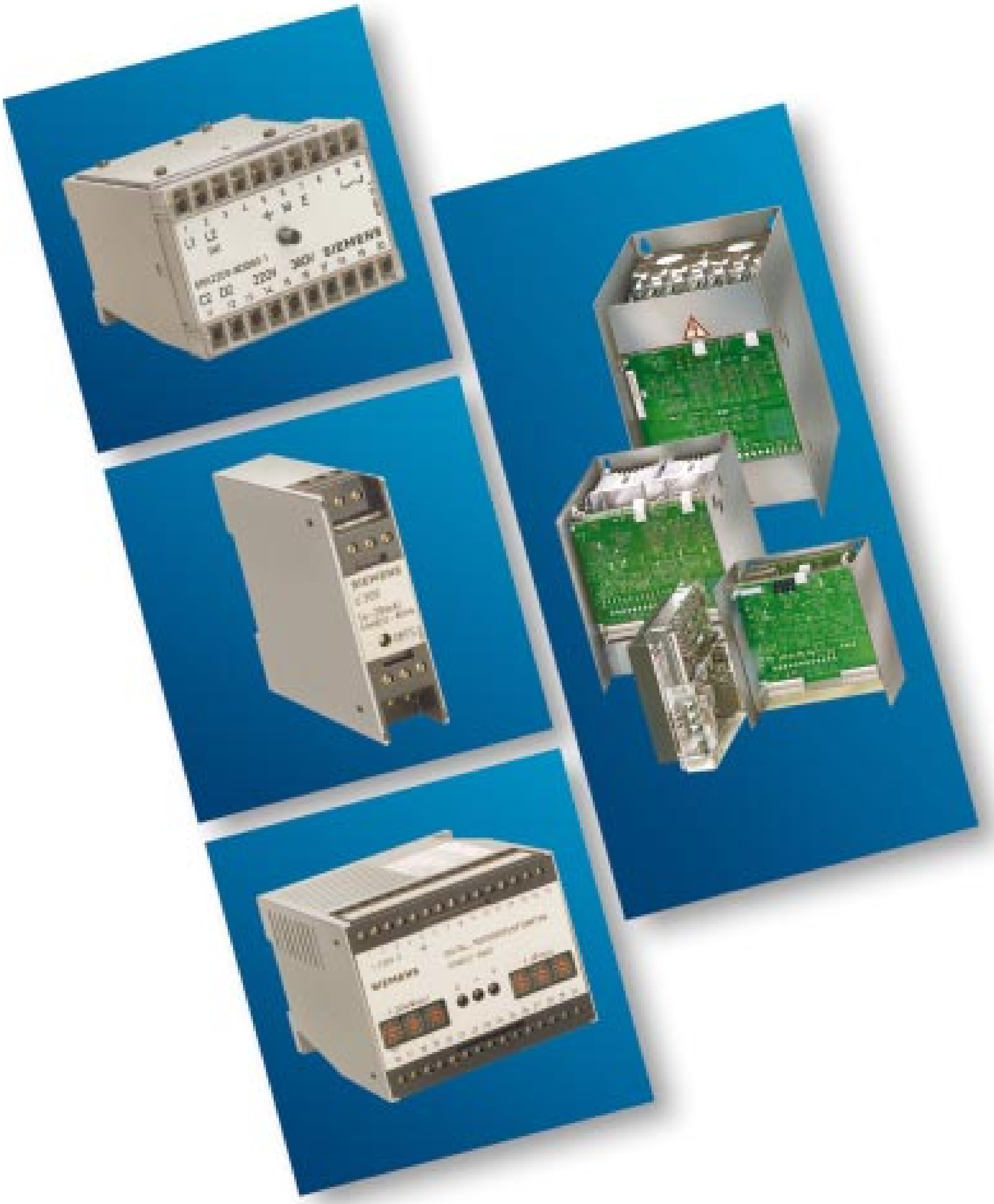
SIEMENS

DC DRIVES

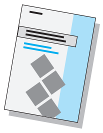
SIMOREG K 6RA22
Analog Chassis Converters

Catalog DA 21.2 · 2001



Catalogs for "Large Drives"

DC Motors — DA 12

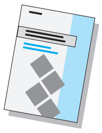


Order No.:
German: E20002-K4012-A101-A2
English: E20002-K4012-A101-A2-7600

DC Motors
1GG7, 1GH7, 1HS7 and 1HQ7 — DA 12 Supplement July 2001

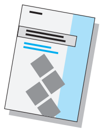
Order No.:
German: E86060-K5112-E101-A1
English: E86060-K5112-E101-A1-7600

DC Drives
Preferred Series up to 500 kW — DA 12.1



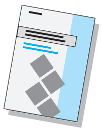
Order No.:
German: E20002-K4012-A111-A2
English: E20002-K4012-A111-A2-7600

DC Drives
Preferred Series 215 kW to 1500 kW — DA 12.2



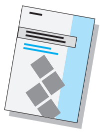
Order No.:
German: E20002-K4012-A121-A1
English: E20002-K4012-A121-A1-7600

SIMOREG 6RA70 DC MASTER
Digital Chassis Converters — DA 21.1



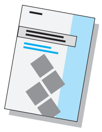
Order No.:
German: E86060-K5121-A111-A1
English: E86060-K5121-A111-A1-7600

SIMOREG 6RA22 Analog Chassis Converters — DA 21.2



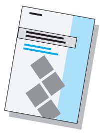
Order No.:
German: E86060-K4021-A121-A1
English: E86060-K4021-A121-A1-7600

Spare Parts for SIMOREG Converters (Chassis Units) — DA 21 E



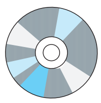
Order No.:
German: E20002-K4021-A900-A4
English: E20002-K4021-A900-A4-7600

SIMOREG Static Converter Cabinets — DA 22



Order No.:
German: E20002-K4022-A101-A3
English: E20002-K4022-A101-A3-7600

Automation and Drives — CA 01



Order No.:
German: E86060-D4001-A100-B5
English: E86060-D4001-A110-B4-7600

Internet

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SIMOREG K 6RA22

Analog Chassis Converters

Catalog DA 21.2 · 2001

Supersedes: Catalog DA 21 · 1998

Note!

The technical data is intended for general information.
Please observe the Operating Instructions and the references indicated on the products for installation, operation and maintenance.

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- The technical data, selection and ordering data (Order Nos.), accessories and availability are subject to alteration.
- All dimensions in this catalog are stated in mm.

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SIMOREG K Chassis Converters 6RA22

1

Design and mode of operation

1

Applications

6RA22 SIMOREG K converters for single-phase or three-phase input are used for the armature supply of shunt-wound DC motors. Even in the basic version, 6RA22 converters have several technological functions, such as:

- a ramp-function generator,
- a limit monitor,
- armature voltage actual value sensing with (I x *R*) compensation for units in B2HK and B6C connections (i.e. the tacho-generator is not required),
- an automatic electronic switch-on/off circuit for units in (B2)A(B2)C, (B6)A(B6)C connections,
- for units in (B2)A(B2)C, (B6)A(B6)C connections, additional inputs and outputs are routed to a matrix board for customized circuits.

Function options provide additional advantages, such as:

- separately adjustable P gain and integral action time for the speed controller,
- supplementary current setpoint incorporated in the current limiting,
- speed actual value adaptation with fine adjustment.

Design and mode of operation

6RA22 SIMOREG K converters for single-phase input are available in two types of construction. Units with housing are recommended for single-motor drives. Units without housing, installed in a sub-rack, provide a space-saving arrangement where two or more drives are to be combined to form a unit.

Power section

6RA22 SIMOREG K converters for single-phase, single-quadrant drives have B2HK half-controlled, single-phase bridge connections, and 6RA22 SIMOREG K converters for single-phase, four-quadrant drives have a circulating-current-free inverse-parallel connection with two fully controlled single-phase bridge circuits (B2)A(B2)C.

6RA22 SIMOREG K converters for three-phase single-quadrant drives use a fully-controlled three-phase bridge connection B6C; SIMOREG K converters for three-phase, four-quadrant drives in circulating-current-free inverse-parallel connection use two fully controlled three-phase bridge circuits (B6)A(B6)C.

Cooling

6RA22 SIMOREG K converters with rated DC ≤ 160 A are designed for natural air cooling, and units with rated DC ≥ 240 A for forced air cooling (fan).

Field power supply

For 6RA22 SIMOREG K converters (except for the (B2)A(B2)C connection), a field rectifier in an uncontrolled single-phase bridge circuit B2 is integrated in the unit. When the rectifier is connected to a two-phase 400 V supply voltage, a rated output voltage of 340 V is obtained at terminals C2/D2, and when connected to a two-phase 230 V supply, a rated output voltage of 200 V is obtained. For 6RA22 SIMOREG K converters with (B2)A(B2)C connection, a field supply unit, e.g. the 6RA2200-8DD00 (refer to Section 3 of this Catalog) should be separately ordered and fitted.

Fig. 1/1
Converters in B2HK connection for single-quadrant drives, without enclosure

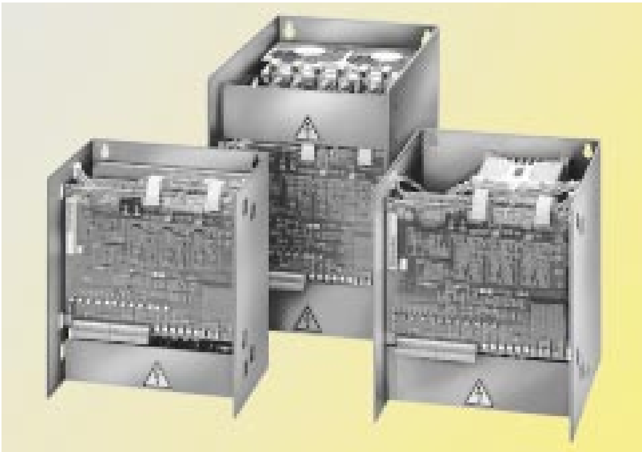

Fig. 1/2
Converters in B6C connection for single-quadrant drives, with enclosure

Power supply

The power supply of the 6RA22 SIMOREG K converter provides the following:

- Unregulated ±24 V voltages for the trigger pulses and relays;
- regulated ±15 V voltages for the controllers and internal signal processing (external ±50 mA max.);
- regulated ±10 V voltages as reference voltages (e.g. for the setpoints; external ±10 mA).

The power supply transformer input for converters in B2HK connection is taken directly from the incoming supply (terminals U1, V1). Depending on the supply voltage (two-phase 400 V or two-phase 230 V), a jumper must be changed at the input of the power supply transformer. Converters in (B2)A(B2)C connection have separate supply terminals for the power supply transformer and the power section. Here too, either the two-phase 400 V or two-phase 230 V can be connected. Converters in B6C and (B6)A(B6)C connection are connected to three-phase 400 V through separate power supply terminals.

The supply voltages for the controllers (±15 V) are regulated with an accuracy of approx. 1%, and the reference voltages (±10 V) with an accuracy of 1‰ so that essentially only the speed actual value sensing values are decisive (DC tacho-generator).

Functions of the open-loop and closed-loop control for converters in B2HK and B6C connections

Ramp-function generator

In response to a step-change in input voltage (external speed setpoint), the ramp-function generator limits the rate of change of the speed setpoint fed to the speed controller to a technologically permissible value for the drive. Ramp-up and ramp-down times are adjustable via a potentiometer. The setting range of the potentiometer can, if necessary, be adapted to other conditions by changing a capacitor.

Speed controller

The speed controller has three inputs:

- The speed actual value can either be supplied from the integral armature voltage actual value sensing with (I x R) compensation or from a DC tacho-generator. The actual value voltage is adapted and the maximum speed set using two potentiometers for coarse and fine adjustment.
- The speed setpoint is either supplied from the integral ramp-function generator or directly via a terminal.
- A supplementary speed setpoint can be fed to the speed controller either directly via a terminal or via an adjustment potentiometer (e.g. compensator roll controller) or from the internal current actual value and potentiometer V (for (I x R) compensation for EMF control without tacho-generator).

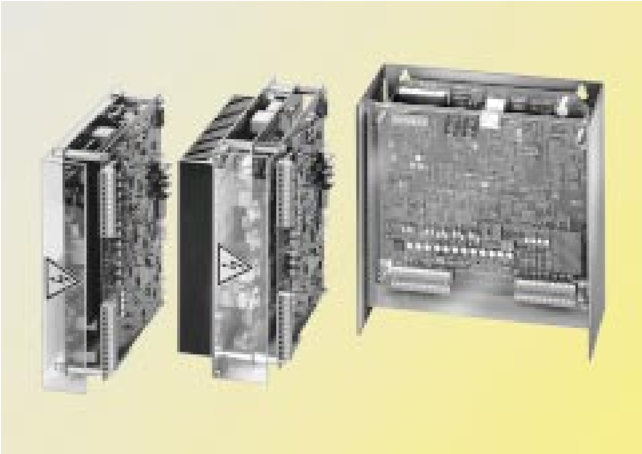

Fig. 1/3
Converters in (B2)A(B2)C connection for four-quadrant drives

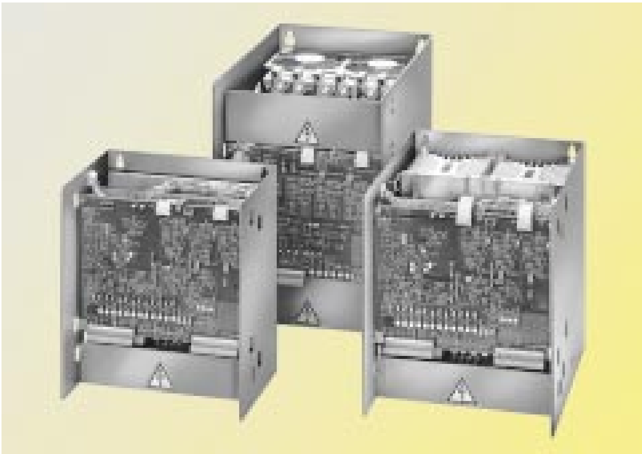

Fig. 1/4
Converters in (B6)A(B6)C connection for four-quadrant drives, with enclosure

The speed controller has separate amplifiers for the P and I components. The P gain and I component can be adjusted separately, and thus very easily at start-up.

A supplementary setpoint, preset via a terminal, can be added to the speed controller output value (current setpoint) via a summing amplifier connected after the speed controller.

The output value (current setpoint + supplementary current setpoint) is limited by a limiting controller (current limiting). Current limiting is internally set to a maximum value (the maximum being the converter's rated DC) and can be externally set to lower values via a terminal.

Design and mode of operation

Current controller

The current controller is configured as a PI controller with gain and integral-action time designed for armature supply. The feedback can be adapted by soldering-in other components.

The current controller's output voltage is limited by two limiting controllers to values corresponding to the maximum and minimum converter firing-angle setting.

The current actual value is sensed with a current transformer and is fed to the current controller with electrical isolation. The current setpoint is supplied from the speed controller.

Trigger unit

The trigger unit generates the control pulses for triggering the thyristors, according to the output voltage of the current controller. The trigger unit automatically adapts itself to different supply frequencies or supply frequencies which change over the range 45 to 65 Hz during operation.

Automatic switch-on circuit and controller enable for units in the B2HK connection

When the converter has been switched on, the automatic switch-on circuit only enables operation when the power supply has established its voltages and the controllers are enabled.

Controller enable can be initiated immediately with the enable signal by the automatic switch-on circuit (terminals 8/20 jumpered) or in accordance with other operating states (terminals 8 and 20 connected via an enable contact).

Converters in B6C connection have a switch-on control as described for units in (B2)A(B2)C or (B6)A(B6)C.

Limit monitor

The limit monitor serves to detect whether a value has dropped below or exceeded a speed or current setpoint. In the basic configuration, a speed dropping below about 5% of the rated speed is signaled (0 V at terminal 14). The response value can be adapted by changing a resistor or by setting a potentiometer (for units in B6C connection).

Operating state display

The following operating states are indicated by LEDs:

- Converter is switched on.
- Controllers are enabled.
- Limit monitor has responded.

Functions of open-loop and closed-loop control for converters in (B2)A(B2)C or (B6)A(B6)C connections

Ramp-function generator

The ramp-function generator responds to a step-change in input voltage (external speed setpoint) by limiting the rate of change of the speed setpoint fed to the speed controller to a technologically permissible value for the drive. Ramp-up and ramp-down times are adjustable via two potentiometers independently of each other, over the range 2 to 30 s. The setting range can be adapted to other conditions, if necessary, by changing a capacitor.

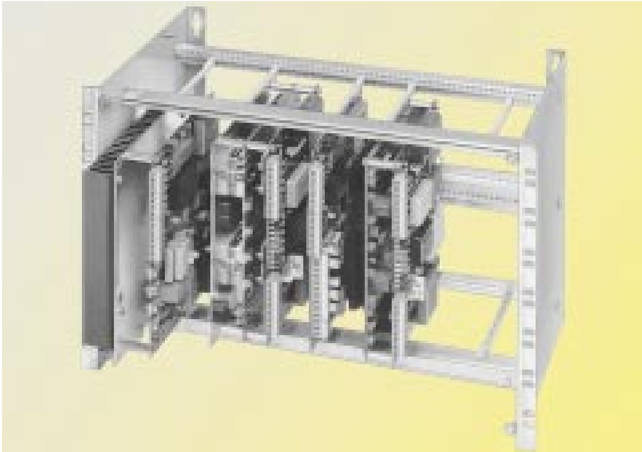

Fig. 1/5
6DM9005 subrack equipped with 6RA22 SIMOREG K converters without enclosure

Speed controller

The speed controller has three inputs:

- The speed actual value is supplied from a DC tacho-generator. The actual value voltage is adapted and the maximum speed set by means of two potentiometers for coarse and fine adjustment.
- The speed setpoint is supplied either from the integral ramp-function generator or through a free input and the matrix board.
- A supplementary speed setpoint can be fed in via a free input and the matrix board.

The speed controller is configured with separate amplifiers for the P and I components. The P gain and I component can be adjusted separately, and thus very easily at start-up.

A supplementary current setpoint, preset via a free input and the matrix board, can be added to the output value of the speed controller (current setpoint) via a summing amplifier connected after the speed controller. The output value (current setpoint + supplementary current setpoint) is limited in the positive and negative directions by two limiting controllers (current limiting). The current limiting is internally set to a maximum value (the maximum being the rated DC). Lower values can be set externally by providing a suitable circuit on the matrix board, and by feeding in via a free (low-resistance) output terminal.

Current controller

The current controller has very high-grade dynamic performance with the following functions:

- Trigger unit feed-forward control with
- PI control with corrective intervention
- Current-dependent stability limit changeover.

The controller can be optimized without measuring instruments, using only the integral LEDs.

The PI controller feedback is designed for armature supply. It can be adapted to other applications by soldering-in other components.

The output voltage of the current controller is limited by two limiting controllers to values corresponding to the maximum and minimum firing-angle setting of the converter.

The current actual value is sensed via an AC current transformer (with series-connected rectifier and load resistor) and fed to the current controller. The current setpoint is supplied by the speed controller.

The trigger unit and auto-reverse stage

The trigger unit generates the control pulses for triggering the thyristors, according to the output voltage of the current controller. By means of the auto-reverse stage, the trigger pulses are fed, according to the required torque direction, to the thyristors associated with the required current direction via pulse amplifiers and the transformer section. The trigger unit automatically adapts itself to different supply frequencies, or supply frequencies which change over the range 45 to 65 Hz during operation.

The auto-reverse stage, together with the current controller and trigger unit, reverses the current direction when the current setpoint polarity changes (torque direction), by logically processing the conditions.

Automatic switch-on and switch-off circuit

The automatic switch-on and switch-off circuit assumes the function of an external interlock comprising an IC system, relays or contactors.

After the switch-on command and after the power supply voltages have developed, the power contactor is switched-in through a relay integrated in the converter, and operation is enabled after a checkback signal and an optional, additional external controller enable signal.

After the switch-off command, the current is first reduced by shifting the trigger pulses to the inverter stability limit and the power contactor is then switched off when the current is zero.

Limit monitor

The limit monitor can be used to detect whether a value has dropped below or exceeded a speed or current setpoint. Responding of the limit monitor is indicated by an LED. The response value can be set on a potentiometer. The output of the limit monitor can also optionally be set to setpoint/actual value monitoring by changing a plug-in jumper (refer to "Setpoint/actual value monitoring and fault signal").

The basic configuration is such that a signal is output when a speed drops below about 5% of the rated speed (P24 at terminal 14). If the speed is not reached, an L signal is output at terminal 14.

Setpoint/actual value monitoring and fault signal

In their basic configuration, the converters have a stall protection function which responds if a long-term speed setpoint/actual value deviation occurs. The protective function can only be practically used in conjunction with the ramp-function generator. However, the protective function can be changed over to a setpoint/actual value signal by removing a diode.

The output signal of the limit monitor can also be set to setpoint/actual value monitoring and used for a protective function (controller inhibit) by changing over a plug-in jumper.

Any fault signal from the protective function is stored and indicated by an LED. It can only be acknowledged and cleared by pressing a button.

Freely usable functions and mounting locations

Required supplementary functions can be created in the converter, to a limited extent, by using these facilities.

Four inputs and four outputs, each routed via terminals, as well as two inputs with switching function, are available. The inputs are equipped with resistors and capacitors for use as analog inputs. The outputs are routed via an RC circuit for noise suppression. The inputs with switching function each transfer an external electronic or contact switching signal in a floating arrangement through an optocoupler.

All signals are fed to a matrix board on which the required supplementary functions can be established. Various values from the power supply and closed-loop control are also fed to the matrix board.

Technical data

Order No.		6RA22..-8DD21-. 03	11	16	21	6RA22..-8DD21-. 03	11	16	21
Converters for single-phase connection and single-quadrant operation (B2HK)									
Rated supply voltage 3)	V	2-ph. 230 (+10%/-10%)				2-ph. 400 (+10%/-10%)			
Rated frequency		Automatic adaptation 45 to 65 Hz							
Rated DC voltage	V	180				315			
Rated direct current	A	5	12	22	40	5	12	22	40
Rated output	kW	0.9	2.2	4.0	7.2	1.6	3.8	6.9	12.6
Power loss at rated direct current (approx.)	W	30	50	80	135	30	50	80	135
Rated supply voltage, field	V	max. 2-ph. 400 V (+10%) at U2-V2							
Rated DC voltage, field	V	340							
Rated current, field	A	1.5	1.5	5.0	5.0	1.5	1.5	5.0	5.0
Ambient in-service temperature 5)	°C	0 to 45° at rated DC							
Temperature during storage and transportation	°C	-30 to +85							
Site altitude above sea level 6)	m	≤ 1 000 at rated DC							
Control stability 4)		0.1% of rated speed							
Humidity rating DIN 40 040, SN 26 556		F							
Degree of protection DIN 40 050, IEC 144		IP 00							
Dimensions		See dimension drawings							
Weight (approx.) 1)	kg	2.2	2.2	2.8	4.4	2.2	2.2	2.8	4.4
Weight (approx.) 2)	kg	1.25	1.25	1.6	3.6	1.25	1.25	1.6	3.6
Mounting width (basic grid dimension) 2)		22	22	36	50	22	22	36	50

1) For converters with enclosure: 6RA22..-8DD21-1

2) For draw-out converters: 6RA22..-8DD21-0

3) The rated output voltage for the armature and field circuits is reached at 5% undervoltage in the line-side supply. If the rated input voltage value is present, the output voltage value will be 5% higher. If the undervoltage is more than 5%, the output voltage must be reduced linearly.

4) Conditions:
The control stability is referred to the rated motor speed and applies to SIMOREG K units at operating temperature.

The following conditions apply:

- Temperature fluctuations of ±10 ° K
- Line voltage fluctuations of +10% -5% of rated supply voltage
- Load fluctuations of up to 100% of maximum torque
- Temperature coefficient of temperature-compensated tacho-generator 0.15‰ per 10 ° K
- Constant setpoint

5) Load values as a function of coolant temperature

Ambient or coolant temperature	Derating in units with natural air cooling
+35° C	
+40° C	
+45° C	0%
+50° C	-6%
+55° C	-11%
+60° C	-18%

6) Load values as a function of site altitude

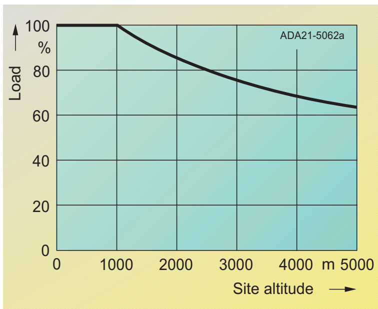

Fig. 1/6

Technical data

Order No.		6RA22..-8DK27-.. 03	11	16	21	6RA22..-8DK27-.. 03	11	16	21
Converters for single-phase connection and four-quadrant operation (B2)A(B2)C									
Rated supply voltage [3]	V	2-ph. 230 (+10%/-10%)				2-ph. 400 (+10%/-10%)			
Rated frequency		Automatic adaptation 45 to 65 Hz							
Rated DC voltage	V	150				260			
Rated direct current	A	5	12	22	40	5	12	22	40
Rated output	kW	0.75	1.8	3.3	6	1.3	3.1	5.7	10.4
Power loss at rated direct current (approx.)	W	35	60	85	140	35	60	85	140
Current input, terminals U2-V2	mA	80							
Ambient in-service temperature [5]	° C	0 to 45							
Temperature during storage and transportation	° C	-30 to +85							
Site altitude above sea level [6]	m	≤ 1 000 at rated DC							
Control stability [4]		0.1% of rated speed							
Humidity rating DIN 40 040, SN 26 556		F							
Degree of protection DIN 40 050, IEC 144		IP 00							
Dimensions		See dimension drawings							
Weight (approx.) [1]	kg	2.8	2.8	3.1	5.4	2.8	2.8	3.1	5.4
Weight (approx.) [2]	kg	1.8	1.8	2.1	4.1	1.8	1.8	2.1	4.1
Number of required slots [2]		22	22	52	66	22	22	52	66

1) For converters with enclosure: 6RA22..-8DK27-1

2) For draw-out converters: 6RA22..-8DK27-0

3) The rated output voltage for the armature and field circuits is reached at 5% undervoltage in the line-side supply. If the rated input voltage value is present, the output voltage value will be 5% higher. If the undervoltage is more than 5%, the output voltage must be reduced linearly.

4) Conditions:
The control stability is referred to the rated motor speed and applies to SIMOREG K units at operating temperature.

The following conditions apply:

- Temperature fluctuations of ±10 ° K
- Line voltage fluctuations of +10% -5% of rated supply voltage
- Load fluctuations of up to 100% of maximum torque
- Temperature coefficient of temperature-compensated tacho-generator 0.15‰ per 10 ° K
- Constant setpoint

5) Load values as a function of coolant temperature

Ambient or coolant temperature	Derating in units with natural air cooling
+35° C	
+40° C	
+45° C	0%
+50° C	-6%
+55° C	-11%
+60° C	-18%

6) Load values as a function of site altitude

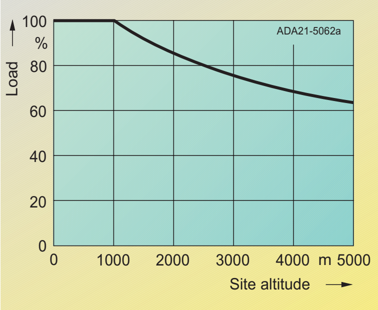

Fig. 1/7

Technical data

Order No.		6RA22..-8DS31 20	23	26	30	32	33	76	80	83
Converters for three-phase connection and single-quadrant operation (B6C)										
Rated supply voltage Power 1)	V	3-ph. 400 (+10%/-15%)								
Rated supply voltage Electronics power supply	V	3-ph. 400 (+35%/-20%), 40 mA								
Rated supply voltage Fan	V							2-ph. 230 (+10% / -10%) 0.12 A Air flow rate 160 m^3/h		2-ph. 230 (+10%/ -10%) 0.24 A 320 m^3/h
Rated supply voltage, field	V	2-ph. max. 400 (+35%)								
Rated frequency	Hz	Automatic adaptation 45 to 65								
Rated DC voltage	V	485								
Rated direct current	A	35	50	70	110	130	160	240	350	500
Rated output	kW	17	24	34	53	63	78	116	170	242
Power loss at rated direct current (approx.)	W	130	170	230	350	410	500	760	1 100	1 580
Rated DC voltage, field	V	340								
Rated direct current, field	A	8	8	8	8	8	8	15	15	15
Ambient in-service temperature 3)	°C	0 to 45 at rated DC, natural air cooling						0 to 35 at rated DC, forced-air cooling		
Temperature during storage and transportation	°C	-30 to +85								
Site altitude above sea level 4)	m	≤ 1 000 at rated DC								
Control stability 2)		Δn = 0.1% of rated speed								
Humidity rating DIN 40 040, SN 26 556		F								
Degree of protection DIN 40 050, IEC 144		IP 00								
Dimensions		See dimension drawings								
Weight (approx.)	kg	4.4	4.4	6.5	10.3	10.8	12.4	22.2	24	30

1) The rated output voltage for the armature and field circuits is reached at 5% undervoltage in the line-side supply. If the rated input voltage value is present, the output voltage value will be 5% higher. If the undervoltage is more than 5%, the output voltage must be reduced linearly.

2) Conditions:
The control stability is referred to the rated motor speed and applies to SIMOREG K units at operating temperature.

The following conditions apply:

- Temperature fluctuations of ±10 °K
- Line voltage fluctuations of +10% -5% of rated supply voltage
- Load fluctuations of up to 100% of maximum torque
- Temperature coefficient of temperature-compensated tacho-generator 0.15‰ per 10 °K
- Constant setpoint

3) Load values as a function of coolant temperature

Ambient or coolant temperature	Derating in units with natural air cooling	Derating in units with forced – air cooling
+35° C		0%
+40° C		-6%
+45° C	0%	-12%
+50° C	-6%	-17%
+55° C	-11%	
+60° C	-18%	

4) Load values as a function of site altitude

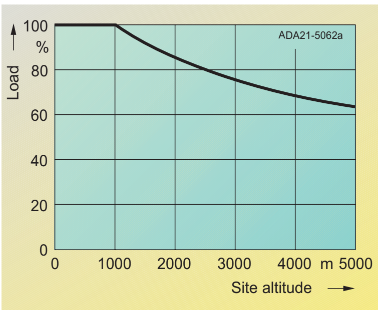

Fig. 1/8

Order No.		6RA22..-8DV71 20	23	26	30	32	33	76	80	83
Converters for three-phase connection and four-quadrant operation (B6)A(B6)C)										
Rated supply voltage Power 1)	V	3-ph. 400 (+15%/-10%)								
Rated supply voltage Electronics power supply	V	3-ph. 400 (+35%/-20%), 40 mA								
Rated supply voltage Fan	V							2-ph. 230 (+10%/-10%) 0.24 A Air flow rate 320 m³/h		
Rated supply voltage, field	V	2-ph. max. 400 (+35%)								
Rated frequency	Hz	Automatic adaptation 45 to 65								
Rated DC voltage	V	420								
Rated direct current	A	35	50	70	110	130	160	240	350	500
Rated output	kW	14.7	21	29	46	55	67	100	147	210
Power loss at rated direct current (approx.)	W	130	170	230	350	410	500	780	1 130	1 580
Rated DC voltage, field	V	340								
Rated direct current, field	A	8	8	8	8	8	8	15	15	15
Ambient in-service temperature 3)	°C	0 to 45 at rated DC, natural air cooling						0 to 35 at rated DC, forced-air cooling		
Temperature during storage and transportation	°C	-30 to +85								
Site altitude above sea level 4)	m	≤ 1 000 at rated DC								
Control stability 2)		Δn = 0.1% of rated speed								
Humidity rating DIN 40 040, SN 26 556		F								
Degree of protection DIN 40 050, IEC 144		IP 00								
Dimensions		See dimension drawings								
Weight (approx.)	kg	5.4	5.4	7.3	15.4	15.9	17.5	22.2	24	30

1) The rated output voltage for the armature and field circuits is reached at 5% undervoltage in the line-side supply. If the rated input voltage value is present, the output voltage value will be 5% higher. If the undervoltage is more than 5%, the output voltage must be reduced linearly.

2) Conditions:
The control stability is referred to the rated motor speed and applies to SIMOREG K units at operating temperature.

The following conditions apply:

- Temperature fluctuations of ±10 ° K
- Line voltage fluctuations of +10% -5% of rated supply voltage
- Load fluctuations of up to 100% of maximum torque
- Temperature coefficient of temperature-compensated tacho-generator 0.15‰ per 10 ° K
- Constant setpoint

3) Load values as a function of coolant temperature

Ambient or coolant temperature	Derating in units with natural air cooling	Derating in units with forced – air cooling
+35° C		0%
+40° C		-6%
+45° C	0%	-12%
+50° C	-6%	(-17%)
+55° C	-11%	
+60° C	-18%	

4) Load values as a function of site altitude

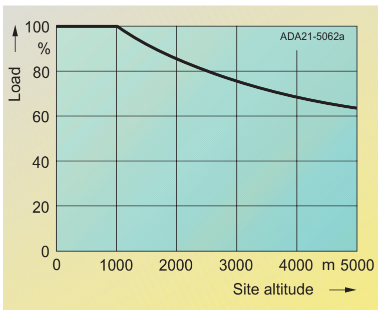

Fig. 1/9

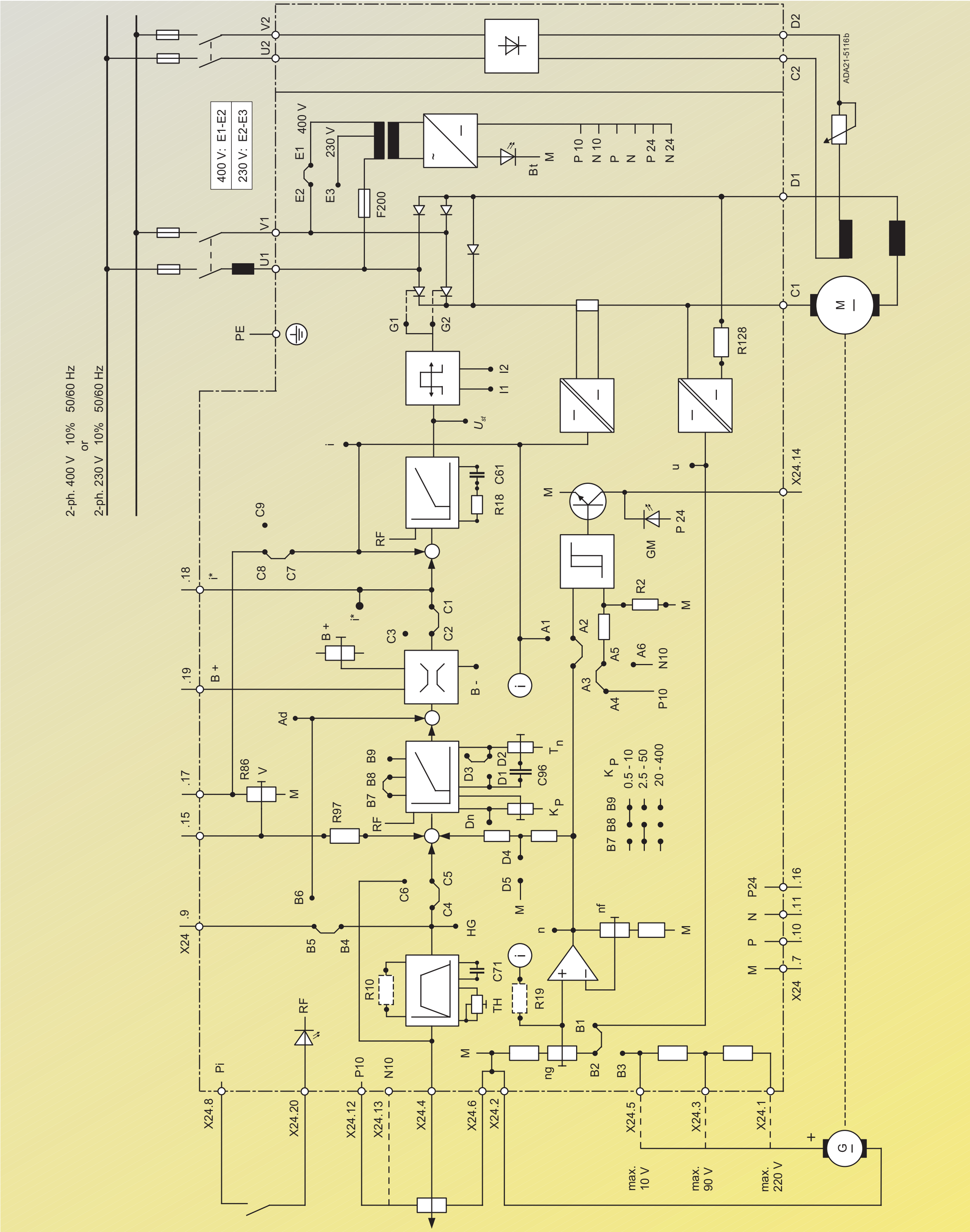

Fig. 1/10
6RA22 SIMOREG K converter in half-controlled, single-phase bridge connection B2HK for single-quadrant drives

	Function	Terminal	Type	Connection values	Comments
Connections of 6RA22 SIMOREG K converters in B2HK connection for single-quadrant drives					
Power section	L1 L2	U1 V1	Input Input	2-ph. 400 V or 2-ph. 230 V	See technical data
	+ -	C1 D1	Output Output	max. 315 V or 180 V max. 315 V or 180 V	
Field rectifier	L1 L2	U2 V2	Input Input	2-ph. 400 V 2-ph. 400 V	See technical data
	+ -	C2 D2	Output Output	340 V 340 V	
Power supply	L1 L2	– –	– –	2-ph. 400 V or 2-ph. 230 V	Connected internally to terminals U1/V1 of the power section. For 400 V solder jumper E2-E1 closed, for 230 V solder jumper E2-E3 closed.
	M P N P24	7 10 11 16	Output Output Output Output	0 V (M potential) +15 V/50 mA - 15 V/50 mA +24 V/50 mA	Total loading for each polarity: 50 mA
	M P10 N10	6 12 13	Output Output Output	0 V (ref. potential) +10 V/10 mA - 10 V/10 mA	Connection for speed setpoint potentiometer M/P10: with ramp-function generator, jumper C5-C4 closed; M/N10: without ramp-function generator, jumper C5-C6 closed.
Speed controller	Setpoint	4	Input	0 to +10 V/200 kΩ	Jumper C5-C4 closed: ramp-function generator setpoint input
		4	Input	0 to -10 V/20 kΩ	Jumper C5-C6 closed: speed controller setpoint input
		9	Output	0 to -10 V	Jumper B5-B4 closed: ramp-function generator output (e.g. for 2nd unit)
		9	Input	0 to +10 V	Jumper B5-B6 closed: summing amplifier setpoint input (supplementary current setpoint)
	Actual value	2 1 3 5	Input Input Input Input	0 V (ref. potential) 80 to 220 V/78 kΩ 30 to 90 V/31 kΩ 10 to 40 V/13 kΩ	Jumper B2-B3 closed: speed controller actual value input (connection only for speed actual value sensing by tacho-generator)
	Ext. current limiting	19	Input	0 to +10 V	Current setpoint + supplementary current setpoint limiting
Current controller	Setpoint	18	Output	0 to +10 V	Jumper C2-C1 closed: current setpoint from speed controller
		18	Input	0 to +10 V	Jumper C2-C3 closed: external current setpoint
Other functions	Controller enable (Pi) (Rf)	8 20	Output Input	+24 V/100 Ω +20 to +30 V/4 mA	Power supply for ext. controller enable Connect to terminal 8 for controller enable
	Limit monitor	14	Output	Open collector	Jumpers A2-A3 and A5-A4 closed: speed actual value interrogation (*n* > comparison voltage results in P24 over 2.7 kΩ; jumpers A2-A1 and A5-A6 closed: current actual value interrogation (*i* > comparison voltage results in M)
	Potentiometer R86	17	Input	0 to -10 V/10 kΩ	Jumper C8-C9 closed: speed controller setpoint input (supplementary speed setpoint)
		17	Input	0 to -10V	Jumper C8-C7 closed: speed controller setpoint input (*I* x *R*) compensation for EMF control without tacho-generator.
	Potentiometer R86 tap	15	Output	0 to -10 V	Jumper C8-C7 closed, resistor R97 removed: current actual value tap
		15	Output	0 to ±10 V/10 kΩ	Jumper C8-C9 closed, resistor R97 removed: potentiometer R86 can be used as required.

Block diagrams / Terminal assignment

Function	Matrix board	Function	Matrix board
Matrix board assignment for 6RA22 SIMOREG K converters in connection (B2)A(B2)C for four-quadrant drives			
Supplementary setpoint input, speed controller	RA1	Output, free CMOS inverter	RB6
Setpoint filtering, speed controller	RA2	Input, free CMOS inverter	RB7
Input positive current limit	RA3	Input, current setpoint to current control loop	RB8
Input negative current limit	RA4	Input, supplementary current setpoint before current limiting	RB9
Input EMF actual values for EMF precontrol	RA5	Output n (±10 V)	RB11
Free output via terminal X23.18 (filtered)	RA6	Output + i (±10 V)	RB13
Free output via terminal X23.17 (filtered)	RA7	Separate inhibit for ramp-function generator (+15 to +24 V inhibits)	RB15
Free input via 2 x 10 kΩ/10 nF at terminal X23.26	RA8	Input, speed setpoint at speed controller	RC1
Free input via 2 x 10 kΩ/10 nF at terminal X23.25	RA9	Speed controller output after current limiting	RC3
Free input via 2 x 10 kΩ/10 nF at terminal X23.24	RA10	Technology connector X1.7	RC4
Free input via 2 x 100 kΩ/10 nF at terminal X23.23	RA11	Current actual value	RC5
Free FET switch (1) driven via terminal X23.22	RA12/RA13	Positive reference voltage +10 V	RD1
Free FET switch (2) driven via terminal X23.21	RA14/RA15	Negative reference voltage -10 V	RE1
Free output via 2 x 56 Ω/47 nF at terminal X23.16	RA 16	M reference potential 0 V	RF1
Free output via 2 x 56 Ω/47 nF at terminal X23.15	RA17	P15 regulated +15 V	RG1
Direct connection to terminal X23.18	RA18	N15 regulated -15 V	RH1
Ramp-function generator output	RB1	Output, fault signal	RM4
Extension input for ramp-function generator	RB3	Ack. button connection to reset fault signal	RM5/RM6
Technology connector X1.1	RB4	Connection to X35.32	RM8
Matrix board assignment for SIMOREG K converters in circuit B6C for single-quadrant drives			
Power supply		+10 V (P10)	RA4*)
		- 10 V (N10)	RA5*)
		0 V (M)	RA3*)
		+15 V (P)	RA1*)
		- 15 V (N)	RA2*)
Speed controller		Speed setpoint	RA9
		Speed controller setpoint smoothing	RA13
		Speed actual value	RA12
		Ramp-function generator output overdrive amplifier	RA11
		Controller enable	RA6
		Current limiting B+	RA7
		Current actual value	RA8
		Extension input, ramp-function generator	RB9
Other functions		Current actual value V_{actual}	RA10
		Speed actual value decoupled	RH1
		Supplementary current setpoint	RB11
		Current actual value decoupled	RR7
		Input, reset ramp-function generator	RR3
Matrix board assignment for SIMOREG K converters in circuit (B6)A(B6)C for four-quadrant drives			
Selector output terminal X1.18 without smoothing	RA4	+10 V (P10)	RD1
Selector output terminal X1.18 with smoothing 2 x 50 Ω/47 nF	RA5	- 10 V (N10)	RE1
Selector output terminal X1.17 with smoothing 2 x 50 Ω/47 nF	RA6	0 V (M)	RA1
Selector output terminal X1.16 with smoothing 2 x 50 Ω/47 nF	RA9	+15 V (P)	RB1
Selector output terminal X1.15 with smoothing 2 x 50 Ω/47 nF	RA10	- 15 V (N)	RC1
Selector input terminal X1.26 (2 x 10 kΩ/10 nF)	RA7	Speed setpoints smoothing	RF2
Selector input terminal X1.25 (2 x 10 kΩ/10 nF)	RA8	Speed actual value	RG2
Selector input terminal X1.24 (2 x 50 kΩ/10 nF)	RA11	Connection to technology connector (X4.1)	RD2
Selector input terminal X1.23 (2 x 100 kΩ/10 nF)	RA12	Connection to technology connector (X4.7)	RC2
Free inverter (input)	RB6	Ramp-function generator supplementary setpoint	RB9
Free inverter (output)	RB7	Output, speed controller	RB2
Free FET switch (via optocoupler input terminal 21)	RA15, RA16	Speed supplementary setpoint	RB5
Free FET switch (via optocoupler input terminal 22)	RA13, RA14	Positive current limiting	RE2
Current setpoint	RB4	Negative current limiting	RB10
Speed setpoint	RB3	EMF precontrol external	RA3
Current actual value	RB8	Free terminal 27	RI16
Speed actual value	RH1	Free terminal 28	RK16
Ramp-function generator output	RA2	± current actual value	RO7
Current supplementary setpoint input	RB11	Ramp-function generator	RO3
		Fault	RO4
		Fault acknowledge	RO6
		Contact for fault acknowledge button	RO5/RO6

*) Total loading per polarity: 50 mA

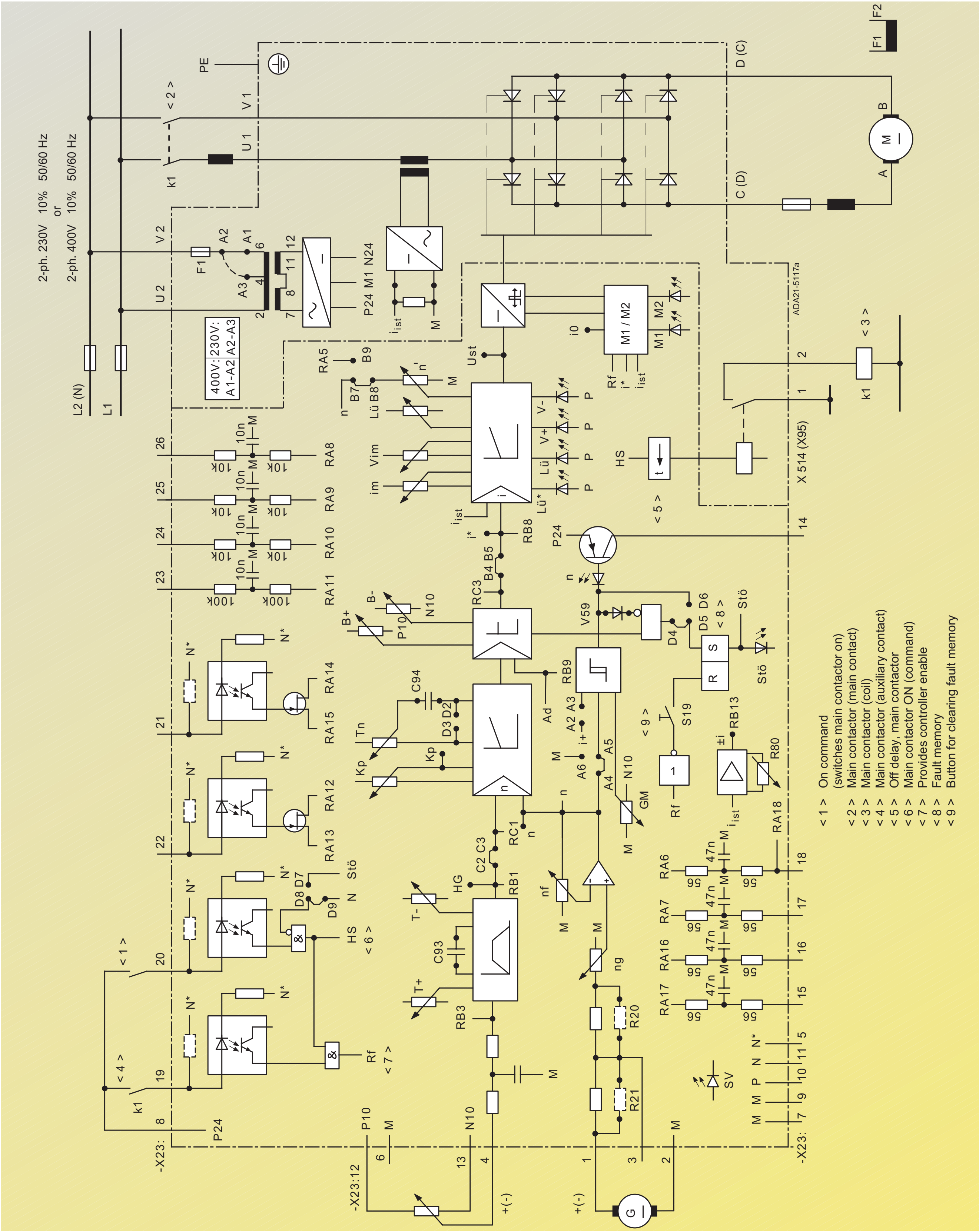

Fig. 1/11
6RA22 SIMOREG K converter in a circulating-current-free inverse-parallel connection using two fully controlled single-phase bridge circuits (B2)A(B2)C for four-quadrant drives

Block diagrams / Terminal assignment

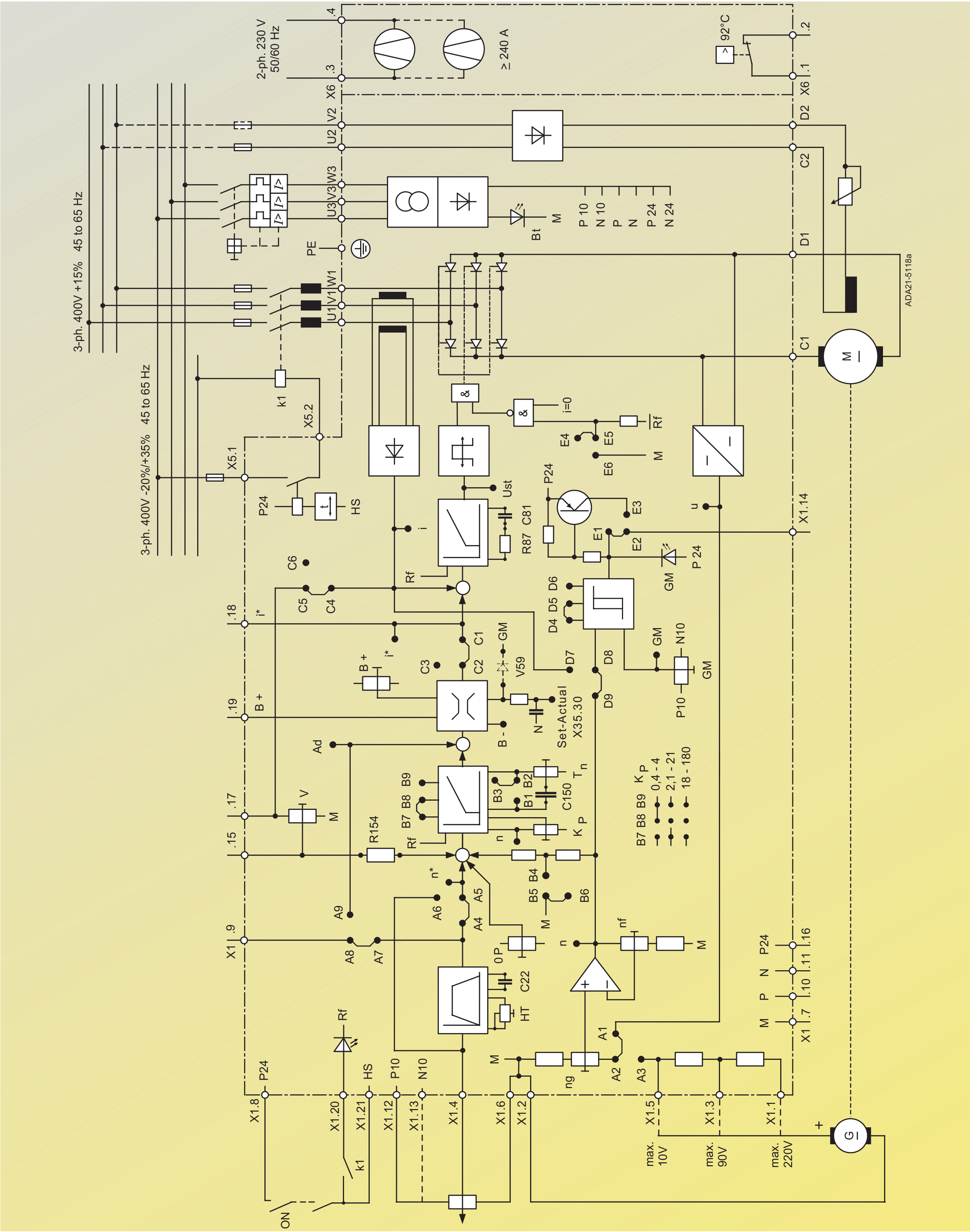

Fig. 1/12
6RA22 SIMOREG K converter in fully-controlled, three-phase bridge connection B6C for single-quadrant drives

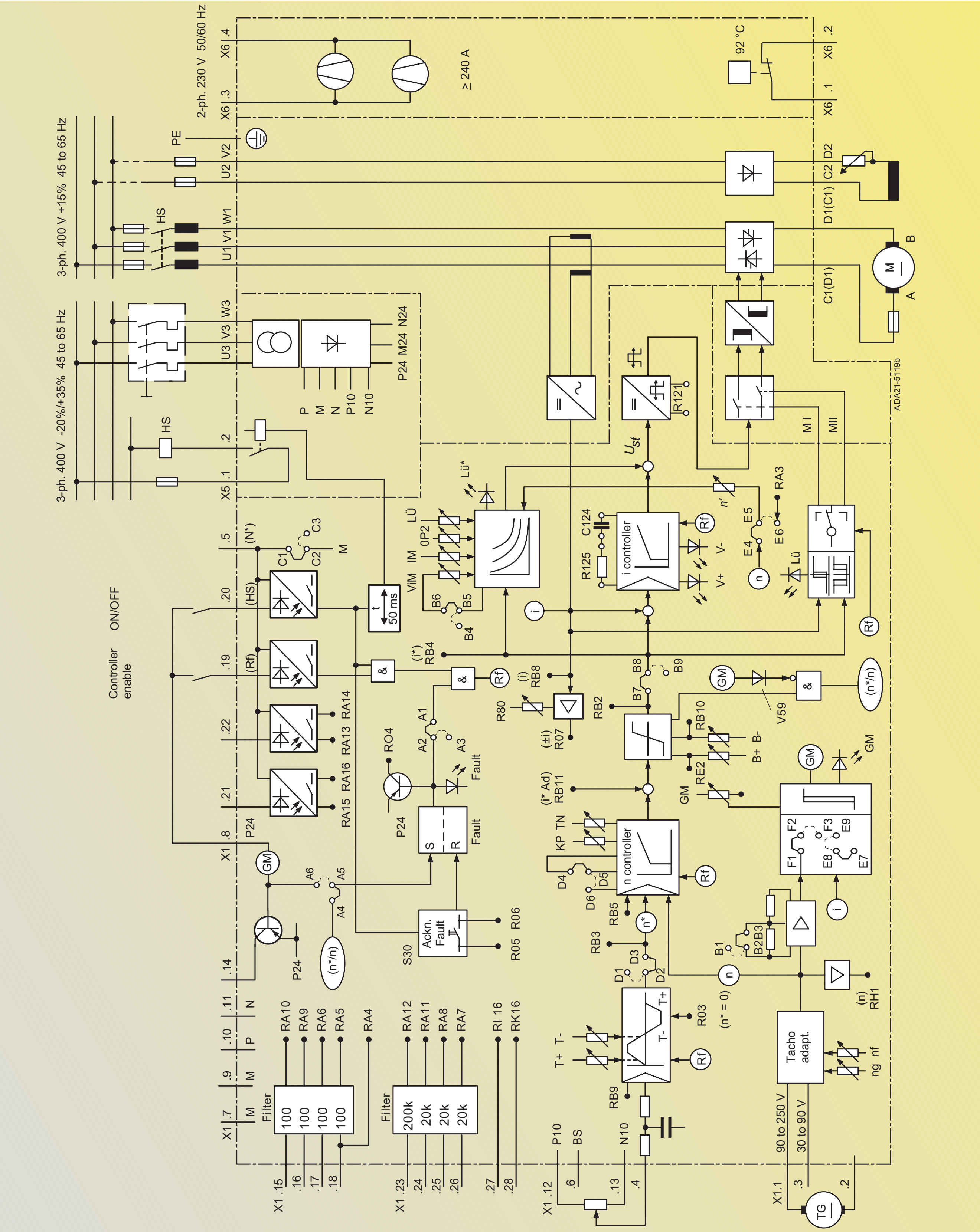

Fig. 1/13
6RA22 SIMOREG K converter in circulating-current-free inverse-parallel connection using two fully-controlled three-phase bridge circuits (B6)A(B6)C for four-quadrant drives

Block diagrams / Terminal assignment

1

	Function	Terminal	Type	Connection values	Comments
Connections of 6RA22 SIMOREG K converters in (B2)A(B2)C connection for four-quadrant drives					
Power section	L1 L2	U1 V1	Input Input	2-ph. 400 V or 2-ph. 230 V	See technical data
	+ (-) - (+)	C (D) D (C)	Output Output	Max. 260 V or 150 V	
	Relay contact	X95.1/2	Output	250 V/5 A AC Max. switching capacity 1100 VA	For switching-in the main contactor
Power supply	L1 L2	U2 V2	Input Input	2-ph. 400 V or 2-ph. 230 V	For 400 V solder jumper A2/A1 closed, for 230 V solder jumper A2-A3 closed See technical data
	M M P N P24	X23.7 X23.9 X23.10 X23.11 X23.8	Output Output Output Output Output	0 V (M potential) 0 V (M potential) +15 V - 15 V +24 V	 Total loading per polarity: 50 mA
	M P10 N10	X23.6 X23.12 X23.13	Output Output Output	0 V (ref. potential) +10 V/10 mA - 10 V/10 mA	Connection for speed setpoint potentiometer M/P10 (with ramp-function generator): direction I; M/N10 (with ramp-function generator): direction II.
Speed controller	Setpoint	X23.4	Input	+10 to -10 V/20 kΩ	Jumper C2-C3 closed: ramp-function generator setpoint input
	Actual value	X23.2 X23.1 X23.3 X23.3	Input Input Input Input	0 V (ref. potential) 80 to 220 V/78 kΩ 30 to 90 V/31 kΩ 10 to 30 V/13 kΩ	 Bridge resistor R20
Other functions	ON command (power contactor ON)	X23.20	Input	+20 to +30 V	Reference potential M: jumpers B2-B3 and A8-A7 closed, terminal 5 open
		X23.20	Input	0 to +24 V	Reference potential N24: jumpers B2-B3 and A8-A9 closed, terminal 5 open
		X23.20	Input	+20 to +30 V	Reference potential provided externally via terminal 5: jumper B2-B1 closed (floating control signal)
	Controller enable (checkback for power contactor ON)	X23.19	Input	See terminal X23.20	See terminal X23.20
	Free optocoupler	X23.21	Input	See terminal X23.20	See terminal X23.20
	Free optocoupler	X23.22	Input	See terminal X23.20	See terminal X23.20
	Floating control signal	X23.5	Input	0 to -30 V	Externally provided reference potential for floating control signal at terminals X23.19, X23.20, X23.21 and X23.22: jumper B2-B1 closed
	Limit monitor	X23.14	Output	+24 V/50 mA	Jumpers A2-A1 and A5-A4 closed: speed actual value interrogation Jumpers A2-A3 and A5-A6 closed: current actual value interrogation
	Free input terminals	X23.23 X23.24 X23.25 X23.26	Input Input Input Input	2 x 100 kΩ/10 nF 2 x 10 kΩ/10 nF 2 x 10 kΩ/10 nF 2 x 10 kΩ/10 nF	Matrix board RA11 Matrix board RA10 Matrix board RA9 Matrix board RA8
	Free output terminals	X23.15 X23.16 X23.17 X23.18	Output Output Output Output	2 x 50 Ω/47 nF 2 x 50 Ω/47 nF 2 x 50 Ω/47 nF 2 x 50 Ω/47 nF	Matrix board RA17 Matrix board RA16 Matrix board RA7 Matrix board RA6

	Function	Terminal	Type	Connection values	Comments
Connections of 6RA22 SIMOREG K converters in B6C connection for single-quadrant drives					
Power section	L1	U1	Input	3-ph. 400 V	See technical data
	L2	V1	Input	3-ph. 400 V	
	L3	W1	Input	3-ph. 400 V	
	+	C1	Output	DC 485 V	
	-	D1	Output	DC 485 V	
	Relay contact	X5.1/2	Output	AC 250 V/5 A	For switching the main contactor
Field rectifier	L1	U2	Input	2-ph. 400 V	See technical data
	L2	V2	Input	2-ph. 400 V	
	+	C2	Output	DC 340 V	See technical data
	-	D2	Output	DC 340 V	
Power supply	L1	U3	Input	3-ph. 400 V	See technical data
	L2	V3	Input	3-ph. 400 V	
	L3	W3	Input	3-ph. 400 V	
	M	X1.7	Output	0 V (M potential)	Total loading per polarity: 50 mA
	P	X1.10	Output	+15 V/50 mA	
	N	X1.11	Output	- 15 V/50 mA	
	P24	X1.8/16	Output	+24 V/50 mA	
	M	X1.6	Output	0 V (ref. potential)	Connection for speed setpoint potentiometer
	P10	X1.12	Output	+10 V/10 mA	
	N10	X1.13	Output	- 10 V/10 mA	
Speed controller	Setpoint	X1.4	Input	0 to +10 V/200 kΩ	Jumper A5-A4 closed: ramp-function generator setpoint input
		X1.4	Input	0 to -10 V/ 20 kΩ	Jumper A5-A6 closed: speed controller setpoint input
		X1.9	Input	0 to -10V/100kΩ	Jumper A8-A9 closed: summing amplifier input (supplementary current setpoint)
		X1.9	Output	0 to -10 V	Jumper A7-A8 closed: ramp-function generator output
	Actual value	X1.2	Input	0 V (ref. potential)	Jumper A2-A3 closed: speed controller actual value input (connection only for speed actual value sensing by means of tacho-generator)
		X1.1	Input	80 to 220 V/78 kΩ	
		X1.3	Input	30 to 90 V/31 kΩ	
		X1.5	Input	0 to +10 V	
	External current limiting	X1.19	Input	0 to +10 V/33 kΩ	Limiting the sum of current setpoint + supplementary current setpoint
Current controller	Setpoint	X1.18	Input	0 to +10 V/100 nF, 56 Ω	Jumper C1-C2 closed: current setpoint from speed controller C2-C3 closed: external current setpoint
Other functions	On/Off command	X1.21	Input	+20 to +30 V	Switching command, main contactor On
	Controller enable	X1.20	Input	+20 to +30 V	Prerequisite, terminal X1.21 = H signal
	Power supply	X1.8	Output	+24 V across 100 Ω	Exclusively for supply to terminals X1.20 and X1.21
	Limit monitor	X1.14	Output	+24 V/50 mA	Switch loads with respect to P24, because terminal X1.14 switches to M
	Wiper of potentiometer R157	X1.15	Input		Supplementary input for speed controller or (I x R) compensation
	Free connection of potentiometer R157	X1.17	Input	±10 V	
	Selector input	X1.22	Input	±10 V	On matrix board A14 for free use
Fan	Supply	X6.3	Input	2-ph. 230 V	Fan connection for units ≥ 240 A
		X6.4	Input	2-ph. 230 V	
	Temperature switch	X6.1	Output	Floating relay contact	Opens at overtemperature
		X6.2	Output		

Block diagrams / Terminal assignment

1

	Function	Terminal	Type	Connection values	Comments
Connections of 6RA22 SIMOREG K converters in (B6)A(B6)C connection for four-quadrant drives					
Power section	L1	U1	Input	3-ph. 400 V	See technical data
	L2	V1	Input	3-ph. 400 V	
	L3	W1	Input	3-ph. 400 V	
	+ (-)	C (D)	Output	DC 420 V	
	- (+)	D(C)	Output	DC 420 V	
	Relay contact	X5.1/2	Output	AC 250 V/5 A	For switching the main contactor
Power supply	L1	U3	Input	3-ph. 400 V	See technical data
	L2	V3	Input	3-ph. 400 V	
	L3	W3	Input	3-ph. 400 V	
	M	X1.7	Output	0 V (M potential)	See technical data
	M	X1.9	Output	0 V (M potential)	
	P	X1.10	Output	+15 V/50 mA	
	N	X1.11	Output	- 15 V/50 mA	
	M	X1.6	Output	0 V (ref. potential)	Connection for speed setpoint potentiometer
	P10	X1.12	Output	+10 V/10 mA	
	N10	X1.13	Output	- 10 V/10 mA	
Field rectifier	L1	U2	Input	2-ph. 400 V	See technical data
	L2	V2	Input	2-ph. 400 V	
	+	C2	Output	DC 340 V	See technical data
	-	D2	Output	DC 340 V	
Speed controller	Setpoint	X1.4	Input	±10 V/20 kΩ	Setpoint for ramp-function generator (2 to 30 s)
	Actual value	X1.2	Input	0 V (ref. potential)	
		X1.1	Input	80 to 220 V/78 kΩ	
		X1.3	Input	30 to 90 V/31 kΩ	
		X1.3	Input	10 to 30 V	Bridge R32
Other functions	On command (switches main contactor On)	X1.20	Input	+20 to +30 V	Reference potential M: jumpers C1-C2 and C4-C5 closed
		X1.20	Input	0 to +24 V	Reference potential N24: jumpers C1-C2 and C5-C6 closed
		X1.20	Input	+20 to +30 V	External reference potential via terminal 5: jumpers C2-C3 and C4-C5 closed
	Controller enable	X1.19	Input	As for terminal 20	As for terminal X1.20
	Free optocoupler	X1.21	Input	As for terminal 20	As for terminal X1.20
	Free optocoupler	X1.22	Input	As for terminal 20	As for terminal X1.20
	P24	X1.8	Output	+24 V (across 100 Ω)	Only for supplying terminals X1.19 to X1.22
	Floating control signal (N*)	X1.5	Input	0 to -30 V (ext.)	External reference potential at terminal X1.5
	Limit monitor	X1.14	Output	+24 V/50 mA	
	Free input terminals	X1.23	Input	±10 V/2 x 100 kΩ/10 nF	Matrix board RA12
		X1.24	Input	±10 V/2 x 10 kΩ/10 nF	Matrix board RA11
		X1.25	Input	±10 V/2 x 10 kΩ/10 nF	Matrix board RA8
		X1.26	Input	±10 V/2 x 10 kΩ/10 nF	Matrix board RA7
	Free input/output terminals	X1.27	Input/Output		Matrix board RI16
		X1.28	Input/Output		Matrix board RK16
	Free output terminals	X1.15	Output	2 x 50 Ω/47 nF	Matrix board RA10
		X1.16	Output	2 x 50 Ω/47 nF	Matrix board RA9
		X1.17	Output	2 x 50 Ω/47 nF	Matrix board RA6
		X1.18	Output	2 x 50 Ω/47 nF	Matrix board RA5
Fan	Supply	X6.3	Input	2-ph. 230 V	Fan connection for units ≥ 240 A
		X6.4	Input	2-ph. 230 V	
	Temperature switch	X6.1	Output	Floating relay contact	Opens at overtemperature
		X6.2	Output		

Rated supply voltage	Rated direct voltage	Rated DC	Rated output at 2-ph. 400 V	2-ph. 230 V	SIMOREG K converter Order No.	Type designation accord. to DIN 41 792	Fuses
V	V	A	kW	kW			Order No.
SIMOREG K converters in B2HK connection for single-quadrant drives							
Units without enclosure (for mounting in 6DM9005 subracks)							
2-ph. 400	315	5	1.6	0.9	**6RA2203-8DD21-0**	E315/ 5 MRE-GDE8-0	**5SD4 20**
or	or	12	3.8	2.2	**6RA2211-8DD21-0**	E315/12 MRE-GDE8-0	**5SD4 20**
2-ph. 230	180	22	6.9	4.0	**6RA2216-8DD21-0**	E315/22 MRE-GDE8-0	**3NE8 015**
		40	12.6	7.2	**6RA2221-8DD21-0**	E315/40 MRE-GDE8-0	**3NE8 017**
Units with enclosure (for individual mounting)							
2-ph. 400	315	5	1.6	0.9	**6RA2203-8DD21-1**	E315/ 5 MRE-GDE8-1	**5SD4 20**
or	or	12	3.8	2.2	**6RA2211-8DD21-1**	E315/12 MRE-GDE8-1	**5SD4 20**
2-ph. 230	180	22	6.9	4.0	**6RA2216-8DD21-1**	E315/22 MRE-GDE8-1	**3NE8 015**
		40	12.6	7.2	**6RA2221-8DD21-1**	E315/40 MRE-GDE8-1	**3NE8 017**

Rated supply voltage	Rated direct voltage	Rated DC	Rated output	SIMOREG K converter Order No.	Type designation accord. to DIN 41 792	Fuses
V	V	A	kW			Order No.
SIMOREG K converters in B6C connection for single-quadrant drives						
3-ph. 400	485	35	17	**6RA2220-8DS31**	D485/ 35 MRE-GDE8 S31	**3NE8 003**
		50	24	**6RA2223-8DS31**	D485/ 50 MRE-GDE8 S31	**3NE8 017**
		70	34	**6RA2226-8DS31**	D485/ 70 MRE-GDE8 S31	**3NE8 020**
		110	53	**6RA2230-8DS31**	D485/110 MRE-GDE8 S31	**3NE8 021**
		130	63	**6RA2232-8DS31**	D485/130 MRE-GDE8 S31	**3NE8 023**
		160	78	**6RA2233-8DS31**	D485/160 MRE-GDE8 S31	**3NE8 024**
		240	116	**6RA2276-8DS31**	D485/240 MRE-GDEF S31	**3NE4 327-0B**
		350	170	**6RA2280-8DS31**	D485/350 MRE-GDEF S31	**3NE4 333-0B**
		500	242	**6RA2283-8DS31**	D485/500 MRE-GDEF S31	**3NE4 334-0B**

Ordering and engineering data

Rated supply voltage V	Rated direct voltage V	Rated DC A	Rated output at 2-ph. 400 V kW	Rated output at 2-ph. 230 V kW	SIMOREG K converter Order No.	SIMOREG K converter Type designation accord. to DIN 41 792	Fuses Line fuses Order No.	Fuses DC fuses Order No.
SIMOREG K converters in (B2)A(B2)C connection for four-quadrant drives								
Units without enclosure (for mounting in 6DM9005 subracks)								
2-ph. 400	260	5	1.3	0.75	**6RA2203-8DK27-0**	E260/ 5 MREQ-GDG8-0	**5SD4 20**	**5SD4 20**
or	or	12	3.1	1.8	**6RA2211-8DK27-0**	E260/10 MREQ-GDG8-0	**5SD4 20**	**5SD4 20**
2-ph. 230	150	22	5.7	3.3	**6RA2216-8DK27-0**	E260/22 MREQ-GDG8-0	**3NE8 015**	**3NE8 015**
		40	10.4	6	**6RA2221-8DK27-0**	E260/40 MREQ-GDG8-0	**3NE8 017**	**3NE8 017**
Units with enclosure (for all mounting)								
2-ph. 400	260	5	1.3	0.75	**6RA2203-8DK27-1**	E260/ 5 MREQ-GDG8-1	**5SD4 20**	**5SD4 20**
or	or	12	3.1	1.8	**6RA2211-8DK27-1**	E260/10 MREQ-GDG8-1	**5SD4 20**	**5SD4 20**
2-ph. 230	150	22	5.7	3.3	**6RA2216-8DK27-1**	E260/22 MREQ-GDG8-1	**3NE8 015**	**3NE8 015**
		40	10.4	6	**6RA2221-8DK27-1**	E260/40 MREQ-GDG8-1	**3NE8 017**	**3NE8 017**

Rated supply voltage V	Rated direct voltage V	Rated DC A	Rated output kW	SIMOREG K converter Order No.	SIMOREG K converter Type designation accord. to DIN 41 792	Fuses Line fuses Order No.	Fuses DC fuses Order No.
SIMOREG K converters in (B6)A(B6)C connection for four-quadrant drives							
3-ph. 400	420	35	14.7	**6RA2220-8DV71**	D420/ 35 MREQ-GDG8 V71	**3NE8 003**	**3NE8 003**
		50	21	**6RA2223-8DV71**	D420/ 50 MREQ-GDG8 V71	**3NE8 017**	**3NE8 017**
		70	29	**6RA2226-8DV71**	D420/ 70 MREQ-GDG8 V71	**3NE8 020**	**3NE8 020**
		110	46	**6RA2230-8DV71**	D420/110 MREQ-GDG8 V71	**3NE8 021**	**3NE8 021**
		130	55	**6RA2232-8DV71**	D420/130 MREQ-GDG8 V71	**3NE8 022**	**3NE8 024**
		160	67	**6RA2233-8DV71**	D420/160 MREQ-GDG8 V71	**3NE8 024**	**3NE8 024**
		240	100	**6RA2276-8DV71**	D420/240 MREQ-GDGF8 V71	**3NE4 327-0B**	**3NE4 327-0B**
		350	147	**6RA2280-8DV71**	D420/350 MREQ-GDGF8 V71	**3NE4 333-0B**	**3NE4 333-0B**
		500	210	**6RA2283-8DV71**	D420/500 MREQ-GDGF8 V71	**3NE4 334-0B**	**3NE4 334-0B**

Fuses for the integrated field power supply

For 6RA22..-8DK27-. converters, an external field supply must be provided (see Part 2 of this catalog).

For 6RA22..-8DD21-. converters, fuses or a circuit breaker must be provided for the line protection of the field supply.

Type 5SD4 20 fuses are specified for the field supply of 6RA22..-8DS31 and 6RA22..-8DV71 converters.

Commutating reactors for the armature circuit

The required commutating reactor can be designed for the rated current of the motor and can be found in Catalog DA 93.1.

Converter type	Order No. of the German/English operating manual
Other documentation for 6RA22 SIMOREG K converters in analog technology	
6RA22..-8DD21-.	6RX1220-0DD 74
6RA22..-8DK27-.	6RX1220-0KD 74
6RA22..-8DS31	6RX1220-0SD 74
6RA22..-8DV71	6RX1220-0VD 74

Converter type	Order No. of the French operating manual
Other documentation for 6RA22 SIMOREG K converters in analog technology	
6RA22..-8DD21-.	6RX1220-0.D 77
6RA22..-8DK27-.	Letter according to converter type
6RA22..-8DS31	
6RA22..-8DV71	

Dimension drawings

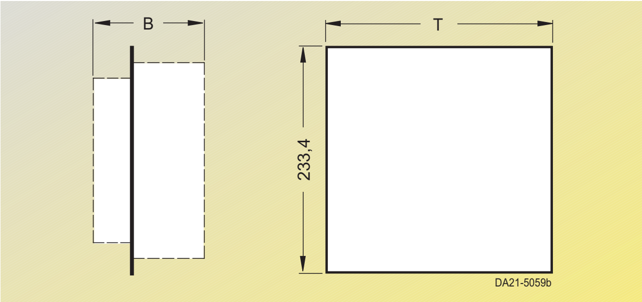

Fig. 1/14

Converter Order No.	Dimension B [1] mm	Dimension T mm	No. of required basic grid dimensions in the subrack [1]
Converters in B2HZ connection for single-quadrant drives, without enclosure			
6RA2203-8DD21-0	50	210	24
6RA2211-8DD21-0	50	210	24
6RA2216-8DD21-0	78	233	36
6RA2221-8DD21-0	112	233	50
Convert. in (B2)A(B2)C connection for four-quadrant drives, without enclosure			
6RA2203-8DK27-0	94	233	42
6RA2211-8DK27-0	94	233	42
6RA2216-8DK27-0	92	238	42
6RA2221-8DK27-0	124	238	54

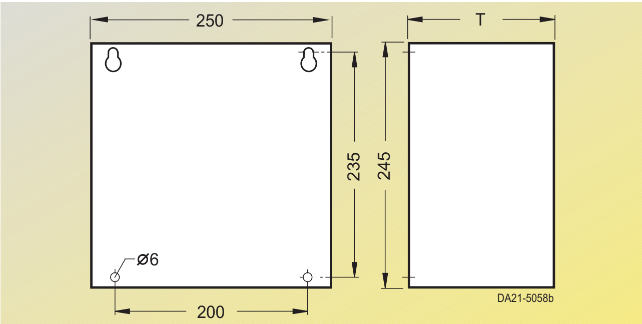

Fig. 1/15

Converter Order No.	Dimension T mm
Converters in B2HZ connection for single-quadrant drives, with enclosure	
6RA2203-8DD21-1	86
6RA2211-8DD21-1	86
6RA2216-8DD21-1	121
6RA2221-8DD21-1	152
Converters in (B2)A(B2)C connection for four-quadrant drives, with enclosure	
6RA2203-8DK27-1	137
6RA2211-8DK27-1	137
6RA2216-8DK27-1	152
6RA2221-8DK27-1	182

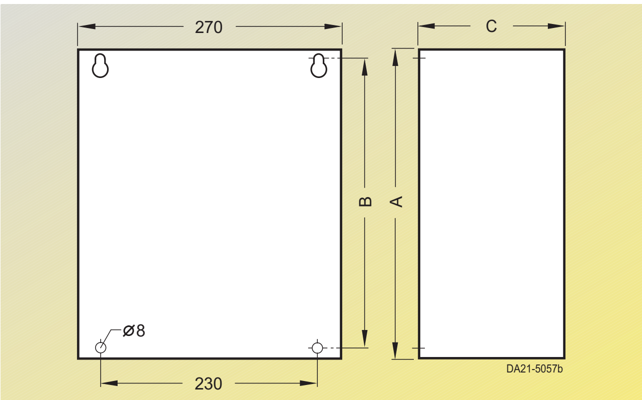

Fig. 1/16

Converter Order No.	Dimension A mm	Dimension B mm	Dimension C mm
Converters in B6C connection for single-quadrant drives, with enclosure			
6RA2220-8DS31	310	290	195
6RA2223-8DS31	310	290	195
6RA2226-8DS31	310	290	227
6RA2230-8DS31	310	290	317
6RA2232-8DS31	310	290	320
6RA2233-8DS31	310	290	320
6RA2276-8DS31	400	373	390
6RA2280-8DS31	400	373	390
6RA2283-8DS31	400	373	390
Converters in (B6)A(B6)C connection for four-quadrant drives, with enclosure			
6RA2220-8DV71	310	290	190
6RA2223-8DV71	310	290	190
6RA2226-8DV71	310	290	222
6RA2230-8DV71	310	290	315
6RA2232-8DV71	310	290	345
6RA2233-8DV71	310	290	345
6RA2276-8DV71	400	373	390
6RA2280-8DV71	400	373	390
6RA2283-8DV71	400	373	390

1) The specifications apply to units without mounted supplementar technology board, but they do include the required clearance between two mounted units.

Supplementary boards / Accessories

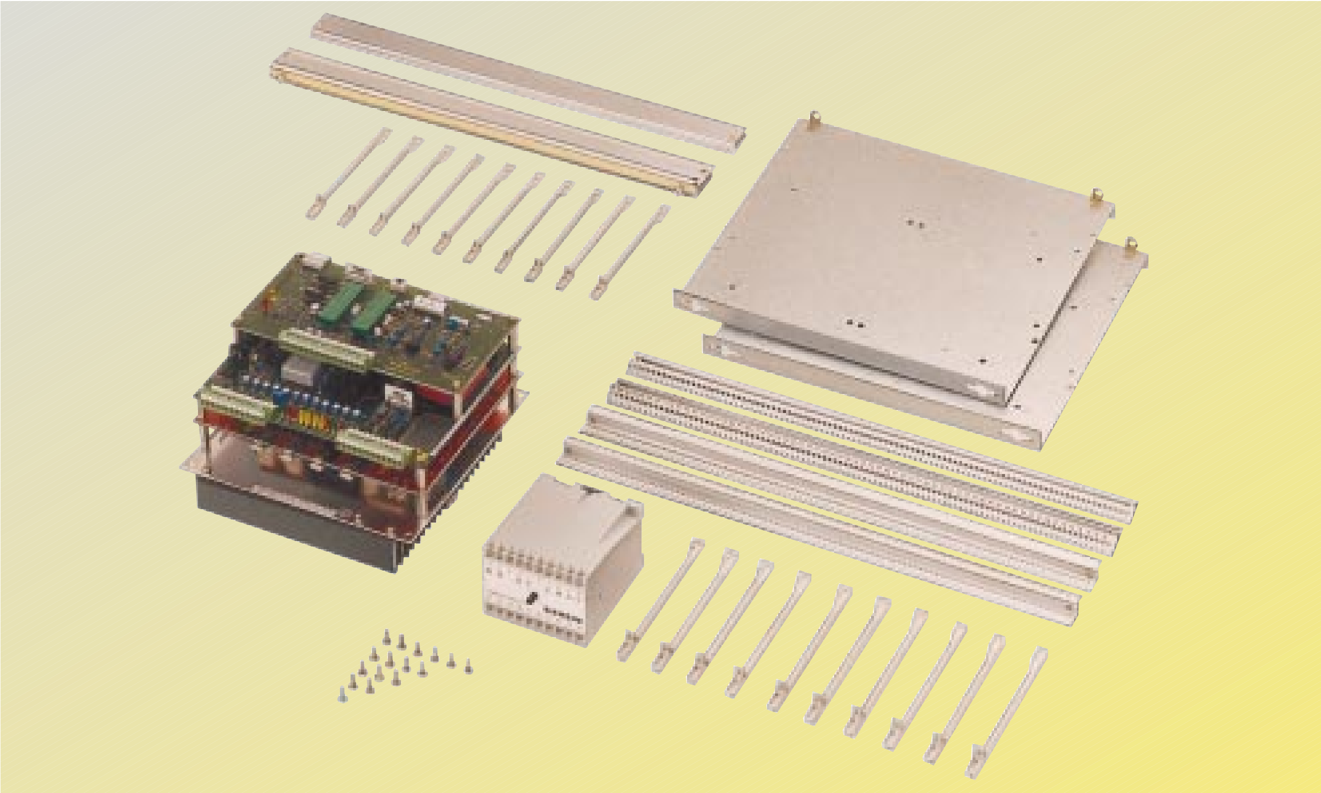

Fig. 1/17
6RA22 SIMOREG K converter with mounted supplementary technology board, 6RA2200-8DD00 field supply unit and 6DM9005 subrack as an assembly kit

Accessories for 6RA22 SIMOREG K converters

	Order No.	Comments	
Subrack as assembly kit	**6DM9005**	Subrack with 186 basic grid dimensions (1 BGD = 2.54 mm) for mounting 6RA22 SIMOREG K converters without enclosure. External dimensions (W x H x D): 537 mm x 336 mm x 300 mm	
Uncontrolled field rectifier alternative to the field supply unit	**6RA8222-8AA0**	Supply voltage:	max. 2-ph. 50/60 Hz 400 V +10%
		Field voltage:	340 V DC
		Field current:	4 A max. (up to 16 A when mounted on metal)
		Fuse:	5SD4 20

Z 702 supplementary board for winder drives Order No. **6RA8222-1BB0**

Application

The Z 702 supplementary board is intended for use with SIMOREG compact units for controlled drives for axle-driven winders and unwinders.

Winders and unwinders always require that the material web have a specific tension. It is usually desirable for this tension, also known as “web tension”, to be adjustable and to have the required characteristics over the entire winding range.

Winder drives can either be operated with “direct tension control” (sensing of the tension actual value via tension transducer or via compensator roll) or with “indirect tension control”.

Both modes are possible with the Z 702 supplementary board.

A prerequisite is that the web speed, the so-called “web velocity *v*” is always specified by the driven machine. The web velocity is either constant (e. g. for paper machines) or variable during acceleration and deceleration (e. g. for calenders).

For *winder operation,* the winding roll speed must be reduced according to the *increasing* roll diameter; for *unwinding operation,* in contrast, the speed must be increased in accordance with the descreasing roll diameter.

The set web tension must be maintained in both cases.

Z 702 supplementary board for winder drives Order No. 6RA8222-1BB0

Description

The Z 702 supplementary board mainly contains the following functions

- Higher-level controller (tension, position, current)
- Diameter computer
- Speed controller

This is therefore a variable-speed winder drive. The following setpoints act on the speed controller:

1. Master reference voltage V_L determines the basic speed.
2. Signal $n \times d$ from the diameter computer takes into account the diameter change of the winder roll.
3. Signal ΔV_{set} from the higher-level controller ensures that the web tension is maintained.
4. If necessary, a supplementary signal from a maneuvering potentiometer to run the winder motor when threading the material web.

A DC tachometer coupled to the winder motor supplies the speed actual value. The winder motor speed is adapted over the complete winding range

$\left(\text{i.e.} = \frac{\text{Full roll}}{\text{Empty roll}}\right)$

only via the armature voltage, at constant motor field. Thus a variable field supply is not needed.

Direct or indirect tension control can be provided for the higher-level controller. For direct tension control, the tension actual value is sensed via a tension transducer, and the tension setpoint is adjusted with a potentiometer.

If, however, a compensator roll is provided, the controller operates as a position controller. The material web tension is governed solely by the weight of the compensator roll or its load.

For indirect tension control, the armature current is a measure of the tension in the material web. The higher-level controller has the function of an additional current controller.

For more detailed information, please refer to the Operating Instructions, Order No. E31910-J5035-X-A1.

Mounting and connection

The Z 702 has the same width as the basic unit electronics board but only half its height. It is mounted onto the basic unit with spacers. The board is powered via ribbon cable from the basic unit (X2). A terminal strip is available for external connection (X1).

The mounting components, spacers and ribbon cables are supplied together with the board.

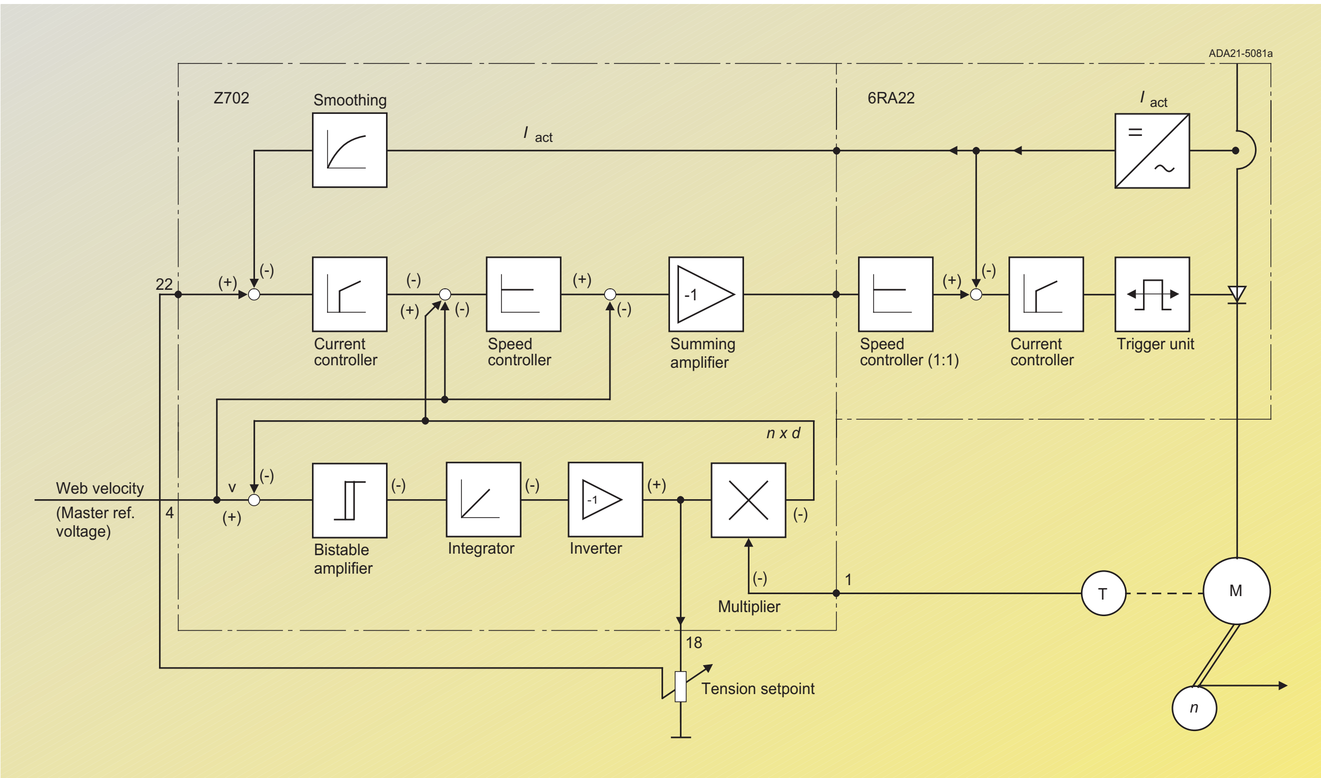

Fig. 1/18
Example: Simplified block diagram of an unwinder with indirect tension control

Supplementary boards / Accessories

Z 707 supplementary board for EMF control Order No. **6RA8222-1GB0**

1

Application

A drive can be operated with EMF control in conjunction with the Z 707 supplementary board.

This is often necessary if, for reasons of space for example, a tachometer cannot be mounted on the machine and the requirements for stability and accuracy of the closed-loop control allow EMF-controlled operation.

Described as an example is a DC door drive for which this board was originally designed.

Description

The Z 707 supplementary board mainly consists of:

a) Setpoint generator (V*)

b) Two-quadrant voltage converter

For more detailed information, please refer to the Operating Instructions, Order No. BA- 6RA82 22-1GB0.

Mounting and connection

The Z 707 supplementary board is mounted on the SIMOREG K unit electronics board with spacers and is connected to it with a ribbon cable.

Power is supplied to the voltage converter via two additional leads from the power board to the supplementary board (terminal points 13 - 15).

A terminal strip is available for other connections. The mounting components, spacers and ribbon cable are supplied together with the board.

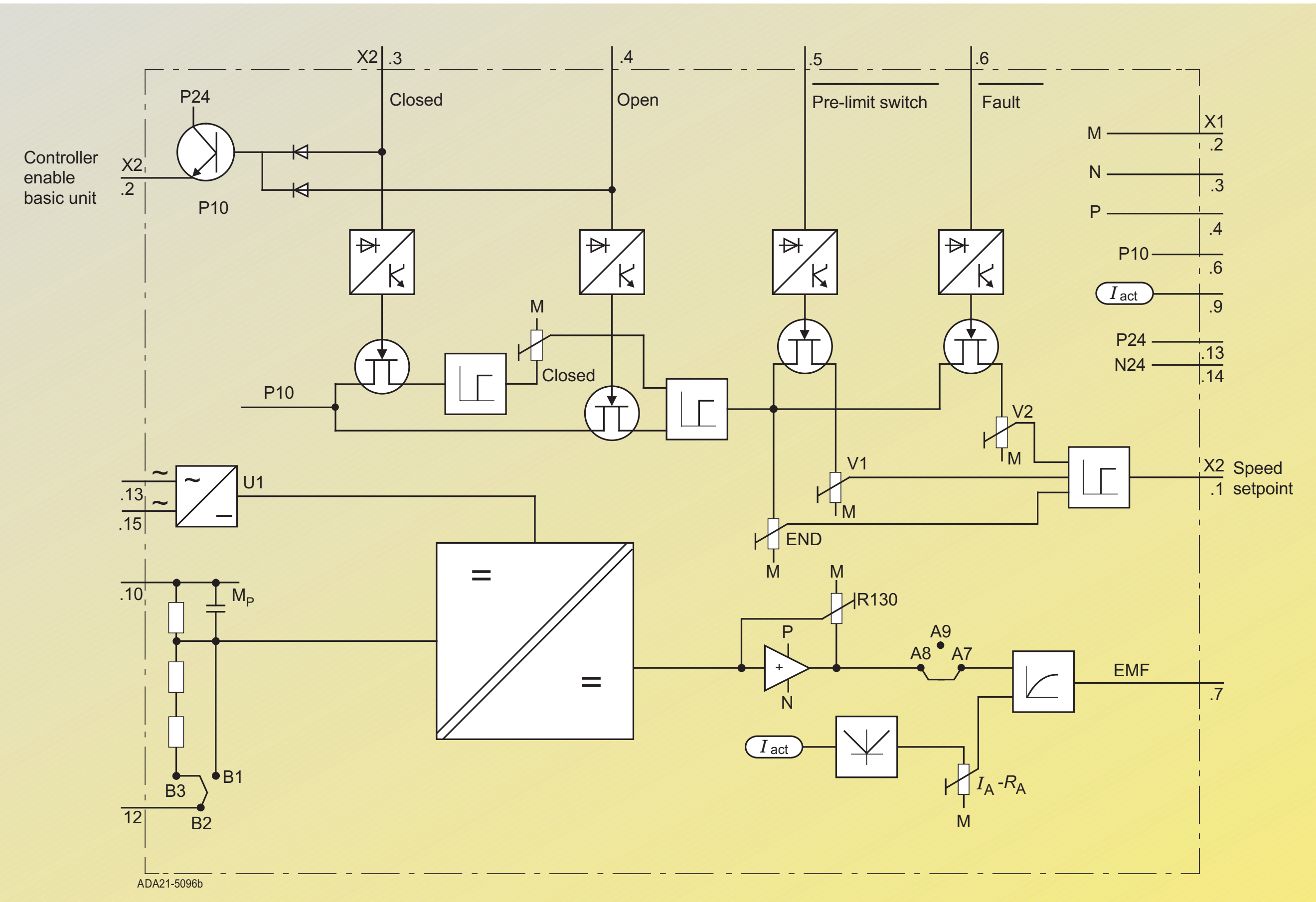

Fig. 1/19

Z 708 analog, higher-level PID controller Order No. **6RA8222-1HB0**

Application

The board is suitable for general higher-level PID control. The P gain, I component and D component of the PID controller are adjusted separately. The controller output is fed directly, or after multiplication by a master voltage V_{master} (e.g. web velocity), to a summing circuit. There, if required, it can be added to a speed setpoint n_{master} and fed to the setpoint output n^*_{set} of the board (e.g. as speed setpoint for the SIMOREG unit).

Typical applications: position, tension and pressure control.

For more detailed information, please refer to the Operating Instructions, Order No. V18-6RA82 22-1HB00.

Mounting

The Z 708 has the same width as the basic unit electronics board but only half the height.

The supplementary board is mounted directly onto the SIMOREG K converter by means of spacers. The SIMOREG K basic converter provides the board with the supply voltage (±15 V and ±24 V) via a ribbon cable.

Supplementary wiring:

Setpoint output X2.12 or X2.13 of the supplementary board must be connected to the setpoint input terminal X_.4 of the basic unit. The setpoint input is situated on the basic unit electronics board.

The mounting components, spacers and ribbon cable are supplied together with the board.

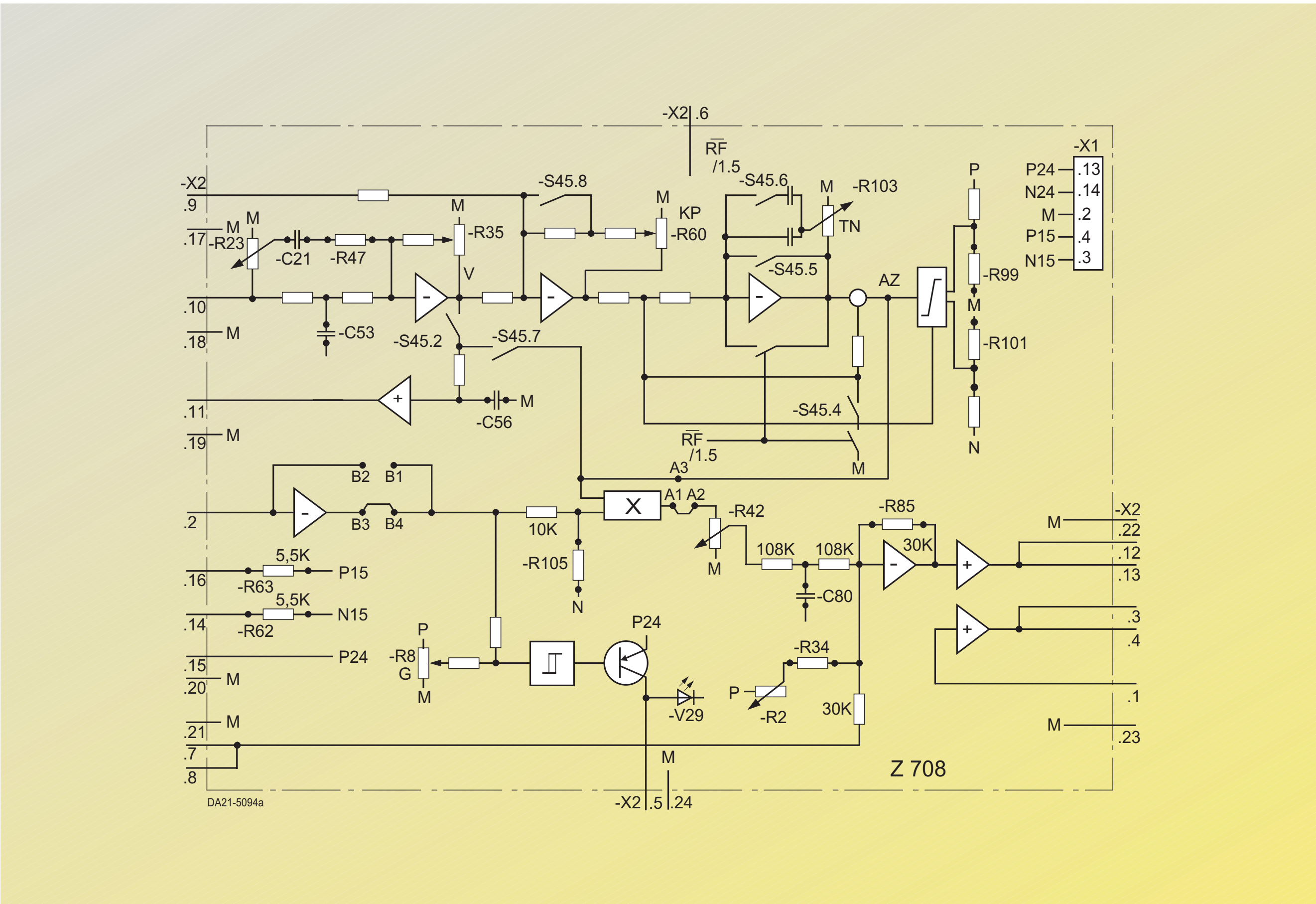

Fig. 1/20

Supplementary boards / Accessories

Z 714 technology board for wire-drawing machines Order No. 6RA8222-1PB0

1

Application

The Z 714 supplementary board is a technology board for use with SIMOREG K converters of the 6RA22 series in analog technology.

The board is equipped with the I-P-D-position controller functions including limiting, controlled braking and standstill monitoring.

It is used for position-controlled winder drives (e.g. wire-drawing machines) in conjunction with the basic unit.

The position controller has the function of maintaining the wire tension at the specified setpoint during winding. It involves position control. The transducer connected to the compensator roll (e.g. a magnetoresistive potentiometer) should be adjusted so that at the set position (e.g. midpoint of the compensator roll) 0 V is output for the controller. A position deviation results in a proportional value with sign.

For more detailed information, please refer to the Operating Instructions, Order No. BA-6RA8222-1PB0.

Mounting

The Z 714 has the same width as the basic unit electronics board but only 2/3 of its height.

The board is mounted on the basic unit by means of spacers. The board can either be powered via ribbon cable (X1) or via the terminal strip (X2). The terminal strip (X2) is also provided for external connections.

The mounting components, spacers and ribbon cable are supplied together with the board.

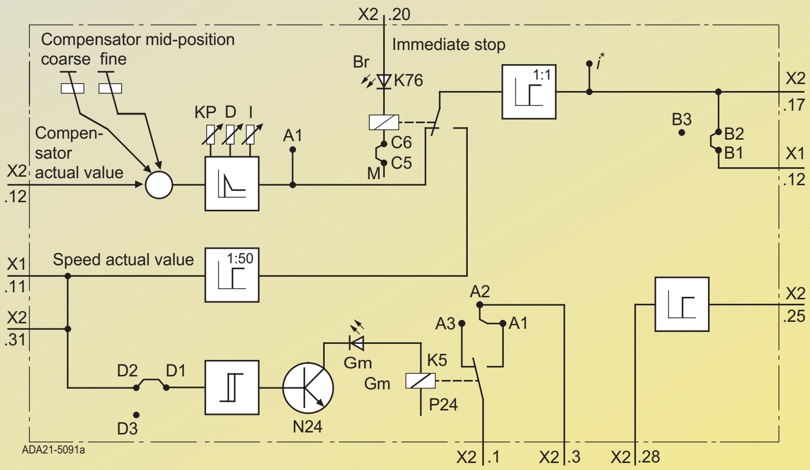

Fig. 1/21

Z 716 universal supplementary board Order No. **6RA8222-1RB0**

Application

The Z 716 supplementary board is intended as a universal supplementary board for all 6RA22 SIMOREG K converters, to allow improved adaptation of the basic units to simple technological processes.

The supplementary board mainly contains the following functions:

- Setpoint cascade with six inputs
- Six limit monitors
- Output for external speed display
- Four switchable amplifier circuits
- Freely available potentiometers

For more detailed information, please refer to the Operating Instructions, Order No. EMA-B1-6RA8222-1RB0.

Mounting

The board is mounted on the electronics board by means of spacers. The signal connection is achieved by ribbon cable X1 to the basic unit. A terminal strip is provided for external connections.

The mounting components, spacers and ribbon cable are supplied with the board.

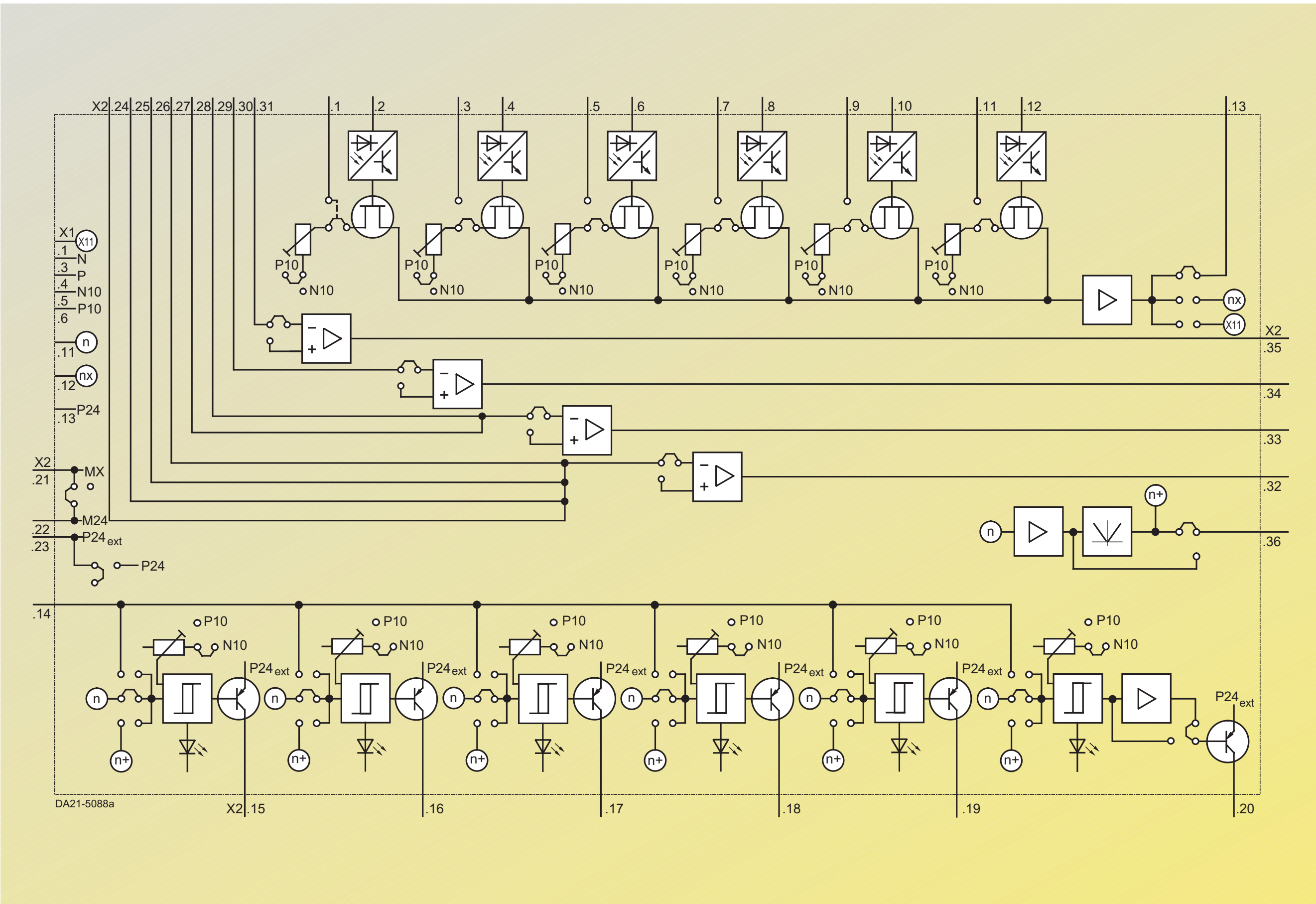

Fig. 1/22

Supplementary boards / Accessories

Z 722 axle winder and unwinder Order No. 6RA8222-2BB0

Application

The Z 722 supplementary board is suitable, in conjunction with a SIMOREG K unit, for controlling the material web tension of an axle winder motor.

The board is suitable for both winding and unwinding operations.

With the appropriate circuitry, the board can be used for the following control tasks:

- Direct tension control
- Position control with compensator roll
- Indirect tension control
- Winding hardness control

Description

The Z 722 supplementary board mainly contains the following functions

- Higher-level controller (tension, position, current)
- Diameter computer
- Diameter-dependent field weakening
- Speed controller

This is therefore a variable-speed winder drive. The following setpoints act on the speed controller:

1. Master reference voltage V_L determines the basic speed.
2. Signal *n x d* from the diameter computer takes into account the diameter change of the winder roll.
3. Signal ΔV_{set} from the higher-level controller ensures that the web tension is maintained.
4. If necessary, a supplementary signal from a maneuvering potentiometer to run the winder motor when threading the material web.

A DC tachometer coupled to the winder motor supplies the speed actual value.

The winder motor speed is adapted over the complete winding range

$\left(\text{i.e.} = \frac{\text{Full roll}}{\text{Empty roll}}\right)$

Direct or indirect tension control can be provided for the higher-level controller. For direct tension control, the tension actual value is sensed via a tension transducer, and the tension setpoint is adjusted with a potentiometer.

If, however, a compensator roll is provided, the controller operates as a position controller. The material web tension is governed solely by the weight of the compensator roll or its load.

For indirect tension control, the armature current is a measure of the tension in the material web. The higher-level controller has the function of an additional current controller.

Please refer to the Operating Instructions, Order No. E31910-T9008-X-A2 for more detailed information.

Mounting

The Z 722 has the same width as the basic unit electronics board but only half the height.

The supplementary board is mounted on the basic unit by means of spacers. The board is powered via a ribbon cable. A terminal strip is available for external connections.

The mounting components, spacers and ribbon cable are supplied with the board.

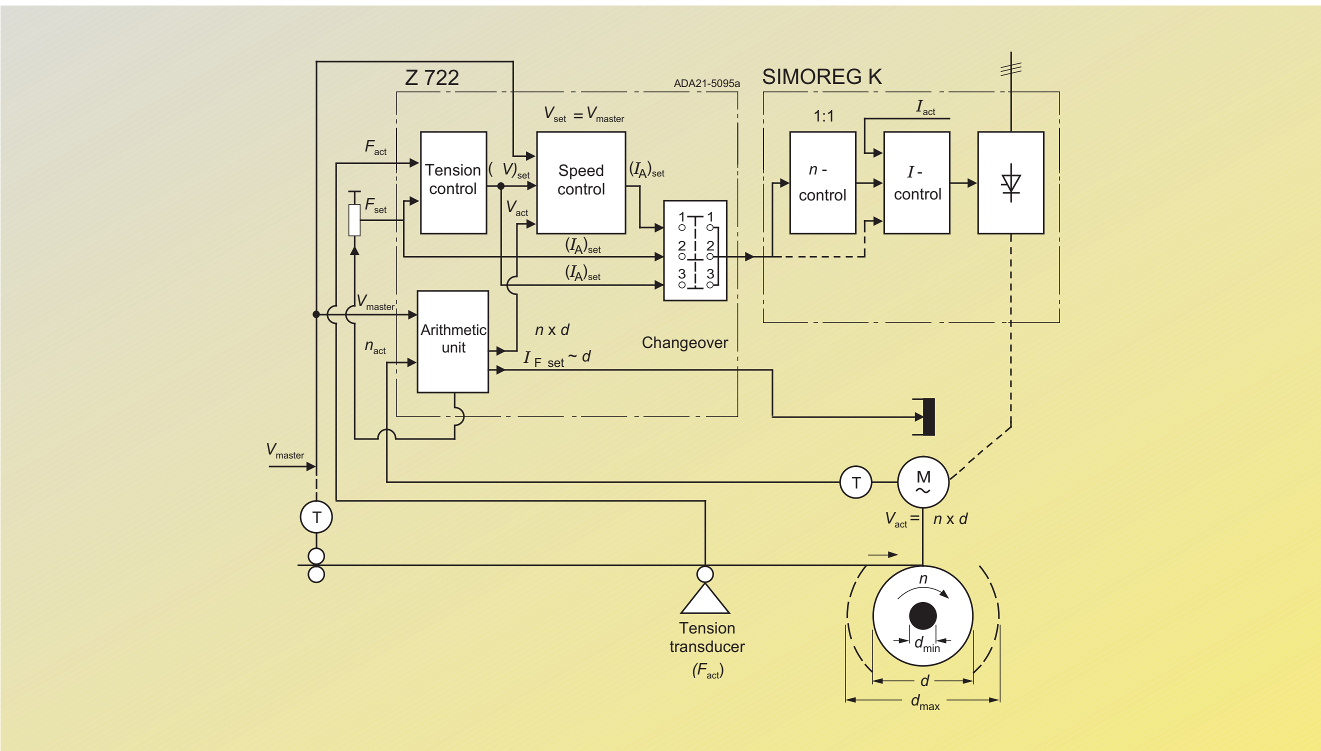

Fig. 1/23
Example: Simplified block diagram of a winder drive (direct tension control with tension transducer)

SIMOREG K
Field Supply Units

F 33 Minireg Order No. 6DM1001-0WB00-2

Application

The "F 33 Minireg" board is a current-controlled thyristor power unit with half-controlled single-phase bridge circuit, which is used for the field supply of DC shunt-wound motors.

Power section

The power section consists of a module containing two thyristors, two diodes in half-controlled single-phase bridge circuit and an additional free-wheeling diode. An aluminum support plate serves simultaneously as heatsink for the module.

Current actual value sensing

The current actual value is measured on the DC side of the power section with a chopper converter. With this measuring method, the "zero diode current" of the thyristor circuit is also sensed.

Current controller

When the F 33 Minireg Version 2 is used for the field supply of DC shunt-wound motors, the current controller has the task of keeping the current through the field winding constant, independently of temperature rise and supply voltage fluctuations, according to a specified setpoint.

The setpoint which, for example, corresponds to the rated field, can be set with potentiometer R120.

Monitoring

A limit monitor is provided for monitoring the load current by comparing the current actual value to a selectable reference value.

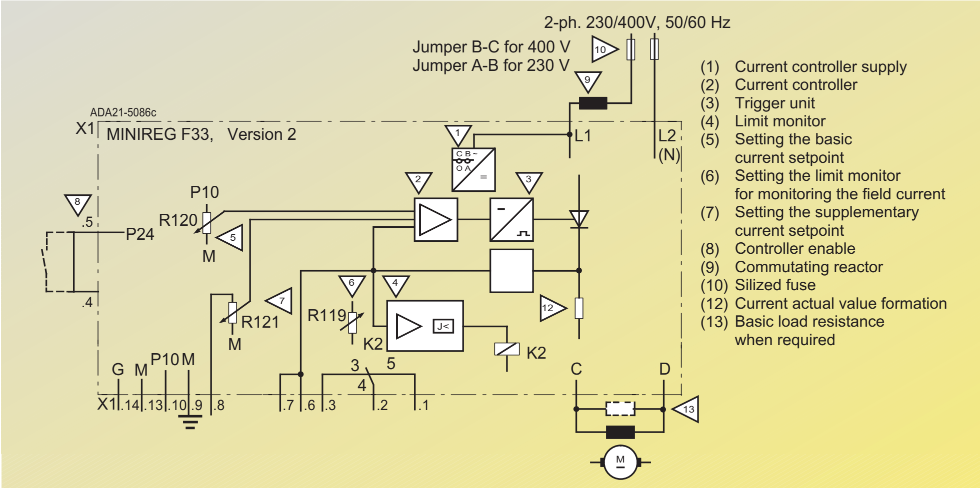

Fig. 2/1

Terminal	Function	Terminal strip codes	Connection value	Comments
L1 L2 (N)	Rated supply voltage		2-ph. 230 or 400 V 50/60 Hz	±10%
L+ L-	Rated DC voltage		DC 190 V or DC 325 V	
X1.1 X1.2 X1.3	Contact terminals of relay K2	NO contact CO contact NC contact	Contact rating AC 230 V, 2.5	Changeover contact
X1.4	Controller enable	Rf	+24 V ≙ enable	
X1.5	P24	P24		For controller enable
X1.6 X1.7	Actual value output	i	0 to -10 V	e.g. for measuring purposes
X1.8	External supplementary setpoint	i*	0 to ±10 V	
X1.9	Reference potential M (0 V)	M	0 V	⏚
X1.10	Supply from ext. setpoint potentiometer	P10	+10 V	10 kΩ potentiometer
X1.13	Reference potential M (0 V)	M	0 V	
X1.14	Tag	G		
X3.1 X3.2 X3.3 X3.4 X3.5 X3.6	Connector for connecting cable to supplementary board	P N M N24 i_e* ie_{act}		
⏚	Protective conductor terminal			

Rated supply voltage (50/60 Hz) V	Rated DC voltage V	Rated DC current 1) A	Order No.	Fuse
2-ph. 230	190	8	**6DM1001-0WB00-2**	**5SD4 20**
		15	**6DM1001-0WB00-2**	**5SD4 20**
		22	**6DM1001-0WB00-2**	**5SD4 40**
2-ph. 400	325	15	**6DM1001-0WB00-2**	**5SD4 20**
		22	**6DM1001-0WB00-2**	**5SD4 40**

Please refer to Catalog DA 93.1 for the required commutating reactors.

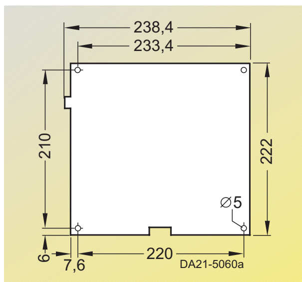

Fig. 2/2
Support plate, overall height approx. 72 mm

1) The maximum field current of the unit is 22 A. The intermediate values are governed by the commutating rectors and fuses.

Mounting

Subrack 6DM9005 is intended for mounting a total of seven F 33 Miniregs.

The F 33 Minireg can also be mounted on a vertical surface by means of four spacers, e.g. in a cubicle.

U 315 simple field supply unit Order No. **6RA2200-8DD00**

Function	Terminal	Connection values
Connection for power section supply and electronics power • Supply phase L1 • Supply phase L2 or N	 1 2	Rated supply voltages; 2-ph. 50/60 Hz 400 V +10 – 15% or 2-ph. 50/60 Hz 230 V +10 – 15% (see also terminals 14/15/16) Fuse 2 x 5SD420
Unit ground connection	5	
Control voltage connection for field weakening • Ground potential • Ext. control voltage E	 6 7	 0 V 0 to +10 V (only field weakening possible)
Field current monitoring (floating)	9 10	1 NO contact: 230 V/2.5 A AC max. Contact opens at a field current <80 mA
Field winding connection • Connection C2(+) • Connection D2(-)	 11 12	Rated DC voltage: 325 V DC at a rated supply voltage of 2-ph. 400 V; 190 V DC at a rated supply voltage of 2-ph. 230 V; max. field current: 3 A
Adaptation to rated supply voltages of 2-ph. 400 V or 2-ph. AC 230 V (external jumpers)	14 15 16	Jumper 15 - 16 for a rated supply voltage of 2-ph. 400 V; jumper 15-14 for a rated supply voltage of 2-ph. 230 V

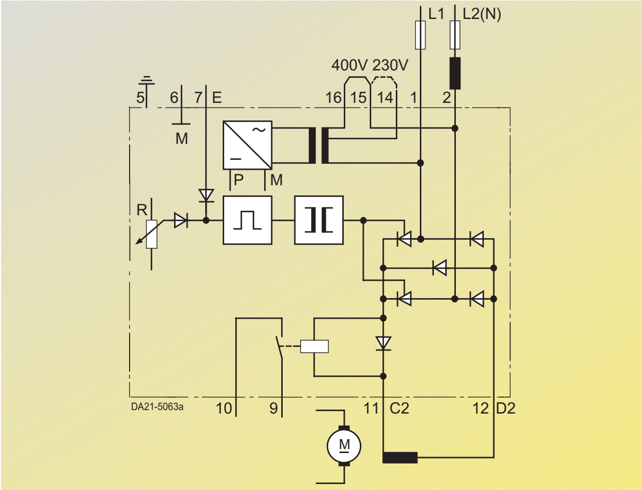

Fig. 2/3

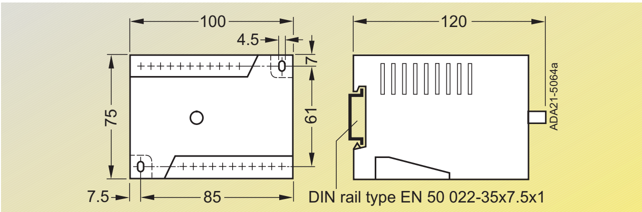

Fig. 2/4

F 10 Minireg Order No. **6RA8222-8PA0**

Function	Terminal	Connection values	Comments
Rated supply voltage	L1 L2	2-ph. 50/60 Hz 400 V	Tolerance: ±15% Fuses (2 required): 5SD4 20
Rated DC voltage	C2 D2	325 V DC 10 A max.	
Monitoring relay connection	1 2	Contact rating 230 V AC, 2.5 A	Contact closed as long as current flows
Controller enable	4	Via internal P or SIMATIC	
Reference potential	5	M	
External analog setpoint	6	0 to +10 V	e.g. from U318 field weakening unit
Measured field current	7	0 to -10 V max. 10 mA	For measuring purposes
Reference potential	8	M	
Internal P	9	12 V Short-circuit protected	For controller enable

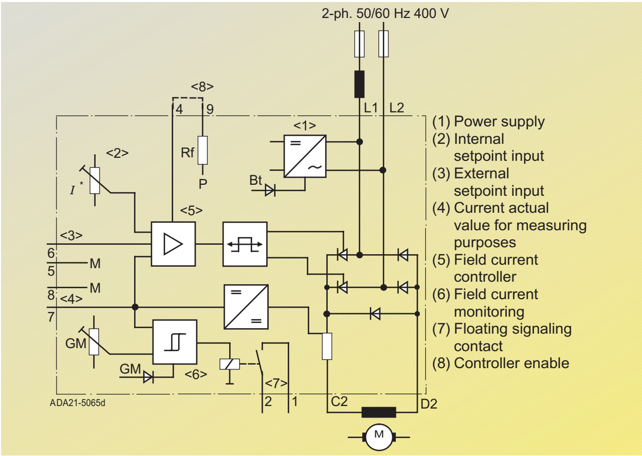

Fig. 2/5

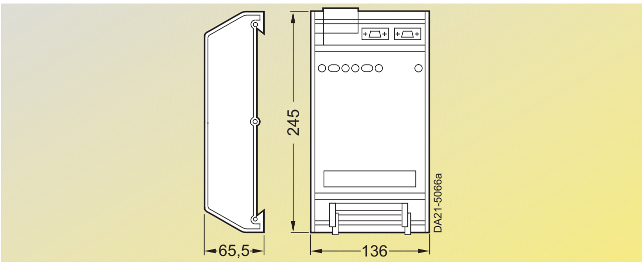

Fig. 2/6

The F 10 Minireg field supply unit is suitable for the supply of controlled fields of up to 10 A.

Please consult Catalog DA 93.1 for the required commutating reactor.

U 318 cut-in field weakening control Order No. **6RA8222-8QA0**

Application

The U 318 module is used for cut-in field weakening control in conjunction with, for example, the F 33 Minireg or F 10 Minireg.

The unit contains the power supply, voltage transformer for sensing the armature voltage with isolation, and cut-in controller. The level of the cut-in voltage is preset via potentiometer V $*_A$; the value can be weakened via a switchable input with potentiometer A. Potentiometer V_A serves for adaptation to the armature voltage. The field current setpoint is made available at two different outputs, one from 0 to +10 V and the other from 0 to -10 V, both rated at up to 5 mA max. The maximum or minimum field limit can be set on the potentiometers: Max. and Min.

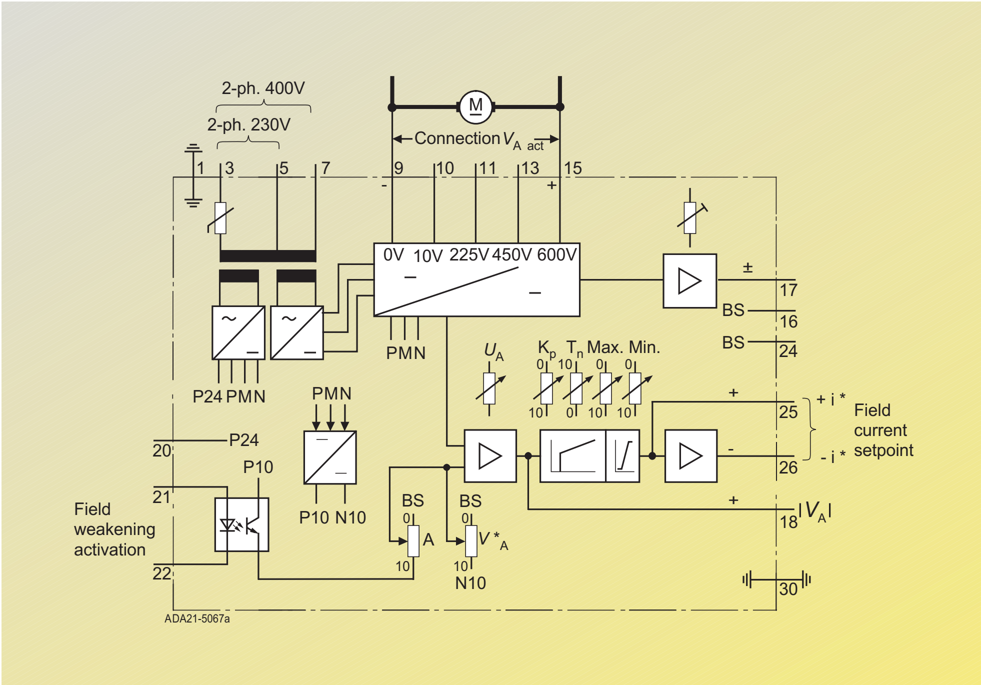

Fig. 2/7

Mounting

The U 318 cut-in field weakening control can be snapped onto a standard mounting rail to DIN 46 277 (35 mm DIN rail).

The unit can also be mounted directly on a vertical surface using two screwed fixtures to DIN 46 121 and DIN 43 660, e.g. in a cubicle.

For more detailed information, please refer to the Operating Instructions BA-6RA8222-8QA0-X0076.

Technical data

Power supply: Rated supply voltage Permissible tolerance Current consumption	 2-ph. 50/60 Hz, 230/400 V +10%/-15% 50 mA
Voltage transformer: Rated input voltage	10 V (terminals 9, 10) 225 V (terminals 9, 11) 450 V (terminals 9, 13) 600 V (terminals 9, 15)
Input current	≤ 7 mA
Output voltage	±10 V (5 mA)
Linear overdrive capability 1)	1.1 · V_{EN}
Max. overdrive capability 2) 10 V input 225 V input 450 V input 600 V input	Continuous 12 V 270 V 540 V 720 V
Setpoint output	0 to +10 V (terminal 25) 5 mA 0 to -10 V (terminal 26) 5 mA

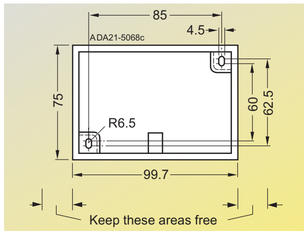

Fig. 2/8

1) Increase of input signal at which the converter still operates linearly (error as in the rated range).

2) Increase of input signal at which the converter is still not damaged.

Supplementary Units for Drives

U 307 motorized potentiometer

Design and mode of operation · Technical data

U 307 digital motorized potentiometer Order No. **6RA8222-8BA0**

Application

The U 307 digital motorized potentiometer is used as a setpoint generator for closed-loop control equipment. It can serve for the following applications:

- Remote changing of setpoints with separately adjustable ramp-up and ramp-down times
- Ramp-function generator (slope limiter) for analog voltages 0 to -10 V or 0 to +10 V
- Diameter tracking and storage for winder functions (e.g. in conjunction with SIMOREG supplementary boards such as Z 702)

The U 307 operates completely wear-free because a microprocessor is used.

Reliable storage of the output variable is ensured, even when the supply voltage is switched off for any length of time.

The U 307 has its own 230 V power supply.

Mode of operation

Ramp-up and ramp-down times are reproducibly adjustable with quartz accuracy using a thumbwheel switch over the range 1 to 999 s (corresponding to 16:40 min.).

MANUAL mode
(MAN switch setting)

The output voltage is changed via the UP and DOWN control inputs according to the set ramp-up or ramp-down time *t*-UP and *t*-DOWN.

AUTOMATIC mode
(AUTO switch setting)

The output voltage follows an analog reference setpoint along a ramp according to the preset ramp-up/ramp-down time. The reference setpoint can be preset as a voltage signal (0 to -10 V or 0 to +10 V) or as a current signal (0 to 20 mA). Additionally, a potentiometer can serve as the setpoint generator. The U 307 provides a highly accurate +10 V reference voltage for the purpose.

Control inputs

All control inputs are SIMATIC compatible and isolated via optocouplers.

Reset facilities

- The output value can be reset to 0 V at any time via the RESET control input.
- The nonvolatile storage can be canceled by inserting an optional terminal jumper between terminals 27 and 28. When the 230 V supply voltage is switched on, 0 V then appears at the output and not the value in the nonvolatile memory.

External ramp-up time changeover

The external ramp-up time changeover can be activated by inserting a jumper between terminals 29 and 30. In this case, the ramp-up or ramp-down time can be changed during operation with external switch *t*-DN/*t*-UP. At the *t*-DN setting, the time selected at the *t*-DOWN thumbwheel is valid, and at the *t*-UP setting the time selected at the *t*-UP thumbwheel is valid. Whether the motorized potentiometer is ramping-up or ramping-down is insignificant.

For example, the "fast/slow acceleration" function can be implemented in this way.

External reference voltage

An external reference voltage can be applied to terminal 19 for special applications, thus allowing the maximum output voltage to be varied.

Mounting

The U 307 can be snapped onto a standard mounting rail to DIN 46 277. The unit can also be mounted directly on a vertical surface (e.g. in a cubicle) by means of two screw fixtures to DIN 46 121 and DIN 43 660.

A clearance of approx. 15 mm on all sides must be maintained without fail, on account of the temperature rise in the unit.

For more detailed information, please refer to the Operating Instructions, Order No. E31930-T7001-X-A3-7400.

Technical data

Design, mounting	Terminal housing for mounting on standard 35 mm DIN rail
Dimensions	H x W x D = 75 mm x 99.7 mm x 110 mm (see page 4/4)
Rated supply voltage Power supply	2-ph. 50/60 Hz 230 V +10%/-15% Current consumption 50 mA
External control signals	SIMATIC-compatible 24 V signal LOW = 0 to 4.0 V HIGH = 13 to 35 V
Resolution (step change) of the output voltage	2.5 mV
Nonvolatile memory	NOVRAM*-IC, storage time > 10 years; backup battery is not necessary
Ambient temperature	0 to +45 °C

* NOVRAM = Nonvolatile random access memory

Fig. 3/1

3

U 307 digital motorized potentiometer (continued)

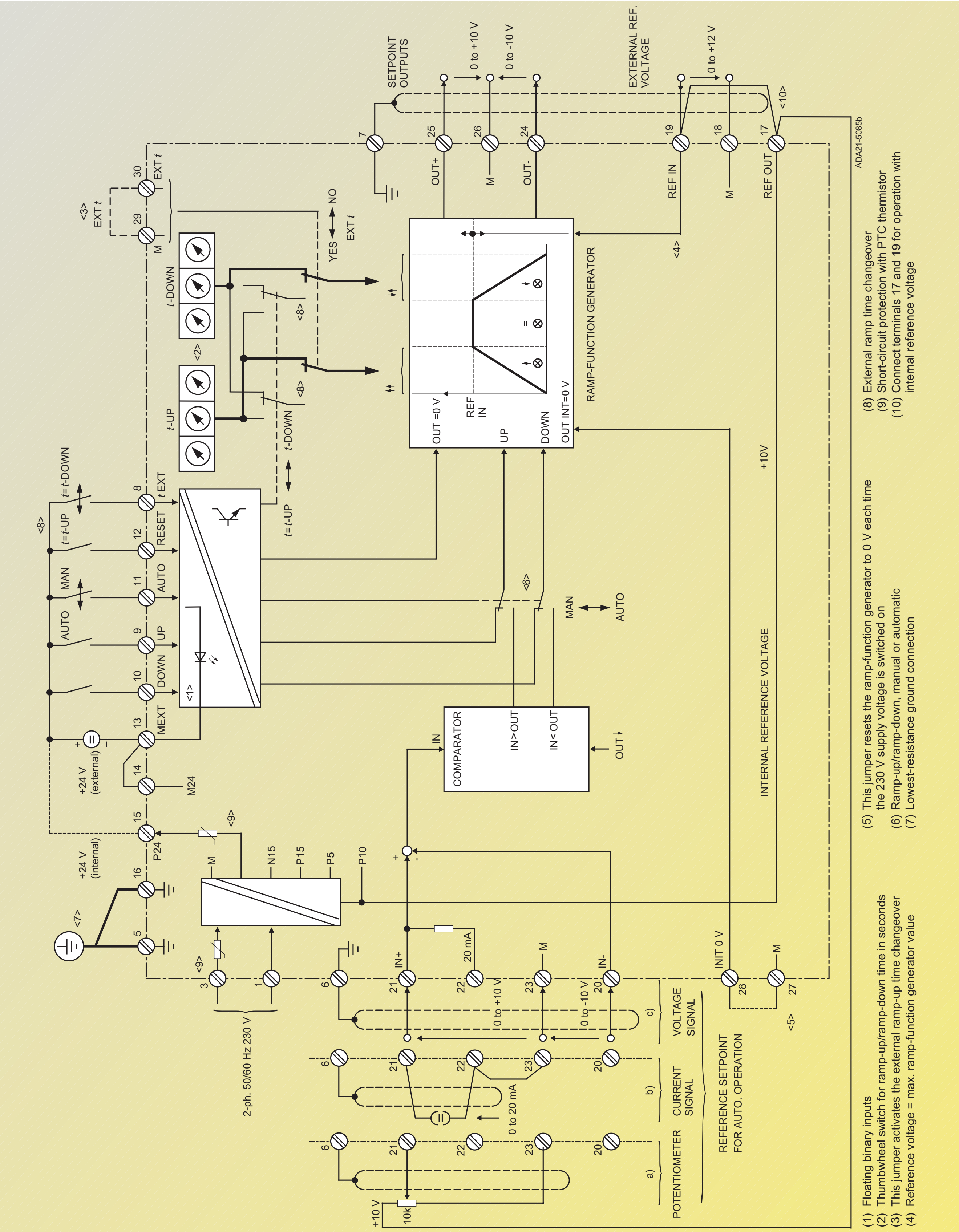

Fig. 3/2

U 308 A frequency-voltage converter for pulse generator evaluation Order No. **6RA8222-8CA1**

Application

The U 308 A frequency-voltage converter converts a signal, which is present as a pulse train (frequency), to a direct voltage which is proportional to the pulse frequency.

The direction of rotation can be evaluated by connecting two channels, electrically offset by 90 °, so that the DC output voltage is also available with sign.

On account of its 100 kHz input frequency, the converter is also suitable for fast and dynamic drives.

The *f/V* converter and the preceding rotary pulse encoder are powered by an internal power supply (230 V supply).

The basic function of the U 308 A module can be seen in the figure.

The input signals of channels I and II are available at two decoupled outputs.

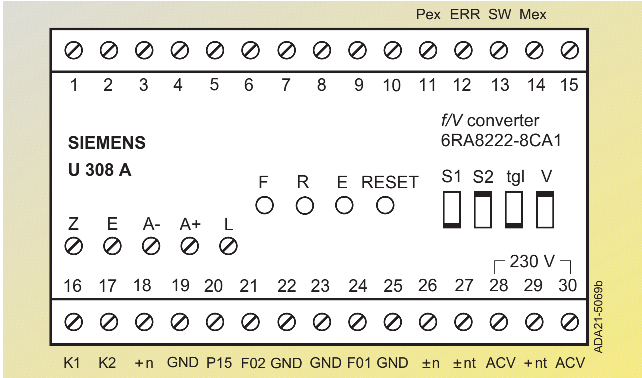

Fig. 3/3
Front view of the U 308 A *f/V* converter

Technical data

Supply	
Rated supply voltage	2-ph. 50 Hz 230 V +10% – 15%
Current consumption	50 mA
Rotary encoder supply	
Voltage	+15 V with respect to M (0 V)
Rating	80 mA
Input level for actual value channels	
High	12 to 30 V
Low	-0.6 to 3.5 V
Outputs	
Positive output	+10 V 5 mA
Bipolar output	±10 V 5 mA
Decoupled inverted frequency outputs	Low 0.2 V High 15 V
f/V converter (N38)	
Input frequency range	0 to 100 kHz (Freq. in)
of the DC output voltage	0 to 9.9 V ±0.05 V
Temperature sensitivity of DC output voltage	1 mV/°C
Nonlinearity	0.01% referred to max. output voltage
Short-circuit protection	Continuous with respect to M (0 V)
Permissible ambient temperature	0 to 45 °C

For more detailed information, please refer to the Operating Instructions, Order No. BA-6RA8222-8CA1.

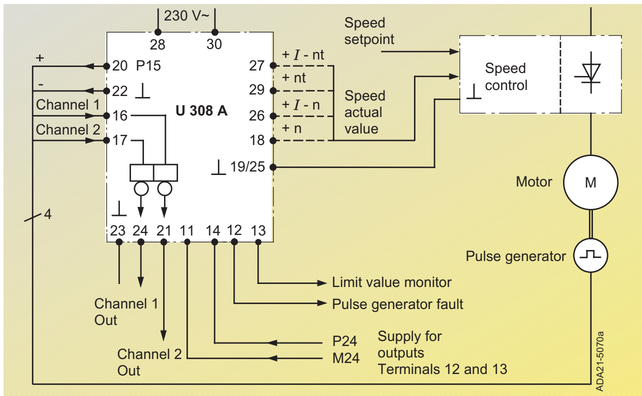

Fig. 3/4
Block diagram

Mounting

The U 308 A frequency-voltage converter can be snapped onto a standard mounting rail to DIN 46 277 (35 mm DIN rail).

The unit can also be mounted directly on a vertical surface, e.g. in a cabinet, by means of two screw fixtures to DIN 46 121 and DIN 436 60.

Dimensions:
H x W x D = 75 mm x 99.7 mm x 110 mm (see also dimension drawing).

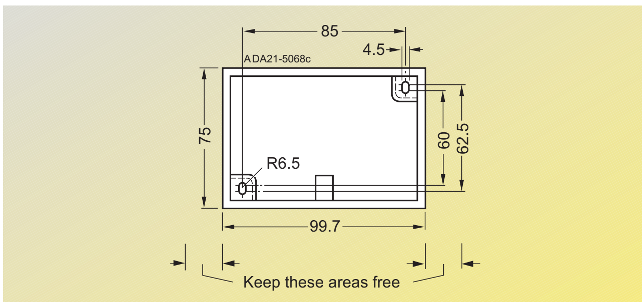

Fig. 3/5

U 309 adaptor module 4 to 20 mA for U 307 digital motorized potentiometer Order No. **6RA8222-8DA0**

Application

The U 309 adaptor module allows the U 307 digital motorized potentiometer to be operated also in the automatic mode with a reference setpoint of 4 to 20 mA (impressed current with live zero).

Circuit description

The circuit diagram is shown in the figure. A voltage of exactly 2.50 V is obtained via a voltage divider (R4-R7) from the +10.00 V reference voltage available at terminal 17 of the motorized potentiometer. This voltage is applied to input IN- of the motorized potentiometer (terminal 20) and compensates the 4 mA live zero current.

A load resistance of exactly 634 Ω (R1 + R2 + R3) is inserted between terminals 21 and 23 of the motorized potentiometer; the 4 to 20 mA signal source is also connected at that point. The total signal excursion of 16 mA results in a voltage drop of exactly +10.00 V at motorized potentiometer input IN+. The input impedance of IN+ of 44 kΩ was taken into account for the design rating of the resistors.

Fig. 3/6

3

Technical data

Dimensions Weight	H x W x D = 75 mm x 22.5 mm x 100 mm approx. 0.15 kg
Max. zero point error when supplied (without fine adjustment) at I_{IN} = 4 mA	OUT+, OUT- = 0 V ±12 mV
Max. gain error at I_{IN} = 20 mA	OUT+ = +10 V ±110 mV OUT- = -10 V ±110 mV
Input impedance of the current input (between terminals 32 and 31)	634 Ω

For more detailed information, please refer to the Operating Instructions, Order No. E319/An/U 309 BA.

Mounting

The U 309 adaptor module can be snapped onto a standard mounting rail to DIN 46 277 (35 mm DIN rail). It is not intended for screw fixing.

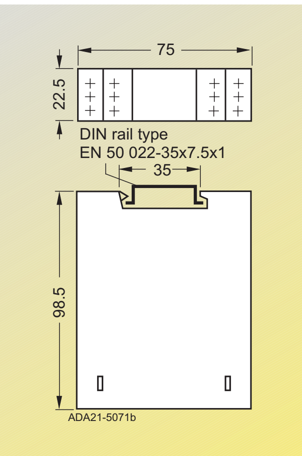

Fig. 3/7

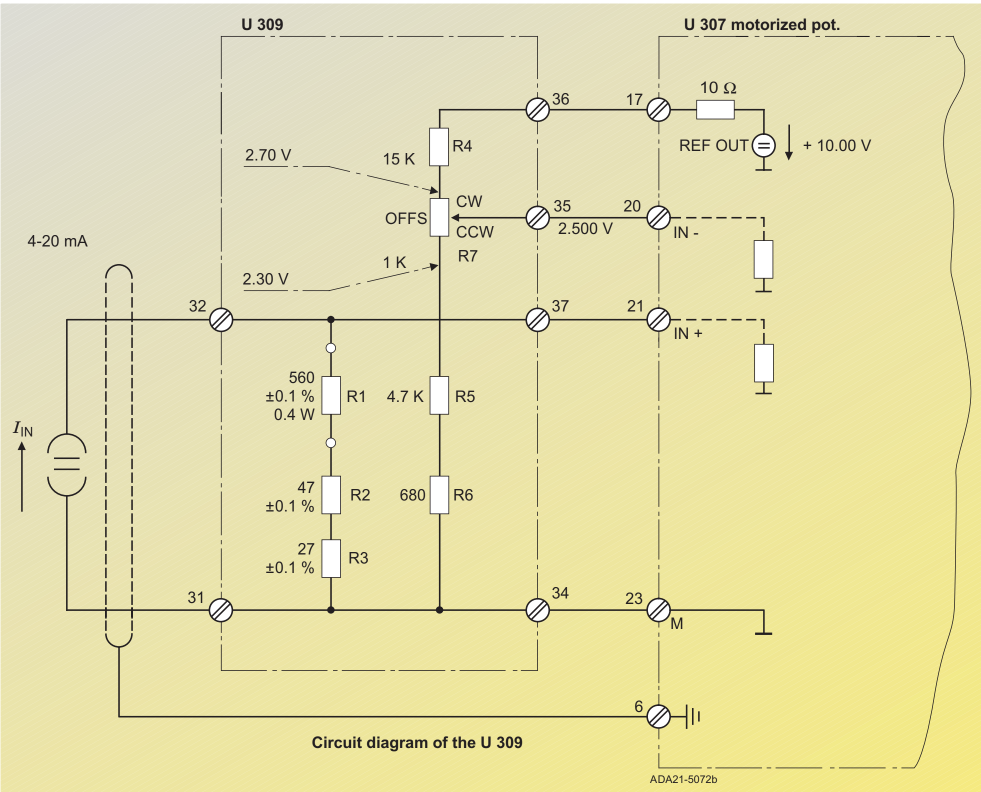

Fig. 3/8

Design and mode of operation · Block diagrams
Technical data · Dimension drawings

U 312 voltage converter Order No. **6RA8222-8GA0**

Application

The U 312 direct voltage converter is used for sensing the voltage actual value for voltage and EMF closed-loop controls.

It converts the DC input voltage to a floating, proportional voltage with sign of 0 to ±10 V.

Mounting

The U312 is directly screwed onto the cabinet mounting plate.

The components of the converter are mounted on a PC board and are encapsulated in a vibration-proof molded-plastic enclosure.

If necessary, the transmitter can be installed in the 6KA9902 shielded housing.

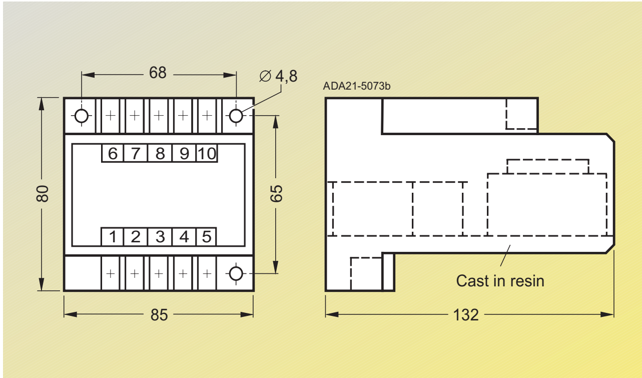

Fig. 3/9

3

Technical data

Power supply	
Rated supply voltage	2-ph. 50/60 Hz 230/400 V
Permissible tolerance	+10% to -15%
Current consumption	≤ 10 mA
Input	
Rated input voltage	10 V (terminals 9, 10) 225 V (terminals 8, 10) 450 V (terminals 7, 10) 600 V (terminals 6, 10)
Rated input current	≤ 7 mA
Linear overdrive capability 1)	1.1 · U_{EN}
Max. overdrive capability 2)	Continuous
10 V input	12 V
225 V input	270 V
450 V input	540 V
600 V input	720 V

Output	
Rated output voltage	±10 V
Max. output current	5 mA
Conversion error (proportional error)	≤ 1%
Zero point error	≤ 0.2%
Short-circuit protection	Continuous
No-load protection	Continuous
Clock frequency	4 kHz
Ripple V_{pp}/V- of the 4 kHz clock frequency	≤ 0.5%
Test voltage to DIN VDE 0160	
Input with respect to output	4 kV (rms)
Output with respect to supply voltage	2.5 kV (rms)
Permissible ambient temperature	
in operation	0 to 45 ° C
for storage	-50 to +85 ° C

For more detailed information, please refer to the Operating Instructions, Order No. BA-6RA8222-8GA0.

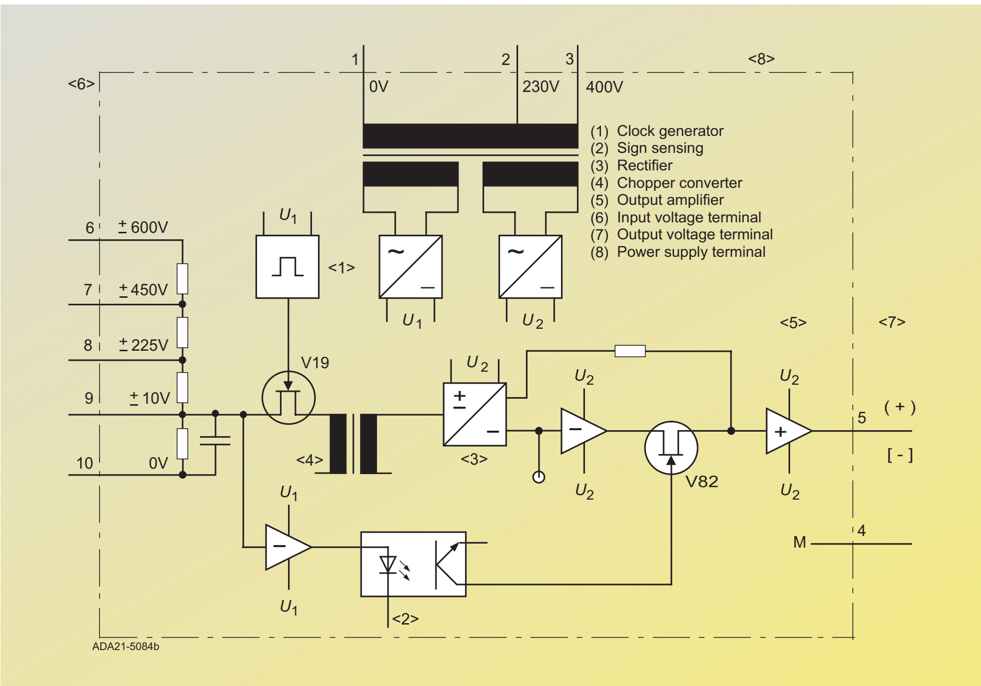

Fig. 3/10

Fig. 3/11

1) Increase of input signal at which the converter still operates (error as in the rated range).

2) Increase of input signal at which the converter is still not damaged.

U 313 current-voltage / voltage-current converter Order No. **6RA8222-8HA0**

Description

The U 313 adaptor module contains two independent circuit branches:

1. Current/voltage conversion (0/4 to 20 mA -> 0 to 10 V)
2. Voltage/current conversion (0 to 10 V -> 0/4 to 20 mA)

The current range 0 to 20 mA or 4 to 20 mA (live zero) can be selected with a switch on the front plate.

The inputs and outputs as well as power supply are referred to unit ground (non-floating).

Fig. 3/12

Technical data

Design, mounting	Terminal housing for mounting on 35 mm standard rail to DIN 46 227 and DIN EN 50 022
Terminals	Screw terminals, max. conductor cross-section 2.5 mm^2
Dimensions	H x W x D = 75 mm x 22.5 mm x 100 mm
Supply voltage	+24 V (+20 to +30 V) external
Current consumption	45 mA max. (if both branches are in operation)
Storage and transportation temperature	-50 to +85 ° C
Ambient temperature	0 to +45 ° C
Humidity rating	F

Circuit branch: current-voltage conversion	
Input resistance	167.3 Ω (209.3 Ω for live zero operation)
Input current	0 to 20 mA (4 to 20 mA for live zero operation)
Output resistance	112 Ω
Output voltage	0 to +10 V; 0 to -10 V (+11.5 V max. or -11,5 V max.)
Max. output current	2 mA (≙ 5 kΩ load resistance)
Short-circuit protection	Continuous
Accuracy	±25 mV at 10 V (±30 mV for live zero)
Zero point error	±10 mV (±20 mV for live zero)
Circuit branch: voltage-current conversion	
Input resistance	10 MΩ
Input voltage	0 to +10 V; 0 to -10 V
Output resistance	≤ 0.1 Ω
Output current	0 to 20 mA (4 to 20 mA for live zero)
Permissible load resistance	0 to 700 Ω
Accuracy	±70 µA at 20 mA (±80 µA for live zero)
Zero point error	±20 µA (±30 µA for live zero)

For more detailed information, please refer to the Operating Instructions, Order No. E319-6RA8222-8HA0.

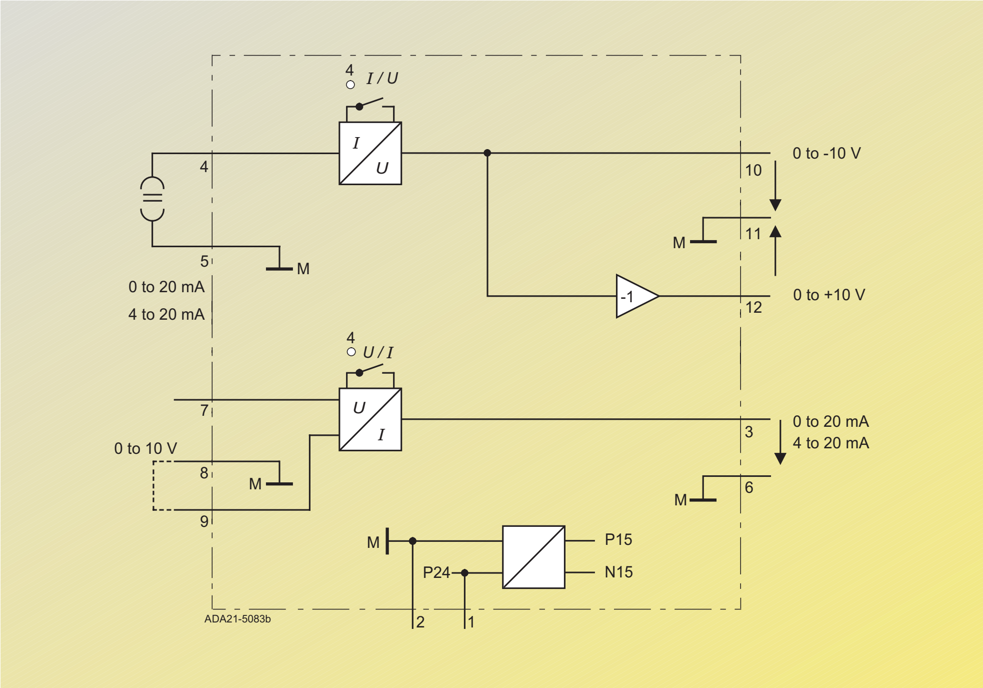

Fig. 3/13

External power supply

Design and mode of operation · Technical data
Dimension drawings

External power supply for Z 7.. supplementary boards Order No. **6RA8222-1WB0**

Application

The 6RA8222-1WB0 unit acts as the power supply and mechanical support for Z 7.. supplementary technology boards with order number 6RA8222-1.. or -2.. which are not installed in a SIMOREG K analog converter from which they are powered. These supplementary boards can therefore also be operated in conjunction with other drive control devices which have not been prepared for the installation of such boards.

Design

The power supply consists of a power supply unit board with the same dimensions as the Z 7.. supplementary boards, and is mounted on a bracket with spacer bolts. The supplementary board to be powered is mounted, in turn, on the power supply board with spacer bolts. The mounting hardware required is provided with the power supply.

The power supply is designed as standard for connection to three-phase 400 V ±10% 50/60 Hz. It provides all the ±10 V, ±15 V and ±24 V DC voltages required to operate a Z 7.. supplementary board. It does not support boards which require floating AC voltages. The Z 7.. supplementary boards have a non-detachable ribbon cable for the supply of power. The free end of this cable must be inserted into socket X4 on the power supply bo-ard. All supply voltages produced are also available at the plug-in terminal strip X2 of the power supply board. This therefore provides the supply for setpoint potentiometers, actual value sensors, etc.. The maximum permissible loading of individual voltages must be observed according to the technical data table.

One inverting and one non-inverting operational amplifier, the inputs and outputs of which are routed to terminals strip X2, are also provided for optional applications.

Availability of the +15 V and -15 V voltages is indicated by an LED in each case.

All DC voltage outputs of the power supply are short-circuit protected.

Terminals

Terminal	Function	Connection values	Comments
X1.1 X1.3 X1.5	Input supply	3-ph. 400 V ±10% 50/60 Hz	Input
X2.1	N10	-10 V/0.01 A	Output
X2.2	M	0 V	Reference potential
X2.3	P10	+10 V/0.01 A	Output
X2.4	N15	-15 V/0.1 A	Output
X2.5	M	0 V	Reference potential
X2.6	P15	+15 V/0.1 A	Output
X2.7	N24	-24 V/0.1 A	Output
X2.8	M	0 V	Reference potential
X2.9	P24	+24 V/0.3 A	Output
X2.10	In A-	0 to ±10 V; 33 kΩ	Input, amplifier A (inverting)
X2.11	Out A	0 to ±10 V; 10 mA	Output, amplifier A
X2.12	In B+	0 to ±10 V; > 1 MΩ	Input, amplifier B (non-inverting)
X2.13	Out B	0 to ±10 V; 10 mA	Output, amplifier B
X3	⏚	PE	Protective conductor

Technical data

Ambient temperature in operation	0 to 45 ° C
Storage temperature	-30 to +85 ° C
Humidity rating DIN 40 040/SN 26 556	F
Degree of protection DIN 40 050/IEC 144	IP00
Dimensions W x H x D	270 mm x 155 mm x 80 mm
Weight	approx. 1.6 kg

For further information, please refer to the Operating Instructions, Order No. BA-6RA8222-1WB0.

Mounting

The power supply is mounted on an L-shaped bracket. The wide side of this bracket can be snapped onto a 35 mm DIN rail. Each arm of the bracket also has four mounting holes of 5.5 mm diameter, allowing the unit to be screwed onto the mounting plate. If the unit is to be screwed on with the wide side of the bracket, the two retaining clips for DIN rail mounting should first be removed.

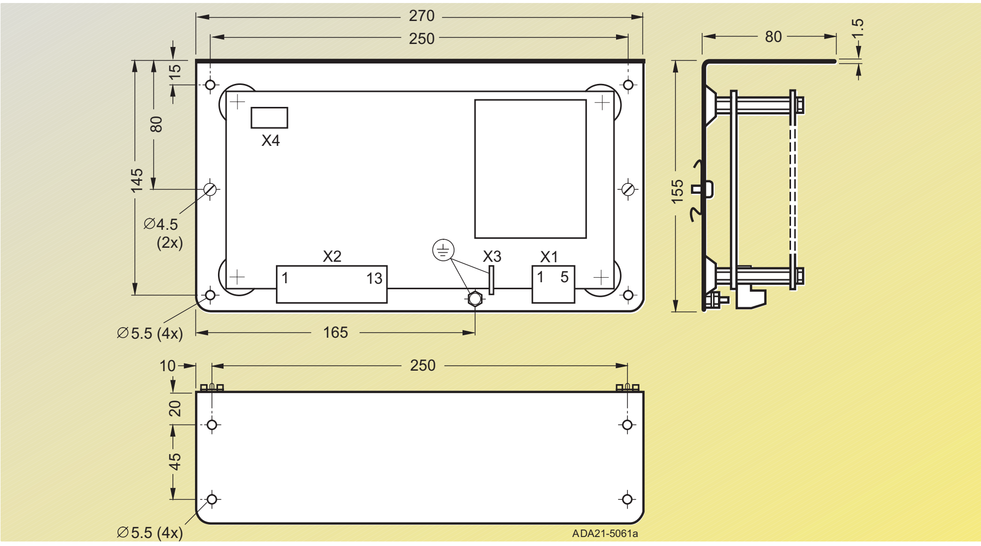

Fig. 3/14

Planning Guide

4

Installation notes for drives with Electromagnetic Compatibility (EMC)

Fundamentals of EMC

What is EMC?

EMC stands for "**e**lectro-**m**agnetic **c**ompatibility"; it describes the capability of a device to operate satisfactorily in the electromagnetic environment, without causing electromagnetic interference which is unacceptable for other devices in this environment. In other words, the different devices must not interfere with each other.

Emitted interference and interference immunity

EMC depends on two characteristics of the devices involved: emitted interference and interference immunity. Electrical devices can be interference sources (transmitters) and/or interference sinks (receivers).

Electromagnetic compatibility exists when the interference sources do not affect functioning of the interference sinks.

A device can be simultaneously an interference source and sink. For example, the power section of a converter can be considered as an interference source, and the control section as an interference sink.

Limit values

Product standard EN 61 800-3 (IEC 61 800-3, VDE 160 Part 100) covers electrical drives. According to this product standard, not all EMC measures are essential for industrial supply systems; a solution must be defined which is adapted to the actual environment. Thus it may be economically more advantageous to increase the interference immunity of a sensitive device rather than implement interference suppression on the converter. The choice of solution, therefore, also depends on economic factors.

To some extent, adherence to EN 55 011 is required. This defines the limit values for emitted interference in industry and in residential buildings. Conducted interference at the supply connection is measured under standardized conditions as a radio interference voltage, electromagnetically emitted interference as interference emission. The standard defines limit values "A1" and "B1" which apply to radio interference voltage over the range 150 kHz to 30 MHz, and to interference emission over the range 30 MHz to 2 GHz. Since the SIMOREG K converters are used in industry, limit value "A1" applies. To achieve limit value "A1," the SIMOREG K units must be provided with external RFI filters.

Interference immunity describes the behavior of a device under the influence of electromagnetic interference. Standard EN 50 082-2 governs the requirements and assessment criteria for the behavior of the devices in industry. This standard is met by the converters listed in the following chapter.

Application in industry

In industry, the interference immunity of the devices must be very high, whilst lower demands are made on emitted interference.

The SIMOREG K converters are components of an electrical drive, as are contactors and switches. Skilled personnel must integrate them in a drive system comprising at least the converter, motor cables and the motor. Commutating reactors and fuses are usually also needed. Proper installation thus also determines whether or not a limit value will be met. To limit the emitted interference according to limit value "A1," at least the corresponding RFI filter and the commutating reactor are also needed in addition to the converter. Without RFI filter, the emitted interference of the SIMOREG K converters exceeds limit value A1 of EN 55 011.

If the drive is part of an installation, it need not initially meet requirements relating to emitted interference. However, the EMC legislation requires that the entire installation be electromagnetically compatible with the environment.

If all the control components of the installation, such as automation equipment, exhibit industrial-grade interference immunity, there is no need for each drive to satisfy limit value "A1."

Ungrounded supply systems

In some branches of industry, ungrounded supply systems (IT systems) are used to increase availability of the plant. In the event of a ground fault, there is no ground current and the plant can continue with production. In conjunction with RFI filters, however, there is a fault current in the event of a ground fault which can result in a shutdown of the drives or even the destruction of the RFI filter. The product standard therefore does not specify limit values for these systems. For economic reasons, interference suppression, if required, should be implemented on the grounded primary side of the supply transformer.

EMC planning

If two devices are electromagnetically incompatible, you can reduce the emitted interference of the source or increase the interference immunity of the sink. Interference sources are usually devices of power electronics with a high current consumption. To reduce their emitted interference, elaborate filters are required. Interference sinks are, in particular, control units and sensors including their evaluation circuitry. Enhancing the interference immunity of low-power devices is less involved. For economical reasons in industry, therefore, it is often more favorable to increase the interference immunity than to reduce emitted interference. To satisfy limit value class A1 of EN 55 011, for example, the radio interference voltage at the supply terminals must not exceed 79 dB (µV) between 150 and 500 kHz, and 73 dB (µV) (9 mV or 4.5 mV) between 500 kHZ and 30 MHz.

In industry, EMC of devices should be based on a judicious balance between emitted interference and interference immunity.

The least expensive suppression method is to separate the interference sources and sinks, provided that this is allowed for during the planning of a machine/plant. For each device used, the first question is whether it is a potential interference source or sink. Examples of interference sources in this context are converters and contactors. Examples of interference sinks are programmable controllers, encoders and sensors.

The components in the cabinet (interference sources and sinks) should be separated, if necessary with partition plates or by installing them in metal housings. Shown in Fig. 5/1 is a possible arrangement of components in the cabinet.

Installation of drives with EMC (installation notes)

General

Since the drives are operated in very different environments, and additional electrical components (controllers, switched-mode power supplies, etc.) can differ greatly with regard to interference immunity and emitted interference, each installation guideline can only be a sensible compromise. In individual cases, therefore, after examination, deviation from the EMC rules is permissible.

To ensure electromagnetic compatibility (EMC) in your cabinets in an electrically harsh environment, and to be able to meet the legal standards, the following EMC rules should be observed during design and installation.

Rules 1 to 10 are generally valid. Rules 11 to 15 are necessary to meet the emitted interference standards.

Rules for electromagnetically compatible installation

Rule 1

All metal parts of the cabinet must be joined to each other with good electrical contact (not paintwork on paint-work!). Contact or toothed washers should be used where necessary. The cabinet door should be connected to the cabinet via ground straps (at top, middle and bottom) with as short a path a possible.

Rule 2

Contactors, relays, solenoid valves, electromagnetic hours-run counters, etc. in the cabinet, and if necessary in adjacent cabinets, should be provided with suppression combinations, such as RC networks, varistors, diodes. The circuitry must be implemented directly at the particular coil.

Rule 3

Signal lines [1]) should be routed into the cabinet from one level if possible.

Rule 4

Unshielded conductors of the same circuit (outgoing and return conductors) should be twisted together if possible, i.e. the surface between outgoing and return conductors should be kept as small as possible to prevent the creating of unnecessary frame antennas.

Rule 5

Spare cores should be connected to the cabinet ground [2]). This achieves additional shielding.

Rule 6

Unnecessary line lengths should be avoided. Coupling capacitances and inductances are thus kept low.

Rule 7

In general, crosstalk is reduced when conductors are placed close to the cabinet ground. Wiring should therefore not be placed in free space in the cabinet but, where possible, routed closely along the cabinet housing or installation plates. This also applies to spare cables.

Rule 8

Signal lines and power cables should be laid separately from each other (to avoid coupling paths). A minimum clearance 20 cm is desirable.

If segregation between sensor and motor cables is not possible, the sensor cable should be decoupled by a partition plate or by installing it in a metal conduit. The partition plate or metal conduit should be grounded at several points.

Rule 9

The shields of digital signal cables should have large-area good electrical grounding at each end (source and destination). In the event of poor equipotential bonding between the shield connections, an additional equalizing conductor of at least 10 mm^2 should be laid in parallel with the shield to reduce the shield current. In general, shields may be connected to the cabinet housing (ground) at several points. Even outside the cabinet, the shields may be connected in several places.

Foil shields are not satisfactory. Compared to braid shields, their shielding effect is inferior by a factor of at least 5.

Rule 10

With good equipotential bonding, the shields of analog signal lines may be grounded at both ends (with large-area good electrical contact). Good equipotential bonding can be assumed if all metal parts make good contact and the electronic components involved are powered from the same power supply.

Single-ended shield grounding prevents low-frequency, capacitive interference pickup such as 50 Hz hum. The shield connection should be made in the cabinet; a sheath wire may be used to connect the shield.

Rule 11

Positioning the RFI filter in the vicinity of the suspected interference source. The filter should be mounted with its surface on the cabinet housing, mounting plate, etc.. Input and output leads should be separated.

Rule 12

The use of RFI filters is mandatory for meeting limit value class A1. Additional loads should be connected ahead of the filter (supply system side).

The need to install an additional line filter depends on the controller in use and on the type of wiring of the rest of the cabinet.

Rule 13

With a regulated field current supply, a commutating reactor is needed in the field circuit.

Rule 14

A commutating reactor is needed in the armature circuit of the converter.

Rule 15

With SIMOREG drives, the motor cables may be unshielded. The supply cable must have a clearance of at least 20 cm from the motor cables (field, armature). A partition plate should be used if necessary.

1) Signal lines are defined as:
Digital signal line: lines for pulse generators
Serial interfaces, e.g. PROFIBUS-DP or analog signal line (e.g. ±10 V setpoint line).

2) The definition of ground, in general, is all metallically conductive parts which can be connected to a protective conductor, e.g. cabinet housing, motor housing, foundation earth, etc.

Installation notes for drives with Electromagnetic Compatibility (EMC)

Cabinet arrangement and shielding

The cabinet arrangement of Fig. 4/1 is intended to draw the user's attention to the EMC-critical parts. The example does not necessarily show all possible cabinet components or arrangements.

Details affecting interference immunity/emitted interference of the cabinet and which do not clearly appear in the block diagram, are described in Figs. 4/2 and 4/3.

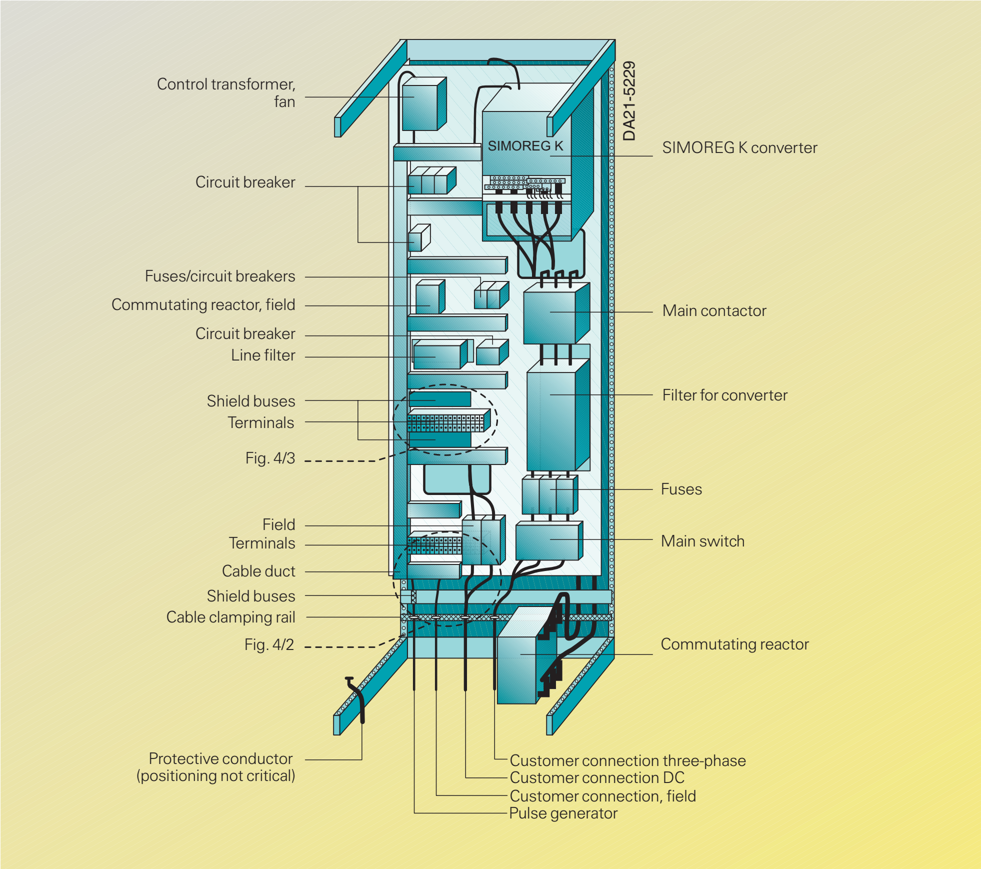

Fig. 4/1
Example of cabinet arrangement with a SIMOREG K

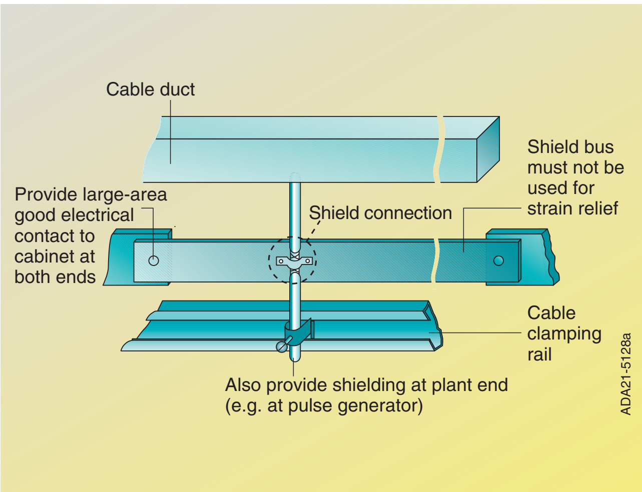

Fig. 4/2
Shielding with routing into the cabinet

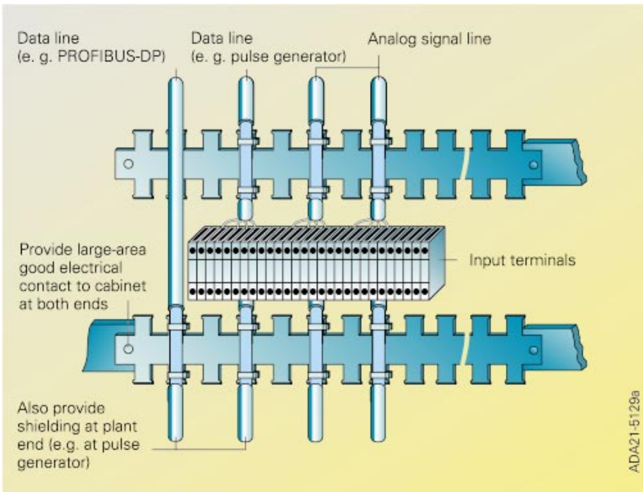

Fig. 4/3
Shielding in the cabinet

Arrangement of RFI filters and commutating reactors:

Shown in the following section is the arrangement of RFI filters and commutating reactors for SIMOREG K converters. The order of installation of reactors and filters must be followed. The choice of fuses for semiconductor protection is based on the operating instructions of the converters.

Components for the converters

The arrangement of radio interference suppression filters and commutating reactors for SIMOREG K converters is shown in the Figures below. The reactors and filters must be installed in the specified order.

Caution

When filters are used, commutating reactors are always needed between the filter and the input of the unit to decouple the RC circuit.

For selection of the commutating reactors, see page 4/6.
For selection of the radio interference suppression filters, see page 4/7.

SIMOREG K 6RA22 for three-phase systems: arrangement of reactors and filters

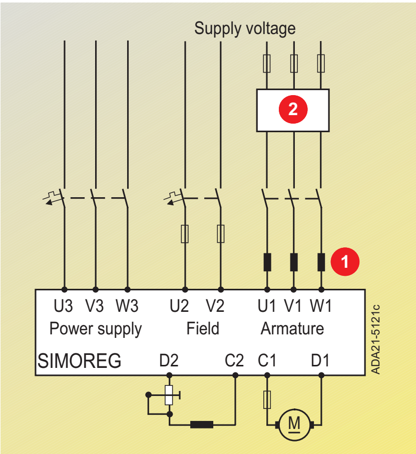

Fig. 4/4

SIMOREG K 6RA22..-8DD21-.: arrangement of reactors and filters

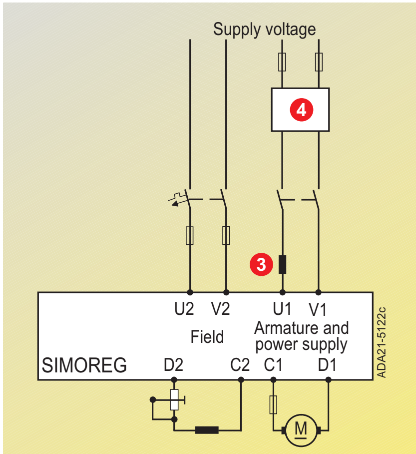

Fig. 4/5

SIMOREG K 6RA22..-8DK27-.: arrangement of reactors and filters

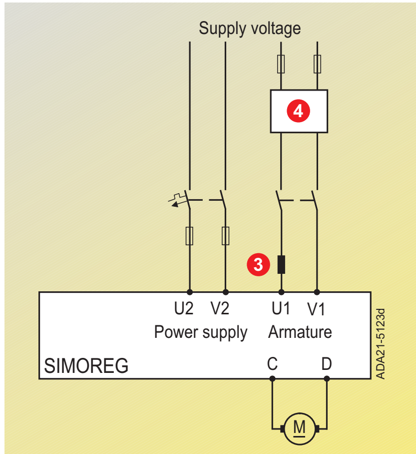

Fig. 4/6

U 315 field supply unit: 6RA2200-8DD00: arrangement of reactors and filters

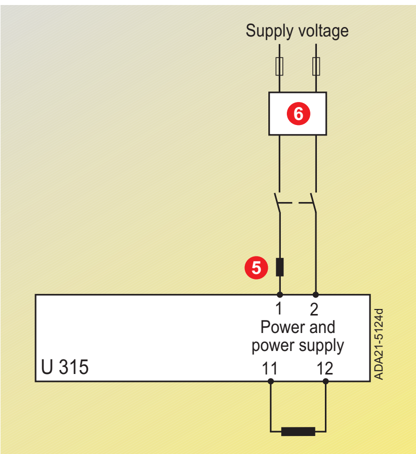

Fig. 4/7

F 10 Minireg field supply unit: 6RA8222-8PA0: arrangement of reactors and filters

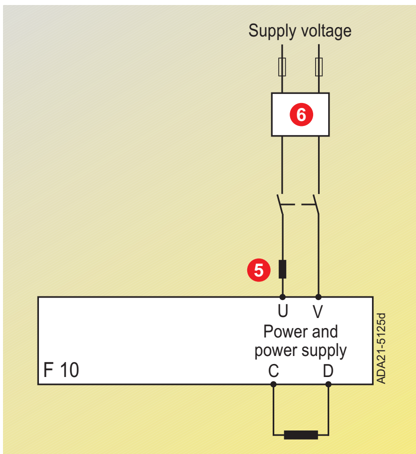

Fig. 4/8

F 33 Minireg field supply unit: 6DM1001-0WB00-2: arrangement of reactors and filters

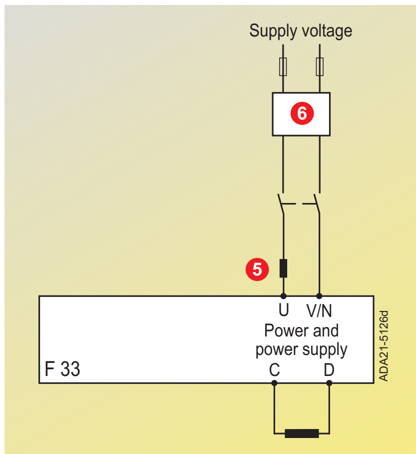

Fig. 4/9

1. The commutating reactor in the armature circuit is designed for the rated motor current in the armature. The supply current is equal to the DC multiplied by 0.82.
2. The filter for the armature circuit is designed for the rated motor current in the armature. The supply current is equal to the DC multiplied by 0.82.
3. The commutating reactor in the armature circuit is designed for the rated motor current in the armature.
4. The filter for the armature circuit is designed for the rated motor current in the armature.
5. The commutating reactor is designed for the rated motor current in the field.
6. The filter is designed for the rated motor current in the field.

4

Components

Line commutating reactors

Line commutating reactors

A converter must always be connected to the supply via a commutating inductance. This must be at least 4 % u_k! The commutating inductance can be implemented as a converter transformer or, with appropriate mains voltage, as a commutating reactor.

A supply can be regarded as "constant" when the output ratio $P_S/S_k \leq 0.01$. Even in the case of a constant supply, the commutating reactor must have a u_k of at least 4 %!

For high-power converters, the supply reactance, i.e. the total short-circuit power of the supply must be taken into account, which also results in a larger u_k value. The recommended ratio of supply short-circuit power to apparent drive power is > 33:1.

The commutating reactors are dimensioned for the rated motor current in the armature or field circuit.

Operation on a 50 Hz and 60 Hz supply

The rated currents I_{Ln} specified in the Table for the reactors apply for operation at a supply frequency $f = 50$ Hz. Operation of the reactors at a supply frequency $f = 60$ Hz is permissible. In this case, the permissible rated current I_{Ln} is reduced to 90 %.

I_{Ln} (60 Hz) = 0.9 · I_{Ln} (50 Hz)

At the same time, the voltage drop ΔU increases by 8 %.

For further details, see Catalog PD 30.

Rated AC current I_{Ln} A	Max. AC current I_{Lmax} A	Permissible continuous DC current I_{dn} 1) A	Referred voltage drop u_D of the reactor at I_{Lmax} and U_N Order No.: **400 V**
Single-phase commutating reactors $I_{Ln} = I_{Lmax}$ with inductive load			
8	8	9,8	**4EM48 07-1CB**
10	10	12,3	**4EM49 11-7CB**
11.2	11.2	13.7	**4EM49 11-8CB**
12.5	12.5	15.3	**4EM49 12-0CB**
14	14	17.2	**4EM49 12-1CB**
15	15	18.4	**4EM50 00-2CB**
18	18	22	**4EM50 05-6CB**
20	20	24.5	**4EM50 05-7CB**
22.4	22.4	27.4	**4EM50 05-8CB**
24	24	29.4	**4EM51 00-2CB**
28	28	34	**4EM61 00-2CB**
31.5	31.5	39	**4EM61 00-3CB**
35.5	35.5	43	**4EM52 12-8CB**
40	40	49	**4EM52 00-1CB**
Three-phase commutating reactors $I_{Ln} = 0.8 \cdot I_{Lmax}$ with inductive load, 3-ph. AC 50 Hz			
16	20	19.6	**4EP36 01-3DS**
18	22.4	22	**4EP36 01-4DS**
20	25	24.5	**4EP36 01-5DS**
22.4	28	27.4	–
25	31.5	31	**4EP37 01-5DS**
28	35.5	34	**4EP37 01-6DS**
31.5	40	39	**4EP37 01-7DS**
35.5	45	43	**4EP37 01-8DS**
40	50	49	**4EP38 00-2DS**
45	56	55	**4EP38 01-6DS**
50	63	61	**4EP38 00-3DS**
56	71	69	**4EP39 01-4DS**
63	80	77	**4EP39 00-2DS**
71	91	87	**4EP40 02-7DS**
80	100	98	**4EP40 00-3DS**
91	112	112	**4EP40 02-8DS**
100	125	123	**4EP40 03-0DS**
112	140	137	**4EU24 22-6AA00-0A**
125	160	153	**4EU24 22-7AA00-0A**
140	180	172	**4EU25 22-2BA00-0A**
160	200	196	**4EU25 22-3BA00-0A**
180	224	221	**4EU25 22-4BA00-0A**
200	250	245	**4EU25 22-5BA00-0A**
224	280	275	**4EU27 22-5BA00-0A**
250	315	306	**4EU27 22-6BA00-0A**
280	355	343	**4EU27 22-7BA00-0A**
315	400	386	**4EU27 22-8BA00-0A**
355	450	435	**4EU30 22-1BA00-0A**
400	500	490	**4EU30 22-2BA00-0A**
450	560	551	**4EU30 22-3BA00-0A**
500	630	613	**4EU30 22-4BA00-0A**
560	710	686	**4EU36 22-0CA00-0A**

1) With series-connected 6-pulse bridge circuit

Radio interference suppression filters

SIMOREG applications comply with the EMC product standard EN 61 800-3 for electrical drives provided that the rules for electromagnetically compatible installation of the converters in the plant are observed.

However, the EMC legislation requires that the entire installation be electromagnetically compatible with the environment.

If the system is to comply with the "A1" degree of radio interference suppression according to EN 55011, RI suppression filters must be installed in addition to commutating reactors. In conjunction with the commutating reactors, the RI suppression filters reduce the radio interference voltages that arise due to the converters. RI suppression filters can only be installed in grounded-neutral systems.

The RI suppression filters generate discharge currents. In accordance with DIN VDE 0160, a PE connection with a cross-sectional area of 10 mm^2 is necessary. To ensure the best possible action of the filter it must be mounted with the converter on a common metal plate.

For converters with a three-phase system, the minimum rated current of the filter is equal to the output DC current multiplied by 0.82. For units with a two-phase system (field supply and electronics power supply), only two phases are connected to the three-phase RI suppression filter. The line current is equal to the field DC current (plus 1 A for the electronics power supply).

List of suggested RI suppression filters from EPCOS

*) In place of *, the identification number for the design type must be inserted:
0 = 480 V
2 = 530 V

*) In place of **, the identification number for the design type must be inserted:
20 = 500 V
21 = 760 V
24 = 690 V

For further information about filters, visit www4.ad.siemens.de. Please enter 65 67 129 under "Article number".

Rated current Radio interference suppression filters A	Radio interference suppression filters Type	Terminal cross-section mm² Holes for M . .	Weight approx. kg	Dimensions H x W x D mm x mm x mm
8	B84143-G8-R11*	4 mm²	1.3	80 x 230 x 50
20	B84143-G20-R11*	4 mm²	1.3	80 x 230 x 50
36	B84143-G36-R11*	6 mm²	2.8	150 x 280 x 60
50	B84143-G50-R11*	16 mm²	3.3	150 x 60 x 330
66	B84143-G66-R11*	25 mm²	4.4	150 x 330 x 80
90	B84143-G90-R11*	25 mm²	4.9	150 x 330 x 80
120	B84143-G120-R11*	50 mm²	7.5	200 x 380 x 90
150	B84143-G150-R11*	50 mm²	8.0	200 x 380 x 90
220	B84143-G220-R11*	95 mm²	11.5	220 x 430 x 110
150	B84143-B150-S**	M10	13	140 x 310 x 170
180	B84143-B180-S**	M10	13	140 x 310 x 170
250	B84143-B250-S**	M10	15	115 x 360 x 190
320	B84143-B320-S**	M10	21	115 x 360 x 260
400	B84143-B400-S**	M10	21	115 x 360 x 260
600	B84143-B600-S**	M10	22	115 x 410 x 260

List of suggested RI suppression filters from Siemens

Rated current Radio interference suppression filters A	Radio interference suppression filters Type	Terminal cross-section mm²	Ground bolt	Weight approx. kg	Dimensions H x W x D mm x mm x mm
12	6SE7021-0ES87-0FB1	4	M6	2.5	215 x 90 x 81
18	6SE7021-8ES87-0FB1	4	M6	2.5	215 x 90 x 81
36	6SE7023-4ES87-0FB1	16	M6	4	231 x 101 x 86
80	6SE7027-2ES87-0FB1	50	M10	9	308 x 141 x 141
120	6SE7031-2ES87-0FA1	50	M10	10	348 x 171 x 141
180	6SE7031-8ES87-0FA0	95	M10	10	404 x 171 x 141
320	6SE7033-2ES87-0FA1	Terminal link	M10 x 30	21	300 x 260 x 116
600	6SE7036-0ES87-0FA1	Terminal link	M10 x 30	22	350 x 260 x 116

Technical Data

Rated supply voltage	3-ph. AC 380-460 V (±15%)
Rated frequency	50/60 Hz (±6%)
Operating temperature	0 to +40°C
Degree of protection	IP 20 (EN 60529); IP 00 from 500 A

Supply harmonics

Data on supply harmonics of converters in fully controlled, three-phase bridge connections B6C and (B6)A(B6)C

Converters for medium power are mainly designed in fully controlled three-phase bridge connection. Shown in the following is an example of harmonics of a typical installed configuration for two delay angles ($\alpha = 20°$ and $\alpha = 60°$).

The values have been adopted from a previous publication: "Oberschwingungen im netzseitigen Strom sechspulsiger netzgeführter Stromrichter" (Harmonics in the supply current of six-pulse line-commutated converters) by H. Arremann and G. Möltgen, Siemens Forschungs- und Entwicklungsberichte, Vol. 7 (1978) No. 2, © Springer-Verlag 1978.

This is accompanied by formulae with which, depending on the operating data in the specific case, supply voltage (no-load voltage U_{V0}), line frequency f_N and DC I_d), the short-circuit power S_K and armature inductance L_a of the motor are determined, and to which the specified harmonic spectrum applies. If the actual system short-circuit power and/or the actual armature inductance deviate from the values thus calculated, an individual calculation is necessary.

The given harmonic spectrum is attained when the values calculated with the following formulae for short-circuit power S_K at the connection point of the unit, and the armature inductance L_a of the motor coincide with the actual values of the installation. If the values differ, a separate calculation of harmonics is necessary.

a) $\alpha = 20°$
Fundamental factor $g = 0.962$

ν	I_ν/I_1	ν	I_ν/I_1
5	0.235	29	0.018
7	0.100	31	0.016
11	0.083	35	0.011
13	0.056	37	0.010
17	0.046	41	0.006
19	0.035	43	0.006
23	0.028	47	0.003
25	0.024	49	0.003

b) $\alpha = 60°$
Fundamental factor $g = 0.953$

ν	I_ν/I_1	ν	I_ν/I_1
5	0.283	29	0.026
7	0.050	31	0.019
11	0.089	35	0.020
13	0.038	37	0.016
17	0.050	41	0.016
19	0.029	43	0.013
23	0.034	47	0.013
25	0.023	49	0.011

The fundamental current I_1 as the reference quantity is calculated with the following formula:

$$I_1 = g \times 0.817 \times I_d$$

where I_d = DC of the examined operating point and g = fundamental factor (see above).

The harmonic currents calculated from the above tables apply **only** to

a) Short-circuit power S_K at the connection point of the converter:

$$S_K = \frac{U^2_{V0}}{X_N} \text{ (VA)}$$

where

$$X_N = X_K - X_D = 0.03536 \times \frac{U_{V0}}{I_d} - 2\pi f_N \times L_D \ (\Omega) \quad \text{and}$$

U_{V0} No-load voltage at the connection point of the converter in V
I_d DC of the examined operating point in A
f_N Line frequency in Hz
L_D Inductance of the commutating choke in H

b) Armature inductance L_a:

$$L_a = 0.0488 \times \frac{U_{V0}}{f_N \times I_d} \text{ (H)}$$

If the actual values of short-circuit power S_K and/or armature inductance L_a differ from the values calculated using the above formulae, a separate calculation is necessary.

Example:

The given drive has the following data:

$U_{V0} = 400$ V

$I_d = 150$ A

$f_N = 50$ Hz

$L_D = 0.169$ mH (4EU2421-7AA10 with $I_{L_n} = 125$ A)

where

$$X_N = 0.03536 \times \frac{400}{150} - 2\pi \times 50 \times 0.169 \times 10^{-3} = 0.0412\ \Omega$$

resulting in the following required short-circuit power of the system at the connection point of the converter:

$$S_K = \frac{400^2}{0.0412} = 3.88 \text{ MVA}$$

and the following required armature inductance of the motor:

$$L_a = 0.0488 \times \frac{400}{50 \times 150} = 2.0 \text{ mH}$$

The harmonic currents I_ν (where $I_1 = g \times 0.817 \times I_d$ for delay angle $\alpha = 20°$ and $\alpha = 60°$) apply **only** to the values S_K and L_a thus calculated. If the values differ, a separate calculation is required.

When designing filters and reactor compensations, the harmonic values thus calculated can only serve as a basis if the calculated values for S_K and L_a coincide with the actual values of the drive. In all other cases a separate calculation must be made (especially when compensated machines are used, because of the very low armature inductance).

Appendix

A

Environment, resources and recycling

Siemens AG has committed itself to protecting the environment and conserving valuable natural resources. This applies both to production and to the products we sell.

As early as the development phase, the possible impact of future products and systems on the environment is taken into consideration. Our aim is to prevent environmental pollution or, at least, reduce it to a minimum and, in doing so, look beyond existing regulations and legislation.

Environmental aspects of development

The use of dangerous substances (such as arsenic, asbestos, beryllium, cadmium, CFC, halogens and many others) has already been avoided in the development stage.

Easily dismantled joints have been designed and attention has been paid to increased uniformity of types and grades of materials.

Furthermore, recyclable materials have been given priority, or materials which can be disposed of without any problems.

Environmental aspects were an important criteria in selecting the supplied components.

Environmental aspects of manufacturing

The supplied components are mainly transported in reusable packaging. The packaging material itself is reusable, mainly comprising cardboard.

The manufacturing facility produces no emissions.

Materials for manufacturing purposes are identified in accordance with their recyclability. This applies, in particular, to components which contain unavoidable, hazardous materials. These components are installed or mounted in such a way that they can be easily separated, thus facilitating disposal in an environmentally-friendly manner. Wherever possible, recycled components are used.

Despatch

Environmentally-compatible packaging materials are used for shipping and storage. If possible we pack our products in reusable packaging.

Environmental aspects of disposal

We have already made preparations to enable the converters to be disposed of after use in accordance with the regulations governing the disposal of electronic equipment (not yet in force).

This catalog is printed on Chlorine-free bleached paper.

A

CERTIFICATE

DQS Deutsche Gesellschaft zur Zertifizierung von Managementsystemen mbH

hereby certifies that the company

Siemens AG
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Industrial Services (I&S IS)
Günther-Scharowsky-Straße 2
D-91058 Erlangen

with the I&S IS Regions listed in the annex

for the scope

Systems Integration, On Call- and Logistic-Service, Maintenance, Electronic Design and Manufacturing Services, Cement, Water, Food and Beverage

has implemented and maintains a

Quality Management System.

An audit, documented in a report, has verified that this quality management system fulfills the requirements of the following standard:

DIN EN ISO 9001 : 2000
December 2000 edition

This certificate is valid until 2004-03-06
Certificate Registration No.: 001784 QM
Frankfurt am Main, Berlin 2001-03-07

Dr.-Ing. K. Petrick   Dipl.-Ing. S. Heinloth
MANAGING DIRECTORS

Offices: D-60433 Frankfurt am Main, August-Schanz-Straße 21
D-10787 Berlin, Burggrafenstraße 6

Annex 1 to Certificate Registration No.: 001784 QM

Siemens AG
Industrial Solutions and Services (I&S)
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ZN Würzburg	Andreas-Grieser-Str. 30	D - 97084	Würzburg

ZN = Regional Office Gst = Sales Office StO = Location

This annex (Date: 2001-03-07) is only valid in connection with the above-mentioned certificate.

Annex 2 to Certificate Registration No.: 001784 QM

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Industrial Services (I&S IS)

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ZN Koblenz	Frankenstr. 21	D - 56068	Koblenz
ZN Siegen	Sandstr. 42-48	D - 57072	Siegen
ZN Wuppertal	Rudolfstr. 8	D - 42285	Wuppertal
I&S IS PGD (Power Generation and Distribution)			
StO Erlangen	Werner-von-Siemens-Str. 60	D - 91052	Erlangen
StO Karlsruhe	Siemensallee 84	D - 76181	Karlsruhe
StO Mülheim	Zinkhüttenstr. 45	D - 45473	Mülheim/Ruhr
StO Frankfurt	Carl-Benz-Str. 22	D - 60386	Frankfurt/Main
StO Nürnberg	Gugelstr. 86	D - 90459	Nürnberg
I&S IS Saarbrücken			
ZN Saarbrücken	Martin-Luther-Str. 25	D - 66111	Saarbrücken
Gst St. Ingbert	Im Schiffelland 10	D - 66386	St. Ingbert
Gst Trier	Löbstr. 15	D - 54292	Trier
Gst Kaiserslautern	Am Schmiedeturm 3	D - 67655	Kaiserslautern
I&S IS Südbayern			
ZN München (Mch R)	Richard-Strauss-Str. 76	D - 81679	München
ZN München (Mch R Tü)	Tübinger Str. 1-5	D - 80286	München
ZN Augsburg	Werner-von-Siemens Str. 6	D - 86159	Augsburg
I&S IS Südwest			
ZN Stuttgart	Weissacher Str. 11	D - 70499	Stuttgart
ZN Stuttgart- Ditzingen	Siemensstr. 33	D - 71254	Ditzingen
ZN Stuttgart STG F	Rödelheimer Landstr. 5-9	D - 60487	Frankfurt/Main
ZN Heilbronn	Neckarsulmer Str. 59	D - 74076	Heilbronn
ZN Freiburg	Habsburger Str. 132	D - 79104	Freiburg
ZN Ulm	Lise-Meitner-Str. 7 / 1	D - 89081	Ulm
Gst Konstanz	Max-Stromeyer-Str. 116	D - 78467	Konstanz
StO Pfullingen	Marktstr. 148	D - 72793	Pfullingen
StO Weingarten	Hähnlehofstr. 5	D - 88250	Weingarten
I&S IS Ruhr			
ZN Essen	Frohnhauser Str. 69	D - 45127	Essen
ZN Dortmund	Märkische Str. 8-14	D - 44135	Dortmund
ZN Dortmund	Alte Str. 65	D - 44143	Dortmund
ZN Lingen	Kaiserstr. 10a	D - 49809	Lingen
ZN Osnabrück	Eversburger Str. 32	D - 49090	Osnabrück
ZN Münster	Siemensstr. 55	D - 48153	Münster (Westfalen)
ZN Arnsberg	Grafenstr. 50	D - 59821	Arnsberg

ZN = Regional Office Gst = Sales Office StO = Location

This annex (Date: 2001-03-07) is only valid in connection with the above-mentioned certificate.

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Eisenstadt
Graz
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La-Suze-sur-Sarthe
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Montrouge
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Cumbernauld
East Kilbridge
Fareham
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Shenzhen
Suzhou
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Xi’an
Xiaogan City
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Siemens Inc.
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Pasig City
Cebu
Davao City

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Engineering Company
Doha

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A & D in the WWW

Detailed information about the product range to be used and the services that are available is essential at the planning and project engineering phases of plant automation projects. It is a fact that this information has to be as up-to-date as possible.

For this reason, the Siemens Group Automation and Drives (A&D) provides a comprehensive information service on the World Wide Web that makes it easy for our customers to access all the necessary information.

You will find everything you need to know about products, systems and service contracts at:

http://www.siemens.de/automation

Product selection with the interactive catalogs

Providing comprehensive information and user-friendly interactive functions:
The interactive catalogs, CA 01 and ET 01, featuring over 80000 products, provide a comprehensive overview of the Siemens Automation and Drives product spectrum.

You will find everything that you need to fulfill any task in the fields of automation, controlgear, electrical installation and drives. All the information is embedded in a user-interface that supports easy, intuitive operation.

When you have selected you products, you can submit your order by fax or via an online link at the press of a button.

You will find Information on the interactive catalogs on the Internet at:

http://www.siemens.de/automation/ca01

or on CD-ROM:

Automation and Drives, CA 01
Order No.:
E86060-D4001-A100-B5

Installation Systems, ET 01
Order No.:
E86060-D8200-A107-A2

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Easy shopping with the Siemens Mall

The Siemens Mall is the virtual department store of Siemens AG on the Internet. You can access a gigantic product spectrum that is presented clearly and informatively in electronic catalogs.

Data transfer via EDIFACT allows the complete ordering process, from selection to ordering and order tracking, to take place online via the Internet.

Numerous functions are available to you which make the job easier.

Powerful search functions make it easy to find the required products and check their availability immediately. Individual customer discounts and quotations are available online as well as tracking and tracing of your order.

You will find the Siemens Mall on the Internet at:

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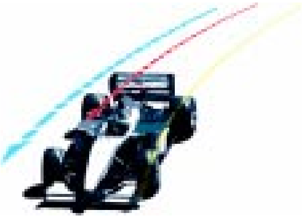
Customer support

Automation & Drives customer support



Whether you need a service specialist or a spare part, advice from a product expert or just an answer to a question: Contact the Service & Support Team – The team for your success.

Helpline for service and support

You need help and are not sure who to contact. We will ensure that you get assistance quickly.

The helplines guarantee that the right local specialist provides you with technical support. The helpline, for example in Germany, provides assistance 365 days a year round-the-clock in English and German.

Tel.: +49 (0)180 50 50 111

Online support

Our online support provides fast, effective assistance – round-the-clock, worldwide and in five different languages.

Online support offers a wide range of technical information:

- FAQs, Tips and Tricks, downloads and news
- Free manuals
- Helpful programs and software products – payment accepted with the SIMATIC Card

http://www.siemens.de/automation/service&support

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Field service

Your plant is installed and you need help quickly on site. We have the specialists with the necessary expertise near you wherever you are in the world.

Our dense service network means that you will receive attention quickly and reliably.

In Germany, you can request an expert 365 days a year round-the-clock.

Tel.: 0180 50 50 444 1)

Naturally we also offer service contracts tailored to your individual needs. Please contact your local Siemens representative for further information.

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Our worldwide network of regional spare parts warehouses and repair shops responds quickly and reliably with the latest in logistics.

In the event of queries concerning repairs or spare parts, please call the following number (in Germany):

Tel.: 0180 50 50 446 1)

Out of office hours and at the weekend, you can contact our emergency spare parts service under the following number.

Technical support

Technical support with using our products, systems and solutions in the field of automation and drives is available in English and German. Capable, trained and experienced specialists also offer Teleservice and Video Conferencing for particularly difficult problems.

FreeContact – the route to technical support free of charge

- European and African time zones

Tel.: +49 (0)180 50 50 222
Fax: +49 (0)180 50 50 223
E-mail: techsupport@ad.siemens.de
Mo.-Fr.: 7:00 to 17:00 (CET)

- USA time zones

24h hotline toll-free: +1 (0)800 241-4453

Tel.: +1 (0)770 740-3505
Fax: +1 (0)770 740-3396
E-mail: drives.support@sea.siemens.com
Mo.-Fr.: 8:00 to 20:00
(local time: Eastern Time)

- Asian/Australian time zones

Tel.: +65 (0)740-7000
Fax: +65 (0)740-7001
E-mail: drives.support@sea.siemens.com.sg
Mo.-Fr.: 8:30 to 17:30
(local time: Singapore)

1) Germany only, for local "Länder" telephone numbers visit: http://www.siemens.de/automation/service&support

Knowledge Base on CD-ROM

For working environments without an online connection to the Internet, an extract of the information provided free of charge is available on CD-ROM (Service & Support Knowledge Base). This CD-ROM contains all the up-to-date product information (FAQs, downloads, Tips and Tricks, news) as well as general information about service and technical support.

You will also find on the CD-ROM a complete text search function and our Knowledge Manager which will help you to locate solutions. The CD-ROM is updated every 4 months.

As with our online service on the Internet, the CD Service & Support Knowledge Base is available complete in 5 languages (English, German, French, Italian and Spanish).

You can order the CD **Service und Support Knowledge Base** from your Siemens contact partner.

Order No.
6ZB5310-0EP30-0BA1

Order over the Internet (using the SIMATIC Card or a credit card) at:

http://www.siemens.de/automation/service&support

under “Shop”.

SIMATIC Card

You can use the SIMATIC Card to purchase service credit.
This credit can then be used to access the technical support services that are subject to charge (FastContact, Service-Line) or to download software products and application examples from the Internet.

The SIMATIC Card operates on the same principle as a telephone card.

You can access your credit using the SIMATIC Card number and the SIMATIC Card PIN (both numbers are on the rear of your SIMATIC Card or will be supplied by e-mail when you purchase over the Internet).

On the Internet you can also view the account for your SIMATIC Card at:

http://www.siemens.de/automation/simatic-card

The **SIMATIC Card** can be ordered as follows:

From your Siemens contact partner

SIMATIC Card	
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200	**6ES7 997-0AA00-0XA0**
500	**6ES7 997-0AB00-0XA0**
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Validity: 2 years from date of purchase

On the Internet in conjunction with a credit card, the SIMATIC Card can be used immediately:

http://www.siemens.de/automation/simatic-card

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Conditions of sale and delivery, export regulations

In Germany

Subject to the General Conditions of Sale as well as the General Conditions of Supply and Delivery for Products and Services of the Electrical and Electronics Industry.

For Export

Subject to the General Conditions of Supply and Delivery for Products and Services of the Electrical and Electronics Industry and to any other conditions agreed upon with the recipients of catalogs/price lists.

■

Software products are subject to the General Licence Conditions for Software Products for Automation and Drives.

■

Prices are listed in € (Euro) ex delivery point, excluding packaging.

Turnover tax (VAT) is not included in the prices. It will be added according to legal provisions at the applicable rate.

We reserve the right to adjust prices and shall charge the prices applying on the date of delivery.

Notes

All dimensions in this catalog/price list are in mm. The illustrations are for reference only.

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The products listed in this catalog/price list may be subject to European/German and/or US export provisions.

Any export requiring approval is therefore subject to authorization by the relevant authorities.

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AL	Number of the German export list Products with a code other than “N” must be approved for export. The export codes of the respective data medium must also be adhered to for software products. Goods labeled with “AL not equal to N” are subject to European or German export authorization when being exported out of the EU.
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Catalogs of the
Automation and Drives Group (A&D)

Further information can be obtained from our branch offices listed in the appendix of this catalog

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