

SIMATIC S7-400 advanced controller

Digital modules

SM 421 digital input module**Ordering data****Article No.****Article No.****SM 421 digital input modules**16 inputs, 24 V DC,
with process/diagnostics interrupt**6ES7421-7BH01-0AB0**

32 inputs, 24 V DC

6ES7421-1BL01-0AA0

32 inputs, 120 V AC/DC

6ES7421-1EL00-0AA016 inputs, 120/230 V AC/DC, inputs
according to IEC 1131-2 Type 2**6ES7421-1FH20-0AA0**16 inputs, 24 to 60 V AC/DC,
with process/diagnostics interrupt**6ES7421-7DH00-0AB0****Front connector**

48-pin

- with screw contacts, 1 unit
- with screw contacts, 84 units
- with spring-loaded terminals,
1 unit
- with crimp contacts, 1 unit
- with crimp contacts, 84 units

6ES7492-1AL00-0AA0**6ES7492-1AL00-1AB0****6ES7492-1BL00-0AA0****6ES7492-1CL00-0AA0****6ES7492-1CL00-1AB0****Cover film for labeling strips****6ES7492-2XX00-0AA0**

Spare part

**Labeling sheets for machine
inscription**DIN A4, for printing using laser
printer; pack of 10

petrol

6ES7492-2AX00-0AA0

light-beige

6ES7492-2BX00-0AA0

yellow

6ES7492-2CX00-0AA0

red

6ES7492-2DX00-0AA0**SIMATIC Manual Collection****6ES7998-8XC01-8YE0**Electronic manuals on DVD,
multilingual: LOGO!, SIMADYN,
SIMATIC bus components,
SIMATIC C7,
SIMATIC distributed I/O,
SIMATIC HMI, SIMATIC Sensors,
SIMATIC NET, SIMATIC PC Based
Automation, SIMATIC PCS 7,
SIMATIC PG/PC, SIMATIC S7,
SIMATIC Software, SIMATIC TDC**SIMATIC Manual Collection
update service for 1 year****6ES7998-8XC01-8YE2**Current "Manual Collection" DVD
and the three subsequent updates

SIMATIC S7-400 advanced controller

Digital modules

SM 422 digital output module

1

Ordering data	Article No.		Article No.
SM 422 digital output modules		Labeling sheets for machine inscription	
16 outputs, 24 V DC; 2 A	6ES7422-1BH11-0AA0	DIN A4, for printing using laser printer; pack of 10	
32 outputs, 24 V DC; 0.5 A	6ES7422-1BL00-0AA0	petrol	6ES7492-2AX00-0AA0
32 outputs, 24 V DC, 0.5 A; with diagnostics	6ES7422-7BL00-0AB0	light-beige	6ES7492-2BX00-0AA0
16 outputs, 120/230 V AC; 2 A	6ES7422-1FH00-0AA0	yellow	6ES7492-2CX00-0AA0
16 outputs, relay contacts	6ES7422-1HH00-0AA0	red	6ES7492-2DX00-0AA0
Front connector		SIMATIC Manual Collection	6ES7998-8XC01-8YE0
48-pin		Electronic manuals on DVD, multilingual: LOGO!, SIMADYN, SIMATIC bus components, SIMATIC C7, SIMATIC distributed I/O, SIMATIC HMI, SIMATIC Sensors, SIMATIC NET, SIMATIC PC Based Automation, SIMATIC PCS 7, SIMATIC PG/PC, SIMATIC S7, SIMATIC Software, SIMATIC TDC	
• with screw contacts, 1 unit	6ES7492-1AL00-0AA0		
• with screw contacts, 84 units	6ES7492-1AL00-1AB0		
• with spring-loaded terminals, 1 unit	6ES7492-1BL00-0AA0		
• with crimp contacts, 1 unit	6ES7492-1CL00-0AA0		
• with crimp contacts, 84 units	6ES7492-1CL00-1AB0		
Cover film for labeling strips	6ES7492-2XX00-0AA0	SIMATIC Manual Collection update service for 1 year	6ES7998-8XC01-8YE2
Spare part		Current "Manual Collection" DVD and the three subsequent updates	

SIMATIC S7-400 advanced controller

Analog modules

SM 431 analog input module

1

Technical specifications (continued)

Article number	6ES7431-7QH00-0AB0	6ES7431-7KF00-0AB0	6ES7431-7KF10-0AB0
	SM 431, 16AE, U/I/R/PT100, 16BIT	SM 431, 8AI, U/I/THERMO, 16BIT	SM 431, 8AI, RESIST/PT100, 16BIT
Isolation			
Isolation checked with	2120 V DC between bus and L+/M; 2120 V DC between bus and analog part; 500 V DC between bus and local ground; 707 V DC between analog part and L+/M; 2120 V DC between analog part and local ground; 2120 V DC between L+/M and local ground	1500 V DC	1500 V DC
Dimensions			
Width	25 mm	25 mm	25 mm
Height	290 mm	290 mm	290 mm
Depth	210 mm	210 mm	210 mm
Weights			
Weight, approx.	500 g	650 g	650 g

Ordering data

Article No.	Article No.
SM 431 analog output modules	Cover film for labeling strips
16 inputs, non-isolated, 13 bit	Spare part
8 inputs, isolated, 13 bit	Labeling sheets for machine inscription
8 inputs, isolated, 14 bit, with linearization	DIN A4, for printing using laser printer; pack of 10
8 inputs, isolated, 14 bit	petrol
16 inputs, isolated, 16 bit, process interrupt capability	light-beige
8 inputs, isolated, 16 bit, process interrupt capability, for thermocouples (I, U)	yellow
8 inputs, isolated, 16 bit, process interrupt capability, for thermal resistors	red
Front connector	SIMATIC Manual Collection
48-pin	Electronic manuals on DVD, multilingual: LOGO!, SIMADYN, SIMATIC bus components, SIMATIC C7, SIMATIC distributed I/O, SIMATIC HMI, SIMATIC Sensors, SIMATIC NET, SIMATIC PC Based Automation, SIMATIC PCS 7, SIMATIC PG/PC, SIMATIC S7, SIMATIC Software, SIMATIC TDC
• with screw contacts, 1 unit	SIMATIC Manual Collection update service for 1 year
• with screw contacts, 84 units	Current "Manual Collection" DVD and the three subsequent updates
• with spring-loaded terminals, 1 unit	
• with crimp contacts, 1 unit	
• with crimp contacts, 84 units	
1 unit; for 6ES7431-7KF00-0AB0; spare part, included in scope of delivery	
Measuring range module for analog inputs	
1 module for 2 inputs (spare part)	

SIMATIC S7-400 advanced controller

Analog modules

SM 432 analog output module

1

Ordering data	Article No.		Article No.
SM 432 analog output module 8 outputs, isolated, 13 bit	6ES7432-1HF00-0AB0	SIMATIC Manual Collection Electronic manuals on DVD, multilingual: LOGO!, SIMADYN, SIMATIC bus components, SIMATIC C7, SIMATIC distributed I/O, SIMATIC HMI, SIMATIC Sensors, SIMATIC NET, SIMATIC PC Based Automation, SIMATIC PCS 7, SIMATIC PG/PC, SIMATIC S7, SIMATIC Software, SIMATIC TDC	6ES7998-8XC01-8YE0
Front connector 48-pin - with screw contacts, 1 unit - with screw contacts, 84 units - with spring-loaded terminals, 1 unit - with crimp contacts, 1 unit - with crimp contacts, 84 units	6ES7492-1AL00-0AA0 6ES7492-1AL00-1AB0 6ES7492-1BL00-0AA0 6ES7492-1CL00-0AA0 6ES7492-1CL00-1AB0		
Cover film for labeling strips Spare part	6ES7492-2XX00-0AA0	SIMATIC Manual Collection update service for 1 year Current "Manual Collection" DVD and the three subsequent updates	6ES7998-8XC01-8YE2
Labeling sheets for machine inscription DIN A4, for printing using laser printer; pack of 10 petrol light-beige yellow red	6ES7492-2AX00-0AA0 6ES7492-2BX00-0AA0 6ES7492-2CX00-0AA0 6ES7492-2DX00-0AA0		

SIMATIC S7-400 advanced controller

Function modules

FM 450-1 counter module

1

Technical specifications (continued)

Article number	6ES7450-1AP01-0AE0 FM 450-1, COUNTER MODULE, 2 CHANNELS
Encoder	
Connectable encoders	
• Incremental encoder (symmetrical)	Yes; With 2 pulse trains offset by 90°
• Incremental encoder (asymmetrical)	Yes
• 24 V initiator	Yes
• 24 V directional element	Yes; 1 pulse train, 1 direction level
Counter	
Number of counter inputs	2; 32 bit or +/-31 bit
Counter input 5 V	
• Type	RS 422
• Terminating resistor	220 Ω
• Differential input voltage	min. 0.5 V
• Counting frequency, max.	500 kHz
Counter input 24 V	
• Input voltage, for signal "0"	-30 to +5V
• Input voltage, for signal "1"	+11 to +30V
• Input current, for signal "1", typ.	9 mA
• Counting frequency, max.	200 kHz
• Minimum pulse width	>= 2.5 μs (200 kHz); >= 25 μs (20 kHz) (parameterizable)
Parameter	
Remark	Assigned binary addresses: 64 bytes / 64 bytes
Galvanic isolation	
Galvanic isolation digital inputs	
• between the channels and the backplane bus	Yes; Optocoupler
Galvanic isolation digital outputs	
• between the channels and the backplane bus	Yes; Optocoupler
Galvanic isolation counter	
• between the channels and the backplane bus	Yes; Optocoupler
Permissible potential difference	
between different circuits	75V DC/60V AC
Isolation	
Isolation checked with	500 V
Connection method	
required front connector	1x 48-pin
Dimensions	
Width	25 mm
Height	290 mm
Depth	210 mm
Weights	
Weight, approx.	650 g

Ordering data

Article No.

FM 450-1 counter module

with 2 channels, max. 500 kHz;
for incremental encoder

6ES7450-1AP01-0AE0

Front connectors

48-pin

- with screw contacts, 1 item
- with screw contacts, 84 items
- with spring-loaded terminals, 1 item

6ES7492-1AL00-0AA0
6ES7492-1AL00-1AB0
6ES7492-1BL00-0AA0

- with crimp contacts, 1 item
- with crimp contacts, 84 items

6ES7492-1CL00-0AA0
6ES7492-1CL00-1AB0

Front covers for CPU and function modules

6ES7492-1XL00-0AA0

Spare part

SIMATIC S7-400 advanced controller

Function modules

FM 451 positioning module

1

Technical specifications (continued)

Article number	6ES7451-3AL00-0AE0 FM 451 positioning module
Galvanic isolation	
Galvanic isolation digital inputs	
• Galvanic isolation digital inputs	Yes
Galvanic isolation digital outputs	
• Galvanic isolation digital outputs	Yes
Degree and class of protection	
Degree of protection to EN 60529	
• IP20	Yes
Ambient conditions	
Ambient temperature in operation	
• Min.	0 °C
• max.	55 °C
Storage/transport temperature	
• Min.	-40 °C
• max.	70 °C
Relative humidity	
• Humidity class F	Yes
Connection method	
required front connector	1x 48-pin
Dimensions	
Width	50 mm
Height	290 mm
Depth	210 mm
Weights	
Weight, approx.	1 300 g

Ordering data

Article No.

Signal cable

Pre-assembled for SSI absolute encoder, UL/DESINA

6FX50

2-2CC11-

Pre-assembled for TTL encoder 6FX2001-1, UL/DESINA

6FX50

2-2CD01-

Pre-assembled for TTL encoder 24 V, UL/DESINA

6FX50

2-2CD24-

Not crimped

0

Module end crimped, connector case supplied

1

Motor end crimped, connector case supplied

4

0 m

1

100 m

2

200 m

3

0 m

A

10 m

B

20 m

C

30 m

D

40 m

E

50 m

F

60 m

G

70 m

H

80 m

J

90 m

K

0 m

A

1 m

B

2 m

C

3 m

D

4 m

E

5 m

F

6 m

G

7 m

H

8 m

J

0 m

K

0.0 m

0

0.1 m

1

0.2 m

2

0.3 m

3

0.4 m

4

0.5 m

5

0.6 m

6

0.7 m

7

0.8 m

8

Ordering data

Article No.

FM 451 positioning module	6ES7451-3AL00-0AE0
for rapid traverse and creep speed drives	
Front connector	
48-pin	
• with screw contacts, 1 item	6ES7492-1AL00-0AA0
• with screw contacts, 84 items	6ES7492-1AL00-1AB0
• with spring-loaded terminals, 1 item	6ES7492-1BL00-0AA0
• with crimp contacts, 1 item	6ES7492-1CL00-0AA0
• with crimp contacts, 84 items	6ES7492-1CL00-1AB0
Front covers for CPU and function modules	6ES7492-1XL00-0AA0
Spare part	

SIMATIC S7-400 advanced controller

Function modules

FM 452 cam controller

1

Technical specifications (continued)

Article number	6ES7452-1AH00-0AE0 FM 452 electronic cam controller
Ambient conditions	
Ambient temperature in operation	
• Min.	0 °C
• max.	55 °C
Storage/transport temperature	
• Min.	-40 °C
• max.	70 °C
Relative humidity	
• Humidity class F	Yes
Connection method	
required front connector	1x 48-pin
Dimensions	
Width	25 mm
Height	290 mm
Depth	210 mm
Weights	
Weight, approx.	650 g

Ordering data

Article No.

FM 452 electronic cam controller	6ES7452-1AH00-0AE0
Front covers for CPU and function modules	6ES7492-1XL00-0AA0
Spare part	
Front connector	
48-pin	
• with screw contacts, 1 item	6ES7492-1AL00-0AA0
• with screw contacts, 84 items	6ES7492-1AL00-1AB0
• with spring-loaded terminals, 1 item	6ES7492-1BL00-0AA0
• with crimp contacts, 1 item	6ES7492-1CL00-0AA0
• with crimp contacts, 84 items	6ES7492-1CL00-1AB0
Signal cable	
Pre-assembled for HTL and TTL encoder, without Sub-D connector, UL/DESINA	6FX5002-2CA12-■ ■ ■ ■
Pre-assembled for SSI absolute encoder 6FX2001-5, without Sub-D connector, UL/DESINA	6FX5002-2CC12-■ ■ ■ ■
Length code	see FM 451, page 1/73

SIMATIC S7-400 advanced controller

Function modules

FM 453 positioning module

1

Technical specifications (continued)

Article number	6ES7453-3AH00-0AE0 FM 453 positioning module
Drive interface	
Signal input I	
• Type	Drive interface step, signal input "READY 1"
• Function	"Power section ready" where $U_i < 1\text{ V}$, $I_i = 2\text{ mA}$
Signal output I	
• Type	5 V (phys. RS 422)
• Function	Clock pulse, direction, enable, current control
• Differential output voltage, min.	2 V; $R_L = 100\text{ ohms}$
• Differential output voltage for signal "0", max.	1.1 V; $I_o = 30\text{ mA}$
• Differential output voltage, for signal "1", min.	3.7 V; $I_o = -30\text{ mA}$
• Load impedance	55 Ω
• Pulse frequency	200 kHz; 500 kHz available soon
• Cable length, max.	35 m; 35 m with symm. transmission; 10 m with asymm. transmission
Signal output II	
• Type	Contact relay
• Function	Drive disconnection for operation
• Load	1 A/50 V / 30 VA DC
Signal output III	
• Type	Analog output
• Function	Drive interface Servo: Setpoint output for drive
• Output current	-3 to +3 mA
• Cable length, max.	30 m
Galvanic isolation	
Galvanic isolation digital inputs	
• Galvanic isolation digital inputs	Yes; Optocoupler
Galvanic isolation digital outputs	
• Galvanic isolation digital outputs	Yes; Optocoupler
Degree and class of protection	
Degree of protection to EN 60529	
• IP20	Yes
Ambient conditions	
Ambient temperature in operation	
• Min.	0 °C
• max.	55 °C
Storage/transport temperature	
• Min.	-40 °C
• max.	70 °C
Relative humidity	
• Humidity class F	No
Connection method	
required front connector	1x 48-pin
Dimensions	
Width	50 mm
Height	290 mm
Depth	210 mm
Weights	
Weight, approx.	1 620 g

Ordering data

Article No.

FM 453 positioning module with 3 channels/axes	6ES7453-3AH00-0AE0
Setpoint connecting cable for 3 servo motors Length code	6FX2002-3AD01-■■■■■ See page 1/73
Front connector 48-pin • with screw contacts, 1 item • with screw contacts, 84 items • with spring-loaded terminals, 1 item • with crimp contacts, 1 item • with crimp contacts, 84 items	6ES7492-1AL00-0AA0 6ES7492-1AL00-1AB0 6ES7492-1BL00-0AA0 6ES7492-1CL00-0AA0 6ES7492-1CL00-1AB0
Front covers for CPU and function modules Spare part	6ES7492-1XL00-0AA0
Signal cable Pre-assembled for SSI absolute encoder, UL/DESINA Pre-assembled for TTL encoder 6FX2001-1, UL/DESINA Pre-assembled for TTL encoder 24 V, UL/DESINA Length code	6FX50 2-2CC11-■■■■■ 6FX50 2-2CD01-■■■■■ 6FX50 2-2CD24-■■■■■ See page 1/73

SIMATIC S7-400 advanced controller

Function modules

FM 455 controller module

Technical specifications (continued)

Article number	6ES7455-0VS00-0AE0 FM 455 C controller module	6ES7455-1VS00-0AE0 FM 455 S controller module
Basic error limit (operational limit at 25 °C)		
• Voltage, relative to input area, (+/-)	+/-0.4 to +/-0.6 %	+/-0.4 to +/-0.6 %
• Current, relative to input area, (+/-)	+/-0.4 to +/-0.6 %	+/-0.4 to +/-0.6 %
• Resistance thermometer, relative to input area, (+/-)	+/-0.4 to +/-0.6 %	+/-0.4 to +/-0.6 %
• Voltage, relative to output area, (+/-)	0.4 %	
• Current, relative to output area, (+/-)	0.5 %	
Interference voltage suppression for $f = n \times (f_1 \pm 1 \%)$, f_1 = interference frequency		
• Series mode interference (peak value of interference < rated value of input range), min.	40 dB	40 dB
• common mode voltage ($U_{SS} < 2.5 \text{ V}$), min.	70 dB	70 dB
Interrupts/diagnostics/ status information		
Substitute values connectable	Yes; Parameterizable	Yes; Parameterizable
Control technology		
Number of closed-loop controllers	16; With thermo- couples or 2-wire connection; 8 with Pt 100 or 4-wire connection	16; With thermo- couples or 2-wire connection; 8 with Pt 100 or 4-wire connection
Galvanic isolation		
Galvanic isolation controller		
• between the channels	No	No
• between the channels and the backplane bus	Yes; Optocoupler	Yes; Optocoupler
Permissible potential difference		
between inputs and MANA (UCM)	2.5 V DC	2.5 V DC
between M internally and the inputs	75V DC/60V AC	75V DC/60V AC
Isolation		
Isolation checked with	500 V DC	500 V DC
Connection method		
required front connector	2x 48-pin	2x 48-pin
Dimensions		
Width	50 mm	50 mm
Height	290 mm	290 mm
Depth	210 mm	210 mm
Weights		
Weight, approx.	1 400 g	1 400 g

Ordering data

Article No.

FM 455 C controller module
with 16 analog outputs
for 16 continuous controllers

6ES7455-0VS00-0AE0

FM 455 S controller module
with 32 digital outputs
for 16 step or pulse controllers

6ES7455-1VS00-0AE0

Front connectors

48-pin

- with screw contacts, 1 item
- with screw contacts, 84 items
- with spring-loaded terminals,
1 item
- with crimp contacts, 1 item
- with crimp contacts, 84 items

6ES7492-1AL00-0AA0

6ES7492-1AL00-1AB0

6ES7492-1BL00-0AA0

6ES7492-1CL00-0AA0

6ES7492-1CL00-1AB0

SIMATIC S7-400 advanced controller

Connection methods

Front connectors

1

Overview



- For simple and user-friendly connection of sensors and actuators
- For retaining the wiring when replacing modules
- With coding to avoid mistakes when replacing modules

Ordering data

Article No.

Front connectors

48-pin for signal modules, function modules; 1 unit

- With screw contacts
- With spring-loaded terminals
- With crimp contacts

6ES7492-1AL00-0AA0

6ES7492-1BL00-0AA0

6ES7492-1CL00-0AA0

48-pin for signal modules, function modules; 84 units per pack

- With screw contacts
- With crimp contacts

6ES7492-1AL00-1AB0

6ES7492-1CL00-1AB0

for 6ES7 431-7KF00-0AB0; spare part, included in scope of delivery; 1 piece

6ES7431-7KF00-6AA0

Crimp contacts

6XX3070

250 units

Crimping tool

6XX3071

for crimping the contacts

Front cover for front connector

6ES7492-2XL00-0AA0

6 units

Connection terminal for modules

6ES7490-1BA00-0AA0

6 units

SIMATIC Manual Collection

6ES7998-8XC01-8YE0

Electronic manuals on DVD, multilingual: LOGO!, SIMADYN, SIMATIC bus components, SIMATIC C7, SIMATIC distributed I/O, SIMATIC HMI, SIMATIC Sensors, SIMATIC NET, SIMATIC PC Based Automation, SIMATIC PCS 7, SIMATIC PG/PC, SIMATIC S7, SIMATIC Software, SIMATIC TDC

SIMATIC Manual Collection update service for 1 year

6ES7998-8XC01-8YE2

Current "Manual Collection" DVD and the three subsequent updates

SIMATIC S7-400 advanced controller

Connection methods

S7-400 front connector with single cores

1

Overview



- Can be used for modules of the SIMATIC S7-400.
- The front connectors with single wires replace the standard SIMATIC connectors:
 - 6ES7492-1AL00-0AA0
 - 6ES7492-1BL00-0AA0
 - 6ES7492-1CL00-0AA0

Technical specifications

Front connector with single cores	
Rated operating voltage	24 V DC
Max. permissible continuous current with simultaneous load on all cores	1.0 A
Permissible ambient temperature	0 to +60 °C
Core type	H05V-K or with UL style 1007/1569 CSA TR64
Number of cores	46
Core cross-section	0.5 mm², Cu
Bundle diameter in mm	approx. 17
Core color	Blue, RAL 5010
Designation of cores	Numbered 3 to 48 (adapter contact = core number)
Assembly	Screw-type or crimp contacts

Ordering data

Article No.

Front connector with single cores for 32-channel module SIMATIC S7-400, 46 x 0.5 mm²	
Core type H05V-K	
<u>Screw connection</u>	
Packaging unit: 1 unit	
Length:	
• 2.5 m	6ES7922-4BC50-0AD0
• 3.2 m	6ES7922-4BD20-0AD0
• 5 m	6ES7922-4BF00-0AD0
• Custom lengths	On request
Packaging unit: 5 units	
Length:	
• 2.5 m	6ES7922-4BC50-5AD0
• 3.2 m	6ES7922-4BD20-5AD0
• 5 m	6ES7922-4BF00-5AD0
<u>Crimp connection</u>	
Packaging unit: 1 unit	
Length:	
• 2.5 m	6ES7922-4BC50-0AE0
• 3.2 m	6ES7922-4BD20-0AE0
• 5 m	6ES7922-4BF00-0AE0
• Custom lengths	On request
Packaging unit: 5 units	
Length:	
• 2.5 m	6ES7922-4BC50-5AE0
• 3.2 m	6ES7922-4BD20-5AE0
• 5 m	6ES7922-4BF00-5AE0
Core type UL/CSA-certified	
<u>Screw-type version</u>	
Packaging unit: 1 unit	
• 3.2 m	6ES7922-4BD20-0UD0
• 5 m	6ES7922-4BF00-0UD0
• Custom lengths	On request