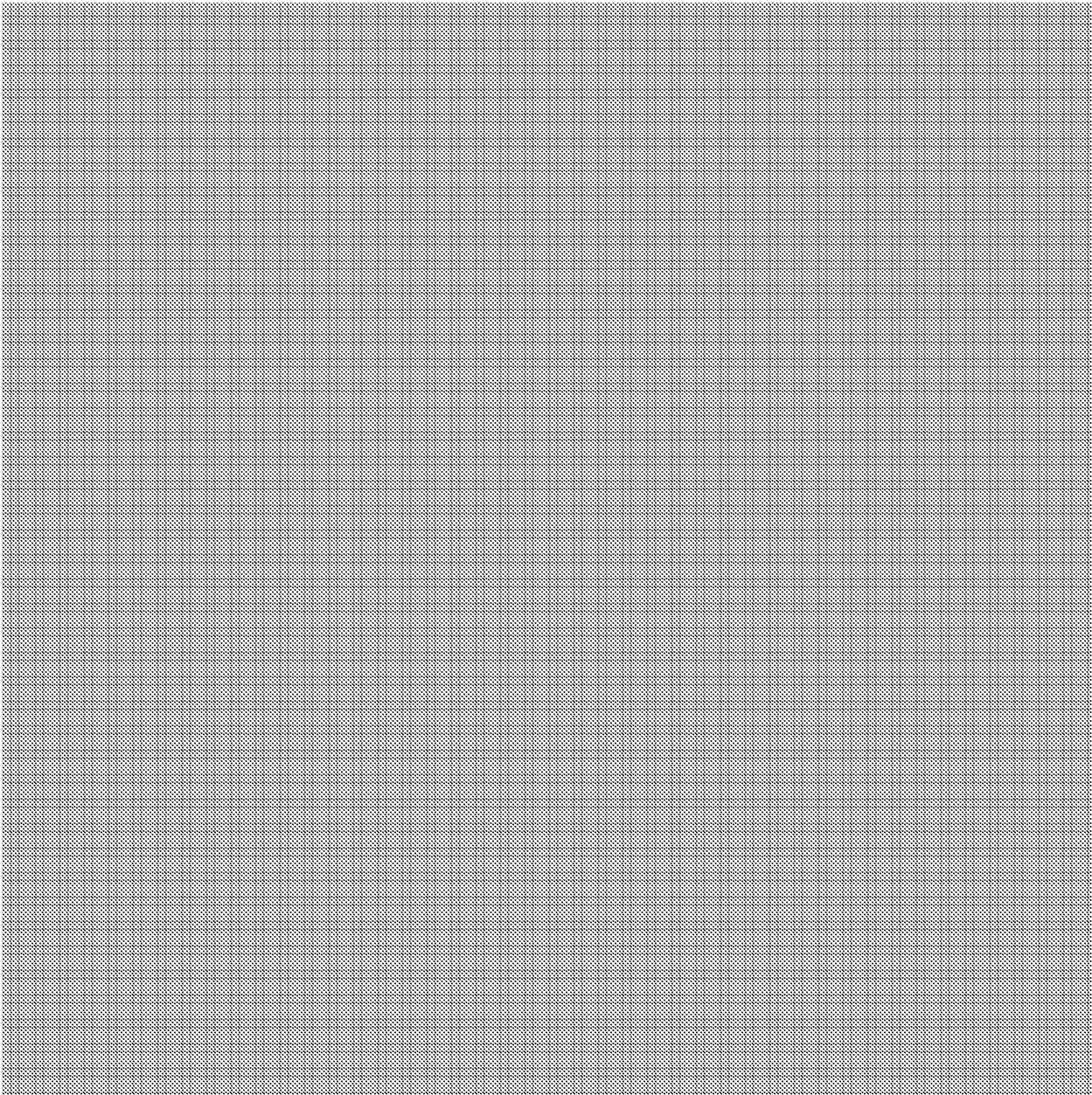


Equipment for Special Machines
WF 705
Position Measuring Module

Description	Edition 11.96
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1 Overview

1.1 Application

In addition to positioning of closed loop servo axes, today's automated machines require position measurements of a number of axes.

The WF 705 position measuring module offers:

- Auxiliary axes
- Set up axes
- Handling and transportation functions
- Measuring functions

The WF 705 provides these functions in a space-saving and cost-effective way, compared to conventional solutions.

The WF 705 module can be used as a peripheral device in medium- and high-performance SIMATIC S5 PLCs (control versions S5-115U, S5-135U, S5-155U) and SIMATIC S7-400.

The WF 705 can measure up to 12 independent axes.

Up to 8 WF 705 modules can be used in one SIMATIC S5 PLC and this makes it possible to work with up to 96 axes.

1.2 Characteristics of the WF 705

- 12 axes per module
- Installation width
 - 1 SEP (SIMATIC S5)
 - 2 SEP in adapter casing (SIMATIC S7)
- Digital absolute position measurement with synchronous-serial data transfer
- Less cabling needed than with parallel-absolute position measurement
- Data format: Dual Code at transfer to SIMATIC S5/S7
- Interference-free data transfer: RS 422
- Settable transfer rate dependent on length of cabling
 - 1 Mbit/s: max. cable length 25 m
 - 125 Kbit/s: max. cable length 120 m
- Required peripheral address space per WF 705: 4 bytes
- Cable break and short circuit monitoring

1.3 Data of the SSI Absolute Encoder

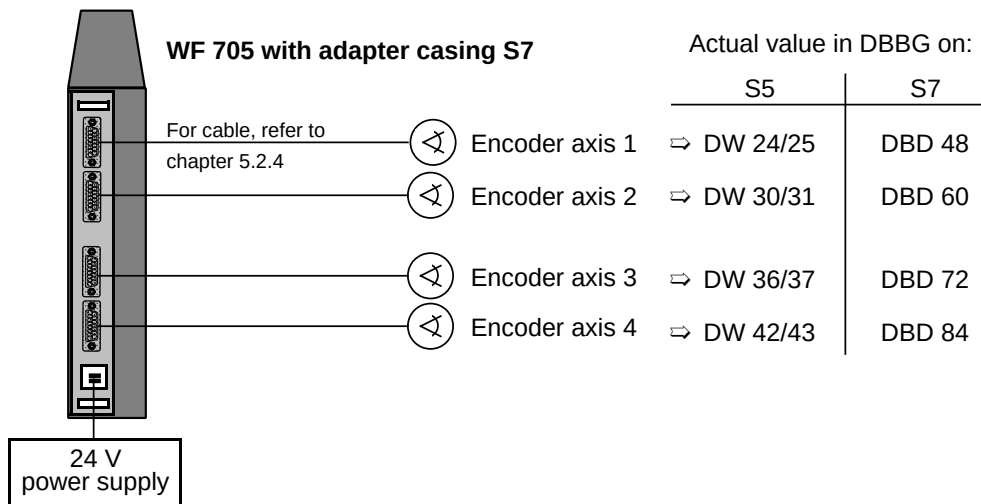
- Gray code
- 125 Kbit/s to 1 Mbit/s transfer rate
- Possible number of steps per revolution at Standard SSI (pine-tree array):
 - 128
 - 256
 - 512
 - 1024
 - 2048
 - 4096
 - 8192
- Maximum of 4096 revolutions
- 25-bit data transfer format
- 24 V power supply voltage

2 Configuration

2.1 Versions

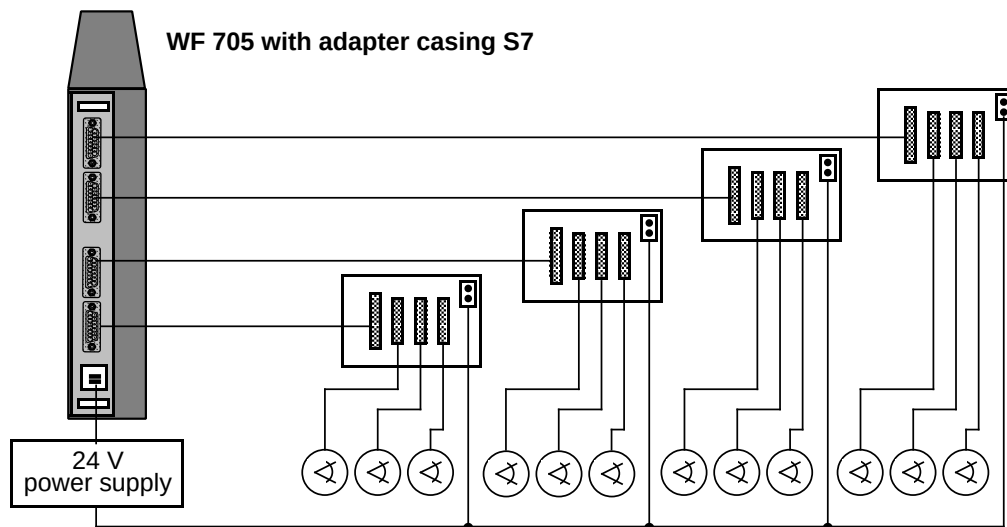
The serial-absolute encoders can either be connected directly to the WF 705 module or via the actual value distributor. If the encoders are connected directly to the WF 705, their 24V DC power supply is provided by the module.

2.1.1 Example with four Encoders on the WF 705



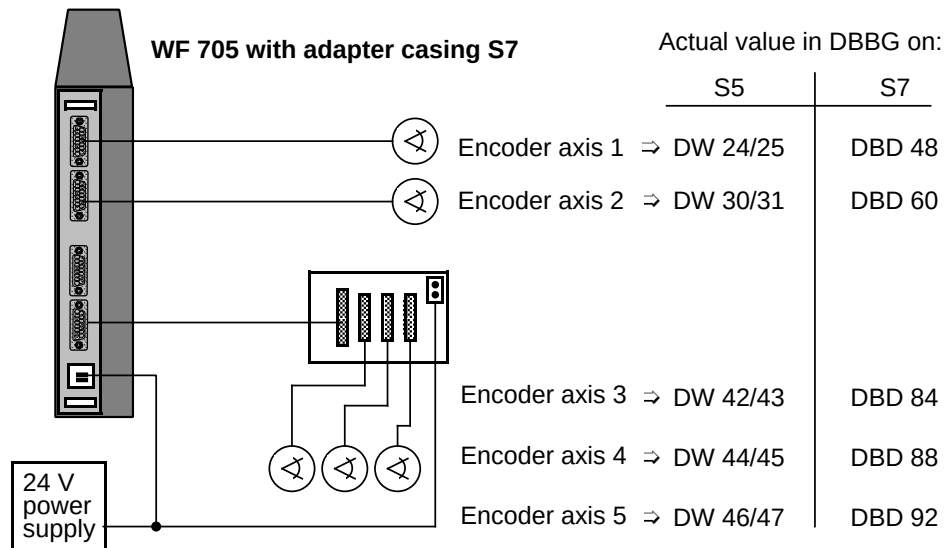
2.1.2 Example with twelve Encoders on the WF 705

If more than four axes have to be connected, then three axes are connected to one actual value distributor. The 24 V DC power supply for these encoders is fed through the actual value distributor.

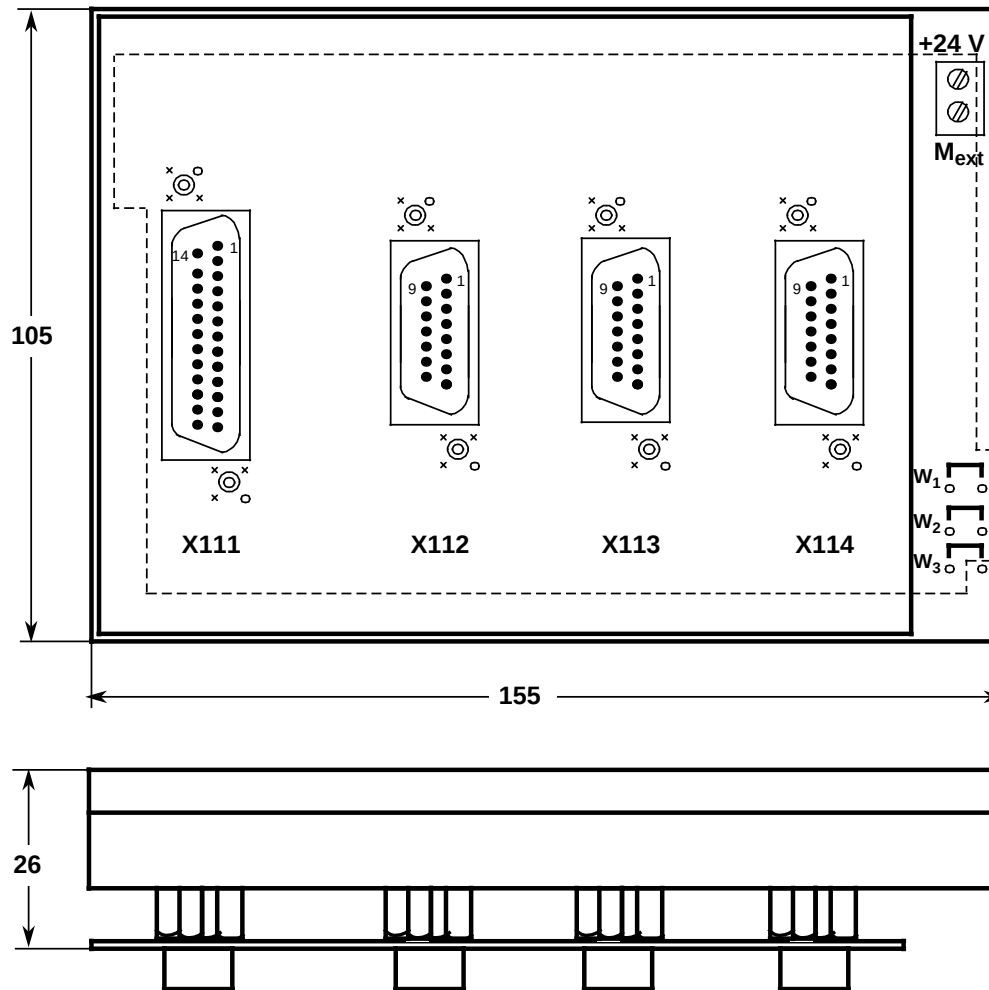


2.1.3 Example with five Encoders on the WF 705

Hybrid operation of directly connected encoders and encoders connected via the actual value distributor is possible. However, the power supply for those two versions must be the same (common ground).



2.2 Configuration of the Actual Value Distributor



The actual value distributor transmits the clock pulses (CLK) arriving from the WF 705 on connector X111 via X112/X113/X114 to max. three encoders or transmits the signals (data) of max. 3 encoders via X112/X113/X114 to the connector X111 and thus to the WF 705.

3 Operation with SIMATIC S5

3.1 Possible Slots for WF 705 in the SIMATIC S5 Rack

It is not possible to use the WF 705 module in remote-linked extension racks (with IM 308/ IM 318). Each WF 705 module needs four address bytes in the peripheral area. The starting address must therefore be a multiple of four. Ensure that the maximum current of the power supply is not exceeded!

 Available slots are shaded grey.

Central unit S5-115U - subrack CR 700-0LA

Slot designation	PS	CPU	0	1	2	3	IM
WF 705							

Central unit S5-115U - subrack CR 700-0LB

Slot designation	PS	CPU	0	1	2	3	IM
WF 705							

Central unit S5-115U - subrack CR 700-1

Slot designation	PS	CPU	0	1	2	3	4	5	6	IM
WF 705										

Central unit S5-115U - subrack CR 700-2

Slot designation	PS	CPU	0	1	2	3	4	5	6	IM
WF 705										

Central unit S5-115U - subrack CR 700-3

Slot designation	PS	CPU	0	1	2	3	4	5	6	IM
WF 705										

3.2.3.4 Block Parameters

DBBG Module data block

GE 1 Number of steps per revolution for axis 1
 ⋮ ⋮
 GE12 Number of steps per revolution for axis 12

The following values for steps/revolution can be entered:

4, 8, 16, 32, 64,	1024, 2048
128, 256, 512	4096, 8192

A zero must be entered for an axis which is not used. With programmable encoders, the number of steps per revolution can be set at the user's discretion. The value stated above which is in accordance with the programming must be entered in the parameter GE of the relevant axis as the function block is designed for the so-called „tree” format. Please ask the encoder manufacturer if you require further information.

BAUD Data transfer rate between encoder and WF 705 or actual value distributor

0: 125 Kbit/s up to a cable length of 120 m

1: 1 Mbit/s up to a cable length of 25 m

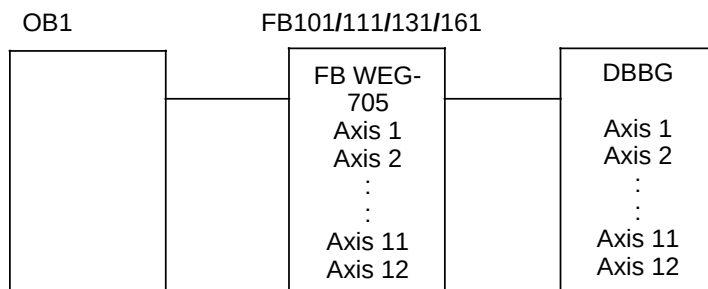
See chapter 3.5.5 for the formats of the parameters.

ADR Address of the module: The value range is PB 4...252 and the value must be a multiple of 4 (see chapter 2.3, Possible slots).

FEHL This parameter is set if the DBBG cannot be generated, e.g because there is not enough available memory, or the wrong resolution has been selected, e.g. 500 instead of 512.

3.2.4 Normal Operation (cyclical)

The program reads out the actual position value of the desired axis if a request is made (single fetch). The program should be written in such a way that the actual values are made available to the user as quickly as possible. The actual values are stored in a data block (see data block interface).

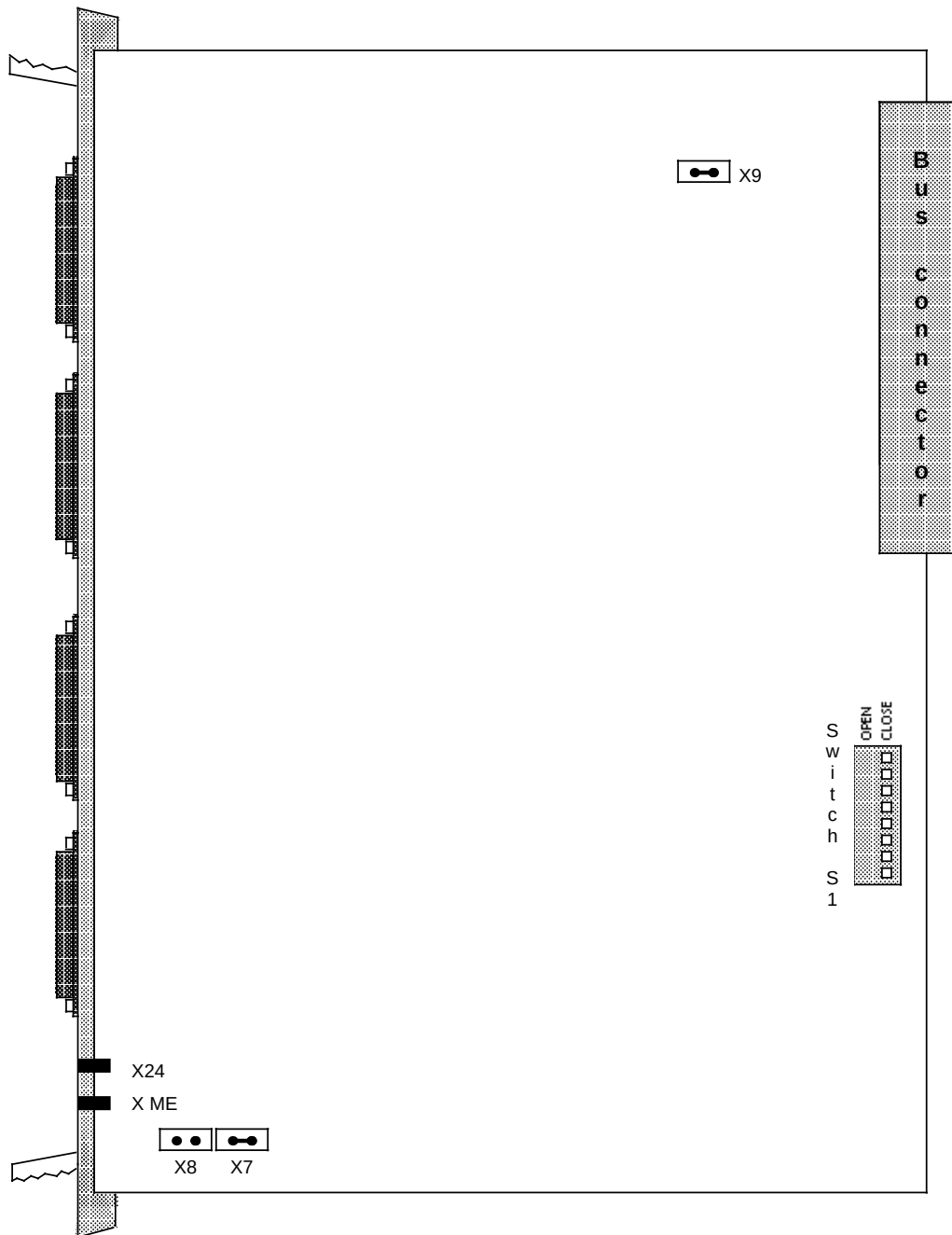


- The actual values are transferred in dual format to the user (refer to chapter 3.2.6).
- Code conversions (e.g.: dual BCD) have to be carried out by the user.
- The actual values are always read-out from the WF705 via a "single fetch".

3.4 Commissioning/Trouble-Shooting

3.4.1 WF 705 Jumper and Switch Settings

WF 705



3.4.1.1 Module Address (DPR Address)

Switch S 1

Evaluation 2^2 2^3 2^4 2^5 2^6 2^7

Switch No.	1	2	3	4	5	6	7	8
OPEN								
CLOSE								

The actual position of the switch is marked white

Example 1: Address 8

0	0	0	1	0	0	0	0
---	---	---	---	---	---	---	---

Switch No.	1	2	3	4	5	6	7	8
OPEN								
CLOSE								

Example 2: Address 128

0	0	0	0	0	0	0	1
---	---	---	---	---	---	---	---

Switch No.	1	2	3	4	5	6	7	8
OPEN								
CLOSE								

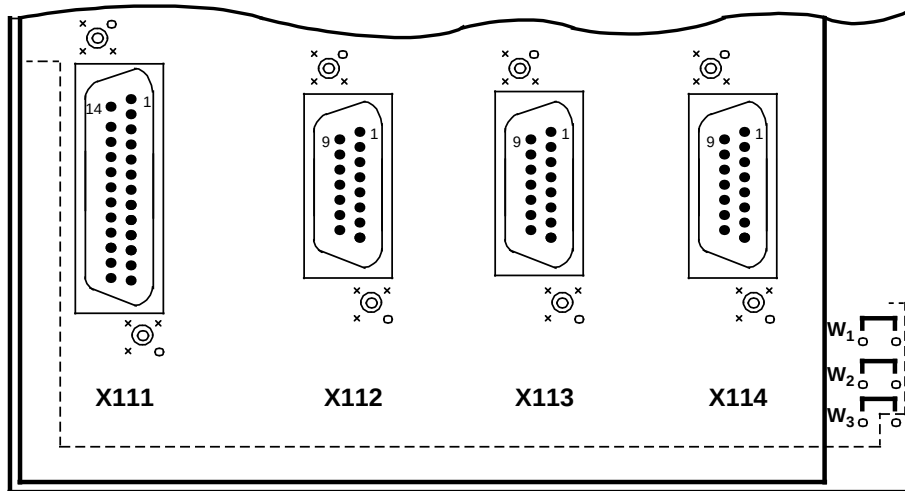
3.4.1.2 Other Jumper Settings on the WF 705 Module:

Jumper X7:  CLOSE External ground: 5 V ground connected to 24V ground (state on delivery)
 OPEN External ground: 5 V ground not connected to 24V ground

Jumper X8:  OPEN 5V ground connected to screen via plug housing and wiper of the SIMATIC S5 (state on delivery)
 CLOSE see OFF but additionally connected to ground of X6

Jumper X9:  CLOSE
 OPEN For testing: Interrupts the clock line (used in factory only)

3.4.2 Jumper Settings on the Actual Value Distributor:



Jumper W1:  CLOSE Screen with external ground
 OPEN (No function in WF 705)

Jumper W2:  CLOSE Connection of external 24V ground to WF 705 module
 OPEN

Jumper W3:  CLOSE (No function in WF 705)
 OPEN

3.4.3 Information about Trouble-Shooting

Please check the following items:

- Is the address set on the module the same as the one parameterized in FB100?
- Is the 24V DC power supply for the encoders connected to the actual value distributor and/or connected directly to the WF 705 module?
- If no position values are read-out for certain axes or if the values do not change when the encoder is turned by hand, e.g. 1AAA AAAA or 003A AAA5, check the following:
 - whether a read-out has been requested for the axes in question;
 - whether the cable break monitor has been triggered;
 - whether an encoder has been connected for that axis;
 - whether the cable has been connected correctly. If necessary, change the connector.
- whether jumpers X7 are open except for one module?
- whether jumpers X8 are open and the encoder cables's screens are generously grounded (see chapter 4.3)

4.4.2.3 Information about Trouble-Shooting

Please check the following items:

- Is the address set on the module the same as the one parameterized in FC100?
- Is the 24V DC power supply for the encoders connected to the actual value distributor and/or connected directly to the WF 705 module?
- If no position values are read-out for certain axes or if the values do not change when the encoder is turned by hand, e.g. 1AAA AAAA or 003A AAA5, check the following:
 - whether a read-out has been requested for the axes in question;
 - whether the cable break monitor has been triggered;
 - whether an encoder has been connected for that axis;
 - whether the cable has been connected correctly. If necessary, change the connector.
- whether Jumpers X7 are open except for one module
- whether jumpers X8 are open and the encoder cables's screens are generously grounded (see chapter 4.3)

4.5 Multiprocessing

In multiprocessing, one WF module each has to be assigned to a certain central processor. It is not possible to address a WF module from different central processors.

No standard block is provided with an interlocking for multiprocessing. Access is possible from any processor (user's responsibility).

5 Technical Data

5.1 Characteristics of the Module

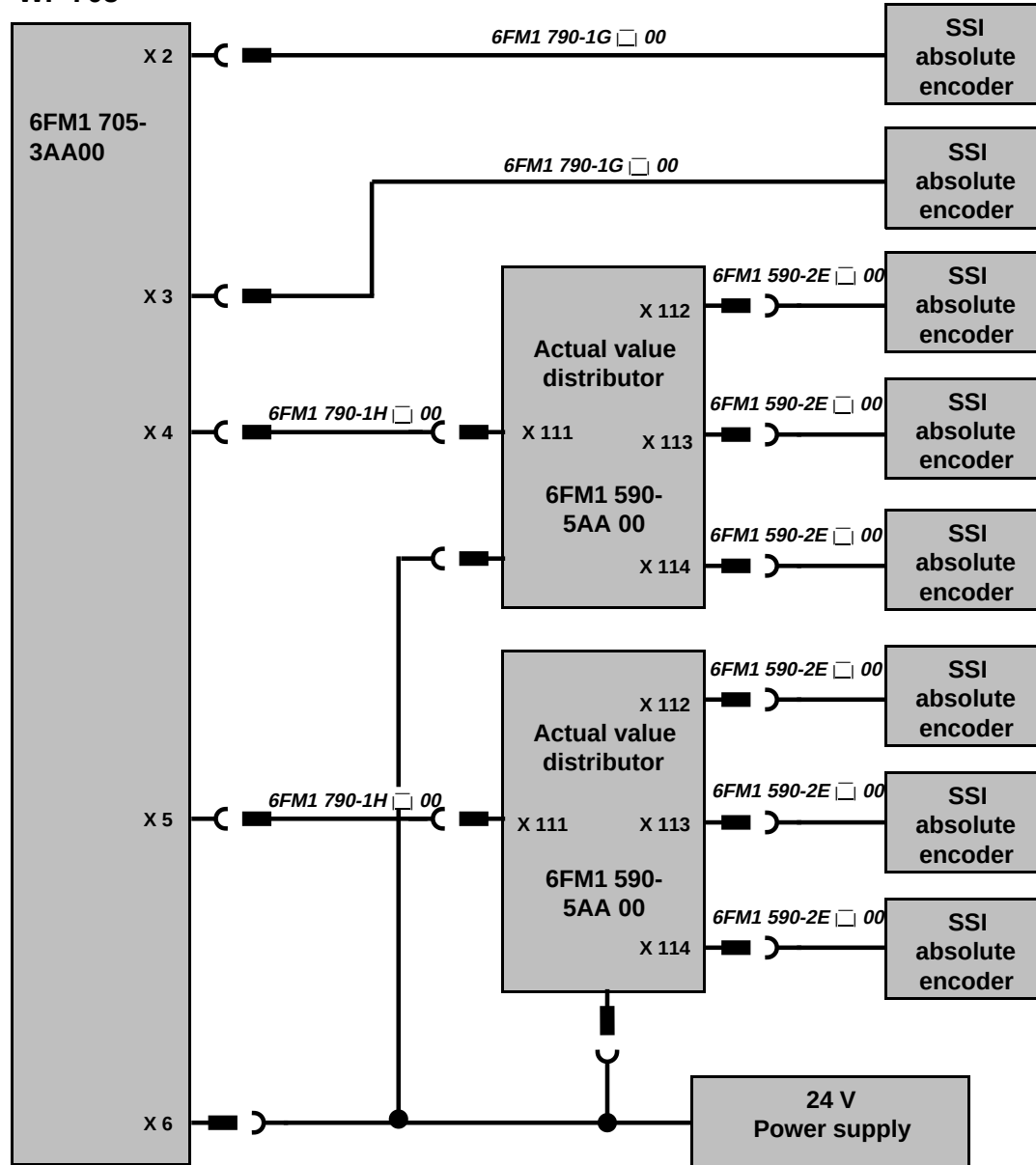
Electrical and mechanical characteristics	WF 705
Voltage level DC 5 V	is supplied by SIMATIC
Internal current consumption at DC 5 V (without encoders)	500 mA
Voltage level DC 24 V for encoders	has to be externally provided via connector X6
Inputs 24 V	—
Outputs 24 V	—
Max. admissible current consumption per encoder in case of direct connection	300 mA
Necessary input current of encoder signals	10 mA
SSI absolute encoder: Transfer rate up to a distance of 25 m up to a distance of 120 m Data length Code	1 MBit/s 125 Kbit/s 25 bit Gray
Space required in SIMATIC S5 rack	1 $\frac{1}{3}$ SEP
Space required in SIMATIC S7 rack	2 $\frac{2}{3}$ SEP

The WF 705 module does not need a fan rack.

5.2 Connection of the Module

5.2.1 Overview of Cables and Devices

WF 705



See chapter 5.2.2 for pin assignment of the front connectors.
Observe the screening instructions in chapter 6!

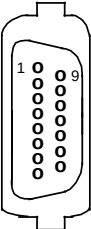
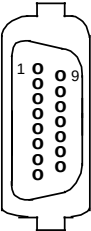
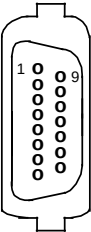
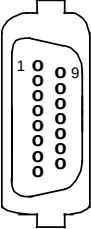
6FM1 790-1G 00
↑
Space for
the length code

For details, see chart. 7

5.2.2 Pin Assignment of Front Connectors

The following table shows the pin assignment for SSI absolute encoders (synchronous serial interface for absolute angular encoders).

If up to 4 encoders are connected, only one encoder will be connected per connector (for the corresponding graphics, refer to chapter 2; for cable, refer to chapter 5.2.3).

X2  X3  X4  X5  X6 +24V 0V	Connector X 2		
	Pin	Signal	
	1	Screen	
	2	Power supply	+24V
	3	Power supply	0V
	4	Encoder 1 DATA	+
	5	Encoder 1 DATA	–
	6	Encoder 1 CLK	+
	7	Encoder 1 CLK	–
	8	Encoder 2 DATA	+
	9	Encoder 2 DATA	–
	10	Encoder 2 CLK	+
	11	Encoder 2 CLK	–
	12	Encoder 3 DATA	+
	13	Encoder 3 DATA	–
14	Encoder 3 CLK	+	
15	Encoder 3 CLK	–	

Connector X 3		
Pin	Signal	
1	Screen	
2	Power supply	+24V
3	Power supply	0V
4	Encoder 4 DATA	+
5	Encoder 4 DATA	–
6	Encoder 4 CLK	+
7	Encoder 4 CLK	–
8	Encoder 5 DATA	+
9	Encoder 5 DATA	–
10	Encoder 5 CLK	+
11	Encoder 5 CLK	–
12	Encoder 6 DATA	+
13	Encoder 6 DATA	–
14	Encoder 6 CLK	+
15	Encoder 6 CLK	–

Connector X 4		
Pin	Signal	
1	Screen	
2	Power supply	+24V
3	Power supply	0V
4	Encoder 7 DATA	+
5	Encoder 7 DATA	–
6	Encoder 7 CLK	+
7	Encoder 7 CLK	–
8	Encoder 8 DATA	+
9	Encoder 8 DATA	–
10	Encoder 8 CLK	+
11	Encoder 8 CLK	–
12	Encoder 9 DATA	+
13	Encoder 9 DATA	–
14	Encoder 9 CLK	+
15	Encoder 9 CLK	–

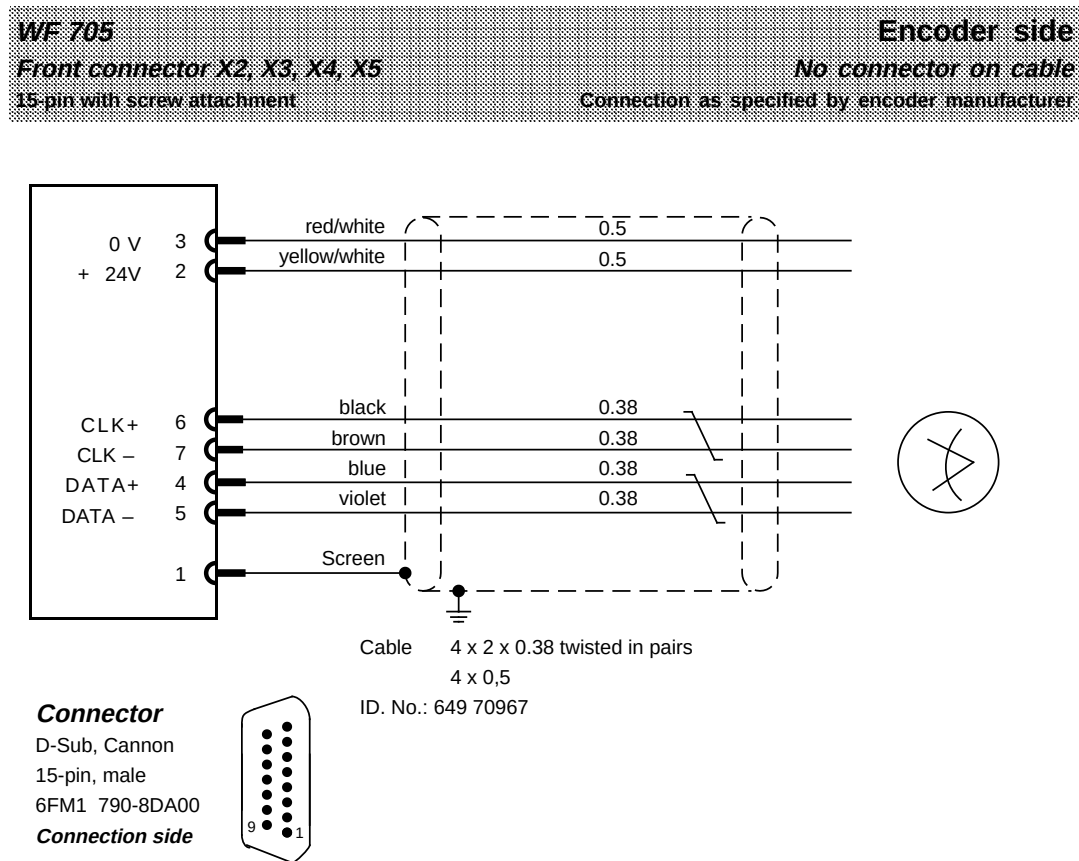
Connector X 5		
Pin	Signal	
1	Screen	
2	Power supply	+24V
3	Power supply	0V
4	Encoder10 DATA	+
5	Encoder10 DATA	–
6	Encoder10 CLK	+
7	Encoder10 CLK	–
8	Encoder11 DATA	+
9	Encoder11 DATA	–
10	Encoder11 CLK	+
11	Encoder11 CLK	–
12	Encoder12 DATA	+
13	Encoder12 DATA	–
14	Encoder12 CLK	+
15	Encoder12 CLK	–

Connector X 6	
	+24V for encoders which get their power from the WF 705

5.2.3 Cable from WF 705 Module to SSI Absolute Encoder

Cable from WF 705 module directly to encoder, no connector on cable.
This cable is always connected to the first axis in the front connector.

Order No.: **MLFB 6FM1 790-1G □00**

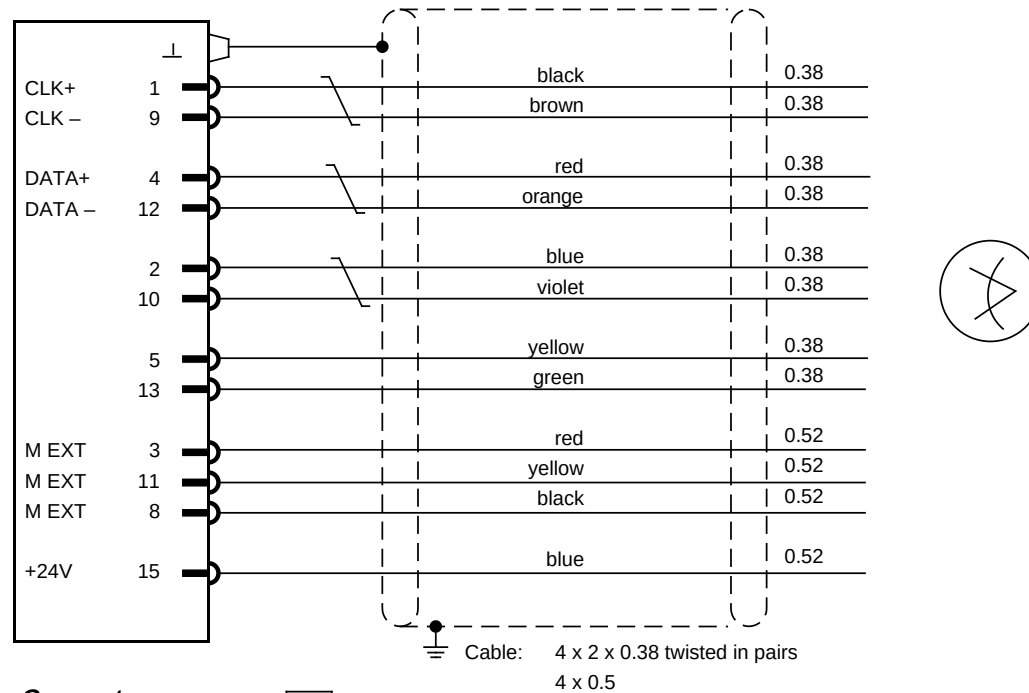


The screen of the actual value cable must be generously grounded on the component side (refer to chapter 6).

5.2.4 Cable from Actual Value Distributor to SSI Absolute Encoder

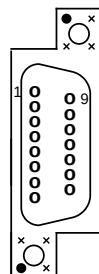
Order No.: **MLFB 6FM1 590-2E □00**

Actual value distributor	Encoder side
Front connector X112/113/114	No connector on cable
Connection as specified by encoder manufacturer	



Connector

D-Sub
15-pin, female
SINUMERIK casing
6FC9 341-1EC
Front view



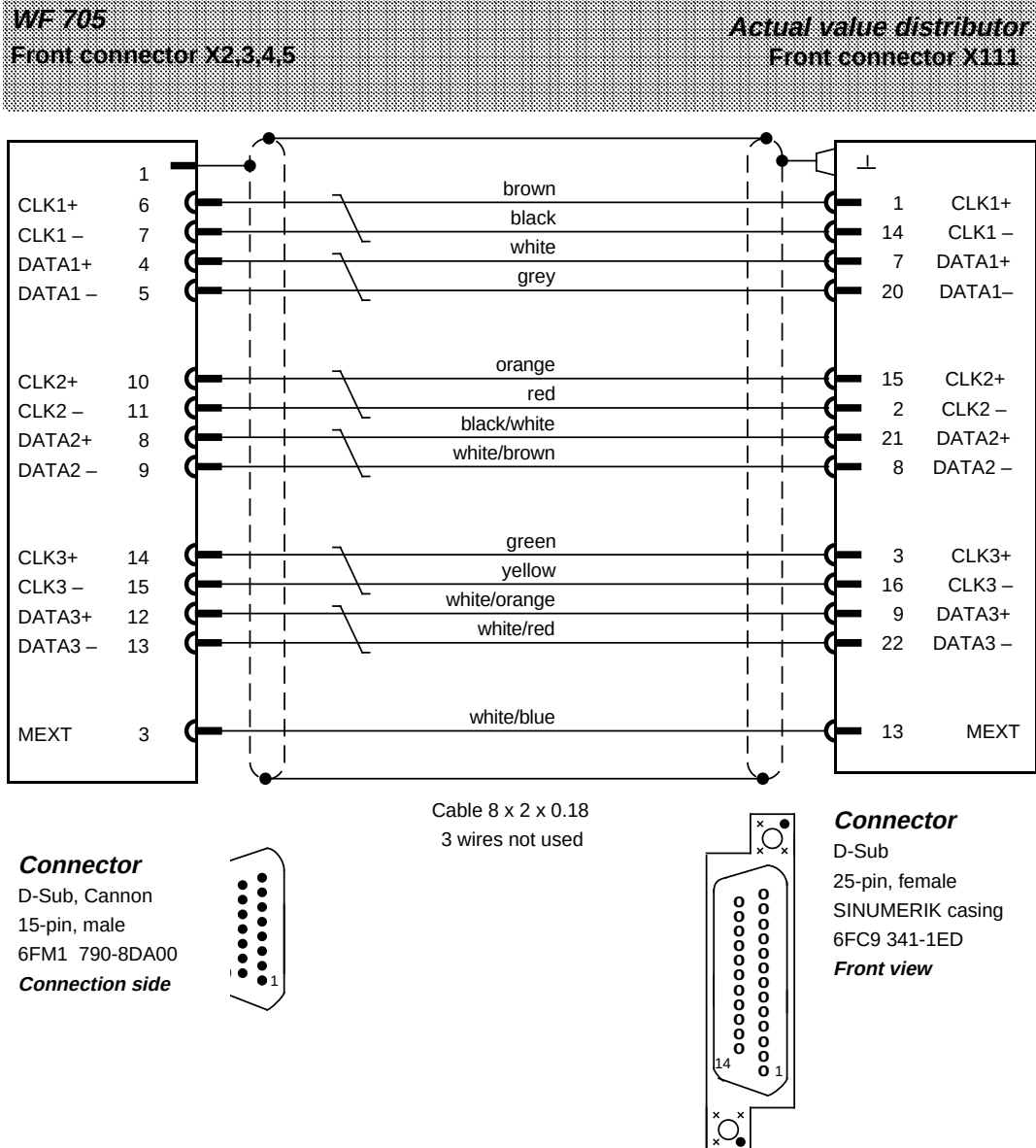
Connector code

- pin/socket
- × no pin/no socket

The screen of the actual value cable must be generously grounded on the actual value distributor side (refer to chapter 6).

5.2.5 Cable from WF 705 Module to Actual Value Distributor

Order No.: **MLFB 6FM1 790-1H □00**



The shield has to be connected on both sides.

7 Ordering Data/Documentation

Devices and Modules	Order Number	Max. Length
WF 705		
• Use in the SIMATIC S5 and its extension units	6FM1 705-3AA00	–
• Use in the SIMATIC S7-400 incl. adapter casing	6FM1 705-3AA70	–
Actual value distributor	6FM1 590-5AA00	–
Software Package on 3.5" diskettes	Order Number	
Standard software package for WF 705 (actual value measuring) for use in the SIMATIC S5/S7-400	6FM1 705-7UA30-1AA0	– – –
Connecting Cables	Order Number	
WF 705 – SSI absolute encoder (no connector on cable)		
2 m	6FM1 790-1GA00	Depending on the baud rate: 120 m at 125 Kbit/s 25 m at 1 Mbits/s
5 m	6FM1 790-1GB00	
10 m	6FM1 790-1GC00	
18 m	6FM1 790-1GD00	
WF 705 – to actual value distributor		
2 m	6FM1 790-1HA00	10 m
5 m	6FM1 790-1HB00	
Actual value distributor to SSI absolute encoder (no connector on cable)		
5 m	6FM1 590-2EB00	Depending on the baud rate: 120 m at 125 Kbit/s 25 m at 1 Mbits/s
10 m	6FM1 590-2EC00	
18 m	6FM1 590-2ED00	
Documentation		
WF 705 Product Brief	6ZB5 400-0AD02-0BA1	–
WF 705 Description	6ZB5 400-0AA02-0BA5	–