SIMOREG K 6RA22
Analog Chassis Converters

Catalog DA 212 · 2001
## DC Motors

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

## DC Motors
1GG7, 1GH7, 1HS7 and 1HQ7

**Order No.:**
- German: E86060-K5112-E101-A1

## DC Drives
Preferred Series up to 500 kW

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

## DC Drives
Preferred Series 215 kW to 1500 kW

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

## SIMOREG 6RA70 DC MASTER
Digital Chassis Converters

**Order No.:**
- German: E86060-K5121-A111-A1

## SIMOREG 6RA22 Analog Chassis Converters

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

## Spare Parts for SIMOREG Converters (Chassis Units)

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

## SIMOREG Static Converter Cabinets

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

## Automation and Drives

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

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**Internet**

Visit Siemens Automation and Drives Group on the Internet at [http://www.siemens.de/automation](http://www.siemens.de/automation)
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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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 \( (I \times R) \) 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 \( \leq 160 \text{ A} \) are designed for natural air cooling, and units with rated DC \( \geq 240 \text{ A} \) 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.
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) and (B6)A(B6)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 \((I \times R)\) 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 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 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.

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
- 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.

  - 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.

  - 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.

- 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.

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.
Current controller
The current controller has very high-grade dynamic performance with the following functions:
- Trigger unit feed-forward control
- 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.
6RA22 SIMOREG K Chassis Converters

### Technical data

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

**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

<table>
<thead>
<tr>
<th>Ambient or coolant temperature</th>
<th>Derating in units with natural air cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>+35° C</td>
<td></td>
</tr>
<tr>
<td>+40° C</td>
<td>0%</td>
</tr>
<tr>
<td>+45° C</td>
<td>0%</td>
</tr>
<tr>
<td>+50° C</td>
<td>-6%</td>
</tr>
<tr>
<td>+55° C</td>
<td>-11%</td>
</tr>
<tr>
<td>+60° C</td>
<td>-18%</td>
</tr>
</tbody>
</table>

**6)** Load values as a function of site altitude

![Site altitude Load graph](image)

---

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
### Technical data

#### Conformers for single-phase connection and four-quadrant operation (B2A(B2)C

<table>
<thead>
<tr>
<th>Order No.</th>
<th>6RA22..-8DK27...</th>
<th>6RA22..-8DK27...</th>
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<td>11</td>
</tr>
<tr>
<td></td>
<td>03</td>
<td>11</td>
</tr>
</tbody>
</table>

- **Rated supply voltage**<sup>1)</sup> V 230 (+10%/-10%) 230 (-10%/+10%)
- **Rated frequency** Automatic adaptation 45 to 65 Hz
- **Rated DC voltage** V 150 260
- **Rated direct current** A 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
- **Current input, terminals U2-V2** mA 80
- **Ambient in-service temperature**<sup>2)</sup> °C 0 to 46
- **Temperature during storage and transportation** °C -30 to +85
- **Site altitude above sea level**<sup>3)</sup> m ≤ 1,000 at rated DC
- **Control stability**<sup>4)</sup> 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.)**<sup>5)</sup> kg 2.8 2.8 3.1 5.4 2.8 2.8 3.1 5.4
- **Weight (approx.)**<sup>6)</sup> kg 1.8 1.8 2.1 4.1 1.8 1.8 2.1 4.1
- **Number of required slots**<sup>7)</sup> 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% 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
     - +35 °C
     - +40 °C
     - +45 °C
     - +50 °C
     - +55 °C
     - +60 °C
   - Derating in units with natural air cooling
     - 0%
     - -6%
     - -11%
     - -18%
6) Load values as a function of site altitude

---

**Fig. 1/7**
### Technical data

<table>
<thead>
<tr>
<th>Order No.</th>
<th>6RA22...8DS31</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>26 30 32 33 76 80 83</td>
</tr>
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</table>

#### Converters for three-phase connection and single-quadrant operation (B6C)

<table>
<thead>
<tr>
<th>Order No.</th>
<th>6RA22...8DS31</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>26 30 32 33 76 80 83</td>
</tr>
</tbody>
</table>

#### Power 1)

- **Rated supply voltage**
  - 3-ph. 400 (+10%/-15%)

- **Power**
  - 2 ph. 230 (+10%/-10%)
  - 2 ph. 230 (+10%/-10%)
  - 0.12 A
  - 0.24 A

- **Air flow rate**
  - 160 m³/h
  - 320 m³/h

#### Order No.

- **Rated supply voltage**
  - 3-ph. 400 (+35%/-20%), 40 mA

- **Rated supply voltage, field**
  - 2-ph. max. 400 (+35%)

- **Rated frequency**
  - Hz: Automatic adaptation 45 to 65

- **Rated DC voltage**
  - V: 465

- **Rated direct current**
  - A: 35 50 70 110 130 160 240 350 500

- **Rated output**
  - kW: 17 24 34 53 63 78 116 120 242

- **Power loss at rated direct current (approx.)**
  - W: 130 170 230 350 410 500 760 1100 1580

- **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: ≤ 1000 at rated DC

- **Control stability 2)**
  - Bn = 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

<table>
<thead>
<tr>
<th>Ambient or coolant temperature</th>
<th>Derating in units with natural air cooling</th>
<th>Derating in units with forced-air cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>+35°C</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>+40°C</td>
<td>-6%</td>
<td></td>
</tr>
<tr>
<td>+45°C</td>
<td>0%</td>
<td>-12%</td>
</tr>
<tr>
<td>+50°C</td>
<td>-6%</td>
<td>-17%</td>
</tr>
<tr>
<td>+55°C</td>
<td>-11%</td>
<td></td>
</tr>
<tr>
<td>+60°C</td>
<td>-18%</td>
<td></td>
</tr>
</tbody>
</table>

4) Load values as a function of site altitude

---

Fig. 1/8
6RA22 SIMOREG K Chassis Converters

Technical data

<table>
<thead>
<tr>
<th>Order No.</th>
<th>6RA22...8DV71</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

Converters for three-phase connection and four-quadrant operation (B6/A(B6/C))

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated supply voltage</td>
<td>V 3-phrase 400 (+15%/-10%)</td>
</tr>
<tr>
<td>Rated supply voltage</td>
<td>2-phrase 230 (+10%/-10%), 40 mA</td>
</tr>
<tr>
<td>Electronics power supply</td>
<td>V 3-phrase 400 (+35%/-20%), 40 mA</td>
</tr>
<tr>
<td>Rated supply voltage</td>
<td>Air flow rate 320 m³/h</td>
</tr>
<tr>
<td>Fan</td>
<td>0.24 A</td>
</tr>
<tr>
<td>Air flow rate</td>
<td>320 m³/h</td>
</tr>
<tr>
<td>Rated frequency</td>
<td>Hz Automatic adaptation 45 to 66</td>
</tr>
<tr>
<td>Rated DC voltage</td>
<td>V 420</td>
</tr>
<tr>
<td>Rated direct current</td>
<td>A 14.7 21 29 46 55 67 100 147 210</td>
</tr>
<tr>
<td>Rated output</td>
<td>kW 130 170 230 250 410 500 780 1130 1580</td>
</tr>
<tr>
<td>Power loss at rated direct current (approx.)</td>
<td>W 340</td>
</tr>
<tr>
<td>Rated DC voltage, field</td>
<td>V 8 8 8 8 8 8 15 15 15</td>
</tr>
<tr>
<td>Rated direct current, field</td>
<td>A 0 to 46 at rated DC, natural air cooling 0 to 35 at rated DC, forced-air cooling</td>
</tr>
<tr>
<td>Ambient in-service temperature</td>
<td>°C 0 to 45 at rated DC, natural air cooling</td>
</tr>
<tr>
<td>Temperature during storage and transportation</td>
<td>°C -30 to +85</td>
</tr>
<tr>
<td>Site altitude above sea level</td>
<td>m ≤ 1 000 at rated DC</td>
</tr>
<tr>
<td>Control stability</td>
<td>Δn = 0.1% of rated speed</td>
</tr>
<tr>
<td>Humidity rating</td>
<td>DIN 40 040, SN 26 556 F</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>DIN 40 050, IEC 144 IP 00</td>
</tr>
<tr>
<td>Dimensions</td>
<td>See dimension drawings</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>kg 5.4 5.4 7.3 15.4 15.9 17.5 22.2 24 30</td>
</tr>
</tbody>
</table>

1) The rated output voltage for the armature and field circuits is reached at 6% 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% to ±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

4) Load values as a function of site altitude

Fig. 1/9

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

### Power section
- **L1** U1 Input 2-ph. 400 V or 2-ph. 230 V
- **L2** V1 Input 2-ph. 400 V or 2-ph. 230 V
- **C1** D1 Output max. 315 V or 180 V
- **C2** D2 Output max. 315 V or 180 V

### Field rectifier
- **L1** U2 Input 2-ph. 400 V or See technical data
- **L2** V2 Input 2-ph. 400 V

### Power supply
- **M** Output 0 V (M potential)
- **P** Output +15 V/50 mA
- **N** Output - 15 V/50 mA
- **P24** Output +24 V/50 mA

### Speed controller
- **Setpoint** Input 0 to +10 V/200 kΩ
- **Actual value** Input 0 to -10 V/20 kΩ

### Current controller
- **Setpoint** Output 0 to +10 V

### Other functions
- **Controller enable (Pi)** Input +24 V/100 Ω
- **Limit monitor** Output Open collector
- **Potentiometer R86** Input 0 to -10 V/10 kΩ
- **Potentiometer R86 tap** Output 0 to ±10 V/10 kΩ

---

### Block diagrams / Terminal assignment

<table>
<thead>
<tr>
<th>Function</th>
<th>Terminal</th>
<th>Type</th>
<th>Connection values</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power section</strong></td>
<td>L1</td>
<td>Input</td>
<td>2-ph. 400 V or 2-ph. 230 V</td>
<td>See technical data</td>
</tr>
<tr>
<td></td>
<td>L2</td>
<td>Input</td>
<td>2-ph. 400 V or 2-ph. 230 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C1</td>
<td>Output</td>
<td>max. 315 V or 180 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>Output</td>
<td>max. 315 V or 180 V</td>
<td></td>
</tr>
<tr>
<td><strong>Field rectifier</strong></td>
<td>L1</td>
<td>Input</td>
<td>2-ph. 400 V or 2-ph. 400 V</td>
<td>See technical data</td>
</tr>
<tr>
<td></td>
<td>L2</td>
<td>Input</td>
<td>2-ph. 400 V or 2-ph. 400 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>U2</td>
<td>Output</td>
<td>340 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V2</td>
<td>Output</td>
<td>340 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>Output</td>
<td>340 V</td>
<td></td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>M</td>
<td>Output</td>
<td>0 V (M potential)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>Output</td>
<td>+15 V/50 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>Output</td>
<td>- 15 V/50 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P24</td>
<td>Output</td>
<td>+24 V/50 mA</td>
<td></td>
</tr>
<tr>
<td><strong>Speed controller</strong></td>
<td>4</td>
<td>Input</td>
<td>0 to +10 V/200 kΩ</td>
<td>Jumper C5-C4 closed: ramp-function generator setpoint input</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Input</td>
<td>0 to -10 V</td>
<td>Jumper C5-C6 closed: speed controller setpoint input</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Input</td>
<td>0 to +10 V</td>
<td>Jumper B5-B6 closed: summing amplifier setpoint input (supplementary current setpoint)</td>
</tr>
<tr>
<td><strong>Actual value</strong></td>
<td>2</td>
<td>Input</td>
<td>0 V (ref. potential)</td>
<td>Jumper B2-B3 closed: speed controller actual value input (connection only for speed actual value sensing by tacho-generator)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Input</td>
<td>80 to 220 V/78 kΩ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Input</td>
<td>30 to 90 V/31 kΩ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Input</td>
<td>10 to 40 V/3 kΩ</td>
<td></td>
</tr>
<tr>
<td><strong>Ext. current limiting</strong></td>
<td>19</td>
<td>Input</td>
<td>0 to +10 V</td>
<td>Current setpoint + supplementary current setpoint limiting</td>
</tr>
<tr>
<td><strong>Current controller</strong></td>
<td>18</td>
<td>Output</td>
<td>0 to +10 V</td>
<td>Jumper C2-C1 closed: current setpoint from speed controller</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>Input</td>
<td>0 to +10 V</td>
<td>Jumper C2-C3 closed: external current setpoint</td>
</tr>
<tr>
<td><strong>Other functions</strong></td>
<td>8</td>
<td>Input</td>
<td>+24 V/100 Ω</td>
<td>Power supply for ext. controller enable</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Output</td>
<td>+20 to +30 V/4 mA</td>
<td>Connect to terminal 8 for controller enable</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>Input</td>
<td>0 to -10 V/10 kΩ</td>
<td>Jumper C8-C9 closed: speed controller setpoint input (supplementary speed setpoint)</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>Input</td>
<td>0 to -10 V</td>
<td>Jumper C8-C7 closed: speed controller setpoint input (x ½) compensation for EMF control without tacho-generator</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>Output</td>
<td>0 to -10 V</td>
<td>Jumper C8-C7 closed, resistor R97 removed: current actual value tap</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>Output</td>
<td>0 to ±10 V/10 kΩ</td>
<td>Jumper C8-C9 closed, resistor R97 removed: potentiometer R86 can be used as required.</td>
</tr>
</tbody>
</table>
## 6RA22 SIMOREG K Chassis Converters

### Block diagrams / Terminal assignment

#### Function

<table>
<thead>
<tr>
<th>Function</th>
<th>Matrix board</th>
<th>Function</th>
<th>Matrix board</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplementary setpoint input, speed controller</td>
<td>RA1</td>
<td>Output, free CMOS inverter</td>
<td>RB6</td>
</tr>
<tr>
<td>Setpoint filtering, speed controller</td>
<td>RA2</td>
<td>Input, free CMOS inverter</td>
<td>RB7</td>
</tr>
<tr>
<td>Input positive current limit</td>
<td>RA3</td>
<td>Input, current setpoint to current control loop</td>
<td>RB8</td>
</tr>
<tr>
<td>Input negative current limit</td>
<td>RA4</td>
<td>Input, supplementary current setpoint before current limiting</td>
<td>RB9</td>
</tr>
<tr>
<td>Input EMF actual values for EMF precontrol</td>
<td>RA5</td>
<td>Output n 10 V</td>
<td>RB11</td>
</tr>
<tr>
<td>Free output via terminal X23.18 (filtered)</td>
<td>RA6</td>
<td>Output p (±10 V)</td>
<td>RB13</td>
</tr>
<tr>
<td>Free output via terminal X23.17 (filtered)</td>
<td>RA7</td>
<td>Separate inhibit for ramp-function generator (±15 to +24 V inhibits)</td>
<td>RB15</td>
</tr>
<tr>
<td>Free output via 2 x 10 kΩ/10 nF at terminal X23.26</td>
<td>RA8</td>
<td>Input, speed setpoint at speed controller</td>
<td>RC1</td>
</tr>
<tr>
<td>Free output via 2 x 10 kΩ/10 nF at terminal X23.25</td>
<td>RA9</td>
<td>Speed controller output after current limiting</td>
<td>RC3</td>
</tr>
<tr>
<td>Free output via 2 x 10 kΩ/10 nF at terminal X23.24</td>
<td>RA10</td>
<td>Technology connector X1.7</td>
<td>RC4</td>
</tr>
<tr>
<td>Free output via 2 x 100 kΩ/10 nF at terminal X23.23</td>
<td>RA11</td>
<td>Current actual value</td>
<td>RC5</td>
</tr>
<tr>
<td>Free FET switch (1) driven via terminal X23.22</td>
<td>RA12/RA13</td>
<td>Positive reference voltage +10 V</td>
<td>RD1</td>
</tr>
<tr>
<td>Free FET switch (2) driven via terminal X23.21</td>
<td>RA14/RA16</td>
<td>Negative reference voltage -10 V</td>
<td>RE1</td>
</tr>
<tr>
<td>Free output via 2 x 56 Ω/47 nF at terminal X23.18</td>
<td>RA16</td>
<td>EMF reference potential 0 V</td>
<td>RF1</td>
</tr>
<tr>
<td>Free output via 2 x 56 Ω/47 nF at terminal X23.15</td>
<td>RA17</td>
<td>P15 regulated +15 V</td>
<td>RG1</td>
</tr>
<tr>
<td>Direct connection to terminal X23.18</td>
<td>RA18</td>
<td>N15 regulated -15 V</td>
<td>RH1</td>
</tr>
<tr>
<td>Ramp-function generator output</td>
<td>RB1</td>
<td>Output, fault signal</td>
<td>RM4</td>
</tr>
<tr>
<td>Extension input for ramp-function generator</td>
<td>RB3</td>
<td>Ack. button connection to reset fault signal</td>
<td>RM5/RM6</td>
</tr>
<tr>
<td>Technology connector X1.1</td>
<td>RB4</td>
<td>Connection to X35.32</td>
<td>RM8</td>
</tr>
</tbody>
</table>

#### Matrix board assignment for SIMOREG K converters in circuit B6C for four-quadrant drives

<table>
<thead>
<tr>
<th>Power supply</th>
<th>RA1, RA2</th>
</tr>
</thead>
<tbody>
<tr>
<td>+10 V (P10)</td>
<td>RA4*1</td>
</tr>
<tr>
<td>-10 V (N10)</td>
<td>RA5*1</td>
</tr>
<tr>
<td>0 V (M)</td>
<td>RA3*1</td>
</tr>
<tr>
<td>+15 V (P)</td>
<td>RA1*1</td>
</tr>
<tr>
<td>-15 V (N)</td>
<td>RA2*1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Speed controller</th>
<th>RA6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed setpoint</td>
<td>RA8</td>
</tr>
<tr>
<td>Speed controller setpoint smoothing</td>
<td>RA13</td>
</tr>
<tr>
<td>Speed actual value</td>
<td>RA12</td>
</tr>
<tr>
<td>Ramp-function generator output overdrive amplifier</td>
<td>RA11</td>
</tr>
<tr>
<td>Controller enable</td>
<td>RA6</td>
</tr>
<tr>
<td>Current limiting B+</td>
<td>RA7</td>
</tr>
<tr>
<td>Current actual value</td>
<td>RA8</td>
</tr>
<tr>
<td>Extension input, ramp-function generator</td>
<td>RB9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other functions</th>
<th>RA10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed actual value V&lt;sub&gt;actual&lt;/sub&gt;</td>
<td>RA10</td>
</tr>
<tr>
<td>Speed actual value decoupled</td>
<td>RH1</td>
</tr>
<tr>
<td>Supplementary current setpoint</td>
<td>RB9</td>
</tr>
<tr>
<td>Current actual value decoupled</td>
<td>RR7</td>
</tr>
<tr>
<td>Input, reset ramp-function generator</td>
<td>RR3</td>
</tr>
</tbody>
</table>

#### Matrix board assignment for SIMOREG K converters in circuit B6C for single-quadrant drives

<table>
<thead>
<tr>
<th>Power supply</th>
<th>RA4</th>
</tr>
</thead>
<tbody>
<tr>
<td>+10 V (P10)</td>
<td>RA4</td>
</tr>
<tr>
<td>-10 V (N10)</td>
<td>RA5</td>
</tr>
<tr>
<td>0 V (M)</td>
<td>RA3</td>
</tr>
<tr>
<td>+15 V (P)</td>
<td>RA1</td>
</tr>
<tr>
<td>-15 V (N)</td>
<td>RA2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Speed controller</th>
<th>RA6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed setpoint</td>
<td>RA8</td>
</tr>
<tr>
<td>Speed controller setpoint smoothing</td>
<td>RA13</td>
</tr>
<tr>
<td>Speed actual value</td>
<td>RA12</td>
</tr>
<tr>
<td>Ramp-function generator output overdrive amplifier</td>
<td>RA11</td>
</tr>
<tr>
<td>Controller enable</td>
<td>RA6</td>
</tr>
<tr>
<td>Current limiting B+</td>
<td>RA7</td>
</tr>
<tr>
<td>Current actual value</td>
<td>RA8</td>
</tr>
<tr>
<td>Extension input, ramp-function generator</td>
<td>RB9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other functions</th>
<th>RA10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed actual value V&lt;sub&gt;actual&lt;/sub&gt;</td>
<td>RA10</td>
</tr>
<tr>
<td>Speed actual value decoupled</td>
<td>RH1</td>
</tr>
<tr>
<td>Supplementary current setpoint</td>
<td>RB9</td>
</tr>
<tr>
<td>Current actual value decoupled</td>
<td>RR7</td>
</tr>
<tr>
<td>Input, reset ramp-function generator</td>
<td>RR3</td>
</tr>
</tbody>
</table>

---

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6RA22 SIMOREG K Chassis Converters

Block diagrams / Terminal assignment

Fig. 1/11
6RA22 SIMOREG K converter in a circulating-current-free inverse-parallel connection using two fully controlled single-phase bridge circuits (B2A)/(B2C) for four-quadrant drives
6RA22 SIMOREG K Chassis Converters

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 (B6A/B6C) for
four-quadrant drives
# Block diagrams / Terminal assignment

## Connections of 6RA22 SIMOREG K converters in (B2)A(B2)C connection for four-quadrant drives

<table>
<thead>
<tr>
<th>Power section</th>
<th>Terminal</th>
<th>Type</th>
<th>Connection values</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>U1</td>
<td>Input</td>
<td>2-ph. 400 V or</td>
<td>See technical data</td>
</tr>
<tr>
<td>L2</td>
<td>V1</td>
<td>Input</td>
<td>2-ph. 230 V</td>
<td></td>
</tr>
<tr>
<td>+ (-)</td>
<td>C (D)</td>
<td>Output</td>
<td>Max. 260 V or 150 V</td>
<td></td>
</tr>
<tr>
<td>- (+)</td>
<td>D (C)</td>
<td>Output</td>
<td>Max. switching capacity 1100 VA</td>
<td></td>
</tr>
<tr>
<td>Relay contact</td>
<td>X95.1/2</td>
<td>Output</td>
<td>250 V @ 5 A AC</td>
<td>For switching-in the main contactor</td>
</tr>
</tbody>
</table>

## Power supply

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Terminal</th>
<th>Type</th>
<th>Connection values</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>U2</td>
<td>Input</td>
<td>2-ph. 400 V or</td>
<td>For 400 V solder jumper A2/A1 closed,</td>
</tr>
<tr>
<td>L2</td>
<td>V2</td>
<td>Input</td>
<td>2-ph. 230 V</td>
<td>for 230 V solder jumper A2-A3 closed</td>
</tr>
<tr>
<td>M</td>
<td>X23.7</td>
<td>Output</td>
<td>0 V (M potential)</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>X23.9</td>
<td>Output</td>
<td>0 V (M potential)</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>X23.10</td>
<td>Output</td>
<td>+15 V</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>X23.11</td>
<td>Output</td>
<td>-15 V</td>
<td></td>
</tr>
<tr>
<td>P24</td>
<td>X23.8</td>
<td>Output</td>
<td>+24 V</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>X23.6</td>
<td>Output</td>
<td>0 V (ref. potential)</td>
<td>Total loading per polarity: 50 mA</td>
</tr>
<tr>
<td>P10</td>
<td>X23.12</td>
<td>Output</td>
<td>+10 V/10 mA</td>
<td>Connection for speed setpoint potentiometer</td>
</tr>
<tr>
<td>N10</td>
<td>X23.13</td>
<td>Output</td>
<td>-10 V/10 mA</td>
<td>M/N10 (with ramp-function generator): direction I; M/P10 (with ramp-function generator): direction II.</td>
</tr>
</tbody>
</table>

## Speed controller

<table>
<thead>
<tr>
<th>Speed controller</th>
<th>Terminal</th>
<th>Type</th>
<th>Connection values</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setpoint</td>
<td>X23.4</td>
<td>Input</td>
<td>+10 to -10 V/20 kΩ</td>
<td>Jumper C2-C3 closed: ramp-function generator setpoint input</td>
</tr>
<tr>
<td>Actual value</td>
<td>X23.2</td>
<td>Input</td>
<td>0 V (ref. potential)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X23.1</td>
<td>Input</td>
<td>80 to 220 V/78 kΩ</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X23.3</td>
<td>Input</td>
<td>30 to 90 V/51 kΩ</td>
<td>Bridge resistor R20</td>
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<tr>
<td></td>
<td>X23.11</td>
<td>Input</td>
<td>10 to 30 V/13 kΩ</td>
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</tr>
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</table>

## Other functions

<table>
<thead>
<tr>
<th>Other functions</th>
<th>Terminal</th>
<th>Type</th>
<th>Connection values</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>ON command</td>
<td>X23.20</td>
<td>Input</td>
<td>+20 to +30 V</td>
<td>Reference potential M: jumpers B2-B3 and</td>
</tr>
<tr>
<td>(power contactor ON)</td>
<td>X23.20</td>
<td>Input</td>
<td>0 to +24 V</td>
<td>A6-A7 closed, terminal 5 open</td>
</tr>
<tr>
<td></td>
<td>X23.20</td>
<td>Input</td>
<td>+20 to +30 V</td>
<td>Reference potential N24: jumpers B2-B3 and</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A8-A9 closed, terminal 5 open</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reference potential provided externally via</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>terminal 5: jumper B2-B1 closed,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(floating control signal)</td>
</tr>
<tr>
<td>Controller enable</td>
<td>X23.19</td>
<td>Input</td>
<td>See terminal X23.20</td>
<td>See terminal X23.20</td>
</tr>
<tr>
<td>(checkback for power contactor ON)</td>
<td>X23.21</td>
<td>Input</td>
<td>See terminal X23.20</td>
<td>See terminal X23.20</td>
</tr>
<tr>
<td>Free optocoupler</td>
<td>X23.22</td>
<td>Input</td>
<td>See terminal X23.20</td>
<td>See terminal X23.20</td>
</tr>
<tr>
<td>Floating control signal</td>
<td>X23.5</td>
<td>Input</td>
<td>0 to -30 V</td>
<td>Externally provided reference potential</td>
</tr>
<tr>
<td>Limit monitor</td>
<td>X23.14</td>
<td>Output</td>
<td>+24 V/50 mA</td>
<td>Jumper B2-B1 closed</td>
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<tr>
<td></td>
<td>X23.23</td>
<td>Input</td>
<td>2 x 100 kΩ/10 nF</td>
<td>Jumper A2-A1 and A5-A4 closed:</td>
</tr>
<tr>
<td></td>
<td>X23.24</td>
<td>Input</td>
<td>2 x 10 kΩ/10 nF</td>
<td>speed actual value interrogation</td>
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<tr>
<td></td>
<td>X23.25</td>
<td>Input</td>
<td>2 x 10 kΩ/10 nF</td>
<td>Jumpers A2-A3 and A5-A6 closed:</td>
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<tr>
<td></td>
<td>X23.26</td>
<td>Input</td>
<td>2 x 10 kΩ/10 nF</td>
<td>current actual value interrogation</td>
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<td></td>
<td>X23.15</td>
<td>Output</td>
<td>2 x 50 Ω/47 nF</td>
<td>Matrix board RA11</td>
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<tr>
<td></td>
<td>X23.16</td>
<td>Output</td>
<td>2 x 50 Ω/47 nF</td>
<td>Matrix board RA10</td>
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<tr>
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<td>X23.17</td>
<td>Output</td>
<td>2 x 50 Ω/47 nF</td>
<td>Matrix board RA9</td>
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<td></td>
<td>X23.18</td>
<td>Output</td>
<td>2 x 50 Ω/47 nF</td>
<td>Matrix board RA8</td>
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</table>

## Function Terminal Type Connection values Comments

- Block diagrams / Terminal assignment
### Connections of 6RA22 SIMOREG K converters in B6C connection for single-quadrant drives

#### Power section
- L1: Input, 3-ph., 400 V
- L2: Input, 3-ph., 400 V
- L3: Input, 3-ph., 400 V
- + C1: Output, DC 485 V
- - D1: Output, DC 485 V
- X5.1/2: Output, AC 250 V/5 A

#### Field rectifier
- L1: Input, 2-ph., 400 V
- L2: Input, 2-ph., 400 V
- + C2: Output, DC 340 V
- - D2: Output, DC 340 V

#### Power supply
- L1: Input, 3-ph., 400 V
- L2: Input, 3-ph., 400 V
- M: Output, 0 V (M potential)
- P: Output, +15 V/50 mA
- N: Output, -15 V/50 mA
- P24: Output, +24 V/50 mA
- M: Output, 0 V (ref. potential)
- P10: Output, +10 V/10 mA
- N10: Output, -10 V/10 mA

#### Speed controller
- X1.4: Input, 0 to +10 V/200 kΩ
- X1.9: Input, 0 to -10 V/20 kΩ
- X1.1: Input, 0 to -10 V
- X1.12: Input, 0 to -10 V
- X1.13: Input, 0 to +10 V/33 kΩ

#### Current controller
- X1.18: Input, 0 to +10 V/100 mA, 56 kΩ

#### Other functions
- X1.21: Input, +20 to +30 V
- X1.20: Input, +20 to +30 V
- X1.14: Input, 24 V across 100 Ω
- X1.15: Input, +24 V/50 mA
- X1.17: Input, +10 V
- X1.22: Input, +10 V

#### Fan
- X8.3: Input, 2-ph., 230 V
- X8.4: Input, 2-ph., 230 V
- X8.1: Output, Floating relay contact
- X8.2: Output

<table>
<thead>
<tr>
<th>Function</th>
<th>Terminal</th>
<th>Type</th>
<th>Connection values</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>Power section</td>
<td>L1</td>
<td>Input</td>
<td>3-ph., 400 V</td>
<td>See technical data</td>
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<tr>
<td></td>
<td>L2</td>
<td>Input</td>
<td>3-ph., 400 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L3</td>
<td>Input</td>
<td>3-ph., 400 V</td>
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<tr>
<td></td>
<td>+ C1</td>
<td>Output</td>
<td>DC 485 V</td>
<td>For switching the main contactor</td>
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<tr>
<td></td>
<td>- D1</td>
<td>Output</td>
<td>DC 485 V</td>
<td></td>
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<td></td>
<td>X5.1/2</td>
<td>Output</td>
<td>AC 250 V/5 A</td>
<td></td>
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<tr>
<td>Field rectifier</td>
<td>L1</td>
<td>Input</td>
<td>2-ph., 400 V</td>
<td>See technical data</td>
</tr>
<tr>
<td></td>
<td>L2</td>
<td>Input</td>
<td>2-ph., 400 V</td>
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<tr>
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<td>+ C2</td>
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<tr>
<td></td>
<td>- D2</td>
<td>Output</td>
<td>DC 340 V</td>
<td></td>
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<tr>
<td>Power supply</td>
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<td>Input</td>
<td>3-ph., 400 V</td>
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<td></td>
<td>L2</td>
<td>Input</td>
<td>3-ph., 400 V</td>
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<td>M</td>
<td>Output</td>
<td>0 V (M potential)</td>
<td>Total loading per polarity: 50 mA</td>
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<td>P</td>
<td>Output</td>
<td>+15 V/50 mA</td>
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<tr>
<td></td>
<td>N</td>
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<td>-15 V/50 mA</td>
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<td>P24</td>
<td>Output</td>
<td>+24 V/50 mA</td>
<td></td>
</tr>
<tr>
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<td>M</td>
<td>Output</td>
<td>0 V (ref. potential)</td>
<td>Connection for speed setpoint potentiometer</td>
</tr>
<tr>
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<td>P10</td>
<td>Output</td>
<td>+10 V/10 mA</td>
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</tr>
<tr>
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<td>N10</td>
<td>Output</td>
<td>-10 V/10 mA</td>
<td></td>
</tr>
<tr>
<td>Speed controller</td>
<td>X1.4</td>
<td>Input</td>
<td>0 to +10 V/200 kΩ</td>
<td>Jumper A5-A4 closed: ramp-function generator setpoint input</td>
</tr>
<tr>
<td></td>
<td>X1.9</td>
<td>Input</td>
<td>0 to -10 V/20 kΩ</td>
<td>Jumper A5-A6 closed: speed controller setpoint input</td>
</tr>
<tr>
<td></td>
<td>X1.1</td>
<td>Input</td>
<td>+80 to 220 V/78 kΩ</td>
<td>Terminal X1.21 = H signal</td>
</tr>
<tr>
<td></td>
<td>X1.12</td>
<td>Input</td>
<td>0 to +10 V</td>
<td>Exclusively for supply to terminals X1.20 and X1.21</td>
</tr>
<tr>
<td></td>
<td>X1.13</td>
<td>Input</td>
<td>0 to +10 V/33 kΩ</td>
<td>Switch loads with respect to P24, because terminal X1.14 switches to M</td>
</tr>
<tr>
<td>Current controller</td>
<td>X1.18</td>
<td>Input</td>
<td>0 to +10 V/100 mA, 56 kΩ</td>
<td>Jumper C1-C2 closed: current setpoint from speed controller C2-C3 closed: external current setpoint</td>
</tr>
<tr>
<td>Other functions</td>
<td>X1.21</td>
<td>Input</td>
<td>+20 to +30 V</td>
<td>Switching command, main contactor On</td>
</tr>
<tr>
<td></td>
<td>X1.20</td>
<td>Input</td>
<td>+20 to +30 V</td>
<td>Prerequisite, terminal X1.21 = H signal</td>
</tr>
<tr>
<td></td>
<td>X1.14</td>
<td>Input</td>
<td>+24 V across 100 Ω</td>
<td>Exclusively for supply to terminals X1.20 and X1.21</td>
</tr>
<tr>
<td></td>
<td>X1.15</td>
<td>Input</td>
<td>+24 V/50 mA</td>
<td>Supplementary input for speed controller or (I x R) compensation</td>
</tr>
<tr>
<td></td>
<td>X1.17</td>
<td>Input</td>
<td>+10 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X1.22</td>
<td>Input</td>
<td>+10 V</td>
<td>On matrix board A14 for free use</td>
</tr>
<tr>
<td>Fan</td>
<td>X8.3</td>
<td>Input</td>
<td>2-ph., 230 V</td>
<td>Fan connection for units ≥ 240 A</td>
</tr>
<tr>
<td></td>
<td>X8.4</td>
<td>Input</td>
<td>2-ph., 230 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X8.1</td>
<td>Output</td>
<td>Floating relay contact</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X8.2</td>
<td>Output</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Function** | **Terminal** | **Type** | **Connection values** | **Comments**
---|---|---|---|---
**Power section** | $L_1$ | $U_1$ | Input | 3-ph. 400 V | See technical data
| $L_2$ | $V_1$ | Input | 3-ph. 400 V |
| $L_3$ | $W_1$ | Input | 3-ph. 400 V |
| $+ (+)$ | $C(D)$ | Output | DC 420 V |
| $- (+)$ | $D(C)$ | Output | DC 420 V |
| Relay contact | $X_5.1/2$ | Output | AC 250 V/5 A | For switching the main contactor
**Power supply** | $L_1$ | $U_3$ | Input | 3-ph. 400 V | See technical data
| $L_2$ | $V_3$ | Input | 3-ph. 400 V |
| $L_3$ | $W_3$ | Input | 3-ph. 400 V |
| $M$ | $X_1.7$ | Output | 0 V (M potential) | See technical data
| $M$ | $X_1.9$ | Output | 0 V (M potential) |
| $P$ | $X_1.10$ | Output | +15 V/50 mA |
| $N$ | $X_1.11$ | Output | -15 V/50 mA |
| $M$ | $X_1.16$ | Output | 0 V (ref. potential) |
| $P_{10}$ | $X_1.12$ | Output | +0 V/110 mA |
| $N_{10}$ | $X_1.13$ | Output | -0 V/110 mA |
**Field rectifier** | $L_1$ | $U_2$ | Input | 2-ph. 400 V |
| $L_2$ | $V_2$ | Input | 2-ph. 400 V |
| $+$ | $C_2$ | Output | DC 340 V |
| $-$ | $D_2$ | Output | DC 340 V |
**Speed controller** | Setpoint | $X_{1.4}$ | Input | ±10 V (0/20 kΩ) Setpoint for ramp-function generator (2 to 30 s) |
| Actual value | $X_{1.2}$ | Input | 0 V (ref. potential) |
| | $X_{1.1}$ | Input | 80 to 220 V/78 kΩ |
| | $X_{1.3}$ | Input | 30 to 90 V/31 kΩ |
| | $X_{1.3}$ | Input | 10 to 30 V Bridge R32 |
**Other functions** | On command (switches main contactor On) | $X_{1.20}$ | Input | ± 20 to +30 V |
| | | $X_{1.20}$ | Input | ± 0 to +24 V |
| Controller enable | $X_{1.19}$ | Input | As for terminal 20 |
| Free optocoupler | $X_{1.21}$ | Input | As for terminal 20 |
| Free optocoupler | $X_{1.22}$ | Input | As for terminal 20 |
| P24 | $X_{1.8}$ | Output | +24 V (across 100 Ω) |
| Floating control signal (N*) | $X_{1.5}$ | Input | 0 to -30 V (ext.) External reference potential at terminal X1.5 |
| Limit monitor terminals | $X_{1.23}$ | Input | ±10 V/2 x 10 kΩ/10 nF Matrix board RA12 |
| | $X_{1.24}$ | Input | ±10 V/2 x 10 kΩ/10 nF Matrix board RA11 |
| | $X_{1.25}$ | Input | ±10 V/2 x 10 kΩ/10 nF Matrix board RA8 |
| | $X_{1.26}$ | Input | ±10 V/2 x 10 kΩ/10 nF Matrix board RA7 |
| Free input/output terminals | $X_{1.27}$ | Input/Output | Matrix board R16 |
| | $X_{1.28}$ | Input/Output | Matrix board RX16 |
| Free output terminals | $X_{1.15}$ | Output | 2 x 50 Ω/47 nF Matrix board RA10 |
| | $X_{1.16}$ | Output | 2 x 50 Ω/47 nF Matrix board RA9 |
| | $X_{1.17}$ | Output | 2 x 50 Ω/47 nF Matrix board RA6 |
| | $X_{1.18}$ | Output | 2 x 50 Ω/47 nF Matrix board RA5 |
**Fan** | Supply | $X_{6.3}$ | Input | 2-ph. 230 V |
| Temperature switch | $X_{6.4}$ | Input | 2-ph. 230 V |
| | $X_{6.1}$ | Output | Floating relay contact |
| | $X_{6.2}$ | Output | Opens at overtemperature |

**Connections of 6RA22 SIMOREG K converters in (B6)A(B6)C connection for four-quadrant drives**
# 6RA22 SIMOREG K Chassis Converters

## Ordering and engineering data

<table>
<thead>
<tr>
<th>Rated supply voltage</th>
<th>Rated direct voltage</th>
<th>Rated DC</th>
<th>Rated output at 2-ph. 400 V</th>
<th>2-ph. 230 V</th>
<th>SIMOREG K converter</th>
<th>Type designation accord. to DIN 41 792</th>
<th>Fuses</th>
<th>Order No.</th>
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<tbody>
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<td>V</td>
<td>V</td>
<td>A</td>
<td>kW</td>
<td>kW</td>
<td>Order No.</td>
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<td><strong>SIMOREG K converters in B2HK connection for single-quadrant drives</strong></td>
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<tr>
<td>Units without enclosure (for mounting in 6DM9005 subracks)</td>
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<td>2-ph. 400</td>
<td>315</td>
<td>5</td>
<td>1.6</td>
<td>0.9</td>
<td>6RA2203-8DD21-0</td>
<td>E315/5 MRE-GDE8-0</td>
<td>5SD4 20</td>
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<tr>
<td>or 12</td>
<td>230</td>
<td>22</td>
<td>3.8</td>
<td>4.0</td>
<td>6RA2216-8DD21-0</td>
<td>E315/22 MRE-GDE8-0</td>
<td>3NE8 015</td>
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<tr>
<td>or 12</td>
<td>230</td>
<td>22</td>
<td>3.8</td>
<td>4.0</td>
<td>6RA2221-8DD21-0</td>
<td>E315/22 MRE-GDE8-0</td>
<td>3NE8 015</td>
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<tr>
<td>or 12</td>
<td>230</td>
<td>40</td>
<td>12.6</td>
<td>7.2</td>
<td>6RA2221-8DD21-0</td>
<td>E315/40 MRE-GDE8-0</td>
<td>3NE8 017</td>
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<td>Units with enclosure (for individual mounting)</td>
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<tr>
<td>2-ph. 400</td>
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<td>5</td>
<td>1.6</td>
<td>0.9</td>
<td>6RA2203-8DD21-1</td>
<td>E315/5 MRE-GDE8-1</td>
<td>5SD4 20</td>
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<tr>
<td>or 12</td>
<td>230</td>
<td>22</td>
<td>3.8</td>
<td>4.0</td>
<td>6RA2216-8DD21-1</td>
<td>E315/22 MRE-GDE8-1</td>
<td>3NE8 015</td>
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<tr>
<td>or 12</td>
<td>230</td>
<td>40</td>
<td>12.6</td>
<td>7.2</td>
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<td>E315/40 MRE-GDE8-1</td>
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<td><strong>SIMOREG K converters in B6C connection for single-quadrant drives</strong></td>
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<td>3-ph. 400</td>
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<td>17</td>
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<td>D485/35 MRE-GDE8 S31</td>
<td>3NE8 003</td>
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<td>70</td>
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<td>63</td>
<td>6RA2232-8DS31</td>
<td>D485/130 MRE-GDE8 S31</td>
<td>3NE8 023</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>or 160</td>
<td>78</td>
<td>6RA2233-8DS31</td>
<td>D485/160 MRE-GDE8 S31</td>
<td>3NE8 024</td>
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<td>or 240</td>
<td>116</td>
<td>6RA2276-8DS31</td>
<td>D485/240 MRE-GDE8 S31</td>
<td>3NE4 327-0B</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>or 350</td>
<td>170</td>
<td>6RA2280-8DS31</td>
<td>D485/350 MRE-GDE8 S31</td>
<td>3NE4 333-0B</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>or 500</td>
<td>242</td>
<td>6RA2283-8DS31</td>
<td>D485/500 MRE-GDE8 S31</td>
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### Ordering and engineering data

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>Rated direct voltage</th>
<th>Rated DC</th>
<th>Rated output at 2-ph.</th>
<th>SIMOREG K converter</th>
<th>Fuses</th>
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<tr>
<td>V</td>
<td>V</td>
<td>A</td>
<td>400 V</td>
<td>kW</td>
<td>type designation acc. to DIN 41 792</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>230 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SIMOREG K converters in (B2)(A2) 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 2-ph. 230 | 150 | 22 | 5.7 | 3.3 | 6RA2216-8DK27-0 | E260/22 MREQ-GDG8-0 | 3NE8 015 | 3NE8 015 |
| or 12 | 3.1 | 1.8 | | 6RA2211-8DK27-0 | E260/10 MREQ-GDG8-0 | 5SD4 20 | 5SD4 20 |

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 2-ph. 230 | 150 | 22 | 5.7 | 3.3 | 6RA2216-8DK27-1 | E260/22 MREQ-GDG8-1 | 3NE8 015 | 3NE8 015 |
| or 12 | 3.1 | 1.8 | | 6RA2211-8DK27-1 | E260/10 MREQ-GDG8-1 | 5SD4 20 | 5SD4 20 |

**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 | Order No. of the French operating manual
---|---|---|
6RA22..-8DD21.. | 6RX1220-00D 74 | 6RX1220-0KD 74 |
6RA22..-8DS31 | 6RX1220-0SD 74 | 6RX1220-0VD 74 |
6RA22..-8DV71 | | |

**Other documentation for 6RA22 SIMOREG K converters in analog technology**

| Converter type | Order No. of the German/English operating manual | Order No. of the French operating manual |
---|---|---|
6RA22..-8DD21.. | 6RX1220-0D 77 | Letter according to converter type |
6RA22..-8DS31 | 6RX1220-0KD 74 | |
6RA22..-8DV71 | 6RX1220-0VD 74 | |

**Converter type** | Order No. of the German/English operating manual | Order No. of the French operating manual
---|---|---|
6RA22..-8DD21.. | 6RX1220-00D 74 | 6RX1220-0KD 74 |
6RA22..-8DS31 | 6RX1220-0SD 74 | 6RX1220-0VD 74 |
6RA22..-8DV71 | | |
### Dimension drawings

#### Converters in B2HZ connection for single-quadrant drives, without enclosure

<table>
<thead>
<tr>
<th>Order No.</th>
<th>B (mm)</th>
<th>T (mm)</th>
<th>No. of required basic grid dimensions in the subrack</th>
</tr>
</thead>
<tbody>
<tr>
<td>6RA2203-8DD21-0</td>
<td>50</td>
<td>210</td>
<td>24</td>
</tr>
<tr>
<td>6RA2211-8DD21-0</td>
<td>78</td>
<td>233</td>
<td>36</td>
</tr>
<tr>
<td>6RA2221-8DD21-0</td>
<td>112</td>
<td>233</td>
<td>50</td>
</tr>
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</table>

#### Converters in (B2)(A)(B2)(C) connection for four-quadrant drives, without enclosure

<table>
<thead>
<tr>
<th>Order No.</th>
<th>B (mm)</th>
<th>T (mm)</th>
<th>No. of required basic grid dimensions in the subrack</th>
</tr>
</thead>
<tbody>
<tr>
<td>6RA2203-8DK27-0</td>
<td>94</td>
<td>233</td>
<td>42</td>
</tr>
<tr>
<td>6RA2211-8DK27-0</td>
<td>92</td>
<td>238</td>
<td>42</td>
</tr>
<tr>
<td>6RA2221-8DK27-0</td>
<td>124</td>
<td>238</td>
<td>54</td>
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</tbody>
</table>

#### Converters in B2HZ connection for single-quadrant drives, with enclosure

<table>
<thead>
<tr>
<th>Order No.</th>
<th>T (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6RA2203-8DD21-1</td>
<td>86</td>
</tr>
<tr>
<td>6RA2211-8DD21-1</td>
<td>86</td>
</tr>
<tr>
<td>6RA2221-8DD21-1</td>
<td>152</td>
</tr>
</tbody>
</table>

#### Converters in (B2)(A)(B2)(C) connection for four-quadrant drives, with enclosure

<table>
<thead>
<tr>
<th>Order No.</th>
<th>T (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6RA2203-8DK27-1</td>
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</tr>
<tr>
<td>6RA2211-8DK27-1</td>
<td>137</td>
</tr>
<tr>
<td>6RA2221-8DK27-1</td>
<td>182</td>
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</tbody>
</table>

#### Converters in B6C connection for single-quadrant drives, with enclosure

<table>
<thead>
<tr>
<th>Order No.</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6RA2220-8DS31</td>
<td>310</td>
<td>290</td>
<td>190</td>
</tr>
<tr>
<td>6RA2223-8DS31</td>
<td>310</td>
<td>290</td>
<td>190</td>
</tr>
<tr>
<td>6RA2226-8DS31</td>
<td>310</td>
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<tr>
<td>6RA2230-8DS31</td>
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<td>290</td>
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<td>6RA2232-8DS31</td>
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<td>320</td>
</tr>
<tr>
<td>6RA2276-8DS31</td>
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<td>373</td>
<td>390</td>
</tr>
<tr>
<td>6RA2280-8DS31</td>
<td>400</td>
<td>373</td>
<td>390</td>
</tr>
<tr>
<td>6RA2283-8DS31</td>
<td>400</td>
<td>373</td>
<td>390</td>
</tr>
</tbody>
</table>

#### Converters in (B6)(A)(B6)(C) connection for four-quadrant drives, with enclosure

<table>
<thead>
<tr>
<th>Order No.</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6RA2220-8DV71</td>
<td>310</td>
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<tr>
<td>6RA2223-8DV71</td>
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<td>6RA2226-8DV71</td>
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<td>6RA2230-8DV71</td>
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<tr>
<td>6RA2283-8DV71</td>
<td>400</td>
<td>373</td>
<td>390</td>
</tr>
</tbody>
</table>

---

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

---

Fig. 1/14

Fig. 1/15

Fig. 1/16
6RA22 SIMOREG K Chassis Converters

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

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>6DM9005</td>
<td>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</td>
</tr>
</tbody>
</table>
| 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 decreasing 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 $\Delta V_{\text{set}}$ 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

\[
\text{i.e.} \quad \frac{\text{Full roll}}{\text{Empty roll}}
\]

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
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

Supplementary boards / Accessories

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

Controller enable basic unit

Closed Open Pre-limit switch Fault

EMF
**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 $V_{\text{master}}$ (e.g., web velocity), to a summing circuit. There, if required, it can be added to a speed setpoint $n_{\text{master}}$ and fed to the setpoint output $n_{\text{set}}$ 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 ($\pm 15$ V and $\pm 24$ V) via a ribbon cable.

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.
**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.
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.
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 $V_{\text{set}}$ 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 $V_{\text{set}}$ 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

\[
\begin{align*}
V_{\text{act}} &= \begin{cases} 
\text{Full roll} & \text{if } V_{\text{act}} > V_{\text{set}} \\
\text{Empty roll} & \text{if } V_{\text{act}} < V_{\text{set}} 
\end{cases}
\end{align*}
\]

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
- U 315 simple field supply unit
- F 10 Minireg
- U 318 cut-in field weakening control
The maximum field current of the unit is 22 A. The intermediate values are governed by the commutating rectors and fuses.

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.

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

Mounting
Subrack 6DM9005 is intended for mounting a total of seven F 33 Miniregs.
<table>
<thead>
<tr>
<th>U 315 simple field supply unit</th>
<th>Order No. 6RA2200-8DD00</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td><strong>Terminal</strong></td>
</tr>
<tr>
<td>Connection for power section</td>
<td></td>
</tr>
<tr>
<td>supply and electronics power</td>
<td>1</td>
</tr>
<tr>
<td>Supply phase L1</td>
<td>2</td>
</tr>
<tr>
<td>Supply phase L2 or N</td>
<td></td>
</tr>
<tr>
<td>Unit ground connection</td>
<td>5</td>
</tr>
<tr>
<td>Control voltage connection</td>
<td></td>
</tr>
<tr>
<td>for field weakening</td>
<td>6</td>
</tr>
<tr>
<td>Ground potential</td>
<td>7</td>
</tr>
<tr>
<td>(only field weakening possible)</td>
<td></td>
</tr>
<tr>
<td>Field current monitoring</td>
<td>9</td>
</tr>
<tr>
<td>(floating)</td>
<td>10</td>
</tr>
<tr>
<td>Field winding connection</td>
<td>11</td>
</tr>
<tr>
<td>• Connection C2(+)</td>
<td></td>
</tr>
<tr>
<td>• Connection D2(+)</td>
<td>12</td>
</tr>
<tr>
<td>Adaptation to rated</td>
<td>14</td>
</tr>
<tr>
<td>supply voltages of</td>
<td>15</td>
</tr>
<tr>
<td>2-ph. 400 V or 2-ph. AC 230 V</td>
<td>16</td>
</tr>
<tr>
<td>(external jumpers)</td>
<td></td>
</tr>
</tbody>
</table>

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.
**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.

**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: 2-ph. 50/60 Hz, 230/400 V
  - Permissible tolerance: +10%/-15%
  - Current consumption: 50 mA

- **Voltage transformer:**
  - 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) Continuous
- **10 V input:** 12 V
- **225 V input:** 270 V
- **450 V input:** 540 V
- **600 V input:** 720 V
- **Setpoint output:**
  - 0 to +10 V (terminal 25): 5 mA
  - 0 to -10 V (terminal 26): 5 mA

---

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

- 3/2 U 307 digital motorized potentiometer
- 3/4 U 308 A frequency-voltage converter
- 3/5 U 309 adaptor module 4 to 20 mA for the U 307 digital motorized potentiometer
- 3/6 U 312 voltage converter
- 3/7 U 313 current-voltage / voltage-current converter
- 3/8 External power supply for Z 7.. supplementary boards
**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.

**Technical data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design, mounting</td>
<td>Terminal housing for mounting on standard 35 mm DIN rail</td>
</tr>
<tr>
<td>Dimensions</td>
<td>H x W x D = 75 mm x 99.7 mm x 110 mm (see page 4/4)</td>
</tr>
<tr>
<td>Rated supply voltage</td>
<td>2-ph. 50/60 Hz 230 V +10%/-15% Current consumption 50 mA</td>
</tr>
<tr>
<td>Power supply</td>
<td>SIMATIC-compatible 24 V signal LOW = 0 to 4.0 V HIGH = 13 to 35 V</td>
</tr>
<tr>
<td>Resolution (step change)</td>
<td>2.5 mV</td>
</tr>
<tr>
<td>of the output voltage</td>
<td></td>
</tr>
<tr>
<td>Nonvolatile memory</td>
<td>NOVRAM* = nonvolatile random access memory</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0 to +45 °C</td>
</tr>
</tbody>
</table>

* NOVRAM = Nonvolatile random access memory

**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.

---

**Fig. 3/1**

3/2

Siemens DA 212 · 2001
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.

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 of the DC output voltage 0 to 100 kHz (Freq. in)
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.

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).
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+ was taken into account for the design rating of the resistors.

Technical data

- Dimensions: H x W x D = 75 mm x 22.5 mm x 100 mm
- Weight: approx. 0.15 kg
- Max. zero point error when supplied (without fine adjustment) at IFN = 4 mA: OUT+ = OUT- = 0 V ± 12 mV
- Max. gain error at IFN = 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.
**Supplementary Units for Drives**

**U 312 voltage converter**

**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.

**Technical data**

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Rated supply voltage 2-ph.</th>
<th>50/60 Hz 230/400 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible tolerance</td>
<td>+10% to -15%</td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>≤ 10 mA</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input</th>
<th>Rated input voltage</th>
<th>10 V (terminals 9, 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>225 V (terminals 8, 10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>450 V (terminals 7, 10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>600 V (terminals 6, 10)</td>
<td></td>
</tr>
</tbody>
</table>

| Rated input current | ≤ 7 mA |
| Max. overdrive capability 1) | 1.1 · U_IN |
| 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_pe V | ≤ 0.5% |

| 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.

---

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 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).

**Technical data**

<table>
<thead>
<tr>
<th>Design, mounting</th>
<th>Terminal housing for mounting on 35 mm standard rail to DIN 46 227 and DIN EN 50 022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminals</td>
<td>Screw terminals, max. conductor cross-section 2.5 mm²</td>
</tr>
<tr>
<td>Dimensions</td>
<td>H x W x D = 75 mm x 22.5 mm x 100 mm</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>+24 V (+20 to +30 V) external</td>
</tr>
<tr>
<td>Current consumption</td>
<td>45 mA max. (if both branches are in operation)</td>
</tr>
<tr>
<td>Storage and transportation temperature</td>
<td>-50 to +85 ° C</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0 to +45 ° C</td>
</tr>
<tr>
<td>Humidity rating</td>
<td>F</td>
</tr>
</tbody>
</table>

**Circuit branch: current-voltage conversion**

- Input resistance: 167.3 Ω (209.3 Ω 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% 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 (±90 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.
Application

The 6RA8222-1WB0 unit acts as the power supply and mechanical support for Z7 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 Z7 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 Z7 supplementary board. It does not support boards which require floating AC voltages. The Z7 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 board. 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

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

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

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<th>Page</th>
<th>Section</th>
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<td>4/3</td>
<td>Installation of drives with EMC (installation notes)</td>
</tr>
<tr>
<td>4/5</td>
<td>Components</td>
</tr>
<tr>
<td>4/8</td>
<td>Data on supply harmonics of converters in fully controlled, three-phase bridge circuit B6C and (B6)A(B6)C</td>
</tr>
</tbody>
</table>
**Fundamentals of EMC**

**What is EMC?**

EMC stands for “electromagnetic compatibility”; 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 61 500-3, 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 controllers 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.
**Planning Guide**

**Installation notes for drives with Electromagnetic Compatibility (EMC)**

**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 as 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 of 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 mm² 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.
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/eradicated 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

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.

Fig. 4/2
Shielding with routing into the cabinet

Fig. 4/3
Shielding in the cabinet
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.

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.

The commutating reactor is designed for the rated motor current in the field.

The filter is designed for the rated motor current in the field.

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.

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.

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.

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.

The commutating reactor is designed for the rated motor current in the field.

The filter is designed for the rated motor current in the field.
### Planning Guide

#### Components

## Line commutating reactors

A converter must always be connected to the supply via a commutating inductance. This must be at least 4 % $\Delta U_k$! 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 $P_d/S_k \leq 0.01$. Even in the case of a constant supply, the commutating reactor must have a $\Delta U_k$ 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 $\Delta U_k$ 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 %.

$I_{Ln} (60 \text{ Hz}) = 0.9 \cdot I_{Ln} (50 \text{ Hz})$

At the same time, the voltage drop $\Delta U$ increases by 8 %.

For further details, see Catalog PD 30.

### Single-phase commutating reactors

$I_{Ln} = I_{Lmax} \text{ with inductive load}$

<table>
<thead>
<tr>
<th>$I_{Ln}$</th>
<th>$I_{Lmax}$</th>
<th>$I_{L}\text{ with inductive load}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>8</td>
<td>9.8</td>
</tr>
<tr>
<td>10</td>
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<td>12.3</td>
</tr>
<tr>
<td>11.2</td>
<td>11.2</td>
<td>13.7</td>
</tr>
<tr>
<td>12.5</td>
<td>12.5</td>
<td>15.3</td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>17.2</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>16.4</td>
</tr>
<tr>
<td>18</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>24.5</td>
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<tr>
<td>22.4</td>
<td>22.4</td>
<td>27.4</td>
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<tr>
<td>24</td>
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<td>29.4</td>
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<tr>
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<td>34</td>
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<td>31.5</td>
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<tr>
<td>35.5</td>
<td>35.5</td>
<td>43</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
<td>49</td>
</tr>
</tbody>
</table>

### Three-phase commutating reactors

$I_{Ln} = 0.8 \cdot I_{Lmax} \text{ with inductive load, 3-ph. AC 50 Hz}$

<table>
<thead>
<tr>
<th>$I_{Ln}$</th>
<th>$I_{Lmax}$</th>
<th>$I_{L} \text{ with inductive load}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>20</td>
<td>19.6</td>
</tr>
<tr>
<td>18</td>
<td>22.4</td>
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<tr>
<td>22.4</td>
<td>28</td>
<td>27.4</td>
</tr>
<tr>
<td>25</td>
<td>31.5</td>
<td>31</td>
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<tr>
<td>29</td>
<td>35.5</td>
<td>34</td>
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<tr>
<td>31.5</td>
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<td>39</td>
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<td>35.5</td>
<td>45</td>
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<td>250</td>
<td>315</td>
<td>306</td>
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<td>280</td>
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<td>343</td>
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<td>315</td>
<td>400</td>
<td>386</td>
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<td>355</td>
<td>450</td>
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<td>560</td>
<td>561</td>
</tr>
<tr>
<td>500</td>
<td>630</td>
<td>613</td>
</tr>
<tr>
<td>560</td>
<td>710</td>
<td>686</td>
</tr>
</tbody>
</table>

1) With series-connected 6-pulse bridge circuit
Radio interference suppression filters

SIMOREG applications comply with the EMC product standard EN 61800-3 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 mm² 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

<table>
<thead>
<tr>
<th>Rated current A</th>
<th>Radio interference suppression filters Type</th>
<th>Terminal cross-section mm²</th>
<th>Weight approx. kg</th>
<th>Dimensions H x W x D mm x mm x mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>BB1413-G8-R11*</td>
<td>4 mm²</td>
<td>1.3</td>
<td>80 x 230 x 50</td>
</tr>
<tr>
<td>20</td>
<td>BB1413-G20-R11*</td>
<td>4 mm²</td>
<td>1.3</td>
<td>80 x 230 x 50</td>
</tr>
<tr>
<td>36</td>
<td>BB1413-G36-R11*</td>
<td>6 mm²</td>
<td>2.8</td>
<td>150 x 280 x 60</td>
</tr>
<tr>
<td>50</td>
<td>BB1413-G50-R11*</td>
<td>16 mm²</td>
<td>3.3</td>
<td>150 x 330 x 80</td>
</tr>
<tr>
<td>66</td>
<td>BB1413-G66-R11*</td>
<td>25 mm²</td>
<td>4.4</td>
<td>150 x 330 x 80</td>
</tr>
<tr>
<td>90</td>
<td>BB1413-G90-R11*</td>
<td>25 mm²</td>
<td>4.9</td>
<td>150 x 330 x 80</td>
</tr>
<tr>
<td>120</td>
<td>BB1413-G120-R11**</td>
<td>50 mm²</td>
<td>7.5</td>
<td>200 x 380 x 90</td>
</tr>
<tr>
<td>150</td>
<td>BB1413-G150-R11**</td>
<td>50 mm²</td>
<td>8.0</td>
<td>200 x 380 x 90</td>
</tr>
<tr>
<td>220</td>
<td>BB1413-G220-R11**</td>
<td>95 mm²</td>
<td>11.5</td>
<td>220 x 430 x 110</td>
</tr>
<tr>
<td>150</td>
<td>BB1413-B150-S**</td>
<td>M10</td>
<td>13</td>
<td>140 x 310 x 170</td>
</tr>
<tr>
<td>180</td>
<td>BB1413-B180-S**</td>
<td>M10</td>
<td>13</td>
<td>140 x 310 x 170</td>
</tr>
<tr>
<td>250</td>
<td>BB1413-B250-S**</td>
<td>M10</td>
<td>15</td>
<td>115 x 360 x 190</td>
</tr>
<tr>
<td>320</td>
<td>BB1413-B320-S**</td>
<td>M10</td>
<td>21</td>
<td>115 x 360 x 260</td>
</tr>
<tr>
<td>400</td>
<td>BB1413-B400-S**</td>
<td>M10</td>
<td>21</td>
<td>115 x 360 x 260</td>
</tr>
<tr>
<td>600</td>
<td>BB1413-B600-S**</td>
<td>M10</td>
<td>22</td>
<td>115 x 410 x 260</td>
</tr>
</tbody>
</table>

List of suggested RI suppression filters from Siemens

<table>
<thead>
<tr>
<th>Rated current A</th>
<th>Radio interference suppression filters Type</th>
<th>Terminal cross-section mm²</th>
<th>Ground bolt M</th>
<th>Weight approx. kg</th>
<th>Dimensions H x W x D mm x mm x mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>6SE7021-0ES87-0FB1</td>
<td>4</td>
<td>M6</td>
<td>2.5</td>
<td>215 x 90 x 81</td>
</tr>
<tr>
<td>18</td>
<td>6SE7021-0ES87-0FB1</td>
<td>4</td>
<td>M6</td>
<td>2.5</td>
<td>215 x 90 x 81</td>
</tr>
<tr>
<td>36</td>
<td>6SE7022-0ES87-0FB1</td>
<td>16</td>
<td>M6</td>
<td>4</td>
<td>231 x 101 x 86</td>
</tr>
<tr>
<td>80</td>
<td>6SE7027-0ES87-0FB1</td>
<td>50</td>
<td>M10</td>
<td>9</td>
<td>308 x 141 x 141</td>
</tr>
<tr>
<td>120</td>
<td>6SE7031-0ES87-0FA1</td>
<td>50</td>
<td>M10</td>
<td>10</td>
<td>348 x 171 x 141</td>
</tr>
<tr>
<td>180</td>
<td>6SE7031-0ES87-0FA0</td>
<td>96</td>
<td>M10</td>
<td>10</td>
<td>404 x 171 x 141</td>
</tr>
<tr>
<td>320</td>
<td>6SE7033-0ES87-0FA1</td>
<td>Terminal link</td>
<td>M10 x 30</td>
<td>21</td>
<td>300 x 260 x 116</td>
</tr>
<tr>
<td>600</td>
<td>6SE7036-0ES87-0FA1</td>
<td>Terminal link</td>
<td>M10 x 30</td>
<td>22</td>
<td>350 x 260 x 116</td>
</tr>
</tbody>
</table>

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
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 ($\alpha = 20^\circ$ and $\alpha = 60^\circ$).

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 formulæ with which, depending on the operating data in the specific case, supply voltage (no-load voltage $U_{0}$), 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 formulæ 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) $\alpha = 20^\circ$

**Fundamental factor $g = 0.962$**

<table>
<thead>
<tr>
<th>$r$</th>
<th>$\lambda / I_{1}$</th>
<th>$r$</th>
<th>$\lambda / I_{1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.235</td>
<td>9</td>
<td>0.018</td>
</tr>
<tr>
<td>7</td>
<td>0.100</td>
<td>11</td>
<td>0.056</td>
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<td>13</td>
<td>0.083</td>
<td>17</td>
<td>0.046</td>
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<td>19</td>
<td>0.036</td>
<td>23</td>
<td>0.029</td>
</tr>
<tr>
<td>25</td>
<td>0.024</td>
<td>29</td>
<td>0.026</td>
</tr>
</tbody>
</table>

### b) $\alpha = 60^\circ$

**Fundamental factor $g = 0.953$**

<table>
<thead>
<tr>
<th>$r$</th>
<th>$\lambda / I_{1}$</th>
<th>$r$</th>
<th>$\lambda / I_{1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.283</td>
<td>9</td>
<td>0.018</td>
</tr>
<tr>
<td>7</td>
<td>0.060</td>
<td>11</td>
<td>0.009</td>
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<td>13</td>
<td>0.064</td>
<td>17</td>
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<td>19</td>
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</tr>
<tr>
<td>25</td>
<td>0.022</td>
<td>29</td>
<td>0.026</td>
</tr>
</tbody>
</table>

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 $I_{d}$ is DC of the examined operating point and $g$ is 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:

$$S_{K} = \frac{U_{0}^{2}}{X_{N}} \text{ (VA)}$$

where

$$X_{N} = X_{e} - X_{f} = 0.03536 \times \frac{U_{0}}{I_{d}} - 2 \pi f_{N} \times L_{D} \text{ (H)}$$

and

- $U_{0}$ 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

This results 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 $I_{h}$ (where $I_{1} = g \times 0.817 \times I_{d}$ for delay angle $\alpha = 20^\circ$ and $\alpha = 60^\circ$) 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

<table>
<thead>
<tr>
<th>A/2</th>
<th>Environment, resources and recycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/3</td>
<td>Certificates</td>
</tr>
<tr>
<td>A/4</td>
<td>Siemens companies and representatives inside Europe</td>
</tr>
<tr>
<td>A/5</td>
<td>Siemens companies and representatives outside Europe</td>
</tr>
<tr>
<td>A/7</td>
<td>Information and ordering on the Internet and on CD-ROM</td>
</tr>
<tr>
<td>A/8</td>
<td>Customer support</td>
</tr>
<tr>
<td>A/10</td>
<td>Conditions of sale and delivery, export regulations</td>
</tr>
</tbody>
</table>
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.
Appendix

Certificates

SIMOREG K Chassis Converters 6RA22

Annex 1 to Certificate Registration No.: 001794 QM

Siemens AG
Industrial Solutions and Services (ISS) Industrial Services (ISS IS)

Annex 2 to Certificate Registration No.: 001794 QM

Siemens AG
Industrial Solutions and Services (ISS) Industrial Services (ISS IS)
Appendix

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Eisenstadt
Graz
Innsbruck
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Klosterneuburg
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Villach

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Baku

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Representative of Siemens AG
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Herentals
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Cesson-Sevigné
Dijon
Hagueau
La Garenne-Colombes
La Suze-sur-Sarthe
Lesquin
Les Ulis
Lisses
Lormont
Marseille
Meudon
Metz
Montrouge
Molsheim
Nantes
Nice
Pantin
Paris La Défense
Reims
Saint-Denis
Saint-Quentin
Strasbourg
Toulouse

Georgia
Representative of Siemens AG
Tbilisi

Great Britain
Siemens plc
Bracknell
Beeston
Belfast
Billingham
Bristol
Camberley
Cheshill
Christchurch
Clevedon
Corby
Congleton
Crewe
Cumbernauld
East Kilbride
Fareham
Glasgow
Hemel Hempstead
Hounslow
Ilford
Isle of Wight
London
Luton
Manchester
Milton Keynes
Newcastle-upon-Tyne
Oldham
Oxford
Poole
Poynton
Runcorn
Salford
Sandbach
Sheffield
Slough
Southampton
Southend
Stansted
Stoke-on-Trent
Swansea
Telford
Wellingborough
Wembley

Greece
Siemens s. t.
Athen, Amaroussio
Athens
Thessaloniki
Vassiliki Evia

Hungary
Siemens Ft.
Budapest
Bicske
Cegléd
Szombathely

Iceland
Smith & Nordland HF
Reykjavik

Italy
Siemens S.p.A.
Milano
Bari
Bologna
Brescia
Cagliari
Casoria
Cassina de Pecchi
Fanglia
Firenze
Genova
Napoli
Padova
Palermo
Pescara
Roma
Torino
Verona

Latvia
Siemens WA
Riga

Lithuania
Dutrutovs LITRA
Vilnius
Klaipeda

Luxembourg
Siemens S. A.
Luxembourg-Hamm

Macedonia
SITAI d.o.o.
Skopje

Malta

Netherlands
Siemens N.V.

Norway
Siemens A/S

Poland
Siemens Sp.z.o.o.

Portugal
Siemens S.A.

Russia
Siemens GmbH Moskau
Moscow
Barnaul
Jakutsk
Yakutsk
Irkutsk
Yaroslavl
Khabarovsk
Kaluga
Krasnodar
Novosibirsk
Perm
St. Petersburg
Tbilisi
Tiflis
Tomsk
Ufa
Vladivostok

Slovak Republic
Siemens s.r.o.
Bratislava
Dolny Kubin
Horná Streda
Michalovce
Nitra
Nové Zámky
Trnava

Slovenia
Siemens d.o.o.
Ljubljana
Maribor

Spain
Siemens S. A.

Sweden
Siemens AB

Switzerland
Siemens Schweiz AG

Turkey

Ukraine
Representative of Siemens AG
Kiev
Charkiv
Odessa
Wishgorod

Yugoslavia
Siemens d.o.o.
Beograd
A

SIMOREG K Chassis Converters 6RA22

Appendix

Siemens companies and representatives outside Europe

Africa
Algeria
Siemens Bureau d’Alger
Hydra

Angola
Escritório de Representação da Siemens em Angola
Luanda

Botswana
Siemens (Pty) Ltd.
Gaborone

Congo
Sofamate S. P. R. L.
Kinshasa

Côte d’Ivoire
Siemens AG
S. A. R. L.
Abidjan

Egypt
Siemens Limited
Cairo-Mohandessin
Simouh Alexandria
Contech
Cairo-Zamalek

Ethiopia
Siemens (Pty) Ltd.
Addis Abeba

Ghana
Impromex ACCRA
Accra

Guinea
Andre & Co. S. A.
Lausanne

Kenya
Siemens Communications Ltd.
Nairobi

Lesotho
Range Telecommunication Systems (Pty) Ltd.
Maseru

Libya
Siemens A. G. Branch Libya
Tripoli

Malawi
Ecologic Ltd.
Blantyre

Mauritius
Iland Blyth Ltd
Port Louis

Morocco
SETEL
Sociétè Électrotechnique et de Télécommunication S. A.
Casablanca

Mosambique
Siemens Limitada
Maputo

Namibia
Siemens (Pty) Ltd.
Windhoek

Nigeria
Siemens Limited
Lagos
Abuja
Kaduna

Republic of South Africa
Siemens Ltd.
Halfway House
Centurion
Isando
Pretoria
Springs
Woodmead

Sudan
National Electrical
Commercial Co.
Khartoum

Swaziland
Siemens (Pty) Ltd.
Matsapha

Tanzania
Tanzania Electrical Services Ltd.
Dar-es-Salaam

Tunisia
Siemens Bureau de Liaison
Tunis

Zambia
Siemens (Pty) Ltd.
Kitwe
Lusaka

Zimbabwe
Siemens (Pty) Ltd.
Harare
Alexandra Park

America
Argentina
Siemens S. A.
Buenos Aires
San Martin
Bahía Blanca
Córdoba
Las Heras
Mar del Plata
Rosario
Boulogne sur Mer

Bolivia
Sociedad Comercial e Industrial Hansa Ltda.
La Paz

Brazil
Siemens Ltda.
Sao Paulo
Belo Horizonte
Brasilia
Campinas
Curitiba
Florianopolis
Fortaleza
Fravelas
Jaboatao dos Guararapes
Jundiai
Manso
Porto Alegre
Riberao Preto
Rio de Janeiro
Salto
Salvador
S. Bernado do Campo
Vila Sao Jose

Canada
Siemens Canada Limited
Mississauga
Ajax
Brampton
Burnaby
Calgary
Cambridge
Clantham
Dartmouth
Drummondville
Edmonton
Kanata
London
Moncton
Montreal
Mount Pearl
Ottawa
Pointe Claire
Sackatoon
Sherbrooke
Tilbury
Vancour
Windsor
Winnipeg

Chile
Siemens S. A.
Santiago de Chile

Colombia
Siemens S. A.
Santafé de Bogotá
Barraquilla
Cali-Occidente
Medellín

Costa Rica
Siemens S. A.
San José

Cuba
EU.MEDA
Representación Consultiva de Siemens Electromédica
Ciudad de la Habana

Curaçao
SANTAMONTO N. V.
Willemstad

Dominican Republic
Electromédica S. A.
Santo Domingo

Ecuador
Siemens S. A.
Quito
Guayaquil

El Salvador
Siemens S. A.
San Salvador

Guatemala
Siemens S. A.
Ciudad de Guatemala

Honduras
Representaciones Electrotécnicas S. de R.L.
San Pedro Sula
Tegucigalpa

Jamaica
Medtron Ltd.
Kingston

Martinique
Pôle Medical
Fort-de-France

Mexico
Siemens S. A de CV
México, D. F.
Aguascalientes
Apopala
Chihuahua
Cd. Juarez
Culiacán
Gómez Palacio
Hermosillo
León
Merida
Puebla
San Juan Cuautlancingo
Tijuana
Tlajomulco de Zuniga
Vera cruz
Villa Corregidora

Nicaragua
Siemens S. A.
Managua

Panama
Siemens S. A.
Panama

Paraguay
Reader & Cia. S. A. C. I.
Asunción

Peru
Siemens S. A.
Lima

Trinidad and Tobago
Biomedical Technologies Ltd.
St. Augustine

United States of America
Siemens Corporation
New York
Allentown
Alpharetta
Arlington
Atlanta
Auburn Hills
Boca Raton
Bridgewater
Brooklyn Park
Camarillo
Charlotte
Columbus
Concord
Cupertino
Denver
Duluth
Fountain Inn
Gainville
Hickory
Hoffman Estates
issaquah
Iselin
Johnson City
Lake Oswego
Lima
Milwaukee
Newport News
Norcross
Oklahoma City
Palo Alto
Piscataway
Princeton
Richmond
Sacramento
Santa Clara
Santa Fe Springs
San Jose
Sunnyvale
Towaco
Washington
Wendell

Uruguay
Conatel S. A.
Montevideo

Venezuela
Siemens S. A.
Caracas
Barcelona
Maracalbo
Porto Ordaz
Valencia
### SIMOREG K Chassis Converters 6RA22

#### Appendix

**SIMOREG K Chassis Converters 6RA22**

### Siemens companies and representatives outside Europe

#### Asia

- **Bahrain**
  - Siemens AG Service Center Transitec Gulf Manama
- **Bangladesh**
  - Siemens Bangladesh Ltd. Dhaka Khulna
- **Brunei**
  - AMX Technologies Sdn Bhd Negara Brunei Darussalam
- **India**
  - Siemens Ltd. Ahmedabad Bangalore Calcutta Chandigarh Chennai Coimbatore Gurgaon Kolkata Mumbai Nashik Navi Mumbai New Delhi Pune Secunderabad Vadodara
- **Indonesia**
  - Siemens Ltd. Jakarta Batam Cilegon Surabaya
- **Iraq**
  - Siemens AG Baghdad
- **Iran**
  - Siemens S.S.K. Teheran
- **Israel**
  - Siemens Ltd. Tel Aviv Holon Herzelya Ramat Hakkialyal

#### Japan

- Siemens K. K.
  - Tokyo Kobe Fukuoka Hiroshima Ishikawa Kanagawa Nagoya Osaka Sapporo Sendai Yokohama

#### Jordan

- Siemens AG Jordan Branch Amman

#### Kazakhstan

- Representative of Siemens AG Almaty

#### Kirghizstan

- Representative of Siemens AG Bishkek

#### Korea (Republic)

- Siemens Ltd.
  - Seoul Changwon Kyungki-Do

#### Kuwait

- National & German Electrical and Electronic Services Co. (NGEECD)

#### Lebanon

- Siemens AG Lebanon Branch Beyrouth

#### Malaysia

  - Petaling Jaya Kuala Lumpur Kajang

#### Myanmar

- Siemens Ltd.
  - Yangon

#### Nepal

- Amaya Enterprises (Pvt.) Ltd. Kathmandu

#### Oman

- Siemens AG Muscat Branch Muscat

#### Pakistan

- Siemens Pakistan Engineering Co. Ltd.
  - Karachi Faisalabad Islamabad Lahore Peshawar Gujrat

#### People’s Republic of China

- Siemens Ltd., China
  - Beijing Changchun Chengdu Chongqing Chuzhou Dalian Fujing Fuzhou Guangzhou Hangzhou Jinlin Jinan Nanhai Nanjing Panyu Pishan Shanghai Shenyang Shenzhen Suzhou Tianjin Wuhan Wuxi Xi’an Xiang’an City Zibo

#### Philippines

- Siemens Inc.
  - Makati City Pasig City Cebu Davao City

#### Qatar

- Arabian Construction Engineering Company Doha

#### Saudi Arabia

- Arabi Electric Ltd. (Equipment) Jeddah Al Khobar Riyadh

#### Singapore

- Siemens Advanced Engineering (Pte.) Ltd.

#### Sri Lanka

- Dimo Limited Colombo

#### Syria

- Siemens AG Damascus Branch Damascus

#### Taiwan

- Siemens Ltd. Taipei Taichung Kaohsiung Taoyuan Hsien

#### Thailand

- Siemens Ltd. Bangkok Rayong

#### Turkmenistan

- Representative of Siemens AG Ashgabad

#### Uzbekistan

- Representative of Siemens AG Tashkent

#### United Arab Emirates

- Siemens Resident Engineers Dubai Abu Dhabi

#### Vietnam

- Siemens AG Representation Hanoi Ho Chi Minh City

#### Yemen

- Thoma Tractors & Engineering Co. Ltd. Sanad Aden

#### Australia

- Siemens Ltd.
  - Melbourne Adelaide Baywater Brisbane Gladstone Milton Pennant Hills Perth Silverwater St. Leonards Sydney

#### New Zealand

- Siemens NZ Limited Auckland Wellington

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*Siemens DA 21.2 · 2001*
**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 80,000 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 your 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

**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:

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

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)

Spare parts and repairs
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:
Tel.: +1 (0)800 241-4453
Fax: +1 (0)770 740-3505
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

<table>
<thead>
<tr>
<th>SIMATIC Card</th>
<th>Units</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200</td>
<td>6ES7 997-0AA00-0XA0</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>6ES7 997-0AB00-0XA0</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>6ES7 997-0AC00-0XA0</td>
</tr>
</tbody>
</table>

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

Tel.: +49 (0)911 895 7777
Fax: +49 (0)911 895 7001
Appendix

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.

We reserve the right to make changes, in particular to the specified values, dimensions and weights, unless specified otherwise on the individual pages of this catalog/price list.

Export regulations
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.

For the products listed in this catalog/price list, the following export regulations must be adhered to in accordance with currently valid regulations.

<table>
<thead>
<tr>
<th>AL</th>
<th>Number of the German export list</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Products with a code other than “N” must be approved for export.</td>
</tr>
<tr>
<td></td>
<td>The export codes of the respective data medium must also be adhered to for software products.</td>
</tr>
<tr>
<td></td>
<td>Goods labeled with “AL not equal to N” are subject to European or German export authorization when being exported out of the EU.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECCN</th>
<th>Number of US export list</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Export Control Classification Number)</td>
</tr>
<tr>
<td></td>
<td>Products with a code other than “N” require approval for re-export to certain countries.</td>
</tr>
<tr>
<td></td>
<td>The export codes of the respective data medium must also be adhered to for software products.</td>
</tr>
<tr>
<td></td>
<td>Goods labeled with “ECCN not equal to N” are subject to US reexport authorization.</td>
</tr>
</tbody>
</table>

Even without a label, or with label “AL: N” or “ECCN: N”, authorization may be required due to the final whereabouts and purpose for which the goods are to be used.

The AL and ECCN export codes specified in our confirmations, delivery notes and invoices apply.

Subject to change without prior notice.

Siemens AG
Automation & Drives Group
Large Drives Division
PO Box 4743, 90025 Nuremberg
Germany
http://www.siemens.de/automation/ld
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.

- **Automation and Drives**: Interactive catalogs on CD-ROM
  - Components for Automation & Drives
  - Installation Systems

- **Analysis Systems**: Gas Analysis Equipment
  - Components for Sample Preparation
  - Liquid Analysis

- **Drive Systems**: DC Motors
  - Siemens Chassis Converters
  - Siemens Static Converter Cabinets
  - Siemens Modular Converter Systems
  - Micromaster 420/440 Converters
  - Combimaster 411/Micromaster 411
  - Simovert A Current-Source DC Link Converters
  - Simovert MV Medium-Voltage Drives
  - Micromaster, Midimaster
  - Voltage-Source DC Link Converters
  - Simovert Masterdrive
  - Voltage-Source DC Link Converters
  - Simovert P Voltage-Source DC Link Converters
  - SiVolT AC and Three-Phase Power Controllers
  - Sitor Thyristor Assemblies
  - Sitor Units and Static Converter Cabinets
  - Chokes
  - Sitor Semiconductor Protection Fuses
  - Sitor Control Devices
  - Simadyn C Control System
  - Modulpac C Control System
  - Drive systems for Machine Tools Simodrive
  - AC Main Spindle Motors 1FE1, 1PH2, 1PH3, 1PH4
  - AC Servomotors 1FK6, 1FT5, 1FT6
  - Linear Motors 1FN1, 1FN3
  - Converter System Simodrive 611
  - Converter Systems Simodrive Posmo A/CD/CA/SI

- **Automation Systems for Machine Tools**: Complete Catalog Sinumerik & Simodrive
  - Cables, Connectors and System Components

- **SIMATIC Industrial Automation Systems**: SIMATIC S5/PC/505 Automation Systems
  - Simatic PCS Process Control System
  - Components for Totally Integrated Automation
  - Simatic PCS 7 Process Control System

- **Industrial Communication and Field Devices**: Industrial Communication and Field Devices

- **Installation Systems**: Characteristic Curves of LV Fuses
  - (see CD-ROM ET 01)
  - N System
  - STAB Wall-Mounting Distribution Boards
  - SIKUS Floor-Mounting Distribution Boards
  - SIpro Meter Cabinet Catalogs
  - Busbar System 8PU
  - DELTA Programs

- **Power Supplies & Components for Drives**

- **SITRAIN Information and Training**: Courses and Computer Based Training

- **SIMATIC HMI Human-Machine Interface Products and Systems**: SIMATIC HMI Human-Machine Interface Products and Systems

- **Systems Engineering**: Power Supplies SITOP power
  - System Cables SIMATIC TOP connect
  - MOBY identification systems
  - Industrial Microcomputers Siocomp
  - Industrial Microcomputers Sicomps
  - Printers and Monitors
  - Cabinet Packaging System for SIMATIC PCS 7

- **Controlgear, Switchgear and Systems**: Low-Voltage Controlgear, Switchgear and Systems
  - Communication-Capable Controlgear, Switchgear for Load Feeders, SiRiSUS 3P
  - SiRiSUS Safety Systems, Control and Signaling Devices, Switchgear for Power Distribution, Transformers and Power Supplies, Control Switches, Terminal Blocks
  - BERO - Sensors for Automation
  - Supplementary Catalog
  - Supplementary Range, Superseded Devices, Spare Parts
  - Products and Systems for Low-Voltage Power
  - SENTRON WL
  - Sicube System Cabinets 8MC and 8MF
  - Fans
  - Power Supplies & Components for Drives (Catalog)

- **TELEPERM M Process Control System**: AS 235, AS 235H and AS 235K Automation Systems
  - AS 388/TM and AS 488/TM Automation Systems
  - CS 275 Bus system

- **Process Engineering**: Field Instruments for Process Automation
  - Measuring Instruments for Pressure, Differential Pressure, Flow, Level and Temperature, Positioners and Liquid Meters
  - Siemens Weighing Systems
  - Analog Indicators and Limit-Value Monitors, Standard Flush-Mounting Instruments
  - Digital and Bargraph Indicators, Standard Flush-Mounting Instruments
  - Process Recorders and Accessories
  - Sipart, Controllers and Software

- **MASTERGUARD**: Uninterruptable Power Supplies

- **Vacuum Pumps/Compressors**: Oil-Free Vacuum Pumps, Compressors, Radial-Flow Fans

- **SIPOS Electrical Actuators**: Electrical Rotary, Linear and Part-Turn Actuators
  - Electrical Rotary Actuators for Nuclear Power Plants

- **System Solutions for Industry**: Combined Catalog: Applications and Products for Automation Solutions in the Plastics Industry
  - With SIMATIC S7
  - With SIMATIC S5