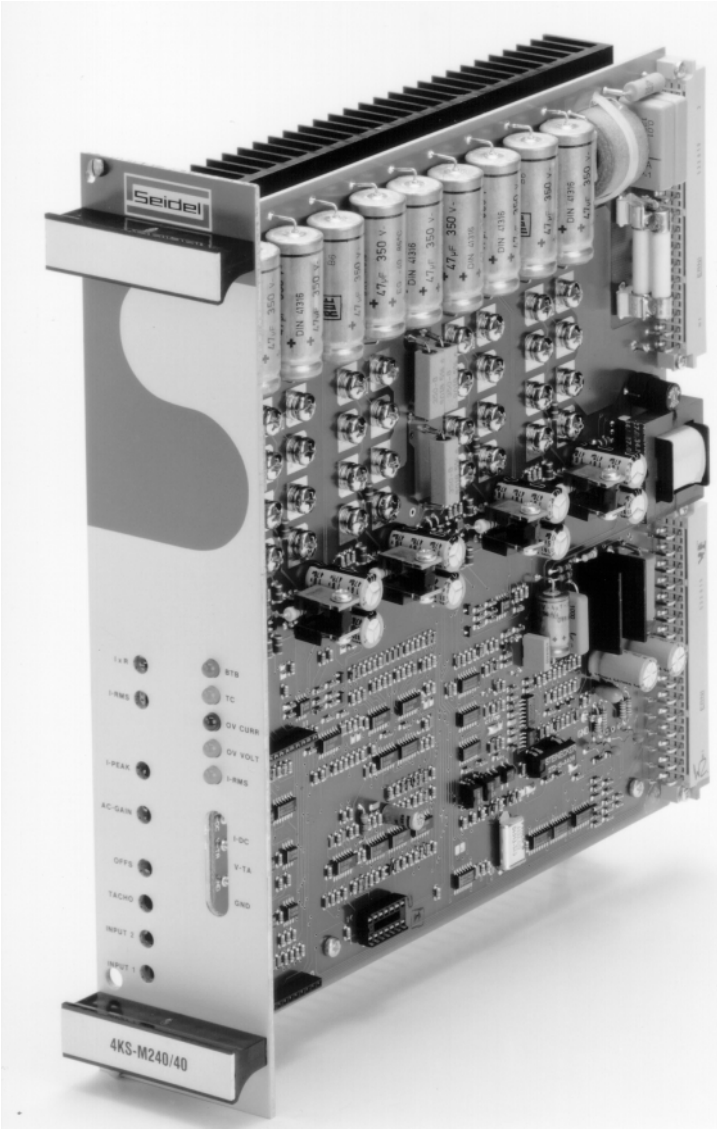
KOLLMORGEN
Seidel

Transistor — Controller
Series : 4KS



Manual

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Technical changes improving performance and specifications, may be made without prior notice !

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I General Information

I.1 Introduction

This manual explains how to install, commission, set and adjust the 4KS transistor controller and describes the power supplues of the **56WK-P** and **03S-P** series.

The manual is divided into 7 chapters :

Chapter 1	:	General information
Chapter 2	:	Installation instructions
Chapter 3	:	Commissioning
Chapter 4	:	Functions and options
Chapter 5	:	Power packs
Chapter 6	:	Drawings and wiring diagrams
Chapter 7	:	Order information

Only qualified personnel with basic electrotechnical knowledge may be authorized to install the controller and its associated equipment.

In particular, please refer to the safety instructions given at the beginning of each chapter. You will only avoid damages and hazards in this way.

Only qualified personnel with extensive knowledge in the sectors of electrical engineering / drive engineering may commission the controller.

On request, we offer instruction and training courses.

I.2 Equipment concept

Continuous development of our proven transistorized controller technology over a number of years has resulted in a new four-quadrant controller for DC servomotors.

The output stage comprising transistor modules operates with pulse-width modulation using the second generation of our “cold technology”.

Modern SMD technology results in compact dimensions and a low price.

The 4KS servo-amplifier replaces the tried and tested 4K series. All the adjustment parameters and adaptations which can be changed by the operator are grouped on the “customer print” accessible from the front panel. As required, the potentiometers can be replaced by fixed resistors at the discretion of the customer.

The extremely low power dissipation of the controller means that equipment with an rms current of up to 15A can be operated with natural convection cooling. It is also ideally suited for battery powering.

Up to 6 units of the 4KS series and 1 power supply unit can be housed in a 6HE 19" rack mount.

The equipment is connected by a backplane with terminals for signalling lines and screwed terminals for power leads.

Optionally, the backplane is available as a **short** version **-F-** for **f**ront mounting or as a **long** version **-R-** for **r**ear-panel mounting with connection from the front.

The unit is adjusted to PLC-compatible 24V logic. The logic inputs can be reconfigured to 4K compatibility by solder straps.

A **56WK** series power supply with integrated overvoltage protection is normally used for DC supply. In addition, the 03S power supplies are available for smaller voltages.

All devices are delivered with front panels as standard.

I.3 Functional groups

On a double European standard pc board 220 x 233,4 x 12TE in SMT, the following moduls are to be found :

- Auxiliary voltage power pack, internal or external supply (option 24V)
- Fuses to the intermediate circuit and the auxiliary voltage power pack
- Four-quadrant output stage
- 2 rated value differential inputs
- Input for d.c. tachometer
- Enable input
- Limit switch inputs positiv/negativ (option)
- Integral-OFF input
- Output for dynamic brake
- I^2t monitoring for actual current value with signal output
- PI current and speed controller
- Balancing potentiometers and fixed components for all important adjustments on a plug-in **customer print**
- Jump wire connections for IxR-controlling
- Slot for **-cl-** and **-vl-** options
- Slot for option board with the supplementary functions:
  - limit switch inputs (**-LS-**)
  - ramp generator (**-RG-**)
  - tacho controll (**-TC-**)
- **Parallel mode** with several controllers (of one type) possible without additional devices
- Jump wire connectors for reconfiguration to 4K compatibility
- Ready-for-operation relay (BTB) with floating contact
- Display LEDs for all important signals
- Auxiliary voltage outputs ±15V

I.4 Specifications

I.4.1 Controller 4KS-M150/xx

			4KS-M150/				
Rated specifications		**Unit**	**7,5**	**15**	**25**	**35**	**40**
Rated supply voltage (intermediate circuit)		V=	150				
Rated connected load (for rated current)		kW	1,2	2,3	3,8	5,3	6,1
Rated output current I_{RMS}		A	7,5	15	25	35	40
Peak output current (available for max. 5 s)		A	10	20	40	60	100
Fuse protection (intermediate circuit)		AM	8	15	20	30	40
Fuse protection (auxiliary voltage)		AM	1				
Switch-off threshold with overvoltage		V	230				
Switch-off threshold with undervoltage (1/3 Ucc)		V	<50				
Minimum motor load inductance		mH	0,9	0,45	0,22	0,15	0,15
Form factor of the output current (rated specifications and minimum motor load inductance)		-	1,01				
Bandwidth of secondary current control circuit		kHz	1				
Clock frequency of output stage		kHz	(2 x) 8,5				
Residual voltage decrease at rated current		V	4				
Quiescent power loss, output stage disable		W	8				
Power loss at rated curren		W	40	70	110	160	185
Auxiliary voltage outputs		V	±15				
		mA	±20				
Dynamic brake output		V	24				
		mA	max.100				
Inputs							
Nominal value 1, adjustable		V	±10				
Nominal value 2, adjustable		V	±10				
Max. common-mode voltage (both nom. value inputs)		V	±10				
Input resistance (both nominal value inputs)		kΩ	20				
Max. input drift (both nominal value input)		µV/K	±15				
24 V auxiliary voltage supply (option)		V	24 (20...30)				
		A	0,7				
Tacho input, adjustable		V	±10...50				
Connections							
Controller:	Control signals	DIN 41612 - D32 (plug)					
	Power signals	DIN 41612 - D32 (plug)					
Rear-panel board:	Control signals	terminals 2 x 11 poles					
	Power signals	screw bolts M6					
Mechanical specifications							
Weight		board 1,9 kg					
Dimensions		double Eurocard (12TE) 220 x 233,4 x 60,6 mm					

I.4.2 Controller 4KS-M240/xx

		4KS-M240/				
Rated specifications	**Unit**	**5**	**10**	**20**	**30**	**40**
Rated supply voltage (intermediate circuit)	V=	240				
Rated connected load (for rated current)	kW	1,3	2,5	4,9	7,3	9,7
Rated output current I_{RMS}	A	5	10	20	30	40
Peak output current (available for max. 5 s	A	10	20	40	60	100
Fuse protection (intermediate circuit	AM	8	15	20	30	40
Fuse protection (auxiliary voltage)	AM	1				
Switch-off threshold with overvoltage	V	320				
Switch-off threshold with undervoltage (1/3 Ucc)	V	<80				
Minimum motor load inductance	mH	1,5	0,75	0,4	0,25	0,2
Form factor of the output current (rated specifications and minimum motor load inductance	-	1,01				
Bandwidth of secondary current control circuit	kHz	1				
Clock frequency of output stage	kHz	(2 x) 8,5				
Residual voltage decrease at rated current	V	4				
Quiescent power loss, output stage disable	W	10				
Power loss at rated current	W	40	70	120	180	230
Auxiliary voltage outputs	V	±15				
	mA	±20				
Dynamic brake output	V	24				
	mA	max.100				
Inputs						
Nominal value 1, adjustable	V	±10				
Nominal value 2, adjustable	V	±10				
Max. common-mode voltage (both nom. value inputs)	V	±10				
Input resistance (both nominal value inputs)	kΩ	20				
Max. input drift (both nominal value input)	µV/K	±15				
24 V auxiliary voltage supply (option)	V	24 (20...30)				
	A	0,7				
Tacho input, adjustable	V	±10...50				
Connections						
Controller: Control signals		DIN 41612 - D32 (plug)				
Power signals		DIN 41612 - D32 (plug)				
Rear-panel board: Control signals		terminals 2 x 11 poles				
Power signals		screw bolts M6				
Mechanical specifications						
Weight		board 1,9 kg				
Dimensions		double Eurocard (12TE) 220 x 233,4 x 60,6 mm				

I.5 Permissible ambient conditions

Tolerance for supply voltage	60 to 150(240) V+10%
Installation position in 19" plug-in module	vertical
Ventilation method:	
Continuous current **up to max. 15 A**	**self ventilated** with free aeration
Continuous current **>15 A**	**force-ventilated**
Ambient temperature (at rated values)	0 to +45°C
Power derating (2,5%/°C) in range	+45...+55°C
Storage temperature (rel. humidity max 95% non condensing)	-25 to +85°C
Protective system (in connection area)	IP 00

I.6 Connectable motor types

Disk drivers and other servomotors with permanent fields, for example series MT30 and 40.

I.7 Protective functions

The 4KS transistor controller features the following protective functions:

- Short-circuit-proof and earth-fault-proof at the motor connection terminals (also without chokes)
- Monitoring of the operating voltages
- Temperature monitoring of the output stage
- Fuse protection of the intermediate circuit
- I^2t monitoring to protect the amplifier and motor
- Overvoltage protection
- HF-Interference filter by a built in RLC network in the armature loop

I.8 Connecting several controllers in parallel

You can easily connect controllers of the same model with no additional technical effort in order to increase power. Please refer to the wiring example on page 34. Ask for our Technical Information on this subject.

I.9 Minimum load inductivity

In order to ensure a form factor of 1.01, load inductivity should not exceed the values specified in the table Model Overview in Chapter VII. Highly dynamic motors with ironless rotors, and disk or moving coil designs require armature circuit chokes to ensure reliable operation.

I.10 Modification to 4K compatibility

In the standard version, the transistorized controllers of the 4KS series can be adapted to PLC-compatible 24V logic. The logic inputs can be matched to 4K compatibility by changing solder straps. The following changes are required:

LB10 — resolder to position 4K
LB11 — connect (disconnected in as-delivered state)
LB9 — replaces plug-in jumper cl/op of 4K unit, select position accordingly

I.10.1 Isolating Transformers

Isolating transformers are required to operate power supplies.
In order to ensure the proper operation of the plant and comply with warranty conditions, isolating transformers must conform with the specifications listed below.

Model: Three-phase isolating transformer with shield effectiveness to VDE 0550 in Y/y or Y/d connection.

Power supply: 400 (380) V with ±5% taps to match fluctuating mains conditions

Secondary voltage: — for 150V DC intermediate circuit: 107V (phase-to-phase)
— for 240V DC intermediate circuit: 172V (phase-to-phase)
The secondary side neutral point must not be grounded.

No-load voltage: (secondary) The permitted no-load voltage overshoot is approx. 4%

Short-circuit voltage: The effective short-circuit voltage u_k must be 4% + 1% to ensure protection of the rectifier diodes during power-on and in the event of overvoltages to VDE 0160. With transformer outputs greater than 6KVA for single-axis systems and up to 8kVA with multi-axis systems, a soft start is required.

Power factor: The transformer loaded with an AC bridge-connected rectifier has a power factor $\lambda = 0.9$.

Overload characteristic: The typical short-term overload in servo mode must not result in greater voltage drops than given by u_k or damage the transformer.

Attention !
The use of a transformer which fails to comply with the above specifications will impair operating reliability and can lead to controller damage. We only assume functional warranty of the controller if SEIDEL isolating transformers are used (see below).

Seidel isolating transformers (three-phase, rated connected voltage 400 [380] V)

The isolating transformers which we supply comply with the above specifications.

Type	Power/kW	Sec.-voltage/V	Order-No.
3T0,7K-240	0,7	172	63391
3T1,5K-150 (240)	1,5 (1,5)	107 (172)	53190 (60075)
3T3,0K-150 (240)	3,0 (3,0)	107 (172)	53740 (56898)
3T5,0K-150 (240)	5,0 (5,0)	107 (172)	53551 (55027)
3T8,0K-150 (240)	8,0 (8,0)	107 (172)	54841 (57006)
3T10K-150 (240)	10 (10)	107 (172)	53221 (56958)

II Installation instructions

II.1 Safety instructions

- Check the nameplate of the controller. Compare the rated voltage and rated current with the transformer specifications and motor specifications.
- An isolating transformer must be used to ensure the safety of personnel and equipment. We can only accept warranty liability if the isolating transformer used complies with the specifications listed in Chapter I.10.1. It is preferable to use the Seidel isolating transformers listed in Chapter I.10.1.
- Never switch on the operating voltage until you have read Chapter III of this manual (Commissioning) .
- Make sure that the maximum permitted rated voltage of 150(240)V DC is not exceeded at the terminals Ucc/0V of the controller. An excessively high voltage at these terminals may destroy the the controller.
- Make sure that the controller is **sufficiently ventilated**:
  up to 15 A rated current : vertical installation, **free convection**
  over 15 A rated current : vertical installation, additional ventilator, **forced convection**
  Incorrect installation or no ventilator for rated currents of over 15 A may destroy the controller.
- Make sure that the conductor cross-sections are sufficient to avoid excessively high power losses and to prevent the conductors from overheating.
- Use twisted pair conductors for rated value, tachometer and motor conductors. The tachometer and rated value conductors must be installed shielded. Refer to chapter II.2.1.
- Ground the intermediate circuit (0 V/GND). A non-grounded intermediate circuit is a hazard to the system operator if there is a ground fault in the motor or fault currents on the GND conductor. The electronic system may also be destroyed in the event of a fault if the intermediate circuit is not grounded. A ground fault in the motor is no longer detected if there is no grounding.
- Never ground any tacho conductor. One conductor is grounded internal by a resistor (100Ω) to AGND.
- All ground connections must start at the same point to prevent ground loops and potential differences on the ground conductor. Connect all ground conductors to a PE rail, e.g. in the control cabinet.
- Check that the screens are correctly connected:
  — Tachometer screen at the controller (GND/PE or 0 V/GND)
  — Rated value screen on the control system at NC-GND
  Screens may only be connected to one side.
- Loop the BTB contact (terminals 21, 22) into the safety circuit of the system. The controller function can only be monitored in this way.
- The ±15 V auxiliary voltages must not be routed out of the control cabinet. This will avoid capacitative and/or inductive interference.

II.2 Connection and wiring

In addition to the correct grounding of equipment and motor housings, proper wiring by qualified personnel is also very important for functional reliability.

The **motor conductors** must be twisted with sufficient cross-sections (for single conductors) or installed in cables (oil-resistant flexible cables, etc.).

Install suppressors, such as annular ferrite cores or chokes, as close as possible to the controller. Tachometer and rated value conductors **must be** twisted in pairs and installed shielded.

The tachometer shields are best connected to GND at the controller and the rated value shield to the rated value source (CNC).

The controller and the control system **must have the same PE/GND** reference point (e.g. the PE rail in the control cabinet). You can connect the control system to the GND reference point for improved interference suppression at medium impedance (e.g. with 100Ω). This is permitted by the common-mode rejection of the nominal value inputs. The logic inputs should be driven by the control system at 24 V (15 to 30V).

Never ground any tacho conductor. One conductor is grounded internal by a resistor (100Ω) to AGND.

II.2.1 Conductor cross-sections

When wiring, consult the minimum conductor cross-sections specified below. You will then prevent high conductor losses and conductor overtemperature.

Rated current /A	Designation	Cross section/mm²	Terminals / Remarks
5 / 7,5 / 10	supply voltage	3i x 2,5	Ucc , 0V , PE
15 / 20	supply voltage	3i x 4	Ucc , 0V , PE
25 / 30 / 35 / 40	supply voltage	3i x 6	Ucc , 0V , PE
5 / 7,5 / 10	Motor cables	3i x 2,5	A1 , A2 , PE
15 / 20	Motor cables	3i x 4	A1 , A2 , PE
25 / 30 / 35 / 40	Motor cables	3i x 6	A1 , A2 , PE
all types	Tachometer	2 x 0,14	twisted pairs, shielded
all types	Rated values	2 x 0,14	twisted pairs, shielded
all types	Control signals, BTB	0,5	
all types	Brake	2 x 1	
all types	+24V/GND	0,75	Option !

II.2.2 Fuse protection

Fuse protection of the supply voltage of the power supply and of the ventilation unit (cable protection) is performed by the user, either using fuses (secondary side) or motor safety switches with phase failure monitoring on the primary side.

Component designation	Module-description	Position	Fuse	Size
F1	DC interm. circuit	Motherboard	see techn. data	6,3 x 32
F2	Auxiliary voltage	Motherboard	1 AM	Mikrofuse
(F2	Option 24 V	Motherboard	2 AM	Mikrofuse)

II.2.3 Ventilation

Make sure that the controller is correctly ventilated. The type of ventilation depends on the set RMS current.

IRMS to 15 A : vertical installation, no ventilator required
IRMS greater than 15 A : vertical installation, additional ventilator required

II.2.4 Connector pin assignment for 4KS

22-pin Combicon block	Signal description	Signal direction	Controller connector
1	Nom. value 1+ ,±10 V	Input	32c
2	Nom. value 1- ,±10 V	Input	32a
3	Nom. value 2+ ,±10 V	Input	30c
4	Nom. value 2- ,±10 V	Input	30a
5	Tacho -	Input	28c
6	Tacho +	Input	28a
7	Current nom. value OUT ±10 V	Output	26c
8	Current nom. value IN ±10 V	Input	26a
9	Analogue GND (AGND)	Input	18c
10	Limit switch positive	Input	24c
11	Limit switch negative	Input	24a
12	Digital GND (DGND)	Input	18a
13	Auxiliary Voltage +15V	Output	22c
14	Auxiliary Voltage -15V	Output	22a
15	Integral OFF	Input	20c
16	Enable	Input	20a
17	Analogue GND (AGND) connected to DGND	Input	18c
18	I2t monitor	Output	16a
19	Auxiliary voltage +24V (referred to 0V/GND)	Input	14c
20	dynamic brake	Output	14a
21	BTB contact	Input	12c
22	BTB contact	Output	12a
—-	IDC-monitor	Output	16c

All analogue inputs ±10 V referred to analogue GND (terminal 17).
All digital inputs H-active 24 V/10 mA to digital GND (terminal 12), floating to analogue GND (if solder strap LB11 is open).
All digital inputs can be operated by the +15 V auxiliary voltage (terminal 13). Solder strap LB11 (closed when delivered) provides the ground connection between AGND and DGND.

II.3 Checklist

- — Check nameplates
- — Unfold wiring diagram
- — Select conductors (Chapter II.2.1)
- — Define main ground point **(every ground referres to this main ground point)**
- — Ground transformer housing and shield
- — Ground motor housing
- — Ground NC-GND of control system
- — Ground intermediate circuit (terminal 0 V/GND) of the controller
- — Loop BTB contact into the safety circuit
- — Connect digital control inputs of the controller
- — Connect nominal value inputs
- — Connect nominal value conductor shield to NC-GND of the control system
- — Connect the tachometer conductor shield to the 0V terminal
- — Connect the tachometer
- — Connect the motor conductors to the chokes
- — Connect the operating voltage (note the maximum permitted voltage values)
- — Check the ventilation (Chapter II.2.3)
- — Make sure that the ±15 V auxiliary voltages do not exit the control cabinet

III Commissioning

III.1 Safety instructions

- Check that the safety instructions in Section II.1 have been observed.
- Observe the instructions for putting into operation in Section III.2.
- The correct sequence of steps for comissioning helps you prevent damage. Please contact us if you require any further information.
- First consult Chapter IV about the functions and options featured in the 4KS controller if you have to make changes to the controller.
  If you need to make any modifications to the controller, first read Chapter IV.
  You are allowed to adjust and optimize the controller and connect circuit parts by solder straps.
  Any other work on the equipment will entail loss of warranty entitlement.
- Adapt the RMS current and the peak current of the controller to the motor. The necessary steps are explained in Sections IV.2.3.5 and IV.2.3.6.

Never remove or plug in the controller when it is switched ON. Observe the operating LED.

This is the only way that you can prevent erosion of the plug-in contacts, the destruction of entire modules of the controller and any personal danger due to fully charged capacitors.

Only **plug** in the controller when the operating voltage is switched off.

Only **remove** the controller when the undervoltage limit is undershot.
Observe the LEDs of the controller after switching off the operating voltage. After a short time, the green LED goes off and the red LED briefly lights up. You can now remove the controller.

III.2 Instructions for commissioning

Commissioning is only summarized here. We can provide you with further information at our **training courses** (on request).

1.- Check the wiring using the **wiring diagram** (transformer, grounding, motor terminal, control signals).

2.- Check the equipment **nameplates** (rated voltage, rated current, special tuning if necessary).

3.- Check the **emergency OFF** circuit before switching on the controller for thefirst time.

4.- Reduce the **gain** (turn AC GAIN potentiometer to the ccw-stop) and the peak current (IPEAK potentiometer almost to the ccw-stop) as a precautionary measure.

5.- Switch on the transformer **after the controllers are removed**; test the DC intermediate circuit voltage (150 or 240V depending on the mains voltage); **switch off the transformer**.

6.- Plug in a controller. **Block the enable signal** and check the emergency OFF function. Switch on if there is no risk of damage or injury to machinery or persons, even if the drive system is unintentionally moved.

7.- **Move the axle** by switching the enable signal at an applied **(small)** nominal value.

8.- **Tune** the axle (AC GAIN, I_{PEAK}, OFFSET, TACHO, IRMS - if not already preset).

9.- **Switch off** and plug in other controllers **if not connected to the power pack**. Further commissioning steps as described from item 6.

III.3 Interference suppression

If there is interference in the CNC or in the analogue or digital position transfer, there are the following additional measures:

— additional ferrite rings in the motor cable
— shielding the motor cable
— RC filter at the nominal value output of the CNC (RC 1 kΩ/10 nF)
— integration of chokes in the motor cable. Check in each case which measures are sufficient to eliminate the interference.

IV Functions and Options

IV.1 Safety instructions

- First read Chapter IV before you make any modifications to the controller.
  If you need to make any modifications to the controller, first read Chapter IV.
  You are allowed to adjust and optimize the controller and connect circuit parts by solder straps.
  Any other work on the equipment will entail loss of warranty entitlement.
- The controller can only be modified by **trained qualified personnel**.
- The controller **must be checked after each modification**.

IV.2 Functional description

IV.2.1 Input functions

IV.2.1.1 Nominal value inputs In1, In2

The controller is fitted with two non-reactive differential inputs for the nominal values (or DC tachometer). Both inputs are fitted with adjustable attenuators (P 301, P 302). Clockwise rotation increases the speed (efficiency is increased).
Both inputs are adjustable for differential voltages up to ±10V.
The common-mode voltage range (important for preventing ground loops) is additionally ±10 V for both inputs; the input resistance is 20 kΩ.
Both inputs are adjustable, see Chapter IV.2.3.1 .

IV.2.1.2 Current rated value - bridge (pins 7 / 8)

The current rated value supplied by the speed controller is fed in normal mode via an **external** bridge across pins 7 and 8 to the actual current controller. All limits and protection functions remain fully active even if the current rated value is fed externally, e.g. from the master unit in parallel circuits.
An **externally switchable current limiter** can be implemented by looping in a voltage divider across pins 7 and 8. At this interface, the conversion is **5V for peak current**.

If the unit is to function as a current controller, select the 1:1 configuration.

IV.2.1.3 Tachometer input Ta

The fixed resistor **R302** (tolerance 1%) determine tachometer calibration. **P 303** is used to fine-tune the tachometer (see chapter IV.2.3.2) . The control range is 10 to 50V.
The standard equipment is designed for tachometer voltages of 10 V or 50 V at rated value of 10V and approximate cw- or ccw-stop of **P 303**.
Clockwise rotation decreases the speed (efficiency is increased).
Filtering of the tacho signal may be changed by C301 if necessary.

One tachometer conductor is internally grounded by a resistor of 100Ohm— in case of this, never ground any tachometer conductor !

IV.2.1.4 Digital control inputs

All inputs are coupled **potential-free** via optocouplers and the ground reference is **digital** GND (DGND, pin 12). The logic is designed for +24V/10mA (**PLC-compatible**).
The H level ranges from +12 to 30V.

If required, control is possible with +15V (pin 13); here the digital GND (pin 12) and analog GND (pin 17) must be connected.

In the as-delivered state, AGND and DGND must be connected by solder strap LB11 on the controller board.

Input Enable E (pin 16)

The controller output stage is released by the enable signal (input 24V, H active, logic level 12V to 30V/10mA to digital GND pin 12, potential-free). In the blocked state, the connected motor is torque-free. The integral sections of the speed and current controllers are also blocked (LB8 in position cl, LB10 in position 4KS).

The signal is **delayed on power-on by 30ms** but is **immediately effective on power-off**..

Input Integral ab IAB (pin 15)

By applying a signal (input 24V, H active, logic level 12V - 30V/10mA to DGND pin 12, potential-free), the integral section of the speed controller is bridged. The result is that the armature current, e.g. running to dead stop, is incapable of integrating up due to drift.

The controller then has a purely proportional (soft) characteristic, thus permitting a specific speed deviation before a notable current builds up.

This property eliminates the use of a differential for driving round bends, e.g. on industrial trucks with several drives.

Inputs Limit Switch PSTOP, NSTOP (LB12, pins 10, 12)

Only together with option -01- or -LS/RG-.

When the option board -01- is plugged in, the solder strap LB12 must be open.

If there is **loss of a signal** (inputs 24V, H active), the associated direction of rotation is blocked. Simultaneously, the integral section of the controller is bridged in order to limit the motor current when running to dead stop.
In the operating mode, the two inputs must receive an H signal.

IV.2.2 Output functions

IV.2.2.1 Armature current monitor output IDC (terminal 23)

The output supplies ±10 V for appliance **peak current** referred to AGND. Source resistance is 1kΩ.
The DC average value, which is **approximately proportional** to the supplied **motor torque**, is emitted.

This signal can also be used as a **current** nominal value signal for a second 1:1 wired (slave) controller of a tandem drive.

IV.2.2.2 Ready-to-operate contact BTB

The **ready for operation signal** (**BTB**, pins 21, 22) is output via a **floating** relay contact (100V/0.1A) when the controller is functional **and** the auxiliary voltage supply is functioning correctly (**contact closed**).
The contact opens immediately when one of the following faults or operating modes occurs:

- loss of operating voltage or defective power supply fuse F2
- overcurrent in the event of short circuit, ground fault or defective controller
- overvoltage
- overtemperature of output stage
- uninterrupted or incorrectly polarized tachometer line (only with option -01-)
- undervoltage of 24V supply
- overshoot of I^2t limit (if LB16 is closed)

The signal can only be reset by switching the power supply +Vcc off and back on again (or +24V on 24V option). The overtemperature signal can only be indicated after the controller has cooled down.

IV.2.2.3 Control output for brake relay (pin 20)

This output (24V, H active), which is driven by the enable signal, can operate an auxiliary relay (24V/max. 100mA) to drive a dynamic (plug) brake.

When the enable signal is applied, the output switches through to 24V. When the enable signal is switched off, the output is released without delay and a connected relay is released.

IV.2.2.4 Measuring Points

Tachometer monitor (V-Ta, pin 5)

The tachometer voltage (actual speed value) can be measured on the front panel at measuring point **V-Ta** and on the rear panel at pin 5 by means of an oscilloscope or a voltmeter to measuring point GND or pin 17.

The output supplies ± 10V for ± maximum speed. The source resistance is 1kΩ.

Armature Current Monitor (I-DC)

The armature current monitor can be measured on the front panel at measuring point I-DC by connecting an oscilloscope or a voltmeter to measuring point GND (source resistance 1kΩ). The ±10V for ± peak current is measured to AGND.

For example, the readings +10V → + 40A
-10V → - 40A
+1V → + 4A

The reading is approximately proportional to the torque.

IV.2.2.5 Auxiliary voltage outputs (±15V, pins 13, 14)

The outputs supply ±15V DC (±20mA). The outputs are **not** resistant to a short circuit. Only use the auxiliary voltages **for commissioning**.
The auxiliary voltages must not be brought outside the control cabinet.

IV.2.3 Possible settings

IV.2.3.1 Rated value potentiometers P301, P302

Both nominal value inputs are adjustable (P301, P302). Clockwise rotation **increases** speed. The inputs are valid for differential input voltages up to ±10V.

IV.2.3.2 Tacho potentiometer P303

P 303 is used to fine-tune the tachometer. The control range is 10 to 50V.
The standard equipment is designed for tachometer voltages of 10 V or 50 V at rated value of 10V and approximate cw- or ccw-stop of P 303.
Clockwise rotation **decreases** the speed (efficiency is increased).
You may enlarge the control range by decreasing R307 (10kΩ).
Filtering of the tacho signal may be changed by C301.

IV.2.3.3 Offset potentiometer P304

The offset potentiometer P304 is used to compensate fault voltages in the operational amplifier or the nominal value voltage source (control) which are present at a nominal value of 0 V.
Adjust to motor standstill when the amplifier is active (enabled) and the nominal value voltage is 0 V. (Setting range ±7.5 mV)

IV.2.3.4 AC GAIN potentiometer P305

You can **increase** the proportional gain of the PI speed controller by rotating the potentiometer P305 clockwise (control becomes stiffer). When the potentiometer reaches the ccw-stop, R307 sets the basic gain to approx. 15. The integral component is set by C304 to 150 kΩ x 0.22μF = 33 ms.
The control circuit becomes slower (softer) by increasing C304. Reducing C304 improves the response sensitivity of the controller but increases the tendency to resonate. The standard equipment only needs to be modified in exceptional cases.
Set P305 when the amplifier is enabled and the motor is stationary (nominal value voltage = 0 V) by rotating clockwise until oscillation starts (very easily observed using the oscilloscope on the current monitor) and then by turning back until just before the oscillation limit. R309 restricts the gain of the integral components to approx. 5000 at very low frequencies.
In case of oscillations caused by torsional resonances you may enlarge C303 up to 0.1μF.

IV.2.3.5 Peak current I_{PEAK} P306

You can reduce the appliance peak current I_{PEAK} by turning P306 **anti-clockwise**. The control range (linear) is 0 to 100%.
You should be aware of the fact that an excessive peak current will shorten the response time of the I_{RMS} limiter. We recommend an adjustment of 1.5 to 2.5 x I_{RMS}.

IV.2.3.6 RMS current I_{RMS}, I^2t limit P307

The controller is capable of supplying the peak current I_{PEAK} (depending on the equipment type) for approx. max. 5s. Afterwards a limiter becomes active and reduces the signal to the preset rated current I_{RMS}. By turning P307 counterclockwise, I_{RMS} is reduced and the setting range (to the power 2) is 0 to 100%. Centre position corresponds to about 70% of the rated current. The time t during which the pulse current can be tapped, changes, depending on the selected settings of I_{RMS} and I_{PEAK}, according to the following formula :

$$t = \frac{(I_{RMS})^2 \times 20s}{(I_{PEAK})^2}$$

From a preload of approx. 50% of the preset rated current I_{RMS} upwards, there is a notable shortening of the available peak current time.
Setting (LB16 open): Turn P307 almost to the counterclockwise stop (with stalled motor), then turn P307 step-by-step clockwise until the yellow I_{RMS} LED D42 lights up.
Setting (LB16 closed): When the I^2t cut-off is activated, the BTB contact opens at the same time as the I_{RMS} LED lights up. Apply an H signal (e.g. +15V from pin 13) to the IAB input (pin 15). Adjust the I_{RMS} limit step-by-step by turning P307 clockwise. With the motor stalled, set the desired current at pin 1/2 by specifying a rated value between 0V and 1V. When the I^2t/I_{RMS} limit is attained, the amplifier switches off after a period of time t (see above formula). Reset the controller by switching off and switching back on the supply voltage Vcc (or +24V on the 24V option).

IV.2.4 Other functions

IV.2.4.1 Frequency response of the controller

If required in **exceptional** cases, the frequency response of the current controller can be altered. The basic setting is designed for a bandwidth of 1 kHz which means that the delay time is negligible short.

IV.2.4.2 I²t monitoring

When the set RMS current limit value is reached, the pulse current is limited until the RMS value load drops.
There is a possibility to switch off the amplifier by reaching the I^2t-limit. To achieve this function jump wire connector LB16 has to be closed.

IV.2.4.3 Displays

Green LED ready for operation BTB (D69)

The **green** LED **BTB** lights up when the supply voltage is present **and** when the power supply fuse F2 is intact.
The controller is ready for operation when the green LED lights up **and** the red LED is off. The BTB contact (floating NO contact **100V/0.1A**, pins 21, 22) is closed when the controller is ready to operate.

As long as the green BTB LED is lit, do not remove the controller.

Red LED for overcurrent (D67)

The **red** LED **OVERCURRENT** lights up when an **overcurrent** occurs as a result of short circuit, ground circuit or defective controller.
At the same time, the **BTB contact opens** and the controller enable signal **Enable** is **disabled** without delay.
The signal can only be reset by switching off and switching back on the supply voltage +Vcc (or +24V on 24V option).

Yellow LED for overvoltage (D66)

The **yellow** LED **OVERVOLTAGE** lights up when an **overvoltage** fault resulting in the switch-off of the controller.
At the same time, the **BTB contact opens** and the controller **enable** signal **is disabled** without delay.
The signal can only be reset by switching off and switching back on the supply voltage +Vcc (or +24V on 24V option).

Red / yellow LEDs for overtemperature (D66, 67)

If the **two** LEDs for **overcurrent and overvoltage** light up, this signals that the overtemperature switch on the output stage board is activated.
At the same time the **BTB contact opens** and the controller **enable** signal **is disabled** without delay.
Should this fault signal occur, first wait until the controller has cooled down before resetting the signal by switching off and switching back on the power supply +Vcc (or +24V on 24V option).

Yellow LED for tachometer monitoring (TC option, D68)

The **yellow** LED **TC** lights up (when the option card 01 (TC) is inserted in its slot and the solder strap LB401 is disconnected) when a tachometer fault occurs such as an line break or an incorrect polarization.

At the same time, the **BTB contact opens** and the controller **enable** signal **is disabled** without delay.
The signal can only be reset by switching off and switching back on the power supply +Vcc (or +24V on 24V option).

Yellow LED for RMS current monitoring (D42)

When the preset RMS current limit is attained, the **yellow** LED I_{RMS} lights up. The H level disappears at pin 18.
When the I^2t cut-off (LB16 close) is activated, the **red** overcurrent LED (D67) lights up **briefly** and the BTB contact opens at the same time.
The signal can only be reset by switching off and switching back on the power supply +Vcc (or +24V on 24V option).

IV.3 Options

IV.3.1 Option Card -01-

The **option card -01-** expands the 4KS controller by the following functions:
— limited switch logic **(-LS-)**
— ramp generator **(-RG-)**
— tachometer monitoring **(-TC-)**
To activate the option card -01-, disconnect the solder strap **LB12** on the controller motherboard before inserting the card (connected in as-delivered state **without** option card -01-).
The tachometer monitoring **TC** is only activated by **disconnecting** the solder strap **LB401** on the option card -01- (connected in as-delivered state).

Limit switch logic -LS- (PSTOP, NSTOP)

In the event of loss of **one** signal, the associated direction of rotation is blocked. The function I-AB is also triggered. If **both** signals are switched off, the drive is shut down by the preset peak current. In the operating state, **both** inputs must receive an H signal.

Ramp generator -RG-

Set the desired rise time for a rated value step change by means of C306 (applies to the two rated value inputs). The ramp time is approx. 1ms for each nF for a rated value step change of 10V and the standard complement is 10nF. This option considerably enhances stability when set correctly, i.e. the ramp time is **less** than the mechanical time constant of the control circuit without notably reducing the control rate. The limit switch inputs are not affected by the ramp generator.

Tachometer monitoring -TC-

When the solder strap **LB401** on the option card -01- is **disconnected**, the tachometer monitoring is activated. Should the tachometer line be broken or should there be an incorrect polarization, the **yellow** LED (D68) **TC** lights up and at the same time the BTB contact opens.

IV.3.2 Option Card -RG/LS-

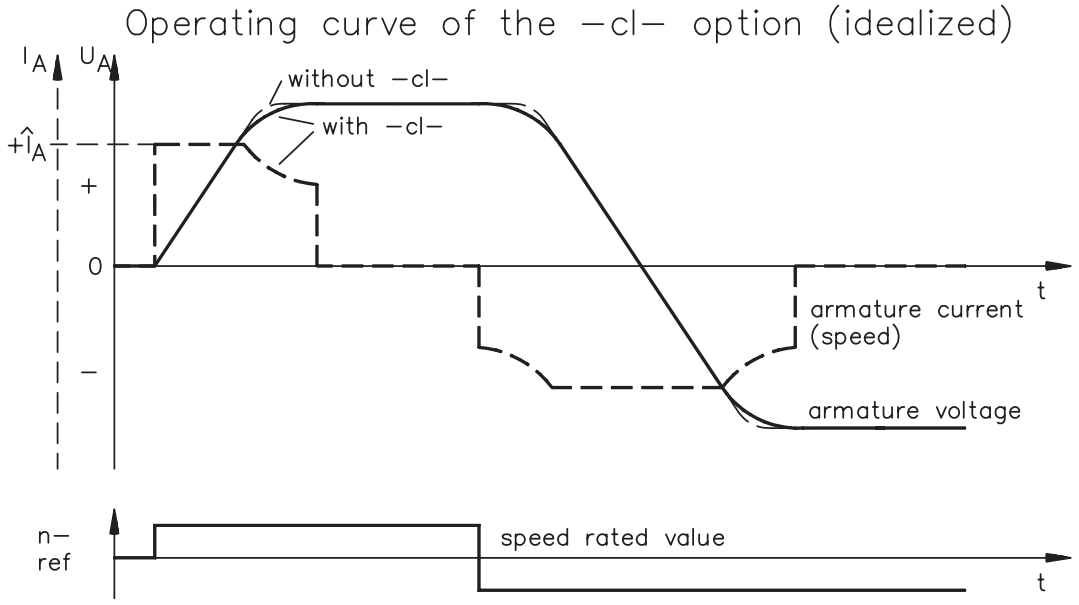
The option card **-RG/LS-** has the same functions as the option card -01- with the exception of tachometer monitoring, i.e.:
— ramp generator **(-RG-)**
— limit switch logic **(-LS-)**

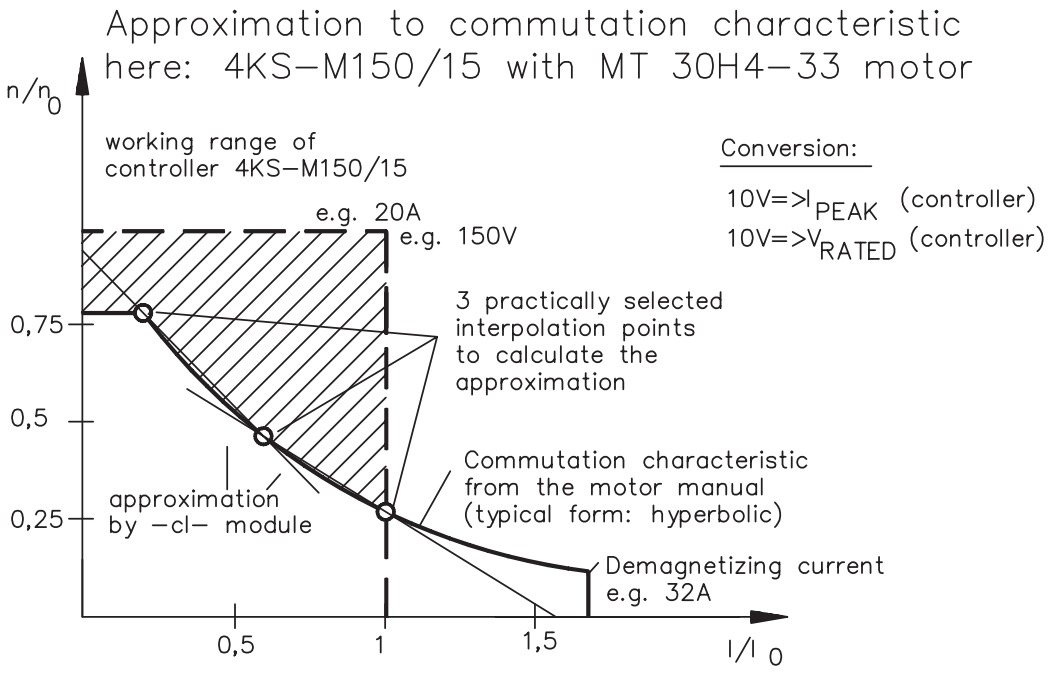
IV.3.3 1:1 Control

The amplifier can be used solely as a **current controller** (torque controller). This is obtained by closing the solder strap **LB302** on the customer print and driving the input IAB. By turning the potentiometer AC GAIN P305 to the left stop, a rated value voltage of ±10V applies almost ± **peak current** to the rated value input 2.
When used as a torque controller, the accuracy is about ± 5%, including the tolerance of the motor torque constant. The I^2t monitor is retained.

IV.3.4 -cl- and -vl- options (slot CL-OPT)

DC motors with wound **iron-cored** armatures often require the peak current to be limited at high speeds (commutation characteristic). After selecting the desired amplifier/motor combination, a limiter module (-cl- option) can be supplied as **option**. The module is inserted in the CL-OPT slot. Ensure that the PIN1 marks coincide.
Should the terminal voltage of a motor in service be limited at a controller notably below the intermediate circuit voltage, a voltage limiting module -vlxxx- option can be supplied as an alternative for the same slot. “xxx” stands for the maximum voltage desired by the customer.





IV.3.5 I x R control

In order to modify to armature voltage control (**without tachometer**) with I x R compensation, first resolder the solder strap **LB301** on the customer print to the position I x R. The two inputs are available as rated value inputs.
The **no-load speed** can be adjusted by the associated rated value potentiometer P301 or P302 when the rated value voltage has been set. The speed is **increased** by turning the potentiometer clockwise.
At a rated value voltage of 10V, the maximum armature voltage just reaches the equipment rated voltage.
After tuning the speed, the I x R positive feedback can be set to the oscillating limit on the I x R potentiometer P308 by turning it clockwise when the motor is cold.
The adjustment range of P308 is from 0Ω to about 0.25 x V_{RATED}/I_{PEAK} (1 to 3Ω) armature resistance.
The adjustment of AC GAIN using potentiometer P305 is described in Chapter IV.2.3.4.

IV.4 Solder straps

IV.4.1 Logic level for all input signals (LB10, 11)

All digital control inputs are designed as **PLC**-compatible for **floating 24V/10mA logic**. The solder strap **LB10** must be in position **4KS**.
H level : 12 to 30V / approx. 10mA to **DGND**
L level : 0 to 5V (open)

The logic levels are selected to obtain a high resistance to interference. However, it is still possible to generate the auxiliary voltage (pin 13) from the +15V supplied by the controller.
If isolation is desired, the solder strap **LB11** between AGND (analog GND) and DGND (digital GND) must be disconnected. DGND is connected via pin 12 to the GND of the superordinate control system.
As-delivered state: LB10 in position 4KS, LB11 connected.

IV.4.2 Logic for enable signal (LB9)

In the **-cl-** position, the controller is enabled when an **active** signal (24V) is applied (as-delivered state position **-cl-**).

IV.4.3 I x R control (LB301)

If the connected motor is to be operated **without tachometer** but with I x R compensation, resolder the solder strap **LB301** on the customer print to the position **IR** (as-delivered state in position **TA**).

IV.4.4 1:1 control (LB302)

If the controller is to be operated solely as a **current controller**, connect the solder strap **LB302** on the customer print (as-delivered state: disconnected).

IV.4.5 External 24V DC auxiliary voltage (LB1 to LB6)

If the auxiliary voltage power supply is to be supplied by an external 24V DC source, resolder the solder straps **LB4** and **LB6** and **coat them with varnish**.
Also connect the solder straps **LB1, 2, 3** and **5** and replace transistor T4 in the switch mode power supply (IRF 820) for type BUZ 73.
Exchange the F2 fuse (1AM) for a 2AM fuse.

IV.4.6 Option cards -01- and -RG/SL- (LB 12, LB 401)

The **option cards -01- and -RG/LS-** are only activated when the solder strap **LB12 is disconnected**.
The tachometer monitor **TC** on the option card -01- is only activated when the solder strap **LB401** on the option card is **disconnected**.
LB12 in the as-delivered state is connected unless option -01- or -RG/LS- was ordered.

IV.4.7 Model basic settings (LB7, 8, 13, 14, 15)

The solder straps **LB7, 8, 13, 14, 15** act as the basic setting of the unit model and **must not be changed**.
As-delivered state: — LB 7, 8 disconnected
— LB 13, 14, 15 connected

IV.4.8 I²t cut-off (LB16)

The I^2t cut-off of the controller which affects the BTB contact is only activated when the solder strap LB16 is connected.
As-delivered state: disconnected.

V Power packs

V.1 Power pack 56WK-P150(240)/80-B

V.1.1 Equipment concept

The heavy-duty power supply of the **56WK-P** series with integrated ballast circuit **-B-** and an external ballast resistor **BAR375** are specially designed to power the transistorized controller 4KS-M150(240)/xx.
The power supply 56WK-P150(240)/80-B is designed as a 19" rack-mount to supply several transistorized controllers.
The rated continuous current is 30A with convection cooling and 90A with forced cooling.
The power point load capability with convection cooling is 60 A and 180A with forced cooling.
The power supply fuse must be provided by the operator.
The power supply supplies up to **90A to the DC intermediate circuit**, whereas the motors are supplied on average with a **much smaller active voltage** via the controller. The power supply is therefore capable of powering several controllers in a 19" rack system. With an axial simultaneity factor of <1, the supply of e.g. 7- and 9-axis systems is possible with only one power supply of this series.
The permitted **peak current of the ballast circuit is 90A** and thus the **smallest** permissible **resistance** for the external ballast resistor is **2.2**Ωs for the 150V model and 3.3Ωs for the 240V model.
Note that the resistor **R616** is dimensioned as a function of the maximum **continuously rated load** of the ballast resistor. In the event of **overload or undervoltage**, the floating BTB contact (pins 1/2) opens.

The anticipated ballast power rating must be roughly calculated by the operator in order to avoid overloading the ballast circuit.
For a flashover calculation, the **sum of the peak powers** of all connected controllers may not exceed the **threefold ballast peak power**. The **rated load** of the ballast circuit should be greater than **3% of the sum of the rated loads** of all connected motors.
In order to avoid overloading the ballast resistor by braking operations after switching off the transistorized controller or as a result of main overvoltages or equipment defects, **the ballast resistor must have a slow-acting 16A fusible link on the 150V model and a slow-acting 10A fusible link on the 240V model**.

If the fuse is omitted or if the tolerance deviations of the fusible links are large, the electronics circuits may be destroyed as a result of an overload of the ballast circuit (see Specifications).
Therefore, the maximum permitted value for rated load of the ballast circuit must be adhered to under all circumstances.

Suppressor diodes are fitted to the unit as overvoltage protection.

V.1.2 Specifications 56WK-P150(240)/80-B

		56WK-	
Rated specifications	**Unit**	**P150/80-B**	**P 240/80-B**
Rated supply voltage	V~	3 x 107	3 x 172
Rated connected load	kVA	16	22
Rated intermediate circuit voltage	V—	150	240
Rated DC output current, free convection	A	30	
Rated DC output current, forced convection	A	90	
Peak output current (max. 5 s), free convection	A	60	
Peak output current (max. 5 s), forced convection	A	180	
Fuse protection (rectifier), external	AM	3 x 63	
Fuse protection (ballast circuit), external	AT	16	10
Nominal capacity of smoothing capacitors	µF	1900	
Power loss at rated current (ballast circuit disengaged)	W	200	
Undervoltage limit (BTB)	V	40	
Ballast circuit			
Switching voltage (min.)	V	185	285
Rated voltage	V	200	300
Rated load, free convection	W	2000#	3000#
Rated load, forced convection	W	4000#	5000#
Smallest permissible ballast resistor	Ω	2,2	3,3
Peak load (1s)	kW	18	27
Peak load (2s)	kW	18	27
Peak load (5s)	kW	15#	20#
Ballast resistor external			
Rated load, free convection	W	375	
Rated load, forced convection	W	500	
Smallest permissible ballast resistor	Ω	2,2	3,3
Displays and monitoring			
LED green -ready for operation			
LED yellow -ballast circuit			
Monitoring of ballast load, BTB-relais			
Connections			
Power module	DIN 41612, type E48		
Rear-panel board Typ N56WKMB	screw bolts M6		
ballast resistor type BAR375	screw bolts M5		
control signals (undervoltage signal)	terminals MSTB 1.5		
Ballast resistor BAR375	Faston 6,3mm		
Mechanical specifications			
Weight	1,2 kg		
Dimensions	double Eurocard (12TE) insertion depth 220mm 220 x 233,4 x 60 mm		
Weight BAR375	1 kg		
Dimensions BAR375	310 x 75 x 35		

Remarks :

= Normally limited by rated power of the ballast resistors

V.2 Power pack 03S-P150(240)/30-B

V.2.1 Equipment concept

The power supply of the O3S-P series with integrated ballast circuit **-B-**, ballast resistors and fuses is also designed to power the transistorized controller 4KS-M150(240)/xx.

The 03S-P150(240)/30-B power supply is a 19" rack-mount to supply one heavy-duty or several small transistorized controllers.

The rated continuous current is 30A with convection cooling.
The power point load capability with convection cooling is 60 A.

The power supply supplies up to **30A to the DC intermediate circuit**, whereas the motors are supplied on average with a **much smaller active voltage** via the controller. The power supply is therefore capable of powering several controllers in a 19" rack system. With an axial simultaneity factor of <1, the supply of e.g. 3-axis systems is possible with only one power supply of this series.

The peak current of the ballast circuit is approx. 18A. The **continuous ballast power rating** can be raised from 250W to approx. 350W by fitting forced ventilation.

The ballast circuit has a **-w- characteristic** which makes it possible to operate in parallel with another power supply or with controllers of the 03S, 60WKS and 65WKS series.

The anticipated ballast power rating must be roughly calculated by the operator in order to avoid overloading the ballast circuit.
For a flashover calculation, the **sum of the peak powers** of all connected controllers may not exceed the **threefold ballast peak power**. The **rated load** of the ballast circuit should be greater than **3% of the sum of the rated loads** of all connected motors.

In the event of sustained mains overvoltages or ballast circuit overloads (see Specifications), the electronic circuits may be destroyed.

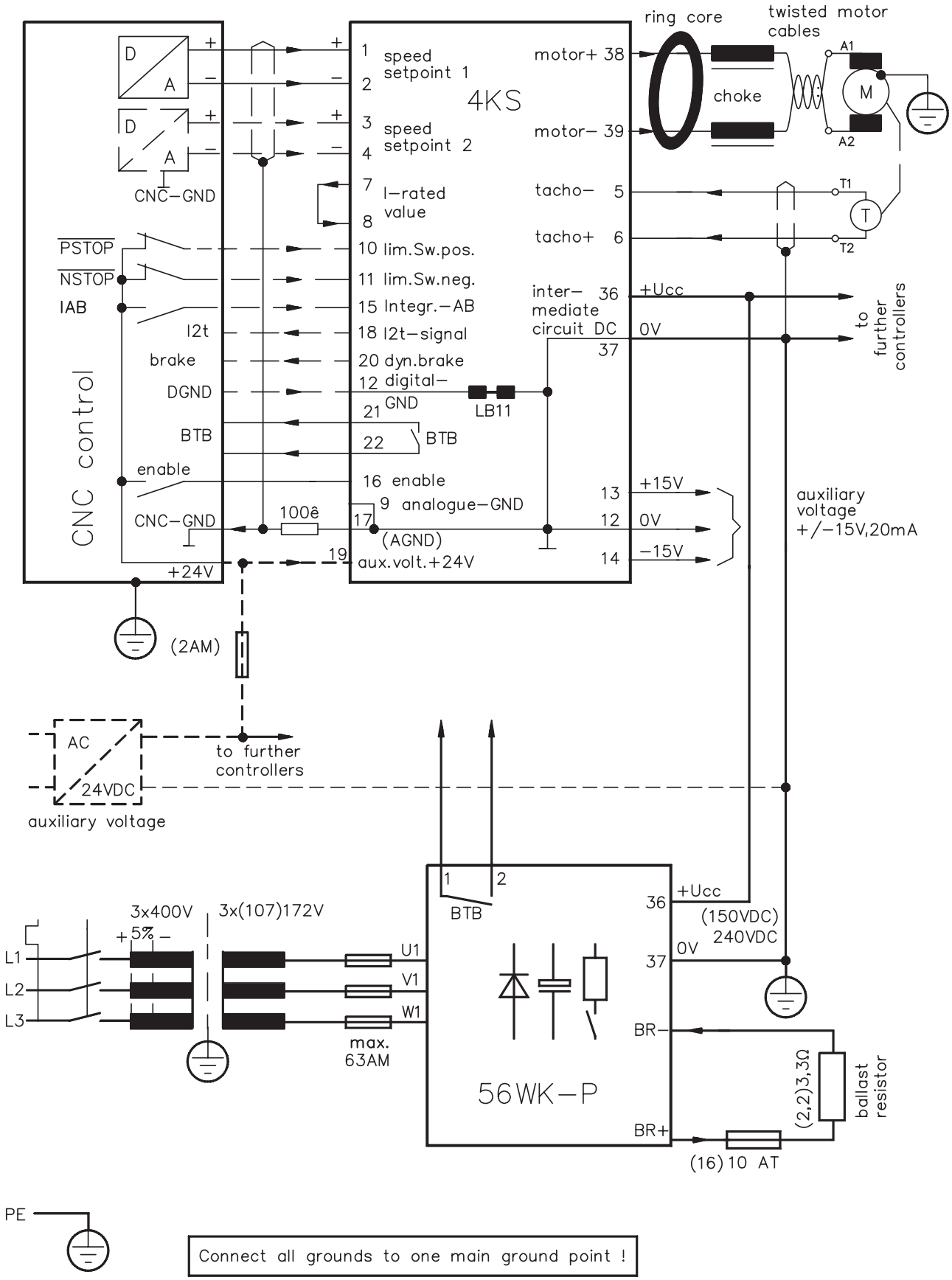
Suppressor diodes are fitted to the unit as protection against mains overvoltages.

V.2.2 Specifications 03S-P150(240)/30-B

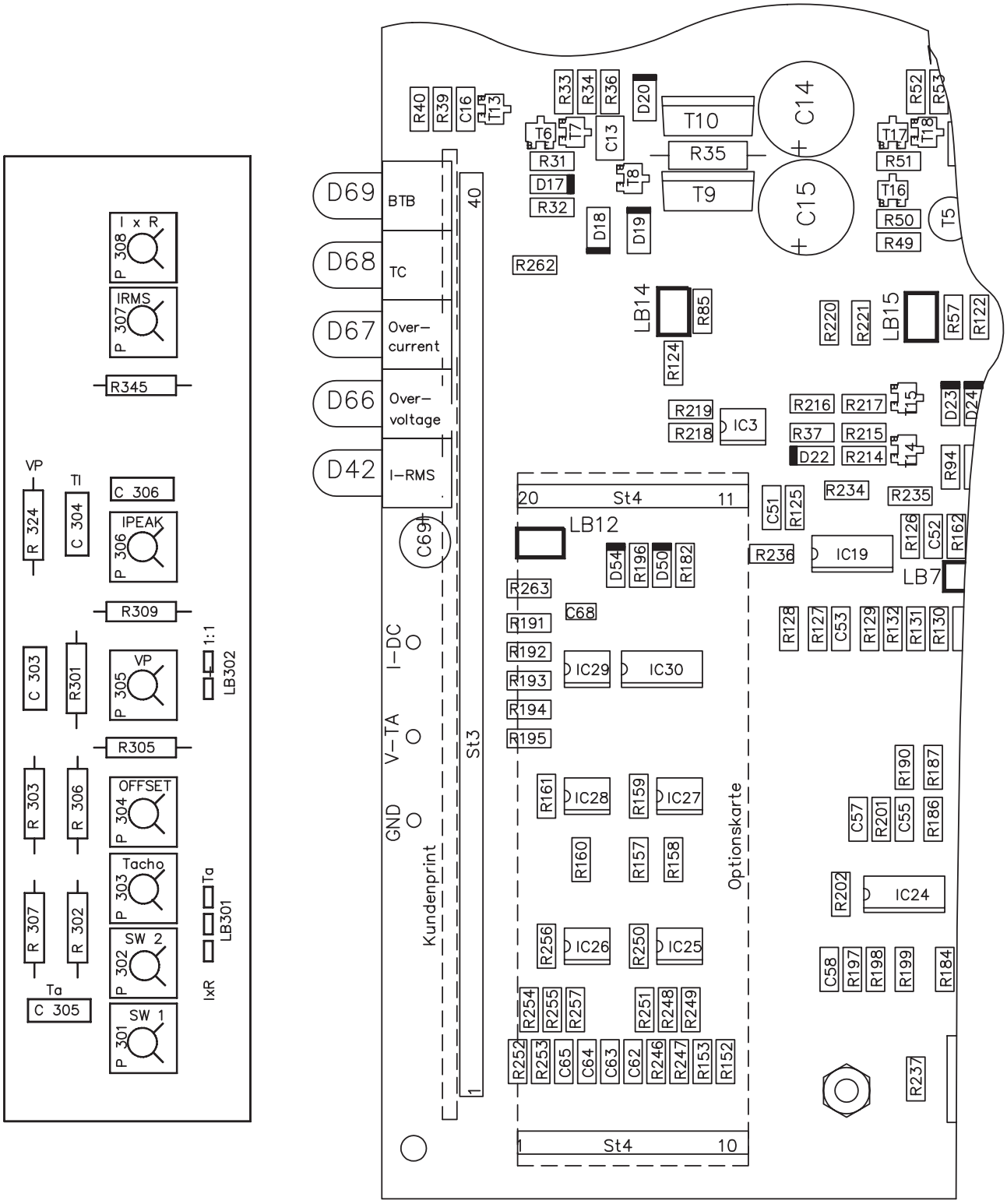
		03S-P	
Rated specifications	**Unit**	**150/30-B**	**240/30-B**
Rated supply voltage	V~	3 x 107	3 x 172
Rated connected load	kVA	5	8
Rated intermediate circuit voltage	V—	150	240
Rated output current, free convection	A	30	
Peak output current (max. 5 s), free convection	A	60	
Fuse protection (rectifier), external, max.	AM	3 x 30	
Fuse protection (ballast circuit), external	AM	8	5
Nominal capacity of smoothing capacitors	µF	2000	
Power loss at rated current (ballast circuit disengaged)	W	75	
Ballast circuit with -w- characteristic			
Switching voltage (min.)	V	185	285
Rated voltage	V	200	300
Rated load, free convection	W	250	
Rated load, forced convection	W	350	
Peak load (1s)	kW	3,4	5,3
Peak load (2s)	kW	3,4	5,3
Peak load (5s)	kW	2	2
Displays and monitoring			
Fuse protection -rectifier-			
Fuse protection -ballast circuit-			
LED green -ready for operation-			
LED yellow -ballast circuit-			
Connections			
Power module	DIN 41612, type D32		
Rear-panel board type N03SMB	screw bolts M6, terminals KDS4		
Mechanical specifications			
Weight	0,8 kg		
Dimensions	9TE, double Eurocard, insertion depth 220mm 220 x 233,4 x 45 mm		

VI Drawings

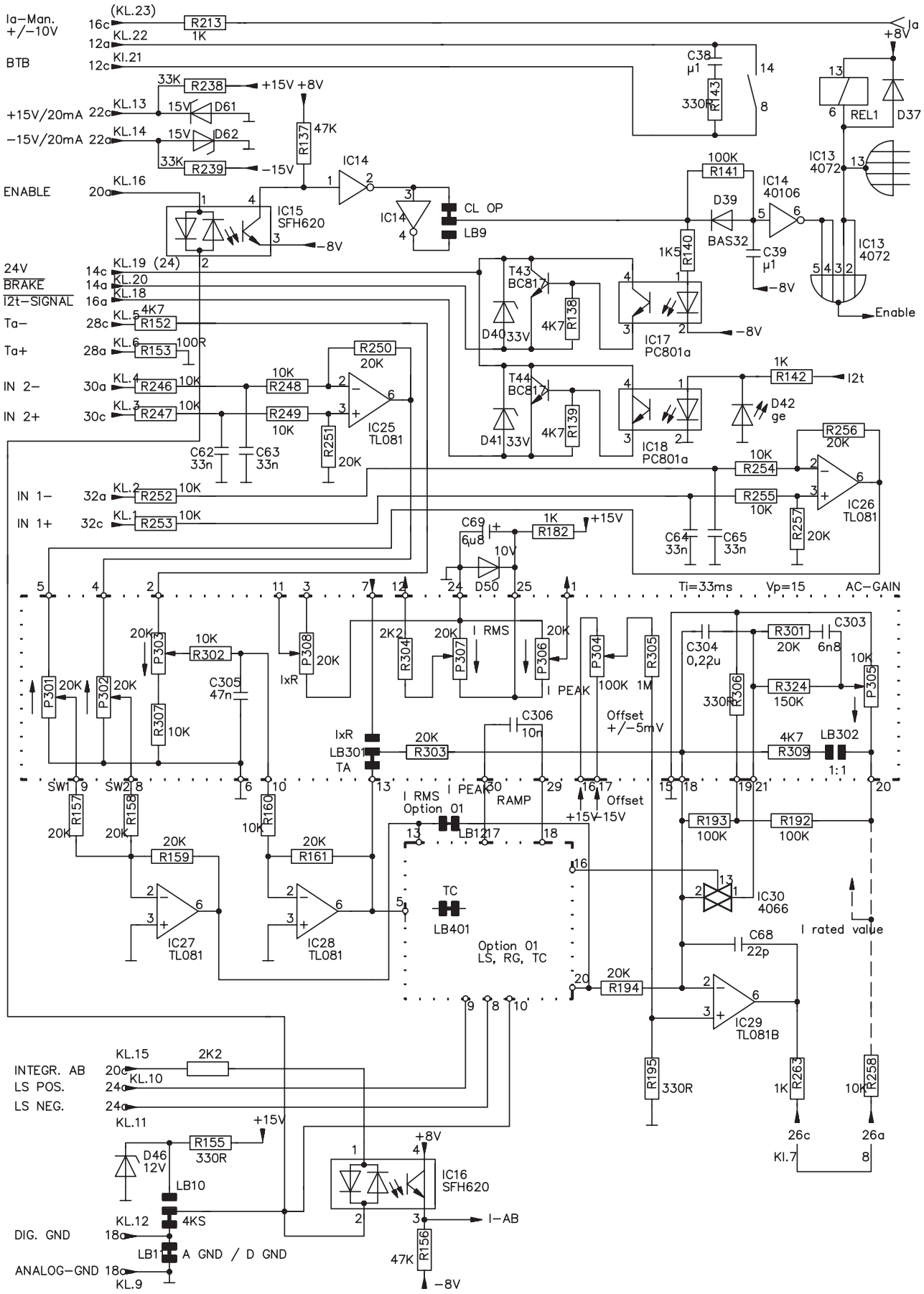
VI.1 Wiring diagram 4KS with 56WK-P



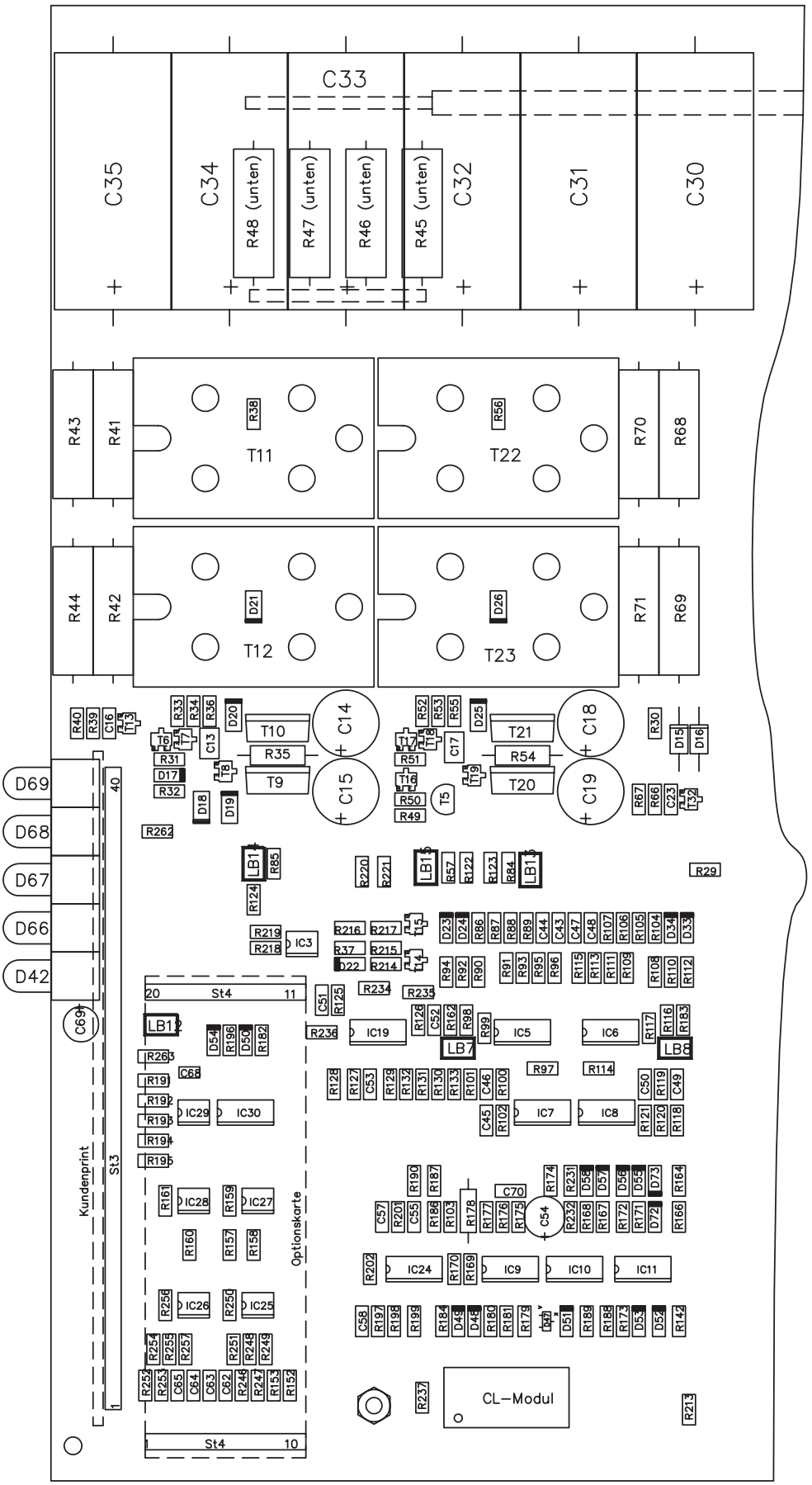
VI.2 LEDs and measuring points



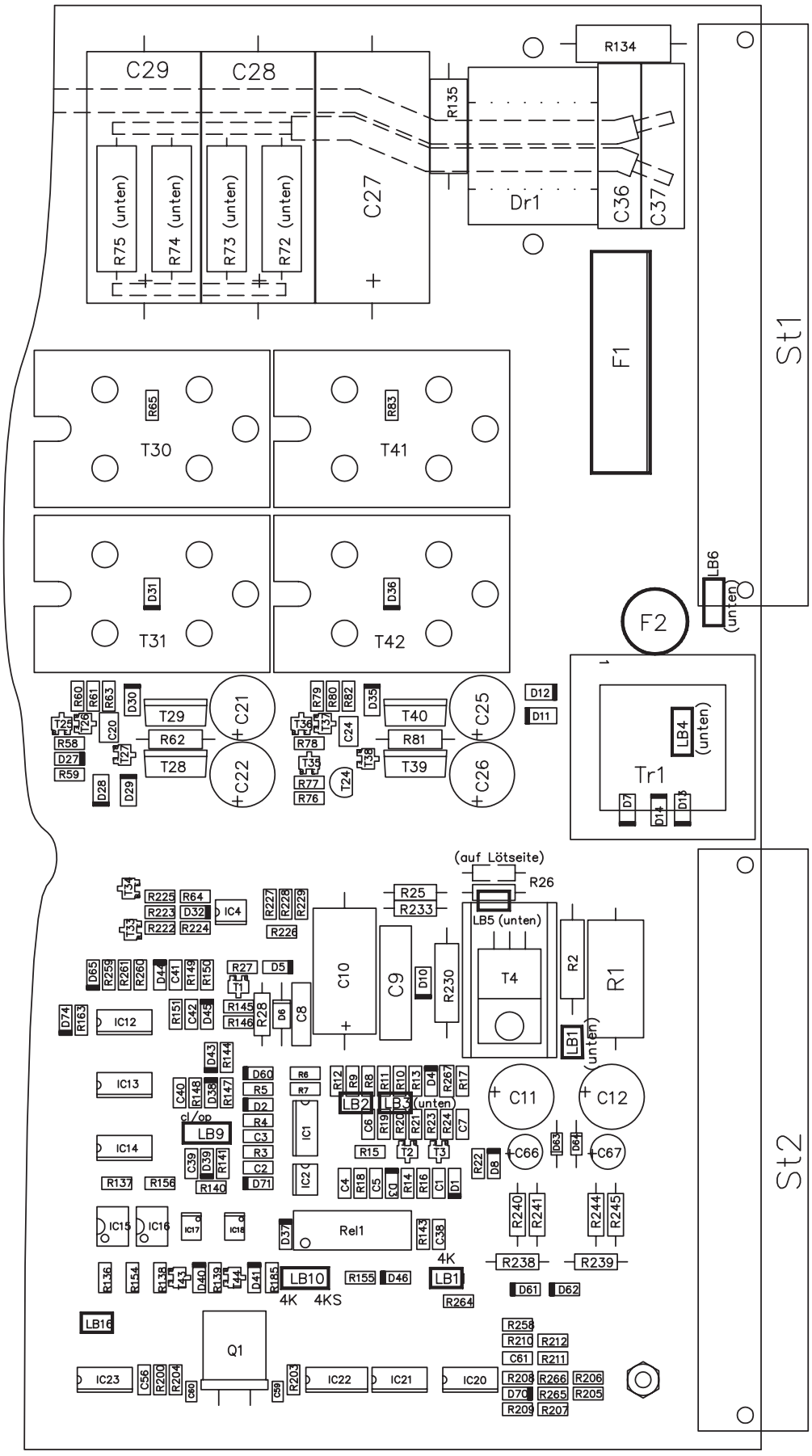
VI.3 Input circuits and speed control 4KS



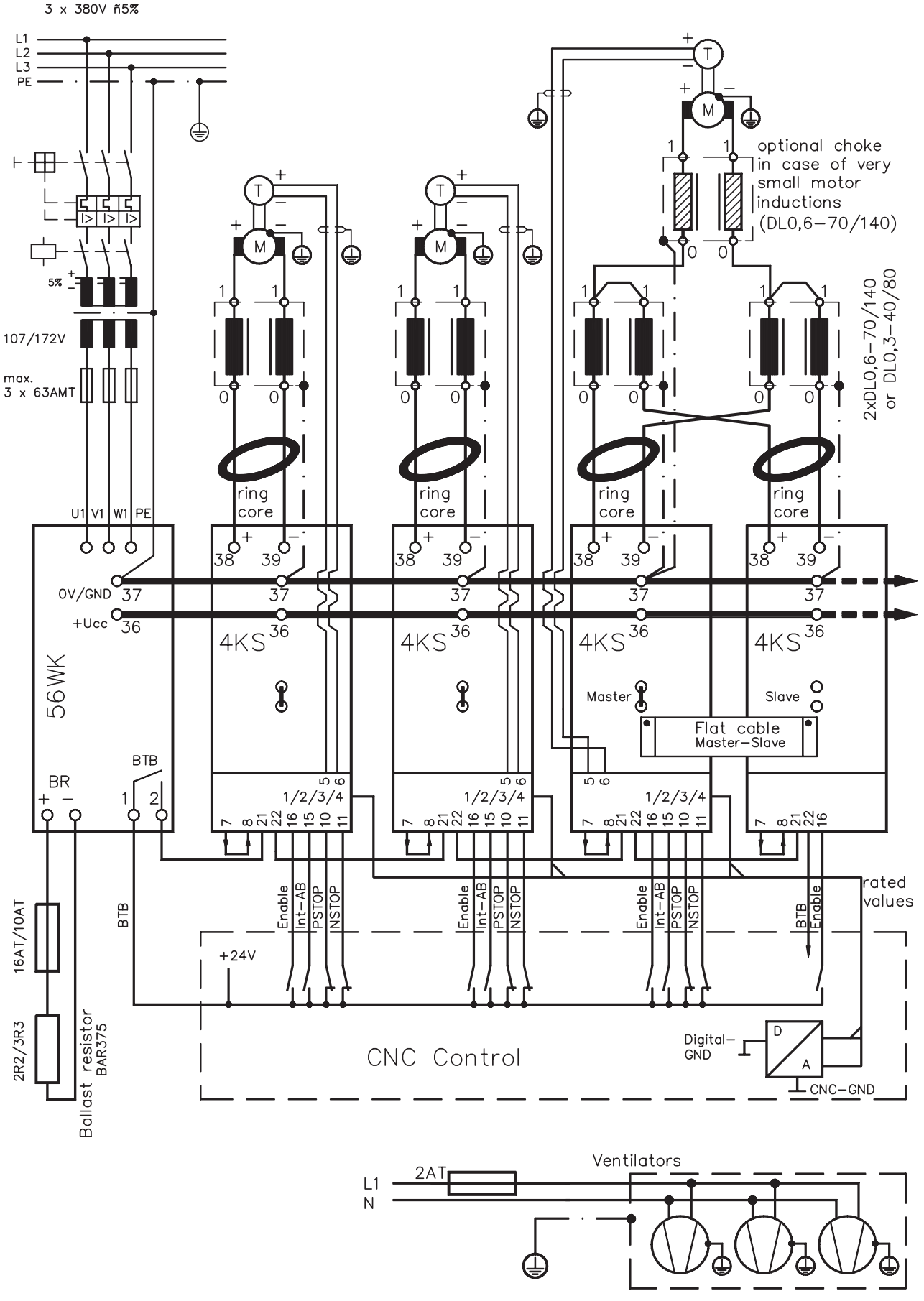
VI.4 Component layout diagram 4KS part 1



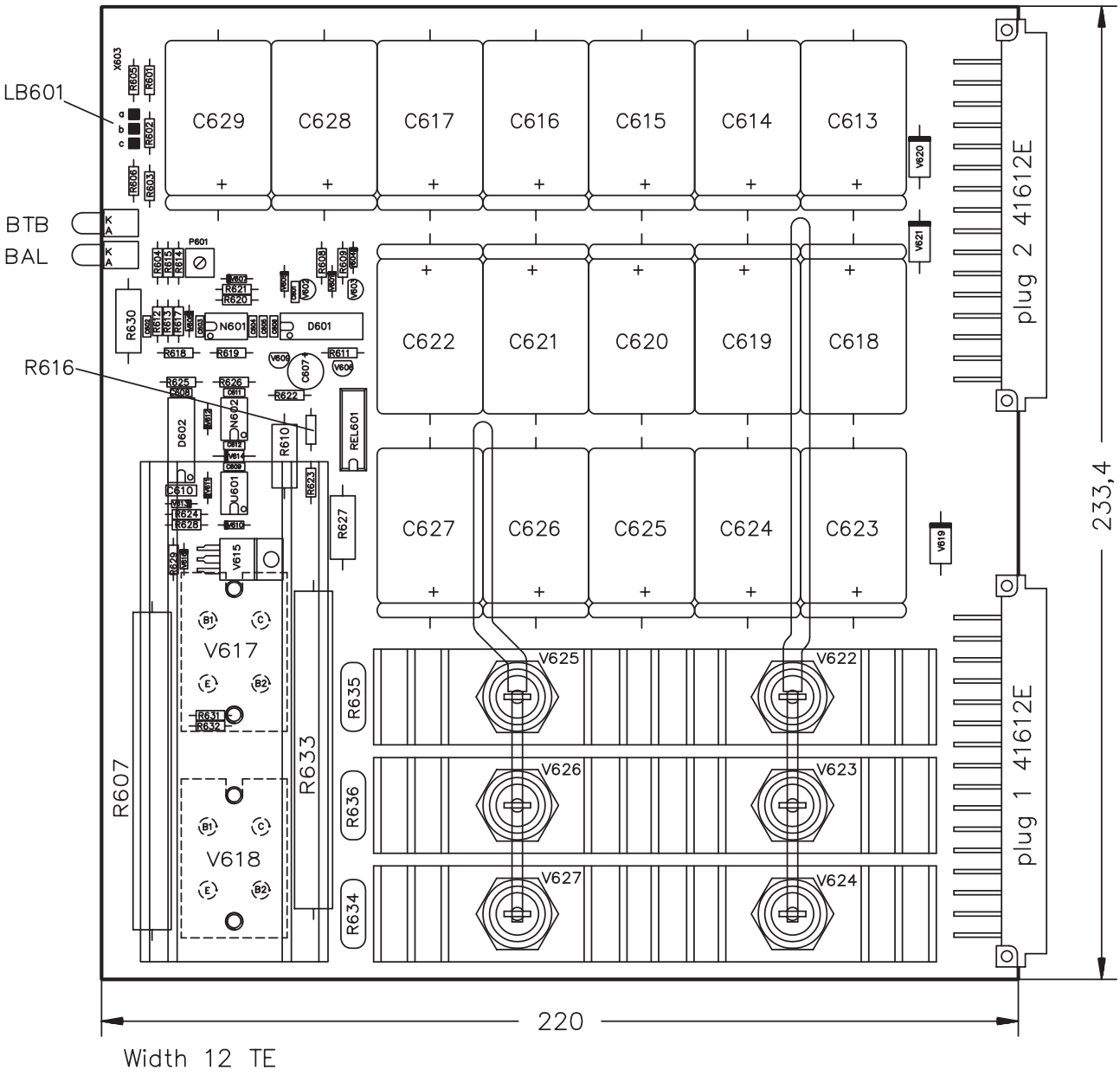
VI.5 Component layout diagram 4KS part 2



VI.6 Three axes system with 4KS



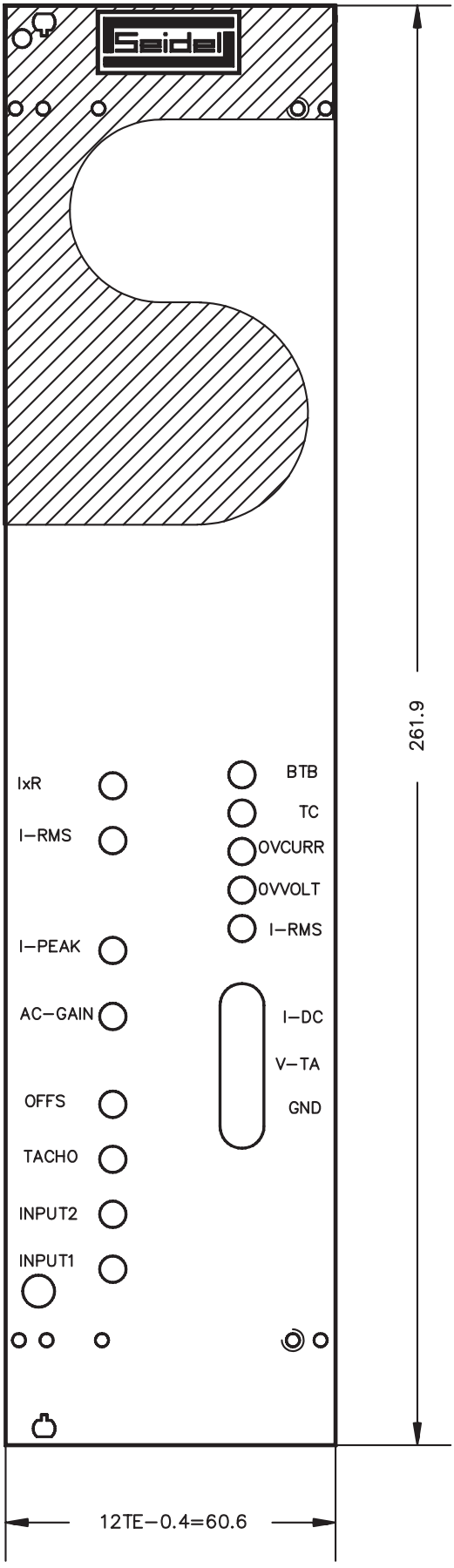
VI.7 Component layout diagram 56WK-P



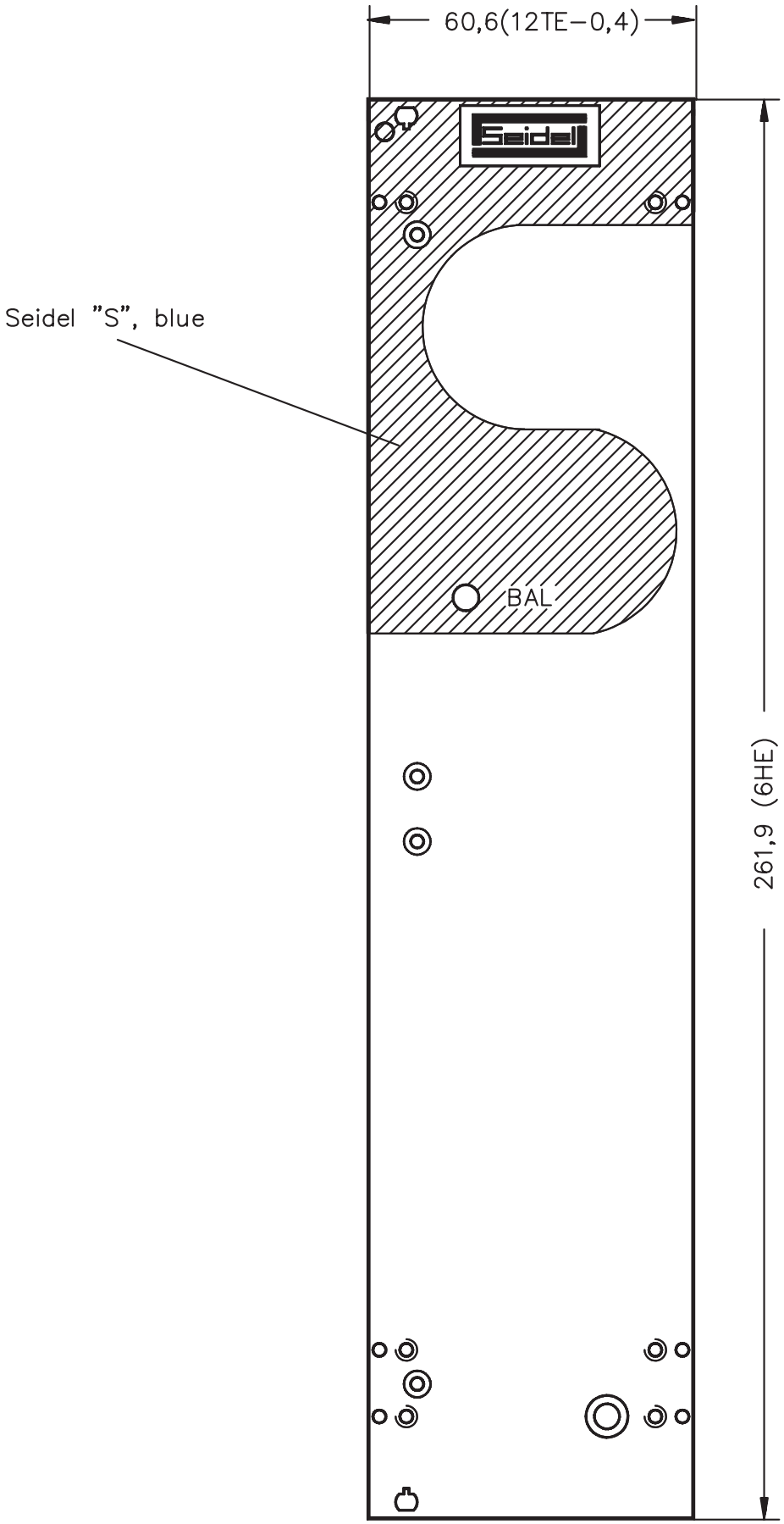
LB601	Ucc	R_{Bmin}
a–b	240 V	3,3 Ω
b–c	150 V	2,2 Ω

P_{BAL}	BAR 375	R616
400 W	1 x R_{Bmin}	470 kΩ
1500 W	4 x R_{Bmin}	2,2 MΩ

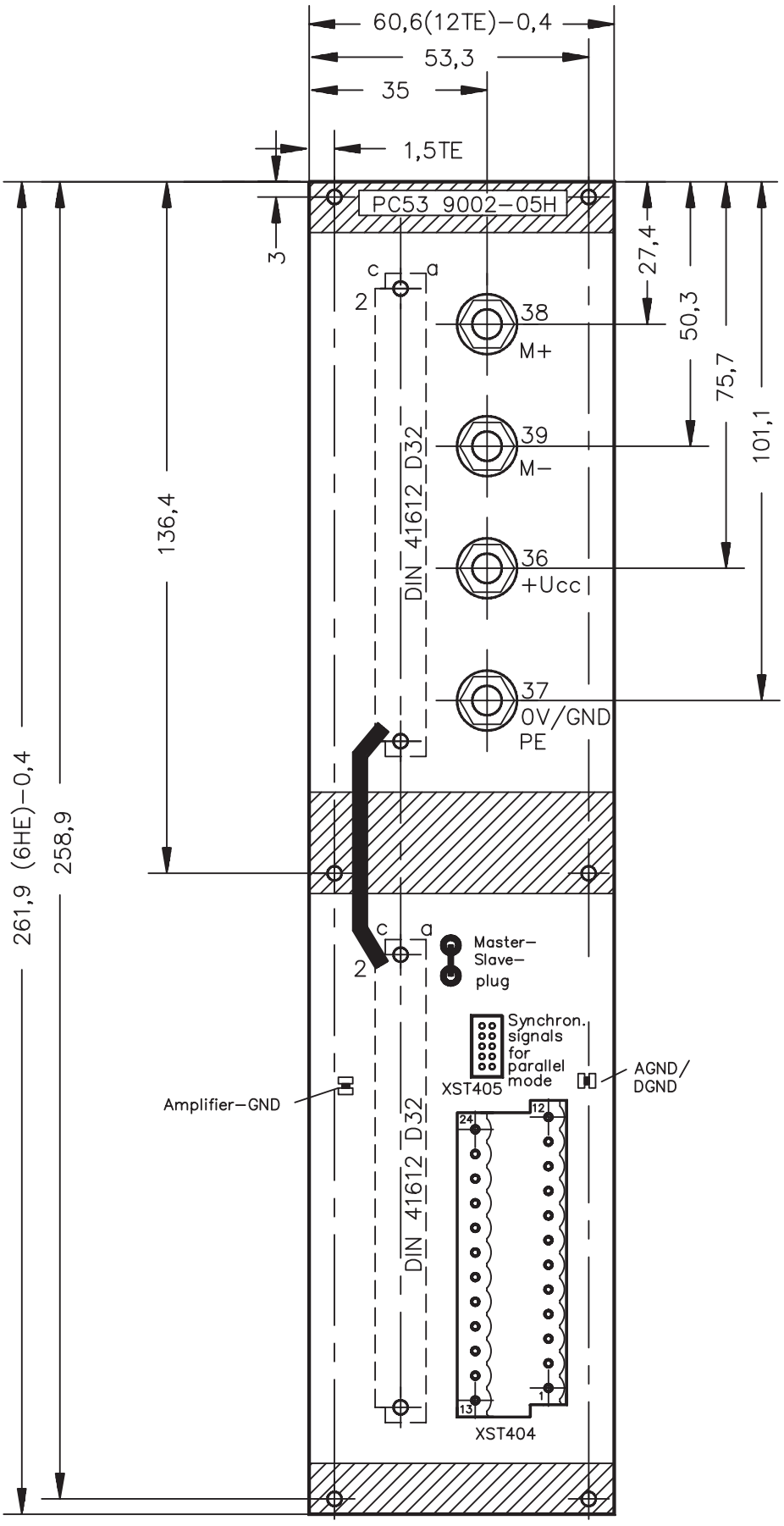
VI.8 Front panel 4KS



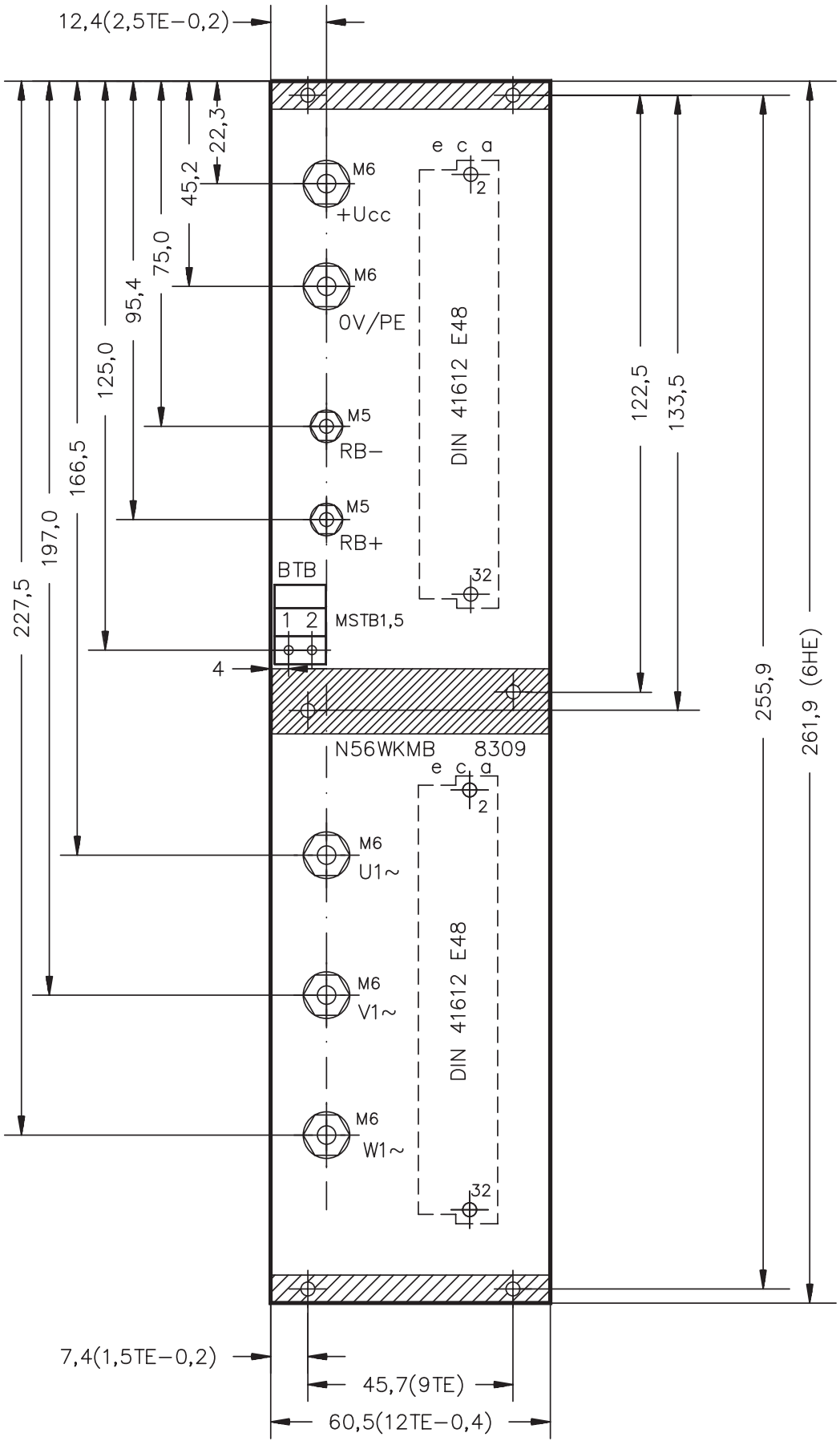
VI.9 Front panel 56WK-P



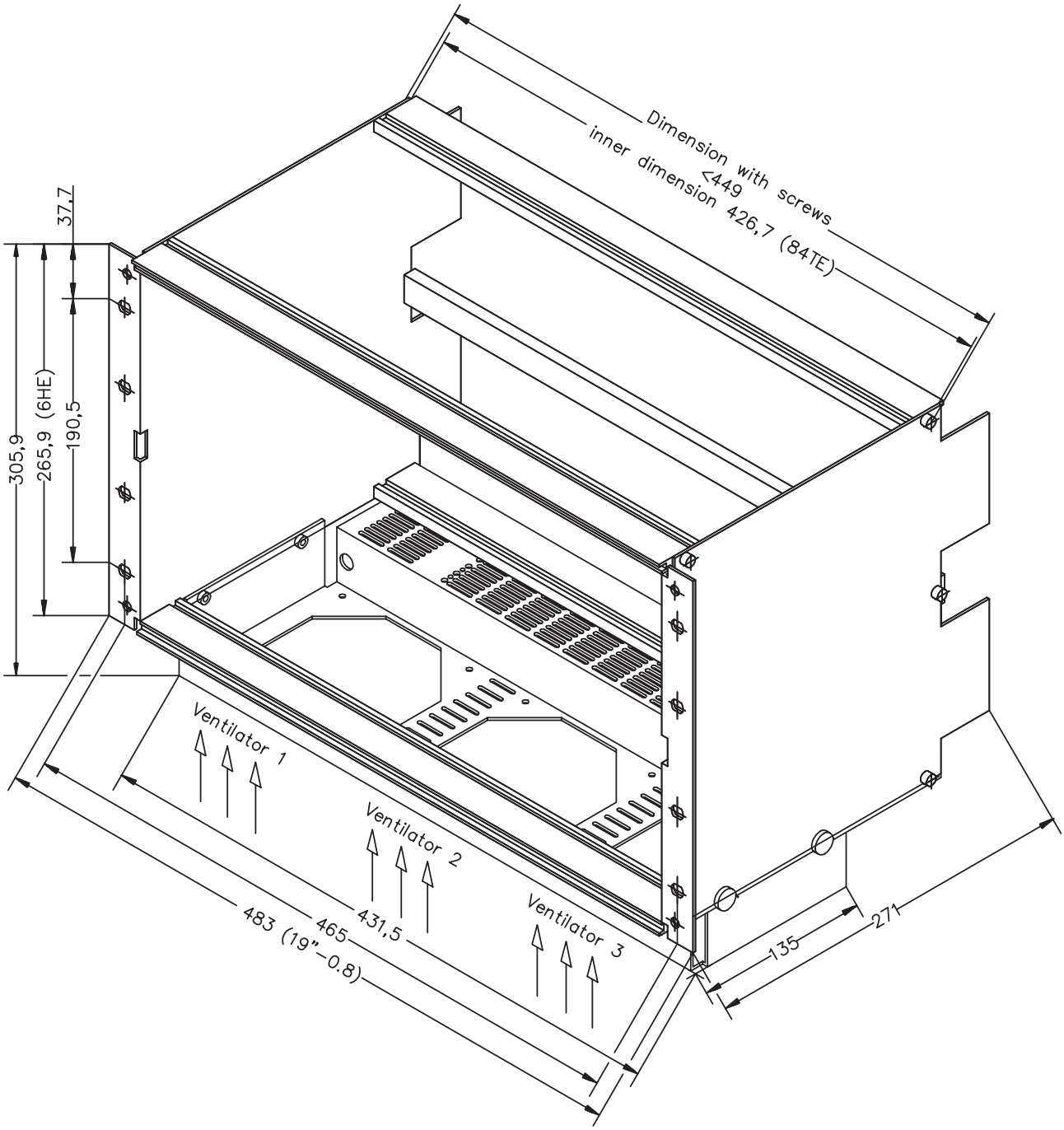
VI.10 Back panel PCB F4KMB



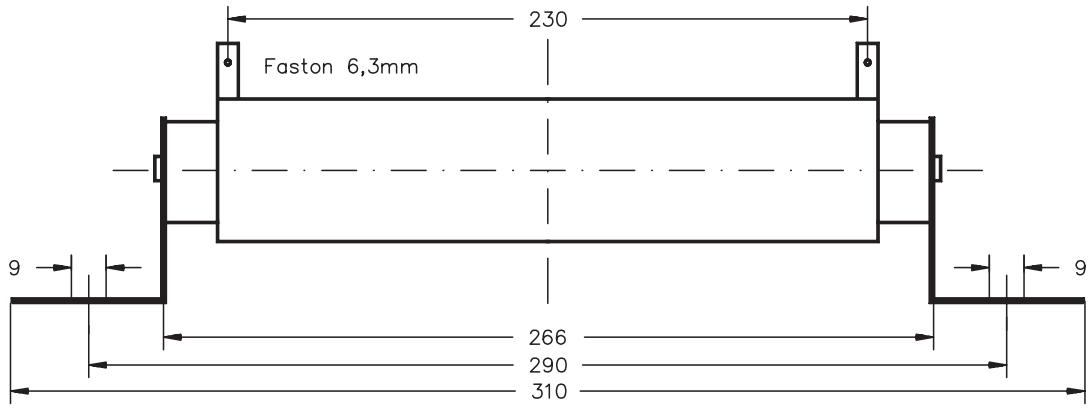
VI.11 Back panel PCB N56WK-MB

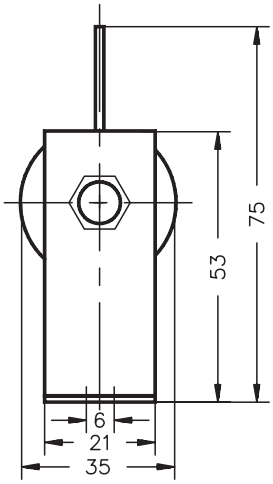


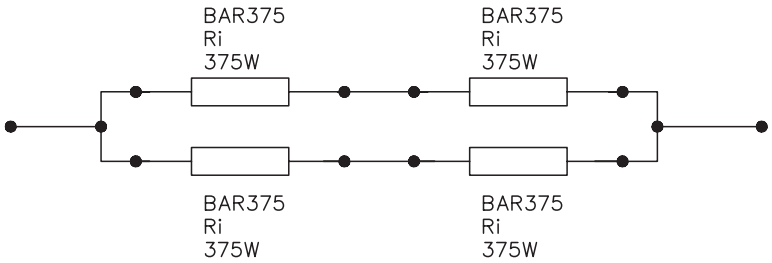
VI.12 19" , 6HE standard cabinet with ventilators



VI.13 Ballast resistor BAR375



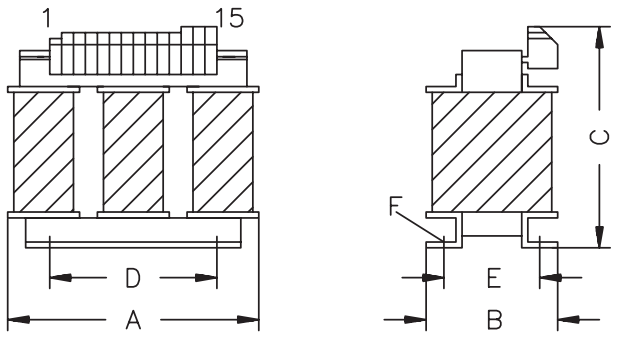




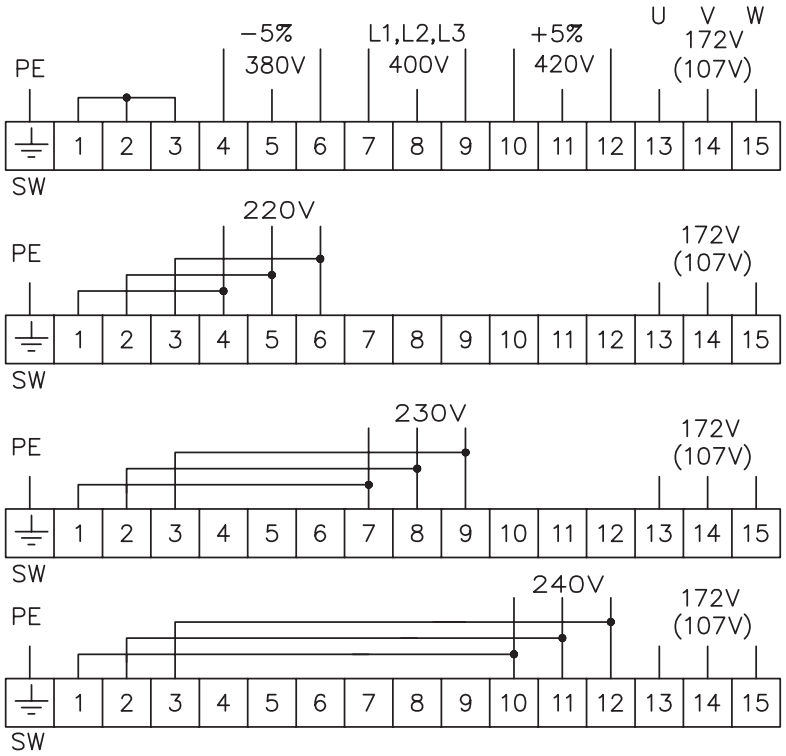
Quadruplicated power with four BAR375

Ri = Rges
Pi = 375W
Pges = 1500W

VI.14 3 phase isolating transformers



Type		Dimensions in mm						Weight
	Phase	A	B	C	D	E	F	kp
3T0,7K−240	3	180	110	195	120	86	8x12	9,2
3T1,5K−240	3	228	140	235	152	105	8x12	18,8
3T2,0K−240	3	240	145	260	143	110	8x12	22,0
3T3,0K−240	3	300	155	310	200	92	10x15	35,0
3T5,0K−240	3	360	175	385	240	135	10x15	62,0
3T8,0K−240	3	450	220	440	280	165	10x15	98,0
3T10K−240	3	450	220	440	280	165	10x15	109,0



Other primary voltages available on special order

Ordering informations

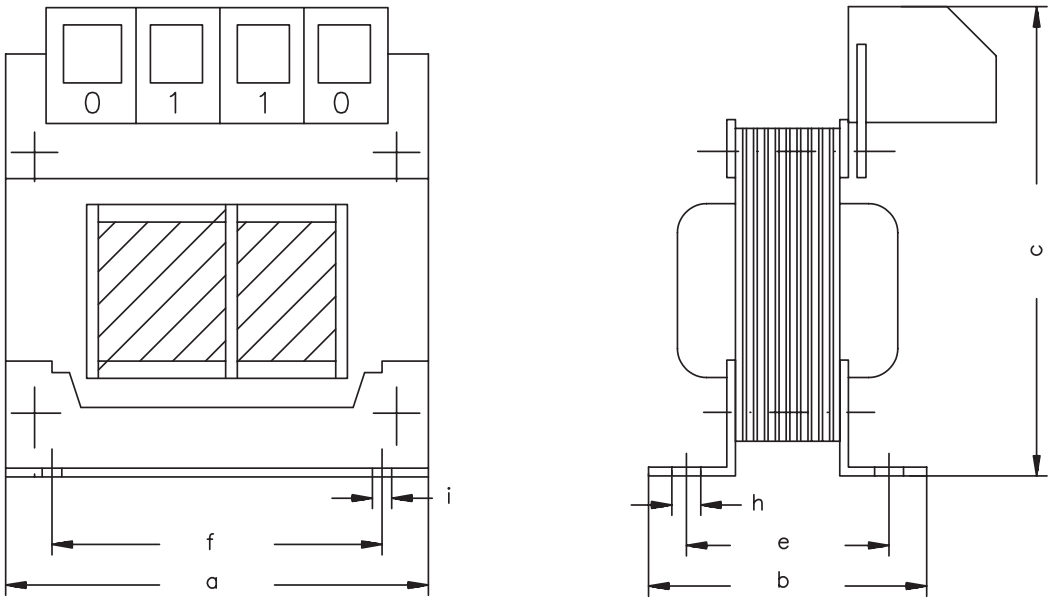
3T 3,0K−240

3−phase
Isolated transformer
with shielding
Uk=4%

Power
in kVA

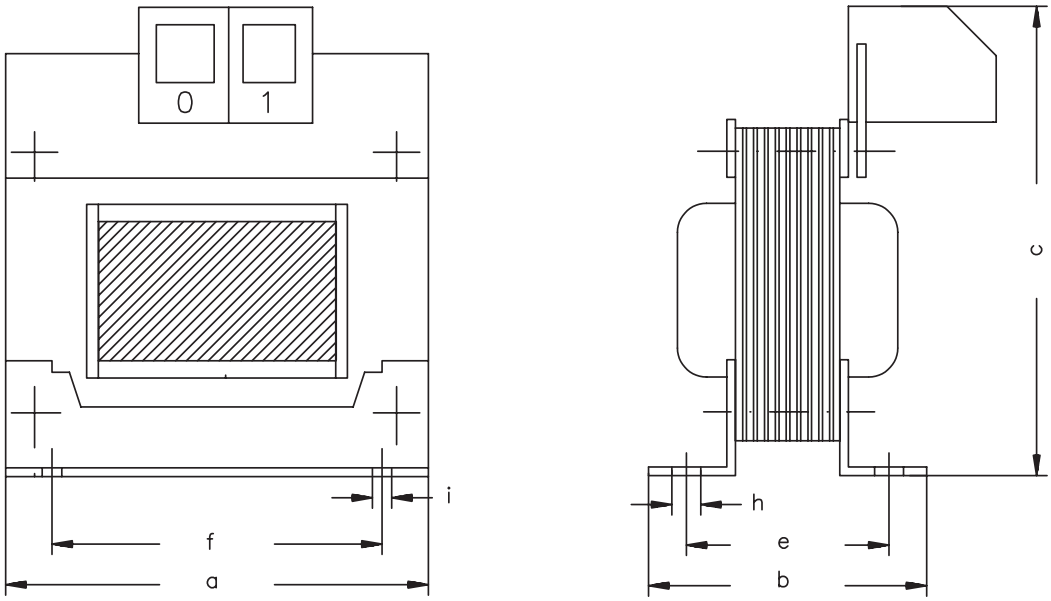
DC−voltage in
intermediate circuit
240 means 172V
secondary voltage

VI.15 Chokes for 4KS



Choke type	a	b	c	e	f	h	i	terminal
DL0,3–40/80	85	61	87	47	64	8,5	4,5	TRK 10
DL0,6–15/35	73	48	80	35	51	8,5	4,5	TRK 4
DL0,6–70/140	150	105	160	72	122	13	7	TRK 10
DL1,5–10/25	73	48	80	35	51	8,5	4,5	TRK 4

dimensions in mm

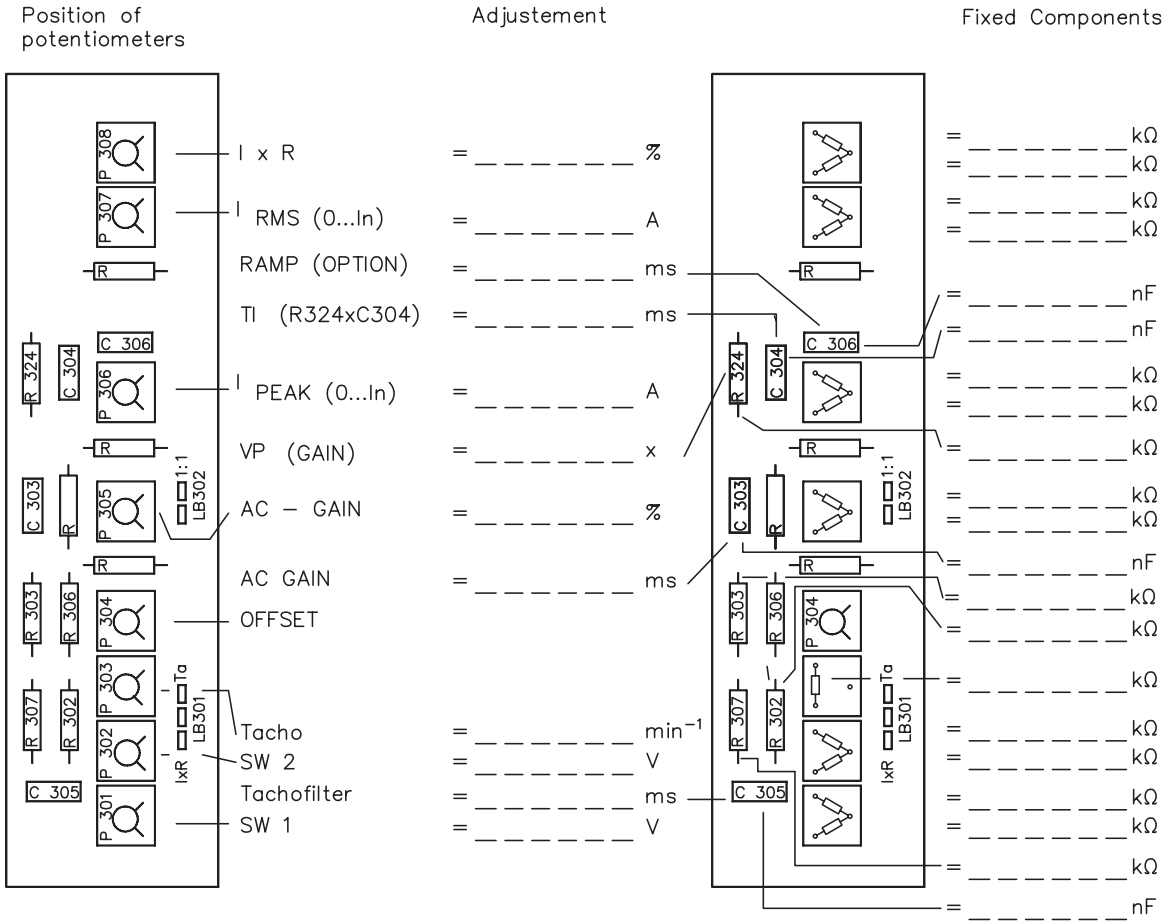


choke type	a	b	c	e	f	h	i	terminals
L0,2–35/60	55	47	72	37	44	7	3,5	TRK 4
L0,4–20/40	55	47	72	37	44	7	3,5	TRK 4
L1,5–15/30	67	58	89	45	50	8,5	4,5	TRK 1,5

dimensions in mm

VI.16 Form for customer print 4KS

Customer:	Commission:	Name:	Material–No.:



Standard components

Solder straps Ta/IxR 1:1	C306	R324	C304	C303	R303	R307	R302	C305
Ta open	10nF	150k	220nF	6,8n	10k	10k	10k	47nF

Remarks

Date	Components	Reason

Date

VII Annex

VII.1 Ordering Information

Device	Rated supply voltage/V	Rated current/A	Peak current/A	Min. indukctance/mH	Order-No.
4KS-M150/ 7,5	60...150	7,5	10	0,9	63628
4KS-M150/ 15	60...150	15	20	0,45	63594
4KS-M150/ 25	60...150	25	40	0,22	64029
4KS-M150/ 35	60...150	35	60	0,15	63593
4KS-M150/ 40	60...150	40	100	0,15	66273
56WK-P150/80-B	3 x 107 AC	90	180	—	59637
03S-P150/30-B	3 x 107 AC	30	60	—	61744
4KS-M240/ 5	60...240	5	10	1,5	64055
4KS-M240/ 10	60...240	10	20	0,75	63789
4KS-M240/ 20	60...240	20	40	0,4	63790
4KS-M240/ 30	60...240	30	60	0,25	63791
4KS-M240/ 40	60...240	40	100	0,2	64054
56WK-P240/80-B	3 x 172 AC	90	180	—	59143
03S-P240/30-B	3 x 172 AC	30	60	—	61745

Ballast resistors :	for 56WK-P150	BAR375	**2,2**Ω	62094
	for 56WK-P240	BAR375	**3,3**Ω	65818

Master-Slave cables :	**two** controllers 4KS	55959
	three controllers 4KS	60126

Back panel PCB :	-F4KMB-	54016
	-R4KMB-	54731
	-N56WKMB-	59636
	-N03SMB-	62916

Options :	Current limitation :	**-cl-**	54015
	Voltage limitationg :	**-vlxxx-**	55295
	LS / RG / TC :	**-01-**	65676
	LS / RG:	**-RG/LS-**	65328
	Tropic isolation:	**-TR-**	
	24V-auxiliary voltage :	**-24V-**	

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