

MANUAL

Thyristor - motor controller

Classic

C2.2 - 230/180 - 12f
potential-free



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1 Basic information

Safety regulations

Electronic devices are fundamentally not fail-safe!

Attention high voltage

AC 230 V~, DC 320 V=

Danger of shock! / Danger to life!



This manual must be carefully read and understood by qualified personnel before installation or commissioning. If anything is unclear, contact the manufacturer or dealer.

The devices are electrical equipment (EB) of the power electronics for the regulation of the energy flow in power installations.

Protection class IP00.

Control and power connections can be Carry voltages without the drive working!



Regulations and guidelines

The units and the associated components must be installed and connected in accordance with the local legal and technical regulations.

EC Directive	2004/108/EC, 2006/95/EC, 2006/42/EC EN60204-1, EN292, EN50178, EN60439-1, EN 61800-3, ECE-R100 ISO 6469, ISO 26262, ISO 16750, ISO 20653, ISO 12100
IEC/UL	IEC 61508, IEC364, IEC664, UL508C, UL840
VDE/TÜV regulations	VDE100, VDE110, VDE160
Regulations of the employers' liability insurance association:	VGB40

The user must ensure:

- that after a failure of the unit
- In the event of incorrect operation
- in case of failure of the regulation and control unit, etc.

the drive is guided into a safe operating state.



Machines, plants and vehicles are also equipped with
The unit must be equipped with monitoring and safety devices
that are independent of the unit.

Non-grounded systems (e.g. vehicles) must be equipped with
independent insulation monitors.



There must be no danger to people or property!!!

Assembly work

- Only in the de-energised state
- Only by trained electrical specialists

Installation work

- Only in the de-energised state
- Only by trained electrical specialists
- Observe safety regulations

Setting and programming work

- only by qualified personnel with knowledge of electronic drives and software
- Observe programming instructions
- Observe safety regulations

CE

When installed in machines, systems and vehicles, the device may not be used for its intended purpose until it has been determined that the machine, system or vehicle complies with the provisions of the EC Machinery Directive 2006/42/EC, the EMC Directive 2004/108/EC and ECE-R100.

The EC Directive 2004/108/EC with the EMC standards EN61000-2 and EN61000-4 is complied with under the specified installation and test conditions (see chapter CE notes).

A manufacturer's declaration can be requested.

Compliance with the limit values required by EMC legislation is the responsibility of the manufacturer of the vehicle, system or machine.

QS

The units are archived by their serial number with the test data at the manufacturer for 5 years. The test records can be requested.

Basic information

General and properties

Thyristor controller

- for inductive and ohmic loads

Main application

- Switch cabinet installation units
- according to VDE, DIN and EC directives
- plug-in terminal connection
- fully insulated power semiconductor
- Field rectifier

Galvanic separation between

- power unit and housing
- power unit and control electronics


The clearance and creepage distances comply with VDE.

To be used:

- fully insulated thyristor bridge, generously dimensioned
- only commercially available components in the industry standard
- Light-emitting diode displays
- Precision trim pot for fine adjustment
- DIP switch for system settings

Properties

- Speed control of DC motors
- 1Q operation, drive
- Power up to 2160 watts
- Speedometer control
- Armature voltage control with IxR compensation
- Torque control
- Cascade control speed-current
- Current-voltage characteristic is a rectangle
- On and off logic
- Mains connection directly switchable

Attention:			
Speedometer control:			
Control unit has	>>>	Potential separation	
Armature voltage control			
Control unit has	>>>	High-impedance mains connection	
Circuit zero (terminal 5) must not be earthed.			

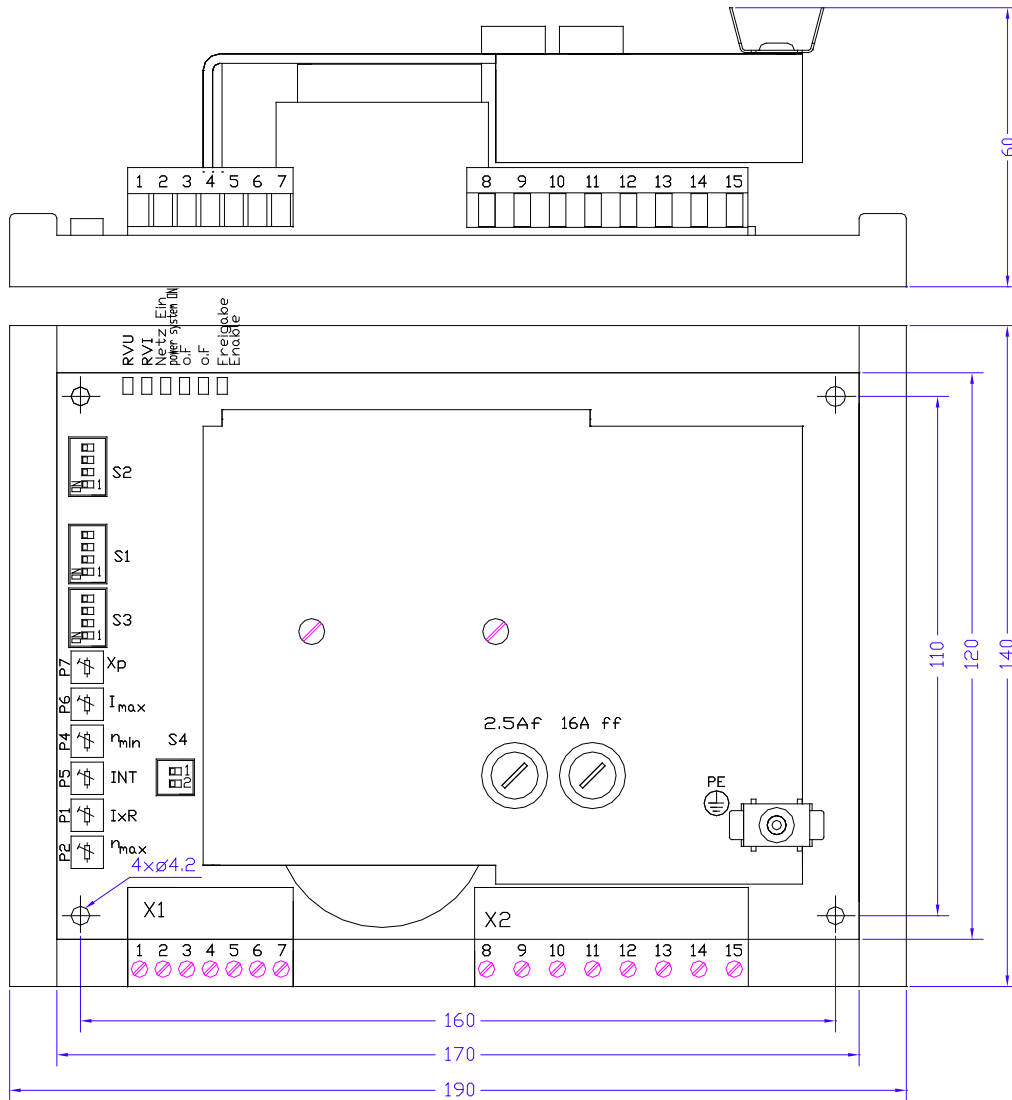
Technical data

Limit values		
Supply voltage		230 V \sim +10 %/-15 %
Output voltage	max.	180 V=
Type current	max.	12 A=
Input current	max.	13,2 A \sim
Power (electrical)	max.	2160 W
Field voltage		210 V=
Field current	max.	1 A=
Working data		
Control range	(DC tachometer)	1:300
Accuracy	(without actual value error)	0,1 %
Working data		
Control range	(armature voltage)	1:50
Accuracy		3 %
Working data		
Control range	(Torque control)	1:50
Accuracy		3 %
Working data		
Setpoint supply		12 V=, 10 mA
External setpoint	max.	12 V=
Actual value	max.	-180 V=
Switch-on logic	type-safe	Release time 100 mS
Built-in fuses		
	F1	2.5 Af
	F2	16 Aff
Accessories		
Mains choke		K78-16 F
Isolating transformer		TE 17/3 F
Smoothing choke		EI 135 A-12

Mechanical installation

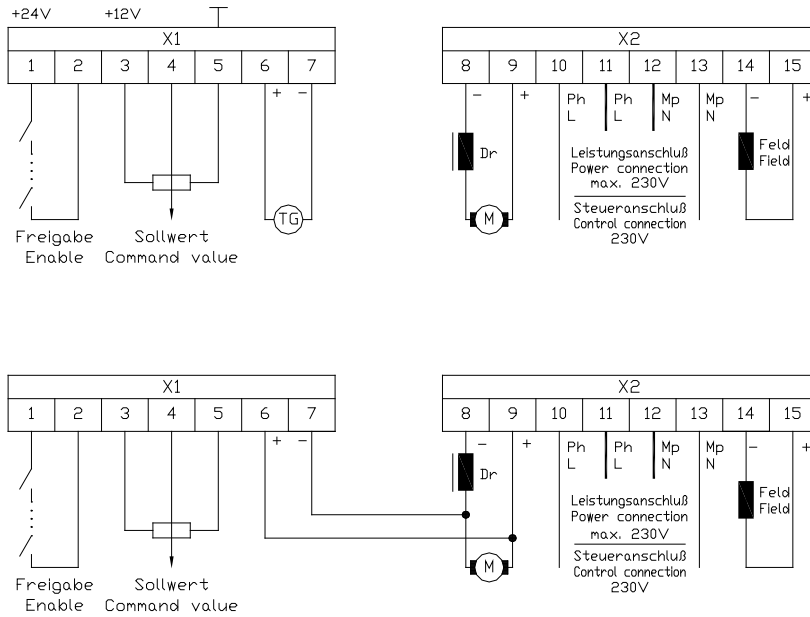
2 Mechanical installation

Dimension drawing



3 Electrical installation

Connection diagrams



Mains connection

Direct mains connection

Phase	L	Clamp	X2:11
Zero	N	Clamp	X2:12
Mains choke		K78-16F	

Connection with isolating transformer

Secondary voltages	230 V~
Transformer type	TE 16/3 F
Transformer fuse protection	16 A ff

Motor connection

Engine - Anchor

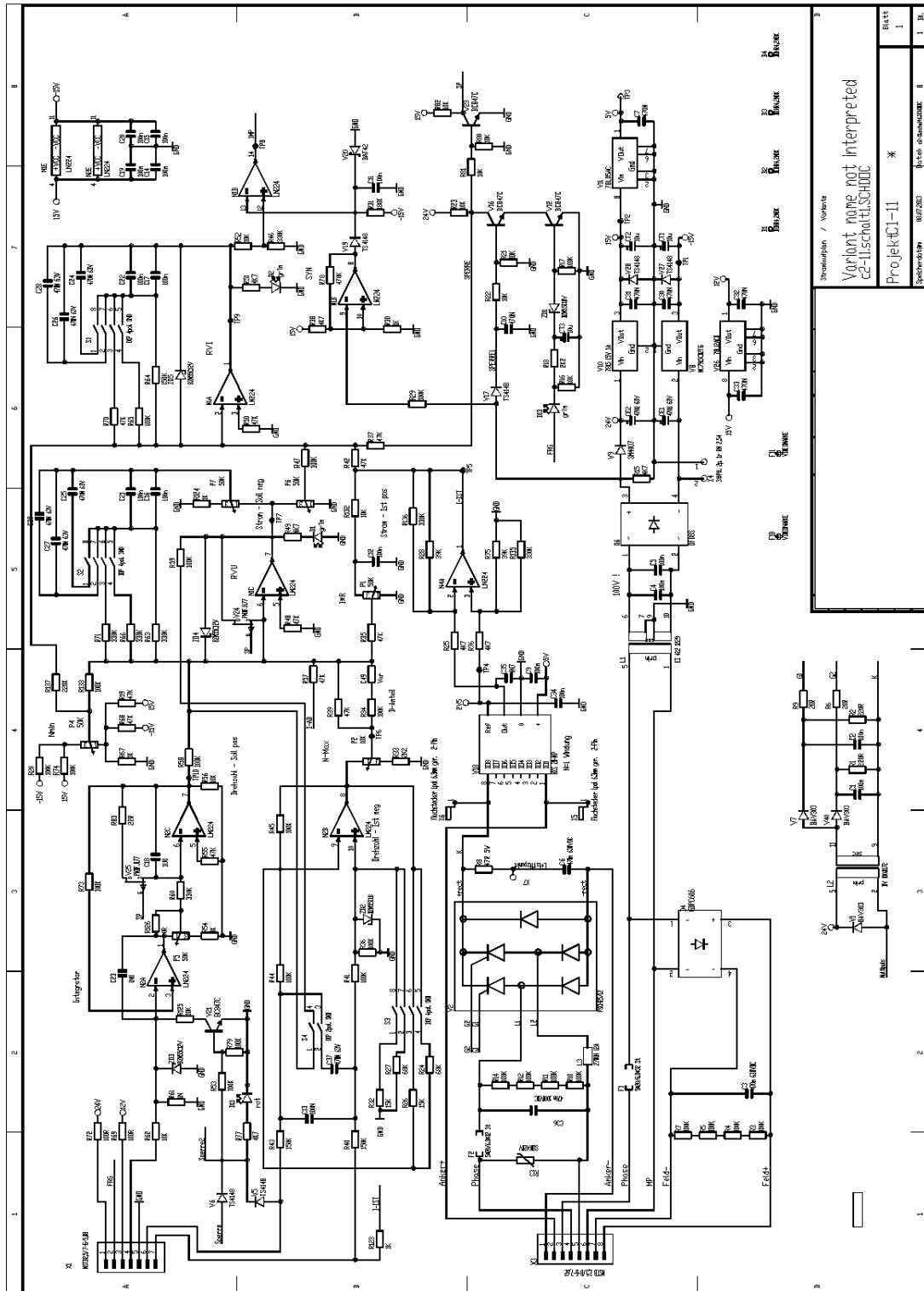
positive	Terminal X2:9
negative	Terminal X2:8

Motor field

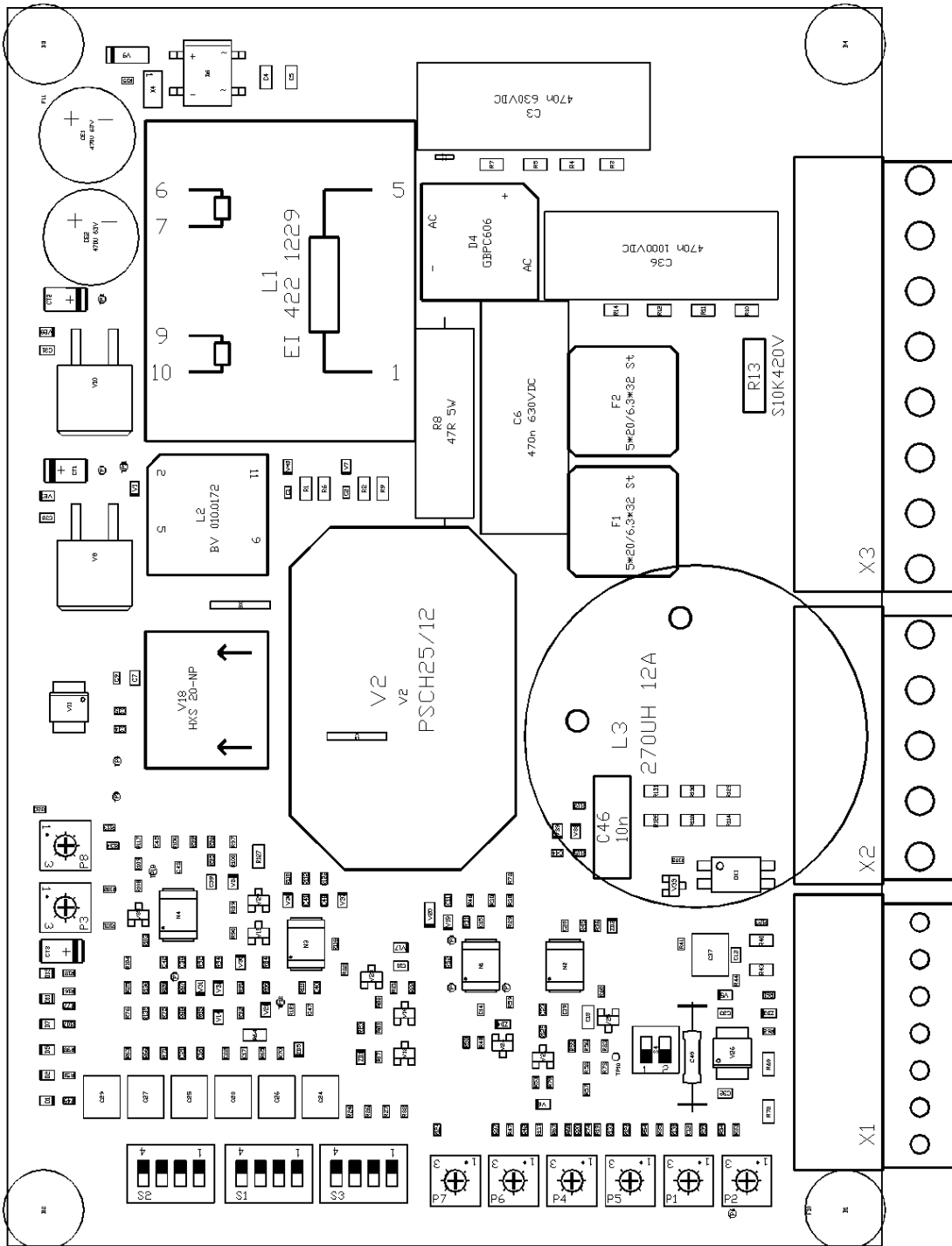
positive	Terminal X2:15
negative	Terminal X2:14

Smoothing choke type	EI 135 A-12
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Circuit diagram



Component overview



4 Settings

Setting functions

Adjustment potentiometer			
No.	Abbreviation	Function	Area
P1	IxR	Speed compensation for Armature voltage control	0 ... 40 %
P2	nmax	Fine tuning maximum speed	80 ... 120 %
P5	INT	Integration time slope limiter	0.08 ... 5 sec.
P4	nmin	Minimum speed	-0,2 ... +2 V
P6	I _{max}	Current limit	0 ... 100 %
P7	XP	Reinforcement	3 ... ∞

Setting switch		
No.	Contact	Function
	Current regulator	
S1	1,2	Integral component
S1	3,4	Proportional amplification
	Speed controller	
S2	1,2	Integral component
S2	3,4	Proportional amplification
S3	1 ... 4	Speedometer coarse adjustment
S4	2	Speedo smoothing

Basic settings

Speedometer control

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

Armature voltage control 180V=

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

Torque control

Switch in ON position: S1-1, S1-4, S4-1

All other switches in OFF position!

Settings

Set point / actual value

Set point

Setpoint voltage

Setpoint potentiometer Resistance >1 k Ω (2.5 ... 10 k Ω)
 Input resistance 50 k Ω
 Input voltage 0 ... max. +12 V=

Setpoint from current source

External terminating resistor 12 V / 20 mA = 0.6 k Ω

Integrator

Setting

Potentiometer INT P5 Area
 clockwise longer time 0.08 to 5 sec.

Actual value

Speedometer control

DC tachometer
 Alternating current or three-phase tachometer with rectification
 Speedometer voltage maximum -180 V=
 IxR potentiometer P1 Left stop!

Speedometer - Coarse adjustment - Switch positions

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

Speed - fine adjustment

Setting

Potentiometer nminP4 Area
 Potentiometer nmaxP2 -0.2 ... 2 V Setpoint value
 clockwise higher speed 50 % of the coarse setting

Attention: First adjust nmin then nmax



Armature voltage control

Armature voltage control				
Setting switch S3				
Armature voltage	S3-1	S3-2	S3-3	S3-4
90 ... 180 V	ON	ON	ON	ON
60 ... 140 V	ON	OFF	ON	OFF
20 ... 60 V	OFF	ON	OFF	ON
11 ... 20 V	OFF	OFF	OFF	OFF

Speed fine tuning

Setting

Potentiometer nmin P4
Potentiometer nmax P2
clockwise higher speed

Area

-0.2 ... 2 V Setpoint value
50 % of the coarse setting



Attention: First adjust nmin then nmax

IxR compensation

- Voltage drop at the internal resistance of the motor
- Compensation through current-proportional speed increase

Setting

Potentiometer IxR P1
clockwise greater compensation

Area

0 ... 40 %

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



Attention:

With armature voltage regulation, the Device zero connected with high impedance to the mains potential.

Torque control

- Speed controller wired with amplification -1. Switch S4-1 closed
- Switch S2 all contacts OFF
- no tachometer, no armature voltage feedback
- Switch S1-1, S1-4 closed

Settings

Current / speed controller

Power

Current limit

Setting

Potentiometer I_{max} P6
clockwise higher current limit
Measure current

Area

0 ... 100 %

>>> Ammeter in the armature circuit

PI circuit Current controller

Setting with DIP switch S1

P values

150 KΩ
60 KΩ
35 KΩ
26 KΩ

Reinforcement

0,68
0,27
0,16
0,12

S1-3

OFF
OFF
ON
ON

S1-4

OFF
ON
OFF
ON

I-values

0,22 μF
0,8 μF
1,2 μF
1,8 μF

S1-1

OFF
ON
OFF
ON

S1-2

OFF
OFF
ON
ON

Integral time constant = I value x P value x 4

Speed controller

PI circuit Speed controller

Setting with DIP switch S2

P values

330 KΩ
165 KΩ
110 KΩ

Reinforcement

3,3
1,65
1,1

S3

OFF
ON
ON

S4

OFF
OFF
ON

I-values

0,22 μF
0,69 μF
1,20 μF
1,69 μF

S1

OFF
ON
OFF
ON

S2

OFF
OFF
ON
ON

Integral time constant = I value x P value x 4

Setting

Potentiometer
clockwise greater amplification

Reinforcement

XP P7

Area

3 ... ∞

Enable open, setpoint zero

Switch on the mains.

The motor must stand still without torque.

Close release switch

The release LED must light up.

Slowly turn up the setpoint potentiometer.

The motor must accelerate according to the setpoint voltage.

(If the motor immediately runs at full speed or full voltage is immediately applied, the actual value connection terminal 6-7 must be replaced).

Speed setting

Use the selector switch S3 to carry out the actual value coarse adjustment.

At 1 V setpoint, set the speed to 10 % with potentiometer nmax (P2).

Set the minimum speed with potentiometer nmin (P4).

Increase the setpoint to 10 V and set the maximum speed with potentiometer nmax (P2).

Current setting

Ammeter in the armature circuit.

Set potentiometer I_{max} to the left stop.

Motor blocked (disconnect field).

Set the permissible motor current by turning the potentiometer I_{max} (P6) clockwise.

Gain speed controller

Default setting:	P-amplification	S2 -3 = ON	S2 -4 = OFF
	I share	S2 -1 = ON	S2 -2 = OFF

With large flywheel masses, S2 -2 must be closed and S2 -3 can be opened.

With predominantly frictional load, S2 -2, S2 -4 can be closed and S2 -1, S2 -2 can be opened.

become.

The fine adjustment is done with the potentiometer XP (P7).

LED Turn the potentiometer to the right until the LED RVU flickers, then turn it to the left until the lights up evenly or is dark.

The brightness of the LED indicates the current requirement of the drive.

Settings

Adjustment without measuring equipment

Connect the motor,

Set point=10 %
 XP =50 %
 Switch S2 -3=Position ON
 Switch S2 -4=Position OFF

Enable controller

Turn potentiometer Xp clockwise until the drive oscillates.
 LED D1 (RVU) flickers.

No vibration is achieved:

- Set switch S2 -3 to OFF position
- Set to oscillate with XP potentiometer
- LED D1 (RVU) flickers
- Turn potentiometer XP anticlockwise until the oscillation subsides
- LED D1 (RVU) lights up evenly
- Turn the XP potentiometer 2 positions further to the left.

Set switches S2 -1 and S2 -2 so that the drive runs smoothly after approx. two oscillations at a setpoint jump of 50 %.

Drive behaviour:

Gain too small

Gain too large

long-wave vibrations 1...0, 1Hz
 long overshoots

short oscillations 30 ... 200 Hz
 shakes >when accelerating

Notes on the EC Directives 89/336/EEC

The EN61000-2 and EN61000-4 standards are complied with under the following conditions.

Speedometer control

Unit, mains choke or transformer, armature choke on mounting plate
500 x 500 x 2 mounted.
Motor interference suppressed by collector capacitors.
Mounting plate connected to PE via 10 mm².
Motor housing connected to PE via 10 mm².
Terminal 5 via 2.5 mm² to PE.

Connection via mains choke

Mains choke with filter Type K 78-16 F
Line length throttle unit 200 mm
Armature choke type EI 135 A- 12
Line length throttle unit 200 mm

Connection via isolating transformer

Transformer with filter type TE 17/3 F
Cable length transformer unit 200 mm
Armature choke type EI 135 A- 12
Line length throttle unit 200 mm

Control line connection

All cables twisted <1.5 m. No shielding.