# S7-200 Micro PLCs

The S7-200 Micro PLC is the smallest member of the SIMATIC S7 family of programmable controllers. The central processing unit (CPU) is internal to the PLC. Inputs and outputs (I/O) are the system control points. Inputs monitor field devices, such as switches and sensors. Outputs control other devices, such as motors and pumps. The programming port is the connection to the programming device.
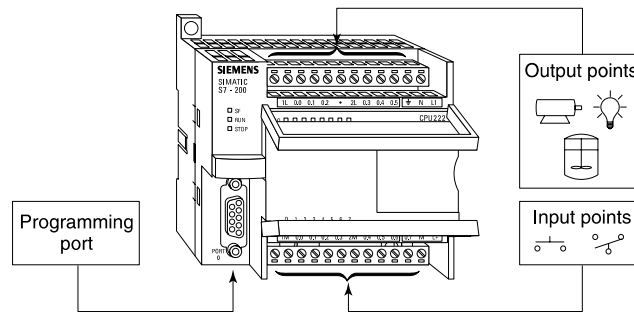

S7-200 Models

There are four S7-200 CPU types: S7-221, S7-222, S7-224, and S7-226 and three power supply configurations for each type.

Model Description	Power Supply	Input Types	Output Types
221 DC/DC/DC 221 AC/DC/Relay	20.4-28.8 VDC 85-264 VAC 47-63 Hz	6 DC Inputs 6 DC Inputs	4 DC Outputs 4 Relay Outputs
222 DC/DC/DC 222 AC/DC/Relay	20.4-28.8 VDC 85-264 VAC 47-63 Hz	8 DC Inputs 8 DC Inputs	6 DC Outputs 6 Relay Outputs
224 DC/DC/DC 224 AC/DC/Relay	20.4-28.8 VDC 85-264 VAC 47-63 Hz	14 DC Inputs 14 DC Inputs	10 DC Outputs 10 Relay Outputs
226 DC/DC/DC 226 AC/DC/Relay	20.4-28.8 VDC 85-264 VAC 47-63 Hz	24 DC Inputs 24 DC Inputs	16 DC Outputs 15 Relay Outputs

The model description indicates the type of CPU, the power supply, the type of input, and the type of output.

Power Supply   Input
CPU 222   DC/DC/DC
   Output
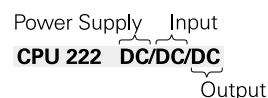
S7-200 Features

The S7-200 family includes a wide variety of CPUs and features. This variety provides a range of features to aid in designing a cost-effective automation solution. The following table provides a summary of the major features, many of which will be covered in this course.

Feature	CPU 221	CPU 222	CPU 224	CPU 226
Memory				
Program	4 kbytes	4 kbytes	8 kbytes	8 kbytes
User Data	2 kbytes	2 kbytes	5 kbytes	5 kbytes
Memory Type	EEPROM	EEPROM	EEPROM	EEPROM
Memory Cartridge	EEPROM	EEPROM	EEPROM	EEPROM
Data Backup	50 Hours	50 Hours	190 Hours	190 Hours
I/O				
Local Digital I/O	6 In/4 Out	8 In/6 Out	14 In/10 Out	24 In/16 Out
Maximun Number of Expansion Modules	None	2	7	7
Max Digital I/O with Expansion	6 In/4 Out	40 In/38 Out	94 In/74 Out	128 In/120 Out
Max Analog I/O with Expansion	None	8 In/2 Out or 0 In/4 Out	28 In/7 Out or 0 In/14 Out	28 In/7 Out or 0 In/14 Out
Instructions				
Boolean Execution Speed	0.37 μs/Inst.	0.37 μs/Inst.	0.37 μs/Inst.	0.37 ms/Inst
Internal Relays	256	256	256	256
Counters	256	256	256	256
TImers	256	256	256	256
Sequential Control Relays	256	256	256	256
For/Next Loops	Yes	Yes	Yes	Yes
Integer Math (+-*/)	Yes	Yes	Yes	Yes
Real Math (+-*/)	Yes	Yes	Yes	Yes
Enhanced Features				
Built-In High-Speed Counter	4 (30 KHz)	4 (30 KHz)	6 (30 KHz)	6 (30 KHz)
Analog Adjustments	1	1	2	2
Pulse Outputs	2 (20 KHz, DC)	2 (20 KHz, DC)	2 (20 KHz, DC)	2 (20 KHz, DC)
Communication Interrupts	1 Transmit/2 Receive	1 Transmit/2 Receive	1 Transmit/2 Receive	1 Transmit/2 Receive
Timed Interrupts	2 (1ms - 255ms)	2 (1ms - 255ms)	2 (1ms - 255ms)	2 (1ms - 255ms)
Hardware Input Interrupts	4	4	4	4
Real-Time Clock	Yes (Cartridge)	Yes (Cartridge)	Yes (Built-In)	Yes (Built-In)
Password Protection	Yes	Yes	Yes	Yes
Communications				
Number of Ports	1 (RS-485)	1 (RS-485)	1 (RS-485)	2 (RS-485)
Protocols Supported Port 0	PPI, MPI Slave, Freeport	PPI, MPI Slave, Freeport	PPI, MPI Slave, Freeport	PPI, MPI Slave, Freeport
Profibus Peer-to-Peer	(NETR/NETW)	(NETR/NETW)	(NETR/NETW)	(NETR/NETW)

Mode Switch and Analog Adjustment

When the mode switch is in the RUN position the CPU is in the run mode and executing the program. When the mode switch is in the STOP position the CPU is stopped. When the mode switch is in the TERM position the programming device can select the operating mode.

The analog adjustment is used to increase or decrease values stored in special memory. These values can be used to update the value of a timer or counter, or can be used to set limits.
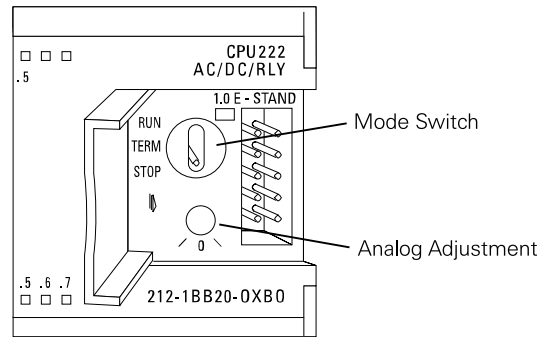

Optional Cartridge

The S7-200 supports an optional memory cartridge that provides a portable EEPROM storage for your program. The cartridge can be used to copy a program from one S7-200 PLC to a like S7-200 PLC.

In addition, two other cartridges are available. A real-time clock with battery is available for use on the S7-221 and S7-222. The battery provides up to 200 days of data retention time in the event of a power loss. The S7-224 and S7-226 have a real-time clock built in. Another cartridge is available with a battery only.
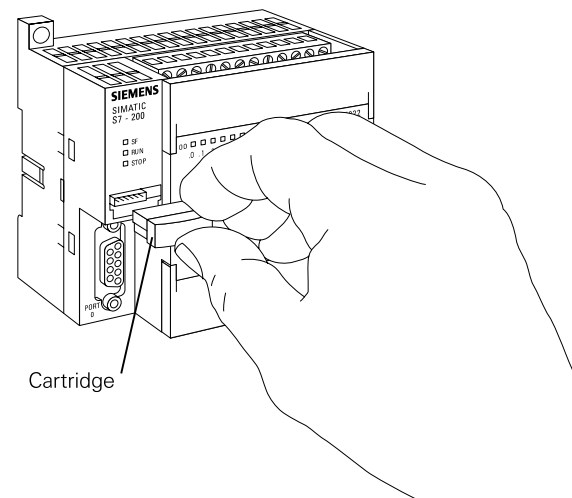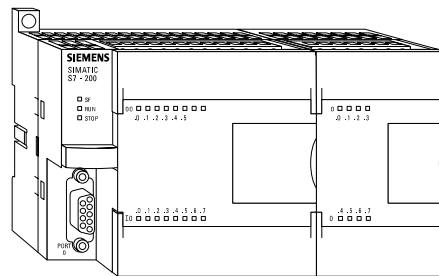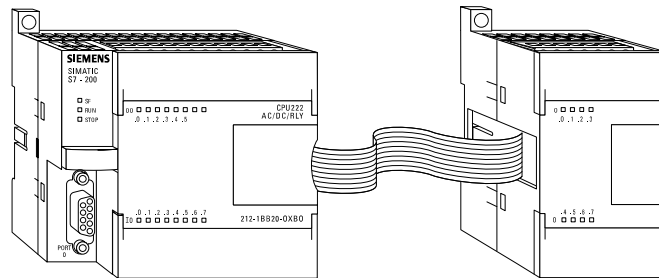
Expansion Modules

The S7-200 PLCs are expandable. Expansion modules contain additional inputs and outputs. These are connected to the base unit using a ribbon connector.
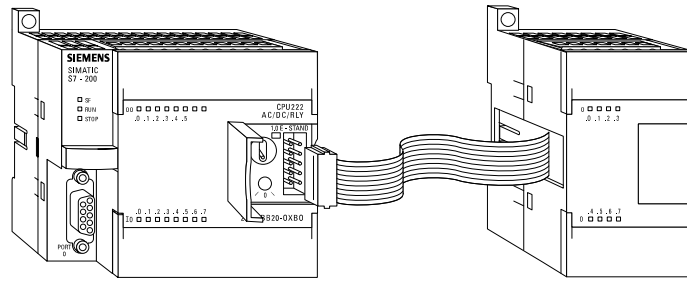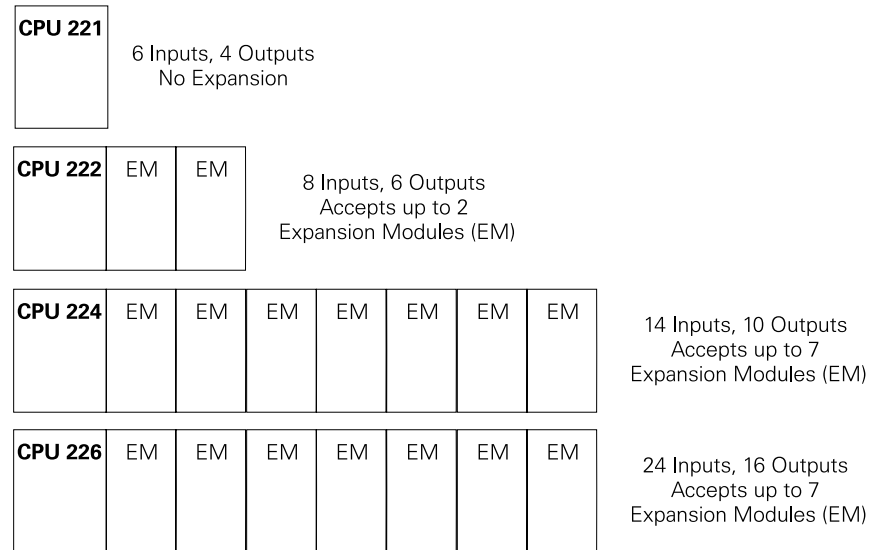
The ribbon connector is protected by a cover on the base unit. Side-by-side mounting completely encloses and protects the ribbon connector.

Available Expansion

The S7-221 comes with 6 digital inputs and 4 digital outputs. These are not expandable. The S7-222 comes with 8 digital inputs and 6 digital outputs. The 222 will accept up to 2 expansion modules. The S7-224 comes with 14 digital inputs and 10 digital outputs. The 224 will accept up to 7 expansion modules. The S7-226 comes with 24 digital inputs and 16 digital outputs. The 226 will accept up to 7 expansion modules.

CPU 221	
6 Inputs, 4 Outputs
No Expansion

| CPU 222 | EM | EM |
8 Inputs, 6 Outputs
Accepts up to 2
Expansion Modules (EM)

| CPU 224 | EM | EM | EM | EM | EM | EM | EM |
14 Inputs, 10 Outputs
Accepts up to 7
Expansion Modules (EM)

| CPU 226 | EM | EM | EM | EM | EM | EM | EM |
24 Inputs, 16 Outputs
Accepts up to 7
Expansion Modules (EM)

Status Indicators

The CPU status indicators reflect the current mode of CPU operation. If, for example, the mode switch is set to the RUN position, the green RUN indicator is lit. When the mode switch is set to the STOP position, the yellow STOP indicator is lit.
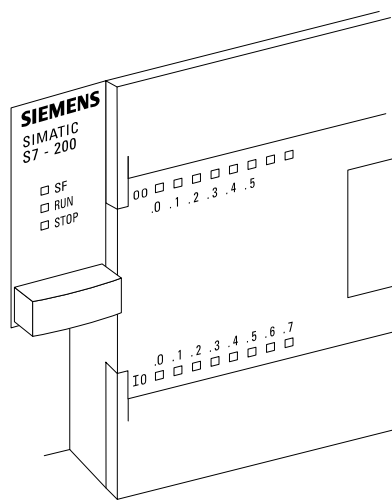
The I/O status indicators represent the On or Off status of corresponding inputs and outputs. When the CPU senses an input is on, the corresponding green indicator is lit.

Installing

The S7-200 can be installed in one of two ways. A DIN clip allows installation on a standard DIN rail. The DIN clip snaps open to allow installation and snaps closed to secure the unit on the rail. The S7-200 can also be panel mounted using installation holes located behind the access covers.
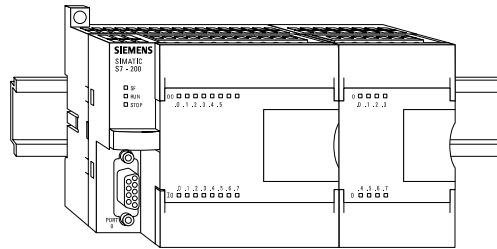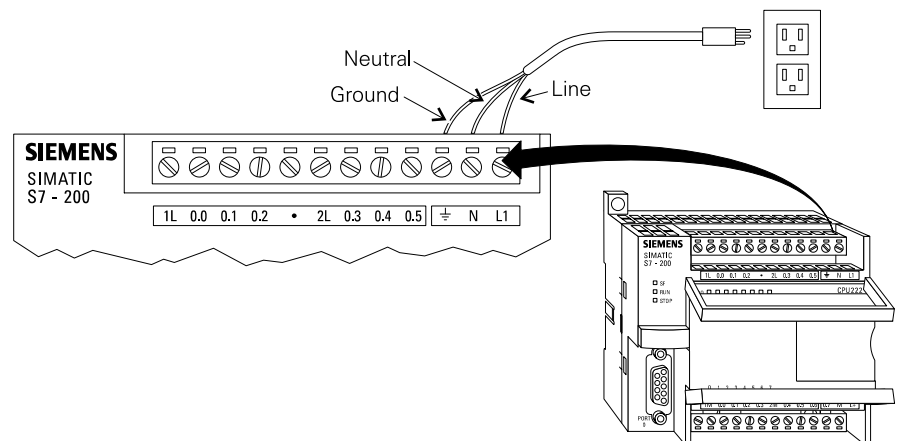

External Power Supply Sources

An S7-200 can be connected to either a 24 VDC or a 120/230 VAC power supply depending on the CPU. An S7-200 DC/DC/DC would be connected to a 24 VDC power supply. The power supply terminals are located on the far right side of the top terminal strip.
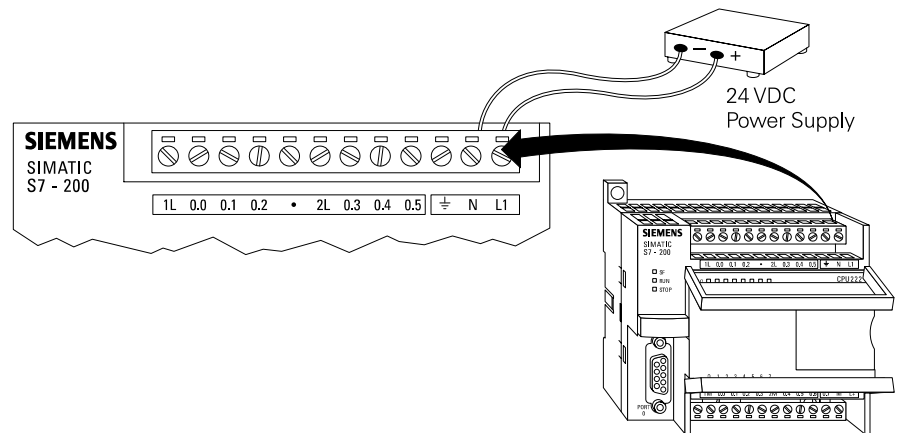
An S7-200 AC/DC/Relay would be connected to a 120 or 230 VAC power supply.

I/O Numbering

S7-200 inputs and outputs are labeled at the wiring terminations and next to the status indicators. These alphanumeric symbols identify the I/O address to which a device is connected. This address is used by the CPU to determine which input is present and which output needs to be turned on or off. **I** designates a discrete input and **Q** designates a discrete output. The first number identifies the byte, the second number identifies the bit. Input I0.0, for example, is byte 0, bit 0.

I0.0 = Byte 0, Bit 0
I0.1 = Byte 0, Bit 1
I1.0 = Byte 1, Bit 0
I1.1 = Byte 1, Bit 1

The following table identifies the input and output designations.

| I0.0	1st Input	I1.0	9th Input	Q0.0	1st Output	Q1.0	9th Output
I0.1	2nd Input	I1.1	10th Input	Q0.1	2nd Output	Q1.1	10th Output
I0.2	3rd Input	I1.2	11th Input	Q0.2	3rd Output		
I0.3	4th Input	I1.3	12th Input	Q0.3	4th Output		
I0.4	5th Input	I1.4	13th Input	Q0.4	5th Output		
I0.5	6th Input	I1.5	14th Input	Q0.5	6th Output		
I0.6	7th Input			Q0.6	7th Output		
I0.7	8th Input			Q0.7	8th Output		

Inputs

Input devices, such as switches, pushbuttons, and other sensor devices are connected to the terminal strip under the bottom cover of the PLC.


Input Devices
Connected Here

Pushbutton   Switch
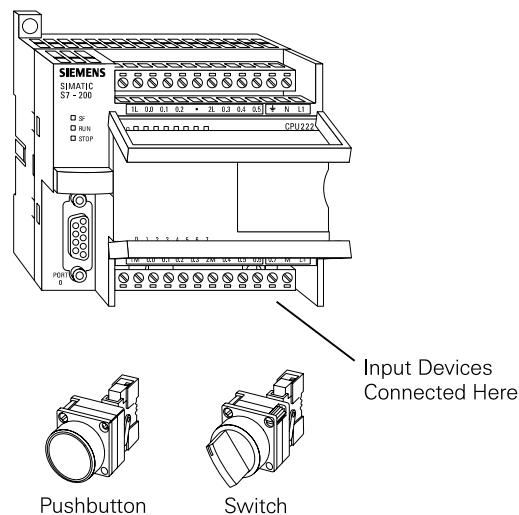
Input Simulator

A convenient method of testing a program is to wire toggle switches to the inputs. Input simulators with prewired toggle switches are available for the S7-200s. Switches are wired between the 24 VDC power supply (L+) and the inputs. For example, the switch on the far left is wired between the first input (0.0) and L+. When the switch is closed, 24 VDC is applied to the input. This is referred to as a logic 1. When the switch is open, 0 VDC is applied to the input. This is referred to as a logic 0.
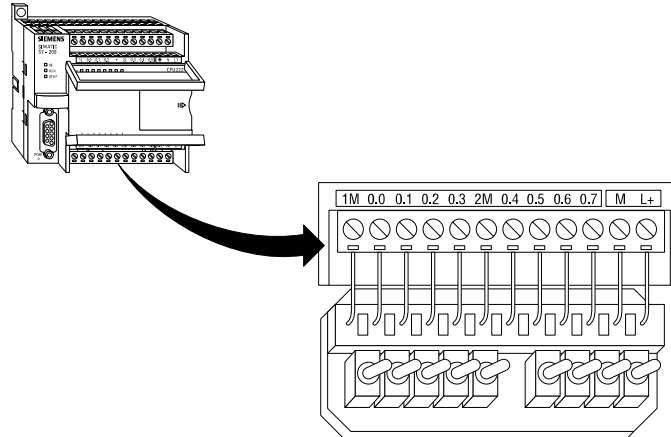

Outputs

Output devices, such as relays, are connected to the terminal strip under the top cover of the PLC. When testing a program, it is not necessary to connect output devices. The LED status indicators signal if an output is active.
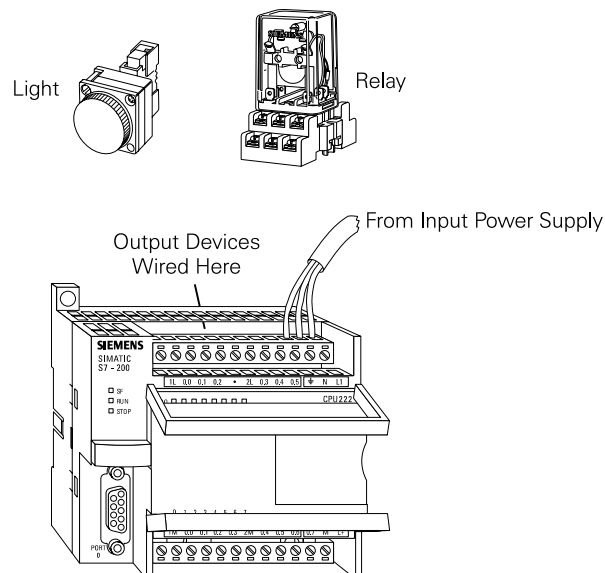
Optional Connector

An optional fan-out connector allows for field wiring connections to remain fixed when removing or replacing an S7-221 or 222. The appropriate connector slides into either the input, output, or expansion module terminals.
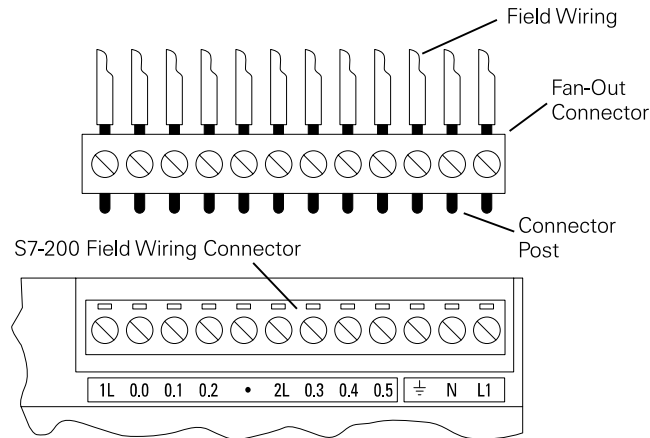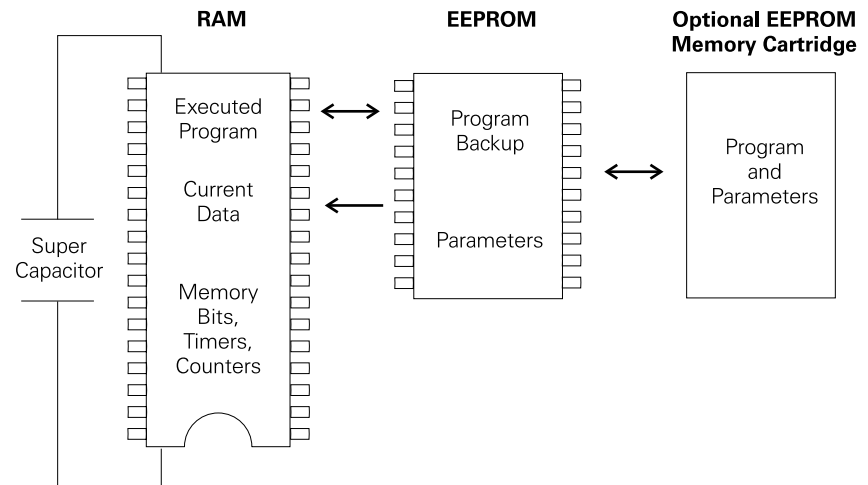

Removable Terminal Strip

The S7-224 and S7-226 do not have an optional fan-out connector. Instead, the terminal strips are removable. This allows the field wiring connections to remain fixed when removing or replacing the S7-224 and S7-226.
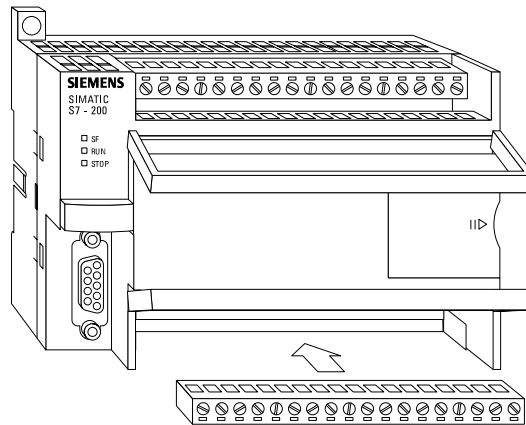
Super Capacitor

A super capacitor, so named because of its ability to maintain a charge for a long period of time, protects data stored in RAM in the event of a power loss. The RAM memory is typically backed up on the S7-221 and 222 for 50 hours, and on the S7-224 and 226 for 72 hours.

RAM	EEPROM	Optional EEPROM Memory Cartridge
Executed Program	Program Backup	Program and Parameters
Current Data		
Super Capacitor	Parameters	
Memory Bits, Timers, Counters		

Reference Manual

The **SIMATIC S7-200 Programmable Controller System Manual** provides complete information on installing and programming the S7-200 PLCs.

SIEMENS

**SIMATIC
S7-200 Programmable Controller**
System Manual

S7-200

Review 3

1. The four models of S7-200 are _____ , _____ , _____ , and _____ .

2. Which of the following is not available on an S7-221?

    a.   Mode Switch
    b.   Expansion Port
    c.   Programming Port
    d.   Status Indicators

3. An S7-222 can have a maximum of _____ expansion modules and an S7-224 can have a maximum of _____ expansion modules.

4. An S7-222 has _____ DC inputs and _____ DC outputs.

5. An S7-224 has _____ DC inputs and _____ DC outputs.

6. The fourth output of an S7-200 would be labeled _____ .

7. S7-200 can be panel mounted or installed on a _____ rail.

8. A super capacitor will maintained data stored in RAM for up _____ hours on an S7-222 and up to _____ hours on an S7-224.

Connecting External Devices

TD200

The S7-200 programming port can be used to communicate with a variety of external devices. One such device is the TD200 text display unit. The TD200 displays messages read from the S7-200, allows adjustment of designated program variables, provides the ability to force, and permits setting of the time and date. The TD200 can be connected to an external power supply or receive its power from the S7-200.
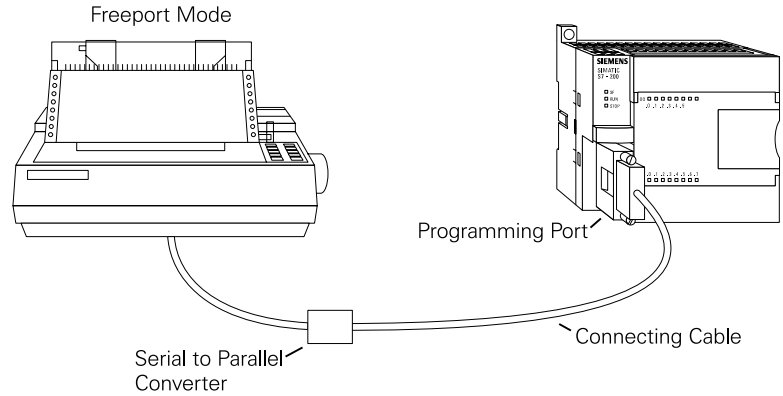

Programming Device Cable

PPI Protocol
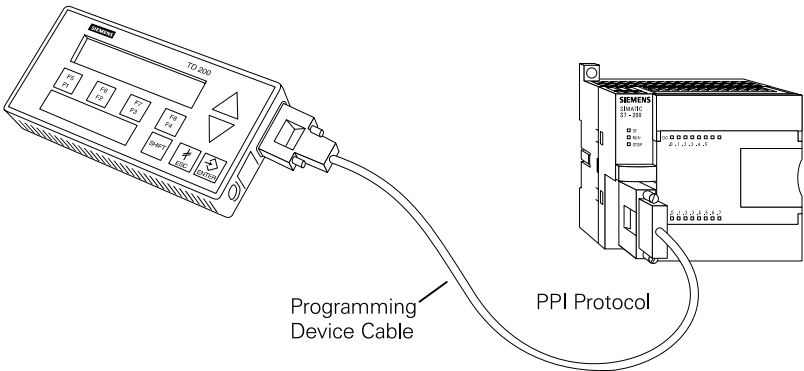
Freeport Mode

The programming port has a mode called freeport mode. Freeport mode allows connectivity to various intelligent sensing devices such as a bar code reader.

Bar-Code Decoder

Bar-Code Reader

Programming Port

RS-485 to RS-232 Interface
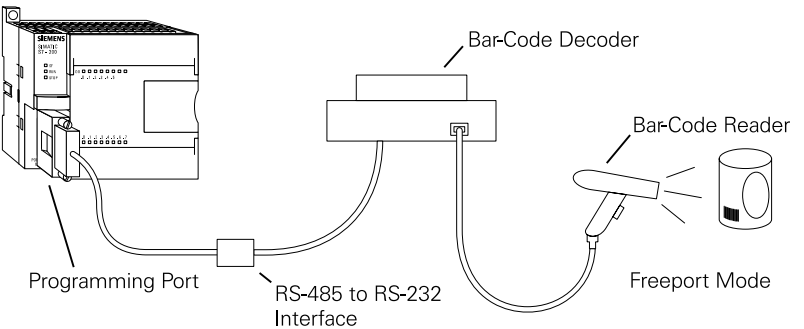
Freeport Mode

Printer

Freeport mode can also be used to connect to a non-SIMATIC printer.

Interconnection

It is possible to use one programming device to address multiple S7-200 devices on the same communication cable. A total of 31 units can be interconnected without a repeater.