Betriebsanleitung / Operating Instructions Ausgabe/Edition: AG

simovert masterdrives

SIEMENS

Bremseinheit / Braking Unit

Contents

1 Definitions and Warnings

Qualified personnel

For the purpose of this documentation and the product warning labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up, operation and maintenance of the product. He or she must have the following qualifications:

- Trained or authorized to energize, de-energize, ground and tag circuits and equipment in accordance with established safety procedures.
- Trained or authorized in the proper care and use of protective equipment in accordance with established safety procedures.
- Trained in rendering first aid.

DANGER

indicates an **imminently** hazardous situation which, if not avoided, will result in death, serious injury and considerable damage to property.

WARNING

indicates a **potentially** hazardous situation which, if not avoided, could result in death, serious injury and considerable damage to property.

CAUTION

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

CAUTION

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

NOTICE

NOTICE used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesireable result or state.

NOTE

For the purpose of this documentation, "Note" indicates important information about the product or about the respective part of the documentation which is essential to highlight.

WARNING

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the warnings can thus result in severe personal injury or property damage.

Only qualified personnel should work on or around the equipment

This personnel must be thoroughly familiar with all warning and maintenance procedures contained in this documentation.

The successful and safe operation of this equipment is dependent on correct transport, proper storage and installation as well as careful operation and maintenance.

NOTE

This documentation does not purport to cover all details on all types of the product, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local SIEMENS sales office.

The contents of this documentation shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of SIEMENS AG. The warranty contained in the contract between the parties is the sole warranty of SIEMENS AG. Any statements contained herein do not create new warranties or modify the existing warranty.

CAUTION

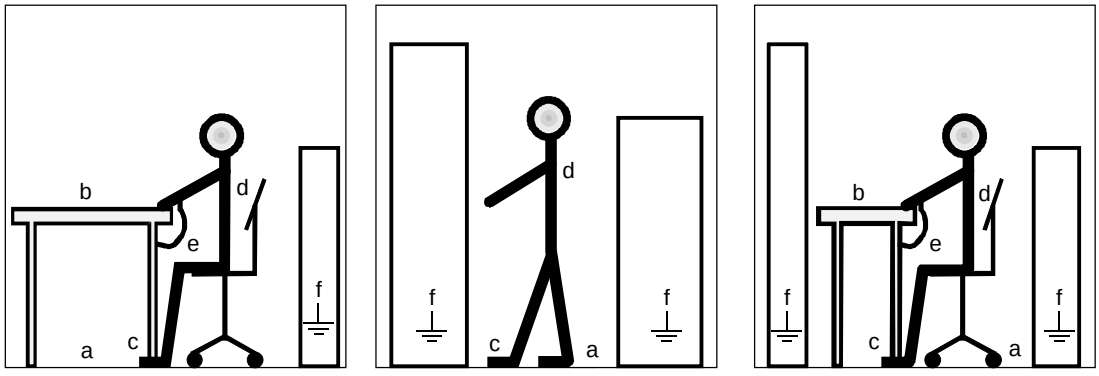
Components which can be destroyed by electrostatic discharge (ESD)

The converters contain components which can be destroyed by electrostatic discharge. These components can be easily destroyed if not carefully handled. If you have to handle electronic boards please observe the following:

- Electronic boards should only be touched when absolutely necessary
- The human body must be electrically discharged before touching an electronic board
- Boards must not come into contact with highly insulating materials - e.g. plastic foils, insulated desktops, articles of clothing manufactured from man-made fibers
- Boards must only be placed on conductive surfaces
- When soldering, the soldering iron tip must be grounded
- Boards and components should only be stored and transported in conductive packaging (e.g. metalized plastic boxes, metal containers)
- If the packing material is not conductive, the boards must be wrapped with a conductive packaging material, e.g. conductive foam rubber or household aluminum foil.

The necessary ECB protective measures are clearly shown in the following diagram:

a = Conductive floor surface
b = ESD table
c = ESD shoes
d = ESD overall
e = ESD chain
f = Cubicle ground connection



2 Product Description

Electric energy is fed into SIMOVERT MASTERDRIVES when a motor is decelerated. In order to prevent overvoltage tripping, a braking resistor is used to convert this energy into heat. This resistor may be a part of the braking unit or it is connected to it.

The braking unit is connected to the DC bus terminals of the drive. When the DC bus voltage reaches a pre-defined limit, the braking unit automatically turns on and prevents the DC bus voltage from continuing to increase.

The braking unit operates autonomously. The power supply of the electronics is integrated in the unit.

The braking unit is available in three frame sizes.

- **frame size S,** 5 kW to 10 kW:
  integrated braking resistor: for short braking operation
  external braking resistor: if the integrated braking resistor is not sufficient
- **frame size A,** 10 kW to 20 kW:
  integrated braking resistor: for short braking operation
  external braking resistor: if the integrated braking resistor is not sufficient

  50 kW:
  external braking resistor
- **frame size B,** 100 kW to 200 kW:
  external braking resistor

3 Mounting, Connecting-up

Mounting

- Braking units are mounted next to SIMOVERT MASTERDRIVES on a G rail or using M6 screws.

Connecting-up

- Braking unit:
  Connect the terminals C/L+ and D/L- (top side of the braking unit) to the terminals C/L+ and D/L- of the drive (see Fig. 3-1).
  - The connecting cables should be max. 3 m long and twisted.
  - For several inverters in parallel with a common DC bus, the braking unit should be connected to the inverter with the highest rating.
- Connecting braking units in parallel:
  - Only braking units with the same ratings or the next highest or next lowest rating (see Table 7-1) may be connected in parallel.
  - Each braking unit must have its own twisted feeder cable, max. length 3 m.
- External braking resistors (selection list see chapter "Braking Resistors")
  - 5 kW to 20 kW Disconnect jumper between terminals H1 and H2, connect resistor to Terminals G and H2.
  - 50 kW to 200 kW Connect the resistor to terminals G and H.
  - Length of the connecting cables between braking unit and external braking resistor < 15 m.

WARNING

Mis-connecting or shorting the DC bus terminals will destroy the drive and the braking unit, respectively.

5 kW to 20 kW If an external resistor is connected, the jumper between H1 and H2 must be removed, otherwise the unit or the braking unit may be destroyed!

For braking units with an internal brake resistor, the air discharge temperature can be > 80 °C.

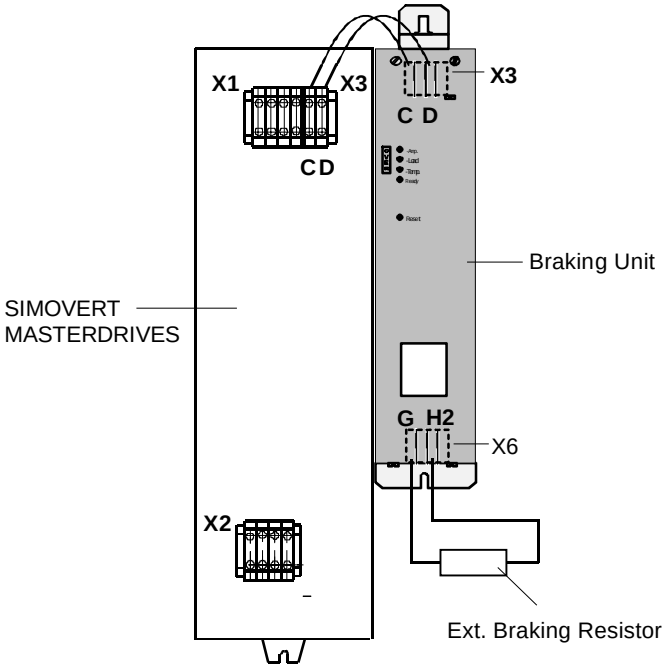


Fig. 3-1 Connection of the braking unit

3.1 Dimension drawings

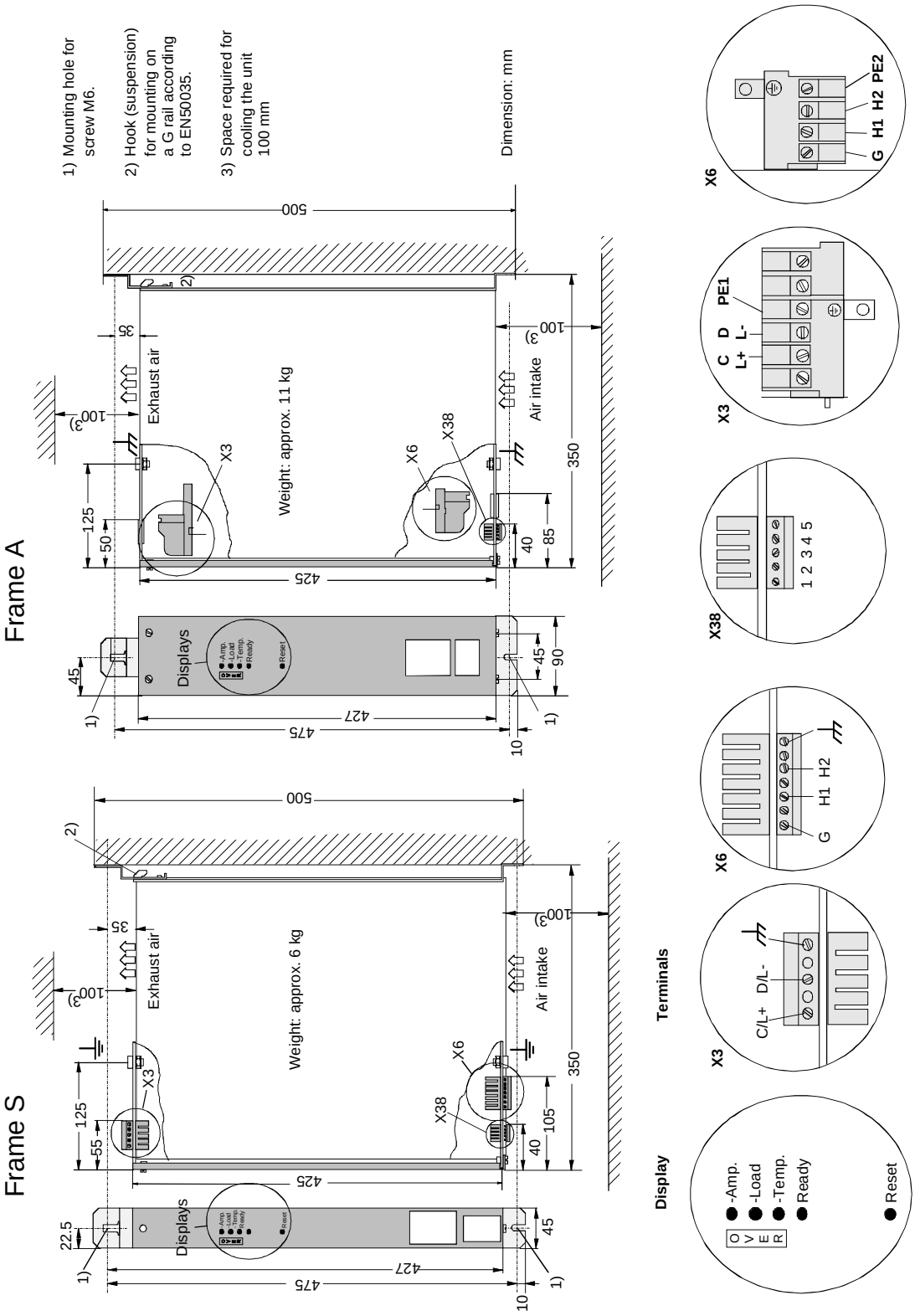


Fig. 3-2 Dimension drawing types S and A

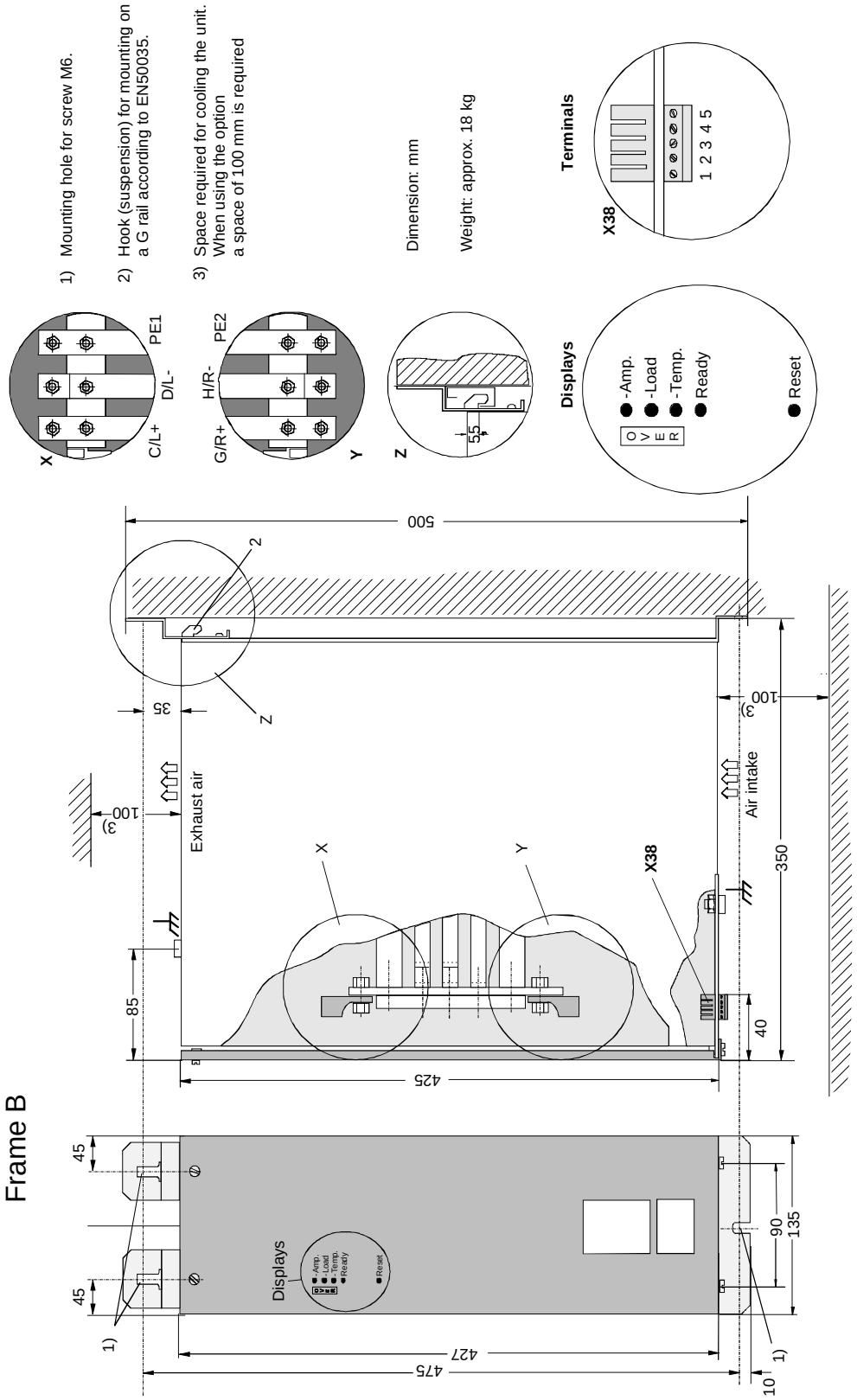


Fig. 3-3 Dimension drawing type B

3.2 Power terminals

Connection		Construction type S		Construction type A		Construction type B	
		Terminal	**Tightening torque [Nm / lbf ft]**	**Terminal**	**Tightening torque [Nm / lbf ft]**	**Terminal**	**Tightening torque [Nm / lbf ft]**
C/+	Input	X3:1	0.5 / 0.37	X3:2	2 / 1.5	Busbar C/L+	13 / 9.6
D/-	Input	X3:3	0.5 / 0.37	X3:3	2 / 1.5	Busbar D/L-	13 / 9.6
⏚	Shielding	X3:5	0.5 / 0.37	M5 screw on top of housing	6 / 4.4	M6 screw on top of housing	10 / 7.4
PE1	⏚	M5 screw on top of housing	6 / 4.4	X3:4	2 / 1.5	Busbar PE1	13 / 9.6
G	external braking resistor	X6:1	0.5 / 0.37	X6:1	2 / 1.5	Busbar G / R+	13 / 9.6
H1	internal braking resistor	X6:3	0.5 / 0.37	X6:2	2 / 1.5		
H2 / H	external braking resistor	X6:5	0.5 / 0.37	X6:3	2 / 1.5	Busbar H / R-	13 / 9.6
⏚	Shielding	X6:7	0.5 / 0.37	M5 screw on bottom of housing	6 / 4.4	M6 screw on top of housing	10 / 7.4
PE2	⏚	M5 screw on bottom of housing	6 / 4.4	X6:4	2 / 1.5	Busbar PE2	13 / 9.6
Connection via		Terminal strip		Terminal strip		Cable lug according to DIN 46235 and M8 screws	
Connectable conductor cross-section	**VDE (mm^2)**	1.5 to 4		2.5 to 10		max. 1 x 95 or 2 x 70	
(stranded):	**AWG**	16 to 10		14 to 6		max. 1 x 000	

NOTE

AWG: American Wire Gauge

Recommended conductor cross-sections: see Table 7-1.

Table 3-1 Power terminals of the braking unit

WARNING

The braking unit may be connected to the DC bus bar with or without using fuses.
The connections between the drive converter and braking unit must be short-circuit- and ground-fault proof.

The voltage withstand capability of the cable must be according to the line voltage.

Fuses

- It is recommended that fuses be used for multi-motor systems using a common DC bus (incoming power ≫ braking unit rating).
- High voltage fuses (1000 V) must be used in the positive and negative branches (fuse type see Table 7-1).
- Fuses are not required for single-motor drives (one inverter for each braking unit).

NOTE

These fuses only provide protection in critical situations. They do not protect the braking unit or external brake resistor.

3.3 Control terminal X38

The braking unit has an inhibit input and a fault output.

- Inhibit input — Pin 1 (+) and Pin 2 (-)
  Connecting 24 V DC:
  locks the braking unit
  Acknowledge "OVERAMP" and "OVERTEMP" faults
- Fault output — Pin 4 and 5
  Relay contact closed: no fault
  Relay contact open: fault (see chapter 5 "Monitoring")
  or
  braking unit locked (Inhibit)
  or
  no DC bus voltage applied

Connectable cross-section:	0.08 – 1.5 mm^2 / AWG 28 – 16
Tightening torque:	0.22 – 0.25 Nm / 0.16 – 0.18 lbf ft

NOTE

Control terminals need not be connected for proper operation of the braking unit.

Relay load current capability:
1 A at 230 V AC (overvoltage category II)
1 A at 24 V DC

3.4 Examples for connection

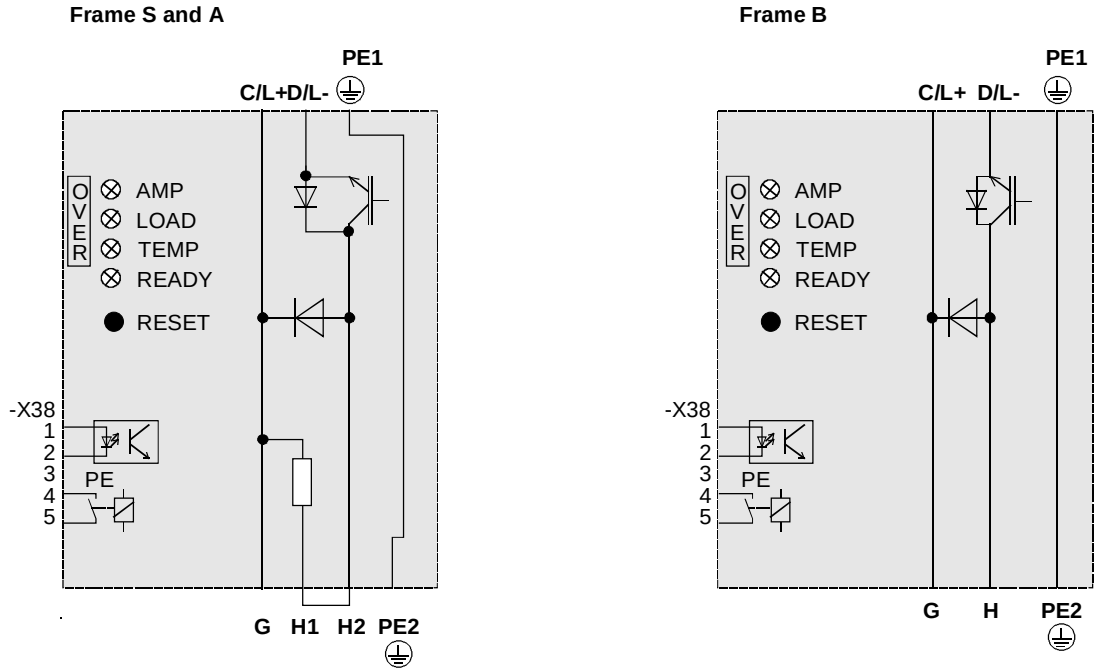


Fig. 3-4 General schematic diagrams

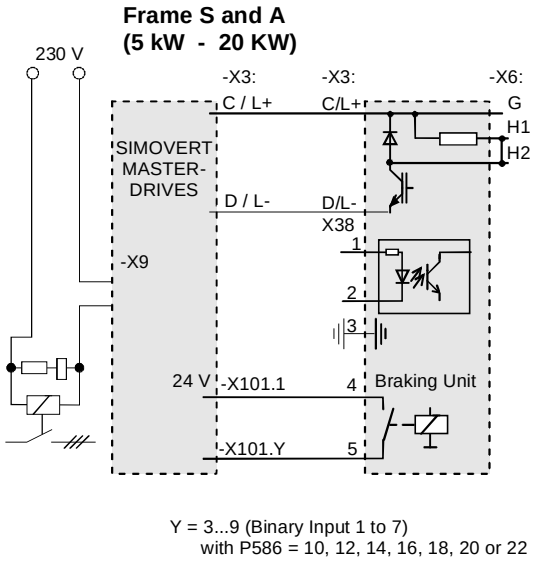


*Fig. 3-5 Drive and braking unit with **internal** braking resistor and tripping of the drive at faults of the braking unit*

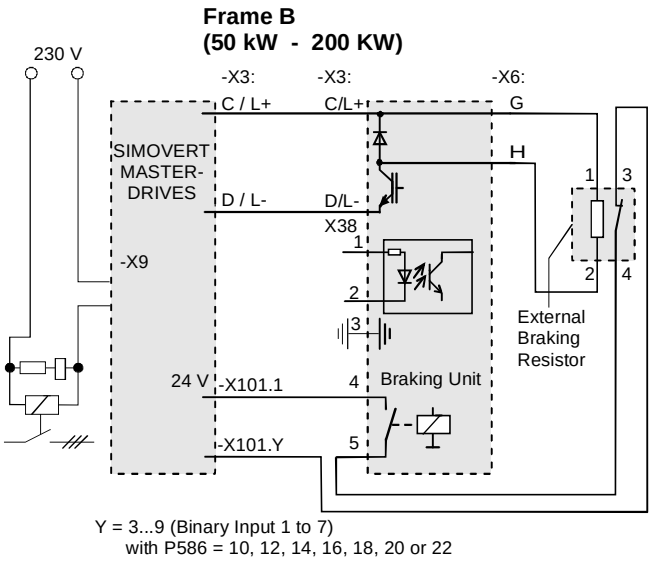


*Fig. 3-6 Drive and braking unit with **external** braking resistor and tripping of the drive at faults of the braking unit*

CAUTION The braking unit may not be connected to the live DC bus via a contactor.

4 Braking Resistors

The braking resistors listed in chapter 7 "Technical Data" match the braking units and allow full utilization of the braking capability.

WARNINGS

When braking resistors and braking units are combined, it must be guaranteed that the resistance of a resistor is not less than the minimum allowed resistance, otherwise the braking unit may be destroyed!

Higher values of the resistors are allowed. Under these circumstances the braking power will be reduced ($P = V^2/R$).

During operation the surface of the braking resistors may have temperatures of several hundred degrees C. Therefore cooling air must not contain flammable or explosive items or gases.

If a resistor is wall-mounted, the wall must not be flammable.

WARNINGS

The external braking resistors must be installed separately and connected on-site.

The listed braking resistors have a thermal contact (NC) which opens at overload of the resistor. This thermal contact can, for example, be connected up to the fault input of the SIMOVERT MASTERDRIVES.

If the thermo-contact of the external braking resistor is evaluated, the drive converter must be isolated from the line supply when the contact responds (e.g. by controlling the main contactor via -X9:4,5 (5-pole terminal strip) or -X9:7,9 (9-pole terminal strip).

4.1 Definitions of the power ratings

Braking unit with external resistor

P20 = Rated Power

P3 = Peak Power = 1.5 × P20

PDB = 0.25 × P20 = Steady State Power Rating

Braking unit with internal resistor

P20 = Rated Power

P3 = Peak Power = 1.5 × P20

PDB = 0.03 × P20 = Steady State Power Rating

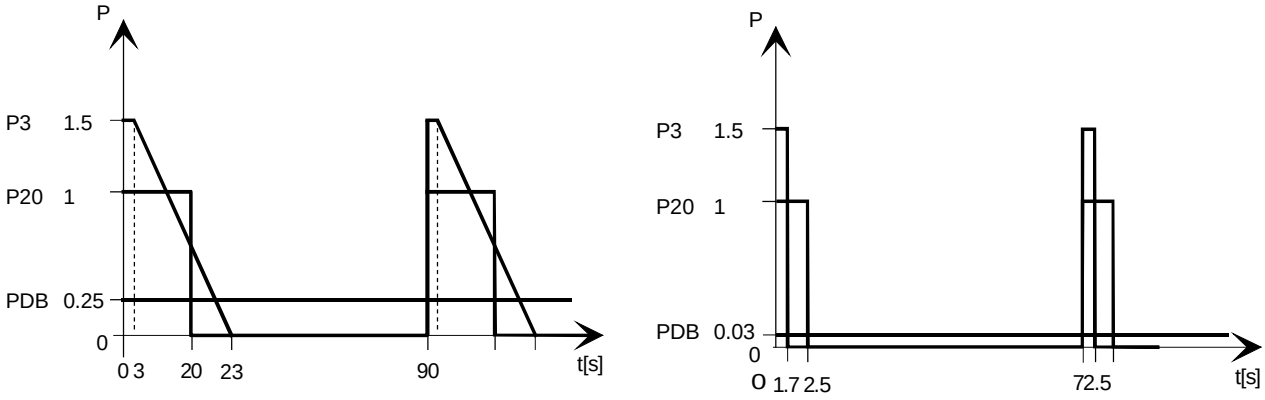


Fig. 4-1 Load characteristics of the braking units

5 Monitoring

In the case of faults, the braking unit will be locked, the fault relay (X38:4-5) is de-energized. The fault is displayed via LEDs at the front cover of the braking unit.

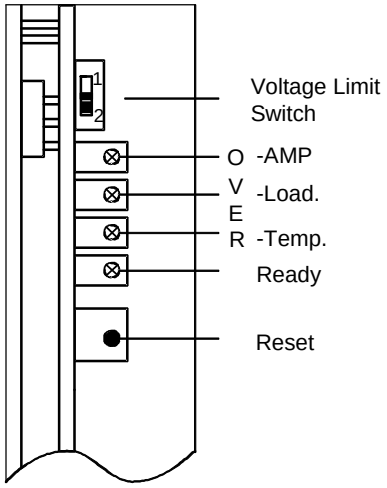


Fig. 5-1 Position of the displays

Displays (LED)	Description of operating state
♦ OVERAMP	LED is on during an output short circuit. This fault is not automatically reset. It can be reset via the Reset key or by applying and releasing the Inhibit command. **Before resetting the braking unit make sure that the short circuit no longer exists!**
♦ OVERLOAD	LED is on when the overload monitoring circuit becomes active (it monitors the duty cycle); if the specified duty cycle is exceeded, the braking unit turns off. **The fault is automatically reset after some 70 sec.** Cannot be reset with the Reset key or by applying the Inhibit signal.
♦ OVERTEMP	LED is on when the temperature monitoring circuit is active (ambient temperature too high or no sufficient cooling air flow). When the resistor overtemperature LED is lit, this means for • braking power ≤ 20 kW excess temperature, internal brake resistor • braking power ≥ 50 kW excess temperature, power semiconductor The fault can be acknowledged when the critical temperature is fallen-below using the reset button or by connecting the inhibit signal.
♦ READY	LED is on after DC bus voltage is applied to the input terminals. During operation the LED becomes darker with increasing duty cycle (Note: a bright LED shows that additional braking power is available). The LED extinguishes if the braking unit is disabled via the "inhibit" input of the X38 control terminal strip.

Operating elements

- **Reset key** is accessible through the front cover to reset an overcurrent or excess temperature fault
- **Voltage limit switch** is accessible after removing the front cover (see chapter 6 "Start-up").

6 Start-up

DANGER

Do not remove the front cover when voltage is applied to the braking unit!

The control circuit is directly connected to the DC bus voltage!

Therefore the voltage limit switch may only be operated when the braking unit is free of voltage.

The units have hazardous voltage levels up to 5 min. after the unit has been powered-down due to the DC link capacitors.

Setting of the voltage limit switch:

In the case of the braking units, the response threshold can be switched over.
This makes sense when a drive is operated from a 380 / 400 V or from a 500 V or 660 V line, because during braking the DC bus voltage increases only slightly. The voltage stress applied to motor insulation will be reduced.

NOTE

For 1 LA 1/5/6/8 type SIEMENS motors the voltage limit does not need to be changed.

If the voltage limit switch is set to the lower limit, the braking power is reduced ($P \sim V^2$).

The voltage limit switch is located behind the front cover.

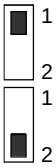
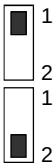
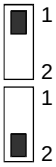
Braking Unit	Rated Voltage	Voltage Limit	Switch position
6SE70__-_C.87-2DA0	208 V to 230 V	387 V	fixed, cannot be changed
6SE70__-_E.87-2DA0	380 V to 460 V 380 V to 400 V	774 V (factory setting) 673 V	
6SE70__-_F.87-2DA0	500 V to 575 V 500 V	967 V (factory setting) 841 V	
6SE70__-_H.87-2DA0	660 V to 690 V 660 V	1158 V (factory setting) 1070 V	

Table 6-1 Setting of the voltage limit switch

Set parameters on converter: (see section headed "Parameterization" in operating manual for SIMOVERT MASTERDRIVES)

- **P515, Vdmax controller**, set parameter value to "0".
- If the braking unit is to report a fault to the SIMOVERT MASTERDRIVES, "Ext Fault 2" must be used ;
  e.g. **P586 "Src No ext Fault 2"**external 2" = 10...22
  (binary inputs 1 to 7).

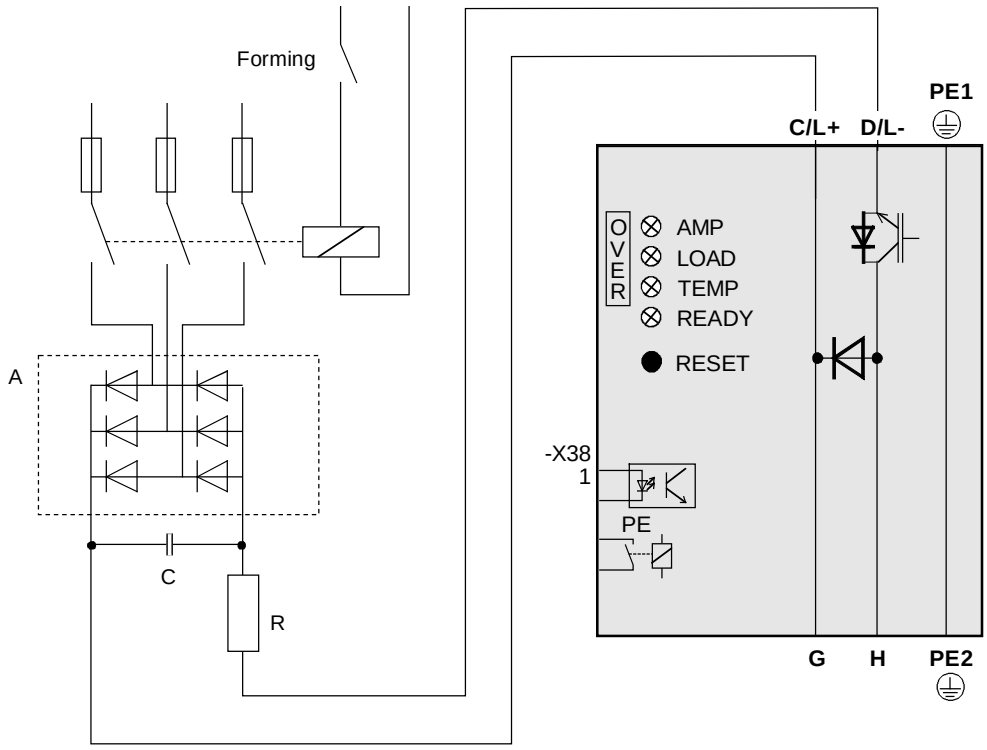
6.1 Capacitor forming

The DC link capacitors must be re-formed if the converter has been non-operational for more than one year. If the converter was started-up within one year after having been shipped (serial number on the rating plate), it is not necessary to re-form the DC link capacitors.

Forming is realized by switching-in a rectifier and resistor, which is connected to the DC link. **The converter supply must be disconnected!**
(circuit: refer to Fig. 6-1.)
The forming time is dependent on the time during which the converter was not operational (see Fig. 6-2).

Position	Example	Significance / Example
7	A B C	Manufacturing year: 2000 2001 2002
8 and 9	06	Manufacturing month: 06
10 and 11	04	Manufacturing day: 04
12 to 14		Not relevant for forming (serial number)

Table 6-2 Serial number structure: NW903160604095



	Recommended components		
	A	**R**	**C**
208 V < Un < 415 V	SKD 50 / 12	220 Ω / 100 W	22 nF / 1600 V
380 V < Un < 460 V	SKD 62 / 16	470 Ω / 100 W	22 nF / 1600 V
500 V < Un < 690 V	SKD 62 / 18	680 Ω / 100 W	22 nF / 1600 V

Fig. 6-1 Circuit for forming

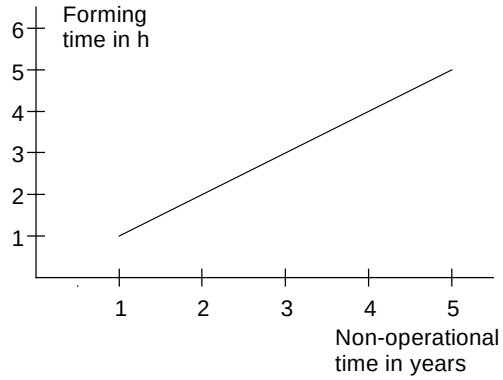


Fig. 6-2 Forming time as a function of the time during which the converter was non-operational

7 Technical Data

Order Number Braking unit 6SE70...	Power Rating P_{20} (kW)	Voltage Limit (V)	Rated DC bus Voltage (V)	I_{eff} Amps (A)	Order Number Braking resistor 6SE70...	(Ω)	Cross Section Area Cu cable mm^2	AWG	Fuses Type
21-6C**S**87-2DA0	5	387	280 to 310	7.9	21-6CS87-2DC0	20	1.5	14	3NE4101
18-0E**S**87-2DA0	5	774	510 to 620	4.0	18-0ES87-2DC0	80	1.5	16	3NE4101
16-4F**S**87-2DA0	5	967	675 to 780	3.2	16-4FS87-2DC0	124	1.5	16	3NE4101
23-2C**A**87-2DA0	10	387	280 to 310	16	23-2CS87-2DC0	10	2.5	14	3NE4102
21-6E**S**87-2DA0	10	774	510 to 620	8	21-6ES87-2DC0	40	1.5	16	3NE4101
21-3F**S**87-2DA0	10	967	675 to 780	6	21-3FS87-2DC0	62	1.5	16	3NE4101
26-3C**A**87-2DA0	20	387	280 to 310	32	26-3CS87-2DC0	5	10	6	3NE4120
23-2E**A**87-2DA0	20	774	510 to 620	16	23-2ES87-2DC0	20	2.5	14	3NE4102
28-0E**A**87-2DA0	50	774	510 to 620	40	28-0ES87-2DC0	8	10	6	3NE4121
26-4F**A**87-2DA0	50	967	675 to 780	32	26-4FS87-2DC0	12.4	10	6	3NE4120
25-3H**A**87-2DA0	50	1158	890 to 930	27	25-3HS87-2DC0	17.8	6	8	3NE4118
31-6E**B**87-2DA0	100	774	510 to 620	80	31-6ES87-2DC0	4	35	0	3NE3225
31-3F**B**87-2DA0	100	967	675 to 780	64	31-3FS87-2DC0	6.2	35	0	3NE3224
32-7E**B**87-2DA0	170	774	510 to 620	135	32-7ES87-2DC0	2.35	50	00	3NE3230-0B
32-5F**B**87-2DA0	200	967	675 to 780	128	32-5FS87-2DC0	3.1	50	00	3NE3230-0B
32-1H**B**87-2DA0	200	1158	890 to 930	107	32-1HS87-2DC0	4.45	50	00	3NE3227

NOTE Load resistor: Resistance value ± 10 %, exception 6SE7032-7ES87-2DC0 ± 8 %

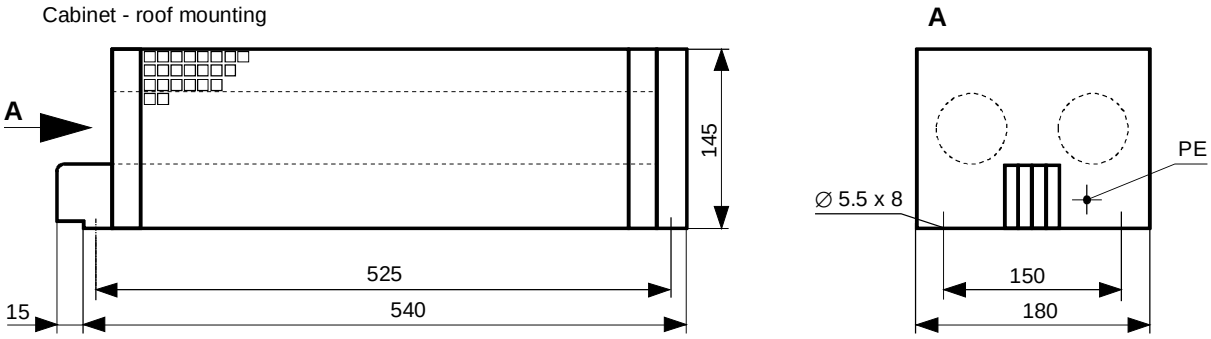
Table 7-1 Technical Data

NOTE The connection cross-sections have been determined for copper cables at an ambient temperature of 40 °C (104 °F) and for cables with a permissible conductor operating temperature of 70 °C (as per DIN VDE 0298-4 / 08.03).

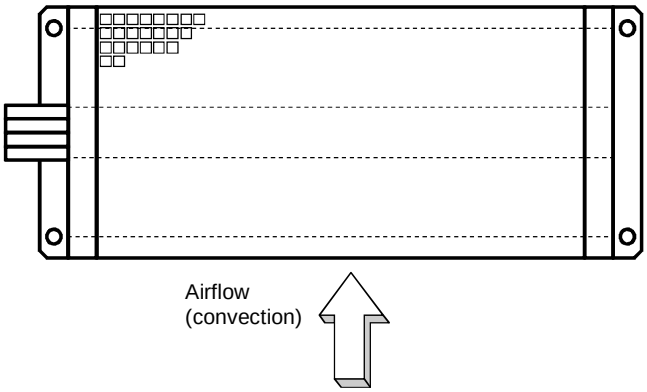
Frame Size	Size (mm)			Weight (kg)	Degree of protection	Cooling
	Width	Height	Depth			
S	45	427	350	6	IP20	self cooling
A	90	427	350	11	IP20	self cooling
B	135	427	350	18	IP20	self cooling

Table 7-2 Technical Data

Cabinet - roof mounting



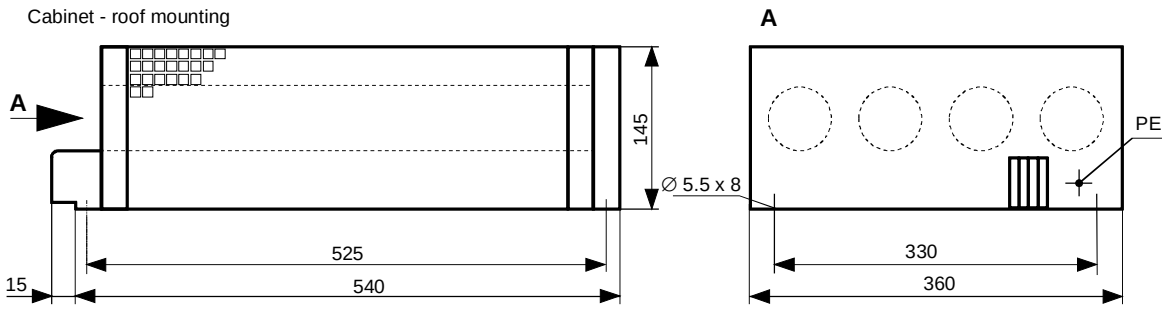
Wall mounting (electrical connection to the left)

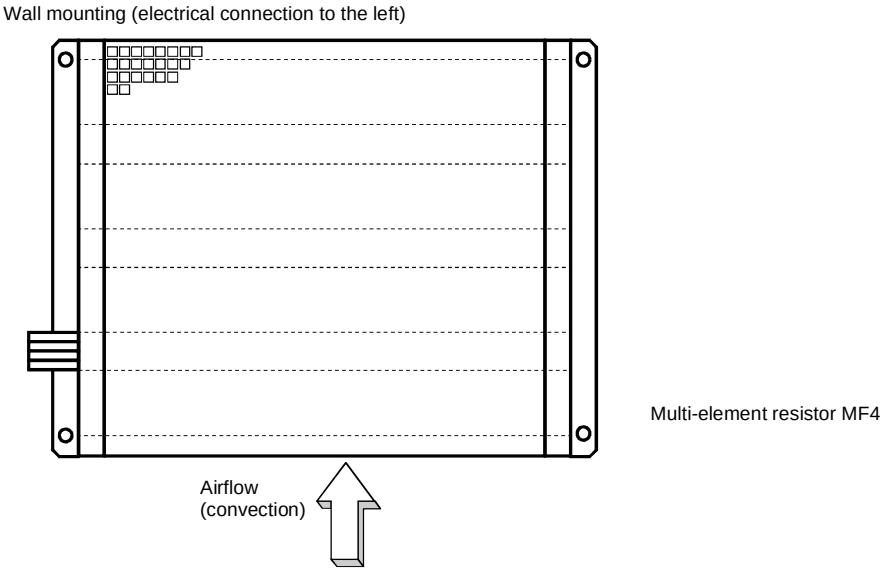


Multi-element resistor MF2

Brake resistor for	Type
5 kW; 20 Ω	6SE7021-6CS87-2DC0
5 kW; 80 Ω	6SE7018-0ES87-2DC0
5 kW; 124 Ω	6SE7016-4FS87-2DC0

Fig. 7-1 Mounting diagram, braking resistor

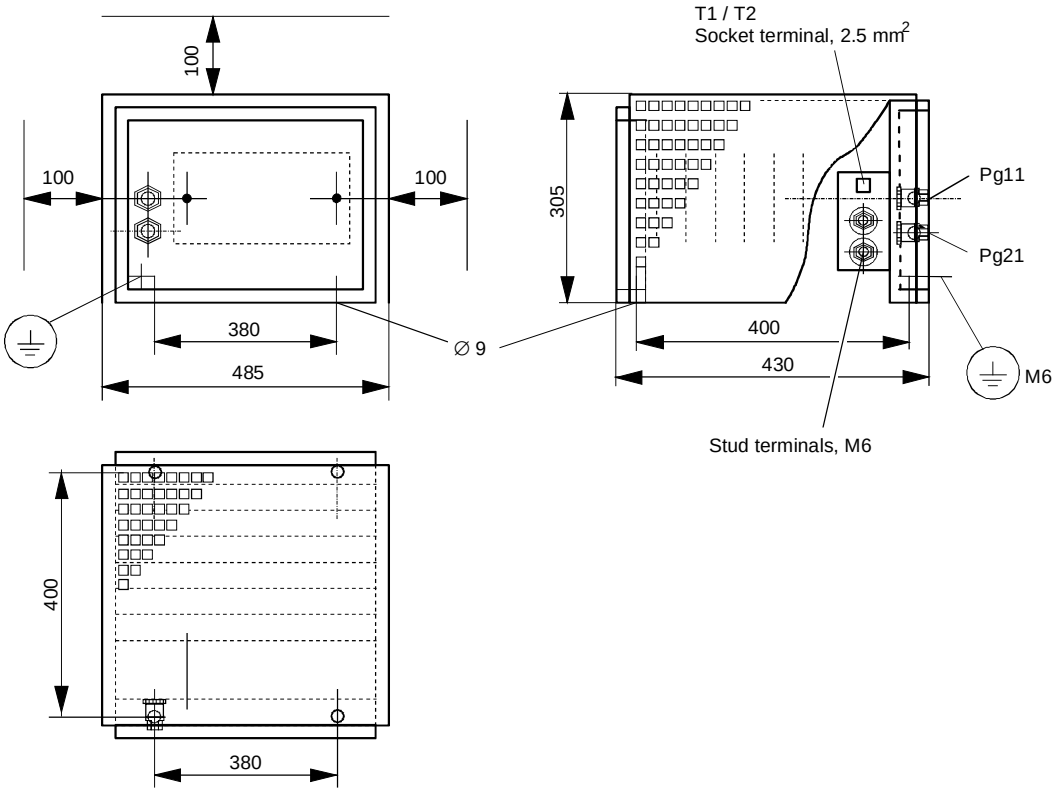




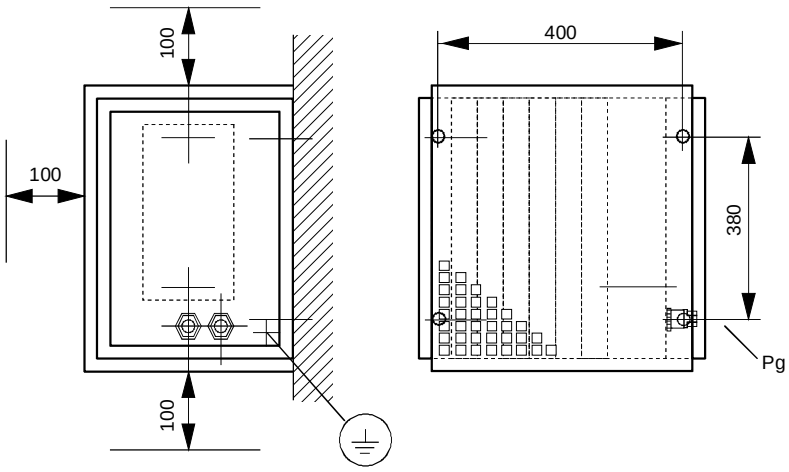
Brake resistor for	Type
10 kW; 10 Ω	6SE7023-2CS87-2DC0
10 kW; 40 Ω	6SE7021-6SE87-2DC0
10 kW; 62 Ω	6SE7021-3FS87-2DC0

Fig. 7-2 Mounting diagram, brake resistor

Floor mounting



Wall mounting

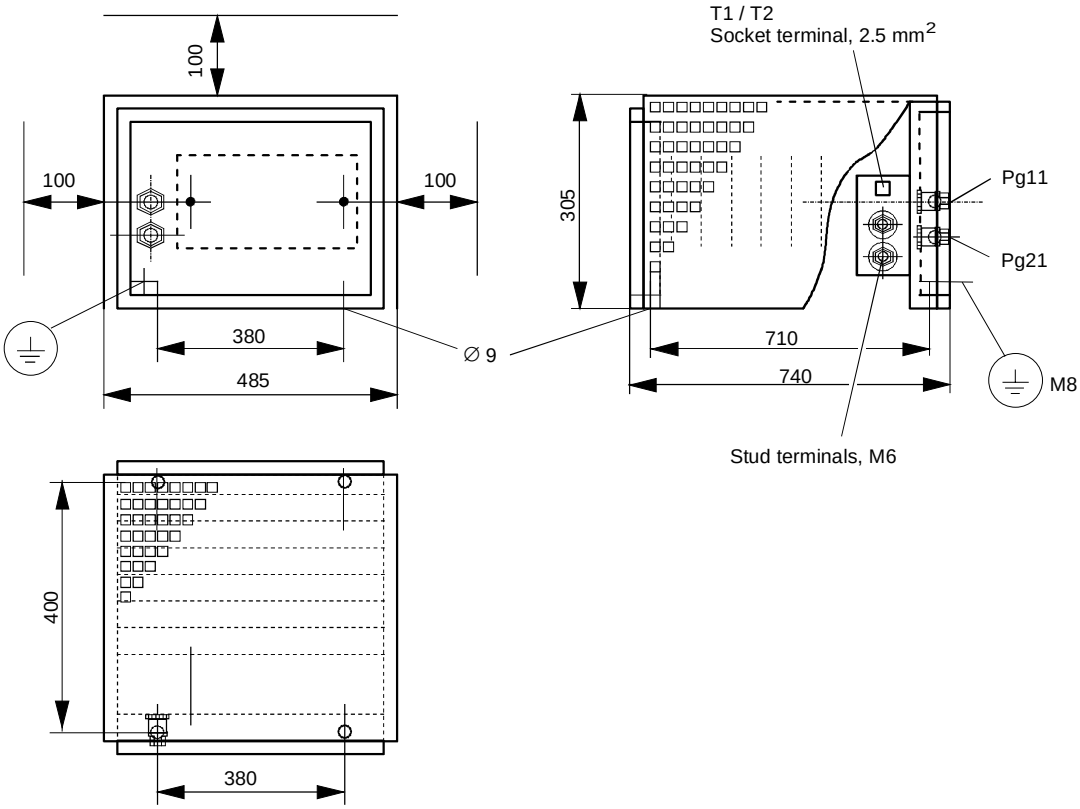


Box dimensions: 450 x 500 x 320

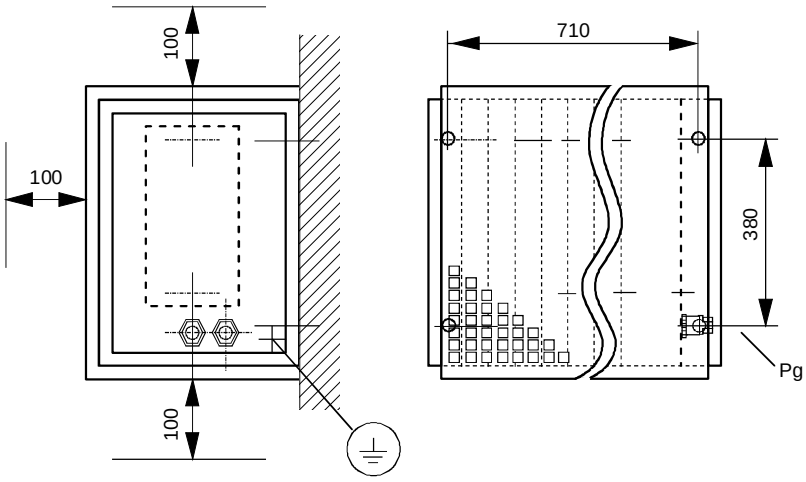
Brake resistor for	Type	Weight, approx.
20 kW; 5 Ω	6SE7026-3CS87-2DC0	15 kg
20 kW; 20 Ω	6SE7023-2ES87-2DC0	17 kg
20 kW; 31 Ω	6SE7022-5FS87-2DC0	17 kg
20 kW; 44.4 Ω	6SE7022-1HS87-2DC0	16 kg

Fig. 7-3 Mounting diagram, brake resistor for floor and wall mounting

Floor mounting



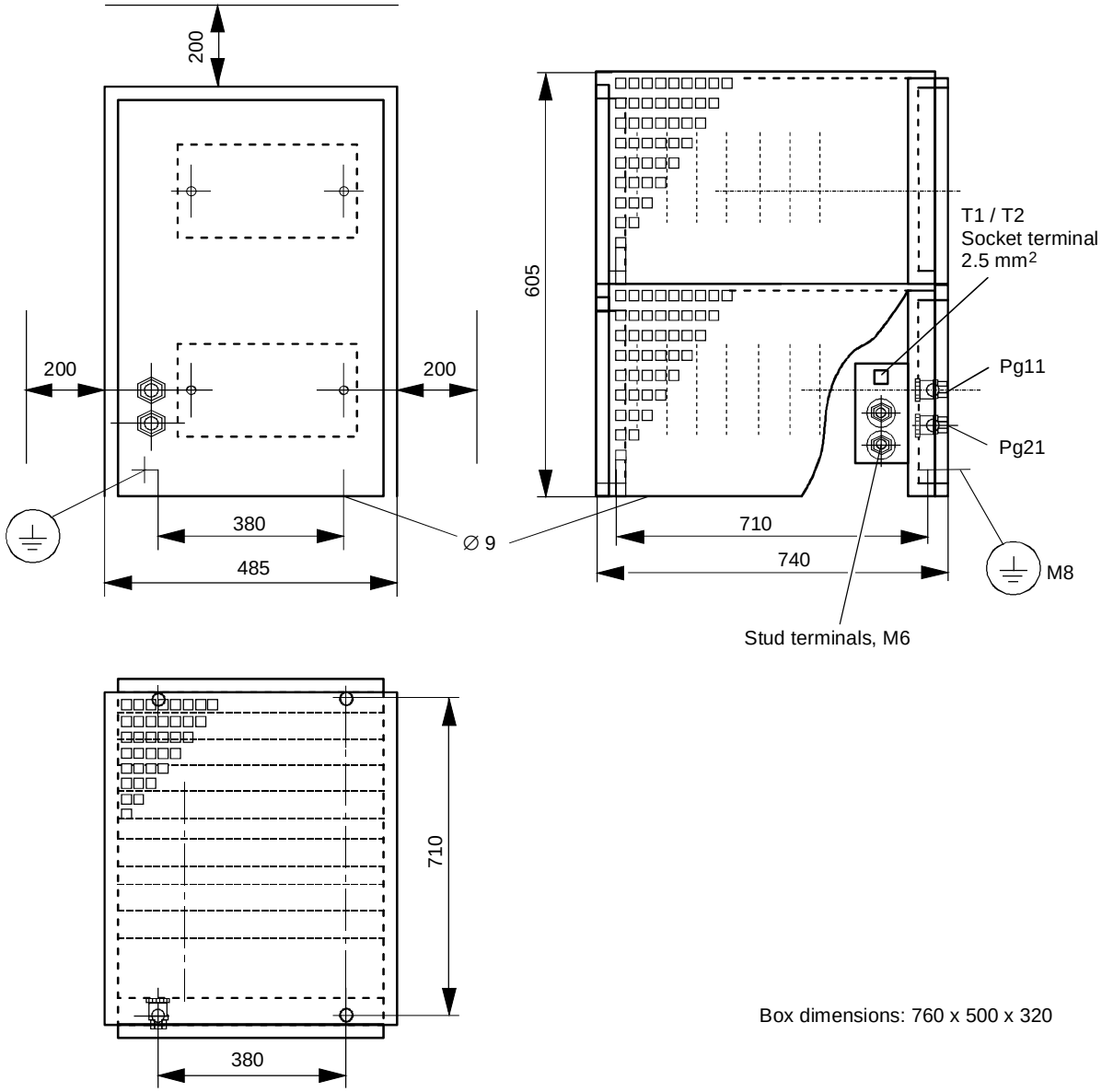
Wall mounting



Box dimensions: 760 x 500 x 320

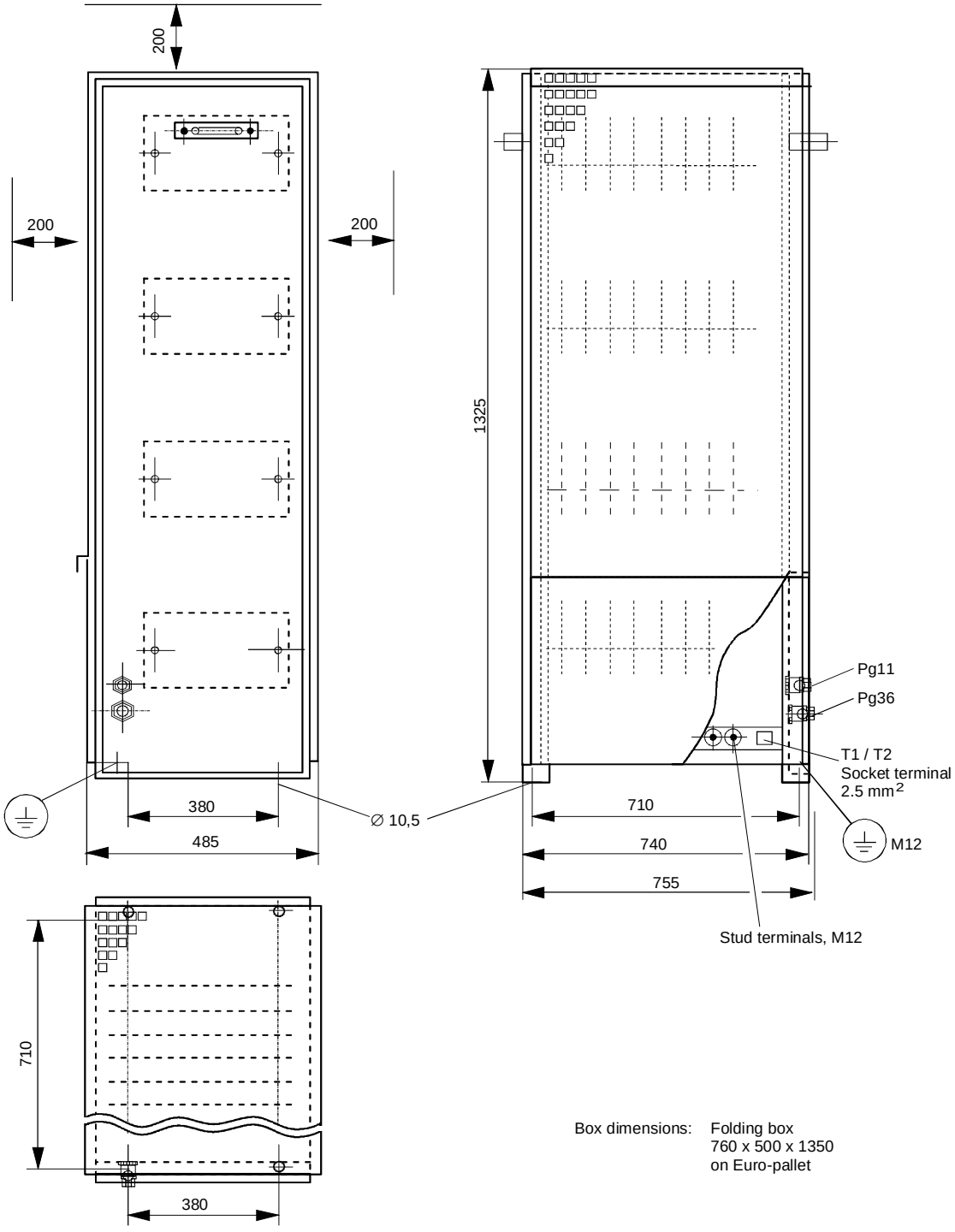
Brake resistor for	Type	Weight, approx.
50 kW; 8 Ω	6SE7028-0ES87-2DC0	27 kg
50 kW; 12.4 Ω	6SE7026-4FS87-2DC0	27 kg
50 kW; 17.8 Ω	6SE7025-3HS87-2DC0	28 kg

Fig. 7-4 Mounting diagram, brake resistor for floor and wall mounting



Brake resistor for	Type	Weight, approx.
100 kW; 4 Ω	6SE7031-6ES87-2DC0	47 kg
100 kW; 6.2 Ω	6SE7031-3FS87-2DC0	43 kg
100 kW; 8.9 Ω	6SE7025-1HS87-2DC0	45 kg

Fig. 7-5 Mounting diagram, brake resistor



Brake resistor for	Type	Weight, approx.
170 kW; 2.35 Ω	6SE7032-7ES87-2DC0	103 kg
200 kW; 3.1 Ω	6SE7032-5FS87-2DC0	95 kg
200 kW; 4.45 Ω	6SE7032-1HS87-2DC0	101 kg

Fig. 7-6 Mounting diagram, brake resistor for floor mounting

Bisher sind folgende Ausgaben erschienen:
The following versions have been published so far:

Ausgabe Version	interne Sachnummer Internal item number
01.95	477 730.4000.76 Ja
AB	477 730.4000.76 J AB-76
AC	477 730.4000.76 J AC-76
AD	477 730.4000.76 J AD-76
AE	477 730.4000.76 J AE-76
AF	477 730.4000.76 J AF-76
AG	A5E00339892

Ausgabe AG besteht aus folgenden Kapiteln:

Kapitel		Änderungen	Seitenzahl	Ausgabedatum
1	Definitionen und Warnungen	überarbeitete Ausgabe	3	03.2004
2	Produktbeschreibung	überarbeitete Ausgabe	1	03.2004
3	Montieren, Anschließen	überarbeitete Ausgabe	8	05.2004
4	Bremswiderstände	überarbeitete Ausgabe	2	03.2004
5	Überwachung	überarbeitete Ausgabe	1	03.2004
6	Inbetriebsetzen	überarbeitete Ausgabe	4	03.2004
7	Technische Daten	überarbeitete Ausgabe	7	03.2004

Version AG consists of the following chapters:

Chapter		Changes	Pages	Version date
1	Definitions and Warnings	reviewed edition	3	03.2004
2	Product Description	reviewed edition	1	03.2004
3	Mounting, Connecting-Up	reviewed edition	8	05.2004
4	Braking Resistors	reviewed edition	2	03.2004
5	Monitoring	reviewed edition	1	03.2004
6	Start-Up	reviewed edition	4	03.2004
7	Technical Data	reviewed edition	7	03.2004

Wir haben den Inhalt der Druckschrift auf Übereinstimmung mit der beschriebenen Hard- und Software überprüft. Dennoch können Abweichungen nicht ausgeschlossen werden, so dass wir für die vollständige Übereinstimmung keine Garantie übernehmen. Die Angaben in dieser Druckschrift werden jedoch regelmäßig überprüft und notwendige Korrekturen sind in den nachfolgenden Auflagen enthalten. Für Verbesserungsvorschläge sind wir dankbar.

We have checked the contents of this document to ensure that they coincide with the described hardware and software. However, differences cannot be completely excluded, so that we do not accept any guarantee for complete conformance. However, the information in this document is regularly checked and necessary corrections will be included in subsequent editions. We are grateful for any recommendations for improvement.

Siemens AG
Automation and Drives
Motion Control Systems
P.O. Box 3180, D – 91050 Erlangen
Germany

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simovert masterdrives

SIEMENS

Bremseinheit / Braking Unit / Unité de Freinage /
Unità di frenatura / Unidad de frenado

Contents

1 Definitions and Warnings

Qualified personnel

For the purpose of this documentation and the product warning labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up, operation and maintenance of the product. He or she must have the following qualifications:

- Trained or authorized to energize, de-energize, ground and tag circuits and equipment in accordance with established safety procedures.
- Trained or authorized in the proper care and use of protective equipment in accordance with established safety procedures.
- Trained in rendering first aid.

DANGER

indicates an **imminently** hazardous situation which, if not avoided, will result in death, serious injury and considerable damage to property.

WARNING

indicates a **potentially** hazardous situation which, if not avoided, could result in death, serious injury and considerable damage to property.

CAUTION

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

CAUTION

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

NOTICE

NOTICE used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesireable result or state.

NOTE

For the purpose of this documentation, "Note" indicates important information about the product or about the respective part of the documentation which is essential to highlight.

WARNING

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the warnings can thus result in severe personal injury or property damage.

Only qualified personnel should work on or around the equipment

This personnel must be thoroughly familiar with all warning and maintenance procedures contained in this documentation.

The successful and safe operation of this equipment is dependent on correct transport, proper storage and installation as well as careful operation and maintenance.

NOTE

This documentation does not purport to cover all details on all types of the product, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local SIEMENS sales office.

The contents of this documentation shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of SIEMENS AG. The warranty contained in the contract between the parties is the sole warranty of SIEMENS AG. Any statements contained herein do not create new warranties or modify the existing warranty.

CAUTION

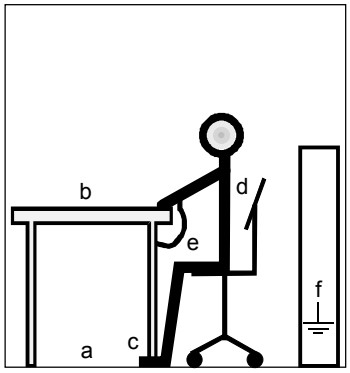
Components which can be destroyed by electrostatic discharge (ESD)

The converters contain components which can be destroyed by electrostatic discharge. These components can be easily destroyed if not carefully handled. If you have to handle electronic boards please observe the following:

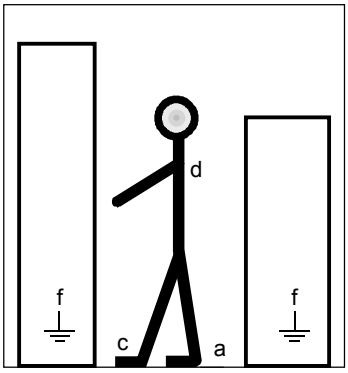
- Electronic boards should only be touched when absolutely necessary
- The human body must be electrically discharged before touching an electronic board
- Boards must not come into contact with highly insulating materials - e.g. plastic foils, insulated desktops, articles of clothing manufactured from man-made fibers
- Boards must only be placed on conductive surfaces
- When soldering, the soldering iron tip must be grounded
- Boards and components should only be stored and transported in conductive packaging (e.g. metalized plastic boxes, metal containers)
- If the packing material is not conductive, the boards must be wrapped with a conductive packaging material, e.g. conductive foam rubber or household aluminum foil.

The necessary ECB protective measures are clearly shown in the following diagram:

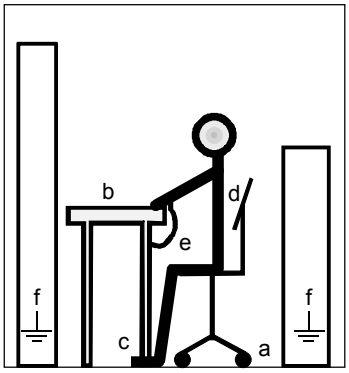
a = Conductive floor surface
b = ESD table
c = ESD shoes
d = ESD overall
e = ESD chain
f = Cubicle ground connection



Sitting



Standing



Standing / Sitting

2 Product Description

When a motor brakes, it feeds electrical energy back to the SIMOVERT MASTERDRIVES, causing the DC link voltage to rise. The braking unit is connected in parallel to the DC link and limits the DC link voltage increase to an acceptable level. The braking unit converts the generated braking energy to heat in an external braking resistor. The appropriate resistor must always be connected to the braking unit. Braking energy cannot be converted without one.

The braking unit is connected to the converter or inverter via the DC link terminals. When the DC bus voltage reaches a pre-defined limit, the braking unit automatically turns on and prevents the DC bus voltage from continuing to increase.

The braking unit operates autonomously of the converter or inverter. The braking unit electronics are supplied from the DC link voltage.

Braking units can be connected in parallel to enhance braking performance.

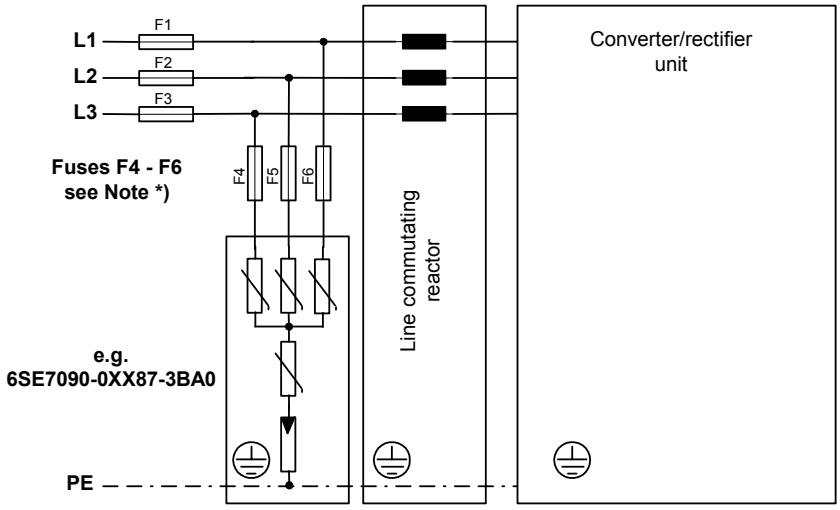
3 Mounting, Connecting-Up

Mounting

- Using M6 screws or adapter plate on G-type mounting rail on 5 – 50 kW braking units (adapter plate is not included in scope of supply).
- Using M6 screws or on G-type mounting rail on 100 and 200 kW braking units.

Connecting-up

- Voltage-limiting components (varistors) must be connected to the incoming supply of the converter/ rectifier unit in order to comply with the UL regulations (see Fig. 3-1).



***) NOTE**

The fuses (F4 – F6 = 125 A gL) only have to be installed if the line fuses are of the converter / rectifier unit (F1 – F3 > 125 A).

Fig. 3-1

- Braking unit:
  Connect the terminals C/L+ and D/L- (top side of the braking unit) or the busbars to the terminals C/L+ and D/L- of the drive (see Fig. 3-3).
  Create the protective connection between the converter and the braking unit (For cross-section of the protective connection see Table 3-1).
  - Connecting cables to DC link must be twisted-pair and max. 3 m long
  - In the case of several parallel inverters with a common DC link, the braking unit must be connected to the inverter with the highest output.
- Connecting braking units in parallel:
  - To increase the braking power, braking units can be connected in parallel. The switch for the response threshold (see Fig. 6-2, Fig. 6-3) must be set identically on all units connected in parallel. The total continuous braking power PDB is calculated from the total continuous braking power of the individual units. For a definition of braking power, see Fig. 4-1.
  - Each braking unit must have its own twisted-pair feeder cable, max. 3 m in length, to the DC link. Feeder cables of the same length must be used for all paralleled braking units to ensure a symmetrical distribution of current.
  - Each braking unit requires its own braking resistor
- External braking resistors (selection list see chapter "Braking Resistors")
  - Connect braking resistor to terminals G and H.
  - Length of the connecting cables between braking unit and external braking resistor < 15 m.

WARNING

Mis-connecting or shorting the DC bus terminals will destroy the drive and the braking unit, respectively.

The exit air from the braking units can reach a temperature of > 80 °C.

The housing surface can reach a temperature of > 65 °C.

A shield plate is included in the scope of supply of the 5 – 50 kW braking units. When using shielded control cables or a shielded cable for the external braking resistor, the shield of these cables can be connected to the shield plate. This plate is also used for strain relief.

The shield plate is mounted via two bolts and the nuts supplied on the bottom of the braking unit as shown in Fig. 3-2.

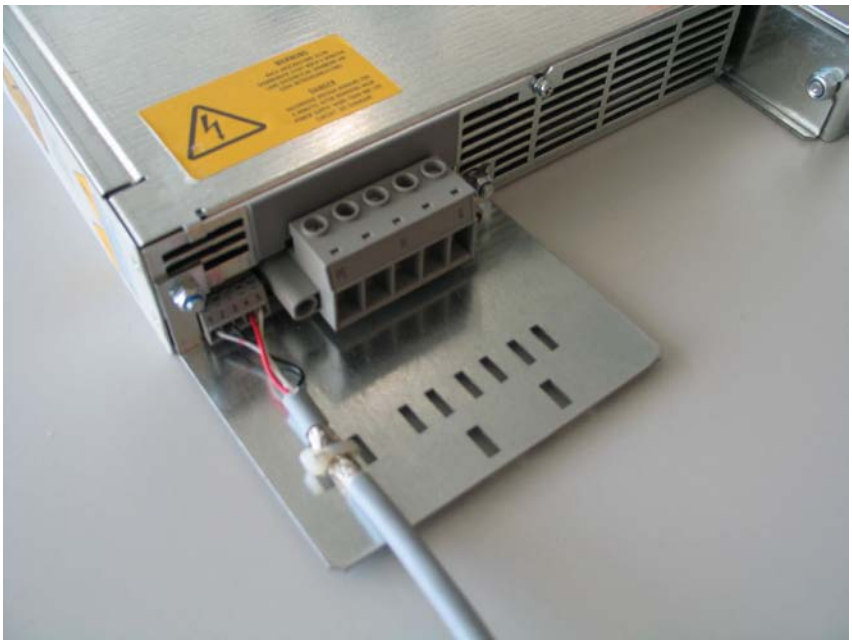


Fig. 3-2 5 – 50 kW braking unit with shield plate

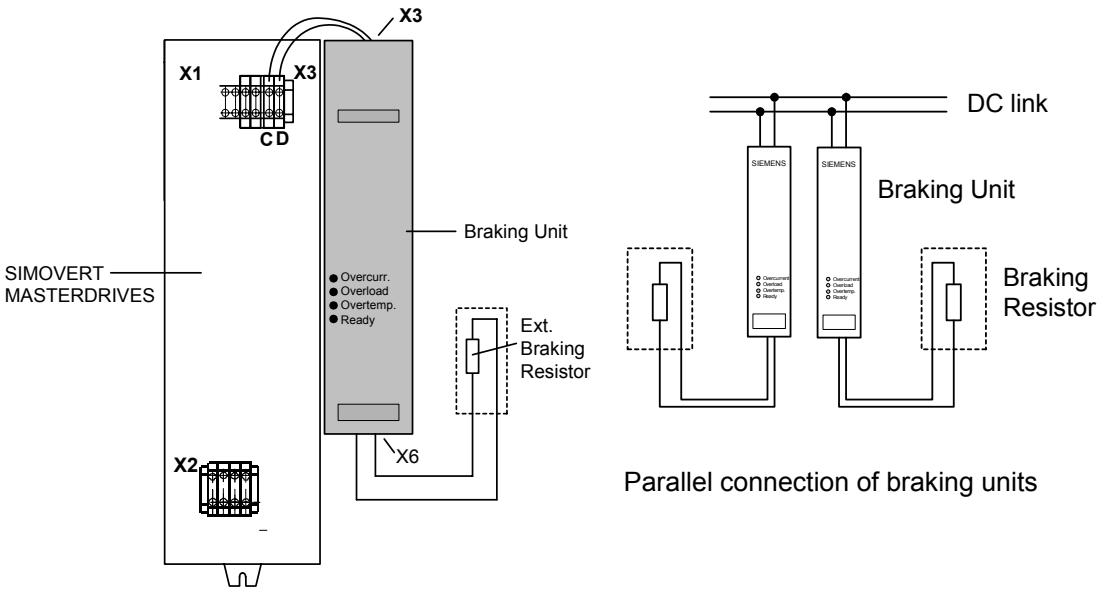


Fig. 3-3 Connection of the braking unit

3.1 Dimension drawing of the 5 – 50 kW braking units

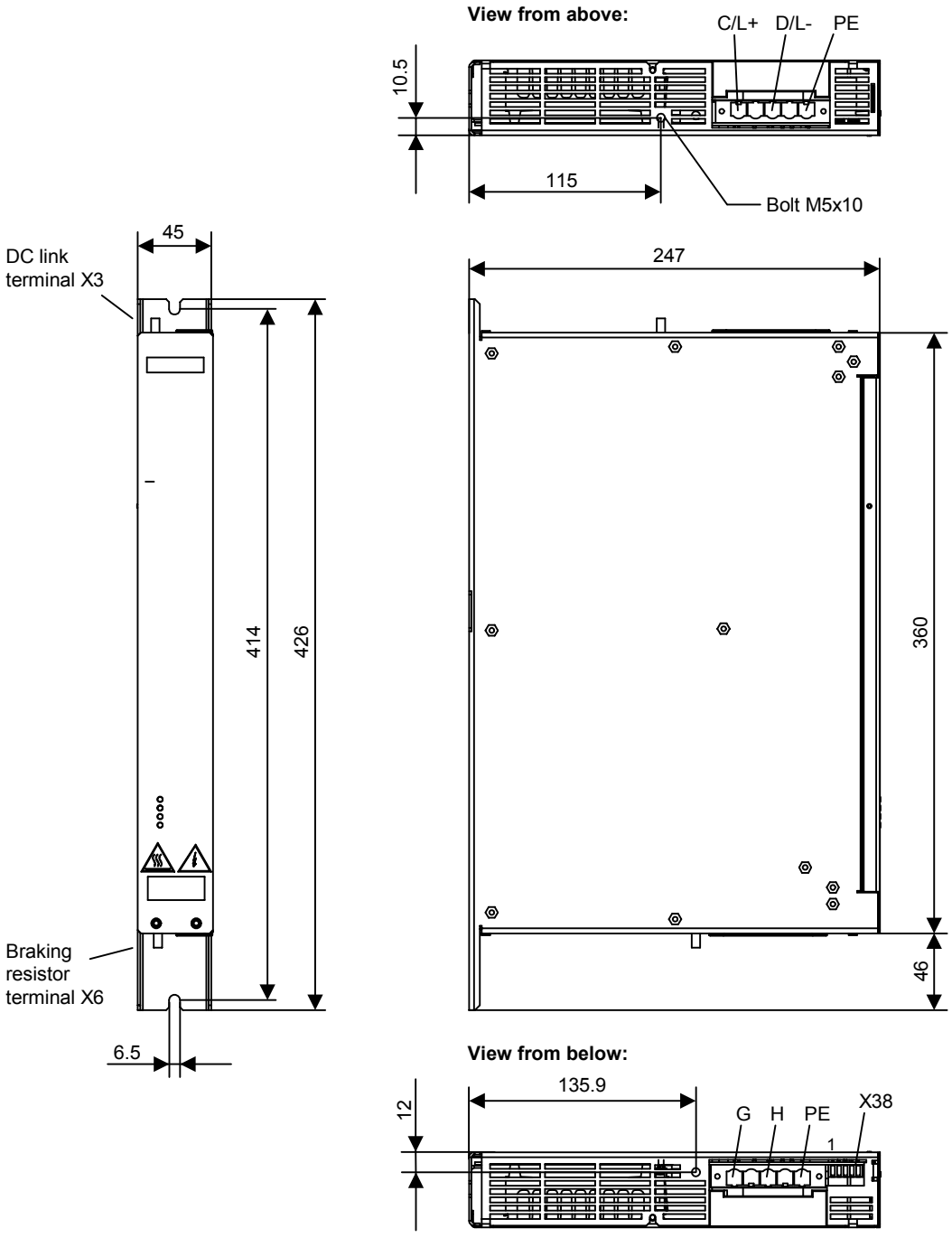
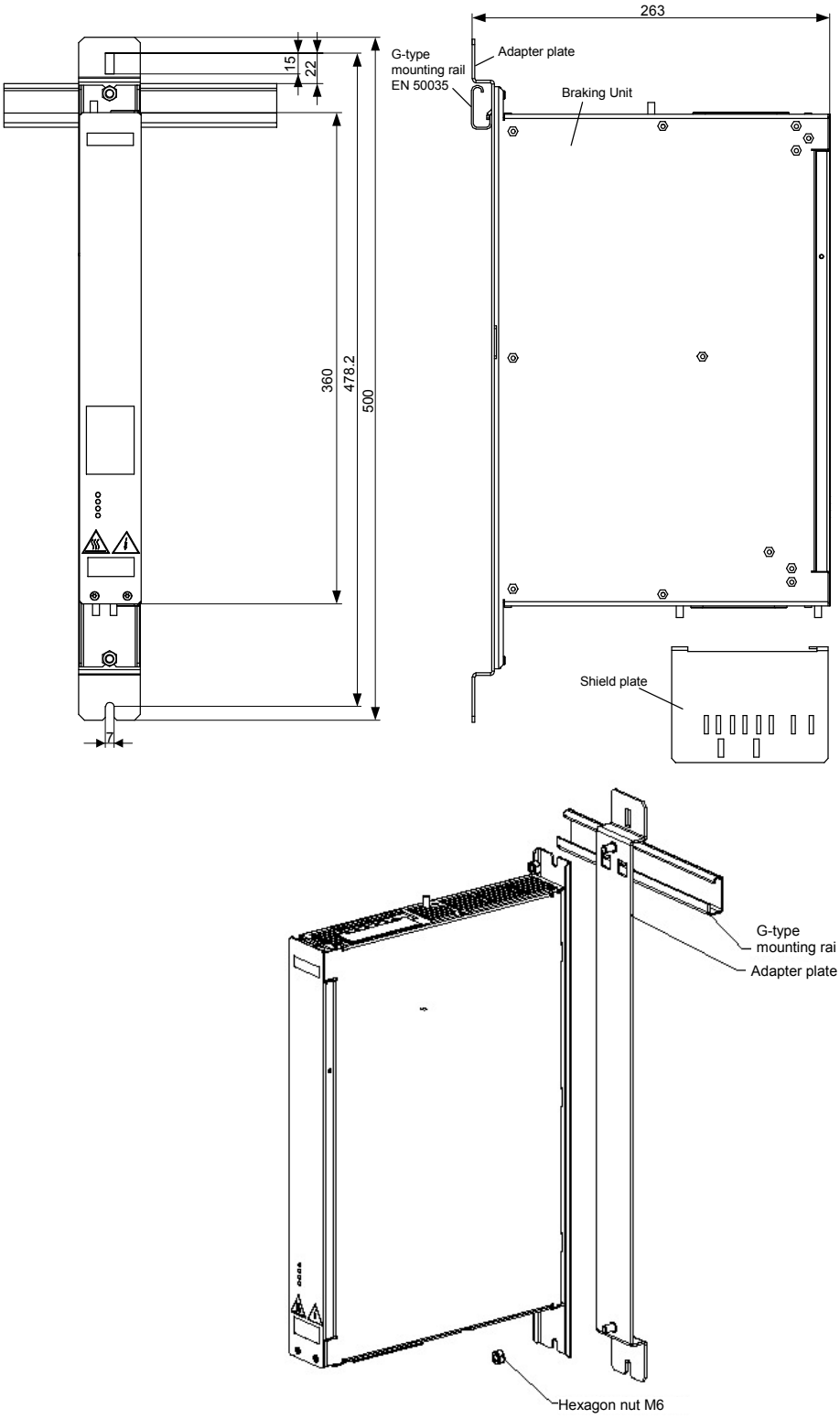


Fig. 3-4 Dimension drawing

3.2 Adaptor plate installation of the 5 – 50 kW braking units



Adapter plate order number: 6SX7010-0KC01

Fig. 3-5

3.3 Dimension drawing of the 100 – 200 kW braking units

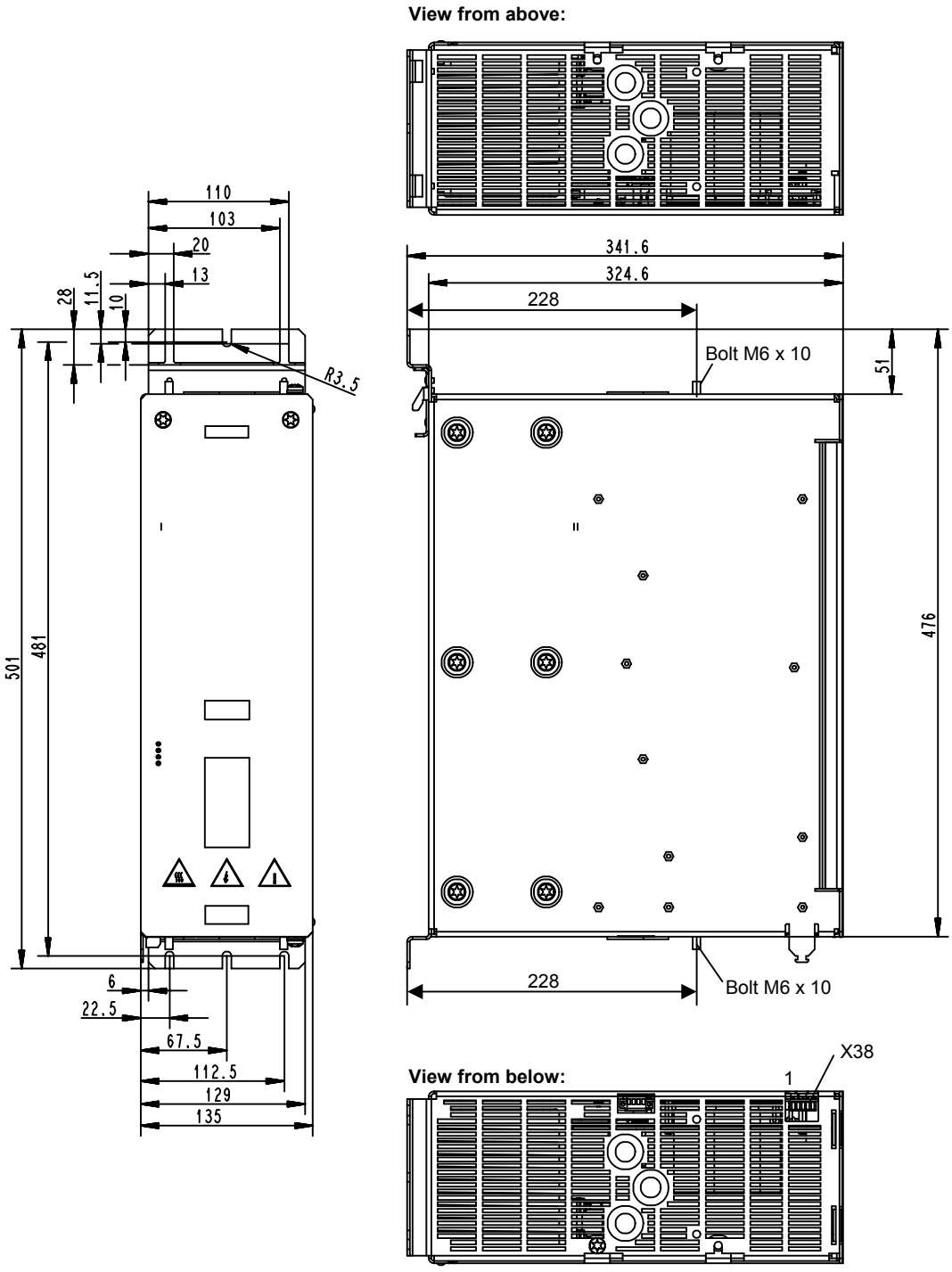


Fig. 3-6

3.4 Power terminals

Cross-section S of DC link line	Minimum cross-section MS of the external PE conductor
$S \leq 16\ mm^2$	$MS \geq S$
$16\ mm^2 < S \leq 35\ mm^2$	$MS \geq 16\ mm^2$
$S > 35\ mm^2$	$MS \geq S/2$
NOTE: PE conductor cross-section must, however, be at least larger than $2.5\ mm^2$.	

Table 3-1 Connection cross-section of the PE conductor of the 5 – 200 kW (DIN EN 61800-5-1)

Braking units 5 – 50 kW:

DC link terminal to X3 terminal strip (5 – 50 kW)		
Terminal / meaning	**Remark**	**Tightening torque [Nm / lbf ft]**
C/L+ Input (Plus DC link)	Terminal strip (top of unit)	1.5 / 1.1
D/L- Input (Minus DC link)	Terminal strip (top of unit)	1.5 / 1.1
PE Protective earth	Terminal strip (top of unit)	1.5 / 1.1
Shield connection	M5 bolt on housing at top	6 / 4.4
Braking resistor terminal to X6 terminal strip (5 – 50 kW)		
Terminal / meaning	**Remark**	**Tightening torque [Nm / lbf ft]**
G External braking resistor	Terminal strip (bottom of unit)	1.5 / 1.1
H External braking resistor	Terminal strip (bottom of unit)	1.5 / 1.1
PE Protective earth	Terminal strip (bottom of unit)	1.5 / 1.1
Shield connection	M5 bolt on housing at bottom (above shield plate)	6 / 4.4
NOTE		
Connectable cross section: Multi-core Stranded	 1.5 to 16 mm^2 1.5 to 16 mm^2	
AWG	16 to 6	

Table 3-2 Power connections of the 5 – 50 kW braking units

WARNING

The braking unit may be connected to the DC bus bar with or without using fuses. The connections between the drive converter or inverter and braking unit must be short-circuit- and ground-fault proof.

The dielectric strength rating of the cable must be selected according to the line voltage.

Fuses

- Fuses are necessary for multi-motor systems with a common DC link (incoming power ≫ braking unit rating).
- High voltage fuses (1000 V) must be used in the positive and negative branches (fuses type see Table 7-1).
- Fuses are not required for single-motor drives (one braking unit on converter).

NOTE

These fuses only provide protection in "critical situations". They do not protect the braking unit or external braking resistor.

Braking units 100 – 200 kW:

DC link terminal (via busbars, 100 - 200 kW)		
Terminal / meaning	**Remark**	**Tightening torque [Nm / lbf ft]**
C/L+ Input (Plus DC link)	Busbar C/L+	16 / 11.8
D/L- Input (Minus DC link)	Busbar D/L-	16 / 11.8
⏚ Protective earth	Busbar PE ⏚	16 / 11.8
Shield connection	M6 bolt on housing at top	**8 / 5.9**
Braking resistor terminal (via busbars, 100 - 200 kW)		
Terminal / meaning	**Remark**	**Tightening torque [Nm / lbf ft]**
G/R+ External braking resistor	Busbar G/R+	16 / 11.8
H/R- External braking resistor	Busbar H/R-	16 / 11.8
⏚ Protective earth	Busbar PE ⏚	16 / 11.8
Shield connection	M6 bolt on housing at bottom	**8 / 5.9**
NOTE		
Connection via	crimping connector according to DIN 46234 covered with shrinkable tube connection of cable via provided M8 x 25 bolts	
AWG	max 2/ 0	

Table 3-3 Power connections of the 100 - 200 kW braking units

WARNING

The braking unit may be connected to the DC bus bar with or without using fuses. The connections between the drive converter or inverter and braking unit must be short-circuit- and ground-fault proof.

The dielectric strength rating of the cable must be selected according to the line voltage.

Fuses

- Fuses are necessary for multi-motor systems with a common DC link (incoming power ≫ braking unit rating).
- High voltage fuses (1000 V) must be used in the positive and negative branches (fuses type see Table 7-1).
- Fuses are not required for single-motor drives (one braking unit on converter).

NOTE

These fuses only provide protection in "critical situations". They do not protect the braking unit or external braking resistor.

3.5 Control terminal X38

Terminal / meaning	Remark
1 Inhibit input	The braking unit is inhibited when + 24 V DC to reference potential (pin 2) is applied. All active error messages are acknowledged at the same time. For an error to be acknowledged, high level must be applied to this input for at least 2 ms (for information about error acknowledgement, see also chapter 5 "Monitoring"). To enable the braking unit, remove the 24 V DC supply again (low level). High level: 15 ... 30 V (Input current I ≤ 10 mA) Low level: -0.6 … 5 V Inhibition and acknowledgement are possible only if the external 24 V DC supply is connected to pins 4 and 2.
2 M	Ground for external 24 V supply and reference potential for signals
3 Not assigned	No function
4 P24	Positive pole of external 24V supply 20 V – 30 V DC / 0.5 A
5 Fault output	Output transistor conductive → No fault (output voltage > P24 – 3 V) Output transistor blocked → Fault (0 V) or braking unit inhibited or no DC link voltage or no external 24 V supply The fault output has a maximum current-carrying capacity of 300 mA. The fault output is referred to the potential at ground terminal X38, pin 2

NOTE

The braking unit will work even if control terminal strip X38 is not connected.
When the DC link voltage is disconnected and the internal voltage supply drops (fault LEDs go out), errors are cleared automatically.

The cables for connecting control terminal strip X38 must be installed separately from the power cables.

Length of control cables < 10 m.

3.6 Examples for connection

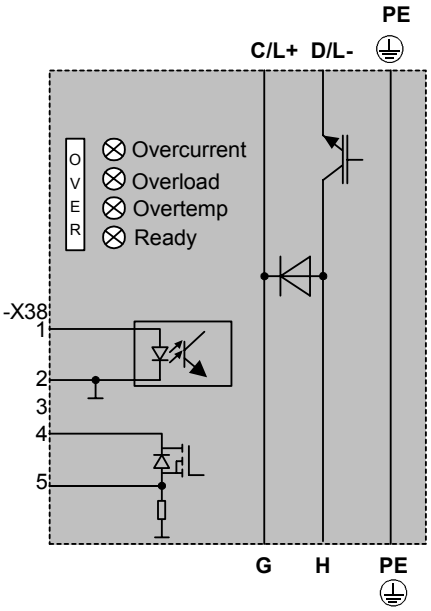


Fig. 3-7 *General schematic diagram*

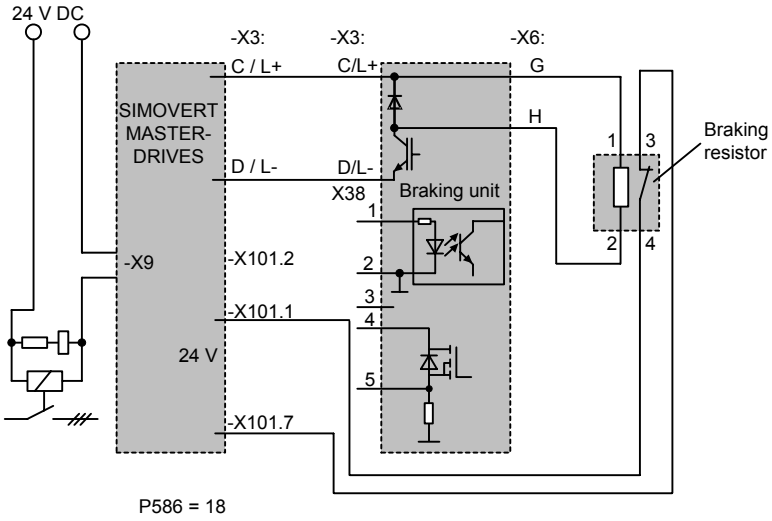


Fig. 3-8 *Converter – braking unit with braking resistor and shutdown of converter on faults via digital input 5*

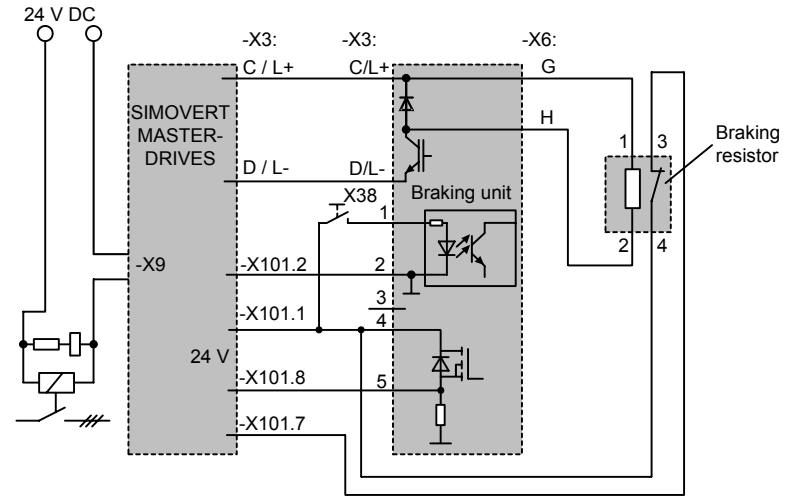


Fig. 3-9 *Converter – braking unit with braking resistor and shutdown of converter on faults; braking unit fault message to converter; acknowledgement of braking unit fault via pushbutton*

CAUTION The braking unit may not be connected to the live DC bus via a contactor.

4 Braking Resistors

The braking resistors listed in chapter 7 "Technical Data" match the braking units and allow full utilization of the braking capability.

WARNINGS

When braking resistors and braking units are combined, it must be guaranteed that the resistance of a resistor is not less than the minimum allowed resistance, otherwise the braking unit may be destroyed!

Higher values of the resistors are allowed. The higher the resistance value, however, the lower the braking power. The braking power varies indirectly in proportion to the resistance value (double the resistance value → half the braking power).

During operation the surface of the braking resistors may have temperatures of several hundred degrees C. Therefore cooling air must not contain flammable or explosive items or gases.

If a resistor is wall-mounted, the wall must not be flammable.

WARNINGS

The external braking resistor must be mounted separately and connected to the plant supply.

The braking resistors recommended by Siemens have a thermocontact (NC contact) which trips when the resistor overloads. In this event, the converter must be disconnected from the supply via a main contactor. The correct functioning of the thermal contact must be checked by the plant manufacturer upon commissioning!

If the main contactor is controlled via the appropriate output of the converter or inverter (X9), the thermocontact can be connected to a binary input that is parameterized as a fault input (see Fig. 3-8).

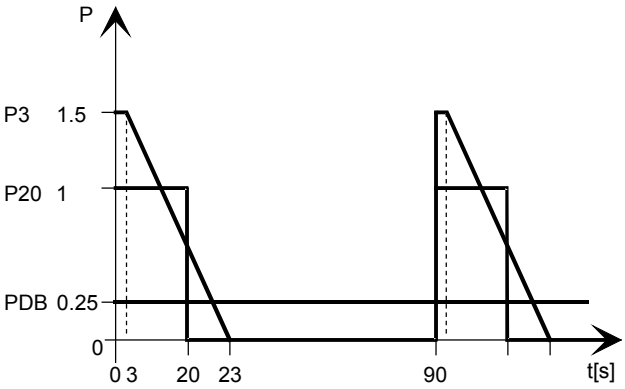
4.1 Definitions of the power ratings

Braking unit with external resistor

P20 = Rated Power

P3 = Peak Power = 1.5 × P20

PDB = 0.25 × P20 = Steady State Power Rating



The following applies with respect to paralleled braking units:

P20 total	=	0.9 x collective P20 of individual units
P3 total	=	collective P3 of individual units
PDB total	=	collective PDB of individual units

Fig. 4-1 Load characteristics of the braking units

5 Monitoring

When faults occur, the braking unit is inhibited and the transistor at the fault output blocked (see 3.5 "Control terminal X38"). The appropriate operating state is indicated by the LEDs on the front panel.

Display elements (LED)	**Description of operating state**	**State of output transistor**	**Acknow-ledgeable?**
♦ Overcurrent (fault)	LED lights up with a short circuit at the output end. This fault is not self-acknowledging. You can acknowledge it by applying and then removing the inhibit signal. **Correct the short circuit before acknowledging the fault!**	Blocked	Yes
♦ Overload	LED lights up when the overload monitor responds (the ratio between load and off-load duration is monitored, I^2t monitoring); the pulse/pause ratio is limited when the specified duty cycle is exceeded. The total continuous braking power (PDB) can be displayed at any time regardless of the status of the LED. The duty cycles shown in Fig. 4-1 (P3/P20) can be deselected complete only after the LED has gone out.	Conductive	Self-acknow-ledging
♦ Overtemp (fault)	The LED lights up when the temperature monitor responds (ambient temperature too high or cooling air inlet inhibited). The fault is automatically acknowledged when the temperature drops below the critical level again.	Blocked	No
♦ Ready	The LED lights up when operating voltage is connected to the input terminals. It goes out if the braking unit is disabled via the "Inhibit" input on control terminal strip X38 or if a temperature fault (→ Overtemp) or short circuit (→ Overcurrent) has occurred. A flashing LED indicates an internal fault in the braking unit, i.e. the unit is defective.	Conductive	Not applicable

6 Start-Up

DANGER

Do not remove the front cover when voltage is applied to the braking unit!

The control circuit is directly connected to the DC bus voltage!

The unit must therefore be disconnected from the supply before the setting of the response threshold switch is adjusted.

The units have hazardous voltage levels up to 5 min. after the unit has been powered-down due to the DC link capacitors.

Switch S1 for response threshold:

It is possible to switch over the response threshold on the braking units. This can be useful for units operating on a supply system with 380 V / 400 V, 500 V or 660 V. In this case, the DC link voltage increases only slightly in braking mode, thus reducing the voltage load on the motor insulation.

NOTE

For 1LA1/5/6/8/ type SIEMENS motors the voltage limit does not need to be changed.

If the voltage limit switch S1 is set to the lower limit, the peak braking power P3 is reduced ($P \sim V^2$).

5 – 50 kW braking units:

How to change setting of switch S1 for the response threshold:

- Remove the two screws at the bottom of the front plate, pull the plate out forwards at the bottom and push to one side (Fig. 6-1). Do not remove the PE conductor connection to the front cover!
- Use a suitable tool, e.g. small screwdriver, to adjust the setting of switch S1 (Fig. 6-2).
- Hook the top of the front panel into the slit in the housing and insert and tighten the two screws at the bottom.

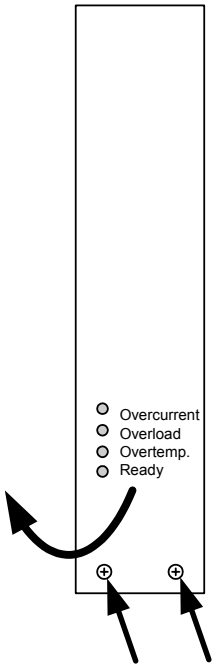


Fig. 6-1 Opening the front cover

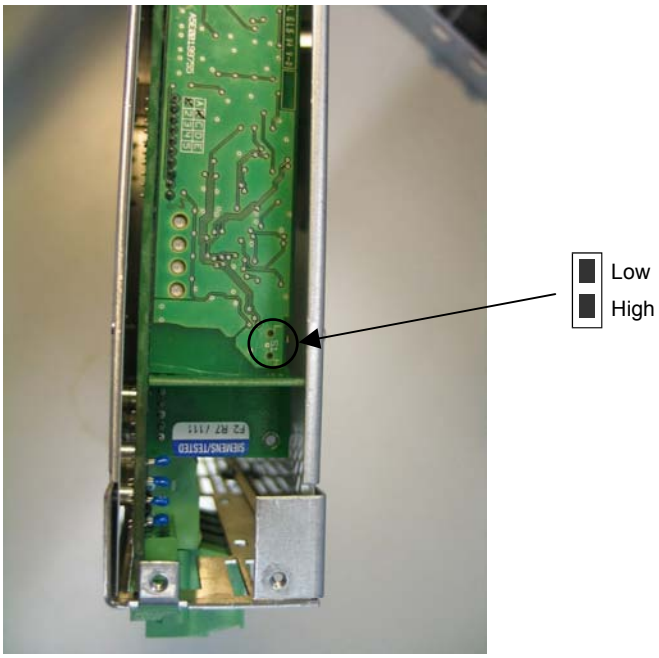


Fig. 6-2 Swith S1 for response threshold for 5 – 50 kW braking units

100 – 200 kW braking units:

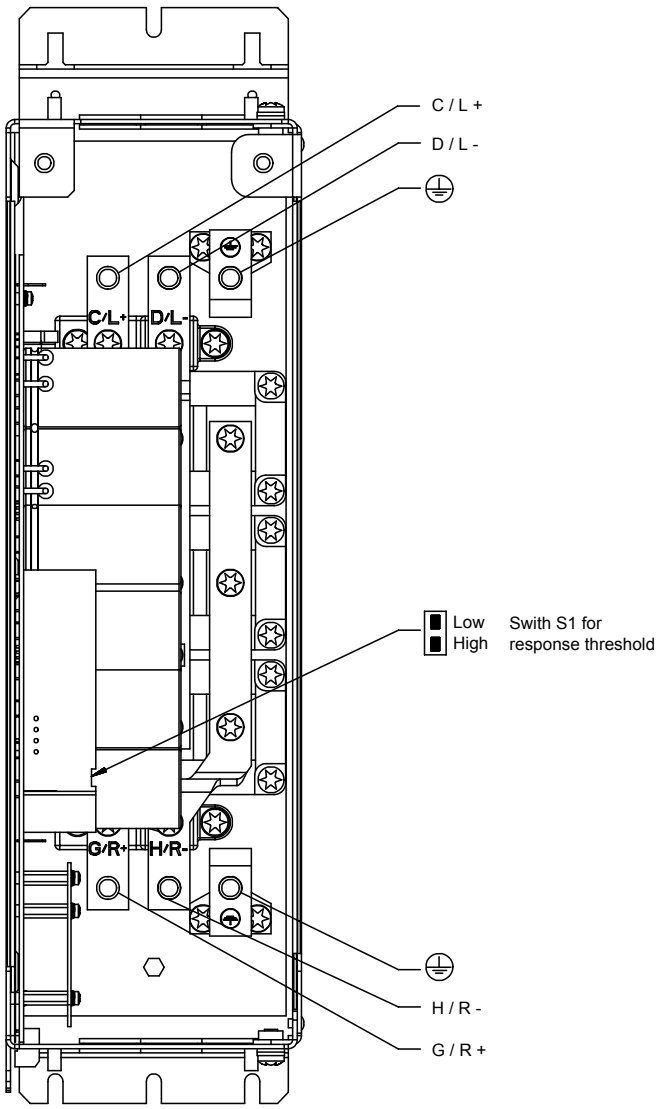


Fig. 6-3 Switch S1 for response threshold for 100 - 200 kW braking units

The voltage limit switch S1 is located behind the front cover.

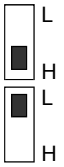
Braking unit	Rated voltage	Response threshold	Switch position
6SE70__-_C.87-2DA1	208 V to 230 V	387 V (not adjustable)	In both positions
6SE70__-_E.87-2DA1	380 V to 460 V 380 V to 400 V	757 V (factory setting) 673 V	
6SE70__-_F.87-2DA1	500 V to 575 V 500 V	945 V (factory setting) 841 V	
6SE70__-_H.87-2DA1	660 V to 690 V 660 V	1105 V (factory setting) 1040 V	

Table 6-1 Setting the response thresholds

Set parameters on converter: (see section headed "Parameterization" in operating manual for SIMOVERT MASTERDRIVES)

- Deactivate the Udmax controller in the converter or inverter. To do this on units with Vector Control functionality, set parameter P515 to "0". Units with Motion Control functionality do not possess this controller and do not therefore require resetting.
- Parameterize the binary inputs and outputs for controlling the braking unit (BICO technology). The specified setting values are based on the assumption that the connections between the MASTERDRIVES and braking unit have been made according to Fig. 3-8 or Fig. 3-9. If different terminals have been used, the setting values must be modified accordingly.

Assuming that the MASTERDRIVES parameters are set to their defaults (factory state), the required parameter settings are as follows:

Example according to Fig. 3-8

P575 Index 001 = 18

Example according to Fig. 3-9

P575 Index 001 = 18
U064 Index 001 = 617
U237 Index 001 = 536
U237 Index 002 = 21
U302 Index 001 = 158
U303 Index 001= 3
U951 Index 099 = 8
U952 Index 054 = 8
U952 Index 062 = 8

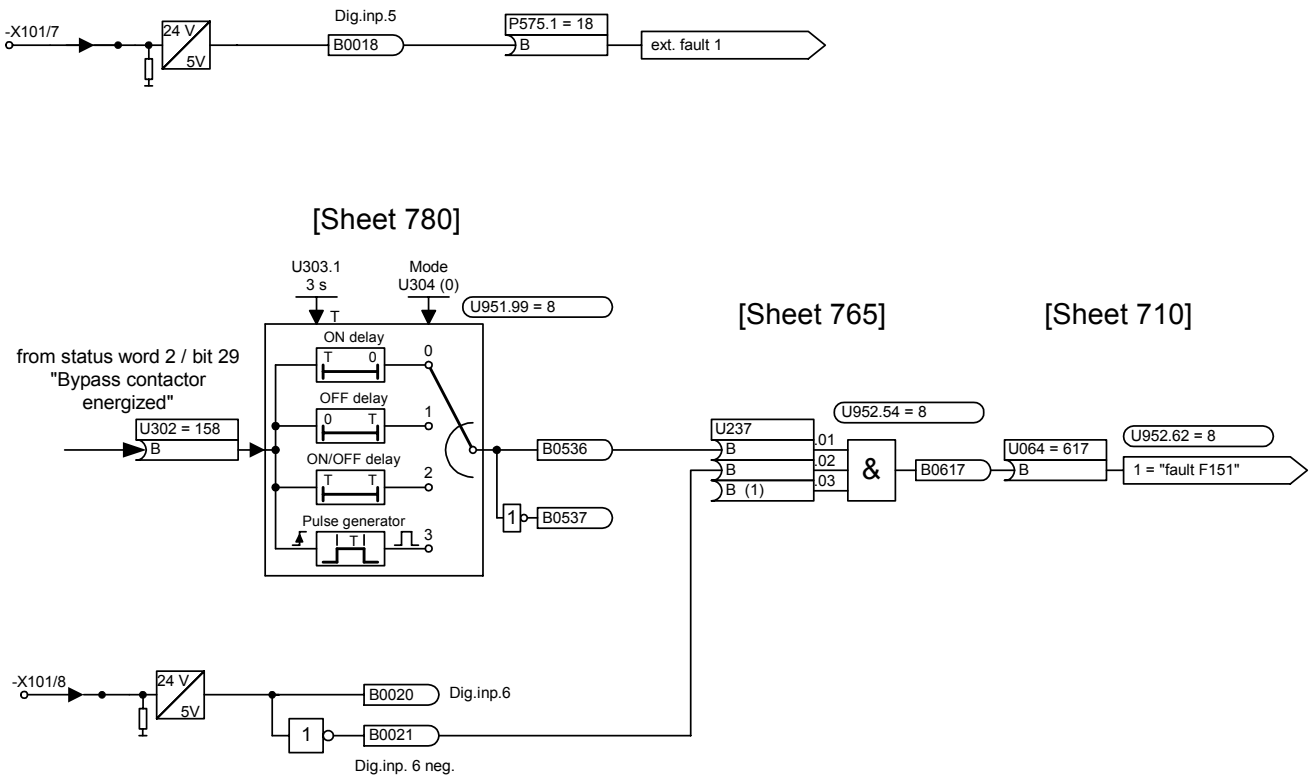


Fig. 6-4

NOTE

When the DC link voltage is applied, fault output –X38/5 is "Low" for about 2 seconds (self-test), i.e. in the fault state. The parameter settings specified above conceal this state when the system is switched on.

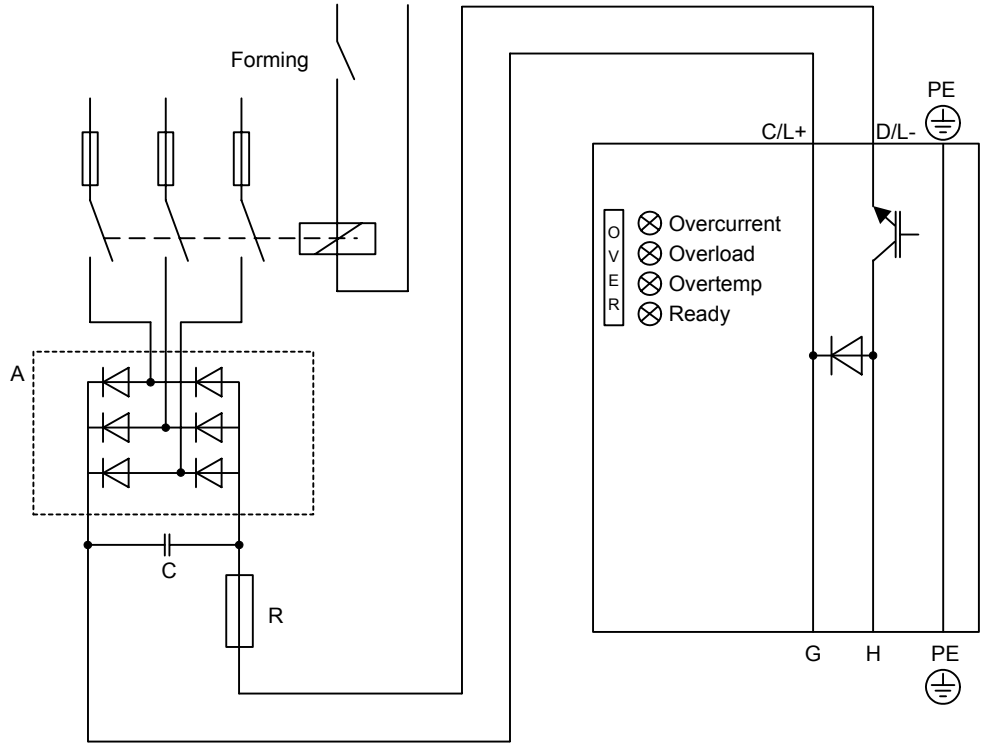
6.1 Capacitor forming

The DC link capacitors must be re-formed if the converter has been non-operational for more than one year. If the converter was started-up within one year after having been shipped (serial number on the rating plate), it is not necessary to re-form the DC link capacitors.

Forming is realized by switching-in a rectifier and resistor, which is connected to the DC link. **The converter supply must be disconnected** (circuit: refer to Fig. 6-5)**!**
The forming period required depends on how long the braking unit has been non-operational (see Fig. 6-6).

Position	**Example**	**Significance / Example**	
1 and 2	F2	Site of manufacture:	Chemnitz
3	R S T U	Manufacturing year:	2003 2004 2005 2006
4	1 to 9 O N D	Manufacturing month:	Jan. to Sept. October November December
5 to 10		Not relevant for forming (serial number)	

Table 6-2 Serial number structure



	Recommended components		
	A	**R**	**C**
208 V < Un < 415 V	SKD 50 / 12	220 Ω / 100 W	22 nF / 1600 V
380 V < Un < 460 V	SKD 62 / 16	470 Ω / 100 W	22 nF / 1600 V
500 V < Un < 690 V	SKD 62 / 18	680 Ω / 100 W	22 nF / 1600 V

Fig. 6-5 Circuit for forming

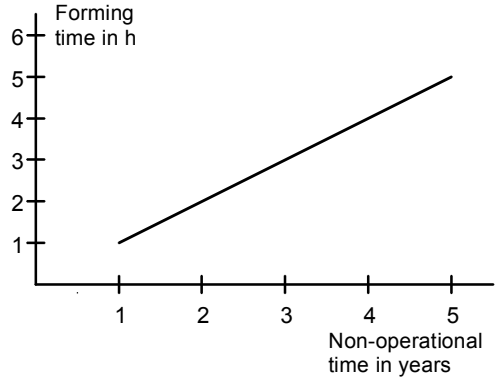


Fig. 6-6 Forming time as a function of how long braking unit has been non-operational

7 Technical Data

Order Number Braking unit 6SE70...	Power Rating P_{20} [kW]	Voltage Limit [V]	Rated DC voltage [V]	Current IRMS [A]	Weight [kg]	Order Number Braking resistor 6SE70...	[Ω]	Conductor sizes DC link and braking resistor Cu cable [mm²]	[AWG]	Fuses for DC link Type
21-6CS87-2DA1	5	387	270 to 310	7.9	3	21-6CS87-2DC0	20	1.5	14	3NE4101
18-0ES87-2DA1	5	757	510 to 650	4.0	3	18-0ES87-2DC0	80	1.5	16	3NE4101
16-4FS87-2DA1	5	945	675 to 810	3.2	3	16-4FS87-2DC0	124	1.5	16	3NE4101
23-2CS87-2DA1	10	387	270 to 310	16	3.3	23-2CS87-2DC0	10	2.5	14	3NE4102
21-6ES87-2DA1	10	757	510 to 650	8	3.1	21-6ES87-2DC0	40	1.5	16	3NE4101
21-3FS87-2DA1	10	945	675 to 810	6	3.1	21-3FS87-2DC0	62	1.5	16	3NE4101
26-3CS87-2DA1	20	387	270 to 310	32	4.1	26-3CS87-2DC0	5	10	6	3NE4120
23-2ES87-2DA1	20	757	510 to 650	16	3.3	23-2ES87-2DC0	20	2.5	14	3NE4102
28-0ES87-2DA1	50	757	510 to 650	40	4.1	28-0ES87-2DC0	8	10	6	3NE4121
26-4FS87-2DA1	50	945	675 to 810	32	4.1	26-4FS87-2DC0	12.4	10	6	3NE4120
25-3HS87-2DA1	50	1105	890 to 930	27	4.1	25-3HS87-2DC0	17.8	6	8	3NE4118
31-6EB87-2DA1	100	757	510 to 650	80	17	31-6ES87-2DC0	4	35	2	3NE3225
31-3FB87-2DA1	100	945	675 to 810	64	17	31-3FS87-2DC0	6.2	35	2	3NE3224
32-7EB87-2DA1	170	757	510 to 650	135	17	32-7ES87-2DC0	2.35	50	2/0	3NE3230-0B
32-5FB87-2DA1	200	945	675 to 810	128	17	32-5FS87-2DC0	3.1	50	2/0	3NE3230-0B
32-1HB87-2DA1	200	1105	890 to 930	107	17	32-1HS87-2DC0	4.45	50	1/0	3NE3227

NOTE

Braking resistor: Resistance value ± 10 %
apart from 6SE7032-7ES87-2DC0 ± 8 %.

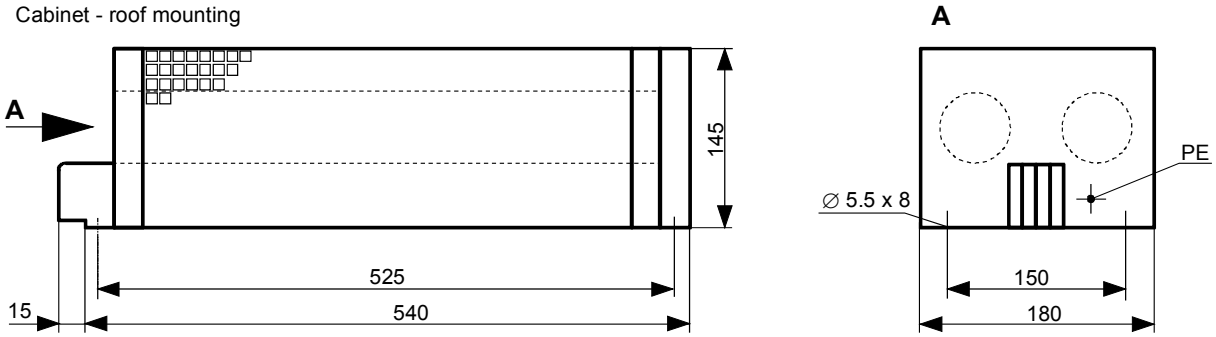
Table 7-1 Technical data

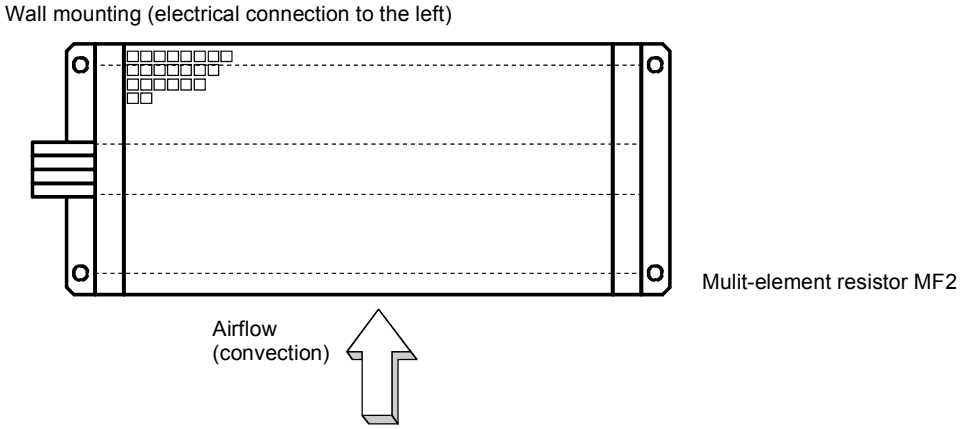
NOTE

The connection cross-sections have been determined for copper cables at an ambient temperature of 40 °C (104 °F) and for cables with a permissible conductor operating temperature of 70 °C (as per DIN VDE 0298-4 / 08.03).

Dimensions [mm]	Width	Height	Depth
• 5 – 50 kW	45	360	247
• 100 – 200 kW	135	427	350
Cooling method	Self cooling		
Degree of protection	IP20 according to EN 60529		
Permissible ambient or coolant temperature			
• In operation	0° C to +40° C (32° F to 104° F)		
• In storage	-25° C to +55° C (-13° F to 131° F)		
• In transport	-25° C to +70° C (-13° F to 158° F)		
Pollution severity	Pollution severity 2 to DIN EN 50178		
Environmental conditions to DIN IEC 721-3-3	Climate: 3K3 Chemically active substances: 3C2		
Humidity rating	Relative air humidity ≤ 95 % in transport and storage ≤ 85 % in operation (no condensation permitted)		

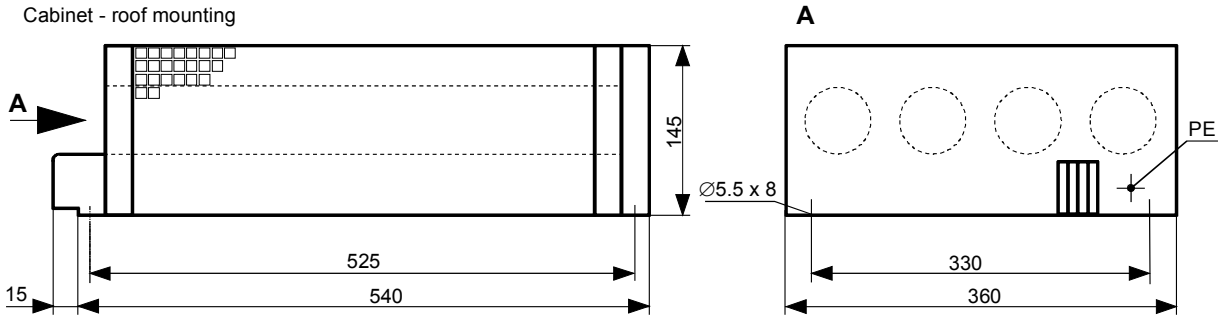
Table 7-2 Technical data

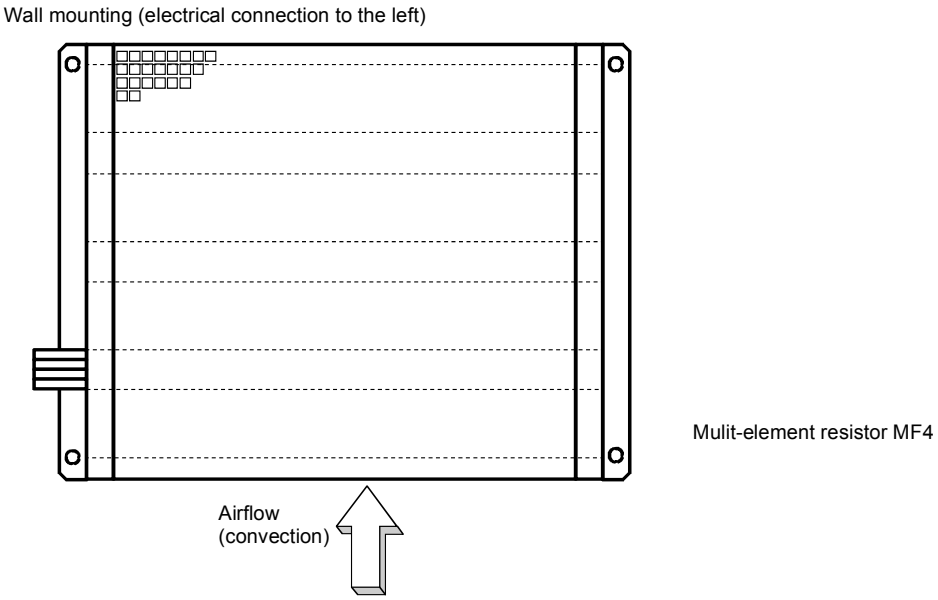




Braking resistor for	Type
5 kW; 20 Ω	6SE7021-6CS87-2DC0
5 kW; 80 Ω	6SE7018-0ES87-2DC0
5 kW; 124 Ω	6SE7016-4FS87-2DC0

Fig. 7-1 Mounting diagram, braking resistor



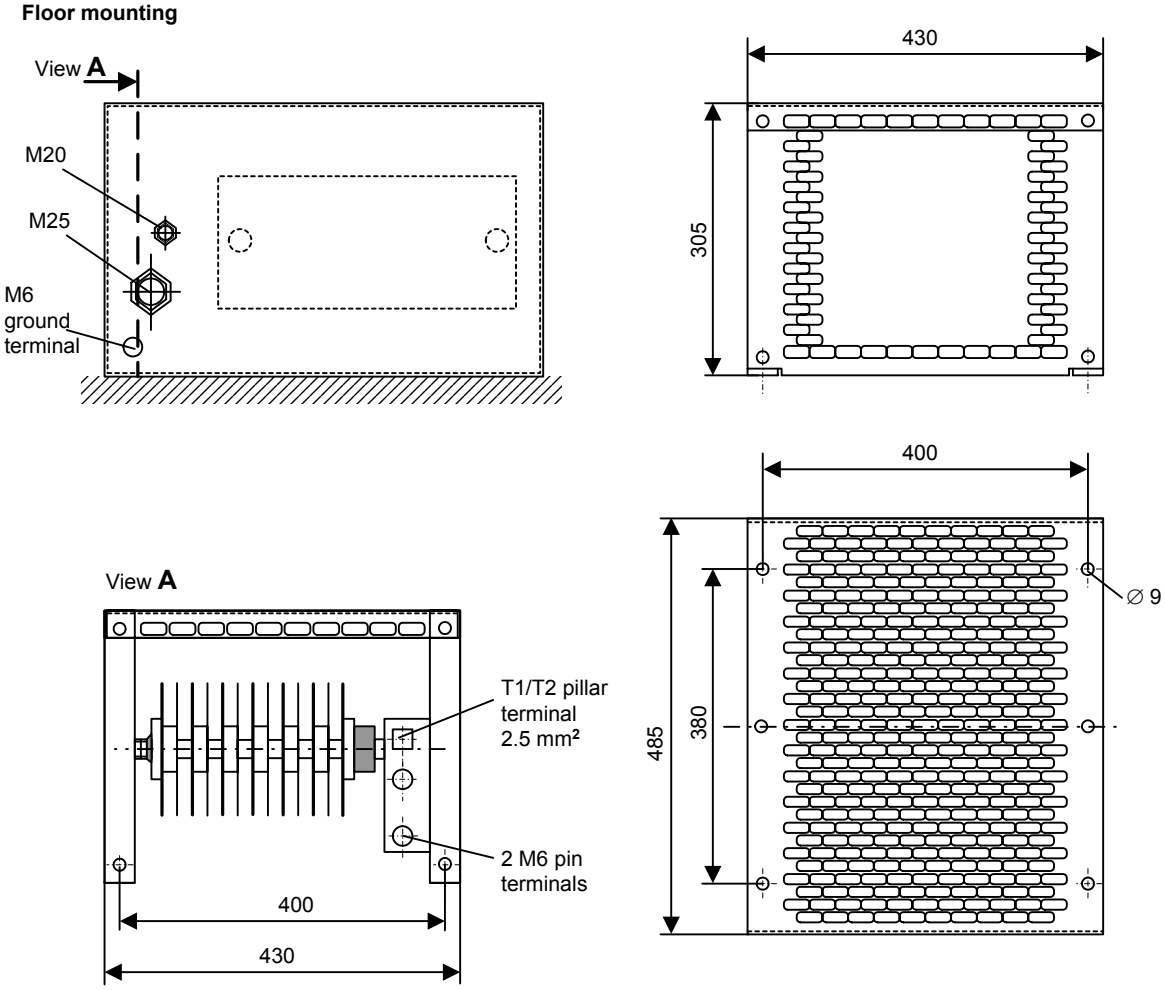


Mulit-element resistor MF4

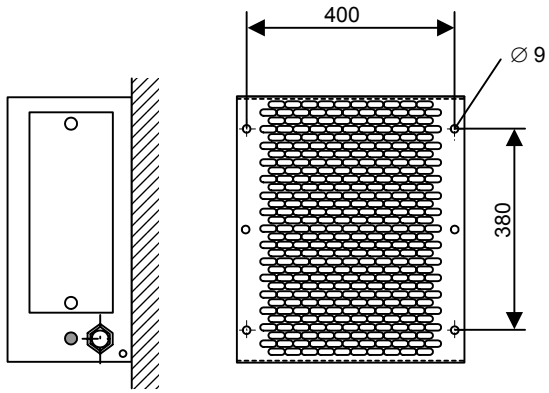
Braking resistor for	Type
10 kW; 10 Ω	6SE7023-2CS87-2DC0
10 kW; 40 Ω	6SE7021-6SE87-2DC0
10 kW; 62 Ω	6SE7021-3FS87-2DC0

Fig. 7-2 Mounting diagram, braking resistor

Floor mounting



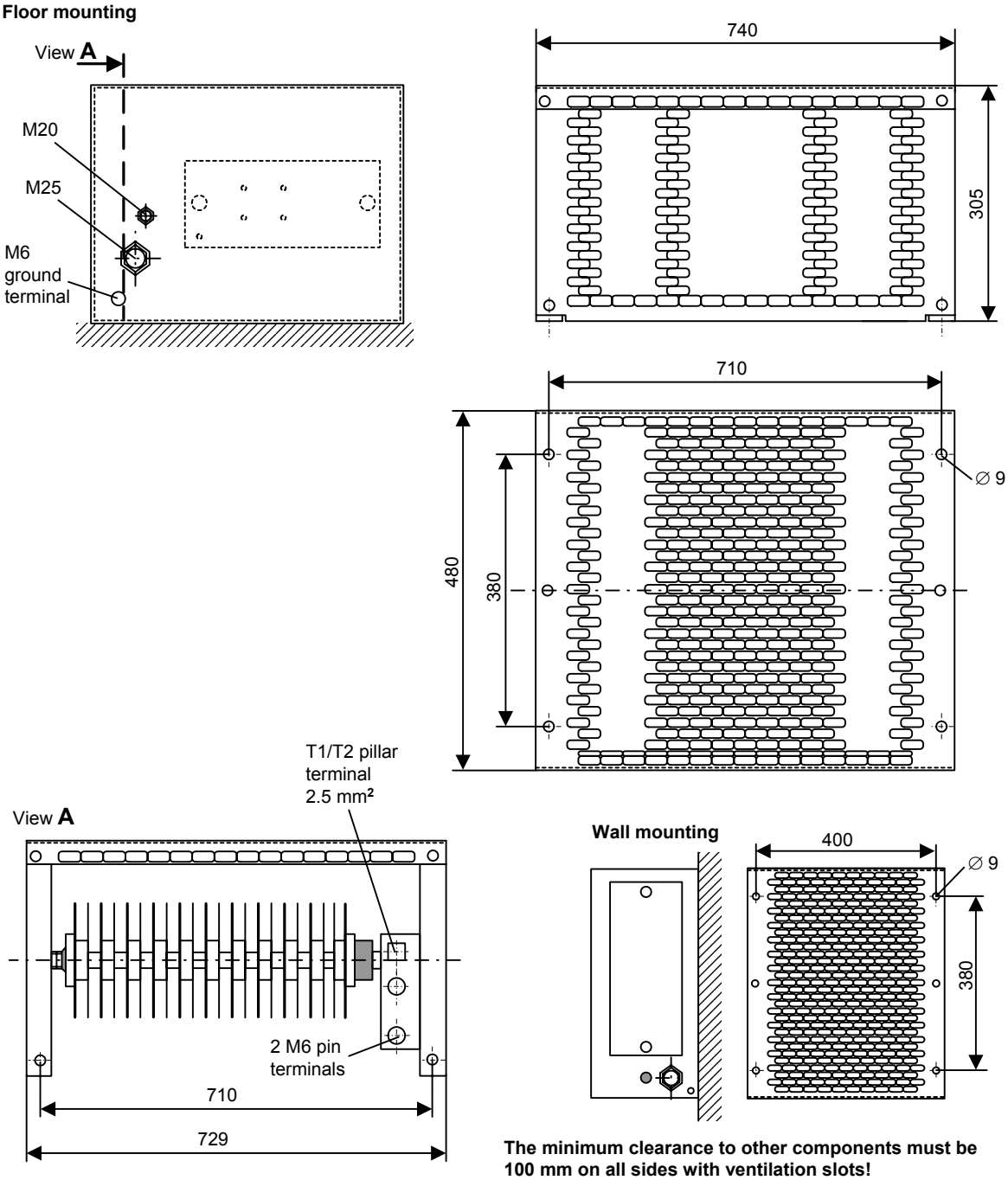
Wall mounting



The minimum clearance to other components must be 100 mm on all sides with ventilation slots!

Braking resistor for	Type	Weight, approx.
20 kW; 20 Ω	6SE7023-2ES87-2DC0	17 kg
20 kW; 5 Ω	6SE7026-3CS87-2DC0	15 kg

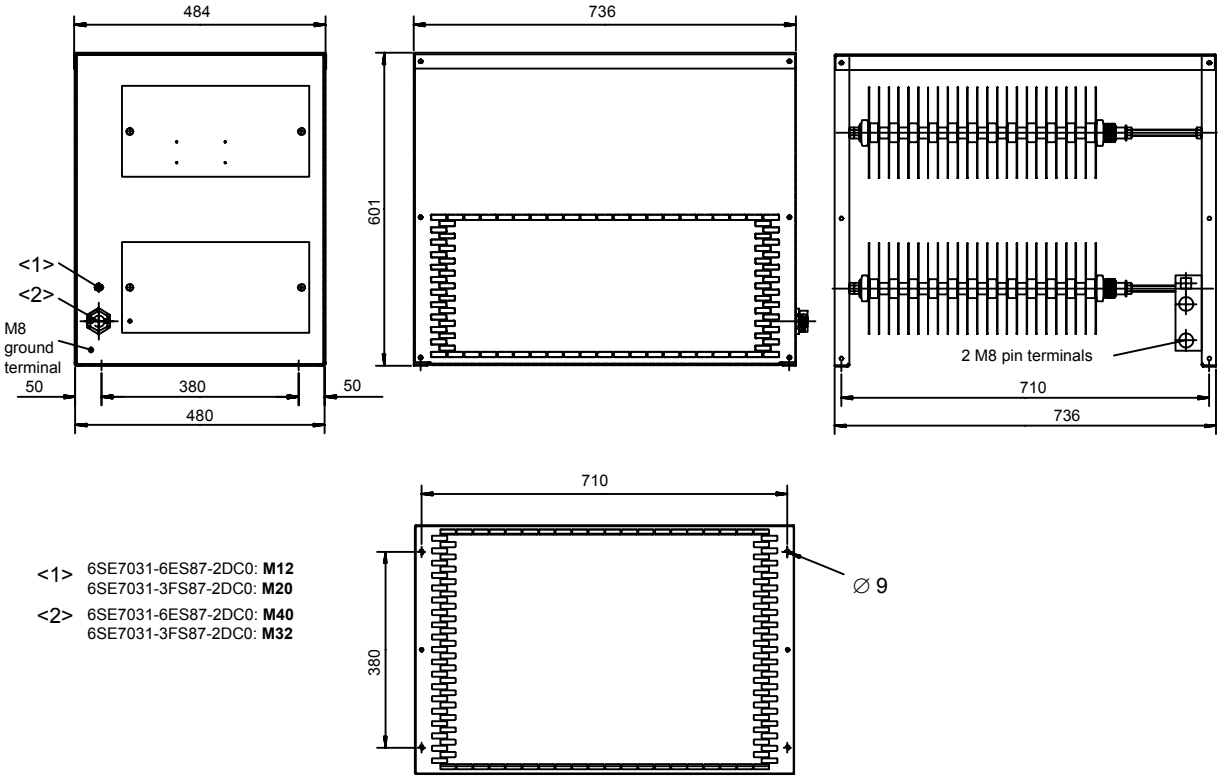
Fig. 7-3 Mounting diagram, braking resistor for floor and wall mounting



The minimum clearance to other components must be 100 mm on all sides with ventilation slots!

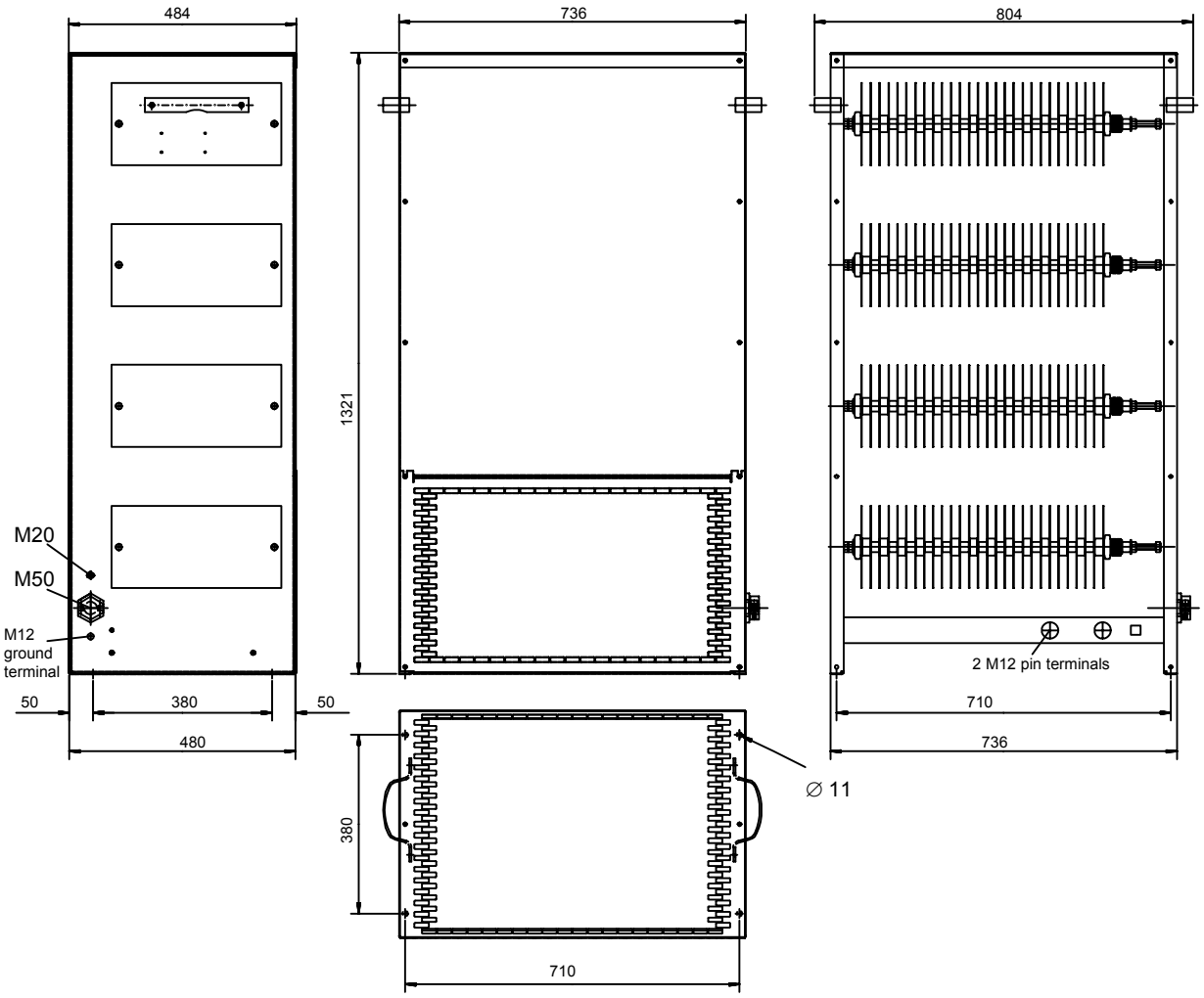
Braking resistor for	Type	Weight, approx.
50 kW; 8 Ω	6SE7028-0ES87-2DC0	27 kg
50 kW; 12.4 Ω	6SE7026-4FS87-2DC0	27 kg
50 kW; 17.8 Ω	6SE7025-3HS87-2DC0	28 kg

Fig. 7-4 Mounting diagram, braking resistor for floor and wall mounting



Braking resistor for	Type	Weight, approx.
100 kW; 4 Ω	6SE7031-6ES87-2DC0	45 kg
100 kW; 6.2 Ω	6SE7031-3FS87-2DC0	45 kg

Fig. 7-5 Mounting diagram, braking resistor



Braking resistor for	Type	Weight, approx.
170 kW; 2.35 Ω	6SE7032-7ES87-2DC0	105 kg
200 kW; 3.1 Ω	6SE7032-5FS87-2DC0	109 kg
200 kW; 4.45 Ω	6SE7032-1HS87-2DC0	109 kg

Fig. 7-6 Mounting diagram, braking resistor for floor mounting

SIEMENS

SIMOVERT MASTER DRIVES
Bremseinheit
Braking Unit

Betriebsanleitung
Operating Instructions

Ausgabe / Edition: AB

Bestell-Nr. / Order-No.: 6SE7087-6CX87-2DA0

Von dieser Betriebsanleitung sind folgende fremdsprachige Ausgaben lieferbar:
These Operating Instructions are available in the following languages:

Sprache Language	Französisch French	Spanisch Spanish	Italienisch Italian
Bestell-Nr. Order-No.	6SE7087-7CX87-2DA0	6SE7087-8CX87-2DA0	6SE7087-2CX87-2DA0

Contents

0 Definitions

- QUALIFIED PERSONAL

  For the purpose of these instructions and product labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up and operation of the equipment and the hazards involved. He or she must have the following qualifications:

  1. Trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.
  2. Trained in the proper care and use of protective equipment in accordance with established safety procedures.
  3. Trained in rendering first aid.

- DANGER

  For the purpose of these instructions and product labels, "Danger" indicates death, severe personal injury or substantial property damage will result if proper pre

  cautions are not taken.

- WARNING

  For the purpose of these instructions and product labels, "Warning" indicates death, severe personal injury or property damage can result if proper precautions are not taken.

- CAUTION

  For the purpose of these instructions and product labels, "Caution" indicates that minor personal injury or material damage can result if proper precautions are not taken.

- NOTE

  For the purpose of these instructions, "Note" indicates information about the product or the respective part of the Instruction Manual which is essential to highlight.

NOTE
These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office. The contents of this Instruction Manual shall not become part of or modify any prior or existing agreement, committment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

CAUTION

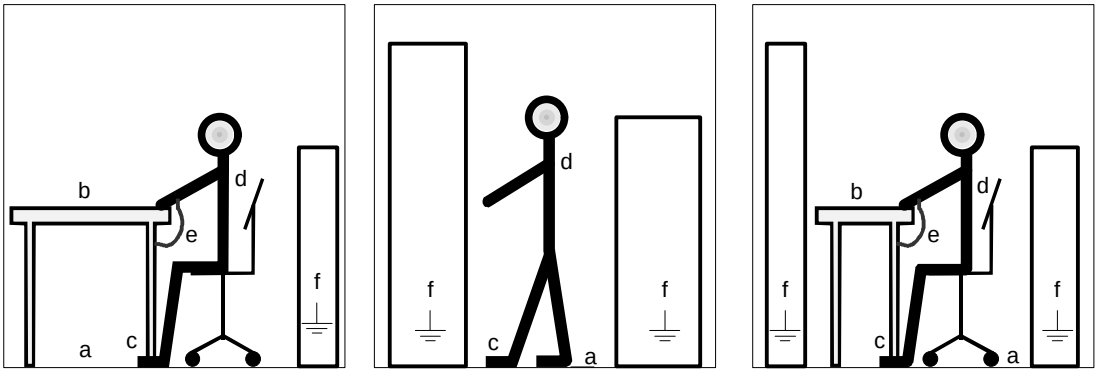
Components which can be destroyed by electrostatic discharge (ESD)

The converters contain components which can be destroyed by electrostatic discharge. These components can be easily destroyed if not carefully handled. If you have to handle electronic boards please observe the following:

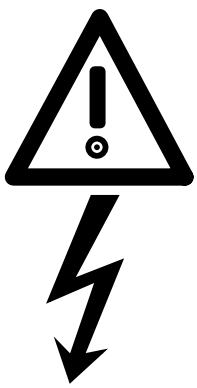
- Electronic boards should only be touched when absolutely necessary.
- The human body must be electrically discharged before touching an electronic board
- Boards must not come into contact with highly insulating materials - e.g. plastic foils, insulated desktops, articles of clothing manufactured from man-made fibers
- Boards must only be placed on conductive surfaces
- When soldering, the soldering iron tip must be grounded
- Boards and components should only be stored and transported in conductive packaging (e.g. metalized plastic boxes, metal containers)
- If the packing material is not conductive, the boards must be wrapped with a conductive packaging material, e.g. conductive foam rubber or household aluminum foil.

The necessary ECB protective measures are clearly shown in the following diagram:

a	=	Conductive floor surface	d	=	ESD overall
b	=	ESD table	e	=	ESD chain
c	=	ESD shoes	f	=	Cubicle ground connection



Sitting **Standing** **Standing / Siting**



WARNING

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the safety instructions can result in severe personal injury or property damage.

Only qualified personnel should work on or around the equipment after first becoming thoroughly familiar with all warning and safety notices and maintenance procedures contained herein.

The successful and safe operation of this equipment is dependent on proper handling, installation, operation and maintenance.

1 Product Description

Electric energy is fed into SIMOVERT MASTER DRIVES when a motor is decelerated. In order to prevent overvoltage tripping, a braking resistor is used to convert this energy into heat. This resistor may be a part of the braking unit or it is connected to it.

The braking unit is connected to the DC bus terminals of the drive. When the DC bus voltage reaches a pre-defined limit, the braking unit automatically turns on and prevents the DC bus voltage from continuing to increase.

The braking unit operates autonomously. The power supply of the electronics is integrated in the unit.

The braking unit is available in three frame sizes:

♦ **frame size S**	5 kW to 10 kW:	integrated braking resistor external braking resistor	for short braking operation: if the integrated braking resistor is not sufficient:
♦ **frame size A**	10 kW to 20 kW:	integrated braking resistor external braking resistor	for short braking operation: if the integrated braking resistor is not sufficient:
	50 kW	external braking resistor	
♦ **frame size B**	100 kW bis 200 kW:	external braking resistor	

2 Mounting, Connection

Mounting:

- Braking units are mounted side to side to SIMOVERT MASTER DRIVES on a G rail or using M6 screws.

Connection:

- Braking unit
  Connect the terminals C/L+ and D/L- (top side of the braking unit) to the terminals C/L+ and D/L- of the drive (☞ Fig. 2.1).
  - The connecting cables should be max. 3 m long and twisted.
  - For several inverters in parallel with a common DC bus, the braking unit should be connected to the inverter with the highest rating.
- Connecting braking units in parallel:
  - Only braking units with the same ratings or the next highest or next lowest rating (☞ Table 6.1) may be connected in parallel.
  - Each braking unit must have its own twisted feeder cable, max. length 3 m.
- External braking resistors (Selection list ☞ section 3 „Braking Resistors“)
  - 5 kW to 20 kW Disconnect jumper between terminals H1 and H2, connect resistor to Terminals G and H2.
  - 50 kW and more Connect the resistor to terminals G and H.

WARNING

Mis-connecting or shorting the DC bus terminals will destroy the drive and the braking unit, respectively.

5 kW to 20 kW: If the internal and an external resistor are connected at same time, or if an external resistor is connected without disconnecting the jumper between H1 and H2, the braking unit may be destroyed!

For braking units with an internal brake resistor, the air discharge temperature can be > 80 °C.

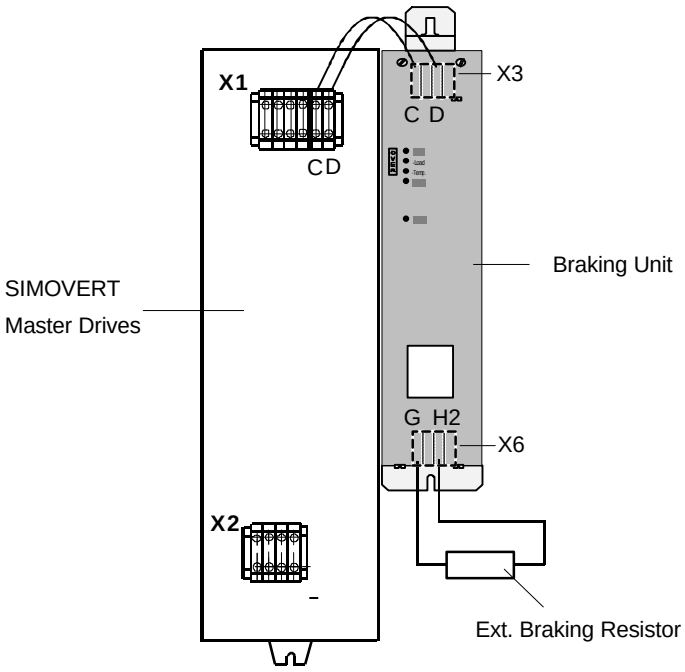
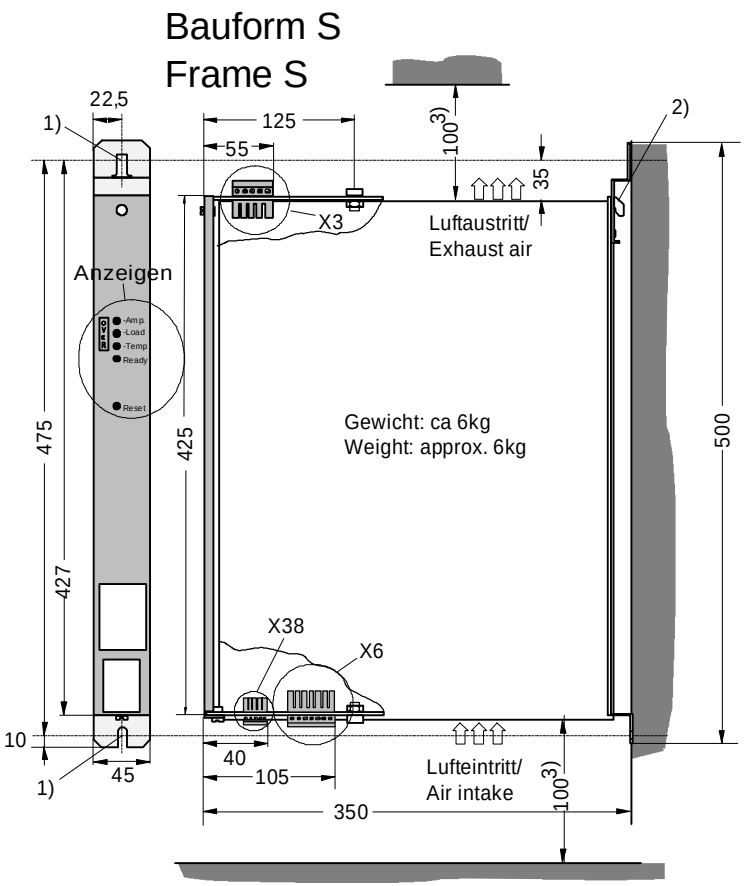
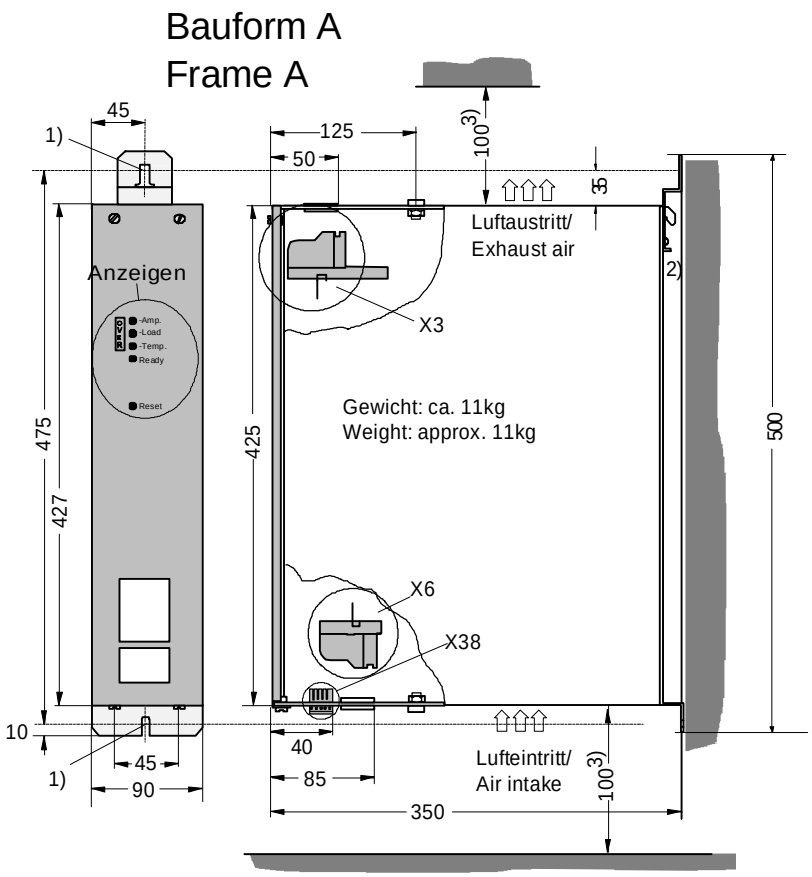


Fig. 2.1 Connection of the braking unit





1) Durchgangsloch für Schraube M6.

Mounting hole for Screw M6.

2) Haken (Aufhängung) zur Befestigung an einer G-Schiene nach EN50035.

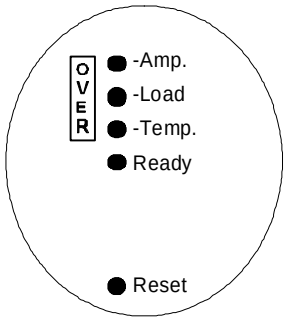
Hook (suspension) for mounting on a g-rail according to EN50035.

3) Notwendiger Abstand zur Kühlung der Geräte 100 mm

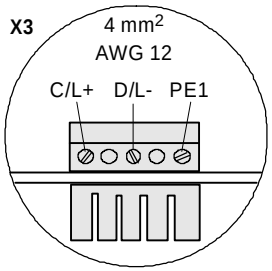
Space required for cooling the unit 100 mm

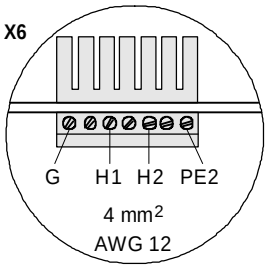
Maße: mm
Dimension: mm

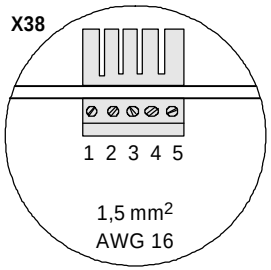
Anzeigen / Display

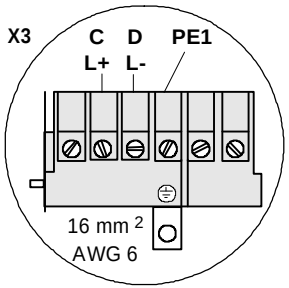


Klemmenleisten / Terminals









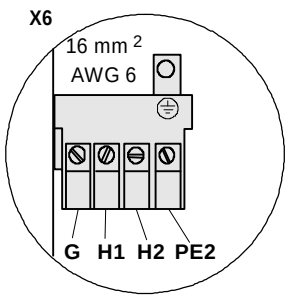
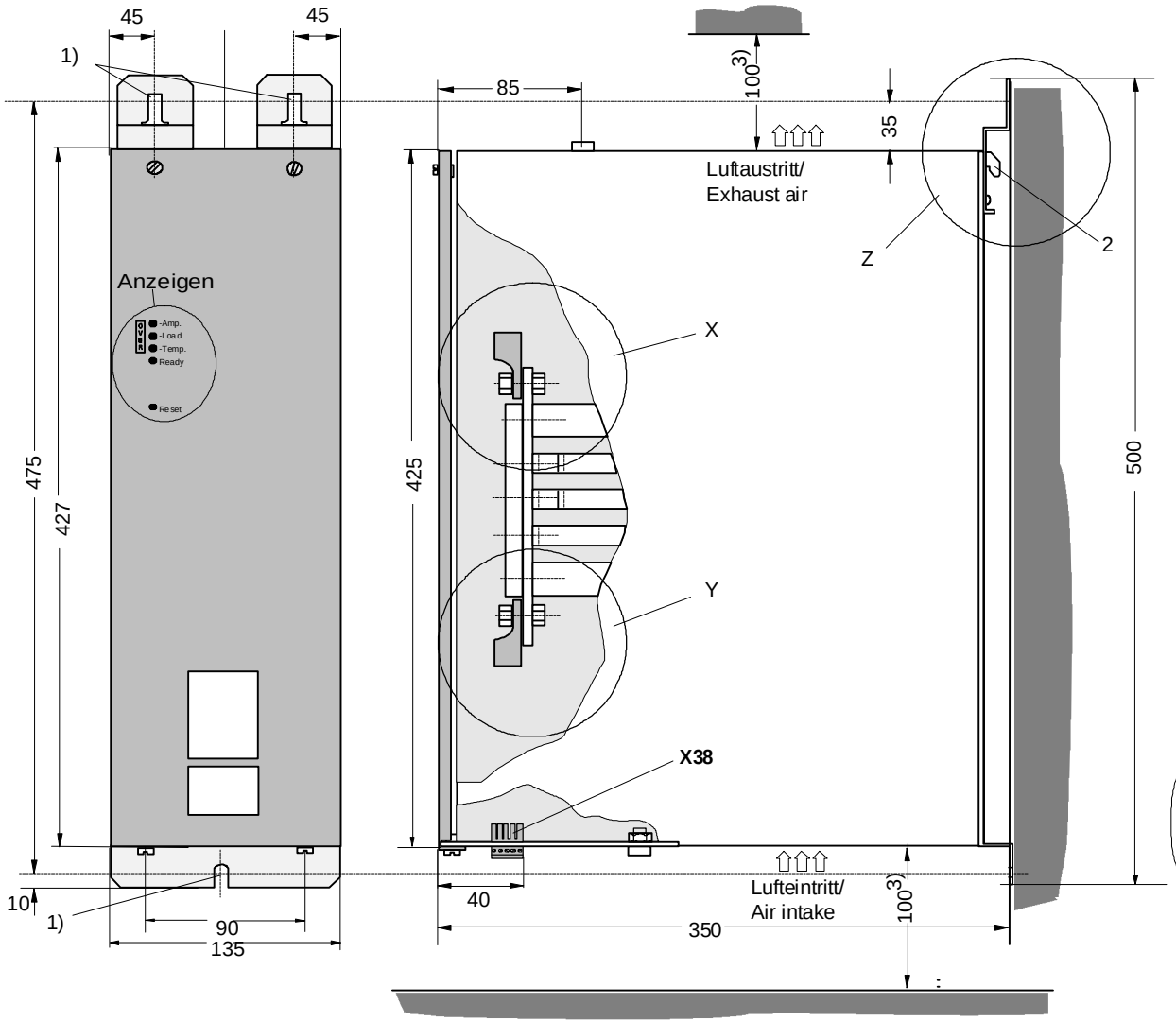
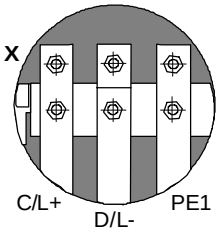


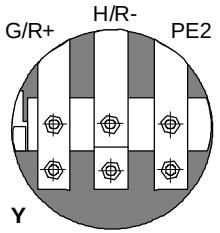
Fig. 2.2 Dimension drawing

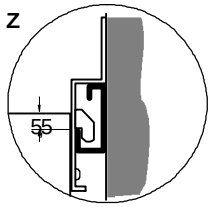
Fig. 2.3 Dimension drawing

Bauform B
Frame B









1) Durchgangsloch für Schraube M6.
Mounting hole for screw M6.

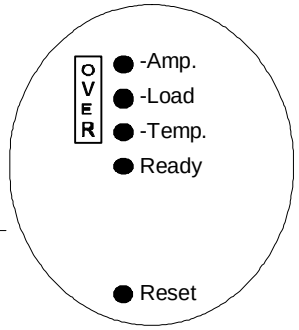
2) Haken (Aufhängung) zur Befestigung an einer G-Schiene nach EN50035.
Hook (suspension) for mounting on a g-rail according to EN50035.

3) Notwendiger Luftraum zur Kühlung der Geräte. Bei Option (Nachrüstung) ist eine Höhe von 100 mm notwendig.
Space requiered for cooling the unit. By using the option a space of 100 mm is required

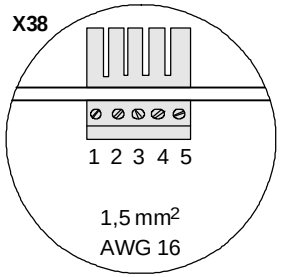
Maße: mm
Dimension: mm

Gewicht: ca 18kg
Waight: approx. 18kg

Anzeigen / Displays



Klemmenleisten
Terminals



2.2 Power Terminals

Terminal	**Frame S**	**Frame A**	**Frame B**
C/+ Input	X3:1	X3:2	Bar C/L+
D/- Input	X3:3	X3:3	Bar D/L-
⊥ Schielding	X3:5	top side	top side
PE1 ⏚	top side	X3:4	Bar PE1
G external braking resistor	X6:1	X6:1	Bar G/R+
H1 internal braking resistor	X6:3	X6:2	
H2 external braking resistor	X6:5	X6:3	Bar H/R-
⊥ Schielding	X6:7	bottom side	bottom side
PE2 ⏚	bottom side	X6:4	Bar PE2
connected via	Terminals	Terminals	Cable lug according to DIN 46235 and M8 screws
Cross section area: VDE (mm^2)	1,5 to 4	2,5 to 10	max. 1 × 95
AWG	16 to 10	14 to 6	max. 1 × 000

NOTES

AWG: American Wire Gauge

Table 2.1 Power terminals of the braking unit

The minimum cross section areas are calculated for copper wire at an ambient temperature of 40° C (according to DIN VDE 0298 part 4 / 02.88 group 5). The maximum cross section areas are limited by the terminal size. All data are for multi-wire cables..

WARNING

The braking unit may be connected to the DC bus bar with or without using fuses.
The connections between the drive converter and braking unit must be short-circuit- and ground-fault proof.

The voltage withstand capability of the cable must be according to the line voltage.

Fuses: It is recommended that fuses are used for multi-motor systems using a common DC bus (incoming power ≫ braking unit rating).

High voltage fuses (1000 V) must be used in the positive- and negative branches (fuse type ☞ Table 6.1).

Fuses are not required for single-motor drives (one inverter for each braking unit).

NOTE

These fuses only provide protection against critical situations. They do not protect the braking unit or external brake resistor.

2.3 Control Terminal X38

The braking unit has an inhibit input and a fault output.

- Inhibit Input — Pins 1 and 2
  - Connecting 24 V DC: locks the braking unit
    Acknowledge “OVERAMP“ and “OVERTEMP“ faults
- Fault output — Pins 4 and 5
  - Relay contact closed: no fault
  - Relay contact open: fault (☞ section 4 "Monitoring")
    or
    braking unit locked (Inhibit)
    or
    no DC bus voltage applied

NOTE
Control terminals need not be connected for proper operation of the braking unit.
Relay load current capability: 1 A at 230 V AC 1 A at 24 V DC

2.4 Examples for Connection

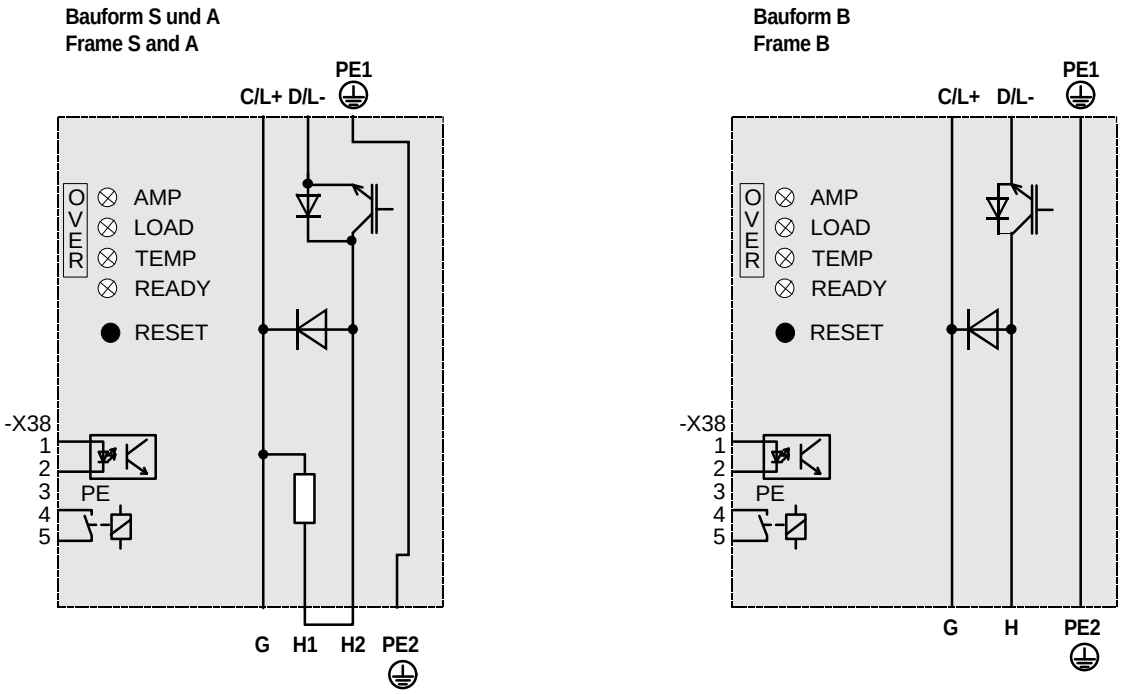


Fig. 2.4 General Schematics

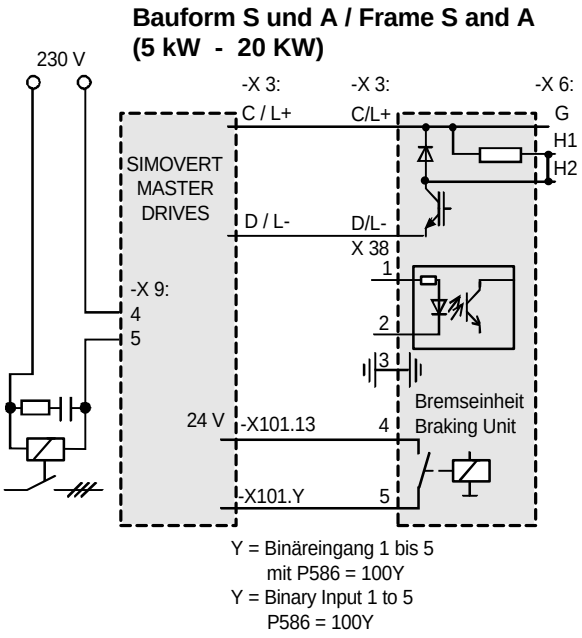


Fig. 2.5 Drive and braking unit with internal braking resistor and tripping of the drive at faults of the braking unit

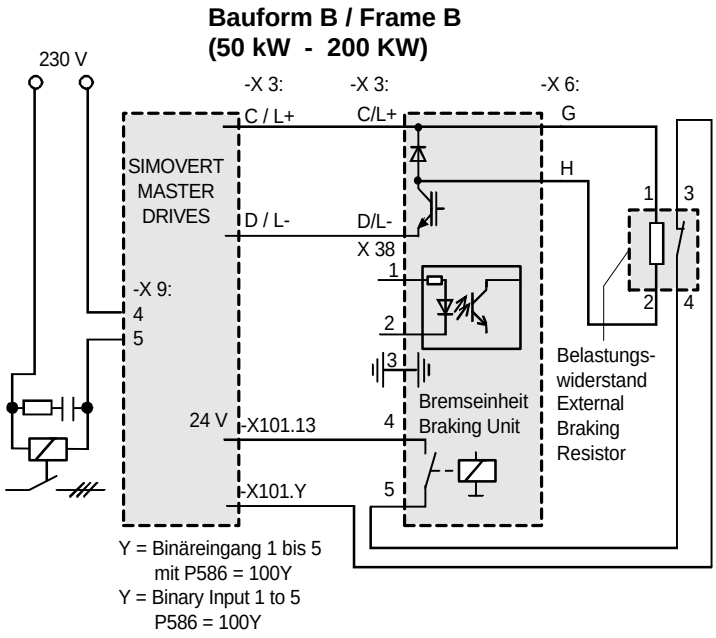


Fig. 2.6 Drive and braking unit with external braking resistor and tripping of the drive at faults of the braking unit

NOTE
The braking unit may not be connected to the live DC bus via a contactor.

3 Braking Resistors

The braking resistors listed in section 6 "Technical Data" match the braking units and allow full utilization of the the braking capability.

NOTE
The external braking resistors must be installed separately and connected on-site. The listed braking resistors have a thermal contact (NC) which opens at overload of the resistor. This thermal contact may be connected to a fault input of the drive or to an automation system.

CAUTION

When braking resistors and braking units are combined, it must be guaranteed that the resistance of a resistor is not less than the minimum allowed resistance, else the braking unit may be destroyed!

Higher values of the resistors are allowed. Under these circumstances the braking power will be reduced ($P = V^2/R$)

During operation the surface of the braking resistors may have temperatures of several 100° C. Therefore cooling air must not contain flammable or explosive items or gases.

If a resistor is mounted to the wall, the wall must not be flammable.

WARNING

If the thermo-contact of the external brake resistor is evaluated, the drive converter must be isolated from the line supply when the contact responds (e.g. by controlling the main contactor via -X9:4,5; ☞ Fig. 2.5).

3.1 Definitions of the Power Ratings

Braking Unit with external Resistor

P20 = Rated Power

P3 = Peak Power = 1,5 × P20

PDB = 0,25 × P20 = Steady State Power Rating

Braking Unit with internal Resistor

P20 = Rated Power

P3 = Peak Power = 1,5 × P20

PDB = 0,03 × P20 = Steady State Power Rating

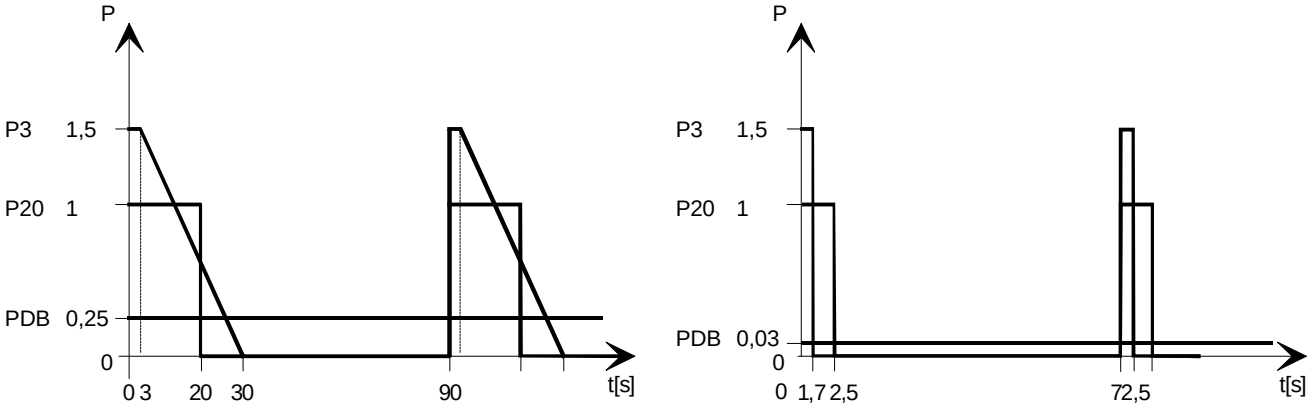


Fig. 3.1 Load Characteristics of the Braking Units

4 Monitoring

In the case of faults, the braking unit will be locked, the fault relay (X38:4-5) is de-energized. The fault is displayed via LEDs at the front cover of the braking unit.

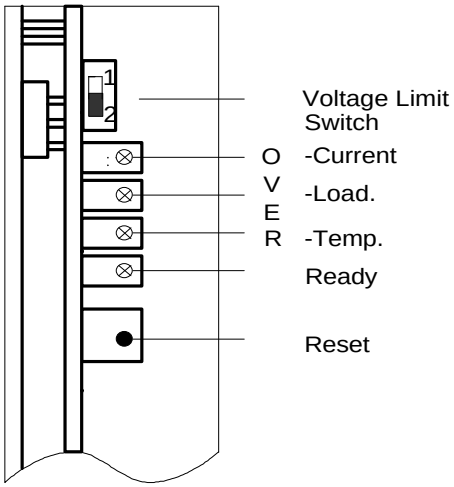


Fig. 4.1 Position of the Displays

Displays (LED):

- ♦ OVERAMP — LED is on during an output short circuit. This fault is not automatically reset. It can be reset via the Reset key or by applying and releasing the Inhibit command.
  Before resetting the braking unit make sure that the short circuit is no more existing!

- ♦ OVERLOAD — LED is on when the overload monitoring circuit becomes active (it monitors the duty cycle); if the specified duty cycle is exceeded, the braking unit turns off. The fault is automatically reset after some 70 sec.
  It can not be reset via the Reset key or by applying the Inhibit command.

- ♦ OVERTEMP — LED is on when the temperature monitoring circuit is active (ambient temperature too high or no sufficient cooling air flow).

  When the resistor overtemperature LED is lit, this means for
  - braking power ≤ 20 kW overtemperature, internal brake resistor
  - braking power ≥ 50 kW overtemperature, power semiconductor

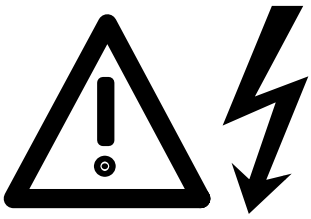
  The fault can be acknowledged when the critical temperature is fallen-below using the reset button or by connecting the inhibit signal.

- ♦ READY — LED is on after DC bus voltage is applied to the input terminals.
  During operation the LED becomes darker with increasing duty cycle
  (Note: a bright LED shows that additional braking power is available).

Operation Elements:

- ♦ **Reset Key** is accessible through the front cover to reset an overcurrent or overtemp fault
- ♦ **Voltage Limit Switch** is accessible after removing the front cover (☞ section 5 "Commissioning").

5 Commissioning



WARNING

Don't remove the Front Cover when Voltage is applied to the Braking Unit!

The control circuit is directly connected to the DC bus voltage!

Therefore the Voltage Limit Switch may only be operated when the braking unit is free of voltage.

The units have hazardous voltage levels up to 5 min. after the unit has been powered-down due to the DC link capacitors.

Setting of the Voltage Limit Switch:

The Voltage Limit for braking may be adjusted in braking units which are rated for 380 V to 460 V and 500 V to 575 V, respectively.
This may make sense if a drive is operated from a 380 / 400 V or from a 500 V line, because during braking the DC bus voltage increases only slightly. The voltage stress applied to motor insulation will be reduced.

NOTE

For 1 LA 1/5/6/8 type SIEMENS motors the voltage limit needs not to be changed.

If the Voltage Limit Switch S1 is set to the lower limit, the braking power is reduced ($P \sim V^2$)

The Voltage Limit Switch S1 is located behind the front cover.

Braking Unit	Rated Voltage	Voltage Limit	Position S1
6SE70__-_C.87-2DA0	208 V to 230 V	387 V	fix, can not be changed
6SE70__-_E.87-2DA0	380 V to 460 V	774 V (factory setting)	
	380 V to 400 V	673 V	
6SE70__-_F.87-2DA0	500 V to 575 V	967 V (factory setting)	
	500 V	841 V	
6SE70__-_H.87-2DA0	660 V to 690 V	1158 V	fix, can not be changed

Tabelle 5.1 ***Setting of the Voltage Limit Switch***

Adjust parameters at SIMOVERT MASTER DRIVES: (refer to operating Instructions, parameter list / Section 5)

- Set **DC Bus Volts Reg** to ”0”.
- If the braking unit is to report a fault to the SIMOVERT MASTER DRIVES, “Ext Fault 2“ must be used ; e.g. **P586 “Src No ext Fault 2 “**extern 2“ = 100Y (Y=Binary Input 1to5)Fault is reported to terminal X101.Y at the CU board.

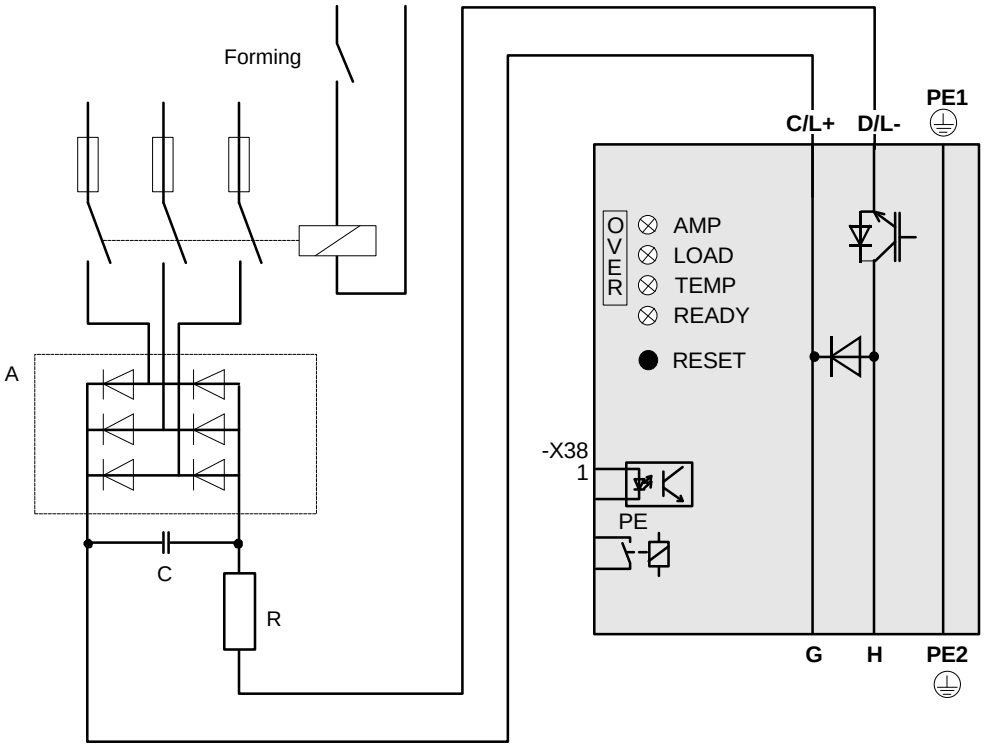
5.1 Capacitor forming

The DC link capacitors must be re-formed if the converter has been non-operational for more than one year. If the converter was started-up within one year after having been shipped (serial number on the rating plate), it is not necessary to re-form the DC link capacitors.

Forming is realized by switching-in a rectifier and resistor, which is connected to the DC link. The converter supply must be disconnected (Circuit: Refer to Fig. 5.2). The forming time is dependent on the time where the converter was not operational (refer to Fig. 5.1).

Position	Example	Significance
7	6	Manufactoring year: 1996
8 and 9	06	Manufactoring month: 06
10 and 11	04	Manufactoring day: 04
12 to 14		Not relevant for forming (Serial number)

Table 5.1 Serial number structure: NW903160604095



	Recommended components		
	A	R	C
208 V < Un < 415 V	SKD 50 / 12	220 Ω / 100 W	22 nF / 1600 V
380 V < Un < 460 V	SKD 62 / 16	470 Ω / 100 W	22 nF / 1600 V
500 V < Un < 690 V	SKD 62 / 18	680 Ω / 100 W	22 nF / 1600 V

Fig. 5.2 Circuit for forming

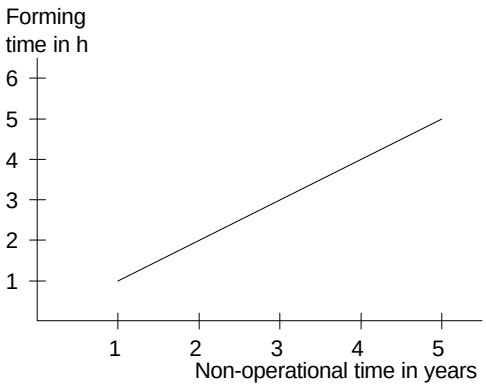


Fig. 5.1 Forming time as a function for the time which the converter was non-operational

6 Technical Data

Order Number Braking unit 6SE70...	Power Rating P_{20} (kW)	Voltage Limit (V)	Rated DC bus Voltage (V)	I_{eff} Amps (A)	Order Number Braking Resistor 6SE70...	(Ω)	Cross Section Area Cu cable mm^2	AWG	Fuse Type
21-6C**S**87-2DA0	5	387	280 to 310	7,9	21-6CS87-2DC0	20	1,5	14	3NE4101
18-0E**S**87-2DA0	5	774	510 to 620	4,0	18-0ES87-2DC0	80	1,5	16	3NE4101
16-4F**S**87-2DA0	5	967	675 to 780	3,2	16-4FS87-2DC0	124	1,5	16	3NE4101
23-2C**A**87-2DA0	10	387	280 to 310	16	23-2CS87-2DC0	10	2,5	14	3NE4102
21-6E**S**87-2DA0	10	774	510 to 620	8	21-6ES87-2DC0	40	1,5	16	3NE4101
21-3F**S**87-2DA0	10	967	675 to 780	6	21-3FS87-2DC0	62	1,5	16	3NE4101
26-3C**A**87-2DA0	20	387	280 to 310	32	26-3CS87-2DC0	5	10	6	3NE4120
23-2E**A**87-2DA0	20	774	510 to 620	16	23-2ES87-2DC0	20	2,5	14	3NE4102
22-5F**A**87-2DA0	20	967	675 to 780	13	22-5FS87-2DC0	31	2,5	14	3NE4101
22-1H**A**87-2DA0	20	1158	890 to 930	11	22-1HS87-2DC0	44,4	1,5	16	3NE4101
28-0E**A**87-2DA0	50	774	510 to 620	40	28-0ES87-2DC0	8	10	6	3NE4121
26-4F**A**87-2DA0	50	967	675 to 780	32	26-4FS87-2DC0	12,4	10	6	3NE4120
25-3H**A**87-2DA0	50	1158	890 to 930	27	25-3HS87-2DC0	17,8	6	8	3NE4118
31-6E**B**87-2DA0	100	774	510 to 620	80	31-6ES87-2DC0	4	35	0	3NE3225
31-3F**B**87-2DA0	100	967	675 to 780	64	31-3FS87-2DC0	6,2	35	0	3NE3224
31-1H**B**87-2DA0	100	1158	890 to 930	53	31-1HS87-2DC0	8,9	25	2	3NE3222
32-7E**B**87-2DA0	170	774	510 to 620	135	32-7ES87-2DC0	2,35	50	00	3NE3230-0B
32-5F**B**87-2DA0	200	967	675 to 780	128	32-5FS87-2DC0	3,1	50	00	3NE3230-0B
32-1H**B**87-2DA0	200	1158	890 to 930	107	32-1HS87-2DC0	4,45	50	00	3NE3227

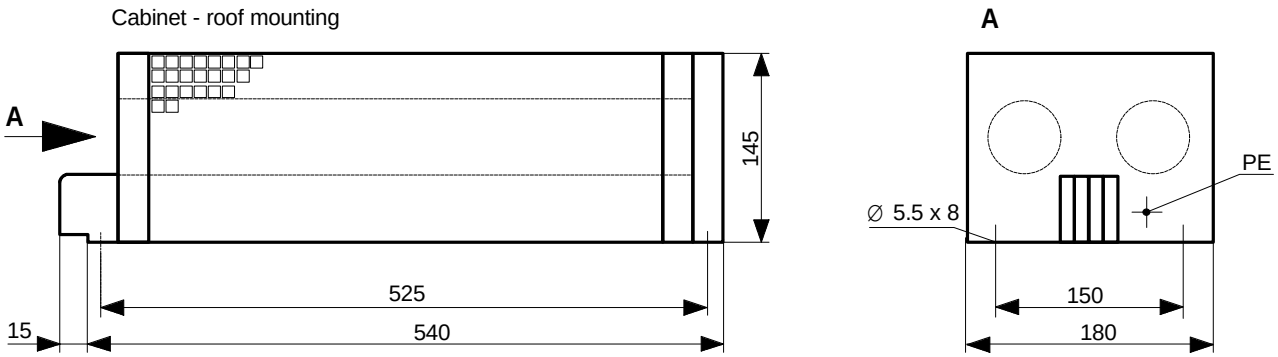
NOTE

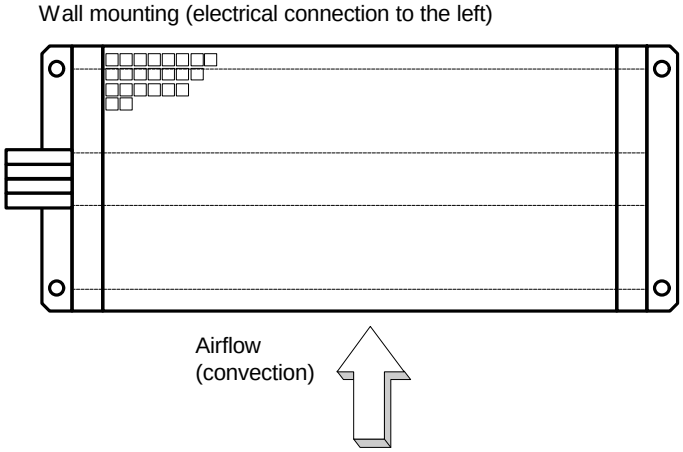
Load resistor: Resistance value ± 10 %, exception 6SE7032-7ES87-2DC0 ± 8 %

Table 6.1 Technical Data

Frame Size	Size (mm)			Weight (kg)	Degree of ptotection	Cooling
	Width	Height	Depth			
S	45	427	350	6	IP20	self cooling
A	90	427	350	11	IP20	self cooling
B	135	427	350	18	IP20	self cooling

Table 6.2 Technical Data



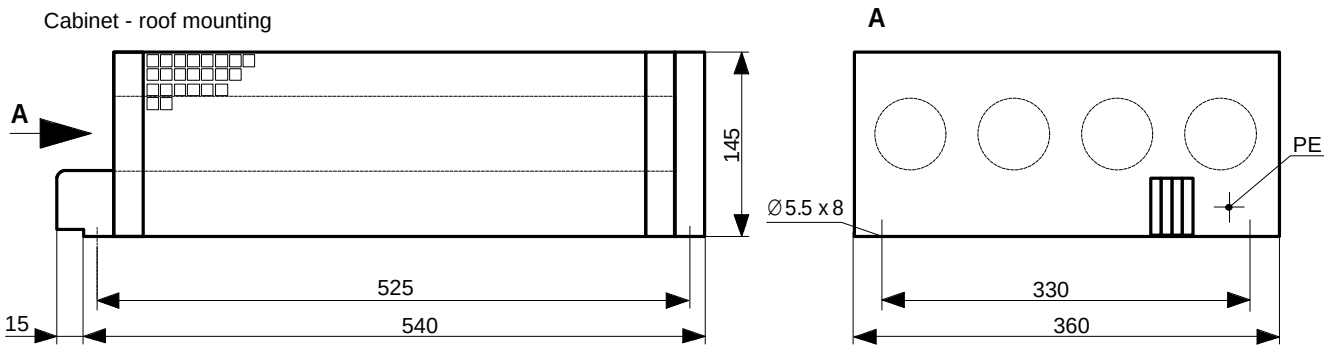


Multi-element resistor MF2

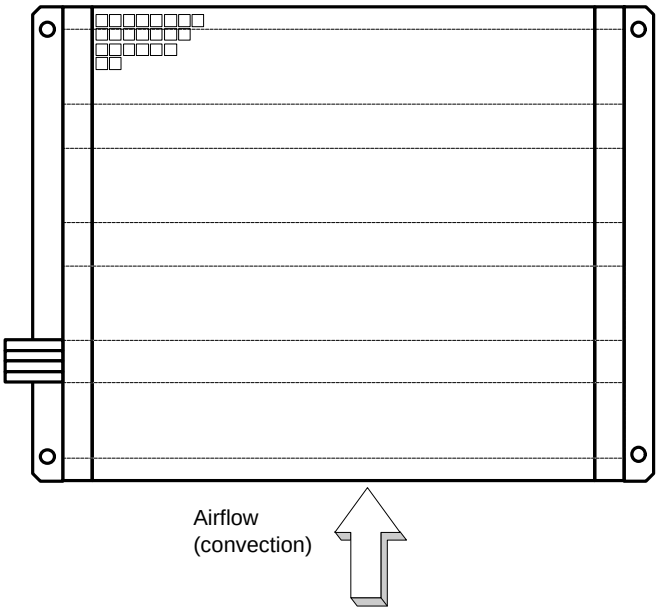
Brake resistor for	Type
5 kW; 20 Ω	6SE7021-6CS87-2DC0
5 kW; 80 Ω	6SE7018-0ES87-2DC0
5 kW; 124 Ω	6SE7016-4FS87-2DC0

Fig. 6.1 Mounting diagram, brake resistor

Cabinet - roof mounting



Wall mounting (electrical connection to the left)

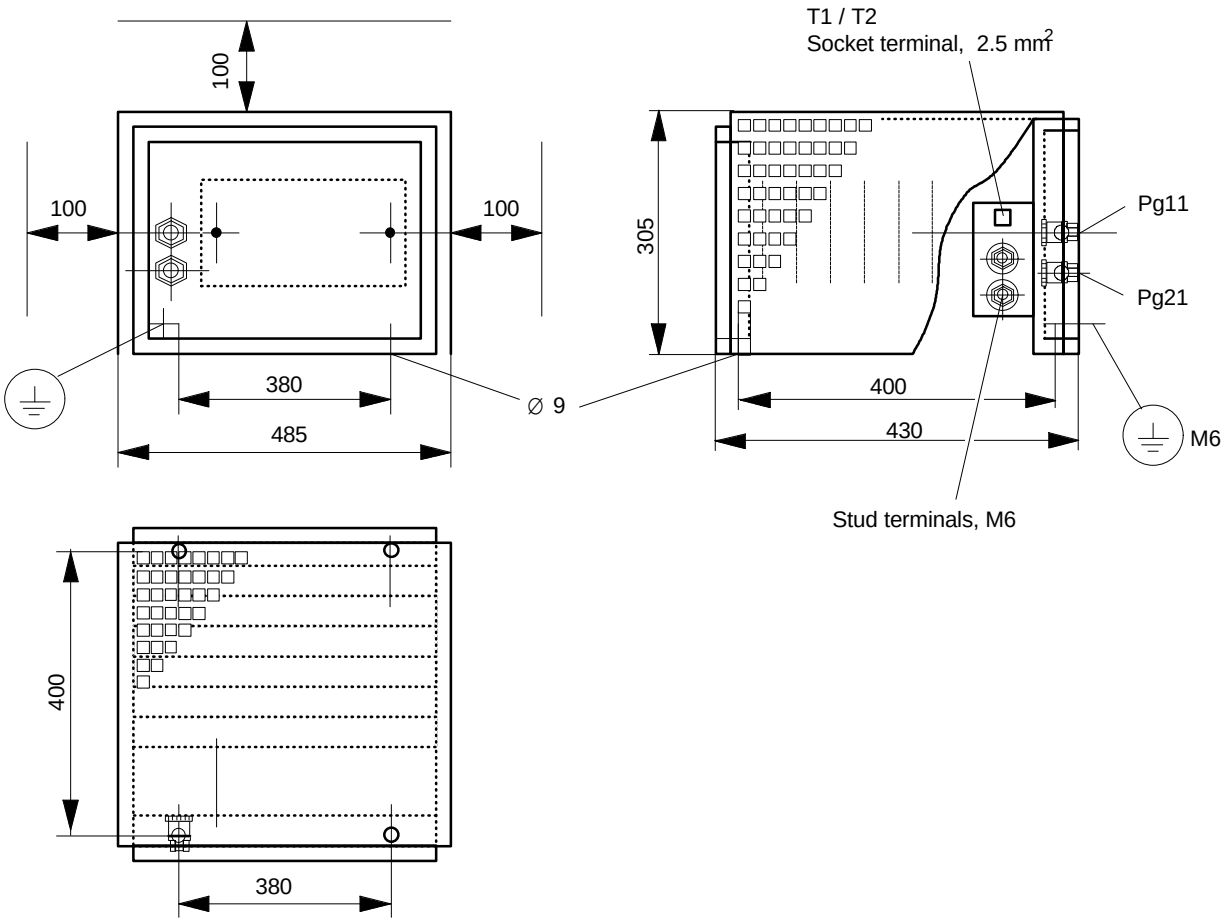


Multi-element resistor MF4

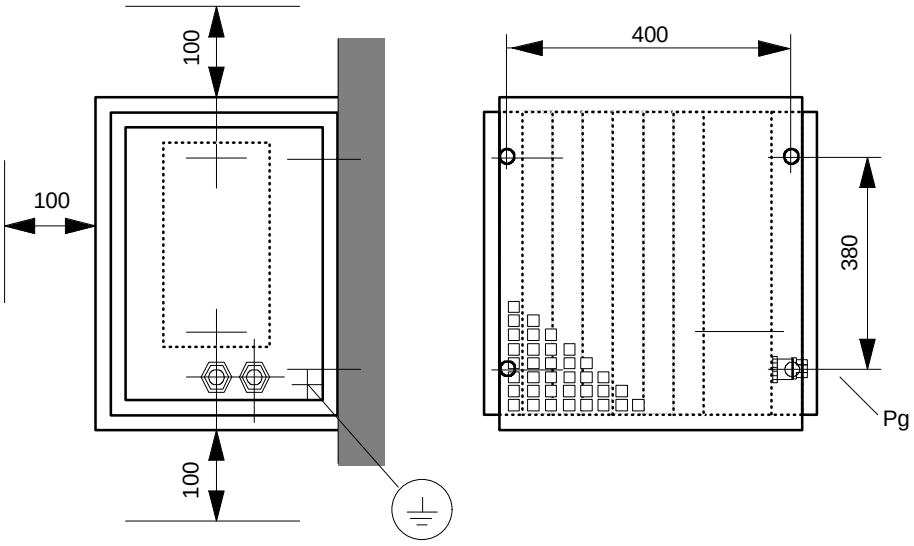
Brake resistor for	Type
10 kW; 10 Ω	6SE7023-2CS87-2DC0
10 kW; 40 Ω	6SE7021-6SE87-2DC0
10 kW; 62 Ω	6SE7021-3FS87-2DC0

Fig. 6.2 Mounting diagram, brake resistor

Floor mounting



Wall mounting

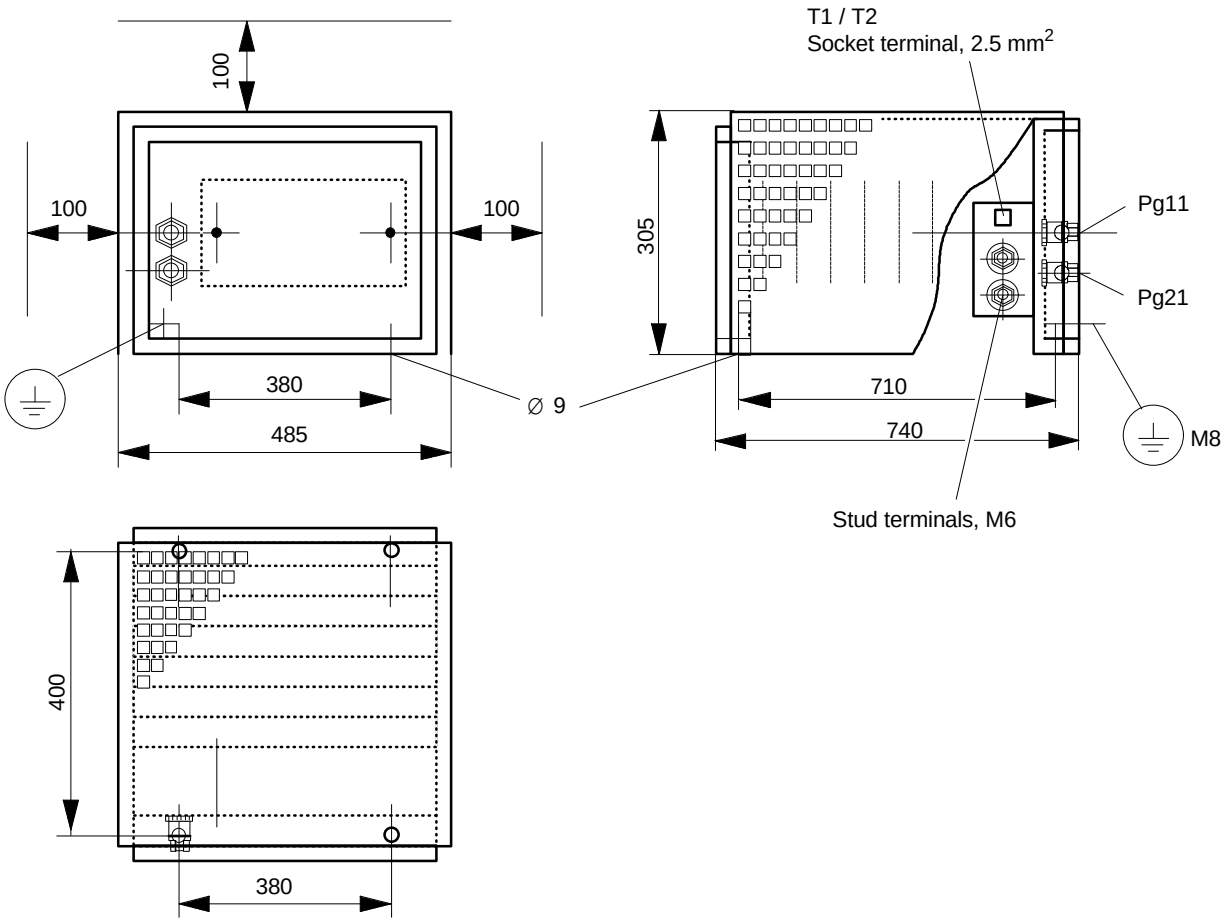


Box dimensions: 450 x 500 x 320

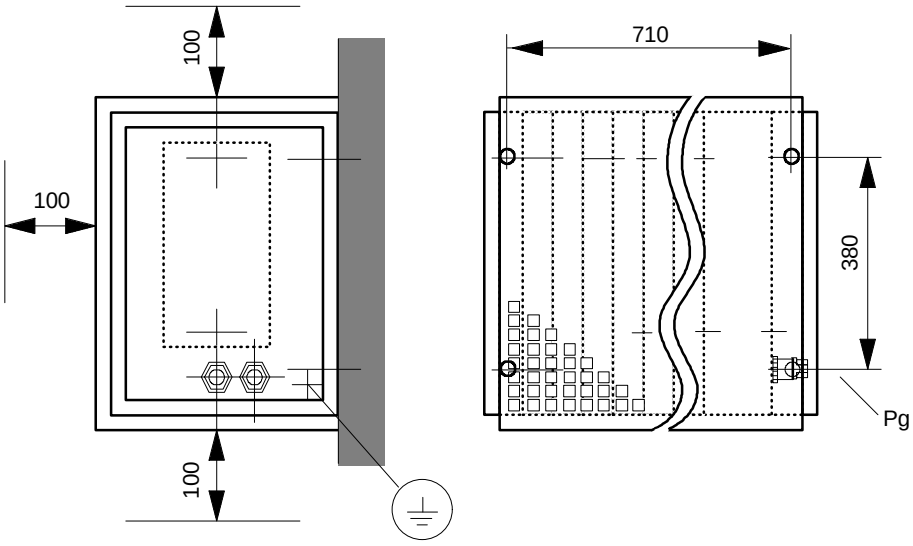
Brake resistor for	Type	Weight, approx.
20 kW; 5 Ω	6SE7026-3CS87-2DC0	15 kg
20 kW; 20 Ω	6SE7023-2ES87-2DC0	17 kg
20 kW; 31 Ω	6SE7022-5FS87-2DC0	17 kg
20 kW; 44.4 Ω	6SE7022-1HS87-2DC0	16 kg

Fig. 6.3 Mounting diagram, brake resistor for floor- and wall mounting

Floor mounting



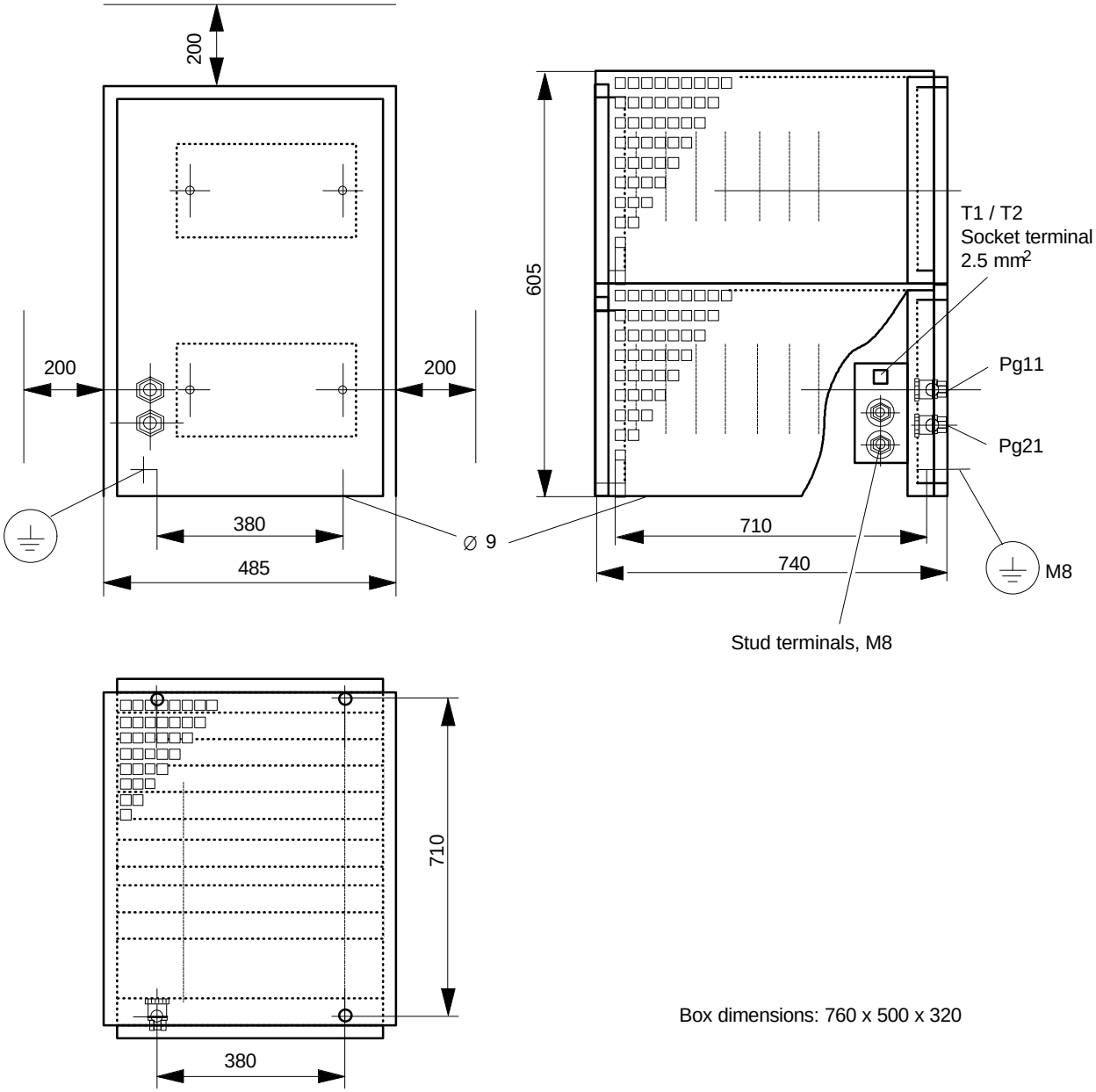
Wall mounting



Box dimensions: 760 x 500 x 320

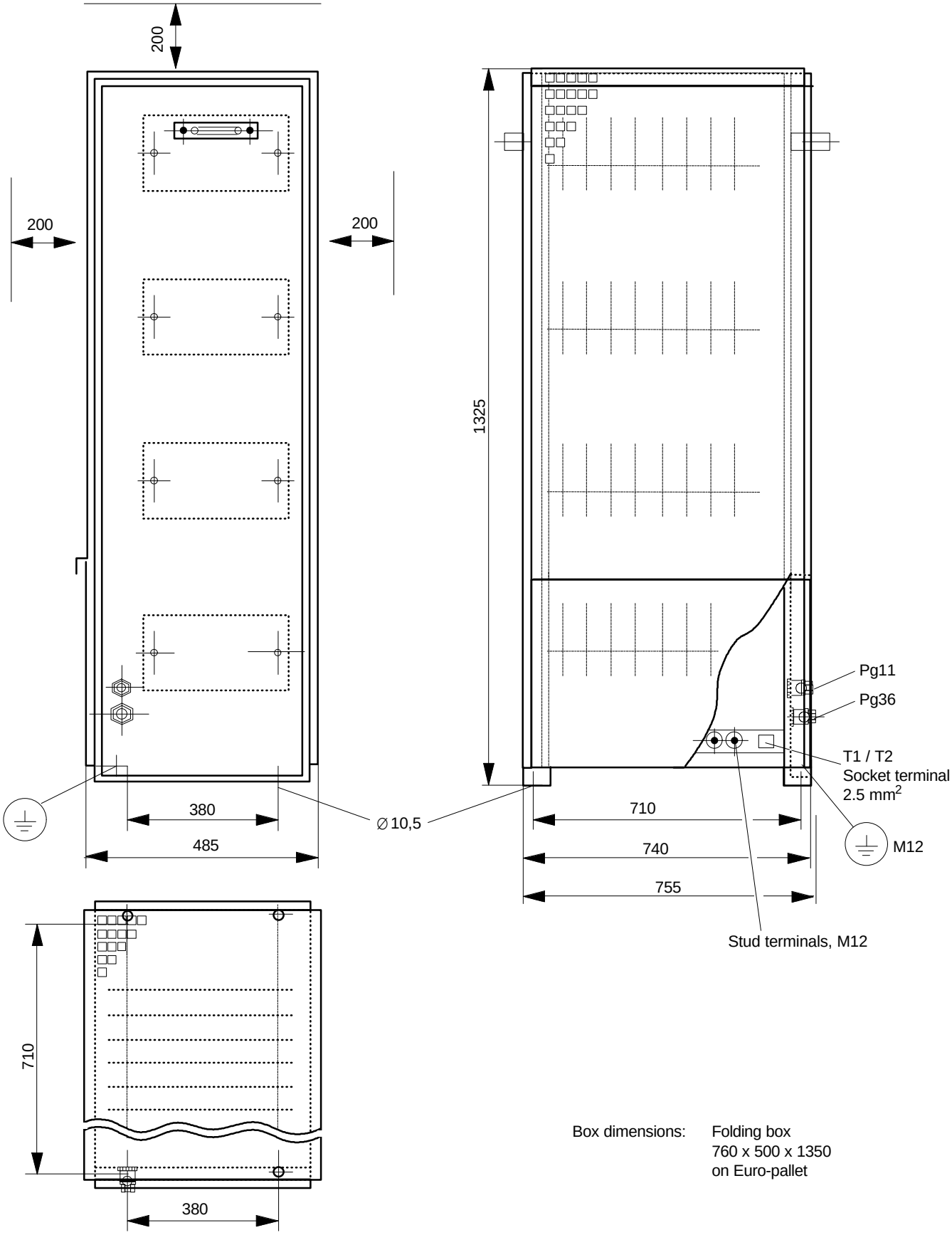
Brake resistor for	Type	Weight approx.
50 kW; 8 Ω	6SE7028-0ES87-2DC0	27 kg
50 kW; 12.4 Ω	6SE7026-4FS87-2DC0	27 kg
50 kW; 17.8 Ω	6SE7025-3HS87-2DC0	28 kg

Fig. 6.4 Mounting diagram, brake resistor for floor- and mounting



Brake resistor for	Type	Weight approx.
100 kW; 4 Ω	6SE7031-6ES87-2DC0	47 kg
100 kW; 6.2 Ω	6SE7031-3FS87-2DC0	43 kg
100 kW; 8.9 Ω	6SE7025-1HS87-2DC0	45 kg

Fig. 6.5 Mounting diagram, brake resistor



Brake resistor for	Type	Weight approx.
170 kW; 2.35 Ω	6SE7032-7ES87-2DC0	103 kg
200 kW; 3.1 Ω	6SE7032-5FS87-2DC0	95 kg
200 kW; 4.45 Ω	6SE7032-1HS87-2DC0	101 kg

Fig. 6.6 Mounting diagram, brake resistor for floor mounting

Bisher sind folgende Ausgaben erschienen:

Ausgabe	interne Sachnummer
01.95	477 730.4000.76 Ja
AB	477 730.4000.76 J AB-76

Kapitel		Änderung
0	Definitionen	überarbeitete Ausgabe
1	Produktbeschreibung	überarbeitete Ausgabe
2	Montieren, Anschließen	überarbeitete Ausgabe
3	Bremswiderstände	überarbeitete Ausgabe
4	Überwachung	überarbeitete Ausgabe
5	Inbetriebsetzen	überarbeitete Ausgabe
6	Technische Daten	überarbeitete Ausgabe

The following versions have appeared so far::

Version	Internal item number
01.95	477 730.4000.76 Ja
AB	477 730.4000.76 J AB-76

Sections		Changes
0	Definitions	reviewed edition
1	Product Description	reviewed edition
2	Mounting, Connection	reviewed edition
3	Braking Resistors	reviewed edition
4	Monitoring	reviewed edition
5	Commissioning	reviewed edition
6	Technical Data	reviewed edition

Drives and Standard Products Group
Variable-Speed Drives Division
Postfach 3269, D-91050 Erlangen

ASI 1
System-Based
Drive Technology

Siemens Aktiengesellschaft

Subject to change without notice

Order-No. 6SE7087-6CX87-2DA0
Printed in the federal Republic of Germany
0797

SIEMENS

SIMOVERT MASTERDRIVES

Betriebsanleitung
Operating Instructions

Kondensatormodul Bauform Kompakt PLUS
Capacitor Module Compact PLUS Type

Ausgabe / Edition: AB

Bestell-Nr. / Order No.: 6SE7087-6NP87-2DD0

Änderungen von Funktionen, technischen Daten, Normen, Zeichnungen und Parametern vorbehalten.

We reserve the right to make changes to functions, technical datas, standards, drawings and parameters.

Wir haben den Inhalt der Druckschrift auf Übereinstimmung mit der beschriebenen Hard- und Software überprüft. Dennoch können Abweichungen nicht ausgeschlossen werden, so daß wir für die vollständige Übereinstimmung keine Garantie übernehmen. Die Angaben in dieser Druckschrift werden jedoch regelmäßig überprüft und notwendige Korrekturen sind in den nachfolgenden Auflagen enthalten. Für Verbesserungsvorschläge sind wir dankbar

SIMOVERT® ist ein Warenzeichen von Siemens

We have checked the contents of this document to ensure that they coincide with the described hardware and software. However, differences cannot be completely excluded, so that we do not accept any guarantee for complete conformance. However, the information in this document is regularly checked and necessary corrections will be included in subsequent editions. We are grateful for any recommendations for improvement.

SIMOVERT® Registered Trade Mark

Contents

1 Definitions and Warnings

Qualified personnel

For the purpose of this documentation and the product warning labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up, operation and maintenance of the product. He or she must have the following qualifications:

- Trained or authorized to energize, de-energize, ground and tag circuits and equipment in accordance with established safety procedures.
- Trained or authorized in the proper care and use of protective equipment in accordance with established safety procedures.
- Trained in rendering first aid.

DANGER

For the purpose of this documentation and the product warning labels, "Danger" indicates death, severe personal injury or substantial property damage will result if proper precautions are not taken.

WARNING

For the purpose of this documentation and the product warning labels, "Warning" indicates death, severe personal injury or property damage can result if proper precautions are not taken.

CAUTION

For the purpose of this documentation and the product warning labels, "Caution" indicates that minor personal injury or material damage can result if proper precautions are not taken.

NOTE

For the purpose of this documentation, "Note" indicates important information about the product or about the respective part of the documentation which is essential to highlight.

WARNING

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the warnings can thus result in severe personal injury or property damage.

Only qualified personnel should work on or around the equipment

This personnel must be thoroughly familiar with all warning and maintenance procedures contained in this documentation.

The successful and safe operation of this equipment is dependent on correct transport, proper storage and installation as well as careful operation and maintenance.

NOTE

This documentation does not purport to cover all details on all types of the product, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local SIEMENS sales office.

The contents of this documentation shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of SIEMENS AG. The warranty contained in the contract between the parties is the sole warranty of SIEMENS AG. Any statements contained herein do not create new warranties or modify the existing warranty.

Safety and Operating Instructions for Drive Converters

(in conformity with the low-voltage directive 73/23/EEC)

1. General

In operation, drive converters, depending on their degree of protection, may have live, uninsulated, and possibly also moving or rotating parts, as well as hot surfaces.

In case of inadmissible removal of the required covers, of improper use, wrong installation or maloperation, there is the danger of serious personal injury and damage to property.

For further information, see documentation.

All operations serving transport, installation and commissioning as well as maintenance are to be carried out **by skilled technical personnel** (observe IEC 364 or CENELEC HD 384 or DIN VDE 0100 and IEC Report 664 or DIN VDE 0110 and national accident prevention rules).

For the purposes of these basic safety instructions, "skilled technical personnel" means persons who are familiar with the installation, mounting, commissioning and operation of the product and have the qualifications needed for the performance of their functions.

2. Intended use

Drive converters are components designed for inclusion in electrical installations or machinery.

In case of installation in machinery, commissioning of the drive converter (i.e. the starting of normal operation) is prohibited until the machinery has been proved to conform to the provisions of the EC directive 89/392/EEC (Machinery Safety Directive - MSD). Account is to be taken of EN 60204.

Commissioning (i.e. the start of normal operation) is admissible only where conformity with the EMC directive (89/336/EEC) has been established.

The drive converters meet the requirements of the low-voltage directive 73/23/EEC. They are subject to the harmonized standards of the series prEN 50178/DIN VDE 0160 in conjunction with EN 60439-1/DIN VDE 0660 Part 500 and EN 60146/DIN VDE 0558.

The technical data as well as information concerning the supply conditions shall be taken from the rating plate and from the documentation and shall be strictly observed.

3. Transport, storage

The instructions for transport, storage and proper use shall be complied with.

The climatic conditions shall be in conformity with prEN 50178.

4. Installation

The installation and cooling of the appliances shall be in accordance with the specifications in the pertinent documentation.

The drive converters shall be protected against excessive strains. In particular, no components must be bent and/or isolating distances altered in the course of transportation or handling. No contact shall be made with electronic components and contacts.

Drive converters contain electrostatic sensitive components which are liable to damage through improper use. Electronic components must not be mechanically damaged or destroyed (potential health risks).

5. Electrical connection

When working on live drive converters, the applicable national accident prevention rules (e.g. VBG 4) must be complied with.

The electrical installation shall be carried out in accordance with the relevant requirements (e.g. cross-sectional areas of conductors, fusing, PE connection). For further information, see documentation.

Instructions for the installation in accordance with EMC requirements, such as screening, grounding, location of filters and wiring, are contained in the drive converter documentation. They must always be complied with, also for drive converters bearing a CE marking. Observance of the limit values required by the EMC law is the responsibility of the manufacturer of the installation or machine.

6. Operation

Installations which include drive converters shall be equipped with additional monitoring and protective devices in accordance with the relevant applicable safety requirements, e.g. Act respecting technical equipment, accident prevention rules, etc. Changes to the drive converters by means of the operating software are permissible.

After disconnection of the drive converters from the voltage supply, live appliance parts and power terminals must not be touched immediately because of possibly energized capacitors. In this regard, the corresponding signs and markings on the drive converter must be respected.

During operation, all covers and doors shall be kept closed.

7. Maintenance and servicing

The manufacturer's documentation shall be followed.

Keep these safety instructions in a safe place!

2 Description

Range of application

The capacitor module is essentially made up of capacitors. It is connected to the DC link and is used for short-time storage of energy which is fed back into the DC link when the drives are decelerated. This energy is then available for subsequent accelerations. The capacitor module limits the rise of the DC link voltage and smooths it additionally.

Buffer capacitors, pre-charging resistors and a DC link fuse are accommodated in the capacitor module. Pre-charging is effected through an additional connection to the AC/rectifier unit and is monitored by this unit.

The capacitor module does not require a 24 V supply.

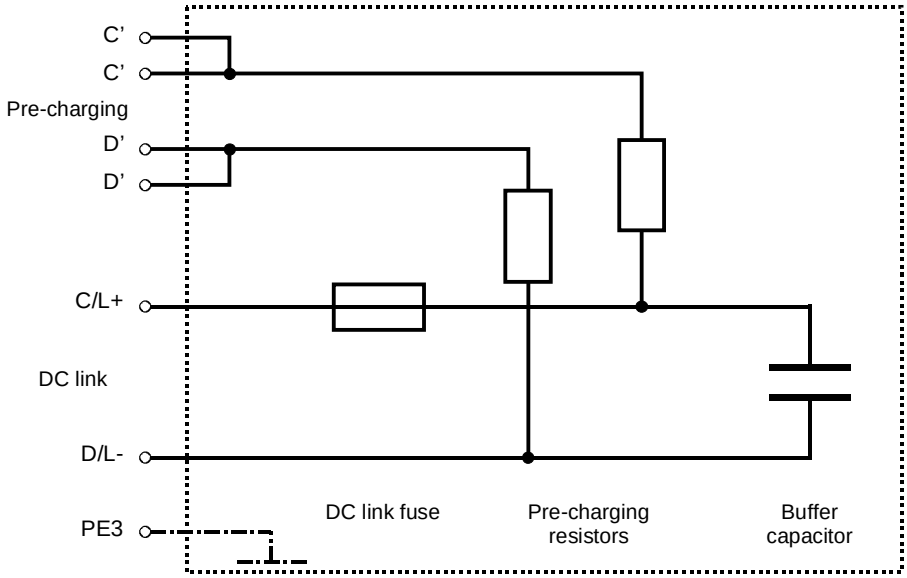


Fig. 2-1 Circuit principle of the capacitor module

3 Transport, Storage, Unpacking

The units and components are packed in the manufacturing plant corresponding to that specified when ordered. A packing label is located on the outside of the packaging. Please observe the instructions on the packaging for transport, storage and professional handling.

Transport

Vibrations and jolts must be avoided during transport. If the unit is damaged, you must inform your shipping company immediately.

Storage

The units and components must be stored in clean, dry rooms. Temperatures between -25 °C (-13 °F) and +70 °C (158 °F) are permissible. Temperature fluctuations must not be more than 30 K per hour.

NOTE

If the storage period of one year is exceeded, the unit must be newly formed. See Section ”Forming".

Unpacking

The packaging comprises board and corrugated paper. It can be disposed of corresponding to the appropriate local regulations for the disposal of board products. The units and components can be installed and commissioned after they have been unpacked and checked to ensure that everything is complete and that they are not damaged.

4 Installation

WARNING

Safe converter operation requires that the equipment is mounted and commissioned by qualified personnel taking into account the warning information provided in these Operating Instructions.

The general and domestic installation and safety regulations for work on electrical power equipment (e.g. VDE) must be observed as well as the professional handling of tools and the use of personal protective equipment.

Death, severe bodily injury or significant material damage could result if these instructions are not followed.

Clearances

The units can be mounted flush with each other.

In order to ensure an adequate supply of cooling air, a clearance of 100 mm must be left at the top of the unit and at the bottom of the unit respectively to components which may considerably affect the flow of cooling air.

Requirements at the point of installation

- Foreign particles
  The units must be protected against the ingress of foreign particles as otherwise their function and operational safety cannot be ensured.
- Dust, gases, vapors
  Equipment rooms must be dry and dust-free. Ambient and cooling air must not contain any electrically conductive gases, vapors and dust which could diminish the functionality. If necessary, filters should be used or other corrective measures taken.
- Cooling air
  The units must only be operated in an ambient climate in accordance with DIN IEC 721-3-3 Class 3K3. For cooling air temperatures of more than 45 °C (113 °F) and installation altitudes higher than 1000 m, derating is required.

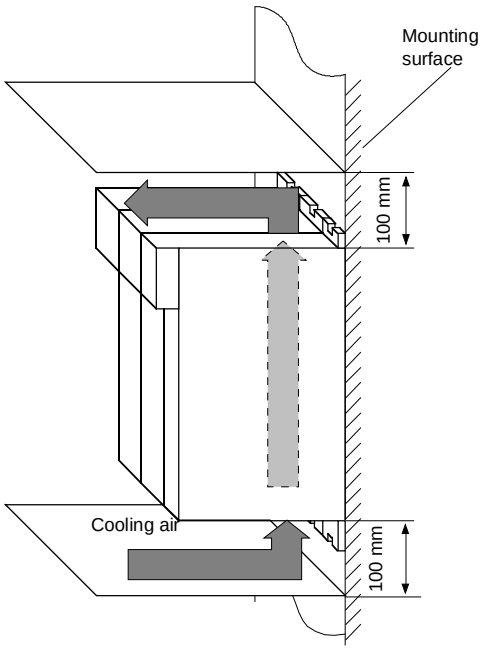


Fig. 4-1 Minimum clearances for cooling

Installation

The unit is mounted directly to a mounting surface. Fixing is by means of two M5 screws.

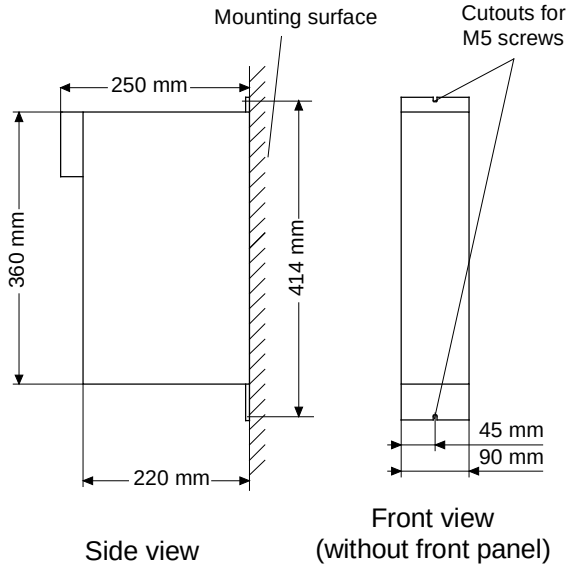


Fig. 4-2 Dimension Drawing

5 Connecting-up

WARNING

SIMOVERT MASTERDRIVES units are operated at high voltages.
The equipment must be in a no-voltage condition (disconnected from the supply) before any work is carried out!
Only professionally trained, qualified personnel must work on or with the units.
Death, severe bodily injury or significant property damage could occur if these warning instructions are not observed.

Hazardous voltages are still present in the unit up to 5 minutes after it has been powered down due to the DC link capacitors. Thus, the appropriate delay time must be observed before working on the unit or on the DC link terminals.

The power terminals and control terminals can still be live even when the motor is stationary.
If the DC link voltage is supplied centrally, the converters must be reliably isolated from the DC link voltage!

When working on an opened unit, it should be observed that live components (at hazardous voltage levels) can be touched (shock hazard).

The user is responsible that all the units are installed and connected-up according to recognized regulations in that particular country as well as other regionally valid regulations. Cable dimensioning, fusing, grounding, shutdown, isolation and overcurrent protection should be particularly observed.

WARNING

If the capacitor module has been in storage for longer than one year or has been continuously switched off, the capacitors must be newly formed. Please refer to the section "Forming" in this regard.

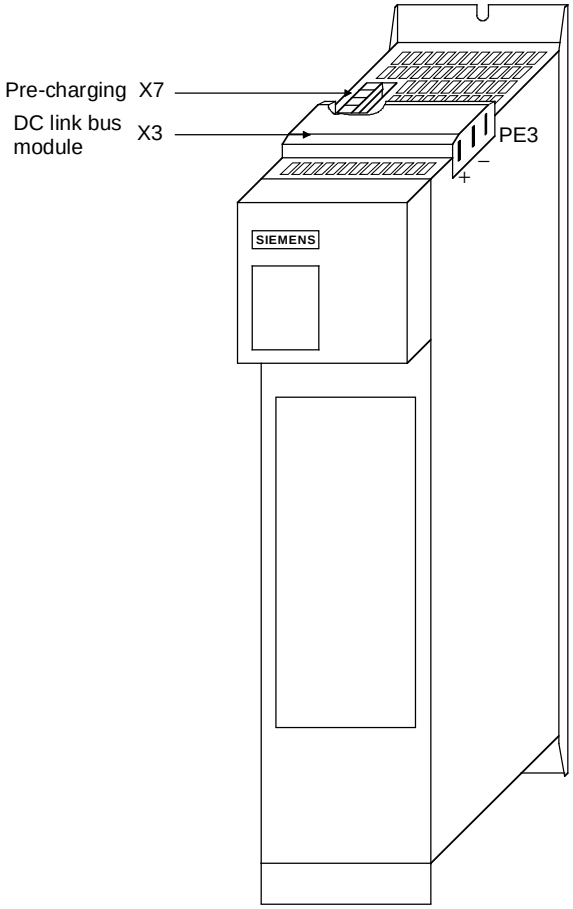


Fig. 5-1 Connection overview

X3 - DC link bus module

The DC link bus module is used to transfer energy between the capacitor module and the connected inverters.

Bar	Designation	Meaning	Range
3	PE3	Protective conductor connection	
2	D / L-	DC link voltage -	DC 510 - 650 V
1	C / L+	DC link voltage +	DC 510 - 650 V

Connectable cross-section: “Electro-plated copper" 3x10 mm, rounded off according to DIN 46433.

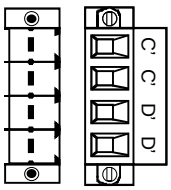
Bar 1 is at the front when installed.

Table 5-1 DC link bus module

X7 - Pre-charging

The connections are used for pre-charging the buffer capacitors.

The two remaining free contacts are used for looping the pre-charging cable to other capacitor modules.



Terminal	Meaning	Range
C’	+ Terminal of pre-charging	DC 510 V - 650 V
C’	+ Terminal of pre-charging	DC 510 V - 650 V
D’	- Terminal of pre-charging	DC 510 V - 650 V
D’	- Terminal of pre-charging	DC 510 V - 650 V

Connectable cross-section: 4 mm² (AWG 10)

Terminal D’ is at the front when installed.

Table 5-2 Pre-charging connection

NOTES

- During operation, the full DC link voltage is always present at the terminals for pre-charging the capacitor module.
- During pre-charging, the charging current of all connected capacitor modules flows via the terminals.
- For reasons of protection, cables with 4 mm² Cu must be used at connection X7!

6 Forming

If a unit has been non-operational for more than one year, the DC link capacitors have to be newly formed. If this is not carried out, the unit can be damaged when the line voltage is powered up.

If the unit was started-up within one year after having been manufactured, the DC link capacitors do not have to be re-formed. The date of manufacture of the unit can be read from the serial number.

How the serial number is made up

(Example: RFU-J60147512345)

Position	Example	Meaning
1 to 3	RFU-	Place of manufacture
4	J	1997
	K	1998
	L	1999
	M	2000
5	1 to 9	January to September
	O	October
	N	November
	D	December
6 to 15		Not relevant for forming

The following applies for the above example:
Manufacture took place in June 1997.

During forming, the DC link of the unit is connected up via a rectifier, a smoothing capacitor and a resistor.

As a result, the DC link capacitors receive a defined voltage and a limited current, and the internal conditions necessary for the function of the DC link capacitors are restored.

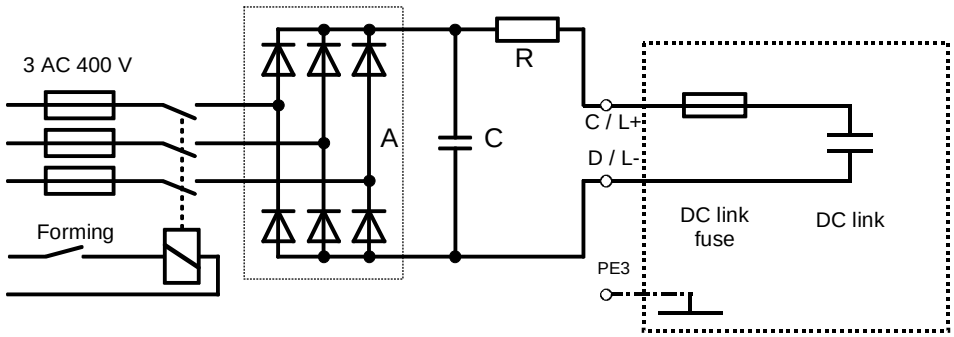


Fig. 6-1 Forming circuit

Components for the forming circuit (suggestion)

- Rectifier (A): SKD 62/16
- Resistor (R): 470 Ω, 100 W
- Capacitor (C): 22 nF, 1600 V

WARNING

The unit has hazardous voltage levels up to 5 minutes after it has been powered down due to the DC link capacitors. The unit or the DC link terminals must not be worked on until at least after this delay time.

Procedure

- Before you form the DC link capacitors, the unit must be removed or the front and middle DC link bus module must be taken out.
- Connect the required components in accordance with the circuit example.
- Energize the forming circuit. The duration of forming is dependent on the idle time of the capacitor module.

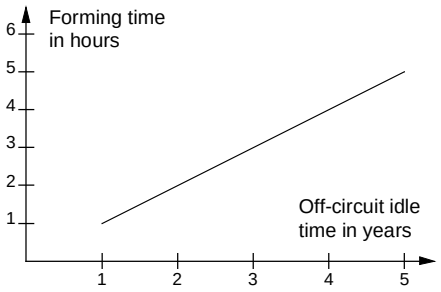


Fig. 6-2 Forming time as a function of the capacitor module idle time

7 Technical Data

EU low-voltage directives 73/23/EEC and RL93/68/EEC	EN 50178
EU directive EMC 89/336/EEC	EN 61800-3
EU machine directive 89/392/EEC	EN 60204-1
Approval	UL: E 145 153 CSA: LR 21 927
Type of cooling	Air cooling with built-in fan
Permissible ambient and cooling-medium temperature • during operation • during storage • during transport	 0° C to +45° C (32° F to 113° F) -25° C to +70° C (-13° F to 158° F) -25° C to +70° C (-13° F to 158° F)
Installation altitude	≤ 1000 m above sea level (100 % load capability) > 1000 m to 4000 m above sea level (for load capability. see Fig. "Derating curves")
Permissible humidity rating	Relative humidity ≤ 95 % during transport and storage ≤ 85 % during operation (moisture condensation not permissible)
Climatic class	Class 3K3 to DIN IEC 721-3-3 (during operation)
Degree of pollution	Pollution degree 2 to IEC 664-1 (DIN VDE 0110. Part 1). Moisture condensation during operation is not permissible
Overvoltage category	Category III to IEC 664-1 (DIN VDE 0110. Part 2)
Degree of protection	IP20 EN 60529
Class of protection	Class 1 to EN 536 (DIN VDE 0106. Part 1)
Shock protection	to EN 60204-1 and DIN VDE 0106 Part 100 (VBG4)
Radio interference suppression • Standard • Options	to EN 61800-3 No radio interference suppression Radio interference suppression filter for Class B1 or A1 to EN 55011
Interference immunity	Industrial to EN 61800-3
Paint finish	For interior installation
Mechanical specifications - Vibrations During stationary use: Constant amplitude • of deflection • of acceleration During transport: • of deflection • of acceleration - Shocks - Drop and topple	 to DIN IEC 68-2-6 0.075 mm in the frequency range 10 Hz to 58 Hz 9.8 m/s² in the frequency range > 58 Hz to 500 Hz 3.5 mm in the frequency range 5 Hz to 9 Hz 9.8 m/s² in the frequency range > 9 Hz to 500 Hz to DIN IEC 68-2-27 / 08.89 30 g, 16 ms half-sine shock to DIN IEC 68-2-31 / 04.84 on a surface and on a corner

Table 7-1 General data

Order number	**6SE7025-0TP87-2DD0**
Rated voltage [V] Input	 DC 510 to 650 (-15 % / +10 %)
Rated current [A] Input Output	 50 50
Rated power [kW]	15
DC link capacity [µF]	5100
Storage capacity [Ws] $U_{DC, stationary}$ = 510 V $U_{DC, stationary}$ = 620 V	 720 420
Cooling air required [m^3/s]	-
Width [mm]	90
Height [mm]	360
Depth [mm]	260
Weight [kg]	6.2

Table 7-2 Technical Data

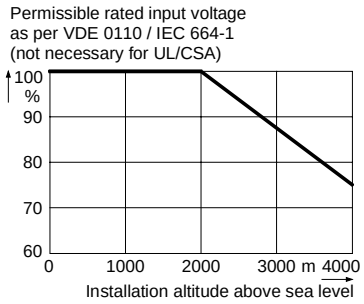


Fig. 7-1 Derating

8 Environmental Friendliness

Environmental aspects during the development

The number of components has been significantly reduced over earlier converter series by the use of highly integrated components and the modular design of the complete series. Thus, the energy requirement during production has been reduced.

Special significance was placed on the reduction of the volume, weight and variety of metal and plastic components.

Plastics components used

ABS:	PMU board, Siemens logo
PC / ABS:	Front cover MC Large
PA6:	Front cover MC, terminal strips, spacer bolts, fan impeller
PA6.6:	DC link terminal cover, through terminals, terminal strips, terminal blocks
PVC:	Optional card covers
PP:	PMU covers
PBTP:	Fan housing
PC (Makrolon):	Fan guides
HP2061 (Phenolharz):	Insulating plates
NOMEX:	Insulating paper

Halogen-containing flame retardants were, for all essential components, replaced by environmentally-friendly flame retardants.

Environmental compatibility was an important criterium when selecting the supplied components.

Environmental aspects during production

Purchased components are generally supplied in recyclable packaging materials (board).

Surface finishes and coatings were eliminated with the exception of the galvanized sheet steel side panels.

ASIC devices and SMD devices were used on the boards.

The production is emission-free.

Environmental aspects for disposal

The unit can be broken down into recyclable mechanical components as a result of easily releasable screw and snap connections.

The plastic components are to DIN 54840 and have a recycling symbol.

Units can be disposed of through certified disposal companies. Addresses are available from your local Siemens partner.

9 Certificates

SIEMENS Automation and Drives

Confirmation

Erlangen,15.09.1998

This confirms that

Equipment	drive converter
• Type	SIMOVERT MASTERDRIVES
• Order No.	6SE70xx-xxPxx [1)]

is manufactured in conformance with EN 60204 Section 6.2
(corresponds to DIN VDE 0113 Section 6.2).

1) See rating plate for complete type designation, serial number and technical data

This equipment fulfills the protection requirements against electric shock according to DIN VDE 0106 Part 100 when the following safety rules are observed:

- Service work in operation is only permissible on a unit which is not live.
- The converter must be switched into a no-voltage condition and isolated from the supply when replacing any part/component.
- All panels and the DC link terminals must be closed during operation.

Thus, this equipment conforms to the appropriate regulations in Germany according to VBG 4 §2 (2) (VBG is a German regulatory body for safety-related issues).

The local operating regulations (e.g. EN 50110-1, EN 50110-2) must be observed when operating the equipment.

A&D DS A P1

Mickal

Automation &Drives

SIEMENS Automation and Drives

Test Certificate

Erlangen, 15.09.1998

Equipment	drive converter
• Type	SIMOVERT MASTERDRIVES
• Order No.	6SE70xx-xxPxx 1)

The 100% inspection was performed according to test instructions Motion Control 6SE70xx-xxPxx.

Test scope:		
	I. Protective conductor test	• According to DIN VDE 0411
	II. Insulation test	• Acc. to EN 50178, Section 9.4.5.2 and UL508/CSA 22.2-14.M 91, Section 6.8
	III. Function test acc. to EN 50178	• Initialization and start-up • Customer terminals test • Power section inspection • Inspection of protection and monitoring devices
	IV. RUN-IN	• Continuous test > 5 hours ambient temperature 55 °C
	V. Function test acc. to EN 50178	• see III. Function test

The equipment complied with the test requirements.
The test results are documented within the test database.

1) See rating plate for complete type designation, serial number and technical data

A&D DS A PE D P

Schlögel

Automation &Drives

SIEMENS

Factory certificate *

regarding electromagnetic compatibility

EMC 0998 / Motion Control

Manufacturer:	Siemens Aktiengesellschaft	
	Group	Automation and Drives
	Business Division	Variable-speed drives
	Sub-Division	AC drive systems
Address:	P.O. Box 3269	
	D-91050 Erlangen	
Product name:	SIMOVERT Type 6SE70xx-xxPxx 1)	

When correctly used, the designated product fulfills all the requirements of Directive 89/336/EEC regarding electromagnetic compatibility.

We confirm the conformance of the above designated product with the Standards:

EN 61800-3 10-1996

EN 61000-4-2 (old IEC 801-2)

EN 61000-4-4 (old IEC 801-4)

EN 61000-4-5 (old IEC 801-5)

IEC 1000-4-3 (old IEC 801-3)

Note:

These instructions relating to EMC-correct installation, correct operation, connecting-up conditions and associated instructions in the product documentation supplied must be observed.

1) See rating plate for complete type designation, serial number and technical data

Erlangen, 15.09.1998

H. Mickal

A&D DS A P1

*) Acc. to EN 10204 (DIN 50049)

This declaration does not guarantee any features

Bisher sind folgende Ausgaben erschienen:

Ausgabe	Interne Sachnummer
AA	475 903 4070 76 J AA-74
AB	475 903 4070 76 J AB-74

Ausgabe AB besteht aus folgenden Kapiteln:

Kapitel		Änderungen	Seitenzahl	Ausgabedatum
1	Definitionen und Warnungen	überarbeitete Ausgabe	3	10.98
2	Beschreibung	überarbeitete Ausgabe	1	10.98
3	Transportieren, Lagern, Auspacken	überarbeitete Ausgabe	1	10.98
4	Montage	überarbeitete Ausgabe	2	10.98
5	Anschließen	überarbeitete Ausgabe	3	10.98
6	Formieren	überarbeitete Ausgabe	2	10.98
7	Technische Daten	überarbeitete Ausgabe	2	10.98
8	Umweltverträglichkeit	überarbeitete Ausgabe	1	10.98
9	Bescheinigungen	überarbeitete Ausgabe	3	10.98

The following editions have been published so far:

Edition	Internal Item Number
AA	475 903 4070 76 J AA-74
AB	475 903 4070 76 J AB-74

Version AB consists of the following chapters:

Chapter		Changes	Pages	Version date
1	Definitions and Warnings	reviewed edition	3	10.98
2	Description	reviewed edition	1	10.98
3	Transport, Storage, Unpacking	reviewed edition	1	10.98
4	Installation	reviewed edition	2	10.98
5	Connecting-up	reviewed edition	3	10.98
6	Forming	reviewed edition	2	10.98
7	Technical Data	reviewed edition	2	10.98
8	Environmental Friendliness	reviewed edition	1	10.98
9	Certificates	reviewed edition	3	10.98

Group: Automation and Drives (A&D)
Division: Variable-Speed Drive Systems
Postfach 3269, D-91050 Erlangen

Siemens Aktiengesellschaft

Subject to change

Order No.: 6SE7087-6NP87-2DD0
Printed in the Federal Republic of Germany
10.98

SIEMENS

SIMOVERT MASTERDRIVES

Betriebsanleitung
Operating Instructions

Koppelmodul Bauform Kompakt PLUS
DC Link Module Compact PLUS Type

Ausgabe / Edition: AA

Bestell-Nr. / Order No.: 6SE7087-6NP87-3CR0

Änderungen von Funktionen, technischen Daten, Normen, Zeichnungen und Parametern vorbehalten.

We reserve the right to make changes to functions, technical datas, standards, drawings and parameters.

Wir haben den Inhalt der Druckschrift auf Übereinstimmung mit der beschriebenen Hard- und Software überprüft. Dennoch können Abweichungen nicht ausgeschlossen werden, so daß wir für die vollständige Übereinstimmung keine Garantie übernehmen. Die Angaben in dieser Druckschrift werden jedoch regelmäßig überprüft und notwendige Korrekturen sind in den nachfolgenden Auflagen enthalten. Für Verbesserungsvorschläge sind wir dankbar

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For the purpose of this documentation and the product warning labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up, operation and maintenance of the product. He or she must have the following qualifications:

- Trained or authorized to energize, de-energize, ground and tag circuits and equipment in accordance with established safety procedures.
- Trained or authorized in the proper care and use of protective equipment in accordance with established safety procedures.
- Trained in rendering first aid.

DANGER

For the purpose of this documentation and the product warning labels, "Danger" indicates death, severe personal injury or substantial property damage will result if proper precautions are not taken.

WARNING

For the purpose of this documentation and the product warning labels, "Warning" indicates death, severe personal injury or property damage can result if proper precautions are not taken.

CAUTION

For the purpose of this documentation and the product warning labels, "Caution" indicates that minor personal injury or material damage can result if proper precautions are not taken.

NOTE

For the purpose of this documentation, "Note" indicates important information about the product or about the respective part of the documentation which is essential to highlight.

WARNING

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the warnings can thus result in severe personal injury or property damage.

Only qualified personnel should work on or around the equipment

This personnel must be thoroughly familiar with all warning and maintenance procedures contained in this documentation.

The successful and safe operation of this equipment is dependent on correct transport, proper storage and installation as well as careful operation and maintenance.

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Safety and Operating Instructions for Drive Converters

(in conformity with the low-voltage directive 73/23/EEC)

1. General

In operation, drive converters, depending on their degree of protection, may have live, uninsulated, and possibly also moving or rotating parts, as well as hot surfaces.

In case of inadmissible removal of the required covers, of improper use, wrong installation or maloperation, there is the danger of serious personal injury and damage to property.

For further information, see documentation.

All operations serving transport, installation and commissioning as well as maintenance are to be carried out **by skilled technical personnel** (observe IEC 364 or CENELEC HD 384 or DIN VDE 0100 and IEC Report 664 or DIN VDE 0110 and national accident prevention rules).

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Drive converters are components designed for inclusion in electrical installations or machinery.

In case of installation in machinery, commissioning of the drive converter (i.e. the starting of normal operation) is prohibited until the machinery has been proved to conform to the provisions of the EC directive 89/392/EEC (Machinery Safety Directive - MSD). Account is to be taken of EN 60204.

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The technical data as well as information concerning the supply conditions shall be taken from the rating plate and from the documentation and shall be strictly observed.

3. Transport, storage

The instructions for transport, storage and proper use shall be complied with.

The climatic conditions shall be in conformity with prEN 50178.

4. Installation

The installation and cooling of the appliances shall be in accordance with the specifications in the pertinent documentation.

The drive converters shall be protected against excessive strains. In particular, no components must be bent and/or isolating distances altered in the course of transportation or handling. No contact shall be made with electronic components and contacts.

Drive converters contain electrostatic sensitive components which are liable to damage through improper use. Electronic components must not be mechanically damaged or destroyed (potential health risks).

5. Electrical connection

When working on live drive converters, the applicable national accident prevention rules (e.g. VBG 4) must be complied with.

The electrical installation shall be carried out in accordance with the relevant requirements (e.g. cross-sectional areas of conductors, fusing, PE connection). For further information, see documentation.

Instructions for the installation in accordance with EMC requirements, such as screening, grounding, location of filters and wiring, are contained in the drive converter documentation. They must always be complied with, also for drive converters bearing a CE marking. Observance of the limit values required by the EMC law is the responsibility of the manufacturer of the installation or machine.

6. Operation

Installations which include drive converters shall be equipped with additional monitoring and protective devices in accordance with the relevant applicable safety requirements, e.g. Act respecting technical equipment, accident prevention rules, etc. Changes to the drive converters by means of the operating software are permissible.

After disconnection of the drive converters from the voltage supply, live appliance parts and power terminals must not be touched immediately because of possibly energized capacitors. In this regard, the corresponding signs and markings on the drive converter must be respected.

During operation, all covers and doors shall be kept closed.

7. Maintenance and servicing

The manufacturer's documentation shall be followed.

Keep these safety instructions in a safe place!

2 Description

Range of application

The DC link module is used to connect the DC bus system of Compact PLUS type units to the DC voltage supply of Compact or chassis units.

A 24 V power supply is not necessary for the DC link module.

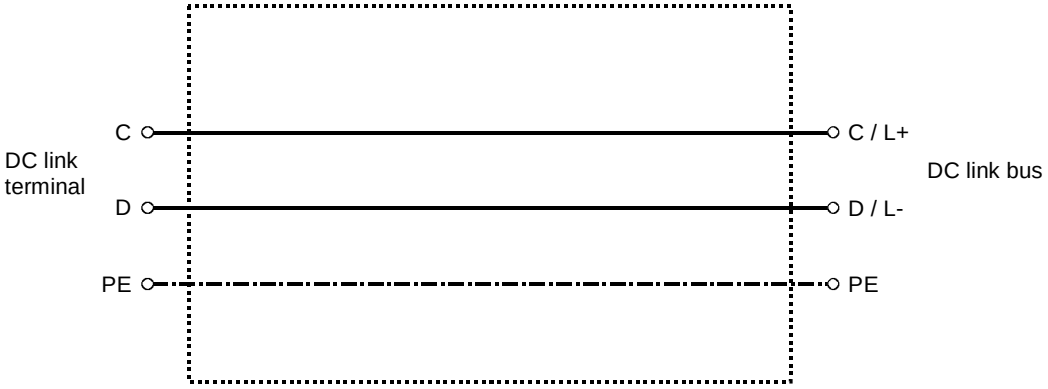


Fig. 2-1 Circuit principle of the DC link module

3 Transport, Storage, Unpacking

The units and components are packed in the manufacturing plant corresponding to that specified when ordered. A packing label is located on the outside of the packaging. Please observe the instructions on the packaging for transport, storage and professional handling.

Transport

Vibrations and jolts must be avoided during transport. If the unit is damaged, you must inform your shipping company immediately.

Storage

The units and components must be stored in clean, dry rooms. Temperatures between -25 °C (-13 °F) and +70 °C (158 °F) are permissible. Temperature fluctuations must not be more than 30 K per hour.

Unpacking

The packaging comprises board and corrugated paper. It can be disposed of corresponding to the appropriate local regulations for the disposal of board products.The units and components can be installed and commissioned after they have been unpacked and checked to ensure that everything is complete and that they are not damaged.

4 Installation

WARNING

Safe converter operation requires that the equipment is mounted and commissioned by qualified personnel taking into account the warning information provided in these Operating Instructions.

The general and domestic installation and safety regulations for work on electrical power equipment (e.g. VDE) must be observed as well as the professional handling of tools and the use of personal protective equipment.

Death, severe bodily injury or significant material damage could result if these instructions are not followed.

Clearances

The units can be mounted flush with each other.

In order to ensure an adequate supply of cooling air, a clearance of 100 mm must be left at the top of the unit and at the bottom of the unit respectively to components which may considerably affect the flow of cooling air.

Requirements at the point of installation

- Foreign particles
  The units must be protected against the ingress of foreign particles as otherwise their function and operational safety cannot be ensured.
- Dust, gases, vapors
  Equipment rooms must be dry and dust-free. Ambient and cooling air must not contain any electrically conductive gases, vapors and dust which could diminish the functionality. If necessary, filters should be used or other corrective measures taken.
- Cooling air
  The units must only be operated in an ambient climate in accordance with DIN IEC 721-3-3 Class 3K3. For cooling air temperatures of more than 45 °C (113 °F) and installation altitudes higher than 1000 m, derating is required.

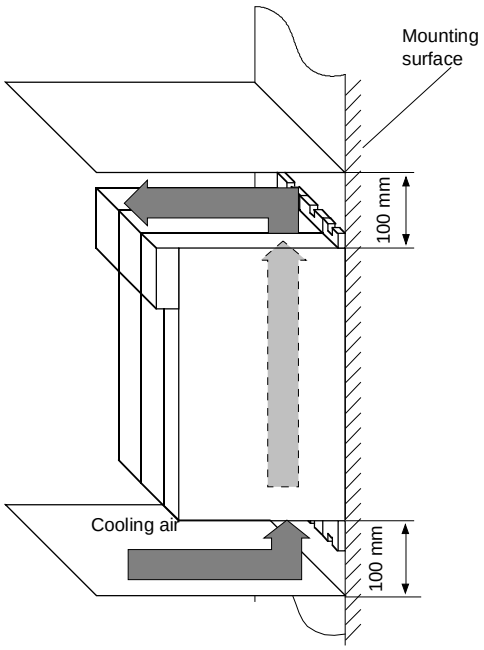


Fig. 4-1 Minimum clearances for cooling

Installation

The unit is mounted directly to a mounting surface. Fixing is by means of two M5 screws.

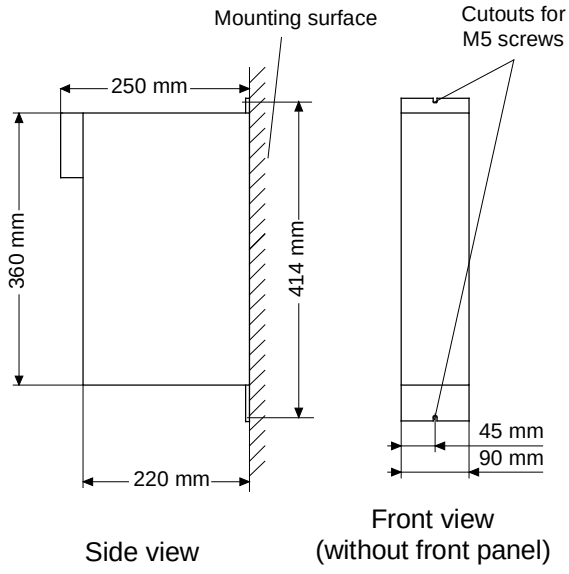


Fig. 4-2 Dimension Drawing

5 Connecting-up

WARNING

SIMOVERT MASTERDRIVES units are operated at high voltages.
The equipment must be in a no-voltage condition (disconnected from the supply) before any work is carried out!
Only professionally trained, qualified personnel must work on or with the units.
Death, severe bodily injury or significant property damage could occur if these warning instructions are not observed.

Hazardous voltages are still present in the unit up to 5 minutes after it has been powered down due to the DC link capacitors. Thus, the appropriate delay time must be observed before working on the unit or on the DC link terminals.

The power terminals and control terminals can still be live even when the motor is stationary.
If the DC link voltage is supplied centrally, the converters must be reliably isolated from the DC link voltage!

When working on an opened unit, it should be observed that live components (at hazardous voltage levels) can be touched (shock hazard).

The user is responsible that all the units are installed and connected-up according to recognized regulations in that particular country as well as other regionally valid regulations. Cable dimensioning, fusing, grounding, shutdown, isolation and overcurrent protection should be particularly observed.

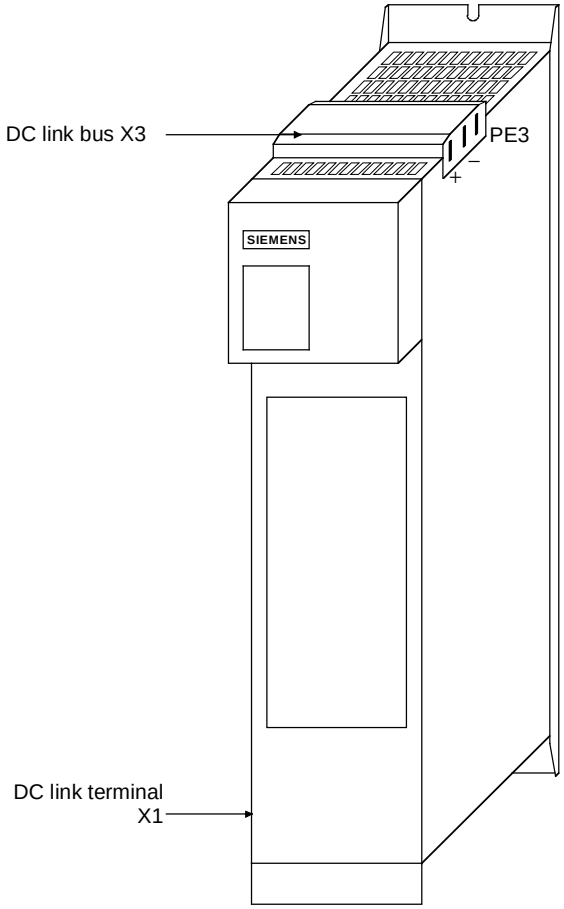
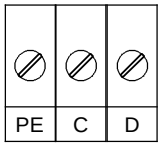


Fig. 5-1 Connection overview

X1 – DC link terminal



The DC link terminal is located at the bottom of the unit on a terminal block.

Terminal	Meaning	Range
PE	Protective conductor connection	
C	DC link voltage -	DC 510 - 650 V
D	DC link voltage +	DC 510 - 650 V

Connectable cross-section: 50 mm² (AWG 1/0)

Terminal PE is at the left when viewed from the front.

Table 5-1 DC link terminal

NOTE

Make sure that the feeder cable is laid in a short-circuit proof manner (max. 5 m with 2 x 50 mm^2 twisted with 5 twists per metre) if there is no DC link fuse.

X3 - DC link bus

The DC link bus is used to transfer energy between the DC link module and the connected inverters.

Bar	Designation	Meaning	Range
3	PE3	Protective conductor connection	
2	D / L-	DC link voltage -	DC 510 - 650 V
1	C / L+	DC link voltage +	DC 510 - 650 V

Connectable cross-section: ”Electro-plated copper" 3x10 mm, rounded off according to DIN 46433.

Bar 1 is at the front when installed.

Table 5-2 DC link bus

6 Technical Data

EU low-voltage directives 73/23/EEC and RL93/68/EEC	EN 50178
EU directive EMC 89/336/EEC	EN 61800-3
EU machine directive 89/392/EEC	EN 60204-1
Approval	UL: E 145 153 CSA: LR 21 927
Permissible ambient and cooling-medium temperature • during operation • during storage • during transport	 0° C to +45° C (32° F to 113° F) -25° C to +70° C (-13° F to 158° F) -25° C to +70° C (-13° F to 158° F)
Installation altitude	≤ 1000 m above sea level (100 % load capability) > 1000 m to 4000 m above sea level (for load capability. see Fig. "Derating curves")
Permissible humidity rating	Relative humidity ≤ 95 % during transport and storage ≤ 85 % during operation (moisture condensation not permissible)
Climatic class	Class 3K3 to DIN IEC 721-3-3 (during operation)
Degree of pollution	Pollution degree 2 to IEC 664-1 (DIN VDE 0110. Part 1). Moisture condensation during operation is not permissible
Overvoltage category	Category III to IEC 664-1 (DIN VDE 0110. Part 2)
Degree of protection	IP20 EN 60529
Class of protection	Class 1 to EN 536 (DIN VDE 0106. Part 1)
Shock protection	to EN 60204-1 and DIN VDE 0106 Part 100 (VBG4)
Radio interference suppression • Standard • Options	to EN 61800-3 No radio interference suppression Radio interference suppression filter for Class B1 or A1 to EN 55011
Interference immunity	Industrial to EN 61800-3
Paint finish	For interior installation
Mechanical specifications - Vibrations During stationary use: Constant amplitude • of deflection • of acceleration During transport: • of deflection • of acceleration - Shocks - Drop and topple	 to DIN IEC 68-2-6 0.075 mm in the frequency range 10 Hz to 58 Hz 9.8 m/s² in the frequency range > 58 Hz to 500 Hz 3.5 mm in the frequency range 5 Hz to 9 Hz 9.8 m/s² in the frequency range > 9 Hz to 500 Hz to DIN IEC 68-2-27 / 08.89 30 g, 16 ms half-sine shock to DIN IEC 68-2-31 / 04.84 on a surface and on a corner

Table 6-1 General data

Order numbers		6SE7090-0XP87-3CR0
Rated voltage	[V]	DC 510 to 650 (-15 % / +10 %)
Rated current	[A]	120
Short-time current for 250 ms	[A]	360
Cooling air required	[m^3/s]	-
Width	[mm]	90
Height	[mm]	360
Depth	[mm]	260
Weight	[kg]	2.6

Table 6-2 Technical Data

Derating curves

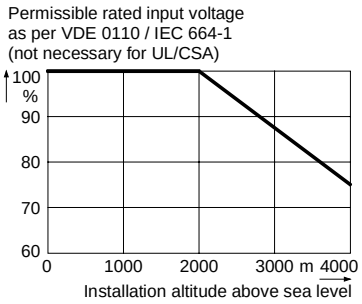


Fig. 6-1 Derating

7 Environmental Friendliness

Environmental aspects during the development

The number of components has been significantly reduced over earlier converter series by the use of highly integrated components and the modular design of the complete series. Thus, the energy requirement during production has been reduced.

Special significance was placed on the reduction of the volume, weight and variety of metal and plastic components.

Plastics components used

ABS:	PMU board, Siemens logo
PC / ABS:	Front cover MC Large
PA6:	Front cover MC, terminal strips, spacer bolts, fan impeller
PA6.6:	DC link terminal cover, through terminals, terminal strips, terminal blocks
PVC:	Optional card covers
PP:	PMU covers
PBTP:	Fan housing
PC (Makrolon):	Fan guides
HP2061 (Phenolharz):	Insulating plates
NOMEX:	Insulating paper

Halogen-containing flame retardants were, for all essential components, replaced by environmentally-friendly flame retardants.

Environmental compatibility was an important criterium when selecting the supplied components.

Environmental aspects during production

Purchased components are generally supplied in recyclable packaging materials (board).

Surface finishes and coatings were eliminated with the exception of the galvanized sheet steel side panels.

ASIC devices and SMD devices were used on the boards.

The production is emission-free.

Environmental aspects for disposal

The unit can be broken down into recyclable mechanical components as a result of easily releasable screw and snap connections.

The plastic components are to DIN 54840 and have a recycling symbol.

Units can be disposed of through certified disposal companies. Addresses are available from your local Siemens partner.

8 Certificates

SIEMENS Automation and Drives

Confirmation

Erlangen,15.09.1998

This confirms that

Equipment	drive converter
• Type	SIMOVERT MASTERDRIVES
• Order No.	6SE70xx-xxPxx [1)]

is manufactured in conformance with EN 60204 Section 6.2
(corresponds to DIN VDE 0113 Section 6.2).

1) See rating plate for complete type designation, serial number and technical data

This equipment fulfills the protection requirements against electric shock according to DIN VDE 0106 Part 100 when the following safety rules are observed:

- Service work in operation is only permissible on a unit which is not live.
- The converter must be switched into a no-voltage condition and isolated from the supply when replacing any part/component.
- All panels and the DC link terminals must be closed during operation.

Thus, this equipment conforms to the appropriate regulations in Germany according to VBG 4 §2 (2) (VBG is a German regulatory body for safety-related issues).

The local operating regulations (e.g. EN 50110-1, EN 50110-2) must be observed when operating the equipment.

A&D DS A P1

Mickal

Automation &Drives

SIEMENS Automation and Drives

Test Certificate

Erlangen, 15.09.1998

Equipment drive converter

- Type SIMOVERT MASTERDRIVES
- Order No. 6SE7090-0XP87-3CR0

The 100% inspection was performed according to test instructions Motion Control 6SE70xx-xxPxx.

Test scope:

I. Protective conductor test
II. Insulation test
III. Function test acc. to EN 50178

- According to DIN VDE 0411
- Acc. to EN 50178, Section 9.4.5.2 and UL508/CSA 22.2-14.M 91, Section 6.8

The equipment complied with the test requirements.
The test results are documented within the test database.

A&D DS A PE D P

Schlögel

Automation &Drives

SIEMENS

Factory certificate *

regarding electromagnetic compatibility

EMC 0998 / Motion Control

Manufacturer:	Siemens Aktiengesellschaft	
	Group	Automation and Drives
	Business Division	Variable-speed drives
	Sub-Division	AC drive systems
Address:	P.O. Box 3269	
	D-91050 Erlangen	
Product name:	SIMOVERT Type 6SE70xx-xxPxx 1)	

When correctly used, the designated product fulfills all the requirements of Directive 89/336/EEC regarding electromagnetic compatibility.

We confirm the conformance of the above designated product with the Standards:

EN 61800-3 10-1996

EN 61000-4-2 (old IEC 801-2)

EN 61000-4-4 (old IEC 801-4)

EN 61000-4-5 (old IEC 801-5)

IEC 1000-4-3 (old IEC 801-3)

Note:

These instructions relating to EMC-correct installation, correct operation, connecting-up conditions and associated instructions in the product documentation supplied must be observed.

1) See rating plate for complete type designation, serial number and technical data

Erlangen, 15.09.1998

H. Mickal

A&D DS A P1

*) Acc. to EN 10204 (DIN 50049)

This declaration does not guarantee any features

Bisher sind folgende Ausgaben erschienen:

Ausgabe	Interne Sachnummer
AA	475 904 4070 76 J AA-74

Ausgabe AA besteht aus folgenden Kapiteln:

Kapitel		Änderungen	Seitenzahl	Ausgabedatum
1	Definitionen und Warnungen	Erstausgabe	3	06.99
2	Beschreibung	Erstausgabe	1	06.99
3	Transportieren, Lagern, Auspacken	Erstausgabe	1	06.99
4	Montage	Erstausgabe	2	06.99
5	Anschließen	Erstausgabe	3	06.99
6	Technische Daten	Erstausgabe	2	06.99
7	Umweltverträglichkeit	Erstausgabe	1	06.99
8	Bescheinigungen	Erstausgabe	3	06.99

The following editions have been published so far:

Edition	Internal Item Number
AA	475 904 4070 76 J AA-74

Version AA consists of the following chapters:

Chapter		Changes	Pages	Version date
1	Definitions and Warnings	first edition	3	06.99
2	Description	first edition	1	06.99
3	Transport, Storage, Unpacking	first edition	1	06.99
4	Installation	first edition	2	06.99
5	Connecting-up	first edition	3	06.99
6	Technical Data	first edition	2	06.99
7	Environmental Friendliness	first edition	1	06.99
8	Certificates	first edition	3	06.99

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Siemens Aktiengesellschaft

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Order No.: 6SE7087-6NP87-3CR0
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05.99

SIEMENS

SIMOVERT MASTERDRIVES

Betriebsanleitung
Operating Instructions

Funk-Entstörfilter Bauform Kompakt PLUS
EMC-Filter Compact PLUS Type

Ausgabe / Edition: AA

Bestell-Nr. / Order No.: 6SE7087-6NP87-0FB0

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6. Operation

Installations which include drive converters shall be equipped with additional monitoring and protective devices in accordance with the relevant applicable safety requirements, e.g. Act respecting technical equipment, accident prevention rules, etc. Changes to the drive converters by means of the operating software are permissible.

After disconnection of the drive converters from the voltage supply, live appliance parts and power terminals must not be touched immediately because of possibly energized capacitors. In this regard, the corresponding signs and markings on the drive converter must be respected.

During operation, all covers and doors shall be kept closed.

7. Maintenance and servicing

The manufacturer's documentation shall be followed.

Keep these safety instructions in a safe place!

2 Description

Application

The Compact PLUS type EMC filters consist of a radio-interference filter with an integrated line commutating reactor. They are for reducing radio-interference voltages and harmonic currents caused by the converters or rectifier units which are connected.

If the whole drive system is installed in accordance with EMC standards, use of this radio-interference filter provides radio-interference suppression level B in accordance with EN61800-3 (residential areas).

In addition to containing the elements necessary for interference suppression, the radio interference filters also have a commutating reactor with a per-unit short-circuit voltage of 2 %. This reduces system perturbations of the units' B6 input circuit.

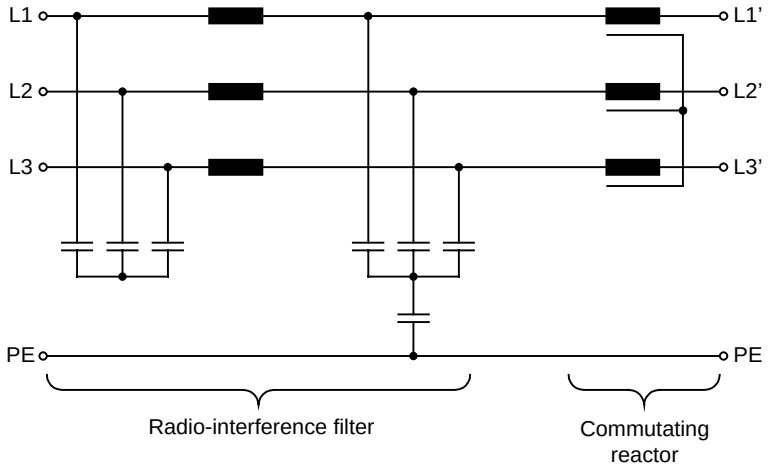


Fig. 2-1 Circuit of the EMC filter

3 Transport, Storage, Unpacking

The units and components are packed in the manufacturing plant corresponding to that specified when ordered. A packing label is located on the outside of the packaging. Please observe the instructions on the packaging for transport, storage and professional handling.

Transport

Vibrations and jolts must be avoided during transport. If the unit is damaged, you must inform your shipping company immediately.

Storage

The units and components must be stored in clean, dry rooms. Temperatures between -25 °C (-13 °F) and +70 °C (158 °F) are permissible. Temperature fluctuations must not be more than 30 K per hour.

Unpacking

The packaging comprises board and corrugated paper. It can be disposed of corresponding to the appropriate local regulations for the disposal of board products. The units and components can be installed and commissioned after they have been unpacked and checked to ensure that everything is complete and that they are not damaged.

4 Installation

WARNING

Safe converter operation requires that the equipment is mounted and commissioned by qualified personnel taking into account the warning information provided in these Operating Instructions.

The general and domestic installation and safety regulations for work on electrical power equipment (e.g. VDE) must be observed as well as the professional handling of tools and the use of personal protective equipment.

Death, severe bodily injury or significant material damage could result if these instructions are not followed.

Requirements for the place of installation

- It is only permissible for radio-interference filters to be used with TN systems (earthed neutral point).
- If mounted in a cabinet, the radio-interference filter must be mounted directly next to the converter. The cabling is to be kept as short as possible. The supply cable leading to the radio-interference filter is to be laid separately from the other cables so that interference which could cancel the effect of the radio-interference filter cannot be injected into the interference-suppressed supply cable.
- For high-frequency interference currents, the housings of the converter and the radio-interference filter must be connected to each other with low-resistance. This requirement is met by mounting the converter and the radio-interference filter on a common mounting plate. The converter and the radio-interference filter are to be installed so that their bases rest flat on the mounting plate. A bare metal mounting plate is most suitable, e.g. made of stainless-steel sheet or galvanized steel sheet, because the whole mounting surface is used for establishing electrical contact. If the mounting plate is painted, all the paint must be removed from the screw connections of the converter and radio-interference filter so that there is electrical contact with the mounting plate.

WARNING

It is absolutely necessary that the motor be connected by means of a shielded cable! The shield is to be flat-connected to the motor and converter.

Example of installation

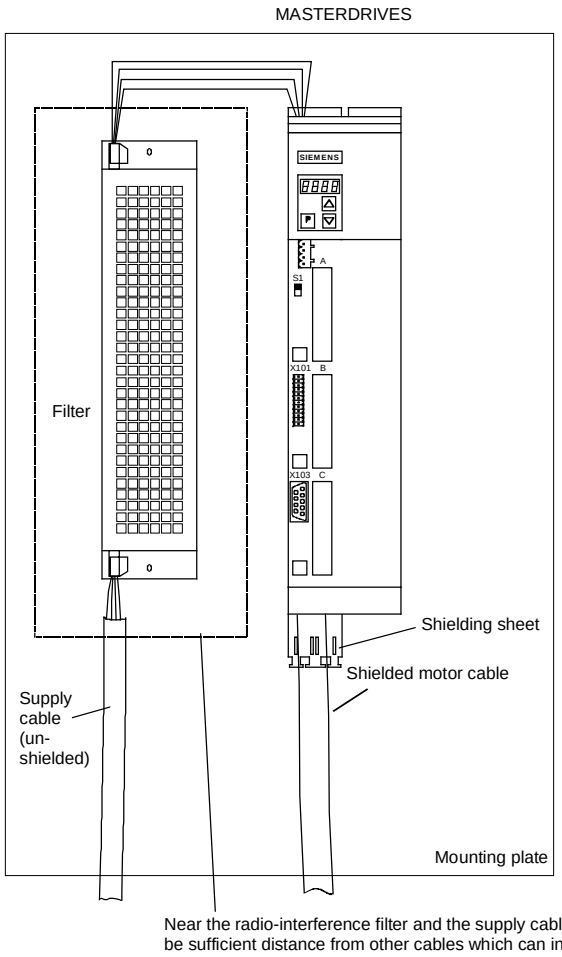


Fig. 4-1 Installation example for Compact PLUS type of construction

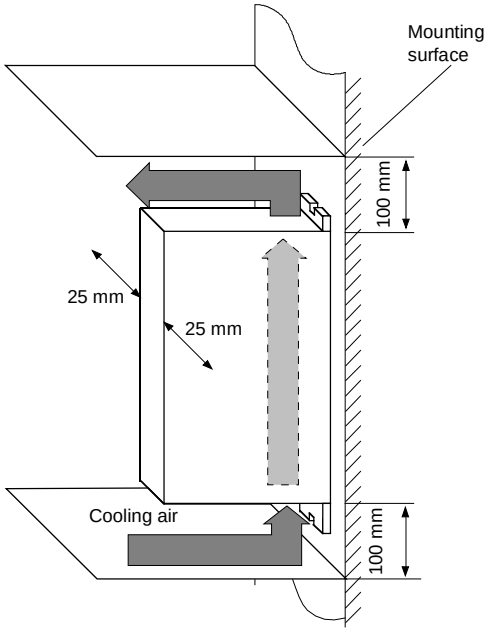


Fig. 4-2 Minimum distances for cooling

Mounting

For sufficient suppression of radio interference, the filter must be directly mounted on a bare metal surface and fastened with two or four M5 screws.

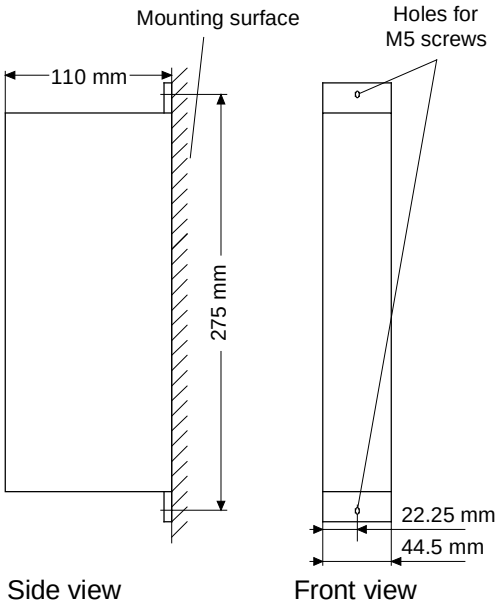


Fig. 4-3 Dimension drawing of the 2A EMC filter

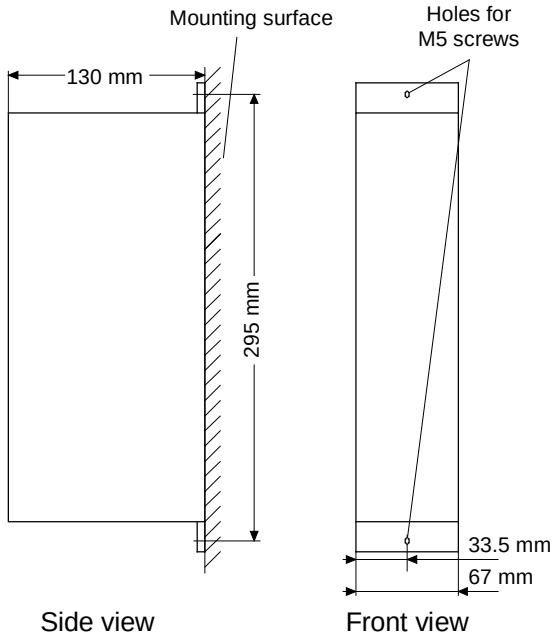


Fig. 4-4 Dimension drawing of the 6 A EMC filter

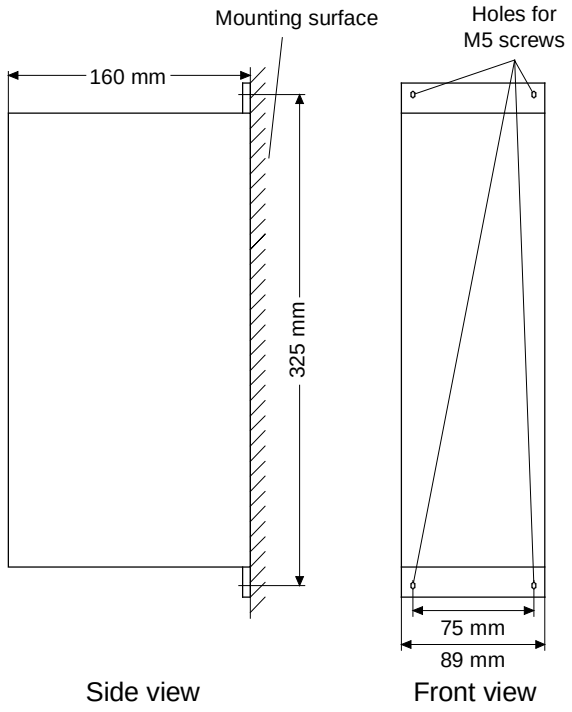


Fig. 4-5 Dimension drawing of the 12 A / 18 A EMC filter

5 Connecting-up

WARNING

SIMOVERT MASTERDRIVES units are operated at high voltages.
The equipment must be in a no-voltage condition (disconnected from the supply) before any work is carried out!
Only professionally trained, qualified personnel must work on or with the units.
Death, severe bodily injury or significant property damage could occur if these warning instructions are not observed.

Hazardous voltages are still present in the unit up to 5 minutes after it has been powered down due to the DC link capacitors. Thus, the appropriate delay time must be observed before working on the unit or on the DC link terminals.

The power terminals and control terminals can still be live even when the motor is stationary.
If the DC link voltage is supplied centrally, the converters must be reliably isolated from the DC link voltage!

When working on an opened unit, it should be observed that live components (at hazardous voltage levels) can be touched (shock hazard).

The user is responsible that all the units are installed and connected-up according to recognized regulations in that particular country as well as other regionally valid regulations. Cable dimensioning, fusing, grounding, shutdown, isolation and overcurrent protection should be particularly observed.

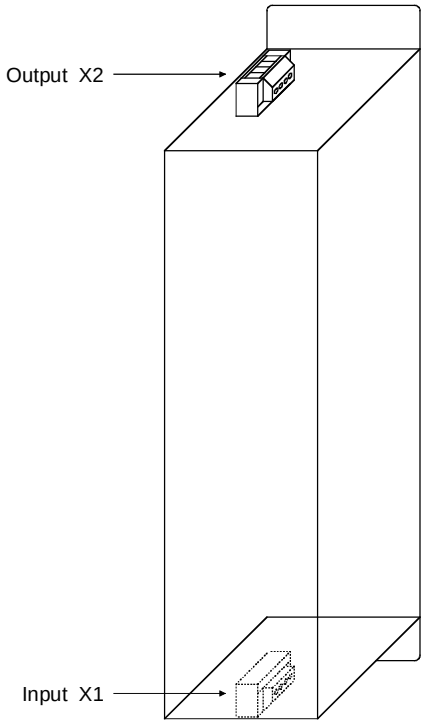


Fig. 5-1 Connection overview

- Use shielded control cables. The shield is to be connected at the transmitter end and at the receiver end.

  In the case of analog control cables, two-end shield connection can lead to hum pick-up. In this case, the shield must only be connected at one end, at the converter.
- Lay control cables and power cables separately. Power cables in this context are the motor cable or connecting cables from the converter's DC link (terminals C/ L+ and D/ L-) to other components, e.g. brake resistor. Control cables and power cables must never be laid parallel to each other in a single cable pit, even if all the cables are shielded.

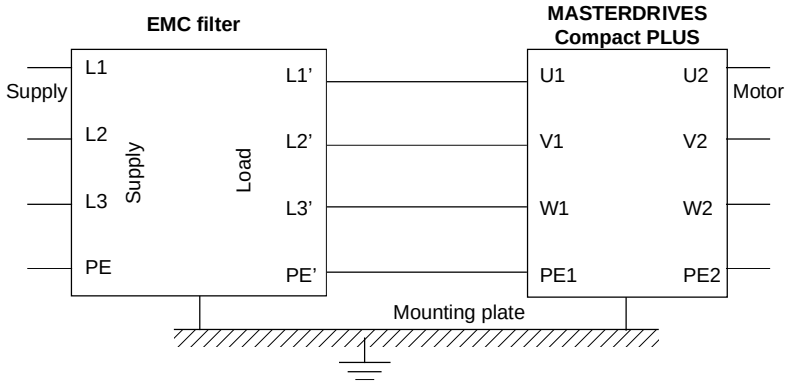
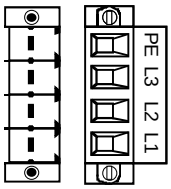


Fig. 5-2 Circuit diagram

X1 input



The terminal is on the bottom of the unit. It is for connecting the radio-interference filter to the power supply voltage.

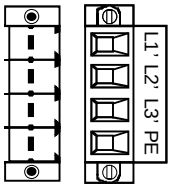
Terminal	Significance	Range
PE	Protective conductor terminal	3AC 380 V - 480 V
L3	Phase L3	3AC 380 V - 480 V
L2	Phase L2	3AC 380 V - 480 V
L1	Phase L1	3AC 380 V - 480 V

Connectable cross-section: 4 mm² (AWG 10)

Terminal PE is at the front when unit has been installed.

Table 5-1 Terminal X1: input of the radio-interference filter

X2 output



The terminal is on the top of the unit. It is for connecting the radio-interference filter to the connected converter.

Terminal	Significance	Range
L1'	Phase L1'	3AC 380 V - 480 V
L2'	Phase L2'	3AC 380 V - 480 V
L3'	Phase L3'	3AC 380 V - 480 V
PE	Protective conductor terminal	3AC 380 V - 480 V

Connectable cross-section: 4 mm² (AWG 10)

Terminal PE is at the front when unit has been installed.

Table 5-2 Terminal X2: output of the radio-interference suppression filter

NOTE

Please ensure that the cable from the supply system to the filter input and the output cables of the converter are laid separately from each other.

6 Technical Data

EU low-voltage directives 73/23/EEC and RL93/68/EEC	EN 50178
EU directive EMC 89/336/EEC	EN 61800-3
EU machine directive 89/392/EEC	EN 60204-1
Approval	UL: E 145 153 CSA: LR 21 927
Type of cooling	Air cooling with built-in fan
Permissible ambient and cooling-medium temperature • during operation • during storage • during transport	 0° C to +45° C (32° F to 113° F) -25° C to +70° C (-13° F to 158° F) -25° C to +70° C (-13° F to 158° F)
Installation altitude	≤ 1000 m above sea level (100 % load capability) > 1000 m to 4000 m above sea level (for load capability. see Fig. "Derating curves")
Permissible humidity rating	Relative humidity ≤ 95 % during transport and storage ≤ 85 % during operation (moisture condensation not permissible)
Climatic class	Class 3K3 to DIN IEC 721-3-3 (during operation)
Degree of pollution	Pollution degree 2 to IEC 664-1 (DIN VDE 0110. Part 1). Moisture condensation during operation is not permissible
Overvoltage category	Category III to IEC 664-1 (DIN VDE 0110. Part 2)
Degree of protection	IP20 EN 60529
Class of protection	Class 1 to EN 536 (DIN VDE 0106. Part 1)
Shock protection	to EN 60204-1 and DIN VDE 0106 Part 100 (VBG4)
Radio interference suppression • Standard • Options	to EN 61800-3 No radio interference suppression Radio interference suppression filter for Class B1 or A1 to EN 55011
Interference immunity	Industrial to EN 61800-3
Paint finish	For interior installation
Mechanical specifications - Vibrations During stationary use: Constant amplitude • of deflection • of acceleration During transport: • of deflection • of acceleration - Shocks - Drop and topple	 to DIN IEC 68-2-6 0.075 mm in the frequency range 10 Hz to 58 Hz 9.8 m/s² in the frequency range > 58 Hz to 500 Hz 3.5 mm in the frequency range 5 Hz to 9 Hz 9.8 m/s² in the frequency range > 9 Hz to 500 Hz to DIN IEC 68-2-27 / 08.89 30 g, 16 ms half-sine shock to DIN IEC 68-2-31 / 04.84 on a surface and on a corner

Table 6-1 General data

Designation		Value			
Order No.	6SE70...	12-0EP87-0FB0	16-0EP87-0FB0	21-2EP87-0FB0	21-8EP87-0FB0
Rated voltage	[V]	3 AC 380 (- 15 %) to 480 (+ 10 %)			
Rated frequency	[Hz]	50 / 60 ± 6 %			
Rated current	[A]	2	6	12	18
Load class II to EN 60 146-1-1					
Overload current	[A]	3.2	9.6	19.2	28.8
Overload duration	[s]	30			
Base load time	[s]	300			
Additional short-time load					
Short-time current	[A]	6	18	36	54
Short-time cycle	[s]	1			
Short-time duration	[ms]	250			
Losses					
Power loss (fp = 10 kHz)	[W]	8	20	35	40
Dimensions, weight					
Dimensions	[mm]				
• Width		45	67.s5	90	90
• Height		290	310	340	340
• Depth		110	130	160	160
Weight approx.	[kg]	1.9	3.3	5.5	7.5

Table 6-2 Technical Data

Derating curves

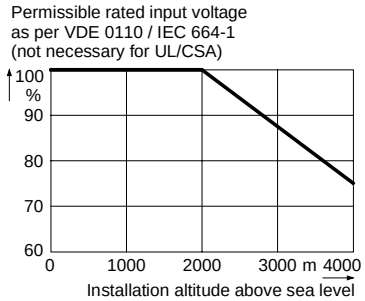


Fig. 6-1 Derating

WARNING

Use shielded motor cable!
Length of motor cable: ≤ 30 m

The shield of the motor cable is to be connected to the shielding sheet and to the motor housing.

Assignment of units

In accordance with the outputs of the units and their possible combination with additional DC units, the radio-interference filters are assigned to the converters as follows:

- If inverters are also connected to the Compact PLUS converter, the radio-interference filter must be correspondingly larger.
- It is only permitted to use the filters in conjunction with the following units:

EMC filter Order No.	Compact PLUS converter Order No.	Compact converter Order No.	Rated current
6SE7012-0EP87-0FB0	6SE7011-5EP50	-	2 A
6SE7016-0EP87-0FB0	6SE7013-0EP50 6SE7015-0EP50	6SE7016-1EA51	6 A
6SE7021-2EP87-0FB0	6SE7018-0EP50 6SE7021-0EP50	6SE7018-0EA51 6SE7021-0EA51	12 A
6SE7021-8EP87-0FB0	6SE7021-4EP50 6SE7022-1EP50	6SE7021-3EB51 6SE7021-8EB51	18 A

7 Environmental Friendliness

Environmental aspects during the development

The number of components has been significantly reduced over earlier converter series by the use of highly integrated components and the modular design of the complete series. Thus, the energy requirement during production has been reduced.

Special significance was placed on the reduction of the volume, weight and variety of metal and plastic components.

Plastics components used

ABS:	PMU board, Siemens logo
PC / ABS:	Front cover MC Large
PA6:	Front cover MC, terminal strips, spacer bolts, fan impeller
PA6.6:	DC link terminal cover, through terminals, terminal strips, terminal blocks
PVC:	Optional card covers
PP:	PMU covers
PBTP:	Fan housing
PC (Makrolon):	Fan guides
HP2061 (Phenolharz):	Insulating plates
NOMEX:	Insulating paper

Halogen-containing flame retardants were, for all essential components, replaced by environmentally-friendly flame retardants.

Environmental compatibility was an important criterion when selecting the supplied components.

Environmental aspects during production

Purchased components are generally supplied in recyclable packaging materials (board).

Surface finishes and coatings were eliminated with the exception of the galvanized sheet steel side panels.

ASIC devices and SMD devices were used on the boards.

The production is emission-free.

Environmental aspects for disposal

The unit can be broken down into recyclable mechanical components as a result of easily releasable screw and snap connections.

The plastic components are to DIN 54840 and have a recycling symbol.

Units can be disposed of through certified disposal companies. Addresses are available from your local Siemens partner.

8 Certificates

SIEMENS Automation and Drives

Confirmation

Erlangen,15.09.1998

This confirms that

Equipment	drive converter
• Type	SIMOVERT MASTERDRIVES
• Order No.	6SE70xx-xxPxx [1)]

is manufactured in conformance with EN 60204 Section 6.2
(corresponds to DIN VDE 0113 Section 6.2).

1) See rating plate for complete type designation, serial number and technical data

This equipment fulfills the protection requirements against electric shock according to DIN VDE 0106 Part 100 when the following safety rules are observed:

- Service work in operation is only permissible on a unit which is not live.
- The converter must be switched into a no-voltage condition and isolated from the supply when replacing any part/component.
- All panels and the DC link terminals must be closed during operation.

Thus, this equipment conforms to the appropriate regulations in Germany according to VBG 4 §2 (2) (VBG is a German regulatory body for safety-related issues).

The local operating regulations (e.g. EN 50110-1, EN 50110-2) must be observed when operating the equipment.

A&D DS A P1

Mickal

Automation &Drives

SIEMENS

Automation and Drives

Test Certificate

Erlangen, 15.09.1998

Equipment drive converter

- Type SIMOVERT MASTERDRIVES
- Order No. 6SE70xx-0EP87-0FB0

The 100% inspection was performed according to test instructions Motion Control 6SE70xx-xxPxx.

Test scope:

I. Protective conductor test
II. Insulation test
III. Function test acc. to EN 50178

- According to DIN VDE 0411
- Acc. to EN 50178, Section 9.4.5.2 and UL508/CSA 22.2-14.M 91, Section 6.8

The equipment complied with the test requirements.
The test results are documented within the test database.

A&D DS A PE D P

Schlögel

Automation &Drives

SIEMENS

Factory certificate *

regarding electromagnetic compatibility

EMC 0998 / Motion Control

Manufacturer:	Siemens Aktiengesellschaft	
	Group	Automation and Drives
	Business Division	Variable-speed drives
	Sub-Division	AC drive systems
Address:	P.O. Box 3269	
	D-91050 Erlangen	
Product name:	SIMOVERT Type 6SE70xx-xxPxx 1)	

When correctly used, the designated product fulfills all the requirements of Directive 89/336/EEC regarding electromagnetic compatibility.

We confirm the conformance of the above designated product with the Standards:

EN 61800-3 10-1996

EN 61000-4-2 (old IEC 801-2)

EN 61000-4-4 (old IEC 801-4)

EN 61000-4-5 (old IEC 801-5)

IEC 1000-4-3 (old IEC 801-3)

Note:

These instructions relating to EMC-correct installation, correct operation, connecting-up conditions and associated instructions in the product documentation supplied must be observed.

1) See rating plate for complete type designation, serial number and technical data

Erlangen, 15.09.1998

H. Mickal

A&D DS A P1

*) Acc. to EN 10204 (DIN 50049)

This declaration does not guarantee any features

Bisher sind folgende Ausgaben erschienen:

Ausgabe	Interne Sachnummer
AA	475 905 4070 76 J AA-74

Ausgabe AA besteht aus folgenden Kapiteln:

Kapitel		Änderungen	Seitenzahl	Ausgabedatum
1	Definitionen und Warnungen	Erstausgabe	3	09.99
2	Beschreibung	Erstausgabe	1	09.99
3	Transportieren, Lagern, Auspacken	Erstausgabe	1	09.99
4	Montage	Erstausgabe	4	09.99
5	Anschließen	Erstausgabe	3	09.99
6	Technische Daten	Erstausgabe	3	09.99
7	Umweltverträglichkeit	Erstausgabe	1	09.99
8	Bescheinigungen	Erstausgabe	3	09.99

The following editions have been published so far:

Edition	Internal Item Number
AA	475 905 4070 76 J AA-74

Version AA consists of the following chapters:

Chapter		Changes	Pages	Version date
1	Definitions and Warnings	first edition	3	09.99
2	Description	first edition	1	09.99
3	Transport, Storage, Unpacking	first edition	1	09.99
4	Installation	first edition	4	09.99
5	Connecting-up	first edition	3	09.99
6	Technical Data	first edition	3	09.99
7	Environmental Friendliness	first edition	1	09.99
8	Certificates	first edition	3	09.99

Group: Automation and Drives (A&D)
Division: Variable-Speed Drive Systems
Postfach 3269, D-91050 Erlangen

Siemens Aktiengesellschaft

Subject to change

Order No.: 6SE7087-6NP87-0FB0
Printed in the Federal Republic of Germany
09.99

SIEMENS

SIMOVERT MASTERDRIVES

Betriebsanleitung
Operating Instructions

Bedienfeld OP1S
Operator Panel OP1S

Ausgabe / Edition: AA

477 459 4070 76 J AA-74

Contents

Note

This operation manual of the OP1S is only valid for MASTER DRIVES units with the control boards CUVC and CUMC and for MASTER DRIVES Kompakt+ units.

The usage of the OP1S as spare part for the OP1 in conjunction with the control boards CU1 (FC), CU2 (VC) and CU3 (SC) is described in the operation manual of the OP1 with the order No. : 6SE7087-6CX84-2FF0.

1 General

The operator control panel (OP1S) is an optional input/output device which can be used for parameterizing and starting up the units. Plain-text displays greatly facilitate parameterization.

The OP1S has a non-volatile memory and can permanently store complete sets of parameters. It can therefore be used for archiving sets of parameters but, first, the parameter sets must be read out (upread) from the units. Stored parameter sets can also be transferred (downloaded) to other units.

The OP1S and the units to be operated communicate with each other via a serial interface (RS485) using the USS protocol. During communication, the OP1S assumes the function of a master whereas the connected units function as slaves.

The OP1S can be operated at baud rates of 9.6 kBd and 19.2 kBd and is capable of communicating with up to 32 slaves (addresses 0 to 31). It can therefore be used in a point-to-point link (e.g. during initial parameterization) or within a bus configuration.

The plain-text displays can be shown in one of five different languages (German, English, Spanish, French, Italian). The language is chosen by selecting the relevant parameter for the slave in question.

Order numbers

Components	Order No.
OP1S	6SE7090-0XX84-2FK0
Connecting cable 3 m	6SX7010-0AB03
Connecting cable 5 m	6SX7010-0AB05
Adapter for installation in cabinet door, incl. 5 m cable	6SX7010-0AA00

NOTE The parameter settings for units connected to the OP1S are given in the corresponding documentation (Compendium).

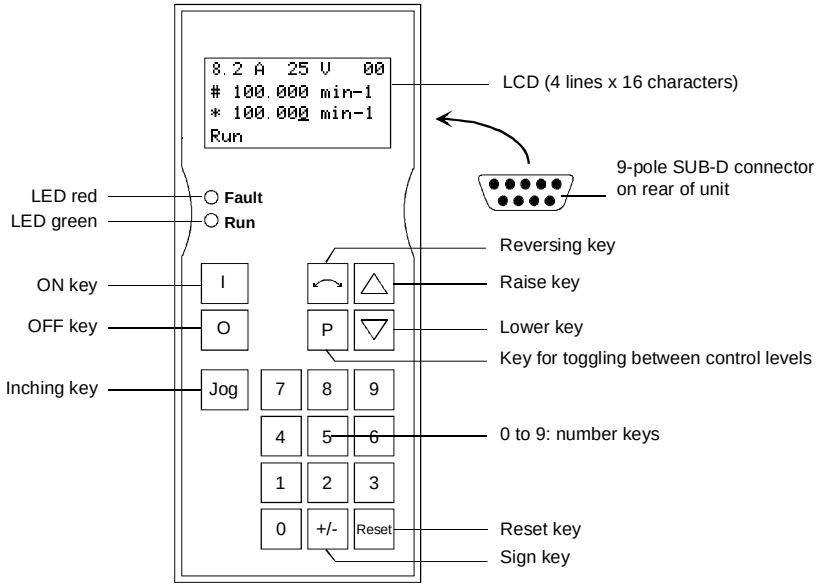
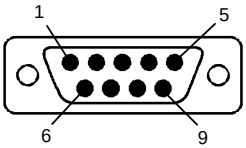


Fig. 1-1 View of the OP1S

OP1S connection



Pin	Designation	Meaning	Range
3	RS485 P	Data via RS485 interface	
5	M5V	Ground	
6	P5V	5 V aux. voltage supply	±5 %, 200 mA
8	RS485 N	Data via RS485 interface	
9		Reference potential	

Table 1-1 Connections of the OP1S

2 Connecting, Run-up

2.1 Connecting

The OP1S can be connected to the units in the following ways:

- Connection via 3 m or 5 m cable (e.g. as a manual input device for start-up)
- Connection via cable and adapter for installation in cabinet door
- Direct plugging into the units provided for it, e.g. MASTERDRIVE Compact units or the Compact PLUS MASTERDRIVE rectifier unit.

Connection via cable

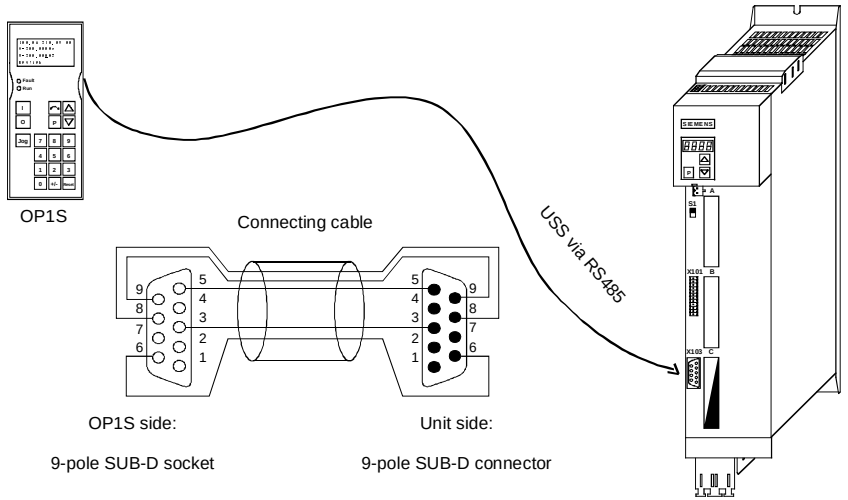


Fig. 2-1 Example: The OP1S in a point-to-point link with the Compact PLUS unit

Plugging into the units provided

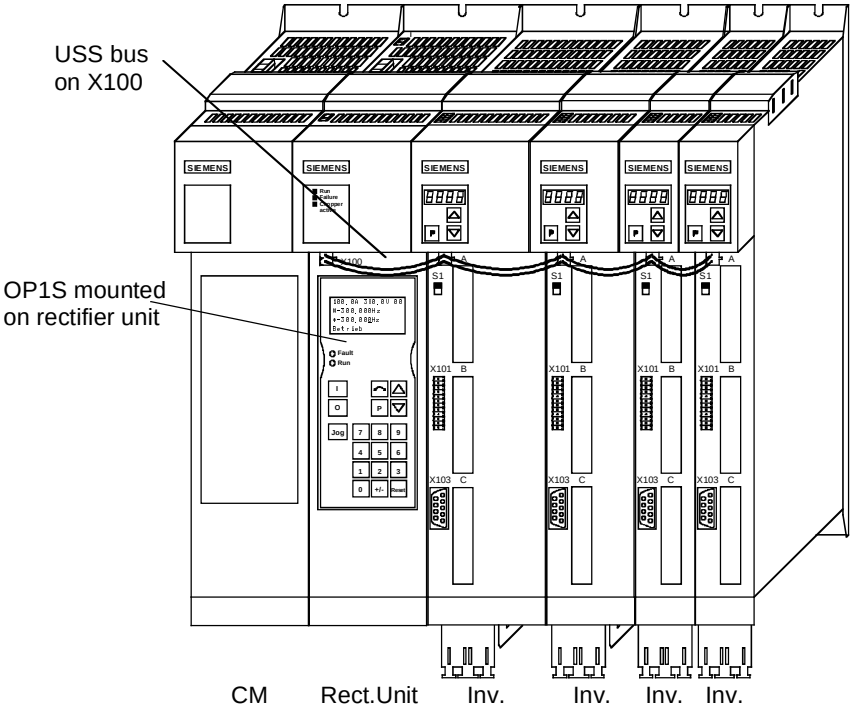


Fig. 2-2 Example: The OP1S during bus operation with Compact PLUS units

NOTE During bus operation, the Compact PLUS rectifier unit is only for mechanically restraining the OP1S and for connecting the bus to the inverters. It does not function as a slave.

2.2 Run-up

After the power supply for the unit connected to the OP1S has been turned on or after the OP1S has been plugged into a unit which is operating, there is a run-up phase.

CAUTION The OP1S must not be plugged into the Sub-D socket if the SCom1 interface parallel to the socket is already being used elsewhere, e.g. bus operation with SIMATIC as the master.

NOTE In the as-delivered state or after a reset of the parameters to the factory setting with the unit's own control panel, a point-to-point link can be adopted with the OP1S without any further preparatory measures.

When a bus system is started up with the OP1S, the slaves must first be configured individually. The plugs of the bus cable must be removed for this purpose (see section "Bus operation").

During the run-up phase, the text "Search slave" is shown in the first line of the display, followed by "Slave found" and the found slave number as well as the set baud rate.

```
Slave found
Address:   [00]
Baud rate:  [6]
```

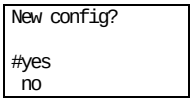
Example of a display after the run-up phase (6 corresponds to 9.6 kBd)

After approximately 4 s, the display changes to

```
     SIEMENS
MASTERDRIVES MC
6SE7014-0TP50
SW:V1.0 OP:V2T20
```

Example of what is displayed after a slave address has been found

After a further 2 s, there is a changeover to the operating display. If it is not possible to start communicating with the slave, an error message "Error: Configuration not ok" appears. About 2 s later, a request is made for new configuration.



Error message displayed when communication not possible

If the "P" key is pressed, the connected unit is reconfigured, i.e. the interface parameters are set to the standard values.

Number of PKWs:	127
Number of PZDs:	2 or 4
Telegram failure time:	0 ms

If communication with the slave is still impossible, the reasons may be as follows:

- Defective cabling
- Bus operation with two or more slaves with the same bus address (see section "Bus operation").
- The baud rate set in the slave is neither 9.6 nor 19.2 kBd.

In the latter case, an error message appears: "Error: No Slave found". The unit's own control panel must then be used to set the baud rate to 9.6/19.2 kBd or to reset the parameters to the factory setting.

3 Operator control

3.1 Operator control elements

Key	Meaning	Function
	ON key	• For energizing the drive (enabling motor activation). This function must be enabled by means of parameterization.
	OFF key	• For de-energizing the drive by means of OFF1, OFF2 or OFF3, depending on parameterization. This function must be enabled by means of parameterization.
	Jog key	• For jogging with jog setpoint 1 (only effective when the unit is in the "ready to start" state). This function must be enabled by means of parameterization.
	Reversing key	• For reversing the direction of rotation of the drive. This function must be enabled by means of parameterization.
	Toggle key	• For selecting menu levels and switching between parameter number, parameter index and parameter value in the sequence indicated. The current level is displayed by the position of the cursor on the LCD display (the command comes into effect when the key is released). • For concluding a numerical input
	Reset key	• For leaving menu levels • If fault display active, this is for acknowledging the fault. This function must be enabled by means of parameterization.
	Raise key	For increasing the displayed value • Short press = single-step increase • Long press = rapid increase • If motor potentiometer is active, this is for raising the setpoint. This function must be enabled by means of parameterization.
	Lower key	For lowering the displayed value • Short press = single-step decrease • Long-press = rapid decrease • If motor potentiometer is active, this is for lowering the setpoint. This function must be enabled by means of parameterization.

Key	Meaning	Function
+/-	Sign key	• For changing the sign so that negative values can be entered
0 ... 9	Number keys	• Numerical input

Table 3-1 Operator control elements of the OP1S

3.2 Operating display

After run-up of the OP1S, the following operating display appears.

```
 0.0 A   0 V  00
#     0.00 min-1
*     0.00 min-1
Ready
```

Example of an operating display in the "Ready" state

The values shown in the operating display (except for slave number, 1st line on the far right) can be specified by means of parameterization.

1st line left	in the example "Output current"
1st line right	in the example "DC link voltage"
2nd line actual value	in the example, "Actual speed" (only a visualization parameter)
3rd line setpoint	in the example "Speed setpoint"
4th line	in the example "Operating state"

In the operating display, the actual value is indicated with "#“ and the setpoint with "*“.

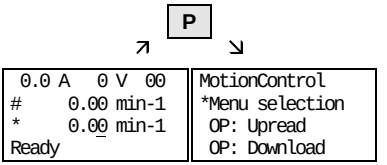
In addition to the operating display on the display unit, the operating state is indicated by the red and green LEDs as follows:

	Flashing	Continuous
Red LED	Warning	Fault
Green LED	Ready	Operating

Table 3-2 Operating displays

3.3 Basic menu

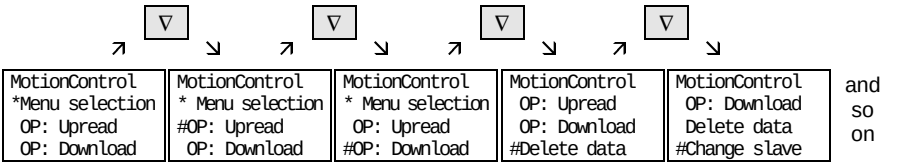
When the "P" key is pressed, a changeover is made from the operating display to the basic menu.



The basic menu is the same for all units. The following selections can be made:

- Menu selection
- OP: Upread
- OP: Download
- Delete data
- Change slave
- Config. slave
- Slave ID

As all the lines cannot be shown at the same time, it is possible to scroll the display as required with the "Lower" and "Raise" keys.



Example of switching from one line to the next

The currently active function is indicated by the "*" symbol and the selected function by the "#" symbol. After the "P" key has been pressed, the relevant symbol jumps to the selected function. The "Reset" key is for returning to the operating display.

3.4 Slave ID

With the "Slave ID" function, the user can request information about the connected slave. The slave ID consists, for example, of the following lines:

MASTERDRIVES MC

PLUS

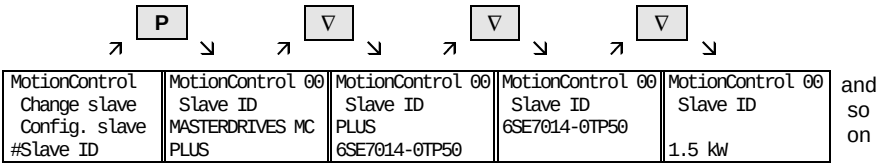
6SE7014-0TP50

1.5 kW

V1.0

15.09.1997

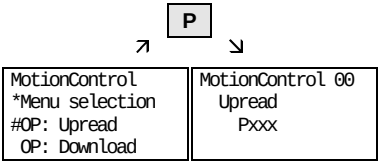
Starting from the basic menu, the "Slave ID" function is selected with "Raise" or "Lower" and activated with "P". As all the lines cannot be shown at the same time, it is possible to scroll the display as required with the "Lower" and "Raise" keys. In addition, the slave number is shown at the top on the right-hand side.



Example of a slave ID

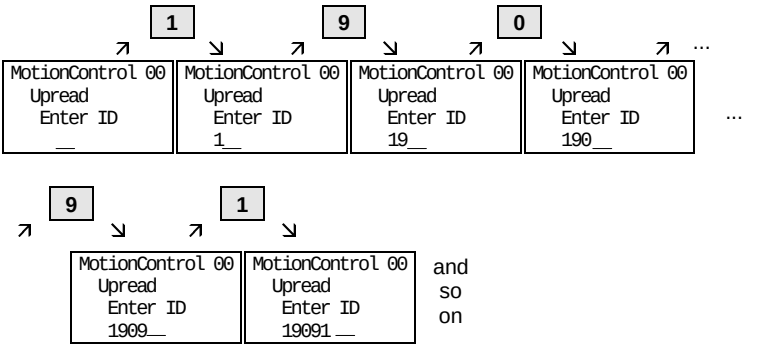
3.5 OP: Upread

With the "OP: Upread“ function, the parameters of the connected slave can be upread and stored in the flash memory inside the OP1S. Parameters of a possibly inserted technology board are not taken into account (e.g. T100, T300). The SIMOVIS program is required here. Starting from the basic menu, the "OP: Upread" function is selected with "Lower" or "Raise" and started with "P". If the available memory is insufficient, the procedure is interrupted with an appropriate error message. During upread, the OP1S indicates the parameters currently being read. In addition, the slave number is shown at the top on the right-hand side.



Example: Selecting and starting the "Upread" procedure

With "Reset", the procedure can be interrupted at any time. If the upread procedure has been completed in full, the user is requested to enter an ID, with a maximum of 12 characters, for the stored parameter set. This identification can, for example, consist of the date and two differentiating numbers. It is entered with the numerical keypad. With "Lower", a number which has been entered can be deleted.

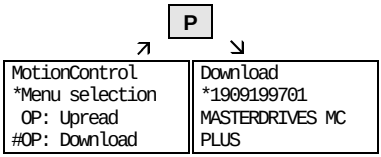


Example of an entry

When "P" is pressed, the message "Upread ok" appears and the display changes to the basic menu.

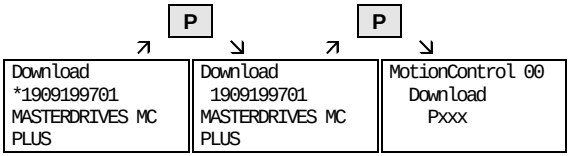
3.6 OP: Download

With the "OP: Download" function, a parameter set stored in the OP1S can be written into the connected slave. Parameters of a possibly inserted technology board are not taken into account (e.g. T100, T300). The SIMOVIS program is required here. Starting from the basic menu, the "OP: Download" function is selected with "Lower" or "Raise" and activated with "P".



Example: Selecting and activating the "Download" function.

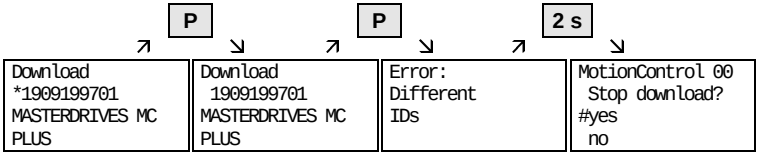
One of the parameter sets stored in the OP1S must now be selected with "Raise" or "Lower" (displayed in the second line). The selected ID is confirmed with "P". The slave ID can now be displayed with "Raise" or "Lower" (see section "Slave ID"). The "Download" procedure is then started with "P". During download, the OP1S displays the currently written parameters.



Example: Confirming the ID and starting the "Download" procedure

With "Reset", the procedure can be stopped at any time. If downloading has been fully completed, the message "Download ok" appears and the display returns to the basic menu.

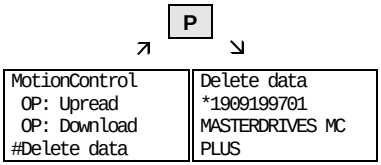
After the data set to be downloaded has been selected, if the identification of the stored data set does not agree with the identification of the connected unit, an error message appears for approximately 2 seconds. The operator is then asked if downloading is to be discontinued.



- Yes: Downloading is discontinued.
- No: Downloading is carried out.

3.7 Delete data

With the "Delete data" function, the user can delete parameter sets stored in the OP1S, thus, for example, creating space for new sets of parameters. Starting from the basic menu, the "Delete data" function is selected with "Lower" or "Raise" and activated with "P".



Example: Selection and activation of the "Delete data" function

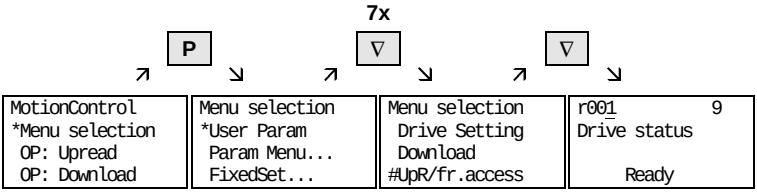
One of the parameter sets stored in the OP1S must now be selected with "Lower" or "Raise" (displayed in the second line). With "P", the selected ID is confirmed. The slave ID can now be displayed with "Lower" or "Raise" (see section "Slave ID"). The "Delete data" procedure can then be started with "P". After completion, the message "Data deleted" appears and the display returns to the basic menu.

3.8 Menu selection

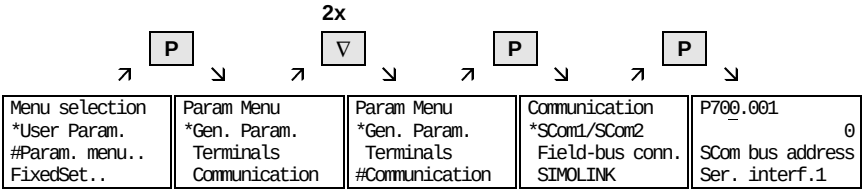
Actual parameterization and start-up of the connected slave is performed by means of the "Menu selection" function. Starting from the basic menu, the "Menu selection" function is selected with "Lower" or "Raise". By pressing "P", the unit-specific sub-menu is displayed with the following choices:

- User Param.
- Param Menu..
- FixedSet...
- Quick Param....
- Board Conf.
- Drive Set.
- Download
- UpR/fr. Access
- Power Def.

Two or more points after these items means that there is a further sub-menu level. If "Parameter menu.." is selected, access is possible to all parameters via correspondingly structured sub-menus. If "UpR/fr.access" is selected, direct access is gained to the parameter level.



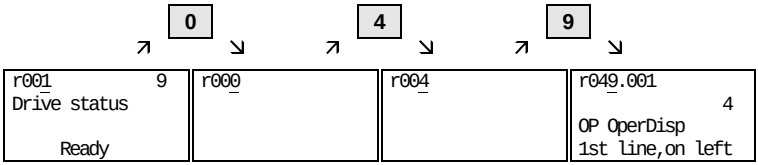
Example: Selecting the parameter level by means of UpR/fr.access



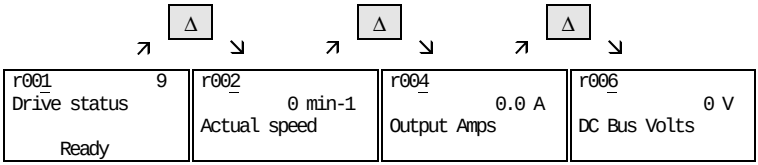
Example: Selecting a parameter by means of sub-menus

3.8.1 Displaying and correcting parameters

A parameter number can be selected from the parameter level directly with the numerical keys or with "Raise"/"Lower". The parameter number is shown as a three-figure quantity. In the event of four-figure parameter numbers, the first figure (1, 2 or 3) is not displayed. A distinction is made with the letters (P, H, U etc.).



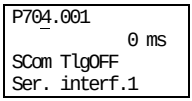
Example: Direct input of the parameter number with the numerical keypad



Example: Correcting the parameter number by means of "Raise"

If the parameter is found not to exist when the number is entered, a message "No PNU" appears. A non-existent parameter number can be skipped by selecting "Raise" or "Lower".

How the parameters are shown on the display depends on the type of parameter. There are, for example, parameters with and without an index, with and without an index text and with and without a selection text.



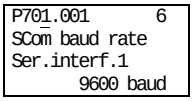
Example: Parameter with index and index text

1st line: Parameter number, parameter index

2nd line: Parameter value with unit

3rd line: Parameter name

4th line: Index text



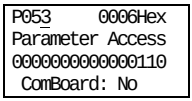
Example: Parameter with index, index text and selection text

1st line: Parameter number, parameter index, parameter value

2nd line: Parameter name

3rd line: Index text

4th line: Selection text



Example: Parameter without index, with selection text, binary value

1st line: Parameter number, hexadecimal parameter value

2nd line: Parameter name

3rd line: Parameter value, binary

4th line: Selection text

The "P" key is used to move between the levels parameter number, parameter index and parameter value.

Parameter number → "P" → Parameter index → "P" → Parameter value

If there is no parameter index, this level is skipped. The parameter index and parameter value can be corrected directly with the numerical keys or with the "Raise"/"Lower" keys. An exception to this are parameter values shown in binary form. In this case, the individual bits are selected with "Raise"/"Lower" and corrected with the numerical keys (0 or 1).

If the index number is entered by means of the numerical keys, the value is not accepted until "P" is pressed. If the "Raise" or "Lower" keys are used to correct the number, the value comes into effect immediately. The acceptance of an entered parameter value and return to the parameter number does not take place until "P" is pressed. The level selected in each case (parameter number, parameter index, parameter value) is marked with the cursor. If an incorrect parameter value is entered, the old value can be obtained by pressing "Reset". The "Reset" key can also be used to go one level lower.

Parameter value → "Reset" → Parameter index → "Reset" → Para. No.

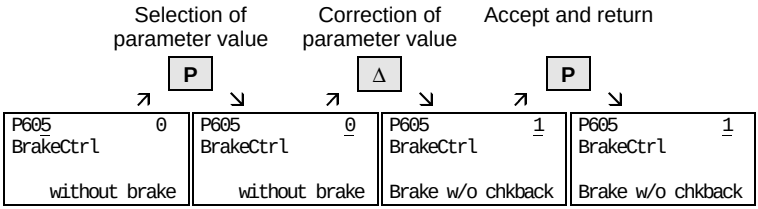
Parameters which can be altered are shown in upper-case letters and those which cannot be altered in lower-case letters. If a parameter can only be changed under special conditions or if an incorrect value has been entered with the numerical keys, an appropriate message follows, e.g.:

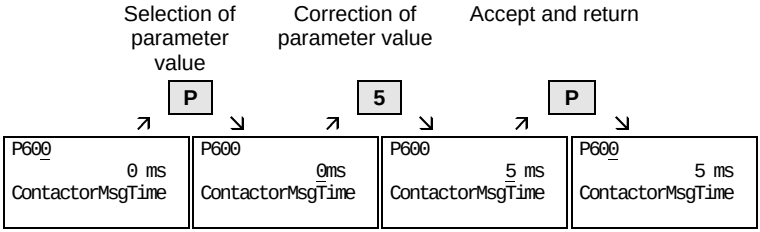
"Value not perm."	Incorrect value entered
"Value <> min/max“	Value too large or too small
"P53/P927?“	No parameter access
"Operating status?“	Value can only be changed in "Drive setting" status, for example

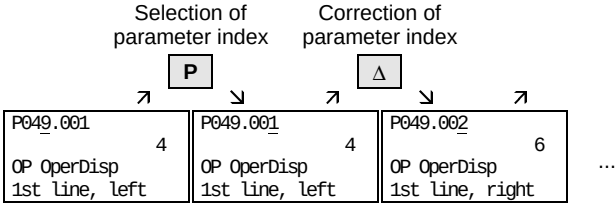
With "Reset“, the message is deleted and the old value is re-instated.

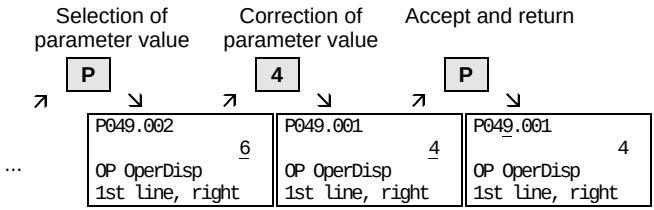
NOTE Parameter changes are always stored with power-failure protection in the EEPROM of the unit connected to the OP1S.

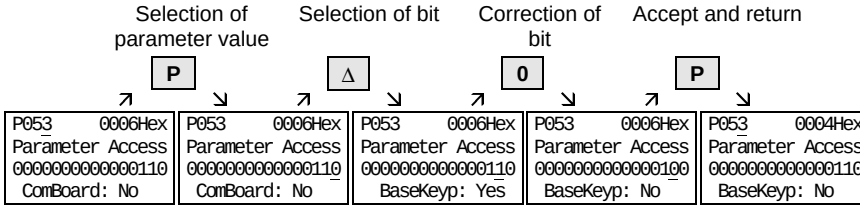
Examples of parameter correction





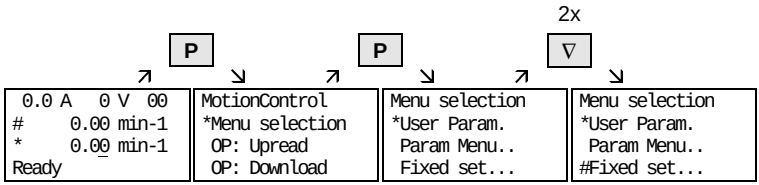




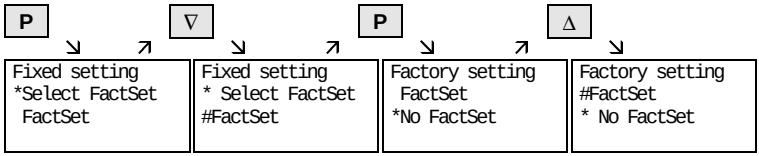


Parameters may also be displayed without a parameter number, for example during quick parameterizing or if "Fixed setting" is selected. In this case, parameterization is carried out via various sub-menus.

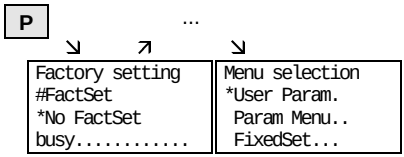
Example of how to proceed for a parameter reset



Selection of fixed setting



Selection of factory setting

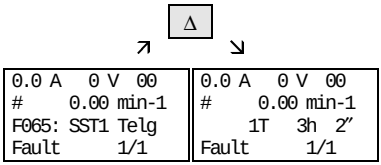


Start of factory setting

NOTE It is not possible to start the parameter reset in the "RUN" state.

3.8.2 Fault and alarm messages

A fault or alarm message is indicated by the red LED. In the event of a fault, the red LED lights up and stays on. A fault message appears in the 3rd and 4th line of the operating display.

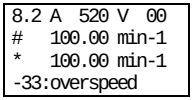


Example of a fault display

The fault number and the respective text are shown in the 3rd line. Up to 8 fault messages can be stored but only the first fault to occur is shown on the display. Several subsequent faults are shown in the 4th line, e.g. with 1/3 (first of three). Information on all faults can be obtained from the fault memory. With "Raise"/"Lower", the associated operating hours are shown when a fault is waiting to be remedied.

After the cause of a fault has been removed, the fault is acknowledged with "Reset" inside the operating display (the "Reset" key must be appropriately parameterized. See section "Issuing commands via the OP1S"). By pressing "P" and "Lower" at the same time, it is possible to skip back directly to the operating display from the parameter level.

When there is an alarm, the red LED flashes. A warning appears in the 4th line of the operating display.



Example of an alarm display

The alarm number and the respective text is shown in the 4th line. There can be several alarms at the same time but only the first alarm to occur is shown on the display. Several alarms are shown in the 4th line before the alarm number with an "+“ instead of "-“. Information on all alarms can be obtained with the alarm parameters.

An alarm cannot be acknowledged. As soon as the cause no longer exists, the alarm/display disappears automatically.

3.9 Issuing commands via the OP1S

Control functions and setpoint specifications for the connected unit can be selected with the corresponding keys of the OP1S, for example during start-up. To do so, the sources of the control commands have to be added to the corresponding bits of word 1 of the SCom1 interface. For setpoint specification, the sources of the setpoints must be appropriately "interconnected". In addition, the setpoint to be changed is to be parameterized as a displayed value in the 3rd line of the operating display.

Key	Function
I O	ON / OFF1
△ ▽	Motor potentiometer: setpoint higher, lower (only effective within the operating display)
0 bis 9 or △ ▽	Setpoint specification by means of fixed setpoint (only effective within the operating display. If entered with numerical key, confirm with "P")
↶	Reversing
Reset	Acknowledging (only effective within the operating display)
Jog	Jogging with jog setpoint 1 (only effective in the "Ready" state

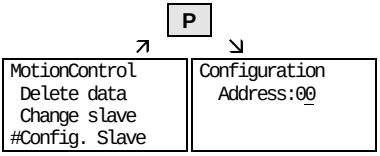
NOTE The OFF function can also be performed with OFF2 or OFF3 instead of OFF1. For this, the source of OFF2 or OFF3 must be appropriately "interconnected" in addition to setting ON/OFF1.

4 Bus operation

In order to start operating a bus system with the OP1S, the slaves must first be configured individually. To do this, the bus connecting cable between the slaves must be interrupted (pull out the bus-cable plug). For configuration, the OP1S is connected with each slave one after the other. A precondition for carrying out the configuration is a baud rate of 9.6 or 19.2 kBd set in the slave (see section "Run-up").

4.1 Configuring slaves

Starting from the basic menu, the "Config. slave" function is selected with "Lower"/"Raise" and activated with "P". The user is now requested to enter a slave address.



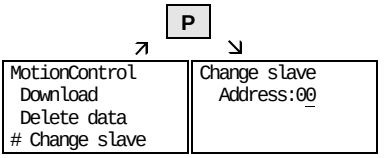
Example of activating the "Config. slave" function

After a different slave address for each slave has been entered by means of the "Raise" key or with the numerical keypad and confirmed with "P", configuration is carried out, i.e. the interface parameters are set to the standard value (see section "Run-up"). In addition, the slave address is entered and a baud rate of 9.6 kBd is set in the slave. After configuration has been completed, the message "Configuration ok" appears, followed by a return to the basic menu. If the configuration of all slaves has been successfully completed, bus operation can be started after the bus connection between the slaves has been restored.

NOTE During bus operation, each slave must have a different address. Bus operation is also possible at 19.6 kBd. The baud rate, however, must be set the same in all slaves.

4.2 Change slave

During bus operation, a specific slave can be selected via the OP1S with the "Change slave" function without any re-plugging. Starting from the basic menu, the "Change slave" function is selected with the "Lower"/"Raise" key and activated with "P". The user is then requested to enter a slave address.



Example of activating the "Change slave" function

After the slave address has been entered with "Raise"/"Lower" and confirmed with "P", a change is made to the required slave and the display returns to the basic menu. If the slave cannot be found, an error message is output.

5 Technical data

Order number	6SE7090-0XX84-2FK0
Supply voltage	5 V DC ± 5%, 200 mA
Operating temperature	0 °C to +55 °C
Storage temperature	-25 °C to +70 °C
Transport temperature	-25 °C to +70 °C
Environment class • Humidity • Pollution resistance	Acc. to DIN IEC 721 Part 3-3/04.90 3K3 3C3
Protection class	II acc. to DIN VDE 0160 Part 1/05.82 IEC 536/1976
Degree of protection • Front • Rear	Acc. to DIN VDE 0470 Part 1/11.92 IP54 EN60529 IP21
Dimensions W x H x D	74 x 174 x 26 mm
Standards	VDE 0160/E04.91 VDE 0558 Part 1/07.87 UL, CSA
Battery life	> 5a at 20°C

Table 5-1 Technical data

Bisher sind folgende Ausgaben erschienen:
The following versions have appeared so far:

Ausgabe Version	interne Sachnummer Internal item number
AA	477 459.4070.76 J AA-74

Ausgabe AA besteht aus folgenden Kapiteln

Kapitel		Änderung	Ausgabe-datum
1	Allgemeines	Erstausgabe	10.97
2	Anschließen, Hochlauf	Erstausgabe	10.97
3	Bedienen	Erstausgabe	10.97
4	Busbetrieb	Erstausgabe	10.97
5	Technische Daten	Erstausgabe	10.97

Version AA consists of the following chapters

Chapter		Changes	Version date
1	General	First edition	10.97
2	Connecting, Run-up	First edition	10.97
3	Operator control	First edition	10.97
4	Bus operation	First edition	10.97
5	Technical data	First edition	10.97

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simovert masterdrives

SIEMENS

SIGATE

Contents

1 Definitions and Warnings

1.1 Definitions

Target group

These operating instructions are targeted at readers who already know the MASTERDRIVES and SIMOTION systems. Their content is based on the assumption that the reader is thoroughly familiar with the relevant manuals and instructions.

Qualified personnel

For the purpose of this documentation and the product warning labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up, operation and maintenance of the product. He or she must have the following qualifications:

- Trained or authorized to energize, de-energize, ground and tag circuits and equipment in accordance with established safety procedures.
- Trained or authorized in the proper care and use of protective equipment in accordance with established safety procedures.
- Trained in rendering first aid.

DANGER

indicates an **imminently** hazardous situation which, if not avoided, will result in death, serious injury and considerable damage to property.

WARNING

indicates a **potentially** hazardous situation which, if not avoided, could result in death, serious injury and considerable damage to property.

CAUTION

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

CAUTION

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

NOTICE

NOTICE used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesirable result or state.

NOTE

For the purpose of this documentation, "Note" indicates important information about the product or about the respective part of the documentation which is essential to highlight.

1.2 Safety notices

WARNING

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the warnings can thus result in severe personal injury or property damage.

Only qualified personnel should work on or around the equipment

This personnel must be thoroughly familiar with all warning and maintenance procedures contained in this documentation.

The successful and safe operation of this equipment is dependent on correct transport, proper storage and installation as well as careful operation and maintenance.

NOTE

This documentation does not purport to cover all details on all types of the product, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local SIEMENS sales office.

The contents of this documentation shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of SIEMENS AG. The warranty contained in the contract between the parties is the sole warranty of SIEMENS AG. Any statements contained herein do not create new warranties or modify the existing warranty.

CAUTION

Components which can be destroyed by electrostatic discharge (ESD)

The board contains components which can be destroyed by electrostatic discharge. These components can be easily destroyed if not carefully handled. If you have to handle electronic boards, please observe the following:

Electronic boards should only be touched when absolutely necessary.

The human body must be electrically discharged before touching an electronic board.

Boards must not come into contact with highly insulating materials - e.g. plastic parts, insulated desktops, articles of clothing manufactured from man-made fibers.

Boards must only be placed on conductive surfaces.

Boards and components should only be stored and transported in conductive packaging (e.g. metalized plastic boxes or metal containers).

If the packing material is not conductive, the boards must be wrapped with a conductive packaging material, e.g. conductive foam rubber or household aluminum foil.

The necessary ESD protective measures are clearly shown again in the following diagram:

- a = Conductive floor surface
- b = ESD table
- c = ESD shoes
- d = ESD overall
- e = ESD chain
- f = Cubicle ground connection

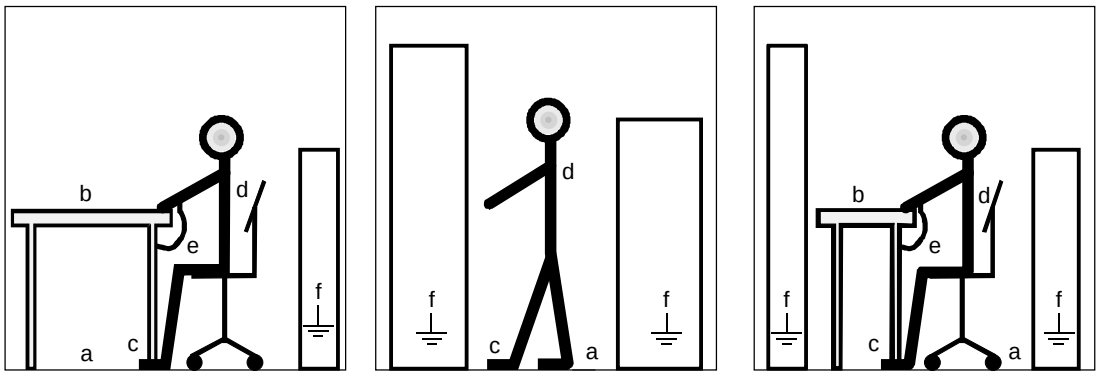

Fig. 1-1 ESD protective measures

Safety and Operating Instructions for Drive Converters

(in conformity with the low-voltage directive 73/23/EEC)

1. General

In operation, drive converters, depending on their degree of protection, may have live, uninsulated, and possibly also moving or rotating parts, as well as hot surfaces.

In case of inadmissible removal of the required covers, of improper use, wrong installation or maloperation, there is the danger of serious personal injury and damage to property.

For further information, see documentation.

All operations serving transport, installation and commissioning as well as maintenance are to be carried out by **skilled technical personnel** (Observe IEC 60364 or CENELEC HD 384 or DIN VDE 0100 and IEC 60664 or DIN VDE0110 and national accident prevention rules!).

For the purposes of these basic safety instructions, "skilled technical personnel" means persons who are familiar with the installation, mounting, commissioning and operation of the product and have the qualifications needed for the performance of their functions.

2. Intended use

Drive converters are components designed for inclusion in electrical installations or machinery.

In case of installation in machinery, commissioning of the drive converter (i.e. the starting of normal operation) is prohibited until the machinery has been proved to conform to the provisions of the directive 98/37/EG (Machinery Safety Directive - MSD). Account is to be taken of EN 60204.

Commissioning (i.e. the starting of normal operation) is admissible only where conformity with the EMC directive (89/336/EEC) has been established.

The drive converters meet the requirements of the low-voltage directive 73/23/EEC.
They are subject to the harmonized standards of the series EN 50178 / DIN VDE 0160 in conjunction with EN 60439-1 / DIN VDE 0660 part 500 and EN 60146 / VDE 0558.

The technical data as well as information concerning the supply conditions shall be taken from the rating plate and from the documentation and shall be strictly observed.

3. Transport, storage

The instructions for transport, storage and proper use shall be complied with.

The climatic conditions shall be in conformity with EN 50178.

4. Installation

The installation and cooling of the appliances shall be in accordance with the specifications in the pertinent documentation.

The drive converters shall be protected against excessive strains. In particular, no components must be bent or isolating distances altered in the course of transportation or handling. No contact shall be made with electronic components and contacts.

Drive converters contain electrostatic sensitive components which are liable to damage through improper use. Electric components must not be mechanically damaged or destroyed (potential health risks).

5. Electrical connection

When working on live drive converters, the applicable national accident prevention rules (e.g. BGV A2) must be complied with.

The electrical installation shall be carried out in accordance with the relevant requirements (e.g. cross-sectional areas of conductors, fusing, PE connection). For further information, see documentation.

Instructions for the installation in accordance with EMC requirements, like screening, earthing, location of filters and wiring, are contained in the drive converter documentation. They must always be complied with, also for drive converters bearing a CE marking. Observance of the limit values required by EMC law is the responsibility of the manufacturer of the installation or machine.

6. Operation

Installations which include drive converters shall be equipped with additional control and protective devices in accordance with the relevant applicable safety requirements, e.g. Act respecting technical equipment, accident prevention rules etc. Changes to the drive converters by means of the operating software are admissible.

After disconnection of the drive converter from the voltage supply, live appliance parts and power terminals must not be touched immediately because of possibly energized capacitors. In this respect, the corresponding signs and markings on the drive converter must be respected.

During operation, all covers and doors shall be kept closed.

7. Maintenance and servicing

The manufacturer's documentation shall be followed.

KEEP SAFETY INSTRUCTIONS IN A SAFE PLACE!

WARNING

Safe converter operation requires that the equipment is mounted and commissioned by qualified personnel taking into account the warning information provided in these Operating Instructions.

The general and domestic installation and safety regulations for work on electrical power equipment (e.g. VDE) must be observed as well as the professional handling of tools and the use of personal protective equipment.

Death, severe bodily injury or significant material damage could result if these instructions are not followed.

CAUTION

The option board may be inserted and removed only when the control unit and option board itself are disconnected from the power supply.

CAUTION

The SIGATE option module may only be operated by properly qualified personnel. The ESD guidelines must be followed.

The SIGATE option module may only be inserted in slot A. The cutout provided in the front plate for slot A must be enlarged as required for this purpose.

The SIGATE option module must never be inserted in any other slot!

The SIGATE option module can be installed only in MASTERDRIVES MC Performance2 units. Firmware version V2.40 or later must be installed on the host unit.

The basic MASTERDRIVES unit in which the SIGATE option module is installed must not be used to control the drive. It functions purely as a communication gateway in order to provide a link between the SIMOLINK and PROFINET IO buses.

CAUTION

The shields of the Ethernet/PROFINET cables must be bonded at the cable entry/exit points on the control cabinet.

CAUTION

The SIGATE option module functions as the link between the two bus systems SIMOLINK and PROFINET IO.

Unless additional protective measures are implemented, the module provides

- **no** protection against intentional or unintentional manipulation of data areas and/or system states.
- **no** firewall functionality
  It is therefore recommended that the option module be used only within local Intranet networks that are shielded against public networks by appropriate protective mechanisms.

CAUTION

The SIGATE option module may only be operated in LANs in which all connected nodes are equipped with SELV/PELV power supplies. It is also important to ensure that equalizing currents cannot be conducted via data or shield cables.

The module must not be directly connected to telecommunications equipment (e.g. WAN), but must be linked via a data transfer interface which guarantees the security described above.

2 Description

2.1 Overview

Range of application

The SIMOVERT MASTERDRIVES product range is being replaced by SIMOTION and SINAMICS products.

The two product generations use different bus systems for drive synchronization:

- SIMOVERT MASTERDRIVES uses SIMOLINK
- SIMOTION uses PROFINET IO

To be able to operate both drive generations together in a synchronized axis grouping, it is necessary to use a gateway as an interface between the two bus systems SIMOLINK and PROFINET IO.

A MASTERDRIVES device (MASTERDRIVES MC, Performance 2) functions as this gateway. It contains a SIMOLINK option module which provides access to the SIMOLINK bus. The PROFINET IO bus is accessed via the SIGATE option module.

The basic configuration of the gateway and the method used to embed the SIGATE option module into the overall drive concept are illustrated in Fig. 2-1.

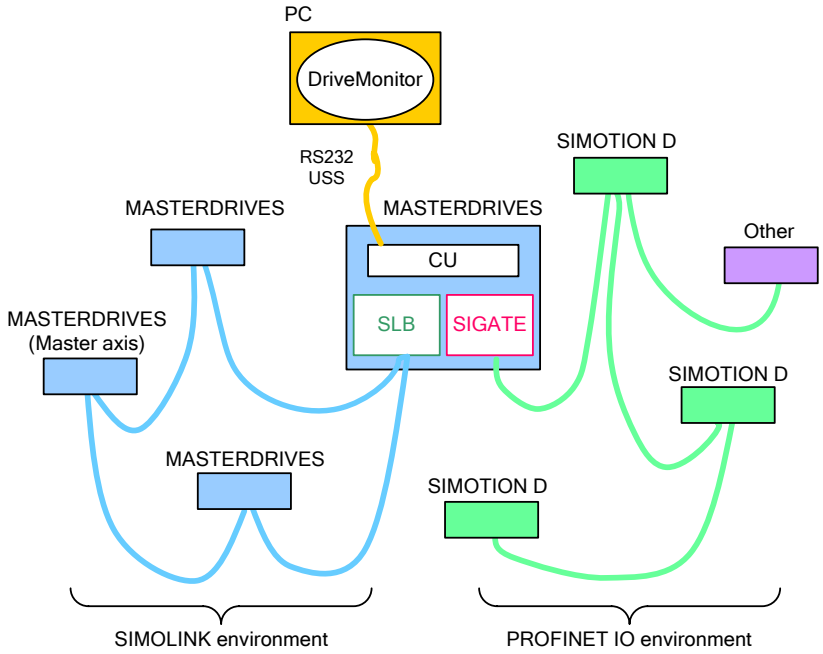

Fig. 2-1 Configuration

Interfaces

The SIGATE option module features two Ethernet interfaces, both of which support PROFINET IO communication. SIGATE functions as an IO device and can be linked via PROFINET IO to a SIMOTION system operating as the IO controller.

These two Ethernet interfaces allow the SIGATE option module to be integrated at any point into a PROFINET network, but they do not currently support configurations with a redundant ring structure.

Mode of operation

The SIGATE option module supports the following methods of value transfer between the two bus systems:

- Copying
- Linear interpolation/extrapolation for speed values
- Quadratic interpolation/extrapolation for position values

The interpolation/extrapolation functions offered by the SIGATE option module allow setpoints and actual values to be exchanged between the two bus systems, even if they are both operating with different cycle times.

Up to 8 values with 32 bits each can be exchanged in each transmission direction.

Data coupling

The data to be transferred are selected on the SIMOLINK bus through interconnection of the connectors with the send and receive parameters of the SIGATE option module. The SIMOTION system programming parameters on the PROFINET IO bus determine the I/O data assignments.

Parameter settings and diagnosis

The parameters of the SIGATE option module are set with DriveMonitor. This configuring tool is also used to read diagnostic information out of the option module. The PROFINET IO network is configured with SIMOTION Scout.

Installation of the SIGATE option module

When the SIGATE option module is ordered, it is installed with a SIMOLINK option module at the factory in a basic MASTERDRIVES unit. The unit is then supplied as a pre-configured MASTERDRIVES drive.

2.2 Channels

Similar to the SIMOLINK option module, the SIGATE option module administers transmit and receive data in channels. Two words in each case of the send/receive area with a total of 32 bits represent one channel.

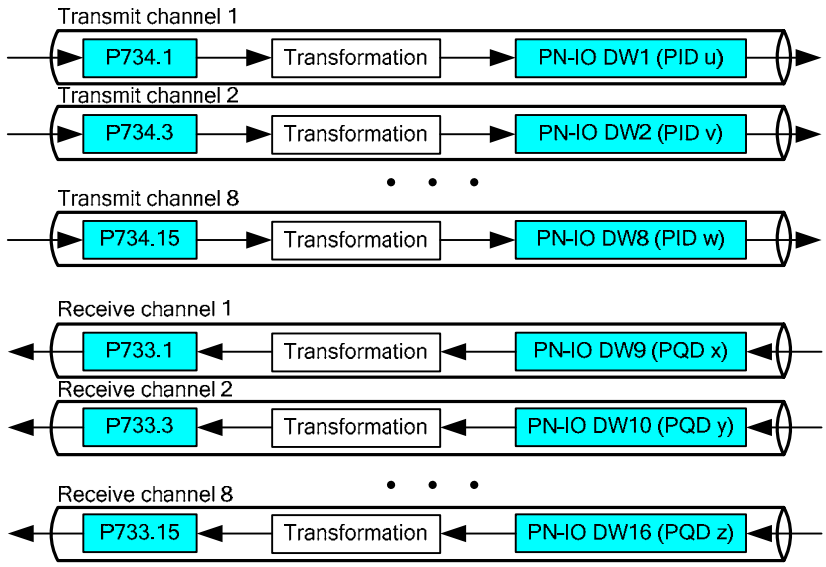

Fig. 2-2 Principle of transmit and receive channels

Each channel is linked to the receive end by means of a transformation. The type of transformation can be selected in parameter P694.

The following transformation types are supported:

copy: Incoming data are transmitted unchanged

linear: Incoming data are interpolated/extrapolated linearly

square: Incoming data are interpolated/extrapolated quadratically

2.3 Transformation

In a synchronized drive grouping, a master axis supplies:

- the current setpoint position and
- the current setpoint speed

This information can be passed on in order to synchronize the slave axes with the master. Data are transmitted isochronously, i.e. at fixed time intervals.

Data are sent in a fixed bus cycle on the SIMOLINK bus. In the case of the PROFINET IO, position and speed information are exchanged in the isochronous IRT cycle. The size of the two cycles is determined by parameters, such as the number of nodes, propagation times, the quantity of information to be transferred, etc. The cycle times of the two systems can therefore differ and these are not generally synchronized.

The transfer of values from one bus system to the other gives rise to dead times with the result that values arrive later at the receive end than at the transmit end. This delay means that the drives at the receive end can never operate in synchronism with the drives at the transmit end.

The SIGATE option module allows dead times to be included in the interpolation/extrapolation of position and speed values. These dead times can be specified in parameter P692. All changes to this parameter are accepted immediately by the firmware of the SIGATE module.

2.3.1 Interpolation/extrapolation of speed

To transfer speed data via a channel, transformation type "linear" must be specified in parameter P694. With this transformation type, the speed characteristic is interpolated/extrapolated linearly on the basis of stored interpolation values.

The dead time programmed in P692 is included in the interpolation/extrapolation calculation of the transferred values.

NOTE

The deviation between the interpolated/extrapolated values and the real speed characteristic becomes more marked as the dead time increases. For this reason, dead times should be minimized wherever possible.

2.3.2 Interpolation/extrapolation of position

To transfer position values via a channel, the transformation type "square" must be specified in parameter P694. With this transformation type, the position characteristic is interpolated/extrapolated quadratically on the basis of stored interpolation values. In addition to position setpoints, speed setpoints are also included in the interpolation/extrapolation calculation. The speed setpoints are interpolated/extrapolated linearly beforehand. The channel in which the linear interpolation/extrapolation is to be performed must be specified in parameter P696.

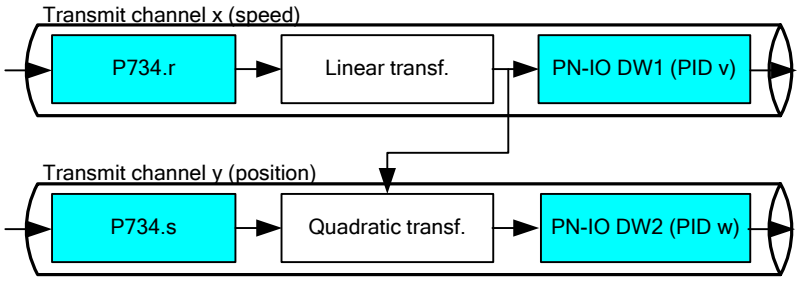

Fig. 2-3 Channel configuring for interpolation/extrapolation

The dead time programmed in P692 is included in the interpolation/extrapolation calculation of the transferred values.

NOTE

The deviation between the interpolated/extrapolated values and the real characteristic becomes more marked as the dead time increases. For this reason, dead times should be minimized wherever possible.

2.3.3 Copying

In addition to the position and speed values, it might be necessary to exchange values, which should not be interpolated/extrapolated, between the two bus systems. Transformation type "copy" is selected in such cases. This transformation transfers the data unchanged from one bus system to the other.

No allowance is made for dead times with this transformation type.

3 Transport, Storage, Unpacking

The units and components are packed in the manufacturing plant corresponding to that specified when ordered. A packing label is located on the outside of the packaging. Please observe the instructions on the packaging for transport, storage and professional handling.

Transport

Vibrations and jolts must be avoided during transport. If the unit is damaged, you must inform your shipping company immediately.

Storage

The units and components must be stored in clean, dry rooms. Temperatures between -25 °C (-13 °F) and +70 °C (158 °F) are permissible. Temperature fluctuations must not be more than 30 K per hour.

Unpacking

The packaging comprises board and corrugated paper. It can be disposed of corresponding to the appropriate local regulations for the disposal of board products. The units and components can be installed and commissioned after they have been unpacked and checked to ensure that everything is complete and that they are not damaged.

4 Connections

NOTE

Please read Section "Safety notices" in chapter "Definitions and Warnings" carefully.

CAUTION

The SIGATE option module contains components which are susceptible to serious damage by electrostatic discharge. These components can easily be destroyed if they are not handled with care.

Refer also to the ESD protective measures in chapter "Definitions and Warnings".

4.1 Power supply

The SIGATE option module itself does not require a separate power supply as it is supplied via the basic MASTERDRIVES unit.

The basic unit with SIGATE option module can operate without a three-phase supply to the power unit.

4.2 Connecting the Ethernet cable

The SIGATE option module is equipped with two Ethernet sockets with identical functional priority. The module can be connected to PROFINET IO via each of the two sockets.

Ethernet socket

The pin assignments of these two Ethernet sockets are shown in Table 4-1.

Pin	Signal name	Function
1	TX+	Transmission Data +
2	TX-	Transmission Data –
3	RX+	Receive Data +
4	–	To shield ground
5	–	To shield ground
6	RX-	Receive Data –
7	–	To shield ground
8	–	To shield ground

Table 4-1 Pin assignments of Ethernet socket

Ethernet connector

The Fast Connect Ethernet connectors made by SIEMENS (order number: 6GK1901-1BB10-2AA0) and the cables approved for PROFINET IO must be used to make the PROFINET IO connection.

Cables

The cables used to connect the SIGATE option module must be Ethernet cables compliant with Category 5e or higher and constructed with a special shield for industrial applications. FastConnect (FC) Industrial Ethernet cables (IE FC cable 2 x 2) made by SIEMENS, fitted with FastConnect RJ45 sockets (also SIEMENS) are the recommended cable type.

PROFINET networks must generally be configured in accordance with the requirements specified by the PNO (PROFIBUS User Organization) in the "PROFInet Installation Guideline". You can obtain a copy of this guideline under order number 2.251 from PNO Germany (www.profinet.com).

4.3 Ground connection

All metal parts of the installation must be incorporated in the grounding system. PROFINET operates in a frequency range of approximately 10 MHz to 100 MHz.
To ensure the effectiveness of cable shields in this frequency range, they must be grounded at both ends. If impermissibly high shield currents occur, an equipotential bonding lead must be routed in parallel.

The following points relating to shield bonding must be noted:

- When connectors are attached to cables, the cable shield must make 360° contact with the shielded connector housing.
- Shielded cables must be connected directly to frame or bonded with a shield/PE bus at the entry point to control cabinets or housings.
- The shielding braid must be attached with metal cable clamps.
- The cable must always be contacted via the copper braided shield, but not via the aluminum foil shield which is often a feature of shielded cables.
- The shielding foils and braids must not be damaged when the insulation is stripped from the PROFINET cable.
- Cable clamps and contacts should not be used as strain relief devices. This could damage the contact or cause it to break off.

The requirements specified in the "PROFInet Installation Guideline" generally apply. You can obtain a copy of this guideline under order number 2.251 from PNO Germany (PROFIBUS User Organization, www.profinet.com).

5 Commissioning

5.1 Requirements

You will need the following tools to commission the SIGATE option module:

- DriveMonitor version 5.4 or higher
- SIMOTION Scout version 4.0 or higher
- SIMATIC STEP7 V5.4 or higher
- Firmware for SIMOTION and CBE30 which supports IRT operation for PROFINET IO

The following description is based on the assumption that you are operating a grouping of MASTERDRIVES and SIMOTION axes. Each grouping of the two systems is configured for synchronized operation of several axes and has a master axis or virtual master.

The objective is to synchronize these two groups. Position and speed setpoints must be exchanged via the SIGATE option module for this purpose.

Synchronization will work only if the same calculation time base is used in both groupings. The interpolation/extrapolation algorithm on the SIGATE option module expects all speed values to be normalized to seconds. If the speed data used refer to a different time base, they must be converted to a per-second value before they are passed to the option module.

5.2 General procedure

1. For connection and commissioning of the basic unit with the SIGATE option module. This is described in the MASTERDRIVES compendium and in Chapter 4 of these operating instructions.

2. Parameter assignment with DriveMonitor:
   - Assignment of SIMOLINK option module parameters
   - Assignment of SIGATE option module parameters

3. Configuring with SIMOTION Scout:
   - Integration of the SIGATE option module in the PROFINET IO IRT data exchange process
   - Integration of data for axis synchronization

5.3 Parameter assignment with DriveMonitor

NOTE

The option module accepts parameters from the basic unit once after starting. Once the drive is in operation, the module will accept only the dead time compensation parameter (P692).

5.3.1 Assignment of SIMOLINK option module parameters

In order to integrate the basic unit in the data exchange process on the SIMOLINK bus, the following parameters must be specified as a minimum:

- SLB node address (parameter P740)

  Assignment of a free SIMOLINK address (1-200) for the basic unit
  Address 0: Simultaneous selection of dispatcher function
  Address 1 - 200: Simultaneous selection of transceiver function

- SLB read address (parameter P749)

  Setting of channels to be read. The input notation is *Address.Channel*. Up to 8 channels can be defined in the 8 indices of the parameter. The data in these channels are transferred to connectors K7001 - K7016 or KK7031 - KK7045 and can be interconnected with the send mailbox of the SIGATE module by means of the connectors.

- Source SLB transmit data (parameter P751)

  This parameter selects the connectors which are to be transmitted via SLB channels 1 to 8 (divided into low word and high word). Double connectors must be entered in two successive indices so that they are transmitted in full resolution.

  The connectors of the receive mailbox of the first communication board (K3001 ...) can be interconnected with the indices of this parameter. These connectors contain the receive data of the SIGATE option module.

- SLB channel number (parameter P745)

  The number of channels to be transferred via the SIMOLINK bus is set in this parameter.

- SLB cycle time (parameter P746)

  Sets the bus cycle time. This time can be set to between 0.20 ms and 6.50 ms in increments of 10 µs.

Please note that, depending on the parameterization, you may also need to alter the SIMOLINK settings, e.g. dead time compensation, of the connected equipment.

NOTE

For further information and a guide on setting the SIMOLINK option module parameters, please refer to the MASTERDRIVES Compendium, Section 8.3 "SIMOLINK".

5.3.2 Assignment of CU parameters

In order to minimize the transfer times of the data to be exchanged between the SIMOLINK and PROFINET IO buses, the time slices in which the functions involved in the transmission are executed must be adjusted to the SIMOLINK cycle used. If the SIMOLINK cycle used is 3.2 ms, for example, then the functions involved in the transmission must be assigned to time slice T4 in the following way:

Parameter	Index	Value to be set	Comment
2950	11	4	Time slice for setpoints 1st CB
2950	12	4	Time slice for setpoints SLB
2950	21	4	Time slice for actual values 1st CB

Table 5-1 Settings for the time slices on the CU

The functions on the CU which are involved in the transfer of data from the SIMOLINK bus to the PROFINET_IO bus must be assigned to the time slice which corresponds to the SIMOLINK cycle used.

In order to minimize the data transfer times from the SIMOLINK bus to the PROFINET IO bus, the sequence priorities of functions involved in the transmission must be adjusted as follows:

Parameter	Index	Value to be set	Comment
2960	11	115	Sequence for setpoints 1st CB
2960	12	110	Sequence for setpoints SLB
2960	21	120	Sequence for actual values 1st CB

Table 5-2 Settings for sequence priorities on the CU

The following setting must be made to ensure that the CU triggers an interrupt on the SIGATE option module as soon as it has stored the transmission data in the DPRAM:

Parameter	Index	Value to be set	Comment
724	-	2	CU generates an interrupt on the SIGATE option module

Table 5-3 Settings for interrupt triggering

5.3.3 Assignment of SIGATE option module parameters

5.3.3.1 Transformation type (parameter P694)

8 channels with 32 bits each are exchanged between the SIMOLINK and PROFINET IO buses. The following transformation types are available for this purpose:

none: The channel is not in use.

copy: The input values of the channel are transferred unchanged.

linear: The input values of the channel are interpolated/extrapolated linearly for the target cycle. This transformation type is used typically for the transmission of speed data.

square: The input values of the channel are interpolated/extrapolated quadratically with the mean variation in a second channel. This transformation type is used typically for the transmission of position data.

Parameter P694 with its indices contains the specified channel configuration for both directions:

Parameter structure

Parameter P694		
Index	**Meaning**	**Direction**
01	Transformation type for SIMOLINK for channel 1	SL <- PN
02	Transformation type for PROFINET IO for channel 1	SL -> PN
03	Transformation type for SIMOLINK for channel 2	SL <- PN
04	Transformation type for PROFINET IO for channel 2	SL -> PN
05	Transformation type for SIMOLINK for channel 3	SL <- PN
06	Transformation type for PROFINET IO for channel 3	SL -> PN
07	Transformation type for SIMOLINK for channel 4	SL <- PN
08	Transformation type for PROFINET IO for channel 4	SL -> PN
09	Transformation type for SIMOLINK for channel 5	SL <- PN
10	Transformation type for PROFINET IO for channel 5	SL -> PN
11	Transformation type for SIMOLINK for channel 6	SL <- PN
12	Transformation type for PROFINET IO for channel 6	SL -> PN
13	Transformation type for SIMOLINK for channel 7	SL <- PN
14	Transformation type for PROFINET IO for channel 7	SL -> PN
15	Transformation type for SIMOLINK for channel 8	SL <- PN
16	Transformation type for PROFINET IO for channel 8	SL -> PN

NOTE

The transformation type for PROFINET IO for channel 1 must always be set to *copy*. The 10th bit in this channel must be set to 1.

In order to suppress quantization errors with transformation types "linear" and "square", a filter for 1-bit changes is applied to the input values.

Transformations for channels with a channel number greater than the number of PROFINET IO channels configured with SIMOTION SCOUT must not be programmed in parameter P694.

5.3.3.2 Second input value for quadratic interpolation (parameter P696)

The two values below must be entered for the quadratic interpolation/extrapolation function (position calculation):

- Input value for setpoint position
- Input value for linearly interpolated/extrapolated speed

Both input values are specified in parameter P694 (see Section 5.3.3.1) and are combined in parameter P696 which specifies which channel will supply the input value for the linearly interpolated/extrapolated speed.

If the value transferred in one channel is to be interpolated/extrapolated quadratically, then the appropriate index of parameter P694 must contain the number of the channel which will supply the input value for the linearly interpolated/extrapolated speed. The transformation type for this channel must always be set to "linear".

In exactly the same way as parameter P694, parameter P696 contains an index for each channel and for each of the two transmission directions:

Parameter structure

Parameter P696		
Index	**Meaning**	**Direction**
01	Channel number for SIMOLINK channel 1	SL <- PN
02	Channel number for PROFINET channel 1	SL -> PN
03	Channel number for SIMOLINK channel 2	SL <- PN
04	Channel number for PROFINET channel 2	SL -> PN
05	Channel number for SIMOLINK channel 3	SL <- PN
06	Channel number for PROFINET channel 3	SL -> PN
07	Channel number for SIMOLINK channel 4	SL <- PN
08	Channel number for PROFINET channel 4	SL -> PN
09	Channel number for SIMOLINK channel 5	SL <- PN
10	Channel number for PROFINET channel 5	SL -> PN
11	Channel number for SIMOLINK channel 6	SL <- PN
12	Channel number for PROFINET channel 6	SL -> PN
13	Channel number for SIMOLINK channel 7	SL <- PN
14	Channel number for PROFINET channel 7	SL -> PN
15	Channel number for SIMOLINK channel 8	SL <- PN
16	Channel number for PROFINET channel 8	SL -> PN

The value 0 (means: no channel) must be entered in the corresponding index of parameter P696 for all channels which must not be interpolated/extrapolated quadratically.

NOTE

The linear channel entered is relevant only for a channel configured for quadratic interpolation/extrapolation.

5.3.3.3 Substitution counter (parameter P693)

The SIGATE option module can be required to send substitute setpoints to the slave axes independently, i.e. without a corresponding command from the master axis, for the following two reasons:

- The bus cycle time for communication set on the SIMOLINK bus is not the same as the PROFINET bus cycle time.
- As a result of transmission errors, inputs from the master axis are not reaching the SIGATE option module.

In both cases, the SIGATE option module extrapolates the "substitute" setpoints on the basis of the most recent setpoint packets it has received from the master axis.

Using the substitution counter, you can define the maximum number of substitute setpoints which can be sent in direct succession by the SIGATE option module before it switches to a fault state.

In this case, the SIGATE module activates an appropriate warning (see Section 6.1) and the entire cyclic communication process is aborted.

If the SIGATE module does begin to receive input values again before the parameterized number of cycles is reached, the substitution counter is reset to zero and the interpolation/extrapolation process is resumed in the normal way.

Parameter structure

Parameter P693		
Index	**Meaning**	**Direction**
01	Substitution counter for SIMOLINK	SL <- PN
02	Substitution counter for PROFINET IO	SL -> PN

NOTE

When different bus cycle times are set on the SIMOLINK and PROFINET IO buses, the system requires that substitute setpoints are transmitted on the bus with the faster cycle at specific intervals. The number of substitute values to be sent depends in this case on the relation between the two bus cycle times. This number of substitute values required by the system must be taken into account in parameter P693.
To this setting must be added a number which is calculated from the maximum number of packet failures that can be tolerated in the system as a whole, and the bus cycle time in which the SIGATE option module sends the data to the slave axes.

For example, with a clock cycle ratio between SIMOLINK : PROFINET IO of 3.2 ms : 4.0 ms, one substitute value must be sent in the SIMOLINK direction at specific intervals.
In this case, therefore, a "1" must be entered as the substitution counter for SIMOLINK, because the SIMOLINK cycle fits "more than once" into the PROFINET IO cycle. If then with this clock cycle ratio, no failure may be tolerated at the PROFINET IO end, but two failures at the SIMOLINK end, a "1" must be entered as the substitution counter for SIMOLINK and a "2" for PROFINET IO.

5.3.3.4 Modulo value (parameter P697)

If the position characteristic is cyclic with continuous motion in one direction, the SIGATE option module can also take this into account for the interpolated/extrapolated values. For this purpose, the axis cycle length configured on the master axis must be entered in parameter P697.

The appropriate modulo calculation is then performed on the interpolated/extrapolated values for the relevant channel.

Parameter structure

Parameter P697		
Index	**Meaning**	**Direction**
01	Modulo value for SIMOLINK for channel 1	SL <- PN
02	Modulo value for PROFINET IO for channel 1	SL -> PN
03	Modulo value for SIMOLINK for channel 2	SL <- PN
04	Modulo value for PROFINET IO for channel 2	SL -> PN
05	Modulo value for SIMOLINK for channel 3	SL <- PN
06	Modulo value for PROFINET IO for channel 3	SL -> PN
07	Modulo value for SIMOLINK for channel 4	SL <- PN
08	Modulo value for PROFINET IO for channel 4	SL -> PN
09	Modulo value for SIMOLINK for channel 5	SL <- PN
10	Modulo value for PROFINET IO for channel 5	SL -> PN
11	Modulo value for SIMOLINK for channel 6	SL <- PN
12	Modulo value for PROFINET IO for channel 6	SL -> PN
13	Modulo value for SIMOLINK for channel 7	SL <- PN
14	Modulo value for PROFINET IO for channel 7	SL -> PN
15	Modulo value for SIMOLINK for channel 8	SL <- PN
16	Modulo value for PROFINET IO for channel 8	SL -> PN

NOTE

The modulo value refers to the existing system-related modulo of the input values. This modulo value is multiplied by the relevant coefficient to calculate the output values.
Only then is it applied to the output values.

5.3.3.5 Coefficient (parameter P695)

The transmission values of all channels with linear or quadratic transformation can be multiplied by a coefficient before they are interpolated/extrapolated, e.g. for the purpose of unit adjustment.

This coefficient is specified in the form of a numerator and a denominator so as to preclude rounding errors.

Parameter structure

Parameter P695		
Index	**Meaning**	**Direction**
01	Coefficient numerator for SIMOLINK for channel 1	SL <- PN
02	Coefficient denominator for SIMOLINK for channel 1	SL <- PN
03	Coefficient numerator for PROFINET IO for channel 1	SL -> PN
04	Coefficient denominator for PROFINET IO for channel 1	SL -> PN
05	Coefficient numerator for SIMOLINK for channel 2	SL <- PN
06	Coefficient denominator for SIMOLINK for channel 2	SL <- PN
07	Coefficient numerator for PROFINET IO for channel 2	SL -> PN
08	Coefficient denominator for PROFINET IO for channel 2	SL -> PN
…	...	...
29	Coefficient numerator for SIMOLINK for channel 8	SL <- PN
30	Coefficient denominator for SIMOLINK for channel 8	SL <- PN
31	Coefficient numerator for PROFINET IO for channel 8	SL -> PN
32	Coefficient denominator for PROFINET IO for channel 8	SL -> PN

NOTE

The coefficients are applied to the input values for the purpose of converting various length and time units before the data are interpolated/extrapolated in the SIGATE option module.

A correct interpolation/extrapolation result can be guaranteed only if the length units for position and speed are standardized. These units can be defined by the user (°/sec; LU/sec).

The algorithm in the SIGATE option module calculates with a predefined time base of seconds.

5.3.3.6 Dead time compensation (parameter P692)

The SIGATE option module requires dead times to be specified at the receive end for channels with linear or quadratic interpolation/extrapolation.

The dead time corresponds to the total time period which elapses until data are evaluated at the receive end. Typical examples of delays which add to the dead time are:

- Bus cycle times
- Program execution times
- Task cycles

The total dead time period must be entered in parameter P692.1 for the SIMOLINK end and in P692.2 for the PROFINET IO end.

The interpolation/extrapolation function automatically makes allowance for the offset between the bus cycles of both systems and these need not be included in the dead time specification.

Parameter structure

Parameter P692		
Index	**Meaning**	**Direction**
01	Dead time compensation value for SIMOLINK	SL <- PN
02	Dead time compensation value for PROFINET IO	SL -> PN

NOTE

The CU of the MASTERDRIVES also requires a SIMOLINK cycle so that it can pass the data calculated by the SIGATE option module to the SIMOLINK bus. This cycle time is applied as a dead time and must be included in the dead time compensation function for SIMOLINK.

5.3.4 Interconnection of transmit and receive data

Similar to the SIMOLINK option module, the SIGATE option module administers transmit and receive data in channels. Two 16-bit words in each case of the send/receive area represent one channel.

5.3.4.1 Interconnection of transmit data (parameter P734)

The SIGATE option module operates as a communications board in the MASTERDRIVES unit. Communications boards have a send and a receive mailbox with a parameter that is determined by the slot assignment. The SIGATE option module must always be inserted in slot A of the MASTERDRIVES basic unit. This means that parameter P734 is the relevant send data parameter, i.e. for those data that are transferred from SIMOLINK to PROFINET IO. P734 is the parameter for configuring the send data of the first communications board. Using BICO technology you can interconnect the transmit data connectors in this parameter.

For further information about using BICO technology, please refer to the MASTERDRIVES MC Compendium, Chapter 4 "Function Blocks and Parameters".

Example

Example illustrating interconnection between receive data from the SIMOLINK and transmit parameters of the SIGATE option module:

P734.1 = Reserved

P734.2 = Reserved

P734.3 = 0x7001 >> 2nd channel low: 1st data word from SLB receive

P734.4 = 0x7002 >> 2nd channel high: 2nd data word from SLB receive

P734.5 = 0x7003 >> 3rd channel low: 3rd data word from SLB receive

P734.6 = 0x7004 >> 4th channel high: 4th data word from SLB receive

NOTE

The transformation type for PROFINET IO for channel 1 must always be set to *copy*. The 10th bit in this channel must be set, i.e. a "1" must always be assigned to the 10th bit in parameter P734.1.

5.3.4.2 Interconnection of receive data (parameter P2015)

Data from the PROFINET IO bus which arrive on the MASTERDRIVES unit via the SIGATE option module are stored in the receive buffer of the first communications board and can be configured via the relevant BICO connectors.

K3001 = Channel 1 - LOW WORD
K3002 = Channel 1 - HIGH WORD
K3003 = Channel 2 - LOW WORD
K3004 = Channel 2 - HIGH WORD
K3005 = Channel 3 - LOW WORD
K3006 = Channel 3 - HIGH WORD
K3007 = Channel 4 - LOW WORD
K3008 = Channel 4 - HIGH WORD
K3009 = Channel 5 - LOW WORD
K3010 = Channel 5 - HIGH WORD
K3011 = Channel 6 - LOW WORD
K3012 = Channel 6 - HIGH WORD
K3013 = Channel 7 - LOW WORD
K3014 = Channel 7 - HIGH WORD
K3015 = Channel 8 - LOW WORD
K3016 = Channel 8 - HIGH WORD

For further information, please refer to the relevant function diagrams in the MASTERDRIVES Compendium (see Section 8.2, "References").

5.3.5 Validation of parameters

The DriveMonitor configuring software prevents you from entering parameter settings that are outside the valid range.

When values are input, however, they are not checked for correct logic as some of the information required for this purpose is not available offline.

The logic check on parameter settings is not performed until the SIGATE option module boots. If logical errors are detected in the parameter settings, an appropriate warning is generated by the SIGATE option module (see section "Diagnosis and Troubleshooting", subsection "Warnings").

5.4 Configuring with SIMOTION Scout

5.4.1 Integrating the SIGATE option module

You will need the relevant GSDML- (Generic Station Description Markup Language) and the appropriate symbol file in order to integrate the SIGATE module in the hardware configuration:

- sigate.bmp
- GSDML-V2.0-SIEMENS-Sigate-V002-20060317.xml

You will find both files on the DriveMonitor CD.

To install the files, open the hardware configuration of your SIMOTION station in the SIMOTION Scout configuring tool and select option "Install GSD files..." in the "Tools" menu. This will start a dialog which will guide you through the installation process.

For detailed instructions, please refer to the Scout user documentation (see section "References").

After you have installed the two files, you will find an entry for the SIGATE option module under "PROFINET IO" ⇒ "Drives" ⇒ "MASTERDRIVES".

From here you can drag and drop the SIGATE module onto the PROFINET IO bus and configure it with the required number of channels. A dialog will then assist you in configuring the IP node and assigning a name. You will later need to assign the name of the IO device manually to the SIGATE option module (see section "Commissioning the PROFINET IO device").

The SIGATE option module now occupies an I/O address area of the SIMOTION system depending on the number of channels selected. You can access the channels of the SIGATE module via this I/O address area when you configure your SIMOTION system.

5.4.2 Commissioning the PROFINET IO device

Each PROFINET IO device is detected by an IO controller on the basis of its name and receives the configuring data stored in its configuration from this IO controller.

The SIGATE option module is not assigned a default name at the factory. You must therefore choose a meaningful name for the module as part of the configuring process.

To do this, open the hardware configuration of one of your SIMOTION systems in the SIMOTION Scout configuring software. Under item "Ethernet" in the "Target system" menu you will find subitem "Edit Ethernet nodes...". If you select this subitem, a setting screen will appear in which you will find the SIGATE option module in the network.

Once you have located the SIGATE module, the dialog will help you to assign a name and an IP configuration to it.

For further information on this topic, please refer to the Scout user documentation (see section "References").

5.5 Booting behavior of the SIGATE module

- The CU of the basic MASTERDRIVES unit boots first after the power supply is connected.

LED behavior

- After a short delay, the SIGATE option module also starts to boot. The red LED illuminates continuously first to signal this state. As soon as the firmware of the SIGATE option module has booted, the red LED changes from continuous illumination to cyclic flashing, indicating that the SIGATE option module is ready to exchange data with the PROFINET IO and SIMOLINK environments.
- The yellow LED starts to flash as soon as communication begins on the SIMOLINK bus and a data exchange with the CU is established.
- The green LED starts to flash as soon as cyclic communication on the PROFINET IO bus has commenced.
- As soon as the SIGATE option module firmware has booted correctly and communication on the SIMOLINK and PROFINET IO buses is established, all three LEDs flash cyclically at the same time.

The exact meaning of the LEDs is described in Section 6.2 "Diagnos".

Bus system booting

The SIGATE option module boots irrespective of the status of the SIMOLINK and PROFINET IO bus systems. If one of the two bus systems is not connected or not operational when the SIGATE module boots, then the module performs as a passive module on the other, i.e. the remaining functional bus. In other words, the module does not participate in the cyclic exchange of useful data.

Parameter transfer

During booting, the SIGATE option module is initialized once with the device-specific data stored in the CU. From this time onwards, the module will only accept changes to the dead time compensation (parameter P692). No other changes made via the DriveMonitor parameterization software will be read out of the CU until the system next boots.

The PROFINET IO device can be set to initial values via the PROFINET IO bus. These are immediately accepted by the SIGATE module firmware. However, only the configured name of the IO device is stored in the CU of the MASTERDRIVES basic unit. All other settings are stored centrally in the IO controller configuration from where they are distributed every time the system boots.

6 Diagnosis and Troubleshooting

This chapter describes only the fault messages and error numbers generated by the SIGATE option module. Other error and fault messages and the relevant potential causes and appropriate remedial action are described in section "Error and fault messages" of the drive operating instructions.

6.1 Warnings

When serious problems occur, the SIGATE option module generates warnings that are displayed on the DriveMonitor configuring tool interface.

The following warnings can be activated by the SIGATE option module:

Warning	Meaning	Remarks
81	Substitutions exceeded	The number of permitted substitutions has been exceeded (see parameter P693)
82	IRT down	No further IRT packets are being received via the PROFINET IO bus, i.e. a cyclic communication error has occurred on the PROFINET IO bus
83	SL down	No further packets are being received via the SIMOLINK bus, i.e. a cyclic communication error has occurred on the SIMOLINK bus
84	No Config	Parameter reading error
85	Invalid Config	Parameterization error The number of the faulty parameter which has triggered the alarm, plus the relevant index number, are specified in this case in parameter R732.10-11.
86	Channel mismatch	The number of configured PROFINET transformations exceeds the number of configured I/O channels.
87	SLB Transmit Buffer Error	The transmit buffer via which data are transferred from the SIGATE option module to the MASTERDRIVES CU is not working correctly.
88	SLB Receive Buffer Error	The receive buffer via which data are transferred from the MASTERDRIVES CU to the SIGATE option module is not working correctly.

Table 6-1 Warnings

NOTE

As usual with communication boards, the following errors can occur:

F080: CB initialization error

F081: Opt.mod. heartbeat counter

F082: CB telegram failure

An exact description of these errors can be found in the "SIMOVERT MASTERDRIVES Compendium".

6.2 Diagnosis

Diagnostic LEDs

The SIGATE option module features 3 diagnostic LEDs which are mounted on the front panel of the module.

These three LEDs basically provide information about the condition of the SIGATE firmware, the communication status between the SIGATE module and the MASTERDRIVES CU or SIMOLINK option module, and about communication on the PROFINET IO bus.

If the SIGATE option module has finished booting and all components are operating correctly, all three LEDs will flash cyclically and simultaneously.

The meaning of individual diagnostic LEDs in the event of a fault is explained in Table 6-2.

	red	**green**	**yellow**
off	Power is not connected or the SIGATE firmware has not yet booted.	Isochronous PROFINET IO communication has not yet booted or has been terminated.	Communication with the CU or the SIMOLINK board has not yet booted or has been terminated.
on	The SIGATE firmware is still initializing or has been terminated.	Isochronous PROFINET IO communication has stopped.	Communication with the CU or the SIMOLINK board has stopped.
flashing	The SIGATE firmware is running.	Isochronous PROFINET IO communication is running.	Communication with the CU or the SIMOLINK board is running.

Table 6-2 Meaning of LEDs

Each of the two Ethernet connection sockets is also provided with two LEDs. The green LED signals the LINK status. The yellow LED signals Ethernet activity, i.e. it always flashes when a packet is being transmitted or received on the Ethernet. No distinction is made in this case between the transmit and receive directions.

The meaning of the two LEDs on the Ethernet sockets is explained in Table 6-3.

	green	**yellow**
off	No physical connection on the Ethernet.	No Ethernet activity.
on	Physical Ethernet connection established.	–
flashing	–	Packets are being transferred on the Ethernet.

Table 6-3 Meaning of LEDs on the Ethernet sockets

Diagnostic parameters of SIGATE option module

The parameters listed in Table 6-4 are used to display further diagnostic information. They can be read out with the DriveMonitor configuring tool.

Parameter	Meaning	Remarks
R732.1	Cycle time for PROFINET IO	In µsec Example: R732.1 = 0x0FA0 corresponds to a PROFINET IO cycle of 4000 µsec
R732.2-4	MAC address	R732.2 contains bytes 1 and 2 R732.3 contains bytes 3 and 4 R732.3 contains bytes 5 and 6 Example: R732.2 = 0x0800 R732.3 = 0x0674 R732.4 = 0xA2D8 corresponds to MAC address = 08:00:06:74:A2:D8
R732.5-6	IP address	R732.5 contains bytes 1 and 2 R732.6 contains bytes 3 and 4 Example: R732.5 = 0xC0A8 R732.6 = 0x092A corresponds to IP address 192.168.009.042
R732.7-8	Subnet mask	Structure as for R732.5-6
R732.9	Internal status information	Internal use
R732.10	Parameter error	When warning 84 is activated, provides information about parameter which has triggered the warning
R732.11	Index error	When warning 84 is activated, provides information about index which has triggered the warning
R732.12-13	IP address of gateway	Structure as for R732.5-6
R732.14	Highest substitution counter used for SIMOLINK	Internal use
R732.15	Highest substitution counter used for PROFINET	Internal use
R732.16	Maximum delay of StartOP start	Internal use
R732.17	Maximum delay of StartOP end	Internal use
R732.18	Maximum delay of SYNC start	Internal use
R732.19	Maximum delay of SYNC end	Internal use
R732.20-32	Reserved	–
P698.1-13	Unit name for PROFINET IO	Displayed in hexadecimal format
R699	Unit name for PROFINET IO	Displayed in plain text

Table 6-4 Diagnostic parameters

MAC address

The MAC address of the SIGATE option module is printed on a sticker on the option module.

7 Technical Data

Module name	SIGATE (CGE)		
Order No.	6SE7090-0XX84-0FL0 (Z = G01)		
Rated input voltage	5 V ± 2 %, approx. 400 mA, internally from drive		
Operating temperature range	0 °C to +50 °C (32 °F to 122 °F)		
Storage temperature	-25 °C to +70 °C (-13 °F to 158 °F)		
Transport temperature	-25 °C to +70 °C (-13 °F to 158 °F)		
Environmental conditions - Climatic class: - Pollution stress:	 3K3 to DIN IEC 721 Part 3-3 / 04.90 3C2 to DIN IEC 721 Part 3-3 / 04.90		
Degree of pollution	2 DIN VDE 0110, Section 1/01.89. Moisture condensation is not permissible		
Degree of protection	IP00 DIN VDE 0470, Section / 11.92 ≙ EN 60529		
Mechanical specifications	DIN EN 60068-2-6: 1996		
	Frequency range	Constant amplitude of	
		deflection	acceleration
	[Hz]	[mm]	[m/s^2 (g)]
For steady-state applications	10 to 58 over 58 to 200	0.075	 9.8 (1)

NOTE

The SIGATE option module must be ordered in combination with a basic unit and the Z option G01.

8 Appendix

8.1 SIGATE parameter list

Parameter	Meaning	Remarks
P692.1	Dead time compensation for SIMOLINK	in *µsec* Can be changed in operation
P692.2	Dead time compensation for PROFINET IO	in *µsec* Can be changed in operation
P693.1	Substitution counter for SIMOLINK	The number of successive packet failures which can be tolerated on the SIMOLINK bus.
P693.2	Substitution counter for PROFINET IO	The number of successive packet failures which can be tolerated on the PROFINET IO bus.
P694.(*k* * 2 - 1)	Transformation type for SIMOLINK channel *k*	Possible settings: 0 None 1 Copy 2 Linear 3 Square
P694.(*k* * 2)	Transformation type for PROFINET IO channel *k*	Possible settings: 0 None 1 Copy 2 Linear 3 Square
P695.(*k* * 4 - 3)	Numerator for coefficient of SIMOLINK channel *k*	–
P695.(*k* * 4 - 2)	Denominator for coefficient of SIMOLINK channel *k*	–
P695.(*k* * 4 - 1)	Numerator for coefficient of PROFINET IO channel *k*	–
P695.(*k* * 4)	Denominator for coefficient of PROFINET IO channel *k*	–
P696.(*k* * 2 - 1)	SIMOLINK channel for second value with quadratic interpolation	Specified channel must be set to linear interpolation ("*linear*" transformation type).
P696.(*k* * 2)	PROFINET IO channel for second value with quadratic interpolation	Specified channel must be set to linear interpolation ("*linear*" transformation type).
P697.(*k* * 2 - 1)	Modulo value for SIMOLINK channel	0 means that modulo calculation is deactivated
P697.(*k* * 2)	Modulo value for PROFINET IO channel	0 means that modulo calculation is deactivated

Table 8-1 SIGATE parameters

8.2 References

Operating Instructions SIMOVERT MASTERDRIVES Option Modules,
Order No.: 6SE7087-6NX84-0FF5

SIMOVERT MASTERDRIVES Compendium Motion Control,
Order No.: 6SE7080-0QX70

Configuring Manual SIMOTION SCOUT,
on Scout CD

"PROFInet Installation Guideline" of PNO Germany
(PROFIBUS User Organization, www.profinet.com)
Order No.: 2.251, version V1.8, November 2002

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1	Definitionen und Warnungen	Erstausgabe	6	07.2006
2	Beschreibung	Erstausgabe	5	07.2006
3	Transportieren, Lagern, Auspacken	Erstausgabe	1	07.2006
4	Anschließen	Erstausgabe	3	07.2006
5	Inbetriebnahme	Erstausgabe	14	07.2006
6	Diagnose und Fehlersuche	Erstausgabe	3	07.2006
7	Technische Daten	Erstausgabe	1	07.2006
8	Anhang	Erstausgabe	2	07.2006

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1	Definitions and Warnings	first edition	6	07.2006
2	Description	first edition	5	07.2006
3	Transport, Storage, Unpacking	first edition	1	07.2006
4	Connections	first edition	3	07.2006
5	Commissioning	first edition	14	07.2006
6	Diagnosis and Troubleshooting	first edition	3	07.2006
7	Technical Data	first edition	1	07.2006
8	Appendix	first edition	2	07.2006

Änderungen von Funktionen, technischen Daten, Normen, Zeichnungen und Parametern vorbehalten.

We reserve the right to make changes to functions, technical data, standards, drawings and parameters.

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We have checked the contents of this document to ensure that they coincide with the described hardware and software. However, differences cannot be completely excluded, so that we do not accept any guarantee for complete conformance. However, the information in this document is regularly checked and necessary corrections will be included in subsequent editions. We are grateful for any recommendations for improvement.

Siemens AG
Automation and Drives
Motion Control Systems
P.O. Box 3180, D – 91050 Erlangen
Germany

www.siemens.com/motioncontrol

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SIMOVERT MASTERDRIVES

Betriebsanleitung
Operating Instructions

SLE / SLE-DP – SIMOLINK-Encoder

Ausgabe / Edition: AA

GWE-477 763 4070.76 J

Änderungen von Funktionen, technischen Daten, Normen, Zeichnungen und Parametern vorbehalten.

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Appendix

1 Definitions and Warnings

Qualified personnel

For the purpose of this documentation and the product warning labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up, operation and maintenance of the product. He or she must have the following qualifications:

- Trained or authorized to energize, de-energize, ground and tag circuits and equipment in accordance with established safety procedures.
- Trained or authorized in the proper care and use of protective equipment in accordance with established safety procedures.
- Trained in rendering first aid.

DANGER

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

WARNING

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

CAUTION

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

CAUTION

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

NOTICE

NOTICE used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesirable result or state.

NOTE

For the purpose of this documentation, "Note" indicates important information about the product or about the respective part of the documentation which is essential to highlight.

WARNING

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the warnings can thus result in severe personal injury or property damage.

Only qualified personnel should work on or around the equipment

This personnel must be thoroughly familiar with all warning and maintenance procedures contained in this documentation.

The successful and safe operation of this equipment is dependent on correct transport, proper storage and installation as well as careful operation and maintenance.

NOTE

This documentation does not purport to cover all details on all types of the product, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local SIEMENS sales office.

The contents of this documentation shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of SIEMENS AG. The warranty contained in the contract between the parties is the sole warranty of SIEMENS AG. Any statements contained herein do not create new warranties or modify the existing warranty.

CAUTION

Components which can be destroyed by electrostatic discharge (ESD)

The board contains components which can be destroyed by electrostatic discharge. These components can be easily destroyed if not carefully handled. If you have to handle electronic boards, please observe the following:

Electronic boards should only be touched when absolutely necessary.

The human body must be electrically discharged before touching an electronic board.

Boards must not come into contact with highly insulating materials - e.g. plastic parts, insulated desktops, articles of clothing manufactured from man-made fibers.

Boards must only be placed on conductive surfaces.

Boards and components should only be stored and transported in conductive packaging (e.g. metalized plastic boxes or metal containers).

If the packing material is not conductive, the boards must be wrapped with a conductive packaging material, e.g. conductive foam rubber or household aluminum foil.

The necessary ESD protective measures are clearly shown again in the following diagram:

- a = Conductive floor surface
- b = ESD table
- c = ESD shoes
- d = ESD overall
- e = ESD chain
- f = Cubicle ground connection

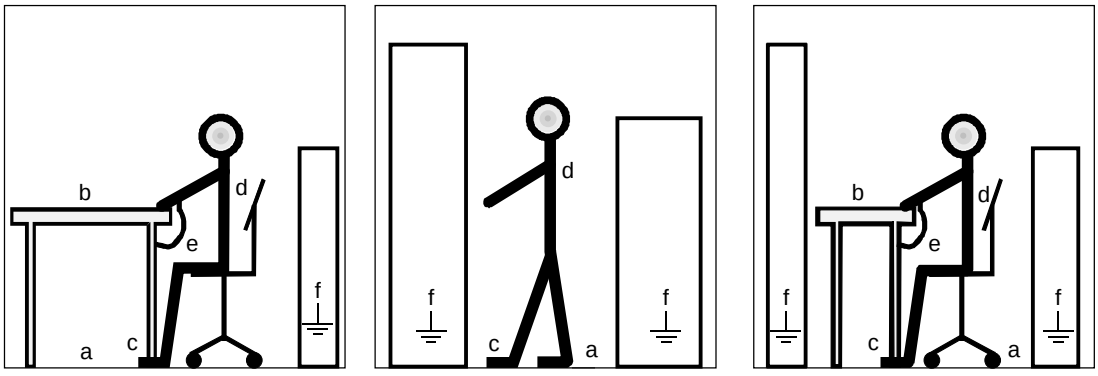


Fig. 1-1 ESD protective measures

2 Description

In drive configurations with an "electrical shaft", simple auxiliary drives operating in angular synchronism or other devices which require an actual position value of the machine are often needed in addition to the main position-controlled drives. These auxiliary drives and devices have a pulse encoder input and read in the data supplied by a pulse encoder mounted centrally on the line shaft. On drives with an electrical shaft and flexible configuration, this central point is often impossible to physically define. The SIMOLINK Encoder (SLE) thus simulates an encoder on the electrical shaft and supplies a central actual machine value (actual position) which is generated from the master setpoint. The electrical shaft with the position-controlled main drives is implemented by means of SIMOLINK and MASTERDRIVES Motion Control drives.

Using an angle setpoint transported via SIMOLINK, the SIMOLINK Encoder generates two pulse signals in quadrature and a zero pulse. These are supplied to further devices via the RS422 (EIA422 standard). It thus simulates a pulse encoder with selectable pulse number per revolution (1024, 2048, 4096, 8192).

There are two models of SIMOLINK Encoder. The SLE module offers SIMOLINK functionality and a built-on parameterization device. The SLE-DP module (SIMOLINK Encoder with PROFIBUS-DP interface) features the additional option of altering certain parameter settings remotely via the PROFIBUS.

The SIMOLINK transmission medium is a fiber-optic cable. Fiber optics made of glass or plastic may be used. SIMOLINK has a ring-shaped structure, with each node in the ring acting as a signal amplifier. A maximum of 201 active nodes can be interconnected on the SIMOLINK ring.

NOTE

For further information about SIMOLINK, please refer to Chapter "Communication / SIMOLINK" of the SIMOVERT MASTERDRIVES Compendium Motion Control, Order No.: 6SE7087-6QX50.

2.1 SIMOLINK functionality

The incoming optical signals from the fiber-optic cable are converted to electrical signals by means of fiber optic receivers on all SIMOLINK modules and then transferred to the fiber-optic transmitter where they are converted back to optical signals. The propagation delays caused by this process are calculated while SIMOLINK is booting and the dead times compensated accordingly for active SIMOLINK nodes. The receive information is derived, depending on parameterization, from the buffered, electrical signals and transferred with the SYNC interrupt (last telegram in SIMOLINK polling). The transmit information of the node is transferred in the opposite direction and written to the associated telegrams (electrical signals).

The SIMOLINK Encoder is incorporated in the SIMOLINK ring like a SIMOLINK slave; it is an active node and included in the dead-time calculation. It returns its actual angle output and status via the SIMOLINK. Its SIMOLINK addresses (node address and receive address) are set via the DIL switches on the right-hand housing panel. The telegram of the set receive address (dispatcher mode: address of SIMOLINK node which transmits the setpoint) and receive channel contains the 15-bit-wide angle setpoint (0…32767, i.e. 360° of one encoder revolution is resolved with approximately 0.01°), an offset of the SIMOLINK Encoder zero pulse as well as an output enable control bit.

The position of the zero pulse of the SIMOLINK Encoder need not coincide with the zero position of the setpoint. This offset is managed by the transmitting node, sent to the SIMOLINK Encoder as a setting value and loaded when enabled.

The setpoint resolution of 32768 corresponds to 8192 encoder pulses per revolution (pulse quadruplication is needed to ensure a correct signal sequence of edge changes on tracks A and B). Other possible pulse numbers per revolution (4096, 2048, 1024) are obtained by frequency division. The rated speed of the SIMOLINK Encoder is 25 revolutions of the electrical shaft per second (rated output frequency: 204.800 kHz with 8192 pulses); the SIMOLINK Encoder is capable of outputting 125 % correctly (maximum output frequency: 256.000 kHz) and the output pulses are recorded as an actual value via a counter.

The SIMOLINK Encoder has an internal controller which accepts the new position setpoint from the receive telegram with every SYNC interrupt. It uses this and its own actual value to calculate a manipulated variable (number of pulses to be output for the next SIMOLINK cycle, i.e. frequency setpoint) for the frequency generator.

The SIMOLINK Encoder operates only in the SIMOLINK dispatcher mode, with cycle times of 1.6 ms or 3.2 ms (dispatcher mode means exactly 251 SIMOLINK telegrams in 1.6 ms cycle or 503 SIMOLINK telegrams in 3.2 ms cycle).

2.2 PROFIBUS function expansion

In addition to the SIMOLINK functionality described above which is incorporated in both encoder models, the SLE-DP variant has been expanded by a PROFIBUS interface which supports data transmission rates of up to 12 Mbaud. The SLE-DP can be installed as a compatible alternative to the SLE since it features the same built-on parameterization device. Only its housing is wider than that of the SLE variant.

The SLE-DP is a passive PROFIBUS-DP slave with 2 bytes each of output and input data which must be processed as consistent data (i.e. word processing permitted only on transfer) and transmitted cyclically. The encoder can be activated and deactivated via its PROFIBUS interface. The same interface can be used to change the SIMOLINK receive address and receive channel, allowing automatic switchover between setpoints from different sources.

NOTE

For further information about PROFIBUS, please refer to Chapter "Communication / PROFIBUS" of the SIMOVERT MASTERDRIVES Compendium Motion Control, Order No.: 6SE7087-6QX50.

3 Technical Data

Product name	**SLE-DP**	**SLE**
Order number	6SX7005-0AG01	6SX7005-0AG00
Size [mm]: – Width – Height – Depth	Dimensions (housing) 52 (52) 118 (107) 88 (80)	Dimensions (housing) 35 (35) 118 (107) 88 (80)
Weight	Approx. 400 g	Approx. 300 g
Degree of protection	IP20 to EN 60529	
Degree of pollution	Not applicable Moisture condensation is not permissible in operation	
Mechanical strength: – In steady-state operation – During transportation	Not applicable	
Climate class	Class 3K3 to DIN IEC 721-3-3 (in operation)	
Cooling method (operation)	Convection	
Permissible ambient or coolant temperature: – In operation – In storage – During transportation	 0 °C to +55 °C –25 °C to +70 °C –25 °C to +70 °C	
Permissible humidity rating: – Transport/storage – In operation	Relative air humidity ≤ 95 % ≤ 85 % (condensation not permitted)	
Power supply		
Rated supply voltage	DC +24 V (+21 V to +28 V)	
Power consumption	Approx. 200 mA	Approx. 130 mA
Encoder interface		
Track A, track B, zero track	RS422 to EIA422 standard	
Supply voltage: – Electrical isolation	Internal Isolating voltage 500 V DC to 24 V voltage supply Isolating voltage 500 V DC to PROFIBUS interface	
Fiber-optic cable connection		
Transmitter power	Fixed (maximum transmitter power defined for SIMOLINK)	
Fiber-optic cable modules – Transmitter – Receiver	Hewlett Packard: HFBR 1528 HFBR 2528	
PROFIBUS interface		
Supply voltage: – Electrical isolation	Internal Isolating voltage 500 V DC to 24 V voltage supply **and** encoder interface	
Output voltage	DC + 5 V, max. 100 mA – for bus connection or – supply of an OLP	
Data transfer rate	Max. 12 Mbaud	

Table 3-1 Technical data

4 Installation

The SIMOLINK Encoder module is snapped onto an EN 50022-compliant TS 35 top-hat rail. The requisite mechanical mounting elements are fitted in the housing.

4.1 EMC measures

The module is connected to ground via the top-hat rail. The ground connection between the rail and the equipotential bonding conductor must be made by the end-user during installation.

NOTE

For further information, please refer to Chapter "Instructions for Design of Drives in Conformance with EMC Regulations" of the SIMOVERT MASTERDRIVES Compendium Motion Control, Order No.: 6SE7087-6QX50.

4.2 Housing

The following diagrams show a schematic illustration of the housing and the layout of connections and operating elements.

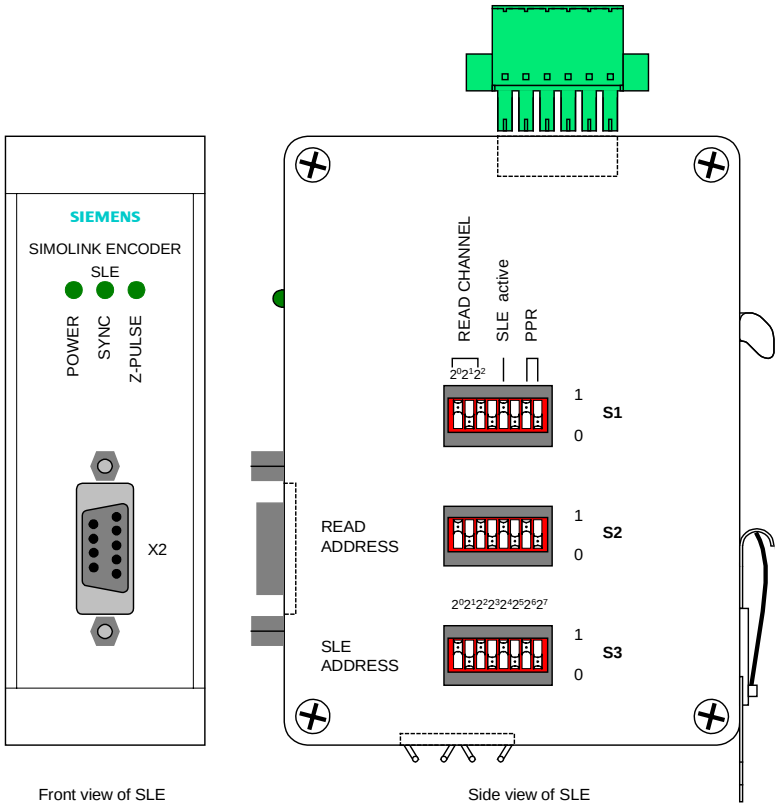


Fig. 4-1

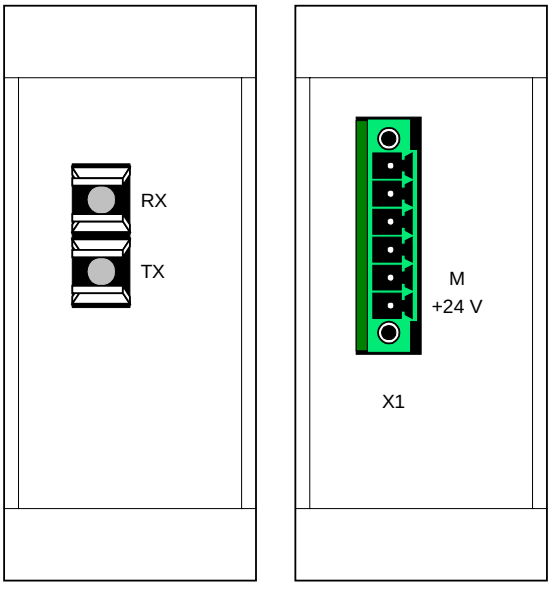


Fig. 4-2

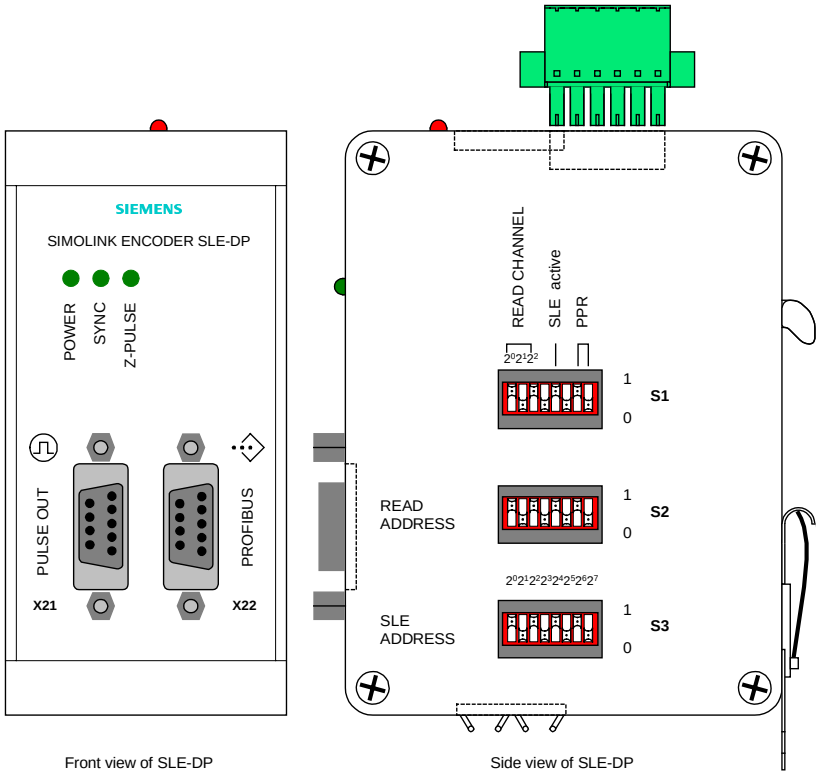

SIEMENS
SIMOLINK ENCODER SLE-DP
POWER
SYNC
Z-PULSE
PULSE OUT
PROFIBUS
X21
X22
READ CHANNEL
SLE active
PPR
S1
S2
S3
READ ADDRESS
SLE ADDRESS
Front view of SLE-DP
Side view of SLE-DP

Fig. 4-3

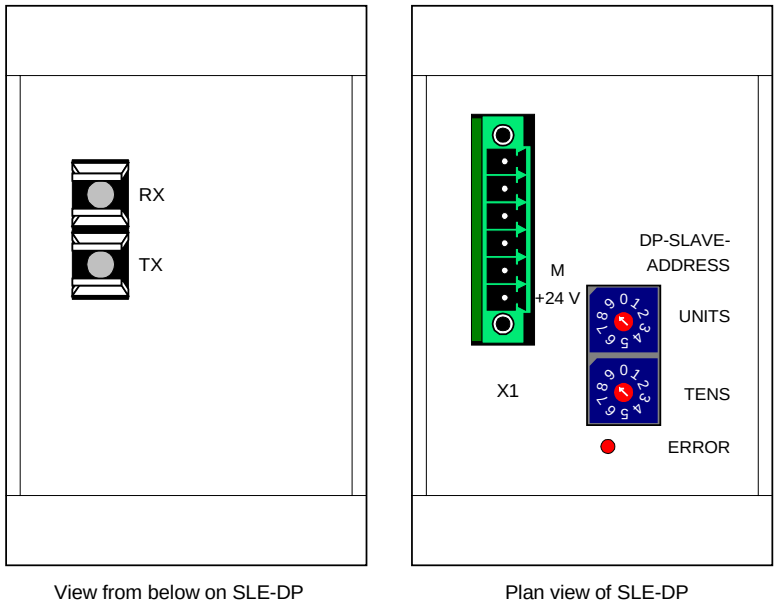

RX
TX
M
+24 V
X1
DP-SLAVE-ADDRESS
UNITS
TENS
ERROR
View from below on SLE-DP
Plan view of SLE-DP

Fig. 4-4

5 Connections

The SIMOLINK Encoder has

- the X1 sockets for voltage supply,
- an encoder interface for signal outputs (X2 on SLE, X21 on SLE-DP) and
- a SIMOLINK fiber-optic cable connection with one transmit socket and one receive socket.

The SLE-DP module also has socket X22 for the PROFIBUS-DP connection in compliance with EN 50170.

5.1 Connector X1

The 6-pin connector is on top of the housing. The 24 V power supply to the SIMOLINK Encoder is connected via X1 (connector type MINI-COMBICON MC1.5/6-STF-3.81).

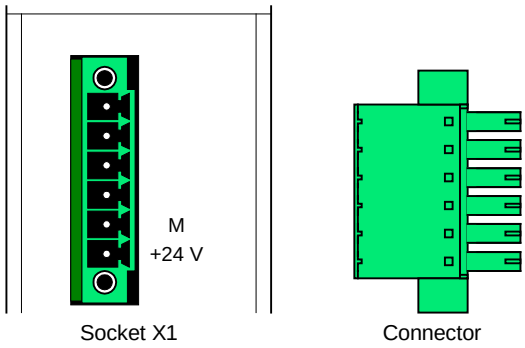


Fig. 5-1

Terminal	Designation	Meaning	Range
1			n.c.
2			n.c.
3			n.c.
4			n.c.
5	M	Ground	
6	+24 V	24 V voltage supply	+21 ... 28 V

Connectable cross-section: 1.5 mm^2 (AWG 16)

Terminal 1 is the terminal to the rear of the module top plate (see plan view).

Table 5-1 Connector assignments

5.2 Encoder interface (X2 on SLE, X21 on SLE-DP)

The encoder interface of the SIMOLINK Encoder is the 9-pin, SUB D socket with screw locking mechanism (UNC) on the front of the housing. Three RS422 drivers each supply two signals per pulse output, one with non-inverted signal level and one with inverted signal level. The output signals of the encoder interface are isolated from the 24 V supply voltage (X1) and (on the SLE-DP) from the PROFIBUS interface (X22).

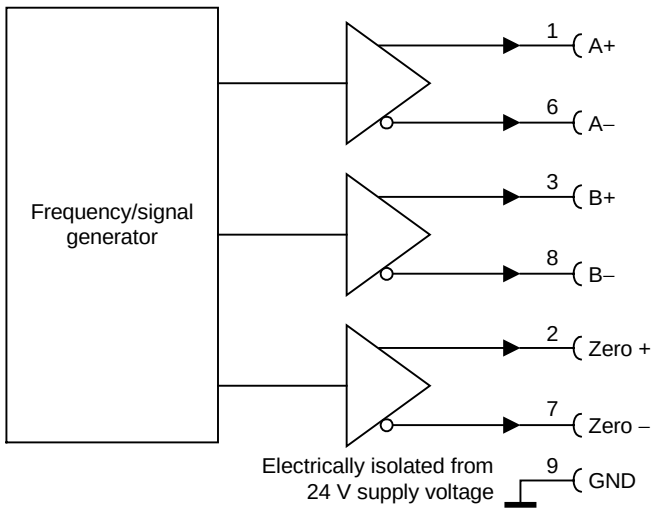


Fig. 5-2 Schematic of output circuit

The encoder interface on the SLE module is labeled X2. The encoder interface on the SLE-DP module has the designation X21, but is also labeled with "PULSE OUT" and the following symbol: ⏚

CAUTION

The connector hardware for both the encoder interface and the PROFIBUS interface is a 9-pin SUB D socket. The two interfaces are distinguishable only by their labeling and position (cf. Fig. 4-3). The plug and socket must be connected correctly by the end-user during installation.

Pin	Signal	Meaning	Range
1	A +	Track A Not inverted	RS422 standard
6	A –	Track A Inverted	
3	B +	Track B Not inverted	RS422 standard
8	B –	Track B Inverted	
2	Zero +	Track zero pulse, not inverted	RS422 standard
7	Zero –	Track zero pulse, inverted	
9	GND	Signal ground (see below)	
4, 5		Unused	n.c.
Housing	Outer shield		

9-pin SUB D socket with screw locking mechanism (UNC)

Table 5-2 Assignments on encoder interface connector (X2 on SLE, X21 on SLE-DP)

NOTICE

To maintain immunity to interference, a shielded cable must be used and the shield attached in the connector housing.

CAUTION

One or several drives/devices can be connected to the SIMOLINK Encoder. When the SIMOLINK Encoder is operated in conjunction with one drive/device, the GND signal should be connected in the cable. If several drives/devices are connected to the SIMOLINK Encoder, the GND signal should not be connected; it must be noted in this respect that large deviations in the 0 V (GND) on different drives/devices can cause disturbances or malfunctions on the RS422 bus.

The signal generator forms three signals, two with a phase displacement of ± 90° and one as a zero pulse. The pulse/pause ratio of the two phase-displaced signals is 1:1 in each case. The pulse width of the zero pulse is ¼ of a period of the phase-displaced signals (pulse width 90° el.).

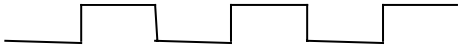
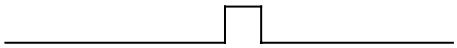
Setpoint input		Signal shape at output t →
Increasing setpoints (pos. rotation)	Track A	
	Track B	
	Zero track	
Decreasing setpoints (neg. rotation)	Track A	
	Track B	
	Zero track	

Table 5-3 Signal output on zero crossover

The number of pulses/rev of the encoder interface can be selected by means of DIL switches on the right-hand panel (Table 6-1). The following pulses/rev settings are available: 8192, 4096, 2048, 1024.

5.3 PROFIBUS interface (X22 on SLE-DP)

The interface between the SLE-DP and the PROFIBUS line is the EN 50170-compliant 9-pin SUB D socket with screw locking mechanism (UNC) on the front of the housing. It is labeled with the designation X22 as well as "PROFIBUS" and the following symbol: ⋰◇. The interface supplies an electrically isolated, short-circuit-proof supply voltage for the optional connection of an OLP (Optical Link Plug). All PROFIBUS signals are isolated from the 24 V voltage supply (X1) and the encoder signals (X21).

CAUTION

The connector hardware for both the encoder interface and the PROFIBUS interface is a 9-pin SUB D socket. The two interfaces can be distinguished only by their labeling and position (cf. Fig. 4-3). The plug and socket must be connected correctly by the end-user during installation.

Pin	Signal	Meaning	Range
1		Unused	n.c.
2		Unused	n.c.
3	RxD/TxD-P	PROFIBUS data - P (non-inverted)	RS485
4	CNTR-P	Control signal for PROFIBUS OLP	TTL
5	DGND	Ground for PROFIBUS data	0 V
6	VP	Positive supply voltage for terminating resistor and OLP	DC + 5 V ± 10 % for OLP max. 100 mA
7		Unused	n.c.
8	RxD/TxD-N	PROFIBUS data - N (inverted)	RS485
9		Unused	n.c.
Housing	Outer shield		

9-pin SUB D socket with screw locking mechanism (UNC)

Table 5-4 Assignments of PROFIBUS interface connector (X22 on SLE-DP)

NOTE

The cables must be connected by means of PROFIBUS connectors since these contain the bus terminating resistors.

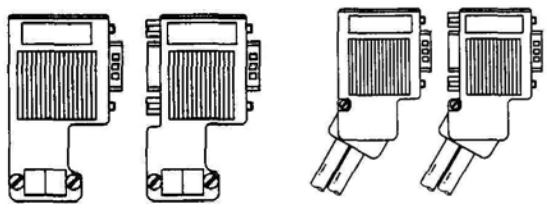


Fig. 5-3 Suitable PROFIBUS connectors

NOTICE

The terminating resistors must be switched on in the first and last nodes in the PROFIBUS line; correct setting of these resistors is essential for error-free data transmission. The cable shield must be connected at both ends in a 360° connection.

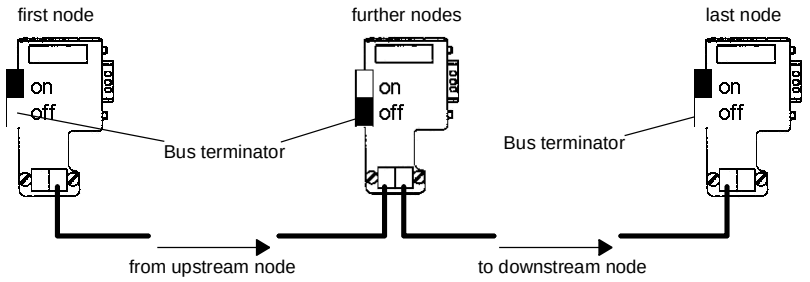


Fig. 5-4 Position of bus terminating resistors

5.4 Fiber-optic cable connection

The fiber-optic cables are connected via plug-and-socket connectors. The transmit and receive sockets are on the bottom of the housing (Fig. 4-2, Fig. 4-4). The output power of the fiber-optic transmitter is not variable, but permanently set to the maximum transmitter power defined for SIMOLINK.

SIMOLINK is a clocked, ring-shaped fiber-optic bus system. To allow the flow of signal traffic, the transmit socket of the first node must be connected to the receive socket of the next node and so on, until the transmit socket of the last node is connected to the receive socket of the first node.

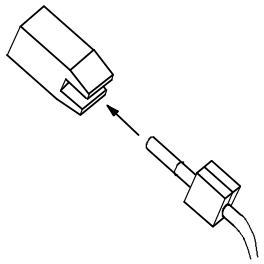


Fig. 5-5 Bus connector

The receive socket is dark gray and labeled RX. The transmit socket is light gray and labeled TX.

The following Hewlett Packard fiber-optic modules are installed in the SIMOLINK Encoder:

- Transmitter: HFBR 1528
- Receiver: HFBR 2528

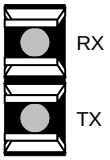


Fig. 5-6 Fiber-optic connector

Plastic or glass fiber-optic cables can be used. Depending on the type of cable selected, the inter-node distances are as follows:

- Max. 40 m between each node in the case of plastic cables or
- Max. 300 m between each node in the case of glass cables.

The maximum permissible ring bus length is 1000 m.

NOTE

A components package for assembling plastic fiber-optic cable connections can be ordered under number 6SX7010-0FJ50. This contains: 100 m plastic fiber-optic cable, 40 fiber-optic connectors, 20 connectors for terminal strip X470 SLB.

NOTICE

If glass fiber optics are the selected medium, the connectors attached to the fiber-optic cable must be suitable, i.e. they must fit into the transmit and receive sockets on the SIMOLINK Encoder.

How to assemble a bus cable

To make connections on a plastic fiber-optic cable, please follow the instructions below:

1. Cut the correct length of fiber-optic cable. Make sure you cut the cable at right angles, use a sharp knife (Fig. 5-7 ①).
2. Remove approximately 7 mm of the outer, black sheath on the cable using a suitable cable stripping device. Take great care not to damage the fiber optic when removing the sheath!
3. Insert the fiber-optic cable into the connector (Fig. 5-7 ②) and push it into the cylindrical sleeve as far as it will go. The transparent fiber optic will protrude out of the other side of the sleeve.
4. Fold round the gripping half of the connector and close it by hand (Fig. 5-7 ③). Once the top half of the connector is latched into the lower half, the cable is lodged securely in the connector.
5. Use a sharp knife to cut the protruding end of the cable almost flush with the connector surface. Cut at right angles to the fiber-optic cable axis.
6. You now need to polish the surface of the fiber optic. To do this, place the end of the sleeve flat on the surface of the matt, rough side of the green polishing paper supplied, and "draw" a figure of 8. Then clean the end with a clean, lint-free cloth.
7. The sleeve end can be polished finely to reduce throughput losses to a minimum. Fine polishing reduces throughput losses by approximately 2 dB. To fine polish the sleeve, place it vertically on the matt, rough side of the pink polishing paper and "draw" a figure of 8 about 25 times. Then clean the end again with a clean, lint-free cloth.

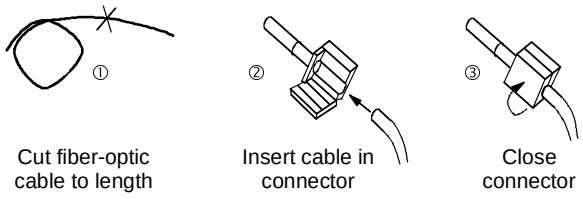


Fig. 5-7 Connecting a plastic cable

6 Start-Up

The sequence of parameterizing steps for starting up the SIMOLINK Encoder is as follows:

1. Set the SIMOLINK Encoder address on DIL switch S3
2. Set the SIMOLINK receive address on DIL switch S2
3. Set the SIMOLINK receive channel on DIL switches S1.1 - 1.3
4. Set the required number of pulses/revolution on DIL switches S1.7 - 1.8
5. Activate the SIMOLINK Encoder via DIL switch S1.5
6. Configure the SIMOLINK node which will transmit the setpoint

The SIMOLINK node which transmits the setpoint sets the position of the zero pulse and starts the output of pulses via SIMOLINK if required.

When the parameters listed above have been set, both the SLE and the SLE-DP encoder model is ready to operate. The PROFIBUS network must also be set up and running before the PROFIBUS functionality can be utilized. The remote parameter setting capability of the SLE-DP via PROFIBUS will be available once the following settings have been made (example given for SIMATIC S7):

1. Configure the SLE-DP as a PROFIBUS-DP slave in the SIMATIC Manager
2. Program the SLE-DP address swap and the SLE-DP activation in the control program

Via the PROFIBUS network the SLE-DP can be deactivated and the receive address and receive channel altered; for this purpose, the address and channel set via the DIL switches are OR'd bit-serially with the value from the PROFIBUS telegram. The local and PROFIBUS activation commands for the encoder have equal priority but DIL switch S1.5 must be set for the PROFIBUS activation option. The SIMOLINK node that transmits the setpoint and whose receive telegram is selected in the SLE-DP also determines the position of the zero pulse and starts pulse outputs via SIMOLINK if required.

6.1 DIL switch settings

The DIL switch settings apply to both models of SIMOLINK Encoder. Special features of the SLE-DP encoder are described in Section 6.4.

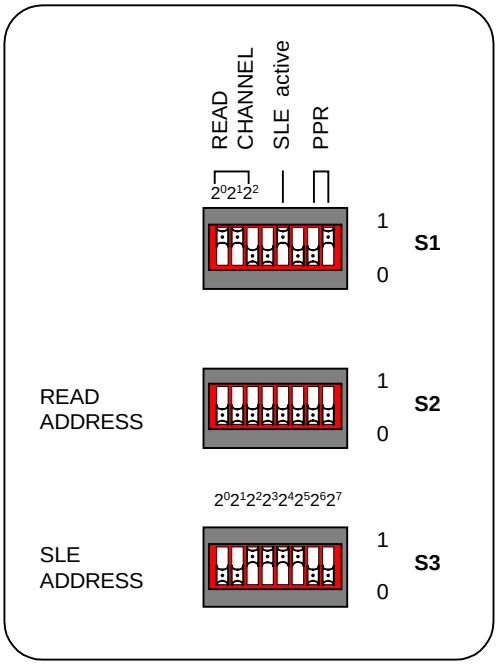


Fig. 6-1 *Layout of DIL switches on right-hand side panel of SLE / SLE-DP*
Illustrated settings:
Read channel = 3, SLE active, number of pulses = 4096 pulses/rev, read address = 0, SLE address = 60

6.1.1 Top DIL switch S1

DIL switch S1 serves to set the receive (read) channel for the SIMOLINK setpoint telegram, select the number of pulses/revolution of the encoder interface and activate or deactivate the SIMOLINK encoder.

Switch	Designation	Meaning	Range
S1.1	2^0 READ CHANNEL	Receive channel for setpoint telegram (part of telegram addressing which contains the setpoint for the SIMOLINK Encoder) Note: S1.1 is the least significant bit	0…7
S1.2	2^1		
S1.3	2^2		
S1.4	-	Reserved	0
S1.5	SLE active	'0': SLE deactivated / '1': SLE active	0 / 1
S1.6	-	Reserved	0
S1.7	PPR	Number of pulses/rev. see Table 6-2	0…3
S1.8			

Table 6-1 Meaning of DIL switch S1

The setpoint telegram is addressed via the receive address (DIL switch S2) and the receive channel. The same channel number must be set on DIL switches S1.1 to S1.3 as is used for this setpoint by the setpoint-generating SIMOLINK node.

The SIMOLINK Encoder can operate with pulse/rev. numbers of 8192, 4096, 2048, 1024.

S1.7	S1.8	Number of pulses/rev. on encoder interface
0	0	1024
1	0	2048
0	1	4096
1	1	8192

Table 6-2 Selection of pulses/rev. number on encoder interface

Switch S1.5 is used to activate the SIMOLINK Encoder. The settings of all the DIL switches, i.e. S1 to S3, are accepted only when the encoder is deactivated (S1.5 in position 0) and remain frozen as soon as the encoder is activated or are accepted when the supply voltage is connected and S1.5 = 1.

The SIMOLINK Encoder does not output pulses until it has been started with the control bit by the setpoint-transmitting node and has received a setpoint (speed other than zero).

6.1.2 Center DIL switch S2

The receive (read) address of the SIMOLINK setpoint telegram is set on DIL switch S2 (dispatcher mode: Address of setpoint-transmitting SIMOLINK node).

Switch	Designation	Meaning	Range
S2.1	2^0	Receive address for setpoint telegram (part of telegram addressing which contains the setpoint for the SIMOLINK Encoder) Note: S2.1 is the least significant bit	0…200
S2.2	2^1		
S2.3	2^2		
S2.4	2^3		
S2.5	2^4		
S2.6	2^5		
S2.7	2^6	Receive address for setpoint telegram for hardware versions from 02 onwards	0…255
S2.8	2^7		

Table 6-3 Meaning of DIL switch S2

NOTE

If the SIMOLINK Encoder is activated even though the receive address is incorrectly set (i.e. >200), then in the case of hardware version 01 the wrong receive address is transferred for the read channel and displayed via LEDs on the housing front panel.

From hardware version 02 onwards, receive addresses from 201...255 (Channel 0 to 7) can also be set on the SLE-DP. But the only values that make sense are Address 201, Channel 0 (special data double word 1), Address 202, Channel 0 (special data double word 2), Address 203, Channel 0 (special data double word 3) and Address 204 (special data double word 4).

6.1.3 Bottom DIL switch S3

The node address of the SIMOLINK Encoder is set via DIL switch S3.

Switch	Designation	Meaning	Range
S3.1	2^0	SIMOLINK Encoder node address Note: S3.1 is the least significant bit	1…200
S3.2	2^1		
S3.3	2^2		
S3.4	2^3		
S3.5	2^4		
S3.6	2^5		
S3.7	2^6		
S3.8	2^7		

Table 6-4 Meaning of DIL switch S3

The SIMOLINK Encoder returns its internal pulse counter actual value plus a status bit "STATUS-SLE" via SIMOLINK. It writes this to its actual-value telegram that is defined by the send address (= node address) and channel address (= 0, fixed setting).

NOTICE

If the SIMOLINK Encoder is activated even though the node address is incorrectly set (i.e. 0 or >200), then ’1’ is transferred as the node address, i.e. the SIMOLINK Encoder writes to the telegram of the node with address ’1’.

6.2 LED displays

6.2.1 SIMOLINK Encoder status

The status of the SIMOLINK Encoder as regards SIMOLINK addressing and pulse outputs is indicated via three green LEDs on the front panel.

NOTE

The status of the SLE-DP encoder module can also be read out via the PROFIBUS (cf. Section 6.4.6).

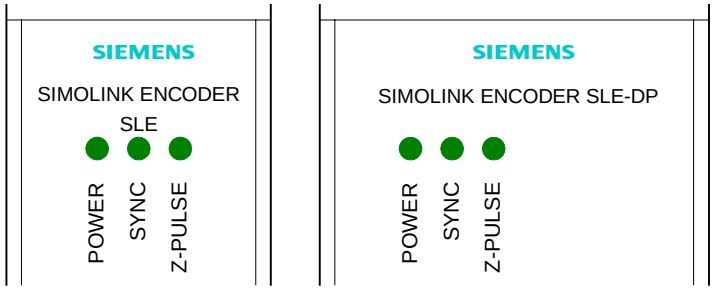


Fig. 6-2

LED			Description
POWER	**SYNC**	**Z-Pulse**	
○	○	○	Device not connected to supply voltage No + 24 V supply voltage available
●	○	○	Supply voltage connected: SYNC interrupt is **not** being received
●	✸	✸	DIL switch is incorrectly set: Address switch is outside permissible range, SYNC and Z-Pulse LEDs are flashing synchronously
●	✸	○	SIMOLINK cycle time is not defined: SYNC interrupt is outside 1.6 / 3.2 ms cycle (251/502 telegram times, dispatcher mode)
●	●	○	SYNC interrupt is being received in the correct cycle: SIMOLINK Encoder has not been activated **or** setpoint telegram is not being received **or** pulse output is not enabled via the control bit **or** speed setpoint = 0 is being transmitted
●	●	●	Device is outputting signals Z-PULSE LED is flashing in synchronism with zero pulse (appears to be illuminated steadily at high speeds)

○ LED off

● LED illuminated continuously

✸ LED flashing (approximately twice per second)

Table 6-5 SIMOLINK Encoder operating states

NOTICE

An illuminated POWER LED does not necessarily confirm that the supply voltage level is correct. The operator is responsible for ensuring that the voltage supply remains stable within the specified limits.

6.2.2 PROFIBUS interface status (SLE-DP)

The status of the PROFIBUS interface on the SLE-DP is indicated via a red LED on top of the housing next to the address switches.

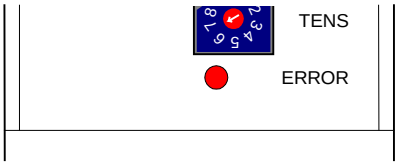


Fig. 6-3 SLE-DP; PROFIBUS display

LED ERROR	Description
○	LED off: SLE-DP is activated cyclically via the PROFIBUS
●	LED illuminated continuously: SLE-DP is **not** activated via the PROFIBUS or there is a communication error in the PROFIBUS network

Table 6-6 SLE-DP; status of PROFIBUS interface

6.3 SIMOLINK data interface

6.3.1 General

The SIMOLINK Encoder does not output any pulses when the supply voltage has been connected; instead, the SIMOLINK data interface waits for the SIMOLINK ring connection to be established.

In every cycle, the encoder receives a setpoint with control bit in a 32-bit telegram via the SIMOLINK data interface and returns its actual value with status bit in a 32-bit telegram via the same route.

The setpoint telegram is defined by means of the receive channel and address set on DIL switches S1 and S2 (cf. Section 6.1). On the SLE-DP both of these values can be altered via the PROFIBUS interface (cf. Section 6.4). The actual-value telegram is defined by the SIMOLINK node address = transmit address of the SIMOLINK Encoder, as well as the permanently set transmit channel ’0’.

To ensure that the SIMOLINK Encoder can operate in the SIMOLINK ring, the cycle time in SIMOLINK dispatcher mode must be 1.6 or 3.2 ms, i.e. exactly 251 telegrams for one SIMOLINK cycle of approximately 1.6 ms or exactly 503 telegrams for one SIMOLINK cycle of approximately 3.2 ms. The SYNC LED illuminates continuously only if one of these two cycle times is selected and only then is the encoder ready to operate.

NOTICE

The SYNC LED flashes if a cycle time other than the two above is selected (flashing frequency about 2 Hz, Z-PULSE LED remains off). When a cycle other than 1.6 / 3.2 ms is selected, the encoder will not output any pulses, even if it is correctly activated, and the bit ’SLE status’ in the SIMOLINK actual-value telegram remains inactive at ’0’.

6.3.2 Data format of setpoint telegram

The 32-bit setpoint telegram contains the momentary 15-bit setpoint, the 15-bit setting value for the zero pulse and a control bit.

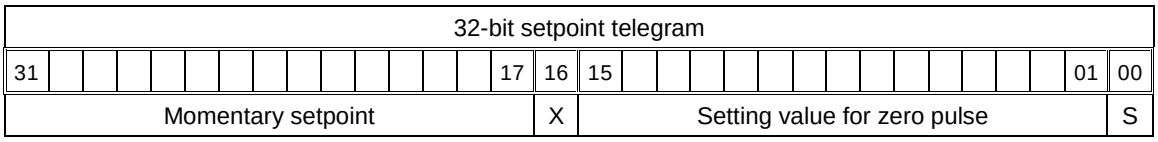


Fig. 6-4 SIMOLINK setpoint telegram

Bit	Designation	Meaning
31…17	Momentary setpoint	Momentary 15-bit setpoint: 0…32767 corresponds to an encoder revolution of 0…360° or 8192 output pulses (4096, 2048 and 1024 can also be set on the SIMOLINK Encoder)
16	-	Unused
15…01	Setting value for zero pulse	Momentary 15-bit setting value for the zero pulse: Identical normalization to 'momentary setpoint'; absolute position of zero pulse of SIMOLINK Encoder; transferred once when edge of bit 00 changes from 0 → 1.
00	SLE control	Enabling of pulse outputs: 'SLE control' = 0 Pulse output by SIMOLINK Encoder is disabled 'SLE control' = edge change 0 → 1 Internal counters of SIMOLINK Encoder are loaded with reference values (position of zero pulse) 'SLE control' = 1 Pulse output by SIMOLINK Encoder is enabled

Table 6-7 Meaning of SIMOLINK setpoint telegram

6.3.3 Data format of actual-value telegram

The 32-bit actual-value telegram contains the momentary 15-bit actual pulse output value, a status bit plus an internal counter value.

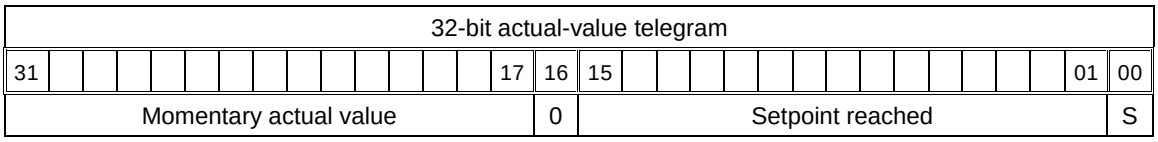


Fig. 6-5 SIMOLINK actual-value telegram

Bit	Designation	Meaning
31…17	Momentary actual value	Momentary 15-bit actual value: 0…32767 corresponds to an encoder revolution of 0…360° or 8192 output pulses (4096, 2048 and 1024 can also be set on the SIMOLINK Encoder); the zero pulse is output on transition from 32767 to 0
16	-	Unused: Preset to '0'
15…01	Setpoint reached	Assigned to internal counter: Setpoint reached by the SIMOLINK Encoder
00	SLE status	Status feedback of SIMOLINK Encoder: 'SLE status' = 0 SIMOLINK Encoder is not outputting pulses (not started) 'SLE status' = 0 and 'SLE control' = 1 Activation error: SIMOLINK Encoder has not been activated via DIL switch S1.5 **or** has not been activated via PROFIBUS in the case of SLE-DP **or** is indicating an error **or** receive telegram set for the SIMOLINK Encoder does not match the setpoint telegram 'SLE status' = 1 SIMOLINK Encoder is active and outputting pulses

Table 6-8 Meaning of SIMOLINK actual-value telegram

NOTICE

The actual position value that can be read from the SIMOLINK Encoder is affected by a SIMOLINK-dependent time delay.

6.3.4 Operating principle

A position setpoint that is identical to the master setpoint transferred to the main drives except for its normalization is sent to the SIMOLINK Encoder in the 1.6 or 3.2 ms cycle in the setpoint telegram. Since the position of the zero pulse (zero position) of the encoder need not match the zero position of the master setpoint, it is possible to supply the encoder with an offset by transmitting the reference position of the zero pulse when pulse output is enabled (the offset cannot be altered once the encoder is operating).

The SIMOLINK Encoder has two internal counters, one actual-value counter and one setpoint counter. The actual-value counter is set to the transferred 'setting value for zero pulse' by the 'SLE control' bit when pulse output is enabled. This device counts the pulses output to the encoder interface, and also outputs the zero pulse when it overruns from 32767 to 0. The transferred 'momentary' setpoint is stored in the setpoint counter. The difference between the contents of these two counters constitutes the manipulated variable (number of pulses to be output) for the frequency generator during the next cycle. The counters always operate in a numerical range of 0 to 32767 owing to the pulse quadruplication at 8192 pulses/rev needed to ensure a correct pulse sequence and the 90° zero pulse. The electrical pulses output on the encoder interface are acquired by frequency division depending on the selected number of pulses per revolution.

The maximum speed of the SIMOLINK Encoder is 25 revolutions per second (rated output frequency 204.800 kHz for 8192 pulses/rev.); it is capable of outputting speeds of up to 125 % (max. output frequency 256.000 kHz) correctly.

NOTICE

The SIMOLINK Encoder achieves the same dynamic response as MASTERDRIVES MC devices by delaying transfer of the setpoint for a period corresponding to the setpoint transit delay in the MASTERDRIVES MC. This means in practice that a position-controlled MC device reaches the same position as the SIMOLINK Encoder in terms of actual position in every cycle (both devices with no offset or an identical offset in relation to master axis). The configuring parameter settings for the MC device must be noted in this respect (cf. Section 6.5).

CAUTION

If transmission errors occur on the SIMOLINK, then a transmission cycle may be missed, i.e. the SYNC pulse is not transferred. If the SLE has reached its interpolated setpoint before the error occurs, then it stops. Since the SYNC pulse does not arrive, no pulses are output, and the angular position thus left unchanged, until the next SYNC pulse arrives.

6.4 PROFIBUS interface on SLE-DP

This Chapter contains the technical descriptions and start-up instructions relating to the PROFIBUS functional expansion of the SIMOLINK Encoder. It therefore applies only to the SLE-DP encoder model.

The receive address and address channel for the SLE-DP encoder can be altered via the PROFIBUS-DP. This is done by OR'ing the DIL switch position and the value from the PROFIBUS telegram bit by bit. For the purpose of data transfer control, the method of activating or deactivating the SLE-DP via the PROFIBUS has equal priority to the method using DIL switch setting S1.5.

The PROFIBUS configuration and a sample program are explained below based on the example of a SIMATIC S7 application.

6.4.1 General

The SIMOLINK Encoder SLE-DP is a passive PROFIBUS-DP slave node with 2 bytes each of output and input data which must be processed as consistent data (i.e. word processing permitted only on transfer via PROFIBUS) and transmitted cyclically. It supports data transfer rates of up to 12 Mbaud and guarantees conformity with EN 50170 through the use of a PROFIBUS ASIC.

The term "input data" refers to data which the SLE-DP as a PROFIBUS slave makes available to the PROFIBUS master (in this instance, SLE-DP status and error bits) and the term "output data" to information which the PROFIBUS master transfers to the SLE-DP (in this instance, address changes to the SLE-DP).

PROFIBUS telegram	Telegram type	Meaning for SLE-DP	Impl.
SET_PARAM	Parameter	Necessary data stored in the GSD file	Yes
GET_CONFIG	Configuration	Identifier bytes contained in the GSD file	Yes
SLAVE_DIAG	Diagnosis	SLE-DP makes no user-specific diagnostic data available	-
SET_SLAVE_ADRESS	Change slave address	SLE-DP station address **cannot** be altered via the PROFIBUS	No
FREEZE-/SYNC mode	Data transfer control	Supported by the ASIC, but irrelevant for SLE-DP	-

Table 6-9 SLE-DP: PROFIBUS telegrams supported by encoder

6.4.2 PROFIBUS station address

A station address between 1 and 99 can be allocated via two BCD rotary switches on top of the SLE-DP housing. Changing the station address via PROFIBUS is not supported (SET_SLAVE_ADRESS see above).

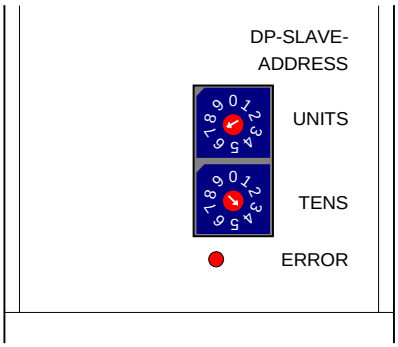


Fig. 6-6 SLE-DP; BCD rotary switch for station address (illustrated setting: Station address = 47)

Switch	Designation	Meaning	Range
	DP-SLAVE-ADDRESS	PROFIBUS-DP station address = 10 * *TENS* + *UNITS*	1…99
	UNITS	Units digit of PROFIBUS station address	0…9
	TENS	Tens digit of PROFIBUS station address	0…9

UNITS rotary switch is the rear switch on the housing top panel (see plan view).

Table 6-10 SLE-DP; BCD rotary switches

NOTICE

The possible setting of the BCD rotary switches to station address 0 is converted internally to a station address of 126.

6.4.3 Device master file (GSD file)

The SLE-DP is defined in a PROFIBUS environment via its Ident number and the associated device master file (GSD file, Appendix C).

Ident No.: 0x80A9
File: SIEM80A9.GSD
Version: V1.0 dated March 23, 2000 (Appendix B)

To be able to operate the SLE-DP in conjunction with a SIMATIC within a PROFIBUS network, this GSD file must be copied into 'HW Config' of the SIMATIC Manager. To do this, proceed as follows:

1. Start the SIMATIC Manager
2. Call HW Config
3. Select the 'Tools' menu and
4. Execute menu command 'Install new GSD' and integrate file 'SIEM80A9.GSD'.

The SLE-DP can then be found as a 'PROFIBUS Object' for connection configuring in 'NETPRO' under: 'Network Objects / PROFIBUS-DP / Other Field Devices / General'.

6.4.4 Sample program for SLE-DP with S7-300

After the GSD file has been installed (HW Config) and the PROFIBUS connection configured (NETPRO), the SLE-DP can be addressed with simple load or transfer commands provided that its PROFIBUS-DP station address has been set (NETPRO Fig. 6-7 and HW Config) and the input and output addresses assigned (HW Config Fig. 6-8).

NOTICE

Input and output data words must be processed as 2-byte consistent data words.

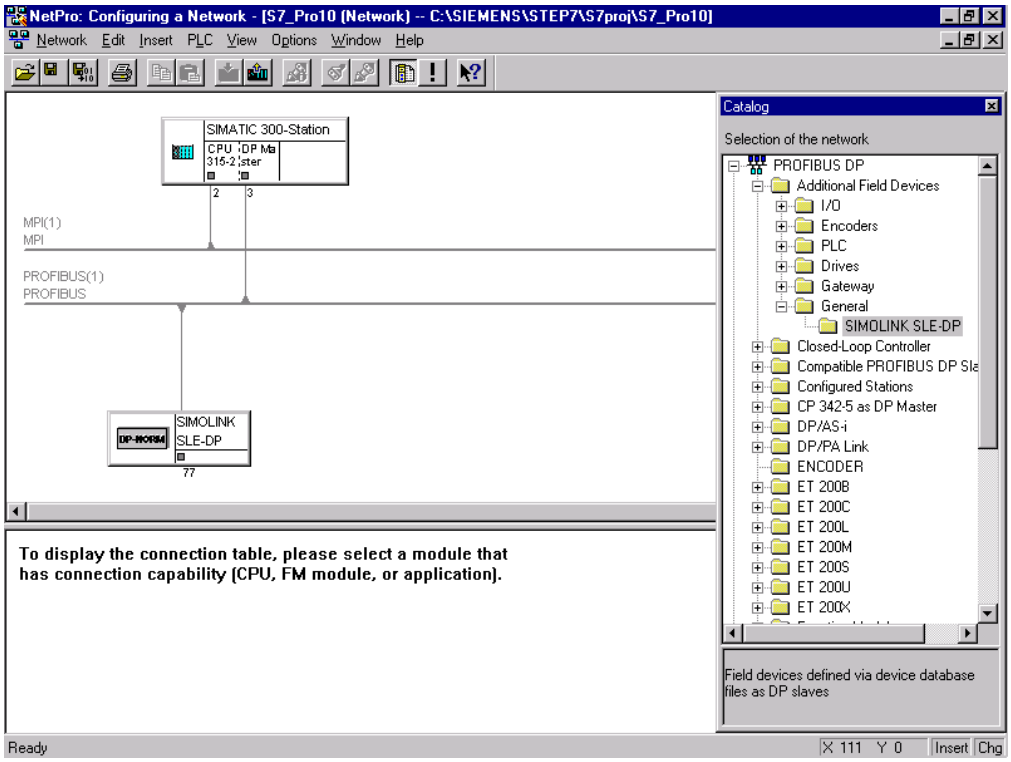


Fig. 6-7 SLE-DP; NETPRO PROFIBUS station address =77

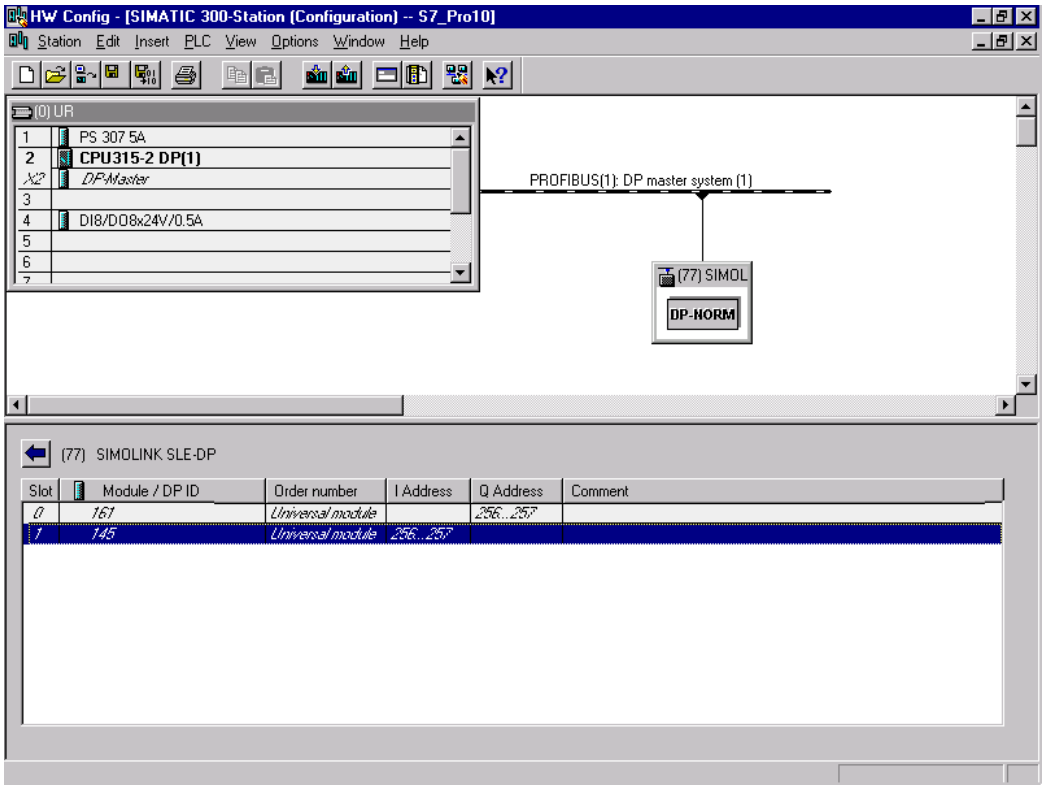


Fig. 6-8 SLE-DP; HW Config I/O address range
Input addresses 256…257 and output addresses 256…257

```
…
A           I        0.4
=           F        0.0
A           I        0.5
=           F        0.1
A           I        0.6
=           F        0.2

A           I        0.7
=           F        0.7

L          FW         0
T         PQW       256

L         PIW       256
T          FW         2

BE
```

Fig. 6-9 SLE-DP; Sample program

The important program lines in the example are:

T PQW 256

Write output data word (address change and activation) as word command and

L PIW 256

Read input data word (status and error bits) as word command.

The word transfer commands ensure that the 2-byte data are processed consistently.

6.4.5 Structure of PROFIBUS output data word

The PROFIBUS output data word (ODW) contains:
8 bits of read address, 3 bits of read channel and 1 bit of transfer control

2-byte output data word															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
U Control bit	**0**	**0**	**0**	**0**	**2^2**	2^1	**2^0**	**2^7**	**2^6**	**2^5**	**2^4**	**2^3**	**2^3**	**2^1**	**2^0**
	Reserved				Receive channel			Receive address							

Fig. 6-10 SLE-DP; structure of PROFIBUS output data word

As long as the logical state of transfer control bit **U** is ’0’, the value of the bits for the receive channel and address is irrelevant. The SLE-DP outputs pulses according to the DIL switches, the last PROFIBUS activation command and the SIMOLINK data. The transfer of the receive channel and address from the PROFIBUS output data word is initiated when the transfer control bit is set to ’1’. At this instant (in the same PROFIBUS telegram), the receive channel and address must contain the new value and remain unchanged. The SLE-DP is deactivated at the same time (no pulse output) and the receive channel and address defined by the PROFIBUS telegram and DIL switches are OR’d bit-serially. The operation of changing the receive channel and address is terminated when the transfer control bit switches from ’1’ to ’0’; the SLE-DP then expects the starting sequence via SIMOLINK (cf. Section 6.3).

NOTICE

With the reverse significance, the transfer control bit has the same function as DIL switch S1.5 (cf. Section 6.1.1). This means that changes to all DIL switches are transferred, i.e. not merely the receive channel and address OR’d bit-serially with the output data word, but the number of pulses per revolution and the encoder’s SIMOLINK address are also transferred again.

As regards the value ranges for receive channel and address in the PROFIBUS output data word, the same limits apply as to the DIL switch settings (cf. Sections 6.1.2 and 6.1.3).

NOTE

If the bit-serial ORing of the PROFIBUS output data word and DIL switches produces an illegal receive address, the error is indicated by LEDs on the housing front panel ('SYNC' and 'Z-PULSE' flash, cf. Section 6.2.1) and via error bit 5 in the PROFIBUS input data word (see below.

6.4.6 Structure of PROFIBUS input data word

The PROFIBUS input data word (IDW) contains:
4 status bits and 2 error bits (remaining bits have permanent status)

2-byte input data word															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	Error bit Parameter setting error	Error bit Incorrect SYNC cycle	Status bit SYNC monoflop	Status bit PULSE mode	Status bit SLE-DP status	Status bit SYNC toggle
Reserved, permanent status															

Fig. 6-11 SLE-DP; structure of PROFIBUS input data word

Bit	Designation	Meaning
0	'SYNC toggle'	Switches between 0 and 1 after 256 SYNC interrupts have been received (sign-of-life check when pulse output is enabled).
1	'SLE-DP status'	Checkback from DIL switch bit and PROFIBUS output data word; indicates whether parameterization is in progress or SLE-DP is active. '1' = SLE-DP active '0' = SLE-DP **not** active
2	'PULSE mode'	Status of encoder interface; indicates whether SLE-DP is outputting pulses. Corresponds to 'SLE-DP status' bit in SIMOLINK actual value of SLE-DP. '1' = Pulse output '0' = **No** pulse output
3	'SYNC monoflop'	Status of SIMOLINK ring; indicates whether SYNC interrupts are being received. Logical '1' equals steady illumination of the SYNC LED. '1' = SYNC telegrams '0' = **No** SYNC telegrams
4	'Incorrect SYNC cycle'	Checkback indicating whether SLE-DP can operate with the selected SIMOLINK cycle time (251 or 503 telegram transit times). Logical '1' equals SYNC LED flashing at approximately 2 Hz. '1' = Incorrect cycle time '0' = Correct cycle time
5	Parameter setting error	Checkback indicating whether ORing of DIL switch and PROFIBUS output data word has produced valid address. Logical '1' equals SYNC and Z-PULSE LEDs flashing at approximately 2 Hz. '1' = Parameterization error '0' = Parameterized correctly
6	-	= 0
7	-	= 0
8	-	= 0
9	-	= 0
10	-	= 0
11	-	= 0
12	-	= 1
13	-	= 1
14	-	= 1
15	-	= 1

Bits 6…15 are not used. When read, they have the status value indicated on the left.

Table 6-11 SLE-DP; meaning of PROFIBUS input data word

With correct parameter settings and pulse output enabled,
W#16#F00F and W#16#F00E (S7 syntax)
are displayed alternately in the input data word.

6.4.7 Behavior of SLE-DP after power ON

When the SLE-DP power supply is switched on, the SIMOLINK receive addresses set on the DIL switches are transferred, since, at this stage, the PROFIBUS interface is still running up with the PROFIBUS master (if the PROFIBUS interface is not activated, the addresses set on the DIL switches remain valid). With switch S1.5 in position 1, the SLE-DP can be started with this receive address via SIMOLINK.

As soon as the red PROFIBUS error LED goes out and address bits are set in the PROFIBUS output data word, these bits are OR'd bit-serially with the DIL switches of the receive telegram when DIL switch S1.5 is set to position 0 or when the control bit in the PROFIBUS output data word is set.

6.4.8 Changing the SIMOLINK receive address on SLE-DP

The SLE-DP module can be activated/deactivated via DIL switch S1.5 and the transfer control bit in the PROFIBUS output data word. Changes to the DIL switches and in the output data word are accepted only when the SLE-DP is deactivated. Both sources of activation command have equal priority. However, the SLE-DP can be activated via the transfer control bit in the PROFIBUS output data word only if DIL switch S1.5 is set to 'SLE active'.

DIL switch S1.5 implements the transfer sequence of receive channel and address via the switching sequence 1 to 0 to 1. The starting sequence via SIMOLINK must then be initiated to enable pulse output. If S1.5 is switched to position 0, the SLE-DP is deactivated. No pulses are output and the status in the SIMOLINK write channel and the PROFIBUS input data word equals 'SLE-DP not active'. The DIL switches are read in simultaneously and OR'd with the bits of the receive channel and address from the output data word. The results for receive channel and address are checked; if an error is detected, this is indicated by the LEDs on the front panel and by bits in the input data word. The settings of the remaining DIL switches are still transferred again. After the SLE-DP has been activated (S1.5 to position 1), the encoder waits for the starting sequence via the new (or unchanged) SIMOLINK receive telegram.

The transfer control bit **U** (bit 15 in output data word) implements the transfer sequence for the receive channel and address by changing logical states 0 to 1 to 0. The starting sequence must then be initiated via SIMOLINK to enable pulse output. If bit **U** is switched to status 1 in the output data word, the SLE-DP is deactivated. No pulses are output and the status in the SIMOLINK write channel and the PROFIBUS input data word equals 'SLE-DP not active'. The bits for receive channel and address of the output data word are read in at the same time and OR'd with the bits of the DIL switches. The results for receive channel and address are checked; if an error is detected, this is indicated by the LEDs on the front panel and by bits in the input data word. The settings of the remaining DIL switches are still transferred again. After the SLE-DP has been activated (**U** in status 0), the encoder waits for the starting sequence via the new (or unchanged) SIMOLINK receive telegram.

NOTICE

When the receive channel and address are changed via the PROFIBUS, the bit-serial ORing of DIL switches and PROFIBUS output data word must be noted (example below illustrates bit-serial ORing based on a presetting and change strategy which are not recommended).

Receive channel					Receive address									
DIL switch S1	.3	.2	.1		DIL switch S2	.8	.7	.6	.5	.4	.3	.2	.1	
Value:	**1**	**0**	**1**	**5_{dec}**	Value:	**1**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**180_{dec}**
PROFIBUS ODW Bit number	10	9	8		PROFIBUS ODW Bit number	7	6	5	4	3	2	1	0	
Value:	**0**	**0**	**1**	**1_{dec}**	Value:	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**50_{dec}**
Result:	**1**	**0**	**1**	**5_{dec}**	Result:	**1**	**0**	**1**	**1**	**0**	**1**	**1**	**0**	**182_{dec}**

Table 6-12 SLE-DP; Example of bit-serial ORing of receive channel and address

Recommendation:

- Set a fixed receive channel via DIL switches S1.1...S1.3.
- Do **not** change the receive channel via the PROFIBUS output data word.
- Set DIL switch S2 for the receive address permanently to its default.
- Input the complete receive address, including bits from the default address set via DIL switch, via the PROFIBUS output data word.
- Set DIL switch S1.5 to 'SLE active' (position 1) (SLE can always be started on the default address after 'power ON').
- Activate the SLE-DP only via the PROFIBUS in conjunction with the current receive address

6.5 Configuring instructions for setpoint generation

The system-dependent setpoint transit delays of the MASTERDRIVES MC are simulated by the SIMOLINK Encoder. Consequently, the SIMOLINK Encoder behaves as regards output pulses (actual value) in the same way as a position-controlled MASTERDRIVES MC with respect to its encoder actual value. This means in practice that the SIMOLINK Encoder reaches the same actual counter value in every SIMOLINK cycle as the actual encoder value of the position-controlled MASTERDRIVES MC unit (ignoring any differences in pulses per revolution; the MC device must not exhibit any permanent position control deviation). However, the setpoint transit times of the MASTERDRIVES MC are dependent on a number of parameters and the following therefore applies only to standard configurations.

Relevant parameters in standard configuration:

- Scanning time slot of master setpoint (U953.35 or U953.34):
  Recommended setting: T4; must be calculated in the SIMOLINK cycle time.
- Scanning time slot of setpoint calculation for the SIMOLINK Encoder (U953.28):
  Recommended setting: T4; must be calculated in the same time slot as the master setpoint.
- Scanning sequence of setpoint calculation for the SIMOLINK Encoder (U963.28):
  Recommended setting: U963.28 =3360, U963.35 =3350; must be calculated after the master setpoint computation.

These parameter settings can provide a common basis for the master setpoint for the drives and the setpoint for the SIMOLINK Encoder, ensuring that both are available simultaneously on the SIMOLINK ring.

- Scanning time slot of synchronism block (U953.33):
  Recommended setting: T4; must be calculated in the same time slot as master setpoint and SIMOLINK cycle time.
- Scanning sequence of synchronism operation block (U963.33):
  Recommended setting: U963.33 =10; must be processed at the beginning of T4 and all blocks in the setpoint path must be calculated in order from SIMOLINK reception (U960.12 = 5) to synchronism operation block.
- Position setpoint coupling to position controller (U953.40, U963.40):
  Default setting: U953.40 =3, U963.40 =3400; time-optimized position setpoint coupling
- Position setpoint interpolation of position controller (P770):
  Default setting: P770 =1; Extrapolation mode.
- Speed precontrol of position controller (P209):
  Default setting: P209 =312; the speed precontrol for the position controller must be utilized without producing any permanent position control deviation (MD49 = 100 %).

If these settings are made for all axes in the synchronous operation drive grouping (MASTERDRIVES MC devices), it can be guaranteed that the MASTERDRIVES MC units will have the same dynamic response as the SIMOLINK Encoder.

NOTICE

If the position setpoint interpolator is set to 'interpolation' (P770 = -1) to improve the time symmetry of the position control loop, the SIMOLINK Encoder will lead by 1.6 msec. If this is the case, the setpoint to the SIMOLINK Encoder must be delayed by this period. In firmware version V1.41 of MASTERDRIVES MC and later, a deadtime adaptation can be set on the user-assignable block "SLE SIMOLINK Encoder". To implement a 1.6 ms delay, -1.6 ms must be set (negative time values effect a delay, i.e. a deadtime, while positive values effect deadtime compensation).

Setpoints for the SIMOLINK Encoder are calculated in firmware version V1.4 and later by means of a user-assignable block ('SLE Setpoint Assignment', Function Diagram [793], see Appendix B). This block facilitates the transfer of a setpoint and offset to the encoder as well as the readback of actual value and status. The block characteristics are as follows:

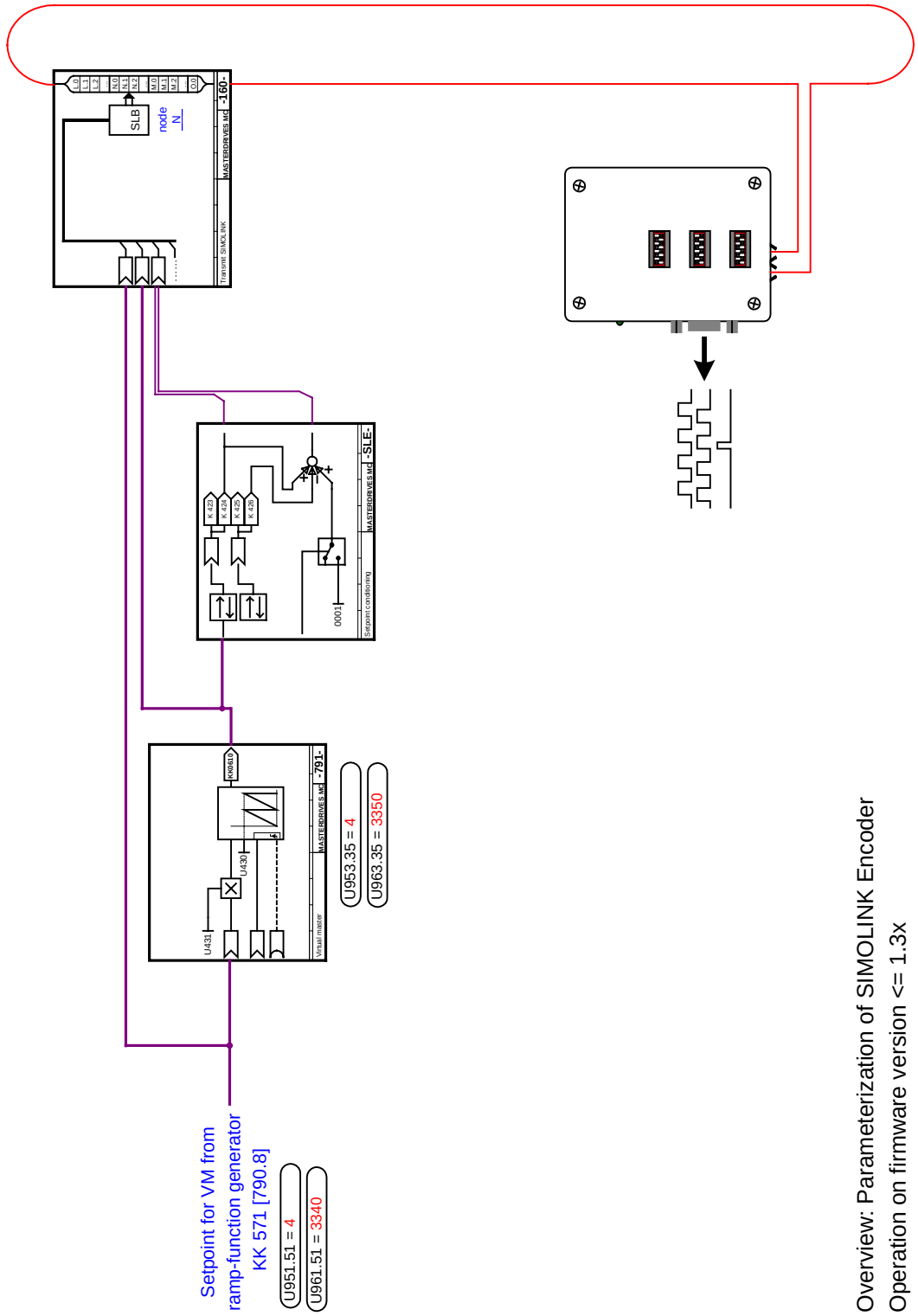
- Master setpoint with any axis cycle can be linked.
- Offset of SIMOLINK Encoder zero pulse can be specified with the same normalization as the master setpoint. The offset to be specified is the position in the axis cycle of the master setpoint at which the zero pulse of the SIMOLINK Encoder must be output.
- Setpoint assignment to SIMOLINK Encoder can be adapted to match the relevant MASTERDRIVES MC device through a deadtime setting (either delay or compensation as required).
- Actual value available as connector (0…32767).

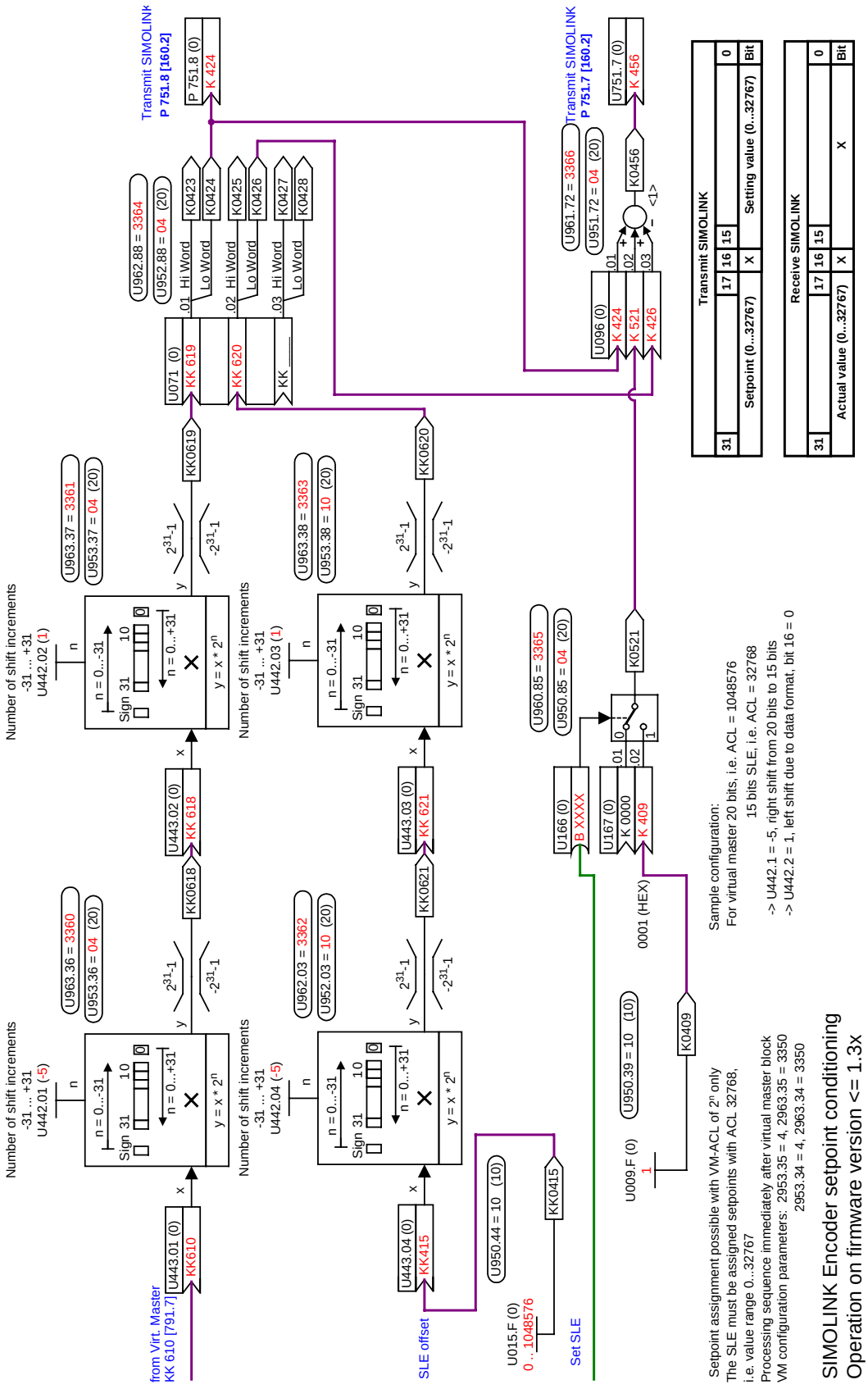
A recommended configuration based on user-assignable blocks (see Appendix A) is available for firmware version V1.3 and earlier. The configuration is subject to the restriction, however, that only master setpoints with axis cycles in the 2^n format can be processed. To configure the encoder as shown in the example, the following blocks will be needed:

- 2 shift multipliers/dividers (U953.36, U953.37):
  For re-normalization of the master setpoint to the 15-bit setpoint of the SIMOLINK Encoder.
- 2 shift multipliers/dividers (U953.38, U952.03):
  For re-normalization of the zero pulse offset to the value range of the SIMOLINK Encoder.
- 2 channels of double connector/connector converter (U952.88):
  For conversion of setpoint and offset
- Modulo 2^16 adder/subtracter (U951.72):
  For conversion of zero pulse offset to 'Setting value for zero pulse' of SIMOLINK Encoder and insertion of control bit in the setpoint telegram.
- 1 analog signal switch (1 word) (e.g. U950.85):
  For evaluation of 'SLE control' control bit.
- Fixed setpoint (1-word) (U950.39):
  For insertion of control bit into setpoint telegram.
- Fixed setpoint (2-word) (e.g. U950.44):
  For input of zero pulse offset as a fixed setpoint.

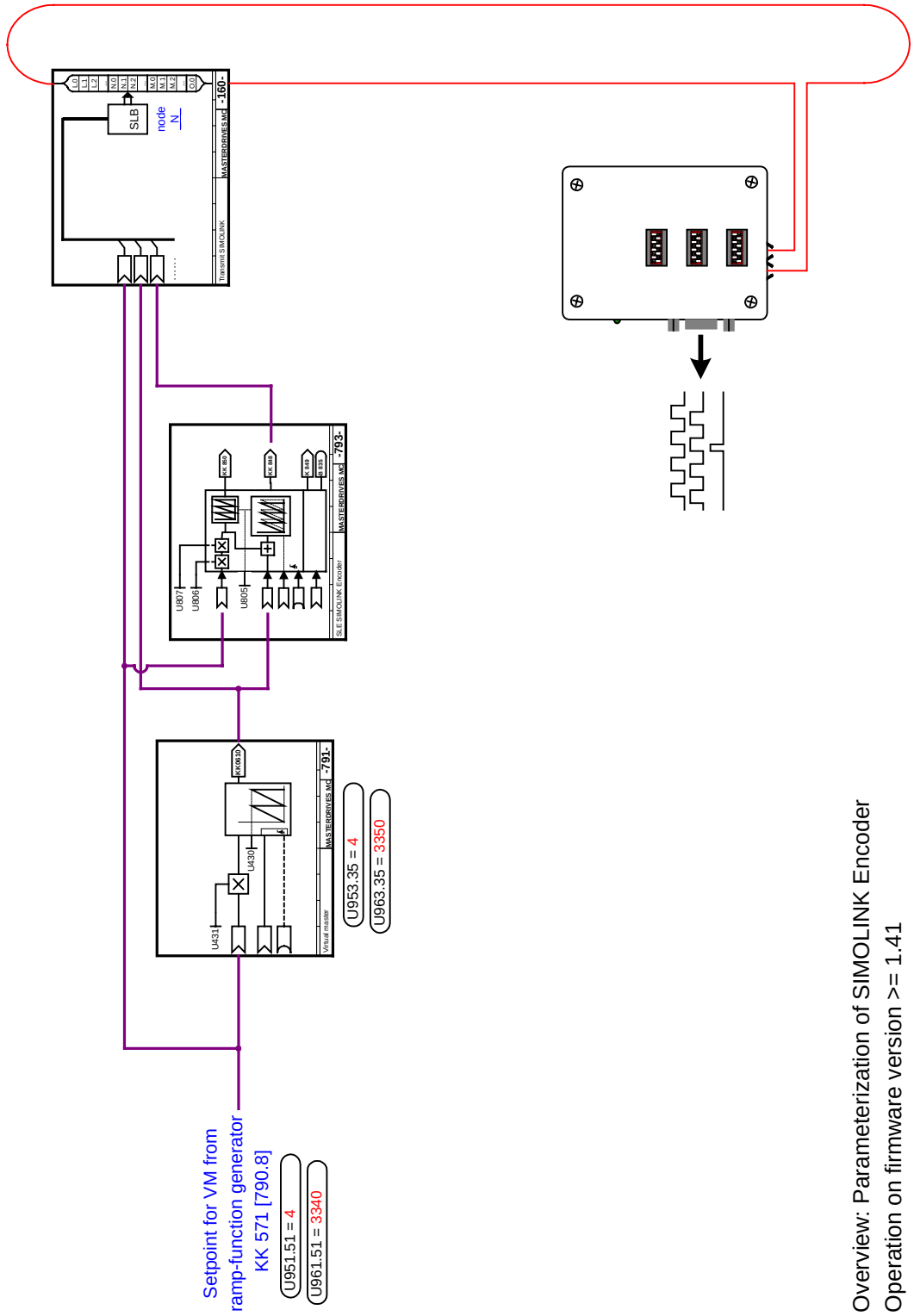
If no offset is used, two of the shift multipliers/dividers and the fixed setpoint (2-word) will not be needed. The offset can also be specified by means of the 2-word fixed setpoint, i.e. without shift multipliers/dividers, if it is converted to SIMOLINK Encoder format. Likewise, with appropriate parameterization, it is possible to substitute the 1-word fixed setpoint for the control bit by the 2-word fixed setpoint.

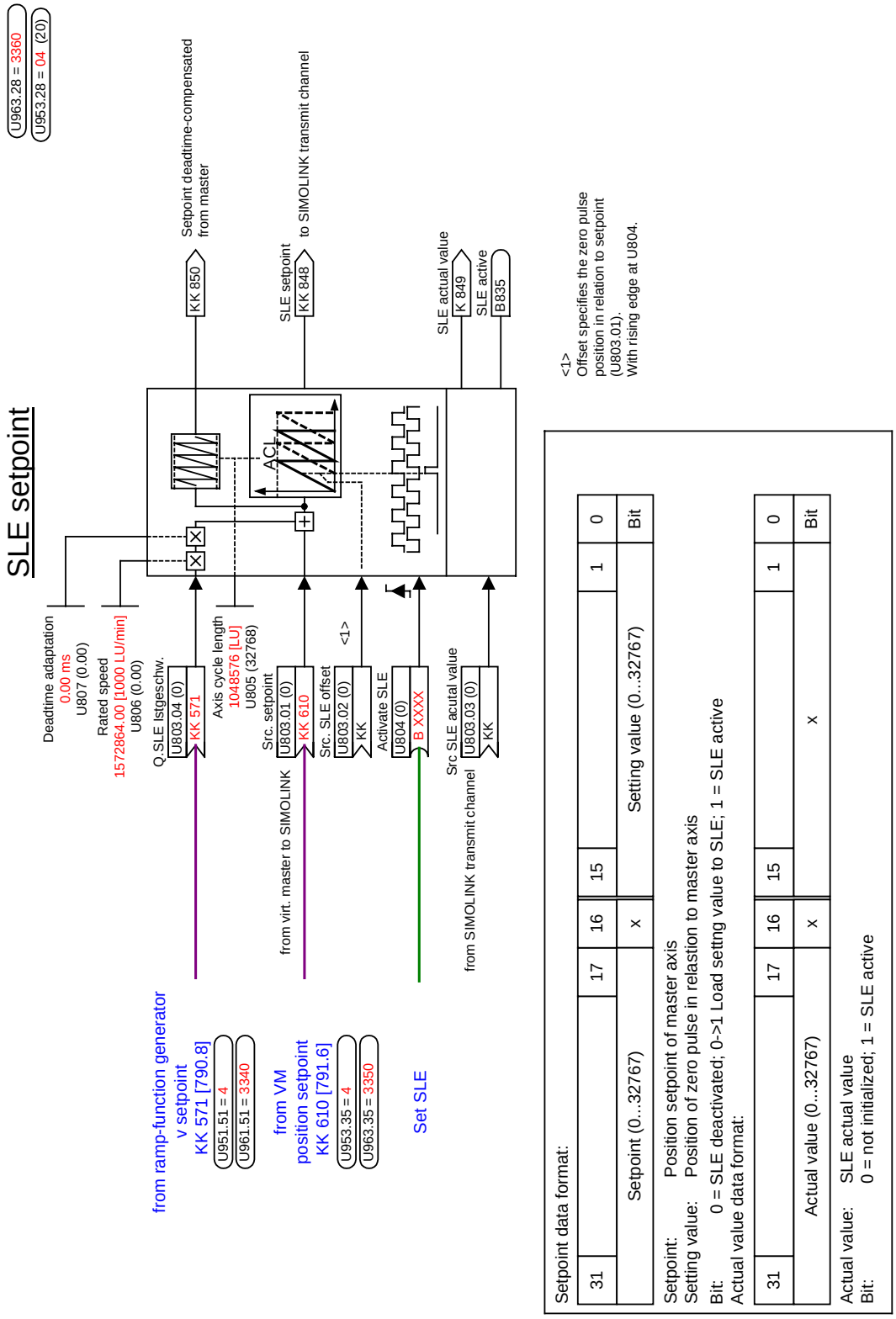
Appendix A: Sample configuration for MASTERDRIVES MC, firmware ≤ 1.3




SIMOLINK Encoder setpoint conditioning
Operation on firmware version <= 1.3x
from Virt. Master
KK 610 [791.7]
U443.01 (0)
KK610
Number of shift increments
-31 ... +31
U442.01 (-5)
U963.36 = 3360
U953.36 = 04 (20)
U443.02 (0)
KK 618
KK0618
U962.03 = 3362
U952.03 = 10 (20)
U443.03 (0)
KK 621
KK0621
SLE offset
U443.04 (0)
KK415
U442.04 (-5)
U963.37 = 3361
U953.37 = 04 (20)
U442.02 (1)
U963.38 = 3363
U953.38 = 10 (20)
U442.03 (1)
KK0619
KK0620
U071 (0)
KK 619
KK 620
KK
01 Hi Word
Lo Word
02 Hi Word
Lo Word
03 Hi Word
Lo Word
U962.88 = 3364
U952.88 = 04 (20)
K0423
K0424
K0425
K0426
K0427
K0428
Transmit SIMOLINK
P 751.8 [160.2]
P 751.8 (0)
K 424
U950.44 = 10 (10)
KK0415
U015.F (0)
0 ... 1048576
Set SLE
U960.85 = 3365
U950.85 = 04 (20)
U166 (0)
B XXXX
U167 (0)
K 0000
K 409
K0521
U950.39 = 10 (10)
K0409
U009.F (0)
1
0001 (HEX)
U961.72 = 3366
U951.72 = 04 (20)
U096 (0)
K 424
K 521
K 426
K0456
U751.7 (0)
K 456
Transmit SIMOLINK
P 751.7 [160.2]
Transmit SIMOLINK
31 17 16 15 0
Setpoint (0...32767) X Setting value (0...32767) Bit
Receive SIMOLINK
31 17 16 15 0
Actual value (0...32767) X X Bit
Sample configuration:
For virtual master 20 bits, i.e. ACL = 1048576
15 bits SLE, i.e. ACL = 32768
-> U442.1 = -5, right shift from 20 bits to 15 bits
-> U442.2 = 1, left shift due to data format, bit 16 = 0
Setpoint assignment possible with VM-ACL of 2n only
The SLE must be assigned setpoints with ACL 32768,
i.e. value range 0...32767
Processing sequence immediately after virtual master block
VM configuration parameters: 2953.35 = 4, 2963.35 = 3350
2953.34 = 4, 2963.34 = 3350

Appendix B: Sample configuration for MASTERDRIVES MC, firmware 1.41 and later





Free block, SLE SIMOLINK Encoder
Operation on firmware version >= 1.41

Appendix C: GSD file

```
;=========================================================

; GSD File for SIMOLINK Encoder SLE-DP           SIEMENS AG
; MLFB   : 6SX7005-0AG01
;
; Release: 23.03.2000 / I.II
; File   : SIEM80A9.GSD
; Version: V1.0
;=========================================================
#Profibus_DP
GSD_Revision=1

;General parameters
Vendor_Name="Siemens AG ATD TD 6 EPG"
Model_Name="SIMOLINK SLE-DP"
Revision="Version 01"
OrderNumber="6SX7005-0AG01"
Ident_Number=0x80A9
Protocol_Ident=0
Station_Type=0
FMS_supp=0
Hardware_Release="V2.0"
Software_Release="-"
9.6_supp=1
19.2_supp=1
93.75_supp=1
187.5_supp=1
500_supp=1
1.5M_supp=1
3M_supp=1
6M_supp=1
12M_supp=1
MaxTsdr_9.6=60
MaxTsdr_19.2=60
MaxTsdr_93.75=60
MaxTsdr_187.5=60
MaxTsdr_500=100
MaxTsdr_1.5M=150
MaxTsdr_3M=250
MaxTsdr_6M=450
MaxTsdr_12M=800
Implementation_Type="LSPM2"
Repeater_Ctrl_Sig=2
24V_Pins=0
; Slave-Specification:
Slave_Family=0
Freeze_Mode_supp=1
Sync_Mode_supp=1
Set_Slave_Add_Supp=0
Auto_Baud_supp=1
Min_Slave_Interval=50
Max_Diag_Data_len=13
Modular_Station=0

; UserPrmData: Length and Preset:
User_Prm_Data_Len=5
User_Prm_Data=0x00,0x00,0x00,0x00,0x00

; Module Definition List
Module="Module 2 Byte OUT / 2 Byte IN" 0xA1,0x91
EndModule
```

Bisher sind folgende Ausgaben erschienen:

Ausgabe	Interne Sachnummer
AA	GWE-477 763 4070.76 J AA-76

Ausgabe AA besteht aus folgenden Kapiteln:

Kapitel		Änderungen	Seitenzahl	Ausgabedatum
1	Definitionen und Warnungen	Erstausgabe	3	02.2001
2	Beschreibung	Erstausgabe	3	02.2001
3	Technische Daten	Erstausgabe	1	02.2001
4	Montage	Erstausgabe	3	02.2001
5	Anschließen	Erstausgabe	8	02.2001
6	Inbetriebsetzung	Erstausgabe	23	02.2001
	Anhang	Erstausgabe	5	02.2001

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Chapter		Changes	Pages	Version date
1	Definitions and Warnings	first edition	3	02.2001
2	Description	first edition	3	02.2001
3	Technical Data	first edition	1	02.2001
4	Installation	first edition	3	02.2001
5	Connections	first edition	8	02.2001
6	Start-up	first edition	23	02.2001
	Appendix	first edition	5	02.2001

Group: Automation and Drives (A&D)
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GWE-477 763 4070.76 J
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SIEMENS

SIMOVERT MASTERDRIVES

Betriebsanleitung
Operating Instructions

SLP – SIMOLINK Puls Generator
SLP – SIMOLINK Pulse Generator

Ausgabe / Edition: AA

GWE-477 764 4070.76 J

Änderungen von Funktionen, technischen Daten, Normen, Zeichnungen und Parametern vorbehalten.

We reserve the right to make changes to functions, technical data, standards, drawings and parameters.

Wir haben den Inhalt der Druckschrift auf Übereinstimmung mit der beschriebenen Hard- und Software überprüft. Dennoch können Abweichungen nicht ausgeschlossen werden, so daß wir für die vollständige Übereinstimmung keine Garantie übernehmen. Die Angaben in dieser Druckschrift werden jedoch regelmäßig überprüft und notwendige Korrekturen sind in den nachfolgenden Auflagen enthalten. Für Verbesserungsvorschläge sind wir dankbar

We have checked the contents of this document to ensure that they coincide with the described hardware and software. However, differences cannot be completely excluded, so that we do not accept any guarantee for complete conformance. However, the information in this document is regularly checked and necessary corrections will be included in subsequent editions. We are grateful for any recommendations for improvement.

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Contents

1 Definitions and Warnings

Qualified personnel

For the purpose of this documentation and the product warning labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up, operation and maintenance of the product. He or she must have the following qualifications:

- Trained or authorized to energize, de-energize, ground and tag circuits and equipment in accordance with established safety procedures.
- Trained or authorized in the proper care and use of protective equipment in accordance with established safety procedures.
- Trained in rendering first aid.

DANGER

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

WARNING

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

CAUTION

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

CAUTION

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

NOTICE

NOTICE used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesirable result or state.

NOTE

For the purpose of this documentation, "Note" indicates important information about the product or about the respective part of the documentation which is essential to highlight.

WARNING

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the warnings can thus result in severe personal injury or property damage.

Only qualified personnel should work on or around the equipment

This personnel must be thoroughly familiar with all warning and maintenance procedures contained in this documentation.

The successful and safe operation of this equipment is dependent on correct transport, proper storage and installation as well as careful operation and maintenance.

NOTE

This documentation does not purport to cover all details on all types of the product, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local SIEMENS sales office.

The contents of this documentation shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of SIEMENS AG. The warranty contained in the contract between the parties is the sole warranty of SIEMENS AG. Any statements contained herein do not create new warranties or modify the existing warranty.

CAUTION

Components which can be destroyed by electrostatic discharge (ESD)

The board contains components which can be destroyed by electrostatic discharge. These components can be easily destroyed if not carefully handled. If you have to handle electronic boards, please observe the following:

Electronic boards should only be touched when absolutely necessary.

The human body must be electrically discharged before touching an electronic board.

Boards must not come into contact with highly insulating materials - e.g. plastic parts, insulated desktops, articles of clothing manufactured from man-made fibers.

Boards must only be placed on conductive surfaces.

Boards and components should only be stored and transported in conductive packaging (e.g. metalized plastic boxes or metal containers).

If the packing material is not conductive, the boards must be wrapped with a conductive packaging material, e.g. conductive foam rubber or household aluminum foil.

The necessary ESD protective measures are clearly shown again in the following diagram:

- a = Conductive floor surface
- b = ESD table
- c = ESD shoes
- d = ESD overall
- e = ESD chain
- f = Cubicle ground connection

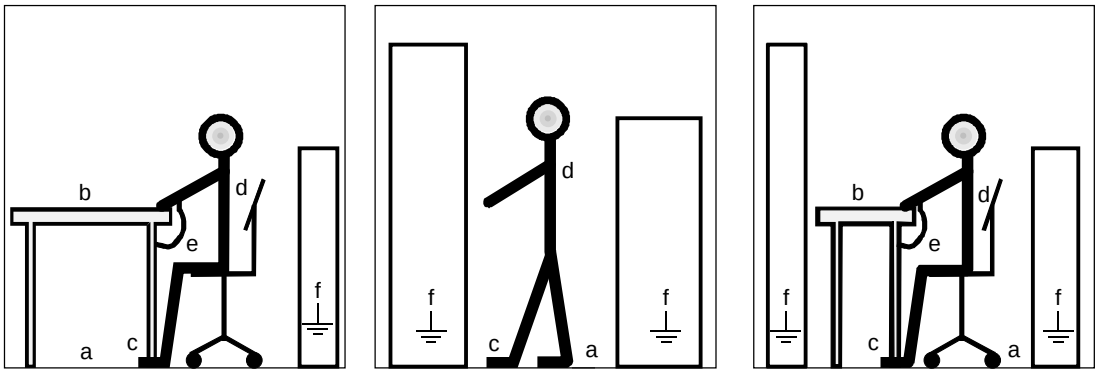


Fig. 1-1 ESD protective measures

2 Product Description

In drive configurations with an "electrical shaft", simple speed-synchronized auxiliary drives or other devices which require an actual machine value proportional to velocity are frequently needed in addition to the main position-controlled drives. These auxiliary drives and devices have a pulse encoder input and read in the data supplied by a pulse encoder mounted centrally on the line shaft. On drives with an electrical shaft and flexible configuration, this central point is often impossible to physically define. The SIMOLINK Pulse Generator (SLP) thus simulates an encoder on the electrical shaft and supplies a central actual machine value (machine velocity) which is generated from the master setpoint. The electrical shaft with the position-controlled main drives is implemented by means of SIMOLINK and MASTERDRIVES Motion Control drives.

The SIMOLINK Pulse Generator uses a speed setpoint transported via SIMOLINK to generate two pulse signals in quadrature of proportional frequency (100 % = 25 kHz). These are supplied to further devices via the RS422 (EIA422 standard). The frequency output corresponds to that of a pulse encoder with 1000 pulses/rev and a speed normalization of 100 % = 1500 rev/min.

A "100 kHz operating mode" can be activated optionally. Instead of the signals in quadrature, one signal supplies the quadruple frequency proportional to the setpoint (100 % = 100 kHz) and the other signal supplies the sign.

The SIMOLINK transmission medium is a fiber-optic cable. Fiber optics made of glass or plastic may be used. SIMOLINK has a ring-shaped structure, with each node in the ring acting as a signal amplifier. A maximum of 201 active nodes can be interconnected on the SIMOLINK ring.

NOTE

For further information about SIMOLINK, please refer to Chapter "Communication / SIMOLINK“ of the SIMOVERT MASTERDRIVES Compendium Motion Control, Order No.: 6SE7087-6QX50.

2.1 Description of function

The incoming optical signals from the fiber-optic cable are converted to electrical signals by means of fiber optic receivers on all SIMOLINK modules and then transferred to the fiber-optic transmitter where they are converted back to optical signals. The propagation delays caused by this process are calculated while SIMOLINK is booting and the dead times compensated accordingly for active SIMOLINK nodes. The receive information is derived, depending on parameterization, from the buffered, electrical signals and transferred with the SYNC interrupt (last telegram in SIMOLINK polling). The transmit information of the node is transferred in the opposite direction and written to the associated telegrams (electrical signals).

The SIMOLINK Pulse Generator is incorporated in the SIMOLINK ring like a SIMOLINK slave; it is an active node and included in the dead-time calculation. However, it does not have its own node address and cannot therefore write transmit telegrams to the SIMOLINK (SLP does not supply a return value).

The SIMOLINK receive address (0 ... 200; dispatcher mode: Address of node which is sending the speed setpoint) is set via the DIL switches on the front panel. The momentary speed setpoint is read in the MASTERDRIVES 32-bit format (4000 0000 hex = 100 %) from channel 0. Only the 10 highest bits are resolved with a maximum output of 112 %, resulting in a speed resolution of 0.4 %. The speed setpoint must be updated (new setpoint or identical value if velocity is constant) in every SIMOLINK cycle by the transmitting node.

The speed setpoint is transferred to the frequency generator with the SYNC interrupt which then generates the equivalent frequency with the correct phase sequence of the two output signals (tracks A and B). An output frequency of 25 kHz corresponds to a speed setpoint of 100 %. Alternatively, a jumper can be inserted in the mating connector of X2 to activate the "100 kHz signal" operating mode. The frequency generator can then output signals from 0 to 100 kHz. In this mode, the frequency signal is output via track A and the sign (direction of rotation) via track B. The sign is a static 0 (positive) or 1 (negative) signal.

The RS422 interface forms the desired signal levels which can be picked off on SUB D socket X2.

The operating states are indicated by the three LEDs on the housing front panel.

3 Technical Data

Product name	**SLP**
Order number	6SX7005-0AD00
Size [mm]: – Width – Height – Depth	Device dimensions (housing) 35 (35) 118 (107) 88 (80)
Weight	Approx. 280 g
Degree of protection	IP20 to EN 60529
Degree of pollution	Not applicable Moisture condensation is not permissible in operation
Mechanical strength: – In steady-state operation – During transportation	Not applicable
Climate class	Class 3K3 to DIN IEC 721-3-3 (in operation)
Cooling method (operation)	Convection
Permissible ambient or coolant temperature: – In operation – In storage – During transportation	 0 °C to +55 °C –25 °C to +70 °C –25 °C to +70 °C
Permissible humidity rating: – Transport/storage – In operation	Relative air humidity ≤ 95 % ≤ 85 % (condensation not permitted)
Power supply	
Rated supply voltage	DC +24 V (+20.4 V to +28.8 V)
Power consumption	Approx. 140 mA
Encoder interface	
Tracks A and B	RS422 to EIA422 standard
Supply voltage: – Electrical isolation	Internal Isolating voltage 500 V DC to 24 V voltage supply
Fiber-optic cable connection	
Transmitter power	Fixed (maximum transmitter power defined for SIMOLINK)
Fiber-optic cable modules – Transmitter – Receiver	Hewlett Packard HFBR 1528 HFBR 2528

Table 3-1 Technical data

4 Installation

The SIMOLINK Pulse Generator module is snapped onto an EN 50022-compliant TS 35 top-hat rail. The requisite mechanical mounting elements are fitted in the housing.

4.1 EMC measures

The module is connected to ground via the top-hat rail. The ground connection between the rail and the equipotential bonding conductor must be made by the end-user during installation.

NOTE

For further information, please refer to Chapter "Instructions for Design of Drives in Conformance with EMC Regulations" of the SIMOVERT MASTERDRIVES Compendium Motion Control, Order No.: 6SE7087-6QX50.

4.2 Housing

The following diagrams show a schematic illustration of the housing and the layout of connections and operating elements.

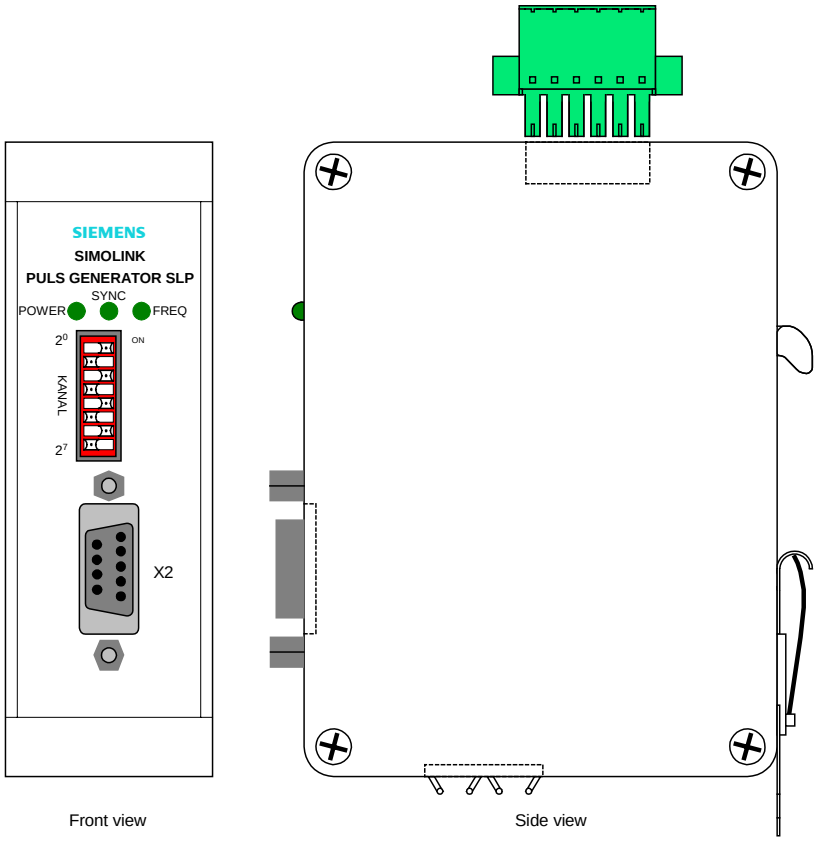


Fig. 4-1

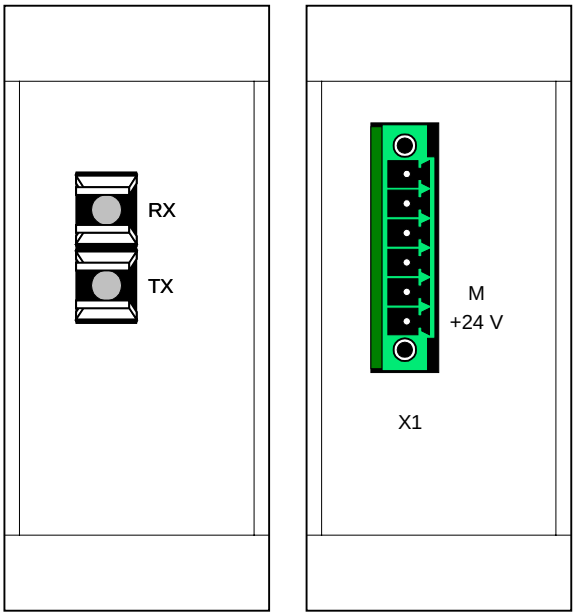


Fig. 4-2

5 Connections

The SIMOLINK Pulse Generator module has the following connectors

- X1 for power supply,
- X2 for signal output and
- a SIMOLINK fiber-optic cable connection with one transmit socket and one receive socket.

5.1 Connector X1

The 6-pin connector is on top of the housing. The 24 V power supply to the SIMOLINK Pulse Generator is connected via X1.

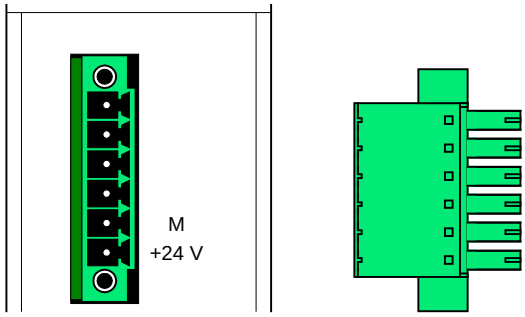


Fig. 5-1

Terminal	Designation	Meaning	Range
1	-	Unused	
2	-	Unused	
3	-	Unused	
4	-	Unused	
5	M	Ground	
6	+24V	24 V power supply	+21 ... 28 V

Connectable cross-section: 1.5 mm^2 (AWG 16)

Terminal 1 is the terminal to the rear of the module top plate (see plan view).

Table 5-1 Connector assignments

5.2 Encoder interface X2

The encoder interface of the SIMOLINK Pulse Generator is the 9-pin, SUB D socket with screw locking mechanism (UNC) on the front of the housing. Two RS422 drivers each supply two signals per pulse output, one signal with non-inverted signal level and one signal with inverted signal level. The driver voltage supply circuit is isolated from the 24 V supply for the module.

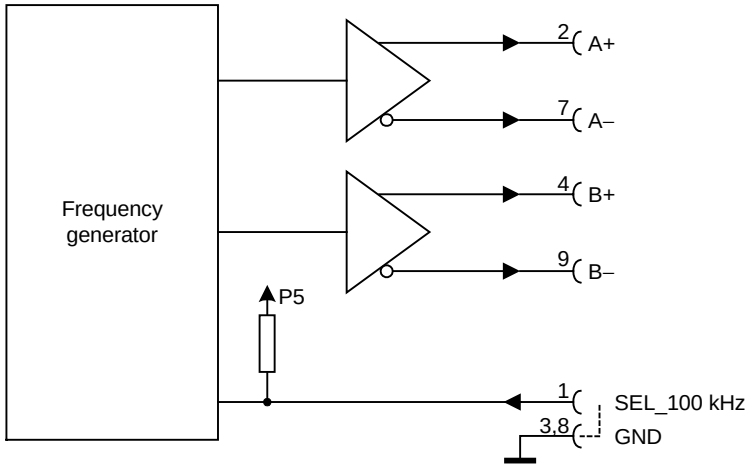


Fig. 5-2 Schematic of output circuit (connector X2)

The two operating modes "90° pulses" and "100 kHz signal" are selected via a jumper in the encoder connector. The 90° pulses setting is the default and is activated when pin 1 in the encoder interface is unused.

Pin	Signal	Meaning for 90° pulses	Range
2	A+	Track A not inverted	RS422
7	A–	Track A inverted	standard
4	B+	Track B not inverted	RS422
9	B–	Track B inverted	standard
1	**SEL_100 kHz**	**Do not assign, selection of 100-kHz signal**	**Do not insert**
3, 8	GND	Ground (see below)	**jumper to GND!**
5, 6	n.c.	Unused	
Housing	Outer shield		

9-pin SUB D socket with screw locking mechanism (UNC)

Table 5-2 Assignment of connector X2 for 90° pulses mode

The SIMOLINK Pulse Generator can be switched over to the other mode "100 kHz signal“ through insertion of a jumper between connector pin "SEL_100kHz" and GND.

Pin	Designation	Meaning for 100 kHz signal	Range
2	A+	Track A 100 kHz not inverted	RS422
7	A–	Track A 100 kHz inverted	standard
4	B+	Sign not inverted	RS422
9	B–	Sign inverted	standard
1	**SEL_100 kHz**	**Selection of 100 kHz signal**	**Insert**
3, 8	GND	Ground (see below)	**jumper to GND!**
5, 6	n.c.	Unused	
Housing	Outer shield		

9-pin SUB D socket with screw locking mechanism (UNC)

Table 5-3 Assignment of connector X2 for 100 kHz signal mode

NOTICE

To maintain immunity to interference, a shielded cable must be used and the shield attached in the connector housing.

CAUTION

One or several drives/devices can be connected to the SLP module. When the SLP is operated in conjunction with one drive/device, the GND signal should be connected in the cable. If several drives/devices are connected to the SLP, the GND signal should not be connected; it must be noted in this respect that large deviations in the 0 V (GND) on different drives/devices can cause disturbances or malfunctions on the RS422 bus.

Signal output 90°pulses

The SIMOLINK Pulse Generator produces two signals with a phase displacement of ± 90°. The pulse-pause ratio for each of these signals is 1:1.

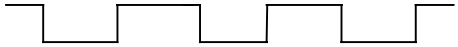
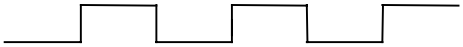
Setpoint input		Signal shape at output
Positive setpoint	Track A	
	Track B	
Negative setpoint	Track A	
	Track B	

Fig. 5-3 Signal shape in 90° pulses mode

Signal output 100 kHz signal

In the "100 kHz signal“ mode, track A outputs 4 times the frequency, i.e. 100 kHz correspond to 100%. Track B supplies the sign according to the following rule: The signal is low for positive setpoints and high for negative setpoints.

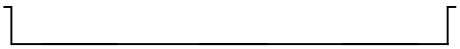
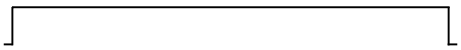
Setpoint input		Signal shape at output
Positive setpoint	Track A	
	Track B	
Negative setpoint	Track A	
	Track B	

Fig. 5-4 Signal shape in 100 kHz signal mode

5.3 Fiber-optic cable connection

The fiber-optic cables are connected via plug-and-socket connectors. The transmit and receive sockets are on the bottom of the housing (Fig. 4-2). The output power of the fiber-optic transmitter is not variable, but permanently set to the maximum transmitter power defined for SIMOLINK.

SIMOLINK is a clocked, ring-shaped fiber-optic bus system. To allow the flow of signal traffic, the transmit socket of the first node must be connected to the receive socket of the next node and so on, until the transmit socket of the last node is connected to the receive socket of the first node.

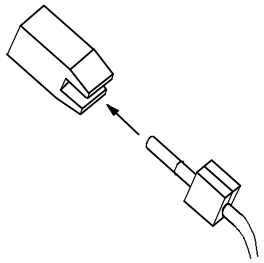


Fig. 5-5 Bus connector

The receive socket is dark grey and labeled RX. The transmit socket is light gray and labeled TX.

The following Hewlett Packard fiber-optic modules are installed in the SIMOLINK Pulse Generator:

- Transmitter: HFBR 1528
- Receiver: HFBR 2528

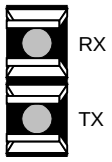


Fig. 5-6 Fiber-optic connector

Plastic or glass fiber-optic cables can be used. Depending on the type of cable selected, the inter-node distances are as follows:

- Max. 40 m between each node in the case of plastic cables or
- Max. 300 m between each node in the case of glass cables.

The maximum permissible ring bus length is 1000 m.

NOTE

A components package for assembling plastic fiber-optic cable connections can be ordered under number 6SX7010-0FJ50. This contains: 100 m plastic fiber-optic cable, 40 fiber-optic connectors, 20 connectors for terminal strip X470 SLB.

NOTICE

If glass fiber optics are the selected medium, the connectors attached to the fiber-optic cable must be suitable, i.e. they must fit into the transmit and receive sockets on the SIMOLINK Pulse Generator.

How to assemble a bus cable

To make connections on a plastic fiber-optic cable, please follow the instructions below:

1. Cut the correct length of fiber-optic cable. Make sure you cut the cable at right angles, use a sharp knife. (Fig. 5-7 ①)
2. Remove approximately 7 mm of the outer, black sheath on the cable using a suitable cable stripping device. Take great care not to damage the fiber optic when removing the sheath!
3. Insert the fiber-optic cable into the connector (Fig. 5-7 ②) and push it into the cylindrical sleeve as far as it will go. The transparent fiber optic will protrude out of the other side of the sleeve.
4. Fold round the gripping half of the connector and close it by hand (Fig. 5-7 ③). Once the top half of the connector is latched into the lower half, the cable is lodged securely in the connector.
5. Use a sharp knife to cut the protruding end of the cable almost flush with the connector surface. Cut at right angles to the fiber-optic cable axis.
6. You now need to polish the surface of the fiber optic. To do this, place the end of the sleeve flat on the surface of the matt, rough side of the green polishing paper supplied, and "draw" a figure of 8. Then clean the end with a clean, lint-free cloth.
7. The sleeve end can be polished finely to reduce throughput losses to a minimum. Fine polishing reduces throughput losses by approximately 2 dB. To fine polish the sleeve, place it vertically on the matt, rough side of the pink polishing paper and "draw" a figure of 8 about 25 times. Then clean the end again with a clean, lint-free cloth.

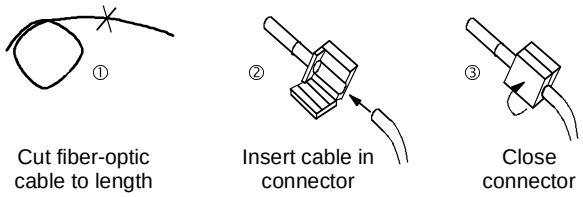


Fig. 5-7 Connecting a plastic cable

6 Start-Up

6.1 Setting the DIL switch

The SIMOLINK receive address (in dispatcher mode, address of the node transmitting the speed setpoint to the SLP) for the SIMOLINK Pulse Generator is set by means of an 8-channel DIL switch on the front of the housing. The receive channel cannot be set; its default setting is 0.

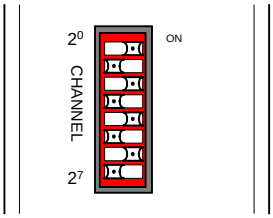


Fig. 6-1 DIL switch for read address (address =75)

Switch	Designation		Meaning	Range
.1	2^0	= 1		
.2	(2^1)	= 2		
.3	(2^2)	= 4	SIMOLINK receive address	0…200
.4	(2^3)	= 8	Note:	
.5	(2^4)	= 16	Switch 1 is the least significant bit.	
.6	(2^5)	= 32	Switch position on right means "1“ or "ON“.	
.7	(2^6)	= 64		
.8	2^7	=128		

Channel

Channel 1 of the DIL switch is at the top of the housing front panel in the assembled state.

Table 6-1 Value assignments for DIL switch

When set via the DIL switches, the receive address is directly transferred and the setpoint contained in the receive telegram is available as an output frequency at the encoder interface.

NOTICE

Address settings 201 to 255 are invalid, LEDs "SYNC“ and "FREQ“ flash alternately and no frequency is output.

6.2 LED displays

The status of the SIMOLINK Pulse Generator is displayed on three green LEDs on the housing front panel.

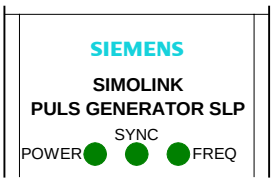


Fig. 6-2 SLP display

LED			Description
POWER	**SYNC**	**FREQ**	
○	○	○	Device not connected to supply voltage No + 24 V supply voltage available
●	○	○	Supply voltage connected: SYNC interrupt is **not** being received
●	✸	✸	DIL switch is incorrectly set SIMOLINK receive address higher than >200 set (alternate flashing of SYNC and FREQ LEDs)
●	●	○	SYNC interrupt is being received: Setpoint = 0 % or 0 Hz output frequency **or** setpoint telegram is **not** being received
●	●	●	FREQ LED flashes at the output frequency: Setpoint telegram is being received **and** setpoint not equal to 0 % (flashing is perceptible at very low setpoints only)

○ LED off

● LED illuminated continuously

✸ LED flashing (approximately twice per second)

Table 6-2 SLP operating states

NOTICE

An illuminated POWER LED does not necessarily confirm that the supply voltage level is correct. The operator is responsible for ensuring that the voltage supply remains stable within the specified limits.

6.3 SIMOLINK data interface

The SIMOLINK data interface comprises a single-channel SIMOLINK receive data word; it does not provide a transmit channel. It expects the speed setpoint for the frequency generator in receive channel 0 of the set receive address. The setpoint is read in the MASTERDRIVES 32-bit format (4000 0000 hex = 100 %); only the 10 highest bits are resolved, corresponding to a speed resolution of 0.4 %.

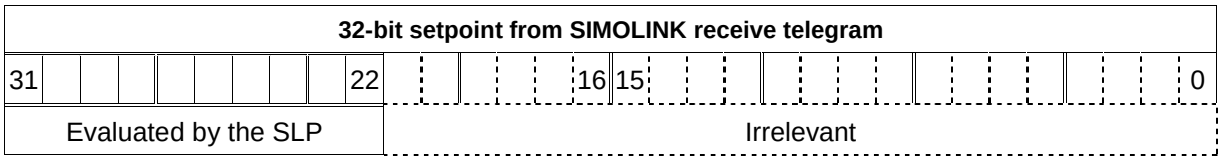


Fig. 6-3 SLP setpoint telegram

The frequency generator has a frequency range of 0 Hz to 112 kHz (at a rated frequency of 100 kHz). In the 90° pulses mode (4 edges required for correct signal sequence from tracks A and B), the resulting rated output frequency per track is 25 kHz and a maximum possible setpoint output of approximately 112 %.

32-bit setpoint (hex)	Setpoint [%]	Output frequency in 90°pulses mode [kHz]	Frequency in 100 kHz / sign mode
47C0 0000	+ 112.1	28.027	112.1 kHz / Low
4780 0000	+ 111.7	27.930	111.7 kHz / Low
4000 0000	+ 100.0	25.000	100.0 kHz / Low
0000 0000	0.0	0.000	0.0 kHz / Low
C000 0000	– 100.0	25.000	100.0 kHz / High
B880 0000	– 111.7	27.930	111.7 kHz / High
B840 0000	– 112.1	28.027	112.1 kHz / High

Table 6-3 Relationship between setpoint and output frequency

NOTICE

When the setpoint exceeds 112 %, the SIMOLINK Pulse Generator outputs the maximum frequency of approximately 28 kHz. If "100 kHz signal“ mode is active, then approximately 112 kHz.

Response to errored SIMOLINK telegrams

The SIMOLINK Pulse Generator updates the setpoint output in response to every SYNC interrupt with which error-free data are received. If a communications error occurs, the generator continues to operate on the old setpoint. If CRC errors occur 8 times in succession, it sets the frequency generator directly to 0 Hz and does not restart it until an error-free setpoint is received. It switches to 0 Hz immediately if communication on the SIMOLINK is aborted.

Setpoint adjustment to the machine velocity

The frequency output of the SIMOLINK pulse generator in the 90° pulses mode is identical to that of a pulse generator with 1000 pulses/rev and a speed normalization of 100 % = 1500 rev/min. If the generator is to simulate shaft encoders with other pulse numbers per revolution or different speed normalization, the setpoint to the SLP must be renormalized. This can be done, for example, by multiplying the machine setpoint. In this regard, it is important to note that the maximum setpoint for the SLP on the SIMOLINK data interface must not exceed 112 % (max. output frequency of approximately 28 kHz in 90° pulse mode).

$$\text{Multiplier} = \frac{\text{Reference speed} \times \text{Encoder pulses/rev}}{60 \times \text{Output frequency}} \text{ x } 100\,\%$$

Output frequency depending on operating mode:

- 25000 In 90° pulse mode
- 100000 In 100 kHz signal mode

Reference speed [rev/min]	No. of encoder pulses per rev.	Multiplier [%]
500	1000	33.333
1000	1000	66.667
1000	2000	133.333 1)
1500	1000	100.000
1500	1024	102.400
1500	2048	Not displayable

1) The speed range of the SLP cannot be output with this combination

Table 6-4 Examples for 90° pulses mode

Reference speed [rev/min]	No. of encoder pulses per rev.	Multiplier [%]
500	1024	8.53
1000	2000	66.66
1500	2048	51.200
2000	5000	166.667 1)
2500	2000	83.333
3000	2000	100.000

1) The speed range of the SLP cannot be output with this combination

Table 6-5 Examples for 100 kHz signal mode

Parameterization example

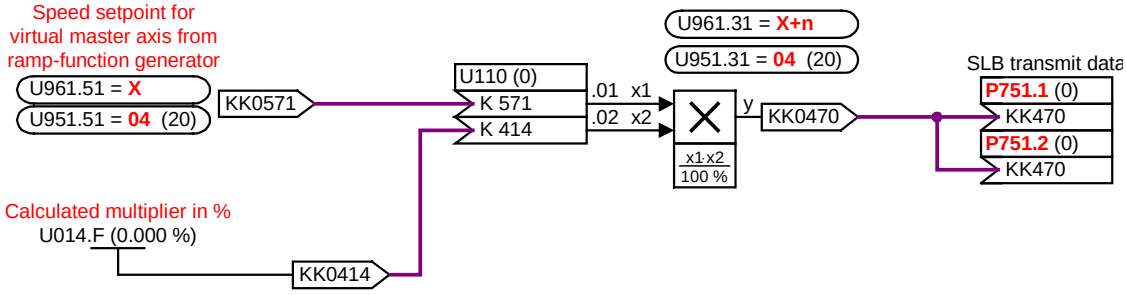


Fig. 6-4 Example of setpoint normalization parameter settings

NOTICE

The processing time slot and sequence must be taken into account in the parameter settings. If a time slot other than the time slot for setpoint calculation is used or the processing sequence altered, the resulting dead times will cause a lag in the signal output when the setpoint is changed.

Bisher sind folgende Ausgaben erschienen:

Ausgabe	Interne Sachnummer
AA	GWE-477 764 4070.76 J AA-76

Ausgabe AA besteht aus folgenden Kapiteln:

Kapitel		Änderungen	Seitenzahl	Ausgabedatum
1	Definitionen und Warnungen	Erstausgabe	3	02.2001
2	Produktbeschreibung	Erstausgabe	2	02.2001
3	Technische Daten	Erstausgabe	1	02.2001
4	Montage	Erstausgabe	2	02.2001
5	Anschließen	Erstausgabe	6	02.2001
6	Inbetriebsetzen	Erstausgabe	5	02.2001

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Edition	Internal Item Number
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Version AA consists of the following chapters:

Chapter		Changes	Pages	Version date
1	Definitions and Warnings	first edition	3	02.2001
2	Product Description	first edition	2	02.2001
3	Technical Data	first edition	1	02.2001
4	Installation	first edition	2	02.2001
5	Connections	first edition	6	02.2001
6	Start-up	first edition	5	02.2001

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SIEMENS

SIMOVERT MASTERDRIVES

Betriebsanleitung
Operating Instructions

SLS – SIMOLINK Switch

Ausgabe / Edition: AA

GWE-477 762 4070.76 J

Änderungen von Funktionen, technischen Daten, Normen, Zeichnungen und Parametern vorbehalten.

We reserve the right to make changes to functions, technical data, standards, drawings and parameters.

Wir haben den Inhalt der Druckschrift auf Übereinstimmung mit der beschriebenen Hard- und Software überprüft. Dennoch können Abweichungen nicht ausgeschlossen werden, so daß wir für die vollständige Übereinstimmung keine Garantie übernehmen. Die Angaben in dieser Druckschrift werden jedoch regelmäßig überprüft und notwendige Korrekturen sind in den nachfolgenden Auflagen enthalten. Für Verbesserungsvorschläge sind wir dankbar

We have checked the contents of this document to ensure that they coincide with the described hardware and software. However, differences cannot be completely excluded, so that we do not accept any guarantee for complete conformance. However, the information in this document is regularly checked and necessary corrections will be included in subsequent editions. We are grateful for any recommendations for improvement.

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Contents

1 Definitions and Warnings

Qualified personnel

For the purpose of this documentation and the product warning labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up, operation and maintenance of the product. He or she must have the following qualifications:

- Trained or authorized to energize, de-energize, ground and tag circuits and equipment in accordance with established safety procedures.
- Trained or authorized in the proper care and use of protective equipment in accordance with established safety procedures.
- Trained in rendering first aid.

DANGER

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

WARNING

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

CAUTION

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

CAUTION

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

NOTICE

NOTICE used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesirable result or state.

NOTE

For the purpose of this documentation, "Note" indicates important information about the product or about the respective part of the documentation which is essential to highlight.

WARNING

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the warnings can thus result in severe personal injury or property damage.

Only qualified personnel should work on or around the equipment

This personnel must be thoroughly familiar with all warning and maintenance procedures contained in this documentation.

The successful and safe operation of this equipment is dependent on correct transport, proper storage and installation as well as careful operation and maintenance.

NOTE

This documentation does not purport to cover all details on all types of the product, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local SIEMENS sales office.

The contents of this documentation shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of SIEMENS AG. The warranty contained in the contract between the parties is the sole warranty of SIEMENS AG. Any statements contained herein do not create new warranties or modify the existing warranty.

CAUTION

Components which can be destroyed by electrostatic discharge (ESD)

The board contains components which can be destroyed by electrostatic discharge. These components can be easily destroyed if not carefully handled. If you have to handle electronic boards, please observe the following:

Electronic boards should only be touched when absolutely necessary.

The human body must be electrically discharged before touching an electronic board.

Boards must not come into contact with highly insulating materials - e.g. plastic parts, insulated desktops, articles of clothing manufactured from man-made fibers.

Boards must only be placed on conductive surfaces.

Boards and components should only be stored and transported in conductive packaging (e.g. metalized plastic boxes or metal containers).

If the packing material is not conductive, the boards must be wrapped with a conductive packaging material, e.g. conductive foam rubber or household aluminium foil.

The necessary ESD protective measures are clearly shown again in the following diagram:

- a = Conductive floor surface
- b = ESD table
- c = ESD shoes
- d = ESD overall
- e = ESD chain
- f = Cubicle ground connection

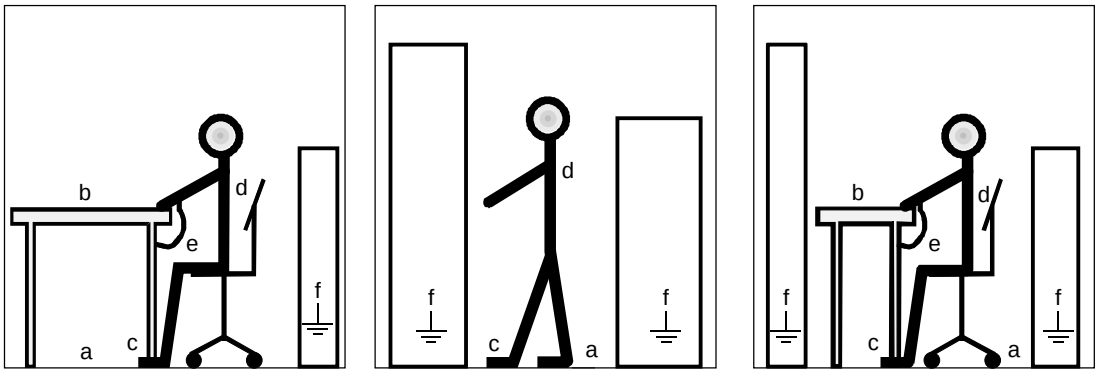


Fig. 1-1 ESD protective measures

2 Description

To replace the "line shaft" by a drive system containing several single drives, these individual drive units must be synchronized with one another. This synchronization functionality is provided by SIMOLINK, which also supports distribution of setpoints and internode data communication. It may be necessary, for example, when a master fails, to assign its slave drives to another master, or to adjust the topology of the SIMOLINK ring to a changing application using a signal "switch".

This is the function of the SIMOLINK Switch (SLS). It allows several (up to 4) SIMOLINK rings to be flexibly interconnected.

The SIMOLINK transmission medium is a fiber-optic cable. Fiber optics made of glass or plastic may be used. SIMOLINK has a ring-shaped structure, with each node in the ring acting as a signal amplifier. A maximum of 201 active nodes can be interconnected on the SIMOLINK ring.

NOTE

For further information about SIMOLINK, please refer to Chapter "Communication / SIMOLINK“ of the SIMOVERT MASTERDRIVES Compendium Motion Control, Order No.: 6SE7087-6QX50.

2.1 Operating principle

The incoming optical signals carried by the fiber-optic cable are converted to electrical signals on fiber-optic receiver modules in the SIMOLINK Switch. The control logic determines which input is switched through to which output. One input can only be connected to one output. The electrical output signals of the switching matrix are converted back to optical signals via fiber-optic transmission modules. The SIMOLINK Switch has 4 ports (channels), each comprising a fiber-optic receiver and transmitter module.

The dead times resulting from the opto-electrical conversion are calculated as the SIMOLINK system is booting and compensated when the SIMOLINK nodes are active. The SIMOLINK Switch is a passive node in the SIMOLINK ring. It does not have a node address and is excluded from the dead-time calculation. These factors must be taken into account as regards the position of the SIMOLINK Switch in the SIMOLINK ring.

The appropriate connections between the input and output signal can be selected via a DIL switch (local) or binary inputs (remote). The settings on the DIL switches have higher priority.

The selected position of the SIMOLINK Switch is displayed by means of 5 green LEDs in the front panel. Two LEDs indicate whether the SIMOLINK Switch mode is selected via the DIL switches (Local) or no switch mode is selected (OFF).

2.2 Example configuration

The following examples illustrate the application of the SIMOLINK Switch, e.g. in the event of a master failure, for the purpose of allocating a SIMOLINK ring and its nodes to another master.

In normal operation, each master is directly connected to its SIMOLINK ring and its nodes via the SIMOLINK Switch.

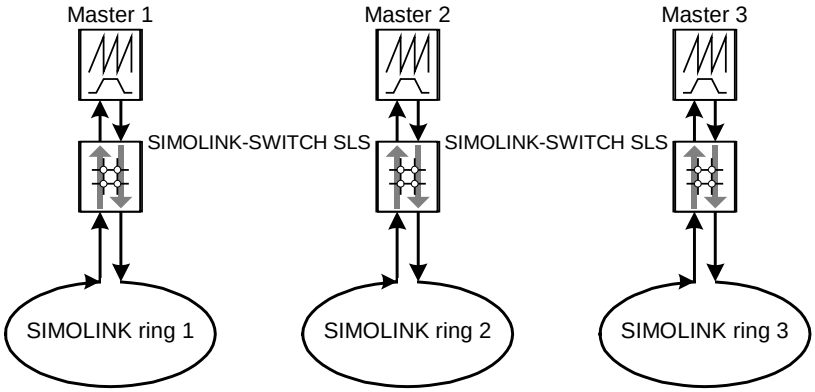


Fig. 2-1 Normal operation

If master 2 fails, the SIMOLINK ring 2 can be linked to master 1 via the two SLS in such a way that it operates the two SIMOLINK rings, i.e. 1 and 2, as if they were one single SIMOLINK ring (1.1 and 1.2).

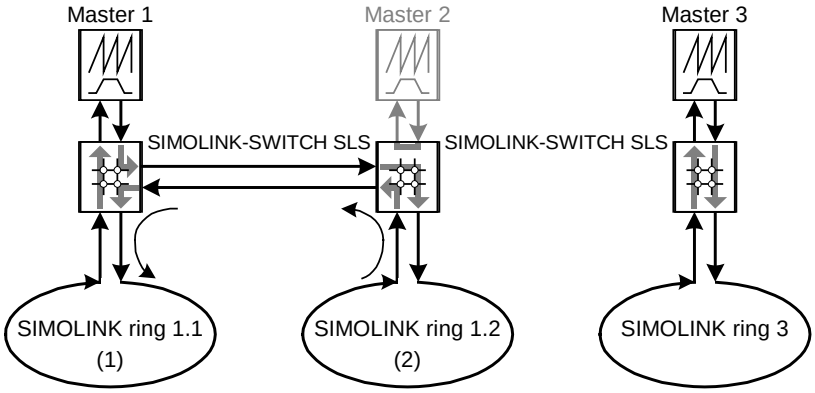


Fig. 2-2 Failure of master 2

NOTE

Nodes can be positioned between the master and the SLS. These are always permanently allocated to this one master and, if it fails, cannot be operated on the SIMOLINK ring.

If the nodes allocated to master 3 need to be operated on master 1, it is possible to switch the whole of SIMOLINK ring 3 over to master 1 and operate it in conjunction with ring 1 as a combined SIMOLINK ring comprising 1.1 and 1.2.

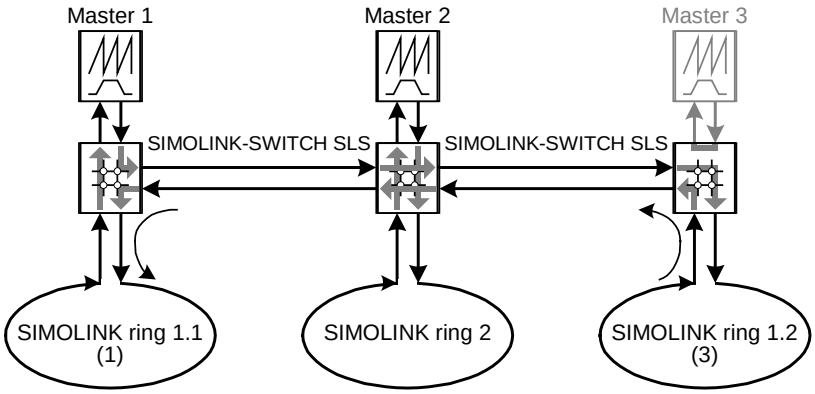


Fig. 2-3 SIMOLINK ring 3 is operating on master 1

3 Technical Data

Product name	**SLS**
Order number	6SX7005-0AE00
Size [mm]: – Width – Height – Depth	Device dimensions (housing) 35 (35) 118 (107) 88 (80)
Weight	Approx. 250 g
Degree of protection	IP20 to EN 60529
Degree of pollution	Not applicable Moisture condensation is not permissible in operation
Mechanical strength: – In steady-state operation – During transportation	Not applicable
Climate class	Class 3K3 to DIN IEC 721-3-3 (in operation)
Cooling method (operation)	Convection
Permissible ambient or coolant temperature: – In operation – In storage – During transportation	 0 °C to +55 °C –25 °C to +70 °C –25 °C to +70 °C
Permissible humidity rating: – Transport/storage – In operation	Relative air humidity ≤ 95 % ≤ 85 % (condensation not permitted)
Power supply	
Rated supply voltage	DC +24 V (+21 V to +28 V)
Power consumption	Approx. 600 mA
Voltage signal at binary inputs	
HIGH signal – Rated value – Voltage range – Power consumption – Smoothing – Electrical isolation	 DC +24 V +13 V to +30 V Typ. 7 mA Approx. 5 ms None
LOW signal – Rated value – Voltage range	 DC ± 0 V –3 V to +5 V
Fiber-optic cable connection	
Transmitter power	Fixed (maximum transmitter power defined for SIMOLINK)
Fiber-optic cable modules – Transmitter – Receiver	Hewlett Packard HFBR 1528 HFBR 2528

Table 3-1 Technical data

4 Installation

The SIMOLINK Switch module is snapped onto an EN 50022-compliant TS 35 top-hat rail. The requisite mechanical mounting elements are fitted in the housing.

4.1 EMC measures

The module is connected to ground via the top-hat rail. The ground connection between the rail and the equipotential bonding conductor must be made by the end-user during installation.

NOTE

For further information, please refer to Chapter "Instructions for Design of Drives in Conformance with EMC Regulations" of the SIMOVERT MASTERDRIVES Compendium Motion Control, Order No.: 6SE7087-6QX50.

4.2 Housing

The following diagrams show a schematic illustration of the housing and the layout of connections and operating elements.

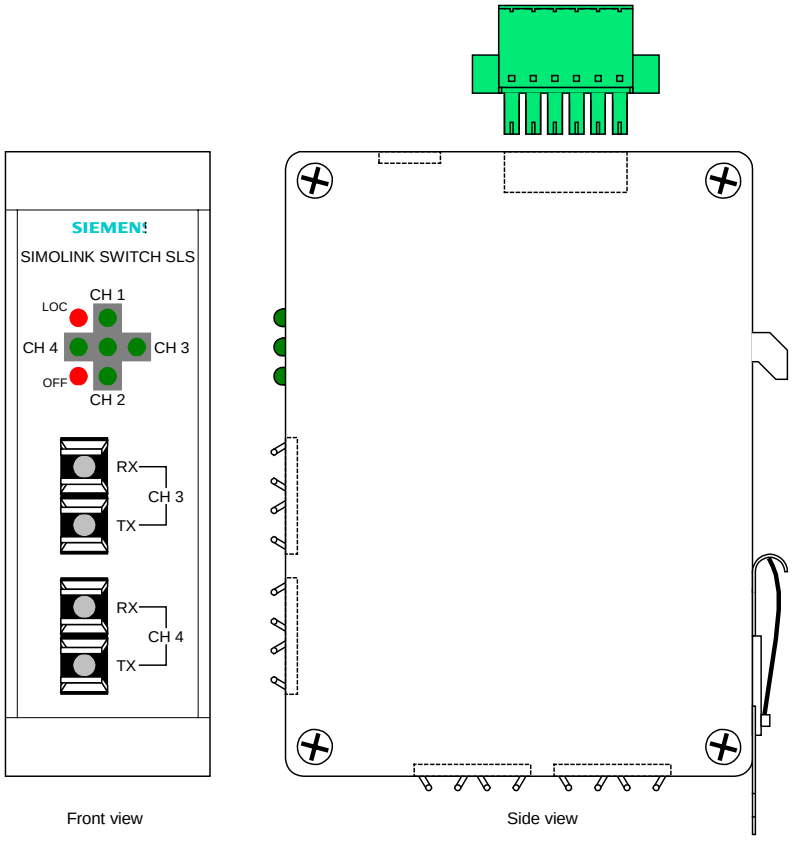
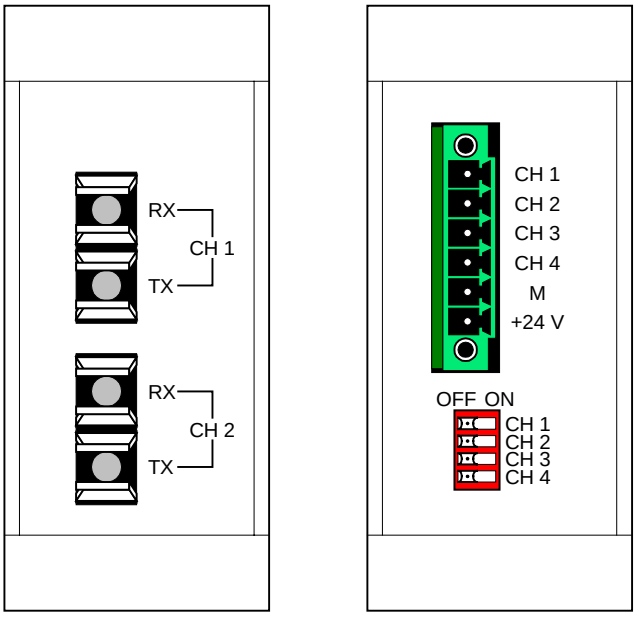


Fig. 4-1



View from below Plan view

Fig. 4-2

5 Connections

The SIMOLINK Switch features

- a connector for supplying the module power and mode activation via binary inputs
- four SIMOLINK fiber-optic cable connections, each with one transmit and one receive socket.

5.1 Connector X1

The 6-pin connector is on top of the housing. The 24 V power supply for the SIMOLINK Switch and the mode activation signals (via binary inputs) are connected to X1.

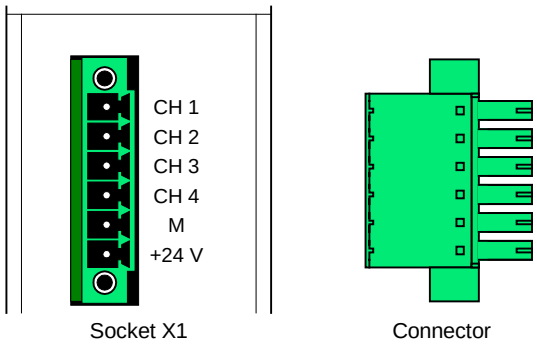


Fig. 5-1

Terminal	Designation	Meaning	Range
1	CH1	Activation of SLS mode CH1	24 V, approx. 7 mA
2	CH2	Activation of SLS mode CH2	24 V, approx. 7 mA
3	CH3	Activation of SLS mode CH3	24 V, approx. 7 mA
4	CH4	Activation of SLS mode CH4	24 V, approx. 7 mA
5	M	Ground	
6	+24 V	24 V voltage supply	+21 ... 28 V

Connectable cross-section: 1.5 mm^2 (AWG 16)

Terminal 1 is the terminal to the rear of the module top plate (see plan view).

Table 5-1 Connector assignments

5.2 Fiber-optic cable connections CH1 to CH4

The fiber-optic cables are connected via plug-and-socket connectors. The sockets are located on the front and bottom of the housing. Each connection (channel) consists of a transmitter and a receiver socket. The output power of the fiber-optic transmitter is not variable, but permanently set to the maximum transmitter power defined for SIMOLINK.

SIMOLINK is a clocked, ring-shaped fiber-optic bus system. To allow the flow of signal traffic, the transmit socket of the first node must be connected to the receive socket of the next node and so on, until the transmit socket of the last node is connected to the receive socket of the first node.

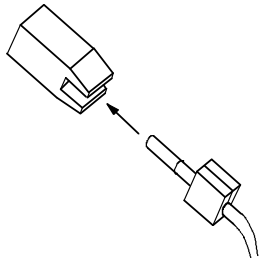


Fig. 5-2 Bus connection

The receive socket is dark grey and labeled RX. The transmit socket is light grey and labeled TX.

The following Hewlett Packard fiber-optic modules are installed in the SIMOLINK Switch:

- Transmitter: HFBR 1528
- Receiver: HFBR 2528

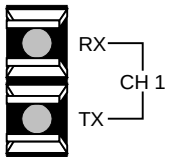


Fig. 5-3 Fiber-optic cable connection CH1

Plastic or glass fiber-optic cables can be used. Depending on the type of cable selected, the inter-node distances are as follows:

- Max. 40 m between each node in the case of plastic cables or
- Max. 300 m between each node in the case of glass cables.

The maximum permissible ring bus length is 1000 m.

NOTE

A components package for assembling plastic fiber-optic cable connections can be ordered under number 6SX7010-0FJ50. This contains: 100 m plastic fiber-optic cable, 40 fiber-optic connectors, 20 connectors for terminal strip X470 SLB.

NOTICE

If glass fiber optics are the selected medium, the connectors attached to the fiber-optic cable must be suitable, i.e. they must fit into the transmit and receive sockets on the SIMOLINK Switch.

How to assemble a bus cable

To make connections on a plastic fiber-optic cable, please follow the instructions below:

1. Cut the correct length of fiber-optic cable. Make sure you cut the cable at right angles, use a sharp knife (Fig. 5-4 ①).
2. Remove approximately 7 mm of the outer, black sheath on the cable using a suitable cable stripping device. Take great care not to damage the fiber optic when removing the sheath!
3. Insert the fiber-optic cable into the connector (Fig. 5-4 ②) and push it into the cylindrical sleeve as far as it will go. The transparent fiber optic will protrude out of the other side of the sleeve.
4. Fold round the gripping half of the connector and close it by hand (Fig. 5-4 ③). Once the top half of the connector is latched into the lower half, the cable is lodged securely in the connector.
5. Use a sharp knife to cut the protruding end of the cable almost flush with the connector surface. Cut at right angles to the fiber-optic cable axis.
6. You now need to polish the surface of the fiber optic. To do this, place the end of the sleeve flat on the surface of the matt, rough side of the green polishing paper supplied, and "draw" a figure of 8. Then clean the end with a clean, lint-free cloth.
7. The sleeve end can be polished finely to reduce throughput losses to a minimum. Fine polishing reduces throughput losses by approximately 2 dB. To fine polish the sleeve, place it vertically on the matt, rough side of the pink polishing paper and "draw" a figure of 8 about 25 times. Then clean the end again with a clean, lint-free cloth.

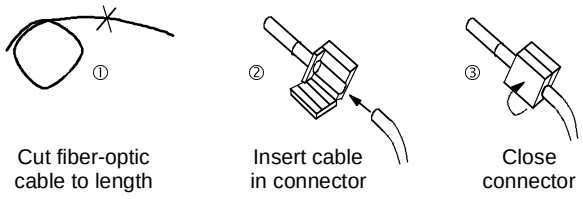


Fig. 5-4 Connecting a plastic cable

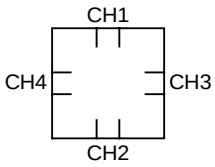
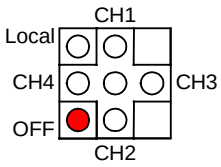
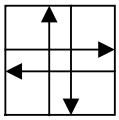
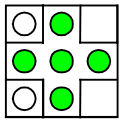
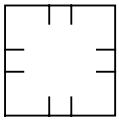
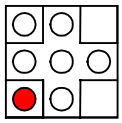
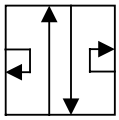
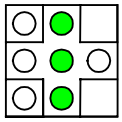
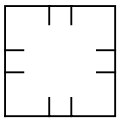
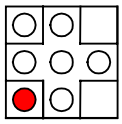
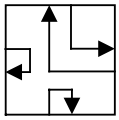
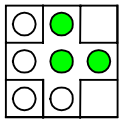
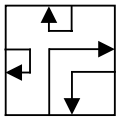
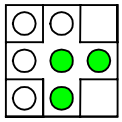
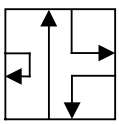
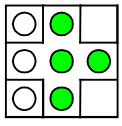
6 Start-Up

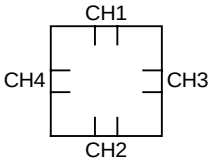
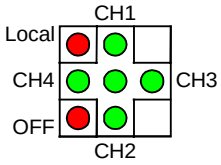
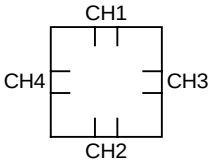
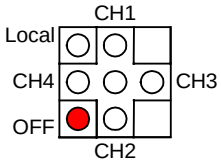
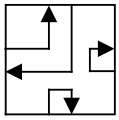
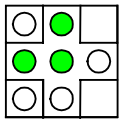
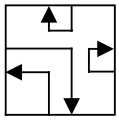
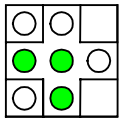
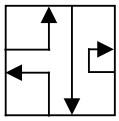
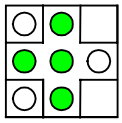
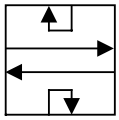
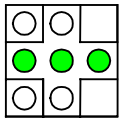
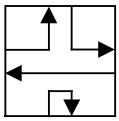
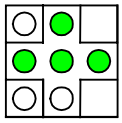
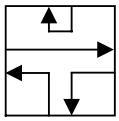
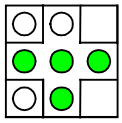
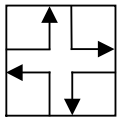
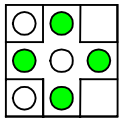
6.1 SIMOLINK Switch mode

The mode of the SIMOLINK Switch determines the connections between the input and output signals. Its modes are activated by means of 4 bits (CH1 to CH4) via DIL switches or binary inputs. The active mode is displayed on LEDs mounted in the front panel.

Switch modes

The following table shows the possible SIMOLINK Switch modes with the relevant activation bit patterns and LED displays. The "Local" LED lights up additionally if the mode is selected via the DIL switches.

SLS mode	Activation CH4	CH3	CH2	CH1	Signal chart	LED display
0	0	0	0	0		
1	0	0	0	1		
2	0	0	1	0		
3	0	0	1	1		
4	0	1	0	0		
5	0	1	0	1		
6	0	1	1	0		
7	0	1	1	1		

SLS mode	Activation CH4	CH3	CH2	CH1	Signal chart	LED display
8 (Local) LED test	1	0	0	0		
8 (Remote)	1	0	0	0		
9	1	0	0	1		
A	1	0	1	0		
B	1	0	1	1		
C	1	1	0	0		
D	1	1	0	1		
E	1	1	1	0		
F	1	1	1	1		

○ LED off

●/● LED illuminated continuously

Table 6-1 SIMOLINK Switch mode

Setting via DIL switches

This setting option enables you to set the mode locally on the switch, e.g. for testing and servicing purposes. The Switch mode is set by means of a 4-channel DIL switch (CH1 to CH4) on top of the switch housing. If you set the SIMOLINK Switch mode on the DIL switches, the "Local" LED lights up and the mode selection commands from the binary inputs become inoperative (the binary inputs are operative only if **all** the DIL switches are in the OFF position).

Please note the following as regards activating the Switch mode using the DIL switches:

- Switch position OFF = 0
- Switch position ON = 1

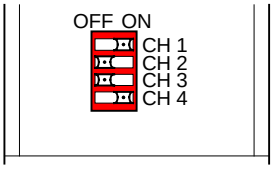


Fig. 6-1 DIL switches (mode =9)

LED test: All LEDs are illuminated for the purpose of lamp testing if you select channel 4 only (mode 8 Local) on the DIL switches.

Setting via binary inputs

The Switch mode can be activated from a PLC via binary signals. The binary inputs are operative only if **all** DIL switches are in the OFF position.

Please note the following as regards activating the Switch mode via binary inputs:

- Level LOW/OFF = 0
- Level HIGH/ON = 1

Display

The LED display on the front panel comprises 7 LEDs. The 5 green LEDs on a grey background indicate the current setting of the SIMOLINK Switch. The two red LEDs indicate whether the mode is selected via DIL switches, i.e. local (LED: LOC) or none is activated (LED: OFF) (cf. Table 6-1).

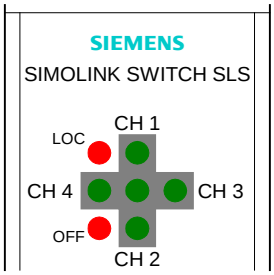


Fig. 6-2 SLS display

6.2 Operating information

If the SIMOLINK Switch mode is changed while the switch is transmitting, the incoming signals (converted from optical to electrical) are switched over to the new outputs. This is performed bit by bit, resulting in destruction of the telegram structure. The telegrams are then transmitted via a new signal route through the modified ring structure (switchover does not take place at telegram limits). Transmit operation cannot be interrupted or ended in dispatcher mode. For this reason, the SLS mode is always changed while the switch is transmitting in dispatcher mode. In order to ensure that all nodes can reliably detect an interruption in transmit operation and the SIMOLINK master and dispatcher can execute a proper bus runup, the SIMOLINK Switch mode must be changed over via OFF mode (mode 0 or 8).

NOTICE

OFF mode must remain selected in dispatcher mode for a period equaling at least the set telegram failure time of the master before the new switch mode can be activated. All nodes switch to SIMOLINK error status during runup at the latest and must be acknowledged.

The bus runup operation is required to allow calculation and compensation of the dead times in SIMOLINK polling caused by propagation delays. The signal propagation delay is dependent on the SIMOLINK ring topology.

NOTE

The dead time of a signal throughput (optical to electrical back to optical from any input to any output) in the SIMOLINK Switch is approximately 273 ns (3 bit times from 11 Mbit/s transmission speed).

6.3 Diagnostics

Diagnostic LEDs are mounted in the front panel. They indicate the current SIMOLINK Switch mode, whether it has been activated via DIL switches or binary inputs or whether no mode is selected. If only channel 4 is selected via the DIL switches, all LEDs light up for lamp testing purposes (Table 6-1).

Bisher sind folgende Ausgaben erschienen:

Ausgabe	Interne Sachnummer
AA	GWE-477 762 4070.76 J AA-76

Ausgabe AA besteht aus folgenden Kapiteln:

Kapitel		Änderungen	Seitenzahl	Ausgabedatum
1	Definitionen und Warnungen	Erstausgabe	3	02.2001
2	Beschreibung	Erstausgabe	3	02.2001
3	Technische Daten	Erstausgabe	1	02.2001
4	Montage	Erstausgabe	2	02.2001
5	Anschließen	Erstausgabe	3	02.2001
6	Inbetriebsetzung	Erstausgabe	4	02.2001

The following editions have been published so far:

Edition	Internal Item Number
AA	GWE-477 762 4070.76 J AA-76

Version AA consists of the following chapters:

Chapter		Changes	Pages	Version date
1	Definitions and Warnings	first edition	3	02.2001
2	Description	first edition	3	02.2001
3	Technical Data	first edition	1	02.2001
4	Installation	first edition	2	02.2001
5	Connection	first edition	3	02.2001
6	Start-up	first edition	4	02.2001

Group: Automation and Drives (A&D)
Division: Variable-Speed Drive Systems
Postfach 3269, D-91050 Erlangen

Siemens Aktiengesellschaft

Subject to change

GWE-477 762 4070.76
Printed in the Federal Republic of Germany
02.2001

SIEMENS

SIMOVERT MASTER DRIVES
Funk - Entstörfilter
EMC-Filter

Betriebsanleitung
Operating Instructions

Ausgabe / Edition: 09.95

Bestell-Nr. / Order-No.: 6SE7087-6CX87-0FB0

0 Definitions

- QUALIFIED PERSONNEL

  For the purpose of these instructions and product labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up and operation of the equipment and the hazards involved. He or she must have the following qualifications:

  1. Trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.
  2. Trained in the proper care and use of protective equipment in accordance with established safety procedures.
  3. Trained in rendering first aid.

- DANGER

  For the purpose of these instructions and product labels, "Danger" indicates death, severe personal injury or substantial property damage will result if proper precautions are not taken.

- WARNING

  For the purpose of these instructions and product labels, "Warning" indicates death, severe personal injury or property damage can result if proper precautions are not taken.

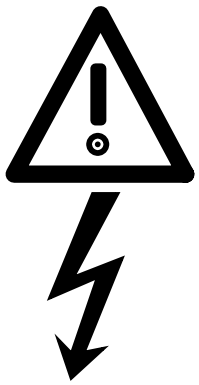
- CAUTION

  For the purpose of these instructions and product labels, "Caution" indicates that minor personal injury or material damage can result if proper precautions are not taken.

- NOTE

  For the purpose of these instructions, "Note" indicates information about the product or the respective part of the Instruction Manual which is essential to highlight.

NOTE
These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office. The contents of this Instruction Manual shall not become part of or modify any prior or existing agreement, committment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.



WARNING

Hazardous voltages are present in this electrical equipment during operation.

Non-observance of the safety instructions can result in severe personal injury or property damage.

Only qualified personnel should work on or around the equipment after first becoming thoroughly familiar with all warning and safety notices and maintenance procedures contained herein.

The successful and safe operation of this equipment is dependent on proper handling, installation, operation and maintenance.

1 Description

In combination with the EMC filters 6SE70..-.ES87-1FB. SIMOVERT MASTER DRIVES meet the EMC limits of EN 55011 when operated at pulse frequencies of 3 and 6 kHz, respectively, if the following mounting and connection rules are observed.

2 Mounting and Connection

2.1 Mounting

The EMC filters may only be used in TN lines (with grounded neutral).

When a radio interference suppression filter is mounted in a cabinet it must be mounted directly next to the converter. The commutating reactor is installed between the the radio interference suppression filter and the converter. The associated cabling should be as short as possible. The line supply cable to the radio interference suppression filter must be routed separately away from other cables so that the suppressed line supply cable doesnt inject any noise into the system which would, to some extent, reduce the effectiveness of the radio interference suppression filter.

The converter and radio interference suppression filter housings must be connected through a low ohmic connection due to the high-frequency noise currents. In practice, this can only be realized by mounting the converter and the filter on a common mounting panel. The converter and the filter must be connected to the panel through the largest surface area. The most suitable is a bare metal mounting panel. e.g. a stainless steel panel or galvanized sheet steel as in this case the complete mounting surface provides an excellent electrical connection. If painted mounting panels are used, the paint must be removed from the screw locations retaining the converter and filter so that a good electrical contact is guarranteed.

The motor must be connected through a shielded cable. The shield must be connected through the largest surface area at the motor and the converter. A connection adapter for cable shields (comprising of section A and section B), used to connect the shield at the converter and is mounted under the converter (see Fig. 2.1). The connection adapter for cable shields is an option.

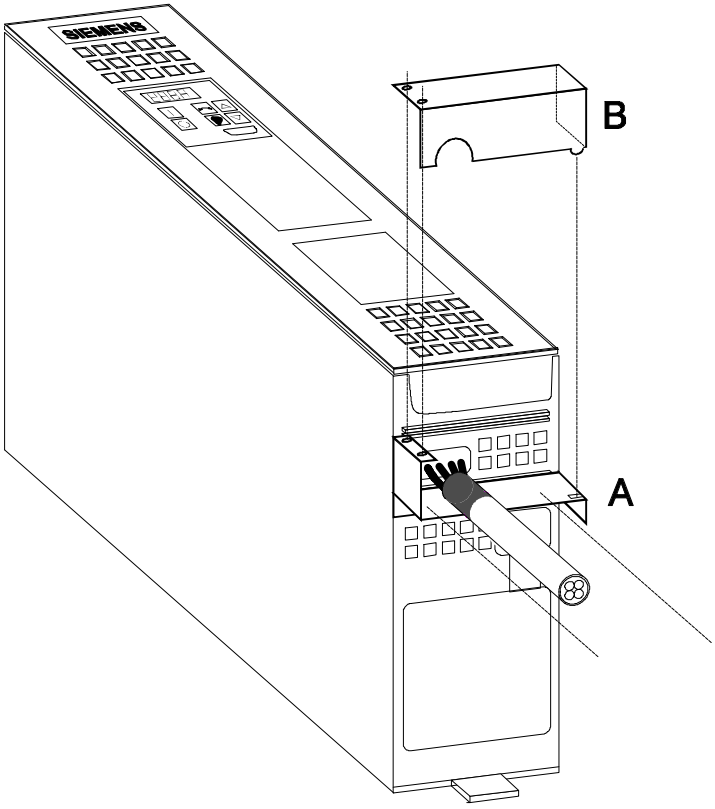


Fig. 2.1 Mounting the shield plate for SIMOVERT Master Drives Bauform A to D

Order-No. for connection adapter for cable shields see Tab.2.1!

- Screw lower section A of the shield plate to the SIMOVERT MASTER DRIVES.
- Mount the SIMOVERT MASTER DRIVES to the mounting panel.
- Connect the shielded motor cable and shield to lower section A through a large surface area, e.g. retain using a cable tie.
- Locate the upper section B and screw into place. Additional shields of other signal cables can be connected to the upper section.

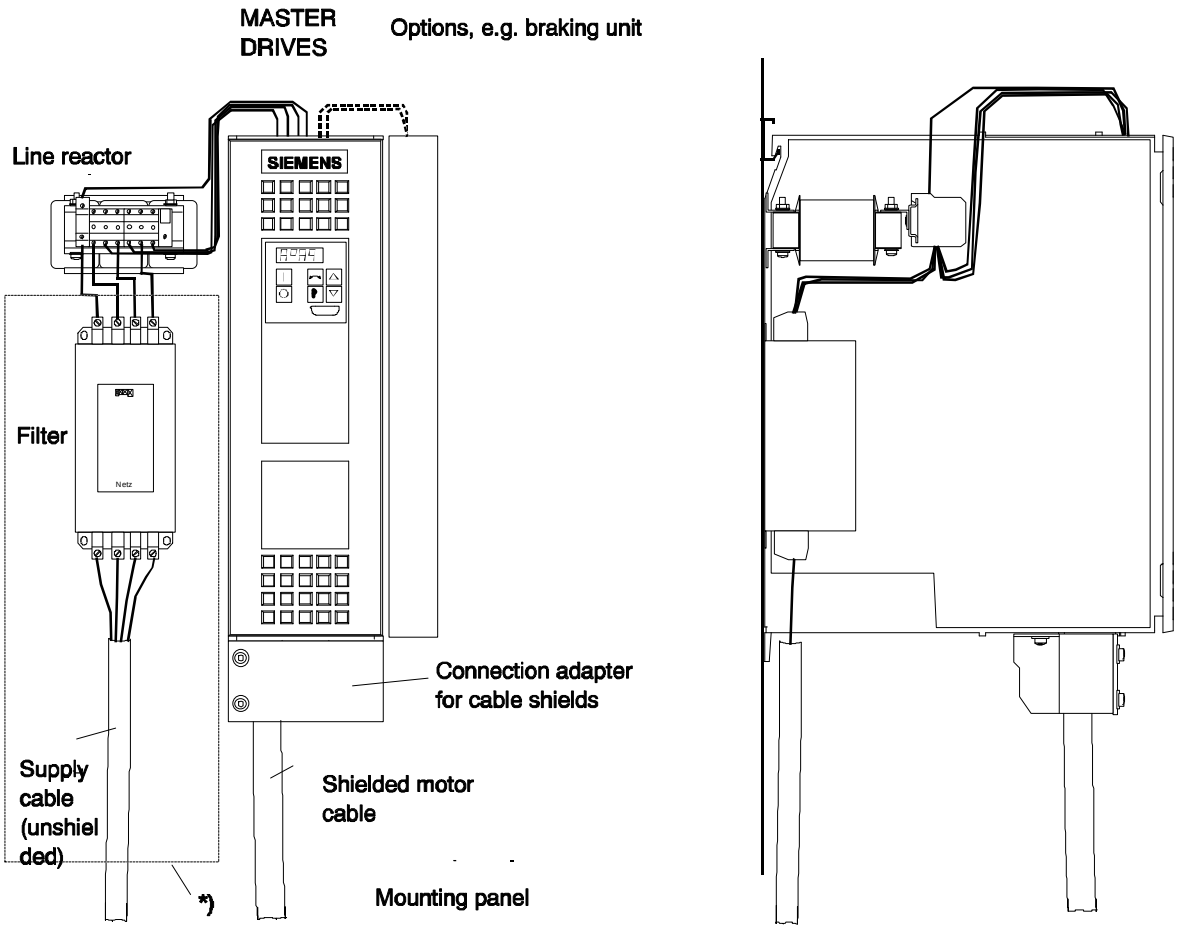


Fig 2.2 Mounting Example for SIMOVERT Masters Drives Size A to D

2.2 Connection

- Use shielded control cables. The shield must be connected to the transmitting and receiving sides.

  For analog control cables, if the shield is connected at both sides this can result in hum (noise); in this case the shield should only be connected at one side - at the converter.

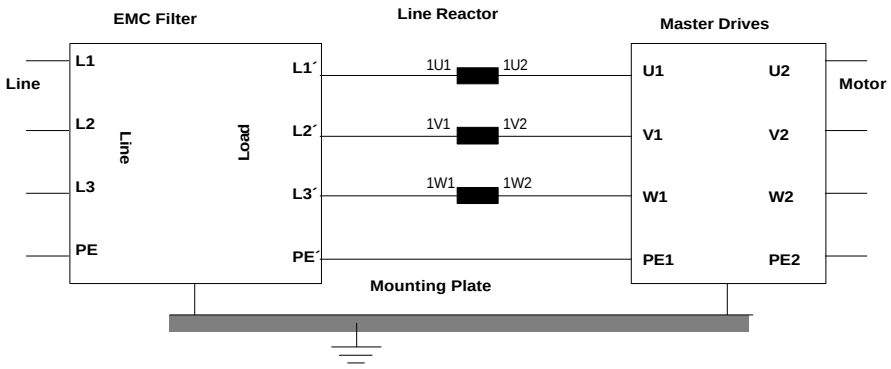


Fig. 2.3 Circuit Diagram

- Route the control cables separately away from power cables. In this case power cables include the motor feeder cable and connecting cables between the converter DC link (terminals „C/ L+“ and „D/ L-“) and other components, e.g. the braking unit. It is especially important that control cables and power cables are not routed in a common cable duct - even if all of the cables are shielded.

- Shielded motor cables must be used. Length of motor cable ≤ 30 m.
  Connect the shield to the connection adapter and case of the motor.

The filters must only be used in combination with the following drives.

EMC Filter Order No	Drive Order No. 6SE70 . . – . . . 10 6SE70 . . – . . . 20 6SE70 . . – . . . 30	Connection Adapter f. Cable Shields Order No	Line Commutation-Reactor Order No
6SE7021-0ES87-0FB0	**16 – 1 EA . .**		**4EP3200 -1UK**
	18 – 0 EA . .	**6SE7090-0XA87-3CA0**	**4EP3400 -2UK**
	21 – 0 EA . .		**4EP3400 -1UK**
6SE7021-8ES87-0FB0	**21 – 3 EB . .**	**6SE7090-0XA87-3CA0**	**4EP3600 -4UK**
	21 – 8 EB . .		
6SE7023-4ES87-0FB0	**22 – 6 EC . .**	**6SE7090-0XA87-3CA0**	**4EP3600 -5UK**
	23 – 4 EC . .		**4EP3700 -2UK**
6SE7027-2ES87-0FB0	**23 – 8 ED . .**		**4EP3700 -5UK**
	24 – 7 ED . .	**6SE7090-0XA87-3CA0**	**4EP3800 -2UK**
	26 – 0 ED . .		**4EP3800 -7UK**
	27 – 2 ED . .		**4EP3900 -2UK**
6SE7031-0ES87-0FA0	**31 – 0 EE . .**		**4EP3900 -2UK**
6SE7031-8ES87-0FA0	**31 – 2 EF . .**		**4EP4000 -6UK**
	31 – 5 EF . .		**4EU2451-2UA00**
	31 – 8 EF . .		**4EU2551-4UA00**
6SE7033-7ES87-0FA0	**32 – 1 EG . .**		**4EU2551-8UA00**
	32 – 6 EG . .		**4EU2751-0UB00**
	33 – 2 EG . .		**4EU2751-7UA00**
	33 – 7 EH . .		**4EU2751-8UA00**

Tabelle 2.1 Filter - Drive -Connection Adapter f.Cable Shields - Line Commutation Reactor Combinations

2.3 Dimension Drawings

2.3.1 Sizes A to D

Order No..	a mm	b mm	c mm	d mm	e mm	f mm	g mm	i mm	h mm
6SE7021-0ES87-0FB0	81	90	60	5,5	75	182	166	196	215
6SE7021-8ES87-0FB0									
6SE7023-4ES87-0FB0	86	101	69	5,5	85				245
6SE7027-2ES87-0FB0	141	141	96	6,6	120	240	221	256	308

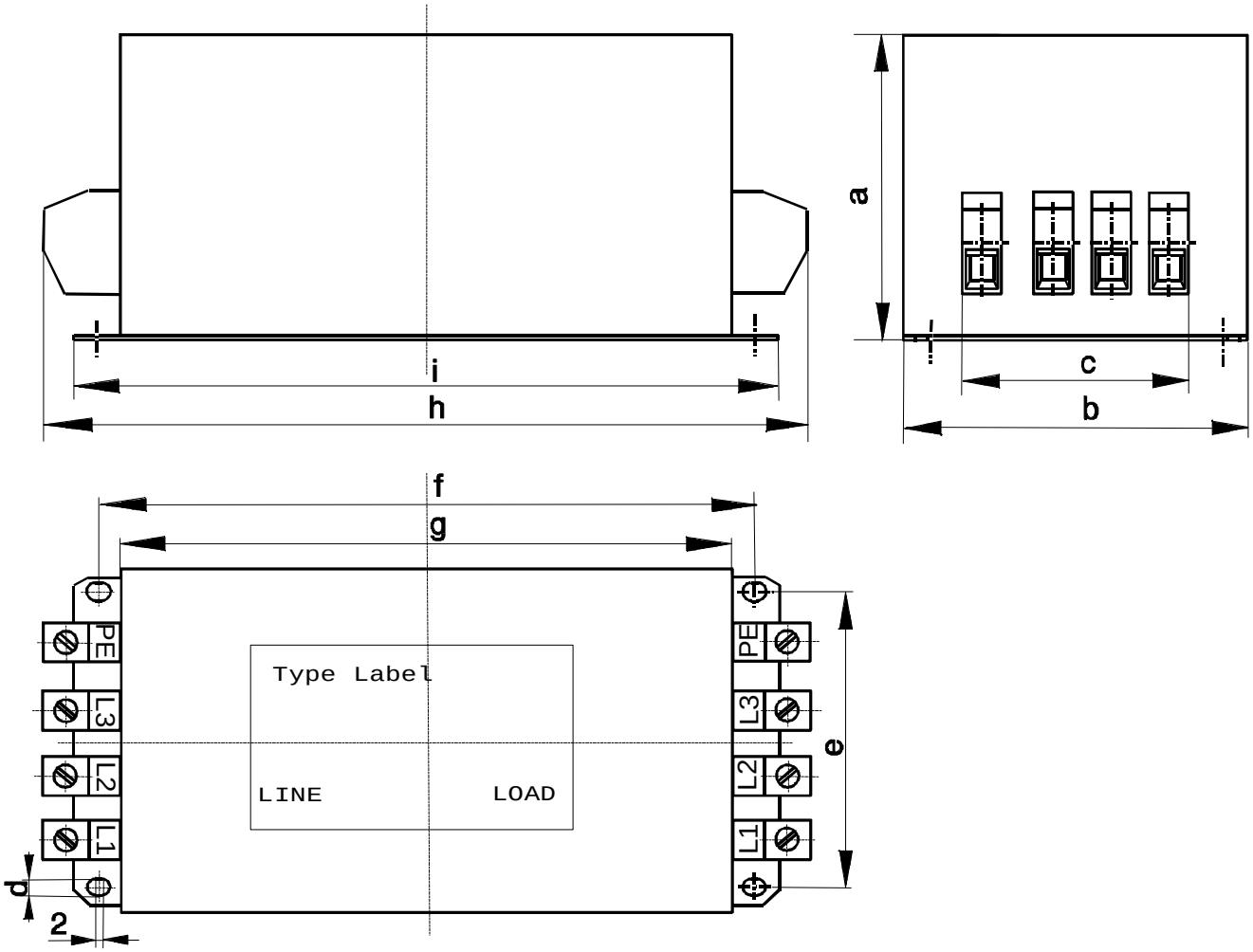


Fig. 2.4 Dimension Drawing EMC filter, sizes A to D

2.3.2 Sizes E to F

Order No.:	A mm	B mm	C* mm	D** mm
6SE7031-0ES87-0FA0	348	261	115	
6SE7023-4ES87-0FB0	404	301		82,5

* dimensions valid only for EMC filter with 4 mounting holes

** dimensions valid only for EMC filter with 6 mounting holes

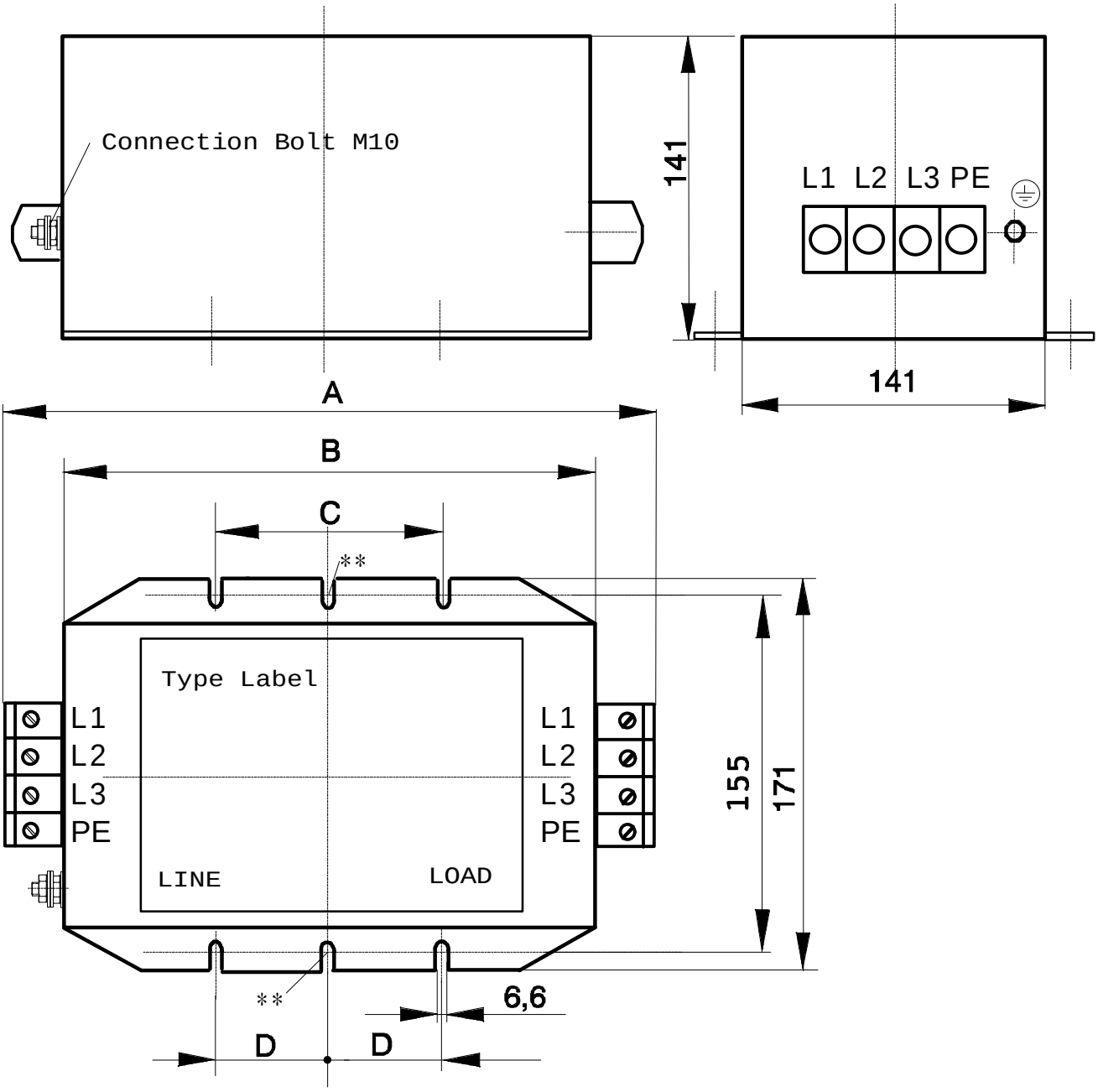


Fig. 2.5 Dimension Drawing EMC filter, sizes E to F

2.3.3 Sizes G to H

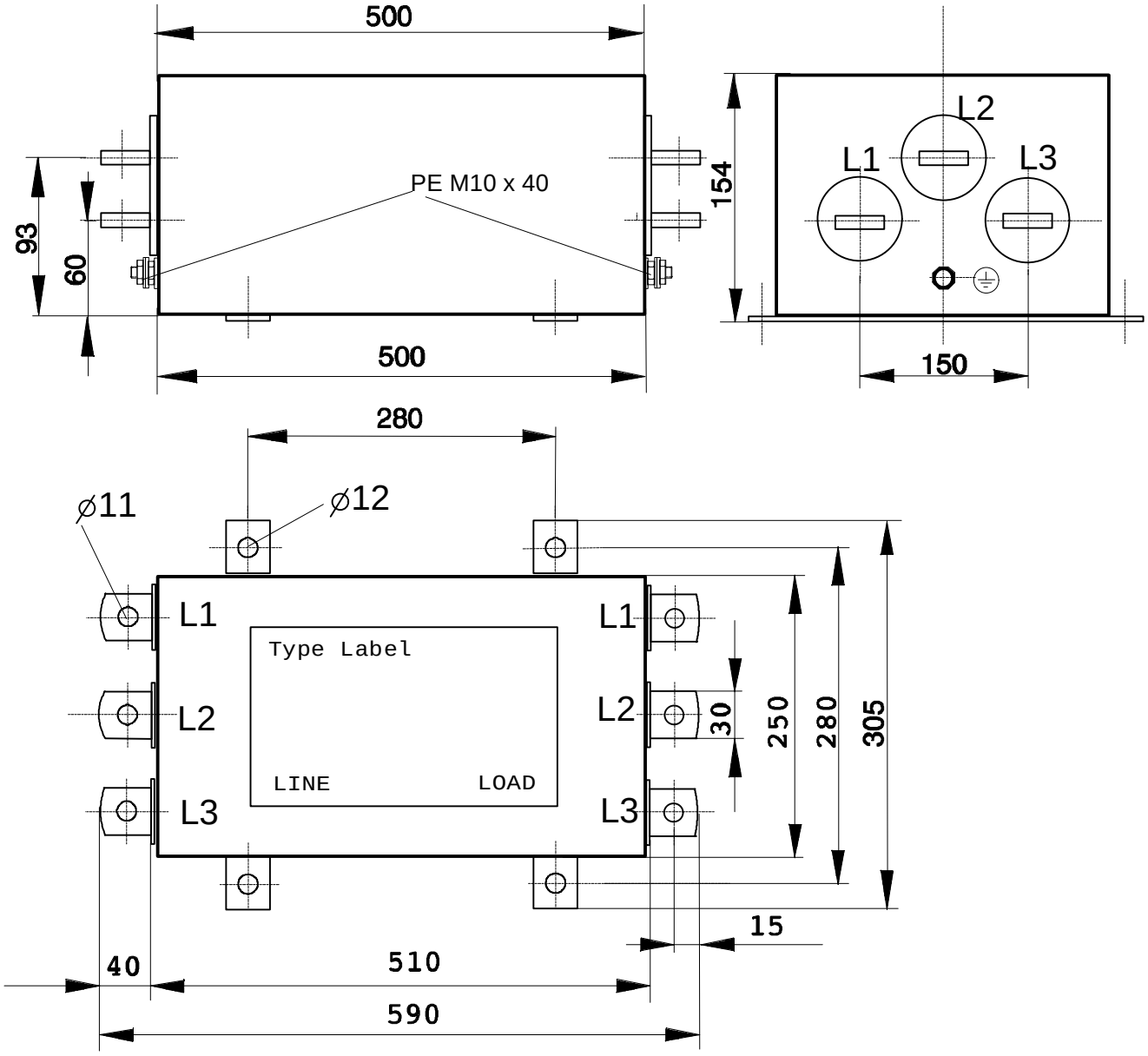


Fig. 2.6 Dimension Drawing EMC filter, sizes G to H

3 Technical Data

Order No.	Rated Volts (V)	Rated frequency (Hz)	Rated Amps (A)	Terminal Cross Section Area (mm^2)	Wight (kg)	Size H × W × D (mm)
6SE7021-0ES87-0FB0	3 AC 380 - 460 V ± 15 %	50/60 ± 6%	12	10∗)	2,2	215 x 90 x 81
6SE7021-8ES87-0FB0			18	10∗)		
6SE7023-4ES87-0FB0			36	25	3,7	245 x 101 x 86
6SE7027-2ES87-0FB0			80	50	9,5	300 x 141 x 141
6SE7031-0ES87-0FA0			120	50	10	348 x 171 x 141
6SE7031-8ES87-0FA0			180	95	13	404 x 171 x 141
6SE7033-7ES87-0FA0			500	Connection bolt	49	590 x 305 x 154

EMC Limit		B1 acc. to EN 55011for Size A to D A1 acc. to EN 55011for Size F to H
Operation temperatur		0 °C to +40 °C
Storage temperature		-25 °C to +70 °C
Transportation temperature		-25 °C to +70 °C
Environmetal Class – Humidity: – Stress of aggressive media:	 3K3 3C3	acc. to DIN IEC 721 part 3-3/04.90
Protection Class	I	acc. to DIN VDE 0160 part 1/05.82 IEC 536/ 1976
Type of protection	IP 20	EN 60529
Mechanical Stability – During Operation – During Transportation	 Class 12 Class 22	acc. to DIN IEC 68-2-67 06.90

∗) The EMC Filters must lead ground current. VDE 0160 requests a ground connection of 10 mm^2.

Bisher sind folgende Ausgaben erschienen:

Ausgabe	interne Sachnummer
01.95	477 451 4000.76
05.95	477 451 4000.76 Jb-76
09.95	477 451 4000.76 Jc-76

Kapitel		Änderung
0	Definitionen	Erstausgabe
1	Produktbeschreibung	Erstausgabe
2	Montage; Anschluß	2.2
3	Technische Daten	Erstausgabe

The following versions have appeared so far:

Version	internal item number
01.95	477 451 4000.76
05.95	477 451 4000.76 Jb-76
09.95	477 451 4000.76 Jc-76

Sections		Change
0	Definitions	First edition
1	Produkt descriptions	First edition
2	Mounting, Connection	2.2, 2.3.2
3	Technical data	First edition

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