

SIEMENS

SIMODRIVE

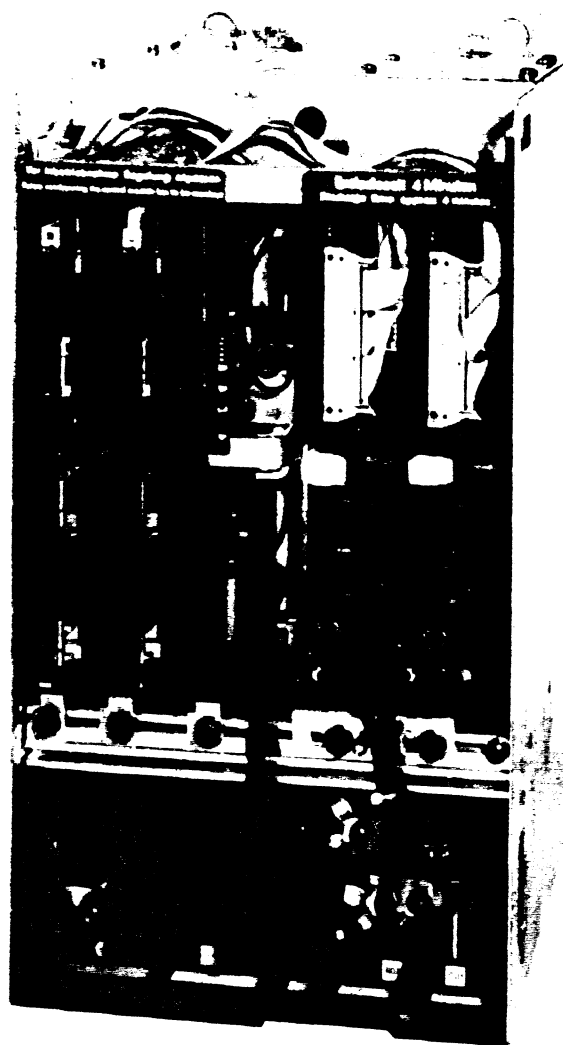
Transistor DC chopper for DC feed drives

6RB21..

Instructions

Order No.

GWE 462 112.9600.00 Ja-101



*Transistor DC chopper
6RB2101-2A-Z*

Order No. GWE 462 112.9600.00 Ja-101

SIMODRIVE® Documentation

Note

The present edition was preceded by the editions listed below. The sections changed as against the previous edition are indicated in the changes column.

<u>Edition</u>	<u>Order No.</u>	<u>Changes</u>
01870.5	GWE 462 112.9600.00 Ja-101	First edition

Notes:

The instructions only apply to units with controller modules

6RB2100-0NA01
6RB2100-0NA11
6RB2100-0NA21

In the operational state, protection against direct touching is afforded in a form to render the units suitable for installation in general operating areas (DIN VDE 0558, Part 1a, Section 5.4.3.2.4).

The modules of the unit include components endangered by electrostatic charges (ESD).

Contents

	Page
1 Description of the unit	5
1.1 Application	5
1.2 Mode of operation	5
1.3 Technical data	6
1.3.1 Ordering data	6
1.3.2 Power modules available	6
1.3.3 Options	7
1.3.4 Rated data	7
2 Installation	9
2.1 Installation of units	9
2.2 Connecting instructions	9
2.3 Terminals	11
3 Commissioning	12
3.1 Matching the control system	12
3.1.1 Matching to feed motors	12
3.1.1.1 Setting the current limit	12
3.1.1.2 Setting the speed-dependent current limit	13
3.1.1.3 Matching tables for 1HU motors	14
3.1.2 Current limitation set, drive against hard stop	21
3.1.3 Tacho-generator input	22
3.1.4 Speed controller adaptation	22
3.1.5 Electrical weight compensation	22
3.1.6 Current-controlled operation	22
3.1.7 External power supply for controller enabling	23
3.2 Signals	23
3.2.1 Ready/fault signals	23
3.2.2 I ² t signal	23
3.3 Test sockets, display elements	23
3.4 Start-up	24

	Page
4 Maintenance	26
4.1 Maintenance instructions	26
4.2 Faults	26
4.3 Spare parts	28
4.4 Cable connectors	29
5 Block diagram	30
6 Terminal connection diagram	31
7 Circuit diagram	33
8 Dimension drawing	36
9 Setting elements	37
Notes on electrostatic charges	38

1 Description of the unit

1.1 Application

Transistor DC choppers 6RB21.. are used in conjunction with DC servomotors e.g. of the 1HU series in the range up to approx. 90 Nm for driving the feed axes of machine tools. They operate in four-quadrant operation and satisfy highest demands on the dynamic control response.

Complete units for driving 1 to 6 feed axes with a maximum DC output voltage of 200 V are available.

1.2 Mode of operation

Transistor DC choppers control the speed of the drive by means of a pulse-width-modulated DC output voltage.

1.3 Technical data

1.3.1 Ordering data

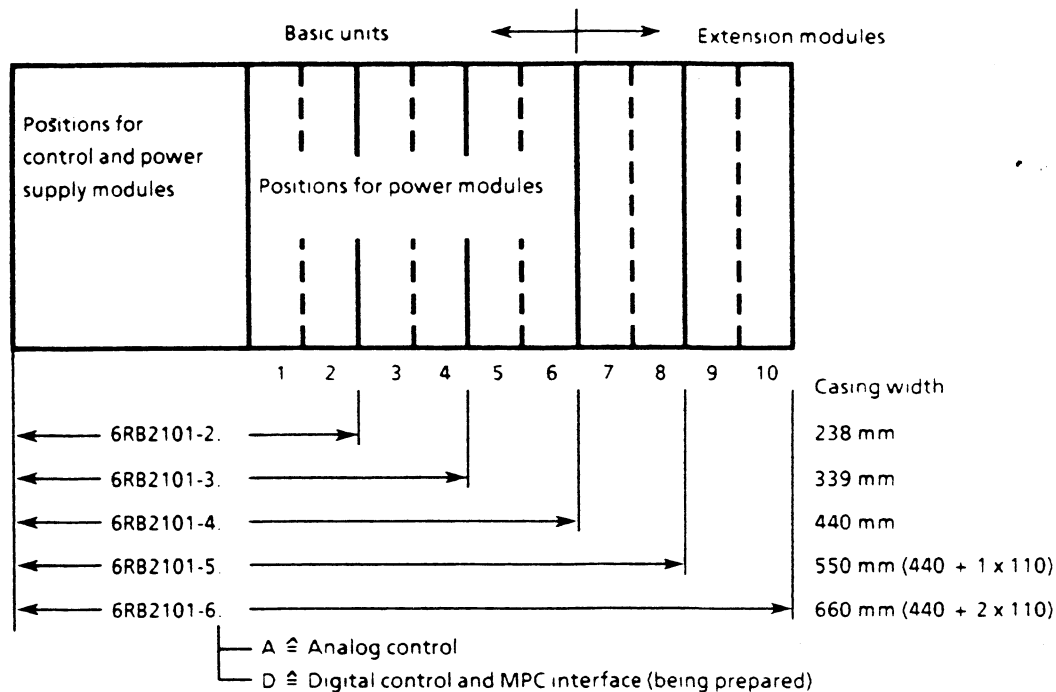


Fig. 1.1 Ordering data

1.3.2 Power modules available

Designation*)	Number of axes	Current I_N/I_{max}	Notes
A15, E15, H15, F15	1	5/15 A	1 axis on one module
A25, E25, H25, F25	2		2 axes on one module
A35, E35, H35, F35	3		3 axes on one module
A19, E19, H19, F19	1	10/30 A	1 axis on one module
A29, E29, H29, F29	2		2 axes on one module
A39, E39, H39, F39	3		3 axes on one module
A20, E20, H20, F20	1	20/60 A	1 module per axis
A30, E30, H30, F30	1	30/90 A	1 module per axis
A40, E40, H40, F40	1	40/120 A	1 module per axis
A60, E60, H60, F60	1	60/180 A	2 modules per axis
A90, E90, H90, F90	1	90/270 A	3 modules per axis

Table 1.1 Power modules available

*) A ≙ Installed H ≙ Design for main spindle operation (installed)
E ≙ Installation prepared F ≙ Prepared for main spindle operation

1.3.3 Options

- C10 Inrush current limitation
- G10 DC link voltage limitation 0.3/30 kW (continuous/short-time rating)
- G20 DC link voltage limitation 0.9/90 kW (continuous/short-time rating)

1.3.4 Rated data

Rated supply voltage	3-phase AC 50/60 Hz 165 V or 220 V DC *)
Rated output voltage	0 to ± 200 V DC
Short-time limit current	$3 \times I_N$ (200 ms)
Efficiency	approx. 95 %
Number of feed axes	1 to 6
Power loss P_V	$P_V \approx 0.05 \times P$
	$P \hat{=}$ Power supplied into a load in typical feed drive conditions
	$I_N \hat{=}$ Rated current
	*) With direct supply via P200 and M200

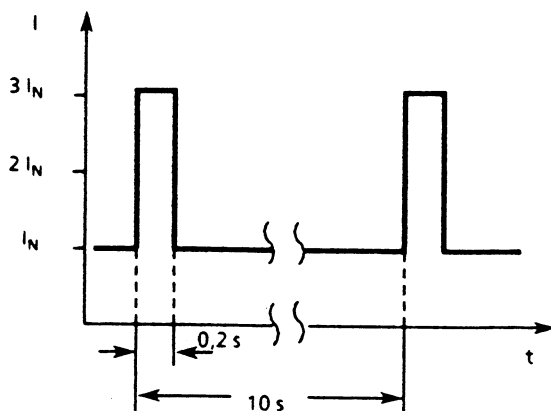


Fig. 1.2 Rated load cycle for power module

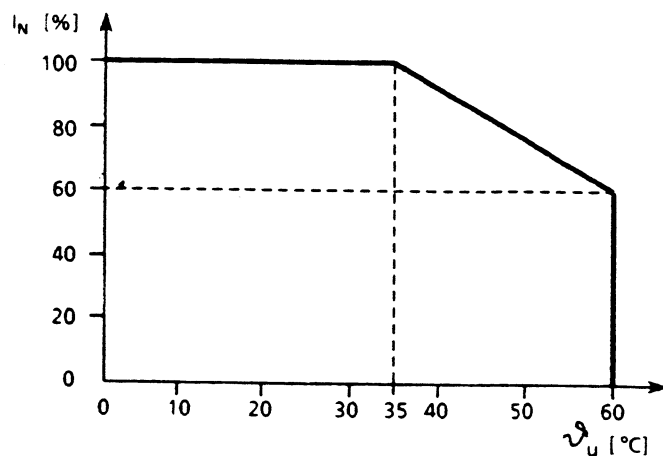


Fig. 1.3 Power reduction with raised inlet air temperature (ϑ_u)

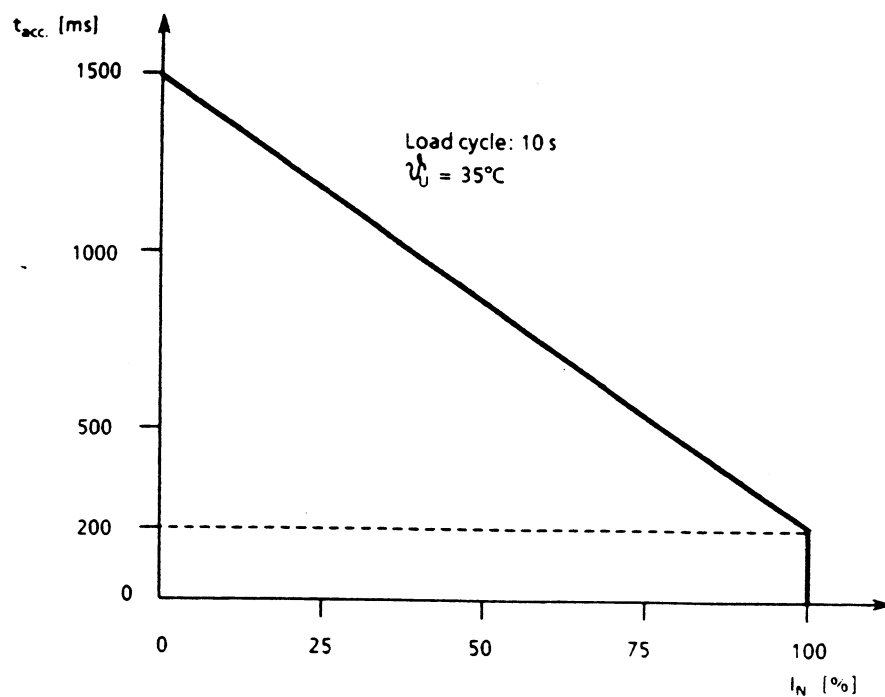


Fig. 1.4 Permissible acceleration time as a function of the steady state load

With reduced rated current I_N , the permissible time for the short-time limit current of $3 I_N$ may be extended to the time indicated in the diagram.

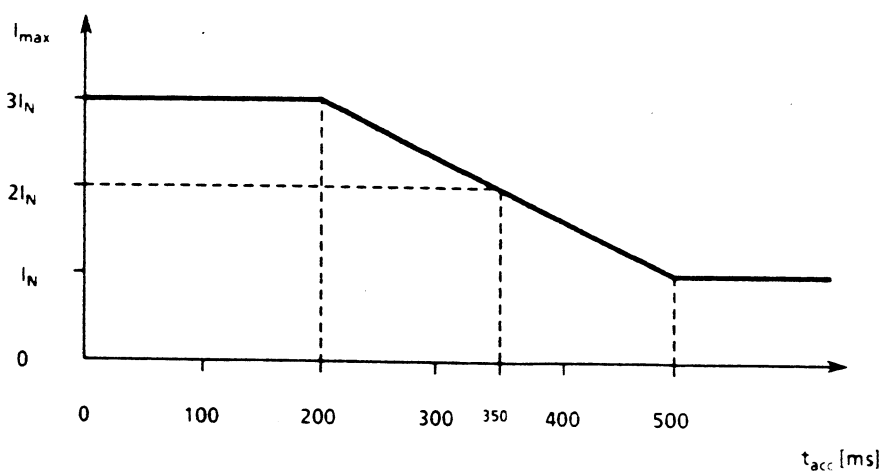


Fig. 1.5 Permissible maximum current as a function of the acceleration time

If necessary, the monitoring time of 200 ms may be extended by increasing the resistance values of R605, R646 and R656 on the control module (for 500 ms, the values of 470 kohms must be increased to 1.2 Mohms).

2 Installation

2.1 Installation of units

A minimum clearance of 100 mm must be available above and below the units to ensure unobstructed air supply.

The unit must be installed so as to be protected against conductive dust accumulations and vapours.

For mounting dimensions and location of the fixing points refer to the dimension drawings.

Note:

The front cover provides protection against contact with live parts according to DIN VDE 0106, Part 7.

2.2 Connecting instructions

The units are connected to the mains via an autotransformer or an isolating transformer. When an isolating transformer is used, M200 on the power module must be earthed. Depending on the transformer and unit size, an inrush current limiting circuit must be provided if necessary (option C10). All the units are available with inrush current limiting circuit.

	Rating of mains fuse	Line protection	Fuse characteristic
Operation without inrush current limitation	6-times transformer rated current	Not obtained	Time-lag
Operation with inrush current limitation	1.3-times transformer rated current	Obtained	Time-lag

Table 2.1

Connect the units in accordance with the connection plan and the circuit diagram supplied by the customer. The current limiting circuit, the tacho input and the current controller gain of the unit must be matched to the type of motor used. For details refer to 3.1 (matching the control system).

The reference and actual value cables must be shielded and installed separately from the power cables. The control cables for the controller enabling circuits must be installed separate from the contactor control cables.

The connection of electronic grounds between position controller and PWM drive should be kept as short as possible using minimum conductor cross-sections of 4 mm². Connect terminal + G0-X131 to the electronic ground of the NC.

Note:

Units supplied with inrush current limiting circuit (see rating plate) must only be operated together with this limiting circuit (see terminal diagram).

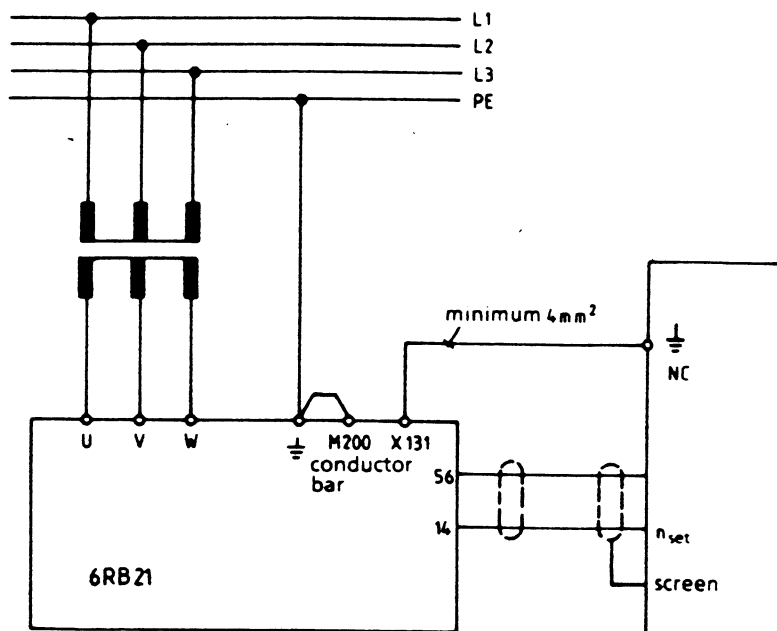


Fig. 2.1 Earthing connections when operated with isolating transformer

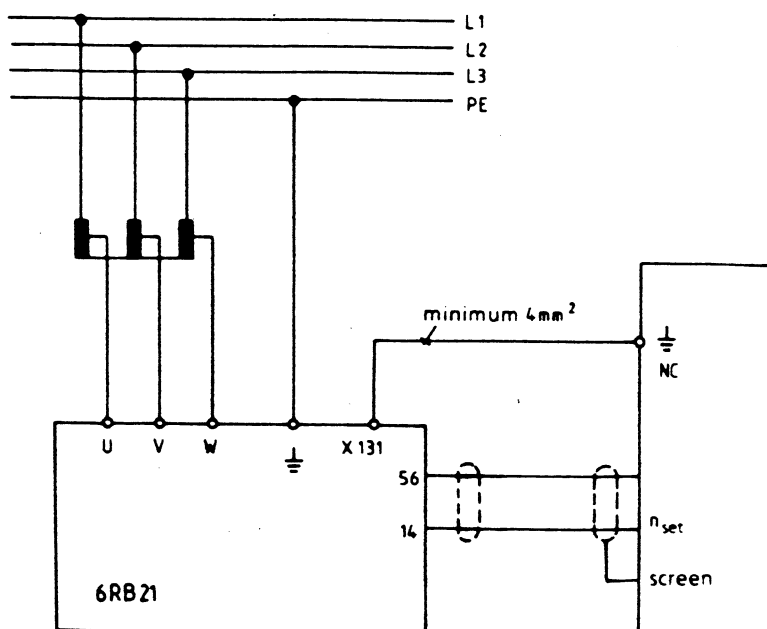


Fig. 2.2 Earthing connections when operated with autotransformer

2.3 Terminales

Terminal number	Location	Function	Type *)	Typical voltage	Maximum permissible cross-section
Power module					
U, V, W	-	Mains connection	E	3 AC 165 V	Connection M6 **)
	-	PE conductor	E	0 V	Connection M8 **)
M200-busbar	-	Only with isolating transformer Mass connection	E	0 V	Connection M6 **)
		Motor connections 5/15 A, 10/30 A 20/60 A, 30/90 A, 40/120 A 60/180 A, 90/270 A	A	DC 200 V	1.5 mm ² 16 mm ² 25 mm ²
Supply voltages					
7, 10	+ G0-X111	Auxiliary voltage (18-30 V)	A	± 24 V/50 mA max.	1.5 mm ²
45, 44	+ G0-X111	Electronics voltage	A	± 15 V/10 mA max.	1.5 mm ²
9, 19	+ G0-X121	Enabling voltage	E/A	+ 24 V/0 V	1.5 mm ²
11, 15	+ G0-X111	External auxiliary voltage	E	± 24 V, 1 A	1.5 mm ²
15	+ G0-X111 + G0-X131	Elec. ground } internally Ref. earth } connected	A E/A	0 V 0 V	1.5 mm ² Connection M6 **)
Electronic signals					
R	+ G0-X111	Fault latch reset	E	0 V	1.5 mm ²
56, 14	+ N ₀ -X1 ₀ 1	Speed setpoint I	E	± 10 V	1.5 mm ²
24, 8	+ N ₀ -X4 ₀ 1	Speed setpoint II	E	± 10 V	1.5 mm ²
6	+ N ₀ -X1 ₀ 1	Integrator inhibition	E	+ 15 V	1.5 mm ²
96	+ N ₀ -X1 ₀ 1	External current limit reduction	E	-15 V	1.5 mm ²
63	+ G0-X121	Pulse enabling	E	+ 12 to + 30 V	1.5 mm ²
64	+ G0-X121	Drive enabling	E	+ 12 to + 30 V	1.5 mm ²
65	+ N ₀ -X1 ₀ 1	Speed controller enabling	E	+ 12 to + 30 V	1.5 mm ²
16	+ N ₀ -X4 ₀ 1	Current actual value	A	± 10 V (R _i = 2 kΩ)	1.5 mm ²
58	+ N ₀ -X4 ₀ 1	current setpoint	E	± 10 V	1.5 mm ²
Tacho generator					
55.1 55.2 55.3 13	+ N ₀ -X1 ₀ 1	Speed actual value n _{act}	E E E E	± 20 V ± 40 V ± 60 V 0 V (no frame)	1.5 mm ² 1.5 mm ² 1.5 mm ² 1.5 mm ²
Messages					
5	+ G0-X111	I ² t »	A	0 V/50 mA	1.5 mm ²
74, 73.1 (NC) 72, 73.2 (NO)	+ G0-X121	Relais contact, signalling drive fault/ready	A	AC 250 V/5 A or DC 30 V/5 A	1.5 mm ²

Table 2.2

*) E ≙ Input, A ≙ Output

**) For cable lugs to DIN 46234

N₀ ≙ N1, N2 X1₀1 ≙ X111, X121, X131 X4₀1 ≙ X411, X421, X431

3 Commissioning

3.1 Matching the control system

3.1.1 Matching to feed motors

The data required for matching the transistor chopper to feed motors of the 1HU series are given in the matching tables for 1HU motors. Section 3.1.1.3.

3.1.1.1 Setting the current limit

The settings are made by the switches S1, S2, S3 on the adjustment module.

Switches S1, S2, S3 Contacts				Current limit I _{max} [A] Power modules						
2	3	4	5	6RB2105	6RB2110	6RB2120	6RB2130	6RB2140	6RB2160	6RB2190
o	o	o	o	15.0	30.0	60.0	90.0	120	180	270
x	o	o	o	12.8	25.5	51.0	76.5	102	153	230
o	x	o	o	10.2	20.4	41.0	61.2	82	122	184
x	x	o	o	9.2	18.3	36.6	54.9	73	110	165
o	o	x	o	7.5	15.0	30.0	45.0	60	90	135
x	o	x	o	6.9	13.8	27.6	41.4	55	83	124
o	x	x	o	6.2	12.3	24.6	36.9	49	74	111
x	x	x	o	5.9	11.7	23.4	35.1	47	70	105
o	o	o	x	5.4	10.8	21.6	32.4	43	65	97
x	o	o	x	5.1	10.2	20.4	30.6	41	61	92
o	x	o	x	4.5	9.0	18.0	27.0	36	54	81
x	x	o	x	4.4	8.7	17.4	26.1	35	52	78
o	o	x	x	3.9	7.8	15.6	23.4	31	47	70
x	o	x	x	3.8	7.5	15.0	22.5	30	45	68
o	x	x	x	3.6	7.2	14.4	21.6	29	43	65
x	x	x	x	3.5	6.9	13.8	20.7	28	41	62

Table 3.1

o ≙ Contact in normal position (OFF)

x ≙ Contacts in ON position

3.1.1.2 Setting the speed-dependent current limit

For 1HU motors see 3.1.1.3.

Characteristics 0 to 15 (Figs. 3.1 and 3.2) are set by switches S1, S2 and S3 on the adjustment module.

As shown in Table 3.1, the 100 % value of current I corresponds to the $I_{\max}$ current limit set and the 100 % value of the speed corresponds to the rated speed of the motor.

A minimum inductance ($L_{\text{motor}} + L_{\text{reactor}} \approx 1 \text{ mH}$) is required for motors with disc-type rotors because of the temperature rise. Speed-dependent current limitation is not required in this case but the following diodes must be removed: V48 (Axes 1 and 4), V82 (Axes 2 and 5) and V100 (Axes 3 and 6); or adjust characteristic 8 if necessary.

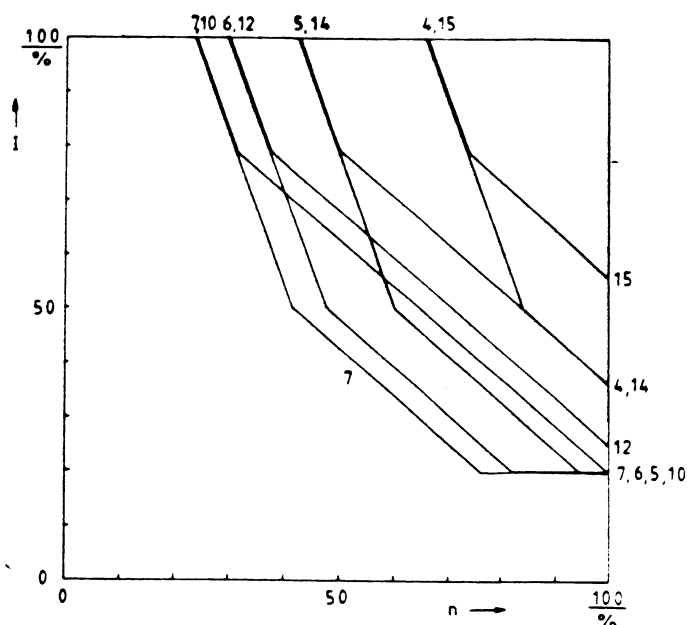


Fig. 3.1 Adjustable characteristics of speed-dependent current limitation

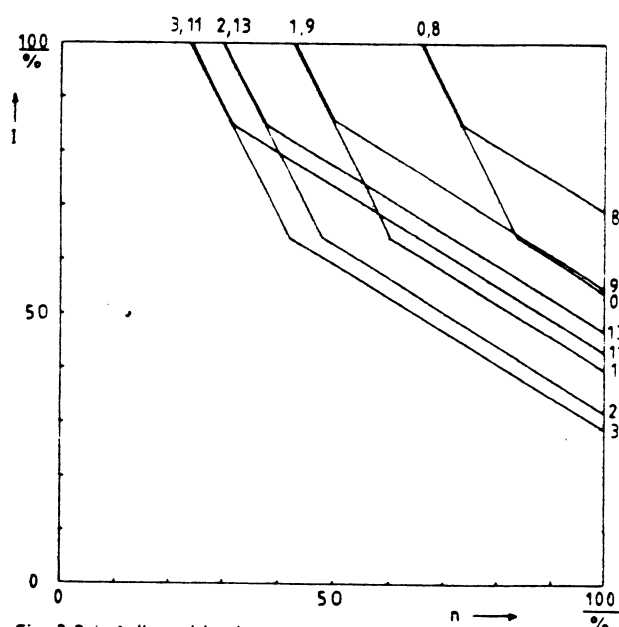


Fig. 3.2 Adjustable characteristics of speed-dependent current limitation

Characteristic number	Switch S1, S2, S3			
	Contacts			
	6	7	8	9
0	o	o	o	o
1	o	o	o	x
2	o	o	x	o
3	o	o	x	x
4	o	x	o	o
5	o	x	o	x
6	o	x	x	o
7	o	x	x	x
8	x	o	o	o
9	x	o	o	x
10	x	x	x	x
11	x	o	x	x
12	x	x	x	o
13	x	o	x	o
14	x	x	o	x
15	x	x	o	o

Table 3.2

o $\hat{=}$ Contacts in normal position (OFF)
x $\hat{=}$ Contacts in ON position

3.1.1.3 Matching tables for 1HU motors

Matching table for SIMODRIVE power modules **6RB2105-...** (5/15 A)

Settings by means of switches S1, S2 and S3 on the adjustment module.

Servomotor				Current limit					Speed-dependent current limit				
1HU	M ₀ [Nm]	I ₀ [A]	n _{rated} rev/min	Contacts				I _{max} [A]	Contacts				Terminal X1.1
				2	3	4	5		6	7	8	9	
3054-0AC01	2.2	3.3	2000	o	o	o	o	15.0	o	x	x	o	55.2
3054-0AF01	2.2	4.7	3000	o	o	o	o	15.0	x	x	o	x	55.3
3056-0AC01	4.5	6.7	2000	o	o	o	o	15.0	x	o	o	o	55.2
3056-0AF01	4.5	10.0	3000	o	o	o	o	15.0	x	o	o	o	55.3
3058-0AC01	6.0	8.8	2000	o	o	o	o	15.0	x	o	o	o	55.2
3058-0AF01	6.0	12.7	3000	o	o	o	o	15.0	x	o	o	o	55.3
3070-0AC01	3.2	4.5	2000	o	o	o	o	15.0	x	o	o	x	55.2
3070-0AF01	3.2	6.4	3000	o	o	o	o	15.0	x	o	o	o	55.3 *
3071-0AC01	5.0	7.1	2000	o	o	o	o	15.0	x	o	o	o	55.2
3071-0AF01	5.0	10.7	3000	o	o	o	o	15.0	x	o	o	o	55.3 *
3073-0AC01	7.0	10.0	2000	o	o	o	o	15.0	x	o	o	o	55.2 *
3073-0AF01	7.0	13.8	3000	o	o	o	o	15.0	x	o	o	o	55.3 *
3074-0AC01	7.0	9.7	2000	o	o	o	o	15.0	x	o	o	o	55.2 *
3074-0AF01	7.0	13.5	3000	o	o	o	o	15.0	x	o	o	o	55.3 *
3076-0AC01	10.0	12.5	2000	o	o	o	o	15.0	x	o	o	o	55.2 *
3100-0AC01	7.0	9.5	2000	o	o	o	o	15.0	x	o	o	o	55.2 *
3100-0AF01	7.0	14.2	3000	o	o	o	o	15.0	x	o	o	o	55.3 *
3101-0AC01	10.0	13.4	2000	o	o	o	o	15.0	x	o	o	o	55.2 *
3102-0AD01	18.0	15.0	1200	o	o	o	o	15.0	x	o	o	o	55.1 *
5040-0AC01	1.2	1.9	2000	o	o	x	o	7.5	x	x	o	x	55.2
5040-0AF01	1.2	2.8	3000	o	o	x	o	7.5	x	x	o	x	55.3
5042-0AC01	1.75	2.7	2000	o	x	o	o	10.2	x	x	o	x	55.2
5042-0AF01	1.75	4.0	3000	o	o	o	o	15.0	x	x	o	x	55.3
5044-0AC01	2.5	3.6	2000	x	o	o	o	12.8	o	o	o	x	55.2
5044-0AF01	2.5	5.3	3000	o	o	o	o	15.0	o	o	o	o	55.3

Table 3.3

o ≙ Contact in normal position (OFF)

x ≙ Contact in ON position

Contact S1.1, S2.1, S3.1: no function

Contact S1.10 or resistor R200: Contact S1.10 in ON position or R200 provided in the form of a jumper:
All three axes are operated in current loop

* The dynamic response can still be increased by removing diodes V48 (Axes 1 and 4), V82 (Axes 2 and 5) and V100 (Axes 3 and 6), the speed-dependent current limitation then becoming inoperative.

Matching table for SIMODRIVE power 6RB2110-... (10/30 A)
 Settings by means of switches S1, S2 and S3 on the adjustment module.

Servomotor				Current Limit					Speed-dependent current limit				
1HU	M ₀ [Nm]	I ₀ [A]	n _{rated} rev/min	Contacts				I _{max} [A]	Contacts				Terminal X1.1
				2	3	4	5		6	7	8	9	
3054-0AF01	2.2	4.7	3000	o	o	o	o	30.0	o	x	x	o	55.3
3056-0AC01	4.5	6.7	2000	o	o	o	o	30.0	o	o	x	o	55.2
3056-0AF01	4.5	10.0	3000	o	o	o	o	30.0	o	o	o	x	55.3
3058-0AC01	6.0	8.8	2000	o	o	o	o	30.0	o	o	o	x	55.2
3058-0AF01	6.0	12.7	3000	o	o	o	o	30.0	o	o	o	x	55.3
3070-0AC01	3.2	4.5	2000	o	x	o	o	20.4	x	o	x	x	55.2
3070-0AF01	3.2	6.4	3000	o	o	o	o	30.0	x	o	x	o	55.3
3071-0AC01	5.0	7.1	2000	o	o	o	o	30.0	o	o	x	x	55.2
3071-0AF01	5.0	10.7	3000	o	o	o	o	30.0	x	x	o	o	55.3
3073-0AC01	7.0	10.0	2000	o	o	o	o	30.0	x	x	o	o	55.2
3073-0AF01	7.0	13.8	3000	o	o	o	o	30.0	x	o	o	o	55.3
3074-0AC01	7.0	9.7	2000	o	o	o	o	30.0	x	o	o	o	55.2
3074-0AF01	7.0	13.5	3000	o	o	o	o	30.0	x	o	o	o	55.3 *
3076-0AC01	10.0	12.5	2000	o	o	o	o	30.0	x	o	o	o	55.2 *
3076-0AF01	10.0	20.0	3000	o	o	o	o	30.0	x	o	o	o	55.3 *
3078-0AC01	14.0	17.0	2000	o	o	o	o	30.0	x	o	o	o	55.2 *
3078-0AF01	14.0	25.0	3000	o	o	o	o	30.0	x	o	o	o	55.3 *
3100-0AC01	7.0	9.5	2000	o	o	o	o	30.0	x	x	o	x	55.2
3100-0AF01	7.0	14.2	3000	o	o	o	o	30.0	x	o	o	o	55.3
3101-0AC01	10.0	13.4	2000	o	o	o	o	30.0	x	x	o	o	55.2
3101-0AF01	10.0	20.5	3000	o	o	o	o	30.0	x	o	o	o	55.3
3102-0AD01	18.0	15.0	1200	o	o	o	o	30.0	x	o	o	o	55.1
3102-0AH01	18.0	24.0	2000	o	o	o	o	30.0	x	o	o	o	55.2 *
3102-0SD01	29.0	23.0	1200	o	o	o	o	30.0	x	o	o	o	55.1
3103-0AC01	12.5	15.7	2000	o	o	o	o	30.0	x	o	o	o	55.2
3103-0AF01	12.5	23.5	3000	o	o	o	o	30.0	x	o	o	o	55.3 *
3104-0AD01	25.0	19.5	1200	o	o	o	o	30.0	x	o	o	o	55.1 *
3104-0AH01	25.0	31.0	2000	o	o	o	o	30.0	x	o	o	o	55.2 *
3106-0AD01	32.0	24.0	1200	o	o	o	o	30.0	x	o	o	o	55.1 *
3108-0AD01	38.0	31.0	1200	o	o	o	o	30.0	x	o	o	o	55.1 *
3132-0AC01	47.0	31.0	1000	o	o	o	o	30.0	x	o	o	x	55.1
5042-0AF01	1.75	4.0	3000	o	o	x	o	15.0	x	x	o	x	55.3
5044-0AC01	2.5	3.6	2000	o	o	x	o	15.0	o	o	o	x	55.2
5044-0AF01	2.5	5.3	3000	o	o	o	o	30.0	o	o	o	x	55.3

Table 3.4

Explanations see Table 3.3

Matching table for SIMODRIVE power 6RB2120-... (20/60 A)
Settings by means of switches S1, S2 and S3 on the adjustment module.

Servomotor				Current limit					Speed-dependent current limit				
1HU	M ₀ [Nm]	I ₀ [A]	n _{rated} rev/min	Contacts				I _{max} [A]	Contacts				Terminal X1.1
				2	3	4	5		6	7	8	9	
3056-0AC01	4.5	6.7	2000	x	o	o	o	51.0	o	x	x	x	55.2
3056-0AF01	4.5	10.0	3000	x	o	o	o	51.0	o	x	x	x	55.3
3058-0AC01	6.0	8.8	2000	o	o	o	o	60.0	o	x	x	o	55.2
3058-0AF01	6.0	12.7	3000	x	x	o	o	36.6	o	o	x	x	55.3
3071-0AC01	5.0	7.1	2000	o	o	x	o	30.0	o	o	x	x	55.2
3071-0AF01	5.0	10.7	3000	x	o	o	o	51.0	o	o	x	x	55.3
3073-0AC01	7.0	10.0	2000	x	o	o	o	51.0	o	o	x	o	55.2
3073-0AF01	7.0	13.8	3000	o	o	o	o	60.0	o	o	x	o	55.3
3074-0AC01	7.0	9.7	2000	o	o	o	o	60.0	o	o	o	x	55.2
3074-0AF01	7.0	13.5	3000	o	o	o	o	60.0	o	o	o	x	55.3
3076-0AC01	10.0	12.5	2000	o	o	o	o	60.0	o	o	o	x	55.2
3076-0AF01	10.0	20.0	3000	o	o	o	o	60.0	o	o	o	x	55.3
3078-0AC01	14.0	17.0	2000	o	o	o	o	60.0	x	o	o	o	55.2
3078-0AF01	14.0	25.0	3000	o	o	o	o	60.0	x	o	o	x	55.3
3100-0AC01	7.0	9.5	2000	o	x	o	o	41.0	o	o	x	o	55.2
3100-0AF01	7.0	14.2	3000	o	o	o	o	60.0	o	o	x	o	55.3
3101-0AC01	10.0	13.4	2000	o	o	o	o	60.0	o	o	x	x	55.2
3101-0AF01	10.0	20.5	3000	o	o	o	o	60.0	x	o	o	x	55.3
3102-0AD01	18.0	15.0	1200	o	o	o	o	60.0	o	o	x	o	55.1
3102-0AH01	18.0	24.0	2000	o	o	o	o	60.0	x	x	o	o	55.2
3102-0SD01	29.0	23.0	1200	o	o	o	o	60.0	o	o	x	o	55.1
3102-0SH01	29.0	39.0	2000	o	o	o	o	60.0	x	o	o	x	55.2
3103-0AC01	12.5	15.7	2000	o	o	o	o	60.0	o	o	x	o	55.2
3103-0AF01	12.5	23.5	3000	o	o	o	o	60.0	x	x	o	o	55.3
3104-0AD01	25.0	19.5	1200	o	o	o	o	60.0	x	x	o	o	55.1
3104-0AH01	25.0	31.0	2000	o	o	o	o	60.0	x	o	o	o	55.2
3104-0SD01	40.0	31.0	1200	o	o	o	o	60.0	x	o	o	x	55.1
3104-0SH01	40.0	50.0	2000	o	o	o	o	60.0	x	o	o	o	55.2
3106-0AD01	32.0	24.0	1200	o	o	o	o	60.0	x	o	o	o	55.1
3106-0AH01	32.0	42.0	2000	o	o	o	o	60.0	x	o	o	o	55.2*
3106-0SD01	50.0	38.0	1200	o	o	o	o	60.0	x	o	o	o	55.1
3108-0AD01	38.0	31.0	1200	o	o	o	o	60.0	x	o	o	o	55.1*
3108-0AH01	38.0	46.0	2000	o	o	o	o	60.0	x	o	o	o	55.2*
3108-0SD01	60.0	48.0	1200	o	o	o	o	60.0	x	o	o	o	55.1
3132-0AC01	47.0	31.0	1000	o	o	o	o	60.0	o	o	x	o	55.1
3132-0AF01	47.0	45.0	1500	o	o	o	o	60.0	x	o	o	x	55.1
3132-0SC01	72.0	48.0	1000	o	o	o	o	60.0	o	o	x	x	55.1
3134-0AC01	65.0	43.0	1000	o	o	o	o	60.0	x	o	o	o	55.1
3134-0AF01	65.0	62.0	1500	o	o	o	o	60.0	x	o	o	o	55.1
3136-0AC01	90.0	59.0	1000	o	o	o	o	60.0	x	o	o	o	55.1
3136-0AF01	90.0	83.0	1500	o	o	o	o	60.0	x	x	o	o	55.1

Table 3.5

Explanations see Table 3.3

Matching table for SIMODRIVE power modules 6RB2130... (30/90 A)
Settings by means of switches S1, S2 and S3 on the adjustment module.

Servomotor				Current limit					Speed-dependent current limit				
1HU	M ₀ [Nm]	I ₀ [A]	n _{rated} rev/min	Contacts				I _{max} [A]	Contacts				Terminal X1.1
				2	3	4	5		6	7	8	9	
3073-0AF01	7.0	13.8	3000	x	o	o	o	76.5	o	o	x	o	55.3
3074-0AC01	7.0	9.7	2000	x	o	o	o	76.5	o	o	x	o	55.2
3074-0AF01	7.0	13.5	3000	x	o	o	o	76.5	o	o	x	o	55.3
3076-0AC01	10.0	12.5	2000	o	x	o	o	61.2	o	o	o	x	55.2
3076-0AF01	10.0	20.0	3000	o	o	o	o	90.0	o	o	x	x	55.3
3078-0AC01	14.0	17.0	2000	x	o	o	o	76.5	o	o	o	o	55.2
3078-0AF01	14.0	25.0	3000	o	o	o	o	90.0	o	o	x	o	55.3
3100-0AF01	7.0	14.2	3000	o	x	o	o	61.2	o	o	x	o	55.3
3101-0AC01	10.0	13.4	2000	o	x	o	o	61.2	o	o	x	x	55.2
3101-0AF01	10.0	20.5	3000	x	o	o	o	76.5	o	o	x	o	55.3
3102-0AD01	18.0	15.0	1200	x	o	o	o	76.5	o	o	x	x	55.1
3102-0AH01	18.0	24.0	2000	o	o	o	o	90.0	o	o	x	o	55.2
3102-0SD01	29.0	23.0	1200	o	o	o	o	90.0	o	x	x	x	55.1
3102-0SH01	29.0	39.0	2000	o	o	o	o	90.0	o	o	x	o	55.2
3103-0AC01	12.5	15.7	2000	x	o	o	o	76.5	o	o	x	x	55.2
3103-0AF01	12.5	23.5	3000	o	o	o	o	90.0	o	o	x	o	55.3
3104-0AD01	25.0	19.5	1200	o	o	o	o	90.0	o	o	o	x	55.1
3104-0AH01	25.0	31.0	2000	o	o	o	o	90.0	x	o	o	o	55.2
3104-0SD01	40.0	31.0	1200	o	o	o	o	90.0	o	o	x	o	55.1
3104-0SH01	40.0	50.0	2000	o	o	o	o	90.0	o	o	o	o	55.2
3106-0AD01	32.0	24.0	1200	o	o	o	o	90.0	o	o	o	x	55.1
3106-0AH01	32.0	42.0	2000	o	o	o	o	90.0	x	o	o	o	55.2
3106-0SD01	50.0	38.0	1200	o	o	o	o	90.0	o	o	o	x	55.1
3106-0SH01	50.0	65.0	2000	o	o	o	o	90.0	x	o	o	o	55.2
3108-0AD01	38.0	31.0	1200	o	o	o	o	90.0	x	o	o	o	55.1
3108-0AH01	38.0	46.0	2000	o	o	o	o	90.0	x	o	o	o	55.2
3108-0SD01	60.0	48.0	1200	o	o	o	o	90.0	x	x	o	o	55.1
3108-0SH01	60.0	72.0	2000	o	o	o	o	90.0	x	o	o	o	55.2
3132-0AC01	47.0	31.0	1000	o	o	o	o	90.0	o	x	x	x	55.1
3132-0AF01	47.0	45.0	1500	o	o	o	o	90.0	o	o	x	o	55.1
3132-0SC01	72.0	48.0	1000	o	o	o	o	90.0	o	x	x	x	55.1
3132-0SF01	72.0	70.0	1500	o	o	o	o	90.0	o	o	o	x	55.1
3134-0AC01	65.0	43.0	1000	o	o	o	o	90.0	x	x	x	o	55.1
3134-0AF01	65.0	62.0	1500	o	o	o	o	90.0	x	x	o	o	55.1
3134-0SC01	100.0	66.0	1000	o	o	o	o	90.0	x	x	o	x	55.1
3136-0AC01	90.0	59.0	1000	o	o	o	o	90.0	o	o	x	o	55.1
3136-0AF01	90.0	83.0	1500	o	o	o	o	90.0	o	x	o	o	55.1
3136-0SC01	135.0	89.0	1000	o	o	o	o	90.0	o	o	x	o	55.1
3138-0AC01	115.0	80.0	1000	o	o	o	o	90.0	x	x	o	x	55.1

Table 3.6

Explanations see Table 3.8

Matching table for SIMODRIVE power modules **6RB2140-...** (40/120 A)

Settings by means of switches S1, S2 and S3 on the adjustment module.

Servomotor				Current limit					Speed-dependent current limit				
1HU	M ₀ [Nm]	I ₀ [A]	n _{rated} rev/min	Contacts				I _{max} [A]	Contacts				Terminal X1.1
				2	3	4	5		6	7	8	9	
3076-0AF01	10	20	3000	o	x	o	o	82	o	o	o	x	55.3
3078-0AF01	14	25	3000	x	o	o	o	102	o	o	x	x	55.3
3101-0AF01	10	20.5	3000	x	o	o	o	102	x	x	x	x	55.3
3102-0AH01	18	24	2000	x	o	o	o	102	o	o	x	x	55.2
3102-0SD01	29	23	1200	x	x	o	o	73	o	o	x	o	55.1
3102-0SH01	29	39	2000	x	o	o	o	102	o	o	x	x	55.2
3103-0AF01	12.5	23.5	3000	o	o	o	o	120	o	x	x	o	55.3
3104-0AD01	25	19.5	1200	o	x	o	o	82	o	o	o	x	55.1
3104-0AH01	25	31	2000	o	o	o	o	120	o	o	o	x	55.2
3104-0SD01	40	31	1200	o	x	o	o	82	o	o	o	x	55.1
3104-0SH01	40	50	2000	o	o	o	o	120	o	o	o	x	55.2
3106-0AD01	32	24	1200	x	o	o	o	102	o	o	x	o	55.1
3106-0AH01	32	42	2000	o	o	o	o	120	o	o	o	x	55.2
3106-0SD01	50	38	1200	x	o	o	o	102	o	o	x	o	55.1
3106-0SH01	50	65	2000	o	o	o	o	120	o	o	o	x	55.2
3108-0AD01	38	31	1200	o	o	o	o	120	x	x	o	x	55.1
3108-0AH01	38	46	2000	o	o	o	o	120	x	x	o	o	55.2
3108-0SD01	60	48	1200	o	o	o	o	120	x	x	o	x	55.1
3108-0SH01	60	72	2000	o	o	o	o	120	x	x	o	o	55.2
3132-0AC01	47	31	1000	o	o	o	o	120	o	x	x	x	55.1
3132-0AF01	47	45	1500	o	o	o	o	120	o	x	x	o	55.1
3132-0SC01	72	48	1000	o	o	o	o	120	o	x	x	x	55.1
3132-0SF01	72	70	1500	o	o	o	o	120	o	x	x	o	55.1
3134-0AC01	65	43	1000	o	o	o	o	120	o	o	x	x	55.1
3134-0AF01	65	62	1500	o	o	o	o	120	o	o	x	o	55.1
3134-0SC01	100	66	1000	o	o	o	o	120	o	o	x	x	55.1
3136-0AC01	90	59	1000	o	o	o	o	120	o	o	x	o	55.1
3136-0AF01	90	83	1500	o	o	o	o	120	o	o	o	x	55.1
3136-0SC01	135	89	1000	o	o	o	o	120	o	o	x	o	55.1
3136-0SF01	135	125	1500	o	o	o	o	120	o	o	o	x	55.1
3138-0AC01	115	80	1000	o	o	o	o	120	x	x	x	o	55.1
3138-0SC01	165	116	1000	o	o	o	o	120	x	x	x	o	55.1

Table 3.7

Explanations see Table 3.8

Matching table for SIMODRIVE power modules 6RB2160-... (60/180 A)
Settings by means of switches S1, S2 and S3 on the adjustment module.

Servomotor				Current limit					Speed-dependent current limit				
1HU	M_o [Nm]	I_o [A]	n_{rated} rev/min	Contacts				I_{max} [A]	Contacts				Terminal X1 1
				2	3	4	5		6	7	8	9	
3102-0SD01	29	23	1200	o	x	x	o	74	o	o	x	x	55 1
3102-0SH01	29	39	2000	o	o	x	o	90	o	o	x	o	55 2
3104-0AH01	25	31	2000	o	x	o	o	122	o	o	o	x	55 2
3104-0SD01	40	31	1200	x	o	x	o	83	o	o	o	x	55 1
3104-0SH01	40	50	2000	o	x	o	o	122	x	x	o	x	55 2
3106-0AH01	32	42	2000	o	o	o	o	180	o	o	x	o	55 2
3106-0SD01	50	38	1200	x	x	o	o	110	o	o	x	o	55 1
3106-0SH01	50	65	2000	x	o	o	o	153	x	x	o	x	55 2
3108-0AD01	38	31	1200	o	x	o	o	122	x	x	o	x	55 1
3108-0AH01	38	46	2000	o	o	o	o	180	o	o	x	o	55 2
3108-0SD01	60	48	1200	x	o	o	o	153	o	o	x	o	55 1
3108-0SH01	60	72	2000	o	o	o	o	180	o	o	x	o	55 2
3132-0AC01	47	31	1000	x	x	o	o	110	o	x	x	x	55 1
3132-0AF01	47	45	1500	x	o	o	o	153	o	x	x	x	55 1
3132-0SC01	72	48	1000	x	x	o	o	110	o	x	x	x	55 1
3132-0SF01	72	70	1500	x	o	o	o	153	o	x	x	x	55 1
3134-0AC01	65	43	1000	x	o	o	o	153	o	x	x	x	55 1
3134-0AF01	65	62	1500	x	o	o	o	153	o	x	x	x	55 1
3134-0SC01	100	66	1000	o	x	o	o	122	o	o	x	x	55 1
3136-0AC01	90	59	1000	o	o	o	o	180	o	x	x	x	55 1
3136-0AF01	90	83	1500	o	o	o	o	180	o	o	x	x	55 1
3136-0SC01	135	89	1000	o	o	o	o	180	o	x	x	x	55 1
3136-0SF01	135	125	1500	o	o	o	o	180	o	o	x	x	55 1
3138-0AC01	115	80	1000	o	o	o	o	180	o	o	x	o	55 1
3138-0AF01	115	134	1800	o	o	o	o	180	x	x	o	x	55 2
3138-0SC01	165	116	1000	o	o	o	o	180	o	o	x	o	55 1

Table 3.8

o $\hat{=}$ Contact in normal position (OFF)

x $\hat{=}$ Contact to ON

Contact S1.1, S2.1, S3.1: no function

Contact S1.10 or resistor R200: Contact S1.10 in ON position or R200 provided in the form of a jumper:
 All three axes are operated in current loop.

Matching table for SIMODRIVE power modules 6RB2190-... (90/270 A)
Settings by means of switches S1, S2 and S3 on the adjustment module.

Servomotor				Current limit					Speed-dependent current limit				
1HU	M_0 [Nm]	I_0 [A]	n_{rated} rev/min	Contacts				I_{max} [A]	Contacts				Terminal X1.1
				2	3	4	5		6	7	8	9	
3104-0SH01	40.0	50.0	2000	o	o	x	o	135	x	x	x	o	55.2
3106-0SH01	50.0	65.0	2000	o	x	o	o	184	o	o	x	o	55.2
3108-0AH01	38.0	46.0	2000	x	x	o	o	165	o	o	o	x	55.2
3108-0SD01	60.0	48.0	1200	o	o	x	o	135	o	o	x	o	55.1
3108-0SH01	60.0	72.0	2000	o	x	o	o	184	x	x	x	o	55.2
3132-0AF01	47.0	45.0	1500	x	x	o	o	165	o	x	x	x	55.1
3132-0SC01	72.0	48.0	1000	x	o	x	o	124	o	x	x	x	55.1
3132-0SF01	72.0	70.0	1500	x	x	o	o	165	o	x	x	x	55.1
3134-0AF01	65.0	62.0	1500	x	x	o	o	165	o	x	x	x	55.1
3134-0SC01	100.0	66.0	1000	o	o	x	o	135	o	x	x	x	55.1
3136-0AC01	90.0	59.0	1000	o	x	o	o	184	o	x	x	x	55.1
3136-0AF01	90.0	83.0	1500	o	o	o	o	270	o	x	x	x	55.1
3136-0SC01	135.0	89.0	1000	o	x	o	o	184	o	x	x	x	55.1
3136-0SF01	135.0	125.0	1500	o	o	o	o	270	o	x	x	x	55.1
3138-0AC01	115.0	80.0	1000	o	o	o	o	270	o	x	x	x	55.1
3138-0AF01	115.0	134.0	1800	o	o	o	o	270	x	x	x	o	55.2
3138-0SC01	165.0	116.0	1000	o	o	o	o	270	o	x	x	x	55.1

Table 3.9

o $\hat{=}$ Contact in normal position (OFF)

x $\hat{=}$ Contact to ON

Contact S1.1, S2.1, S3.1: no function

Contact S1.10 or resistor R200: Contact S1.10 in ON position or R200 provided in the form of a jumper:

All three axes are operated in current loop.

3.1.2 Current limitation set, drive against hard stop

When voltage is applied to terminal 96 (Figs. 2.3 and 3.4), the "speed controller at maximum" monitoring system is deactivated.

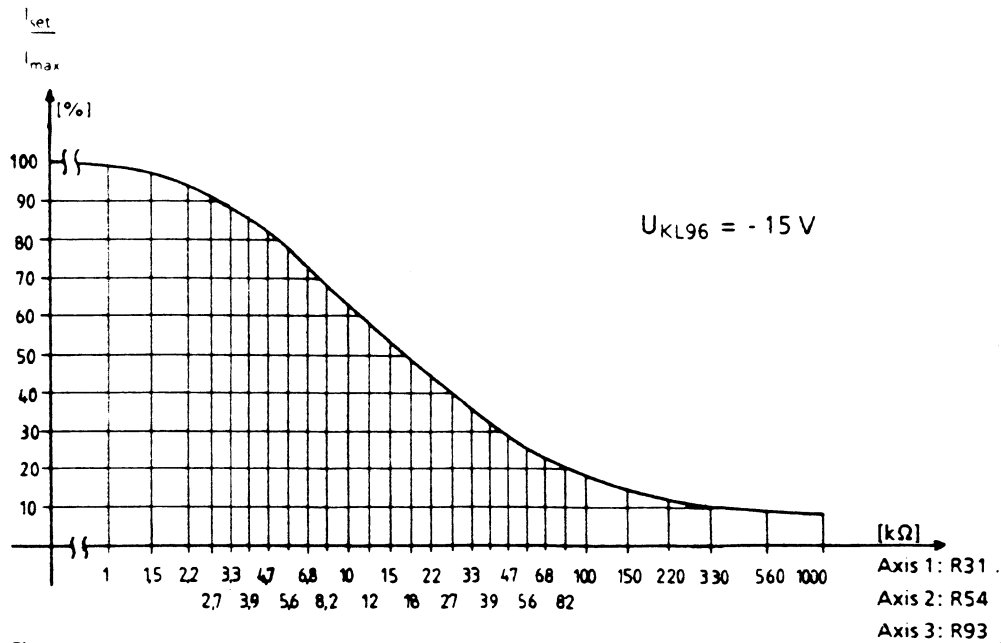


Fig. 3.3 Current limitation set as a function of R_t on the adjustment module

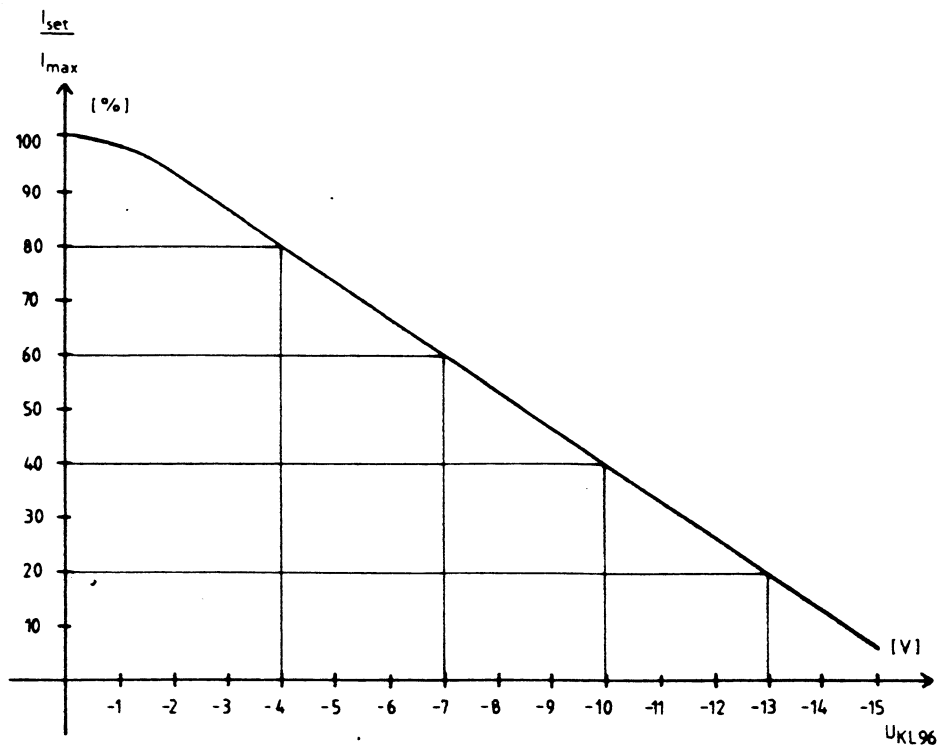


Fig. 3.4 Current limitation set as a function of the voltage applied at terminal 96

3.1.3 Tacho-generator input

The transistor chopper is set to a tachovoltage of 20 V/1000 rev/min in the works (e.g. by tacho-generator 1HU1052).

Connect the tacho-generator as indicated in table 3.10. Higher voltages must be reduced via an external divider. The internal resistance of the tacho-generator is approx. 13 k Ω .

Rated speed [rev/min]	1000 1200 1500	1800 2000	3000
Terminal	55.1	55.2	55.3

Table 3.10

3.1.4 Speed controller adaptation

Adaptive reduction of the speed controller integrating time at lowest speeds is possible by providing the following resistors on the adjustment module: R15 (Axes 1 and 4), R46 (Axes 2 and 5) and R77 (Axes 3 and 6). A resistor of 1 k Ω reduces the reset time to 1/5 of the value adjusted (guide value).

The point at which adaptation becomes effective is set via the following resistors: R94 (Axes 1 and 4), R97 (Axes 2 and 5) and R100 (Axes 3 and 6). The preset value is 60 mV.

With a speed actual value of 3 V/1000 rev/min, the resistors on the controller module must be changed according to Table 3.11.

Axis 1(4)	Axis 2(5)	Axis 3(6)	new resistance value [k Ω]
R181 R433	R241 R436	R248 R441	5.6 470

Table 3.11

3.1.5 Electrical weight compensation

Weight compensation with mechanically preloaded axes is possible by soldering in the following resistors in the adjustment module: R3, R4, R5 (Axes 1 and 4), R32, R35, R36 (Axes 2 and 5) and R63, R64, R67 (Axes 3 and 6).

3.1.6 Current-controlled operation

This is possible by applying a current setpoint to terminal 58 after contact 10 of switch S1 on the adjustment module has been set to ON (resistor R200 on the adjustment module must be jumpered if necessary).

Important: All three axes are changed over by S1.10.

3.1.7 External power supply for controller enabling

The internal power supply for controller enabling can be inhibited by disconnecting resistors R20 and R21 on module G0. An external electrically isolated power supply can then be connected via terminal 19 (reference potential) and 9.

3.2 Signals

3.2.1 Ready/fault signal

The ready indication can be changed into a fault indication by removing diode V13 on the power supply module (G0).

3.2.2 I²t signal

Terminal 5 at insertion place + G0-X111 provides a common output (open collector) for this signal for all the axes. A relay (max. 50 mA) can be connected across this output and terminal 7. The relay picks up when a signal is given.

When terminal 5 is connected direct to the NC, a pull-up resistor of 1.5 k Ω must be connected across terminal 5 and 7 (active indication $\hat{=}$ L signal).

3.3 Test sockets, display elements

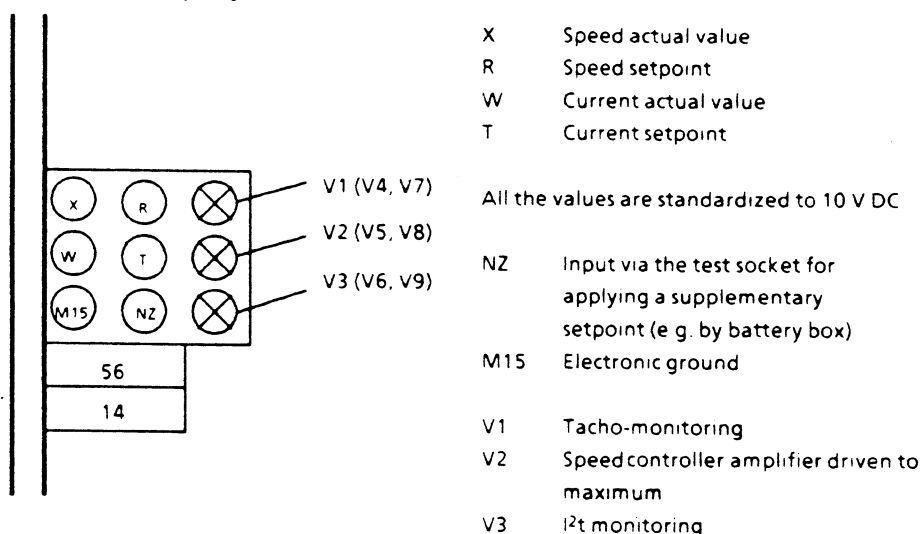


Fig. 3.5 Test sockets and display elements on controller modules N1 and N2

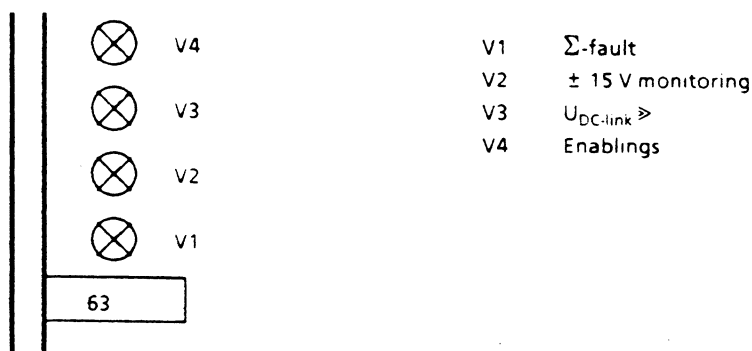
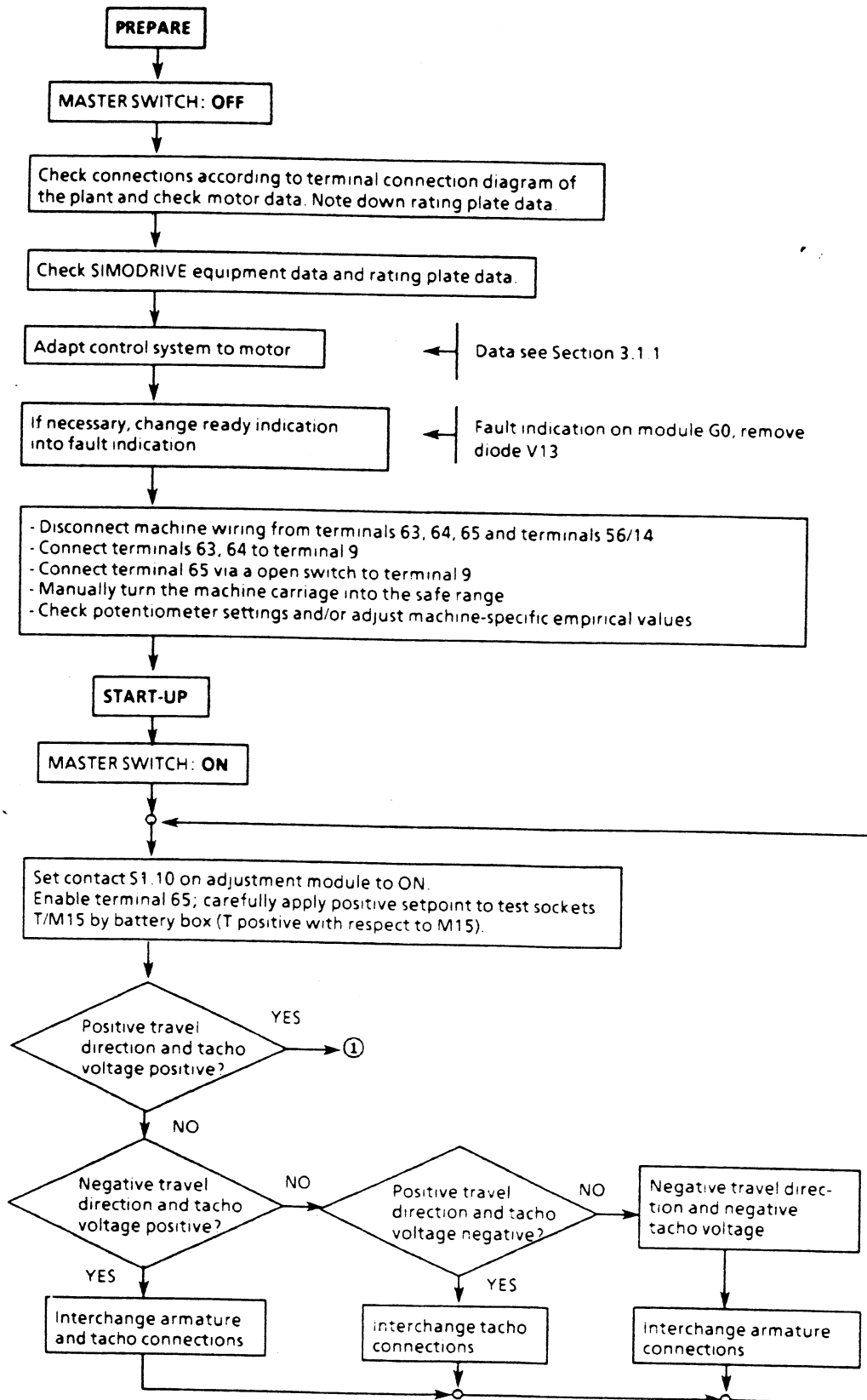
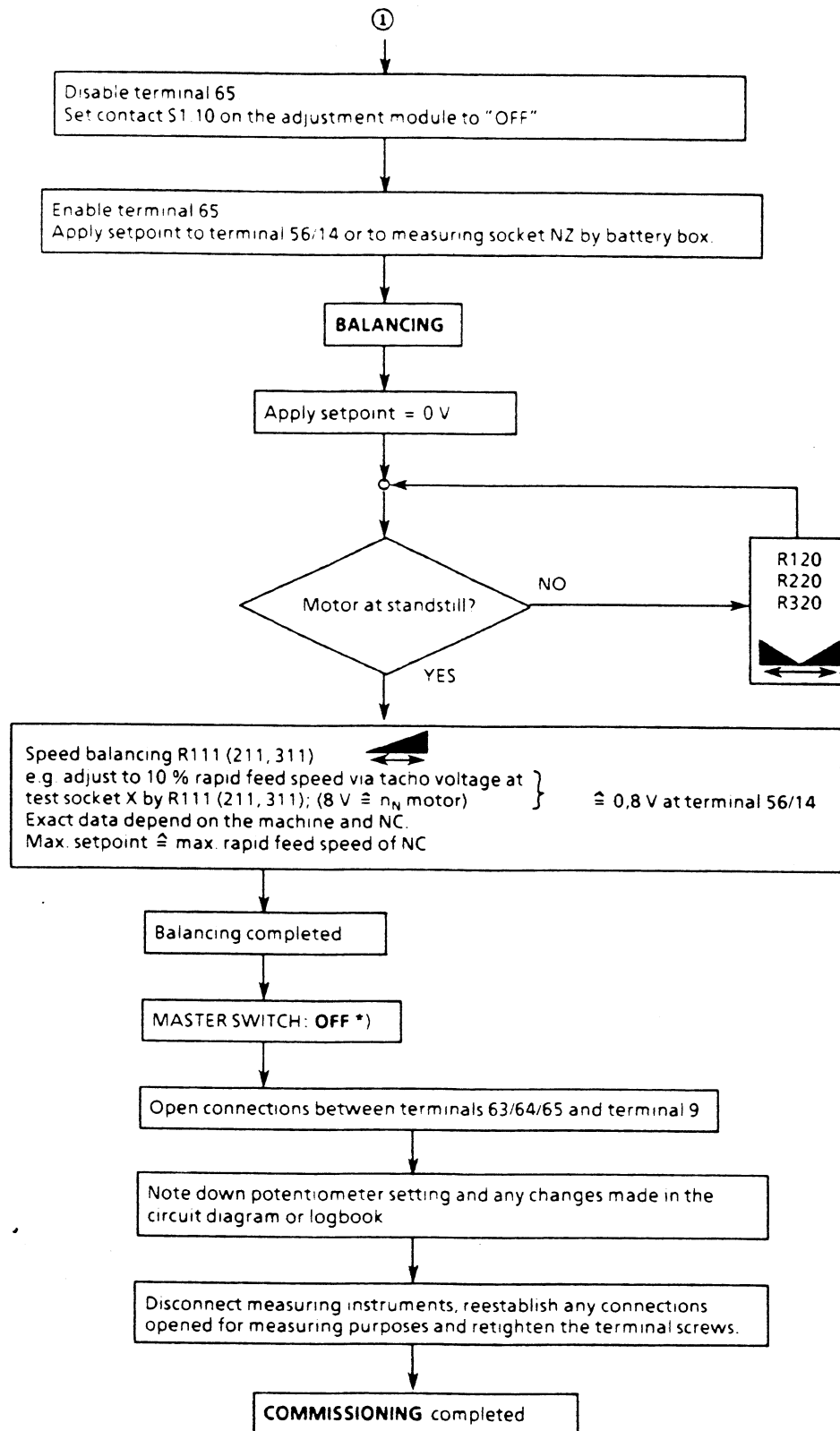


Fig. 3.6 Display elements on power supply module G0

3.4 Start-up





***) Note:**

In the event of faults, the DC-link circuit is still live for approx. 4 minutes after disconnection of the unit. For this reason the master switch must be opened and the DC-link circuit discharged before any work is carried out on the unit with the cover removed.

4 Maintenance

Note: disconnect the unit from the supply before any work is carried out

4.1 Maintenance instructions

The transistor DC chopper does not require any maintenance.

The bearings of the unit fans are permanently lubricated.

4.2 Faults

Test-sockets LEDs

X R • V1

W T • V2

M5 N2 • V3

56

14

9

65

96

6

55 1

55 2

55 3

13

X R • V4

W T • V5

M5 N2 • V6

56

14

9

65

96

6

55 1

55 2

55 3

13

X R • V7

W T • V8

M5 N2 • V9

56

14

9

65

96

6

55 1

55 2

55 3

13

N1, N2

Type of fault	Displays	Meaning	Possible causes
Axis does not move even though the reference value is applied to terminal 56	Green LED + G0-V4 lights up, red LEDs do not light up	No enabling signal at terminals 63 and 64	Customer's interlocking circuit activated; R20, R21 disconnected
	No LED lights up		External main fuse blown or not inserted
	Red LED + G0-V1 lights up, red LEDs (N ₀) do not light up + G0-V2 lights up + G0-V3 lights up	± 15 V out of tolerance or not available Voltage of DC-link circuit too high	Supply voltage too high, load inertia too high, current limit mismatched
	Red LED + G0-V1 lights up Red LED + N ₀ -V1* lights up	Tacho monitoring circuit responded	Tacho or tacho cable defective
	Red LED + G0-V1 lights up Red LED + N ₀ -V2* lights up	Controller monitoring circuit responded (speed controller amplifier driven to maximum)	Motor line interrupted, mechanical system blocked, power section (A1 to A6) defective, ribbon cable between control and power section defective, motor or tacho connected with wrong polarity

Table 4.1a

Table 4.1a

7	
45	
44	
10	
15	
15	
R	
11	
12	
5	
LEDs	
●	V4
●	V3
●	V2
●	V1
63	
9	
9	
64	
19	
74	
-	
73.1	
73.2	
72	

G0

Type of fault	Displays	Meaning	Possible causes
Axis moves, but unit is de-energized again.	Red LED + G0-V1 lights up Red LED + G0-V3 lights up	Overvoltage in DC-link circuit during braking	Load moment of inertia too high, current limit not matched to motor, motor speed, exceeds rated speed, resistor for voltage limitation overloaded, no loading by frictional forces, vertical axis without weight balance
	Red LED + G0-V1 lights up Red LED + N ₀ -V2* lights up	Acceleration or reversing time exceeds limit value (more than 200 ms)	Current limitation set too low or load inertia too high
	Red LED + N ₀ -V3* lights up	I ² t-monitoring circuit responded, motor overtemperature circuit responded	Effective torque too high, ACC/DEC too often, machining forces too high, motor defective
Surface finish is poor or inaccurate positioning			Motor defective (e.g. does not run smooth with low setpoints), P amplifier of speed controller set too low (potentiometers R125, R225, R325); mutual interference of axes (due to wrong shielding or wrong installation of earth wire)
Fuses blow	F10, F110 oder F310 blow		Fault in power section, <u>Remedial action:</u> replace module
	F247 blows		Fault in power supply and monitoring system or in the DC link voltage monitoring circuit 0.3/30 kW (G10) <u>Remedial action:</u> Replace both modules

Table 4.1b

N₀ ≙ N1, N2

+ N₀-V1* ≙ + N₀-V1/-V4/-V7 ≙ Tacho monitoring
+ N₀-V2* ≙ + N₀-V2/-V5/-V8 ≙ Speed controller amplifier at maximum

+ N₀-V3* ≙ + N₀-V3/-V6/-V9 ≙ I²t monitoring circuit

+ G0-V1 ≙ Σ-fault

+ G0-V2 ≙ ± 15 V

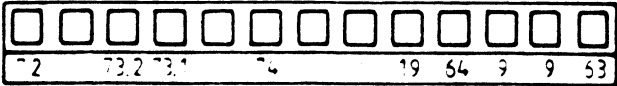
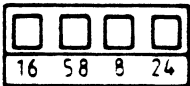
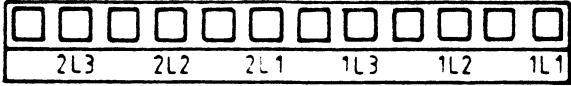
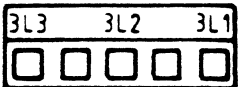
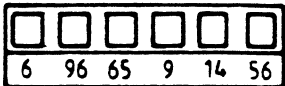
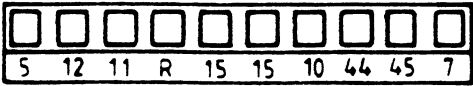
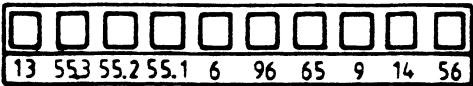
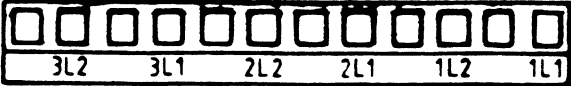
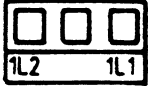
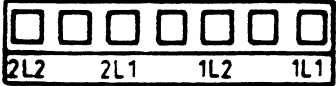
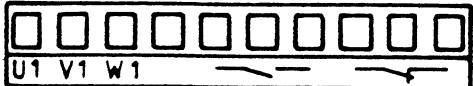
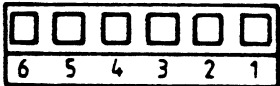
+ G0-V3 ≙ U_{DC-link} >
+ G0-V4 ≙ Enablings

4.3 Spare parts

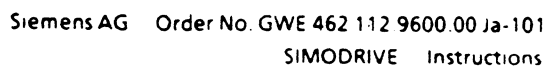
Function			Designation	Order No.
Power supply and monitoring			G0	6SC6100-0GA00
Power supply and monitoring including voltage limitation			G0	6SC6100-0GB00
DC-link voltage limitation G20			A0.2	6SC6100-0AB00
Inrush current limitation C10			A0.3	6SC6100-0AC00
Controller, analog	1 axis		N1, N2	6RB2100-0NA01
	2 axes			6RB2100-0NA11
	3 axes			6RB2100-0NA21
Adjustment module	1 axis		-	6RB2100-0SA01
	2 axes			6RB2100-0SA11
	3 axes			6RB2100-0SA21
Power modules	5/15 A	1 axis	A1 to A 10	6RB2105-0SD00
	5/15 A	2 axes		6RB2105-0SF00
	5/15 A	3 axes		6RB2105-0SG00
	10/30 A	1 axis		6RB2110-0FD00
	10/30 A	2 axes		6RB2110-0FF00
	10/30 A	3 axes		6RB2110-0FG00
	20/60 A	1 axis		6RB2120-0FD00
	30/90 A	1 axis		6RB2130-0FD00
	40/120 A	1 axis		6RB2140-0FD00
	60/180 A	1/2 axis		6RB2160-0FB00
	90/270 A	1/2 axis		6RB2190-0FB00
Rectifier	90 A		V0	310 755
Capacitor	6000 μ F/350 V		C0 1 to C0 5	278 044
Fan	Type 3314		E0 1 to E0 5	308 684
Wiring material	(assembly)		-	462 000.7030.00
Ribbon cable	50pole to 3 x 16pole			462 000.7009.00
	50pole to 1 x 34pole and 1 x 16pole			462 000.7009.01
	50pole to 1 x 16pole and 1 x 34pole			462 000.7009.04

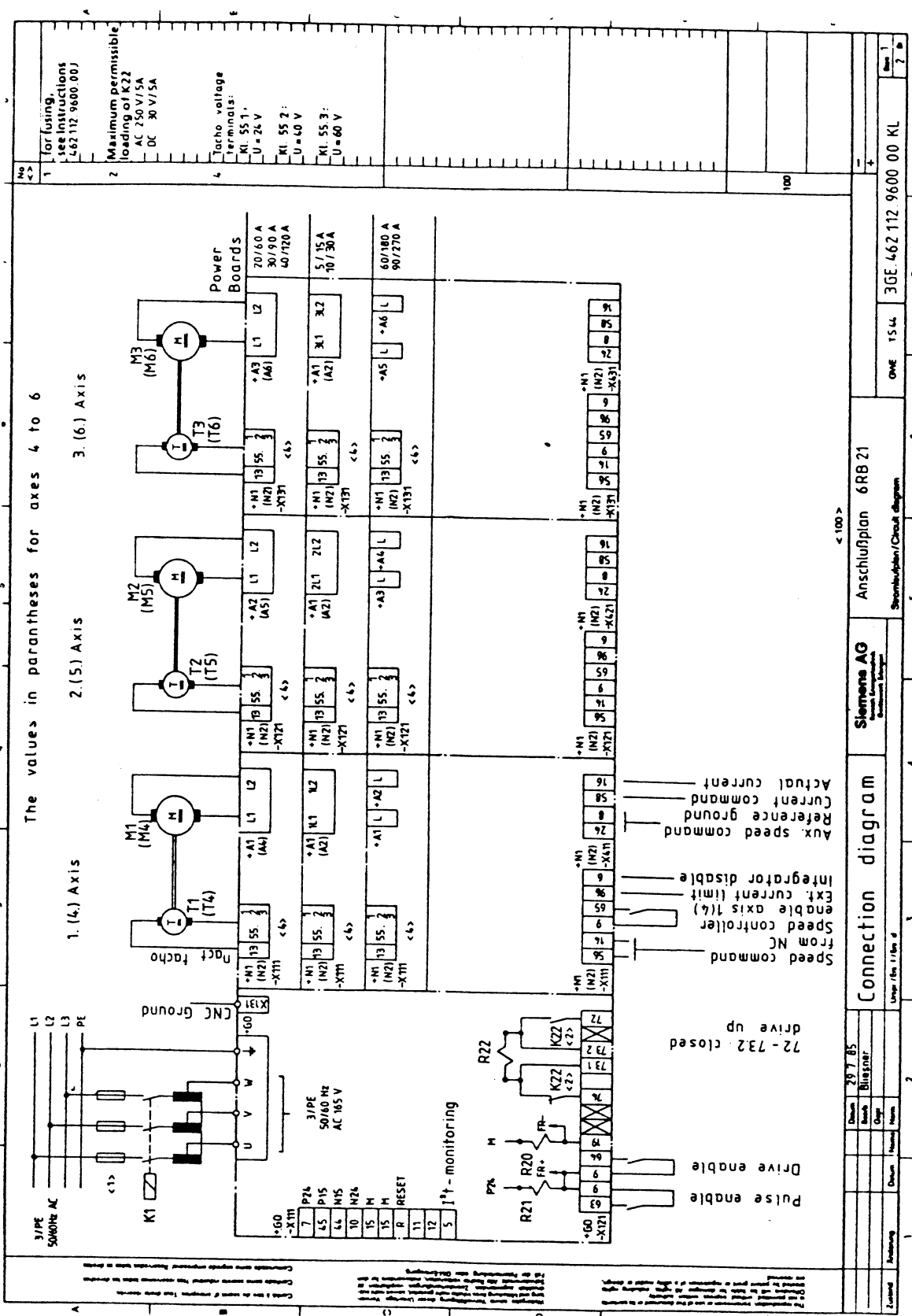
Table 4.2 Spare parts

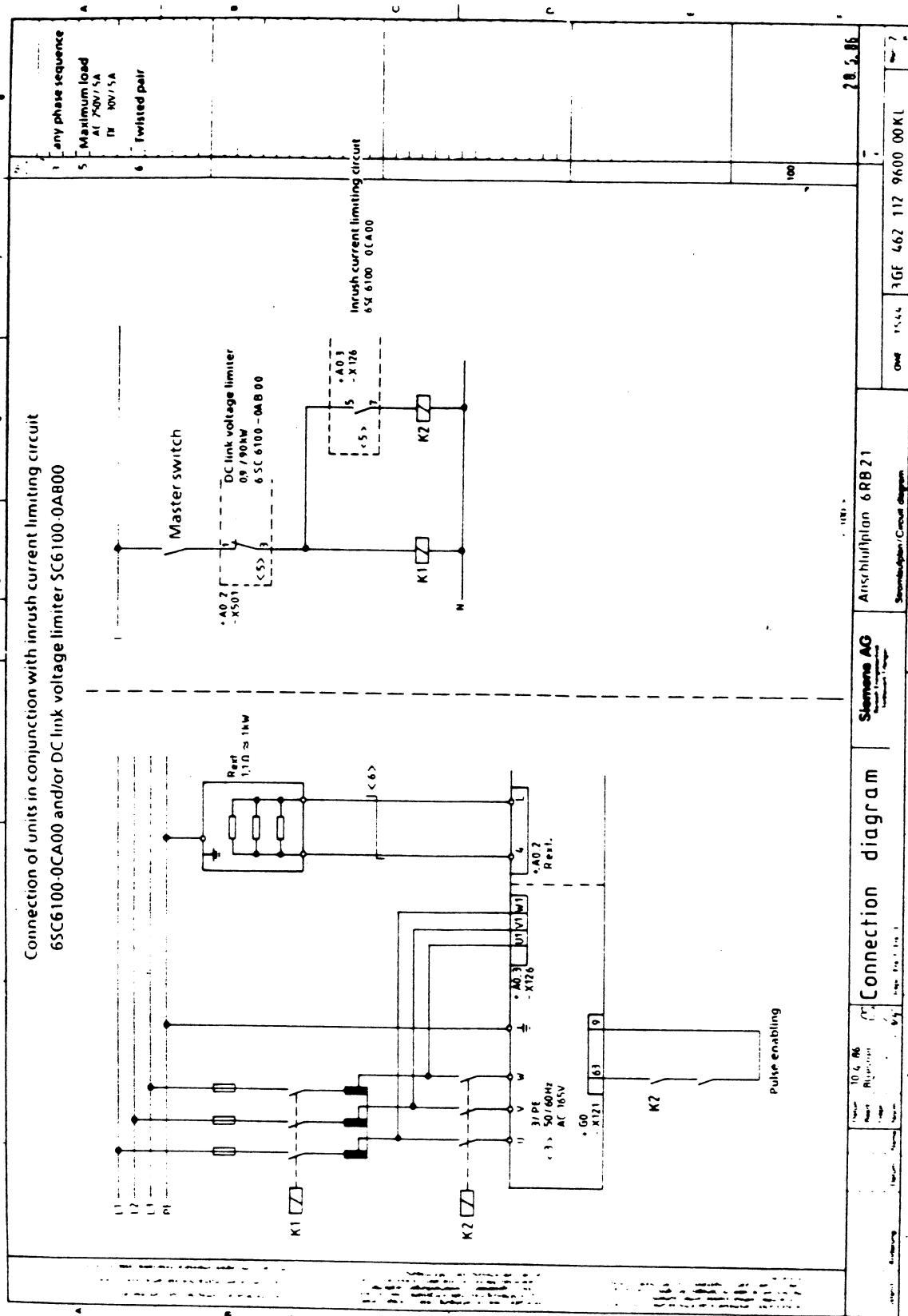
4.4 Cable connectors

Version		Insertion place	
.01		GO X 121	AC DC
.02		N17/N2 X 411 X 421 X 431	AC DC
.03		A. X 231	AC
.04		A. X 232	AC
.05		N17/N2 X 111 X 121 X 131	AC
.06		GO X 111	AC DC
.07		N17/N2 X 111 X 121 X 131	DC
.08		A. X 231	DC
.09 ⑤		A. X 231	DC
.10 ⑤		A. X 231	DC
.11 ③		A 0.3 X 126	AC DC
.12 ③		A 0.2 X 501	AC DC

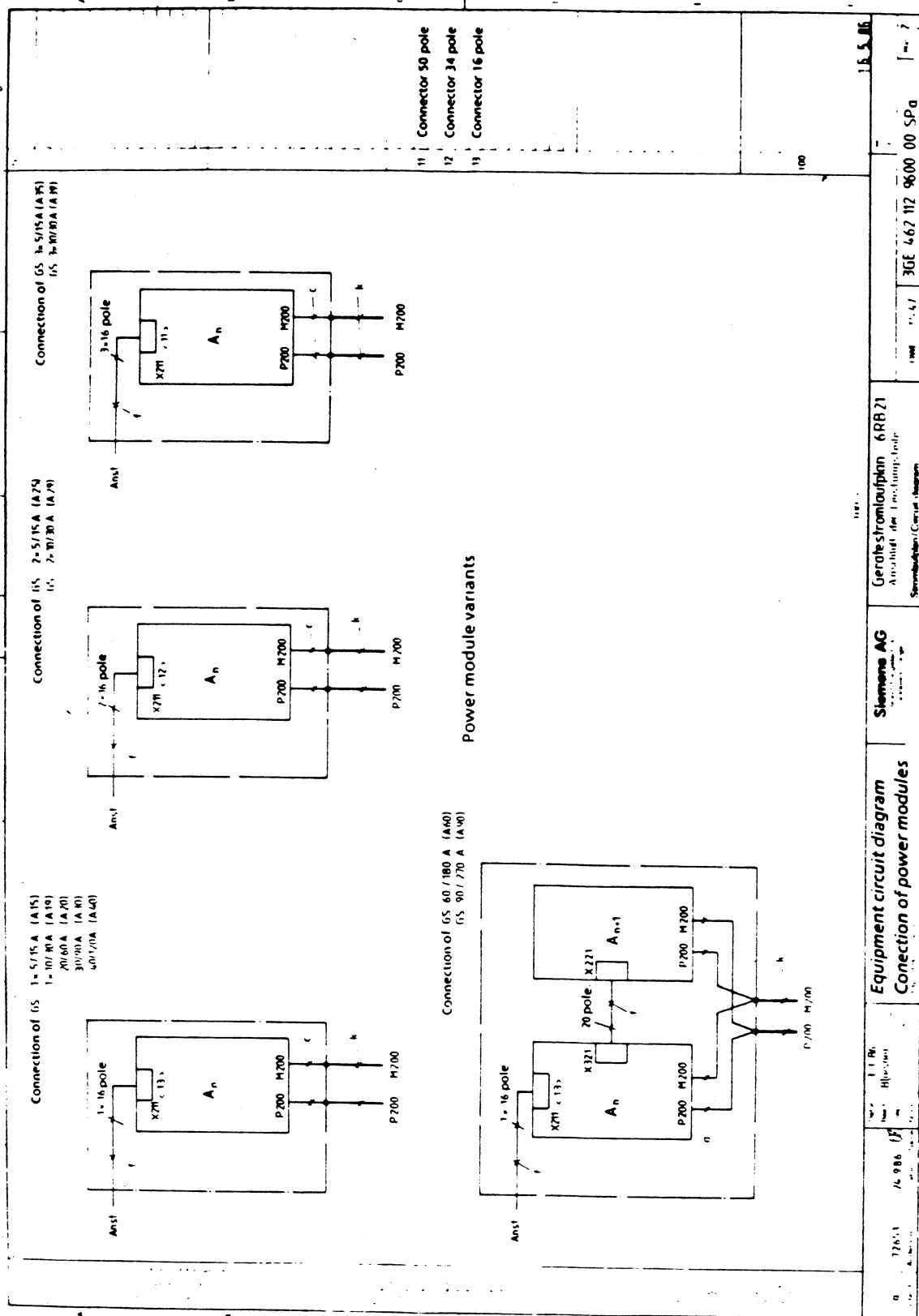
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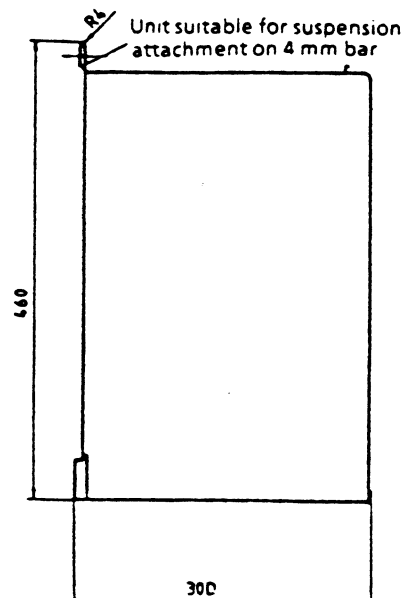
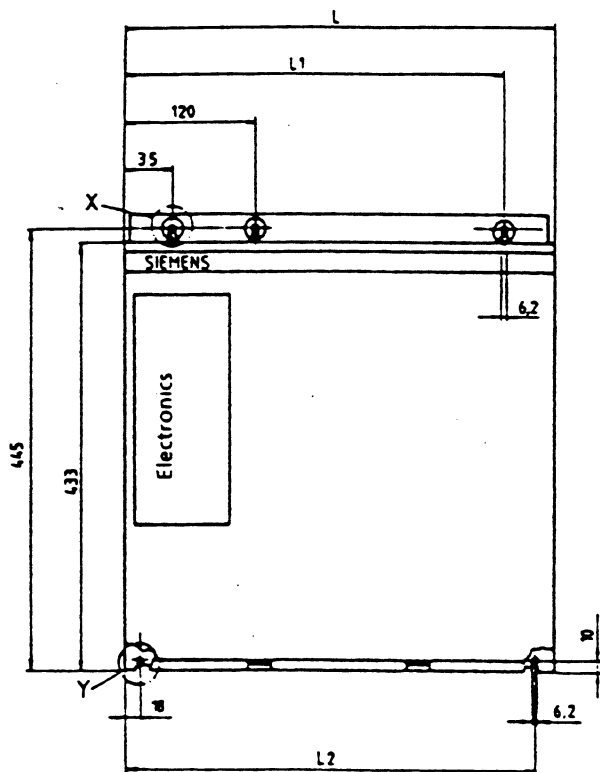




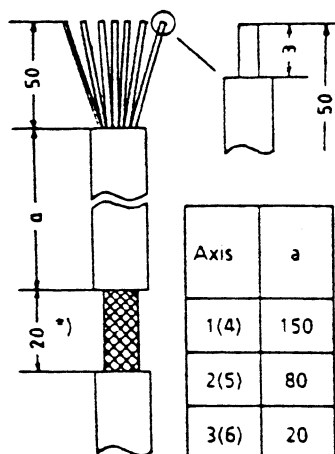
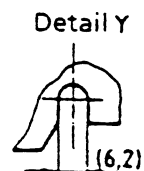
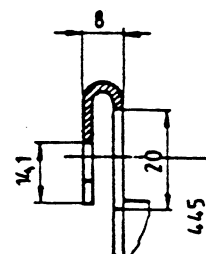
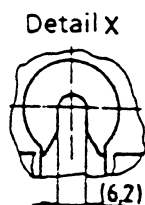
1	for details, see Sheet 2
2	connecting module
3	only with units using digital control
4	universal distribution
5	control module
6	power supply and monitoring module
7	voltage limiting module 0.7/700W
8	voltage limiting module 0.7/700W
9	Inrush current limiting circuit
10	Connector 50 pole
11	Connector 34 pole
12	Connector 16 pole
13	
14	0.7/700W max
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99	0.7/700W max
100	0.7/700W max



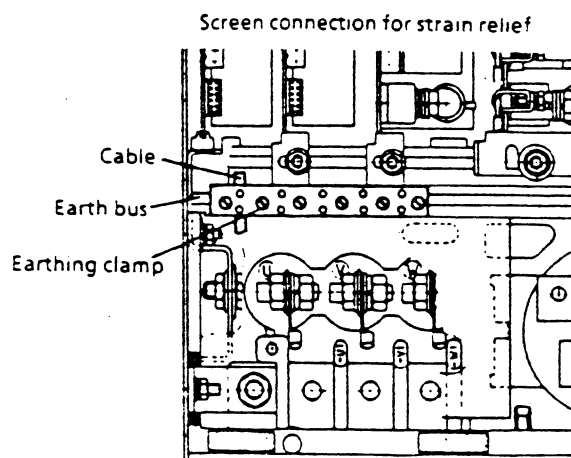
8 Dimension drawing



Positions for power modules	L	L1	L2
6	440	405	422
4	339	304	321
2	238	203	220



*) Insulation stripped for connection to shield and strain relief



[illegible]

Notes on electrostatic charges

Electrostatic sensitive devices (ESD)

Generally, PCBs should not be touched unless work has to be carried out on them.

Before touching a PCB, the person carrying out the work must himself be electrostatically discharged. The simplest way of doing this is to touch an electrically conducting earthed object (e.g. a bare metal part of a switchboard or the protective earth contact of a socket outlet).

PCBs must not be allowed to come in contact with electrically insulating materials such as plastic foil, insulating table tops or clothing made of synthetic fibres.

PCBs may only be set down or stored on electrically conducting surfaces.

When carrying out soldering jobs on PCBs, make sure that the soldering tip has been earthed.

PCBs and electronic components should generally be packed in electrically conducting containers (such as metallized-plastic boxes or metal cans) before being stored or shipped.

If the use of non-conducting packing containers cannot be avoided, PCBs must be wrapped in a conducting material before being put in them. Examples of such materials include electrically conducting foam rubber or household aluminium foil.

For easy reference, the protective measures necessary when dealing with sensitive electronic components are illustrated in the sketches below.

a = Conductive flooring

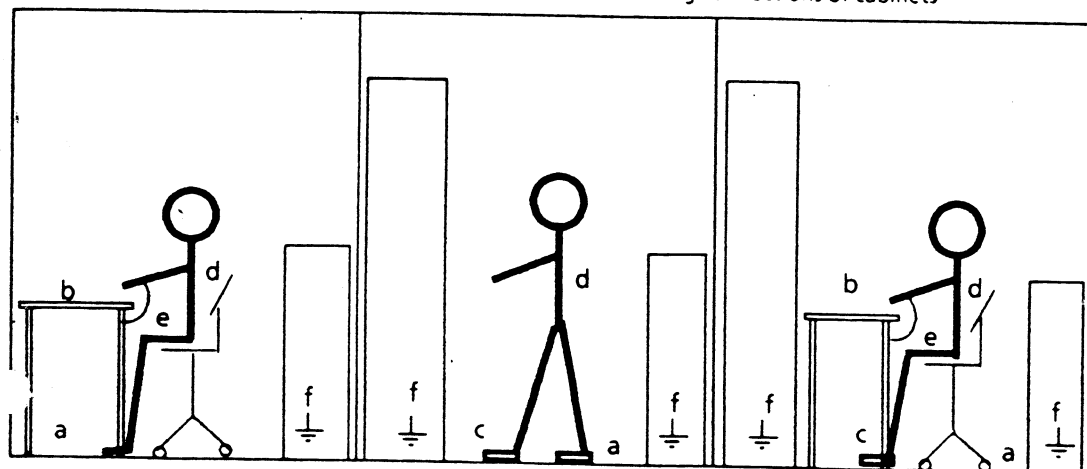
b = Anti-static table

c = Anti-static footwear

d = Anti-static overall

e = Anti-static chain

f = Earthing connections of cabinets



Seated work station

Standing work station

Standing / seated work station

DIN 46234

Cable lugs

DIN VDE 0106

Protection against electric shock

DIN VDE 0558

VDE specifications for semiconductor converters

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D-1000 Berlin 30

DIN VDE specifications:

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Merianstraße 29

D-6050 Offenbach

Notes

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