MANUAL

Thyristor Drive
Classic

C1 230/180 - 4(f)

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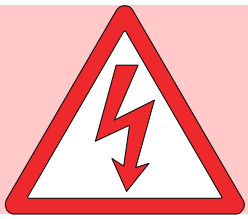
Electronic equipment is not fault proof. This fact should be borne in mind for all possible operating conditions.

ATTENTION - High voltage

AC 230V~, DC 320V=



Before installation or commissioning begins, this manual must be thoroughly read and understood by the technical staff involved.
If any uncertainty arises, the manufacturer or dealer should be contacted.
P3 devices are power electric parts used for regulating energy flow.
Protection rating IP00.

Standards and guidelines

The device and its associated components can only be installed and switched on where the local regulations and technical standards have been strictly adhered to:

EU Guidelines	89/392/EWG, 84/528/EWG, 86/663/EWG, 72/23/EWG EN60204, EN50178, EN60439-1, EN60146, EN61800-3
IEC/UL	IEC364, IEC 664, UL508C, UL840
VDE Regulations	VDE100, VDE110, VDE160
TÜV Regulations	
Trade body guidelines	VGB4

The user must ensure that in the event of:

- device failure
- incorrect operation
- loss of regulation or control

the axis will be safely de-activated.
It must also be ensured that the machine or equipment are fitted with device independent monitoring and safety features.

Setting adjustments

- should only be carried out by suitably trained personnel
- should only be carried out in accordance with health and safety guidelines

Assembly

- should only be carried out when all voltages have been removed.

QS

Test results are archived with the device serial number by the manufacturer.

CE

The device adheres to the following: Guideline EU 89/336/EWG. EMC standards EN61000-2 and EN61000-4.

Features

Thyristor Drive

- for inductive and ohmic consumer loads'

Applications

- speed control of dc motors
- 1-quadrant operation, driving
- power: up to 720W
- tacho control
- armature voltage control with IxR compensation
- torque control
- cascade control speed/current
- rectangular current/speed characteristic curve
- switch on and switch off logic
- mains connection can directly be switched

Compact single-board device

- European format
- pluggable terminal connection (-W)
- C1: galvanic connection
- C1-4f: galvanic isolation of the control and the power section
- fully insulated power semi-conductor
- field rectifier

Note for C1 devices:

Direct mains connection

- zero connection	>>	on thyristor negative electrode potential
- all control connections	>>	on mains potential
- switches and poti	>>	isolation voltage > 1500V

Connection via an isolating transformer

- zero connection	>>	with potential isolation
- control connections	>>	to be earthed and shielded

Note for C1-4f devices:

Tacho control

- device	>>	with potential isolation

Armature voltage control

- control unit	>>	with a high impedance mains connection

- zero connection (terminal no. 5) must not be earthed

Build

- switch cabinet mounting according to the VDE, DIN and EU regulations
- standard control electronics REG
- intrinsically safe power section with current control loop
- optional units

Galvanic isolation between

- the power section and the housing
- the power section and the control electronics

The distance of air gaps and leakage paths adhere to the VDE standards (>8mm).

Components

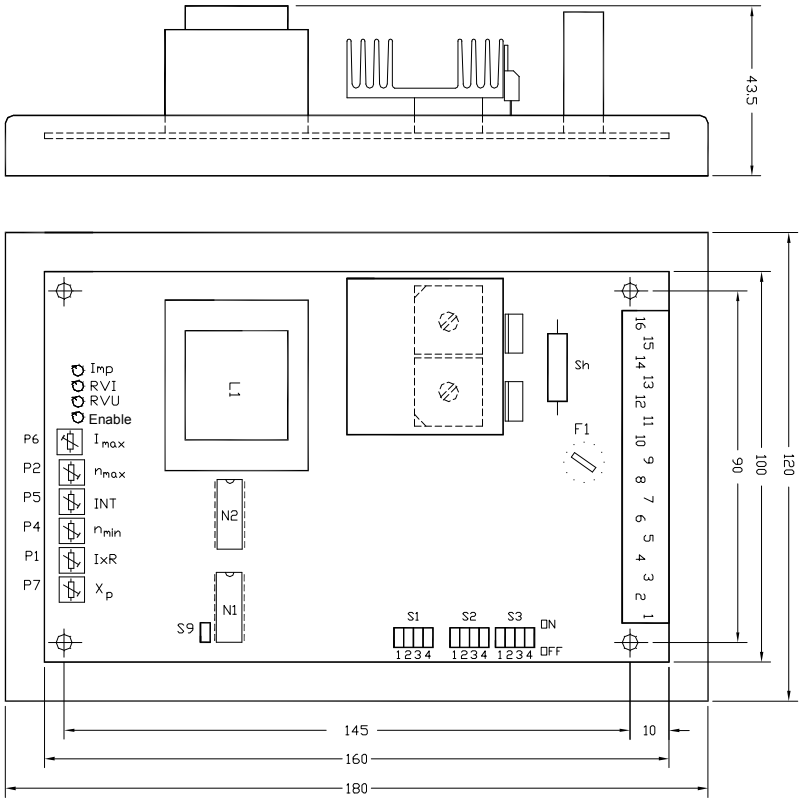
- fully insulated thyristor modules, comfortably over-dimensioned
- only components customary in trade and industrially standardised are used
- high-quality bases for the IC with external connections
- LED displays
- DIP switches for the P-I adjustment of the current control loop
- precision potentiometers for fine adjustments
- plug-in jumpers for the system set-up

Characteristics

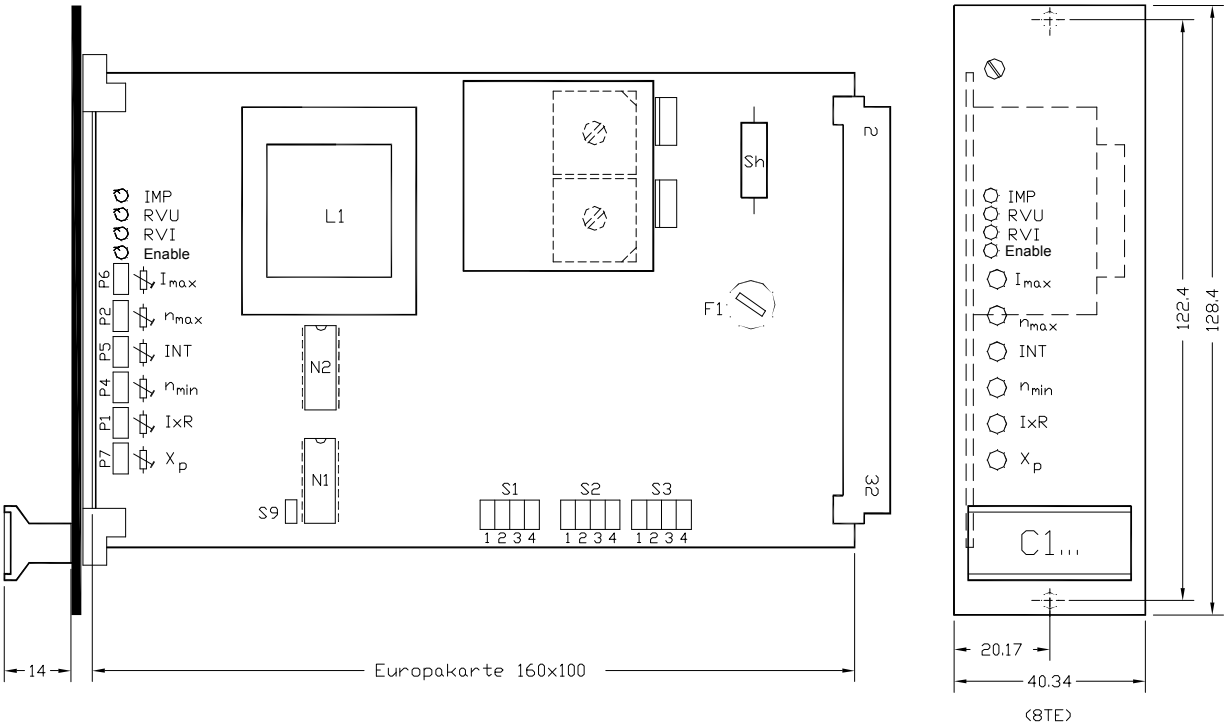
* Series Classic C1
* Thyristor drive for dc motors
* Power range 6.75kW to 22kW
* Drive in the first quadrant
* Energy recovery
* Intrinsically safe power section
* Completely controlled three-phase bridge circuit as output stage
* Fast analogue current control
* 26-pin interface
* Features of the control electronics:
  see Manual REG or third-party product documentation
* Optional units

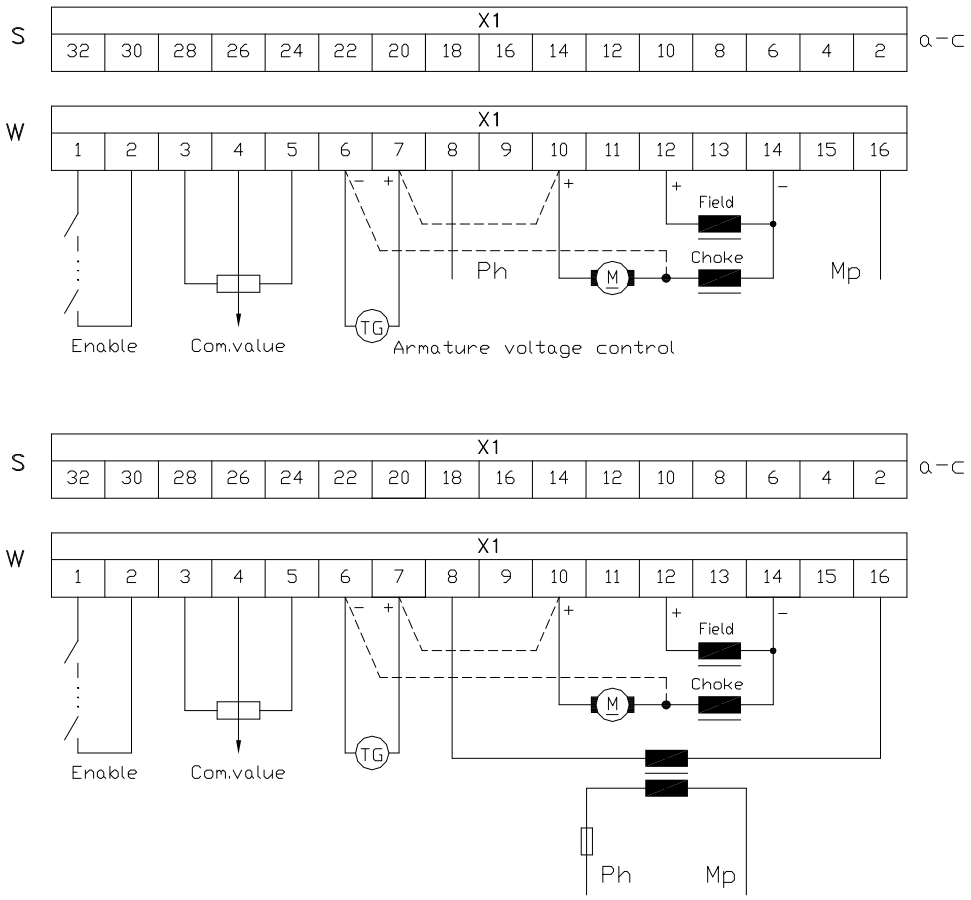
Technical data		**C1 230/180 - 4**	**C1 230/180 - 4f**
Limits			
Power connection		230~ +10% / -15%	230~ +10% / -15%
Output voltage	max.	180V=	180V=
Type current	max.	4A=	4A=
Input current	max.	4.8A~	4.8A~
El. power	max.	720W	720W
Field voltage		200V=	200V=
Control range	(dc tacho)	1:300	1:300
Precision	(Without act value error)	0.1%	0.1%
Control range	(Armature voltage)	1:50	1:50
Precision		3%	3%
Control range	(Torque control)	1:50	1:50
Precision		3%	3%
Command value supply		12V=, 10mA	12V=, 10mA
External command value	max.	12V=	12V
Actual value	max.	-180V=	-180V=
Switch-on logic	enable time (save entry)	100ms	100ms
Installed fuse	F1	3.15AT	3.15AT
Accessories			
Mains chokes		K60-6 (F)	K60-6 (F)
Isolating Transformer		TE 12/1 (F)	TE 12/1 (F)

Dimensions C1 x/x-4-W



Dimensions C1 x/x-4f-W





Mains connection

Connection directly to the mains power supply		wall mounting
	Phase L	terminal X1:8
	Zero N	terminal X1:16
	Mains chok	K60-6 (F)

Note:

C1:	Zero connection on mains potential!
C1f:	Zero connection has no connection to the mains potential!

Connection via an isolating transformer

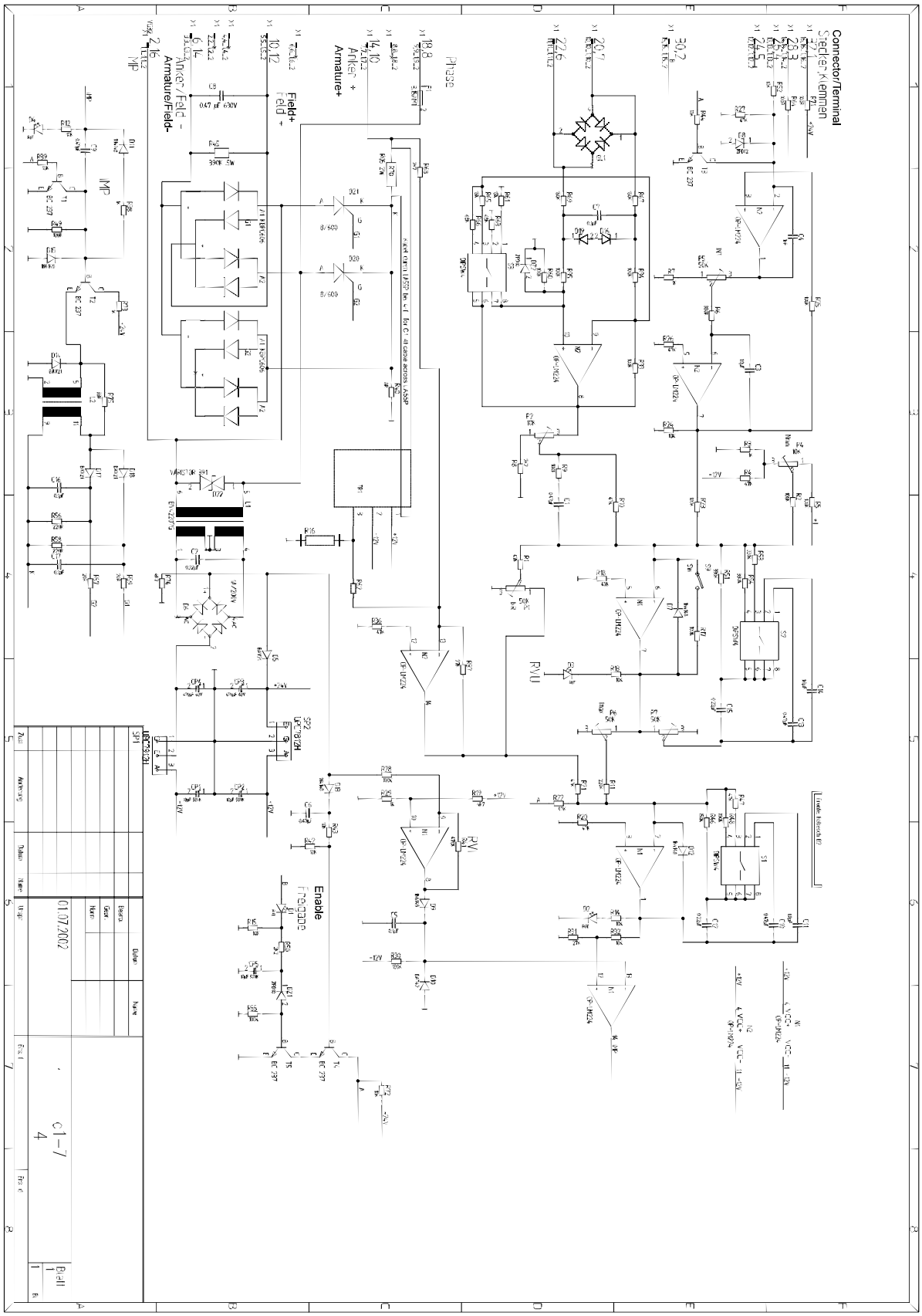
Secondary voltages 230V~, special voltages 42V~, 115V~

Transformer type	TE 12/1 (F)
Transformer fuse	6AT

Motor connection

Motor armature		wall mounting
	positive	terminal X1:10
	negative	terminal X1:14
Motor field	positive	terminal X1:12
	negative	terminal X1:14
	Smoothing choke type	EI 78A-4

Circuit diagram



Adjustment potentiometers

No.	Short symbol	Function	Range
P1	IxR	Speed compensation with armature voltage control	0 ... 10%
P2	n_{max}	Exact adjustment - max. speed	80 ... 120%
P5	INT	Integration time - slope limiting device	0.08 ... 5s
P4	n_{min}	Min. speed	-0.2 ... +2V
P6	I_{max}	Current limit	0 ... 100%
P7	X_P	Amplification	3 ...4

Adjustment switches

No.	Contact	Function	Range
		Current control loop	
S1	1, 2	Integral term	xx
S1	3, 4	Proportional amplification	xx
		Speed control loop	
S2	1, 2	Integral term	xx
S2	3, 4	Proportional amplification	xx
S3	1 ... 4	Coarse tacho adjustment	xx

Basic set-up

Tacho control

Switch in position 'ON': S1-1, S1-4, S2-1, S2-3, S3-1 to S3-4

Armature voltage control 180V=

Switch in position 'ON': S1-1, S1-4, S2-1, S2-3, S3-1 to S3-4

Torque control

Switch in position 'ON': S1-1, S1-4
Jumper: S9 plugged

All other contacts in position 'OFF' (open)!

Command value/actual value

Command value

Command value voltage	
Command value potentiometer	Resistance >1k (2.5 ... 10kOhm)
Input resistance	50kOhm
Input voltage	0 ... max. +12V

Command value from current source

External terminating resistance 12V/20mA = 0.6kOhm

Note for C1x/x-4-W:
The command value input is connected to the mains potential!

Integrator

Adjustment		**Range**
Potentiometer INT P5		0.08 to 5s
longer time	>>>	turn potentiometer clockwise

Actual value
Tacho control

- DC tacho
- AC or three-phase tacho with rectification
- Tacho voltage max. - 180V=
- IxR potentiometer P1 full left scale!

Coarse tacho adjustment

Tacho voltage	S3-1	S3-2	S3-3	S3-4
90 ... 180V	ON	ON	ON	ON
60 ... 140V	ON	OFF	ON	OFF
20 ... 60V	OFF	ON	OFF	ON
11 ... 20V	OFF	OFF	OFF	OFF

Exact speed adjustment

Adjustment	Range
Potentiometer n_{min} P4	-0.2 ... 2V command value
Potentiometer n_{max} P2	50% of the coars adjustment

higher speed >> turn potentiometer clockwise

Attention: First adjust n_{min} and then n_{max}.

Armature voltage control

Adjustment switch S3

Armature voltage	S3-1	S3-2	S3-3	S3-3
90 ... 180V	ON	ON	ON	ON
60 ... 140V	ON	OFF	ON	OFF
20 ... 60V	OFF	ON	OFF	ON
11 ... 20V	OFF	OFF	OFF	OFF

Exact speed adjustment

Adjustment	Range
Potentiometer n_{min} P4	-0.2 ... 2V command value
Potentiometer n_{max} P2	50% of the coarse adjustment

higher speed >>> turn potentiometer clockwise

Attention: First adjust n_{min} and then n_{max}.

Note for C1:
With armature voltage control the zero connection is connected to the mains potential!

IxR compensation

- Voltage drop across the internal resistance of the motor
- Compensation by means of a current proportional increase of the speed

Adjustment	Range
Potentiometer IxR P1	0 ... 10%

higher compensation >>> turn potentiometer clockwise

- at 10% speed
- increase load up to 100%
- increase compensation
- load speed >>> idle speed

Torque control

- Speed controller loop circuit with -1 amplification
- Jumper S9 closed; X_P without function
- All contacts of switch S2 in 'OFF' position
- No tacho; no armature voltage feedback

Current
Current limit

Adjustment	**Range**
Potentiometer P6 Imax	0 ... 100%

Higher current limit >>> turn potentiometer clockwise
Current measiring >>> amperemeter in thearmature circuit

PI loop circuit - current controller **Adjustment by means of DIP switch S1**			
P-values	**amplification**	**S1-3**	**S1-4**
150 K	xx	OFF	OFF
60 K	xx	OFF	ON
35 K	xx	ON	OFF
26 K	xx	ON	ON

I-values		**S1-1**	**S1-2**
0.22 µF		OFF	OFF
0.69 µF		ON	OFF
1.22 µF		OFF	ON
1.69 µF		ON	ON

Integral time constant = I-value x P-value x 4

PI loop circuit - current controller **Adjustment by means of DIP switch S2**			
P-values	**amplification**	**S2-3**	**S2-4**
330 K	xx	OFF	OFF
165 K	xx	ON	OFF
110 K	xx	ON	ON

I-values		**S2-1**	**S2-2**
0.22 µF		OFF	OFF
0.69 µF		ON	OFF
1.22 µF		OFF	ON
1.69 µF		ON	ON

Integral time contant = I-value x P-value x 4

Adjustment amplification	**Range**
Potentiometer X_P P7	3 ...
Low amplification >>>	turn potentiometer clockwise

Adjustment without measurement equipment

Connect the motor,

command value	= 10%
X_P	= 50%
Switch S2-3	= position ON
Switch S2-4	= position OFF

Enable the drive,
Turn the potentiometer X_P anti-clockwise until the axis begins to oscillate.
LED RVU flickers.

If no oscillation is achieved,

- set switch S2-3 to position OFF
- adjust to oscillations with potentiometer X_P
- LED RVU flickers
- turn the potentiometer X_P clockwise until the oscillations disappear
- LED RVU lights constantly
- turn the potentiometer X_P another 2 clicks clockwise

Adjust the switches S2-1 and S2-2 such that after a command value change of 50% the drive runs smoothly after approx. two oscillations

Drive behaviour

Amplification too low	**Amplification too high**
Long-wave oscillations 1 to 0.1Hz	Short oscillations 30 to 200Hz
Large overshoots	Vibrates during acceleration

EMC Advice

The devices adhere to the EU guidelines 89/336/EWG and the technical standards EN 61000-2 and 61000-4 provided that the following conditions are observed:

Tacho control

- The device, the transformer or the motor choke, and the armature choke are mounted on a 500x500x2 mm mounting plate.
- The motor is shielded through the use of collector condensers.
- The mounting plate must be connected to ground using a 10mm² wire.
- The motor housing must be connected to ground using a 10mm² wire.
- The terminal no. 5 must be connected to ground using a 2.5mm² wire.

Connection using a mains choke

Mains choke with filter type K60-6F
Conductor length choke - device: 200mm
Armature choke type EI78A-4
Conductor length choke - device: 200mm

Connection using a isolating transformer

Transformer with filter type TE12/1F
Conductor length transformer - device: 200mm
Armature choke type EI78A-4
Conductor length choke - device: 200mm

Connection of the control conductors:

All control conductors must be twisted, <1.5m. No shield.

Note for C1-x/x-4-W:
Direct mains connection

Zero connection	>>>	on the negative electrode potential of the thyristor
All control conductors	>>>	on the mains potential
Switches and poti	>>>	isolation voltage >1500V

Connection using an isolating transformer

Zero connection	>>>	isolated from the potential
Control connections	>>>	to be earthed and shielded

Commissioning
Enable open, command value zero
Switch on mains supply
The motor must be at a torque-free standstill.

Close the drive enable switch

The LED 'enable' must light.
Turn the command value potentiometer slowly up.
The motor must accelerate according to the command value voltage.
(If the motor immediately accelerates to full speed or if full voltage is immediately applying, the actual value connection across terminal 6-7 must be swapped).

Speed adjustment

Adjust the coarse actual value using the switch S3 (rf. to page 10).
When the command value is 1.2V adjust the speed to 10% by means of the potentiometer n_{max} (P2).
Adjust the min. speed by means of the potentiometer n_{min} (P4).
Increase the command value to 12V and adjust the max. speed by means of the potentiometer n_{max} (P2).

Current adjustment

Connect an ammeter to the armature circuit.
Set the potentiometer I_{max} to left full scale.
Disable the motor (disconnect the field).
Adjust the permissible motor current by turning the potentiometer I_{max} (P6) clockwise.

Amplification speed controller

Basic set-up:	P-amplification	S2-3 = ON, S2-4 = OFF
	I-term	S2-1 = ON, S2-2 = OFF

For large centrifugal masses switch S2-2 must be closed and switch S2-3 can be opened.
If friction loads are predominant the switches S2-2 and S2-4 can be closed and the switches S2-1 and S2-2 can be opened.
Exact adjustment by means of the potentiometer X_P (P7).
Turn the potentiometer anti-clockwise until the LED RVU flickers.
Then turn it clockwise until the LED either lights constantly or is dark.
The brightness of the LED indicates the current demand of the drive.

Amplification current controller

If the armature circuit inductivity is high, all contacts of the switch S1 are in 'OFF' position.

If the inductivity is low, all contacts are in 'ON' position.

The adjusted values can be exactly measured by displaying the motor current on an oscilloscope.

Preset the command value step-change.

The first current half-wave must not exceed 1.5A.
(Adjustment by means of S1-3, S1-4).

The current should rise to 4A via 5 half-waves.
(Adjustment by means of S1-1, S1-2)

IxR compensation (only for armature voltage control)

Adjust the speed to 10%.

Change the load between idle running and full load.

Compensate for the speed loss at full load by turning the potentiometer IxR (P1) clockwise.

We guarantee that the device is free from material and production defects. Test results are recorded and archived with the serial number.

The guarantee time begins from the time the device is shipped, and lasts one year. WE undertakes no guarantee for devices which have been modified for special applications.

During the warranty period, we will, at its option, either repair or replace products that prove to be defective, this includes guaranteed functional attributes. We specifically disclaim the implied warranties or merchantability and fitness for a particular purpose. For warranty service or repair, this product must be returned to a service facility designated by us.
For products returned to us for warranty service, the Buyer shall prepay shipping charges to us and we shall pay shipping charges to return the product to the Buyer.
However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to us from another country.
The foregoing warranty shall not apply to defects resulting from:

* improper or inadequate repairs effected by the Buyer or a third party,
* non-observance of the manual which is included in all consignments,
* non-observance of the electrical standards and regulations
* improper maintenance
* acts of nature

All further claims on transformation, diminution, and replacement of any kind of damage, especially damage, which does not affect ou r device, cannot be considered. Follow-on damage within the machine or system, which may arise due to malfunction or defect in the device cannot be claimed.
This limitation does not affect the product liability laws as applied in the place of manufacture (i. e. Germany).

We reserve the right to change any information included in this MANUAL.
All connection circuitry described is meant for general information purposes and is not mandatory.
The local legal regulations, and those of the Standards Authorities have to be adhered to. We do not assume any liability, expressively or inherently, for the information contained in this MANUAL, for the functioning of the device or its suitability for any specific application.

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