SIMATIC S5

308-3UA12 Expansion Unit Interface Module

Manual

EWA 4NEB 812 6051-02b

Edition 04

Introduction

The 308-3 interface module is used for connecting the following devices in series:

- The EU 183U, EU185U, and EU 186 expansion units on the ER 701-2 or ER 701-3 module subracks. You can use digital and analog input/output modules in these expansion units.
- The ET 100U electronic terminator for distributed I/O.
- The ICM 560 individual control modules.

The 308-3 interface module can be used in the S5-115U, S5-135U, S5-150U and S5-155U central controllers. The interface module can also be used in the EU 185U and EU 186U expansion units if the expansion units are connected to a higher-level central controller via the IM 304/314 interface module pair.
The following can be connected on the distributed side:

- The 318-3 interface module used in the EU 183U, EU 185U, and EU 186U expansion units and in the ER 701-2 or ER 701-3 subracks.
- The 318-8 interface module used in the ET 100U electronic terminator for distributed I/O.
- The ICM 560 individual control module.

The 308-3 interface module has an interface with two isolated terminals, each of which is designed for a serial two-wire bus. A distance of up 3000 m/9850 ft. can be covered via by each of these interface chains.

1 System Overview

Figures

1 System Overview

The following subsections contain information on the principle of operation and design of the 308-3 interface module, and also on possible device configurations with the different nodes.

1.1 Principle of Operation

The 308-3 interface module controls the complete information exchange between the peripheral nodes and the CPU in the central controller.
The module has a 2K-byte dual-port RAM with 1K bytes for inputs and 1K bytes for outputs, which acts a transfer buffer for this purpose. This memory is accessed by both the CPU in the central controller and the microcontroller on the interface module. Data is exchanged between the CPU and the dual-port RAM via the parallel S5 bus on the backplane of the subrack.
The microcontroller accepts output data from the buffer previously stored there by the CPU and also transfers input data to the buffer to be scanned there later by the CPU. In a similar manner, the microcontroller also controls data traffic via the serial interface.

An EPROM submodule must be plugged into the module if you connect an ET 100U electronic terminator for distributed I/O or ICM 560 individual control modules. The addresses of the input/output modules used and the device configuration are read out of this submodule.
The EPROM submodule is programmed using COM ET 100 communications software.
No EPROM submodule is required for connecting a 318-3 interface module.

You can use the three coding switches on the module to set the diagnostics address (switch 1), the start of the page area (switch 2), the baud rate, the chain watchdog and the time-out mode (switch 3) of the serial interface (3.4).

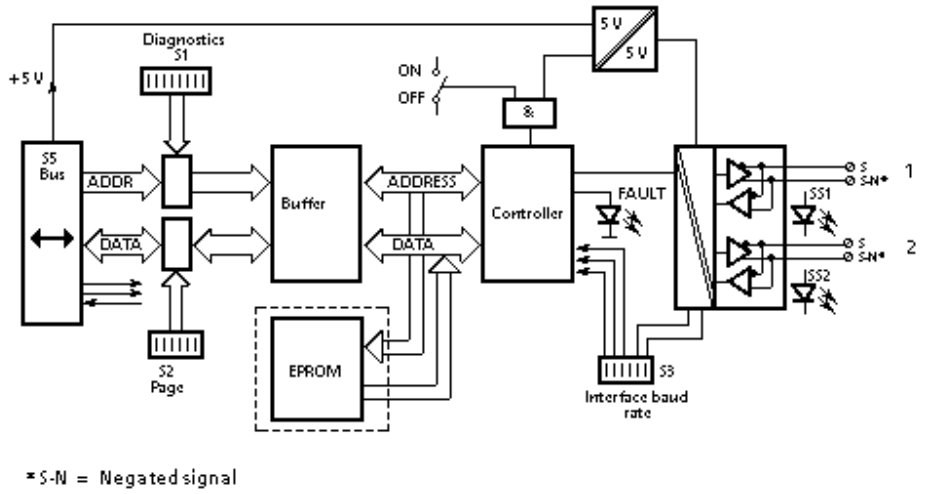
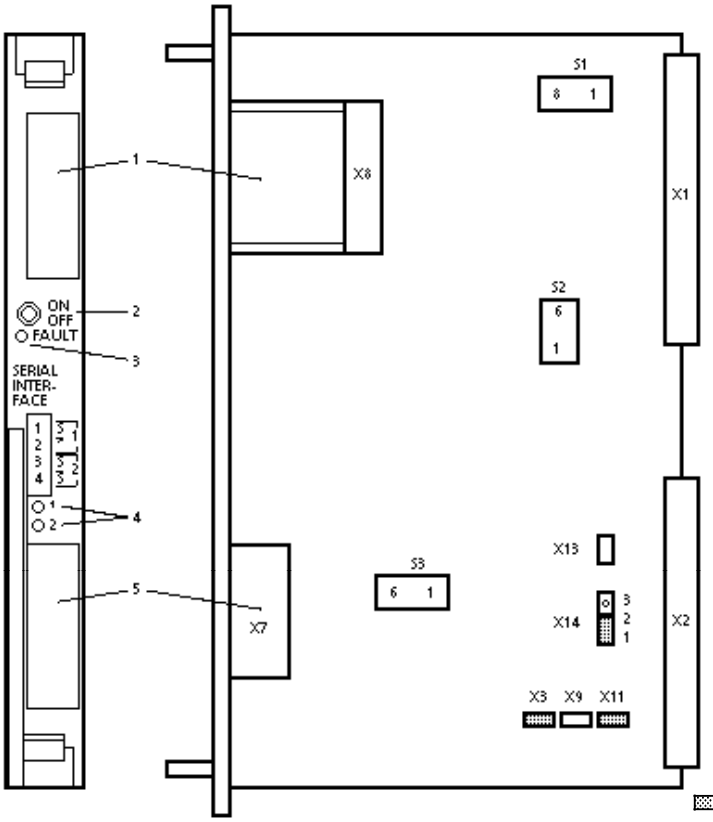


Figure 1-1 Block Diagram of the 308-3 Interface Module

1.2 Design of the 308-3 Interface Module

The 308-3 interface module is a printed-circuit board which can be used both in controllers with block-type modules (e.g. S5-115U) and also controllers with compact modules (e.g. S5-135U). An adapter casing (Order No. 6ES5 491-0L .11) is required for use in controllers with block-type modules.
There are two backplane connectors (X1, X2) on the module which mate with the connectors of the parallel S5 bus on the backplane of the mounting rack.
Besides the mode selector for switching the module on and off, there is a receptacle on the frontplate for an EPROM submodule (only required if an ET 100U or ICM 560 is connected), as well as a four-pin plug connector into which the interface connector is plugged.
Also on the frontplate are a red FAULT LED and two green LEDs which show the operating status of the module.
There are three coding switches on the PCB which can be used to make the various settings (3.4)



1 Receptacle for memory submodule

2 Mode selector

3 Red FAULT LED

4 Green LEDs (interface display)

5 Receptacle for the serial interfaces (2 chains via socket connectors)

Jumper inserted*

X1/X2	48-way backplane connector	X 13	Jumper for PESP evaluation
X3/X9/X11	Jumpers for page addressing	X14 PIN 1/2	CPKLA/ X2. z18 jumper (if the 308-3 interface module is plugged into a central controller) *
X7	4-way plug connector for serial interfaces		
X8	Memory submodule		
S1	”Diagnostics address” switch	X14 PIN 2/3	CPKLA/ X2. z14 jumper (if the 308-3 interface module is plugged into an expansion unit)
S2	”Page number” switch		
S3	Switch for ”Baud rate”, QVZ and ”Interface watchdog”		

* On delivery

Figure 1-2 Design of the 308-3 Interface Module

1.3 Device Configuration

There is a wide range of device configurations possible thanks to the large number of nodes which you can operate simultaneously on both interface chains of the 308-3 interface module.

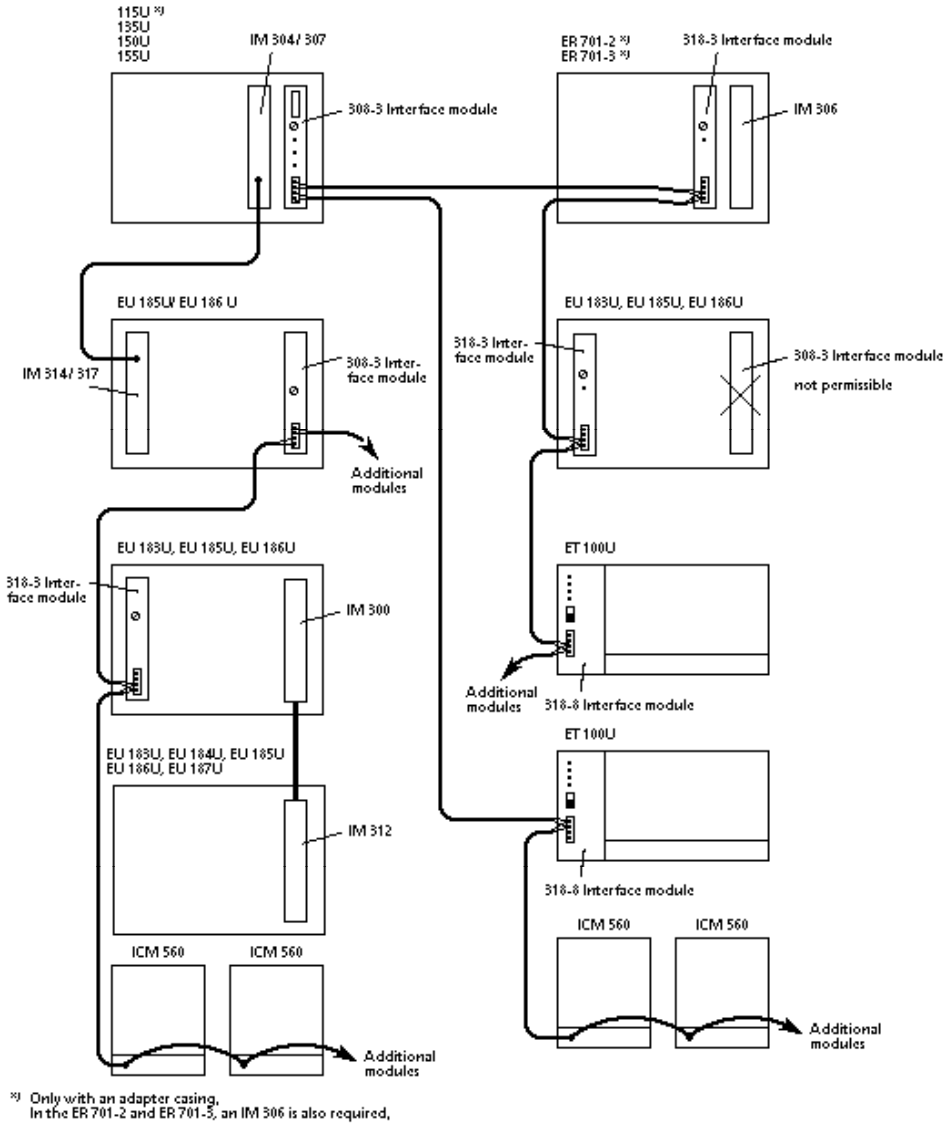


Figure 1-3 Typical Module Configurations

2 Hardware Installation

Figures

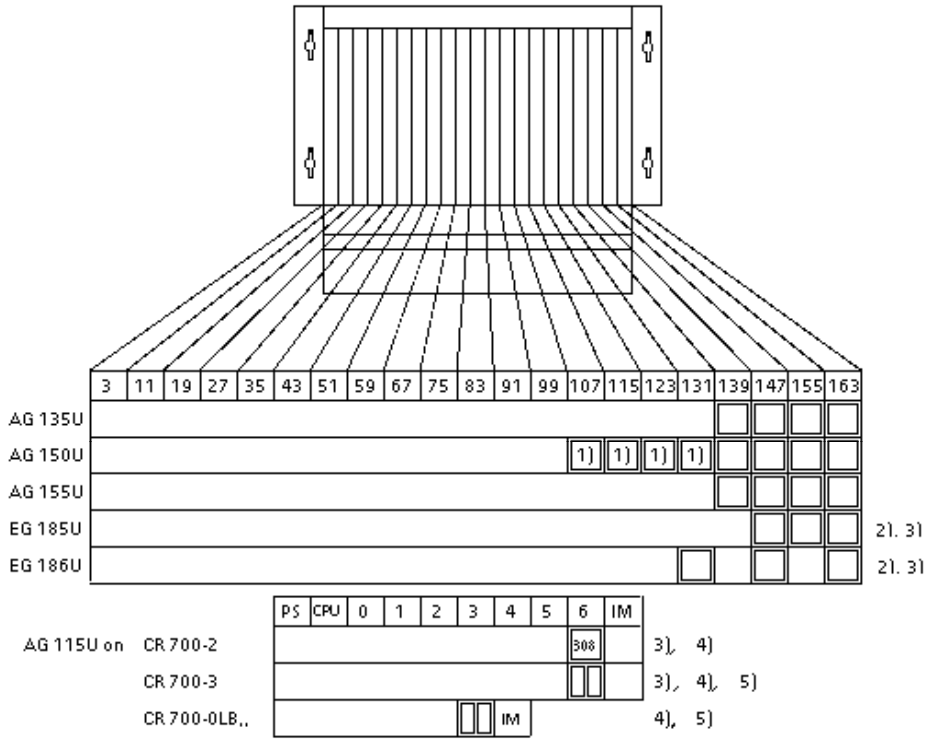
Tables

2 Hardware Installation

The 308-3 interface module can be used only in certain slots of the various central controllers and expansion units.
The following pages contain information on the various requirements to be met when selecting and connecting the transmission cable.

2.1 Slots for the 308-3 Interface Module

The 308-3 interface module can be plugged into the S5-115U, S5-135U, S5-150U and S5-155U programmable contollers, as well as the EU 185U und EU 186U expansion units. Figure 2-1 shows the slots which can be used.



1) The CP and IM 308-3 cannot be operated simultaneously when plugged into these slots!
2) The 308-3 interface module can usually only be plugged into the EU 185U and EU 186U expansion units if the expansion units and the central controller are interconnected via the IM 304/314 pair.
3) If the IM 308-3 is to be operated with page mode in the expansion unit, jumper X13 must be removed.
4) Only subracks CR 700-2, CR 700-3 and CR 700-0LB.. can be used with the S5-115U. In addition, an adapter casing is required for adding the 308-3 interface module.
5) Two 308-3 interface modules in one adapter casing can be plugged into slot 6 of subrack CR 700-3 or slot 3 of CR 700-0LB..

Figure 2-1 Possible Slots for the 308-3 Interface Module

2.2 Assembly

The 308-3 interface module can be used both in compact controllers and controllers with block-type modules. The following is a description of the differences in assembly between these two types.

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

2.2.1 Assembly in Compact Controllers

Proceed as follows when plugging the module into a compact central controller or 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.

Pull the module out by gripping the handle and applying a gentle up and down rocking motion.

2.2.2 Assembly in Central Controllers or Expansion Units for Block-Type Modules

If you wish to use the module in central controllers or expansion units 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 308-3 interface module and all connected nodes, please note the following points with regard to the transmission cable. Data transmission is also possible via sliprings or light barriers.

2.3.1 Cable Types

Use a shielded, twisted-pair cable for transmission. The type of cable selected depends on the necessary cable length and the required baud rate. The following is a list of possible cable types.

Table 2-1 Possible Cable Types

Type of cable	Baud rate over a distance of			
	500 m 1640ft	700 m 2296 ft	1000 m 3280 ft	3000 m 9840 ft
SIEMENS control cable, type A[1)] (6XV1 830-0AH10) two-wire buried cable (6XV1 830-3AH10)	375 kBaud	187.5 kBaud	187.5 kBaud	---
two-wire drum cable (6XV1 830-3BH10)	375 kBaud	187.5 kBaud	---	----
SIEMENS control cable, type B[2)] (V45551-F21-B5)	187.5 kBaud	62.5 kBaud	62.5 kBaud	31.25 kBaud

1) Supplied by the meter: specify length in ... m; minimum order quantity 20 m

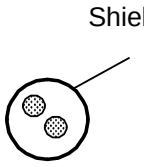
2) Maximum length delivered 1000 m; greater lengths on request

2.3.2 Physical Characteristics of Cables

Please note the following criteria if you wish to use cable types other than those listed in 2.3.1:

Cable Design

- Normal case: Twisted-pair cable within one shield.

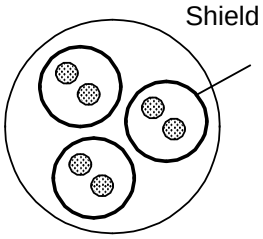


Permissible baud rates and maximum cable lengths:

375,00	bps	not permissible
187,50	bps	max.300 m/1000 ft.
62,50	bps	max.1000 m/3300 ft.
31,25	bps	max.2000 m/6600 ft.

Longer cables are not permissible!

- Special case: Several individually shielded conductor pairs combined to form one cable. One conductor pair is used for the serial interface between the 308-3 interface module and its nodes and other conductor pairs for other data transfers.

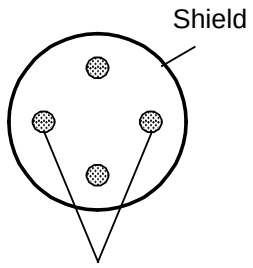


Permissible baud rates and maximum cable lengths:

62,50	bps	max.500 m/1650 ft.
31,25	bps	max.1000 m/3300 ft.

- Not permissible: Unshielded cable or non-twisted pairs, or several conductors within one shield transmitting other signals in addition to the signals between the 308-3 interface module and its nodes.

- Exception: One twisted pair or several twisted pairs where only one pair where only one pair is used for the serial interface between the 308-3 interface module and its nodes and the other conductor pairs remain unused.



Permissible baud rates and maximum cable lengths:

62,50 bps	max. 250 m/825 ft.
31,25 bps	max. 500 m/1650 ft.

- General: Shielding and twisting are prerequisites for error-free data transmission.

Electrical Characteristics of the Cable

- The cable must be designated by the manufacturer as a transmission cable.
- Two cores must be twisted to form a pair. Insulation must be of polyethelyne. The wire cross-section must be between 0.5 mm^2/20 AWG and 1.5 mm^2/15 AWG; braided copper-wire shielding; in some cases, tinned PVC outer sheath.
- The total resistance of the loop (sum of the supply and return wire) must not exceed 100 ohms.
- The resistance of the shielding must not exceed 20 ohms/km.
- The capacitance per unit length of the cable must not exceed 60 nF/km (= 60 pF/m).
- The surge impedance must be between 90 and 130 ohms. (Measuring frequency approximately 100 kHz to 1 MHz).

If the cable capacitance and surge impedance are kept within the required limits, the line attenuation will also remain within the permissible range.

Unfamiliar Cable

If you wish to use a cable which meets the cable design requirements but which has electrical characteristics unkown to you, the following restrictions apply:

- Maximum cable length is limited to 500 m/1650 ft.
- Transmission must be tested at a rate of 375,000 baud and must be free of noise. All noise-generating parts of the system must be in operation during this test.
  Then set the baud rates as follows:
  - up to 250 m: max. 62,500 bps
  - up to 500 m: 31,250 bps

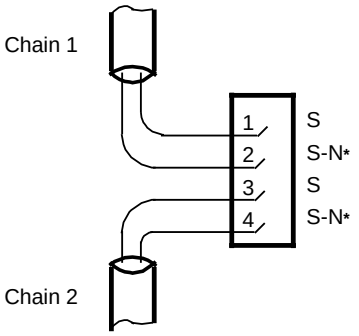
  Longer cables are not permissible!

  If you comply with these requirements, fault-free operation should result, but cannot be guaranteed.

2.3.3 Connecting the Transmission Cable

Signal Line Connections

The 308-3 interface module is supplied with the interface connector for the transmission cable. 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.
A connection schematic is shown below (Figure 2-2)



* S-N = Negated signal

Figure 2-2 Connecting the Transmission Cable

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

Terminating Resistor

Each interface chain 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). Slide the insulation sleeve (also supplied) over the resistor to prevent unintentional contact with the connecting wires. Then simply clamp the resistor between terminals 3 and 4 on the interface connector of the last node. Make sure that good contact is made. If possible, press the resistance wires together with the stranded transmission conductor into the same core end sleeves.

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.
For further information, please refer to the Description ”Richtlinien zum störsicheren Aufbau Speicherprogrammierbarer Steuerungen”, Order No. 6ES5 998-7AB11.

2.3.4 Laying the Transmission Cable

Please note the following when laying transmission cable.

Table 2-2 Laying the Transmission Cable

	Baud rate up to 62,500 bps	**Baud rate greater than 62,500 bps**
Parallel to signal cables up to 60 V	In the same cable duct	In separate cable ducts
Parallel to power cables from 380 V	At distances greater than 10 cm/4 in. or in separate ducts or racks	At distances greater than 20 cm/4 in. or in separate ducts or racks

2.3.5 Protection Against Lightning

If cables and lines for SIMATIC S5 devices are to be run outside buildings, you must take measures to ensure internal and external lightning protection.

Outside buildings run your cables
either
- In metal conduits grounded at both ends
  or
- In steel-reinforced concrete cable channels

Protect signal lines from overvoltage by using:
- Varistors
  or
- Lightning arresters filled with inert gas

We recommend you to use the BLITZDUCTOR® ARE, 8 V, as a protective element for the transmission cable to the ET 100U station (Figure 2-3).

Install the protective elements at the point where the cable enters the building.

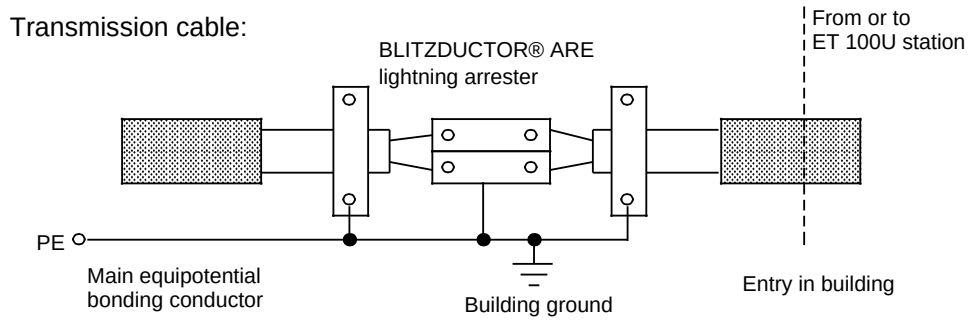


Figure 2-3 Protection Against Lightning

2.4 Addressing

Data can be exchanged in the following input/output areas. You will learn later how to set the desired input/output area on the module (3.4.5).

Table 2-3 I/O Areas

Area	Initial address	End address
P	$F000_H$	$F0FF_H$
Q	$F100_H$	$F1FF_H$
IM3	$FC00_H$	$FCFF_H$
IM4	$FD00_H$	$FDFF_H$

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

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

Exceptions:

- One byte per 308-3 interface module is required as a diagnostics address in the P area.
- The diagnostics address in initial page area Q_n is required for the purpose of page addressing.

The address areas of all ET 100Us and ICM 560s are assigned using COM ET 100U communications software and stored in an EPROM submodule. The EPROM submodule is plugged into the 308-3 interface module after being programmed.
Neither an address list nor an EPROM submodule are required for addressing the I/O area in expansion units with the 318-3 interface module.

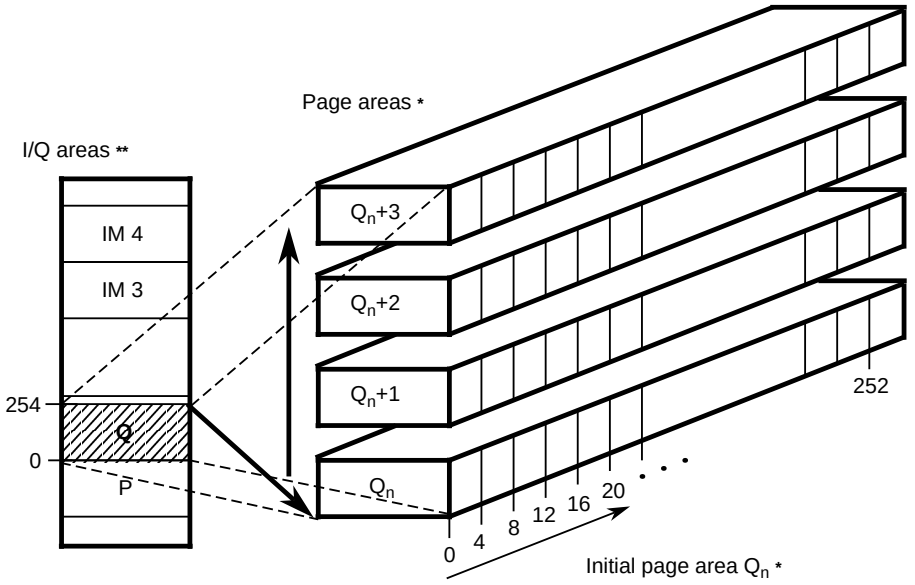
Note:

- Address 255 is reserved for page selection during page addressing and cannot be used for input/output modules in the Q area.
- Make sure that the Q area cannot be directly referenced in the same central controller (double addressing) in the case of page addressing.
- The diagnostics address set cannot be used for input/output modules.
- There must be no I/O module having the same address in the central controller if the 308-3 interface module references address areas Q, IM3 or IM4 (double addressing).
- The S5-115U recognizes the following address area:
  - CPU 941 ... 944 address area P
  - CPU 945 address areas P and Q.

2.5 Page Addressing (Duplication of the Q Area)

Page addressing is based on the duplication of the Q area. For page addressing, this area must be present in your programmable controller. This is the case in the S5-135U, S5-150U and S5-155U.
In the S5-115U, CPU 941 ... 944 have only the P area.

You can convert any 308-3 interface module to page addressing by changing jumpers X3, X9 and X11 on the module (3.4.5).
This allows you to process up to 4 x 255 bytes of input data and 4 x 255 bytes of output data in the Q area of each 308-3 interface module.
Each 308-3 interface module in the central controller can also be converted to another initial page area. A total of 64 initial page areas are available. Page addressing thus frees 4 x 64 x 255 bytes for input data and 4 x 64 x 255 bytes for output data.
Use linear addressing first.
Up to 1K bytes (4 x 256 bytes) of address area are available to you for linear addressing, depending on your programmable controller. Duplication of the Q area is only to be recommended if this address area is insufficient.



* Must be set on the 308-3 interface module

** Must be set on the 318-3 interface module, or must be programmed for the ET 100U and ICM 560 using COM ET 100 communications software

Figure 2-4 Graphical Representation of Page Addressing

3 Start-Up

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3 Start-Up

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

3.1 Start-Up of the Interface Module

Mode Selector in ON Position

- The interface module starts the configuration run after power up or when power is restored after a failure.
  All units connected are initialized during configuration. The power supply to these units must therefore be on.
- The configuration run lasts approximately 5 to 20 seconds, during which time the red LED flashes with a frequency which depends on the baud rate set.
- The 308-3 interface module will start up properly, even if the CPU is in the STOP mode.
- If the red LED flashes for longer than 20 seconds, there is either a fault in the module (RAM or ROM error) or the EPROM submodule has been wrongly programmed (check with COM ET 100U)

Note:
The CPU switches must not be operated during the configuration run.

Mode Selector in OFF Position

- When the mode selector on the frontplate is in the OFF position, the units connected to the serial interface can no longer be referenced and assume the wait status.
  The CPU generates a BASP signal (command output disable).
- The CPU receives diagnostics byte 0. Bit F6 in this byte means "Distributed I/O not ready".
- If QVZ (time-out) mode is active (3.4.3), a time-out will be recognized by the CPU.

3.2 Serial Interface

The serial interface is floating and is similar to the EIA (Electronic Industries Association) RS 485 standard. Both interface chains are at the same potential and operate in parallel. You must activate the relevant interface when the transmission cable is connected and the terminating resistor is connected to the end of the chain (3.4.1). The relevant green LED will then light up.
If one of the interface chains is not used, the relevant interface must be switched off . The relevant green LED will then remain dark.
If you activate an unused interface, a time-out will result, irrespective of the position of the time-out switch (QVZ).

3.3 Data Exchange

I/O data is exchanged in half-duplex mode on the master-slave principle between the central controller and the expansion units, the ET 100U or the ICM 560 via a serial transmission link. Both interfaces together can take a maximum of 64 nodes, of which only 62 may be ET 100Us or ICM 560s. A terminating resistor (120 ohms, 0.25 W) is required at the end of each chain.

Using COM ET 100U communications software, you must program the number of input and output bytes and their initial addresses for all ET 100Us and ICM 560s connected and store this information in the EPROM submodule.
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 monitor the data transmitted 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 data transmission 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 appears.
Parasitic signals can cause a unit to switch off automatically (the ICM 560 switches to manual mode). 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.

3.4 Default Settings on the Module

Before putting the module into service, you must use the three coding switches to set the diagnostics address (switch S1), the initial page area (switch S2) and the baud rate, chain monitoring facility and QVZ mode of the serial interface (switch 3).
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: •.
Switch S3.4 is not assigned.

3.4.1 Chain Watchdog

The chain watchdog of both serial interfaces is set using switches S3.5 or S3.6.
When activated (S3.5 or S3.6 at OFF), the interface chain watchdog checks whether the transmission cable connected has a terminating resistor of 120 ohms. The relevant green LED lights up.
If one of the interface chains is not in use, you must set the relevant switch to ON. The relevant green LED then remains off.
If you activate an unused interface, this will always result in a time-out, irrespective of the position of the QVZ mode switch.

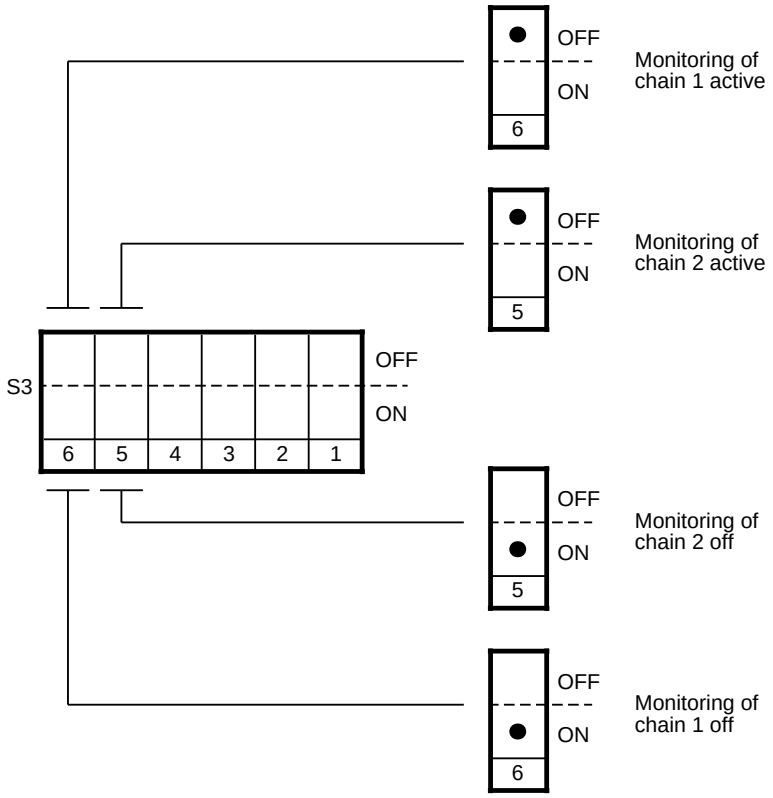


Figure 3-1 Monitoring of the Serial Interface Chain

3.4.2 Baud rate

You will achieve the greatest possible noise immunity on your data transmission line if you select the lowest possible baud rate. However, you must 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 S3.1 and S3.2.

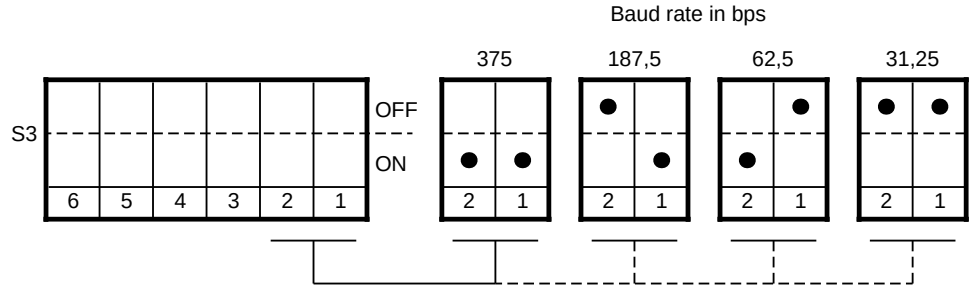


Figure 3-2 Setting the Baud Rate

3.4.3 QVZ Mode

You can activate or deactivate QVZ mode with switch S.3.3. To operate the module and the relevant I/O modules under normal SIMATIC S5 conditions (time-out when module is unplugged, etc.), QVZ mode must be activated (switch S3.3 in the OFF position).
The 308-3 interface module transmits the READY (RDY) signal for all those modules which were plugged in during configuration and which were assigned addresses in the EPROM submodule using COM ET 100U communications software.
However, it may be useful to switch off QVZ mode during the start-up procedure of your system (switch S3.3 to ON), in order to test the system section by section, for example.
Unplugging a module will not then result in a time-out.
It is necessasry to program the relevant organization block (QVZ-OB) to prevent the CPU from stopping in the event of a time-out. You will find more details in your programmable controller manual.

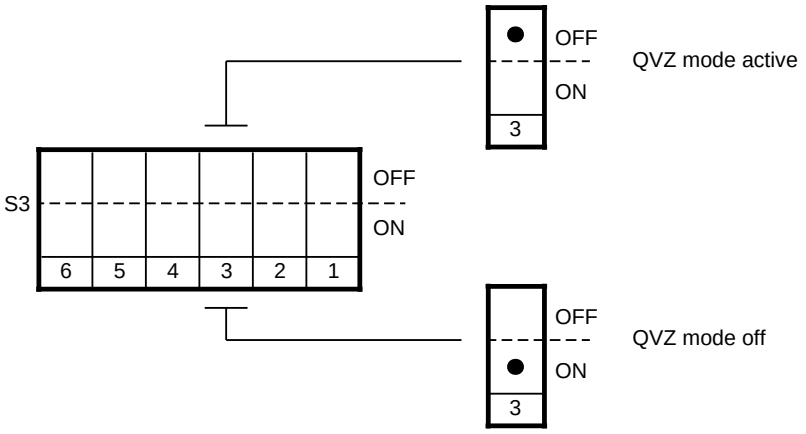


Figure 3-3 Selecting the QVZ Mode

The 308-3 interface module will react differently to errors in the I/O modules, depending on which QVZ mode you have selected.

QVZ Mode Active

Table 3-1 Response to Errors when QVZ Mode Activated

Diagnostics bit*	308-3 interface module generates READY signal	Input data of the relevant module set to 0 in the dual-port RAM	Output data of the relevant module set to 0 in the dual-port RAM
F0	no	yes	yes
F1	yes	no	no
F2	no	yes	yes
F3	no	yes	yes
F4	no	yes	yes
F5	no	yes	yes
F6	no	yes	yes
BASP	yes	yes	yes

***** You will find an explanation of the various diagnostics bits in the chapter on Error Diagnostics (Chapter 4)

QVZ Mode Inactive

Table 3-2 Response to Errors when QVZ Mode Off

Diagnostics bit*	308-3 interface module generates READY signal	Input data of the relevant module set to 0 in the dual-port RAM	Output data of the relevant module set to 0 in the dual-port RAM
F0	yes	yes	yes**
F1	yes	no	no
F2	yes	yes**	no
F3	yes	yes	yes**
F4	yes	no	no
F5	no	yes	yes
F6	no	yes	yes
BASP	yes	no	yes

***** You will find an explanation of the various diagnostics bits in the chapter on Error Diagnostics (Chapter 4)

****** In this case, the data in the relevant module is set to 0.

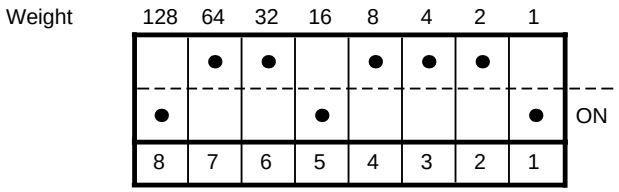
If the 308-3 interface module does not generate a READY Signal, it will not transfer any data to the S5 bus and the CPU will not recognize a time-out. If you want the CPU to continue to run after a time-out, you must take the CPU's response in this situation into account (see the relevant PC manual).

3.4.4 Diagnostics Address

A diagnostics byte is stored in the 308-3 interface module for each node (Chap. 4). You can set the diagnostics address for each diagnostics byte with switch S1.
The diagnostics address must be set in the P area within the limits m = 128 to 255. In the case of page addressing, the diagnostics address must be set in the initial page area Q_n within the limits m = 0 to 254.

Note:
Assign diagnostics addresses from 255 or 254 down (one diagnostics address per 308-3 interface module). The diagnostics address occupies both the input and output byte.

The diagnostics address set can be used for neither input modules nor output modules.
Set the desired diagnostics address on switch 1 by pressing the switch with the desired weight or significance down into the ON position.
The sum of the weights set must correspond to the desired diagnostics address (Figure 3-4).



Diagnostics address set: 1 + 16 + 128 = 145

Figure 3-4 Typical Diagnostics Address Setting

3.4.5 Setting the Input/Output Areas or Page Areas

Note:
This section is only of interest if you are using page addressing.

Set the I/O areas or the page areas by positioning the X3, X9, and X11 plug-in jumpers on the module (1.2) according to the following instructions.
The symbol: • represents a plugged-in jumper.

In the case of interface modules operated in page mode, the positioning of the plug-in jumpers also depends on the module slot. The reason for this is that, if several interfaces are operated in page mode, only the interface module with the highest slot number (the one furthest from the CPU) generates a READY signal.

Nonpage Mode (P, Q, IM3, IM4)

- Position the plug-in jumpers in the same way in all modules, irrespective of how many 308-3 interface modules there are in your central controller:

Jumper X3	Jumper X9	Jumper X11
●		●

Page Mode (Qn, Qn +1, Qn +2, Qn +3)

- If you are operating only one 308-3 interface module in your central controller:

Jumper X3	Jumper X9	Jumper X11
	●	

- If you are operating several 308-3 interface modules in your central controller, locate the jumper in the page mode interface module with the highest slot number (module furthest from the CPU) as follows:

Jumper X3	Jumper X9	Jumper X11
	●	

The other interface modules operating in page mode do not have jumpers plugged in:

Jumper X3	Jumper X9	Jumper X11

Mixed Mode, Page and Nonpage

- All 308-3 interface modules operated in nonpage mode:

Jumper X3	Jumper X9	Jumper X11
		●

- If you are operating only one 308-3 interface module in page mode:

Jumper X3	Jumper X9	Jumper X11
	●	

- If you are operating several 308-3 interface modules, locate the plug-in jumper in the interface module with the highest slot number (furthest from the CPU) as follows:

Jumper X3	Jumper X9	Jumper X11
	●	

The other interface modules operating in page mode do not have jumpers plugged in:

Jumper X3	Jumper X9	Jumper X11

Note:
Do not discard the remaining jumpers. Keep them in a safe place in case your system has to be modified at a later date.

3.4.6 Initial Page Area

Note:
This section is only of interest if you are using page addressing.

You can set the initial page area for all 309-3 interface modules in steps of four using switch S2.

Parameter n = 0, 4, 8, 12 to 252

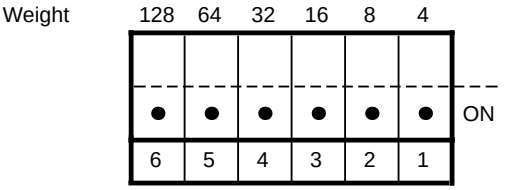


Figure 3-5 Selecting the Initial Page Area with Switch S2

If you have several 308-3 interface modules in one central controller, you can select the same initial page area for all or assign different areas to each.
However, make sure that no double addresses occur within the same page area.
Your selection of an initial page area for a 308-3 interface module will establish the four page areas Q_{n}, Q_{n+1}, Q_{n+2}, and Q_{n+3} for that module.
For example, if you select initial page area 16,

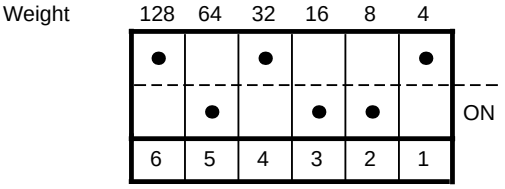
Q_{n}	will be called with parameter	16
Q_{n+1}	will be called with parameter	17
Q_{n+2}	will be called with parameter	18
Q_{n+3}	will be called with parameter	19

In this chapter, under the heading "Page Selection", you will learn which STEP 5 operations you need to access a page area. You can have 255 bytes of input data and 255 bytes of output data in each page area.
You must preset a given node according to the page area within which you wish to communicate with that node.
This area is set in the 318-3 interface module using Switch S2, and in the ET 100U and ICM 560 using COM ET 100 communications software. Setting is the same as for areas P, Q, IM3 und IM4 in the case of normal addressing.

For this purpose:	Q_{n}	corresponds to area	P
	Q_{n+1}	corresponds to area	Q
	Q_{n+2}	corresponds to area	IM 3
	Q_{n+3}	corresponds to area	IM 4

Setting the Initial Page Area

Set the selected initial page area at Switch S2 by pressing the switch with the relevant value down into the ON position.
The sum of the values set must correspond to the initial page area (Figure 3-6).



Initial page area set: 8 + 16 + 64 = 88
This allows you to access page areas 88 to 91.

Figure 3-6 Typical Initial Page Area Setting

Page Selection

Address 255 (F1FFH) is reserved for page selection in the Q area.
The following operations are used for page selection:

```
L   KB    n     where n= 0 to 255 (desired page area)
T   QB    255
```

This selects page area n. You can now use any of the load and transfer operations of the Q area (byte and word operations).Your page selection applies until you select a new area.
Data exchange then takes place in this new page area.

3.5 Transmission Time of the Serial Transmission Link

Specific transmission times are required in order to update the contents of the buffer (dual-port RAM) of the 308-3 interface module. These transmission times depend on the individual module configuration and the baud rate set.
You will find the relevant values in the following tables.

Transmission Time t_{ET} Between the 308-3 Interface Module and the 318-3 Interface Module (ET 100U)

Table 3-3 Transmission Time t_{ET}

Baud rate	Transmission Time t_{ET}
375,000 bps	a x 0.7 ms/ET + b x 0.04 ms/Byte
187,500 bps	a x 1.0 ms/ET + b x 0.07 ms/Byte
62,500 bps	a x 2.0 ms/ET + b x 0.19 ms/Byte
31,250 bps	a x 3.4 ms/ET + b x 0.36 ms/Byte

Parameters a and b are defined as follows:
a=Total number of ET 100Us connected to the 308-3 interface modue
(both chains)
b=The sum of all input and output bytes of all ET 100Us

Transfer Time t_{EU} Between the 308-3 Interface Module and the 318-3 Interface Module (Expansion Unit)

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}.

Table 3-4 Transmission time t_{EU}

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

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=Sum of all input and output bytes of all expansion units.

Transmission Time t_{ICM} Between the 308-3 Interface Module and the ICM 560

Table 3-5 Transmission time t_{ICM}

Baud rate	Transmission time t_{ICM}
375,000 bps	e x 1.0 ms/ICM
187,500 bps	e x 1.5 ms/ICM
62,500 bps	e x 3.5 ms/ICM
31,250 bps	e x 6.3 ms/ICM

Parameter c is defined as follows:
e = Total number of ICM 560 individual control modules connected to the 308-3 interface module (both chains)

Total Transmission Time t_T

The total transmission time t_T is calculated as follows in the case of a mixed configuration of expansion units, ET 100Us and ICM 560s:

$$t_T = t_{EU} + t_{ET} + t_{ICM}$$

Transmission time t_T is the time required for a whole cycle. At the end of this time, the status information of, for example, an input in the buffer (dual-port RAM) of the 308-3 interface module is updated.

The time required for data transmission on the I/O bus of the modules connected must be taken into account as well as the transmission time of the serial transmission link:

- See Manual 6ES5 998-2ET11 for the transmsission times of the ET 100U I/O bus. 1 ms per byte of input/output data is a typical value.
- In the expansion unit, data transmission to the I/O modules is via the parallel S5 bus. The time required for this is negligible and already accounted for in t_{EU}.
- The internal response times for the ICM 560 individual control module are given in Manual 6ES5 998-0KC11, but these times are already accounted for in t_{ICM}.

Note:

From version 308-3UA**12** upwards, the 308-3 interface module has a minimum cycle time which depends on the baud rate set.

At	375,000 bps	the cycle time is	3 ms
at	187,500 bps		5 ms
at	62,500 bps		12 ms
at	31,250 bps		40 ms

Example for the Calculation of the Transmission Time t_T

The calculation is based on the following module configuration.
The baud rate is set at 187,500 bps.

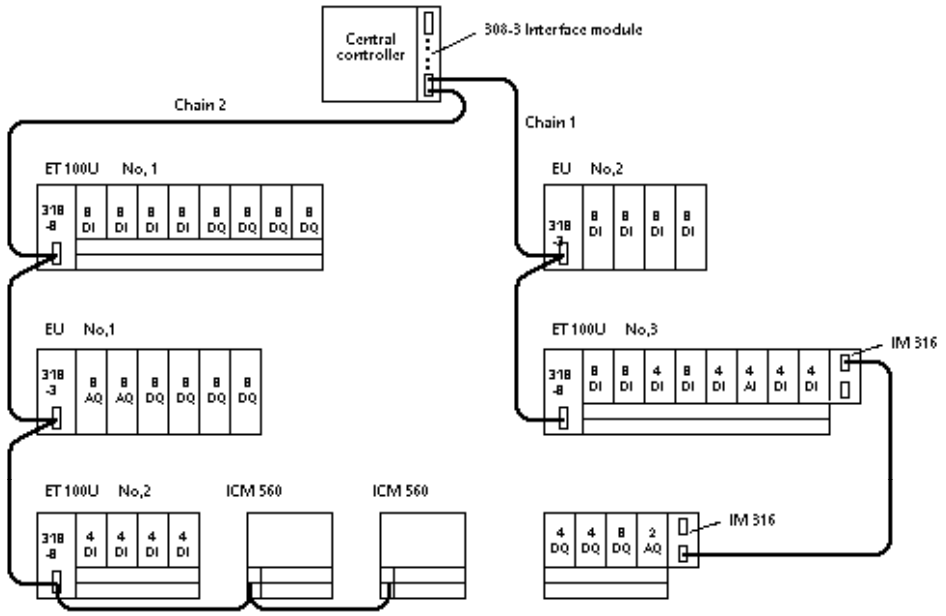


Figure 3-7 Module Configuration for Calculating the Transmission Time

The input/output modules of the U range have the following data capacities:

Legend:
- DI = Digital Input Module
- DQ = Digital Output Module
- AI = Analog Input Module
- AQ = Analog Output Module

Table 3-6 Data Capacity of Digital Modules

Baud rate	Data capacity
4 DIs or 4 DQs	bytes
8 DIs or 8 DQs	1 bytes
16 DIs or 16 DQs	2 bytes
32 DIs or 32 DQs	4 bytes

Table 3-7 Data Capacity of Analog Modules

Baud rate	Data capacity
2 AIs or 2 AQs	4 bytes
4 AIs or 4 AQs	8 bytes
8 AIs or 8 AQs	16 bytes
16 AIs or 16 AQs	32 bytes

Each ICM 560 individual control module takes up four input bytes and four output bytes (32 DIs and 32 DQs).

- There are three ET 100Us connected to the 308-3 interface module represented in Figure 3-7.

Data capacity in the individual ET 100Us is as follows:

ET No. 1: 8 bytes
No. 2: 3 bytes → Incomplete half-bytes within one ET 100U are expanded into full bytes, in this case:
No. 3: 19 bytes
1 bytes DI 2 bytes
bytes DQ 1 bytes

Total b = 30 bytes Total 3 bytes

This defines all the variables required for the calculation:

The transmission time t_{ET} is derived as follows:

t_{ET} = a x 1.0 ms/ET + b x 0.07 ms/ bytes=
= 3 ET x 1.0 ms/ET + 30 bytes x 0.07 ms/ bytes= 5.1 ms

Value from Table 3-3

- There are two further ICM 560 individual control modules connected (e = 2).

The transmission time t_{ICM} is derived as follows:

t_{ICM} = e x 1.5 ms/ICM
2 ICM x 1.5 ms/ICM = 3 ms

↓

Value from Table 3.5

- Finally, two more expansion units are added (c=2).

Data capacity in the individual expansion units is as follows:

EG	No. 1:	36 bytes
	No. 2:	4 bytes
Total d =		40 bytes

This defines all the variables required for the calculation:

The transmission time t_{EU} is derived as follows:

t_{EU} = c x 4.5 ms/EU + d x 0.12 ms/byte =
= 2 EU x 4.5 ms/EU + 40 bytes x 0.12 ms/bytes = 13.8 ms

↘ ↙

Value from Table 3.4

- The total transmission time t_T is calculated as follows:

$t_T = t_{ET} + t_{ICM} + t_{EU}$

t_T = 5.1 ms + 3 ms + 13.8 ms = 21.9 ms

4 Error Diagnostics

4 Error Diagnostics

Faults on the transmission link or at the nodes communicating with the 308-3 interface module can have various causes. This chapter is designed to help you to detect and remove faults.

4.1 Accessing the Diagnostics Byte

A diagnostics byte is stored for every node in the 308-3 interface module plugged into the central controller . The diagnostics byte for ET 100U electronic terminators for distributed I/O and for ICM 560 individual control modules is stored under the number of the relevant unit (Nos. 1 to 63).
The diagnostics byte for expansion units and group messages is stored under No. 0.
The diagnostics bytes of all nodes are stored in the buffer (dual-port RAM) of the 308-3 interface module, and can be referenced by load and transfer operations.
You must set the address of the diagnostics byte (diagnostics address) on the module (3.4.4).
Accessing the diagnostics byte:

L	KB	i	i = 0 for expansion units i = 1 to 63 for ET 100Us and ICM 560
T	PY	m	m = 128 to 255 (diagnostics address)
L	PY	m	

If you use the STUDOS (S0; S1) operating system in the programmer (PG 675, earlier version), you must write the T PB m and L PB m operations in place of the T PY m and L PY m operations.

If you are using page addressing for the 308-3 interface module, you must note that the diagnostics byte can only be read in the initial page area Q_n (n= 0, 4, 8, 12 to 252). Access is then as follows:

L	KB	n	Select initial page area
T	QB	255	
L	KB	i	i = 0 for expansion units i = 1 to 63 for ET 100U and ICM 560
T	QB	m	m = 0 to 254 (diagnostics address)
L	QB	m	

This means you can respond quickly to specific error states by making bit comparisons. To avoid a time-out being activated by an error and causing the CPU to stop (3.4.3), it is necessary to program the relevant organization block.

Note:

- Diagnostics bits can occur in combinations.
- Error information is scanned cyclically. This can mean that errors which appear briefly are not captured and the relevant diagnostics bits are not set.
- Error messages are not stored.
  Exception: Diagnostics bits which existed before the generation of FO remain set.

4.2 Diagnostics Byte for Expansion Units and Group Messages

Diagnostics byte No. 0 contains both group messages concerning all I/O modules and the diagnostics bits for expansion units. You can tell from the bit pattern whether an error has occurred and, if so, which error. The relevant bit then has signal state "1".

Bit	7	6	5	4	3	2	1	0
	BASP	F6	F5	0	0	F2	0	F0

Group Messages Concerning All I/O Modules

F5:
- The 308-3 interface has read an unknown identifier from the EPROM submodule. Check the identifiers used.

F6:
- The mode selector of the 308-3 interface module is in the OFF position or there is interference on the transmission link (e.g. the interface connector has been unplugged, the transmission line has been interrupted, or the terminating resisitor is missing).
- The measuring circuit has detected excessive loop resistance.

Diagnostics Bits for Expansion Units

F0:
- One or more expansion units no longer accessible:e.g. interface module power supply has failed, the interface connector has been unplugged, the 318-3 interface module has been disconnected, the line has been interrupted.
- Frequent interference on the transmission line:
  Messages are repeated twice; if no valid data is received (BCH check), the unit is 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 transmission 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:
- Command output disable activated (BASP can be output both by the CPU and by the 318-3 interface module).

0:
- Bits meaningless

4.3 Diagnostics Byte for the ET 100U and the ICM 560

You can tell from diagnostics bytes Nos. 1 to 63 (depending on the ET No. or the ICM 560 No.) whether an error has occurred in an ET 100U or an ICM 560 and, if so, which error. The relevant bit then has signal state "1".

Bit	7	6	5	4	3	2	1	0
	BASP	0	0	F4	F3	F2	F1	F0

F 0:
- One or more ET 100Us or ICM 560s no longer accessible: e.g. power supply has failed, the interface connector has been unplugged, the interface module has been disconnected, or the line has been interrupted.
- Frequent interference on the transmission line:
  Messages are repeated twice; if no valid data is received (BCH check), the unit is 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 transmission is resumed.

F 1:
- Load voltage missing or output short-circuit to M:
  A readback module (e.g.: 6ES5 440-8MA...) reports that the load voltage has failed, or at least one output has a short-circuit to M.

F 2:
- I/O modules unplugged:
  One or more I/O modules configured using COM ET 100U are not in their slots. This fact is also reported by a time-out (QVZ) if the QVZ mode is activated on the 308-3 interface module. The time-out applies to all addresses used in the relevant ET 100U.

F 3:
- I/O bus error or wrong bus units connected:
  Interference on the shift register bus of the ET 100U.
  Maximum configuration has been exceeded.
  ET 100U configuration does not agree with configuration in COM ET 100U.

F 4:
- Wrong output activated:
  The output of a readback module (e.g.: 6ES5 440-8MA...) is "1", although it was driven with a "0" signal.
  Process wiring is shorted to L+.
  Module driver is defective (output transistor has failed).

BASP:
- Command output disable activated (BASP can be output both by the CPU and by the 318-3 interface module).

0:
- Bits meaningless.

5 Technical Specifications

5 Technical Specifications

5.1 Technical Specifications of the 308-3UA12 Interface Module

Can be plugged into (6ES5 308-3UA12)	S5-135U, S5-150U, S5-155U; S5-115U with adapter casing; (Chap. 2.1)
Address areas - in the case of page addressing	P, Q, IM3, IM4 Q_{n}, Q_{n+1}, Q_{n+2}, Q_{n+3}
Page addressing	Duplication of the Q area possible
Initial page addresses	max. 64, can be set on the interface module
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 low baud rates (62,500/31,250 bps)	Enhanced by a low-pass filter
Number of interfaces	1 with 2 electrically isolated connections (floating, parallel)
Design	Similar to EIA RS-485 standard
No. of modules per interface	max. 32 ETs or EUs
No. of nodes per interface	max. 64, but max. 63 ETs or ICMs

Input voltage for receiving	max. 5V, symmetrical
Output voltage for transmitting	max. 5V, symmetrical
Max. cable length for	
- 375,000 baud	0.5 km/0.3 miles per interface chain
- 187,500 baud	1.0 km/0.6 miles per interface chain
- 62,500 baud	1.0 km/0.6 miles per interface chain
- 31,250 baud	3.0 km/1.8 miles per interface chain
Conductor cross-section	0.5 to1.5 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 the central controller)	0.5 A
376 memory submodule (EPROM) 6ES5 376- . AA11 (only required whenET 100U or ICM 560 connected)	8K words
Weight	approx. 400 g/14 oz.

5.2 Connector Pin Assignments

Backplane connector X1:

	D	B	Z
PIN NO.	SIG. NAME	SIG. NAME	SIG. NAME
2		M	+5 V
4		PESP	
6	ADB12	ADB0	CPKL_N *
8	ADB13	ADB1	MEMR_N
10	ADB14	ADB2	MEMW_N
12	ADB15	ADB3	RDY_N
14		ADB4	DB0
16		ADB5	DB1
18		ADB6	DB2
20		ADB7	DB3
22		ADB8	DB4
24		ADB9	DB5
26		ADB10	DB6
28		ADB11	DB7
30		BASP	
32		M	M

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

Backplane connector X2:

	D	B	Z
PIN NO.	SIG. NAME	SIG. NAME	SIG. NAME
2		M	+5V
4			
6			
8			
10			
12			
14			CPKLA_N*
16			
18			CPKLA_N**
20			
22			
24			
26			
28			
30			
32		M	M

***** CPKLA_N is applied via jumper X14 PIN 2/3 (Caution! There are +5V on interface positions here)

****** CPKLA_N is applied via jumper X14 PIN 1/2 (as supplied)

6 Spare Parts

6 Spare Parts

Interface connector	4NES 812 2203-01000
Resistance 120 ohms, 0.25 W, 5 %	Commercial
Coding socket	W79070-G2602-N2
EPROM submodule	6ES5 376- . AA11

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7 Index

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