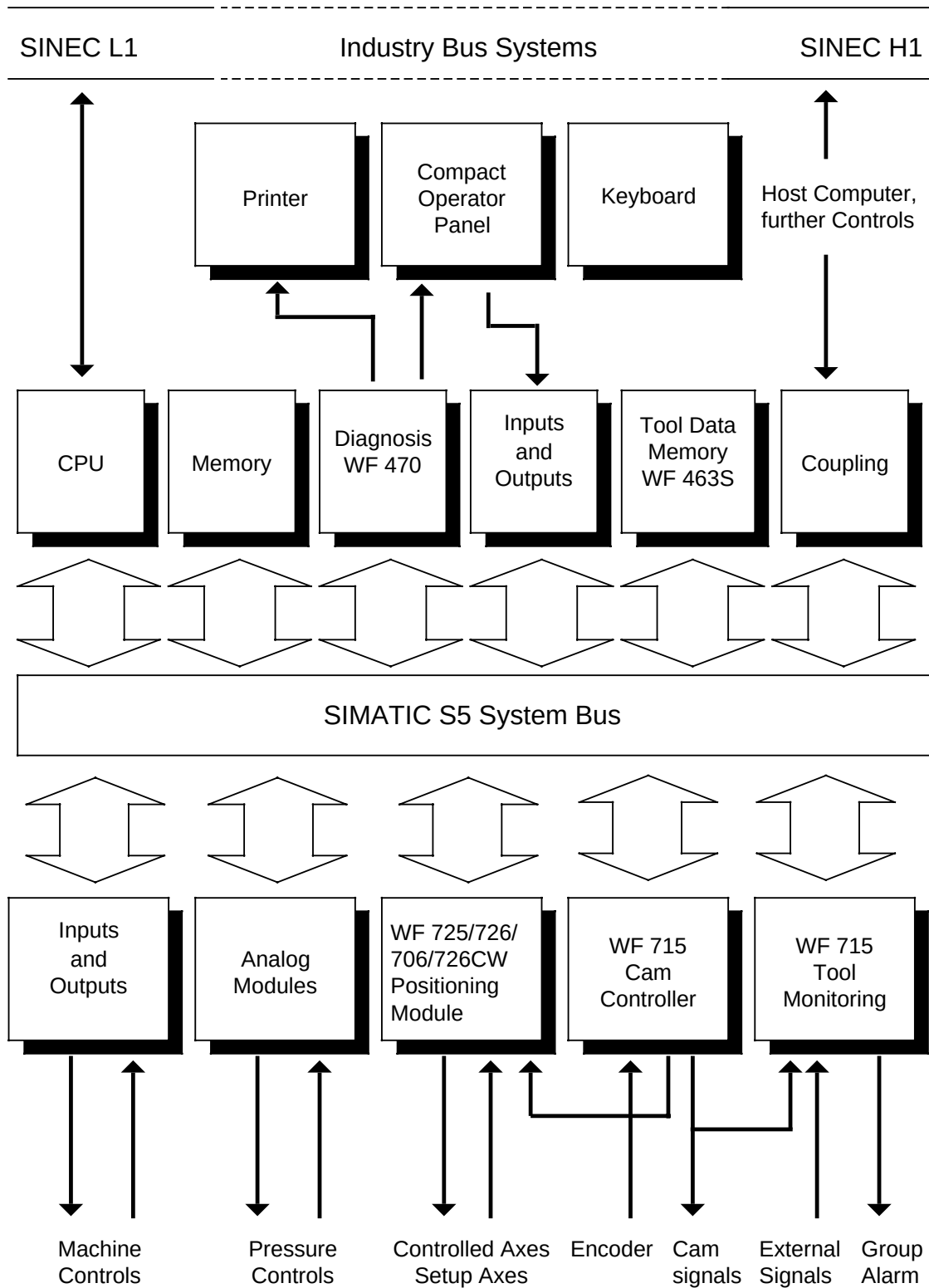
1.1.3 Hardware Structure of the Standard III-715 with WS 400 CRT Operator Interface and Tool Data Management



1.1.4 Tool Monitoring

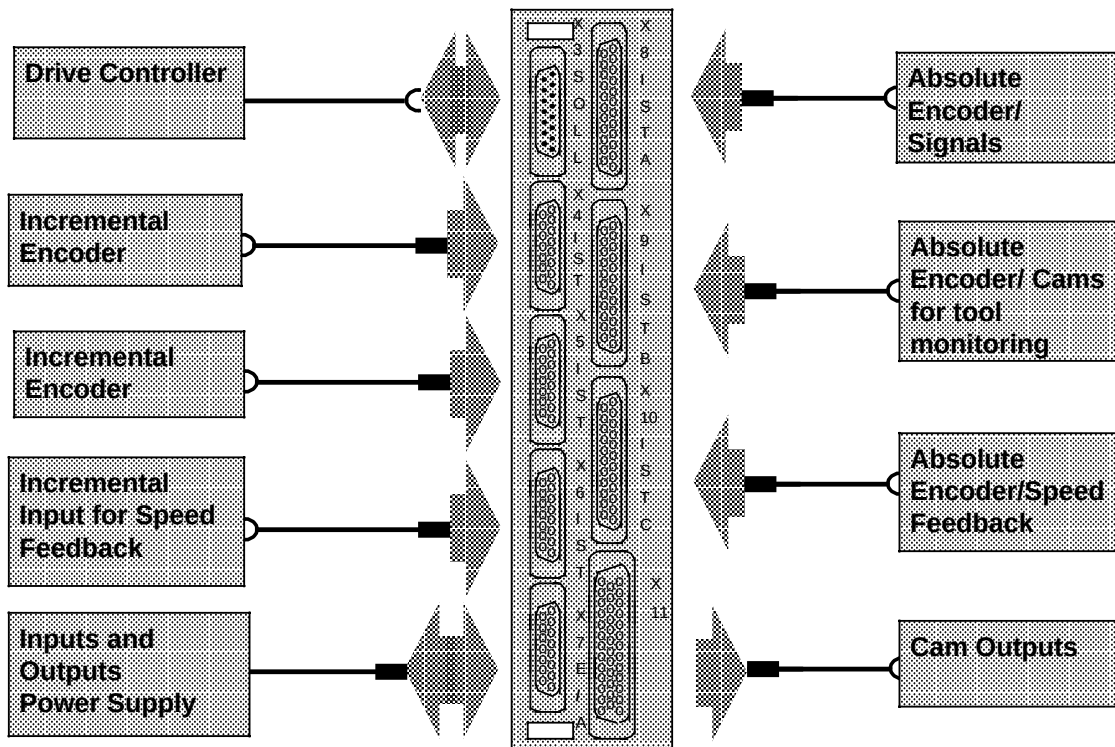


1.2 Bus Structure



2 Overview of Cables and Accessories

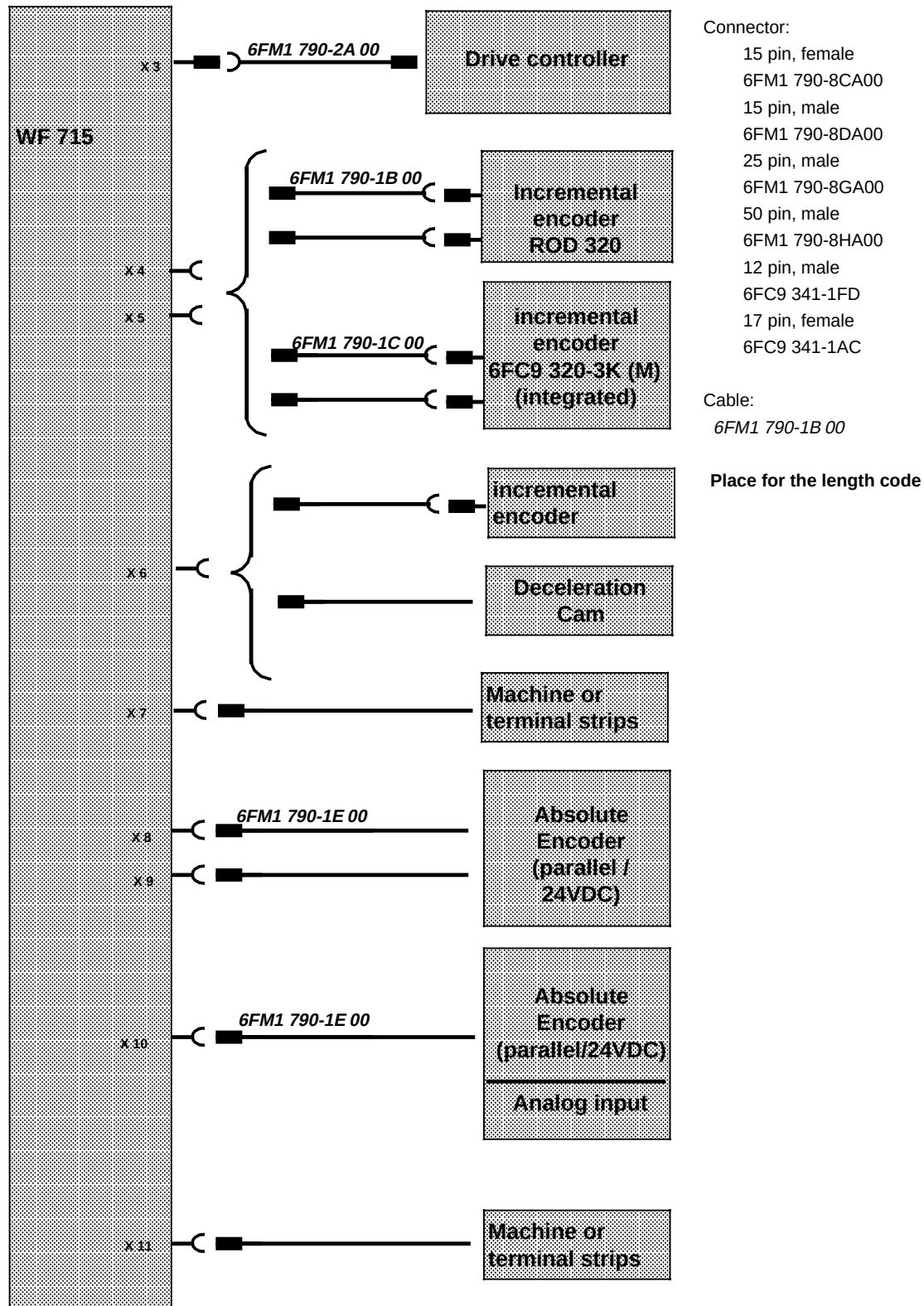
2.1 Connector Pin Assignment



Connector	Function	Remarks
X 3	Analog inputs Digital inputs Digital outputs	Command values Ready signals from the both setup axes Axis enable signal
X 4	Digital inputs	Incremental encoder, setup axis 1
X 5	Digital inputs	Incremental encoder, setup axis 2
X 6	Digital inputs	Speed feedback, incremental
X 7	Input Digital inputs Digital outputs	24 VDC power supply (see signal description)
X 8	Digital inputs	Absolute encoder, cam controller 1 Absolute encoders, both setup axes *
X 9	Digital inputs	Absolute encoder, cam controller 2 Absolute encoders, both setup axes *
X 10	Analog inputs Digital inputs	Speed feedback (analog) Absolute encoders, both setup axes *
X 11	Digital outputs	Cam outputs to the both cam controllers BCD display, actual value

*) Function assignment in commissioning data 8

2.2 Cable Overview



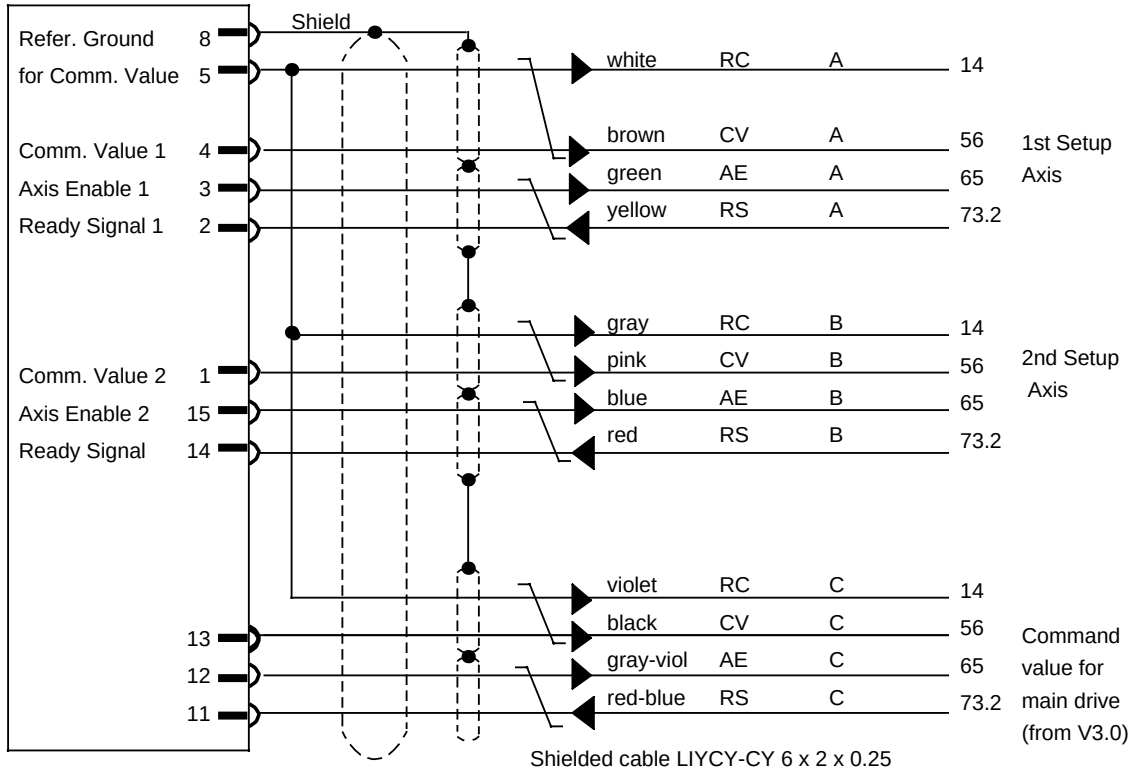
3 Cable Diagrams

3.1 Command Value Output (Connector X3)

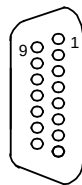
Cable from command value output connector to the drive controller
Order number: 6FM1 790-2A 00

WF 715 Module
 Connector X3

Drive Controller
 Cable end unfinished



Connector
 Cannon
 15 pin, female
 6FM1 790-8CA00
Terminal Side



Stripped wire ends and labeled for connection to SIMOREG 6SC61

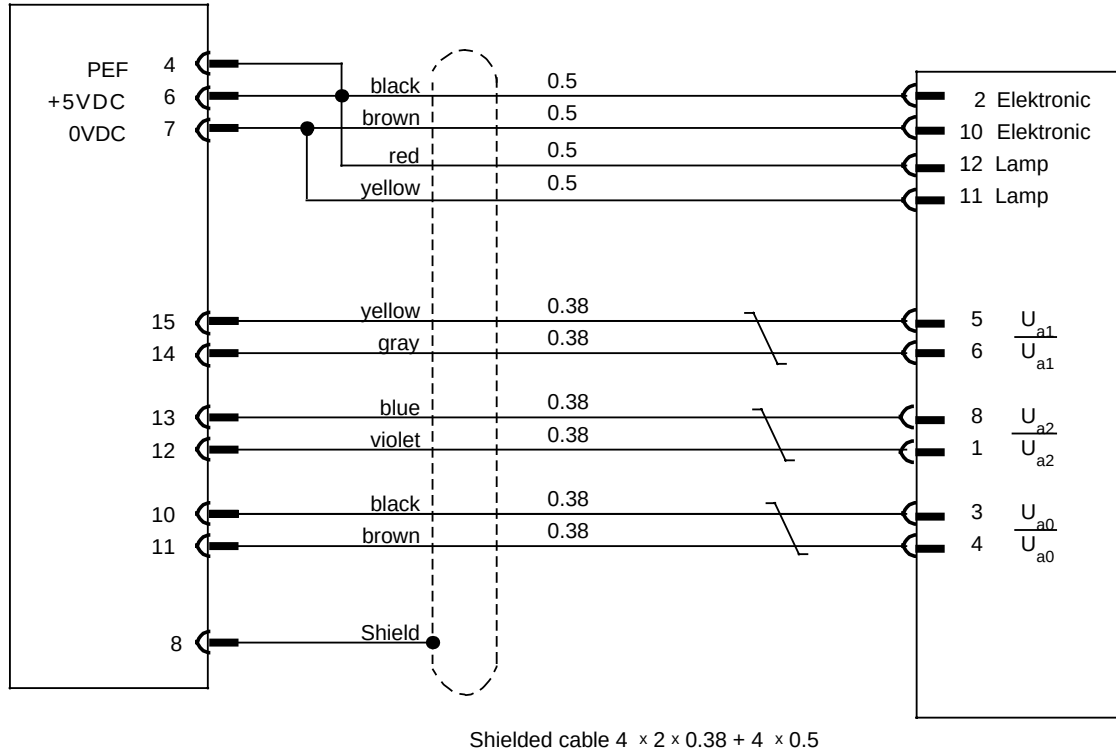
The 24 VDC power supply to the RF (Controller Enable Signal) and to the RM (Controller Ready, response signal) has to be provided to the connector X7. The WF 715 is not ready if the feedback signals (RM) are not connected. The ends of the wires which are not in use have to be insulated.

3.2 Incremental Encoders (Connectors X4, X5 and X6)

Cable from actual value feedback connector to SIEMENS Digital Rotatory Encoder
Order no.: 6FM1 790-1C 00

WF 715 Module
 Connectors: X4, X5, X6

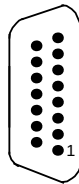
SIEMENS Position Encoder
 6FC9 320-3K (M)



Connector

Cannon
 15 pin, male
 6FM1 790-8DA00

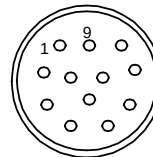
Terminal Side



Round Connector

12 pin, female
 SIEMENS
 6FC9 941-1FD

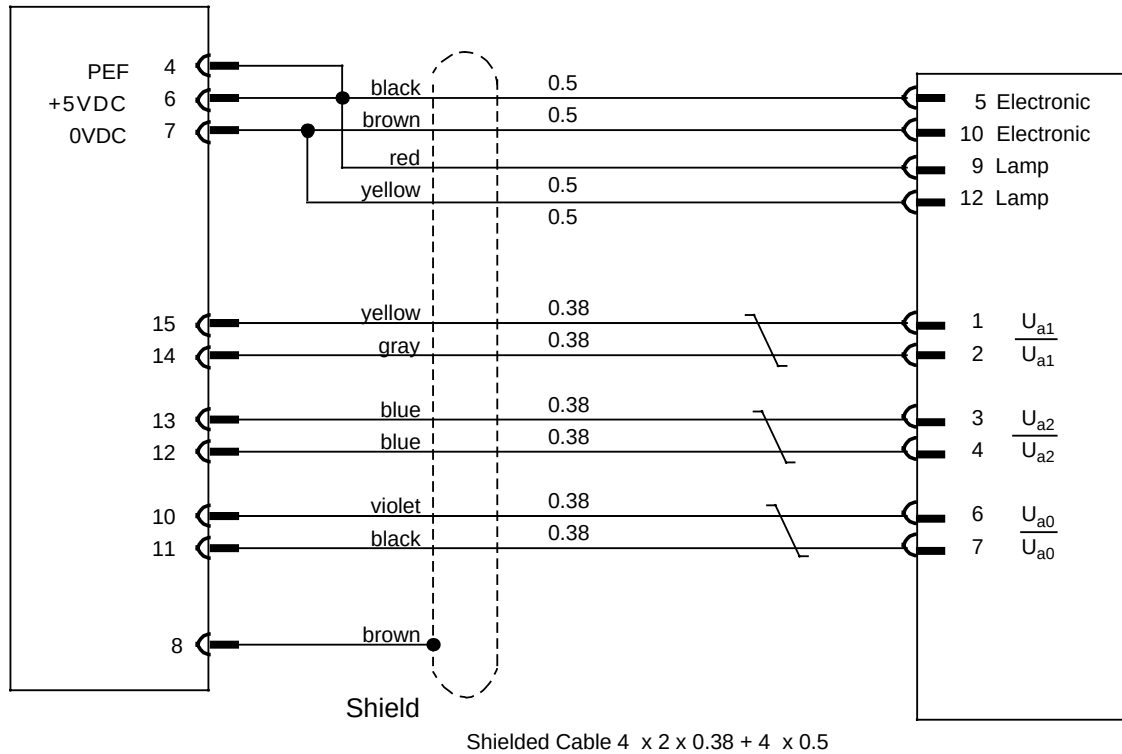
Terminal Side



Cable from actual value feedback connector to ROD 426 Digital Rotatory Encoder
Order no.: 6FM1 790-1A 00

WF 715 Module
 Connectors: X4, X5, X6

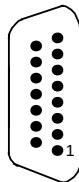
ROD 426 Digital Rotatory Encoder



Connector

Cannon
 15 pin, male
 6FM1 790-8DA00

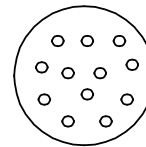
Terminal Side



Round Connector

12 pin, female
 Souriau connector
 6FC99341-1 A B

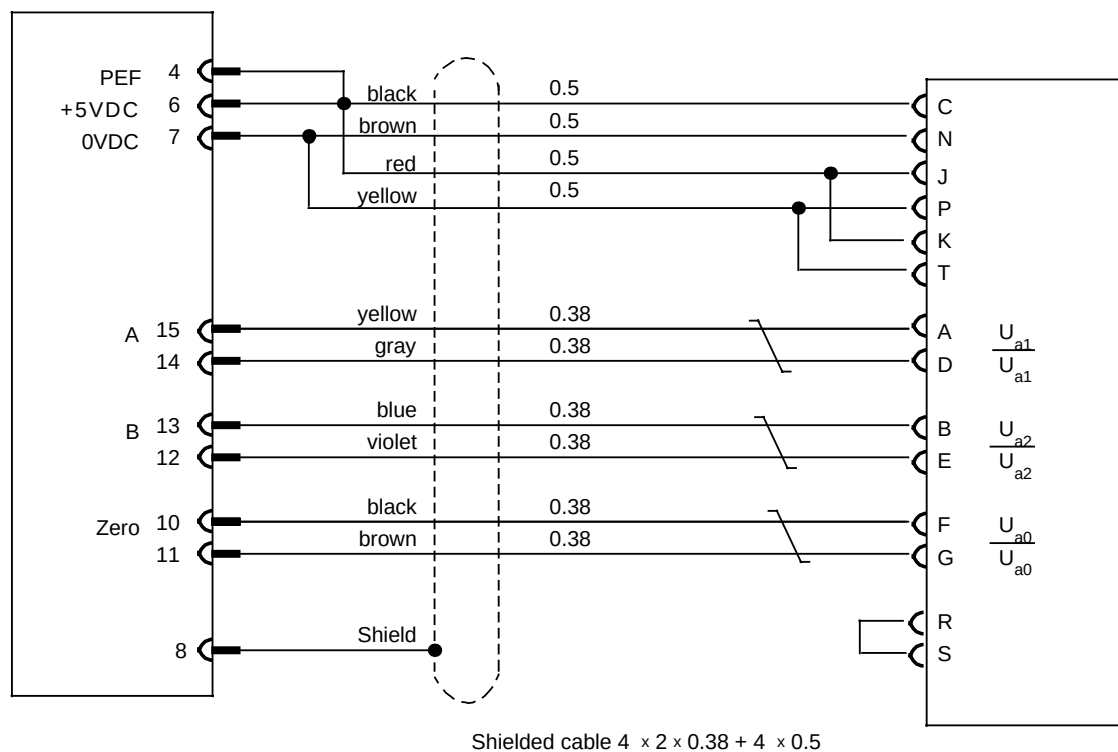
Terminal Side



Cable from actual value feedback connector to ROD 320 Digital Rotatory Encoder
Order no.: 6FM1-1B 00

WF 715 Module
 Connectors: X4, X5, X6

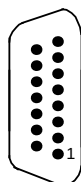
ROD 320 Position Encoder



Connector

Cannon
 15 pin, male
 6FM1 790-8DA00

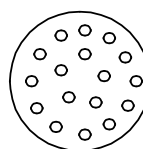
Terminal Side



Round Connector

17 pin, female
 Amphenol-Tuchel
 6FC9 341-1AC

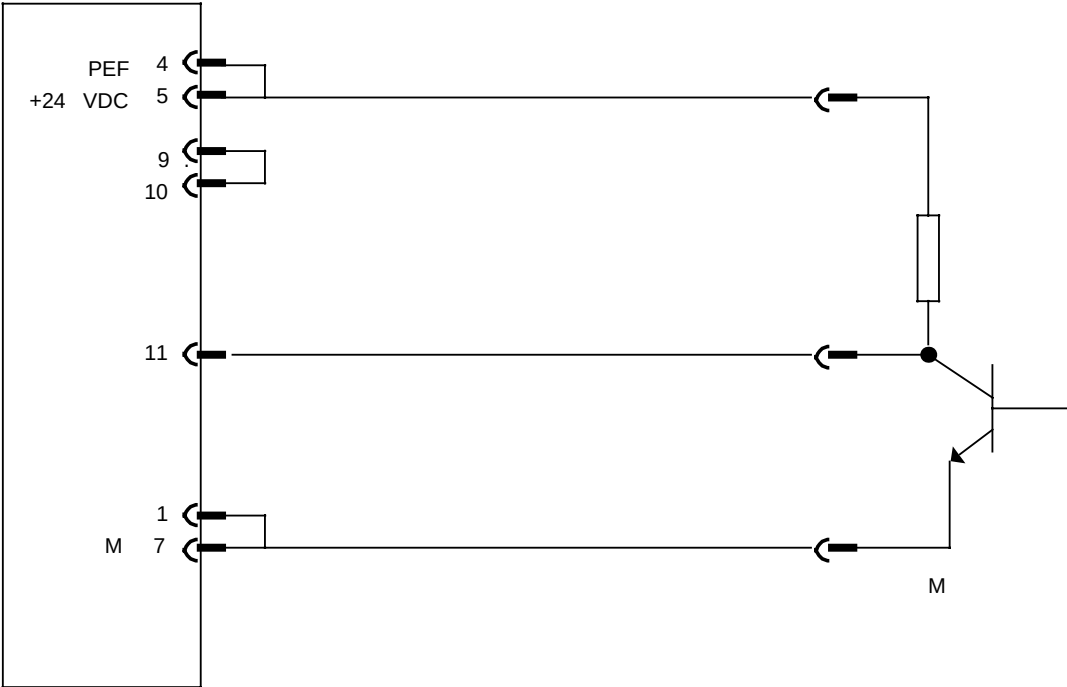
Terminal Side



24 VDC BERO (proximity sensor) for speed sensing

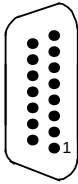
WF 715 Module

24 VDC BERO



Connector

Cannon
15 pin, male
6FM 1790 - 8DA00



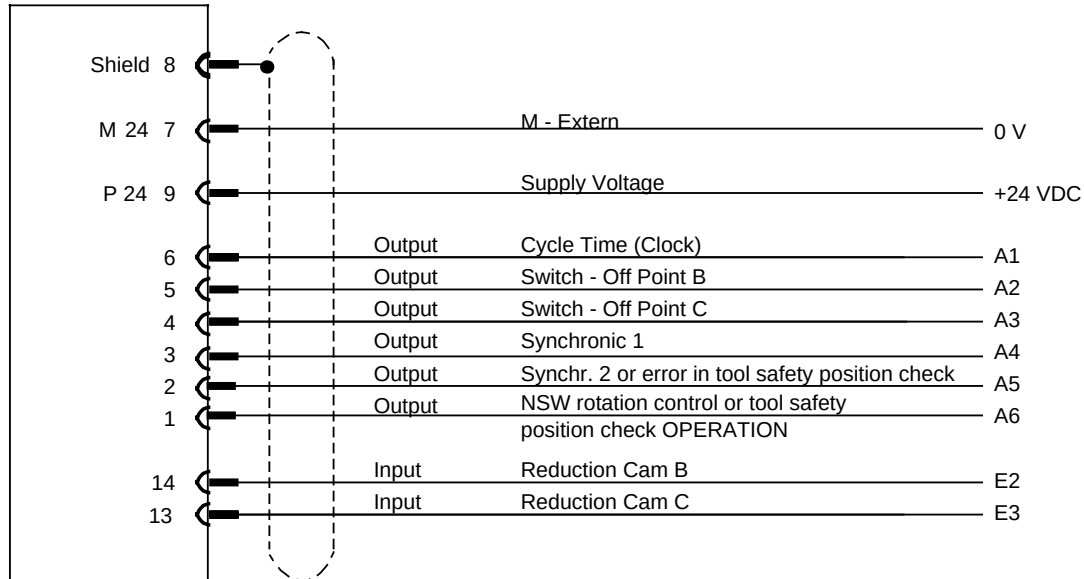
Terminal side

3.3 Inputs, Outputs, Power Supply (Connector X7)

Cable for connection of the fast inputs and outputs

WF 715 Module
Connector: X7

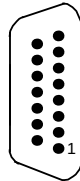
24 VDC Power Supply
and Fast Inputs and Outputs



Connector

Cannon
15 pin, male
6FM1 790-8DA00

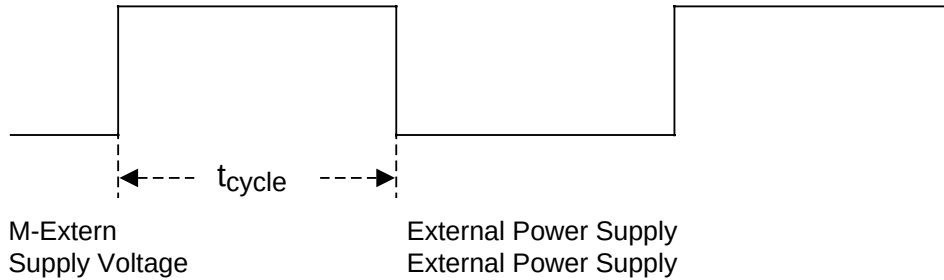
Terminal side



In order to get a defined signal condition on the cam outputs, during the power up of the WF 715, it is necessary that the 24 VDC power supply, on connector X7, is switched on after the power up of the WF 715. If the power supply of the absolute encoders is connected to the WF 715, a "Supply Encoder Fault" message will appear. This message has to be acknowledged.

Signal description

- A1 Cycle Time
The WF Cycle Time can be determined using an oscilloscope.

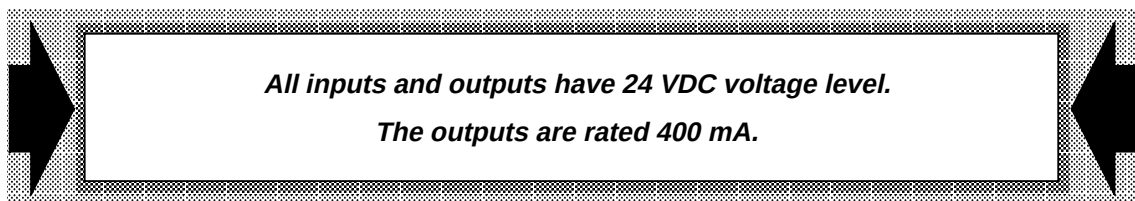


- A2 Switch - Off Point B
In case the B axis is used as an open-loop setup axis, this output will have a "1" signal (high) from the start of the axis traverse to the moment when the axis will reach the in-position tolerance band, as set by the commissioning data.
- A3 Switch - Off Point C
The same as above, but referring to the C axis
- A4 Synchronic 1
In case of the synchronic operation of two Cam Controllers this output will have "1" signal (high) as long as the controllers operate within the Synchronic 1 Band.
- A5 Synchronic 2

<u>Cam controller:</u>	The same as above, but referring to the Synchronic 2 Band.
<u>Tool safety pos. check:</u>	Error
- A6 Cam controller:

With the rotation control being active, the output is set. When the rotation control responds, the output will be zero. In case of error messages 31 _{Hex} to 34 _{Hex} , output A6 is reset (0 V). If none of these errors is pending, the output will be set (24 V). Error messages, see Configuring Instructions, Part 2.
<u>Tool safety pos. check:</u>

If the programmed linking conditions are not fulfilled, the output A6 will have "0" signal. With this output, a fast switch-off of the press is possible (see Configuring Instructions, Part 4, Tool Safety Position Check).
- E2 Reduction Cam B
In case the B axis is used as a Setup Axis with incremental encoder, this input will be used for connection of the proximity sensor for the speed reduction during the approaching of the reference point.
- E3 The same as above, but referring to the C axis.



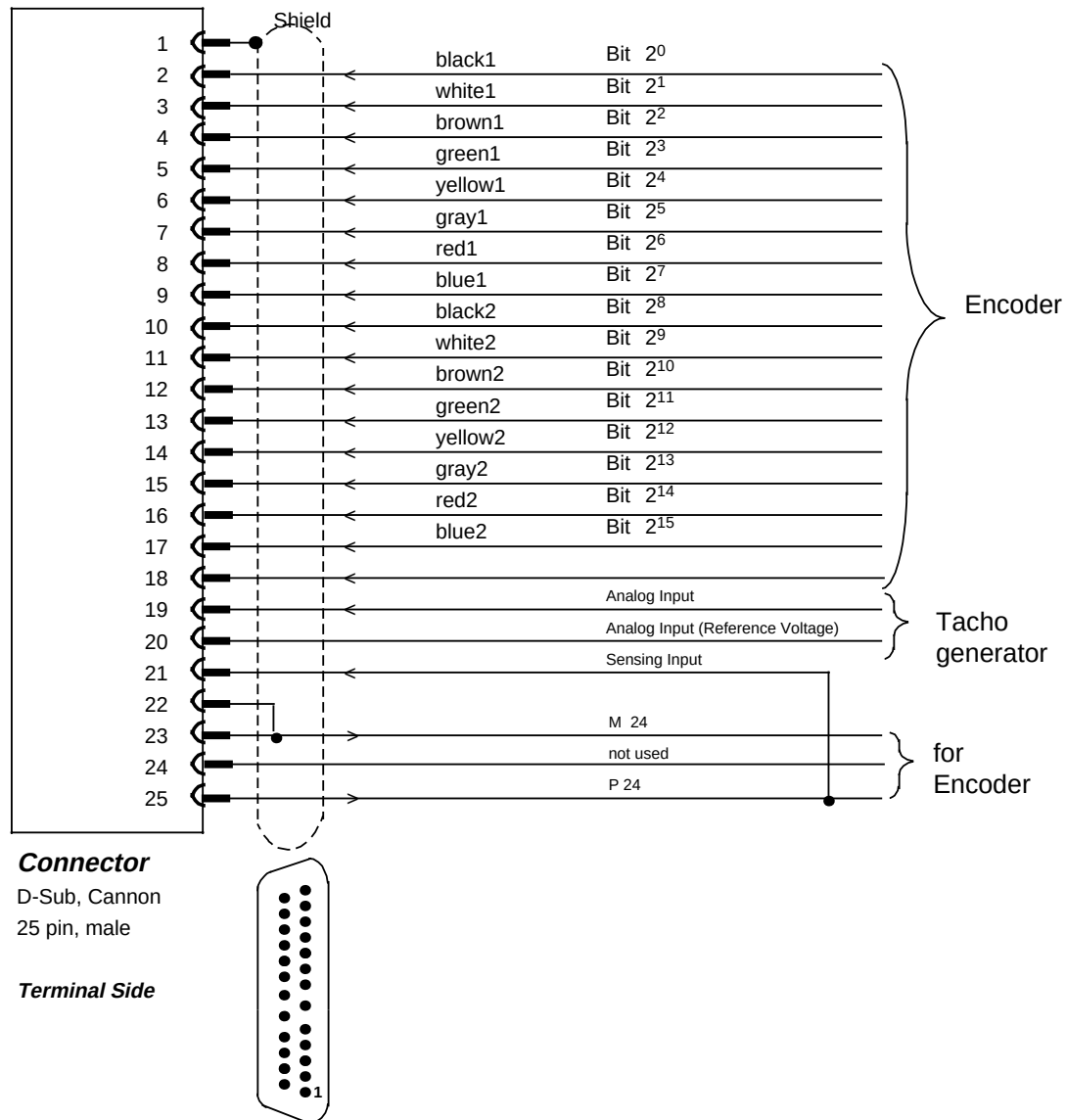
3.4 Signal Inputs, Encoder Inputs (Connectors X8, X9, X10)

Cables from the parallel interface to the absolute encoders
Order No.: 6FM1 790-1E 00

WF 715 Module

Connectors: X8, X9, X10

24 VDC Encoder
(Push-pull)



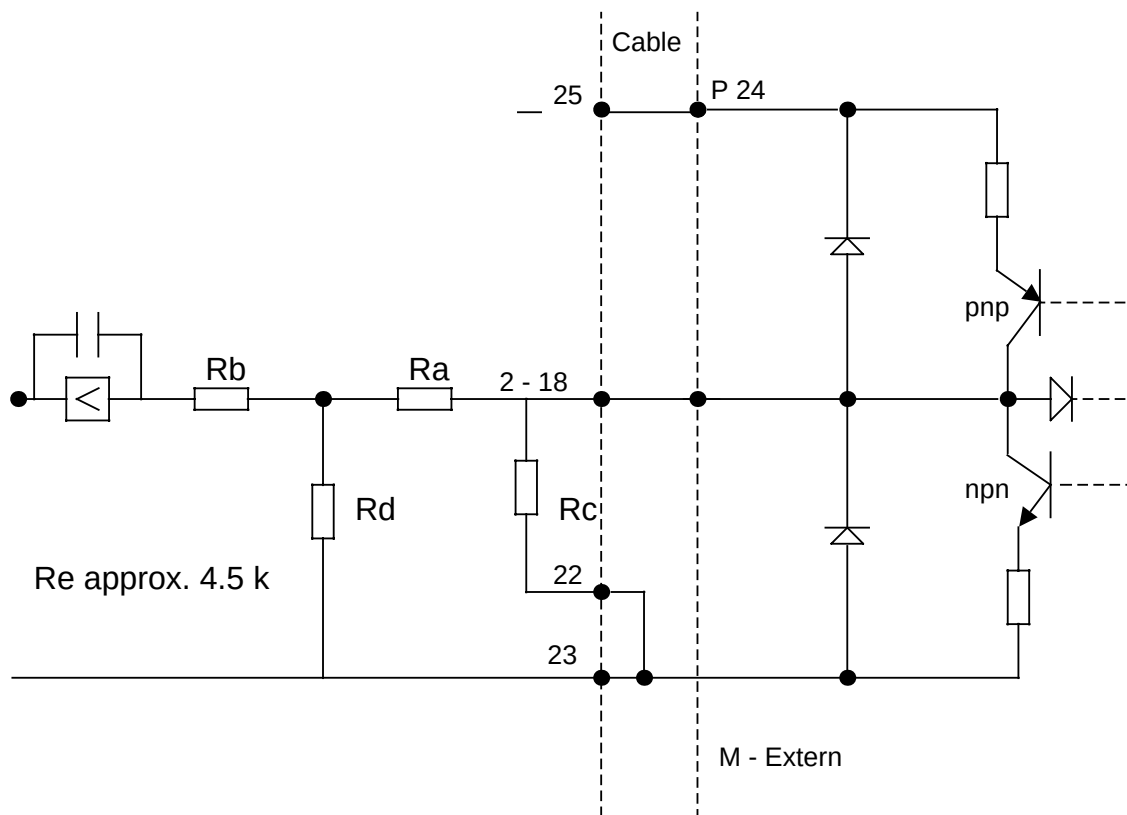
Connector

D-Sub, Cannon
25 pin, male

Terminal Side

WF 715 Module

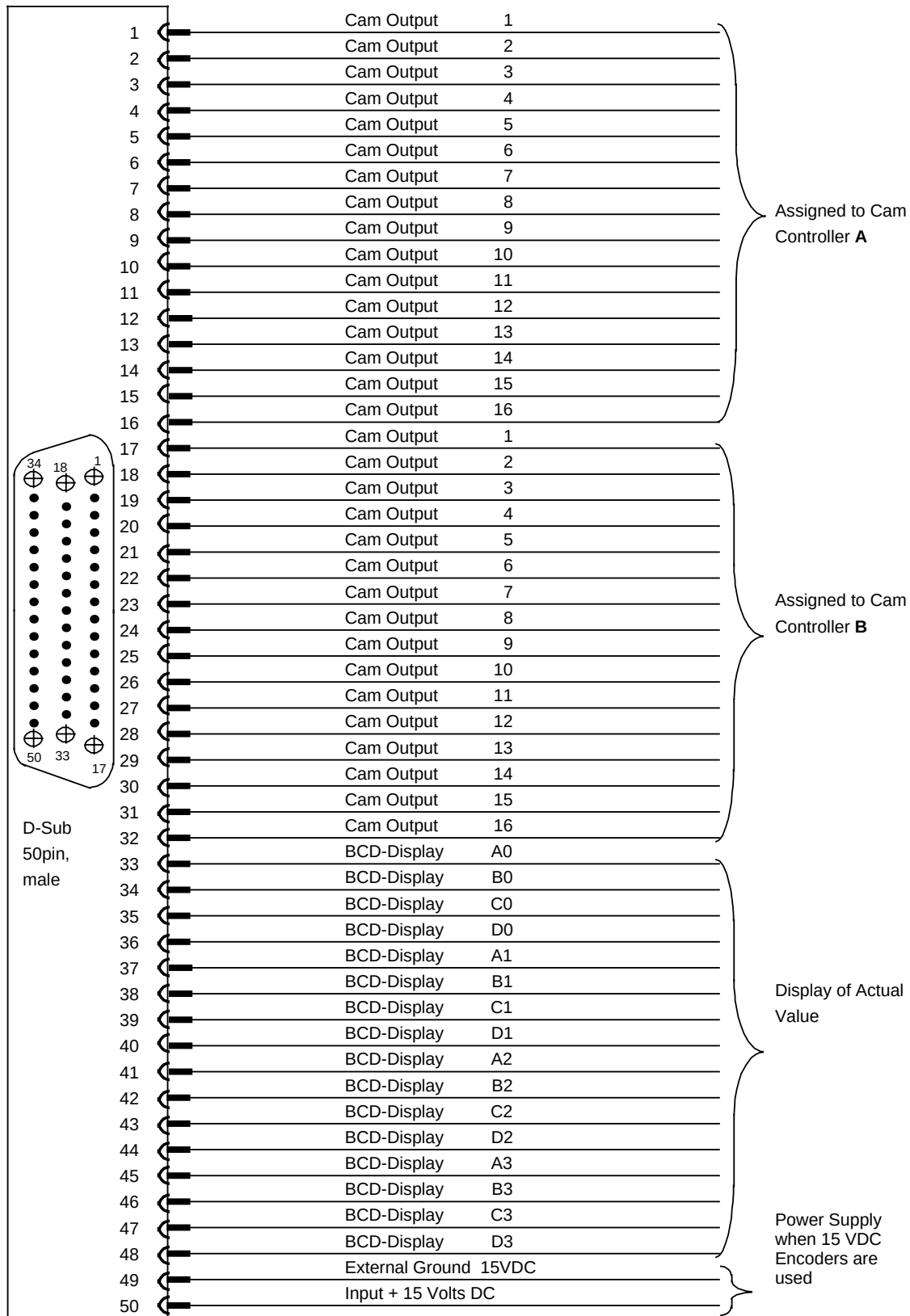
Encoder



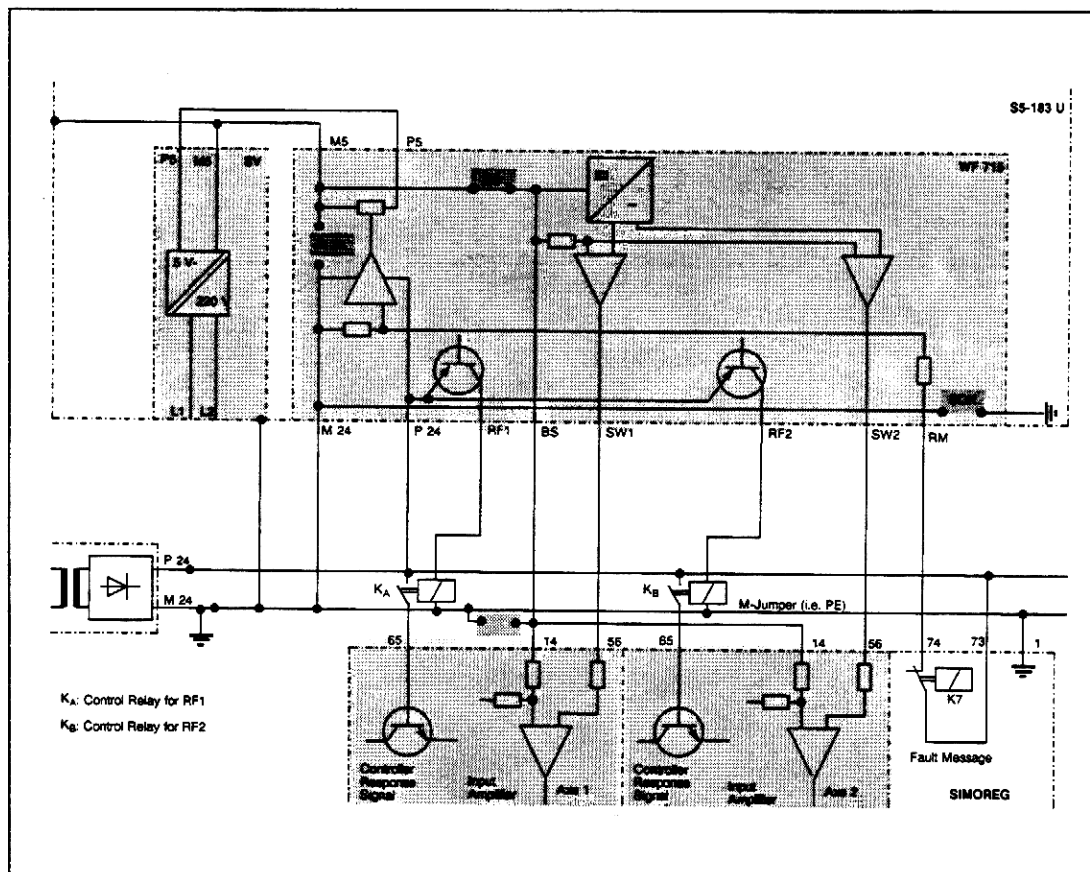
3.5 Cam Outputs (Connector X9)

24 VDC Level, 100 mA, non-short-circuit-proof

WF 715 Connector X11



3.6 Connection Diagram SIMATIC S5-WF-Drive Unit



Jumper SCH: The jumper SCH has to be installed when WF715 module is operated in adapter casing or rack without sliding contacts for the shield connection.

Jumper M24: May only be removed by the factory for test purposes.

Jumper BS: The jumper BS has to be removed, when the input of the servo controller is non-floating type of input. The voltage between M5 and BS must not exceed 0.1 VDC.

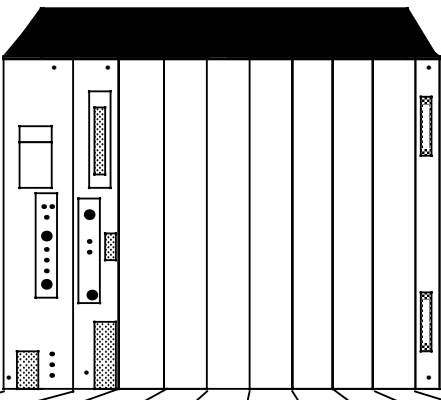
RS	-	Reference Signal
SH	-	M-Extern Shield
PS	-	SIMATIC Power Supply
CV	-	Command Value
RS	-	Controller Response Signal (Ready Signal)
CE	-	Controller Enable

4 Module Locations and Address Areas in SIMATIC S5

4.1 Module Locations in the SIMATIC Rack and Module Current Consumption

4.1.1 Central Controller SIMATIC S5 - 115 U

4.1.1.1 Module Rack CR 700-2



Slot-number	PS	CPU	0	1	2	3	4	5	6	IM	*
IM 306											
IM 304											1.5 A
WF 705											0.5 A
WF715											3.0 A
WF 716											3.0 A
WF 725 A/B											2.5/3.0 A
WF 726 A/B											2.5/3.0 A
WF 726 C **											1.3 A
WF 470 A											2.5 A
WF 470 B/C											3.0 A
WF 463 S											2.0 A

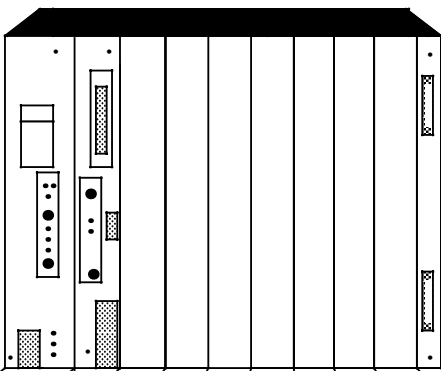
* Current Consumption per Module without encoders

** Operation without fan possible

The following components are prerequisite to this application:

- CPU 943 or 944
- 15 amp power supply
- Fan subassembly
- Adapter casing

4.1.1.2 Module Rack CR 700-3



Slot-number	PS	CPU	0	1	2	3	4	5	6	IM	Current Consumption p.Mod. (without encoders)
Power Supply Module											
CPU 943/944											
WF 705											0.5 A
WF 715											3.0 A
WF 716											3.0 A
WF 725 A/B											2.5/3.0 A
WF 726 A/B											2.5/3.0 A
WF 726 C											1.3 A
WF 470 A											2.5 A
WF 470 B u. C											3.0 A
WF 463 S											2.0 A
IM 304 Interface											

4.1.2 Central Controller SIMATIC S5 - 135 (CPU 928)

A perspective diagram of a SIMATIC S5-135 rack. The rack is a vertical rectangular unit with a black top and bottom section and a white central section. The central section contains 16 vertical slots, each with a black front panel. The rack is mounted on a base. Below the rack, a series of lines connect the 16 slots to the corresponding columns in the table below.

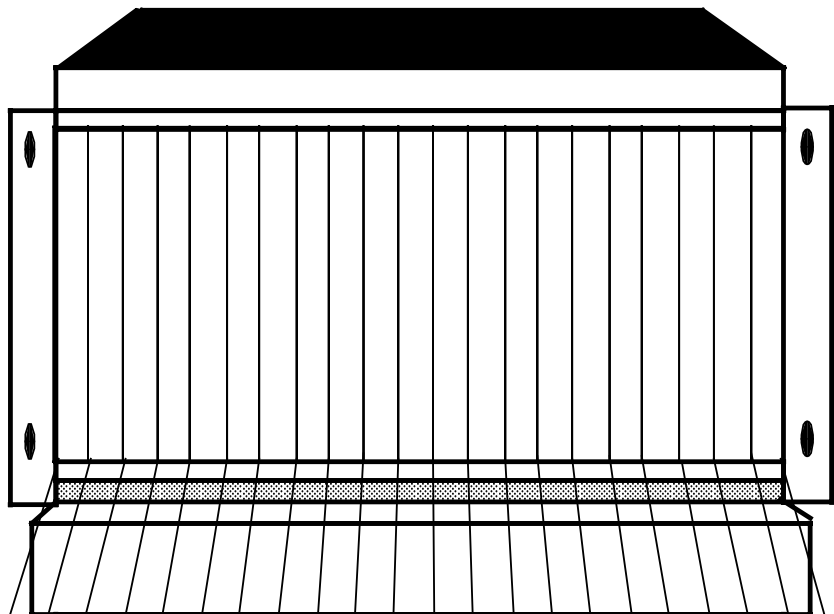
Slot-number	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163	*
WF705																						0.5 A
WF715																						3.0 A
WF716																						3.0 A
WF725 A																						2.5 A
WF725B																						3.0 A
WF726 A																						2.5 A
WF726 B																						3.0 A
WF726 C **																						1.3 A
WF470 A																						2.5 A
WF470 B																						3.0 A
WF470 C																						3.0 A

1 module requires 2 slots

* Current Consumption per Module without encoders

** Operation without fan possible

4.1.3 Central Controller SIMATIC S5 - 155 U



Slot-number	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163	*	
WF705																							0.5 A
WF715																							3.0 A
WF716																							3.0 A
WF725 A																							2.5 A
WF725B																							3.0 A
WF726 A																							2.5 A
WF726 B																							3.0 A
WF726 C **																							1.3 A
WF470 A																							2.5 A
WF470 B																							3.0 A
WF470 C																							3.0 A

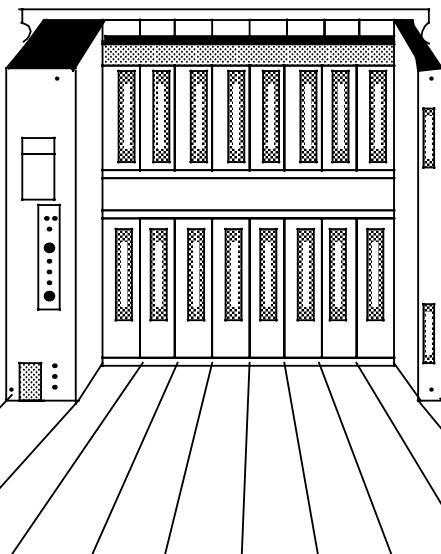
1 module requires 2 slots

* Current Consumption per Module without encoders

** Operation without fan possible

The WF modules located in the expansion unit are operated in the P area. If there is a need to operate them in the Q area the whole expansion unit have to be set for it by setting the 301 Interface Module accordingly.

4.1.4 Expansion Unit ER 701-3



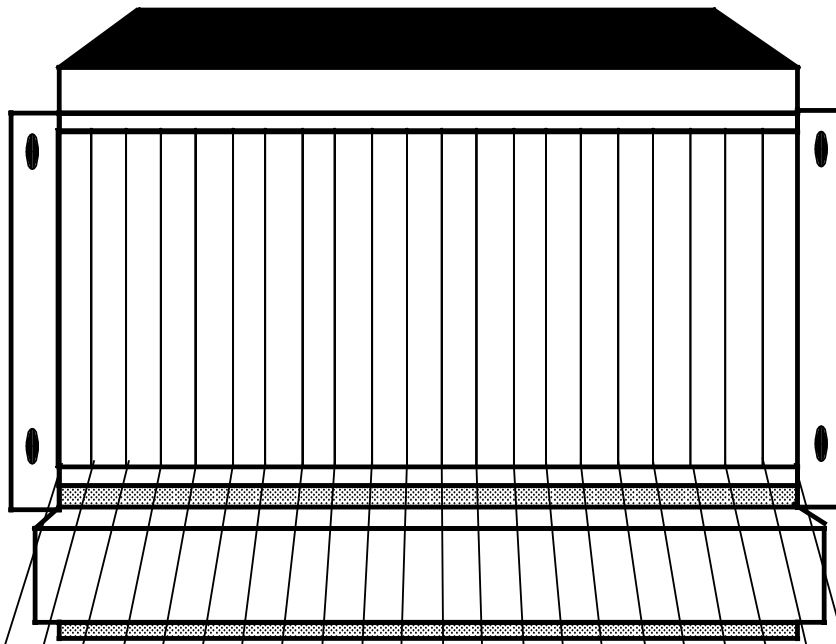
Slot-number	PS	0	1	2	3	4	5	6	7	IM	Current Consumption p.Mod.
Power Supply Module											
IM 306 Interface											
IM 314 Interface											
WF 715											3.0 A
WF 716											3.0 A
WF 725 A/B											2.5/3.0A
WF 726 A/B											2.5/3.0A
WF 726 C **											1.3 A

** Operation without fan possible

The following components are prerequisite to this application:

- ***15 amp power supply***
- ***Fan subassembly***
- ***Adapter casing***

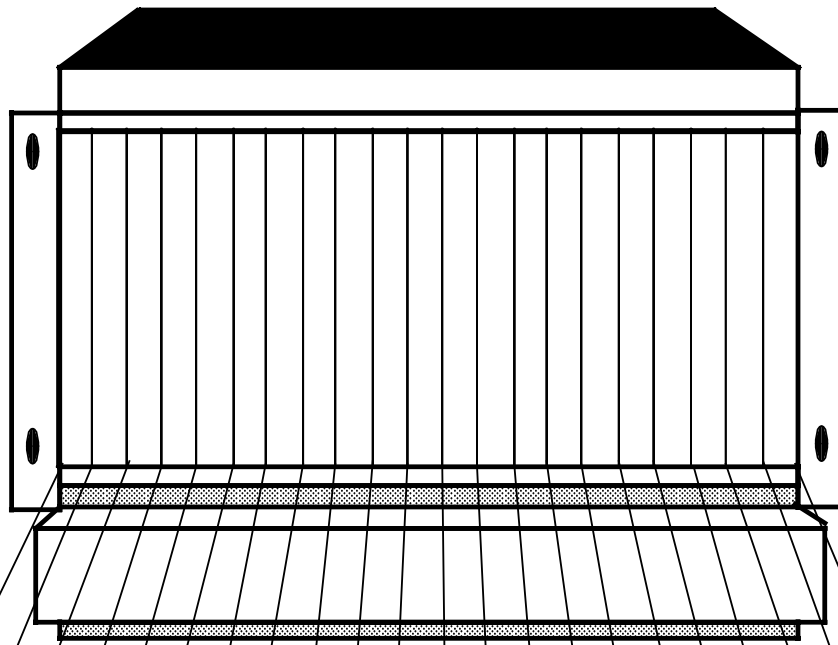
4.1.5 Expansion Unit SIMATIC S5 - 183 U



Slot-number	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163	*
IM 310 Interface																						
IM 311 Interface																						
IM 312 Interface																						
WF 715																						3.0 A
WF 716																						3.0 A
WF725 A/B																						2.5/3 A
WF726 A/B																						2.5/3 A
WF726 C **																						1.3 A
WF470 A/B																						2.5/3 A
WF470 C																						3.0 A

* Current Consumption per Module without encoders
 ** Operation without fan possible

4.1.6 Expansion Unit SIMATIC S5-185 U



Slot-number	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	*
Interface IM 314																				
WF 705*																				0.5 A
WF 715																				3.0 A
WF 716																				3.0 A
WF 725A																				2.5 A
WF 725 B																				3.0 A
WF 726 A																				2.5 A
WF 726 B																				3.0 A
WF 726 C**																				1.3 A
WF 785																				1.5 A
WF 470 A																				2.5 A
WF 470 B																				3.0 A
WF 470 C																				3.0 A

1 module requires 2 slots

* Current Consumption per Module without encoders
 ** Operation without fan possible

4.2 Address Areas in the SIMATIC S5



Address area for central controller type of boards such as WF 470 and WF 463S.



Address Area for periphery type of boards such as WF 715, WF 714, WF 725 / WF 726.

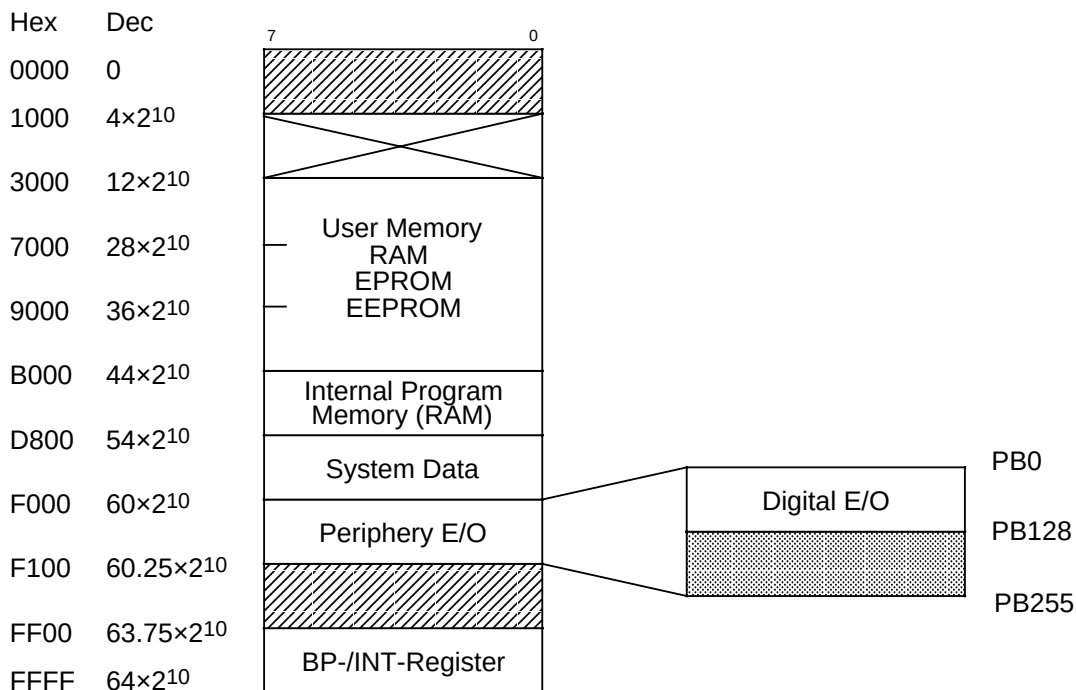
The installation of the WF 715 in expansion racks with long distance coupling is not allowed. Each WF 715 uses 32 address bytes in the periphery range. Therefore the starting address must be a multiple of 32. Check the current consumption. The address areas chosen for WF modules cannot be used by other modules.

(Checked addressing is not allowed)

The following are the Dual-Port RAM area lengths for the modules:

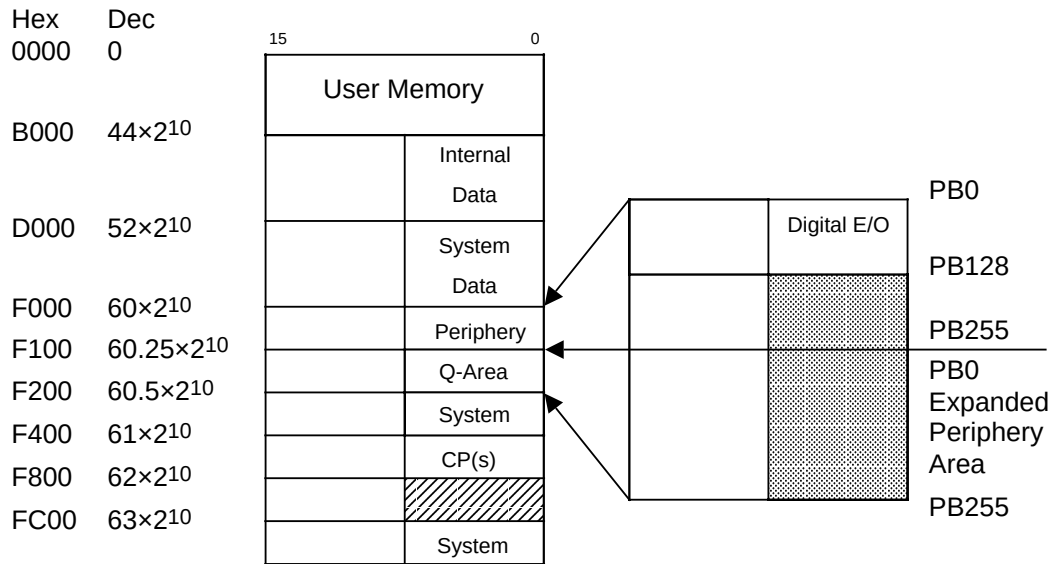
WF 725:	16 Byte
WF 715/716	32 Byte
WF 726:	16/32 Byte
WF 470, WF 463S:	256 Byte

4.2.1 Central SIMATIC S5 - 115 U (CPU 943, 944)



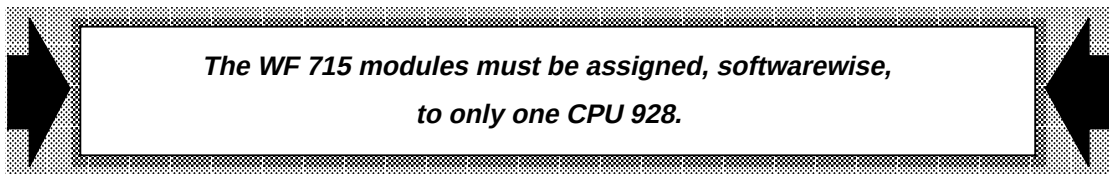
The WF 470 module, if used within SIMATIC S5-115U, should preferably be coded to the address 0000.

4.2.2 SIMATIC S5 - 135U (CPU 928)

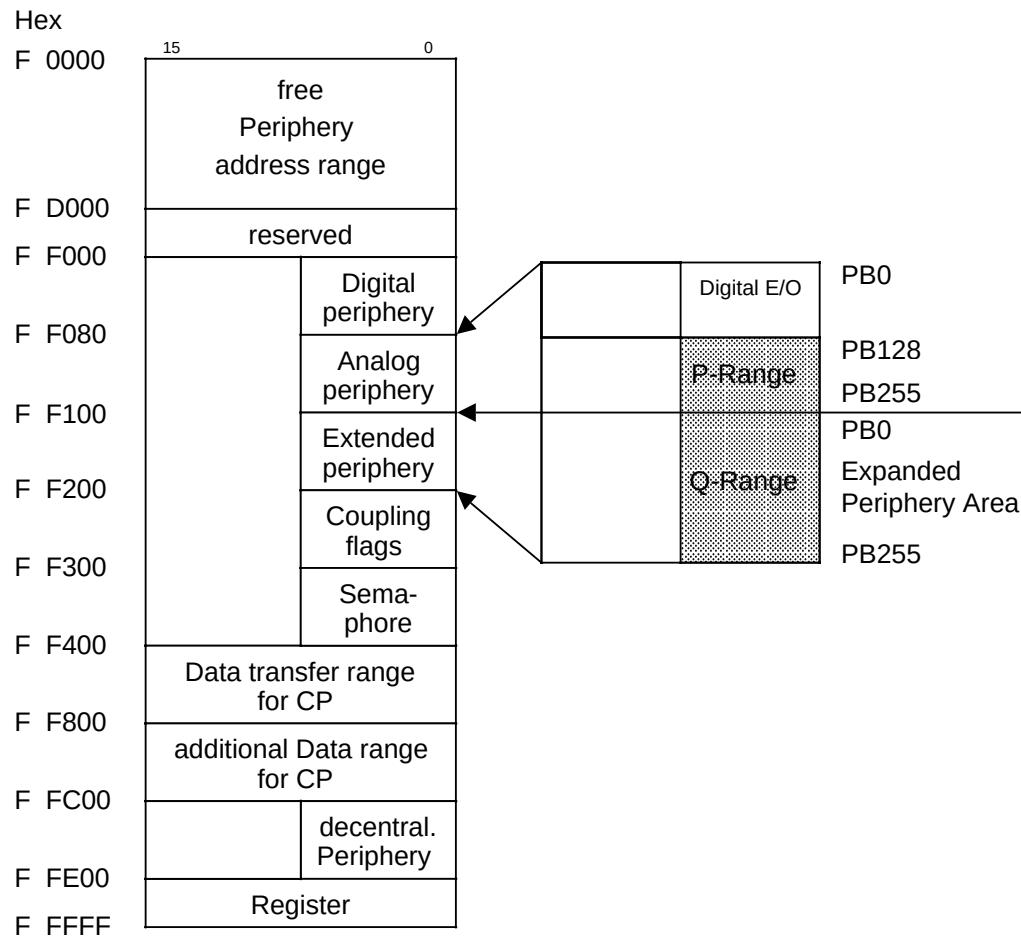


The extended periphery range can only be used in expansion units which are connected with a separate interface to the central unit.

Periphery modules cannot be used in the central unit, if this extended periphery range is used.



4.2.3 SIMATIC S5 - 155U (CPU 946,947)



The extended periphery range can only be used in expansion units which are connected with a separate interface to the central unit.

Periphery modules cannot be used in the central unit, if this extended periphery range is used.

5 Technical Data

5.1 Electrical Specifications

Electrical characteristics 5 VDC	
Voltage 5 VDC ($\pm 5\%$)	Power supplied by SIMATIC S5
Internal current consumption, 5 VDC (without encoders)	3.0 A
Maximum current for each encoder	max. 0.3 A
Fuse F2 for 5 V encoder current	1 A MT
Required input current from the encoder for each Signal (X4-X6)	5 mA
Electrical Characteristics 10 VDC	
Voltage ± 10 VDC (Command valve output X3)	Voltage is formed internally
Maximum output current	2 mA
Electrical Characteristics 24 VDC	
Voltage 24 VDC ($\pm 5\%$)	24 VDC
Inputs	5 mA
Outputs	0.4 A
Maximum current for each encoder	0.3 A
Fuse F1 for 24 VDC encoder current	2 A T
Required input current from encoder for each channel (X8-X10)	5 mA
Frequency limit encoder input (before multiplication by four)	200 kHz
Fast cam outputs (not short circuit proof)	0.1 A
Electrical Characteristics Analog input	
Connection voltage:	0-24 VDC/40 VDC/60 VDC (6FM1 715-3AA00) 0-10 VDC/24 VDC/40 VDC(20 mA)(6FM1 715-3AA10) 0-10 VDC/24-40V DC/20 mA (6FM1 715-3AA20)

5.2 Environmental Conditions

Ambient temperature	- Operation 0 °C to +55 °C - Storage and transport -40 °C to +70 °C Maximum permissible temperature change: 1.1 K/min
Relative humidity	20 to 75%, short-term peaks up to 95%
Concentration of aggressive gases and suspended matter	Threshold Limit Values ¹⁾ (maximum concentration at the place of work)
Mechanical stressing	short-term vibrations with accelerations up to 2.5 kg are permitted

¹⁾List of the Threshold Limit Values is issued by the West German Federal Department of Labor and Social Security.

6 Ordering Data and Documentation

6.1 Ordering Data

Modules	Order No.
WF 715 Cam controller	6FM1 715-3AA20

Software-Packages for SIMATIC S5	Order No.
Standard I-715 Link of SIMATIC S5 with WF 715 Diskette 3.5" MS-DOS for 115U (CPU 943, 944) for 135U (CPU 928) for 155U (CPU 946, 947)	6FM1 715-7UA30-0AA0
Standard III-715 (STEP 5 Software) - Link of Standard I-715 with WF 470 Software for data exchange - Masks for WF 470 visualization of Standard III-715 in German language Screen masks for WF 470 (Diskette 3.5" MS-DOS) for 115U (CPU 943, 944) for 135U (CPU 928) for 155U (CPU 946, 947)	6FM1 715-8AA30-0AA0

Accessories	Order No.
Encoder Incremental encoder, to be attached (without link and clamping claws; axial cable output) 1000 Pulses/Rev. 2000 Pulses/Rev. 2500 Pulses/Rev. Internal encoders are available for 1HU- and 1FT-motors.	6FC9 320-3KA01 6FC9 320-3KK01 6FC9 320-3KN01

Cables	Order No.	Max. Length [m]
Encoder 6FC9 320-3K 01 6FC9 320-3M 01 - WF 715	6FM1 790-1C 00 ¹⁾	35
Integral encoder - WF 715	6FM1 790-1B 00 ¹⁾	35
Absolute encoder - WF 715	6FM1 790-1E 00 ¹⁾	70
Drive unit - WF 715	6FM1 790-2A 00 ¹⁾	30
Tool monitoring Length 0.3 m	6FM1 790-3AA00	

¹⁾ Place for cable length (se catalog AR 10)

Connectors on Module	Order No.
D-Sub connector, 15 pin, female	6FM1 790-8CA00
D-Sub connector, 15 pin, male	6FM1 790-8DA00
D-Sub connector, 25 pin, male	6FM1 790-8GA00
D-Sub connector, 50 pin, male	6FM1 790-8HA00

Connectors for encoders	Order No.
SIEMENS round connector, 12 pin, female	6FC9 341-1FD
Amphenol-Tuchel-connector, 17 pin, female	6FC9 341-1AC

6.2 Documentation

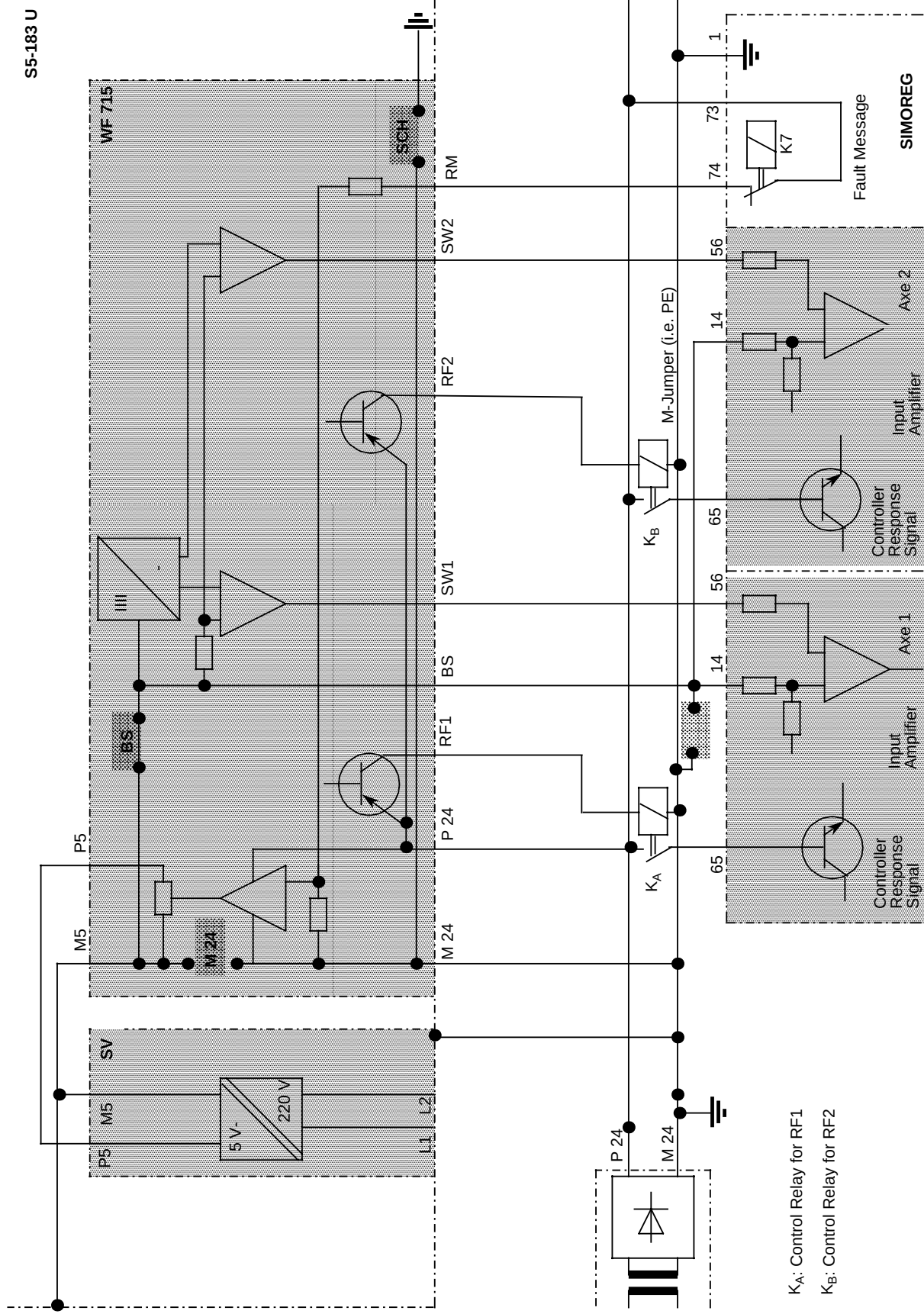
/1/	WF 715 Cam Controller Description	Order No.: 6ZB5 440-0FM01-0BA1 *)
/2/	WF 715 Cam Controller Product Brief	Order No.: 6ZB5 440-0HD02-0BA0
/3/	WF 715 Cam Controller Planning Instructions, Part 1: Interface Description	Order No.: 6ZB5 440-0GT02-0AA2
/4/	WF 715 Cam Controller Planning Instructions, Part 2: Interface Description of the Software Standard I	Order No.: 6ZB5 440-0GU02-0AA0
/5/	WF 715 Cam Controller Planning Instructions, Part 3: Interface Description of the Software Standard III	Order No.: E80850-J125-X-A1-7600
/6/	WF 715 Cam Controller Planning Instructions, Part 4: Tool Safety Position Check	Order No.: 6ZB5 440-0JJ01-0AA0 *)
/7/	WF 715 Cam Controller Installation Instructions Part 1: Description	Order No.: 6ZB5 440-0GS02-0AA2
/8/	WF 715 Cam Controller Installation Instructions Part 2: Lists	Order No.: 6ZB5 440-0JW02-0AA0
/9/	WF 470 Display Module Description	Order No.: 6ZB5 440-0QS02-0AA2
/10/	WS/WF Series, System and Components Catalog AR 10 • 1993	Order No.: E86060-K6310-A101-A4-7600

The current order numbers and notes about the documentation of other modules can be found in the

Documentation Index WS/WF-Technik
Order No.: 6ZB5 440-0KE01-0AB0 *)

The current order numbers can also be called using PRODOK.

*) This Documentation is only available in German.



Siemens AG AUT V260 Postfach 4848 D-90327 Nürnberg Fed. Rep. of Germany	Suggestions/Corrections For Publication/Manual: Equipment for Machine Tools WF 715 Cam Controller Planning Instructions, Part 1 Order No.: 6ZB5 440-0GT02-0AA2 Edition: May 1993
From: Name _____ Company/Dept. _____ Address _____ Telephone _____ / _____	Should you come across any printing errors when reading this publication, please notify us on this sheet. Suggestions for improvement are also welcome.

Suggestions and/or corrections: