

| System | | Voltage Output Range | |
|---------|-------------|----------------------|------------------|
| Decimal | Hexadecimal | ± 10 V | |
| -27649 | 93FF | | Undershoot range |
| -32512 | 8100 | -11.76 V | |
| -32513 | 80FF | See note 1 | Underflow |
| -32768 | 8000 | See note 1 | |

- ¹ In an overflow or underflow condition, analog outputs will behave according to the device configuration properties set for the analog signal module. In the "Reaction to CPU STOP" parameter, select either: Use substitute value or Keep last value.

Table A- 193 Analog output representation for current

| System | | Current Output Range | |
|---------|-------------|----------------------|-----------------|
| Decimal | Hexadecimal | 0 mA to 20 mA | |
| 32767 | 7FFF | See note 1 | Overflow |
| 32512 | 7F00 | See note 1 | |
| 32511 | 7EFF | 23.52 mA | Overshoot range |
| 27649 | 6C01 | | |
| 27648 | 6C00 | 20 mA | Rated range |
| 20736 | 5100 | 15 mA | |
| 1 | 1 | 723.4 nA | |
| 0 | 0 | 0 mA | |

- ¹ In an overflow or underflow condition, analog outputs will behave according to the device configuration properties set for the analog signal module. In the "Reaction to CPU STOP" parameter, select either: Use substitute value or Keep last value.

A.10.4 Thermocouple SBs

A.10.4.1 SB 1231 1 analog thermocouple input specifications

Note

To use this SB, your CPU firmware must be V2.0 or higher.

Table A- 194 General specifications

| Technical data | SB 1231 AI 1 x 16 bit Thermocouple |
|---------------------------|------------------------------------|
| Order number | 6ES7 231-5QA30-0XB0 |
| Dimensions W x H x D (mm) | 38 x 62 x 21 |

A.10 Analog signal boards (SBs)

| Technical data | SB 1231 AI 1 x 16 bit Thermocouple |
|------------------------------|------------------------------------|
| Weight | 35 grams |
| Power dissipation | 0.5 W |
| Current consumption (SM Bus) | 5 mA |
| Current consumption (24 VDC) | 20 mA |

Table A- 195 Analog inputs

| Technical data | SB 1231 AI 1x16 bit Thermocouple |
|---|---|
| Number of inputs | 1 |
| Type | Floating TC and mV |
| Range | See Thermocouple filter selection table (Page 803). |
| <ul style="list-style-type: none"> Nominal range (data word) Overrange/underrange (data word) Overflow/underflow (data word) | |
| Resolution | Temperature 0.1° C / 0.1° F |
| | Voltage 15 bits plus sign |
| Maximum withstand voltage | ±35 V |
| Noise rejection | 85 dB for the selected filter setting (10 Hz, 50 Hz, 60 Hz, 400 Hz) |
| Common mode rejection | > 120 dB at 120 VAC |
| Impedance | ≥ 10 M Ω |
| Accuracy | See Thermocouple selection table (Page 803). |
| Repeatability | ±0.05% FS |
| Measuring principle | Integrating |
| Module update time | See Thermocouple filter selection table (Page 803). |
| Cold junction error | ±1.5° C |
| Isolation (field side to logic) | 500 VAC |
| Cable length (meters) | 100 m to sensor max. |
| Wire resistance | 100 Ω max. |

Table A- 196 Diagnostics

| Technical data | SB 1231 AI 1 x 16 bit Thermocouple |
|---------------------------------|------------------------------------|
| Overflow/underflow ¹ | Yes |
| Wire break ² | Yes |

¹ The overflow and underflow diagnostic alarm information will be reported in the analog data values even if the alarms are disabled in the module configuration.

² When wire break alarm is disabled and an open wire condition exists in the sensor wiring, the module may report random values.

The SM 1231 Thermocouple (TC) analog signal module measures the value of voltage connected to the module inputs.

The SB 1231 Thermocouple analog signal board measures the value of voltage connected to the signal board inputs. The temperature measurement type can be either "Thermocouple" or "Voltage".

- "Thermocouple": The value will be reported in degrees multiplied by ten (for example, 25.3 degrees will be reported as decimal 253).
- "Voltage": The nominal range full scale value will be decimal 27648.

A.10.4.2 Basic operation for a thermocouple

Thermocouples are formed whenever two dissimilar metals are electrically bonded to each other. A voltage is generated that is proportional to the junction temperature. This voltage is small; one microvolt could represent many degrees. Measuring the voltage from a thermocouple, compensating for extra junctions, and then linearizing the result forms the basis of temperature measurement using thermocouples.

When you connect a thermocouple to the SM 1231 Thermocouple module, the two dissimilar metal wires are attached to the module at the module signal connector. The place where the two dissimilar wires are attached to each other forms the sensor thermocouple.

Two more thermocouples are formed where the two dissimilar wires are attached to the signal connector. The connector temperature causes a voltage that adds to the voltage from the sensor thermocouple. If this voltage is not corrected, then the temperature reported will deviate from the sensor temperature.

Cold junction compensation is used to compensate for the connector thermocouple. Thermocouple tables are based on a reference junction temperature, usually zero degrees Celsius. The cold junction compensation compensates the connector to zero degrees Celsius. The cold junction compensation restores the voltage added by the connector thermocouples. The temperature of the module is measured internally, then converted to a value to be added to the sensor conversion. The corrected sensor conversion is then linearized using the thermocouple tables.

For optimum operation of the cold junction compensation, the thermocouple module must be located in a thermally stable environment. Slow variation (less than 0.1° C/minute) in ambient module temperature is correctly compensated within the module specifications. Air movement across the module will also cause cold junction compensation errors.

If better cold junction error compensation is needed, an external iso-thermal terminal block may be used. The thermocouple module provides for use of a 0° C referenced or 50° C referenced terminal block.

Selection table for the SB 1231 thermocouple

The ranges and accuracy for the different thermocouple types supported by the SB 1231 Thermocouple signal board are shown in the table below.

Table A- 197 SB 1231 Thermocouple selection table

| Thermocouple Type | Under range minimum ¹ | Nominal range low limit | Nominal range high limit | Over range maximum ² | Normal range ³ accuracy @ 25°C | Normal range ³ accuracy -20°C to 60°C |
|-------------------|----------------------------------|-------------------------|--------------------------|---------------------------------|---|--|
| J | -210.0°C | -150.0°C | 1200.0°C | 1450.0°C | ±0.3°C | ±0.6°C |
| K | -270.0°C | -200.0°C | 1372.0°C | 1622.0°C | ±0.4°C | ±1.0°C |
| T | -270.0°C | -200.0°C | 400.0°C | 540.0°C | ±0.5°C | ±1.0°C |
| E | -270.0°C | -200.0°C | 1000.0°C | 1200.0°C | ±0.3°C | ±0.6°C |
| R & S | -50.0°C | 100.0°C | 1768.0°C | 2019.0°C | ±1.0°C | ±2.5°C |
| N | -270.0°C | 0.0°C | 1300.0°C | 1550.0°C | ±1.0°C | ±1.6°C |
| C | 0.0°C | 100.0°C | 2315.0°C | 2500.0°C | ±0.7°C | ±2.7°C |
| TXK/XK(L) | -200.0°C | -150.0°C | 800.0°C | 1050.0°C | ±0.6°C | ±1.2°C |
| Voltage | -32511 | -27648 -80mV | 27648 80mV | 32511 | ±0.05% | ±0.1% |

¹ Thermocouple values below the under-range minimum value are reported as -32768.

² Thermocouple values above the over-range minimum value are reported as 32767.

³ Internal cold junction error is ±1.5°C for all ranges. This adds to the error in this table. The signal board requires at least 30 minutes of warmup time to meet this specification.

Table A- 198 Filter selection table for the SB 1231 Thermocouple

| Rejection frequency (Hz) | Integration time (ms) | Signal board update time (seconds) |
|--------------------------|-----------------------|------------------------------------|
| 10 | 100 | 0.306 |
| 50 | 20 | 0.066 |
| 60 | 16.67 | 0.056 |
| 400 ¹ | 10 | 0.036 |

¹ To maintain module resolution and accuracy when 400 Hz rejection is selected, the integration time is 10 ms. This selection also rejects 100 Hz and 200 Hz noise.

It is recommended for measuring thermocouples that a 100 ms integration time be used. The use of smaller integration times will increase the repeatability error of the temperature readings.

Note

After power is applied to the module, it performs internal calibration for the analog to digital converter. During this time, the module reports a value of 32767 on each channel until valid data is available on that channel. Your user program may need to allow for this initialization time.

Table A- 199 Wiring diagram for the analog input thermocouple SB

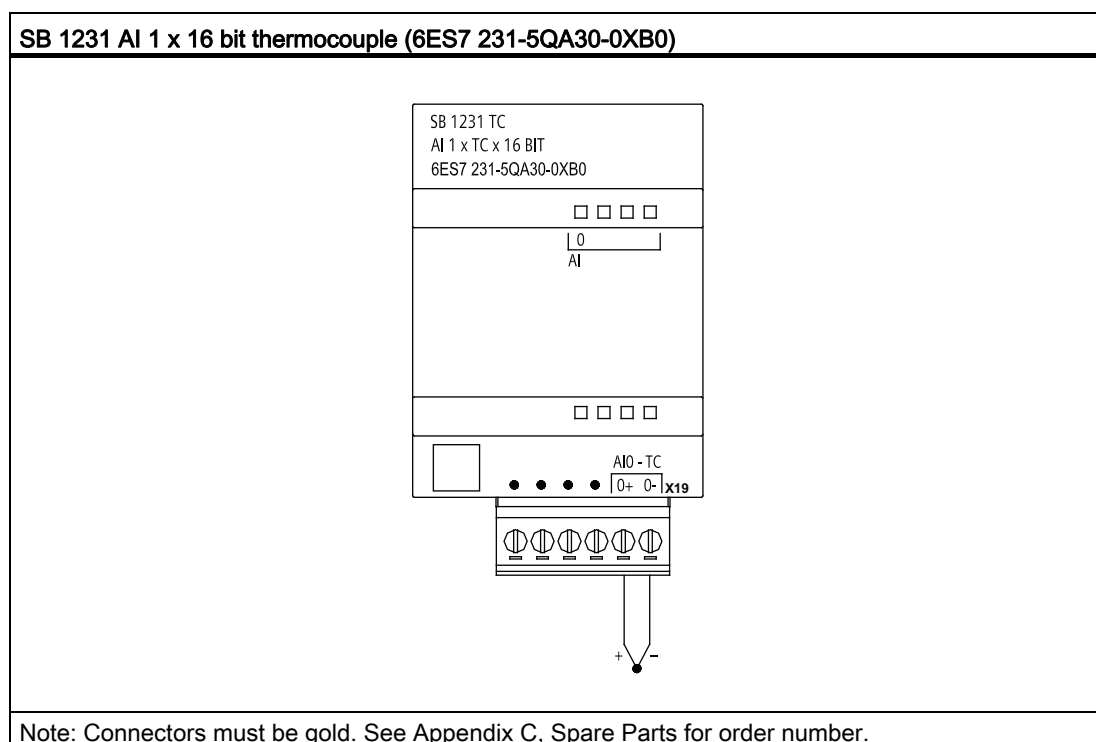


Table A- 200 Connector pin locations for SB 1231 AI 1 x 16 bit thermocouple (6ES7 231-5QA30-0XB0)

| Pin | X19 (gold) |
|-----|---------------|
| 1 | No connection |
| 2 | No connection |
| 3 | No connection |
| 4 | No connection |
| 5 | AI 0- /TC |
| 6 | AI 0+ /TC |

A.10.5 RTD SBs

A.10.5.1 SB 1231 1 analog RTD input specifications

Note

To use this SB, your CPU firmware must be V2.0 or higher.

A.10 Analog signal boards (SBs)

Table A- 201 General specifications

| Technical data | SB 1231 AI 1 x 16 bit RTD |
|------------------------------|---------------------------|
| Order number | 6ES7 231-5PA30-0XB0 |
| Dimensions W x H x D (mm) | 38 x 62 x 2 |
| Weight | 35 grams |
| Power dissipation | 0.7 W |
| Current consumption (SM Bus) | 5 mA |
| Current consumption (24 VDC) | 25 mA |

Table A- 202 Analog inputs

| Technical data | SB 1231 AI 1 x 16 bit RTD |
|---|-------------------------------------|
| Number of inputs | 1 |
| Type | Module referenced RTD and Ohms |
| Range | See Selection tables (Page 808). |
| <ul style="list-style-type: none"> Nominal range (data word) Overrange/underrange (data word) Overflow/underflow (data word) | |
| Resolution | Temperature 0.1° C/ 0.1° F |
| | Voltage 15 bits plus sign |
| Maximum withstand voltage | ±35 V |
| Noise rejection | 85 dB (10 Hz, 50 Hz, 60 Hz, 400 Hz) |
| Common mode rejection | > 120 dB |
| Impedance | ≥ 10 MΩ |
| Accuracy | See Selection tables (Page 808). |
| Repeatability | ±0.05% FS |
| Maximum sensor dissipation | 0.5 m W |
| Measuring principle | Integrating |
| Module update time | See Selection table (Page 808). |
| Isolation (field side to logic) | 500 VAC |
| Cable length (meters) | 100 m to sensor max. |
| Wire resistance | 20 Ω, 2.7 for 10 Ω RTD max. |

Table A- 203 Diagnostics

| Technical data | SB 1231 AI 1 x 16 bit RTD |
|------------------------------------|---------------------------|
| Overflow/underflow ^{1, 2} | Yes |
| Wire break ³ | Yes |

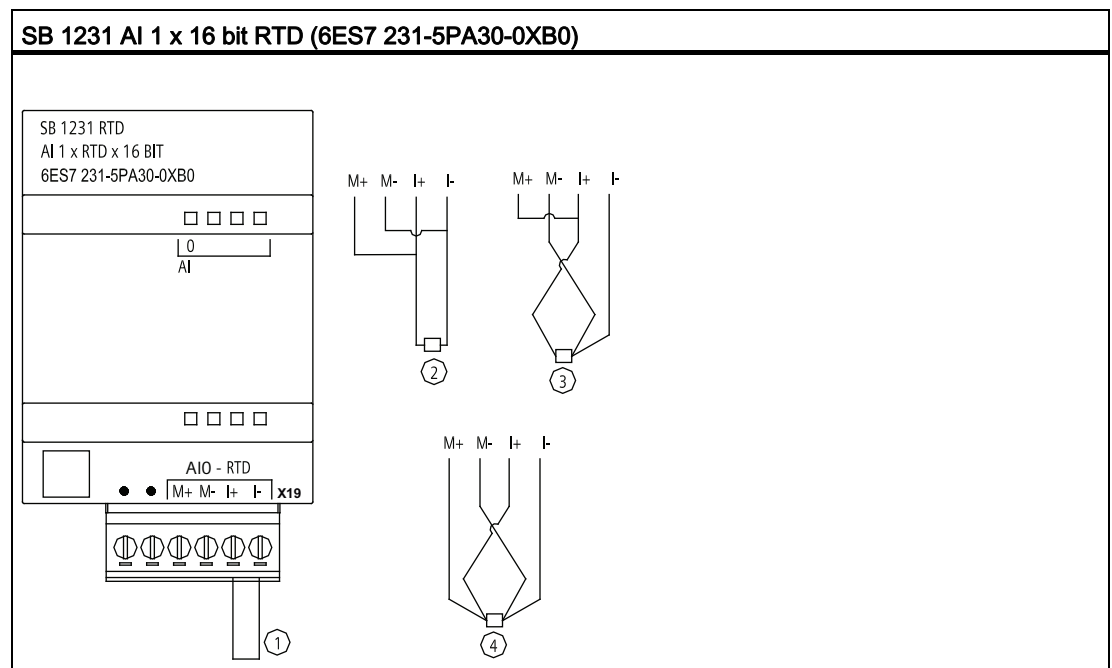
- ¹ The overflow and underflow diagnostic alarm information will be reported in the analog data values even if the alarms are disabled in the module configuration.
- ² For resistance ranges underflow detection is never enabled.
- ³ When wire break alarm is disabled and an open wire condition exists in the sensor wiring, the module may report random values.

The SM 1231 RTD analog signal board measures the value of resistance connected to the signal board inputs. The measurement type can be selected as either "Resistor" or "Thermal resistor".

- "Resistor": The nominal range full scale value will be decimal 27648.
- "Thermal resistor": The value will be reported in degrees multiplied by ten (for example, 25.3 degrees will be reported as decimal 253).

The SB 1231 RTD signal board supports measurements with 2-wire, 3-wire and 4-wire connections to the sensor resistor.

Table A- 204 Wiring diagram for SB 1231 AI 1 x 16 bit RTD



- ① Loop-back unused RTD input
- ② 2-wire RTD
- ③ 3-wire RTD
- ④ 4-wire RTD

Note: Connectors must be gold. See Appendix C, Spare Parts for order number.

Table A- 205 Connector pin locations for SB 1231 AI 1 x 16 bit RTD (6ES7 231-5PA30-0XB0)

| Pin | X19 (gold) |
|-----|---------------|
| 1 | No connection |
| 2 | No connection |
| 3 | AI 0 M+ /RTD |
| 4 | AI 0 M- /RTD |
| 5 | AI 0 I+ /RTD |
| 6 | AI 0 I- /RTD |

A.10.5.2 Selection tables for the SB 1231 RTD

Table A- 206 Ranges and accuracy for the different sensors supported by the RTD modules

| Temperature coefficient | RTD type | Under range minimum ¹ | Nominal range low limit | Nominal range high limit | Over range maximum ² | Normal range accuracy @ 25°C | Normal range accuracy -20°C to 60°C |
|---|----------|----------------------------------|-------------------------|--------------------------|---------------------------------|------------------------------|-------------------------------------|
| Pt 0.003850 ITS90 DIN EN 60751 | Pt 10 | -243.0°C | -200.0°C | 850.0°C | 1000.0°C | ±1.0°C | ±2.0°C |
| | Pt 50 | -243.0°C | -200.0°C | 850.0°C | 1000.0°C | ±0.5°C | ±1.0°C |
| | Pt 100 | | | | | | |
| | Pt 200 | | | | | | |
| | Pt 500 | | | | | | |
| | Pt 1000 | | | | | | |
| Pt 0.003902 Pt 0.003916 Pt 0.003920 | Pt 100 | -243.0°C | -200.0°C | 850.0°C | 1000.0°C | ± 0.5°C | ±1.0°C |
| | Pt 200 | | | | | | |
| | Pt 500 | | | | | | |
| | Pt 1000 | | | | | | |
| Pt 0.003910 | Pt 10 | -273.2°C | -240.0°C | 1100.0°C | 1295°C | ±1.0°C | ±2.0°C |
| | Pt 50 | -273.2°C | -240.0°C | 1100.0°C | 1295°C | ±0.8°C | ±1.6°C |
| | Pt 100 | | | | | | |
| | Pt 500 | | | | | | |
| Ni 0.006720 Ni 0.006180 | Ni 100 | -105.0°C | -60.0°C | 250.0°C | 295.0°C | ±0.5°C | ±1.0°C |
| | Ni 120 | | | | | | |
| | Ni 200 | | | | | | |
| | Ni 500 | | | | | | |
| | Ni 1000 | | | | | | |

| Temperature coefficient | RTD type | Under range minimum ¹ | Nominal range low limit | Nominal range high limit | Over range maximum ² | Normal range accuracy @ 25°C | Normal range accuracy -20°C to 60°C |
|-------------------------|------------|----------------------------------|-------------------------|--------------------------|---------------------------------|------------------------------|-------------------------------------|
| LG-Ni 0.005000 | LG-Ni 1000 | -105.0°C | -60.0°C | 250.0°C | 295.0°C | ±0.5°C | ±1.0°C |
| Ni 0.006170 | Ni 100 | -105.0°C | -60.0°C | 180.0°C | 212.4°C | ±0.5°C | ±1.0°C |
| Cu 0.004270 | Cu 10 | -240.0°C | -200.0°C | 260.0°C | 312.0°C | ±1.0°C | ±2.0°C |
| Cu 0.004260 | Cu 10 | -60.0°C | -50.0°C | 200.0°C | 240.0°C | ±1.0°C | ±2.0°C |
| | Cu 50 | -60.0°C | -50.0°C | 200.0°C | 240.0°C | ±0.6°C | ±1.2°C |
| | Cu 100 | | | | | | |
| Cu 0.004280 | Cu 10 | -240.0°C | -200.0°C | 200.0°C | 240.0°C | ±1.0°C | ±2.0°C |
| | Cu 50 | -240.0°C | -200.0°C | 200.0°C | 240.0°C | ±0.7°C | ±1.4°C |
| | Cu 100 | | | | | | |

¹ RTD values below the under-range minimum value are reported as -32768.

² RTD values above the over-range maximum value are reported as +32768.

Table A- 207 Resistance

| Range | Under range minimum | Nominal range low limit | Nominal range high limit | Over range maximum ¹ | Normal range accuracy @ 25°C | Normal range accuracy -20°C to 60°C |
|-------|---------------------|-------------------------|--------------------------|---------------------------------|------------------------------|-------------------------------------|
| 150 Ω | n/a | 0 (0 Ω) | 27648 (150 Ω) | 176.383 Ω | ±0.05% | ±0.1% |
| 300 Ω | n/a | 0 (0 Ω) | 27648 (300 Ω) | 352.767 Ω | ±0.05% | ±0.1% |
| 600 Ω | n/a | 0 (0 Ω) | 27648 (600 Ω) | 705.534 Ω | ±0.05% | ±0.1% |

¹ Resistance values above the over-range maximum value are reported as 32767.

Note

The module reports 32767 on any activated channel with no sensor connected. If open wire detection is also enabled, the module flashes the appropriate red LEDs.

When 500 Ω and 1000 Ω RTD ranges are used with other lower value resistors, the error may increase to two times the specified error.

Best accuracy will be achieved for the 10 Ω RTD ranges if 4 wire connections are used.

The resistance of the connection wires in 2 wire mode will cause an error in the sensor reading and therefore accuracy is not guaranteed.

Table A- 208 Noise reduction and update times for the RTD modules

| Rejection frequency selection | Integration time | 4-/2-wire, 1-channel module Update time (seconds) | 3-wire, 1-channel module Update time (seconds) |
|-------------------------------|--------------------|--|---|
| 400 Hz (2.5 ms) | 10 ms ¹ | 0.036 | 0.071 |
| 60 Hz (16.6 ms) | 16.67 ms | 0.056 | 0.111 |
| 50 Hz (20 ms) | 20 ms | 0.066 | 1.086 |
| 10 Hz (100 ms) | 100 ms | 0.306 | 0.611 |

¹ To maintain module resolution and accuracy when the 400 Hz filter is selected, the integration time is 10 ms. This selection also rejects 100 Hz and 200 Hz noise.

| |
|---|
| NOTICE |
| After power is applied, the module performs internal calibration for the analog-to-digital converter. During this time the module reports a value of 32767 on each channel until valid data is available on that channel. Your user program may need to allow for this initialization time. Because the configuration of the module can vary the length of the initialization time, you should verify the behavior of the module in your configuration. If required, you can include logic in your user program to accommodate the initialization time of the module. |

A.11 BB 1297 Battery Board

BB 1297 Battery Board

The S7-1200 BB 1297 Battery Board is designed for long-term backup of the Real-time clock. It is pluggable in the signal board slot of the S7-1200 CPU (firmware 3.0 and later versions). You must add the BB 1297 to the device configuration and download the hardware configuration to the CPU for the BB to be functional.

The battery (type CR1025) is not included with the BB 1297 and must be purchased by the user.

Note

The BB 1297 is mechanically designed to fit the CPUs with the firmware 3.0 and later versions.

Do not use the BB 1297 with earlier version CPUs as the BB 1297 connector will not plug into the CPU.

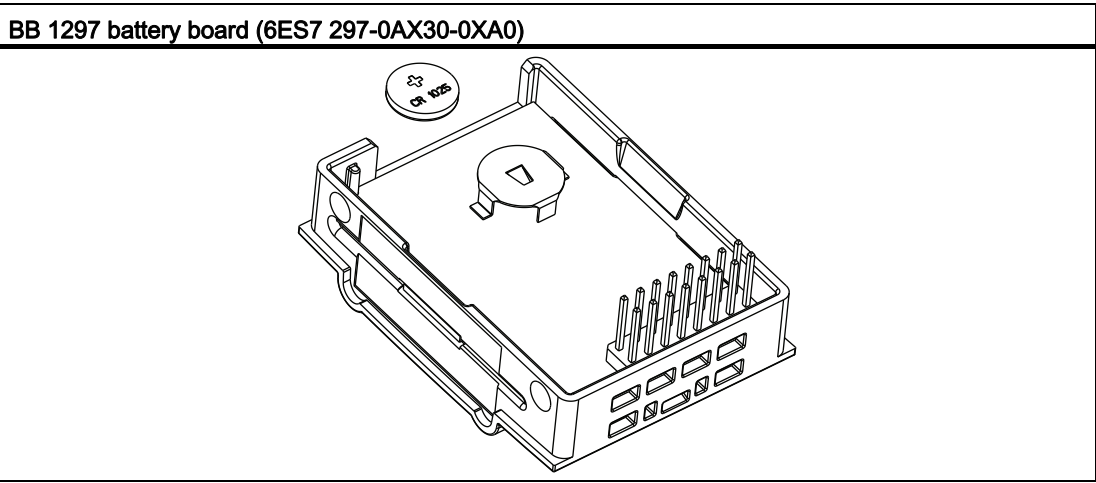
Table A- 209 General specifications

| Technical data | BB 1297 Battery Board |
|------------------------------|-----------------------|
| Order number | 6ES7 297-0AX30-0XA0 |
| Dimensions W x H x D (mm) | 38 x 62 x 21 |
| Weight | 28 grams |
| Power dissipation | 0.5 W |
| Current consumption (SM Bus) | 11 mA |
| Current consumption (24 VDC) | none |

| Battery (not included) | BB 1297 Battery Board |
|------------------------|--|
| Hold up time | Approximately 1 year |
| Battery type | CR1025 Refer to Installing or replacing a battery in the BB 1297 battery board (Page 51) |
| Nominal voltage | 3 V |
| Nominal capacity | At least 30 mAH |

| Diagnostics | BB 1297 Battery Board |
|------------------------|---|
| Critical battery level | < 2.5 V |
| Battery diagnostic | Low voltage indicator: <ul style="list-style-type: none"> • Low battery voltage causes the CPU MAINT LED to illuminate with the amber light continuously ON. • Diagnostic Buffer Event: 16#06:2700 "Submodule maintenance demanded: At least one battery exhausted (BATTF)" |
| Battery status | Battery status bit provided 0 = Battery OK 1 = Battery low |
| Battery status update | Battery status is updated at power up and then once per day while CPU is in RUN mode. |

Table A- 210 Insertion diagram for the BB 1297 battery board



A.12 Communication interfaces

A.12.1 PROFIBUS

A.12.1.1 CM 1242-5

Table A- 211 Technical specifications of the CM 1242-5

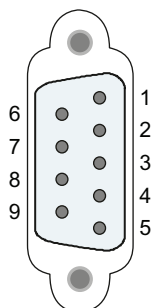
| Technical specifications | |
|--|--|
| Order number | 6GK7 242-5DX30-0XE0 |
| Interfaces | |
| Connection to PROFIBUS | 9-pin D-sub female connector |
| Maximum current consumption on the PROFIBUS interface when network components are connected (for example optical network components) | 15 mA at 5 V (only for bus termination) *) |
| Permitted ambient conditions | |
| Ambient temperature | |
| • during storage | • -40 °C to 70 °C |
| • during transportation | • -40 °C to 70 °C |
| • during operation with a vertical installation (DIN rail horizontal) | • 0 °C to 55 °C |
| • during operation with a horizontal installation (DIN rail vertical) | • 0 °C to 45 °C |
| Relative humidity at 25 °C during operation, without condensation, maximum | 95 % |

| Technical specifications | |
|--|--|
| Degree of protection | IP20 |
| Power supply, current consumption and power loss | |
| Type of power supply | DC |
| Power supply from the backplane bus | 5 V |
| Current consumption (typical) | 150 mA |
| Effective power loss (typical) | 0.75 W |
| Dimensions and weights | |
| <ul style="list-style-type: none"> Width Height Depth | <ul style="list-style-type: none"> 30 mm 100 mm 75 mm |
| Weight | |
| <ul style="list-style-type: none"> Net weight Weight including packaging | <ul style="list-style-type: none"> 115 g 152 g |

*)The current load of an external consumer connected between VP (pin 6) and DGND (pin 5) must not exceed a maximum of 15 mA (short-circuit proof) for bus termination.

PROFIBUS interface

Table A- 212 Pinout of the D-sub socket



| Pin | Description | Pin | Description |
|-----|--|---------|------------------------|
| 1 | - not used - | 6 | P5V2: +5V power supply |
| 2 | - not used - | 7 | - not used - |
| 3 | RxD/TxD-P: Data line B | 8 | RxD/TxD-N: Data line A |
| 4 | RTS | 9 | - not used - |
| 5 | M5V2: Data reference potential (ground DGND) | Housing | Ground connector |

A.12.1.2 CM 1243-5

Table A- 213 Technical specifications of the CM 1243-5

| Technical specifications | |
|--|--|
| Order number | 6GK7 243-5DX30-0XE0 |
| Interfaces | |
| Connection to PROFIBUS | 9-pin D-sub female connector |
| Maximum current consumption on the PROFIBUS interface when network components are connected (for example optical network components) | 15 mA at 5 V (only for bus termination) *) |

| | |
|---|--|
| Technical specifications | |
| Permitted ambient conditions | |
| Ambient temperature | |
| <ul style="list-style-type: none"> during storage during transportation during operation with a vertical installation (DIN rail horizontal) during operation with a horizontal installation (DIN rail vertical) | <ul style="list-style-type: none"> -40 °C to 70 °C -40 °C to 70 °C 0 °C to 55 °C 0 °C to 45 °C |
| Relative humidity at 25 °C during operation, without condensation, maximum | 95 % |
| Degree of protection | IP20 |
| Power supply, current consumption and power loss | |
| Type of power supply | DC |
| Power supply / external | 24 V |
| <ul style="list-style-type: none"> minimum maximum | <ul style="list-style-type: none"> 19.2 V 28.8 V |
| Current consumption (typical) | |
| <ul style="list-style-type: none"> from 24 V DC from the S7-1200 backplane bus | <ul style="list-style-type: none"> 100 mA 0 mA |
| Effective power loss (typical) | |
| <ul style="list-style-type: none"> from 24 V DC from the S7-1200 backplane bus | <ul style="list-style-type: none"> 2.4 W 0 W |
| Power supply 24 VDC / external | |
| <ul style="list-style-type: none"> Min. cable cross section Max. cable cross section Tightening torque of the screw terminals | <ul style="list-style-type: none"> min.: 0.14 mm² (AWG 25) max.: 1.5 mm² (AWG 15) 0.45 Nm (4 lb-in) |
| Dimensions and weights | |
| <ul style="list-style-type: none"> Width Height Depth | <ul style="list-style-type: none"> 30 mm 100 mm 75 mm |
| Weight | |
| <ul style="list-style-type: none"> Net weight Weight including packaging | <ul style="list-style-type: none"> 134 g 171 g |

*)The current load of an external consumer connected between VP (pin 6) and DGND (pin 5) must not exceed a maximum of 15 mA (short-circuit proof) for bus termination.

Note

The CM 1243-5 (PROFIBUS master module) must receive power from the 24 VDC sensor supply of the CPU.

PROFIBUS interface

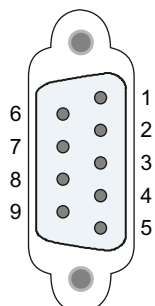


Table A- 214 Pinout of the D-sub socket

| Pin | Description | Pin | Description |
|-----|--------------------------------------|---------|--|
| 1 | - not used - | 6 | VP: Power supply +5 V only for bus terminating resistors; not for supplying external devices |
| 2 | - not used - | 7 | - not used - |
| 3 | RxD/TxD-P: Data line B | 8 | RxD/TxD-N: Data line A |
| 4 | CNTR-P: RTS | 9 | - not used - |
| 5 | DGND: Ground for data signals and VP | Housing | Ground connector |

PROFIBUS cable

NOTICE

Contacting the shield of the PROFIBUS cable

The shield of the PROFIBUS cable must be contacted.

To do this, strip the insulation from the end of the PROFIBUS cable and connect the shield to functional earth.

A.12.2 GPRS

Note

The GPRS CP is not approved for Maritime applications

The following module does not have Maritime approval:

- CP 1242-7 GPRS module

Note

To use these modules, your CPU firmware must be V2.0 or higher.

A.12.2.1 CP 1242-7

Table A- 215 Technical specifications of the CP 1242-7

| Technical specifications | |
|--------------------------|---------------------|
| Order number | 6GK7 242-7KX30-0XE0 |
| Wireless interface | |

| | |
|--|---|
| Technical specifications | |
| Antenna connector | SMA socket |
| Nominal impedance | 50 ohms |
| Wireless connection | |
| Maximum transmit power | <ul style="list-style-type: none"> • GSM 850, class 4: +33 dBm ±2dBm • GSM 900, class 4: +33 dBm ±2dBm • GSM 1800, class 1: +30 dBm ±2dBm • GSM 1900, class 1: +30 dBm ±2dBm |
| GPRS | Multislot class 10 device class B coding scheme 1...4 (GMSK) |
| SMS | Mode outgoing: MO service: point-to-point |
| Permitted ambient conditions | |
| Ambient temperature | <ul style="list-style-type: none"> • during storage • during transportation • during operation with a vertical installation (DIN rail horizontal) • during operation with a horizontal installation (DIN rail vertical) |
| | <ul style="list-style-type: none"> • -40 °C to 70 °C • -40 °C to 70 °C • 0 °C to 55 °C • 0 °C to 45 °C |
| Relative humidity at 25 °C during operation, without condensation, maximum | 95 % |
| Degree of protection | IP20 |
| Power supply, current consumption and power loss | |
| Type of power supply | DC |
| Power supply / external | 24 V |
| <ul style="list-style-type: none"> • minimum • maximum | <ul style="list-style-type: none"> • 19.2 V • 28.8 V |
| Current consumption (typical) | <ul style="list-style-type: none"> • from 24 V DC • from the S7-1200 backplane bus |
| | <ul style="list-style-type: none"> • 100 mA • 0 mA |
| Effective power loss (typical) | <ul style="list-style-type: none"> • from 24 V DC • from the S7-1200 backplane bus |
| | <ul style="list-style-type: none"> • 2.4 W • 0 W |
| 24 V DC power supply | <ul style="list-style-type: none"> • Min. cable cross section • Max. cable cross section • Tightening torque of the screw terminals |
| | <ul style="list-style-type: none"> • min.: 0.14 mm² (AWG 25) • max.: 1.5 mm² (AWG 15) • 0.45 Nm (4 lb-in) |

| Technical specifications | |
|---------------------------------|----------|
| Dimensions and weights | |
| • Width | • 30 mm |
| • Height | • 100 mm |
| • Depth | • 75 mm |
| Weight | |
| • Net weight | • 133 g |
| • Weight including packaging | • 170 g |

Technical specifications of the ANT794-4MR GSM/GPRS antenna

| ANT794-4MR | |
|------------------------------|--|
| Order number | 6NH9860-1AA00 |
| Mobile wireless networks | GSM/GPRS |
| Frequency ranges | <ul style="list-style-type: none"> • 824 to 960 MHz (GSM 850, 900) • 1 710 to 1 880 MHz (GSM 1 800) • 1 900 to 2 200 MHz (GSM / UMTS) |
| Characteristics | omnidirectional |
| Antenna gain | 0 dB |
| Impedance | 50 ohms |
| Standing wave ratio (SWR) | < 2,0 |
| Max. power | 20 W |
| Polarity | linear vertical |
| Connector | SMA |
| Length of antenna cable | 5 m |
| External material | Hard PVC, UV-resistant |
| Degree of protection | IP20 |
| Permitted ambient conditions | <ul style="list-style-type: none"> • Operating temperature • Transport/storage temperature • Relative humidity |
| | <ul style="list-style-type: none"> • -40 °C through +70 °C • -40 °C through +70 °C • 100 % |
| External material | Hard PVC, UV-resistant |
| Construction | Antenna with 5 m fixed cable and SMA male connector |
| Dimensions (D x H) in mm | 25 x 193 |
| Weight | <ul style="list-style-type: none"> • Antenna incl. cable • Fittings |
| | <ul style="list-style-type: none"> • 310 g • 54 g |
| Installation | With supplied bracket |

Technical specifications of the flat antenna ANT794-3M

| | | |
|------------------------------|---|----------------------|
| Order number | 6NH9870-1AA00 | |
| Mobile wireless networks | GSM 900 | GSM 1800/1900 |
| Frequency ranges | 890 - 960 MHz | 1710 - 1990 MHz |
| Standing wave ratio (VSWR) | ≤ 2:1 | ≤ 1,5:1 |
| Return loss (Tx) | ≈ 10 dB | ≈ 14 dB |
| Antenna gain | 0 dB | |
| Impedance | 50 ohms | |
| Max. power | 10 W | |
| Antenna cable | HF cable RG 174 (fixed) with SMA male connector | |
| Cable length | 1.2 m | |
| Degree of protection | IP64 | |
| Permitted temperature range | -40°C to +75°C | |
| Flammability | UL 94 V2 | |
| External material | ABS Polylac PA-765, light gray (RAL 7035) | |
| Dimensions (W x L x H) in mm | 70.5 x 146.5 x 20.5 | |
| Weight | 130 g | |

A.12.3 CM 1243-2 AS-i Master

A.12.3.1 Technical data for the AS-i master CM 1243-2

Table A- 216 Technical data for the AS-i master CM 1243-2

| | |
|---------------------------------|--|
| Technical data | |
| Order number | 3RK7243-2AA30-0XB0 |
| Interfaces | |
| Maximum current consumption | |
| From the SIMATIC backplane bus | Max. 250 mA, SIMATIC backplane bus supply voltage 5 V DC |
| From the AS-i cable | Max. 100 mA |
| Pin assignment | See section Electrical connections of the AS-i master CM 1243-2 (Page 819) |
| Conductor cross-section | 0.2 mm ² (AWG 24) ... 3.3 mm ² (AWG 12) |
| ASI connector tightening torque | 0.56 Nm |

| | |
|---|------------------|
| Technical data | |
| Permissible ambient conditions | |
| Ambient temperature | |
| During storage | -40 °C ... 70 °C |
| During transport | -40 °C ... 70 °C |
| During the operating phase, with vertical installation (horizontal standard mounting rail) | 0 °C ... 55 °C |
| During the operating phase, with horizontal installation (vertical standard mounting rail) | 0 °C ... 45 °C |
| Relative humidity at 25 °C during operating phase, no condensation, maximum | 95 % |
| Degree of protection | IP20 |
| Power supply, current consumption, power loss | |
| Type of power supply | DC |
| Current consumption (typically) | |
| From the S7-1200 backplane bus | 200 mA |
| Power loss (typically) | 2.4 W from AS-i |
| From the S7-1200 backplane bus | 0.5 W |
| Dimensions and weights | |
| Width | 30 mm |
| Height | 100 mm |
| Depth | 75 mm |
| Weight | |
| Net weight | 122 g |
| Weight including packaging | 159 g |

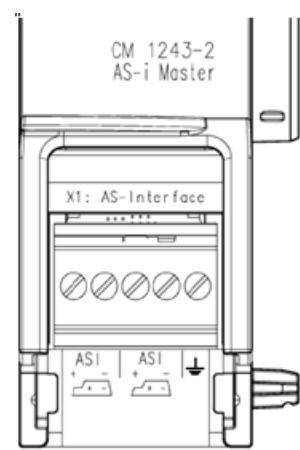
A.12.3.2 Electrical connections of the AS-i master CM 1243-2


Power supply of the AS-i master CM 1243-2

The AS-i master CM 1243-2 is supplied over the communications bus of the S7-1200. This means that a diagnostics message can still be sent to the S7-1200 following failure of the AS-i supply voltage. The connection to the communications bus is on the right-hand side of the AS-i master CM 1243-2.

AS-Interface terminals

The removable terminal for connecting the AS-i cable is located behind the lower cover on the front of the AS-i master CM 1243-2.



If the AS-i shaped cable is used, you can recognize the correct polarity of the cable by means of the symbol .

Information on how to remove and re-install the terminal block can be found in the system manual "SIMATIC S7-1200 Programmable Controller" (Order No.: 6ES7298-8FA30-8AH0).


NOTICE

Maximum current carrying capacity of the terminal contacts

The current carrying capacity of the connection contacts is max. 8 A. If this value is exceeded on the AS-i cable, the AS-i master CM 1243-2 must not be "looped in" to the AS-i cable, but must instead be connected via a spur line (only one connection pair assigned on the AS-i master CM 1243-2).

You will find additional information on connecting the AS-i cable in the section "Installation, connection and commissioning of the modules" in the manual "AS-i Master CM 1243-2 and AS-i data decoupling unit DCM 1271 for SIMATIC S7-1200".

Terminal assignment

| Label | Meaning |
|---|-------------------------------------|
| ASI+ | AS-i connection – positive polarity |
| ASI– | AS-i connection – negative polarity |
|  | Functional ground |

A.12.4 RS232, RS422, and RS485

A.12.4.1 CB 1241 RS485 Specifications

Note

To use this CB, your CPU firmware must be V2.0 or higher.

Table A- 217 General specifications

| Technical data | CB 1241 RS485 |
|---------------------------|---------------------|
| Order number | 6ES7 241-1CH30-1XB0 |
| Dimensions W x H x D (mm) | 38 x 62 x 21 |
| Weight | 40 grams |

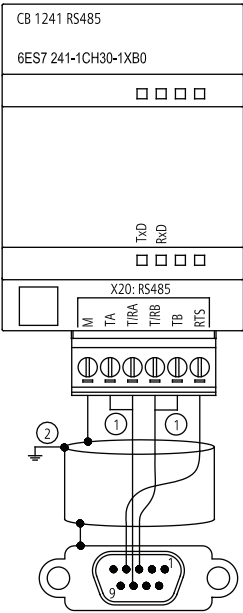
Table A- 218 Transmitter and receiver

| Technical data | CB 1241 RS485 |
|---|--|
| Type | RS485 (2-wire half-duplex) |
| Common mode voltage range | -7 V to +12 V, 1 second, 3 VRMS continuous |
| Transmitter differential output voltage | 2 V min. at $R_L = 100 \Omega$ 1.5 V min. at $R_L = 54 \Omega$ |
| Termination and bias | 10K to +5 V on B, RS485 Pin 3 10K to GND on A, RS485 Pin 4 |
| Optional termination | Short Pin TB to Pin T/RB, effective termination impedance is 127 Ω , connects to RS485 Pin 3 Short Pin TA to Pin T/RA, effective termination impedance is 127 Ω , connects to RS485 Pin 4 |
| Receiver input impedance | 5.4K Ω min. including termination |
| Receiver threshold/sensitivity | +/- 0.2 V min., 60 mV typical hysteresis |
| Isolation RS485 signal to chassis ground RS485 signal to CPU logic common | 500 VAC, 1 minute |
| Cable length, shielded | 1000 m max. |
| Baud rate | 300 baud, 600 baud, 1.2 kbits, 2.4 kbits, 4.8 kbits, 9.6 kbits (default), 19.2 kbits, 38.4 kbits, 57.6 kbits, 76.8 kbits, 115.2 kbits, |
| Parity | No parity (default), even, odd, Mark (parity bit always set to 1), Space (parity bit always set to 0) |
| Number of stop bits | 1 (default), 2 |
| Flow control | Not supported |
| Wait time | 0 to 65535 ms |

Table A- 219 Power supply

| Technical data | CB 1241 RS485 |
|------------------------------------|---------------|
| Power loss (dissipation) | 1.5 W |
| Current consumption (SM Bus), max. | 50 mA |
| Current consumption (24 VDC) max. | 80 mA |

CB 1241 RS485 (6ES7 241-1CH30-1XB0)



- ① Connect "TA" and TB" as shown to terminate the network. (Terminate only the end devices on the RS485 network.)
- ② Use shielded twisted pair cable and connect the cable shield to ground.

You terminate only the two ends of the RS485 network. The devices in between the two end devices are not terminated or biased. See the S7-1200 System Manual section on "Biasing and terminating an RS485 network connector"

Table A- 220 Connector pin locations for CB 1241 RS485 (6ES7 241-1CH30-1XB0)

| Pin | 9-Pin connector | X20 |
|-----|-------------------|----------|
| 1 | RS485 / Logic GND | -- |
| 2 | RS485 / Not Used | -- |
| 3 | RS485 / TxD+ | 3 - T/RB |
| 4 | RS485 / RTS | 1 - RTS |
| 5 | RS485 / Logic GND | -- |
| 6 | RS485 / 5V Power | -- |
| 7 | RS485 / Not used | -- |
| 8 | RS485 / TxD- | 4 - T/RA |

| Pin | 9-Pin connector | X20 |
|-------|------------------|-------|
| 9 | RS485 / Not Used | -- |
| Shell | | 7 - M |

See also

Biassing and terminating an RS485 network connector (Page 564)

A.12.4.2 CM 1241 RS232 Specifications

Table A- 221 General specifications

| Technical data | CM 1241 RS232 |
|-----------------|---------------------|
| Order number | 6ES7 241-1AH30-0XB0 |
| Dimensions (mm) | 30 x 100 x 75 |
| Weight | 150 grams |

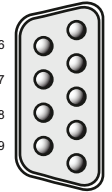
Table A- 222 Transmitter and receiver

| Technical data | CM 1241 RS232 |
|---|---|
| Type | RS232 (full-duplex) |
| Transmitter output voltage | +/- 5 V min. at $R_L = 3K \Omega$ |
| Transmit output voltage | +/- 15 VDC max. |
| Receiver input impedance | 3 K Ω min. |
| Receiver threshold/sensitivity | 0.8 V min. low, 2.4 max. high 0.5 V typical hysteresis |
| Receiver input voltage | +/- 30VDC max. |
| Isolation RS 232 signal to chassis ground RS 232 signal to CPU logic common | 500 VAC, 1 minute |
| Cable length, shielded | 10 m max. |
| Baud rate | 300 baud, 600 baud, 1.2 kbits, 2.4 kbits, 4.8 kbits, 9.6 kbits (default), 19.2 kbits, 38.4 kbits, 57.6 kbits, 76.8 kbits, 115.2 kbits, |
| Parity | No parity (default), even, odd, Mark (parity bit always set to 1), Space (parity bit always set to 0) |
| Number of stop bits | 1 (default), 2 |
| Flow control | Hardware, software |
| Wait time | 0 to 65535 ms |

Table A- 223 Power supply

| Technical data | CM 1241 RS232 |
|--------------------------|---------------|
| Power loss (dissipation) | 1.1 W |
| From +5 VDC | 220 mA |

Table A- 224 RS232 connector (male)

| Pin | Description | Connector (male) | Pin | Description |
|-------|---------------------------------|---|-------|---------------------------|
| 1 DCD | Data carrier detect: Input |  | 6 DSR | Data set ready: Input |
| 2 RxD | Received data from DCE: Input | | 7 RTS | Request to send: Output |
| 3 TxD | Transmitted data to DCE: Output | | 8 CTS | Clear to send: Input |
| 4 DTR | Data terminal ready: Output | | 9 RI | Ring indicator (not used) |
| 5 GND | Logic ground | | SHELL | Chassis ground |

A.12.4.3 CM 1241 RS422/485 Specifications

CM 1241 RS422/485 Specifications

Table A- 225 General specifications

| Technical data | CM 1241 RS422/485 |
|---------------------------|---------------------|
| Order number | 6ES7 241-1CH31-0XB0 |
| Dimensions W x H x H (mm) | 30 x 100 x 75 |
| Weight | 155 grams |

Table A- 226 Transmitter and receiver

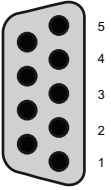
| Technical data | CM 1241 RS422/485 |
|---|---|
| Type | RS422 or RS485, 9-pin sub D female connector |
| Common mode voltage range | -7 V to +12 V, 1 second, 3 VRMS continuous |
| Transmitter differential output voltage | 2 V min. at $R_L = 100 \Omega$ 1.5 V min. at $R_L = 54 \Omega$ |

| Technical data | CM 1241 RS422/485 |
|---|---|
| Termination and bias | 10K Ω to +5 V on B, PROFIBUS Pin 3 10K Ω to GND on A, PROFIBUS Pin 8 Internal bias options provided, or no internal bias. In all cases, external termination is required, see Biasing and terminating an RS485 network connector (Page 564) and Configuring the RS422 and RS485 in the S7-1200 System Manual (Page 599) |
| Receiver input impedance | 5.4K Ω min. including termination |
| Receiver threshold/sensitivity | +/- 0.2 V min., 60 mV typical hysteresis |
| Isolation RS485 signal to chassis ground RS485 signal to CPU logic common | 500 VAC, 1 minute |
| Cable length, shielded | 1000 m max. (baud rate dependent) |
| Baud rate | 300 baud, 600 baud, 1.2 kbits, 2.4 kbits, 4.8 kbits, 9.6 kbits (default), 19.2 kbits, 38.4 kbits, 57.6 kbits, 76.8 kbits, 115.2 kbits, |
| Parity | No parity (default), even, odd, Mark (parity bit always set to 1), Space (parity bit always set to 0) |
| Number of stop bits | 1 (default), 2 |
| Flow control | XON/XOFF supported for the RS422 mode |
| Wait time | 0 to 65535 ms |

Table A- 227 Power supply

| Technical data | CM 1241 RS422/485 |
|--------------------------|-------------------|
| Power loss (dissipation) | 1.2 W |
| From +5 VDC | 240 mA |

Table A- 228 RS485 or RS422 connector (female)

| Pin | Description | Connector (female) | Pin | Description |
|---------------------|---|---|---------------------|---|
| 1 | Logic or communication ground |  | 6 PWR | +5V with 100 ohm series resistor: Output |
| 2 TxD+ ¹ | Connected for RS422 Not used for RS485: Output | | 7 | Not connected |
| 3 TxD+ | Signal B (Rx/D/TxD+): Input/Output | | 8 TXD- | Signal A (Rx/D/TxD-): Input/Output |
| 4 RTS ² | Request to send (TTL level) Output | | 9 TXD- ¹ | Connected for RS422 Not used for RS485: Output |
| 5 GND | Logic or communication ground | | SHELL | Chassis ground |

¹ Pins 2 and 9 are only used as transmit signals for RS422.

² The RTS is a TTL level signal and can be used to control another half duplex device based on this signal. It is active when you transmit and is inactive all other times.

A.13 TeleService (TS Adapter and TS Adapter modular)

The following manuals contain the technical specification for the TS Adapter IE Basic and the TS Adapter modular:

- Industrial Software Engineering Tools
Modular TS Adapter
- Industrial Software Engineering Tools
TS Adapter IE Basic

A.14 SIMATIC memory cards

| Order Number | Capacity |
|---------------------|----------|
| 6ES7 954-8LF01-0AA0 | 24 MB |
| 6ES7 954-8LE01-0AA0 | 12 MB |
| 6ES7 954-8LB01-0AA0 | 2 MB |

A.15 Input simulators

Table A- 229 General specifications

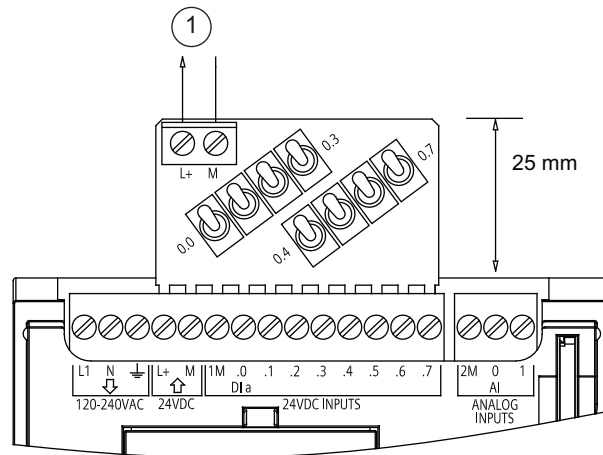
| Technical data | 8 Position Simulator | 14 Position Simulator |
|---------------------------|----------------------|-----------------------|
| Order number | 6ES7 274-1XF30-0XA0 | 6ES7 274-1XH30-0XA0 |
| Dimensions W x H x D (mm) | 43 x 35 x 23 | 67 x 35 x 23 |
| Weight | 20 grams | 30 grams |
| Points | 8 | 14 |
| Used with CPU | CPU 1211C, CPU 1212C | CPU 1214C |



WARNING

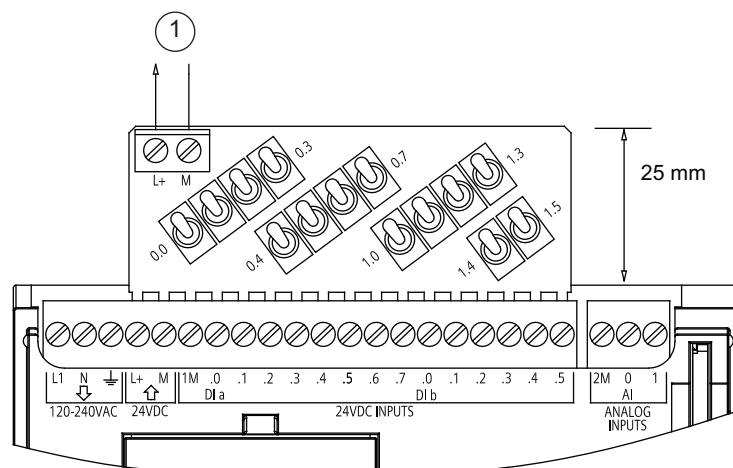
These input simulators are not approved for use in Class I DIV 2 or Class I Zone 2 hazardous locations. The switches present a potential spark hazard/explosion hazard if used in a Class I DIV 2 or Class I Zone 2 location.

8 Position Simulator (6ES7 274-1XF30-0XA0)



① 24 VDC sensor power out

14 Position Simulator (6ES7 274-1XF30-0XA0)



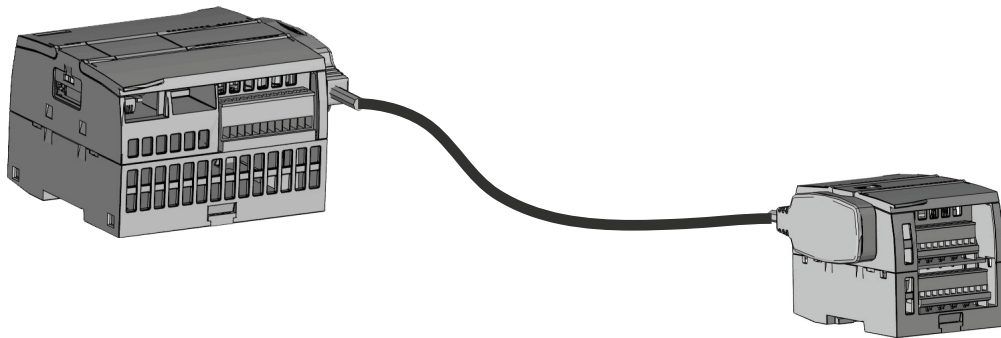
① 24 VDC sensor power out

A.16 I/O expansion cable

Technical Data

| | |
|--------------|---------------------|
| Order number | 6ES7 290-6AA30-0XA0 |
| Cable length | 2 m |
| Weight | 200 g |

Refer to the installation section (Page 56) for information about installing and removing the S7-1200 expansion cable.



A.17 Companion products

A.17.1 PM 1207 power module

The PM 1207 is a power supply module for the SIMATIC S7-1200. It provides the following features:

- Input 120/230 VAC, output 24 VDC/2.5A
- Order number 6ESP 332-1SH71

For more information about this product and for the product documentation, refer to the customer support web site (<http://www.siemens.com/automation/>).

A.17.2 CSM 1277 compact switch module

The CSM1277 is an Industrial Ethernet compact switch module. It can be used to multiply the Ethernet interface of the S7-1200 to allow simultaneous communication with operator panels, programming devices, or other controllers. It provides the following features:

- 4 x RJ45 sockets for connecting to Industrial Ethernet
- 3 pole plug in terminal strip for connection of the external 24 VDC supply on top
- LEDs for diagnostics and status display of Industrial Ethernet ports
- Order number 6GK7 277-1AA00-0AA0

For more information about this product and for the product documentation, refer to the customer support web site (<http://www.siemens.com/automation/>).

Calculating a power budget

The CPU has an internal power supply that provides power for the CPU itself, for any expansion modules, and for other 24 VDC user power requirements.

There are four types of expansion modules:

- Signal modules (SM) are installed on the right-side of the CPU. Each CPU allows a maximum number of signal modules possible without regard to the power budget.
 - CPU 1214C and CPU 1215C allows 8 signal modules
 - CPU 1212C allows 2 signal modules
 - CPU 1211C allows no signal modules
- Communication modules (CM), are installed on the left-side of the CPU. A maximum of 3 communication modules is allowed for any CPU without regard to the power budget.
- Signal boards (SB), communications boards (CB), and battery boards (BB) are installed on top of the CPU. A maximum of 1 signal board, communication board, or battery board is allowed for any CPU.

Use the following information as a guide for determining how much power (or current) the CPU can provide for your configuration.

Each CPU supplies both 5 VDC and 24 VDC power:

- The CPU provides 5 VDC power for the expansion modules when an expansion module is connected. If the 5 VDC power requirements for expansion modules exceed the power budget of the CPU, you must remove expansion modules until the requirement is within the power budget.
- Each CPU has a 24 VDC sensor supply that can supply 24 VDC for local input points or for relay coils on the expansion modules. If the power requirement for 24 VDC exceeds the power budget of the CPU, you can add an external 24 VDC power supply to provide 24 VDC to the expansion modules. You must manually connect the 24 VDC supply to the input points or relay coils.

WARNING

Connecting an external 24 VDC power supply in parallel with the DC 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, severe personal injury and/or property damage.

The DC sensor supply on the CPU and any external power supply should provide power to different points. A single connection of the commons is allowed.

Some of the 24V power input ports in the PLC system are interconnected, with a logic common circuit connecting multiple M terminals. The CPU 24V power supply input, the SM relay coil power input, and a non-isolated analog power supply input are examples of circuits that are interconnected when designated as not isolated in the data sheets. All non-isolated M terminals must connect to the same external reference potential.

⚠ WARNING

Connecting non-isolated M terminals to different reference potentials will cause unintended current flows that may cause damage or unpredictable operation in the PLC and connected equipment.

Such damage or unpredictable operation could result in death, severe personal injury and/or property damage.

Always be sure that all non-isolated M terminals in a PLC system are connected to the same reference potential.

Information about the power budgets of the CPUs and the power requirements of the signal modules is provided in the technical specifications (Page 699).

Note

Exceeding the power budget of the CPU may result in not being able to connect the maximum number of modules allowed for your CPU.

Sample power budget

The following example shows a sample calculation of the power requirements for a configuration that includes one CPU 1214C AC/DC/Relay, one SB 1223 2 x 24 VDC Input/ 2 x 24 VDC Output, one CM 1241, three SM 1223 8 DC In/8 Relay Out, and one SM 1221 8 DC In. This example has a total of 48 inputs and 36 outputs.

Note

The CPU has already allocated the power required to drive the internal relay coils. You do not need to include the internal relay coil power requirements in a power budget calculation.

The CPU in this example provides sufficient 5 VDC current for the SMs, but does not provide enough 24 VDC current from the sensor supply for all of the inputs and expansion relay coils. The I/O requires 456 mA and the CPU provides only 400 mA. This installation requires an additional source of at least 56 mA at 24 VDC power to operate all the included 24 VDC inputs and outputs.

Table B- 1 Sample power budget

| CPU power budget | 5 VDC | 24 VDC |
|-----------------------|---------|--------|
| CPU 1214C AC/DC/Relay | 1600 mA | 400 mA |
| <i>Minus</i> | | |

| CPU power budget | 5 VDC | 24 VDC |
|---|---------------------------------------|--|
| System requirements | 5 VDC | 24 VDC |
| CPU 1214C, 14 inputs | - | $14 * 4 \text{ mA} = 56 \text{ mA}$ |
| 1 SB 1223 2 x 24 VDC Input/ 2 x 24 VDC Output | 50 mA | $2 * 4 \text{ mA} = 8 \text{ mA}$ |
| 1 CM 1241 RS422/485, 5 V power | 220 mA | |
| 3 SM 1223, 5 V power | $3 * 145 \text{ mA} = 435 \text{ mA}$ | - |
| 1 SM 1221, 5 V power | $1 * 105 \text{ mA} = 105 \text{ mA}$ | - |
| 3 SM 1223, 8 inputs each | - | $3 * 8 * 4 \text{ mA} = 96 \text{ mA}$ |
| 3 SM 1223, 8 relay coils each | - | $3 * 8 * 11 \text{ mA} = 264 \text{ mA}$ |
| 1 SM 1221, 8 inputs each | - | $8 * 4 \text{ mA} = 32 \text{ mA}$ |
| Total requirements | 810 mA | 456 mA |
| <i>Equals</i> | | |
| Current balance | 5 VDC | 24 VDC |
| Current balance total | 790 mA | (56 mA) |

Form for calculating your power budget

Use the following table to determine how much power (or current) the S7-1200 CPU can provide for your configuration. Refer to the technical specifications (Page 699) for the power budgets of your CPU model and the power requirements of your signal modules.

Table B- 2 Calculations for a power budget

| CPU power budget | 5 VDC | 24 VDC |
|---------------------------|-------|--------|
| | | |
| <i>Minus</i> | | |
| System requirements | 5 VDC | 24 VDC |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| Total requirements | | |
| <i>Equals</i> | | |
| Current balance | 5 VDC | 24 VDC |
| Current balance total | | |

Order numbers

C.1 CPU modules

Table C- 1 S7-1200 CPUs

| CPU models | | Order Number |
|------------|-----------------------|---------------------|
| CPU 1211C | CPU 1211C DC/DC/DC | 6ES7 211-1AE31-0XB0 |
| | CPU 1211C AC/DC/Relay | 6ES7 211-1BE31-0XB0 |
| | CPU 1211C DC/DC/Relay | 6ES7 211-1HE31-0XB0 |
| CPU 1212C | CPU 1212C DC/DC/DC | 6ES7 212-1AE31-0XB0 |
| | CPU 1212C AC/DC/Relay | 6ES7 212-1BE31-0XB0 |
| | CPU 1212C DC/DC/Relay | 6ES7 212-1HE31-0XB0 |
| CPU 1214C | CPU 1214C DC/DC/DC | 6ES7 214-1AG31-0XB0 |
| | CPU 1214C AC/DC/Relay | 6ES7 214-1BG31-0XB0 |
| | CPU 1214C DC/DC/Relay | 6ES7 214-1HG31-0XB0 |
| CPU 1215C | CPU 1215C DC/DC/DC | 6ES7 215-1AG31-0XB0 |
| | CPU 1215C AC/DC/Relay | 6ES7 215-1BG31-0XB0 |
| | CPU 1215C DC/DC/Relay | 6ES7 215-1HG31-0XB0 |

C.2 Signal modules (SMs), signal boards (SBs) and battery boards (BB)

Table C- 2 Signal modules (SMs)

| Signal modules | | Order Number |
|------------------------|---|---------------------|
| Digital input | SM 1221 8 x 24 VDC Input (Sink/Source) | 6ES7 221-1BF30-0XB0 |
| | SM 1221 16 x 24 VDC Input (Sink/Source) | 6ES7 221-1BH30-0XB0 |
| Digital output | SM 1222 8 x 24 VDC Output (Source) | 6ES7 222-1BF30-0XB0 |
| | SM 1222 16 x 24 VDC Output (Source) | 6ES7 222-1BH30-0XB0 |
| | SM 1222 8 x Relay Output | 6ES7 222-1HF30-0XB0 |
| | SM 1222 8 x Relay Output (Changeover) | 6ES7 222-1XF30-0XB0 |
| | SM 1222 16 x Relay Output | 6ES7 222-1HH30-0XB0 |
| Digital input / output | SM 1223 8 x 24 VDC Input (Sink/Source) / 8 x 24 VDC Output (Source) | 6ES7 223-1BH30-0XB0 |
| | SM 1223 16 x 24 VDC Input (Sink/Source) / 16 x 24 VDC Output (Source) | 6ES7 223-1BL30-0XB0 |
| | SM 1223 8 x 24 VDC Input (Sink/Source) / 8 x Relay Output | 6ES7 223-1PH30-0XB0 |
| | SM 1223 16 x 24 VDC Input (Sink/Source) / 16 x Relay Output | 6ES7 223-1PL30-0XB0 |
| | SM 1223 8 x 120/230 VAC Input (Sink/Source) / 8 x Relay Outputs | 6ES7 223-1QH30-0XB0 |

| Signal modules | | Order Number |
|-----------------------|--|---------------------|
| Analog input | SM 1231 4 x Analog Input | 6ES7 231-4HD30-0XB0 |
| | SM 1231 8 x Analog Input | 6ES7 231-4HF30-0XB0 |
| | SM 1231 4 x Analog Input x 16 bit (high feature) | 6ES7 231-5ND30-0XB0 |
| Analog output | SM 1232 2 x Analog Output | 6ES7 232-4HB30-0XB0 |
| | SM 1232 4 x Analog Output | 6ES7 232-4HD30-0XB0 |
| Analog input / output | SM 1234 4 x Analog Input / 2 x Analog Output | 6ES7 234-4HE30-0XB0 |
| RTD and thermocouple | SM 1231 TC 4 x 16 bit | 6ES7 231-5QD30-0XB0 |
| | SM 1231 TC 8 x 16 bit | 6ES7 231-5QF30-0XB0 |
| | SM 1231 RTD 4 x 16 bit | 6ES7 231-5PD30-0XB0 |
| | SM 1231 RTD 8 x 16 bit | 6ES7 231-5PF30-0XB0 |

Table C- 3 Signal boards (SB) and battery boards (BBs)

| Signal and battery boards | | Order Number |
|---------------------------|---|---------------------|
| Digital input | SB 1221 200 KHz 4 x 24 VDC Input (Source), | 6ES7 221-3BD30-0XB0 |
| | SB 1221 200 KHz 4 x 5 VDC Input (Source) | 6ES7 221-3AD30-0XB0 |
| Digital output | SB 1222 200 KHz 4 x 24 VDC Output (Sink/Source) | 6ES7 222-1BD30-0XB0 |
| | SB 1222 200 KHz 4 x 5 VDC Output (Sink/Source) | 6ES7 222-1AD30-0XB0 |
| Digital input / output | SB 1223 2 x 24 VDC Input (Sink) / 2 x 24 VDC Output (Source) | 6ES7 223-0BD30-0XB0 |
| | SB 1223 200 KHz 2 x 24 VDC Input (Source) / 2 x 24 VDC Output (Sink/Source) | 6ES7 223-3BD30-0XB0 |
| | SB 1223 200 KHz 2 x 5 VDC Input (Source) / 2 x 5 VDC Output (Sink/Source) | 6ES7 223-3AD30-0XB0 |
| Analog | SB 1232 1 Analog Output | 6ES7 232-4HA30-0XB0 |
| | SB 1231 1 Analog Input | 6ES7 231-4HA30-0XB0 |
| | SB 1231 1 Analog Input Thermocouple | 6ES7 231-5QA30-0XB0 |
| | SB 1231 1 Analog Input RTD | 6ES7 231-5PA30-0XB0 |
| Battery | BB 1297 Battery | 6ES7 297-0AX30-0XA0 |

C.3 Communication

Table C- 4 Communication module (CM)

| Communication module (CM) | | | Order Number |
|---------------------------|-------------------|-----------------|---------------------|
| RS232, RS422, and RS485 | CM 1241 RS232 | RS232 | 6ES7 241-1AH30-0XB0 |
| | CM 1241 RS422/485 | RS422/485 | 6ES7 241-1CH31-0XB0 |
| PROFIBUS | CM 1243-5 | PROFIBUS Master | 6GK7 243-5DX30-0XE0 |
| | CM 1242-5 | PROFIBUS Slave | 6GK7 242-5DX30-0XE0 |
| AS-i Master | CM 1243-2 | AS-i Master | 3RK7 243-2AA30-0XB0 |

Table C- 5 Communication board (CB)

| Communication board (CB) | | | Order Number |
|--------------------------|---------------|-------|---------------------|
| RS485 | CB 1241 RS485 | RS485 | 6ES7 241-1CH30-1XB0 |

Table C- 6 Communication Processor (CP)

| Communication processor (CP) | | Order Number |
|------------------------------|------|---------------------|
| CP 1242-7 | GPRS | 6GK7 242-7KX30-0XE0 |

Table C- 7 TeleService

| TS Adapter | Order Number |
|---------------------|---------------------|
| TS Adapter IE Basic | 6ES7 972-0EB00-0XA0 |
| TS Module GSM | 6GK7 972-0MG00-0XA0 |
| TS Module RS232 | 6ES7 792-0MS00-0XA0 |
| TS Module Modem | 6ES7 972-0MM00-0XA0 |
| TS Module ISDN | 6ES7 972-0MD00-0XA0 |

Table C- 8 Accessories

| Accessory | | | Order Number |
|-----------|------------|------------------|----------------|
| Antenna | ANT794-4MR | GSM/GPRS antenna | 6NH9 860-1AA00 |
| | ANT794-3M | Flat antenna | 6NH9 870-1AA00 |

Table C- 9 Connectors

| Type of Connector | | Order Number |
|-------------------|---|---------------------|
| RS485 | 35-degree cable output, screw-terminal connection | 6ES7 972-0BA42-0XA0 |
| | 35-degree cable output, FastConnect connection | 6ES7 972-0BA60-0XA0 |

C.4 Other modules

Table C- 10 Companion products

| Item | | Order Number |
|---------------------|------------------------------------|---------------------|
| Power supply module | PM 1207 power supply | 6EP1 332-1SH71 |
| Ethernet switch | CSM 1277 Ethernet switch - 4 ports | 6GK7 277-1AA10-0AA0 |

C.5 Memory cards

Table C- 11 Memory cards

| SIMATIC memory cards | Order Number |
|----------------------|---------------------|
| SIMATIC MC 2 MB | 6ES7 954-8LB01-0AA0 |
| SIMATIC MC 12 MB | 6ES7 954-8LE01-0AA0 |
| SIMATIC MC 24 MB | 6ES7 954-8LF01-0AA0 |

C.6 Basic HMI devices

Table C- 12 HMI devices

| HMI Basic Panels | Order Number |
|---------------------------|---------------------|
| KTP400 Basic (Mono, PN) | 6AV6 647-0AA11-3AX0 |
| KTP600 Basic (Mono, PN) | 6AV6 647-0AB11-3AX0 |
| KTP600 Basic (Color, PN) | 6AV6 647-0AD11-3AX0 |
| KTP1000 Basic (Color, PN) | 6AV6 647-0AF11-3AX0 |
| TP1500 Basic (Color, PN) | 6AV6 647-0AG11-3AX0 |

C.7 Spare parts and other hardware

Table C- 13 Expansion cables, simulators and connector blocks

| Item | | | Order Number |
|---------------------|--------------------------------------|-------------------|---------------------|
| I/O expansion cable | I/O Expansion cable, 2 m | | 6ES7 290-6AA30-0XA0 |
| I/O simulator | Simulator (1214C/1211C - 8 position) | | 6ES7 274-1XF30-0XA0 |
| | Simulator (1214C - 14 position) | | 6ES7 274-1XH30-0XA0 |
| Spare door kit | CPU 1211C/1212C | | 6ES7 291-1AA30-0XA0 |
| | CPU 1214C | | 6ES7 291-1AB30-0XA0 |
| | CPU 1215C | | 6ES7 291-1AC30-0XA0 |
| | Signal module, 45 mm | | 6ES7 291-1BA30-0XA0 |
| | Signal module, 70 mm | | 6ES7 291-1BB30-0XA0 |
| | Communication module | | 6ES7 291-1CC30-0XA0 |
| Connector block | Tin | 7 terminal, 4/pk | 6ES7 292-1AG30-0XA0 |
| | | 8 terminal, 4/pk | 6ES7 292-1AH30-0XA0 |
| | | 11 terminal, 4/pk | 6ES7 292-1AL30-0XA0 |
| | | 12 terminal, 4/pk | 6ES7 292-1AM30-0XA0 |
| | | 14 terminal, 4/pk | 6ES7 292-1AP30-0XA0 |
| | | 20 terminal, 4/pk | 6ES7 292-1AV30-0XA0 |

| Item | | | Order Number |
|------|------|--|---------------------|
| | Gold | 3 terminal, 4/pk (for analog CPU) | 6ES7 292-1BC30-0XA0 |
| | | 6 terminal, 4/pk (for signal board) | 6ES7 292-1BF30-0XA0 |
| | | 6 terminal, 4/pk (for analog CPU) | 6ES7 292-1BF30-0XB0 |
| | | 7 terminal, 4/pk (for analog signal module) | 6ES7 292-1BG30-0XA0 |
| | | 11 terminal, 4/pk (for analog signal module) | 6ES7 292-1BL30-0XA0 |

C.8 Programming software

Table C- 14 Programming software

| SIMATIC software | | Order Number |
|------------------------|---------------------------------------|---------------------|
| Programming software | STEP 7 Basic V11 | 6ES7 822-0AA01-0YA0 |
| | STEP 7 Professional V11 | 6ES7 822-1AA01-0YA5 |
| Visualization software | WinCC Basic V11 | 6AV2100-0AA01-0AA0 |
| | WinCC Comfort V11 | 6AV2101-0AA01-0AA5 |
| | WinCC Advanced V11 | 6AV2102-0AA01-0AA5 |
| | WinCC Professional 512 PowerTags V11 | 6AV2103-0DA01-0AA5 |
| | WinCC Professional 4096 PowerTags V11 | 6AV2103-0HA01-0AA5 |
| | WinCC Professional max. PowerTags V11 | 6AV2103-0XA01-0AA5 |

C.9 Documentation

Table C- 15 S7-1200 documentation

| Printed documentation | Language | Order Number |
|---|----------|---------------------|
| S7-1200 Programmable Controller System Manual | German | 6ES7 298-8FA30-8AH0 |
| | English | 6ES7 298-8FA30-8BH0 |
| | French | 6ES7 298-8FA30-8CH0 |
| | Spanish | 6ES7 298-8FA30-8DH0 |
| | Italian | 6ES7 298-8FA30-8EH0 |
| | Chinese | 6ES7 298-8FA30-8KH0 |
| S7-1200 Easy Book | German | 6ES7 298-8FA30-8AQ0 |
| | English | 6ES7 298-8FA30-8BQ0 |
| | French | 6ES7 298-8FA30-8CQ0 |
| | Spanish | 6ES7 298-8FA30-8DQ0 |
| | Italian | 6ES7 298-8FA30-8EQ0 |
| | Chinese | 6ES7 298-8FA30-8KQ0 |

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- SM 1231 AI 8 x 13 bit, 760
- SM 1231 AI 8 x 16 bit TC, 772
- SM 1231 AI 8 x RTD x 16 bit, 778
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