SIEMENS

SIMATIC

S7-300
S7-300 Module data

Equipment Manual

General technical data 1

Power supply modules 2

Digital modules 3

Principles of analog value processing 4

Principles of analog modules 5

Analog modules 6

Other signal modules 7

Interface modules 8

Parameter sets of signal modules A

Diagnostics data of signal modules B

Dimensional drawings C

Spare parts and accessories for S7-300 modules D

Directive on handling Electrostatic-Sensitive Devices (ESD) E

Service & support F

Safety-relevant symbols G

Continued on next page

05/2022
A5E00105505-AK

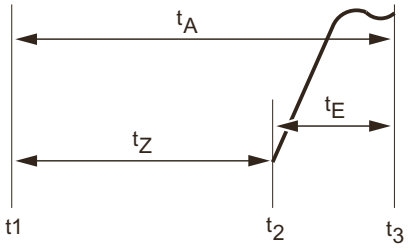
S7-300
S7-300 Module data

Equipment Manual

Response time

The worst case response time (t_1 to t_3), i.e. the time expiring between the input of digital output values to internal memory, and the signal settling time at the analog output, may be equivalent to the total of cycle time plus settling time.
The worst case scenario is given, when the analog channel has been converted immediately before a new output value is transferred, and is not converted again until all other channels have been converted (cycle time.)

Overview of the settling time and response time of analog output modules



t_A Response time
t_C tC = Cycle time, equivalent to n x conversion time (n = active channels)
t_S Settling time
t_1 new digital output value is set
t_2 Output value is applied and converted
t_3 specified output value is reached

5.7 Programming analog modules

Introduction

The properties of analog modules may differ. The module properties can be programmed.

Programming tools

You program analog modules in *STEP 7*. Always program the module while the CPU is in STOP mode.
After you defined all parameters, download these from your PG to the CPU. The CPU transfers the parameters to the relevant analog modules at the STOP → RUN transition.
Also, position the measuring range modules of the module as required.

Static and dynamic parameters

Parameters are organized by static and dynamic properties.
Set the static parameters while the CPU is in STOP, as described earlier.

You can also modify dynamic parameters in the active user program using SFCs. However, the parameters set in *STEP 7* will be applied again after a RUN → STOP, STOP → RUN transition of the CPU.

Parameters	configurable using	CPU operating state
static	PG (STEP 7 HW CONFIG)	STOP
dynamic	PG (STEP 7 HW CONFIG)	STOP
	SFC 55 in the user program	RUN

See also

Programmable parameters (Page 290)

5.7.1 Parameters of analog input modules

Parameters of analog input modules

For information on parameters supported by specific analog modules, refer to the chapter dealing with the relevant module.
The defaults apply if you have not set any parameters in **STEP 7**.

5.8 Diagnostics of analog modules

Programmable and non-programmable diagnostic messages

We distinguish between programmable and non-programmable diagnostic messages.
You only obtain programmable diagnostic messages if you have enabled diagnostics at the relevant parameters. Program these functions in the "Diagnostics" parameter block in *STEP 7*.
The the analog module always provides non-programmable diagnostic messages, irrespective of the enable state of diagnostic functions.

Reactions to a diagnostic message in *STEP 7*

Actions initiated by diagnostic messages:

- The diagnostic message is written to the diagnostics buffer of the analog module, and is then passed to the CPU.
- The error LED on the analog module is lit.
- When "Enable Diagnostics Interrupt" is set in STEP 7, the system triggers a diagnostic interrupt and calls OB82.

Reading diagnostic messages

You can read detailed diagnostic messages in the user program using SFCs.

Viewing the cause of error

You can view the cause of the error in the module diagnostics data in *STEP 7* (refer to the *STEP 7* Online Help.)

Diagnostic message included in the measured value of analog input modules

All analog input modules return the measured value $7FFF_H$ as a reaction to errors, irrespective of parameter settings. This measured value indicates either overflow, error, or a disabled channel.

Diagnostic message using the SF LED

Diagnostics-capable analog modules indicate errors by means of their SF LED (group error LED). The SF LED lights up when the analog module has generated a diagnostic message. It goes dark after all error states are cleared.

See also

Programming analog modules (Page 244)

5.8.1 Diagnostics messages of analog input modules

Overview of the diagnostics messages of analog input modules

The table below provides an overview of the diagnostics messages of analog input modules.

Table 5-44 Diagnostics messages of analog input modules

Diagnostics message	LED	Scope of diagnostics	programmable
External load voltage missing	SF	Module	no
Configuration / programming error	SF	Channel	yes
Common-mode error	SF	Channel	yes
Wirebreak	SF	Channel	yes
Underflow	SF	Channel	yes
Overflow	SF	Channel	yes

5.8.2 Diagnostic messages of analog output modules

Overview of the diagnostic messages of analog output modules

The table below provides an overview of the diagnostic messages of analog output modules.

Table 5-45 Diagnostic messages of analog output modules

Diagnostic message	LED	Scope of diagnostics	programmable
External load voltage missing	SF	Module	no
Configuration / programming error	SF	Channel	yes
Short-circuit to M*	SF	Channel	yes
Wire-break*	SF	Channel	yes

* Not with the SM 332, AO 4 x 16 bit, isochrone

NOTE

The detection of errors which are indicated in programmable diagnostic messages requires appropriate configuration of the analog module in *STEP 7*.

5.8.3 Causes of error and troubleshooting at analog input modules

Overview of the causes of error and troubleshooting at analog input modules

Table 5-46 Diagnostics messages of analog input modules, causes of error and troubleshooting

Diagnostics message	Possible cause of error	To correct or avoid errors
External load voltage missing	Load voltage L+ of module missing	Connect supply L+
Configuration / programming error	Faulty parameters transferred to module	Check the measuring range module
		Program the module
Common-mode error	Potential difference C_{MV} between inputs M- and the reference potential of measuring circuit (M_{ANA} out of limits)	Connect M- with M_{ANA}
Wirebreak	Resistance of transducer circuit too high	Use a different type of sensor, or modify the wiring, for example, using a larger conductor cross-section.
	Open circuit between module and sensor	Connect the cable
	Channel not connected (open)	Disable the channel group ("measuring method" parameter)
		Wire the channel
Underflow	Input value below undershoot range; possible cause of error: wrong measuring range setting	program a different measuring range
	polarity reversal of the sensor wiring in the measuring ranges 4 to 20 mA and 1 to 5 V	Check the connections
Overflow	Input value exceeds overshoot range	program a different measuring range

5.8.4 Causes of error and troubleshooting at analog output modules

Overview of the causes of error and troubleshooting routines at analog output modules

Table 5-47 Diagnostics messages of analog output modules, causes of error and troubleshooting

Diagnostics message	Possible cause of error	To correct or avoid errors
External load voltage missing	Load voltage L+ of module missing	Connect supply L+
Configuration / programming error	Faulty parameters transferred to module	Assign new module parameters
Short-circuit to M	Overload at output	Eliminate overload
	Short-circuit at output Q_V to M_{ANA}	Eliminate the short-circuit
Wirebreak	Actuator impedance too high	Use a different type of actuator, or modify the wiring using cables with a larger conductor cross-section
	Wire-break between the module and actuator	Connect the cable
	Channel not used (open)	Disable the channel group ("output type" parameter)

5.9 Interrupts of analog modules

Introduction

This section describes the interrupt response of analog modules. Always distinguish between the following interrupts:

- Diagnostic interrupt
- Hardware interrupt

Note that certain analog modules do not support interrupts, or are only partially capable of "handling" the interrupts described below. For information on modules which support interrupt functionality, refer to their technical data.

Description of the *STEP 7* blocks

For detailed information on the OBs and SFCs mentioned below, refer to the *STEP 7* Online Help.

Enabling interrupts

There are no default interrupt settings, that is, interrupts are disabled if not set accordingly. Program the interrupt enable parameter in *STEP 7*.

Diagnostic interrupt

Incoming error events (initial occurrence) and outgoing error events (error is cleared) are reported by means of diagnostic interrupt, if this interrupt is enabled.

The CPU interrupts user program execution in order to process diagnostic interrupt OB82.

You can call SFC51 or 59 in OB82 in the user program to view details of diagnostics data output by the module.

Diagnostics data remain consistent until the program exits OB82. The program acknowledges the diagnostic interrupt at the module when it exits OB82.

Hardware interrupt with "high or low limit exceeded" trigger

Define a working range by setting a high and low limit. If the process signal (for example, the temperature) overshoots this working range, the module triggers a hardware interrupt, provided the interrupt is enabled.

The CPU interrupts user program execution in order to execute hardware interrupt OB40.

In the user program of OB 40, you can define the reaction of the automation system to the violation of limits.

The program acknowledges the diagnostic interrupt at the module when it exits OB40.

NOTE

Note: the system does not generate a hardware interrupt if your limit setting exceeds the overshoot or undershoot range.

Structure of the start information variable OB40_POINT_ADDR of OB 40

The channel at which a specific limit is exceeded is logged to the OB40_POINT_ADDR variable in the start information of OB40. The diagram below shows the bit assignment of DWORD 8 in local data.

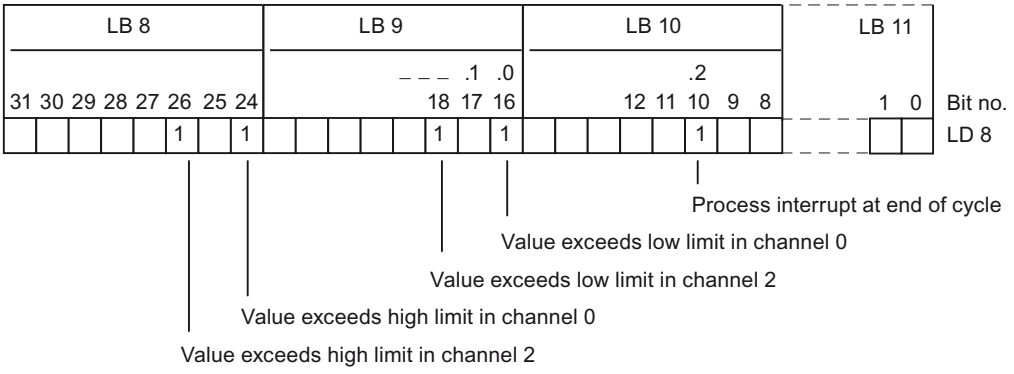


Figure 5-7 Start information of OB40: which limits event has triggered a hardware interrupt

Hardware interrupt triggered by "End of cycle reached"

You can synchronize a process with the cycle of the analog input module by programming a hardware interrupt trigger at the end of the cycle.

One cycle comprises the conversion of the measured values of all active channels of the analog input module. The module processes the channels in successive order. After all measured values were successfully converted, the module outputs an interrupt to the CPU in order to report new measured values at its channels.

You can always use this interrupt to download the actual converted analog values.

Substitute values

You can configure the SM 332; AO 4 x 16 Bit for CPU STOP mode as follows: Outputs off power, hold last value or set substitute values. The set substitute values must lie within the output range.

6.14 Analog output module SM 332; AO 4 x 12 Bit; (6ES7332-5HD01-0AB0)

Order number

6ES7332-5HD01-0AB0

Order number: "SIPLUS S7-300 module"

6AG1332-5HD01-7AB0

Properties

- 4 outputs in one group
- The output can be selected by individual channel
  - Voltage output
  - Current output
- Resolution 12 bits
- Programmable diagnostics and diagnostic interrupt
- Electrically isolated to backplane bus interface and load voltage
- Supports parameter reassignment in RUN

Diagnostics

For information on diagnostic messages at the "group diagnostics" parameter, refer to chapter Diagnostic messages of analog output modules (Page 246).

Terminal assignment

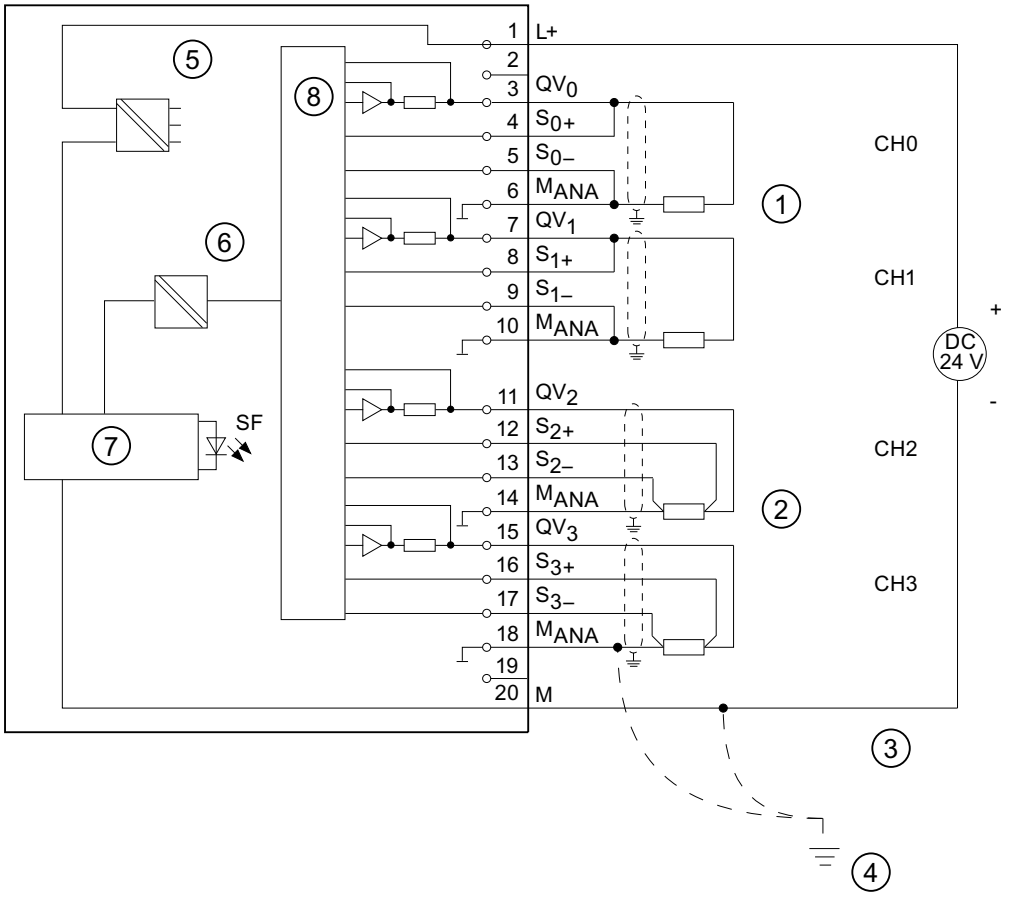
The diagrams below show various wiring options.

NOTE

When you switch the rated load voltage (L+) off and on, the outputs can return incorrect voltage/current values for the duration of about 500 ms.

Wiring: 2 and 4-wire connection for voltage output

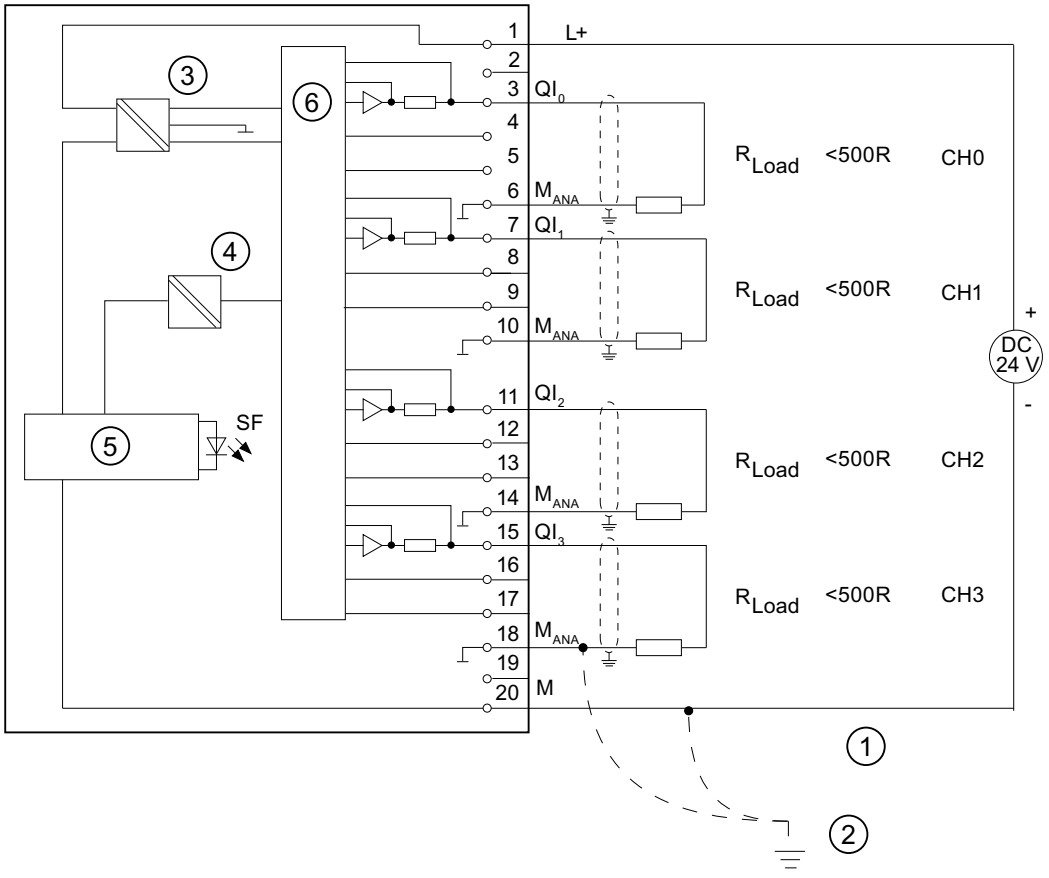
The following Fig. represents the 2-wire connection with no compensation for line resistors and the 4-wire connection with compensation for line resistors.



① 2-wire connection, no compensation for line resistors
② 4-wire connection, with compensation for line resistors
③ Equipotential bonding
④ Functional earthing
⑤ Internal supply
⑥ Electrical isolation
⑦ Backplane bus interface
⑧ Analog-to-Digital Converter (ADC)

Figure 6-46 Wiring and block diagram

Wiring: Current output



① Equipotential bonding
② Functional earthing
③ Internal supply
④ Electrical isolation
⑤ Backplane bus interface
⑥ Analog-to-Digital Converter (ADC)

Figure 6-47 Wiring and block diagram

Technical specifications

Technical specifications	
Dimensions and weight	
Dimensions W x H x D (mm)	40 x 125 x 117
Weight	ca. 220 g
Module-specific data	
Supports parameter reassignment in RUN	yes
Reaction of non-programmed outputs	Return the output value which was valid before the parameterization
Supports isochronous mode	no
Number of outputs	4

Technical specifications	
Cable length • shielded	 max. 200 m
Voltages, currents, electrical potentials	
Rated load voltage L+ • Reverse polarity protection	24 V DC Yes
Electrical isolation • between channels and the backplane bus • between channels and electronics power supply • between channels • between channels and load voltage L+	 Yes Yes no Yes
Maximum potential difference • between S- and M_{ANA} (CMV)	 3 V DC
Isolation test voltage	500 V DC
Current consumption • from the backplane bus • from load voltage L+ (no-load)	 max. 60 mA max. 240 mA
Power loss of the module	typ. 3 W
Generation of analog values	
Resolution (including overshoot range) • ± 10 V; ± 20 mA; • 4 mA to 20 mA; 1 V to 5 V • 0 V to 10 V; 0 mA to 20 mA	 11 bits + sign 12 bits
Conversion time (per channel)	max. 0.8 ms
Transient recovery time • with resistive load • with capacitive load • with inductive load	 0.2 ms 3.3 ms 0.5 ms (1 mH) 3.3 ms (10 mH)
Interference frequency suppression, error limits	
Crosstalk between outputs	> 40 dB
Operational limit (across entire temperature range, relative to measurement range end value in the selected output range)	
• Voltage output • Current output	± 0.5 % ± 0.6 %
Basic error limit (operational limit at 25 °C, relative to the measurement range end value in the selected output range)	
• Voltage output • Current output	± 0.4 % ± 0.5 %
Temperature error (relative to output range)	± 0.002 %/K
Linearity error (relative to output range)	± 0.05 %
Repeat accuracy (in settled state at 25 °C, relative to output range)	± 0.05 %
Output ripple; range 0 Hz to 50 kHz (relative to output range)	± 0.05 %
Status, interrupts, diagnostics	
Interrupts • Diagnostic interrupt	 Programmable

Technical specifications	
Diagnostic functions • Group fault display • Reading diagnostic information	programmable Red LED (SF) Supported
Setting substitute values	Yes, programmable
Actuator selection data	
Output ranges (rated values)	
• Voltage	± 10 V 0 V to 10 V 1 V to 5 V
• Current	± 20 mA 0 mA to 20 mA 4 mA to 20 mA
Load impedance (in the rated range of the output)	
• For voltage outputs – Capacitive load	Min. 1 kΩ Max. 1 µF
• For current outputs – at CMV < 1 V – inductive load	max. 500 Ω max. 600 Ω max. 10 mH
Voltage output • Short-circuit protection • Short-circuit current	 Yes max. 25 mA
Current output • noload voltage	 max. 18 V
Destruction limit against external voltages/currents • Voltage at outputs to M_{ANA} • Current	 max. 18 V continuous; 75 V for the duration of max. 1 s (duty factor 1:20) max. 50 mA d.c.
Wiring of the actuators • for voltage output – 4-wire connection (measuring lead) • for current output – 2-wire connection	using a 20-pin front connector supported supported

Parameter reassignment in RUN

If you reassign parameters in RUN, the following special characteristic applies.

SF LED is lit:

If a diagnostics was pending prior to reconfiguration, the SF LEDs (on CPU, IM or module) may be lit even though diagnostics is no longer pending and the module is operating correctly.

Solution:

- Only assign new parameters if no diagnostics is pending, or
- unplug module and plug it in again.

6.14.1 Output ranges of SM 332; AO 4 x 12 Bit

Introduction

You can configure the outputs for operation as voltage or current outputs, or disable them. You program the outputs at the "output type" parameter in *STEP 7*.

The output type "Voltage" and output range "± 10 V" are set by default at the module. You can always use this combination of output type and range without having to program the SM 332; AO 4 x 12 Bit in *STEP 7*.

Output ranges

Program the voltage and current output ranges in *STEP 7*.

Table 6-36 Output ranges of SM 332; AO 4 x 12 Bit

Selected type of output	Output range
Voltage	1 V to 5 V 0 V to 10 V ± 10 V
Current	0 mA to 20 mA 4 mA to 20 mA ± 20 mA

6.14.2 Programmable parameters

Introduction

For general information on programming analog modules, refer to the chapter Programming analog modules (Page 244).

The table below provides overview of programmable parameters and of their defaults.

Table 6-37 Overview of the parameters of SM 332; AO 4 x 12 Bit

Parameters	Range of values		Default	Parameter type	Scope
Enable • Diagnostic interrupt	yes/no		no	dynamic	Module
Diagnostics • Group diagnostics	yes/no		no	static	Channel
Output • Output type • Output range	disabled Voltage Current See table of *Output ranges for SM 332; AO 4 x 12 Bit*		V ± 10 V	dynamic	Channel
Reaction to CPU STOP	ASS HLV SSV	Outputs zero current/voltage Hold last value Set substitute value	ASS	dynamic	Channel

Assigning parameters to channels

The parameters can be set separately at each output channel of SM 332; AO 4 x 12 Bit. You can assign separate parameters to each output channel.

Spare parts and accessories for S7-300 modules

D

Spare parts

The table below lists the S7-300 parts you can order separately or later.

Table D-1 Accessories and spare parts

S7-300 parts	Order number
Bus connector	6ES7390-0AA00-0AA0
Connection comb between power supply and CPU (older generation, before 2003)	6ES7390-7BA00-0AA0
Labeling strips for • Modules with 20-pin front connector: – (petrol) – (light beige) – (yellow) – (red)	 6ES7392-2AX00-0AA0 6ES7392-2BX00-0AA0 6ES7392-2CX00-0AA0 6ES7392-2DX00-0AA0
Labeling strips for • Modules with 40-pin front connector: – (petrol) – (light beige) – (yellow) – (red)	 6ES7392-2AX10-0AA0 6ES7392-2BX10-0AA0 6ES7392-2CX10-0AA0 6ES7392-2DX10-0AA0
• Instructions for printing labeling strips using print templates	On the Internet (http://www.siemens.com/automation/service&support) Entry ID: 11978022
Slot number plate	6ES7912-0AA00-0AA0
Front connector 20-pin • Screw terminal technology (1 unit) • Screw technology (100 units) • Spring clamp technology (1 unit) • Spring clamp technology (100 units)	 6ES7392-1AJ00-0AA0 6ES7392-1AJ00-1AB0 6ES7392-1BJ00-0AA0 6ES7392-1BJ00-1AB0
Front connector 40-pin • Screw technology (1 unit) • Screw technology (100 units) • Spring clamp technology (1 unit) • Spring clamp technology (100 units)	 6ES7392-1AM00-0AA0 6ES7392-1AM00-1AB0 6ES7392-1BM01-0AA0 6ES7392-1BM01-1AB0
Front connector for 2 ribbon cable connections • screw terminal technology • Spring clamp technology	 6ES7921-3AB00-0AA0 6ES7921-3AA00-0AA0
Front connector for 4 ribbon cable connections • Spring clamp technology	 6ES7921-3AA20-0AA0