SIMATIC S5

IM 307 and IM 317 Fiber Optics Interface Modules

Manual

EWA 4NEB 811 6030-02

Contents

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Preface

You should read this preface carefully before consulting the manual. This will help you to use the manual and also save time.

There is a steady increase in the demands of the users of programmable controllers for more decentralization, and this has considerably sharpened the requirements to be met by the interface modules and transmission link. A fiber optics interface module has therefore been developed to meet users'requirements.

This manual describes the fiber optics (FO) interface module in detail. The manual has the following structure.

Description of contents

- Chapter 1 is a brief general introduction to fiber optics technology. It also gives you information on the length of the transmission link and concerning the PLCs of the SIMATIC S5 family that can use the FO interface module.

- In chapter 2 you will find a description of the expansion options that can be used basically with the FO interface module. A fiber optic link to an S5-115U programmable controller is taken to exemplify a total of sixteen different configurations (Figures 2-1 to 2-16). Specific functions can be implemented with each configuration (Tables 2-1 to 2-16).

- Chapter 3 contains a detailed description of the functions listed in Tables 2-1 to 2-16 (3.4 to 3.8).

- Chapter 4 lists the technical specifications of the interface modules and fiber optic cables, as well as the connector pinouts of the IM 307 / IM 317 and serializer/deserializer.

- Chapter 5 tells you how the modules are installed and what you have to observe when running and connecting the fiber optic cable.
  A description is also given of the operator controls and displays and their functions explained.

Figures

1 Introduction

1.1 General

Fiber optics technology has already proved highly successful in communications and is now being used to an ever increasing extent in industrial plant, especially for high-speed signal and data communications in connection with industrial processes. A fiber optic transmission link has three main components:

- the transmitter, which converts electrical signals into optical signals through the medium of an electrical-to-optical transducer.
- the fiber optic cable to carry the optical signal. These cables consist of optical fibres made of glass or plastic.
- the receiver, which transforms optical signals into electrical signals through the medium of an optical-to-electrical transducer.

This trend in the direction of fiber optics technology has been supported by the following advantages:

- long ranges thanks to minimal line attenuation
- high transmission capacity
- no problems in connection with the galvanic isolation of the systems
- excellent EMC properties, which simplify insulation
- no cross coupling as there is no signal radiation
- light weight and compact dimensions makes cable installation easy
- no sparking can take place at optical contacts allowing you to install optical waveguides in environments subject to explosion hazard

1.2 Application

The interface modules enable you to connect EU 183U, EU 185U and EU 186U, expansion units and expansion units containing block-type modules in the ER 701-2 and ER 701-3LA.. subrack to S5-115U, S5-135U, S5-150U and S5-155U central programmable controllers.

Depending on the particular configuration, you can also use communications processors (CPs) and intelligent I/O modules (IPs) without restrictions in the expansion unit. From the user's point of view, therefore, there is no longer any distinction between a central controller and an expansion unit.

1.3 Transmission Link

The transmission link between two interface modules may have a maximum length of 1500 m (approx. 5000 ft.). However, if you connect a number of expansion units in series, the length of the transmission link from the central controller to the last expansion unit may be considerably greater. On the other hand, connecting several expansion units in series affects the response time of an expansion unit to a central controller request. For this reason, proceed as recommended in section 2.4.

To make sure that the receiver is not overdriven by excessive input power, a minimum distance of 50 m (approx. 150 ft.) must be observed between two interface modules.

1.4 Transmission Medium

The signals are transmitted between the interface modules over a duplex silica fiber cable to VDE 0888. This means that the fiber optic cable has two cores, i.e. one for each direction. Figure 1-1 shows the basic makeup of a duplex fiber optic cable.

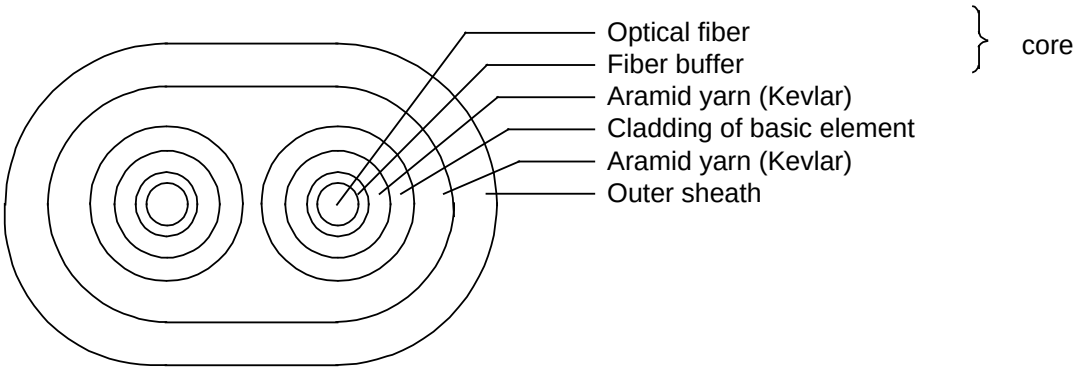


Figure 1-1. Makeup of a Duplex Fiber Optic Cable

1.5 Serializer/Deserializer

Bild eines Medienmoduls mit abgehenden Kabel

((Foto-Nr. 4098/3))

The parallel-to-serial conversion of the data to be transmitted and the serial-to-parallel conversion of the data received take place in the serializer/deserializer.
The serializer/deserializer sends informa-tion over the waveguide at a baud rate of 44 Mbps.

Figure 1-2. Serializer/Deserializer

1.6 Module

Note:
Please note that the IM307 and IM317R are double-width modules.

Figures

Tables

2 Configuration

The nature and number of the functions available on an expansion unit depend on the individual device configuration, subracks and on the slot and switch position of the IM 307 or IM 317 module. The following sections therefore describe the basic device configurations and their functions. The first major parameter is the PLC used in the central controller subrack.
The following subsections (2.1 to 2.3) describe the basic configurations with all the possible expansion units and their functions. The functions themselves are described again in more detail in sections 3.4 to 3.8.

Example 1: You wish to connect an ER 701-2 expansion unit to an S5-115U central controller and need the following function:
- EU (expansion unit) fault: CPU halts

To arrive at the correct solution, you must proceed as follows:
Consult the manual at the section that applies to your device configuration. In this case, it is section 2.1.1. The section begins with an illustration of the basic configuration. The specification ”possible slot for IM 307” does not necessarily mean that the same functions are available on all these slots.
The figure illustrating the basic configuration is always followed by a table containing information on the slot and switch position. This table lists all the functions possible with the particular device configuration on the left.
The ”function possible?” column tells you whether you can use the relevant function also in your device configuration. If this is the case, the slot and switch position for the IM 307 in the central controller is indicated. Depending on which of the possible functions you are interested in, you must select the relevant switch position and slot.
To the right in the table are the switch position and slot for the IM 317 in the expansion unit.

Taking example 1, you have two ways of implementing the two functions you require:

- Either you plug the IM 307 into
  slot 6, switch position 0
  in the central controller
  and
  the IM 317 into slot 7, switch position 0
  in the expansion unit
- or you plug the IM 307 into
  one of slots 0 to 5, switch position 3
  in the central controller
  and
  the IM 317 into slot 7, switch position 0
  in the expansion unit

2.1 Connection to an S5-115U Central Controller

Note:
An S5-115U central controller can only be expanded if one of the following subracks is used:
- CR 700-2
- CR 700-3
- CR 700-0LB

The CR 700-0LB subrack has the same functions as the CR 700-2 and CR 700-3 subracks, but fewer slots.
The following examples refer to the CR 700-2 and CR 700-3 subracks.

2.1.1 Expansion with the ER 701-2 Subrack

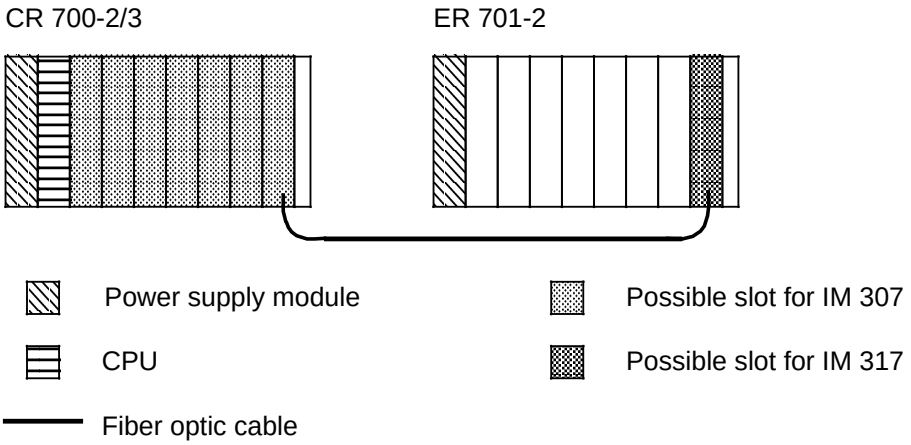


Figure 2-1. Basic Configuration with ER 701-2 Expansion Unit

Table 2-1. Functions with the ER 701-2

Function	Function possible?	Possible slot and switch positions						
		307 in CC					317 in EU	
		Slot	Switch position				Slot	Switch position
			0	2	3	5		
Report EU battery to CPU	no							
EU fault: CPU halts	yes	6 0 to 5	• XX		XX •	XX	7	0
Interrupt handling in EU	no							
Page addressing in EU	no							
Communication link from EU to EU	no							

● Function performed Function not performed XX illegal

2.1.2 Expansion with the ER 701-3LA.. Subrack

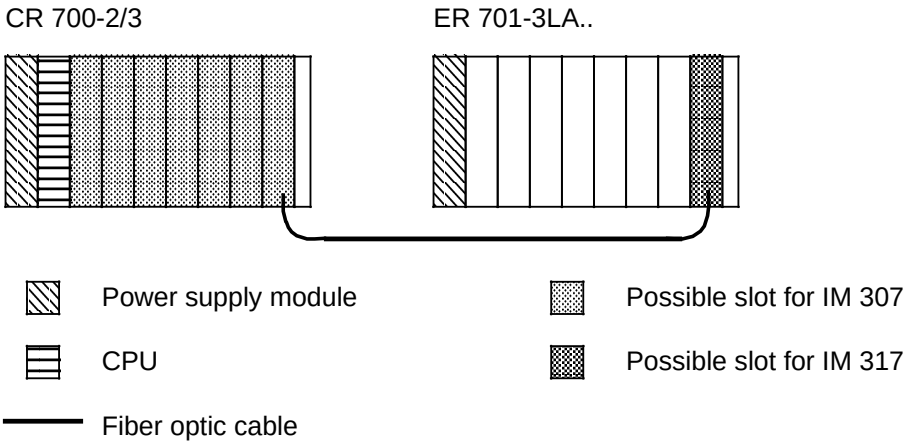


Figure 2-2. Basic Configuration with the ER 701-3LA.. Expansion Unit Subrack

Table 2-2. Functions with the ER 701-3LA..

Function	Function possible?	Possible slot and switch positions						
		307 in CC					317 in EU	
		Slot	Switch position				Slot	Switch position
			0	2	3	5		
Report EU battery to CPU	no							
EU fault: CPU halts	yes	6 / 0 to 5	• / XX	/ XX	XX / •	XX /	7	0
Interrupt handling in EU	no							
Page addressing in EU	yes	6 / 0 to 5	• / XX	• / XX	XX / •	XX / •	7	0
Communication link from EU to EU	no							

● Function performed Function not performed XX illegal

2.1.3 Expansion with ER 701-3LA.. Subracks, without Interrupt Handling in the Expansion Unit

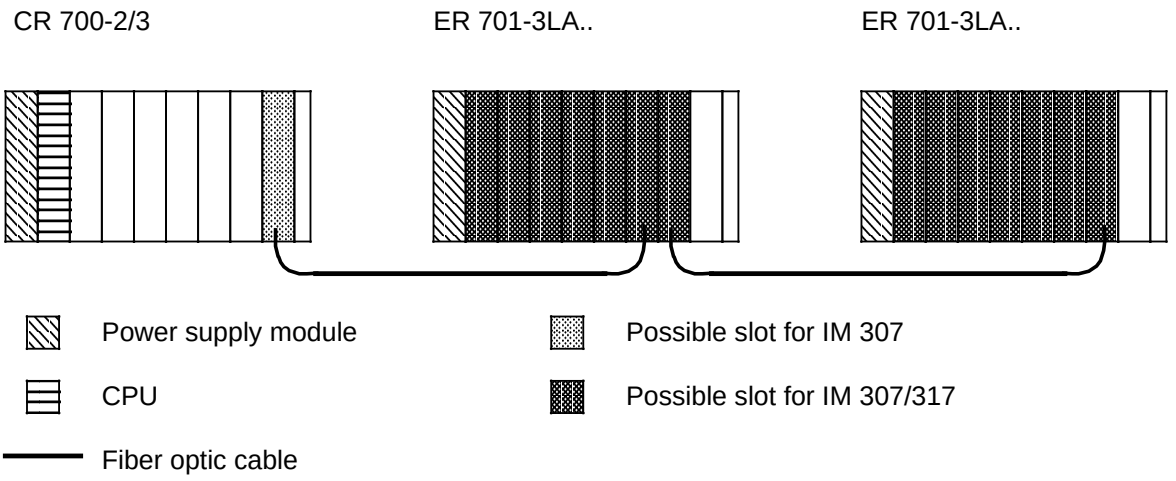


Figure 2-3. Basic Configuration with ER 701-3LA.. Expansion Subracks, without Interrupt Handling in the Expansion Unit

Table 2-3. Functions with the ER-701-3LA.., without Interrupt Handling in the Expansion Unit

Function	Function possible?	Possible slot and switch positions						
		307 in CC			317 in EU		307 in EU	
		Slot	Switch position		Slot	Switch position	Slot	Switch position
			0	2				
Report EU battery to CPU	no							
EU fault: CPU halts	yes	6	•		0 to 6	1	0 to 6	3
Interrupt handling in EU	no							
Page addressing in EU	yes	6	•	•	0 to 6	1	0 to 6	3
Communication link from EU to EU	yes	6	•	•	0 to 6	1	0 to 6	3

● Function performed ☐ Function not performed

2.1.4 Expansion with ER 701-3LA.. Subracks, with Interrupt Handling in the Expansion Unit

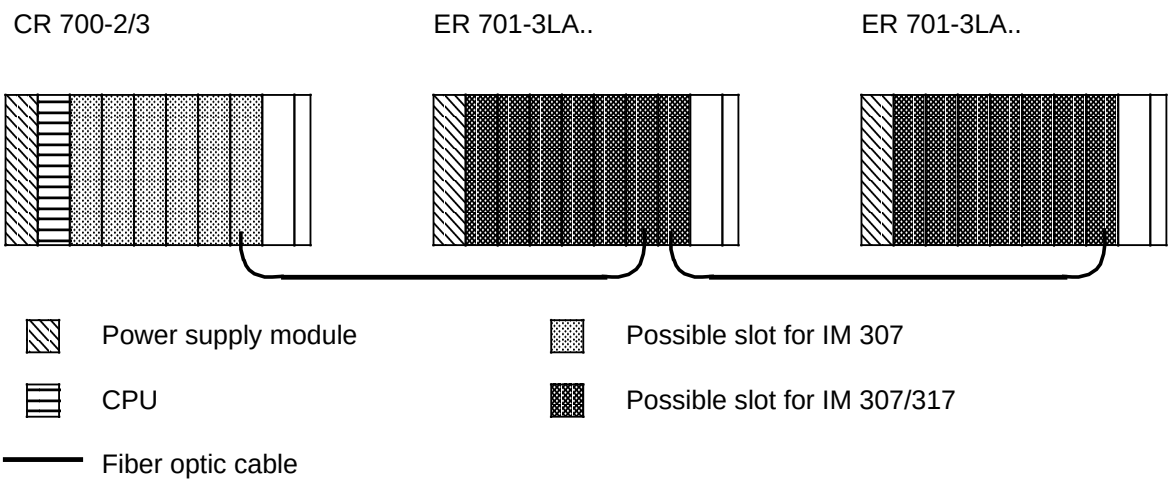


Figure 2-4. Basic Configuration with ER 701-3LA.. Expansion Subracks, with Interrupt Handling in the Expansion Unit

Table 2-4. Functions with the ER 701-3LA.. Subrack, with Interrupt Handling in the Expansion Unit

Function	Function possible?	Possible slot and switch positions						
		307 in CC			317 in EU		307 in EU	
		Slot	Switch position		Slot	Switch position	Slot	Switch position
			3	5				
Report EU battery to CPU	yes	0 to 5	•	•	0 to 6	1	0 to 6	3
EU fault CPU halts	yes	0 to 5	•		0 to 6	1	0 to 6	3
Interrupt handling in EU	yes	0 to 5	•	•	0 to 6	1	0 to 6	3
Page addressing in EU	yes	0 to 5	•	•	0 to 6	1	0 to 6	3
Communication link from EU to EU	yes	0 to 5	•	•	0 to 6	1	0 to 6	3

● Function performed ☐ Function not performed

2.1.5 Expansion with the EU 183U Subrack

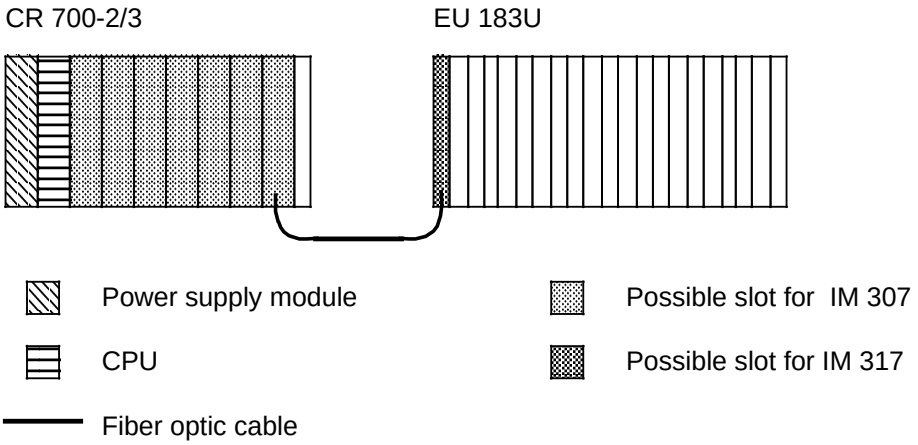


Figure 2-5. Basic Configuration with the EU 183U Expansion Subrack

Table 2-5. Functions with the EU 183U Expansion Subrack

Function	Function possible?	Possible slot and switch positions						
		307 in CC					317 in EU	
		Slot	Switch position				Slot	Switch position
			0	2	3	5		
Report EU battery to CPU	no							
EU fault: CPU halts	yes	6 0 to 5	• XX	 XX	XX •	XX	3	0
Interrupt handling in EG	no							
Page addressing in EU	no							
Communication link from EU to EU	no							

● Function performed Function not performed XX illegal

2.1.6 Expansion with the EU 185U Subrack

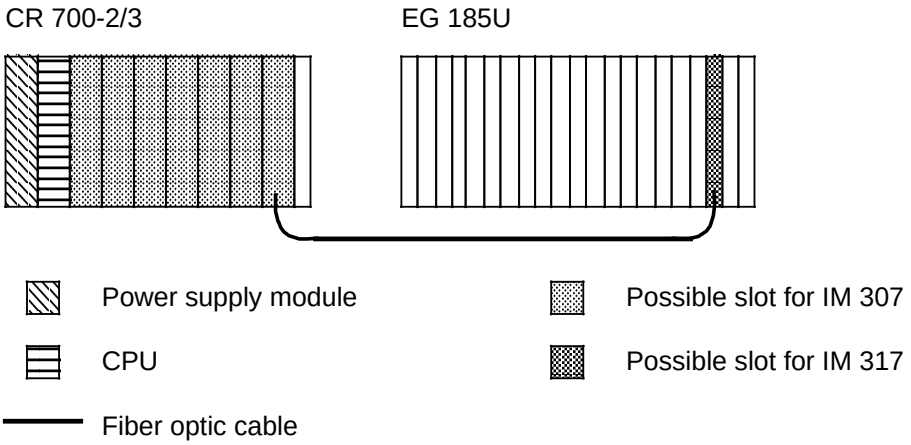


Figure 2-6. Basic Configuration with the EU 185U Expansion Subrack

Table 2-6. Functions with the EU 185U Expansion Subrack

Function	Function possible?	Possible slot and switch positions						
		307 in CC					317 in EU	
		Slot	Switch position				Slot	Switch position
			0	2	3	5		
Report EU battery to CPU	no							
EU fault: CPU halts	yes	6 0 to 5	• XX	 XX	XX •	XX	147	2
Interrupt handling in EU	no							
Page addressing in EU	yes	6 0 to 5	• XX	• XX	XX •	XX •	147	2
Communication link from EU to EU	no							

● Function performed Function not performed XX illegal

2.1.7 Expansion with the EU 186U Subrack, without Interrupt Handling in the Expansion Unit

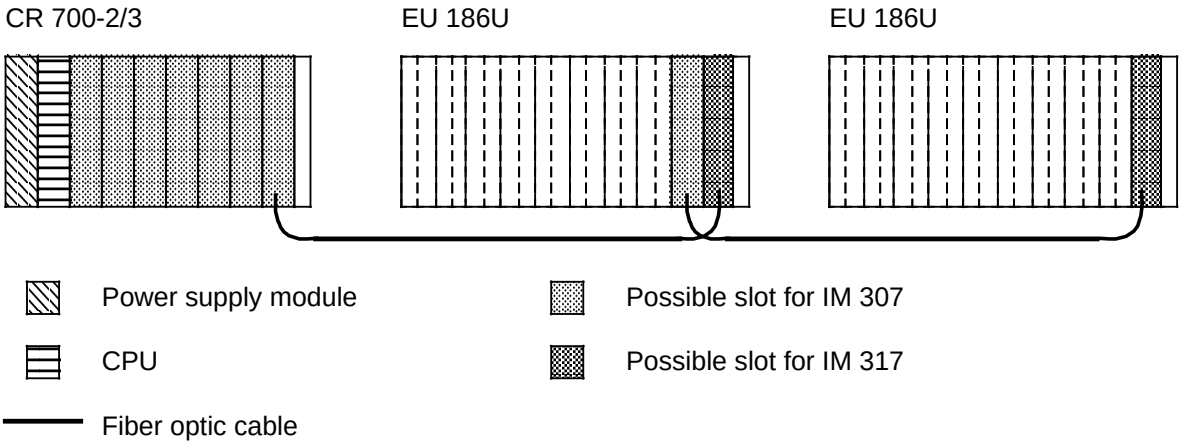


Figure 2-7. Basic Configuration with the EU 186U Expansion Subrack, without Interrupt Handling in the Expansion Unit

Table 2-7. Functions with the EU 186U Expansion Subrack, without Interrupt Handling in the Expansion Unit

Function	Function possible?	Possible slot and switch positions								
		307 in CC					317 in EU		307 in EU	
		Slot	Switch position				Slot	Switch position	Slot	Switch position
			0	2	3	5				
Report EU battery to CPU	no									
EU fault: CPU halts	yes	6	•		XX	XX	147	2	131	9
		0 to 5	XX	XX	•					
Interrupt handling in EU	no									
Page addressing in EU	yes	6	•	•	XX	XX	147	2	131	9
		0 to 5	XX	XX	•	•				
Communication link from EU to EU	yes	6	•	•	XX	XX	147	2	131	9
		0 to 5	XX	XX	•	•				

● Function performed ☐ Function not performed XX illegal

2.1.8 Expansion with the EU 186U Subrack,with Interrupt Handling in the Expansion Unit

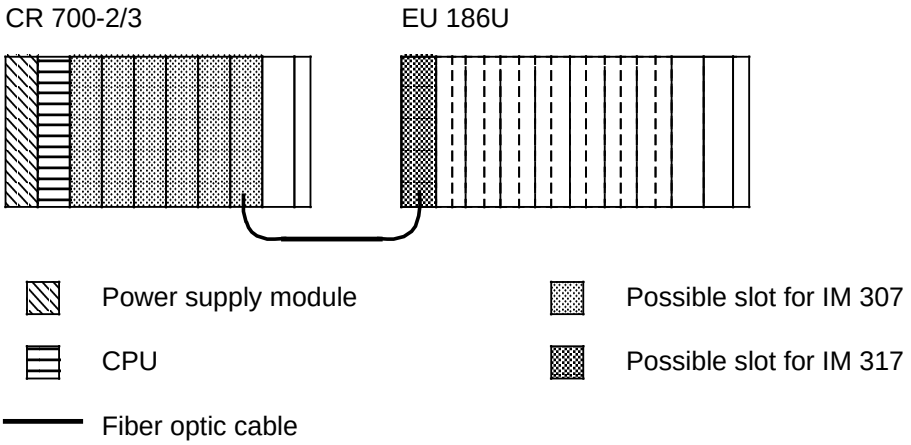


Figure 2-8. Basic Configuration with the EU 186U Expansion Subrack, with Interrupt Handling in the Expansion Unit

Table 2-8. Functions with the EU 186U Expansion Subrack, with Interrupt Handling in the Expansion Unit

Function	Function possible?	Possible slot and switch positions				
		307 in CC			317 in EU	
		Slot	Switch position		Slot	Switch position
			3	5		
Report EU battery to CPU	no					
EU fault: CPU halts	yes	0 to 5	•		3	3
Interrupt handling in EU	yes		•	•	3	3
Page addressing in EU	yes	0 to 5	•	•	3	3
Communication link from EU to EU	no					

● Function performed ○ Function not performed

2.2 Connection to an S5-135U/150U/155U Central Controller

2.2.1 Expansion with the ER 701-2 Subrack

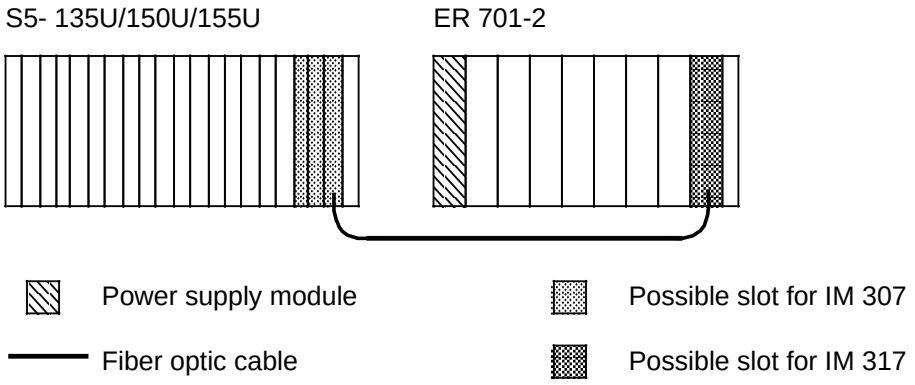


Figure 2-9. Basic Configuration with the ER 701-2 Expansion Subrack

Table 2-9. Functions with the ER 701-2 Expansion Subrack

Function	Function possible?	Possible slot and switch positions				
		307 in CC			317 in EU	
		Slot	Switch position		Slot	Switch position
			0	2		
Report EU battery to CPU	no					
EU fault: CPU halts	yes	139 to 155	•		7	0
Interrupt handling in EU	no					
Page addressing in EU	no					
Communication link from EU to EU	no					

● Function performed ○ Function not performed

2.2.2 Expansion with the ER 701-3LA.. Subrack

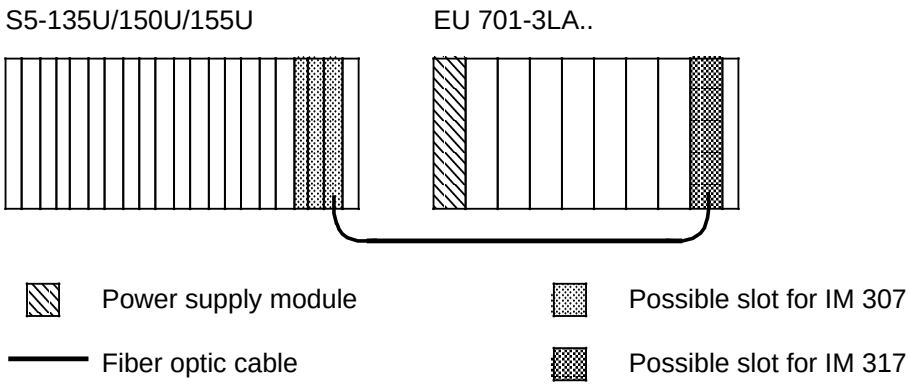


Figure 2-10. Basic Configuration with the ER 701-3LA.. Expansion Subrack

Table 2-10. Functions with the ER 701-3LA.. Expansion Subrack

Function	Function possible?	Possible slot and switch positions				
		307 in CC			317 in EU	
		Slot	Switch position		Slot	Switch position
			0	2		
Report EU battery to CPU	no					
EU fault: CPU halts	yes	139 to 155	•		7	0
Interrupt handling in EU	no					
Page addressing in EU	yes	139 to 155	•	•	7	0
Communication link from EU to EU	no					

● Function performed ☐ Function not performed

2.2.3 Expansion with ER 701-3LA.. Subracks, without Interrupt Handling in the Expansion Unit

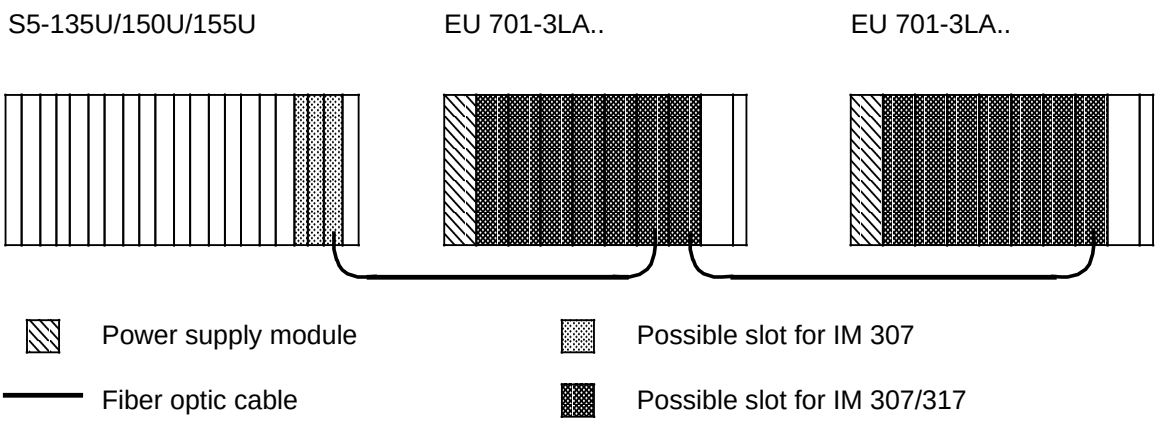


Figure 2-11. Basic Configuration with ER 701-3LA.. Subracks, without Interrupt Handling in the Expansion Unit

Table 2-11. Functions with the ER 701-3LA.. Subrack, without Interrupt Handling in the Expansion Unit

Function	Function possible?	Possible slot and switch positions						
		307 in CC			317 in EU		307 in EU	
		Slot	Switch position		Slot	Switch position	Slot	Switch position
			0	2				
Report EU battery to CPU	no							
EU fault: CPU halts	yes	139 to 155	•		0 to 6	1	0 to 6	3
Interrupt handling in EU	no							
Page addressing in EU	yes	139 to 155	•	•	0 to 6	1	0 to 6	3
Communication link from EU to EU	yes	139 to 155	•	•	0 to 6	1	0 to 6	3

● Function performed ○ Function not performed

2.2.4 Expansion with ER 701-3LA.. Subracks, with Interrupt Handling in the Expansion Unit

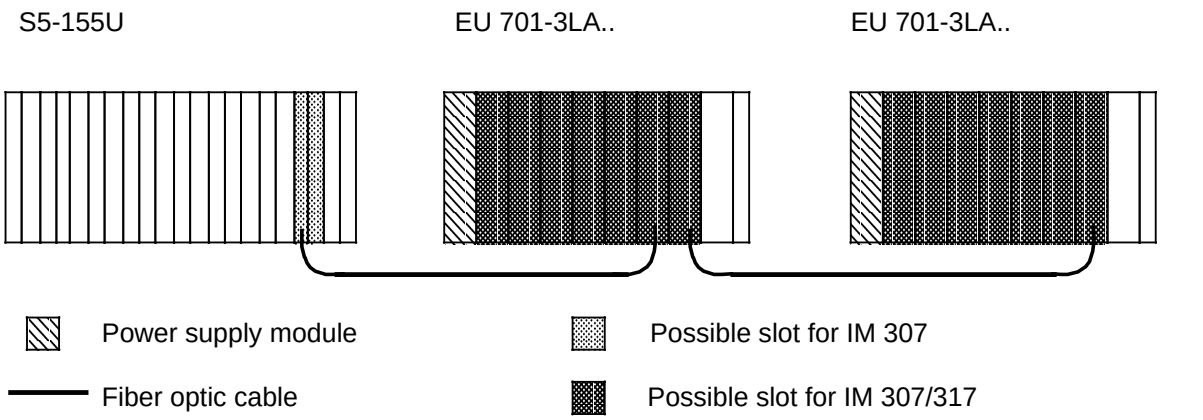


Figure 2-12. Basic Configuration with EU 701-3LA.. Expansion Subracks with Interrupt Handling in the Expansion Unit

Table 2-12. Functions with ER 701-3LA.. Expansion Subracks, with Interrupt Handling in the Expansion Unit

Function	Function possible?	Possible slot and switch positions						
		307 in CC			317 in EU		307 in EU	
		Slot	Switch position		Slot	Switch position	Slot	Switch position
			6	8				
Report EU battery to CPU	yes	139 to 147	•	•	0 to 6	1	0 to 6	3
EU fault: CPU halts	yes	139 to 147	•		0 to 6	1	0 to 6	3
Interrupt handling in EU	yes	139 to 147	•	•	0 to 6	1	0 to 6	3
Page addressing in EU	yes	139 to 147	•	•	0 to 6	1	0 to 6	3
Communication link from EU to EU	yes	139 to 147	•	•	0 to 6	1	0 to 6	3

● Function performed ☐ Function not performed

2.2.5 Expansion with the EU 183U Subrack

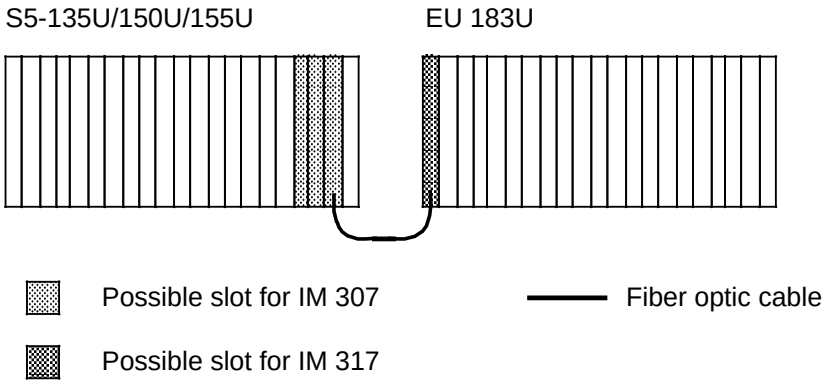


Figure 2-13. Basic Configuration with the EU 183U Expansion Subrack

Table 2-13. Functions with the EU 183U Expansion Subrack

Function	Function possible?	Possible slot and switch positions				
		307 in CC			317 in EU	
		Slot	Switch position		Slot	Switch position
			0	2		
Report EU battery to CPU	no					
EU fault: CPU halts	yes	139 to 155	•		3	0
Interrupt handling in EU	no					
Page addressing in EU	no					
Communication link from EU to EU	no					

● Function performed ☐ Function not performed

2.2.6 Expansion with the EU 185U Subrack, without Interrupt Handling in the Expansion Unit

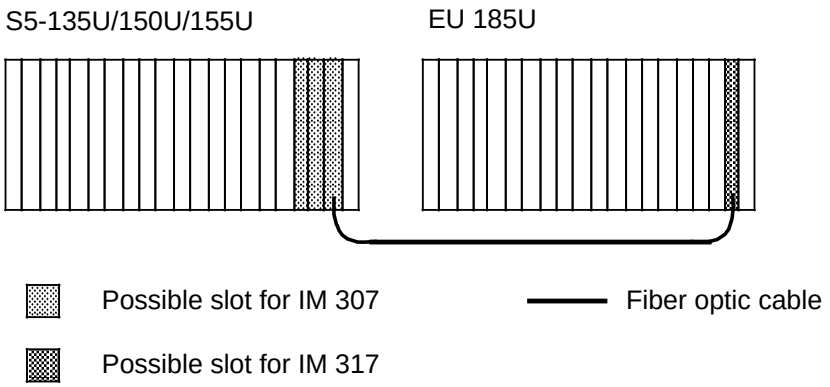


Figure 2-14. Basic Configuration with the EU 185U Expansion Subrack

Table 2-14. Functions with the EU 185U Expansion Subrack

Function	Function possible?	Possible slot and switch positions				
		307 in CC			317 in EU	
		Slot	Switch position		Slot	Switch position
			0	2		
Report EU battery to CPU	no					
EU fault: CPU halts	yes	139 to 155	•		147	2
Interrupt handling in EU	no					
Page addressing in EU	yes	139 to 155	•	•	147	2
Communication link from EU to EU	no					

● Function performed ☐ Function not performed

2.2.7 Expansion with EU 186U Subracks, without Interrupt Handling in the Expansion Unit

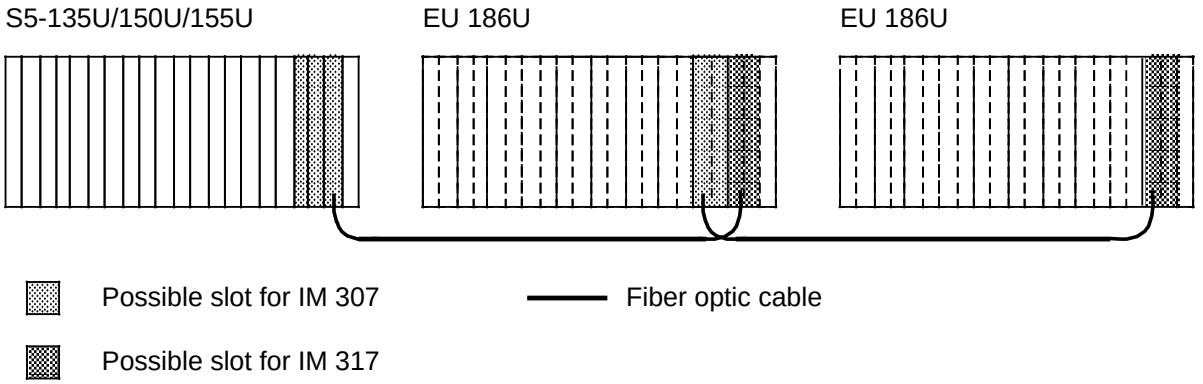


Figure 2-15. Basic Configuration with EU 186U Subracks, without Interrupt Handling in the Expansion Unit

Table 2-15. Functions with EU 186U Expansion Subracks, without Interrupt Handling in the Expansion Unit

Function	Function possible?	Possible slot and switch positions						
		307 in CC			317 in EU		307 in EU	
		Slot	Switch position		Slot	Switch position	Slot	Switch position
			0	2				
Report EU battery to CPU	no							
EU fault: CPU halts	yes	139 to 155	•		147	2	131	9
Interrupt handling in EU	no							
Page addressing in EU	yes	139 to 155	•	•	147	2	131	9
Communication link from EU to EU	yes	139 to 155	•	•	147	2	131	9

● Function performed ☐ Function not performed

2.2.8 Expansion with the EU 186U Subrack, with Interrupt Handling in the Expansion Unit

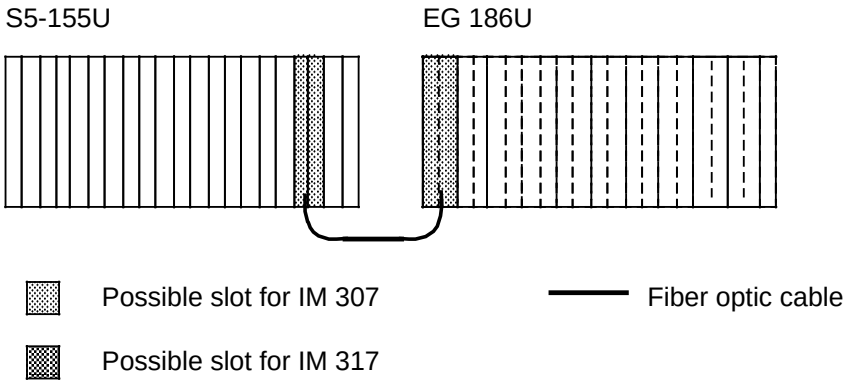


Figure 2-16. Basic Configuration with the EU 186U Expansion Subrack, with Interrupt Handling in the Expansion Unit

Table 2-16. Functions with the EU 186U Expansion Subrack, with Interrupt Handling

Function	Function possible?	Possible slot and switch positions				
		307 in CC			317 in EU	
		Slot	Switch position		Slot	Switch position
			6	8		
Report EU battery to CPU	no					
EU fault: CPU halts	yes	139 to 147	•		3	3
Interrupt handling in EU	yes	139 to 147	•	•	3	3
Page addressing in EU	yes	139 to 147	•	•	3	3
Communication link from EU to EU	no					

● Function performed ☐ Function not performed

2.3 Connecting Several Expansion Units to One Central Controller

As already mentioned, the expansion possibilities described so far have involved basic configurations. However, since you can connect several expansion units, also of different type, to a central controller, combinations of these configurations are also feasible. In this case, each path originating at the central unit must be regarded on its own. The number of expansion units connected in parallel or series may have an effect on the maximum length of the transmission link.
Proceed as recommended in section 2.4.

Example 2: You wish to connect an EG 186U and an expansion unit in an ER 701-3LA13 subrack to a central controller in a CR 700-3 subrack. A second EU 186 subrack is also to be connected to the EU 186 expansion unit. The expansion unit in the ER 701-3LA13 subrack is to have interrupt handling capability.

To arrive at the correct solution, you require information from the following sections of the manual:

- 2 Configuration
- 2.1 Connection to an S5-115U central controller
- 2.2.4 Expansion with ER 701-3LA13 subrack, with interrupt handling
- 2.2.5 Expansion with EU 183U expansion unit
- 2.2.7 Expansion with EU 186U expansion unit

This results in the following configuration.

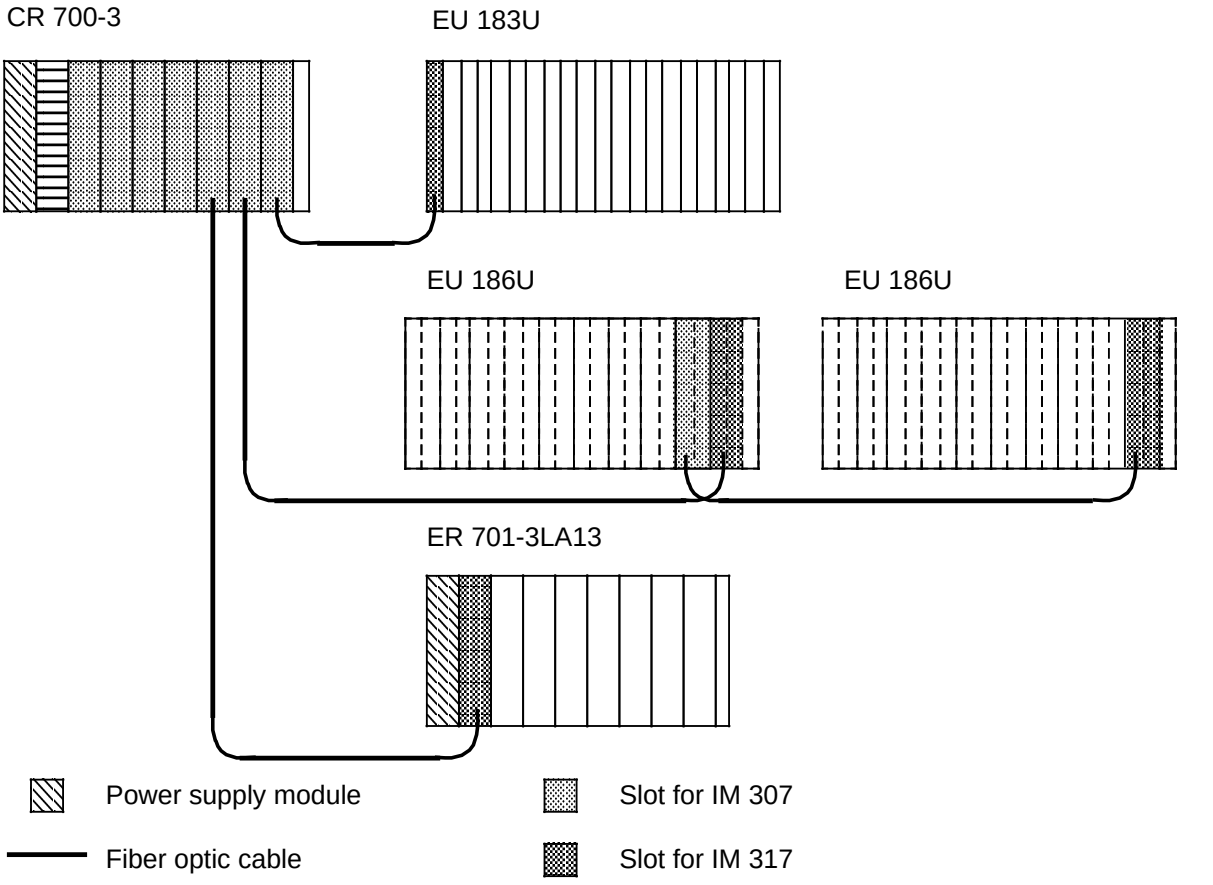


Figure 2-17. System Configuration for Example 2

2.4 Response Time of an Expansion Unit to Requests from the Central Controller

The time an expansion unit requires to return the relevant information in response to requests from the central controller depends on a number of criteria. However, none of the expansion units may have a response time of more than 150 µs because, in that case, the central controller would report a time-out.

You should therefore check the validity of the following equation for each expansion unit you wish to reference via the fiber optics interface modules.

If a response time greater than 150 µs results for one or more expansion units, you must modify your configuration accordingly with respect to the transmission link or module complement.

Formula for checking the response time:

$$l \cdot 30 \frac{\mu s}{km} + n \cdot 30\ \mu s + t_u \quad 150\ \mu s$$

where:

l = Transmission link (length of the fiber optic cable) from the central controller to the expansion unit for which the response time is to be calculated (unit: km).

n = Number of all the IM 317 central controller interface modules in the path from the central controller to the expansion unit under consideration, including the IM 317 in the particular expansion unit.

t_u = Time-out of a module. The values for the time-outs of the modules in the expansion under consideration are listed in Table 2-17. Use the largest value you find in the formula.

Calculation Example

Supposing you wish to check the response time of an expansion unit containing the following modules:

4	Digital modules	(t_u=2 µs)
2	Analogue modules	(t_u=16 µs)
1	IP 245 Valve control module	(t_u=0.5 µs)
4	IP 252 Positioning modules	(t_u=10 µs)
1	CP 551 Communications processor	(t_u=3 µs)

The largest time-out of the above modules is t_u=16 µs.

In this path there is a second expansion unit between the expansion unit under consideration and the central controller. This gives the value n=2.

The total length of the transmission link from the central controller to the expansion unit under consideration is l=1.5 km.

All the parameters required for calculating the response time are now known:

$$l \cdot 30 \frac{\mu s}{km} + n \cdot 30\ \mu s + t_u \quad 150\ \mu s$$

$$1.5\ km \cdot 30 \frac{\mu s}{km} + 2 \cdot 30\ \mu s + 16\ \mu s \quad 150\ \mu s$$

$$45\ \mu s + 60\ \mu s + 16\ \mu s \quad 150\ \mu s$$

$$121\ \mu s \quad 150\ \mu s \quad \text{true!}$$

The time condition is satisfied, i.e. the expansion unit can be used!

Table 2-17. I/O Module Time-Outs

I/O Modules		Time-Out $t_ü$ in µs
Analog modules		16
Digital modules		2
256 DIMOS-interface module		5
313 Watchdog module		1
CP 513	Memory module	5
CP 523	Serial I/O module	100
CP 524	Communications processor	1
CP 525	Communications processor	3
CP 526	Communications processor	3
CP 527	Communications processor	3
CP 530	Communications processor (SINEC L1)	cannot be used
CP 535	Communications processor (SINEC H1)	1
CP 5430	Communications processor (SINEC L2)	1
CP 551	Hard disk drive	3
CP 552	Diagnostics processor	3
IP 240	Counter/position encoder module	1
IP 241	Digital position encoder	1
IP 242	Counter module (hardware release from A01 on)	50
IP 243	Analog module	35
IP 244	Temperature control module	cannot be used

Table 2-17. I/O Module Time-Outs

I/O Modules		Time-Out $t_ü$ in µs
IP 245	Valve control module	0.5
IP 246	Positioning module	1.5
IP 247	Positioning module	1.5
IP 252	Closed-loop control module	10
IP 260	Closed-loop control module	2
IP 261	Proportioning module	2

3 Principle of Operation

3.1 System Functions (taking a read operation as example)

In response to a signal from the CPU, the IM 307 interface module receives the current signal level of the address bus. Since signal transmission over the optical waveguide is serial, the parallel S5 bus must be converted into serial form block by block.

The serial electrical signals resulting are converted into light signals by means of an electrical-to-optical transducer and transmitted through the fiber optic cable to the IM 317 interface module in the expansion unit. Here they are first converted into serial electric in an optical-to-electrical transducer and these electrical signals converted into parallel form for the S5 address bus.

If a module is referenced in the expansion unit, it informs the IM 317 that the data it has placed on the data bus is valid. The data is then transmitted back to the IM 307 in the way described above. The IM 307 informs the CPU that valid data is present and places it on the S5 data bus.

3.2 Normal Operation

During normal operation, the switch on the front plate of the IM 307 is in the ON position. The red LED on the IM 307 is dark.

3.3 ”Power ON/OFF” Conditions

3.3.1 Power Failure in the Central Controller

Failure of the power in the central controller is signaled immediately to the expansion unit. In this case, the ”BASP” signal is activated in all expansion units. This signal remains active in the expansion unit until it is deactivated by the CPU following ”Power ON”in the central controller.

Note:
The restart response of the CPU on power recovery can be influenced by programming OB 22.

3.3.2 Power Failure in the Expansion Unit

If the power in the expansion unit fails, the IM 307 detects a ”PEU”signal. Whether this signal is passed on to the central controller depends on the position of the coding switch (3.5). The response of the central controller depends on the particular PLC.

When power fails in the expansion unit, the input/output modules in the expansion unit can no longer be addressed. You must configure the appropriate message errors in the user program.

3.4 Reporting Battery Failure in the Expansion Unit to the CPU

This function can only be implemented with the S5-115U or S5-115U programmable controller in the expansion unit ER 701-3LA.. subrack (2.1.4 and 2.2.4). To use this function, the following conditions must be satisfied:

In the S5-115U:
1. The coding switch on the IM 307 must be set to the appropriate position.
2. OB 34 (battery monitoring) must be programmed.

In the AG S5-155U:
1. The coding switch on the IM 307 must be in the appropriate position.
2. System data word RS 2.2 must be interrogated for ”1” in the user program.
3. Jumper 2 must be soldered in on the rear of the central controller back plane.

Note:
In multiprocessor mode of the S5-155U programmable controller you can only evaluate this function if you are using CPUs of the S5-155U exclusively.

If the above conditions are satisfied and the backup battery of the expansion unit fails, the ”BAU” signal is first reported to the central controller. This ”BAU”signal has the effect that OB 34 is processed and/or system data word RS 2.2 is set to ”1”.
You can program the response you wish to the ”BAU” signal in OB 34 and/or by evaluating RS 2.2.

Note:
OB 34 is processed and/or RS 2.2 is set to ”1” regardless of whether the ”BAU” signal comes from the central controller or from the expansion unit. It is therefore not possible to determine the origin of the signal at a later date.
If there is a ”BAU” signal from the expansion unit and an ”NAU” signal from the central controller pending simultaneously the CPU enters the ”STOP” mode and a ”BAU” error message is generated. In this case, the PLC/CPU must be reset and reloaded.

3.5 Evaluating Expansion Unit Faults

If you have selected this function with the coding switch on the IM 307, the CPU enters the ”STOP” mode in response to the following faults:

- Expansion unit power failure
- Interruption in the connecting cable between the IM 307 and the IM 317

If either of these faults occur, the ”PEU” signal is sent to the central controller and the CPU immediately enters the ”STOP” mode. When the fault has been cleared, a cold restart must be performed.

If this function has ***not*** been selected and the CPU is properly programmed, the CPU remains in the RUN mode even when a fault occurs in the expansion unit. Other expansion units connected to the central controller in parallel to the faulted expansion unit continue to operate normally. If the CPU is switched to RUN after the expansion unit fault has been eliminated specific modules (IPs and CPs) in this expansion unit must be resynchronized.

3.6 Interrupt Handling

Note:
Interrupt handling (INT A,B,C,D) is possible in connection with the EU 186 and with expansion units in the ER 701-3LA.. subrack. The central controller may be either an S5-155U or an S5-115U in a CR 700-2/3 subrack.

If you are using an S5-155U programmable controller, you must solder the following jumpers in on the rear of the central controller backplane:

INT A jumper 7
INT B jumper 8
INT C jumper 9
INT D jumper 10

Providing the coding switch is in the appropriate position, interrupt requests from function modules in the expansion units are recognized and passed to the CPU in the central controller.

3.7 Page Addressing

The IM 307 supports page addressing. If you have set this function, modules employing this method of addressing can also be used in the expansion unit.

3.8 Interconnecting Expansion Units

Implementation of the interconnection function depends

- on the subrack used
  and
- on the slot assignment.

A point-to-point link between two expansion units is only possible if the respective slots are available in the relevant subracks into which the IM 307/IM 317 can be plugged.

4 Technical Specifications

4.1 General Technical Specifications

Climatic Environmental Conditions		**Mechanical Environmental Conditions**	
Temperature		**Vibration**	to IEC 68-2-6
Operating		- tested with	10 to 57 Hz, (0.15 mm constant amplitude) 57 to 150 Hz, (2 g constant acceleration)
- open air inlet temperature (measured at the bottom of the modules)	0 to +55° C	**Shock**	to IEC 68-2-27
- in cabinet (in the case of cabinet mounting, remember that the heat losses that can be dissipated depend on the type of cabinet, its ambient temperature and the arrangement of the devices) intake air temperature (measured at the bottom of the modules)	0 to +55° C	- tested with	12 shocks (semi-sinusoidal 15 g / 11 ms)
Non operating	- 40 to +85° C	**Free Fall**	to IEC 68-2-32
Temperature change		- tested with	height of fall 1 m (3.3 ft.)
- operating	max. 10 K / h		
- non operating	max. 20 K / h		
Relative atmospheric humidity			
- operating	95% (to DIN 40040)		
- non operating	95% (non condensing)		
Atmospheric pressure			
- operating	860 to 1060 hPa [1]		
- non operating	660 to 1060 hPa [1]		
Pollutants			
- SO_2	0.5 ppm, (relative humidity 60%, non condensing)		
- H_2S	0.1 ppm, (relative humidity 60%, non condensing)		

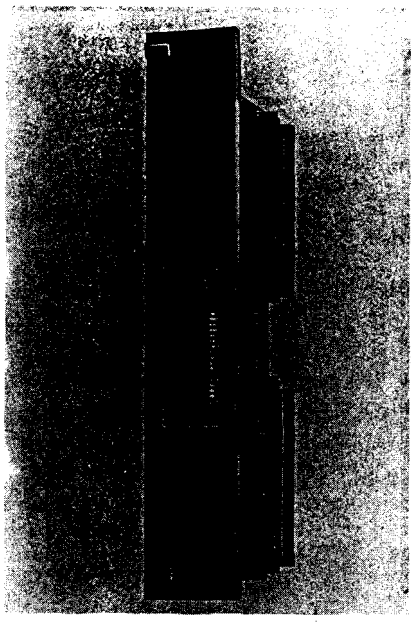
[1] At atmospheric pressures below 900 hPa (=1000 m above sea-level), the user is advised to consult the manufacturer regarding the necessary cooling conditions.

Electromagnetic Compatibility (EMC) **Noise Immunity**	
Damped Oscillitory Wave Test (1 MHz)	to IEC 255-4
- AC-power supply modules	2.5 kV
- DC-power supply modules	1 kV
- 24 V DC output	1 kV
- 115 / 230 V AC input	2.5 kV
- Digital input/output modules	2.5 kV
- Analog input/output modules	1 kV
- Communications interfaces	1 kV
Fast Transient Burst Test	to IEC 65 (Sec) 87
- Power supply modules	2 kV
- Digital input/output modules	2 kV
- Analog input/output modules	1 kV
- Communications interfaces	1 kV
Electrostatic discharge test	to IEC 801-2 (discharge to all parts accessible to the operator in normal operation)
- Power supply module	5 kV
- Digital input/output modules	5 kV
- Analog input/output modules	5 kV
- Communications interfaces	5 kV
Radiated Electromagnetic Field Test	to IEC 801-3
- Test field strength	3 V/m
Burst	to IEC 801-4
- Power supply modules	
- Digital input/output modules	
- Analog input/output modules	
- Communications interfaces	

Specifications on **IEC/VDE Safety**	
Degree of Protection	IP 20 to IEC 529
- Protection class	I to IEC 536
Insulation Rating	
- between electrically independent circuits **and** circuits connected to the central ground	to VDE 0160
- between all circuits **and** central ground (standard sectional rail)	to VDE 0160
Test voltage at a rated voltage V_e of AC or DC circuits	sinusoidal, 50 Hz
V_e= 0 to 50 V	500 V
V_e= 50 to 125 V	1250 V
V_e= 125 to 250 V	1500 V
Impulse voltage test at a rated voltage the V_e of the AC/DC circuits	to IEC 255-4
V_e= 0 to 50 V	1 kV, 1.2 / 50 µs
V_e= 50 to 125 V	1 kV, 1.2 / 50 µs
V_e= 125 to 250 V	3 kV, 1.2 / 50 µs
RI Suppression	to VDE 0871
- Limit class	A
Important: AC output modules are not suppressed.	

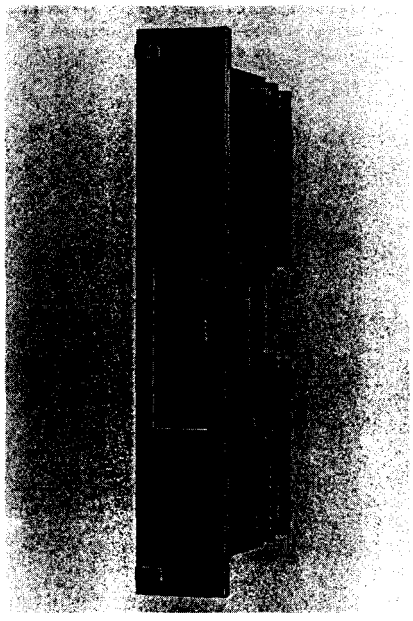
4.2 Interface Module Data

IM 307 Expansion Unit interface Module (6ES5307-3UA11)



Technical Specification	
Current consumption (at 5 V)	1 A
Weight	400 g

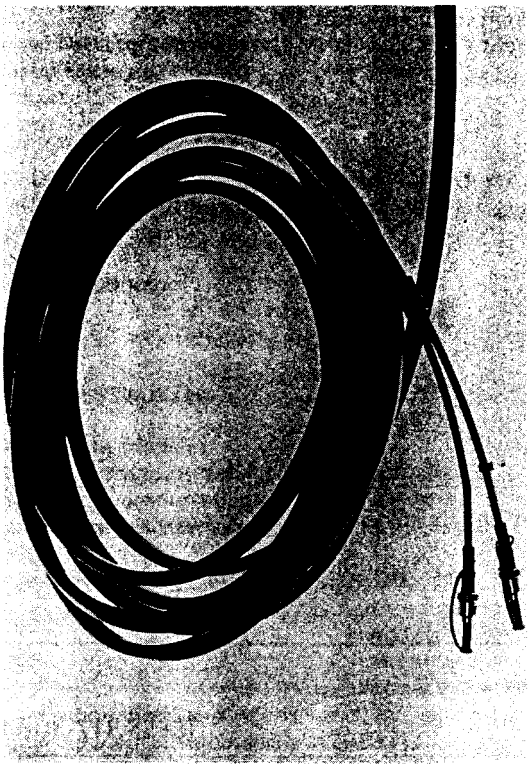
IM 317 Central Controller Interface Module (6ES5317-3UA11)



Technical Specification	
Current consumption (at 5 V)	1A
Weight	400 g

4.3 Duplex Fiber Optic Cable

Duplex Fiber Optic Cable **(6ES5 722-2XXXO)**



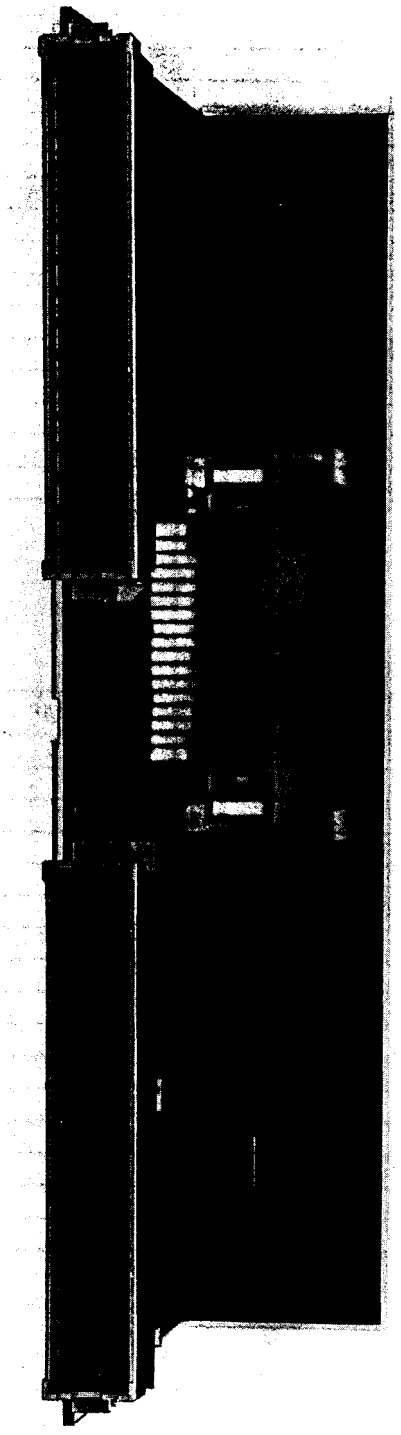
EWA 4097/5

Technical Specifications	
Temperature	
- non operating	-25° to + 70°c
- for installing	-05° to + So"c
- operating	-25° to + 60°C
Cable	
- external dimensions	7.4 mm. 11.2 mm
- weight	84 kg /km
Fiber (graded index)	
- core diameter	62.5 ± 3pm
- cladding diameter	125 ± 3pm
Attenuation at A = 850 nm	s3.2 dB / km
Tensile strength	
- briefly on installation	≤ 500 N
Bending radius (without tensile stress)	
- for once-only bending	
- over the broad side	75 mm
- for final shaping over the narrow side	330 mm
- with tensile stress for repeated bending over the broad side	110 mm

Repeated bending over the narrow side or when installing the cable is not permitted.

4.4 Connector Pinout

IM 307 Expansion Unit Interface Module **(6ES5307-3UA11)**



EWA 4097/6

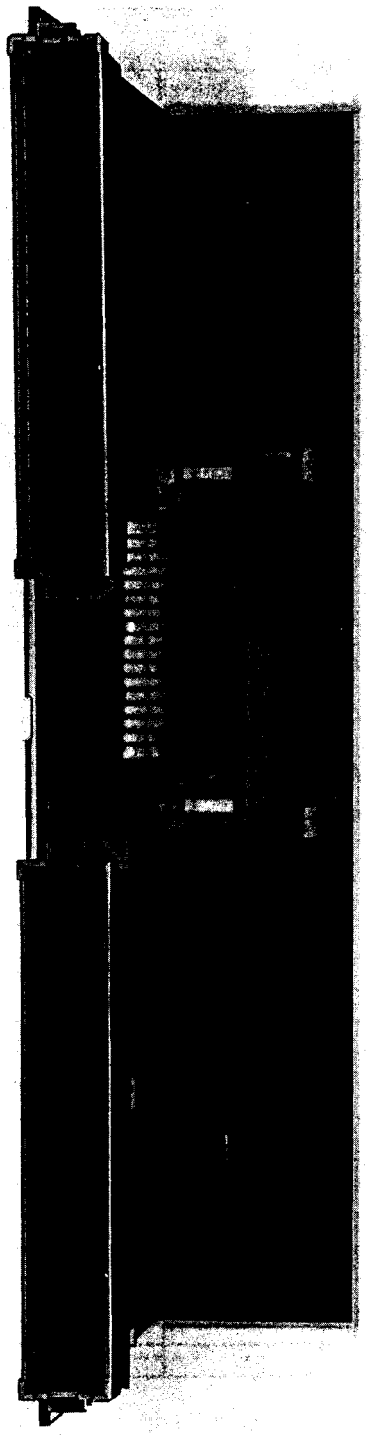
Connector X1 D

PIN NO.	SIG. NAME	B SIG. NAME	z SIG. NAME
2		M	P5
4		PESP	
6	ADB12	ADB0	CPKL
8	ADB13	ADB1	MEMRN
10	ADB14	ADB2	MEMWN
12	ADB15	ADB3	RDYN
14	IRAN	ADB4	DB0
16	IRBN	ADB5	DB1
18	IRCN	ADB6	DB2
20	IRDN	ADB7	DB3
22	BAU1N	MADB8	DB4
24		ADB9	DB5
26	PEU1N	ADB10	DB6
28		ADB11	DB7
30		BASP	
32		M	

Connector X2 D

PIN NO.	SIG. NAME	B SIG. NAME	z SIG. NAME
2		M	
4		DB8	DB12
6		DB8	DB13
8		DB10	DB14
10		DB11	DB15
12			
14			
16			BAU2N
18		PEU2N	CPKLA
20		PEU3N	
22			
24			
26			
28			
30			
32		M	

IM 317 Central Controller Interface Module (6ES5317-3UA11)



EWA 4097/6

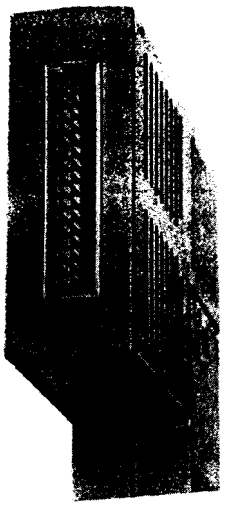
Connector XI D B Z

PIN NO.	SIG. NAME	SIG. NAME	SIG. NAME
		M	
6	ADB12	ADB0	CPKL2_N
8	ADB13	ADB1	MEMR_N
10	ADB14	ADB2	MEMW_N
12	ADB15	ADB3	RDY N
14	IRA_N	ADB4	DB0
16	IRB_N	ADB5	DB1
18	IRC_N	ADB6 "	DB2
20	IRD_N	ADB7	DB3
22	BAU 1 N	ADB8	DB4
24	NAU2_N	ADB9	DB5
26	PEU 1_N	ADB10	DB6
28		ADB11	DB7
30		BASP	
32	BASPA_N	M	

Connector X2 D B Z

PIN NO.	SIG. NAME	SIG. NAME	SIG. NAME
2		M	
4		DB8	DB12
6	CPKL1_N	DB9	DB13
8		DB10	DB14
10		DB11	DB15
12			
16			
18		NAU 1_N	CPKLA
20	PEU2_N		
22			
24			
26			
28			
30			
32		M	

Serializer/Deserializer (6ES5307-OMM1I)



Connector X3	A	B	C
PIN NO.	SIG. NAME	SIG. NAME	SIG. NAME
1	M	M	M
2	65.3	M	T2
3	STRB	ACK	M
4	INSB<0>	M	INSB<5>
5	INSB<3>	INSB<4>	M
6	INSB<6>	INSB<7>	INSB<8>
7	P5_4	INSB<1>	INSB<2>
8	P5_1	M	P52
9	P56	M	CSTRB
10	P5_5	M	DSTRB
11	P5_7	M	E_CLK
12	VLTN	LSI_N	M
13	INEB<O>	INEB<1>	INEB<2>
14	INEB<3>	INEB<4>	INEB<5>
15	INEB<6>	INEB<7>	INEB<8>
16	M	M	M

Figures

Tables

5 Installation and Operation

When working with the two interface modules, the IM 307 and the IM 317, there area number of things you should note. These are described in this chapter.

5.1 Installation

This applies to the installation of the interface modules in the central controller and expansion unit. You will find information on the installation of central controllers and expansion units in the relevant manuals.

5.1.1 Design, Adapter Casing

Both interface modules are of the compact type. They therefore require adapter casings when plugged into central controllers or expansion units of the S5-115U range (Order No. 6ES5 491-OLB1 .X.)

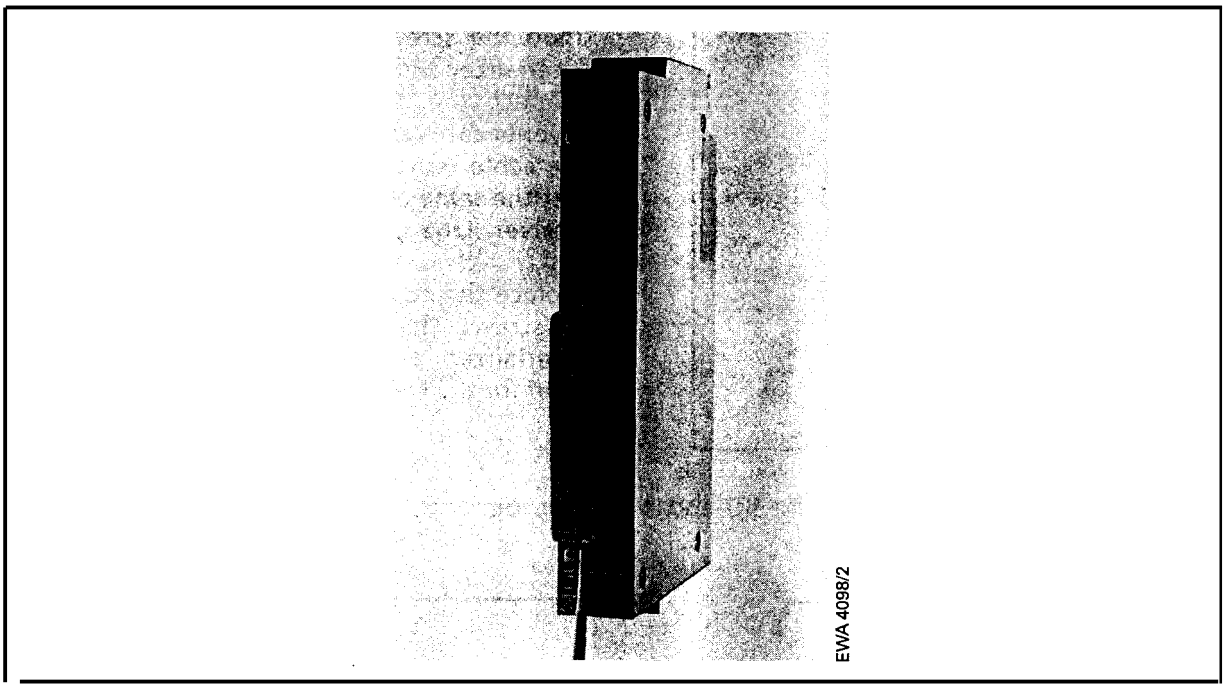


Figure 5-1. Installing an Interface Module in an Adapter Casing

To install an interface module **in an adapter casing, slide the module along the guide track into** the casing. **Then lock the module in place with the excentric collars at the top of the casing.**

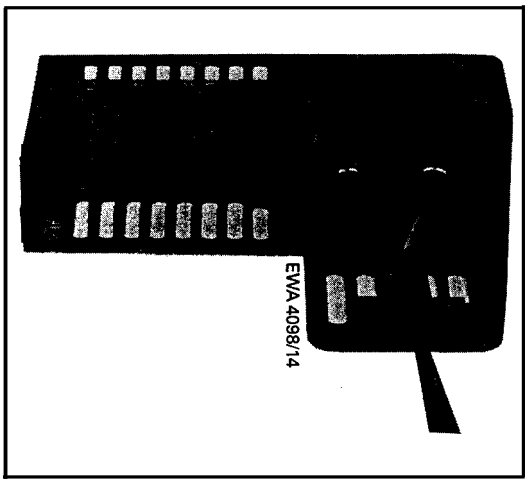
5.1.2 Plugging-in and Withdrawing the Module

CAUTION :
The modules may only be plugged in or withdrawn with the power disconnected.

5.1.3 Connecting the Fiber Optic Cable

When connecting the fiber optic cable, observe the following recommendations:
. Do not contaminate the plug-in connections with grease, dust etc., otherwise this will increase the attenuation unduly.
. Protect open connectors and flanges from contamination and mechanical damage.
. Before making connections, always clean the connectors and plug-and-socket connections with alcohol or similar medium.

Proceed as follows when connecting the fiber optic cable:



- Undo the screws marked on the serialize/ deserializer and remove the cover.
- Connect the two wave guides with the bayonet catch as shown (→ Figure 5-2).
  The cable must be connected in **such a way that the same core serves a transmitter and a receiver. One of the cores is identified by a ring.**
- **Replace the cover and fix it in position with** the screws. **The cable gland of the serialized deserializer provides the necessary strain relief for the cable.**

The serial izers/deserializers in the IM 307 and IM 317 are identical.

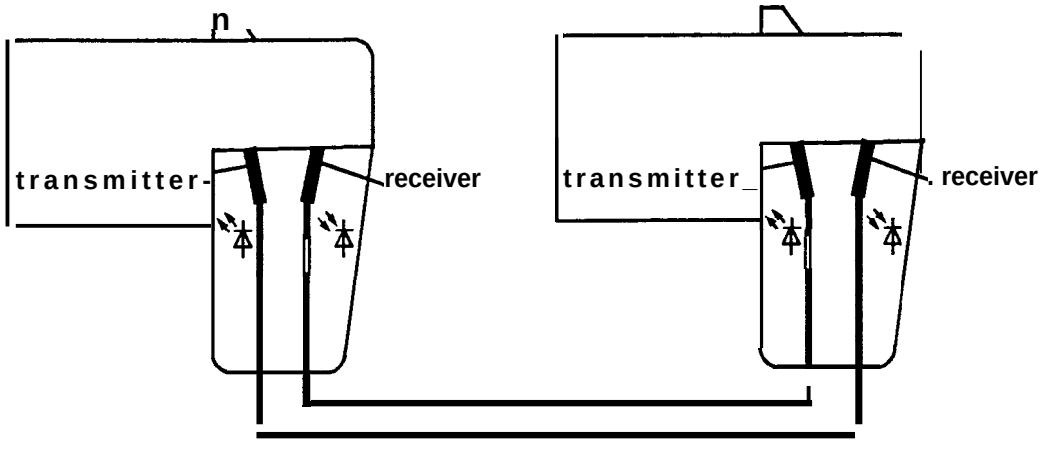


Figure 5-2. Connecting the Fiber Optic Cable to the Transmitter and Receiver

5.1.4 Installing the Fiber Optic Cable

Fiber optic cable for industrial application can be installed on cable racks and risers, in conduit (metal or plastic), wiring ducts and in the ground (using pipes or cable bricks).
Since the cables have a high immunity to noise, they can basically be installed along with all other types of cables (I & C cables, control and power cables and high-voltage cables). However, make sure that no other cables rest against the fiber optic cable in order to avoid transverse compressive stresses.
Wherever the conditions are suitable, always pull the fiber optic cable by hand, i.e. without the use of mechanical aids. If you do this and installation conditions are normal, i.e. the cable does not have to be run in several loops, the permissible stress limits are unlikely to be exceeded.
Since the fiber optic cables are supplied already fitted with connectors, you may only use mechanical aids, such as cable socks, if there is no danger of the permissible tensile stress on the connectors being exceeded.
Also make sure when installing the cable that you do not go beyond the minimum permissible bending radius.
The permissible mechanical and thermal stressing data are listed in the Technical Specifications (4.3). When describing the properties of fiber optic cables, it is important to distinguish between brief and permanent stress. If the specified values are exceeded, this can result in changes in the transmission properties of the cable (increase in attenuation).

Note:
The IM 307 and IM 317 modules are completely maintenance-free.

5.2 Operation

5.2.1 Operator Controls and Displays

The IM 307 and IM 317 modules have the following operator controls and displays.

Table 5-1. Operator Controls and Displays

Operator Control/Display	Labelling	Position/Module
Coding switch	”CONF”	Frontplate/ IM 307 and IM 317
Red LED	”FAULT”	Frontplate/ IM 307
Toggle switch	”STOP” / ”RUN”	Frontplate/ IM 307
DIP switch		PCB/ IM 307

- Coding switch

  The coding switch has 10 positions, 0 through 9. The settings on the IM 307 and IM 317 differ:
  IM 307: 0/2/3/5/6/8/9
  not permitted: 1/4/7 -These settings are intended for later developments and are not yet permitted with the present modules.
  IM 317: 0/1/2/3
  The settings 4 through 9 are not used.
  Set the coding switch to suit your application and configuration (2.1).

- Red LED

  The red LED lights up
  - if no serializer/deserializer has been plugged in
  - if the fiber optic cable has been severed
  - if the fiber optic cable has been unplugged
  - if the toggle switch is at ”STOP”
  - if the expansion unit has failed.

- Toggle switch

  You can use the toggle switch under certain circumstances to decouple the expansion unit from the central controller. This has advantages if a fault occurs in the expansion unit and the central controller has to continue operating alone until the expansion unit fault has been cleared.
  This decoupling feature can only be implemented if a number of software and hardware measures have been taken:

  (Software measures)
  1. The STEP-5 subprograms for the central controller and expansion unit must not exert neutral influences on each other.
  2. Organisation blocks OB 23 and OB 24 must be programmed accordingly. These respond to a time-out (QVZ). Also note the following: these OBs must be programmed to suit the programmable controller used.

  (Hardware measures)
  3. The ”Evaluate the EU fault” function must not be set.

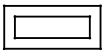
If all the above conditions are satisfied, you can decouple the expansion unit from the central controller using the toggle switch. There are two typical cases where you could possibly apply this function. To describe the decoupling and recoupling in detail we have subdivided the entire procedure into a number of phases (1st case: 5 phases / 2nd case: 10 phases). The phase sequence must be strictly observed when you are operating the toggle switches.

1st case: Central controller and expansion unit are operating together. The CPU is in the ”RUN”mode. You now wish to decouple the expansion unit temporarily and then later recouple it.

Note:
The following procedure only applies if the expansion unit does not contain any intelligent I/O modules or communications processors that would have to be synchronized.

Table 5-2. Phases for Decoupling and Recoupling an Expansion Unit (1st case)

Phase	CPU		IM 307		Description
	LED signals	Toggle switch	LED signals	Toggle switch	
1	RUN	RUN	RUN	RUN	
2	RUN	RUN	STOP	RUN STOP	You decouple the EU
3	RUN	RUN	STOP	STOP	
4	RUN	RUN	RUN	STOP RUN	You recouple the EU
5	RUN	RUN	RUN	RUN	



=^ Operate toggle switch

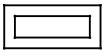
2nd case: The central controller and the expansion unit are operating normally. A fault now occurs in the expansion unit and the CPU enters the ”STOP” mode. The central controller is to continue operating on its own for the time being. The expansion unit is recoupled later.

Note:
The following procedure is only possible with the S5-135U, S5-150U and S5-155U if no DB 1 has been programmed.

Once you have taken the above measures, you can operate the toggle switch as follows:

Table 5-3. Phases for Decoupling and Recoupling an Expansion Unit (2nd case)

Phase	CPU		IM 307		Description
	LED signals	Toggle switch	LED signals	Toggle Switch	
1	RUN	RUN	RUN	RUN	EU and CC operate normally
2	STOP	RUN	STOP / RUN	RUN	EU fault: CPU enters STOP mode
3	STOP	RUN	STOP	RUN STOP	You decouple the EU
4	STOP	RUN STOP	STOP	STOP	Cold restart of the CPU
5	RUN	STOP RUN	STOP	STOP	
6	RUN	RUN	STOP	STOP	CC operates without EU
7	STOP	RUN STOP	STOP	STOP	Switch CPU to STOP
8	STOP	STOP	RUN	STOP RUN	The EU is recoupled
9	RUN	STOP RUN	RUN	RUN	Cold restart of the CPU
10	RUN	RUN	RUN	RUN	CC and EU operate together

 =^ Operate toggle switch

- DIP switch

  The DIP switch is on the PCB on the IM 307. You can use this switch to set the address area in which you wish to address your I/O modules. Only two of the 15 possible address areas are relevant in the STEP-5 operation set:

  - the P (normal I/O) area ($F000_H$ to $F0FF_H$)
  and
  - the O (extended I/O) area ($F100_H$ to $F1FF_H$) (not for S5-115U)

Set the desired address areas as follows:

Table 5-4. Setting the Address Area

X X X X 0 X X X	P area O area	$F000_H$ to $F0FF_H$ $F100_H$ to $F1FF_H$	Default setting
X 0 X X 0 0 X X X X 0 X 0 X 0 X X 0 0 X 0 0 0 X X X X 0 0 X X 0 X 0 X 0 0 0 X 0 X X 0 0 0 X 0 0 X 0 0 0 0 0 0 0		$F200_H$ to $F2FF_H$ $F300_H$ to $F3FF_H$ $F400_H$ to $F4FF_H$ $F500_H$ to $F5FF_H$ $F600_H$ to $F6FF_H$ $F700_H$ to $F7FF_H$ $F800_H$ to $F8FF_H$ $F900_H$ to $F9FF_H$ $FA00_H$ to $FAFF_H$ $FB00_H$ to $FBFF_H$ $FC00_H$ to $FCFF_H$ $FD00_H$ to $FDFF_H$ $FE00_H$ to $FEFF_H$ illegal	

5.2.2 Changing Functions during Operation

CAUTION:
Changing functions with the coding switch on the module is only permissible when the module is disconnected from the power supply.
If you operate the coding switch during operation, this can lead to destruction of the module.

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Manual Release 2 (6ES5 998-0LW21)

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We would also appreciate any suggestions for improvement.

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