SIEMENS

SIVOLT A/V Wechselstromsteller in Hybridtechnik Baureihe 6SG22 . .

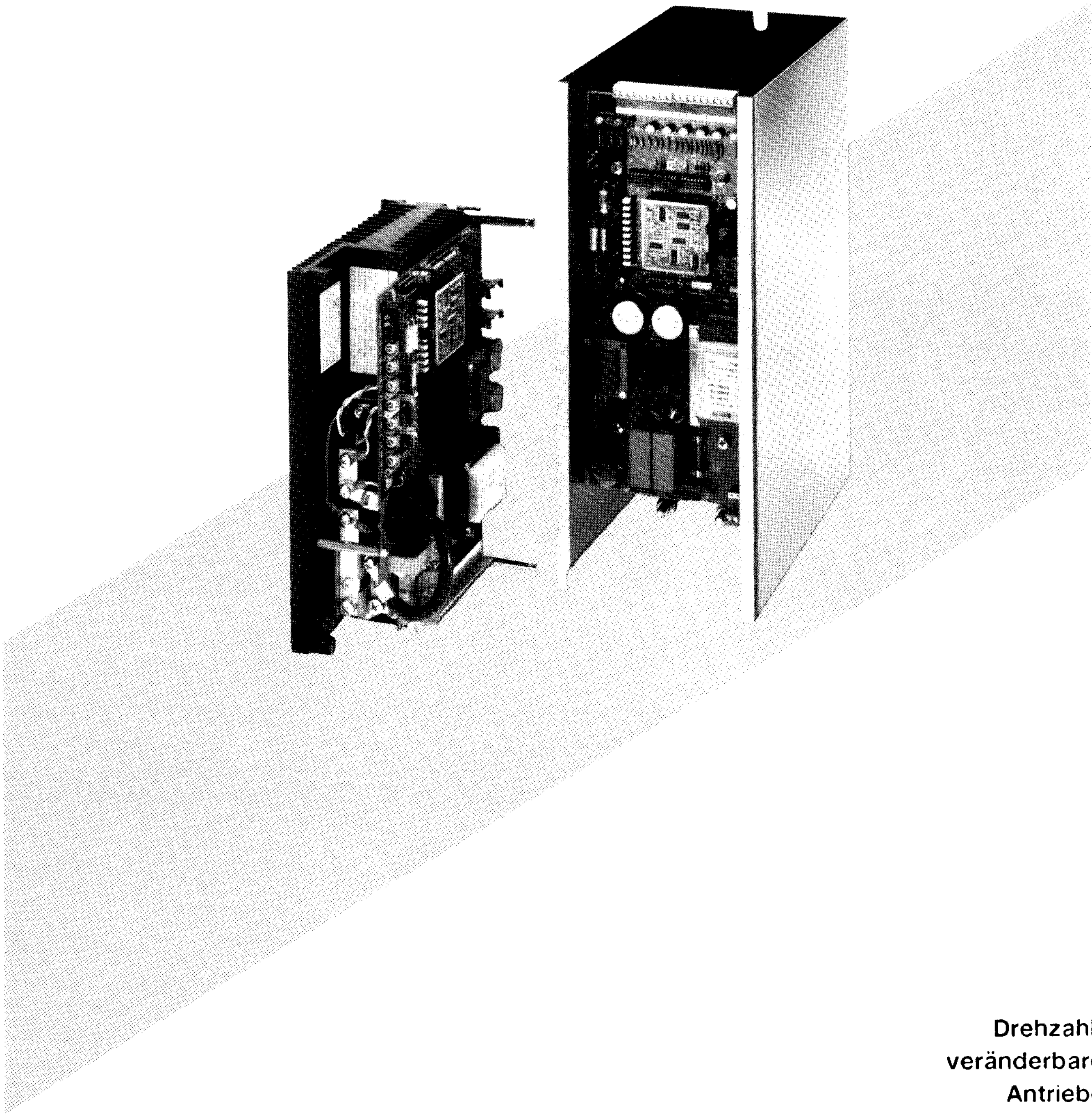
Series 6SG22 . . Hybrid AC Controllers

für Phasenanschnittsteuerung
und Vollschwingungssteuerung

for phase-control
and multi-cycle control

Betriebsanleitung/Operating Instructions Bestell-Nr./Order No. E31930-T9001-X-A3-7400

April 1990



**Drehzahl-
veränderbare
Antriebe**

Hinweise:

Diese Betriebsanleitung ist gültig für Wechselstromsteller
SIVOLT A/V 6SG22..

Weitere SIVOLT A/V-Dokumentation:

Titel	Bestell-Nr.	Sprache
SIVOLT-A/V-Wechselstromsteller 6SG22 für Phasenanschnitt- und Vollschwingungssteuerung	A19100-E319-A364	Deutsch

Die Wechselstromsteller 6SG22.. sind Stromrichtergeräte zum **Einbau**. Die Einbauhinweise nach DIN VDE 0558, Abschn. 5.4.3.2.1 sind zu beachten (Es obliegt dem Anwender, z.B. dem Errichter von Starkstromanlagen, bei Verwendung von Einbaugeräten den erforderlichen Schutz durch entsprechende Gestaltung der Umgebung des Einbaugerätes sicherzustellen, z.B. durch Einbau des Gerätes in ein Gehäuse)

Notes:

These Commissioning Instructions apply to SIVOLT A/V AC Controllers.

Further SIVOLT A/V documentation:

Titel	Order No.	Language
SIVOLT-A/V-6SG22 Single-Phase AC Controllers for Phase Control and Multi-Cycle Control	A19100-E319-A364-X-7600	English

All units are IP00 class of protection.
All controllers to be mounted and operated in compliance with all applicable codes and safety regulations

Baugruppen enthalten elektrostatisch gefährdete Bauelemente

Modules contain electrostatically sensitive components

Eingetragene Warenzeichen/Registered Trade Marks

SIVOLT®

SIEMENS

SIVOLT A/V
AC Controller Series 6SG22
Supplement to Operating Instructions E31930-T9001-X-A3-7400

June 1995

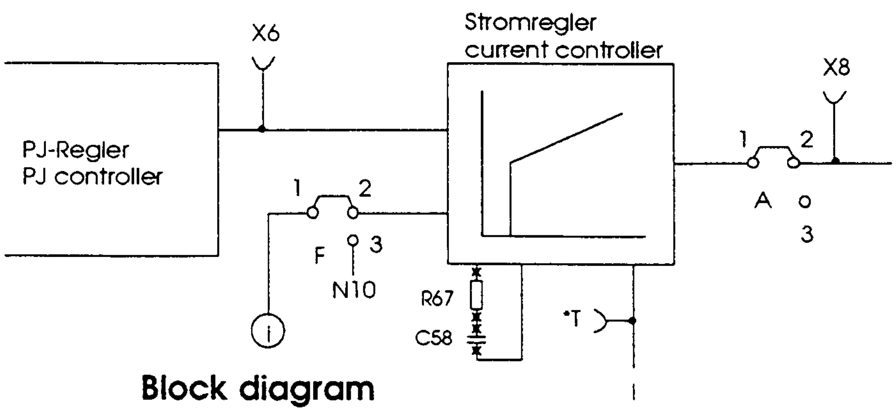
With revision 4 the following additional functions are available:

1) In the multi-cycle control mode the output voltage can now be regulated down to exactly 0V. The special design Z-A24 is no longer needed to implement this functionality. Resistor R47 must remain uninstalled to activate this new feature.

2) With the new controller module in position D83 the controller can now work without using the secondary current contoller. For this purpose the plug-in jumper setting of D83 must be changed from F1-F2 to F2-F3.

Function of the additional plug-in jumper and changes of part values:

Plug-in jumper D83 or part-no.	Factory setting	Function
F1, F2, F3	F1-F2	F1-F2: Function as previously: with secondary current control F2-F3: Without current control, i.e. with jumper C4-C5 the reference value at X1.8 determins directly the control angle respectively the multi-cycle control factor (10V = maximum output voltage). For this purpose a 180kΩ resistor must be installed in position C58 and the following adjustment must be made: With X1.8=10V adjust SB to -10V at X16 and Kp to +10V at X6.
R47	not installed	Limitation of the current controller output signal: with R47 not installed U_{X8max} = 11,7 V with R47 = 0Ω U_{X8max} = 10,0 V In the multi-cycle control mode R47 must remain uninstalled to enable the controller to regulate the output voltage down to exactly 0V.
C91	2,2µF	Ramp-up time for multi-cycle control mode after switching on. Ramp-up time = 2M2 x C91 Example: -> 2M2 x 2µ2 ~ 5s
C109	1,5µF	Clock time (fundamental frequency) for multi-cycle control mode. Function as previously



Block diagram

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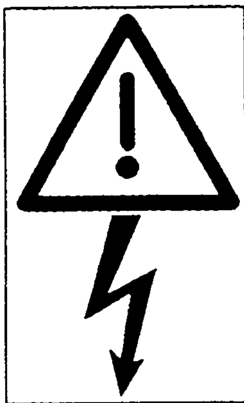
Warning and caution notes



WARNING

This equipment contains hazardous voltages and may control hazardous rotating mechanical machinery. Loss of life, severe personal injury or property damage can result if instructions contained in this manual are not followed. All local codes to be observed.

Only qualified personnel should work on this equipment, and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon proper handling, installation, operation and maintenance of the equipment.

Definitions

- **Qualified person**

For the purposes of this manual and product labels, a qualified person is one who is familiar with the installation, construction, operation and maintenance of this equipment and with the hazards involved. In addition, the person must have the following qualifications:

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

- **DANGER**

For the purposes of this manual and product labels, DANGER indicates loss of life, severe personal injury or substantial property damage WILL result if proper precautions are not taken.

- **WARNING**

For the purposes of this manual and products labels, WARNING indicates loss of life, severe personal injury or substantial property damage CAN result if proper precautions are not taken.

- **CAUTION**

For the purposes of this manual and products labels, CAUTION indicates minor personal injury or property damage CAN result if proper precautions are not taken.

- **NOTE**

For the purposes of this manual and products labels, NOTES merely call attention to information that is especially significant in understanding and operating the drive.

2.1 Description

SIVOLT A/V thyristor AC power controllers, in the following referred to as AC controllers for short, are electronic final controlling elements. They produce a variable AC output voltage from a given AC input voltage (line voltage). The AC controllers operate with

- phase control or with
- multi-cycle control.

The operating mode is selected with the aid of jumpers at the time of commissioning.

Phase control

In this operating mode, the fundamental-wave frequency of the output voltage is equal to the line frequency. The controllers contained in the AC controller maintain the output voltage or the output current constant at a level determined by the setpoint value.

Typical applications:

- *Industrial electric heating equipment for heating of the material by direct passage of current (e.g. wire annealing or glass-melting processes)*
- *Heaters with variable resistance characteristics*
- *Voltage control of electrostatic precipitators*
- *Lighting control systems*

Multi-cycle control

In this case the time characteristic of the output voltage is determined by the setpoint and the internal clock frequency. The line voltage is periodically switched through to the output for a short length of time, the pulse time or ON time, which is dependent on the setpoint. This is followed by an OFF interval. The clock frequency is set to a constant value during commissioning. The OFF interval is the difference between the clock cycle time and the ON time. The multi-cycle control mode is particularly suitable for loads with thermal inertia (e.g. furnaces, heaters, etc.).

Typical of applications:

Industrial furnaces, enamelling furnaces, drying kilns and melting furnaces
Pipeline trace heating systems, extruders, plastics processing machines
Nozzle, feeder and tin-bath heaters
Cooling ducts for float-glass plants

The power range of the AC controllers extends

from 12 kVA to 160 kVA at 400 V supply voltage and
from 15 kVA to 200 kVA at 500 V supply voltage.

The connected loads are either resistive loads (e.g. small heaters) or resistive-inductive loads (e.g. transformer with downstream high-voltage load).

Functions

- The AC controllers have a built-in actual-current and actual-voltage measuring circuit
- The units adapt automatically to line frequencies between 45 Hz and 65 Hz
- Inrush restraint in multi-cycle control mode by phase-controlled voltage build-up following controller enabling
- Rush-free operation with connected transformer and multi-cycle control
- The AC controllers have screw/plug-in terminals for external connections
- A connection is available for a 0 V to 10 V measuring instrument for current display
- A mounting station with appropriate current reserve is available for an additional printed-circuit board

2.2 Technical data

SIVOLT A/V AC controllers conform to DIN VDE 0558.

Order Number	6SG22 □□ - 1CA00							6SG22 □□ - 1EA00						
	10	12	14	16	18	20	22	10	12	14	16	18	20	22
Rating code designation	E400 E400/ □□□WL3RE							E500 E500/ □□□WL3RE						
	30	50	90	130	180	300	400	30	50	90	130	180	300	400
Rated supply voltage	1 AC 50/60 Hz 400 V [1]							1 AC 50/60 Hz 500 V						
Rated frequency	The AC controllers adapt automatically to rated frequencies betw. 45 and 65Hz													
Rated altern. current [2] A	30	50	90	130	180	300	400	30	50	90	130	180	300	400
Rated power [3] kVA	12	20	36	52	72	120	160	15	25	45	65	90	150	200
Power loss W	35	50	100	140	190	300	420	35	50	100	140	190	300	420
Output voltages for external loads	+24 V, 10 mA +10 V, 1 mA - 10 V, 1 mA +15 V, 50 mA - 15 V, 50 mA													
Short-circuit protection for electronics	Fine-wire fuse 0.125 A, medium time-lag, 500 V													
Fan [4] Type Supply voltage Current input	ebm W2S107-AA01-16 1AC 50/60 Hz 230 V 125 mA at 50 Hz, 110 mA at 60 Hz													
Ambient temperatures in operation [5]	0 °C to +65 °C with AN cooling 0 °C to +50 °C with AF cooling													
Storage and transport temperature	- 30 °C to +85 °C													
Site altitude AMSL [6]	≤ 1 000 m													
Humidity rating	acc. to class F (DIN 40 040)													
Creepage distances and clearances in air	acc. to class 2 (DIN VDE 0110)													
Degree of protection	IP00 to DIN 40 050 and IEC 144													
Dimensions	See dimension drawings in Section 2.3.2													
Weight approx. kg	4.5	4.5	4.5	9.7	9.7	12	13	4.5	4.4	4.5	9.7	9.7	12	13

Footnotes on Page 2/3

Footnotes:

1) The units can also be connected to 230 V. For connection to 230 V the appropriate primary winding of the power supply transformer (T131) must be connected by resoldering. The works setting is for connection to 400 V. The unit can be operated from 415 V. In this case, the 400 V winding of transformer T131 remains connected. The necessary steps to be taken are described in Section 2.6 "Commissioning".

2) AC controllers with rated alternating currents of 300 A and 400 A use AF cooling by an integral fan.

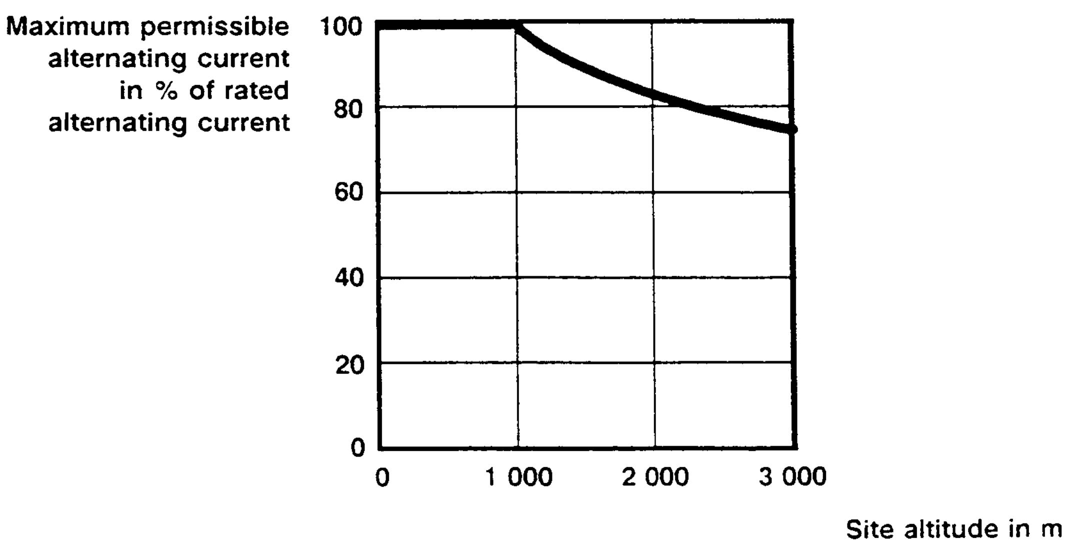
3) In the case of the 6SG22 . . -1CA00 AC controllers, the rated power values are based on a rated input voltage of 400 V.

4) For AC controllers 6SG2220- 1 . A00 and 6SG2222-1 . A00

5) Deviation of maximum permissible alternating current from rated alternating current as a function of ambient temperature

Ambient temperature °C	Deviation of maximum permissible current from rated alternating current AC controllers self ventilated %	AC controllers with forced air cooling %
+30	+12	+4
+35	+8	**0**
+40	+4	-6
+45	**0**	-12
+50	-6	-17
+55	-11	-
+60	-18	-
+65	-26	-

6) Site altitudes >1000 m
Maximum permissible alternating current in % of rated alternating current as a function of site altitude



2.3 Installation

	WARNING
⚠	Improper lifting and handling can cause serious or fatal personal injury and substantial property damage.

SIMOVERT converters are packed at the factory as necessary to resist the stresses and climatic conditions likely to occur during shipment and in the country of destination.

Observe the instructions for transport, storage and proper handling given on the packing.

The consignment must not be stored outdoors! The storage area must be well ventilated and dry.

Avoid severe shocks and vibration, e.g. when setting the converters down.

After the consignment has been unpacked and examined for completeness and possible damage, the converter should be installed in a dry and dust-free room. The supply air to the equipment must be free from corrosive gases.

If the above requirements are not met, it will be necessary to filter the supply air to the room / cabinet or, if the air is dust-laden, to fit filter mats on the ventilation grilles in the cabinet doors.

The ambient conditions in the converter room must not exceed those corresponding to humidity rating F according to DIN 40040 and a temperature of 35 °C (45°C for self ventilated operation); otherwise the equipment must be derated as stipulated in Section 2.2. The converters have degree of protection IP00 (Standard) according to DIN 40050. For locations above 1000m (3300ft) please see table 6) page 1/3 for reduced output.

Transport damage

Thoroughly inspect the equipment before accepting shipment from the transportation company. Compare each item received against the packing slip. Any shortage or damage should be reported promptly to the carrier. If any concealed loss or damage is discovered, file a claim promptly with the carrier, requesting him to to make an inspection. Failure to file a claim promptly may prevent you from collecting for loss or damage. If required, assistance may be requested from the local Siemens sales office.

- **Notes on transport damage**

1. Measures to be taken in the event of damage:

   - Consignee must contribute to damage reduction/limitation
   - Leave the consignment unchanged until the decision of the carrier or insurance company is on hand.
     Note that the Siemens-registered regional claims agent must be consulted as an independent expert in the event of
     - inland damage exceeding DM 10.000,--
     - damage inflicted abroad and exceeding DM 3.000,--.
   - Record the facts of the case in the consignment note and have it countersigned by the carrier.
   - Make out the certificate of damage and send it both to the forwarding agency and to the supplier.
   - Hold the forwarding agency liable by written notification to this effect.

2. Damage to be reported to the police:

   - Damage caused by theft
   - Damage caused by fire
   - Accident damage

3. Notification periods for concealed damage (detected after unpacking):

   - Forwarding agent: 6 days
   - Railway carrier/common carrier: 7 days

   In case of concealed damage, a certificate of damage has to be sent both to the supplier and the forwarding agency.

4. Transport insurance:

   SIVOLT A/V Controllers are insured ex works. Only the following are not insured:
   - Removals
   - In-plant transportation (transportation and handling within company premises, not using public roads)

2.3.1 Mounting the AC controller

SIVOLT A/V AC controllers are designed as chassis units (300 A and 400 A units complete with fan). They are supplied in two different housing sizes, depending on the output, and are intended for installation in

cabinets,
racks or
machine frames.

WARNING

Improper lifting and handling can cause serious or fatal personal injury and substantial property damage.

Installation instructions:

Mount the AC controllers vertically with the terminal lugs at the bottom

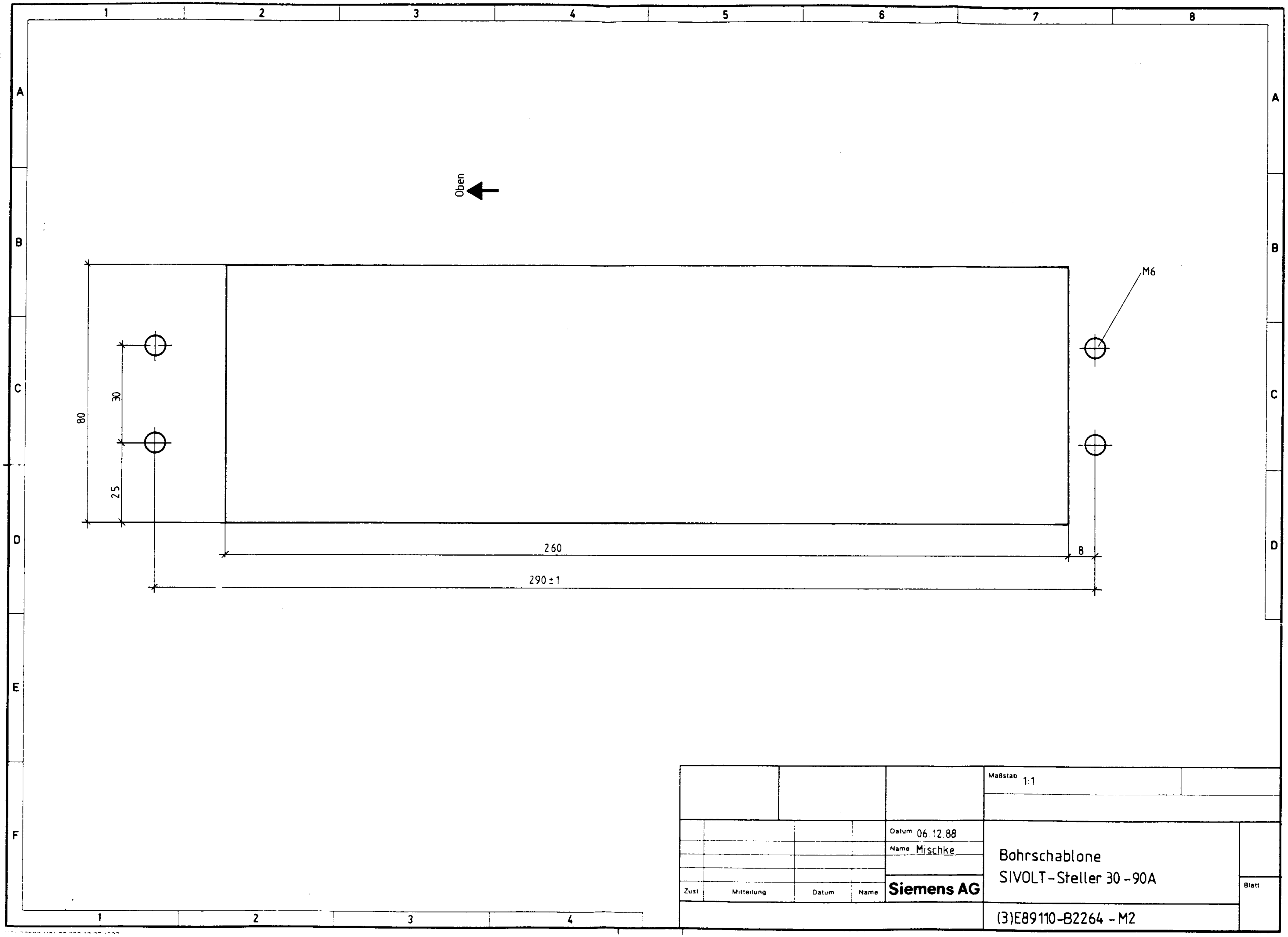
Ensure that cooling air can pass freely in and out

- It is also possible to install several **AC controllers with output currents of up to180 A** (with AN cooling) side by side or one above the other. A **minimum clearance of 100 mm** must in such cases be observed between the units (laterally and at top and bottom).
- **AC controllers with output currents of 300 A or 400 A** may be mounted side by side only. A **minimum clearance of 100 mm** must be observed between the units.

Units with AC rated currents 30 A to 90 A (6SG2210, 6SG2212, 6SG2214)
Two fixing brackets are provided for each unit for mounting in cubicles and frames. Four 7 mm diameter holes should be drilled using the drilling template provided in the Operating instructions in order to mount the equipment. The fixing brackets should be mounted using the M 6 screws so that they can be shifted in the elongated holes.
The unit is installed as follows:

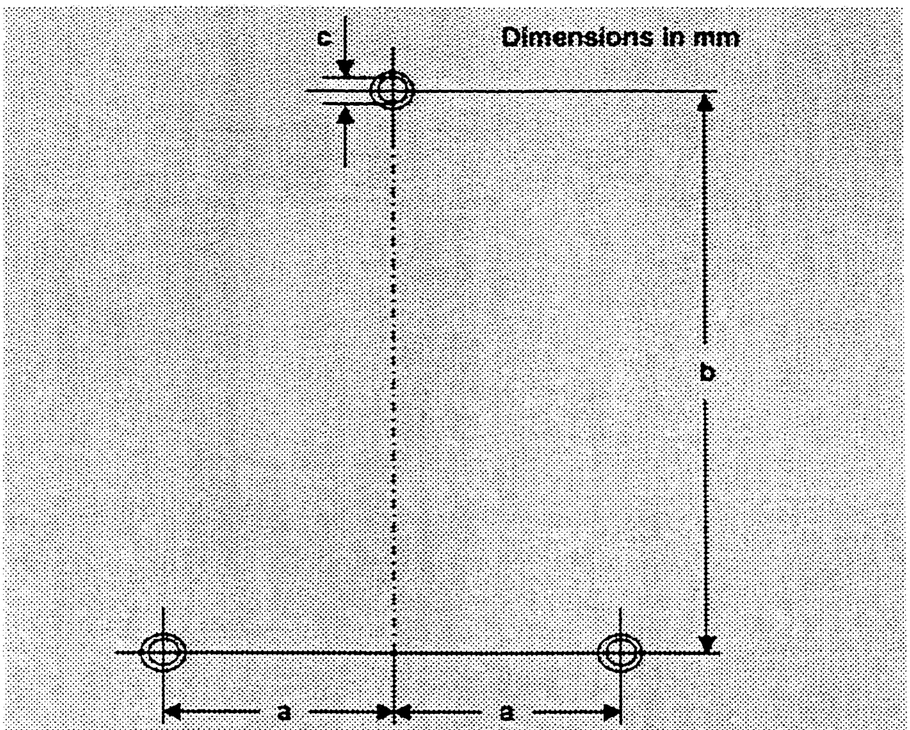
- Position the unit against the mounting surface
- With the unit slightly tilted, raise it so that the upper fixing bracket engages into the two rear retaining slots of the unit heatsink
- Lower the unit so that the lower fixing bracket engages into the two rear fixing slots of the unit heatsink
- Adjust the upper fixing bracket and screw both brackets tightly into place on the mounting surface.

Units with AC rated currents 130 A to 400 A (6SG2216, 6SG2218, 6SG2220, 6SG2222)
The units are retained using their fixing lugs on support rails or panels. Refer to Fig.1.3.1.2 for the retaining hole dimensions.



Oben
M6
80
30
25
260
8
290 ± 1
Maßstab 1:1
Datum 06.12.88
Name Mischke
Zust
Mitteilung
Datum
Name
Siemens AG
Bohrschablone
SIVOLT-Steller 30-90A
Blatt
(3)E89110-B2264-M2

2/7 + 8



	a	b	c
6SG2216	55	345	M8
6SG2218	55	345	M8
6SG2220	55	345	M8
6SG2222	55	345	M8

Fig. 2.3.1.2:
Mounting hole layout for AC controllers
6SG2216, 6SG2218, 6SG2220 and 6SG2222

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2.3.2 Dimension drawings

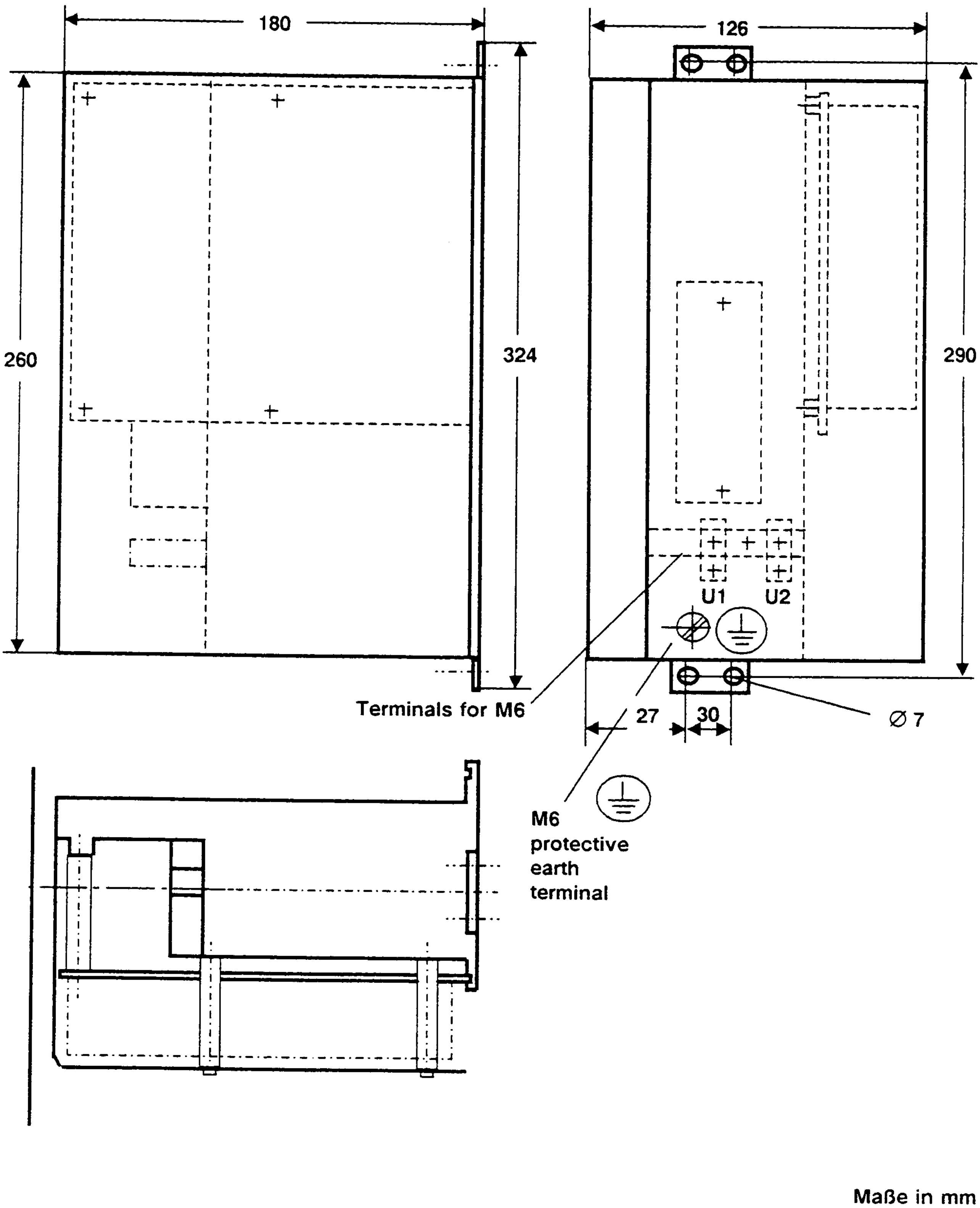

Fig. 2.3.2.1: Dimension drawings for AC controllers 6SG2210, 6SG2212 and 6SG2214

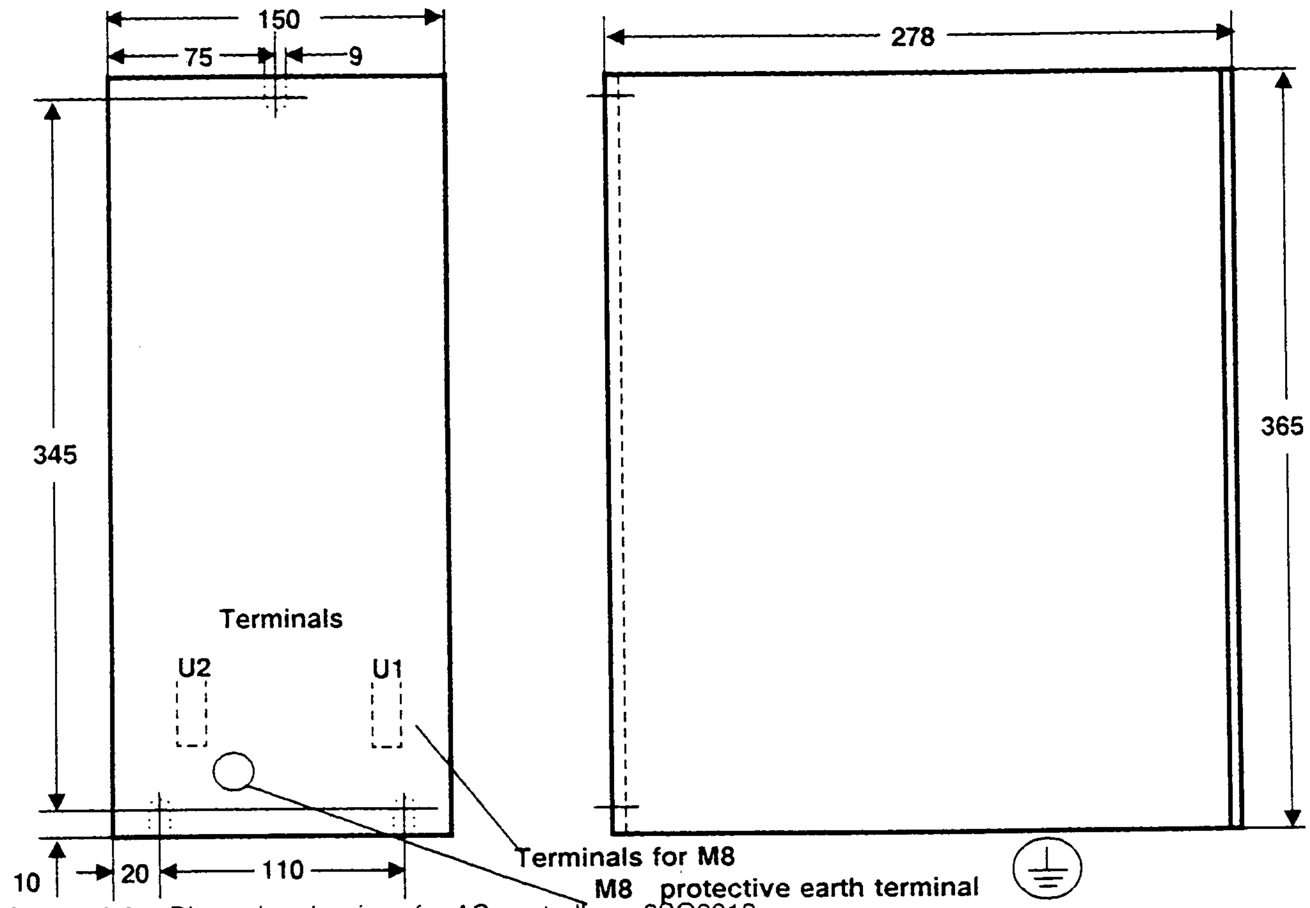

Fig. 2.3.2.2: Dimension drawings for AC controllers 6SG2216

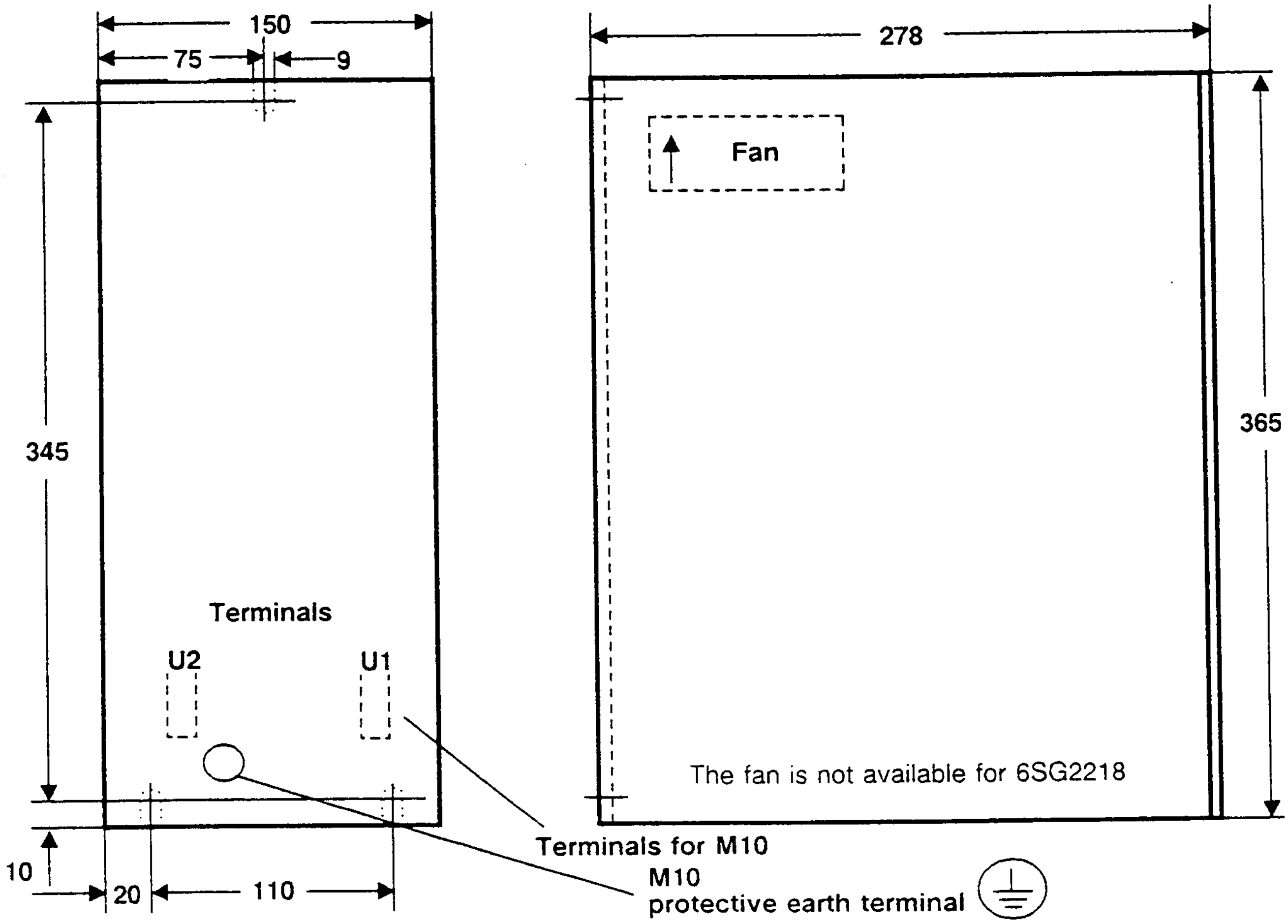

Fig. 2.3.2.3:Dimension drawings for AC controllers 6SG2218. 6SG2220 and6SG2222

2.3.3.1 Layout of components for commissioning and service: AC controllers 6SG2210, 6SG2212 and 6SG2214

Modules contain electrostatically sensitive components

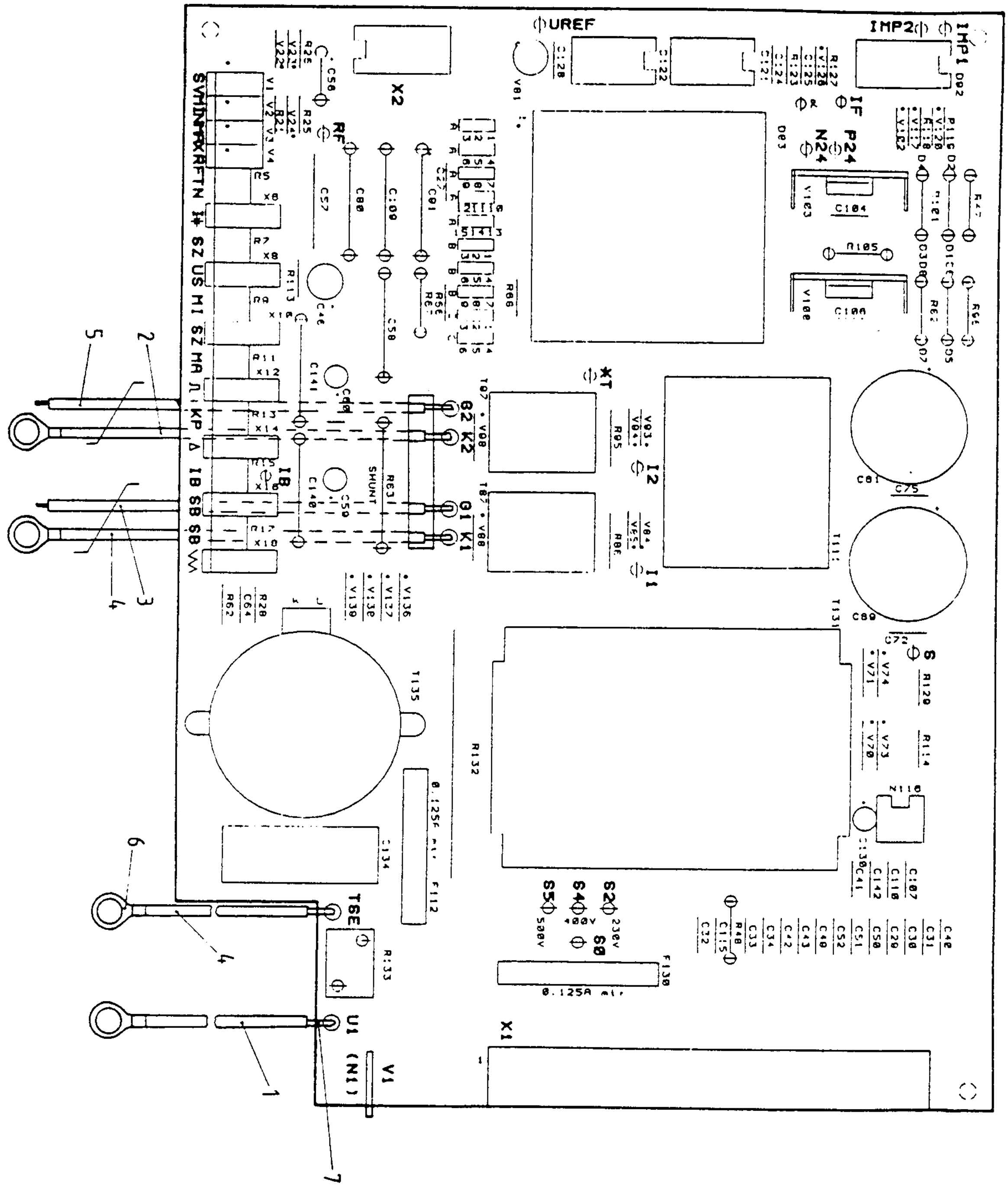

Fig. 2.3.3.1: AC controllers 6SG2210, 6SG2212 and 6SG2214

2.3.3.2 Layout of components for commissioning and service for 6SG2216, 6SG2218, 6SG2220, 6SG2222

Modules contain electrostatically sensitive components

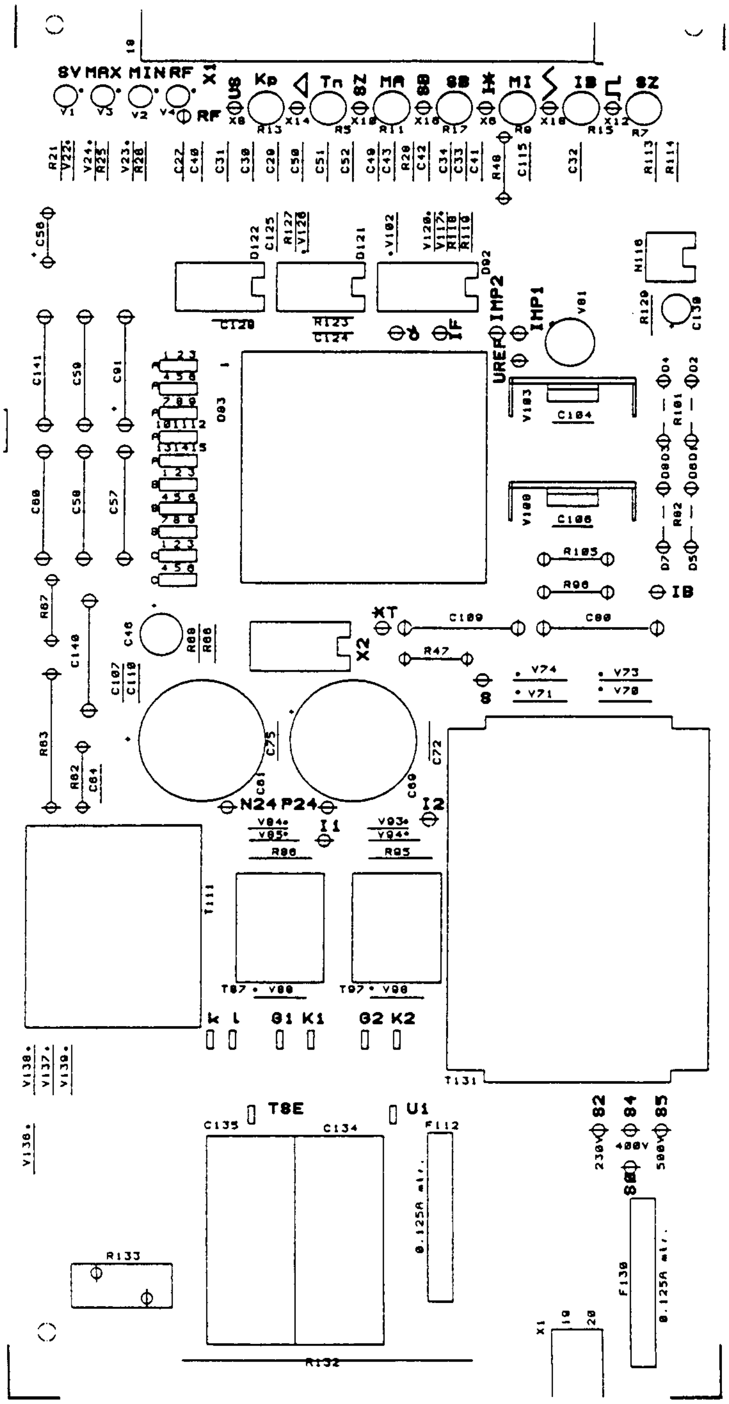

Fig. 2.3.3.2: AC controllers 6SG2216, 6SG2218, 6SG2220 and 6SG2222

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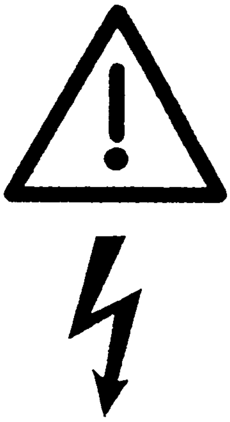
2.4 Connections



WARNING

Hazardous voltages up to 1000 V are used in the operation of this equipment, and can cause severe personal injury or loss of life.
The following precautions should be followed to reduce risk of injury or death:

- Only qualified service technicians should be allowed to test and repair the equipment or parts thereof.
- During normal operation, keep all covers in place and cabinet doors shut.
- Should it be necessary, during commissioning, to make measurements with the power turned on, do not touch any electrical contacts during such work and keep one hand completely free and outside the electrical circuitry.
- Make sure that test equipment is in good, safe operating condition.
- Stand on an ESD-approved insulated surface while performing commissioning work with the power on, being sure not to be grounded.
- When working on the connected load or load supply cable, be sure that the main switch of the equipment or the external feed breaker is padlocked in the OFF position.
- All work on the equipment and its installation must be carried out in accordance with the national electrical code and other state or local codes. This includes proper grounding of the controller cabinet in order to ensure that no accessible part of the equipment is at line potential or any other hazardous potential.
- The user is responsible for it that the controller and all controlled equipment are installed and connected in accordance with the approved codes of the country concerned and any other regional or local codes that may apply. Special attention must be paid to proper conductor sizing, fusing, grounding, isolating and disconnecting means and to overcurrent protection.
- Failing proper grounding of the controllers, the surface of the equipment can carry hazardous voltages which may cause severe or personal injury or loss of life or considerable property damage.

2.4 Connections

WARNING

Hazardous voltages up to 1000 V are used in the operation of this equipment, and can cause severe personal injury or loss of life.
The following precautions should be followed to reduce risk of injury or death:

- Only qualified service technicians should be allowed to test and repair the equipment or parts thereof.
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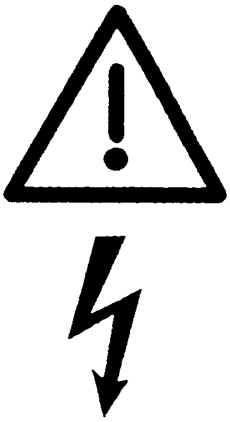
2.4 Connections



WARNING

Hazardous voltages up to 1000 V are used in the operation of this equipment, and can cause severe personal injury or loss of life.
The following precautions should be followed to reduce risk of injury or death:

- Only qualified service technicians should be allowed to test and repair the equipment or parts thereof.
- During normal operation, keep all covers in place and cabinet doors shut.
- Should it be necessary, during commissioning, to make measurements with the power turned on, do not touch any electrical contacts during such work and keep one hand completely free and outside the electrical circuitry.
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- Stand on an ESD-approved insulated surface while performing commissioning work with the power on, being sure not to be grounded.
- When working on the connected load or load supply cable, be sure that the main switch of the equipment or the external feed breaker is padlocked in the OFF position.
- All work on the equipment and its installation must be carried out in accordance with the national electrical code and other state or local codes. This includes proper grounding of the controller cabinet in order to ensure that no accessible part of the equipment is at line potential or any other hazardous potential.
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- Failing proper grounding of the controllers, the surface of the equipment can carry hazardous voltages which may cause severe or personal injury or loss of life or considerable property damage.

2.4.1 Connecting instructions

1. SIVOLT A/V AC controllers have no line switch. An appropriate ON/OFF switch must be provided externally.

2. The **SITOR fuse links** listed in Section 2.4.4 **protect the thyristors** against short circuit. They must be fitted external to the AC controllers.

3. The AC controllers must be wired up in accordance with the terminal connetion diagram or block diagram. Setpoint and actual-value leads must be screened and as far as possible laid separately from load-voltage leads.

4. **AC controllers with rated currents of 30 A and 50 A**
   The **SITOR fuse links** recommended in Section 2.4.4 can also be used **for line protection.** Their utilization category is gR.

5. **AC controllers with rated currents of 90 A, 130 A, 180 A, 300 A and 400 A**
   Line protection must be provided **by supplementary measures.**
   Appropriate measures:
   - circuit-breaker or
   - fuse link of utilization catagory gL or
   - bimetallic relay in combination with the SITOR fuse link.

6. **AC controllers with rated currents of 300 A and 400 A**
   These require forced-air cooling. Thus, the fan must be connected up with the temperature monitoring. The fan is already mounted in these AC controllers, but must be connected separately (terminals X3.3 and X3.4, temperature monitoring terminals X3.1 and X3.2).

Important:

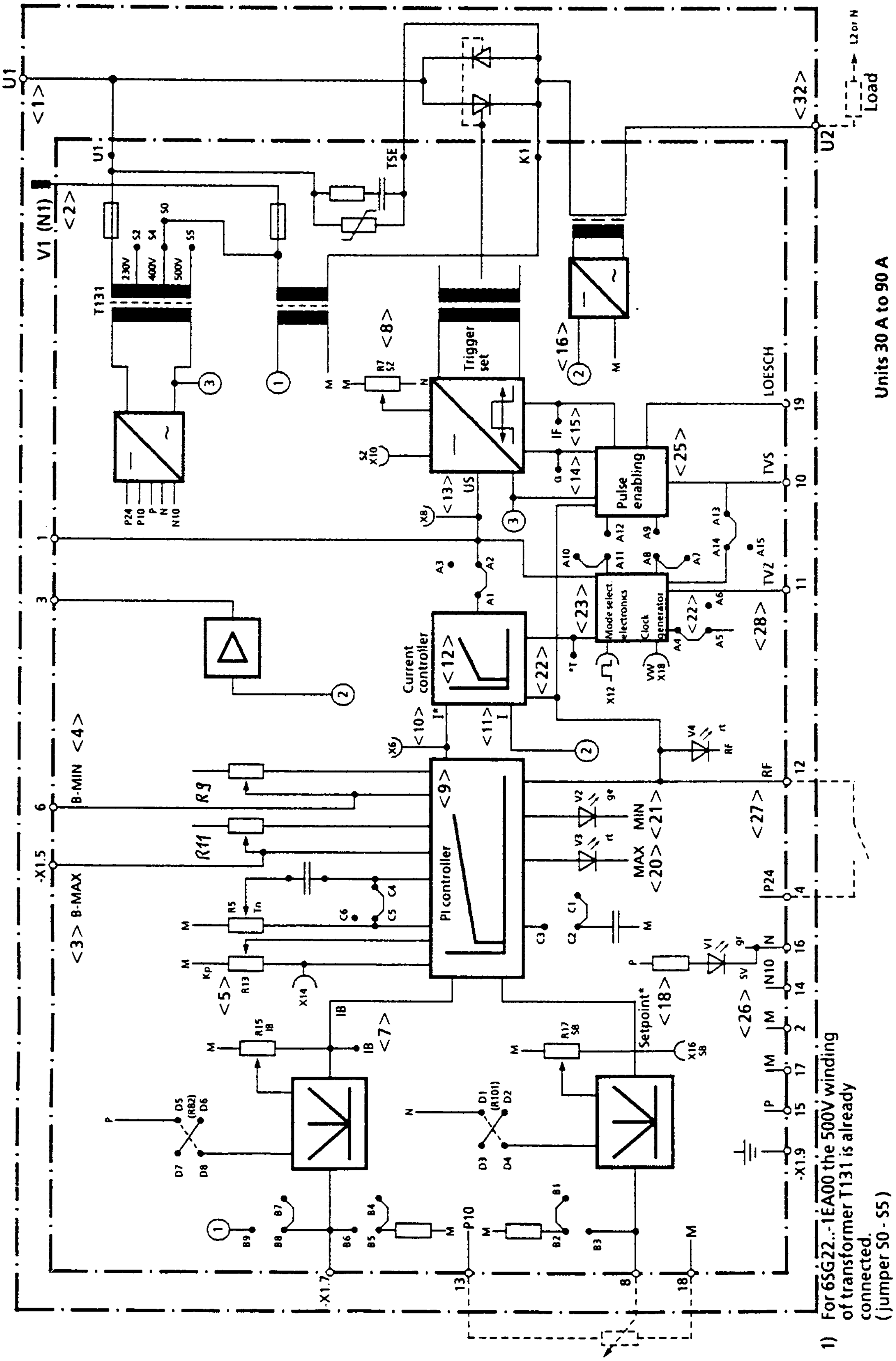
DIN VDE 0100 and DIN VDE 0160 must be observed

Connect the protective earth conductor to the PE terminal of the heat sink (see dimension drawings in Section 2.3.2).

Prevent thermal overload of the protective earth conductor to the AC controller (for operation with grounded supply networks).
Measures: **The protective earth conductor should have the same cross-section as the phase conductor** (the overload protection of the phase conductor also provides overload protection of the protective earth conductor)
or
connect up monitoring equipment (e.g. earth-leakage monitor) which automatically trips the unit when an earth fault occurs (this also allows a smaller conductor cross-section to be used for the protective earth conductor in comparison to the phase conductor)

Make the shortest possible conductive connection between the earth terminal (terminal X1.9) of the AC controller electronics and the cabinet (distance < 30 cm)
Reason: **Provision of interference immunity (EMC)**

2.4.2.1 Overview circuit diagram for AC controller 6SG2210 . . 14 (30...90A)



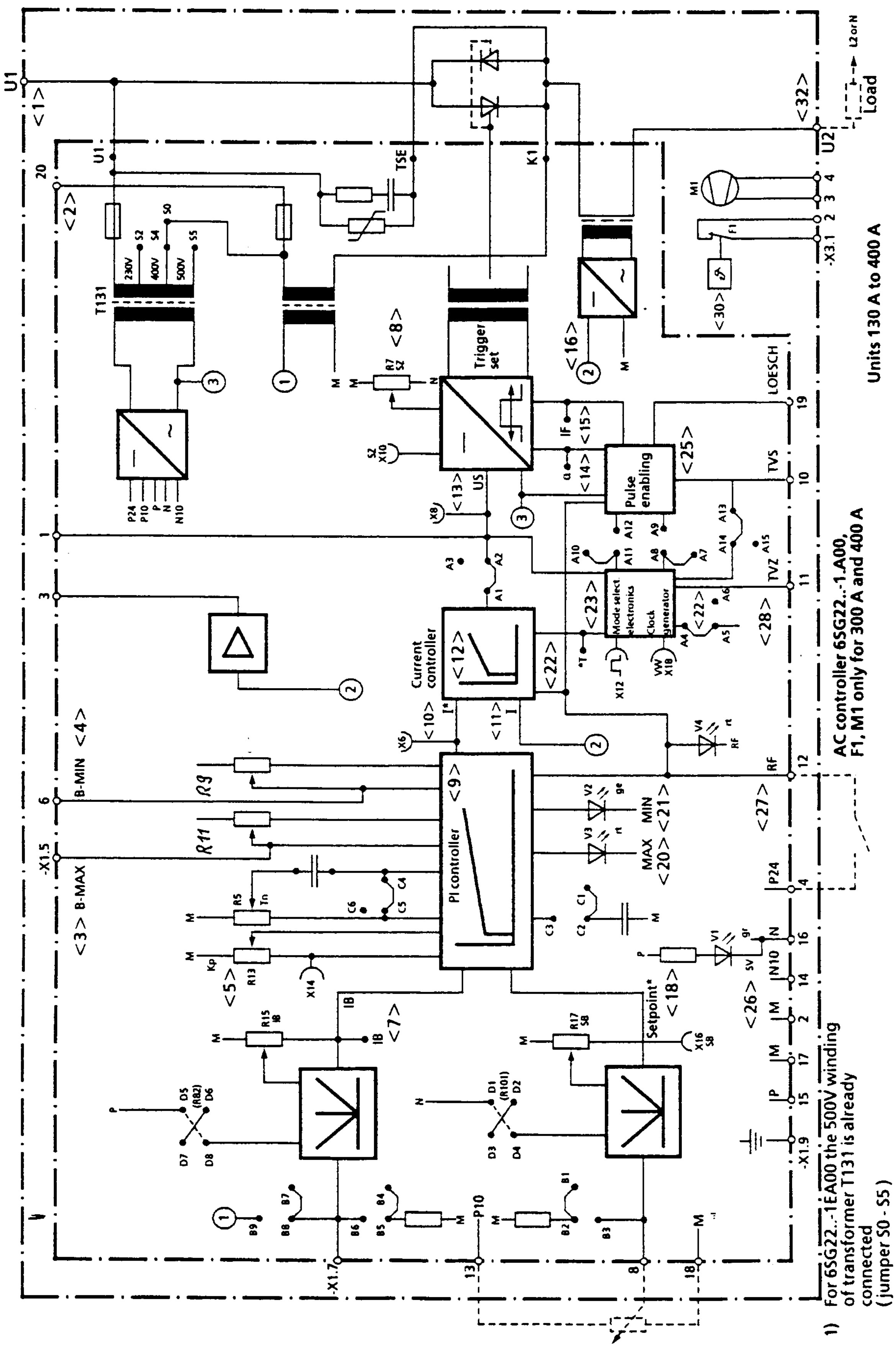
1) For 6SG22..-1EA00 the 500V winding of transformer T131 is already connected. (jumper S0 - S5)

Units 30 A to 90 A

Legend

⟨ 1⟩	U1	Line-side connection of the AC controller (e.g. at L1)
⟨ 2⟩	V1/N1	Power supply connection (e.g. at L2 or N)
⟨ 3⟩	B-MAX	External connection for limitation of current controller setpoint to maximum value
⟨ 4⟩	B-MIN	External connection for limitation of current controller setpoint to minimum value
⟨ 5⟩	Kp	Gain of PI controller
⟨ 6⟩	Tn	Integral-action time of PI controller
⟨ 7⟩	IB	Absolute value of actual value
⟨ 8⟩	SZ	Setting of delay angle α with multi-cycle control and resistive-inductive load
⟨ 9⟩	PI controller	-
⟨10⟩	I*	Current-controller setpoint
⟨11⟩	I	Current actual value
⟨12⟩	Current controller	-
⟨13⟩	US	Control voltage of trigger set
⟨14⟩	α	Delay angle
⟨15⟩	IF	Signal for pulse enabling
⟨16⟩	Trigger set	-
⟨17⟩	SB	Absolute value of setpoint
⟨18⟩	Setpoint*	Absolute value of setpoint
⟨20⟩	MAX	MAX value indicator
⟨21⟩	MIN	MIN value indicator
⟨22⟩	*T	Setpoint for multi-cycle control factor
⟨23⟩	Mode selection electronics	-
⟨24⟩	Clock generator	-
⟨25⟩	Pulse enabling	-
⟨26⟩	SV	Power supply ON indicator
⟨27⟩	RF	Input for controller enabling signal
⟨28⟩	TVZ	Input for multicycle control factor signal
⟨29⟩	TVS	Multicycle control factor synchronization
⟨32⟩	U2	Load-side connection of the AC controller

2.4.2.2 Overview circuit diagram for AC controller 6SG2216 . . .22 (130...400A)



Legend

⟨ 1⟩	U1	Line-side connection of the AC controller (e.g. at L1)
⟨ 2⟩	V1 /N1	Power supply connection (e.g. at L2 or N)
⟨ 3⟩	B-MAX	External connection for limitation of current controller setpoint to maximum value
⟨ 4⟩	B-MIN	External connection for limitation of current controller setpoint to minimum value
⟨ 5⟩	Kp	Gain of PI controller
⟨ 6⟩	Tn	Integral-action time of PI controller
⟨ 7⟩	IB	Absolute value of actual value
⟨ 8⟩	SZ	Setting of delay angle α with multi-cycle control and resistive-inductive load
⟨ 9⟩	PI controller	-
⟨10⟩	I*	Current-controller setpoint
⟨11⟩	I	Current actual value
⟨12⟩	Current controller	-
⟨13⟩	US	Control voltage of trigger set
⟨14⟩	α	Delay angle
⟨15⟩	IF	Signal for pulse enabling
⟨16⟩	Trigger set	-
⟨17⟩	SB	Absolute value of setpoint
⟨18⟩	Setpoint*	Absolute value of setpoint
⟨20⟩	MAX	MAX value indicator
⟨21⟩	MIN	MIN value indicator
⟨22⟩	*T	Setpoint for multicycle control factor
⟨23⟩	Mode selection electronics	-
⟨24⟩	Clock generator	-
⟨25⟩	Pulse enabling	-
⟨26⟩	SV	Display for power supply switched on
⟨27⟩	RF	Input for controller enabling signal
⟨28⟩	TVZ	Input for multicycle control factor signal
⟨29⟩	TVS	Multicycle control factor synchronization
⟨30⟩	ϑ	Thermostat
⟨32⟩	U2	Load-side connection of the AC controller

Legend

⟨ 1⟩	U1	Line-side connection of the AC controller (e.g. at L1)
⟨ 2⟩	V1 /N1	Power supply connection (e.g. at L2 or N)
⟨ 3⟩	B-MAX	External connection for limitation of current controller setpoint to maximum value
⟨ 4⟩	B-MIN	External connection for limitation of current controller setpoint to minimum value
⟨ 5⟩	Kp	Gain of PI controller
⟨ 6⟩	Tn	Integral-action time of PI controller
⟨ 7⟩	IB	Absolute value of actual value
⟨ 8⟩	SZ	Setting of delay angle α with multi-cycle control and resistive-inductive load
⟨ 9⟩	PI controller	-
⟨10⟩	I*	Current-controller setpoint
⟨11⟩	I	Current actual value
⟨12⟩	Current controller	-
⟨13⟩	US	Control voltage of trigger set
⟨14⟩	α	Delay angle
⟨15⟩	IF	Signal for pulse enabling
⟨16⟩	Trigger set	-
⟨17⟩	SB	Absolute value of setpoint
⟨18⟩	Setpoint*	Absolute value of setpoint
⟨20⟩	MAX	MAX value indicator
⟨21⟩	MIN	MIN value indicator
⟨22⟩	*T	Setpoint for multicycle control factor
⟨23⟩	Mode selection electronics	-
⟨24⟩	Clock generator	-
⟨25⟩	Pulse enabling	-
⟨26⟩	SV	Display for power supply switched on
⟨27⟩	RF	Input for controller enabling signal
⟨28⟩	TVZ	Input for multicycle control factor signal
⟨29⟩	TVS	Multicycle control factor synchronization
⟨30⟩	ϑ	Thermostat
⟨32⟩	U2	Load-side connection of the AC controller

2.4.3 Connectors and terminals and their significance

Max. permissible conductor cross-section 2.5mm², single-core or flexible conductor

Terminal X1. □□	Function	Values	Remarks	Diagram No./Circuit
1	Control voltage	+ 10 V to 0 V	Delay angle with phase control + 10 V ≙ α = 180° 0 V ≙ α = 0°	2/6
2	Frame potential	0 V		1/4
3	Current measurement	0 V to - 10 V	Connection of moving-coil instrument with $R_i \geq 1000\ \Omega/V$	4/3
4	Power supply, output via R48 (100 Ω)	+ 24 V / 10 mA	Serves exclusively to supply terminals X1.10 and X1.12	1/2
5	External limitation of current setpoint to maximum value	0 V to + 10 V	Overrides internal limitation with R11	1/7
6	External limitation of current setpoint to minimum value	0 V to + 10 V	Overrides internal limitation with R9	1/5
7	External actual value (freely selectable polarity)	0 V to 10 V (Input resistance: 25 kΩ) 0 mA to 20 mA 4 mA to 20 mA (Input resistance: 270 Ω)	For 4 mA to 20 mA range, solder-in resistor R82 = 540 kΩ between solder tags D5-D8 (refer to Pt. 2.5.3)	1/4
8	Setpoint (freely selectable polarity)	0 V to 10 V (Input resistance: 25 kΩ) 0 mA to 20 mA 4 mA to 20 mA (Input resistance: 270 Ω)	For 4 mA to 20 mA range, solder-in resistor R101 = 540 kΩ between solder tags D1-D4 (refer to Pt. 2.5.3)	1/3
9	Earth connection		Connection to cabinet, maximum 30 cm length	1/1
10	Multi-cycle control factor synchronization	0 V to + 15 V	Multi-cycle control factor signal from master AC controller to slave AC controller	3/3
11	Output of multi-cycle control factor (for supplementary PC board)	~ + 15 V to - 15 V	Square-wave voltage - 12 V to - 15 V ≙ AC controller "ON" + 12 V to + 15 V ≙ AC controller "OFF"	2/4
12	Controller enabling	+ 20 V to + 30 V	External connection from terminal X1.4	3/2
13	Power supply output	+ 10 V / 1 mA		1/2
14	Power supply output	- 10 V / 1 mA		1/4

Terminal table for X1 terminals (screw/plug-in terminals), continued on the next page

Terminal X1. ▫▫	Function	Values	Remarks	Diagram No./Circuit
15	Power supply output	+ 15 V / 50 mA		1/3
16	Power supply output	- 15 V / 50 mA		1/3
17	Frame potential	0 V	Central earthing point	1/3
18	Frame potential	0 V		1/2
19	Pulse cancellation	High signal from the PLC or P24 or P15	Immediate suppression of the firing pulses	
20	Line-side connection for the power supply	Supply voltage corres-ponding to the AC controller supply voltage. Solder-in the applicable jumper on trans-former T131 (for 230V supply voltage)	**Only for units 6SG2216 6SG2218 6SG2220 6SG2222**	4/5

Terminal table for X1 terminals (screw/plug-in terminals), cont.

Terminal X2. ▫▫	Function	Values	Remarks	Diagram No./Circuit
1	P			2/1
2	M			2/2
3	N			2/2
4	$\overline{RF}$		Controller enabling"low"	2/2
5	Rü		Reset Phase control	2/2
6	U-ACT		Voltage actual value	2/2
7	Setpoint*		Absolute value of setpoint	2/3
8	B-MIN			2/3
9	B-MAX			3/3
10	Setpoint		Setpoint	2/3
11	IB			2/3
12	$\overline{IF}$		Pulse enabling "low"	2/3
13	I		Current actual value	2/4
14	TVZ		Mc. contr. factor (suppl. PCB)	2/4
15	MIN			2/4
16	MAX			2/4

Connector pin assignments for X2 connector

Terminal X3. □	Function	Values	Remarks	Diagram No./Circuit
1 2	Temperature monitoring F1, NC contact	1 AC 250 V, 1 A		4/7 4/7
3 4	Fan M1	1 AC 50/60 Hz 230 V 125 mA (50 Hz) or 110 mA (60 Hz)		4/7 4/7

Terminal table for X3 terminal block

	Function	Values	Remarks	Diagram No./Circuit
U1	Line-side connection			4/5
U2	Load-side connection			4/5
V1 / N1	Line-side connection for power supply	Supply voltage corresponding to the AC controller supply voltage. Solder-in the applicable jumper on transformer T131 (for 230V supply voltage	6.3x0.8 Faston connector on the PC board. **Only for units** **6SG2210** **6SG2212** **6SG2214**	4/6

Power terminals

2.4.4 List of recommended fuses, thyristors used

SIVOLT AC controller	Recommended fuse link for short-circuit protection				Built-in thyristor module
Order No.	Order No.	I_N/U_N	Size to DIN 43 620	Matching holder	Type
6SG2210-1CA00	3NE8017	50 A / 660 V	00	3NH3030	SKKT26/12E
6SG2212-1CA00	3NE8018	63 A / 660 V	00	3NH3030	SKKT91/12E
6SG2214-1CA00	3NE8022	125 A / 660 V	00	3NH3030	SKKT91/12E
6SG2216-1CA00	3NE8024	160 A / 60 V	00	3NH3030	SKKT132/12E
6SG2218-1CA00	3NE4327-0B	250 A / 800 V	2 [1]	3NH3330	SKKT250/12E
6SG2220-1CA00	3NE4333-0B	450 A / 800 V	2 [1]	3NH3330	SKKT250/12E
6SG2222-1CA00	3NE4334-0B	500 A / 800 V	2 [1]	3NH3330	SKKT250/12E
6SG2210-1EA00	3NE8017	50 A / 660 V	00	3NH3030	SKKT26/16E
6SG2212-1EA00	3NE8018	63 A / 660 V	00	3NH3030	SKKT91/16E
6SG2214-1EA00	3NE8022	125 A / 660 V	00	3NH3030	SKKT91/16E
6SG2216-1EA00	3NE8024	160 A / 660 V	00	3NH3030	SKKT132/16E
6SG2218-1EA00	3NE4327-0B	250 A / 800 V	2 [1]	3NH3330	SKKT250/16E
6SG2220-1EA00	3NE4333-0B	450 A / 800 V	2 [1]	3NH3330	SKKT250/16E
6SG2222-1EA00	3NE4334-0B	500 A / 800 V	2 [1]	3NH3330	SKKT250/16E

1) Overall dimensions and puller lugs conform to DIN 43 620; the blades, however, are slotted in accordance with DIN 43 653.

2.5 Setting parameters, displays, measuring points and modules

2.5.1 Plug-in jumpers

Position	Function	Diagram No./Circuit
A2 - A1	Connection of control voltage (current-controller output) to trigger set (in single-unit op. or master AC controller with 3-phase economy connection)	2/1
A2 - A3	Disconnection of controllers with 3-phase econ. connection in slave AC contr.	2/1
A5 - A4 and A8 - A7	Selection of operating mode: Phase control	3/4 and 3/2
A5 - A6 and A8 - A9 and A11 - A10 and A14 - A13 and A14 - A15	Selection of operating mode: Multi-cycle control, resistive load Setting of the delay angle α for the first half wave inoperative Three-phase economy connection: in the master AC controller and Three-phase economy connection: in the slave AC controller	3/4 and 3/2 and 3/5 and 3/4 and 3/4
A5 - A6 and A8 - A9 and A11 - A12 and A14 - A13 and A14 - A15	Selection of operating mode: Multi-cycle control, resistive-inductive load Setting of the delay angle α for the first half wave with potentiometer R7 SZ Three-phase economy connection: in the master AC controller and Three-phase economy connection: in the slave AC controller	3/4 and 3/2 and 3/5 and 3/4 and 3/4

Plug-in jumpers for selection of operating mode

Position	Function		Diagram No./Circuit
B2 - B1	Setpoint as voltage signal:	0 V to +10 V or 0 V to - 10 V	1/3
B2 - B3	Setpoint as current signal:	0 mA to +20 mA or 0 mA to -20 mA, +4 mA to +20 mA or -4 mA to -20 mA (resistor R101 must be fitted in the 4 mA to 20 mA ranges)	1/3
B5 - B4 and B8 - B7	Actual value as external voltage signal:	0 V to +10 V or 0 V to - 10 V	1/4 and 1/4
B5 - B6 and B8 - B7	Actual value as external current signal:	0 mA to +20 mA or 0 mA to -20 mA, +4 mA to +20mA or -4 mA to -20 mA (resistor R82 must be fitted in the 4 mA to 20 mA ranges)	1/4 and 1/4
B8 - B9	Operation with closed-loop voltage control; the actual value of the output voltage (load voltage) is applied to the PI controller		1/4

Plug-in jumpers for matching of the setpoints and actual values

Position	Function	Diagram No./Circuit
C2 - C1	Time constant for actual-value signal smoothing: 5,75 ms	1/6
C2 - C3	Time constant for actual-value signal smoothing: 63 ms	1/6
C5 - C4	P controller (1:1)	1/7
C5 - C6	PI controller, integral-action time Tn: 0.1 s to 2.2 s	1/7

Plug-in jumpers for setting the PI controller

2.5.2 Potentiometers

R □□		Function	Diagram No./Circuit
No.	**.Des**		
5	**Tn**	Adjust integral-action time of PI controller; Tn is dependent on R5 and C56 R5 = Left-hand stop ≙ Reduce Tn R5 = Right-hand stop ≙ Increase Tn	1/7
7	**SZ**	Set delay angle α of first half wave (applicable only to multi-cycle control with resistive-inductive load) R7 = Left-hand stop ≙ $\alpha \approx 0°$ R7 = Right-hand stop ≙ $\alpha \approx 180°$	2/5
9	**MI**	Limit current-controller setpoint I^* to minimum value R9 = Left-hand stop ≙ $I^* = 0$ V R9 = Right-hand stop ≙ $I^* = 10$ V	1/5
11	**MA**	Limit current-controller setpoint I^* to maximum value (must be larger than minimum value) R11 = Left-hand stop ≙ $I^* = 0$ V R11 = Right-hand stop ≙ $I^* = 10$ V	1/6
13	**Kp**	Gain of PI controller R13 = Left-hand stop ≙ Kp = 1 R13 = Right-hand stop ≙ Kp = 11	1/6
15	**IB**	Matching an external actual value to the internal 10 V signal voltage in the AC controller; + 10 V is reached when actual-value signal at term. X1.7 equals 1.7 V or 6,3 mA, when R15 = 10 s.d.* actual-value signal at term. X1.7 equals 15 V or 55 mA, when R15 = 2 s.d. or matching the actual voltage value U-ACT to the internal 10 V signal voltage in the AC controller	1/4
17	**SB**	Matching the setpoint to the internal 10 V signal voltage in the AC controller 10 V is reached when Setpoint signal at term. X1.8 equals 1.7 V or 6,3 mA, when R17 = 10 s.d. Setpoint signal at term. X1.8 equals 15 V or 55 mA, when R17 = 2 s.d.	1/4

* s.d. = Scale division(s)

Overview of potentiometers

english

2.5.3 Resistors

The variable resistors listed below are mounted on soldering tags.

R □□□ No.	R □□□ As del.	Function	Diagram No./Circuit
47	0 Ω	Determination of the maximum delay angle α, e.g. R47 = 200 k ≙ $\alpha_{max} = 90°$ R47 = 66 k ≙ $\alpha_{max} = 135°$	2/2
62 and 63	see Tab.	Load resistor for current actual value adaptation Rated alternating current (A) / R62 (Ω) / R63 (Ω) 30 / 1300 / 560 50 / 1300 / 270 90 / 1300 / 150 130 / 200 / 160 180 / 200 / 91 300 / 200 / 47 400 / 200 / 33	4/4 and 4/4
67	39 k	Adjusting the proportional-action coefficient Kp of the current controller (dependent on input resistance R_E, in this case $R_E = 220$ k) Kp = R67 ÷ R_E → 39 k ÷ 220 k ≈ 0.2	2/1
82	-	Without live-zero actual-value operation With live-zero operation → R82 = 540 k Resistor combinations solder-in 1MΩ in parallel with 1.2 MΩ between D5 and D8 or: Solder-in 270 kΩ between D7 and D8 and 270 kΩ between D5 and D6 or: Solder-in 390 kΩ between D7 and D8 and 150 kΩ between D5 and D6	1/4
96	220 k	Adapting the saw-tooth voltage from socket X18 (dependent on clock cycle time, which is determined by the value of C109) **10 V_{pp} saw-tooth voltage must be present at socket X18** Increase resistance; lengthen clock cycle time Note: adjust R96 in proportion with C109	2/3
101	-	Without live-zero setpoint operation With live-zero operation → R101 = 540 k Resistor combinations solder-in 1MΩ in parallel with 1.2 MΩ between D1 and D4 or: Solder-in 270 kΩ between D3 and D4 and 270 kΩ between D1 and D2 or: Solder-in 390 kΩ between D3 and D4 and 150 kΩ between D1 and D2	1/3
105	1 M	No function	2/4

Overview of variable resistors

2.5.4 Capacitors

The variable capacitors listed below are mounted on soldering tags.

C □□□		Function	Diagram No./Circuit
No.	As del.		
56	10 µ	Varying the adjustment range of integral-action time Tn of PI controller Tn = [220 k × C56 × (β + 0.47)] ÷ 10.47 β is dependent on the setting of potentiometer R5 Tn (0 s.d. to 10 s.d.) C56 = 10 µ ≙ Tn from 0.1 s to 2.2 s	1/7
58	0.47µ	Varying the integral-action time Tn of the current controller (as a function of resistance R67) Tn = R67 × C58 → 39 k × 0.47 µ = 18 ms Note: adjust C58 in proportion with C109	2/1
59	1 µ	Smoothing setpoint of PI controller (≙ adjusting time constant) Time constant = 5,75 k × C59, in this case 5,75 k × 1 µ = 5,75 ms	1/5
60	1 µ	Smoothing actual value of PI controller (≙ adjusting time constant) Time constant = 5,75 k × C60, in this case 5,75 k × 1 µ = 5,75 ms with jumper C2 - C3 → time constant = 5 k × (C60 + 10 µ), here 63 ms	1/5
80	1 µ	Adjusting the saw-tooth voltage	2/3
91	4.7 µ	Ramp-up time with multi-cycle control after switching on Ramp-up time = 1 M × C91 → 1 M × 4.7 µ ≈ 5 s	3/4
109	1 µ	Clock time (fundamental frequency) with multi-cycle control, approx. 1200 ms The clock time changes in proportion with C109 Note: adjust R96 and C58 in proportion with C109	2/2
140	-	Increase the existing setpoint smoothing (set at 5.75ms) also refer to C59	1/5
141	-	Increase the existing actual value smoothing (set at 5.75ms) (for jumper setting C2-C1, also refer to C60)! **Warning!** When using supplementary board 6SG8200-1.B00 and power control, a jumper must be soldered-in at solder location C141.	

Overview of variable capacitors

2.5.5 LED displays

Designation	Function	Diagram No./Circuit
V1 SV	Lights up green to indicate "power supply on", i.e. terminals U1 and V1 (N1) are connected to line voltage	1/4
V2 MIN	Lights up yellow when the current-controller setpoint reaches the value set with potentiometer R9 MI or present at terminal X1.6	1/6
V3 MAX	Lights up red when the current-controller setpoint reaches the value set with potentiometer R11 MA or present at terminal X1.5	1/7
V4 RF	Lights up red to indicate "controller enable"	3/3

LED displays

2.5.6 Measuring points

Solder pin desig.	Measured quantity	Function	Diagram No./Circuit
IB	+ 10 V	Absolute value of an external actual value or the actual voltage value; if necessary standardize to + 10 V with potentiometer R15 IB	1/5
*T	 - 10 V 0 V	Setpoint for multicycle control factor ≙ minimum control factor 1 × ON and 9 × OFF ≙ maximum control factor 9 × ON and 1 × OFF	2/2
α	Square-wave 13 V_{pp}	With multi-cycle control the phase angle α of the first half wave is equal to the phase displacement between the square-wave voltage and the synchronizing voltage	2/6
IF	+ 12 V	Pulse enabling as continuous signal with phase control or pulse enabling as alternating signal with multi-cycle control	3/5

Overview of measuring points at solder pins for taking check measurements and for commissioning

Socket[1] desig.	Measured quantity	Function	Diagram No./Circuit
X6 I*	0 V to + 10 V	Setpoint of current controller	1/7
X8 US	+ 10 V to 0 V	Control voltage + 10 V ≙ α ≈ 180° + 0 V ≙ α ≈ 0°	2/2
X10 SZ	0 V to - 10 V	Saw-tooth voltage of trigger set	2/5
X12 ⊓⊔⊓	+ 12 V to - 14 V	Square-wave voltage with clock frequency for multi-cycle control	2/3
X14 Δ	0 V to + 10 V	Setpoint/actual value difference (P offset)	1/6
X16 SB	- 10 V	Absolute value of setpoint, if necessary standardize to -10 V with potentiometer R70 SB	1/4
X18 /\/\/\	- 10 V_{pp}	Saw-tooth voltage of clock generator	2/4

Overview of measuring points at sockets for taking check measurements

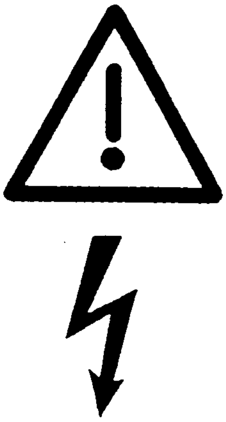
1) Solder pins are provided in AC controllers with rated alternating currents of 130 A, 180 A, 300 A and 400 A

2.5.7 Plug-in components

Designation	Function	Type designation
D83	Open-loop and closed-loop control for SIVOLT A/V AC controllers	U40
D92	Transistor array	ULN 2002 A
D122	D flipflop	

Overview of plug-in components (hybrid modules and ICs)

2.6 Commissioning



WARNING

Hazardous voltages of up to 1000 V are used in the operation of this equipment, and can cause severe personal injury or loss of life.
The following precautions should be followed to reduce risk of injury or death:

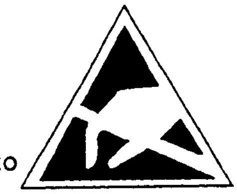
- Only qualified service technicians should be allowed to test and repair the equipment or parts thereof.
- During normal operation, keep all covers in place and cabinet doors shut.
- Should it be necessary, during commissioning, to make measurements with the power turned on, do not touch any electrical contacts during such work and keep one hand completely free and outside the electrical circuitry.
- Make sure that test equipment is in good, safe operating condition.
- Stand on an ESD-approved insulated surface while performing commissioning work with the power on, being sure not to be grounded.
- When working on the connected load or load supply cable, be sure that the main switch of the equipment or the external feed breaker is padlocked in the OFF position.
- All work on the equipment and its installation must be carried out in accordance with the national electrical code and other state or local codes. This includes proper grounding of the controller cabinet in order to ensure that no accessible part of the equipment is at line potential or any other hazardous potential.
- The user is responsible for it that the controller and all controlled equipment are installed and connected in accordance with the approved codes of the country concerned and any other regional or local codes that may apply. Special attention must be paid to proper conductor sizing, fusing, grounding, isolating and disconnecting means and to overcurrent protection.
- Failing proper grounding of the controllers, the surface of the equipment can carry hazardous voltages which may cause severe or personal injury or loss of life or considerable property damage.

2.6.1 Instructions for commissioning

The commissioning steps described in the following ensure reliable operation of the AC controller. Explanations pertaining to the various adjustments (jumpers, potentiometers, etc.) are given in the preceding Section 2.5. Location diagrams for the AC controller, showing the layout of components used, are given in Sections 2.3.3.1 and 2.3.3.2.

It is advisible to record all set values in a commissioning report. Section 2.7 contains a report in which the as-delivered condition is noted. These pages can be copied, completed and added to the documentation of the plant.

Electrostatic sensitive devices (ESD)



Generally, printed circuit boards (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.

Soldering on PCB's only, when power has been removed

When carrying out soldering jobs on PCBs, use an ESD soldering iron or at least make sure that the soldering tip has been earthed.

The following steps must be taken before the AC controller is put into service:

1. **The AC controller must be installed correctly in accordance with Section 2.3.**
2. **The AC controller must be wired up correctly in accordance with**

The commissioning instructions are given in three distinct parts:

- for phase control with single-phase AC connection (Page 2/24)
- for multi-cycle control with single-phase AC connection (Page 2/30)
- for multi-cycle control with three-phase economy connection (Page 2/36)

Spare parts

The SIVOLT A/V AC controllers will be included in Catalog LE 3.

2.6.2 Commissioning for phase control and single-phase AC connection

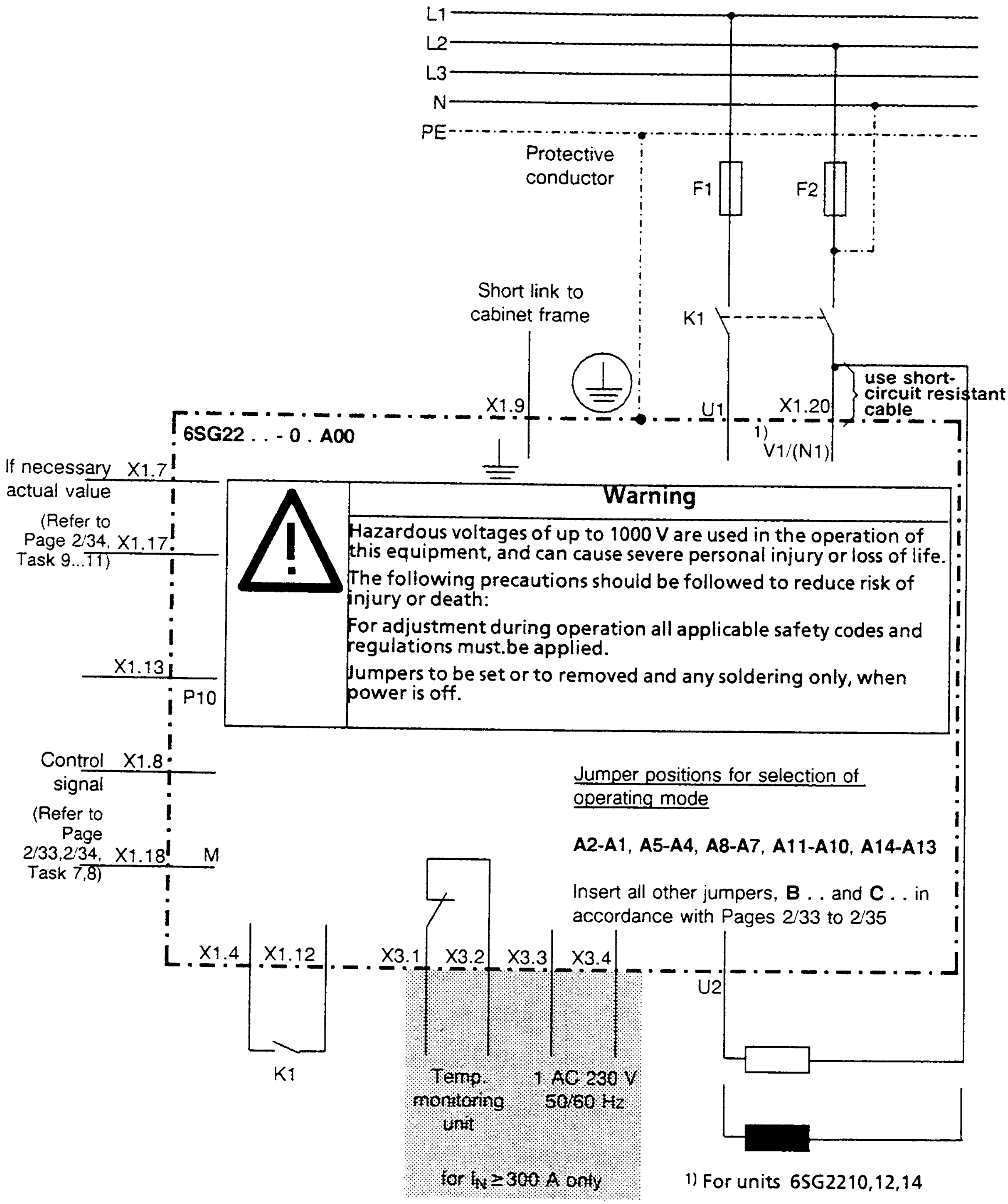


Fig. 2.6.2: Suggested connections for SIVOLT A/V AC controllers with phase control

1	→ **Disconnect unit and load from the power (e.g. open main contactor K1, refer to Fig. 2.6.2)** → **Open terminals U1, V1 (N1)** → **Open terminals U2**			<u>**Warning**</u> **Commissioning tasks 1 to 14 can only be carried out when the unit is in the no-voltage condition without load**			**Modules contain electrotstatically sensitive components**
2	Unit for *rated supply voltage* of 500 V ?	yes→	2a	Continue at 5			
3	Unit for rated supply voltage 400 V is set for *supply voltage* of 400 V (connection at solder pin 400 V of T131)						
4	Other supply voltage ?	yes→	4a	<u>Supply voltage 230 V</u>: → Resolder from solder pin 400V (S4) to 230 V (S2 on T1) → Continue at 5			
5	**Insert jumpers, adjust and connect resistors and capacitors**						
6	**Phase control** → Insert jumper A2-A1 (⊗) → Insert jumper A5-A4 (⊗) → Insert jumper A8-A7 (⊗) → Insert jumper A11-A10 (⊗) → Insert jumper A14-A13 (⊗)						<u>Note</u>: (⊗) indicates factory settings
7	**Setpoint** Setpoint as voltage signal ? <u>Setpoint as current signal</u> → Insert jumper B2-B3 → Connect setpoint to terminal X1.8 → Connect frame potential of setpoint to terminal X1.18 → Input resistance at terminal X1.8 270 Ω	yes→	7a	Insert jumper B2-B1 (⊗) Setpoint from external poti. ? <u>Setpoint from external controller</u>: → Connect setpoint to terminal X1.8 → Connect frame potential of setpoint to terminal X1.18 → Input resistance at terminal X1.8 25 kΩ (in operation) *) → Continue at 9	yes→	7b	→ Min. resistance required 10 kΩ and 20 W → Connect to terminals X1.8, X1.13 and X1.18 (according to block diagrams in Sections 2.4.2.1 and 2.4.2.2) → Average-value control of current → Continue at 9

*) Input resistance at terminal X1.8, 150Ω when T131 has a no-voltage condition

8	Setpoint betw.4 mA and 20 mA ? Setpoint is between 0 and 20 mA	yes→	8a	→ Solder in resistor R101 = 540 kΩ between D1 and D4 (resistor combinations as well as locations, refer to Section 2.5.3) → Continue at 9			
9	**Actual value** ? Load-voltage control with secondary current control	yes→	9a	→ Insert jumper B8-B9 → Insert jumper C5-C6 → Continue at 12			
10	External actual value as voltage signal ? Ext. act. value as current signal → Insert jumper B5-B6 → Insert jumper B8-B7 (⊗) → Connect external actual value to terminal X1.7 → Connect frame potential of actual value to terminal X1.17 → Input resistance at terminal X1.7 270 Ω	yes→	10a	→ Insert jumper B5-B4 (⊗) → Insert jumper B8-B7 (⊗) → Connect actual value to terminal X1.7 → Connect frame potential of actual value to terminal X1.17 → Input resistance at terminal X1.7 25 kΩ (in operation) *) → Continue at 12			
11	Actual value between 4 mA and 20 mA ? Actual value betw. 0 and 20 mA	yes→	11a	→ Solder in resistor R82 = 540 kΩ between D5 and D8 (resistor combinations as well as locations, refer to Section 2.5.3) → Continue at 12			
12	**Parameters of current controller** Adjust Kp or Tn ? As-delivered state: Kp = 0.2 with R67 = 39 k (⊗) Tn = 18 ms with R67 = 39 k (⊗) and C58 = 0.47µ (⊗)	yes→	12a	→ Set Kp of current controller with R67: Kp = R67 ÷ 200 k → Set Tn of current controller with C58: Tn = R67 × C58 → Continue at 13			

*) Input resistance at terminal X1.7, 150Ω when T131 has a no-voltage condition

13	**Parameters of PI controller** P controller ? PI controller is set	yes→	13a	If PI controller is used ? → Insert jumper C5-C4 (⊗) → Continue at 15	yes→	13b	→ Continue at 15
14	→ Insert jumper C5-C6 → Extend input smoothing (actual-value channel) from 5.75 ms to 63 ms ? → Insert jumper C2-C1 (⊗)	yes→	14a	→ Insert jumper C2-C3 → Continue at 15			
15	**Adjustment**			**Warning**			**Warning**
16	→ Connect terminals U1, V1 (N1) to line voltage → Switch-on power			**Unit and load are now live.** Commissioning is still realized without load.			Before connecting to the line, cover to be re-affixed.
17	**Setpoint** As supplied: Poti. R17 SB (⊗) is set such that -10 V is present at socket X16 SB, if: - 20 mA is fed in at terminal X1.8 - and jumper B2-B3 is inserted adjust if necessary						
18	Setpoint as voltage signal ? Setpoint as current signal	yes→	18a	Setpoint from external poti. ? Setpoint from external controller: → If max. setpoint < 10 V Apply max. possible setpoint voltage and rotate poti. R17 SB counter-clockwise until -10V is present at socket X16 SB → Continue at 21	yes→	18b	→ Apply 10V setpoint voltage at terminal X1.8 and rotate poti. R17 SB counter-clockwise until -10V is present at socket X16 SB → Continue at 21
19	Setpoint betw. 4 mA and 20 mA ? Setpoint betw. 0 and 20 mA	yes→	19a	Continue at 21			

20	Maximum setpoint < 20 mA ?	yes→	20a	→ Turn poti. R17 SB clockwise until 10 V is present at socket X16 SB at the maximum possible setpoint current → Continue at 21			
21	**Actual value** → Actual current value for indicating instrument at terminal X1.3						
22	Load-voltage control with secondary current control (average value of load voltage) ?	yes→	22a	→ Set poti. R9 MI to 1 scale division → P24 to terminal X1.12 → After approx. 10 s, adjust poti. R15 IB until + 10 V is present at measuring point IB → Open terminal X1.12 → Continue at 26			
23	External actual value as voltage signal ? <u>Ext. act. value as current signal</u> <u>As supplied</u>: Poti. R15 IB (⊗) is set such that + 10 V is present at measuring point IB if: - 20 mA is fed in at terminal X1.7 - and jumper B5-B6 is inserted adjust as necessary	yes→	23a	→ !!! <u>Min. actual value 1.7 V</u> !!! → Actual value ≤ 10 V ?	yes→	23b	→ Apply max. actual value voltage and adjust poti. R15 IB until + 10V is present at measuring point IB → Continue at 26
24	Actual value between 4 mA and 20 mA ? <u>Actual value betw. 0 and 20 mA</u>	yes→	24a	→ Continue at 26			
25	Maximum actual value < 20 mA ?	yes→	25a	→ Turn poti. R15 IB clockwise until 10 V is present at measuring point IB at maximum possible actual current → Continue at 26			

26	**Parameters from PI controller** P controller ? <u>PI controller is set</u> → Set Kp of PI controller with poti. R13 Kp → Set Tn of PI controller with poti. R5 Tn	yes→	26a	→ Set Kp with poti. R13 Kp (⊗ $K_p = 1$) → Continue at 27			
27	Limit current-controller setpoint I* to maximum and minimum values ? <u>As-delivered state</u>: R9 MI = 0.5 scale division (⊗) (≙ I* = 0.5 V) R11 MA = 10 scale division(⊗) (≙ I* = 10 V)	yes→	27a	→ Set maximum value with poti. R11 MA → Set minimum value with poti. R9 MI → Continue at 28			
28	Limit current-controller setpoint I* to maximum and minimum values by external values ?	yes→	28a	→ !!! <u>Limiting values set with potis. R9 MI and R11 MA have no effect</u>!!! → Preselect maximum value via terminal X1.5 → Preselect minimum value via terminal X1.6 → Continue at 29			
29	**→ Disconnect the unit and load from the power (e.g. open main contactor K1)**			<u>**Warning**</u>:			
30	→ Connect terminals U2 and V2 (N2) to load in accordance with Fig. 2.6.2 → P24 to terminal X1.12 from terminal X1.4 (controller enable) **→ End of commissioning**			**Only connect the load when both the unit and load are in the no-voltage condition (disconnected from the power)**			

2.6.3 Commissioning for multi-cycle control and single-phase AC connection

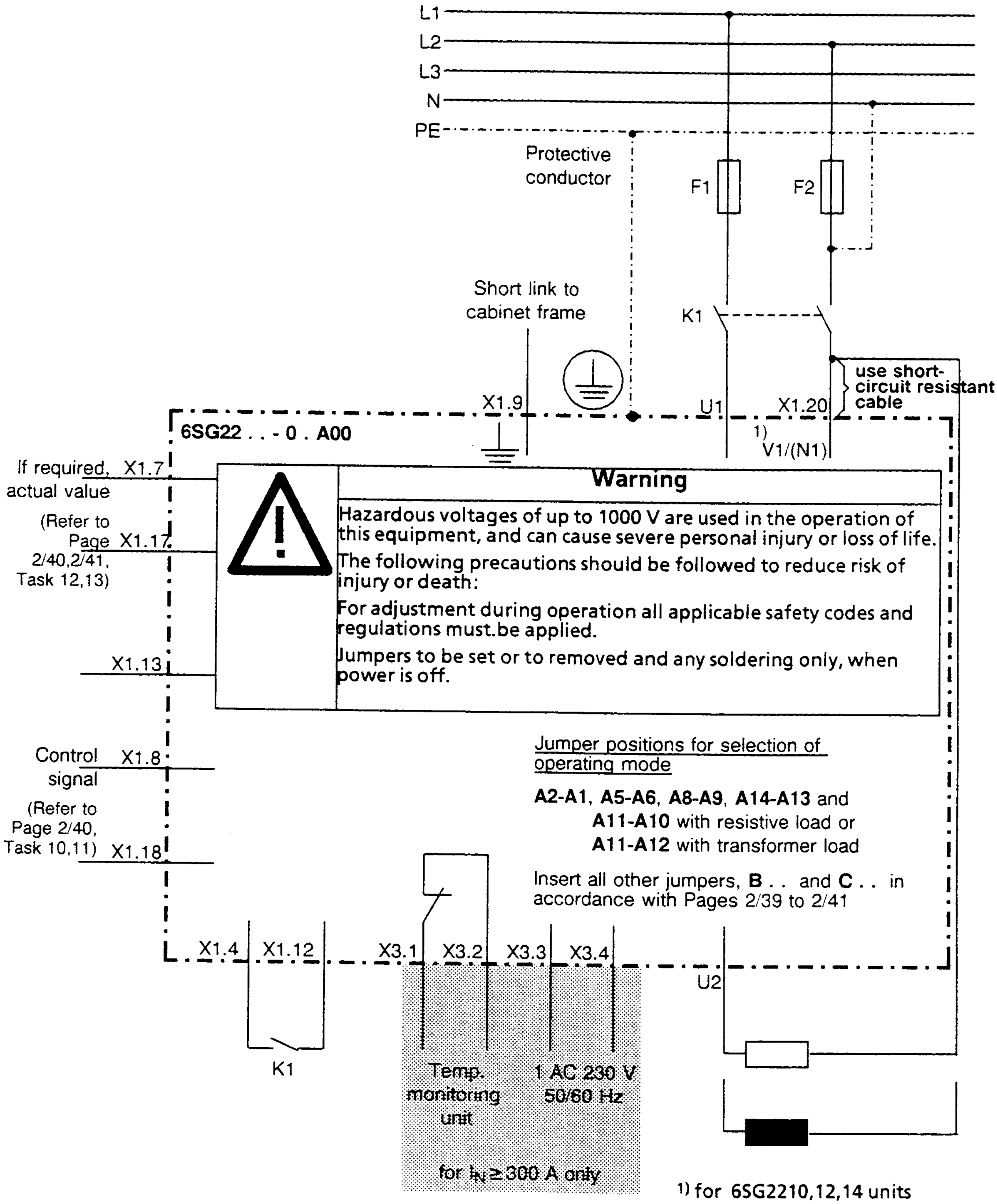


Fig. 2.6.3: Suggested connections for SIVOLT A/V AC controllers with multi-cycle control

1	→ **Disconnect unit and load from the power (e.g. open contactor K1, refer to Fig. 2.6.3)** → **Open terminals U1, V1 (N1)** → **Open terminals U2**			<u>**Warning**</u> **Commissioning tasks 1 to 16 can only be carried out when the unit is in the no-voltage condition without load**	**Modules contain electrotstatically sensitive components**
2	**Supply voltage** Unit for *rated supply voltage* of 500 V ?	yes→	2a	Continue at 5	
3	Unit for rated supply voltage 400 V is set for *supply voltage* of 400 V (connection at solder pin 400 V of T131)				
4	Other supply voltage ?	yes→	4a	<u>Supply voltage 230 V</u>: → Resolder from solder pin 400 V (S4) to 230 V (S2 on T131) → Continue at 5	
5	**Insert jumpers, adjust and connect resistors and capacitors**				
6	**Multi-cycle control** → Insert jumper A2-A1 (⊗) → Insert jumper A5-A6 → Insert jumper A8-A9 → Insert jumper A14-A13 (⊗)				<u>Note</u>: (⊗) indicates factory settings
7	Type of load: resistive load ? <u>Resistive-inductive load</u> (<u>transformer load</u>) → Insert jumper A11-A12 → Poti. R7 SZ to 5 scale div. (⊗)	yes→	7a	→ Insert jumper A11-A10 (⊗) → Continue at 8	
8	Adjust ramp-up time ? <u>As-delivered state</u>: Ramp-up time = approx. 5 s with C91 = 4.7µF (⊗) set	yes→	8a	→ Ramp-up time = 1 MΩ X C91 → Continue at 9	

9	Changing the set *clock pulse time* ? As-delivered state: Clock pulse time 200 ms with C109 = 1µF (⊗) and R96 = 220 kΩ (⊗) set	yes→	9a	→ E.g.: doubling C109 means doubling clock pulse time → Adjust R96 in proportion with C109 (10 V_{pp} is then present at socket X18) → Adjust C58 in proportion with C109 → Continue at 10			
10	**Setpoint** Setpoint as voltage signal ? Setpoint as current signal → Insert B2-B3 → Connect setpoint to terminal X1.8 → Connect frame potential of setpoint to terminal X1.18 → Input resistance at terminal X1.8 270 Ω	yes→	10a	Insert jumper B2-B1 (⊗) Setpoint from external poti. ? Setpoint from external controller: → Connect setpoint to term. X1.8 → Connect frame potential of setpoint to terminal X1.18 → Input resistance at terminal X1.8 25 kΩ (in operation) *) → Continue at 12	yes→	10b	→ Min. resistance required 10 kΩ and 20 W → Connect to terminals X1.8, X1.13 and X1.18 (according to block diagrams in Sections 2.4.2.1 and 2.4.2.2) → Continue at 12
11	Setpoint betw.4 mA and 20 mA ? Setpoint is between 0 and 20 mA	yes→	11a	→ Solder in resistor R101 = 540 kΩ between D1 and D4 (resistor combinations as well as locations, refer to Section 2.5.3) → Continue at 9			
12	**Actual value** External actual value as voltage signal ? Ext. act. value as current signal → Insert jumper B5-B6 → Insert jumper B8-B7 (⊗) → Connect external actual value to terminal X1.7 → Connect frame potential of actual value to terminal X1.17 → Input resistance at terminal X1.7 270 Ω	yes→	12a	→ Insert jumper B5-B4 (⊗) → Insert jumper B8-B7 (⊗) → Connect actual value to terminal X1.7 → Connect frame potential of actual value to terminal X1.17 → Input resistance at terminal X1.7 25 kΩ (in operation) *) → Continue at 14			

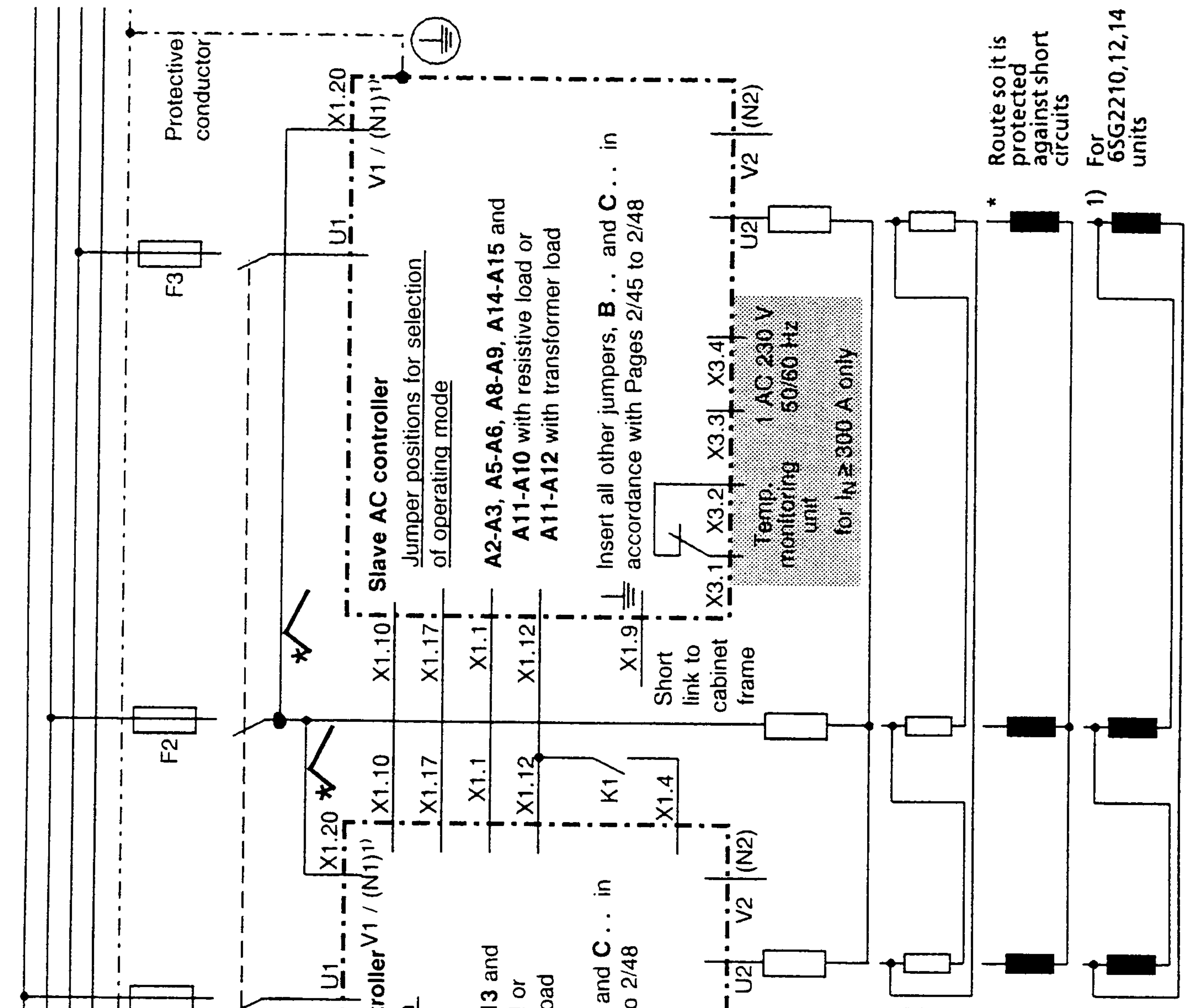
*) Input resistance at terminals X1.7 and X1.8, 150Ω when T131 is in no-voltage condition

13	Actual value between 4 mA and 20 mA ? Actual value betw. 0 and 20 mA	yes→	13a	→ Solder in resistor R82 = 540 kΩ between D5 and D8 (resistor combinations as well as locations, refer to Section 2.5.3) → Continue at 14			
14	**Parameters of current controller** Adjust Kp or Tn ? As-delivered state: Kp = 0.2 with R67 = 39 k (⊗) Tn = 18 ms with R67 = 39 k (⊗) and C58 = 0.47µ (⊗)	yes→	14a	→ Set Kp of current controller with R67: Kp = R67 ÷ 200 k → Set Tn of current controller with C58: Tn = R67 × C58 → Continue at 15			
15	**Parameters of PI controller** P controller ? PI controller is set	yes→	15a	If PI-controller is used ? → Insert jumper C5-C4 (⊗) → Continue at 17	yes→	15b	→ Continue at 17
16	→ Insert jumper C5-C6 → Extend input smoothing (actual-value channel) from 5.75 ms to 63 ms ? → Insert jumper C2-C1 (⊗)	yes→	16a	→ Insert jumper C2-C3 → Continue at 17			
17	**Adjustment**	⚡		**Warning:**	⚡		**Warning:**
18	→ Connect terminals U1, V1 (N1) to supply voltage → Switch on Power			**Unit and load are now live.** Commissioning is still realized without load			Before connecting to the line, cover to be re-affixed.
19	**Setpoint** As supplied: Poti. R17 SB (⊗) is set such that -10 V is present at socket X16 SB if: - 20 mA is fed in at terminal X1.8 - and jumper B2-B3 is inserted adjust as necessary						

20	Setpoint as voltage signal ? Setpoint as current signal	yes→	20a	Setpoint from external poti. ? Setpoint from external controller: → If max. setpoint < 10 V apply max. setpoint voltage and rotate poti. R17 SB counter-clockwise until -10 V is present at socket X16 SB → Continue at 23	yes→	20b	→ Apply 10V setpoint voltage at terminal X1.8 and rotate poti. R17 SB counter-clockwise until -10V is present at socket X16 SB → Continue at 23
21	Setpoint betw. 4 mA and 20 mA ? Setpoint betw. 0 and 20 mA	yes→	21a	Continue at 23			
22	Maximum setpoint < 20 mA ?	yes→	22a	→ Turn poti. R17 SB clockwise until -10 V is present at socket X16 SB at the maximum possible setpoint current → Continue at 23			
23	**Actual value** → Actual current value for indicating instrument at terminal X1.3						
24	External actual value as voltage signal ? Ext. act. value as current signal As supplied: Poti. R15 IB (⊗) is set such that + 10 V is present at measuring point IB if: - 20 mA is fed in at terminal X1.7 - and jumper B5-B6 is inserted Adjust as necessary	yes→	24a	→ !!! Min. actual value 1.7 V !!! → Actual value ≤ 10 V ? → Continue at 27	yes→	24b	→ Apply maximum actual value voltage and adjust poti. R15 IB until + 10 V is present at measuring point IB → Continue at 27
25	Actual value between 4 mA and 20 mA ? Actual value betw. 0 and 20 mA	yes→	25a	→ Continue at 27			

26	Maximum actual value < 20 mA ?	yes→	26a	→ Turn poti. R15 IB clockwise until + 10 V is present at measuring point IB at maximum possible actual current → Continue at 27			
27	**Parameters from PI controller** P controller ? <u>PI controller is set</u> → Set Kp of PI controller with poti. R13 Kp → Set Tn of PI controller with poti. R5 Tn	yes→	27a	→ Set Kp with poti. R13 Kp → Continue at 28			
28	Limit current-controller setpoint I* to maximum and minimum values ? <u>As-delivered state</u>: R9 MI = 0.5 scale division (⊗) (≙ I* = 0.5 V) R11 MA = 10 scale division (⊗) (≙ I* = 10 V)	yes→	28a	→ Set maximum value with poti. R11 MA → Set minimum value with poti. R9 MI → Continue at 29			
29	Limit current-controller setpoint I* to maximum and minimum values by external values ?	yes→	29a	→ !!! <u>Limiting values set with potis. R9 MI and R11 MA have no effect</u>!!! → Preselect maximum value via terminal X1.5 → Preselect minimum value via terminal X1.6 → Continue at 30			
30	→ **Disconnect the unit and load from the power (e.g. open main contactor K1)**			<u>Warning</u>:			
31	→ Connect terminal U2 to load in accordance with Fig. 1.6.3 → P24 to terminal X1.12 from terminal X1.4 (controller enable) → **End of commissioning**			**Only connect the load when both the unit and load are in the no-voltage condition (disconnected from the power)**			

2.6.4 Commissioning for multi-cycle control and three-phase AC connection



Warning

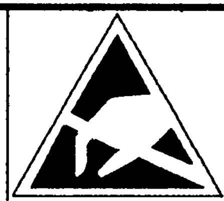
Hazardous voltages of up to 1000 V are used in the operation of this equipment, and can cause severe personal injury or loss of life.

The following precautions should be followed to reduce risk of injury or death:

For adjustment during operation all applicable safety codes and regulations must be applied.

Jumpers to be set or to removed and any soldering only, when power is off.

Fig. 2.6.4: Connection of SIVOLT A/V AC controllers in a three-phase economy circuit with multi-cycle control

1	→ **Disconnect the master controller, slave controller and load from the power (e.g. open main contactor K1, refer to Fig. 2.6.4)** → **Open terminals U1, V1 (N1)** → **Open terminals U2**			<u>**Warning**</u> **Commissioning tasks 1 to 18 can only be carried out when the unit is in the no-voltage condition without load**			**Modules contain electrotstatically sensitive components**
2	**Supply voltage** Both units for *rated supply voltage* of 500 V ?	yes→	2a	Continue at 5			
3	Both units for rated supply voltage 400 V are set for *supply voltage* of 400 V (connection at solder pin 400 V of T131)						
4	Other supply voltage for both units ?	yes→	4a	<u>Supply voltage 230 V</u>: → Resolder from solder pin 400 V (S4) to 230 V (S2 on T1) → Continue at 5			
5	**Insert jumpers, adjust and connect resistors and capacitors**						
6	***Master AC controller*** → Insert jumper A2-A1 (⊗) → Insert jumper A5-A6 → Insert jumper A8-A9 → Insert jumper A14-A13 (⊗)						<u>Note</u>: (⊗) indicates factory settings
7	***Slave AC controller*** → Insert jumper A2-A3 → Insert jumper A5-A6 → Insert jumper A8-A9 → Insert jumper A14-A15						

8	*Master* <u>and</u> *slave AC controllers* Type of load: resistive load ? <u>Resistive-inductive load</u> (<u>transformer load</u>) → Insert jumper A11-A12 → Set poti. R7 SZ on master AC controller to 5 scale div. (⊗) (Phase angle of 1st half wave) → Set poti. R7 SZ on slave AC controller to 6.5 scale division (Phase angle of 1st half wave)	yes→	8a	→ Insert jumper A11-A10 (⊗) → Continue at 9			
9	*Master* <u>and</u> *slave AC controllers* Operating mode: resistive load ?	yes→	9a	R_W : Load resistance in warm condition R_K : Load resistance in cold condition $R_W \div R_K \approx 1$? → Continue at 11	yes→	9b	→ Adjust C91 to 100 nF (shorter ramp-up time) → Continue at 11
10	*Master* <u>and</u> *slave AC controllers* Adjust ramp-up time ? <u>As-delivered state</u>: Ramp-up time = approx. 5 s with C91 = 4.7µF (⊗) set	yes→	10a	→ Ramp-up time = 1 MΩ X C91 → Continue at 11			
11	**Setpoint** for *master AC controller only* Setpoint as voltage signal ? <u>Setpoint as current signal</u> → Insert B2-B3 → Connect setpoint to terminal X1.8 → Connect frame potential of setpoint to terminal X1.18 → Input resistance at terminal X1.8 270 Ω	yes→	11a	Insert jumper B2-B1 (⊗) Setpoint from external poti. ? <u>Setpoint from external controller</u>: → Connect setpoint to terminal X1.8 → Connect frame potential of setpoint to terminal X1.18 → Input resistance at terminal X1.8 25 kΩ (in operation) *) → Continue at 13	yes→	11b	→ Min. resistance required 10 kΩ and 20 W → Connect to terminals X1.8, X1.13 and X1.18 (according to block diagrams in Sections 2.4.2.1 and 2.4.2.2) → Continue at 13

*) Input resistance at terminal X1.8, 150Ω if T131 has a no-voltage condition

12	Setpoint betw.4 mA and 20 mA ? <u>Setpoint is between 0 and 20 mA</u>	yes→	12a	→ Solder in resistor R101 = 540 kΩ between D1 and D4 (resistor combinations as well as locations, refer to Section 2.5.3) → Continue at 13			
13	**Actual value** for *master AC controller only* External actual value as voltage signal ? <u>Ext. act. value as current signal</u> → Insert jumper B5-B6 → Insert jumper B8-B7 (⊗) → Connect external actual value to terminal X1.7 → Connect frame potential of actual value to terminal X1.17 → Input resistance at terminal X1.7 270 Ω	yes→	13a	→ Insert jumper B5-B4 (⊗) → Insert jumper B8-B7 (⊗) → Connect actual value to terminal X1.7 → Connect frame potential of actual value to terminal X1.17 → Input resistance at terminal X1.7 25 kΩ (in operation) *) → Continue at 15			
14	Actual value between 4 mA and 20 mA ? <u>Actual value betw. 0 and 20 mA</u>	yes→	14a	→ Solder in resistor R82 = 540 kΩ between D5 and D8 (Resistor combinations and locations, refer to Section 2.5.3) → Continue at 15			
15	**Parameters of curr. controller** for *master AC controller only* Adjust Kp or Tn ? <u>As-delivered state</u>: Kp = 0.2 with R67 = 39 k (⊗) Tn = 18 ms with R67 = 39 k (⊗) and C58 = 0.47µ (⊗)	yes→	15a	→ Set Kp of current controller with R67: Kp = R67 ÷ 200 k → Set Tn of current controller with C58: Tn = R67 × C58 → Continue at 16			

*) Input resistance at terminal X1.7, 150Ω when T131 is in a no-voltage condition

16	**Parameters of PI controller** for *master AC controller only* P controller ? PI controller is set	yes→	16a	Is the PI-controller used ? → Insert jumper C5-C4 (⊗) → Continue at 18	yes→	16b	→ Continue at 18
17	→ Insert jumper C5-C6 → Extend input smoothing (actual-value channel) from 5.75 ms to 63 ms ? → Insert jumper C2-C1 (⊗)	yes→	17a	→ Insert jumper C2-C3 → Continue at 18			
18	**Connect master and slave AC controllers** Master AC con. Slave AC con. → X1.10 to X1.10 → X1.17 to X1.17 → X1.12 to X1.12 → X1.1 to X1.1						
19	**Adjustment**			<u>**Warning:**</u>			<u>**Warning:**</u>
20	*Master* and *slave AC controllers* → Connect terminals U1, V1 (N1) to supply voltage according to the connection diagram 2.6.4 → Connect supply voltage			**Unit and load are now live.** Commissioning is still realized without load			Before connecting to the line, cover to be re-affixed.
21	**Setpoint** for *master AC controller only* <u>As supplied</u>: Poti. R17 SB (⊗) is set such that -10 V is present at socket X16 SB if: - 20 mA is fed in at terminal X1.8 - and jumper B2-B3 is inserted Adjust as necessary						

22	Setpoint as voltage signal ? <u>Setpoint as current signal</u>	yes→	22a	Setpoint from external poti. ? <u>Setpoint from external controller</u>: → If max. setpoint ≤ 10 V apply max. setpoint voltage and rotate poti. R17 SB counter-clockwise until -10V is present at socket X16 SB → Continue at 25	yes→	22b	→ Apply 10V setpoint voltage at terminal X1.8, and rotate poti. R17 SB counter-clockwise until -10V is present at socket S16 SB → Continue at 25
23	Setpoint betw. 4 mA and 20 mA ? <u>Setpoint betw. 0 and 20 mA</u>	yes→	23a	Continue at 25			
24	Maximum setpoint < 20 mA ?	yes→	24a	→ Turn poti. R17 SB clockwise until -10 V is present at socket X16 SB at the maximum possible setpoint current → Continue at 25			
25	**Actual value** *Master* <u>and</u> *slave AC controllers* → Actual current value for indicating instrument at terminal X1.3						
26	For *master AC controller only* External actual value as voltage signal ? <u>Ext. act. value as current signal</u> <u>As supplied</u>: Poti. R15 IB (⊗) is set such that + 10 V is present at measuring point IB if: - 20 mA is fed in at terminal X1.7 - and jumper B5-B6 is inserted Adjust as necessary	yes→	26a	→ !!! <u>Min. actual value 1.7 V</u> !!! → Actual value ≤ 10 V ? → Continue at 29	yes→	26b	→ Apply max. actual value voltage and set poti. R15 IB until + 10V is present at measuring point IB → Continue at 29
27	Actual value between 4 mA and 20 mA ? <u>Actual value betw. 0 and 20 mA</u>	yes→	27a	→ Continue at 29			

28	Maximum actual value < 20 mA ?	yes→	28a	→ Feed in max. actual value current and turn poti. R15 IB clockwise until + 10V is present at measuring point IB → Continue at 30			
29	*Parameters from PI controller* for *master AC controller only* P controller ? <u>PI controller is set</u> → Set Kp of PI controller with poti. R13 Kp → Set Tn of PI controller with poti. R5 Tn	yes→	29a	→ Set Kp with poti. R13 Kp ($\otimes$ $K_p = 1$) → Continue at 30			
30	For *master AC controller only* Limit current-controller setpoint I* to maximum and minimum values ? <u>As-delivered state</u>: R9 MI = 0.5 scale division ($\otimes$) ($\hat{=}$ I* = 0.5 V) R11 MA = 10 scale division ($\otimes$) ($\hat{=}$ I* = 10 V)	yes→	30a	→ Set maximum value with poti. R11 MA → Set minimum value with poti. R9 MI → Continue at 31			
31	For *master AC controller only* Limit current-controller setpoint I* to maximum and minimum values by external values ?	yes→	31a	→ !!! <u>Limiting values set with potis. R9 MI and R11 MA have no effect</u>!!! → Preselect maximum value via terminal X1.5 → Preselect minimum value via terminal X1.6 → Continue at 32			

32	→ **Disconnect master controller, slave controller and load from the supply (e.g. open main contactor K1)**		Warning:			
33	*Master* and *slave AC controllers* → Connect terminals U2 to the load, in accordance with Fig. 2.6.4 → P24 to terminal X1.12 from terminal X1.4 (controller enable) → ***End of commissioning***		**Only connect the load when both the unit and load are in the no-voltage condition (disconnected from the power)**			

english

Notes on electrostatic charges

Electrostatic sensitive devices (ESD)

Generally, printed circuit boards (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.

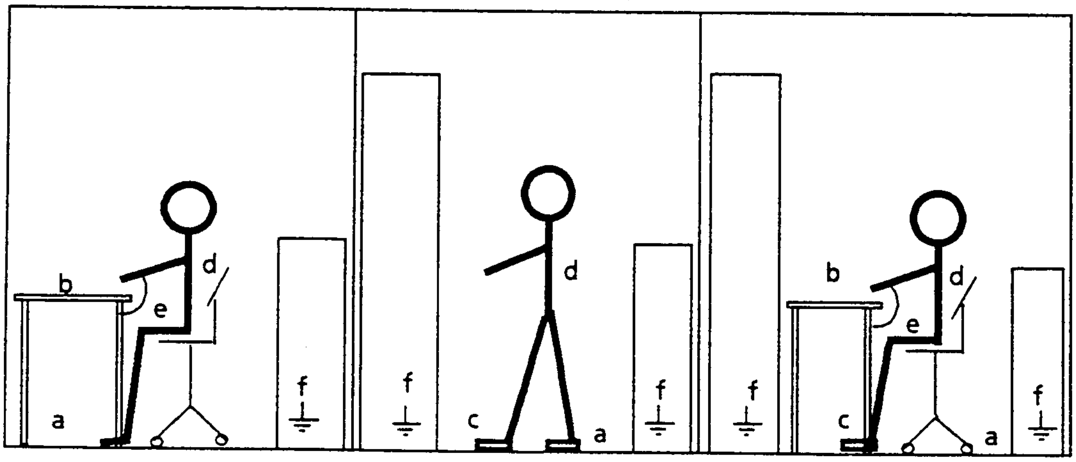
When carrying out soldering jobs on PCBs, use an ESD soldering iron or at least make sure that the soldering tip has been earthed.

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

2.7 Commissioning report

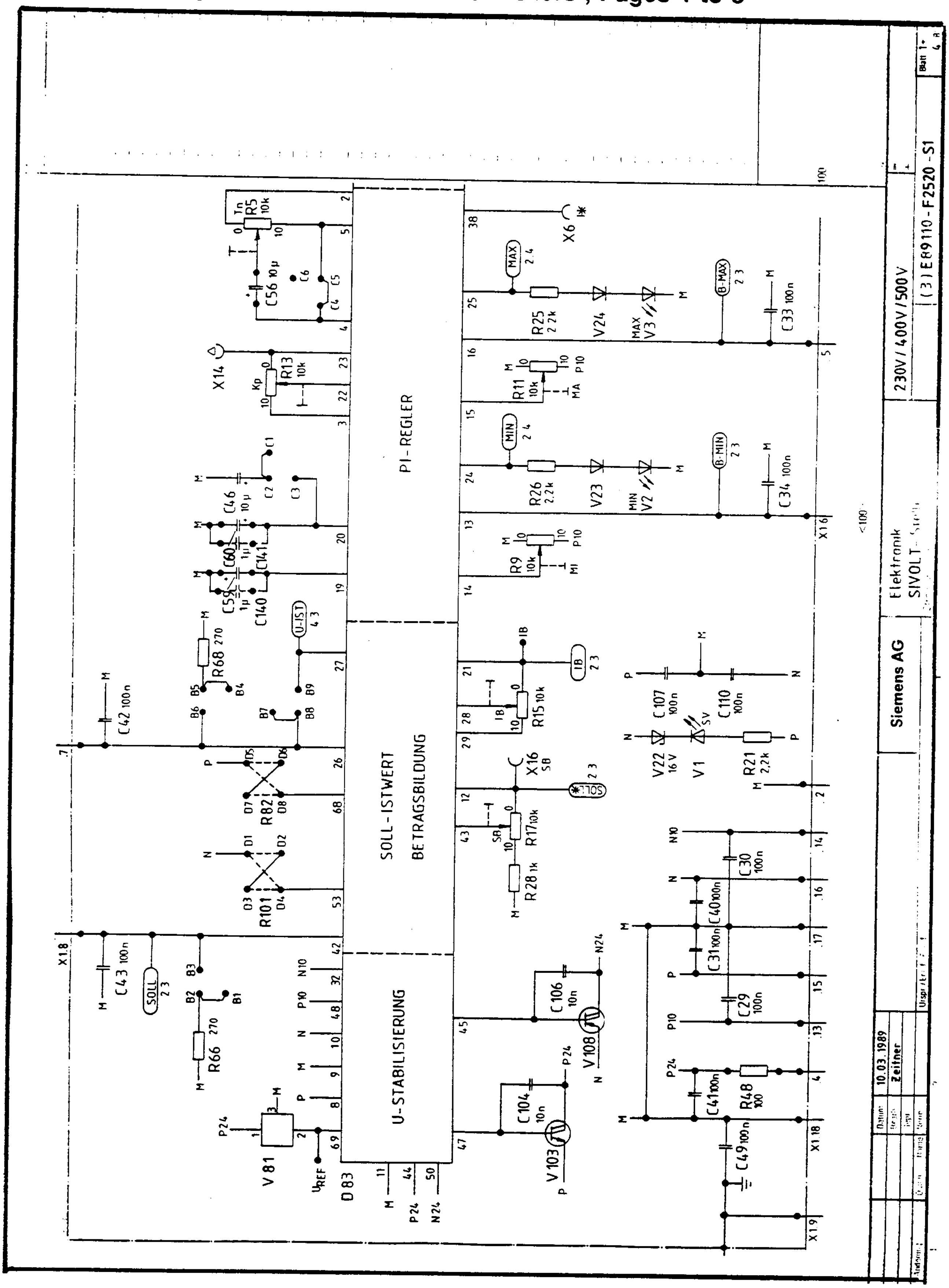
	Factory setting	New setting	Date changed	New setting	Date changed
<u>Jumpers</u>					
A2-A1	inserted				
A2-A3					
A5-A4	inserted				
A5-A6					
A8-A7	inserted				
A8-A9					
A11-A10	inserted				
A11-A12					
A14-A13	inserted				
A14-A15					
B2-B1	inserted				
B2-B3					
B5-B4	inserted				
B5-B6					
B8-B7	inserted				
B8-B9					
C2-C1	inserted				
C2-C3					
C5-C4	inserted				
C5-C6					

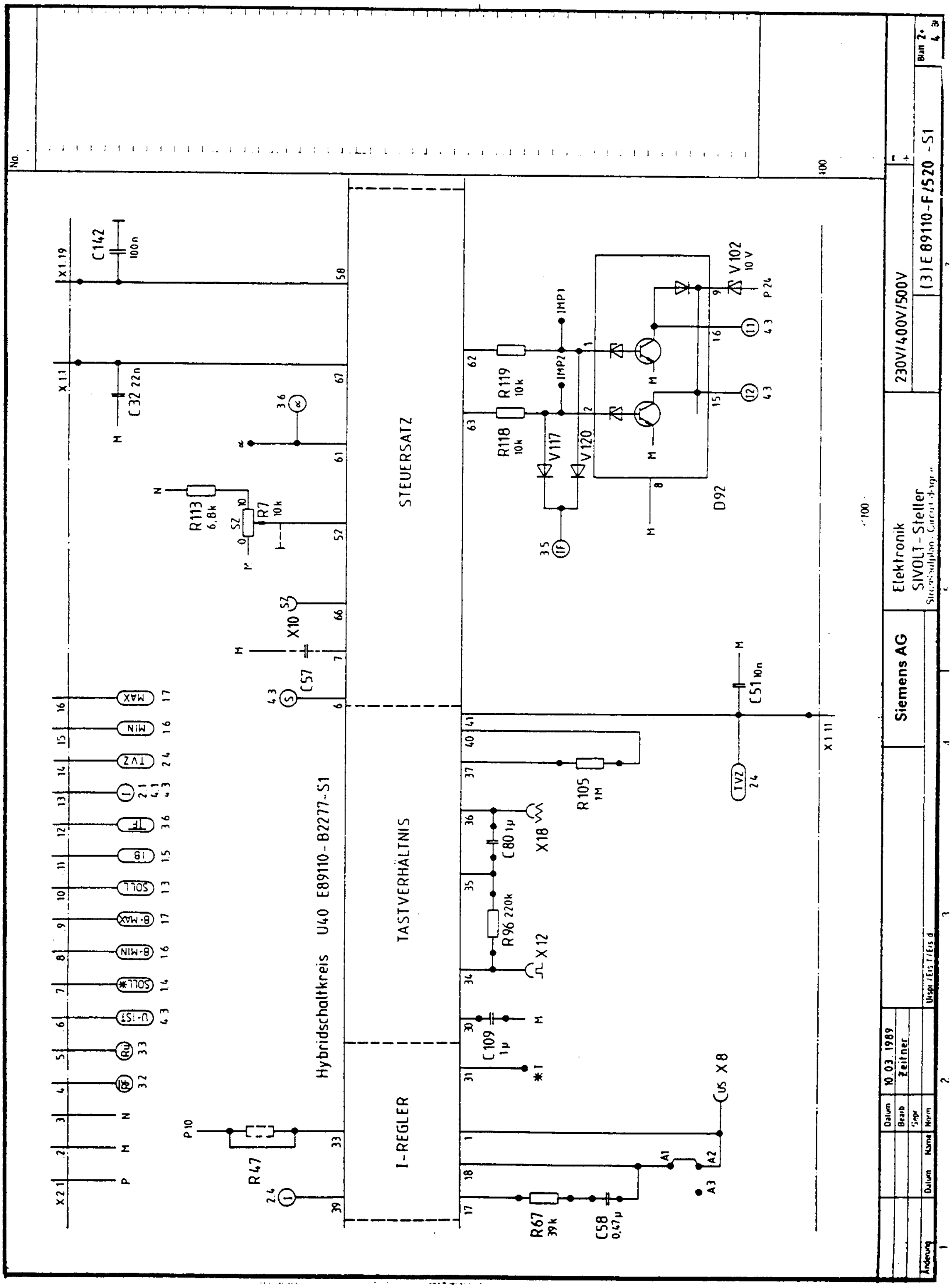
	Factory setting	New setting	Date changed	New setting	Date changed
Potentiometers					
R5	5 s.d.*				
R7	5 s.d.				
R9	0.5 s.d.				
R11	10 s.d.				
R13	0 s.d.				
R15	See Section 2.6				
R17	See Section 2.6				
Resistors					
R47	-				
R62	See Section 2.6				
R63	See Section 2.6				
R67	39 kΩ				
R82	-				
R96	220 kΩ				
R101	-				
R105	-				
Capacitors					
C56	10 µF/63 V, Elko				
C58	0.47 µF/25 V, MKL				
C59	1 µF/25 V, MKL				
C60	1 µF/25 V, MKL				
C80	1 µF/25 V, MKL				
C91	4.7 µF/40 V, Elko				
C109	1 µF/25 V, MKL				

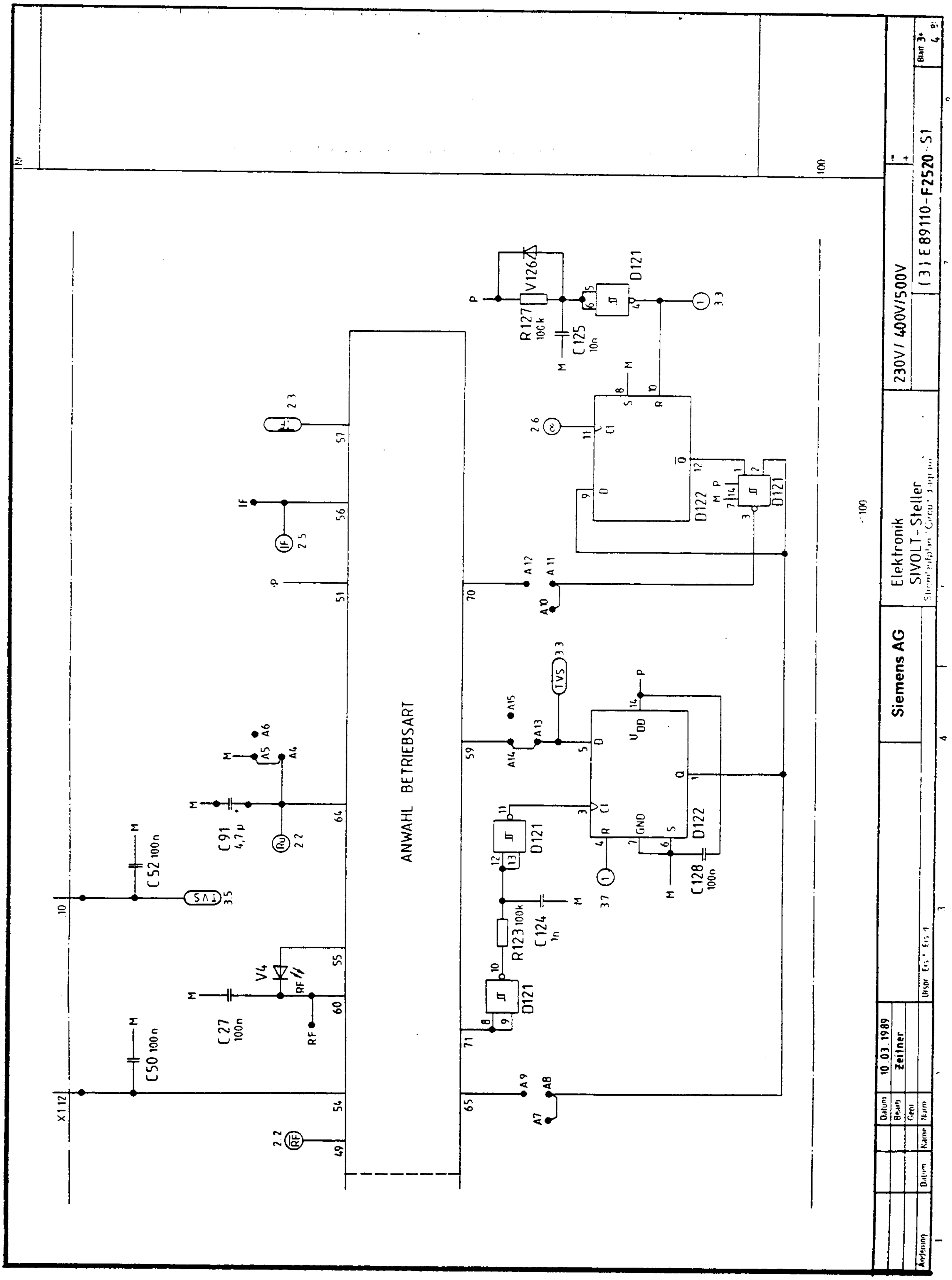
* s.d. = Scale division(s)

3.1 Stromlaufpläne/Circuit diagrams

3.1.1 Stromlaufplan für alle Steller 6SG22, Seiten 1 bis 3
Circuit diagram for all 6SG22 AC controllers , Pages 1 to 3

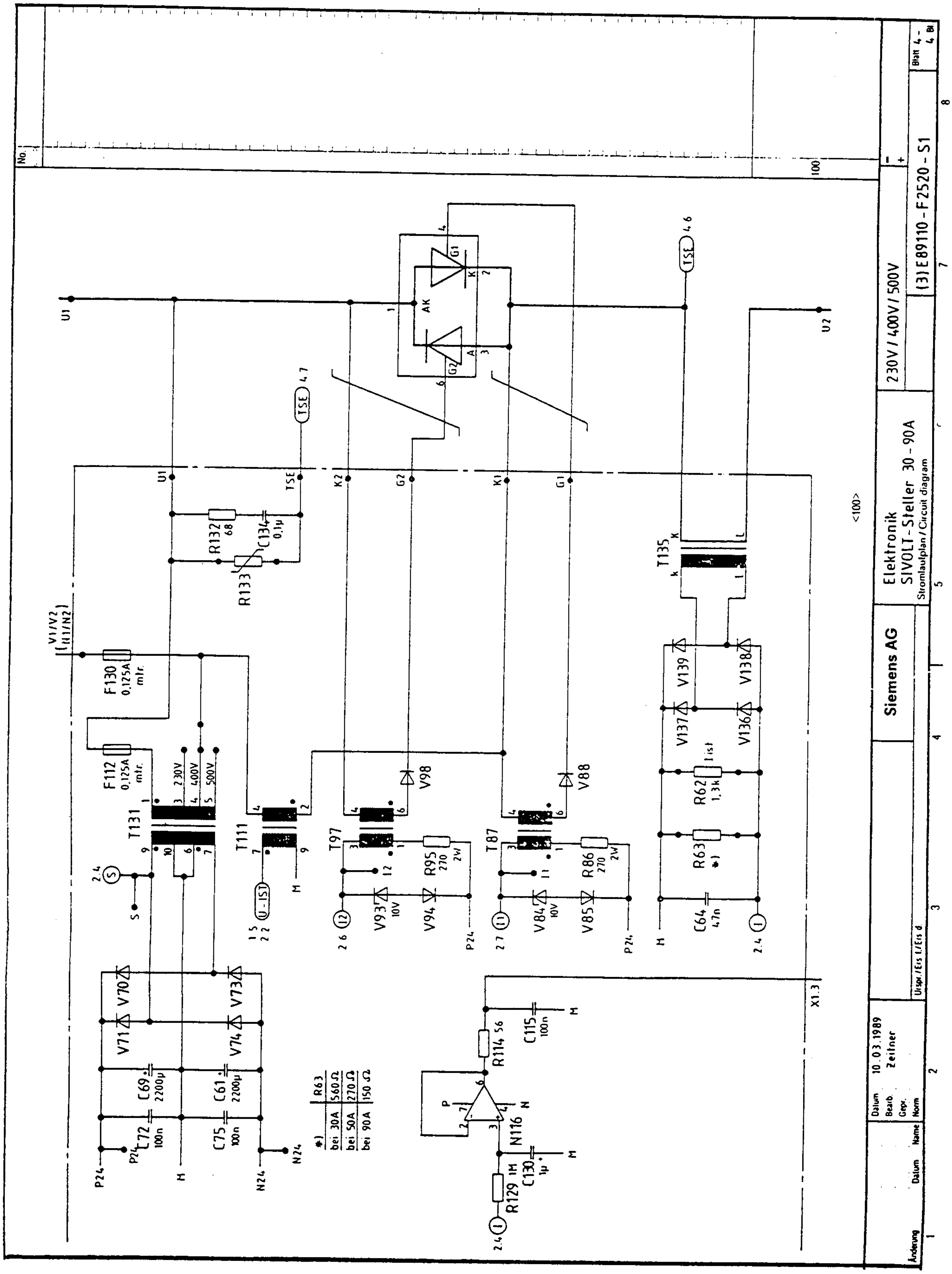



Siemens AG
Elektronik
SIVOLT-Steller
230V/400V/500V
(3) E 89110-F 2520-S1
Hybridschaltkreis U40 E89110-B2277-S1
STEUERSATZ
TASTVERHÄLTNIS
I-REGLER
D92
C142 100n
C32 22n
R113 6,8k
R7 10k
R118 10k
R119 10k
V117
V120
V102 10V
C57
X10
C51 10n
R105 1M
C80 1µ
X18
R96 220k
X12
C109 1µ
R47
R67 39k
C58 0,47µ
US X8
IMP1
IMP2
MAX
MIN
TVZ
TF
IB
SOLL
B-MAX
B-MIN
SOLL*
U-IST
10.03.1989
Zeitner

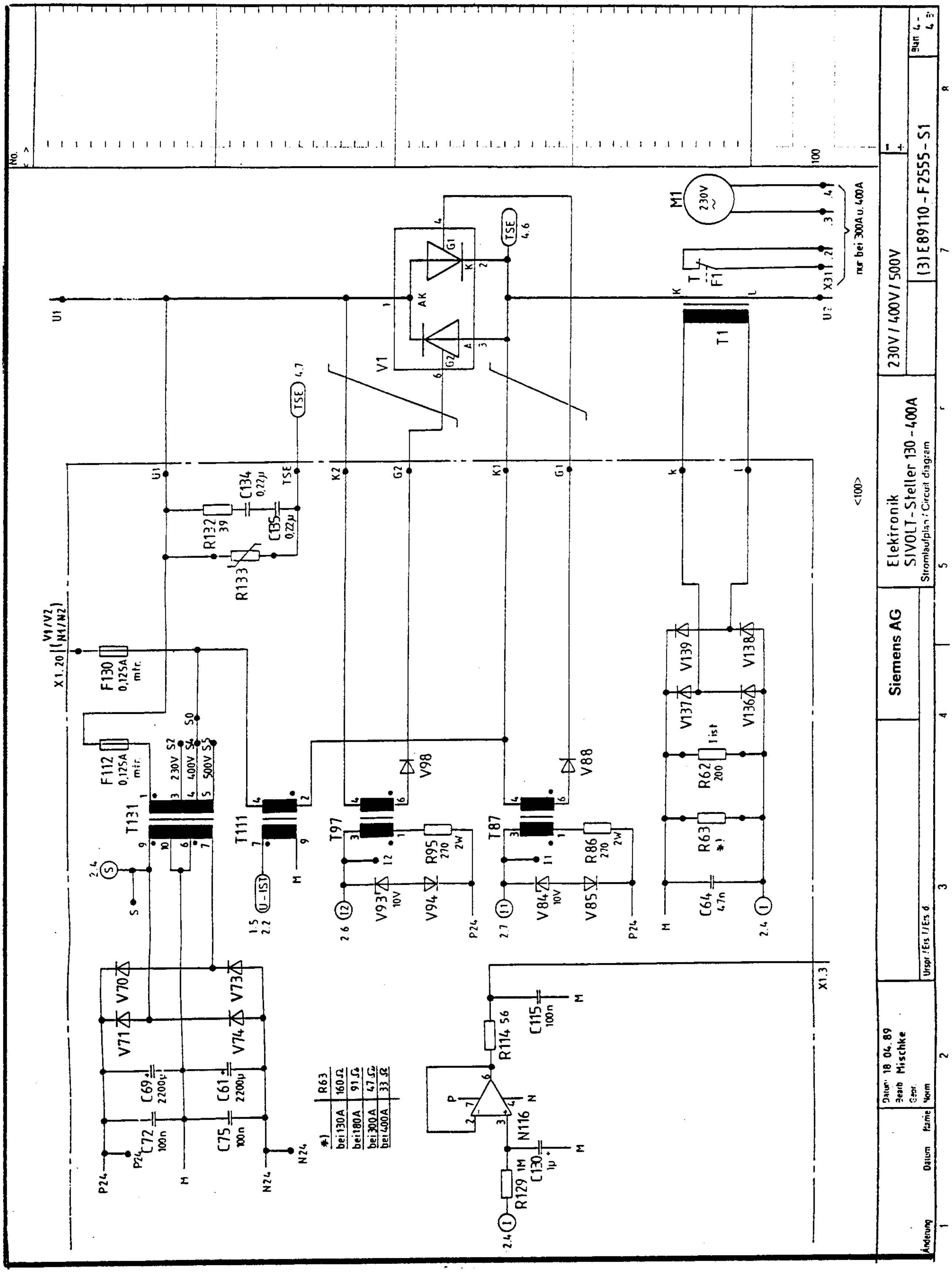

ANWAHL BETRIEBSART
Siemens AG
Elektronik
SIVOLT-Steller
230V/400V/500V
(3) E 89110-F2520-S1
10.03.1989
Zeitner
D121
D122
R127 100k
C125 10n
V126
C128 100n
R123 100k
C124 1n
C27 100n
C50 100n
C52 100n
C91 4,7µ
V4
X112

deutsch/english

3.1.2 Stromlaufplan für Steller 6SG22 . . - 1.A00, Seite 4
6SG2210, 6SG2212, 6SG2214
Circuit diagram for 6SG22 . . - 1.A00 AC controllers, Page 4
6SG2210, 6SG2212, 6SG2214



3.1.3 Stromlaufplan für Steller 6SG22 . . - 1.A00, Seite 4
6SG2216, 6SG2218, 6SG2220, 6SG2222
Circuit diagram for 6SG22 . . - 1.A00 AC controllers, Page 4
6SG2216, 6SG2218,6SG2220, 6SG2222



deutsch

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