OFFICIAL DOCUMENT PACKAGE

Manufacturer's Manual

Amikon cover with selected official Siemens technical pages

SIEMENS S7-200 SMART

6ES7288-1CR30-0AA1

CPU CR30S RELAY CONTROLLER

Selected official pages retain the original technical tables, ratings, notes and pagination.

OFFICIAL SOURCE

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Original pages59-60,64,73-75,243-244,855-856,858-862,865

This technical extract does not replace the complete equipment and system manuals. Check the installed hardware and project before use.

Installation

4

4.1 Guidelines for installing S7-200 SMART devices

The S7-200 SMART equipment is designed to be easy to install. You can install the S7-200 SMART either on a panel or on a standard DIN rail, and you can orient the S7-200 SMART either horizontally or vertically. The small size of the S7-200 SMART allows you to make efficient use of space.

⚠ WARNING

Safety requirements for installing S7-200 SMART PLCs

S7-200 SMART PLCs are Open Type Controllers. You must install the PLC in a housing, cabinet, or electric control room. Open Type Controllers must be installed within an enclosure which protects you from hazards, including mechanical hazards, electrical shock and spread of fire. Limit entry to the housing, cabinet, or electric control room to authorized personnel.

Failure to follow these installation requirements could result in death or serious injury to personnel, and/or damage to equipment.

Always follow these requirements when installing the PLC.

The installation should provide a dry environment for the S7-200 SMART. SELV/PELV circuits are considered to provide protection against electric shock in dry locations.

The installation should provide the appropriate mechanical strength, flammability protection, and stability protection that is approved for open equipment in your particular location category according to applicable electrical and building codes.

Conductive contamination due to dust, moisture, and airborne pollution can cause operational and electrical faults in the PLC.

If you locate the PLC in an area where conductive contamination may be present, the PLC must be protected by an enclosure with appropriate protection rating. IP54 is one rating that is generally used for electronic equipment enclosures in dirty environments and may be appropriate for your application.

⚠ WARNING

Improper installation of the S7-200 SMART can result in electrical faults or unexpected operation of machinery.

Electrical faults or unexpected machine operation can result in death, severe personal injury, and/or property damage.

All instructions for installation and maintenance of a proper operating environment must be followed to ensure the equipment operates safely.

Separate the devices from heat, high voltage, and electrical noise

As a general rule for laying out the devices of your system, always separate the devices that generate high voltage and high electrical noise from the low-voltage, logic-type devices such as the PLC.

When configuring the layout of the PLC inside your panel, consider the heat-generating devices and locate the electronic-type devices in the cooler areas of your cabinet. Reducing the exposure to a high-temperature environment will extend the operating life of any electronic device.

Consider also the routing of the wiring for the devices in the panel. Avoid placing low-voltage signal wires and communications cables in the same tray with AC power wiring and high-energy, rapidly-switched DC wiring.

Provide adequate clearance for cooling and wiring

S7-200 SMART devices are designed for natural convection cooling. For proper cooling, you must provide a clearance of at least 25 mm above and below the devices. Also, allow at least 25 mm of depth between the front of the modules and the inside of the enclosure.

⚠ CAUTION

Temperature considerations

Vertical mounting reduces the maximum allowable ambient temperature by 10 degrees C. Operating outside the maximum temperature range could result in erratic process operation and could result in minor personal injury.

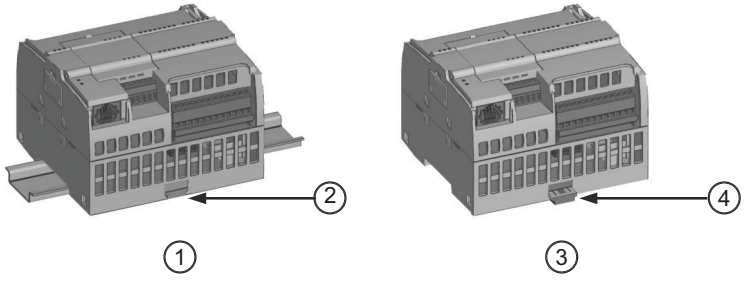
If your installation includes expansion modules, mount the CPU below them as shown in the following figure. Follow the prescribed guidelines for mounting modules to ensure proper cooling.

Note

The compact serial CPUs (CPU SR20s, CPU SR30s, CPU SR40s, and CPU SR60s) do not support expansion modules or signal boards.

4.3.2 Installing and removing the CPU

The CPU can be easily installed on a standard DIN rail or on a panel. DIN rail clips are provided to secure the device on the DIN rail. The clips also snap into an extended position to provide a screw mounting position for panel-mounting the unit.



①	DIN rail installation	③	Panel installation
②	DIN rail clip in latched position	④	Clip in extended position

Figure 4-1 Installation on a DIN rail or on a panel

Before you install or remove any electrical device, ensure that the power to that equipment has been turned off. Also, ensure that the power to any related equipment has been turned off.

⚠ WARNING

Remove power to PLC before installing or removing equipment

Attempts to install or remove the PLC or related equipment with the power applied could cause electric shock or faulty operation of equipment.

Failure to disable all power to the PLC and related equipment during installation or removal procedures could result in death or serious injury to personnel, and/or damage to equipment.

Always follow appropriate safety precautions and ensure that power to the PLC is disabled before attempting to install or remove the CPU or related equipment.

Prerequisites

Before you ground or install wiring to any electrical device, ensure that the power to that equipment has been turned off. Also, ensure that the power to any related equipment has been turned off.

Ensure that you follow all applicable electrical codes when wiring the PLC and related equipment. Install and operate all equipment according to all applicable national and local standards. Contact your local authorities to determine which codes and standards apply to your specific case.

⚠ WARNING

Attempts to install or wire the PLC or related equipment with power applied could cause electric shock or faulty operation of equipment. Failure to disable all power to the PLC and related equipment during installation or removal procedures could result in death or serious injury to personnel, and/or damage to equipment.

Always follow appropriate safety precautions and ensure that power to the PLC is disabled before attempting to install or remove the PLC or related equipment.

Always take safety into consideration as you design the grounding and wiring of your PLC system. Electronic control devices, such as the PLC, can fail and can cause unexpected operation of the equipment that is being controlled or monitored. For this reason, you should implement safeguards that are independent of the PLC to protect against possible personal injury or equipment damage.

⚠ WARNING

Control devices can fail in an unsafe condition, resulting in unexpected operation of controlled equipment. Such unexpected operations could result in death or serious injury to personnel, and/or damage to equipment.

Use an emergency stop function, electromechanical overrides, or other redundant safeguards that are independent of the PLC.

Isolation guidelines

The AC power supply boundaries and I/O boundaries to AC circuits have been designed and approved to provide safe separation between AC line voltages and low voltage circuits. These boundaries include double or reinforced insulation, or basic plus supplementary insulation, according to various standards. Components which cross these boundaries such as optical couplers, capacitors, transformers, and relays have been approved as providing safe separation. Only circuits rated for AC line voltage include safety isolation to other circuits. Isolation boundaries between 24 V DC circuits are functional only, and you should not depend on these boundaries for safety.

The sensor supply output, communications circuits, and internal logic circuits of an S7-200 SMART with included AC power supply are sourced as SELV (safety extra-low voltage) according to EN 61131-2.

To maintain the safe character of the S7-200 SMART low voltage circuits, external connections to communications ports, analog circuits, and all 24 V DC nominal power supply

and I/O circuits must be powered from approved sources that meet the requirements of SELV, PELV, Class 2, Limited Voltage, or Limited Power according to various standards.

⚠ WARNING

Safe use of power converters

Use of non-isolated or single insulation supplies to supply low voltage circuits from an AC line can result in hazardous voltages appearing on circuits that are expected to be touch safe, such as communications circuits and low voltage sensor wiring.

Such unexpected high voltages could result in death or serious injury to personnel, and/or damage to equipment.

Use only high-voltage-to-low-voltage power converters that are approved as sources of touch-safe, limited-voltage circuits.

Grounding guidelines

The best way to ground your application is to ensure that all the common and ground connections of your PLC and related equipment are grounded to a single point. This single point should be connected directly to the earth ground for your system.

All ground wires should be as short as possible and should use a large wire size, such as 2 mm^2 (14 AWG).

When locating grounds, remember to consider safety grounding requirements and the proper operation of protective interrupting devices.

Wiring guidelines

When designing the wiring for your S7-200 SMART CPU, provide a single disconnect switch that simultaneously removes power from the CPU power supply, from all input circuits, and from all output circuits. Provide over-current protection, such as a fuse or circuit breaker, to limit fault currents on supply wiring. Consider providing additional protection by placing a fuse or other current limit in each output circuit.

Install appropriate surge suppression devices for any wiring that could be subject to lightning surges.

Avoid placing low-voltage signal wires and communications cables in the same wire tray with AC wires and high-energy, rapidly switched DC wires. Always route wires in pairs, with the neutral or common wire paired with the hot or signal-carrying wire.

Use the shortest wire possible and ensure that the wire is sized properly to carry the required current.

Use wire and cable with a temperature rating 30 °C higher than the ambient temperature around the S7-200 SMART CPU (for example, a minimum of 85 °C-rated conductors for 55 °C ambient temperature). You should determine other wiring type and material requirements from the specific electrical circuit ratings and your installation environment.

Use shielded wires for optimum protection against electrical noise. Typically, grounding the shield at the S7-200 SMART CPU gives the best results. You should ground communication cable shields to S7-200 SMART CPU communication connector shells using connectors that

engage the cable shield, or by bonding the communication cable shields to a separate ground. You should ground other cable shields using clamps or copper tape around the shield to provide a high surface area connection to the grounding point.

When wiring input circuits that are powered by an external power supply, include an overcurrent protection device in that circuit. External protection is not necessary for circuits that are powered by the 24 V DC sensor supply from the S7-200 SMART CPU because the sensor supply is already current-limited.

All S7-200 SMART CPU modules have removable connectors for user wiring. To prevent loose connections, ensure that the connector is seated securely and that the wire is installed securely into the connector.

To help prevent unwanted current flows in your installation, the S7-200 SMART CPU provides isolation boundaries at certain points. When you plan the wiring for your system, you should consider these isolation boundaries. Refer to the technical specifications (Page 839) for the amount of isolation provided and the location of the isolation boundaries. Circuits rated for AC line voltage include safety isolation to other circuits. Isolation boundaries between 24 V DC circuits are functional only, and you should not depend on these boundaries for safety.

A summary of wiring rules for the S7-200 SMART CPUs, EMs, and SBs is shown below:

Table 4-11 Wiring rules for S7-200 SMART CPUs, EMs, and SBs

Wiring rules for...	CPU and EM connector	SB connector
Connectible conductor cross-sections for standard wires	2 mm^2 to 0.3 mm^2 (14 AWG to 22 AWG)	1.3 mm^2 to 0.3 mm^2 (16 AWG to 22 AWG)
Number of wires per connection	1 or combination of 2 wires up to 2 mm^2 (total)	1 or combination of 2 wires up to 1.3 mm^2 (total)
Wire strip length	6.4 mm	6.3 to 7 mm
Tightening torque* (maximum)	0.56 N-m (5 inch-pounds)	0.33 N-m (3 inch-pounds)
Tool	2.5 to 3.0 mm flathead screwdriver	2.0 to 2.5 mm flathead screwdriver

* To avoid damaging the connector, be careful that you do not over-tighten the screws.

Note

Ferrules or end sleeves on stranded conductors reduce the risk of stray strands causing short circuits. Ferrules longer than the recommended strip length should include an insulating collar to prevent shorts due to side movement of conductors. Cross-sectional area limits for bare conductors also apply to ferrules.

Guidelines for lamp loads

Lamp loads are damaging to relay contacts because of the high turn-on surge current. This surge current will nominally be 10 to 15 times the steady state current for a tungsten lamp. A replaceable interposing relay or surge limiter is recommended for lamp loads that will be switched a large number of times during the lifetime of the application.

Using Freeport mode to control the serial communications port

You can select the Freeport mode to control the serial communications port of the CPU by means of your user program. When you select Freeport mode, your program controls the operation of the communications port through the use of the receive interrupts, the transmit interrupts, the Transmit instruction, and the Receive instruction and entirely controls the communications protocol while in Freeport mode. You use SMB30 and SMB130 to select the baud rate and parity.

The CPU assigns two special memory bytes to the two physical ports:

- SMB30 to the integrated RS485 port (Port 0)
- SMB130 to the CM01 RS232/RS485 Signal Board (SB) port (Port 1)

The Freeport mode is disabled and normal communications are re-established (for example, HMI device access) when the CPU is in STOP mode.

In the simplest case, you can send a message to a printer or a display using only the Transmit (XMT) instruction. Other examples include a connection to a bar code reader, a weigh scale, and a welder. In each case, you must write your program to support the protocol that is used by the device with which the CPU communicates while in Freeport mode.

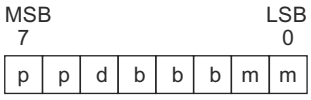
You can only use Freeport communications when the CPU is in RUN mode. Enable the Freeport mode by setting a value of 01 in the protocol select field of SMB30 (Port 0) or SMB130 (Port 1). While in Freeport mode, you cannot communicate with an HMI on the same port.

Note

The serial CR model CPUs disable Freeport mode when you connect a USB-PPI cable to the CPU. Likewise, the CPU inhibits the switch to Freeport mode if you connect a USB-PPI cable to the CRs CPUs.

Changing PPI communications to Freeport mode

SMB30 and SMB130 configure the communications ports, 0 and 1 respectively, for Freeport operation and provide selection of baud rate, parity, and number of data bits. The following figure describes the Freeport control byte. One stop bit is generated for all configurations.

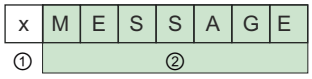


pp	Parity select		d	Data bits per character	
	00 =	No parity		0 =	8 bits per character
	01 =	Even parity		1 =	7 bits per character
	10 =	No parity			
	11 =	Odd parity			

bbb	Freeport baud rate		mm	Protocol selection	
	000 =	38400		00 =	PPI slave mode
	001 =	19200		01 =	Freeport mode
	010 =	9600		10 =	Reserved (defaults to PPI slave mode)
	011 =	4800		11 =	Reserved (defaults to PPI slave mode)
	100 =	2400			
	101 =	1200			
	110 =	115200			
	111 =	57600			

Transmit data

The Transmit instruction lets you send a buffer of one or more characters, up to a maximum of 255. The following figure shows the format of the Transmit buffer.



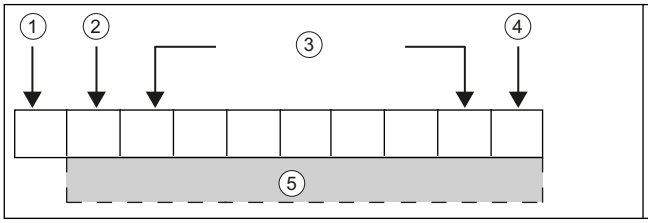
① Number of bytes to transmit
② Characters of the message

If an interrupt routine is attached to the transmit complete event, the CPU generates an interrupt (interrupt event 9 for port 0 and interrupt event 26 for port 1) after the last character of the buffer is sent.

You can transmit without using interrupts (for example, sending a message to a printer) by monitoring SM4.5 (port 0) or SM4.6 (port 1) to signal when transmission is complete.

You can use the Transmit instruction to generate a BREAK condition by setting the number of characters to zero and then executing the Transmit instruction. This generates a BREAK condition on the line for 16-bit times at the current baud rate. Transmitting a BREAK is handled in the same manner as transmitting any other message, in that a Transmit interrupt is generated when the BREAK is complete and SM4.5 or SM4.6 signals the current status of the Transmit operation.

Receive data



The Receive instruction lets you receive a buffer of one or more characters, up to a maximum of 255. The following figure shows the format of the Receive buffer.

① Number of bytes received (byte field)
② Start character
③ Message
④ End character
⑤ Characters of the message

A.2.2 CPU ST30, CPU SR30, and CPU CR30s

A.2.2.1 General specifications and features

General specifications and features of the CPU ST30, CPU SR30 and CPU CR30s

Table A-24 General specifications

Technical data	CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay	CPU CR30s AC/DC/Relay
Article number	6ES7288-1ST30-0AA1	6ES7288-1SR30-0AA1	6E88288-1CR30-0AA1
Dimensions W x H x D (mm)	110 x 100 x 81	110 x 100 x 81	110 x 100 x 81
Weight	375 g	435 g	424 g
Power dissipation	12 W	14 W	7 w
Current available (EM bus)	1400 mA max. (5 V DC)	1400 mA max. (5 V DC)	Not available
Current available (24 V DC)	300 mA max. (sensor power)	300 mA max. (sensor power)	300 mA max. (sensor power)
Digital input current consumption (24 V DC)	4 mA/ input used	4 mA/ input used	4 mA/ input used

Table A-25 CPU features

Technical data		CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay	CPU CR30s AC/DC/Relay
User memory[1]	Program	18 Kbytes	18 Kbytes	12 Kbytes
	User data (V)	16 Kbytes	16 Kbytes	8 Kbytes
	Retentive	12 Kbytes max.[1]	12 Kbytes max.[1]	2 Kbytes max.[1]
On-board digital I/O		18 inputs/12 outputs	18 inputs/12 outputs	18 inputs/12 outputs
Process image		256 bits of inputs (I) / 256 bits of outputs (Q)	256 bits of inputs (I) / 256 bits of outputs (Q)	256 bits of inputs (I) / 256 bits of outputs (Q)
Analog image		56 words of inputs (AI) / 56 words of outputs (AQ)	56 words of inputs (AI) / 56 words of outputs (AQ)	Not available
Bit memory (M)		256 bits	256 bits	256 bits
Temporary (local) memory (L)		64 bytes in the main program and 64 bytes in each subroutine and interrupt routine 60 bytes when programming in LAD or FBD (STEP 7-Micro/WIN reserves 4 bytes)	64 bytes in the main program and 64 bytes in each subroutine and interrupt routine 60 bytes when programming in LAD or FBD (STEP 7-Micro/WIN reserves 4 bytes)	64 bytes in the main program and 64 bytes in each subroutine and interrupt routine 60 bytes when programming in LAD or FBD (STEP 7-Micro/WIN reserves 4 bytes)
Sequential control relays (S)		256 bits	256 bits	256 bits
Expansion modules expansion		6	6	Not available
Signal board expansion		1 max.	1 max.	Not available

Technical data		CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay	CPU CR30s AC/DC/Relay
High-speed counters	Total	6	6	4
	Single phase	5 at 200 kHz 1 at 30 kHz	5 at 200 kHz 1 at 30 kHz	4 at 100 kHz
	A/B phase	3 at 100 kHz 1 at 20 kHz	3 at 100 kHz 1 at 20 kHz	2 at 50 kHz
Pulse outputs [2]		3 at 100 kHz	--	Not available
Pulse catch inputs		12	12	Not available
Cyclic interrupts		2 at 1 ms resolution	2 at 1 ms resolution	2 at 1 ms resolution
Edge interrupts		4 rising and 4 falling (6 and 6 with optional signal board)	4 rising and 4 falling (6 and 6 with optional signal board)	4 rising and 4 falling
Memory card		microSDHC Card (optional)	microSDHC Card (optional)	Not available
Real time clock accuracy		+/- 120 seconds/month	+/- 120 seconds/month	Not available
Real time clock retention time		7 days typ./6 days min. at 25 °C (maintenance-free Super Capacitor)	7 days typ./6 days min. at 25 °C (maintenance-free Super Capacitor)	Not available

[1] You can configure areas of V memory, M memory, C memory (current values), and portions of T memory (current values on retentive times) to be retentive, up to the specified maximum amount.

[2] The specified maximum pulse frequency is possible only for CPU models with transistor outputs. Pulse output operation is not recommended for CPU models with relay outputs.

Table A-26 PROFINET features

Description	CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay
Support Controller function for PROFINET communication	Yes	
Support I-Device function for PROFINET communication	Yes	
Maximum number of PROFINET device	8	
Device number of PROFINET device	1 to 8	
Maximum input size of each PROFINET device	128 Bytes	
Maximum output size of each PROFINET device	128 Bytes	
Maximum input size of PROFINET I-Device	128 Bytes	
Maximum output size of PROFINET I-Device	128 Bytes	
Maximum number of modules	64	
Minimum cyclic update time of PROFINET device	The minimum value of the update time also depends on the communication component set for PROFINET, on the number of PROFINET devices, and the quantity of configured user data.	
CPU address range of PROFINET process image input register	I128.0 to I1279.7	
CPU address range of PROFINET process image output register	Q128.0 to Q1279.7	
CPU address of PROFINET process image input and output register for device #1	I128.0 to I255.7 Q128.0 to Q255.7	
CPU address of PROFINET process image input and output register for device #2	I256.0 to I383.7 Q256.0 to Q383.7	

Table A-29 Communication

Technical data	CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay	CPU CR30s AC/DC/Relay
Number of ports	PROFINET (LAN): 1 Serial ports: 1 (RS485) Add-on serial ports: 1 (with optional RS232/485 signal board)	PROFINET (LAN): 1 Serial ports: 1 (RS485) Add-on serial ports: 1 (with optional RS232/485 signal board)	PROFINET (LAN): 0 Serial ports: 1 (RS485) Add-on serial ports: 0
HMI device	PROFINET (LAN): 8 connections Serial ports: 4 connections per port	PROFINET (LAN): 8 connections Serial ports: 4 connections per port	PROFINET (LAN): Not available Serial ports: 4 connections per port
Programming device (PG)	PROFINET (LAN): 1 connection Serial ports: 1 connection	PROFINET (LAN): 1 connection Serial ports: 1 connection	PROFINET (LAN): Not available Serial ports: 1 connection
CPUs (PUT/GET)	PROFINET (LAN): 8 client and 8 server connections	PROFINET (LAN): 8 client and 8 server connections	PROFINET (LAN): Not available
Open user communication	PROFINET (LAN): 8 active and 8 passive connections	PROFINET (LAN): 8 active and 8 passive connections	PROFINET (LAN): Not available
Data rates	PROFINET (LAN): 10/100 Mb/s RS485 system protocols: 9600, 19200, and 187500 b/s RS485 freeport: 1200 to 115200 b/s	PROFINET (LAN): 10/100 Mb/s RS485 system protocols: 9600, 19200, and 187500 b/s RS485 freeport: 1200 to 115200 b/s	PROFINET (LAN): Not available RS485 system protocols: 9600, 19200, and 187500 b/s RS485 freeport: 1200 to 115200 b/s
Isolation (external signal to PLC logic)	PROFINET (LAN): Transformer isolated, 1500 V AC RS485: RS485 signal to chassis ground, 500 V AC/ 707 V DC; RS485 signal to CPU logic common, 500 V AC/ 707V DC;	PROFINET (LAN): Transformer isolated, 1500 V AC RS485: RS485 signal to chassis ground, 500 V AC/ 707 V DC; RS485 signal to CPU logic common, 500 V AC/ 707V DC;	PROFINET (LAN): Not available RS485: RS485 signal to chassis ground, 500 V AC/ 707 V DC; RS485 signal to CPU logic common, 500 V AC/ 707V DC;
Cable type	PROFINET (LAN): CAT5e shielded RS485: PROFIBUS network cable	PROFINET (LAN): CAT5e shielded RS485: PROFIBUS network cable	PROFINET (LAN): Not available RS485: PROFIBUS network cable
PROFINET Communication			
PROFINET controller	Yes	Yes	No
PROFINET device	Yes	Yes	No
PROFINET controller			
Services			
PG/OP communication	Yes	Yes	No
S7 routing	Yes	Yes	No
Isochronous mode	No	No	No
Open IE communication	Yes	Yes	No
IRT	No	No	No
MRP	No	No	No
PROFIenergy	No	No	No

Technical data	CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay	CPU CR30s AC/DC/Relay
Max. number of PROFINET devices that you can connect for RT	8	8	--
Max. number of module	64	64	--
Update times	The minimum value of the update time also depends on the communication component set for PROFINET, on the number of PROFINET devices, and the quantity of configured user data.	The minimum value of the update time also depends on the communication component set for PROFINET, on the number of PROFINET devices, and the quantity of configured user data.	No
With RT			
Send clock of 1 ms	1 ms to 512 ms	1 ms to 512 ms	--

Table A-30 Power supply

Technical data		CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay		CPU CR30s AC/DC/Relay	
Voltage range		20.4 to 28.8 V DC	85 to 264 V AC	77 to 138 V DC	85 to 264 V AC	77 to 138 V DC
Line frequency		--	47 to 63 Hz	--	47 to 63 Hz	--
Input current	CPU only at max. load	64 mA at 24 V DC (without driving 300 mA sensor power) 365 mA at 24 V DC (with driving 300 mA sensor power)	92 mA at 120 V AC (with power sensor) 40 mA at 120 V AC (without power sensor) 52 mA at 240 V AC (with power sensor) 27 mA at 240 V AC (without power sensor)	122 mA at 110 VDC (with 300 mA power sensor output) 46 mA at 110 VDC (without 300 mA power sensor output)	90 mA at 120 V AC 70 mA at 240 V AC	122 mA at 110 VDC (with 300 mA power sensor output) 46 mA at 110 VDC (without 300 mA power sensor output)
	CPU with all expansion accessories at max. load	624 mA at 24 V DC	136 mA at 120 V AC 72 mA at 240 V AC	208 mA at 110 VDC (with 300 mA power sensor output)	--	208 mA at 110 VDC (with 300 mA power sensor output)
Hold up time (loss of power)		20 ms at 24 V DC	30 ms at 120 V AC 200 ms at 240 V AC	30 ms at 110 V DC	30 ms at 120 V AC 200 ms at 240 V AC	30 ms at 110 V DC
Inrush current (max.)		6A at 28.8 V DC	8.9 A at 264 V AC		16.3 A at 264 V AC	
Isolation (input power to logic)		--	1500 V AC		1500 V AC	

Technical data	CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay	CPU CR30s AC/DC/Relay
Ground leakage, AC line to functional earth	--	0.5 mA max.	0.5 mA max.
Internal fuse, not user replaceable	3 A, 250 V, slow blow	3 A, 250 V, slow blow	3 A, 250 V, slow blow

Table A-31 Sensor power

Technical data	CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay	CPU CR30s AC/DC/Relay
Voltage range	20.4 to 28.8 V DC	20.4 to 28.8 V DC	20.4 to 28.8 V DC
Output current rating (max.)	300 mA (short circuit protected)	300 mA (short circuit protected)	300 mA (short circuit protected)
Maximum ripple noise (<10 MHz)	< 1 V peak to peak	< 1 V peak to peak	< 1 V peak to peak
Isolation (CPU logic to sensor power)	Not isolated	Not isolated	Not isolated

A.2.2.2 Digital inputs and outputs

Table A-32 Digital inputs

Technical data	CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay	CPU CR30s AC/DC/Relay
Number of inputs	18	18	18
Type	Sink/Source (IEC Type 1 sink, except I0.0 to I0.3, I0.6 to I0.7)	Sink/Source (IEC Type 1 sink)	Sink/Source (IEC Type 1 sink)
Rated voltage	24 V DC at 4 mA, nominal	24 V DC at 4 mA, nominal	24 V DC at 4 mA, nominal
Continuous permissible voltage	30 V DC, max	30 V DC, max.	30 V DC, max.
Surge voltage	35 V DC for 0.5 sec.	35 V DC for 0.5 sec.	35 V DC for 0.5 sec.
Logic 1 signal (min.)	I0.0 to I0.3, I0.6 to I0.7: 4 V DC at 8 mA Other inputs: 15 V DC at 2.5 mA	15 V DC at 2.5 mA	15 V DC at 2.5 mA
Logic 0 signal (max.)	I0.0 to I0.3, I0.6 to I0.7: 1 V DC at 1 mA Other inputs: 5 V DC at 1 mA	5 V DC at 1 mA	5 V DC at 1 mA
Isolation (field side to logic)	500 V AC for 1 minute	500 V AC for 1 minute	500 V AC for 1 minute
Isolation groups	1	1	1

Technical data	CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay	CPU CR30s AC/DC/Relay
Filter times	Individually selectable on each channel (points I0.0 to I1.5): μs: 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8 ms: 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8	Individually selectable on each channel (points I0.0 to I1.5): μs: 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8 ms: 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8	Individually selectable on each channel (points I0.0 to I1.5): μs: 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8 ms: 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8
	Individually selectable on each channel (points I1.6 and greater): ms: 0, 6.4, 12.8	Individually selectable on each channel (points I1.6 and greater): ms: 0, 6.4, 12.8	Individually selectable on each channel (points I1.6 and greater): ms: 0, 6.4, 12.8
HSC clock input rates (max.) (Logic 1 Level = 15 to 26 V DC)	Single phase: 5 HSCs at 200 kHz; 1 HSC at 30 kHz A/B phase: 3 HSCs at 100 kHz; 1 HSC at 20 kHz	Single phase: 5 HSCs at 200 kHz; 1 HSCs at 30 kHz A/B phase: 3 HSCs at 100 kHz; 1 HSC at 20 kHz	Single phase: 4 HSCs at 100 kHz A/B phase: 2 HSCs at 50 kHz
Number of inputs on simultaneously	18	18	18
Cable length (max.), in meters	I0.0 to I0.3: Shielded (only): • 500 m normal (low-speed) inputs • 50 m HSC (high-speed) inputs	All inputs: • Shielded: 500 m normal inputs, 50 m HSC inputs • Unshielded: 300 m normal inputs	All inputs: • Shielded: 500 m normal inputs, 50 m HSC inputs • Unshielded: 300 m normal inputs
	I0.6 to I0.7: • Shielded (only): 500 m normal inputs		
	All other inputs: • Shielded: 500 m normal inputs • Unshielded: 300 m normal inputs[1]		

[1] When I0.0 to I0.3 are used at high-speed counter inputs, all other inputs must use shielded cable.

Table A-33 Digital outputs

Technical data	CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay	CPU CR30s AC/DC/Relay
Number of outputs	12	12	12
Type	Solid state - MOSFET (sourcing)	Relay, dry contact	Relay, dry contact
Voltage range	20.4 to 28.8 V DC	5 to 30 V DC or 5 to 250 V AC	5 to 30 V DC or 5 to 250 V AC
Logic 1 signal at max. current	20 V DC min.	--	--
Logic 0 signal with 10 KΩ load	0.1 V DC max.	--	--
Rated current per point (max.)	0.5 A	2.0 A	2.0 A

Technical data	CPU ST30 DC/DC/DC	CPU SR30 AC/DC/Relay	CPU CR30s AC/DC/Relay
Rated current per common (max.)	6 A	10.0 A	10.0 A
Lamp load	5 W	30 W DC/200 W AC	30 W DC/200 W AC
ON state resistance	0.6 Ω max.	0.2 Ω max. when new	0.2 Ω max. when new
Leakage current per point	10 µA max.	--	--
Surge current	8 A for 100 ms max.	7 A with contacts closed	7 A with contacts closed
Overload protection	No	No	No
Isolation (field side to logic)	500 V AC for 1 minute	1500 V AC for 1 minute (coil to contact) None (coil to logic)	1500 V AC for 1 minute (coil to contact) None (coil to logic)
Isolation resistance	--	100 M Ω min. when new	100 M Ω min. when new
Isolation between open contacts	--	750 V AC for 1 minute	750 V AC for 1 minute
Isolation groups	1	1	1
Inductive clamp voltage	L+ minus 48 V DC, 1 W dissipation	Not recommended	Not recommended
Switching delay (Qa.0 to Qa.3)	1.0 µs max., off to on 3.0 µs max., on to off	10 ms max.	10 ms max.
Switching delay (Qa.4 to Qb.7)	50 µs max., off to on, 200 µs max., on to off	10 ms max.	10 ms max.
Maximum relay switching frequency	--	1 Hz	1 Hz
Lifetime mechanical (no load)	--	10,000,000 open/close cycles	10,000,000 open/close cycles
Lifetime contacts at rated load	--	100,000 open/close cycles	100,000 open/close cycles
Output state in STOP mode	Last value or substitute value (default value 0)	Last value or substitute value (default value 0)	Last value or substitute value (default value 0)
Number of outputs on simultaneously	12	12	12
Cable length (max.), in meters	Shielded: 500 m Unshielded: 150 m	Shielded: 500 m Unshielded: 150 m	Shielded: 500 m Unshielded: 150 m

Table A-38 Wiring diagram for the CPU CR30s AC/DC/Relay (6ES7288-1CR30-0AA1)

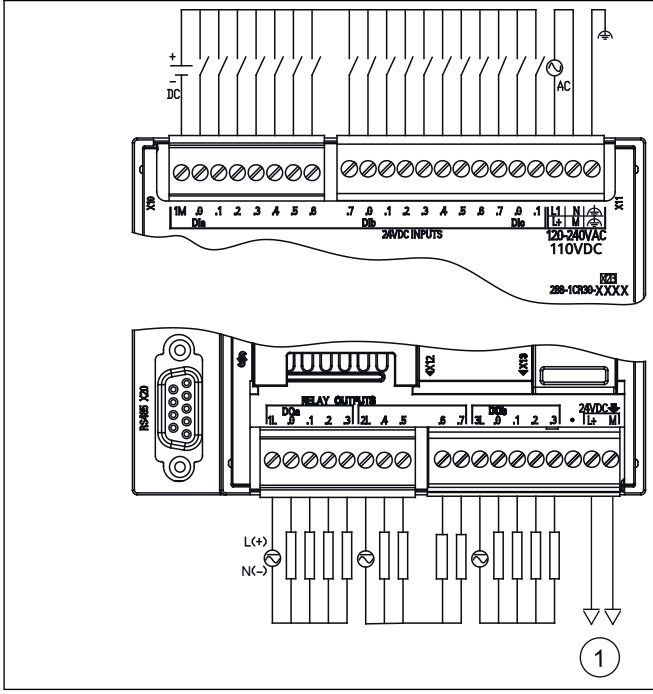
CPU CR30s AC/DC/Relay (6ES7288-1CR30-0AA1)		
	①	24 V DC Sensor Power Out

Table A-39 Connector pin locations for CPU CR30s AC/DC/Relay (6ES7288-1CR30-0AA1)

Pin	X10	X11	X12	X13
1	1M	DI a.7	1L	DQ a.6
2	DI a.0	DI b.0	DQ a.0	DQ a.7
3	DI a.1	DI b.1	DQ a.1	3L
4	DI a.2	DI b.2	DQ a.2	DQ b.0
5	DI a.3	DI b.3	DQ a.3	DQ b.1
6	DI a.4	DIb.4	2L	DQ b.2
7	DI a.5	DIb.5	DQ a.4	DQ b.3
8	DI a.6	DIb.6	DQ a.5	--
9	--	DIb.7	--	L+ / 24 V DC Out
10	--	DIc.0	--	M / 24 V DC Out
11	--	DIc.1	--	--
12	--	L1 / 120 - 240 V AC	--	--
13	--	N / 120 - 240 V AC	--	--
14	--	Functional Earth	--	--