

OFFICIAL DOCUMENT PACKAGE

Manufacturer's Manual

Amikon cover with selected official Siemens technical pages

SIEMENS SIMATIC S7-400

6ES7405-0DA02-0AA0

SIMATIC S7-400 PS 405 4A DC POWER SUPPLY

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

OFFICIAL SOURCE

Siemens A5E00850736-AL, 04/2023; A5E00850741-01, section 4.12

Module Data: PS405 4A and applicable common sections; DC connector instructions

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

Power supply modules

3.1 Common characteristics of the power supply modules

Purpose of the power supply modules

The power supply modules of the S7-400 supply the other modules in the rack with their operating voltages via the backplane bus. They do not provide load voltages for the signal modules.

Common properties of all power supply modules

In addition to their module-specific technical specifications, power supply modules share the following properties:

- Encapsulated design for use in racks of the S7-400 system.
- Heat dissipation through natural convection
- Plug-in connection of the supply voltage with AC - DC coding
- Protection class I (with protective conductor) according to IEC 61140 (VDE 0140, part 1)
- Limiting of inrush current according to NAMUR recommendation NE 21
- Short-circuit-proof outputs
- Monitoring of the two output voltages. If one of these voltages fails, the power supply module signals an error to the CPU.
- The two output voltages (5 V DC and 24 V DC) have a common ground.
- Primary clocked
- Battery backup is possible. The set parameters and the memory contents (RAM) are buffered in CPUs and configurable modules over the backplane bus. The backup battery thus enables a hot restart of the CPU. Both the power supply module and the battery-backed modules monitor the battery voltage.
- Operation and error display via LEDs on the front plate

Note

A disconnect switch must be provided when installing AC power supply modules.

Switching the line voltage off/on

The power supply modules have inrush current limiting in accordance with NAMUR.

Power supply module in improper slot

If you plug the power supply module of a rack into a slot not intended for it, it will not go into operation. In this case, proceed as follows to correctly put the power supply module into operation:

1. Disconnect the power supply from the supply system (not just standby switch).
2. Remove the power supply module.
3. Install the power supply module in slot 1.
4. Wait at least 1 minute and then switch the supply voltage back on.



CAUTION

Property damage may occur.

If you plug a power supply module in a slot that is not intended for power supply modules, the module may be damaged. Slots 1 to 4 are permitted, whereby the power supply modules must be plugged in starting from slot 1 without leaving gaps.

Make sure that power supply modules are only plugged into permitted slots.

3.3 Backup battery (option)

Introduction

The power supply modules of the S7-400 have a battery compartment for one or two backup batteries. The installation of these backup batteries is optional.

Function of the backup battery(ies)

If backup batteries have been installed, the set parameters and the memory contents (RAM) are buffered via the backplane bus if the power supply module is switched off or the supply voltage in CPUs and configurable modules fails, as long as the battery voltage is within tolerance.

Furthermore, the backup battery enables a hot restart of the CPU after power ON.

Both the power supply module and the battery-backed modules monitor the battery voltage.

Inserting the backup battery

Activate battery monitoring after inserting one or two backup batteries. Then make sure that neither the corresponding BATT1F or BATT2F LED nor the BAF LED are lit when the power supply is ON. Only then is the backup battery working properly and the buffering guaranteed, as described above.

Note

Plug the power supply module into the rack and switch it on before inserting a backup battery for the first time. By doing so, you will extend the service life of the backup battery.

Power supply modules with two backup batteries

Some power supply modules have a battery compartment for two batteries. If you insert two batteries and set the switch to 2BATT, the power supply module defines one of the two batteries as the backup battery. This assignment remains in force until the battery is empty. When the backup battery is completely empty, the system switches to the reserve battery, which in turn is used as the backup battery for the duration of its life. The "Backup battery" status is also stored across a power failure.

Battery type

Only batteries approved by Siemens may be used (see Appendix C: Spare parts (Page 365))

The batteries can form a passivation layer. Depassivation takes place after insertion into the power supply module.

Meaning of the LEDs

The meaning of the LEDs on the power supply modules is described in the tables below. The following section contains a list of the faults indicated by these LEDs and notes on how to acknowledge the faults.

LEDs INTF, 5 VDC, 24 VDC

Table 3-2 LEDs INTF, 5 VDC, 24 VDC

LED	Color	Meaning
INTF	Red	Lights up in the event of an internal fault
5 VDC	green	Lights up as long as the 5 V voltage is within the tolerance limits
24 VDC	green	Lights up as long as the 24 V voltage is within the tolerance limits

LEDs BAF, BATTF

Power supply modules with a backup battery have the following indicators:

Table 3-3 LEDs BAF, BATTF

LED	Color	Meaning
BAF	Red	Lights up if the battery voltage on the backplane bus is too low and the BATT.INDIC switch is at the BATT position
BATTF	Yellow	Lights up if the battery is empty, if the polarity is reversed, or if the battery is missing, and the BATT.INDIC switch is at the BATT position

LEDs BAF, BATT1F, BATT2F

Power supply modules with two backup batteries have the following indicators:

Table 3-4 LEDs BAF, BATT1F, BATT2F

LED	Color	Meaning
BAF	Red	Lights up if the battery voltage on the backplane bus is too low and the BATT.INDIC switch is at the 1 BATT or 2 BATT position
BATT1F	Yellow	Lights up if battery 1 is empty or if the polarity is reversed or if the battery is missing, and the BATT.INDIC switch is at the 1 BATT or 2 BATT position
BATT2F	Yellow	Lights up if the battery 2 is empty, if the polarity is reversed, or if the battery is missing, and the BATT.INDIC switch is at the 2 BATT position

Backup voltage to the backplane bus

The backup voltage is either supplied by the backup battery or fed externally into the CPU or receiver IM. In its normal state, the level of the backup voltage is between 2.7 V and 3.6 V.

The backup voltage is monitored at the lower limit. Violation of the lower limit is indicated by the BAF LED and reported to the CPU.

BAF lights up if the backup voltage on the backplane bus is too low. Possible causes of this include:

- Battery (batteries) empty or battery polarity has been reversed.
- External supply via CPU or receive IM is defective or supply from secondary power supply module is defective or missing.
- Short-circuit or overload on the battery voltage.

Note

Due to internal capacities, if you remove the battery or switch off the external supply, some time may elapse before BAF, BATT1F, or BATT2F lights up.

Function of the operator controls of the power supply modules

Table 3-5 Function of the operator controls of the power supply modules

Control	Function
FMR button	For acknowledging and resetting a fault indicator after correcting the fault
Standby switch	Switches the output voltages (5 V VDC/24 VDC) to 0 V by intervening in the control loop (no mains disconnection).
	•  Output voltages at nominal value
	•  Output voltage 0 V
Switches BATT.INDIC	Used for setting LEDs and battery monitoring Where one battery can be used (PS 407 4A, PS 405 4A): • OFF: LEDs and monitor signals inactive • BATT: BAF/BATTF LEDs and monitor signals active Where two batteries can be used (PS 407 10A, PS 407 20A, PS 405 10A, PS 405 20A): • OFF: LEDs and monitor signals inactive • 1 BATT: Only BAF/BATT1F LEDs (for battery 1) active. • 2 BATT: BAF/BATT1F/BATT2F LEDs (for batteries 1 and 2) active.
Battery compart- ment	For backup battery (batteries)
Power connection	3-pin connector for the power main (do not pull and plug under power)

Cover

The battery compartment, battery selector switch, voltage selector switch and power connection are housed under one cover. The cover must remain closed during operation in order to protect these operator controls and to prevent static electricity from affecting the battery connections.

Discharge your body before you start taking any measurements on a module. Do so by touching grounded metallic parts. Always use grounded measuring instruments.

3.5 Fault/Error messages via LEDs

Introduction

The power supply modules of the S7-400 report module faults and backup battery failures via LEDs on the front plate.

Overview of the error messages of the power supply modules

Table 3-6 Error messages of the power supply modules

Type of error	LED display
Module fault	INTF DC5V DC24V
Backup battery failure	Power supply with 1 backup battery: BAF BATTF
	Power supply with 2 backup batteries: BAF BATT1F BATT2F

LED displays INTF, DC5V, DC24V

The following table lists the errors indicated by the LED displays INTF, DC5V and DC24V and provides information on troubleshooting. The status of the LED displays BAF, BATTF, BATT1F and BATT2F is not relevant here.

Table 3-7 LED displays INTF, DC5V, DC24V

INTF LED	DC5V LED	DC24V LED	Cause of error	Remedy
Off	Off	Off	Standby switch in  position	Put standby switch in position
			No line voltage	Check line voltage
			Internal error, power supply module defective	Replace power supply module
			Shutdown after overvoltage at 5 V or impermissible external power supply	Disconnect from supply system and reconnect after approx. 3 minutes, remove external power supply if necessary.
			Operation of the power supply module at the wrong slot	Install the power supply module in the correct slot (slot 1).
			Short-circuit or overload at 5 V	Switch off the power supply module, eliminate the cause of the short-circuit, after approx. 3 s the power supply module can be switched on again with the standby switch or via the supply system.

INTF LED	DC5V LED	DC24V LED	Cause of error	Remedy
Off	On	Off	Overvoltage at 24 V	Check whether external power supply is present; if not, replace power supply module.
On	Off*	Off	Short-circuit or overload at 5 V and 24 V and overtemperature	Check the load on the power supply module. Remove the module if necessary. Wait 5 minutes before switching the power supply module back on.
On	On	Off	If standby switch is in  position, impermissible external power supply at 5 V.	Remove all modules; identify faulty modules.
			Standby switch in position, short-circuit or overload at 24 V.	Check the load on the power supply module. Remove the module if necessary.
Off	Flash	On	Voltage recovery after short-circuit or overload at 5 V, if error occurred during operation.	Press the FMR button: flashing turns to steady light.
			Dynamic overload at 5 V.	Check the load on the power supply module. Remove module if necessary.
Off	Flash	Flash	Voltage recovery after short-circuit or overload at 5 V and 24 V, if error occurred during operation.	Press the FMR button: flashing turns to steady light.
Off	Flash	Flash	Dynamic overload at 5 V and 24 V.	Check the load on the power supply module. Remove module if necessary.
Off = LED is dark; On = LED is lit; Flash = LED is flashing;				

* If the power supply module does not restart after a few seconds after elimination of the overload, disconnect the module from the supply system for 5 minutes and then switch it on again. If the module still does not start up, you must replace it. This applies to the following power supply modules:

- 6ES7405-0DA02-0AA0, 6ES7407-0DA02-0AA0
- 6ES7405-0KA02-0AA0, 6ES7407-0KA02-0AA0
- 6ES7405-0KR02-0AA0, 6ES7407-0KR02-0AA0
- 6ES7405-0RA02-0AA0, 6ES7407-0RA02-0AA0

The response of the built-in overtemperature protection is the same.

If either the DC5V or DC24V LED remains dark after switch-on, the system does not power up.

If either the DC5V or DC24V LED of the PS 407 10AR remains dark for longer than approx. 1 to 2 seconds after switch-on, the power supply module does not start up.

3.5 Fault/Error messages via LEDs

In the event of short-circuit or overload, the power supply modules listed below switch off after 1 s to 3 s. After 3 s at the latest, the module attempts a hot restart. If the error has been eliminated by then, the module starts up. This applies to the modules:

Modules	
PS 405 4A (6ES7405-0DA02-0AA0)	PS 407 4A (6ES7407-0DA02-0AA0)
PS 405 10A (6ES7405-0KA02-0AA0)	PS 407 10A (6ES7407-0KA02-0AA0)
PS 405 10A R (6ES7405-0KR02-0AA0)	PS 407 10A R (6ES7407-0KR02-0AA0)
PS 405 20A (6ES7405-0RA02-0AA0)	PS 407 20A (6ES7407-0RA02-0AA0)

Overload at 24 V

In the event of overload at 24 V, the output current is electronically limited to a value between 100 and 150% of the nominal value. If this causes the voltage to fall below the undervoltage threshold of 19.2 V (-0/+5% corresponds to 19.2 to 20.16 V), the modules behave as follows:

- In the case of the power supply modules, the 24 V voltage is switched off and then switched on again every 0.5 to 1 s until an output voltage above the undervoltage threshold is established.
- In the case of the 6ES740x-0KR00-0AA0 and 6ES740x-0KR01-0AA0 power supply modules, the voltage adjusts itself according to the load resistance; the module operates according to its characteristic curve.

After the overload has been eliminated, the voltage returns to the nominal range and the green 24 V LED flashes. The CPU sets the EXTF LED (external fault) and saves the fault in the diagnostic buffer. Further reactions such as CPU STOP or message to a control room may be triggered in OB 81 "Power supply error". If no OB 81 is configured, the CPU continues to run normally.

Overload at 5 V

In the event of an overload at 5 V, the power supply modules with 10 A or 20 A output current can maintain an output current of 16 A or 26 A for 300 ms. The power supply modules with 4 A output current can maintain an output current of 6 A for 300 ms. After that the CPU changes to DEFECTIVE state. If the DC 5 V LED at the power supply flashes and can be reset with the FMR button, you can execute a hot restart. Afterwards, the CPU remains in STOP and requests a memory reset.

3.9 Power supply module PS 405 4A (6ES7405-0DA02-0AA0)

Function

The power module PS 405 4A is designed for connection to a 19.2 to 72 V DC network, and supplies 5 V/4 A DC and 24 V/0.5 A DC at the secondary side.

PS 405 4A operator control and monitoring elements

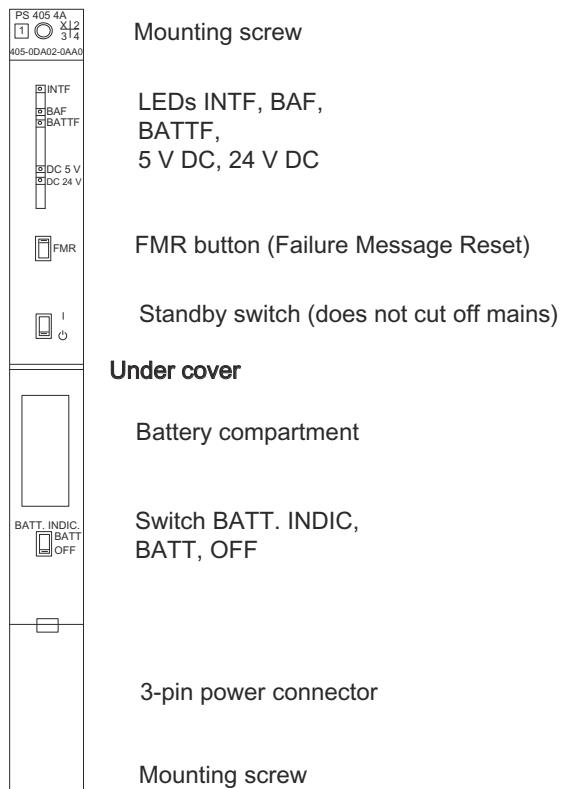


Figure 3-5 PS 405 4A operator control and monitoring elements

PS 405 4A technical specifications

Article number	6ES7405-0DA02-0AA0
Supply voltage	
Rated value (DC)	
• 24 V DC	Yes
• 48 V DC	Yes
• 60 V DC	Yes
Mains buffering	
• Mains/voltage failure stored energy time	20 ms
• Mains buffering according to NAMUR recommendation	Yes
Input current	
Rated value at 24 V DC	2 A
Rated value at 48 V DC	1 000 mA
Rated value at 60 V DC	800 mA
Inrush current, max.	18 A; Full width at half maximum 20 ms
output voltage / header	
Type of output voltage	DC
Rated value (DC)	
• 5 V DC	Yes
• 24 V DC	Yes
Output current	
for backplane bus (5 V DC), max.	4 A; no base load required
for backplane bus (24 V DC), max.	0.5 A; idling-proof
Short-circuit protection	Yes
Power	
Active power input, typ.	48 W
Power loss	
Power loss, typ.	16 W
Battery	
Backup battery	
• Backup battery (optional)	Yes; 2x lithium AA; 3.6 V / 2.2 Ah
• Backup voltage	3.6 V
• Backup current, max.	100 µA; When power off
Hardware configuration	
Slots	
• required slots	1
Potential separation	
primary/secondary	Yes
Isolation	
Overvoltage category	II
Degree and class of protection	
Equipment protection class	I, with protective conductor

3.9 Power supply module PS 405 4A (6ES7405-0DA02-0AA0)

Article number	6ES7405-0DA02-0AA0
Standards, approvals, certificates	
FM approval	Yes; Ta: 0 °C to 60 °C T4
CCC	Yes
BIS	Yes
Ambient conditions	
Ambient temperature during operation	
• min.	0 °C
• max.	60 °C
connection method / header	
Design of electrical connection	3x 1.5 mm ² , solid or stranded wire with end sleeve, external diameter 3 mm to 9 mm
Dimensions	
Width	25 mm
Height	290 mm
Depth	217 mm
Weights	
Weight, approx.	760 g

4.12 Wiring the Power Supply Module

Power Supply Connector

You use the power supply connector to connect a power supply module to your supply. When delivered, the power supply connector is plugged into the power supply module. There are two versions (AC and DC) of power supply connector. The two versions are coded, meaning an AC connector can only be plugged into an AC power supply module, and a DC connector can only be plugged into a DC power supply module.

Disconnecting the Power Supply Connector

Before wiring, you must unplug the power supply connector from the power supply module.

1. Open the cover of the power supply module.
2. Detach the connector by levering it off with a suitable tool, for example, a screwdriver, at the opening provided (1).
3. Pull the connector forward and out of the power supply module (2).

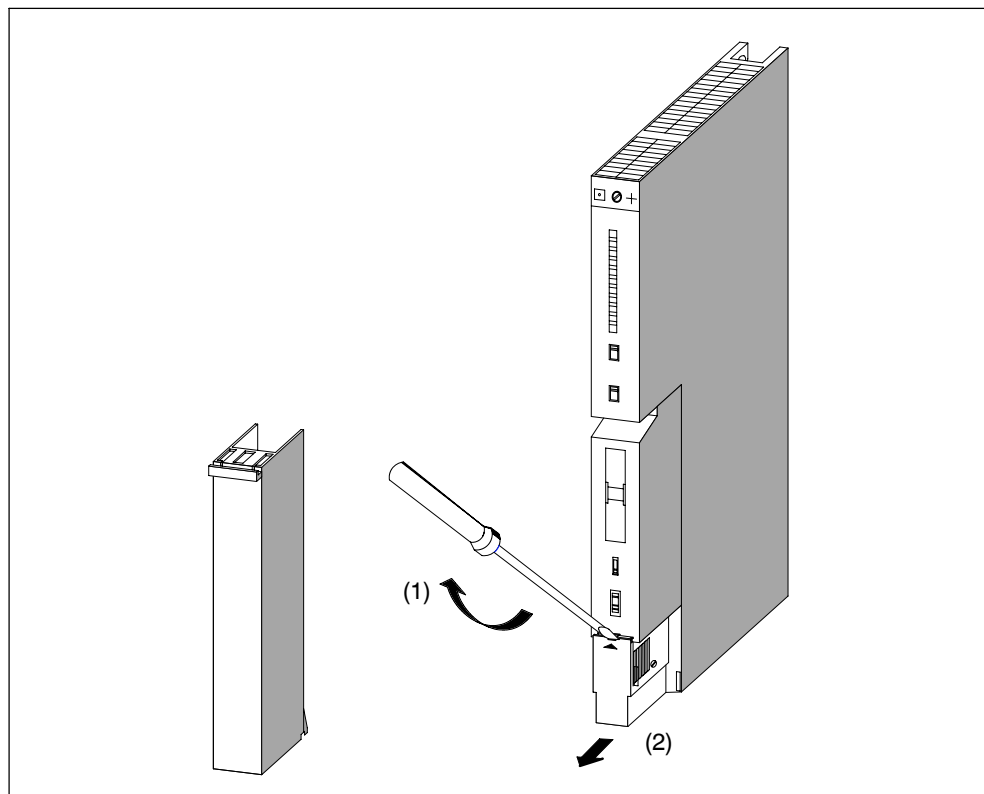


Figure 4-9 Disconnecting power supply connector

Wiring the Power Supply Connector

To wire the power supply connector, follow the steps outlined below:



Warning

There is a risk of personal injury.

If you wire the connector with voltage applied, you may suffer a shock and personal injury.

Only wire the connector with power disconnected.

1. Switch off the line voltage at your VAC supply disconnecter.
-

Note

The standby switch of the power supply module does not disconnect the power supply module from the supply.

2. Are you using a flexible sheathed cable with outer insulation (with 230 VAC)?

If so: Strip the outer insulation over a length of 70 mm. Note that an overall cable diameter of between 3 mm and 9 mm must be present under the strain relief after connection.

If not: Wrap the cores with insulating tape so that an overall cable diameter of between 3 mm and 9 mm will be present under the strain relief after connection. As an alternative to insulating tape, you can use a shrink-on sleeve.

3. Shorten the two cores which are not needed for connection to protective ground (PE) by 10 mm.
4. Strip the cores over a length of 7 mm.
5. Slacken the screw in the cover of the power supply connector and open the connector.

6. Slacken the screw of the strain relief and insert the cable.
7. Connect the cores according to the illustration on the cover of the power supply connector. Connect the longer core to PE. Screw on the cores with a torque of 0.6 to 0.8 N/m.

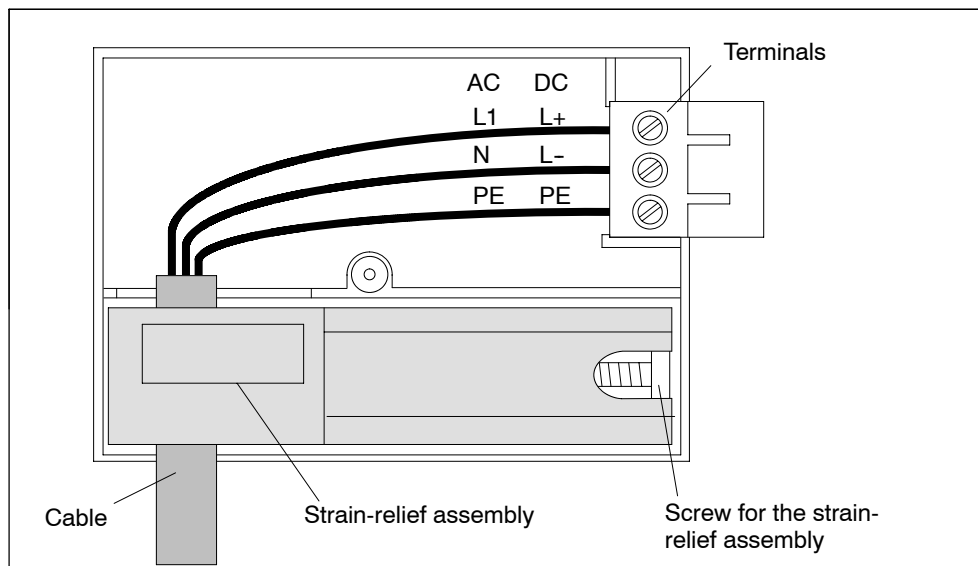


Figure 4-10 Wiring the power supply connector

8. Tighten the screw of the strain relief, so that the cable is secured properly.
9. Close the power supply connector and screw on the cover.



Caution

The power supply module or power supply connector can be damaged.

If you plug in or disconnect the connector with voltage applied, the power supply module or the connector may be damaged.

Only plug in or disconnect the power supply connector with power removed.

Plugging In the Power Supply Connector

You can only plug in the connector when the power supply module is installed (lower mounting screw tightened).

To plug the wired power supply connector into the power supply module, follow the steps outlined below:

1. Open the cover of the power supply module.
2. Insert the power supply connector into the guide groove in the module housing.
3. Slide the power supply connector into the power supply module as far as it will travel.
4. Close the cover of the power supply module.

The following figure shows how to plug the power supply connector into the power supply module.

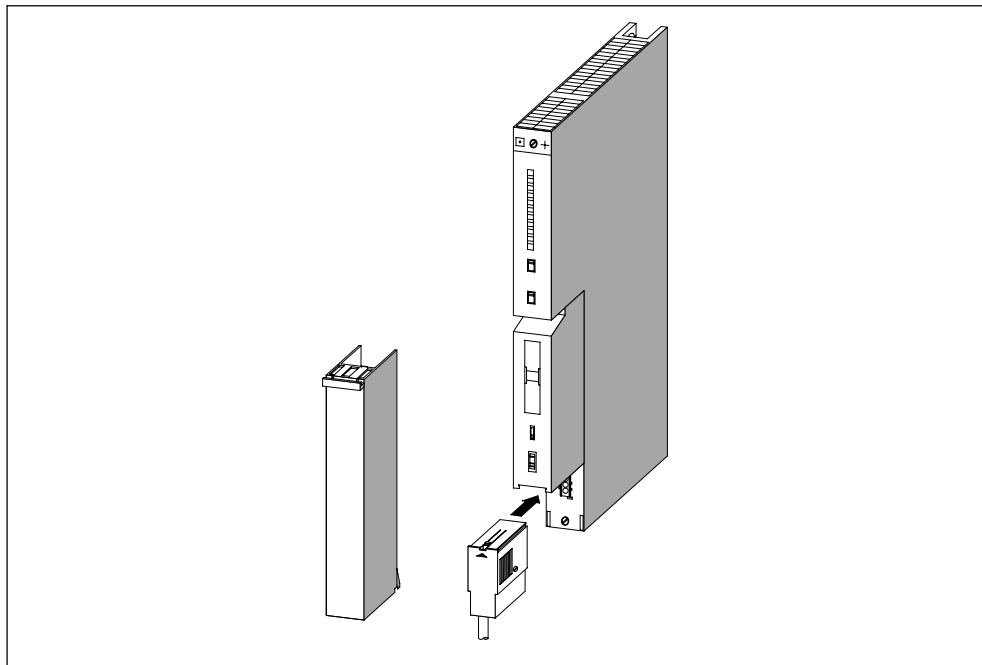


Figure 4-11 Plugging the power supply connector