

SIMATIC S5

**318-3UA11 Central Controller
Interface Module**

Manual

EWA 4NEB 812 6054-02b

Edition 04

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Introduction

The 318-3 central controller interface module is one of a number of serial interface devices that can be connected to the 308-3 expansion unit interface module in the central controller or expansion unit .

The 318-3 interface module can be connected to the EU 183U, EU 185U and EU 186U expansion units as well as to expansion units using the ER 701-2 rack. Both digital and analog input and output modules can be plugged into these expansion units.

You can connect up to 31 further network nodes to the interface chain to which you have connected the 318-3 interface module. Nodes which can be connected include the ET 100U electronic terminator for distributed I/O, ICM 560 individual control modules or further expansion units with the 318-3 interface module.

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1 System Overview

The following subsections contain information on the principle of operation and design of the 318-3 interface module.

1.1 Principle of Operation

The 318-3 interface module receives the output data of the 308-3 interface module via the serial interface, stores this data in an internal buffer memory and passes it on to the output modules via the parallel S5 bus on the backplane of the mounting rack.

Input data is transmitted to the parallel S5 bus by the input modules, read there by the 318-3 interface module and transferred to the serial interface after buffering.

Exchange of input and output data via the serial interface as well as data exchange via the parallel S5 bus on the backplane of the mounting rack both take place within one cycle. These cycles are time-independent thanks to buffering and run asynchronously.

In addition, the diagnostic bits F0, F2 and BASP are generated by the 318-3 interface module according to its operating status and transmitted to the 308-3 interface module (3.5).

You can set the baud rate and the input/output area or page area using the coding switch (switch S2) on the module board (3.3).

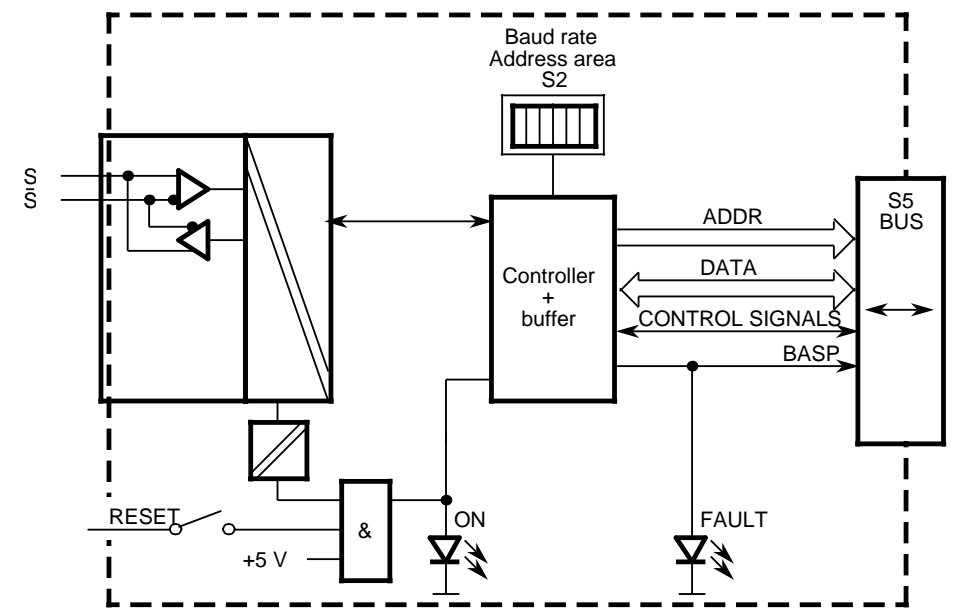


Figure 1-1 Block diagram of the 318-3 Interface Module

1.2 Design of the 318-3 Interface Module

The 318-3 interface module is a printed-circuit board which can be used both in expansion units for block-type modules (e.g. ER 701-2) and also compact expansion units (e.g. EU 185). An adapter casing (Order No. 6ES5 491-0L .11) is required for use in expansion units for block-type modules.

There are two backplane connectors (X1, X2) on the module which make contact with the parallel S5 bus on the backplane of the mounting rack.

As well as the RESET switch for resetting the module or initiating a new configuration run, there is also a four-way plug connector on the frontplate into which the interface connector supplied is plugged.

Also on the frontplate are a red FAULT LED and a green ON LED which show the operating status of the module.

Coding switch S2 on the PCB can be used to set the baud rate and the input/output area or the page area (3.3).

Note:
The X4, X5, X6 and X7 jumpers are plugged in on delivery of the modules and must not be changed.

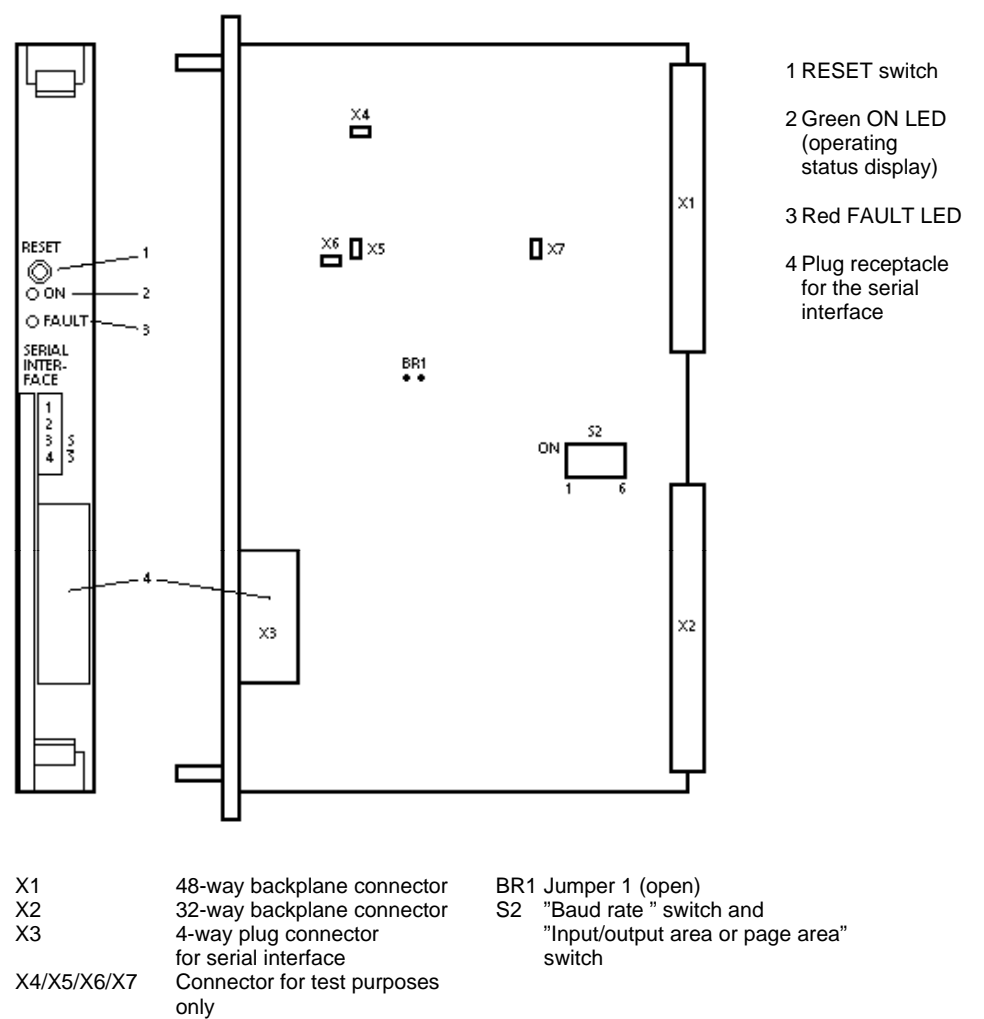


Figure 1-2 Design of the 318-3 Interface Module

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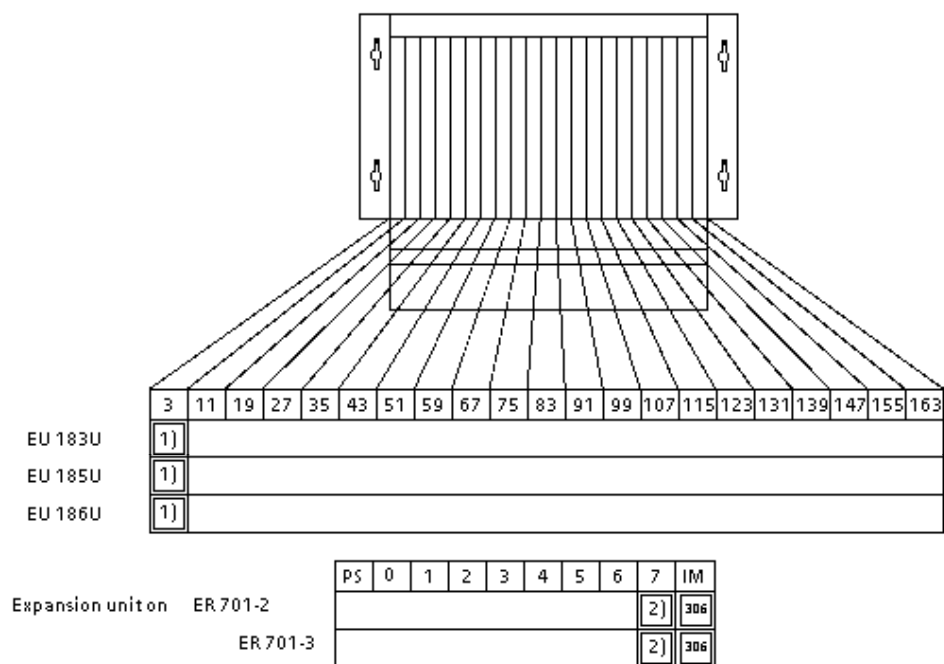
2 Hardware Installation

The 318-3 interface module can be used only in certain slots of the various expansion units.

The following pages contain information on the various requirements to be met when connecting the transmission cable.

2.1 Possible Slots for the 318-3 Interface Module

The 318-3 interface module can be plugged into the EU 183U, EU 185U and EU 186U expansion units as well as the ER 701-2 and ER 701-3 expansion units for block-type modules. Figure 2-1 shows the slots which can be used.



- 1) If an AS 300 interface module is also plugged into the mounting rack, the P address area must be set on the AS 300 irrespective of the setting on the 318-3 interface module.
- 2) An adapter casing is required for installing the 318-3 interface module in this mounting rack. The 318-3 interface module must also always be operated together with the IM 306.

Figure 2-1 Possible Slots for the 318-3 Interface Module

2.2 Assembly

The 318-3 interface module can be used in both compact expansion units and expansion units for block-type modules. The following is a description of the differences in assembly between these two types.

CAUTION:

The module must not be plugged in or unplugged under power.

2.2.1 Assembly in Compact Expansion Units

Proceed as follows to connect the module to a compact expansion unit:

- Position the top and bottom edge of the module board in the top and bottom guide rails of the selected slot.
- Slide the module slowly in until you feel resistance.
- Press the module into place at the top and bottom.

To remove, use the handle to pull the module out with a gentle up and down motion.

2.2.2 Assembly in Expansion Units for Block-Type Modules

If you wish to use the module in an expansion unit for block-type modules, you require an adapter casing (Order No. 6ES5 491-0L .11).

To install the interface module in an adapter casing, push the module along the guide rails into the casing. Lock the module into place with the excentric locking collars at the top and bottom of the casing. If an opening remains on the front after the module has been inserted, cover it with a blanking plate.

2.3 Transmission Cable

To ensure error-free data transfer between the 318-3 interface module and the 308-3 interface module, please note the following points with regard to connecting the transmission cable.

Comprehensive information regarding selection and laying of transmission cables can be found in the 308-3 interface module manual.

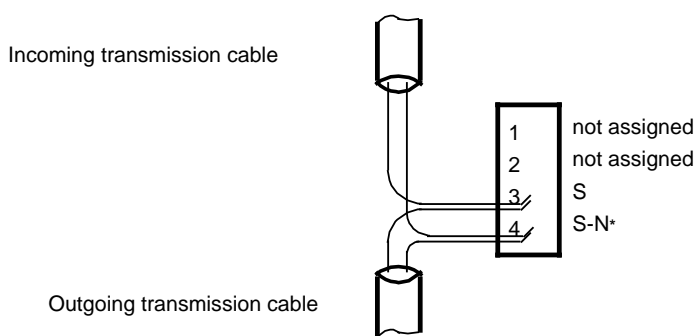
2.3.1 Signal Line Connections

The 318-3 interface module is supplied with the interface connector for connecting the transmission cable to the serial interface.

The screw-type connections are suitable for stranded conductors with a cross-section of between 0.5 mm² (20 AWG) and 1.5 mm² (15 AWG). Core end sleeves are recommended.

The serial interface is floating.

A connection schematic is shown below (Figure 2.2)



* S-N = Negated signal

Figure 2-2 Connecting the Transmission Cables

If you loop the transmission cable through from one node (318 interface module or ICM 560) to the other, clamp the incoming and outgoing transmission cables in parallel on the front connector.

If you should mistakenly cross the wires of one or more interface modules, it will be impossible to reference these modules. The 308-3 interface module will not detect an interface error.

2.3.2 Terminating Resistor

Each interface chain leading from the 308-3 interface module must be terminated at the last node with a standard 120 ohm, 0.25 W carbon layer resistor (supplied with the 308-3 interface module). If the 318-3 interface module in question is the last node of an interface chain, simply connect the resistor between terminals 3 and 4 of the front connector. Before you do this, however, be sure to slide the insulation sleeve over the resistor (also supplied with the 308-3 interface module) in order to prevent unintentional contact with the connecting wires (Figure 2-3).

Ensure that a good contact is made. If possible, press the resistance wires together with the flexible transmission cable into the same core end sleeves.

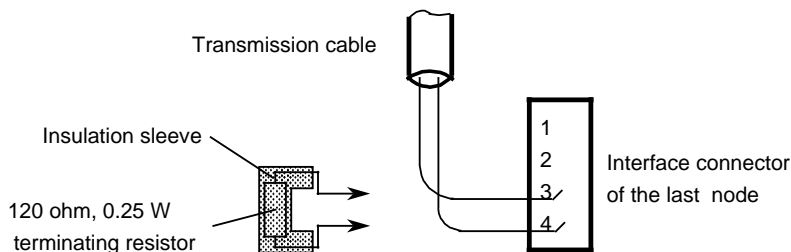


Figure 2-3 Connecting the Terminating Resistor

2.3.3 Connecting the Shielding

You must ground the transmission cable shield as close as possible to the expansion unit using a ground clamp or at the point where the cable enters the cabinet with a shield bar. Continue the shielding right up to the interface connector without grounding it again.

In the case of expansion units for block-type modules, clamp the transmission cable shielding to the standard sectional rail using a 6ES5 728-8MA11 grounding clamp and then run the cable on to the interface connector.

The grounding measures apply both to incoming and outgoing transmission cables.

2.4 Addressing

Data can be **exchanged** in the following **input/output areas** or **page areas**. You will learn later how to set the desired input/output area on the module (3.3.2).

Table 2-1 Input/Output Areas or Page Areas

Area	Initial Address	End Address
P (Q _n)	F000 _H	F0FF _H
Q (Q _{n+1})	F100 _H	F1FF _H
IM3 (Q _{n+2})	FC00 _H	FCFF _H
IM4 (Q _{n+3})	FD00 _H	FDFF _H

Note:

I/O areas IM3 and IM4 are accessible only via the FB 196 standard function block or the LIR and TIR.

Each I/O area encompasses 256 bytes of input data and 256 bytes of output data.

You will find comprehensive information on addressing and **page addressing** (duplicating the Q area) in the 308-3 interface module manual.

Note:

In the case of the expansion units using the ER 701-2 or ER 701-3 rack, the digital I/O modules can only be accessed with addresses 0 to 127 and the analog I/O modules with the addresses 128 to 255.

(Please note possible settings on the **IM 306**).

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3 Start-Up

There are various points to be noted to ensure error-free start-up and operation of your expansion unit.

3.1 Start-Up of the Interface Module

Switching on the expansion unit

Note:

You must ensure that the power supply of the expansion unit is switched on before or simultaneously with the power supply of the central controller.

If this rule is not followed, the expansion unit will not reply to messages of the 308-3 interface module during the configuration run. As a result, the addresses of the I/O modules in the relevant expansion unit will not be entered in the process I/O image on the CPU and you will not be able to reference them.

During a successful power-up procedure, the green ON LED and the red FAULT LED will light up as soon as you switch on the expansion unit power supply. After a successful configuration run by the 308-3 interface module, the fault LED on the 318-3 interface module will go off and data exchange will begin.

A configuration run is automatically executed when power is restored after a power failure in the central controller or in the whole system.

Changing the Modules in the Expansion Unit

The expansion unit must be reconfigured via the 318-3 interface module each time the module complement is changed in the expansion unit. Configuration in the expansion unit is initiated by pressing the RESET switch on the 318-3 interface module. This resets all output modules.

Following this, BASP will apply at least until the first valid message, i.e. the red FAULT LED will light up.

After configuration of the 318-3 interface module, the 308-3 interface module must also execute a configuration run. For this purpose, set the mode selector of the 308-3 interface module to OFF and back again to ON.

Switching Off the Expansion Unit

Note:

Make sure that the power supply of the expansion unit is switched off after or simultaneously with the power supply of the central controller.

If this rule is not followed, the higher-level central controller will detect a time-out (QVZ) and a power failure (NAU) in the expansion unit. As a result, the double error (QVZ and NAU) will prevent the system from restarting after power is restored to the expansion unit.

3.2 Data Exchange

Using a serial transmission procedure, I/O data is exchanged in half-duplex mode on the master-slave principle between the central controller or expansion unit and the expansion unit. The interface for connecting the transmission cable is floating and is similar to the RS 485 standard interface of the EIA (Electronic Industries Association).

You can unplug the interface connector at one of the nodes during operation without interrupting the transmission line to the other nodes (party line).

A terminating resistor (120 ohms, 0.25 W) is required on the end of each interface chain originating at the 308-3 interface module.

As is usual with the input/output modules of the U range, the individual addresses of the modules are set in the expansion units.

Data Transmission Security

You can create a data monitoring facility by inserting one or two check bytes at intervals of up to 18 data blocks with cyclical BCH code (Hamming code).

Noise immunity can be improved for slower baud rates by using a filter.

Baud rate	Number of check bytes	Filter
375,000 bps	1	no
187,500 bps	2	no
62,500 bps	2	yes
31,250 bps	2	yes

After a fault has been detected, the message is repeated twice before an error message occurs.

Parasitic signals can cause a unit to switch off automatically. However, the system prevents erroneous setting of outputs.

After a cold restart following a fault, the 308-3 interface module executes a reconfiguration run.

Please note the following during configuration:

- If you expect severe interference, you should use one of the two lowest baud rates.
- If you have to select a high baud rate for reasons of speed, please pay careful attention to the guidelines for connecting and laying transmission cables.

3.3 Defaults on the Module

Before putting the module into service, you must set the baud rate and the input/output or page area on the coding switch (Switch S2).

Use a ballpoint pen or similar pointed object, but not a pencil, to set the switch blocks.

In the following setting examples, a pressed switch is represented by: •.

Switches S2.5 and S2.6 are not assigned.

3.3.1 Baud Rate

You will achieve the greatest possible noise immunity on your data transmission line if you select the lowest possible baud rate. However, take the required response speed of the process into account. The response speed drops with the baud rate.

Set the same baud rate for all nodes as that set for the 308-3 interface module.

The baud rate of the transmission line is set using switches S2.1 and S2.2 (Figure 3-1).

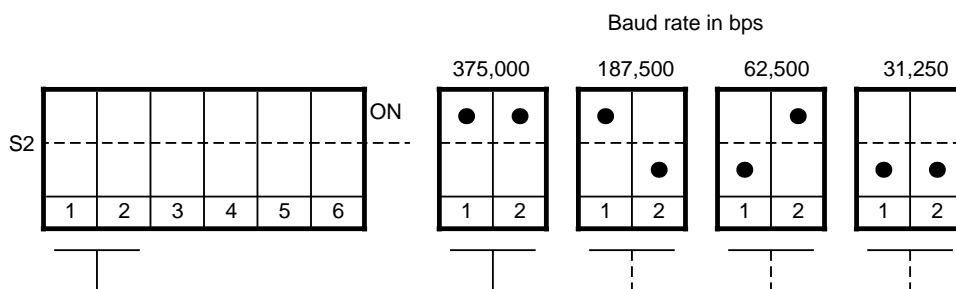


Figure 3-1 Setting the Baud Rate

3.3.2 Setting the Input/Output Area or Page Area

The I/O area or page area (P, Q, IM3, IM4) is set with the S2.3 and S2.4 switches (Figure 3-2).

If you use page addressing, you must set the page area (Q_n , Q_{n+1} , Q_{n+2} , Q_{n+3}) on the 318-3 interface module within which you wish to communicate with the 308-3 interface module (Figure 3-2).

For this purpose,

Q_n	corresponds to area	P
Q_{n+1}	corresponds to area	Q
Q_{n+2}	corresponds to area	IM3
Q_{n+3}	corresponds to area	IM4

You will find further information on page addressing (multiplying the Q area) in the 308-3 interface module manual.

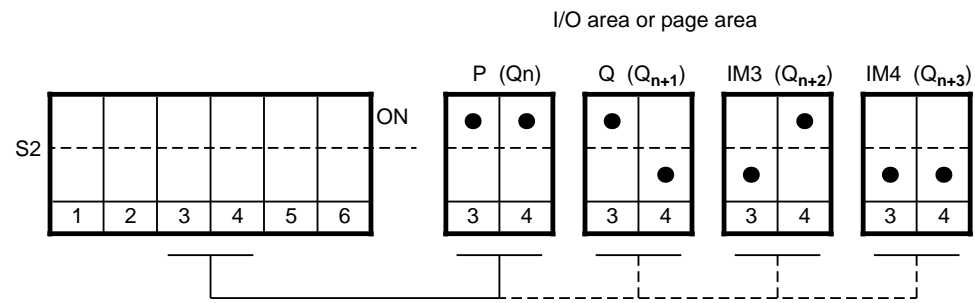


Figure 3-2 Setting the I/O Area or the Page Area

3.4 Transmission Time of the Serial Transmission Link

A specific transmission time t_{EU} is required in order to update the buffer memory contents of the 308-3 or 318-3 interface modules. This transmission time depends on the module configuration in the expansion unit and the baud rate set.

By defining the module addresses in the expansion unit without gaps, you can achieve minimal transmission times on the serial transmission link. Each address gap generates new messages with additional address header and control characters. This increases the transmission time t_{EU} .

Within the expansion unit, data is transferred to the I/O modules via the parallel S5 bus. The time required for this is negligible and already accounted for in t_{EU} .

You will find the relevant values of t_{EU} in the following table:

Table 3-1 Transmission Time t_{EU}

Baud rate	Transmission Time t_{EU}
375,000 bps	$c \times 3.0 \text{ ms/EU} + d \times 0.09 \text{ ms/byte}$
187,500 bps	$c \times 4.5 \text{ ms/EU} + d \times 0.12 \text{ ms/byte}$
62,500 bps	$c \times 8.5 \text{ ms/EU} + b \times 0.25 \text{ ms/byte}$
31,250 bps	$c \times 13.0 \text{ ms/EU} + b \times 0.40 \text{ ms/byte}$

The parameters c and d are defined as follows:

c = Total number of expansion units connected to the 308-3 interface module by the 318-3 interface module (both chains)

d = The sum of all input and output bytes from all expansion units

You will find comprehensive information on the transmission time of the serial transmission link in the 308-3 module manual.

3.5 Error Diagnostics

Diagnostic byte No. 0 contains the diagnostic bits for expansion units. You can tell from this bit pattern whether an error has occurred and, if so, which error. The relevant bit then has signal state "1".

Diagnostic Bits for Expansion Units

Bit	7	6	5	4	3	2	1	0
	BASP	0	0	0	0	F2	0	F0

- F0:**
- One or more expansion units no longer accessible:
e.g. 318-3 interface module supply voltage has failed, the interface connector has been unplugged, the 318-3 interface module has been disconnected, interrupt on the line.
 - Frequent interference on the transmission line:
Messages are repeated twice; if no valid data is received (BCH check), the unit is considered to be no longer accessible. However, the 308-3 interface module will try to access the expansion unit once in each subsequent cycle. If a connection is established, data traffic is resumed.
- F2:**
- I/O modules disconnected, enable voltage missing:
One or more I/O modules are not in their slots, or do not report (READY signal). This fact is also indicated by a time-out (QVZ) if the QVZ mode is activated.
- BASP:**
- Digital outputs are disabled (BASP can be output both by the CPU and by the 318-3 interface module).
- 0:**
- Bits meaningless for expansion units

You will find comprehensive information on error diagnostics in the 308-3 interface module manual.

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4 Technical Specifications

4.1 Technical Specifications of the 318-3UA11 Interface Module

Can be plugged into (6ES5 318-3UA11)	EU 183U, EU 185U, EU 186U; ER 701-2, ER 701-3 with adapter casing
Can be expanded using	300 or IM 306 interface module
Address range for input and output modules:	
- in the P range	max. 255 bytes
- in all other ranges	max. 256 bytes
- in the case of page addressing	max. 255 bytes
Address area	P, Q, IM3, IM4
- in the case of page addressing	$Q_n, Q_{n+1}, Q_{n+2}, Q_{n+3}$
Transmission method	Serial, party line
Synchronization procedure	Asynchronous, half-duplex
Baud rate	375,000/187,500 /62,500/31,250 bps, switch-selectable
Data security at	
- 375,000 bps	1 check byte per 18 data bytes = Hamming distance 3
- other baud rates	2 check bytes per 18 data bytes = Hamming distance 5
Noise immunity at lower baud rates (62500/ 31250)	Increased with low-pass filter
Serial interface	Floating
Design	Similar to EIA RS-485 standard

Technical Specifications _____ *318-3 Interface module*

Input voltage for receiving	max. 5V, symmetrical
Output voltage for transmitting	max. 5V, symmetrical
Terminating resistor	120 ohms, 0.25W
Conductor cross-section	0.5 to 1.5 mm ² (20 to 15 AWG), stranded
Transmission cable	Shielded; twisted pair
Insulation voltage to VDE 0160 (cable connections to ground point)	75 V DC/60 V AC, tested with 500 V AC
Current consumption (internal, 5 V, from central controller)	Typical 0.3 A*
Weight	Approx. 350 g / 12 oz.

* The PS 931-7LB12 or 13 power supply modules may not be used

4.2 Connector Pin Assignments

Backplane
connector X1:

	D	B	Z
PIN NO.	SIG. NAME	SIG. NAME	SIG. NAME
2		M	+5 V
4		PESP	
6		ADB0	CPKL_N *
8		ADB1	MEMR_N
10		ADB2	MEMW_N
12		ADB3	RDY_N
14		ADB4	DB0
16		ADB5	DB1
18		ADB6	DB2
20		ADB7	DB3
22		M	DB4
24		M	DB5
26		M	DB6
28		M	DB7
30		BASP	
32	BASPA	M	

* CPKL_N corresponds to the RESET signal in the S5 115U.

Backplane
connector X2:

	D	B
PIN NO.	SIG. NAME	SIG. NAME
2		
4		
6		
8		
10		
12		
14		
16		
18	NAU_N	CPKL_N *
20		
22		
24		
26		
28		
30		
32	M	

* CPKL_N corresponds to the RESET signal in the S5 115U.

5 Spare Parts

318-3 Interface Module _____ Spare Parts

5 Spare Parts

Interface connector	4NES 812 2203-01000
120 ohms, 0.25 W, 5 % resistor	Commercial (with insulation sleeve)

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