MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Selected official pages for procurement and maintenance review

PRODUCT BRAND

Siemens

PRODUCT MODEL

6ES7214-2BD23-0XB0

CPU 224XP AC/DC/relay. Relevant section pages: 1, 2, 3, 410, 411, 412, 413, 414, 417. Adjacent model text on shared pages is outside this product reference.

OFFICIAL SOURCE

S7-200 Programmable Controller System Manual; 08/2008

Siemens original documentation and product reference

Historical 08/2008 reference for CPU 224XP AC/DC/relay, exact XB0 version. Adjacent CPU/CN variants do not establish interchangeable approvals, wiring or output types.

AMIKON PRODUCT SUPPORT

+86-18020776786 INFO@AMIKON.CN

AMIKONG.COM

Amikon Limited prepared this independent reference package. Selected manufacturer pages follow with their original content and pagination visible.

Guidelines for Installing S7-200 Devices

You can install an S7-200 either on a panel or on a standard rail, and you can orient the S7-200 either horizontally or vertically.

Warning

The SIMATIC S7-200 PLCs are Open Type Controllers. It is required that you install the S7-200 in a housing, cabinet, or electric control room. Entry to the housing, cabinet, or electric control room should be limited 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 S7-200 PLCs.

Separate the S7-200 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 S7-200.

When configuring the layout of the S7-200 inside your panel, consider the heat-generating devices and locate the electronic-type devices in the cooler areas of your cabinet. Operating any electronic device in a high-temperature environment will reduce the time to failure.

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 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 75 mm of depth.

Caution

For vertical mounting, the maximum allowable ambient temperature is reduced by 10 degrees C. Mount the S7-200 CPU below any expansion modules.

When planning your layout for the S7-200 system, allow enough clearance for the wiring and communications cable connections. For additional flexibility in configuring the layout of the S7-200 system, use the I/O expansion cable.

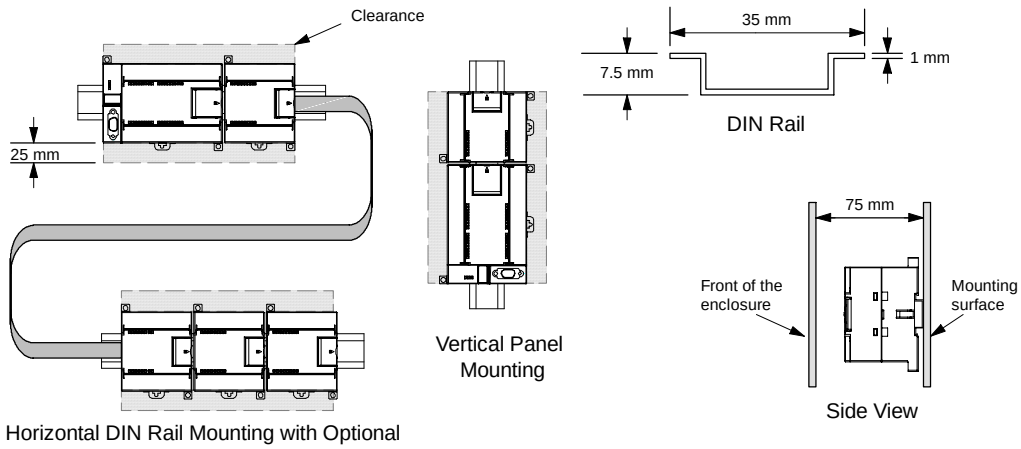


Figure 3-1 Mounting Methods, Orientation, and Clearance

Power Budget

All S7-200 CPUs have an internal power supply that provides power for the CPU, the expansion modules, and other 24 VDC user power requirements.

The S7-200 CPU provides the 5 VDC logic power needed for any expansion in your system. Pay careful attention to your system configuration to ensure that your CPU can supply the 5V power required by your selected expansion modules. If your configuration requires more power than the CPU can supply, you must remove a module or select a CPU with more power capability. Refer to Appendix A for information about the 5 VDC logic budget supplied by your S7-200 CPU and the 5 VDC power requirements of the expansion modules. Use Appendix B as a guide for determining how much power (or current) the CPU can provide for your configuration.

All S7-200 CPUs also provide a 24 VDC sensor supply that can supply 24 VDC for input points, for relay coil power on the expansion modules, or for other requirements. If your power requirements exceed the budget of the sensor supply, then you must add an external 24 VDC power supply to your system. Refer to Appendix A for the 24 VDC sensor supply power budget for your particular S7-200 CPU.

If you require an external 24 VDC power supply, ensure that the power supply is not connected in parallel with the sensor supply of the S7-200 CPU. For improved electrical noise protection, it is recommended that the commons (M) of the different power supplies be connected.



Warning

Connecting an external 24 VDC power supply in parallel with the S7-200 24 VDC sensor supply can result in a conflict between the two supplies as each seeks to establish its own preferred output voltage level.

The result of this conflict can be shortened lifetime or immediate failure of one or both power supplies, with consequent unpredictable operation of the PLC system. Unpredictable operation could result in death or serious injury to personnel, and/or damage to equipment.

The S7-200 DC sensor supply and any external power supply should provide power to different points.

Installing and Removing the S7-200 Modules

The S7-200 can be easily installed on a standard DIN rail or on a panel.

Prerequisites

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

Attempts to install or remove S7-200 or related equipment with the power applied could cause electric shock or faulty operation of equipment.

Failure to disable all power to the S7-200 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 S7-200 is disabled before attempting to install or remove S7-200 CPUs or related equipment.

Always ensure that whenever you replace or install an S7-200 device you use the correct module or equivalent device.



Warning

If you install an incorrect module, the program in the S7-200 could function unpredictably.

Failure to replace an S7-200 device with the same model, orientation, or order could result in death or serious injury to personnel, and/or damage to equipment.

Replace an S7-200 device with the same model, and be sure to orient and position it correctly.

Guidelines for Grounding and Wiring

Proper grounding and wiring of all electrical equipment is important to help ensure the optimum operation of your system and to provide additional electrical noise protection for your application and the S7-200.

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 S7-200 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 S7-200 or related equipment with power applied could cause electric shock or faulty operation of equipment. Failure to disable all power to the S7-200 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 S7-200 is disabled before attempting to install or remove the S7-200 or related equipment.

Always take safety into consideration as you design the grounding and wiring of your S7-200 system. Electronic control devices, such as the S7-200, 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 S7-200 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 S7-200.

Guidelines for Isolation

S7-200 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. Isolation boundaries which meet these requirements have been identified in S7-200 product data sheets as having 1500VAC or greater isolation. This designation is based on a routine factory test of (2Ue + 1000VAC) or equivalent according to approved methods. S7-200 safe separation boundaries have been type tested to 4242 VDC.

The sensor supply output, communications circuits, and internal logic circuits of an S7-200 with included AC power supply are sourced as SELV (safety extra-low voltage) according to EN 61131-2. These circuits become PELV (protective extra-low voltage) if the sensor supply M, or any other non-isolated M connection to the S7-200 is connected to ground. Other S7-200 M connections which may ground reference the low voltage are designated as not isolated to logic on specific product data sheets. Examples are RS485 communications port M, analog I/O M, and relay coil power M.

To maintain the SELV / PELV character of the S7-200 low voltage circuits, external connections to communications ports, analog circuits, and all 24V 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

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.

Only use high voltage to low voltage power converters that are approved as sources of touch safe, limited voltage circuits.

Guidelines for Grounding the S7-200

The best way to ground your application is to ensure that all the common and ground connections of your S7-200 and related equipment are grounded to a single point. This single point should be connected directly to the earth ground for your system.

For improved electrical noise protection, it is recommended that all DC common returns be connected to the same single-point earth ground. Connect the 24 VDC sensor supply common (M) to earth ground.

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.

Guidelines for Wiring the S7-200

When designing the wiring for your S7-200, provide a single disconnect switch that simultaneously removes power from the S7-200 CPU power supply, from all input circuits, and from all output circuits. Provide overcurrent protection, such as a fuse or circuit breaker, to limit fault currents on supply wiring. You might want to provide 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. The connector accepts wire sizes from 2 mm^2 to 0.3 mm^2 (14 AWG to 22 AWG). Use shielded wires for optimum protection against electrical noise. Typically, grounding the shield at the S7-200 gives the best results.

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 VDC sensor supply from the S7-200 because the sensor supply is already current-limited.

Most S7-200 modules have removable connectors for user wiring. (Refer to Appendix A to determine if your module has removable connectors.) To prevent loose connections, ensure that the connector is seated securely and that the wire is installed securely into the connector. To avoid damaging the connector, be careful that you do not over-tighten the screws. The maximum torque for the connector screw is 0.56 N-m (5 inch-pounds).

To help prevent unwanted current flows in your installation, the S7-200 provides isolation boundaries at certain points. When you plan the wiring for your system, you should consider these isolation boundaries. Refer to Appendix A for the amount of isolation provided and the location of the isolation boundaries. Isolation boundaries rated less than 1500 VAC must not be depended on as safety boundaries.



Tip

For a communications network, the maximum length of the communications cable is 50 m without using a repeater. The communications port on the S7-200 is non-isolated. Refer to Chapter 7 for more information.

Guidelines for Inductive Loads

You should equip inductive loads with suppression circuits to limit voltage rise when the control output turns off. Suppression circuits protect your outputs from premature failure due to high inductive switching currents. In addition, suppression circuits limit the electrical noise generated when switching inductive loads.

Tip

The effectiveness of a given suppression circuit depends on the application, and you must verify it for your particular use. Always ensure that all components used in your suppression circuit are rated for use in the application.

DC Outputs and Relays That Control DC Loads

The DC outputs have internal protection that is adequate for most applications. Since the relays can be used for either a DC or an AC load, internal protection is not provided.

Figure 3-3 shows a sample suppression circuit for a DC load. In most applications, the addition of a diode (A) across the inductive load is suitable, but if your application requires faster turn-off times, then the addition of a Zener diode (B) is recommended. Be sure to size your Zener diode properly for the amount of current in your output circuit.

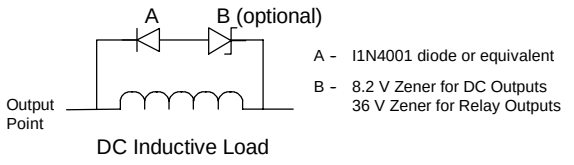


Figure 3-3 Suppression Circuit for a DC Load

AC Outputs and Relays That Control AC Loads

The AC outputs have internal protection that is adequate for most applications. Since the relays can be used for either a DC or an AC load, internal protection is not provided.

Figure 3-4 shows a sample suppression circuit for an AC load. When you use a relay or AC output to switch 115 V/230 VAC loads, place resistor/capacitor networks across the AC load as shown in this figure. You can also use a metal oxide varistor (MOV) to limit peak voltage. Ensure that the working voltage of the MOV is at least 20% greater than the nominal line voltage.

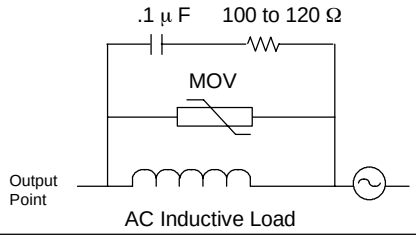


Figure 3-4 Suppression Circuit for an AC Load

Warning

When relay expansion modules are used to switch AC inductive loads, the external resistor/capacitor noise suppression circuit must be placed across the AC load to prevent unexpected machine or process operation. See Figure 3-4.

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.

SIEMENS

SIMATIC

S7-200 Programmable Controller System Manual

Preface, Contents

Product Overview 1

Getting Started 2

Installing the S7-200 3

PLC Concepts 4

Programming Concepts, Conventions and Features 5

S7-200 Instruction Set 6

Communicating over a Network 7

Hardware Troubleshooting Guide and Software Debugging Tools 8

Open Loop Motion Control with the S7-200 9

Creating a Program for the Modem Module 10

Using the USS Protocol Library to Control a MicroMaster Drive 11

Using the Modbus Protocol Library 12

Using Recipes 13

Using Data Logs 14

PID Auto-Tune and the PID Tuning Control Panel 15

Appendices

Index

This manual has the order number:
6ES7298-8FA24-8BH0

Edition 08/2008
A5E00307987-04

Safety Guidelines

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:



Danger

Danger indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



Warning

Warning indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Caution

Caution used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Caution

Caution used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

Notice

Notice indicates a potential situation which, if not avoided, may result in an undesirable result or state.

Qualified Personnel

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground, and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:



Warning

This device and its components may only be used for the applications described in the catalog or the technical descriptions, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

Trademarks

SIMATIC®, SIMATIC HMI® and SIMATIC NET® are registered trademarks of SIEMENS AG.

Some of other designations used in these documents are also registered trademarks; the owner's rights may be violated if they are used by third parties for their own purposes.

Copyright Siemens AG 2008 All rights reserved

The reproduction, transmission or use of this document or its contents is not permitted without express written authority. Offenders will be liable for damages. All rights, including rights created by patent grant or registration of a utility model or design, are reserved.

Disclaimer of Liability

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

Siemens AG
Bereich Automation and Drives
Geschaeftsgebiet Industrial Automation Systems
Postfach 4848, D- 90327 Nuernberg

© Siemens AG 2008
Technical data subject to change.

Preface

Purpose of the manual

The S7-200 series is a line of micro-programmable logic controllers (Micro PLCs) that can control a variety of automation applications. Compact design, low cost, and a powerful instruction set make the S7-200 a perfect solution for controlling small applications. The wide variety of S7-200 models and the Windows-based programming tool give you the flexibility you need to solve your automation problems.

This manual provides information about installing and programming the S7-200 Micro PLCs and is designed for engineers, programmers, installers, and electricians who have a general knowledge of programmable logic controllers.

Required Basic Knowledge

To understand this manual, it is necessary to have a general knowledge of automation and programmable logic controllers.

Scope of the Manual

This manual is valid for STEP 7–Micro/WIN, version 4.0 and the S7-200 CPU product family. For a complete list of the S7-200 products and order numbers described in this manual, see Appendix A.

Changes compared to the previous version

This manual has been revised to include two new analog expansion modules and one additional appendix.

- ❏ EM 231 Analog Input RTD, 4 Inputs
- ❏ EM 231 Analog Input Thermocouple 8 Inputs
- ❏ Appendix H, S7-200CN Products

Certification

The SIMATIC S7-200 products have the following certification:

- ❏ Underwriters Laboratories, Inc. UL 508 Listed (Industrial Control Equipment), Registration number E75310
- ❏ Canadian Standards Association: CSA C22.2 Number 142 (Process Control Equipment)
- ❏ Factory Mutual Research: Class Number 3600, Class Number 3611, FM Class I, Division 2, Groups A, B, C, & D Hazardous Locations, T4A and Class I, Zone 2, IIC, T4



Tip

The SIMATIC S7-200 series meets the CSA standard.

The cULus logo indicates that the S7-200 has been examined and certified by Underwriters Laboratories (UL) to standards UL 508 and CSA 22.2 No. 142.

CPU Specifications

Table A-2 CPU Order Numbers

Order Number	CPU Model	Power Supply (Nominal)	Digital Inputs	Digital Outputs	Comm Ports	Analog Inputs	Analog Outputs	Removable Connector
6ES7 211-0AA23-0XB0	CPU 221	24 VDC	6 x 24 VDC	4 x 24 VDC	1	No	No	No
6ES7 211-0BA23-0XB0	CPU 221	120 to 240 VAC	6 x 24 VDC	4 x Relay	1	No	No	No
6ES7 212-1AB23-0XB0	CPU 222	24 VDC	8 x 24 VDC	6 x 24 VDC	1	No	No	No
6ES7 212-1BB23-0XB0	CPU 222	120 to 240 VAC	8 x 24 VDC	6 x Relay	1	No	No	No
6ES7 214-1AD23-0XB0	CPU 224	24 VDC	14 x 24 VDC	10 x 24 VDC	1	No	No	Yes
6ES7 214-1BD23-0XB0	CPU 224	120 to 240 VAC	14 x 24 VDC	10 x Relay	1	No	No	Yes
6ES7 214-2AD23-0XB0	CPU 224XP	24 VDC	14 x 24 VDC	10 x 24 VDC	2	2	1	Yes
6ES7 214-2AS23-0XB0	CPU 224XPsi	24 VDC	14 x 24 VDC	10 x 24 VDC	2	2	1	Yes
6ES7 214-2BD23-0XB0	CPU 224XP	120 to 240 VAC	14 x 24 VDC	10 x Relay	2	2	1	Yes
6ES7 216-2AD23-0XB0	CPU 226	24 VDC	24 x 24 VDC	16 x 24 VDC	2	No	No	Yes
6ES7 216-2BD23-0XB0	CPU 226	120 to 240 VAC	24 x 24 VDC	16 x Relay	2	No	No	Yes

Table A-3 CPU General Specifications

Order Number	Module Name and Description	Dimensions (mm) (W x H x D)	Weight	Dissipation	VDC Available	
					+5 VDC	+24 VDC[1]
6ES7 211-0AA23-0XB0	CPU 221 DC/DC/DC 6 Inputs/ 4 Outputs	90 x 80 x 62	270 g	3 W	0 mA	180 mA
6ES7 211-0BA23-0XB0	CPU 221 AC/DC/Relay 6 Inputs/ 4 Relays	90 x 80 x 62	310 g	6 W	0 mA	180 mA
6ES7 212-1AB23-0XB0	CPU 222 DC/DC/DC 8 Inputs/ 6 Outputs	90 x 80 x 62	270 g	5 W	340 mA	180 mA
6ES7 212-1BB23-0XB0	CPU 222 AC/DC/Relay 8 Inputs/ 6 Relays	90 x 80 x 62	310 g	7 W	340 mA	180 mA
6ES7 214-1AD23-0XB0	CPU 224 DC/DC/DC 14 Inputs/ 10 Outputs	120.5 x 80 x 62	360 g	7 W	660 mA	280 mA
6ES7 214-1BD23-0XB0	CPU 224 AC/DC/Relay14 Inputs/ 10 Relays	120.5 x 80 x 62	410 g	10 W	660 mA	280 mA
6ES7 214-2AD23-0XB0	CPU 224XP DC/DC/DC 14 Inputs/10 Outputs	140 x 80 x 62	390 g	8 W	660 mA	280 mA
6ES7 214-2AS23-0XB0	CPU 224XPsi DC/DC/DC 14 Inputs/10 Outputs	140 x 80 x 62	390 g	8 W	660 mA	280 mA
6ES7 214-2BD23-0XB0	CPU 224XP AC/DC/Relay 14 Inputs/10 Relays	140 x 80 x 62	440 g	11 W	660 mA	280 mA
6ES7 216-2AD23-0XB0	CPU 226 DC/DC/DC 24 Inputs/16 Outputs	196 x 80 x 62	550 g	11 W	1000 mA	400 mA
6ES7 216-2BD23-0XB0	CPU 226 AC/DC/Relay 24 Inputs/16 Relays	196 x 80 x 62	660 g	17 W	1000 mA	400 mA

[1] This is the 24 VDC sensor power that is available after the internal relay coil power and 24 VDC comm port power requirements have been accounted for.

Table A-4 CPU Specifications

	CPU 221	CPU 222	CPU 224	CPU 224XP CPU 224XPsi	CPU 226
Memory					
User program size with run mode edit without run mode edit	4096 bytes 4096 bytes		8192 bytes 12288 bytes	12288 bytes 16384 bytes	16384 bytes 24576 bytes
User data	2048 bytes		8192 bytes	10240 bytes	10240 bytes
Backup (super cap) (optional battery)	50 hours typical (8 hours min. at 40°C) 200 days typical		100 hours typical (70 hours min. at 40°C) 200 days typical	100 hours typical (70 hours min. at 40°C) 200 days typical	
I/O					
Digital I/O	6 inputs/4outputs	8 inputs/6 outputs	14 inputs/10 outputs	14 inputs/10 outputs	24 inputs/16 outputs
Analog I/O	none			2 inputs/1 output	none
Digital I/O image size	256 (128 In/128 Out)				
Analog I/O image size	None	32 (16 In/16 Out)	64 (32 In/32 Out)		
Max. expansion modules allowed	None	2 modules[1]	7 modules[1]		
Max. intelligent modules allowed	None	2 modules[1]	7 modules[1]		
Pulse Catch inputs	6	8	14		24
High-Speed Counters Single phase Two phase	4 counters total 4 at 30 kHz 2 at 20 kHz		6 counters total 6 at 30 kHz 4 at 20 kHz	6 counters total 4 at 30 kHz 2 at 200 kHz 3 at 20 kHz 1 at 100 kHz	6 counters total 6 at 30 kHz 4 at 20 kHz
Pulse outputs	2 at 20 kHz (DC outputs only)			2 at 100 kHz (DC outputs only)	2 at 20 kHz (DC outputs only)
General					
Timers	256 total timers; 4 timers (1 ms); 16 timers (10 ms); 236 timers (100 ms)				
Counters	256 (backed by super capacitor or battery)				
Internal memory bits Stored on power down	256 (backed by super capacitor or battery) 112 (stored to EEPROM)				
Timed interrupts	2 with 1 ms resolution				
Edge interrupts	4 up and/or 4 down				
Analog adjustment	1 with 8 bit resolution		2 with 8 bit resolution		
Boolean execution speed	0.22 μs per instruction				
Real Time Clock	Optional cartridge		Built-in		
Cartridge options	Memory, Battery, and Real Time Clock		Memory and battery		
Communications Built-in					
Ports (Limited Power)	1 RS-485 port			2 RS-485 ports	
PPI, MPI (slave) baud rates	9.6, 19.2, 187.5 kbaud				
Freeport baud rates	1.2 kbaud to 115.2 kbaud				
Max. cable length per segment	With isolated repeater: 1000 m up to 187.5 kbaud, 1200 m up to 38.4 kbaud Without isolated repeater: 50 m				
Max. number of stations	32 per segment, 126 per network				
Max. number of masters	32				
Peer to Peer (PPI Master Mode)	Yes (NETR/NETW)				
MPI connections	4 total, 2 reserved (1 for a PG and 1 for an OP)				

[1] You must calculate your power budget to determine how much power (or current) the S7-200 CPU can provide for your configuration. If the CPU power budget is exceeded, you may not be able to connect the maximum number of modules. See Appendix A for CPU and expansion module power requirements, and Appendix B to calculate your power budget.

Table A-5 CPU Power Specifications

	DC		AC	
Input Power				
Input voltage	20.4 to 28.8 VDC		85 to 264 VAC (47 to 63 Hz)	
Input current CPU 221 CPU 222 CPU 224 CPU 224XP CPU 224XPsi CPU 226	CPU only at 24 VDC 80 mA 85 mA 110 mA 120 mA 120 mA 150 mA	Max. load at 24 VDC 450 mA 500 mA 700 mA 900 mA 900 mA 1050 mA	CPU only 30/15 mA at 120/240 VAC 40/20 mA at 120/240 VAC 60/30 mA at 120/240 VAC 70/35 mA at 120/240 VAC – 80/40 mA at 120/240 VAC	Max. load 120/60 mA at120/240 VAC 140/70 mA at 120/240 VAC 200/100 mA at 120/240VAC 220/100 mA at 120/240 VAC – 320/160 mA at 120/240VAC
Inrush current	12 A at 28.8 VDC		20 A at 264 VAC	
Isolation (field to logic)	Not isolated		1500 VAC	
Hold up time (loss of power)	10 ms at 24 VDC		20/80 ms at 120/240 VAC	
Fuse (non-replaceable)	3 A, 250 V Slow Blow		2 A, 250 V Slow Blow	
24 VDC Sensor Power				
Sensor voltage (Limited Power)	L+ minus 5 V		20.4 to 28.8 VDC	
Current limit	1.5 A peak, thermal limit non-destructive (See Table A-3 for rated load.)			
Ripple noise	Derived from input power		Less than 1 V peak-to-peak	
Isolation (sensor to logic)	Not isolated			

Table A-6 CPU Digital Input Specifications

General	24 VDC Input (CPU 221, CPU 222, CPU 224, CPU 226)		24 VDC Input (CPU 224XP, CPU 224XPsi)	
Type	Sink/Source (IEC Type 1 Sink)		Sink/Source (IEC Type 1 Sink, except I0.3 to I0.5)	
Rated voltage	24 VDC at 4 mA typical		24 VDC at 4 mA typical	
Max. continuous permissible voltage	30 VDC			
Surge voltage	35 VDC for 0.5 s			
Logic 1 (min.)	15 VDC at 2.5 mA		15 VDC at 2.5 mA (I0.0 to I0.2 and I0.6 to I1.5) 4 VDC at 8 mA (I0.3 to I0.5)	
Logic 0 (max.)	5 VDC at 1 mA		5 VDC at 1 mA (I0.0 to I0.2 and I0.6 to I1.5) 1 VDC at 1 mA (I0.3 to I0.5)	
Input delay	Selectable (0.2 to 12.8 ms)			
Connection of 2 wire proximity sensor (Bero) Permissible leakage current (max.)	1 mA			
Isolation (field to logic) Optical (galvanic) Isolation groups	Yes 500 VAC for 1 minute See wiring diagram			
High Speed Counter (HSC) input rate HSC Inputs All HSC All HSC HC4, HC5 on CPU 224XP and CPU 224XPsi only	Logic 1 Level 15 to 30 VDC 15 to 26 VDC > 4 VDC	Single phase 20 kHz 30 kHz 200 kHz	Two phase 10 kHz 20 kHz 100 kHz	
Inputs on simultaneously	All		All CPU 224XP AC/DC/RELAY only: All at 55° C with DC inputs at 26 VDC max. All at 50° C with DC inputs at 30 VDC max.	
Cable length (max.) Shielded Unshielded	500 m normal inputs, 50 m HSC inputs[1] 300 m normal inputs			

[1] Shielded twisted pair is recommended for HSC inputs.

Table A-7 CPU Digital Output Specifications

General	24 VDC Output (CPU 221, CPU 222, CPU 224, CPU 226)	24 VDC Output (CPU 224XP)	24 VDC Output (CPU 224XPsi)	Relay Output
Type	Solid State-MOSFET (Sourcing)		Solid State-MOSFET (Sinking)	Dry contact
Rated voltage	24 VDC	24 VDC	24 VDC	24 VDC or 250 VAC
Voltage range	20.4 to 28.8 VDC	5 to 28.8 VDC (Q0.0 to Q0.4) 20.4 to 28.8 VDC (Q0.5 to Q1.1)	5 to 28.8 VDC	5 to 30 VDC or 5 to 250 VAC
Surge current (max.)	8 A for 100 ms			5 A for 4 s @ 10% duty cycle
Logic 1 (min.)	20 VDC at maximum current	L+ minus 0.4 V at max. current	External Voltage Rail minus 0.4V with 10K pullup to External Voltage Rail	–
Logic 0 (max.)	0.1 VDC with 10 K Ω Load		1M + 0.4V at max. load	–
Rated current per point (max.)	0.75 A			2.0 A
Rated current per common (max.)	6 A	3.75 A	7.5 A	10 A
Leakage current (max.)	10 μ A			–
Lamp load (max.)	5 W			30 W DC; 200 W AC[2, 3]
Inductive clamp voltage	L+ minus 48 VDC, 1 W dissipation		1M +48 VDC, 1 W dissipation	–
On State resistance (contact)	0.3 Ω typical (0.6 Ω max.)			0.2 Ω (max. when new)
Isolation Optical (galvanic, field to logic) Logic to contact Resistance (logic to contact) Isolation groups	 500 VAC for 1 minute – – See wiring diagram			 – 1500 VAC for 1 minute 100 M Ω See wiring diagram
Delay (max.) Off to on (μs) On to off (μs) Switching	 2μs (Q0.0, Q0.1), 15μs (all other) 10μs (Q0.0, Q0.1), 130μs (all other) –	 0.5μs (Q0.0, Q0.1), 15μs (all other) 1.5μs (Q0.0, Q0.1), 130μs (all other) –		 – – 10 ms
Pulse frequency (max.)	20 kHz[1] (Q0.0 and Q0.1)	100 kHz[1] (Q0.0 and Q0.1)	100 kHz[1] (Q0.0 and Q0.1)	1 Hz
Lifetime mechanical cycles	–	–	–	10,000,000 (no load)
Lifetime contacts	–	–	–	100,000 (rated load)
Outputs on simultaneously	All at 55° C (horizontal), All at 45° C (vertical)			
Connecting two outputs in parallel	Yes, only outputs in same group			No
Cable length (max.) Shielded Unshielded	 500 m 150 m			

1 Depending on your pulse receiver and cable, an additional external load resistor (at least 10% of rated current) may improve pulse signal quality and noise immunity.

2 Relay lifetime with a lamp load will be reduced by 75% unless steps are taken to reduce the turn-on surge below the surge current rating of the output.

3 Lamp load wattage rating is for rated voltage. Reduce the wattage rating proportionally for voltage being switched (for example 120 VAC – 100 W).



Warning

When a mechanical contact turns on output power to the S7-200 CPU, or any digital expansion module, it sends a “1” signal to the digital outputs for approximately 50 microseconds.

This could cause unexpected machine or process operation which could result in death or serious injury to personnel, and/or damage to equipment.

You must plan for this, especially if you are using devices which respond to short duration pulses.

Table A-8 CPU 224XP and CPU 224XPsi Analog Input Specifications

General	Analog Input (CPU 224XP, CPU 224XPsi)
Number of inputs	2 points
Analog input type	Single-ended
Voltage range	±10 V
Data word format, full scale range	–32,000 to +32,000
DC Input impedance	> 100 KΩ
Maximum input voltage	30 VDC
Resolution	11 bits plus 1 sign bit
LSB value	4.88 mV
Isolation	None
Accuracy[1]	
Worst case 0° to 55° C	±2.5% of full scale
Typical 25° C	±1.0% of full scale
Repeatability	±0.05% of full scale
Analog to digital conversion time	125 msec
Conversion type	Sigma Delta
Step response	250 ms max.
Noise rejection	–20 dB @ 50 Hz typical

1 Analog input accuracy may deviate up to +/–10% of full scale when subjected to severe RF interferences such as specified in the product standard EN 61131–2:2007.

Table A-9 CPU 224XP and CPU 224XPsi Analog Output Specifications

General	Analog Output (CPU 224XP, CPU 224XPsi)
Number of outputs	1 point
Signal range	
Voltage	0 to 10 V (Limited Power)
Current	0 to 20 mA (Limited Power)
Data word format, full range	0 to +32767
Date word format, full scale	0 to +32000
Resolution, full range	12 bits
LSB value	
Voltage	2.44 mV
Current	4.88 μA
Isolation	none
Accuracy	
Worst case, 0° to 55° C	
Voltage output	± 2% of full-scale
Current output	± 3% of full-scale
Typical 25° C	
Voltage output	± 1% of full-scale
Current output	± 1% of full-scale
Settling time	
Voltage output	< 50 μS
Current output	< 100 μS
Maximum output drive	
Voltage output	≥ 5000 Ω minimum
Current output	≤ 500 Ω maximum

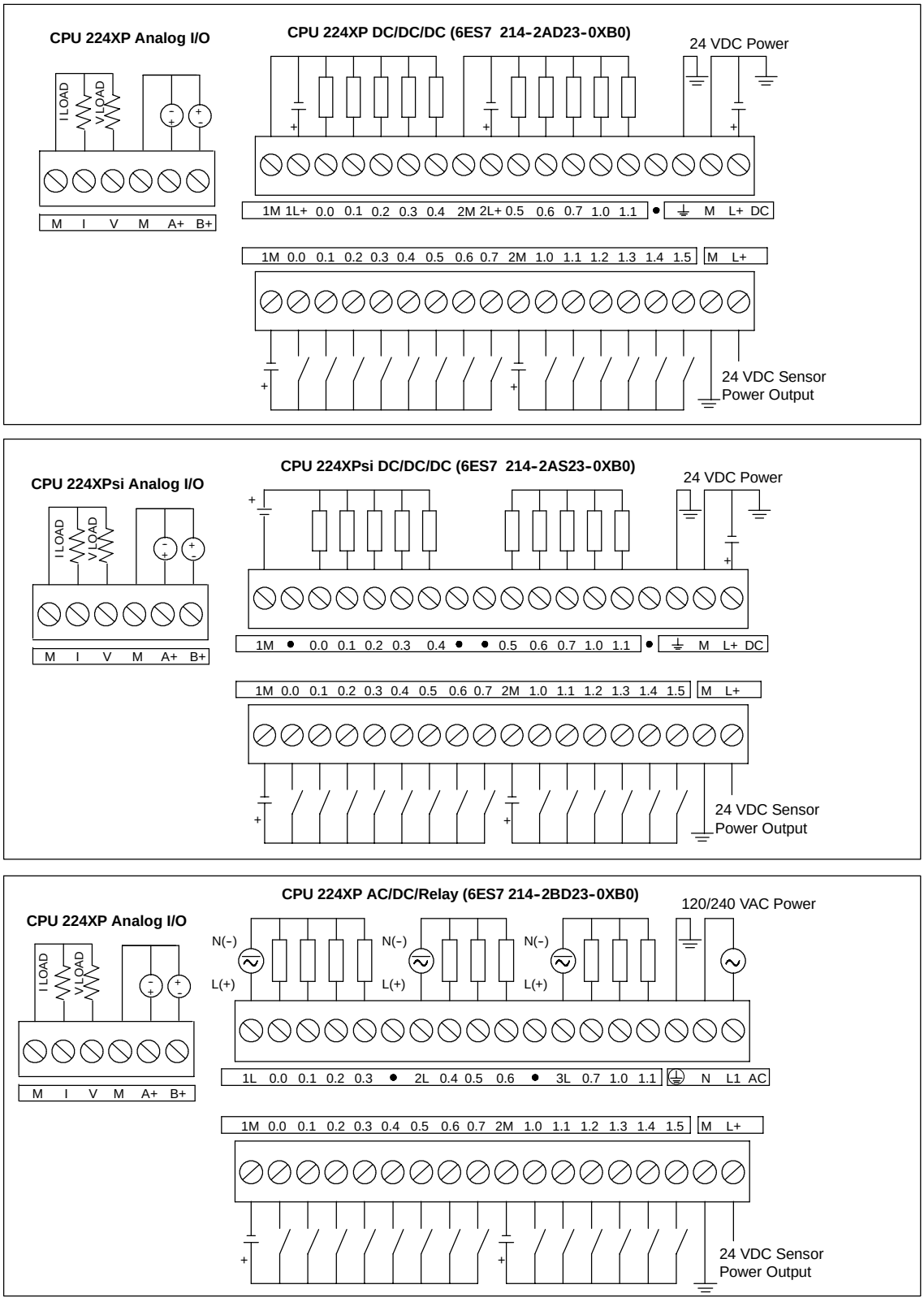


Figure A-5 CPU 224XP Wiring Diagrams