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SIMATIC

S5-135U/155U

System Manual

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Safety Guidelines

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



Warning

indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.

Note

draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

The device/system may only be set up and operated in conjunction with this manual.

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

Correct Usage

Note the following:



Warning

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

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



Caution

UL + CSA: Lithium Battery Replacement
Danger of explosion if battery is incorrectly replaced. Replace only with same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.



Warning

FM WARNING – DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS LOCATION IS KNOWN TO BE NON-HAZARDOUS

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Disclaimer of Liability

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

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2

Centralized and Distributed Configuration of a Programmable Controller

This chapter contains an overview of the methods of configuring an S5-135U/155U PLC. You will find a description of the types of communication between a central controller and the expansion units, and an overview of the interface modules required for the different types of communication.

Chapter Overview

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2.1 Application

The S5-135U/155U programmable controllers comprise a central controller (CC) and, if required, one or more expansion units (EUs). You need EUs when there are insufficient slots in the CC for the modules to be used.

Various interface modules (IMs) are available for communication between the CC and the EUs and between the EUs. It is therefore possible to install an EU or EUs in the immediate vicinity of the CC (centralized configuration) or at some distance (distributed configuration). A combination of both types of configuration is also possible by connecting additional EUs in a centralized configuration with a distributed EU (see Figure 2-5).

This is clarified on the following pages.

2.2 Centralized and Distributed Configuration

You can install a PLC in centralized or distributed configuration according to your application.

IF ...	THEN ...
You wish to position the modules as closely as possible to the CC and can accept longer cable runs to the process,	choose the centralized configuration
You wish to position the I/O modules as closely as possible to the process and can accept longer cable runs to the CC,	choose the distributed configuration

With the centralized configuration, you can install the CC and EUs in the same cabinet or in adjacent cabinets. Data transmission is parallel. Shown in the following figure is a centralized configuration.

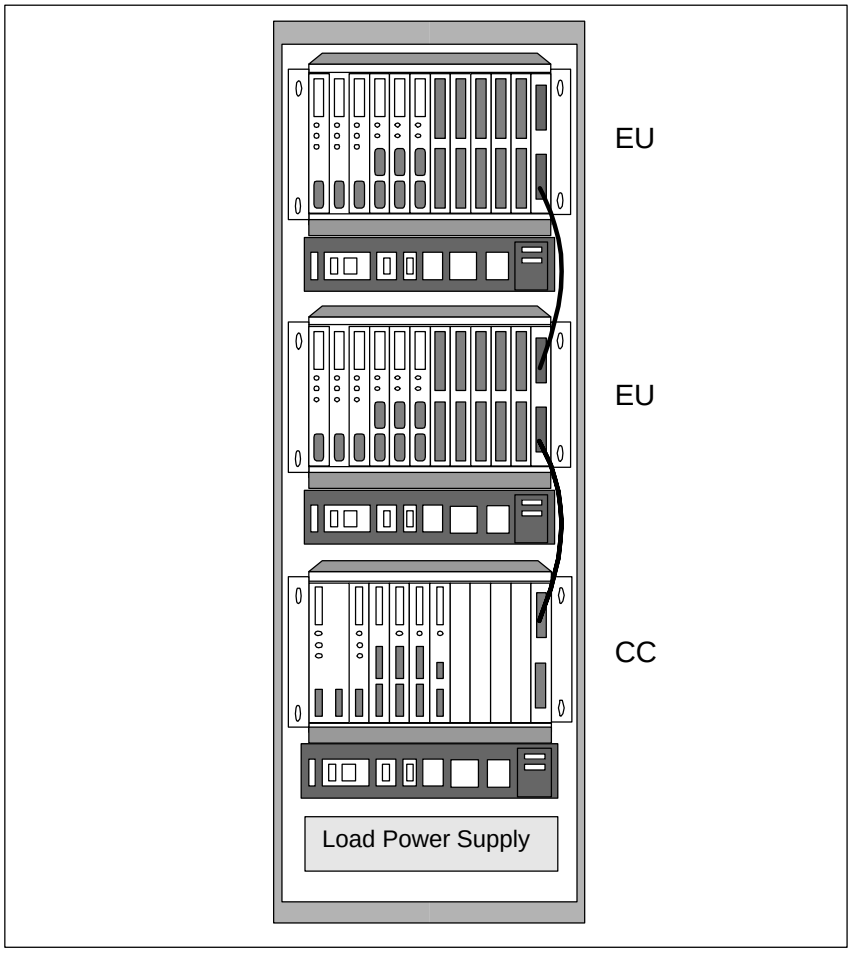


Figure 2-1 Centralized Configuration

With the distributed configuration, a distinction is made between parallel and serial communication. The main features of these types of communication are as follows:

- Parallel — Fast data transmission line length of up to 600 m
- Serial — Slower data transmission line length of up to 3000 m

2.2.1 Installing a PLC with Centralized Configuration

The following table shows which interface modules and connecting cables can be used for connecting the various expansion units to the CC in a centralized configuration.

Interface Module in the CC	Expansion Unit	Interface Module in the EU	Connecting Cable Max. Distance
IM 300-3 6ES5 300-3AB11	EU 183U EU 185U (I/O mod. only)	IM 312-3 [2] 6ES5 312-3AB11	fixed to the IM 312 module 0.5 m; 0.95 m
IM 301-3 [1] 6ES5 301-3AB13	EU 183U EU 185U (I/O mod. only)	IM 312-3 [2] 6ES5 312-3AB31	fixed to the IM 312 module 0.5 m; 0.95 m
IM 300-5 6ES5 300-5CA11	EU 184U EU 187U	IM 312-5 6ES5 312-5CA11	fixed to the IM 312 module 0.5 m; 1.5 m
IM 301-5 [1] 6ES5 301-5CA12	EU 184U EU 187U	IM 312-5 6ES5 312-5CA21	fixed to the IM 312 module 0.5 m; 1.5 m
IM 300-5 6ES5 300-5LB11	ER 701-1	IM 306 6ES5 306-7LA11	6ES5 705-0xxxx 0.5 m to 2,5 m

[1] This IM has a second interface for distributed communication.

[2] The last IM 312-3 always requires a 6ES5 760-0AB11 terminator.

To install a PLC in a centralized configuration, you must observe the following conditions:

- A centralized configuration is generally only suitable for connecting I/O modules (DI, DO, AI, AO) and some intelligent I/O modules (IPs) in the EU (see the Configuring Aids in the catalog and Chapter 4).

- The line length between the IM in the CC and the last IM in the EU must not exceed 2 m.

2.2.2 Installing a PLC with Distributed Configuration

To install a PLC in a distributed configuration, you have a choice of parallel/symmetrical and serial communication. The following table shows which interfaces and connecting cables can be used to connect the various expansion units (EUs/ERs) to the CC in a distributed configuration.

Interface Module in the CC	Expansion Unit	Interface Module in the EU	Connecting Cable Max. Permiss. Line Length
IM 301-3 6ES5 301-3AB13 (not for S5-155H) IM 301-5 6ES5 301-5CA12	EU 183U ER 701-2 ER 701-3 EU 183U EU 185U	IM 310 [1] 6ES5 310-3AB11 IM 310 [1] 6ES5 310-3AB11	6ES5 721-0xxxx 1 m to 200 m
IM 304 6ES5 304-3UB11	ER 701-2 ER 701-3 EU 183U EU 185U	IM 314 [1] 6ES5 314-3UA11	6ES5 721-0xxxx 1 m to 600 m
IM 308 6ES5 308-3UA12	ER 701-2 ER 701-3 EU 183U EU 185U	IM 318-3 6ES5 318-3UA11	6ES5 707-5AA00 V45551-F21-B5 up to 3000 m
	ET 100U (Catalog ST 52.1)	IM 318-8 6ES5 318-8MA12	
	ICM 560	–	
IM 308-B 6ES5 308-3UB11	ET 200	IM 318-B 6ES5 318-8MB11	Cable connection
IM 307 6ES5 307-3UA11	ER 701-2 ER 701-3	IM 317 6ES5 317-3UA11	6ES5 722-2xxxx Fiber optic cable up to 1500 m
	EU 183U EU 185U	IM 317 6ES5 317-3UA11	

[1] The last IM 310 or IM 314 always requires a 6ES5 760-1AA11 terminator.

The ER 701-2 and ER 701-3 always additionally require an IM 306 for communication via an IM 304, IM 307 or IM 308.

To install a PLC in a distributed configuration, you must observe the following conditions:

- With the IM 301/IM 310 pair of interface modules, you can only use I/O modules (DI, DO, AI, AO) and IPs without page addressing in the EUs.
- With the IM 304/314 pair of interface modules, you can use all IPs, CPs and I/O modules in the EU 185U.

Note

The IM 307/317, IM 308/318 and IM 308-B/318-B each have their own manual (see catalog).

2.3 Examples

Given in the following are some examples of centralized and distributed configuration of various SIMATIC S5 components.

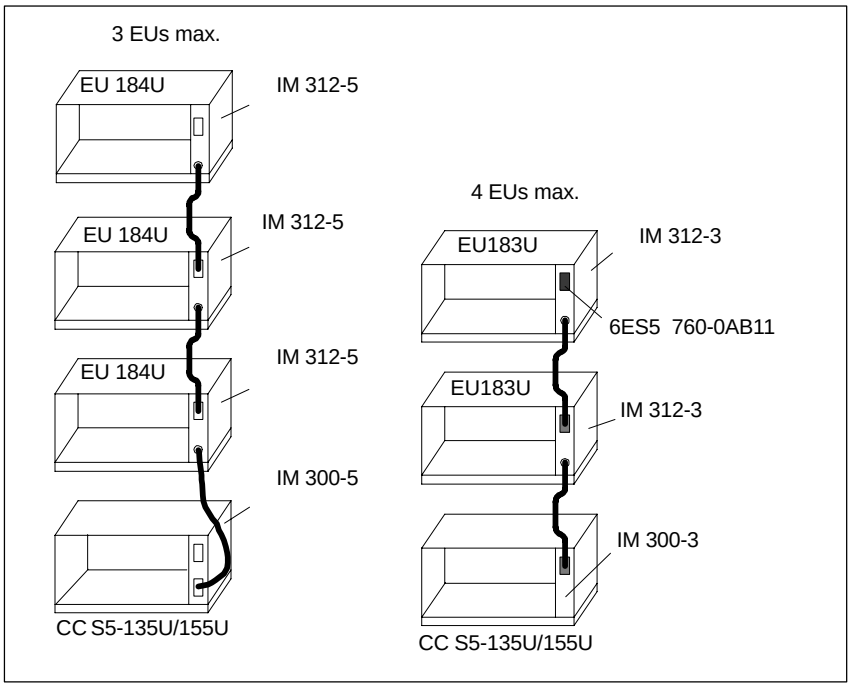


Figure 2-2 Centralized Configuration of an S5-135U/155U with the IM 300 and IM 312

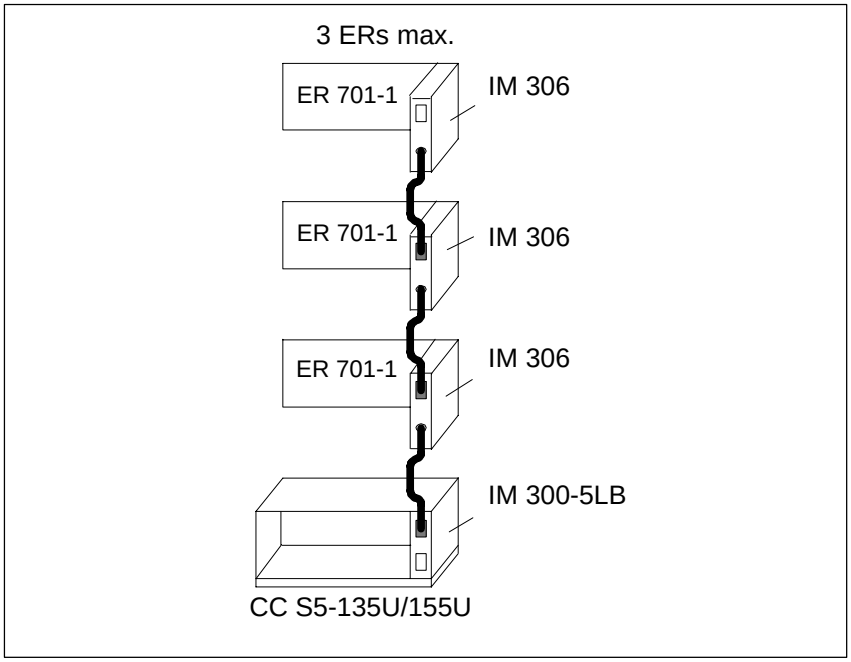


Figure 2-3 Centralized Configuration of an S5-135U/155U with ER 701s

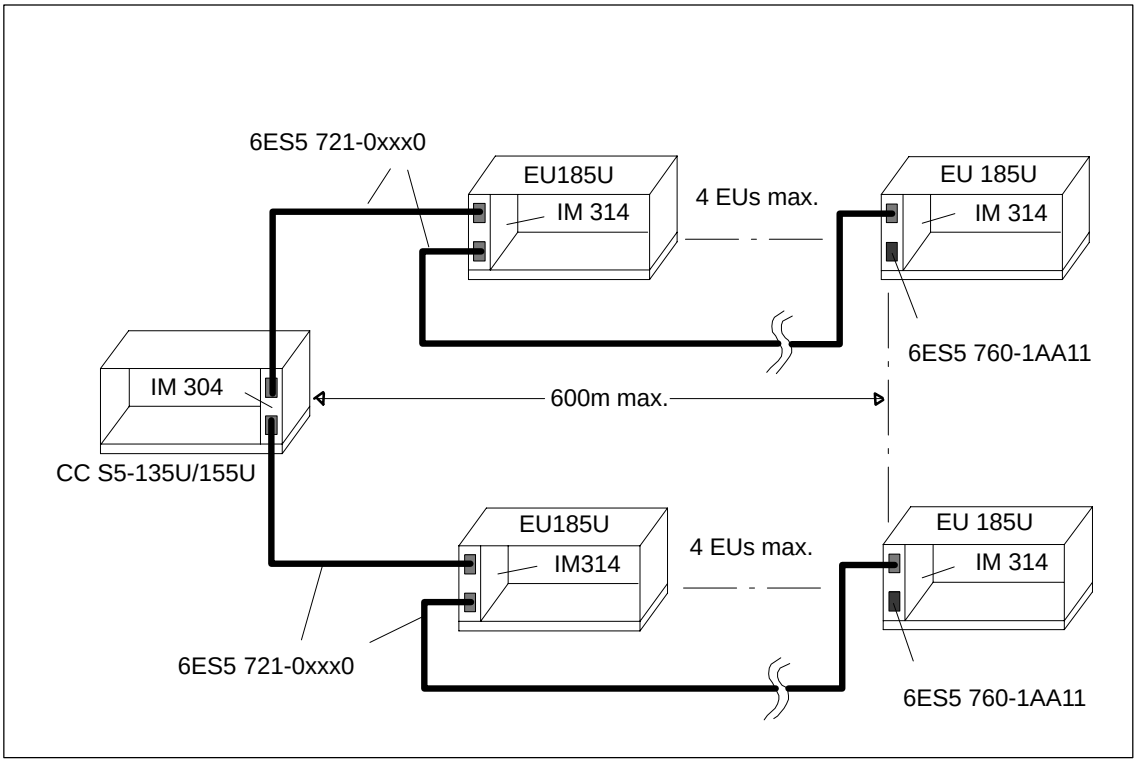


Figure 2-4 Distributed Configuration of an S5-135U/155U with the IM 304 and IM 314

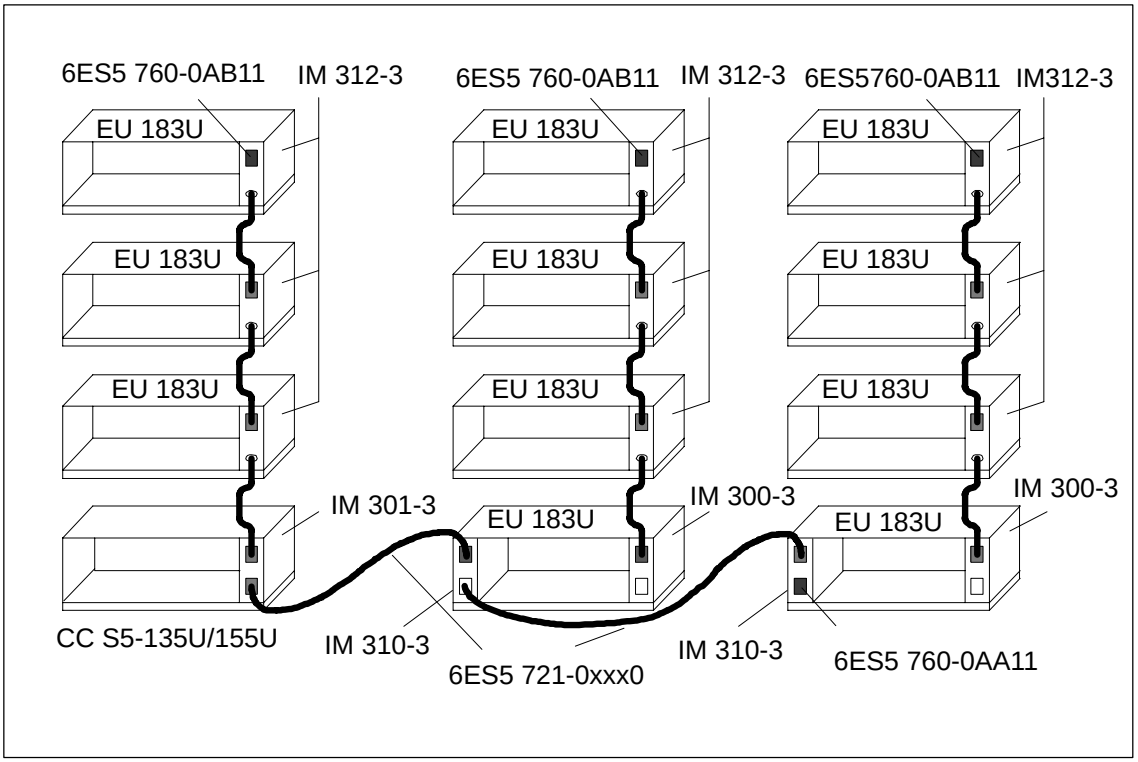


Figure 2-5 Distributed Configuration of an S5-135U/155U with Expansion Units in Centralized Configuration

4.1.5 Technical Specifications

Important for the USA and Canada

The following approvals have been granted for the central controllers and expansion units:

- UL Listing Mark
  Underwriters Laboratories (UL) to
  Standard UL 508, Report E85972

- CSA Certification Mark
  Canadian Standards Association (CSA) to Standard
  C 22.2 No. 142, Report LR 63533C

Unit safety	
The unit complies with:	VDE 0160, IEC 61131-2
Protection against overvoltage Overvoltage Class 2 (not with PS -3NA12)	VDE 0160
Class of protection	I
Type of protection (when empty slots are covered by dummy front plates)	IP 20 to IEC 60529/DIN 40050
Climatic ambient conditions (tested to DIN IEC 60068-2/-1/2/3)	
Ambient temperature in operation (supply air measured at lower air inlet of the unit)	0 to 55 °C
Transportation and storage temperature	- 40 to 70 °C
Temperature variation: in operation during transportation and storage (when delivered at less than 0 °C, at least 3 h acclimatization because of possible condensation)	 10 K/h max. 20 K/h max.
Relative humidity: in operation, during transportation and storage	95% max. at 25 °C, no condensation
Altitude: in operation during transportation and storage	 - 1000 m to + 1500 m above sea level (1080 hPa to 860 hPa) - 1000 m bis + 3500 m above sea level (1080 hPa to 660 hPa)
Pollutants: SO_2 H_2S	 0,5 cm^3 / m^3, 4 days 0,1 cm^3 / m^3, 4 days
Mechanical ambient conditions (tested to DIN IEC 60068-2-6)	
Vibration during operation	10 to58 Hz (const. amplitude 0.075 mm) 58 to 500 HZ (const. acceleration 1g)

Noise immunity, electromagnetic compatibility (EMC)	
RFI suppression Limit value class	To EN 55011 A **2)**
Conducted interference on AC supply lines (230 V AC) to EN 61000-4-4 / IEC 61000-4-4 (burst) to IEC 61000-4-5 between two lines (µs pulses) between line and ground (µs pulses)	 2 kV 1 kV 2 kV
DC supply lines (24 V supply) to EN 61000-4-4 / IEC 61000-4-4 (burst)	 2 kV
Signal lines to EN 61000-4-4 / IEC 61000-4-4 (burst)	2 kV **1)**
Immunity to discharge of static electricity to EN 61000-4-2 / IEC 61000-4-2 (ESD) **2)**	Immunity of 4 kV contact discharge (8 kV air discharge) is ensured with proper installation (see Chapter 3).
Immunity to electromagnetic RF field **2)** amplitude modulated to ENV 50140 / IEC 61004-4-3	80 to 1000 MHz 10 V/m 80% AM (1 kHz)
Immunity to electromagnetic RF field **2)** pulse-modulated to ENV 50204	900 MHz 10 V/m 50% ED
Immunity to high-frequency sinusoidal to ENV 50141	0.15 to 80 MHz 10 V 80% AM
Mechanical data	
Mechanical requirements	Installation in stationary equipment, subject to vibration; installation on ships and in vehicles if special installation rules are observed, but not on the engine.
Weight	approx. 14 kg
Dimensions (W x H x D)	482.6 x 432 x 310 mm

1) Signal lines which do not serve to control the process, for example connections to the external I/O etc.: 1 kV

2) When cabinet door is closed.

4.2 Expansion Units

This chapter contains information on the application, installation and operation of the following expansion units.

Order No. of Expansion Unit	Power Supply or Fan Subassembly
6ES5 183-3UA13 6ES5 183-3UA22	6ES5 955-3LC42 6ES5 955-3NC42
6ES5 184-3UA11 6ES5 184-3UA21	230/120 V AC fan subassembly 24 V DC fan subassembly
6ES5 185-3UA13 6ES5 185-3UA23 6ES5 185-3UA33 6ES5 185-3UA43	6ES5 955-3LC42 6ES5 955-3NC42 6ES5 955-3LF42 6ES5 955-3NF42
6ES5 187-5UA11	–

Interface Modules

Various interface modules (IMs) are available for communication between the CC and EUs and between EUs. Data transmission between CC and EU, and therefore between CPU and I/O module, is governed by the IM. A description of interface modules is given in Chapter 7.

The following table contains information on available types of expansion unit with their main features.

EU Type **Version**	**EU 183**	**EU 184**	**EU 185**	**EU 187**
Own power supply	yes	no	yes	no
With fan	yes	yes	yes	no
With cable duct	yes	yes	yes	no
Number of slots	21	21	21	11
Pluggable modules: DI/DQ AI/AQ IP without page IP with page CP	 yes yes yes no no	 yes yes yes no no	 yes yes yes yes yes	 yes yes no no no
With interrupt processing	no	no	no	no

4.2.1 Technical Description of the Expansion Units

The design of the EUs is comparable to that of the CC: they comprise a compact housing with a type-dependant number of slots for modules and, according to the type of EU, a cable duct, an integral power supply unit or fan subassembly.

The mounting dimensions of the EU 183U, EU 184U and EU 185U are the same as those of the 135U/155U CC (see Figs. 4-3 and 4-4). The EU 187U has neither power supply unit nor cable duct. Its overall height and depth are therefore different from those mounting dimensions of the other EUs.

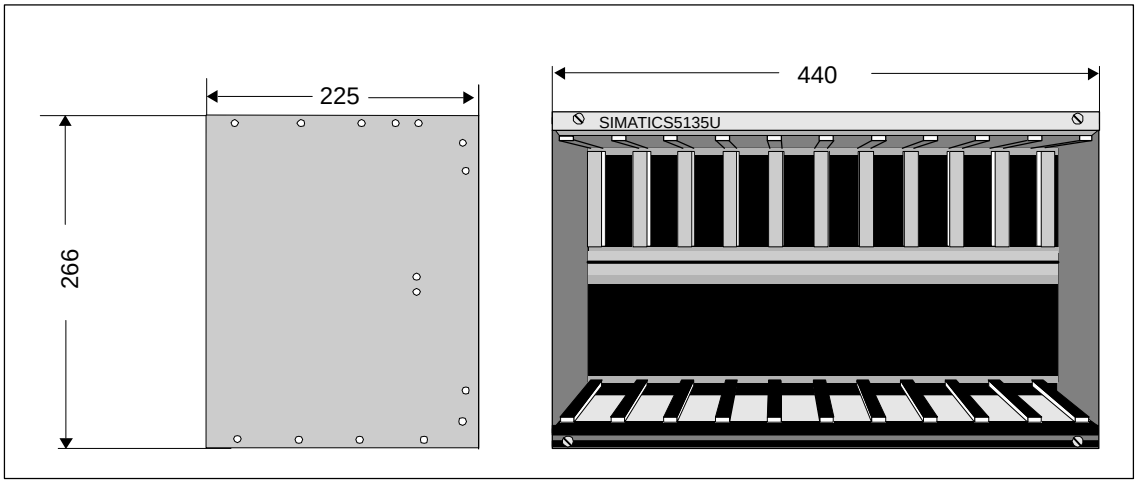


Figure 4-6 Mounting Dimensions of the EU 187U

Modules and Slot Assignments of the Expansion Units

The following tables show which modules can be inserted at which slots.

Modules and slot assignments of the EU 183U

Slot No. / Module type	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163
IM 300																					■
IM 310, IM 314, IM 318	■																				
IM 317	■																		■		
IM 312-3																					■
DI, DQ, AI, AQ	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Signal pre-processing modules (IPs)	See current Catalog ST 54.1 for slot numbers																				
Monitoring module 313	■																				■

Modules and slot assignments of the EU 184U

Slot No. Module type	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163
IM 312-5																					■
DI, DQ, AI, AQ	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Signal pre-processing modules (IPs)	See current catalog ST 54.1 for slot numbers																				
Monitoring module 313	■																				

Modules and slot assignments of the EU 185U

Slot No. Module type	3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163
Coordinator 923 C		■																			
Communication processors (CPs)			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
IM 314 R																			■	■	
IM 300																					■
IM 310, IM 134 IM 318	■																				
IM 317	■																		■		
IM 308																			■	■	■
DI, DQ, AI, AQ		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Signal pre-processing modules (IPs)	See current catalog ST 54.1 for slot numbers																				
Monitoring module 313																					■

Slots 19 to 75 are programmer MUX-capable

Modules and slot assignments of the EU 187U

Slot No. Module type	3		19		35		51		67		83		99		115		131		147		163
IM 312-5																					■
DI, DQ, AI, AQ	■		■		■		■		■		■		■		■		■		■		■
Monitoring module 313	■																				

4.2.2 Installing the Expansion Units

Like a CC, the EUs are designed for installation in cabinets, in racks and on walls. To install an expansion unit, therefore, refer to the description for the CC and Chapter 3.

4.2.3 Technical Specifications of the Expansion Units

- The technical specifications of the expansion units are the same as those of the central controller except for the following (see Section 4.1.5).
- Weight
  EU 183U: approx. 14 kg
  EU 184U: approx. 13 kg
  EU 185U: approx. 14 kg
  EU 187U: approx. 11 kg
- Dimensions: EU 187U: 440 x 266 x 225 mm

4.3 Power Supply Units

Power supply units are part of the S5-135U/155U central controllers and of the EU 183 and EU 185 expansion units.

4.3.1 Product Overview

The following section provides an overview of power supply types, their functions, LEDs and controls and their inputs and outputs.

Power Supply Types

Your CC/EU contains one of the following power supply units (PSUs):

Type of PSU (Designation)	Input Voltage	Output Voltage	Application
6ES5 955-3LC42	120 V AC 230 V AC (selectable)	5V/18A DC 15V/0.5A DC 24V/1A DC	Central controller 6ES5 188-3UA12 Expansion units 6ES5 183-3UA13 6ES5 185-3UA13
6ES5 955-3LF42	120 V AC 230 V AC (selectable)	5V/40A DC 15V/2A DC 24V/2.8A DC	Central controller 6ES5 188-3UA22 Expansion units 6ES5 185-3UA33
6ES5 955-3NC42	24 V DC	5V/18A DC 15V/0.5A DC 24V/1A DC	Central controller 6ES5 188-3UA32 Expansion units 6ES5 183-3UA22 6ES5 185-3UA23
6ES5 955-3NF42	24 V DC	5V/40A DC 15V/2A DC 24V/2.8A DC	Central controller 6ES5 188-3UA52 Expansion units 6ES5 185-3UA43

The 5 V and 15 V output voltages are regulated; the 24 V output voltage has coarse stabilization.

All four power supply units have safe electrical separation according to VDE 0805/EN 60950.

Note

Power supply units are exclusively adapted to operation with CCs/EUs.

Basic Functions

The power supply units offer the following functions:

- System power supply
  All the system voltages required for operation of the modules in a CC or EU are supplied.
- Power supply for backup (in the CC and EU 185):
  A lithium battery or an external battery ensure data backup when the system voltage is switched off or fails.
  - The lithium battery remains in the CC/EU and ensures backup, even during replacement of the power supply unit
  - Instead of the lithium battery, an external battery can be connected for data backup purposes. Situated on the front plate of the power supply unit are two sockets to connect an external battery.

The rechargeable battery (in the power supply) continues to back up while either the lithium battery or external battery is being replaced or fails, ensuring that no data are lost.

- Heat removal
  Three independent fans which are individually replaceable during operation remove the dissipated power. If a fan fails, the supply voltage for this fan is switched off and the other two fans continue operation at increased speed.

Monitoring Functions

The power supply units contain monitoring functions to detect the following faults:

- Failure of system voltage
- Failure of output voltages
- Failure of an externally applied 24 V DC load voltage (voltage monitor)
- Fan failure or inadequate air flow
- Lithium battery failure
- Rechargeable battery failure

In this context, a voltage failure is equivalent to a drop of the monitored voltage below a preset limit (see Section 4.3.6 of the Technical Specifications).

Signaling Functions

The failure of a monitored function is signaled by the power supply units:

- via LED indicators on the front plate;
- via relays with which signaling circuits can be switched;
- via signals to the S5 bus.

Switching on the Power Supply Unit for the First Time



Caution

If you have set the voltage selector switch to 120 V, but the actual voltage value is 230 V, the power supply unit may be damaged when line voltage is switched on.

How to Switch On the Power Supply Unit

When you have made all the settings, switch the power supply unit on as follows:

Step	Action	Result
1	Switch the power supply unit on with the Power switch.	
2	Switch the system voltage on.	If the required basic load (see Section 4.4.6, Technical Specifications) is in circuit, the power supply unit will start. The green LEDs "5V o.k." "15V o.k." "24V o.k." light up. The fans run.

After a maximum of 6 minutes, the rechargeable battery has been charged sufficiently for you to be able to start up the central controller or the expansion unit.

The charge time for the rechargeable battery can be up to 46 hours, depending on how low the battery was. Note that during this time, backup using the rechargeable battery is restricted.

Once the rechargeable battery is fully charged, the following load-dependent backup times apply:

$\mathbf{I_{backup}}$ mA	0.25	1	2	3	4	5
Backup time in weeks	18.8	6.3	3.4	2.3	1.7	1.4

4.3.3 Fault Indications/Fault Diagnostics

This section explains where and how faults are indicated, and how to interpret the LEDs.

Where are Faults Indicated?

Faults of the system power supply, load power supply, battery supply and fans are indicated by LEDs on the front plate of the power supply unit.

How are Faults Indicated and Interpreted?

When all monitoring circuits are switched on (jumper settings), the following indications can appear:

LED Indication	Cause	Action
“Voltage low” LED lights up.	The voltage at the voltage monitor is less than 14 V.	
“MB low” LED lights up.	The lithium battery has failed or the battery compartment is faulty. (Precondition: no external battery voltage is present).	Replace backup battery or battery compartment
“RB low” LED lights up.	The rechargeable battery has failed.	Replace rechargeable battery
“Fan 1” LED lights up.	The speed of fan 1 has dropped or fan 1 has stopped.	Replace fan
“Fan 2” LED lights up.	The speed of fan 2 has dropped or fan 2 has stopped.	Replace fan
“Fan 3” LED lights up.	The speed of fan 3 has dropped or fan 3 has stopped.	Replace fan
At least 2 “Fan” LEDs light up as well as the “Alarm” LED.	At least 2 fans have failed.	Replace fan
All 3 “Fan” LEDs flash and the “Alarm” LED lights up.	The air flow is inadequate.	Replace filter mat

The fan error is indicated approximately 6 s after the monitoring circuits are switched on or 6 s after a reset is performed.

Other Faults

Other faults can be indicated by the green LEDs on the front plate going off.

LEDs	Possible Cause	Action
Green LEDs go off and the power supply fails.	The Enable jumper is out of place	Check the jumper.
	Latching Off-switching by overvoltage at output	Switch the supply voltage off and on again. If this does not clear the fault, there is an internal fault.
	Internal fault in the PSU	Send in the PSU for repair.
	Base load too low	Increase the base load

Fans and Fan Monitoring

The following table contains several examples.

Requirement:
Enable EN present, jumper F - R closed

Causes		LED Indication		Relay		Reaction
Fans	**Air filter/ air flow**	**Fan1 to Fan3**	**Alarm**	**Fan Warning**	**Fan Alarm**	
All fans in order	In order	All LEDs dark	Dark	-	–	5 V, 15 V, 24 V present, fans 1 to 3 running
One fan failed	In order	Corresponding LED lit	Dark	Active	–	5 V, 15 V, 24 V present, faulty fan switched off, the other two fans running at increased speed
Two fans failed	In order	Corresponding LEDs lit	Lit	Active	Active	Power supply switches off
All fans in order	Dirty/halved	All LEDs flashing	Lit	–	Active	Power supply switches off

Requirement:
Enable EN present, jumper F - R open

Causes		LED Indication		Relay		Reaction
Fans	**Air filter/ air flow**	**Fan1 to Fan3**	**Alarm**	**Fan Warning**	**Fan Alarm**	
All fans in order	In order	All LEDs dark	Dark	–	–	5 V, 15 V, 24 V present, fans 1 to 3 running
One fan failed	In order	Corresponding LED lit	Dark	Active	–	5 V, 15 V, 24 V present, faulty fan switched off, the other two fans running at increased speed
Two fans failed	In order	Corresponding LEDs lit	Lit	Active	Active	5 V, 15 V, 24 V present, faulty fans switched off, one fan running at increased speed
All fans in order	Dirty/halved	All LEDs flashing	Lit	–	Active	5 V, 15 V, 24 V present, fans 1 to 3 running

Note:
When the jumper “BB - AA” is closed the relay “Fan Alarm” is also activated by the “output inhibit” signal (BASP via BASPA).

Rechargeable Battery and Battery Monitoring

The following table contains several examples.

Causes			Relay	LED Indication		
Rechargeable Battery	**Battery or external supply**	**Jumpers**	**Battery Warning**	**RB**	**MB**	**/BAU**
In Order	In Order	MA-NA closed MM-NN closed MB-NB open	–	Dark	Dark	Inactive
Faulty	In Order	MA-NA closed MM-NN closed MB-NB open	Active	Lit	Dark	Inactive
In Order	Faulty	MA-NA closed MM-NN closed MB-NB open	Active	Dark	Lit	Inactive
Faulty	Faulty	MA-NA offen MM-NN closed MB-NB open	Active	Lit	Lit	Active
Not monitored	In Order	MA-NA open MM-NN closed MB-NB open	–	Dark	Dark	Inactive
Not monitored	Faulty	MA-NA open MM-NN closed MB-NB open	Active	Dark	Lit	Active
Not monitored	Not monitored	MA-NA irrelevant MM-NN open MB-NB open	–	Dark	Dark	Inactive

Note:
Jumper MB - NB open: when line voltage returns the signal /BAU (battery failure) is activated by a corresponding error.

Jumper MB - NB closed: when line voltage returns and during operation the signal /BAU (battery failure) is activated by a corresponding error.

4.3.4 Maintenance and Repairs

Lithium Battery

The lithium battery should be replaced when a battery failure is indicated. The backup times of the lithium battery are given in the following table:

$\mathbf{I}_{backup}$ mA	0.25	1	2	3	4	5
New battery, backup time in weeks	81.5	27.4	14.5	9.9	7.5	6.0
Battery 3 years old, backup time in weeks	64.2	21.6	11.5	7.8	5.9	4.8

Fans

If a fan fails, replace it as quickly as possible. The behavior of the power supply in the event of fan failure is described in Section 4.3.5.

Rechargeable Battery

The rechargeable battery should be replaced at regular intervals (service life of 6 years at 40 °C (104 °F) ambient temperature). With a failed power supply and failed battery, the backup times of the rechargeable battery are as follows:

$\mathbf{I}_{backup}$ mA	0.25	1	2	3	4	5
Backup time in weeks	18.8	6.3	3.4	2.3	1.7	1.4

Filter Mat

The replacement intervals for the filter mat (with the air filter option) depend on the ambient conditions under which the power supply unit is in operation.

Replacing the Lithium Battery

The lithium battery can be replaced without memory loss if the PSU is switched on, the rechargeable battery is in order or you apply an external (4.5 V) voltage to the “Ext.Batt.” terminals.

How to Replace the Lithium Battery

Replace the lithium battery in the following steps:

Step	Action
1	Slide the battery compartment cover down.
2	Pull the battery compartment out.
3	Remove the old lithium battery from the battery compartment by inserting a screwdriver through a hole in the compartment base to push the battery upwards.
4	Insert the new lithium battery in the battery compartment **Important:** Ensure correct polarity.
5	Slide the battery compartment in.
6	Close the cover.
7	Press the Reset button. Result (only with PSU on): – “MB low” LED goes off. – Contacts 14 and 15 of the Battery Warning relay are bridged.

Replacing a Fan

Location of the Fans

The three fans are situated at the bottom of the power supply unit and can be individually replaced during operation.

Before Replacement

If you operate your power supply with a filter, you must first release the filter subdrawer and pull it out before you can replace a fan (see Section entitled “Replacing the Filter Mat”).

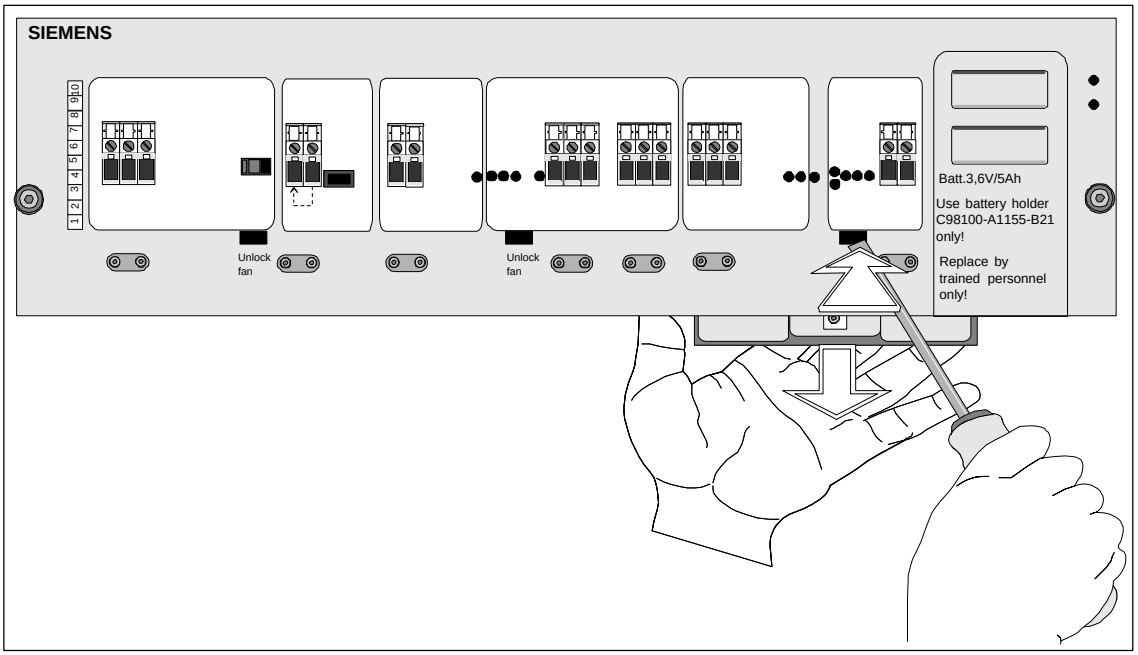
How to Replace a Fan

The following steps are necessary to replace a fan:

<table>
<tr><th>Step</th><th>Action</th><th>Result</th></tr>
<tr><td>1</td><td>Place one hand under the fan you wish to replace, and use the other hand to insert a screwdriver (DIN 5265, blade width 3.5-6.5 mm) into the unlock fan opening.</td><td>When the screwdriver is pulled out, the snap hook is released. By pulling on the round hole on the underside of the fan subassembly it swings down and can be pulled out.</td></tr>
<tr><td>2</td><td colspan="2">– If this is not the right-hand fan subassembly, go directly to step 3 after removing the old fan subassembly.
– If this is the right-hand fan subassembly, proceed as follows:
<table><tr><th>Step</th><th>Action</th></tr><tr><td>2a</td><td>Unscrew the rechargeable battery from below.</td></tr><tr><td>2b</td><td>Disconnect the connecting cable.</td></tr><tr><td>2c</td><td>Insert the rechargeable battery in the new fan subassembly (see Section entitled “Replacing the Rechargeable Battery”) and reconnect the connecting cable.
Important:
Ensure correct polarity.</td></tr></table></td></tr>
<tr><td>3</td><td>Insert the new fan subassembly with the tab at the rear into the housing, and swivel it up.</td><td>The fan subassembly locks in place.</td></tr>
</table>

Releasing the Fan Lock

The following figure shows how to release the fan lock:



After Replacement

After replacement, press the Reset button, the monitor will become active 6 secs after the Reset button is pressed.

IF...	THEN...
the relevant “Fan” LED goes off,	the fan is correctly installed.
the relevant “Fan” LED does not go off,	the fan is incorrectly installed. Make a step-by-step check to ensure correct replacement.
the relevant “Fan” LED goes off but the “Warning” relay does not pick up,	another fan has failed and another “Fan” LED lights up. Replace the second fan also.

Replacing the Rechargeable Battery

Location of the Rechargeable Battery

The rechargeable battery is situated in the right-hand fan subassembly.



Caution

Do not place the rechargeable battery in contact with fire or heat and do not short-circuit it.

The rechargeable battery must not be destroyed or disassembled!

Nickel-cadmium batteries contain an alkali electrolyte which can harm the skin and damage clothing.

If your skin or your eyes make contact with the electrolyte, rinse immediately with clean water and consult a doctor.

Before Replacement

If you operate your power supply with a filter, you must first release the filter subdrawer and pull it out before dismantling the right-hand fan and replacing the rechargeable battery (see Section entitled “Replacing the Filter Mat”).

How to Replace the Rechargeable Battery

The rechargeable battery can be replaced during operation. Proceed as follows:

Step	Action
1	Insert a screwdriver (DIN 5265, blade width 3.5-6.5 mm) into the right-hand unlock fan opening.
2	Swing the right-hand fan subassembly out (by placing your finger in the round opening on the underside at the front and pulling downwards). **Result:** “Fan 3” LED indicates failure of the right-hand fan and the other two fans operate at increased speed.
3	Slacken the screws on the bottom of the fan subassembly and pull out the rechargeable battery.
4	Disconnect the connecting cable of the rechargeable battery.
5	Connect the cable to the new rechargeable battery. **Important:** Ensure correct polarity (red terminal on plus, black terminal on minus, see Figure “Replacing the Rechargeable Battery in the Fan Subassembly”).
6	Insert the new rechargeable battery pack in the left-front part of the fan subassembly (plus pole to the right). Ensure that the black connecting cable is lying on the floor of the battery compartment when you insert the battery. Secure it with the screws from below.
7	Insert the fan subassembly with the tab at the rear into the housing and swivel it up until it locks in place.
8	Press the Reset button. With a fully discharged battery, the message can only be acknowledged after at least 6 minutes.

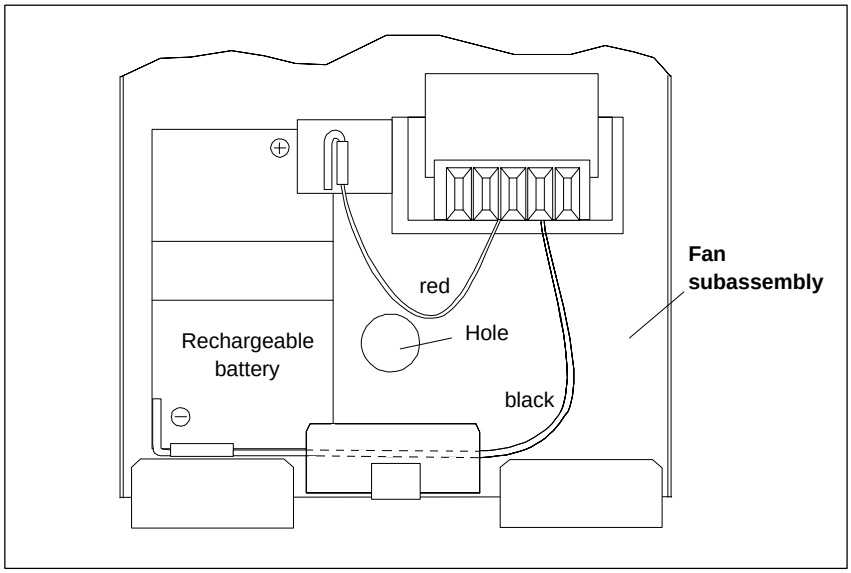
After Replacement

The recharging time for the battery may be up to 46 hours, depending on its state of charge. Please note that backup via the battery is only possible within limits during this time.

If the rechargeable battery does not work after replacement, there may be the following faults:

IF...	THEN...
"RB low" LED does not go off after 6 minutes,	the rechargeable battery is incorrectly connected or faulty or the charging circuit in the PSU is faulty.
"RB low" LED goes off but the relay does not pick up,	the battery has failed and the yellow "MB low" LED lights up or the battery compartment is faulty.

Replacing the Rechargeable Battery in the Fan Subassembly



Replacing the Filter Mat

Inadequate Air Flow

If the filter mat is clogged and the power supply unit no longer receives sufficient air, the “Alarm” LED lights up, LEDs for “Fan 1,” “Fan 2” and “Fan 3” flash and the “Alarm” relay picks up. The fault can be cleared by replacing the filter mat (see ordering information for the order number).

How to Replace the Filter Mat

Correct the fault in the following steps:

Step	Action
1	Release the filter subdrawer.
2	Swivel the filter subdrawer downwards and pull it forwards and out.
3	Remove the old filter mat.
4	Insert a new filter mat in the filter subdrawer.
5	Place the distance grid on the new filter mat.
6	Insert the filter subdrawer in the guide rails, slide it back and swivel it up so that it locks in place.
7	Press the Reset button. **Result:** – Fault LEDs for “Alarm,” “Fan 1,” “Fan 2” and “Fan 3” go off. – Contacts 11 and 12 are closed in the “Alarm” relay.

Replacing a Power Supply Unit

If it should be necessary to replace the power supply unit in a system during commissioning or during operation, we recommend you proceed as follows:

Requirement:
Redundant backup, “Spare power supply” without rechargeable battery (standard spare part).
The lithium battery in the rack is in full working order.

Step	Action
1	Disconnect the faulty power supply from the system voltage and remove it.
2	Set the jumpers on the spare power supply according to your needs.
3	Push the spare power supply into the rack and screw it in place.
4	Remove the right-hand fan subassembly from the defective power supply.
5	Remove the rechargeable battery from the fan subassembly.
6	Replace the right-hand fan subassembly in the defective power supply.
7	Remove the right-hand fan subassembly from the spare power supply.
8	Connect up the spare power supply.
9	Switch on the system voltage and the power supply in any order. **Reaction:** – The system runs up – Both fans run at an increased speed – The LEDs “Fan 3” and “RB low” light up.
10	Insert the rechargeable battery in the fan subassembly and connect it up.
11	Reinsert the right-hand fan subassembly.
12	After the system has run up, press the reset switch on the spare power supply. **Reaction:** – The LED “Fan 3” goes out – The fans run at their normal speed again – The LED “RB low” shows the charge state of the rechargeable battery.

Requirement:
Redundant backup, “Spare power supply” with rechargeable battery. The lithium battery in the rack is in full working order.

Step	Action
1	Disconnect the faulty power supply from the system voltage and remove it.
2	Set the jumpers on the spare power supply according to your needs.
3	Push the spare power supply into the rack and screw it in place.
4	Remove the right-hand fan subassembly from the spare power supply.
5	Connect up the replacement power supply.
6	Switch on the system voltage and the power supply in any order. **Reaction:** – The system runs up – Both fans run at an increased speed – The LEDs “Fan 3” and “RB low” light up.
7	Reinsert the right-hand fan subassembly.
8	After the system has run up, press the reset switch on the spare power supply. **Reaction:** – The LED “Fan 3” goes out – The fans run at their normal speed again – The LED “RB low” shows the battery charge state.

Requirement:
No backup

Step	Action
1	Disconnect the faulty power supply from the system voltage and remove it.
2	Set the jumpers on the spare power supply according to your needs.
3	Push the spare power supply into the rack and screw it in place.
4	Connect up the spare power supply.
5	Switch on the system voltage and the power supply in any order. **Reaction:** – The system runs up.

4.3.5 Description of Internal Sequences in the Power Supply Unit

Given in this section is background information on internal sequences in the power supply unit.

Behavior Upon Failure of the System Supply

When the System Supply Fails

The behavior of the power supply unit after a system supply failure is governed by the duration of the failure:

IF the system supply failure...	THEN...
is shorter than the stored energy time for power failure	the PSU output voltages are within tolerance ranges; no indication appears on the front plate and no signal is sent to the S5 bus.
is longer than the stored energy time for power failure	a data save routine is initiated on the CPU/CPUs and an output inhibit is issued.

Redundant Data Backup

To ensure data backup, your CC and EU 185 are provided with a lithium battery, and the power supply unit with a rechargeable battery.

In the event of system supply failure or switch-off, data backup is provided by the lithium battery and, in the event of battery failure, by the rechargeable battery which is permanently recharged to remain constantly operative.

After replacement of a defective lithium battery, the new one resumes data backup and you must acknowledge the fault LED on the front panel.

As the rechargeable battery is withdrawn during the replacement of a power supply unit, data backup is temporarily performed by the lithium battery.

Behavior Upon Failure of Fans

Failure Indication

If a fan fails (its speed decreases) a fault is indicated, i.e. the red LED assigned to the fan lights up:

"Fan 1" LED = left fan failed
"Fan 2" LED = middle fan failed
"Fan 3" LED = right fan failed

If a Fan Fails

If a fan fails, the following takes place:

Stage	Description
1	A fan fails. Result: – The red LED assigned to the fan lights up.
2	Contacts 9 and 10 in the "Warning" relay are closed.
3	The faulty fan is switched off.
4	The other two fans operate at increased voltage and an audibly higher speed.

If Another Fan Fails

If another fan fails, the following takes place:

Stage	Description
5	Another fan fails. Result: – The red LED assigned to the fan lights up.
6	Contacts 12 and 13 in the "Alarm" relay are closed. **Result:** – "Alarm" LED lights up. – Two "Fan"-red LEDs light up.
7	A data save routine is started and, with the appropriate jumper setting, an output inhibit is issued.
8	The power supply switches off, with the appropriate jumper setting.

Resetting the Fault Message

When the fault has been cleared (faulty fan replaced, filter mat replaced), you can reset the fault messages by pressing the Reset button.



Caution

You can suppress the shutdown of the power supply by opening jumper F-R. In this case, you must ensure that the power supply is switched off after 60 secs at the latest. This can be achieved with a time relay, for example. This prevents modules from overheating and being damaged.

4.3.6 Technical Specifications of the Power Supply Units

Important for the USA and Canada
The following approval has been obtained:

UL-Recognition-Mark (for USA)
Underwriters Laboratories (UL) to
Standard UL 508, Report E 143289

CUL-Recognition-Mark (for Canada) to
Canadian National Standard C 22.2, No. 142, Report E 143289

	6ES5 955-3LC42	**6ES5 955-3LF42**
Safety Specifications	The power supply units comply with safety specifications VDE 0805 / EN 60950 / IEC 60950 / VDE 0160 and VDE 0106 Part 101.	
Shock protection	only insured in the installed state	
Data for EMC in the installed state	see Technical Specifications of the S5-135U/155U CC	
Safe isolation	is ensured.	
Input		
Rated input voltage	120 V (93-132 V) AC 230 V (187-264 V) AC	120 V (93-132 V) AC 230 V (187-264 V) AC
Rated input frequency	50/60 Hz (47-63 Hz)	50/60 Hz (47-63 Hz)
Input current $I_{i/p}$ at rated load and rated $V_{i/p}$ = 120V = 230V	 2.5 A_{rms} 1.5 A_{rms}	 4.5 A_{rms} 2.6 A_{rms}
Peak inrush current $I_{i/p\ max}$	26 A for 2 s, otherwise < 5 A (repetition rate 100 secs)	25 A for 2 ms (repetition rate 100 secs)
I^2t value of inrush current	4 A^2s	5.2 A^2s
Efficiency at rated load (with fans) and $V_{i/p}$ ≙ 230/120 V AC	> 0.63	> 0.68
Max. heat dissipation at rated load at $V_{o/p1}$, $V_{o/p2}$, $V_{o/p3}$ (with fans)	80 W	147 W
Efficiency at rated load (without fans) and $V_{i/p}$ ≙ 230/120 V AC	0.70	0.71
Max. heat dissipation (without fans)	53 W	123 W
Stored energy time during power failure at rated load and $V_{i/p}$ ≙ 187/93 V AC (adjustable)	>20 ms 20 ms 5 ms	>20 ms 20 ms 5 ms
Input fuse	Wickmann G 19343-T4A/250V, 500 A^2s	Wickmann G 19340-8A/250V, 200 A^2s
External battery supply	4.5 V	4.5 V