KOLLMORGEN
Seidel

Transistorized — Inverter

Series: 67WKS

Manual

Edition 10/00

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 67WKS transistor inverter.

The manual is divided into 6 chapters:

Chapter 1	:	General information
Chapter 2	:	Installation instructions
Chapter 3	:	Commissioning
Chapter 4	:	Functions and options
Chapter 5	:	Drawings and wiring diagrams
Chapter 6	:	Ordering information

In particular, please refer to the safety instructions given at the beginning of each chapter. They will help you avoid damage and injury.

Only qualified personnel with a basic knowledge of electrical engineering may be allowed to install the controller and its associated equipment.

Only qualified personnel with extensive knowledge of electrical engineering and drive systems may be allowed to commission the controller.

On request, we offer instruction and training courses.

Seidel only garants a functional warranty for inverters with synchronous motors if SM series motors are used.

I.2 Equipment concept

A four-quadrant controller for brushless DC servo motors (AC servo motors) based on the synchronous principle was accommodated on **one single Eurocard** using state-of-the-art components and hybrid technology.

The output phase is designed as a 3-phase pulse-width-modulated transistor stage. The trapezoidal output currents and motor speed are controlled by PI controllers; phase reversal of the motor and tachometer windings is controlled by the electronic rotor position sensor (RPE) of the motor.

This equipment can be used to implement high dynamic speed or torque proportional (current) control system. Actual speed is determined by electronic power rectification of the 3-phase (brushless) tachometer signal.

Due to the built-in, three-phase rectifier and the ballast circuit with a **"soft" characteristic** available as option -B-, the equipment can be used **on its own** - without any other electronic equipment - or can be combined on a common d.c. bus and a common transformer with other equipment at the same voltage level in **a.c. or d.c.** technology (Series 03S, 60WKS).

The limit switch inputs and a variable ramp generator supplied as standard can either be connected to the second nominal value input.

Due to the controller's very low power loss, it is possible to operate the equipment with **natural convection** at rated values (ambient temperature <45°C) and with a vertical installation (one day). If the ambient temperature rises above 45°C or if two 67WKS units are mounted vertically in a 6U plug-in module, the units must be forced-air ventilated.

Up to 6 units of the 67WKS series can be accommodated in one single 19" x 3U standard shelf.

The units are connected at the rear by plug-in connectors and power terminals.

I.3 Functional groups

The following functional groups are accommodated on a single Eurocard measuring 220x100x14 U designed in hybrid technology:

- 3-phase power supply with smoothing capacitor (**-P-**)
- Fuses for auxiliary voltage power supply and ballast circuit
- Ballast circuit (**can be connected in parallel**) (**-B-**)
- 4-quadrant output stage, 3-phase
- Auxiliary voltage power supply, powered from the intermediate circuit and externally by **24VDC**
- 2 nominal value differential inputs
- Current nominal value output and input
- Input for 3-phase, brushless tachometer
- Input for rotor position encoder (RPE)
- Enable input
- I^2t monitor for actual current value
- PI current and speed controller
- Balancing potentiometer and solid-state components for all important adjustments
- Limit switch inputs (PSTOP, NSTOP), ramp generator, 1:1 controller
- 24 V logic with optocouplers for control signals
- Ready to operate relay (BTB) with floating contact
- Display LEDs for ready to operate, faults (sumcheck error, overcurrent, RPE, overtemperature), I^2t, ballast circuit

I.4 Specifications

Characteristics		Unit	67WKS - M240 / 3 - PB
Rated supply voltage		V~	3 x 60...172
Rated connected power (for 3.5 A rated current)		kVA	0,6
Rated d.c. voltage in intermediate circuit		V=	240
Rated output current		A	3,5
Peak output current (available for max. 2.5 s)		A	10
Max. fuse protection		AM	3 x 16
Starting threshold of ballast circuit		V	285...300
Pulse power of ballast circuit		kW	2,7
Continuous power of ballast circuit		W	50
Switch-off overvoltage threshold		V	325
Form factor of output current (at rated specifications and minimum motor load inductance of 6 mH)		-	1,01
Bandwidth of secondary current control circuit		kHz	1
Clock frequency of output stage		kHz	2 x 8,6
Residual voltage decrease at rated current		V	5
Quiescent power loss, output stage disabled		W	15
Power loss at rated current (incl. power loss of power supply minus ballast power loss)		W	40
Auxiliary voltage outputs		V	±15
		mA	±20
Auxiliary voltage outputs for RPE		V	±15
		mA	±20
Inputs			
Nominal value 1, permanently set		V	±10
Nominal value 2, adjustable between 0 to 100%		V	±10
Max. common-mode voltage (both nominal value inputs)		V	±10
Input resistance (both nominal value inputs)		kΩ	150
Max. input drift (both nominal value inputs)		µV/K	±15
24 V auxiliary voltage supply (option)		V	24 (20...30)
		A	0,5
Connectors			
Controller		DIN 41612 - E48 (connector)	
Backplane Type F:	RPE (RLG)	XST401, Sub D - 9-pol. (socket)	
	Control signals	XST404, Combicon 5,08 , 20 pin	
	U1,V1,W1,Ucc,0V/GND	Terminals Phönix KDS4	
	U2,V2,W2	Terminals Phönix GMRDS3	
Backplane Type R:	RPE (RLG)	XST401, Sub D - 9-pol. (socket)	
	Control signals	XST404, Combicon 2x12pol.	
	Power signals	Terminals Phönix Front4V-7.62	
Mechanical specifications			
Weight board		1kg	
Dimensions	single Eurocard (14MS)	(lxhxw) 220 x 100 x 72 mm	

I.5 Permitted ambient conditions

Tolerance of supply voltages	±10%
Installation position in 19" shelf	vertical
Non-ventilated	with natural ventilation, rated specifications, ϑu<45°C and single-stage installation
Forced ventilation	at ϑu> 45°C or for installation in several stages
Ambient temperature (at rated values)	0 to +45°C
Power reduction (2.5% / °C) in range	+45°C to +55°C (forced-ventilated)
Storage temperature (rel. humidity, max. 95% non-condensing)	-25°C to +85°C
Protection rating (in connection area)	IP 00

I.6 Connectable motor types

The controller is balanced to our **a.c. servo motors**

Series SM 35, torque range 0.30 to 0.75 Nm
Series SM 45, torque range 0.85 to 3.2 Nm
Series SM 56, torque 3,8 Nm

I.7 Protective functions

The 67WKS transistor inverter has the following protective functions:

- Short-circuit and earth-fault protection at motor connection terminals (with integrated protective shokes if backplanes F or R67WKSMB are used)
- Temperature monitoring of output stage
- Fuse protection for ballast circuit and auxiliary voltage
- I^2t monitor to protect amplifier and motor
- Overvoltage protection
- RPE monitor

I.8 Isolating transformers

Isolating transformers are required to operate the controllers.
To ensure the proper operation of the equipment and compliance with warranty conditions, the isolating transformers must conform with the specifications listed below.

Model:	3-phase isolating transformers with shielding winding according to VDE 0550 in Y/y or Y/d connection.
Power supply:	400 (380) V with ±5% tapping to adapt to fluctuating mains conditions
Secondary voltage:	for 240 V DC intermediate circuit: 172 V (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 reference short-circuit voltage vsc must be 4% + 1% to protect the rectifier diodes during power-on and in the event of overvoltages to VDE 0160. At transformer outputs greater than 3kVA (e.g. on multiple axis systems), a soft start is required.
Power factor:	The transformer loaded with an a.c. bridge-connected rectifier has a power factor λ of 0.9.
Overload characteristic:	The typical short-term overload behaviour in the servo mode must not result in greater voltage drops than specified by vsc or damage the transformer.

Caution!
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 (3-phase, rated connection voltage 400[380] V

Model	Power/kW	Sec. voltage/V	Order No.
3T0,7K-240	0.7	172	63391
3T1,5K-240	1.5	172	60075
3T3,0K-240	3.0	172	56898

II Installation instructions

II.1 Safety instructions

- Check the rating plate on the controller. Compare the rated voltage and rated current with the transformer and motor characteristics.
- The front panel of the modules is only protected against accidental contact if the modules are mounted in the 19" shelf and fastened with the screws provided. Securing the modules with the screws also ensures a reliable contact in the connectors. An incomplete contact can lead to contact erosion.
- Make sure that the maximum permitted rated voltage of 172 V a.c. is not exceeded at terminals U1, V1, W1 of the controller. An excessively high voltage at these terminals will destroy the ballast circuit in the controller.
- Make sure that there is sufficient ventilation (vertical installation position, sufficient filtered cold air supply), see Section II.2.2.
- Make sure the conductor cross-sections are sufficient to avoid excessively high conductor losses and to prevent the conductors from overheating, see Section II.2.1.
- Use stranded conductors for nominal value, RPE, tachometer and motor conductors. The tachometer, RPE and nominal value conductors must be installed shielded.
- Ground the intermediate circuit (OV/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 in 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.
- All grounding terminals must start at the same neutral point to prevent ground loops and potential differences on the ground conductor. Connect all ground conductors to a PE bus, e.g. in the switchgear cabinet.
- Make sure that the shields are correctly connected:
  Connect the RPE and tachometer shields to the controller (GND/PE or 0V/GND)
  Connect the nominal value shield to the controller at NC GND
  Shields may only be connected at one end !
- Loop the BTB (ready to operate) contact to 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 switchgear cabinet. This will avoid capacitive and/or inductive interference.
- If you wish to make changes to the controller, please contact us. It is permitted to adjust and optimize the controller and enable circuit parts by means of solder straps.
  Any other intervention will invalidate any warranty claims.
- Only connect the controller to a power source when the operating voltage is switched off. Only disconnect the controller when the voltage drops below the undervoltage limit. Observe the LEDs on the controller after you have switched off the operating voltage. After a short time, the green LED will extinguish and the top red LED will light up for a short time. Then you can disconnect the controller.

II.2 Connection and wiring

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

The **motor conductors** must be stranded with sufficient cross-sectional area (for single conductors) or installed in cables (oil-resistant flexible cables, etc.). To avoid technical problems, we urgently advise the use of preterminated cables from our range of products.

Install suppressors such as annular ferrite cores or chokes as close as possible to the controller.

RPE, tachometer and nominal value conductors **must be** twisted in pairs and shielded for routing purposes.

The RPE and tachometer shields are best connected to GND on the controller. In analogy, the nominal value shield should be connected to GND at the nominal value source (CNC).

The controller and the control system **must have the same PE/GND reference point** (e.g. the PE bus in the switchgear cabinet). You can connect the control system at medium impedance, e.g. 100Ω, to the GND reference point for improved interference suppression. 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 30 V). The use of the 15 V auxiliary power supply should be reserved for commissioning and simple applications.

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.

Designation	Cross-section	Remarks
Power supply	4i x 1.5 mm²	U,V1,W1,PE for single conductors
	4i x 2.5 to 4 mm²	U1,V1,W1,PE in bus systems
Intermediate circuit	4i x 2.5 to 4 mm²	+,- in bus systems
Motor conductors	8i x 1 mm²	U2,V2,W2,PE, brake, protective thermal contact
Tachometer (RPE)	6 x 2 x 0.14 mm²	stranded in pairs, shielded
Nominal value(s)	2(4) x 0.14 mm²	stranded, shielded
Control signals	0.5 mm²	
+24 V/GND	1.0 mm²	option

II.2.2 Ventilation

Make sure that the controller is correctly ventilated. Due to the low power loss of the controller, an additional fan is not required if the units are installed vertically in one stage in the 19" shelf and there is a sufficient supply of filtered fresh air (ϑ<45°C) from below.

If the ambient temperature rises above 45°C or if two 67WKS units are mounted vertically in one 6U shelf, the units must be forced-ventilated.

II.2.3 Fuse protection

The operator is responsible for providing the fuses for the a.c. power supply (line fuses) either in the form of fusible links (on secondary side) or by means of primary-side motor protecting switches with phase-failure monitoring.
You can replace the fuses using pointed pliers without dismounting the controller.

Component description	Module description	Location	Fuse value	Remark
—	a.c. power supply	external	max. 3x16 AM	
S1	Aux. voltage	Motherboard	1 AF	Microfuse 5x20
S2	Ballast circuit	Ballast PCB	1.25 AT	Microfuse 5x20

II.2.4 Backplane pin assignments of F/R67WKSMB

XST401 9-pin sub-D (pin no.)	Signal name on a.c. tachometer	Abbreviation
1	+15 V for RPE	+15 V
2	Tachometer centre point	Ta-Mp
3	Tachometer phase W	Ta-W
4	Tachometer phase V	Ta-V
5	Tachometer phase U	Ta-U
6	GND for RPE	GND
7	RPE phase W	RLG-W
8	RPE phase V	RLG-V
9	RPE phase U	RLG-U

Power terminals (double)	Signal name	Abbreviation
+	d.c. intermediate circuit +240V	+Vcc
U1	a.c. terminal 172 V	U1
V1	a.c. terminal 172 V	V1
W1	a.c. terminal 172 V	W1
—	d.c. intermediate circuit (0V(GND)	0V
U2	Motor U	U2
V2	Motor V	V2
W2	Motor W	W2
PE	Protective ground terminal is linked to d.c. intermediate circuit (0V/GND)	PE

XST404 Combicon block (terminal no.) 60WKSMB, type F	/ R	Signal name	Signal direction	Abbreviation (solder print)
1	/ 1	Nominal value 1+, ±10 V	Input	SW1+
2	/ 2	Nominal value 1-, ±10 V	Input	SW1-
3	/ 3	Nominal value 2+, ±10 V	Input	SW2+
4	/ 4	Nominal value 2-, ±10 V	Input	SW2-
7	/ 7	Current nom. val. OUT ±10 V	Output	ISA
8	/ 8	Current nom. val. IN ±10 V	Input	ISE
10	/ 10	Limit switch, positive	Input	PSTOP
11	/ 11	Limit switch, negative	Input	NSTOP
12	/ 12	Digital GND (DGND)	Input	DGND
13	/ 13	+15 V auxiliary voltage	Output	+15
14	/ 14	-15 V auxiliary voltage	Output	-15
15	/ 15	Integral OFF/1:1	Input	1:1
16	/ 16	Enable	Input	E
17	/ 17	Analogue GND (AGND) connected to 0V	Input	AGND
18	/ 18	Unassigned	—-	—-
19	/ 19	IDC monitor ±10 V / Ipeak	Output	I-DC
21	/ 21	BTB contact	Input	BTB
22	/ 22	BTB contact	Output	BTB
23	/ 23	Tachometer monitor ±3V/1000rpm	Output	V-TA
24	/ 24	+24 V auxiliary voltage ref. to 0V terminal (option)	Input	+24
—-	/ 25	0V/GND	—-	0V
—-	/ 26	Shield	—-	Shield

All analogue inputs ±10 V and the digital input Integral OFF/1:1 (H-activ, 24V/10mA) referred to analogue GND (terminal 17).
The digital inputs PSTOP, NSTOP and Enable H-active 24V/10mA referred to digital GND (terminal 12), floating to analogue GND (if strap 12-17 is open).
All digital inputs can be powered by the +15 V auxiliary voltage (terminal 13) for commissioning.
A wire jumper between terminals 12 and 17 provides the ground connection between AGND and DGND.

II.3 Checklist

- — Check rating plates
- — Select correct wiring diagram
- — Select conductors as described in Section II.2.1
- — Determine common grounding point
- — Ground transformer (core and shielding winding)
- — Ground motor housing
- — Ground NC GND of control system
- — Ground intermediate circuit (terminal 0V/GND) of controller
- — Loop BTB contact in safety circuit
- — Connect digital control inputs of controller
- — Connect nominal value inputs
- — Connect nominal value conductor shield to NC GND of control system
- — Connect tachometer conductor shield to GND/PE terminal
- — Connect tachometer and rotor position sensor
- — Connect motor conductors
- — Check ventilation (see Section II.2.2)
- — Check that the ±15 V auxiliary voltages do not exit the switchgear cabinet
- — Connect operating voltage (keep to maximum permitted supply voltage)

III Commissioning

III.1 Safety instructions

- Check whether the safety instructions in Section II.1 have been fulfilled.
- Read the instructions for commissioning contained in Section III.2
- The correct sequence of steps for commissioning helps you to prevent damage. Please contact us if you require any further information.
- First consult Chapter IV on the functions and options featured in the 67WKS controller if you have to make any changes to the controller.
  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 Section IV.2.3.7.

Never plug in or disconnect the controller when it is switched on.
Observe the operating LED.

This is the only way you can prevent erosion of the plug-in contacts, the destruction of entire controller modules and any personal danger due to fully charged capacitors. For more than 5 seconds after switching off the power supply, the capacitors can have dangerous levels of residual charge. Measure the voltage in the intermediate circuit until it has dropped below 40 V.

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 on the controller switching off the operating voltage. After a short time, the green LED extinguishes and the red LED briefly lights up. You can now remove the controller.

- The front panel of the modules is only protected against accidental contact when the modules are mounted in the 19" shelf and fastened with the screws provided. Securing the modules with the screws also ensures a reliable contact in the connectors. Poor contact can lead to contact erosion.

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 and RPE terminal, grounding, motor terminal, control signals).
2. Check the equipment **rating plates** (rated voltage, rated current, special tuning - if required).
3. Check the **emergency OFF** circuit before switching on for the first time.
4. Reduce the **gain** (AC GAIN potentiometer to the ccw stop) and the **peak current** (I_{PEAK} potentiometer almost to the ccw stop) as a precautionary measure.
5. Switch on the transformer after the controllers are removed; test the a.c. power supply (60 to 172 V a.c.); **switch off the transformer.**
6. Plug in a controller. **Block the enable signal** and check the **emergency OFF** func tion. **Switch on** if there is no risk of damage to machinery or persons, even if the drive system is unintentionally moved.
7. **Move** the axes by switching on the enable signal at an applied **(small)** nominal value.
8. **Tune** the axes (AC GAIN, IPEAK, OFFSET, TACHO, IRMS - if not already preset).
9. **Switch off** and plug in another controller if intermediate circuit voltage has dropped below 40 V (measure the voltage !). Then repeat the commissioning steps from item 6 onwards.

III.3 Interference suppression

If there is interference in the CNC or the analogue or digital position transfer, a number of additional measures can be carried out:

- additional ferrite rings in the motor cable
- shielding the motor cable
- RC filter at the nominal value output of the CNC (RC with 1 kΩ(10nF)
- 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 changes any changes to the controller.
- The controller can only be modified by **trained qualified personnel.**
  You are allowed to adjust and optimize the controller and connect circuit parts by solder straps.
  Any other work on the equipment will entain loss of warranty entitlement.
- The controller must be commissioned again after each modification.
  See Chapter III.

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.

Input 1 is permanently set for differential input voltages of ±10 V.
Input 2 is fitted with an adjustable attenuator (P2).

- — Clockwise rotation increases the speed (efficiency is increased)
- — A positive voltage at terminal 1 connected to terminal 2 and at terminal 3 connected to terminal 4 results in a clockwise rotation of the motor shaft (top view of shaft)

The common-mode voltage range (important for preventing ground loops) is additionally ±10 V for both inputs; the input resistance is 150 kΩ.

IV.2.1.2 Tachometer input Ta

P4 is used to fine-tune the tachometer.
The fixed resistors **R301 to 304** (tolerance 0.5%) determine tachometer calibration.
The standard equipment is designed for tachometer voltages of 3 V or 20 V and approximate cw or ccw stop of **P4**.

IV.2.1.3 Digital control inputs

- **Enable** (**E**, terminal 16), **H level** for controller **enable**.
- **1:1 control** (**1:1**, terminal 15), **H level to switch off** integral section.
- **Limit switch** positive/negative (**PSTOP/NSTOP**, terminals 10/11), **H level in normal mode** (open-circuit-proof). If there is loss of input signal (limit switch open), the associated direction of rotation is disabled.

All inputs are coupled **floating** via optocouplers; the reference ground is **digital** GND (DGND, terminal 12). The logic system is designed for +24 V/8mA (**PLC-compatible**). The H level is +12 to 30V.

If required, the controller can be driven at +15 V (+15 auxiliary voltage, terminal 13). Digital GND (terminal 12) and analogue GND (terminal 17) must then be connected by an **external strap**.

IV.2.1.3.1 Input enable E

The controller output stage is enabled by the enable signal (terminal 16, input 24 V, H-active). The connected motor is torque-free when disabled. The integral components of the speed and current controllers are also disabled.

IV.2.1.3.2 Limit switch inputs PSTOP, NSTOP

If there is loss of one of the signals (terminals 10/11, inputs 24 V, H-active), the associated direction of rotation is **disabled**, thus producing a braking effect. The I component of the controller is then bypassed to limit the motor current when the motor is run to a fixed limit stop. PSTOP (terminal 10) disables ccw rotation, NSTOP (terminal 11) disables cw rotation. If **both** signals fail, the drive brakes to standstill from any direction and speed (e.g. can be used for emergency OFF function).

The limit switch inputs only act on nominal value input 2.

The limit switch inputs must always be connected, even if only nominal value input 1 is used, otherwise the integral gain is off circuit!

If no limit switch is used, you must connect terminals 10 and 11 externally to +15 V (terminal 13).

IV.2.1.3.3 1:1 control

You can switch over the speed controller by applying the 1:1 signal (terminal 15, input 24 V, H-active) to the **current controller**. The **P** gain is then set to **1**, the **I** component of the controller is **bypassed** and the **tachometer signal is switched off internally**. Turn the AC-Gain potentiometer to the ccw-stop.

The 1:1 signal acts on both nominal value inputs.

IV.2.2 Output functions

IV.2.2.1 Armature current monitor output IDC

The output (terminal 19) supplies ±10 V for ± **equipment peak current** connected to AGND, output impedance 2kΩ.
The d.c. rms voltage of all three phases, which is approximately proportional to the supplied **motor torque**, is generated.

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

See Sections IV.2.1.3.3 to operate the controller as a 1:1 current controller.

IV.2.2.2 Tachometer monitor output V-TA

The output (terminal 23) supplies at standard calibration for the described motors the signals listed in the table below:

	SM35-6000	SM56 & SM45-2000/3000	SM45-4000/6000
Tachometer voltage [V/1000rpm]	2.5	5.4	2.7
Tachometer monitor [V/1000rpm]	1.4	3.0	1.5

Calibration is **not** affected by the tachometer potentiometer P4.

IV.2.2.3 Ready to operate contact (BTB)

Ready to operate (**BTB**, terminals 21, 22) is signalled via a floating relay contact.

The contact is **closed** when the controller is ready to operate. The signal is **not** affected by the enable signal or by the I²t limit.
The contact rating is 100 V/0.1 A d.c. and the maximum permitted connected voltage is 50 V d.c. (not a.c.!).

IV.2.2.4 Measuring points

- **Armature** current monitor (I-DC), calibration ±10 V for ± **equipment peak current**, output impedance 2 kΩ, analogue GND is reference point.
- Tachometer monitor (V-TA), voltage corresponding to the tachometer voltage, analogue GND is the reference point.
  The measuring point supplies the same signal as described in IV.2.2.2. The output impedance is 1 kΩ referred to AGND.

IV.2.3 Possible settings

IV.2.3.1 Ramp potentiometer P1

You can adjust the rise time for a nominal value step using potentiometer P1.

This only acts on nominal value input 2!

You can select the maximum rise time of about 10 ms per nF for a nominal value step of 10 V using C306 when the potentiometer is turned to the **ccw stop**.
When this option is correctly set (i.e. the rise time is **smaller** than the mechanical time constant of the regulating circuit), the stability of the regulating circuit can be improved without notably reducing the control rate. With a standard configuration (C306 = 10nF), the potentiometer turned to the ccw stop corresponds to a rise time of 100 ms.
When the P1 is turned to the cw stop, the constant delay time of 5 ms is almost negligible. (setting range 1:20).

IV.2.3.2 Nominal value potentiometer P2

You can attenuate the nominal value input IN2 using the potentiometer 2. The speed is increased by turning the potentiometer cw (setting range 0 to 100%).

IV.2.3.3 Offset potentiometer P3

The offset potentiometer P3 is used to compensate fault voltages in the operational amplifiers or the nominal value power source (controller) when the nominal value is 0V.
Adjust to motor standstill when the amplifier is enabled and the nominal value voltage is 0V (setting range ±10mV).

IV.2.3.4 Tachometer potentiometer P4, tachometer adjustment R310

The potentiometer P4 is to fine-tune the tachometer. The standard configuration is designed for tachometer voltages of 3 V and 20 V when the potentiometer is turned to the ccw or cw stop respectively. The adjustment of the attainable speeds at a nominal value voltage of 10 V are listed in the table below:

	SM 35-6000	SM56 & SM45-2000/3000	SM 45-4000/6000
Smallest adjustable speed approx. [rpm]	1200	1000	1000
Greatest adjustable speed approx [rpm]	8000	3500	7000

= limited by stability of speed controller (P gain)
= limited by the voltage constant of the motor

IV.2.3.5 A.C. GAIN potentiometer P5

You can **increase** the proportional gain of the PI speed controller by turning the potentiometer P5 clockwise (control becomes stiffer). When the potentiometer is turned to the ccw stop, R307 sets the basic gain to approx. 10.
The integral component is set by C304 and R307 to 47 kΩ x 0.1µF = 4.7ms.
The control circuit becomes slower (softer) by increasing C304.
Reducing C304 improves the response sensitivity of the controller but increases its tendency to resonate. The standard equipment only needs to be modified in exceptional cases.
Set P5 when the amplifier is enabled and the motor is at standstill (nominal value voltage =0V) by rotating clockwise until oscillation starts (very easily observed using the oscilloscope on the current monitor) and then by turning back to a point **considerably before** the oscillation threshold.

IV.2.3.6 Peak current I_{PEAK} P6

You can reduce the equipment peak current I_{PEAK} by turning P6 **ccw**.
The control range (linear) is 0 to 100%.
The table below provides you with information on the **basic setting** of I_{PEAK} and I_{RMS} for commissioning. **Precise adjustment** - especially for small currents - is possible using the method described in Section IV.2.3.7.

IV.2.3.7 RMS current I_{RMS}, I^2t limit P7

The controller is capable of supplying the equipment peak current I_{PEAK} = 10A for a maximum period of 2.5s. The current is then limited to the set rated current I_{RMS}. The I_{RMS} is reduced by turning P7 ccw. The control range (rms) is 0 to 100%. Its centre position corresponds to about 70% of the equipment's rated current.

The time t, during which pulse current can be obtained, changes with the selected settings of I_{RMS} and I_{PEAK} according to the formula:

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

The table in Section IV.2.3.6 provides assistance on the **basic setting** of I_{PEAK} and I_{RMS}. You can swap two motor phases to make the task of **finely tuning** the current easier. The motor is then set to a preferred position after the **enable signal is switched on**, even if there is no nominal value. The amplifier current first rises to the set **peak current** and drops to the I_{RMS} value after the I^2t limit is reached. Use an oscilloscope to measure the current at measuring point **IDC** (current monitor) connected to AGDN. **Start the adjustment with a small I_{RMS} current (P7 near the ccw stop).** Set the required current by turning the potentiometer cw step by step.

IV.2.4 Other functions

IV.2.4.1 Ballast circuit with -w- characteristic

A switched resistor is used as ballast circuit to dissipate feedback power when the motor is braked. The circuit response starts at an intermediate circuit voltage of 285 V and is indicated by the internal **yellow** LED [BR] flickering.
If the load is repeated, the switching threshold is increased by the integrated **-w-** characteristic to max. 300 V so that power distribution can take place between several modules **switched in parallel** on the same d.c. bus.
A microfuse on the ballast board provides protection.
You should roughly calculate the anticipated ballast power from the known drive characteristics - in particular for single axes.
For normal servo applications, the following design has proved successful:
Sum of ballast **continuous** power of all units $\geq$ 0.03 x sum of nominal **motor** power
(0.03 x ω_0 x Mo)
Sum of ballast **peak** power $\geq$ 0.3 x sum of **amplifier** peak power

The maximum DC no-load voltage must not exceed the maximum rated voltage of 240 V DC by more than:
10% (mains overvoltage) +4% (transformer no-load overshoot)
The LED of the ballast circuit must not light up, otherwise, thermal destruction can occur within a very short period.

For further technical information, please contact Seidel.

IV.2.4.2 Frequency response of controller

The basic setting of the frequency response of the current controller is designed for a bandwidth of 1 kHz, which means that the delay time is negligibly small.

IV.2.4.3 I²t monitor

When the set RMS current threshold value is reached (I_{RMS}, I²t limit), the pulse current is limited until the RMS value load drops. The BTB (ready to operate) signal is **not** affected.
A yellow LED indicates that the I²t limiter [IRMS] has responded.

IV.2.4.4 Displays

The green LED for the intermediate circuit voltage [BTB] lights up when

— intermediate circuit voltage is applied or the auxiliary voltage power supply (±15 V) is functioning correctly.

The controller is ready to operate when the green LED lights up **and** no red LED does light up. The BTB contact (floating NO contact, terminals 21, 22) is closed when the controller is ready to operate.

LED red sumcheck fault [FAULT] lights up to indicate

— overcurrent (short-circuit)
— output stage failure
— overvoltage (excessive ballast peak output)
— undervoltage of auxiliary power supply
— overtemperature of heat sink

LED red short-circuit [EARTH] lights up to indicate

— ground fault of motor conductors

LED red rotor position sensor [RLG] lights up to indicate

— line break of rotor position sensor cable
— implausible RPE signals

LED red overtemperature [TEMP] lights up to indicate

— overtemperature of heat sink (output stage)

The BTB contact **opens** at the same as each **red** LED lights up. You can only reset the fault memory by **switching off the power supply or the 24 V auxiliary voltage**.

LED yellow for I²t monitor [I-RMS] lights up when

— the set RMS current limit value is reached.
The BTB-contact is **not** affected.

LED yellow for ballast circuit [BR] flickers when

— the ballast circuit responds. Faint flickering denotes a defective ballast fuse (ballast circuit overload). If the LED flickers when the connected motor is at **standstill**, this means that the mains voltage is too high.

IV.2.5 External 24 V auxiliary voltage

In the as-delivered state, the auxiliary voltage power supply is fed from the d.c. intermediate circuit (80 to 240 V).
If you wish to store the fault signals in the memories after the intermediate circuit voltage is switched off, you can supply the auxiliary power supply from an external 24 V d.c. source if the **24 V option** is fitted.
Retrofitting of the units is possible, but requires some modifications. Please contact us.
If the 24 V option is used, the intermediate circuit can be supplied with any low voltage (e.g. 48 V battery). This offers a number of advantages, for example in setting up.

IV.3 Solder straps and external straps

IV.3.1 Solder straps

IV.3.1.1 External 24 V d.c. auxiliary voltage [LB1]

If you wish to supply the controller **subsequently** with an external 24 V d.c. voltage, modifications to the controller motherboard are necessary. Please contact us.
The power supply is connected to terminal 24 referred to **0 V/GND**, not to terminals 12/17.
If you order the controller with the 24 V option, the manufacturers have already performed all the required modifications.
As-delivered state: power from intermediate circuit, LB1 in position “INT”.

IV.3.1.2 Clock frequency [LB2,3,4]

The solder straps LB, LB3 and LB4 are permanently set by the manufacturer to a clock frequency of 8.6 kHz. Intervention at this point can lead to destruction in the controller and are therefore not permitted.

IV.3.1.3 RMS current [LB5]

The solder strap LB5 (Ieff) is permanently set to 3.5 A rms current. Intervention at this point can lead to destruction of the controller and is therefore not permitted.

IV.3.2 External straps

IV.3.2.1 Digital GND, analogue GND

In the as-delivered state, DGND (terminal 12) and AGND (terminal 17) are **not** connected.
To obtain a common GND reference point for digital and analogue signals, you must strap the terminals 12 and 17 externally.
If potential isolation is required, connect terminal 12 to GND of the control unit/NC and remove the external strap between terminals 12 and 17. The **digital** control signals (enable, PSTOP, NSTOP, 1:1) refer to **terminal 12** (DGND). If terminals 12 and 17 are bridged, the **common GND/ground point** of the controller and the control unit are also used as a GND reference point for the control signals. The additional connection of terminal 12 to the control unit should then be omitted to prevent **ground loops**.
Terminal 17 (AGND) always serves **only** as a reference point for (ungrounded) **nominal value** voltages and the **monitor** signals, and must not be loaded.

IV.3.2.2 Operation without limit switches

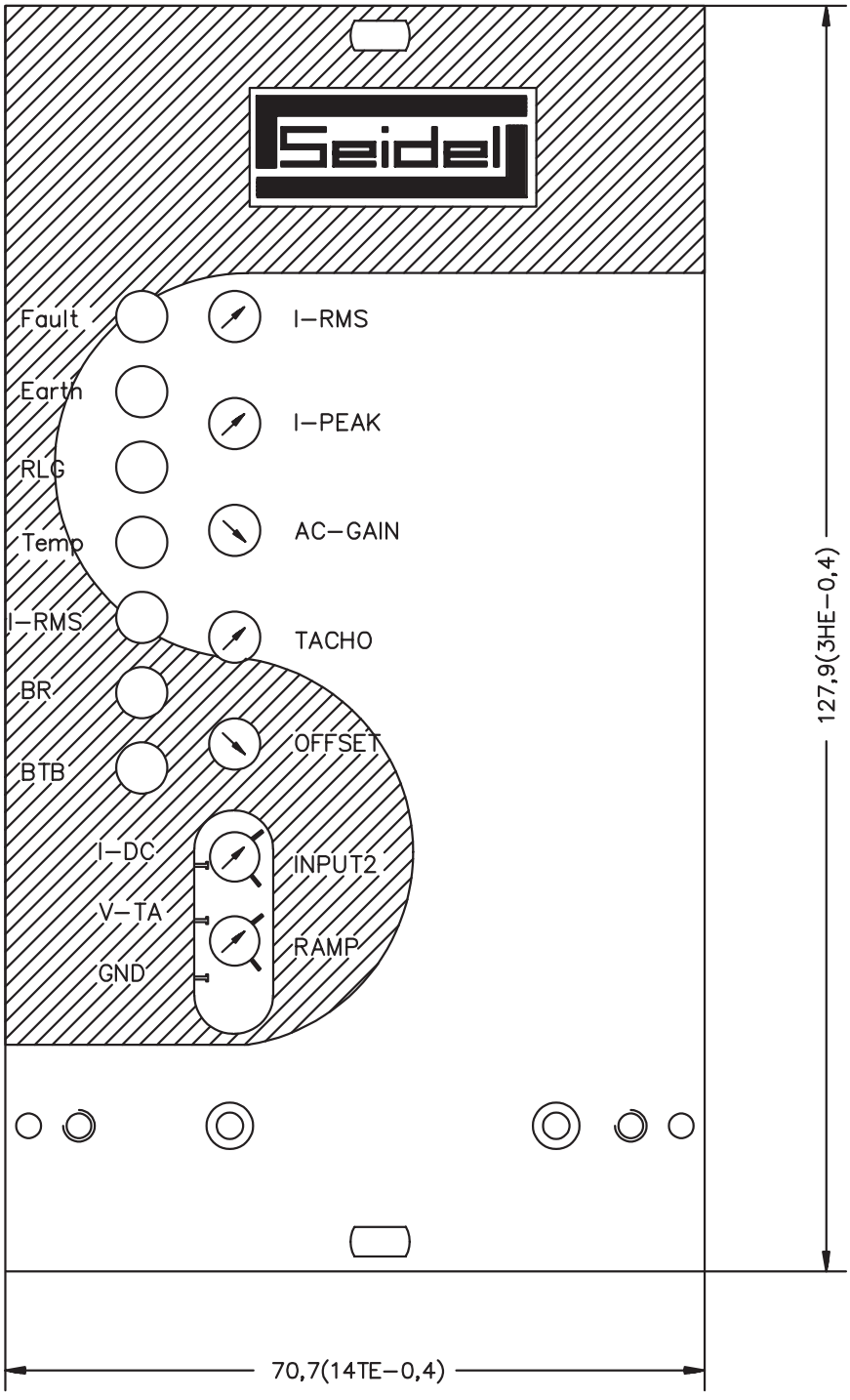
If no limit switches are used, the limit switch inputs (terminals 10 and 11) must be connected externally using terminal 13 (+15 V).

IV.3.2.3 Current nominal value strap

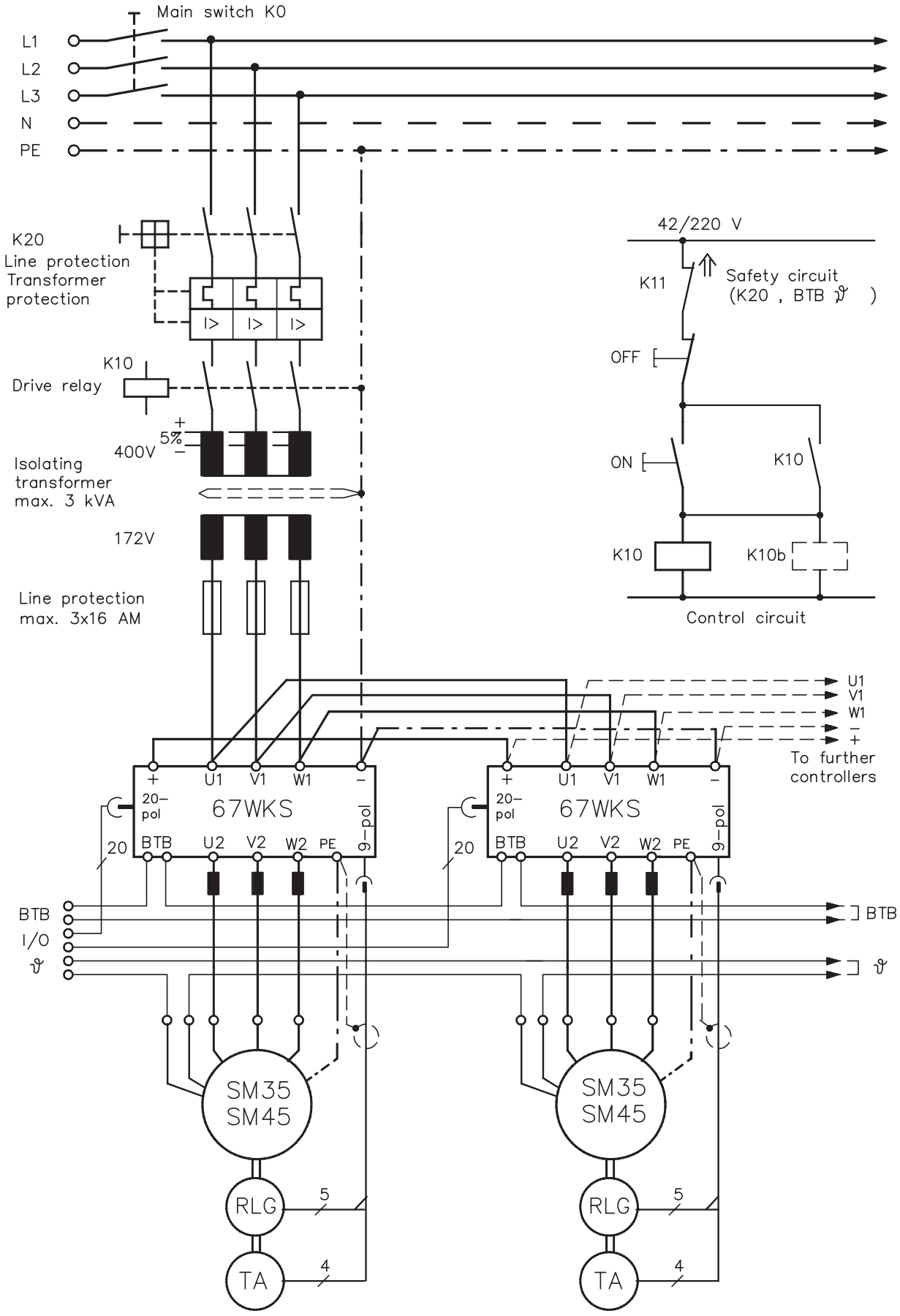
The terminals 7 (current nominal value output) and 8 (current nominal value input) must be connected by an external strap.

V Drawings

V.1 Front view of 67WKS

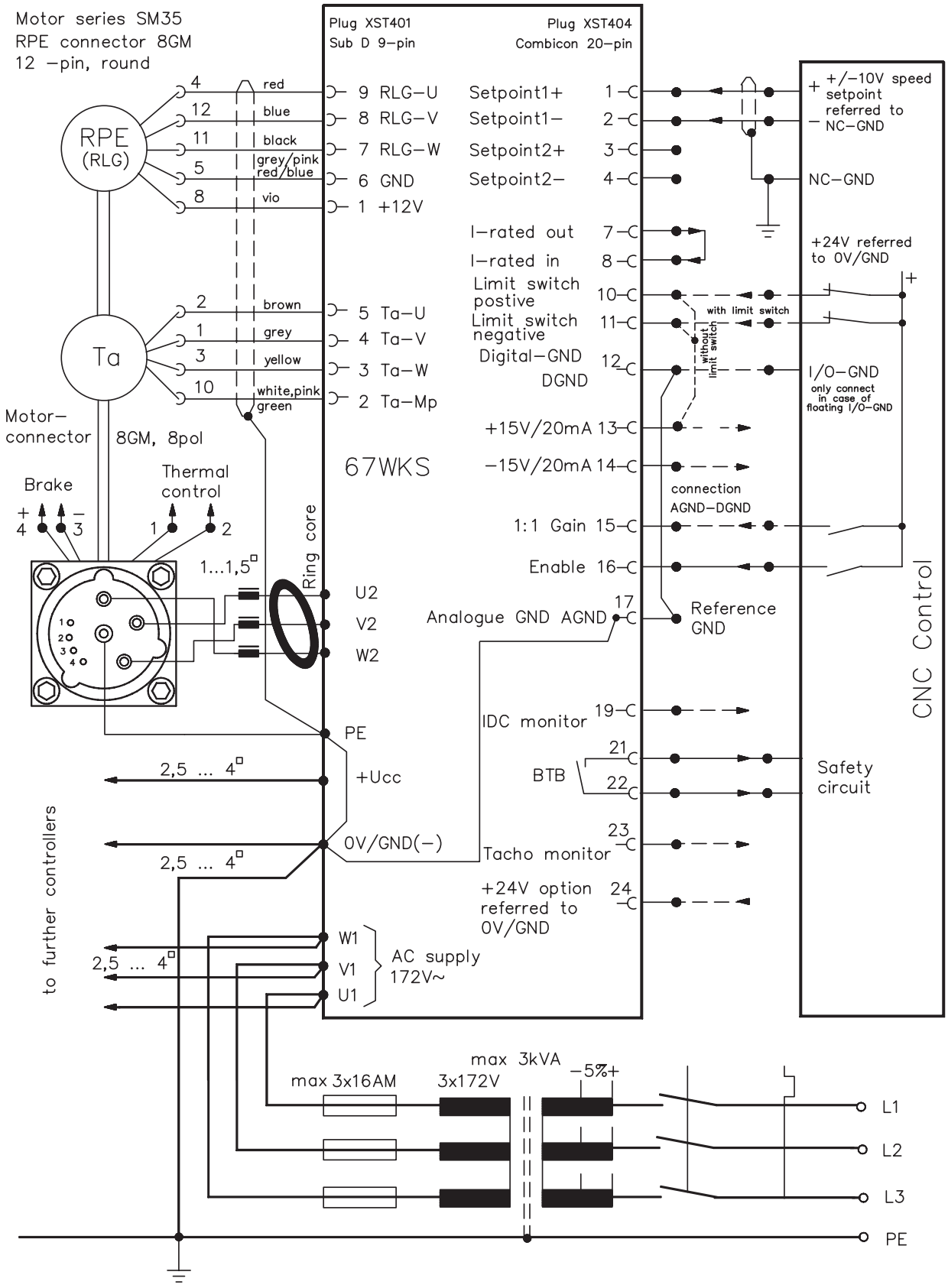


V.2 Proposed wiring diagram 67WKS with SM35, SM45



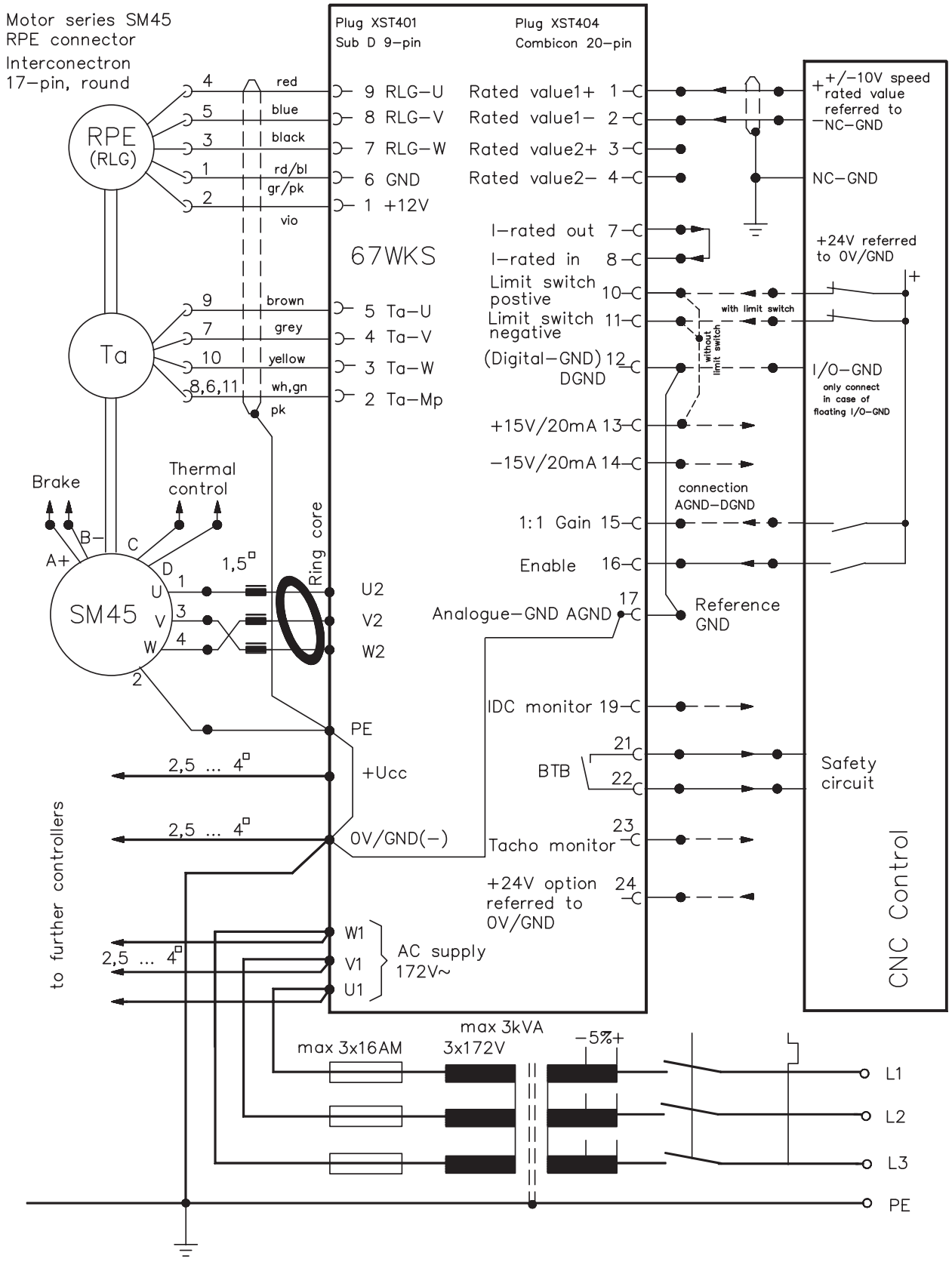
V.3 Wiring diagram 67WKS with SM35

Caution ! Never remove or plug–in the controller when it is alive !



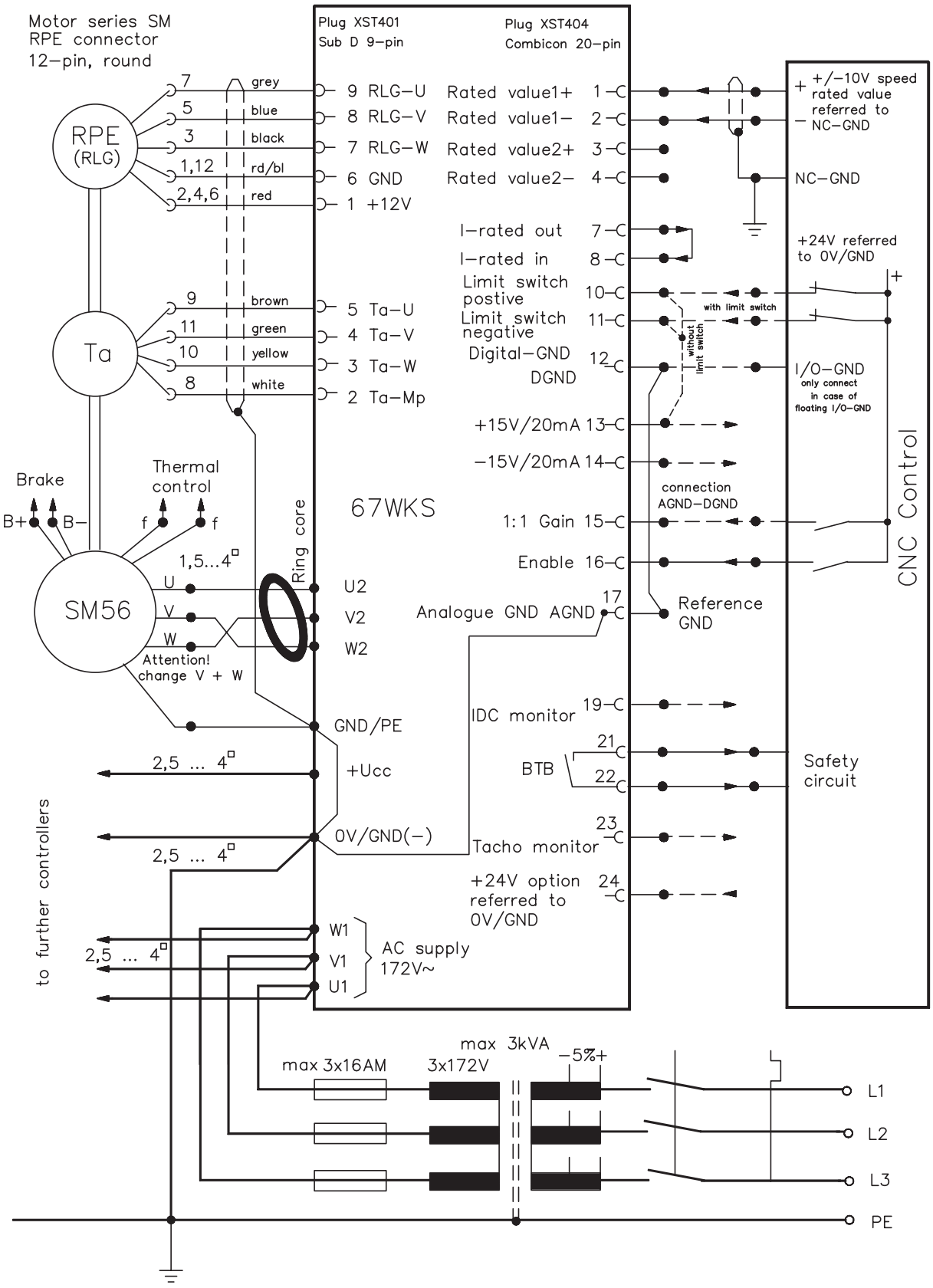
V.4 Wiring diagram 67WKS with SM45

Caution ! Never remove or plug–in the controller when it is alive !

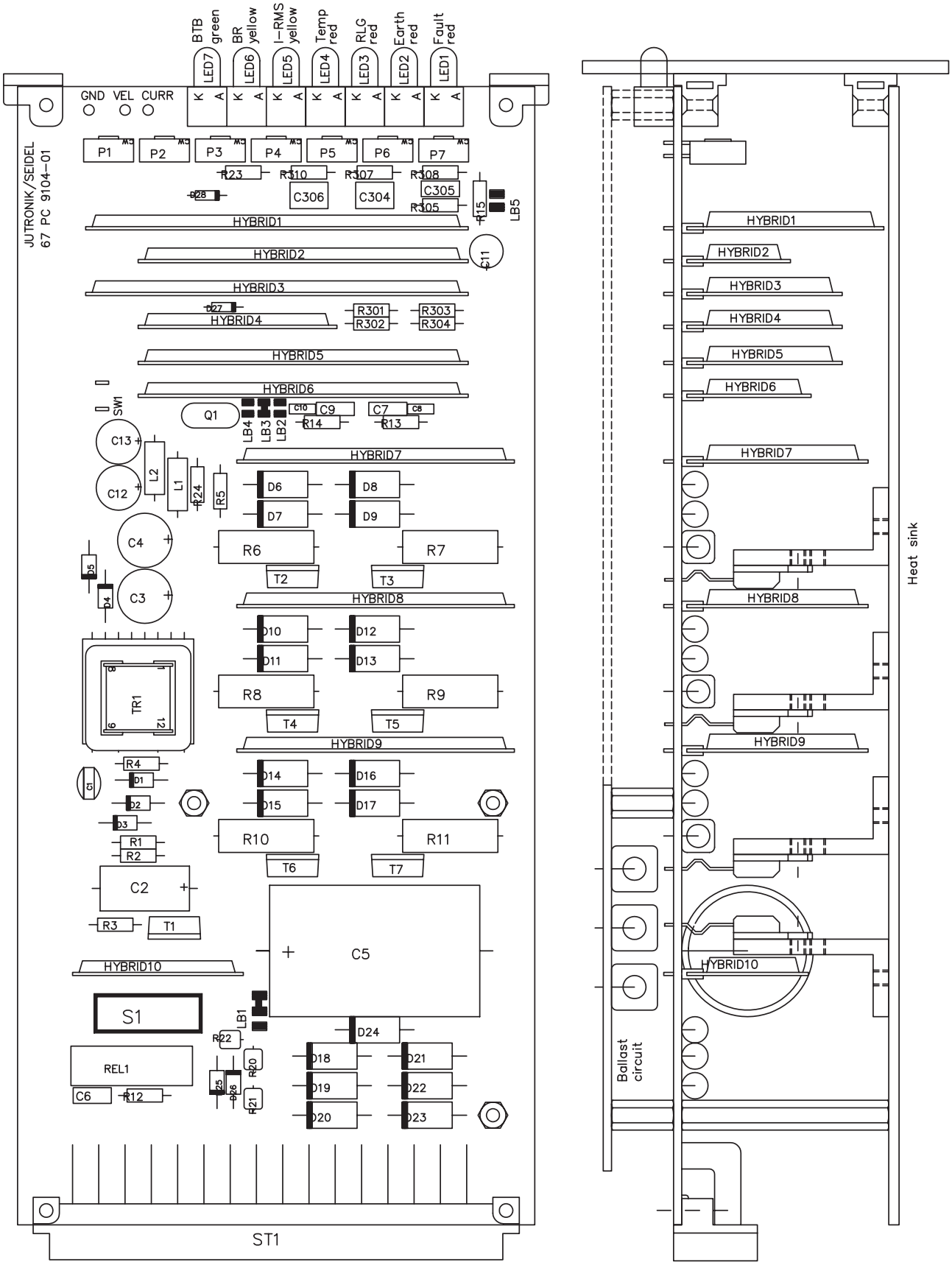


V.5 Wiring diagram 67WKS with SM56

Caution ! Never remove or plug–in the controller when it is alive !

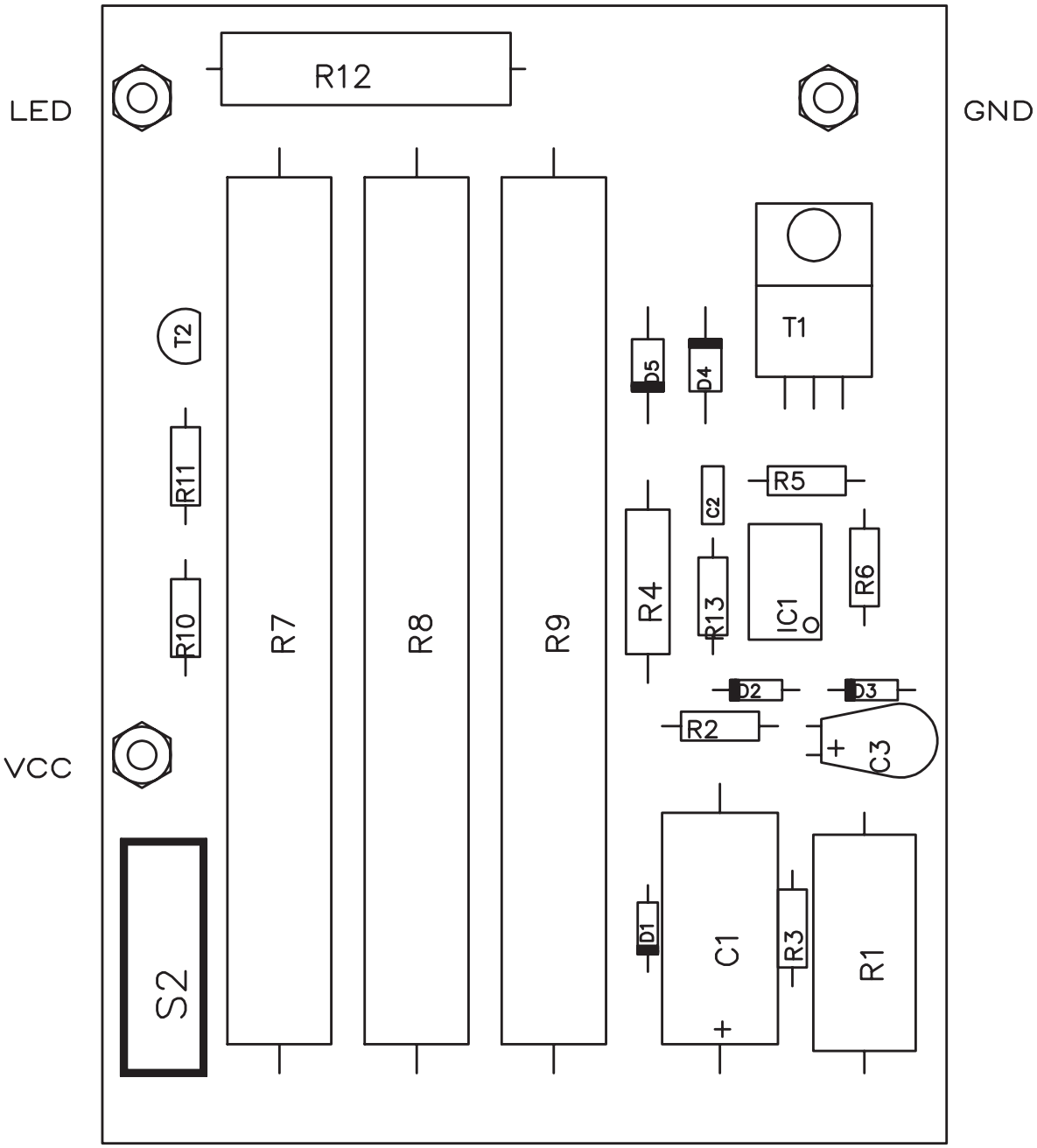


V.6 Component layout of motherboard 67WKS

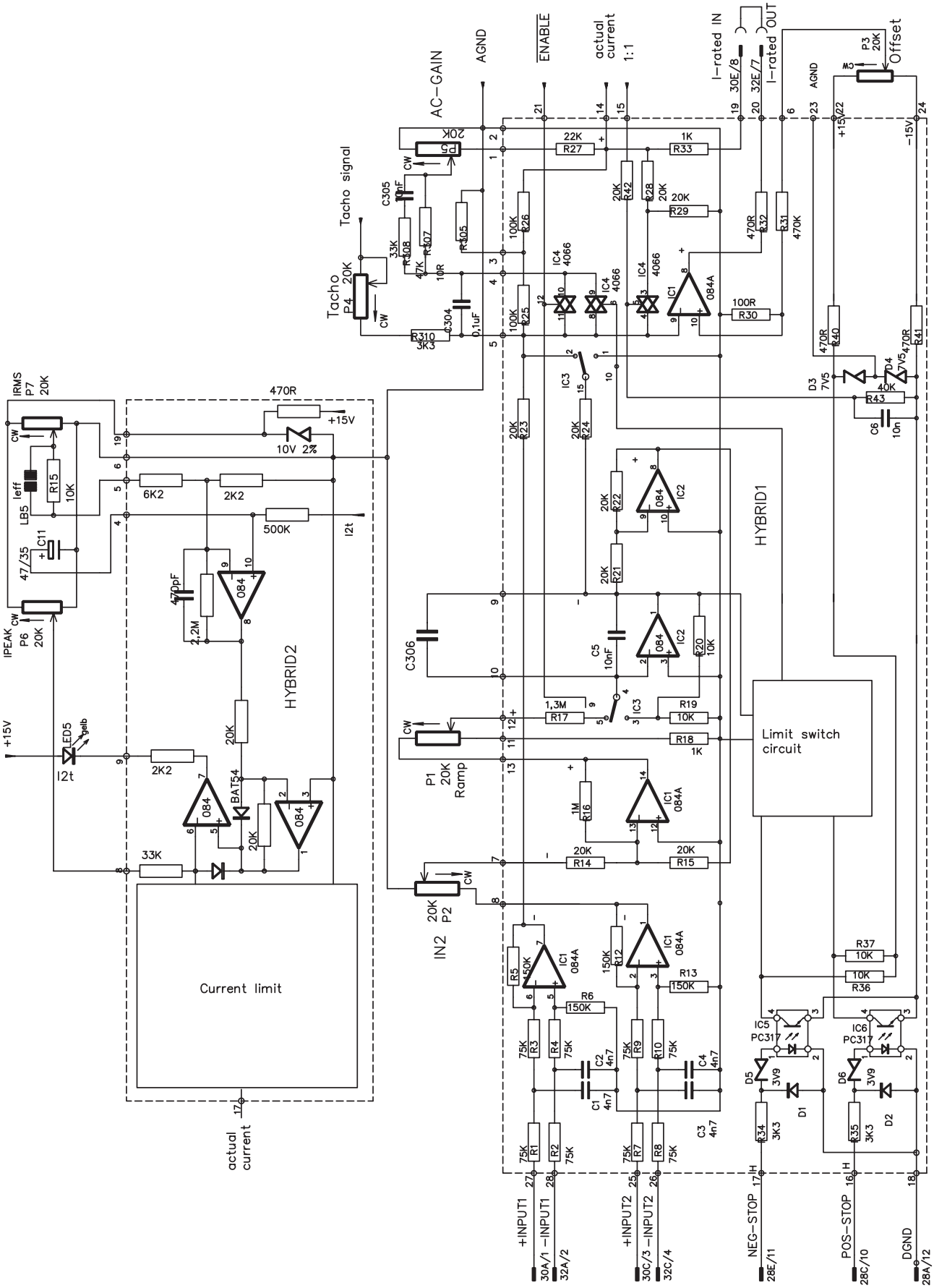


All solder straps on conductor side !

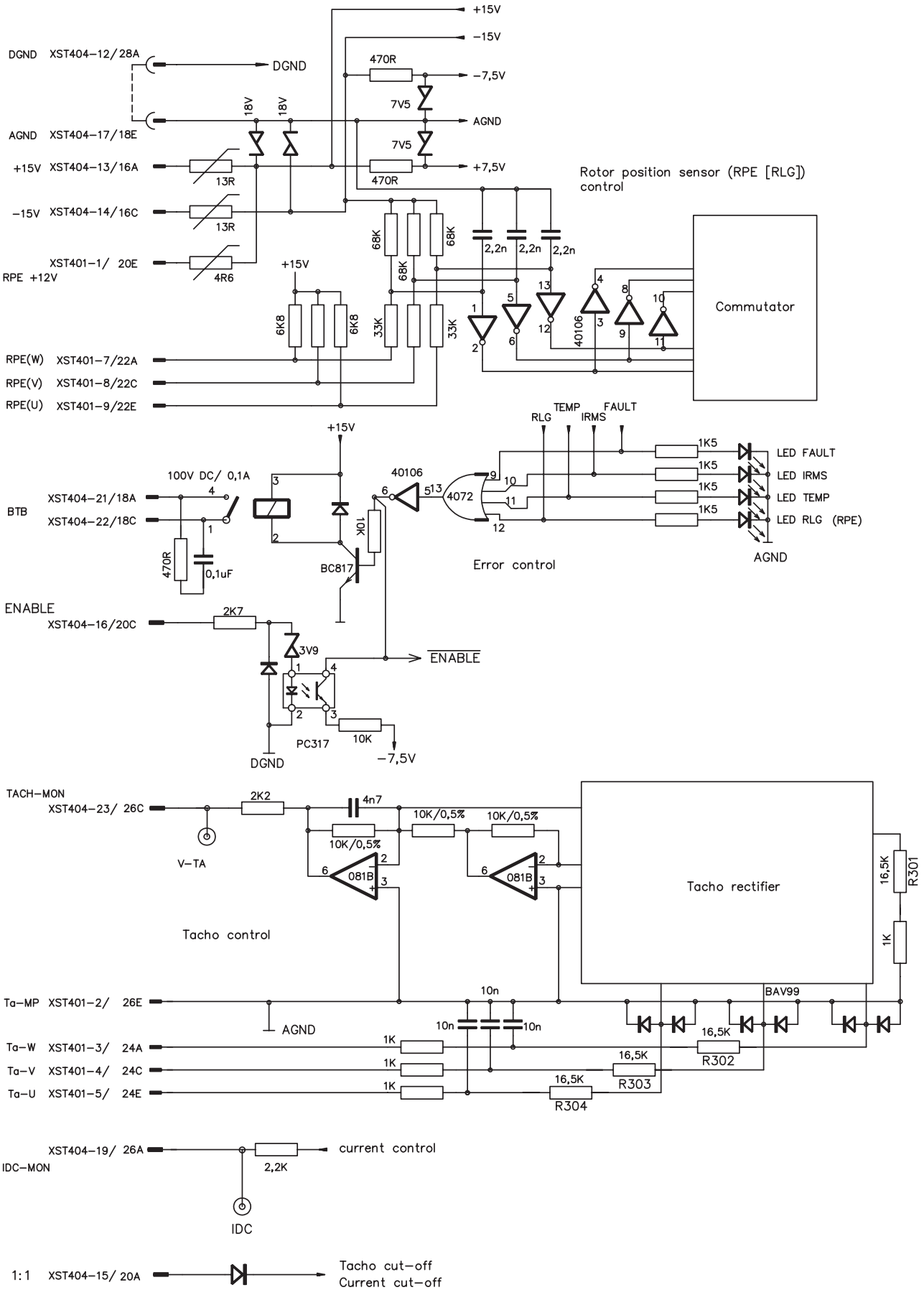
V.7 Component layout of ballast PCB 67WKS



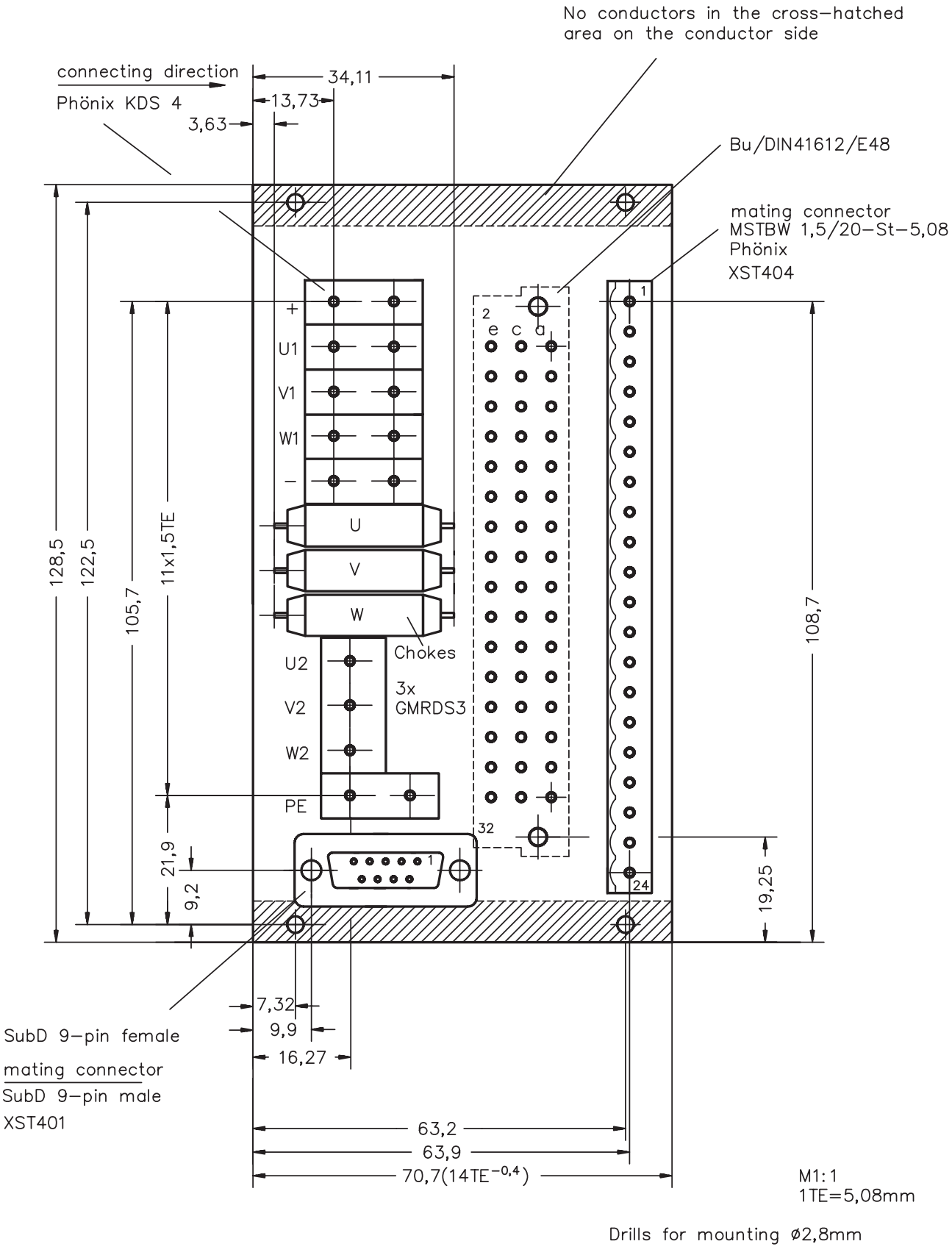
V.8 Speed control circuit 67 WKS (hybrid)



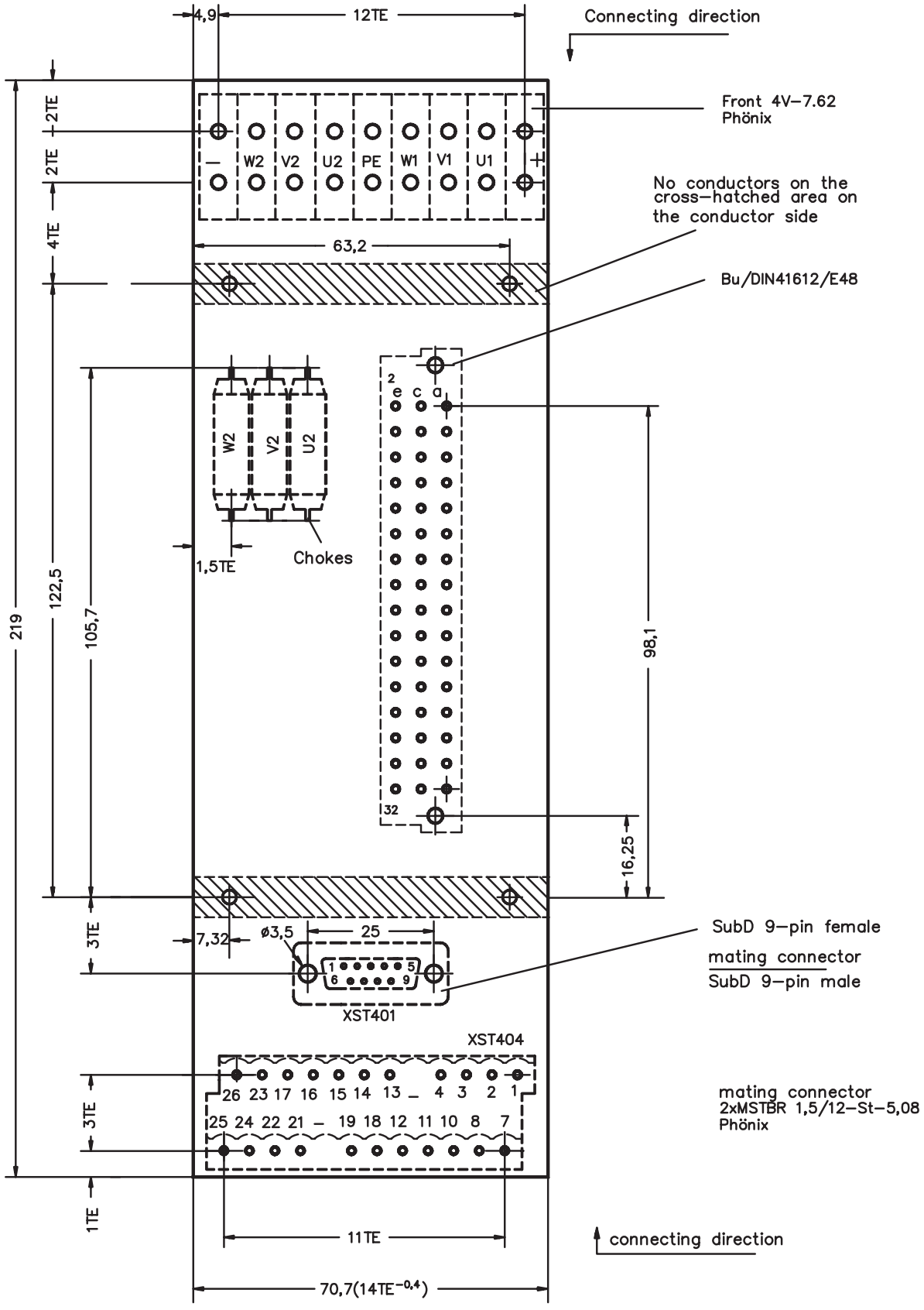
V.9 RPE, TA, input circuits 67WKS (hybrid)



V.10 Backplane F67WKSMB

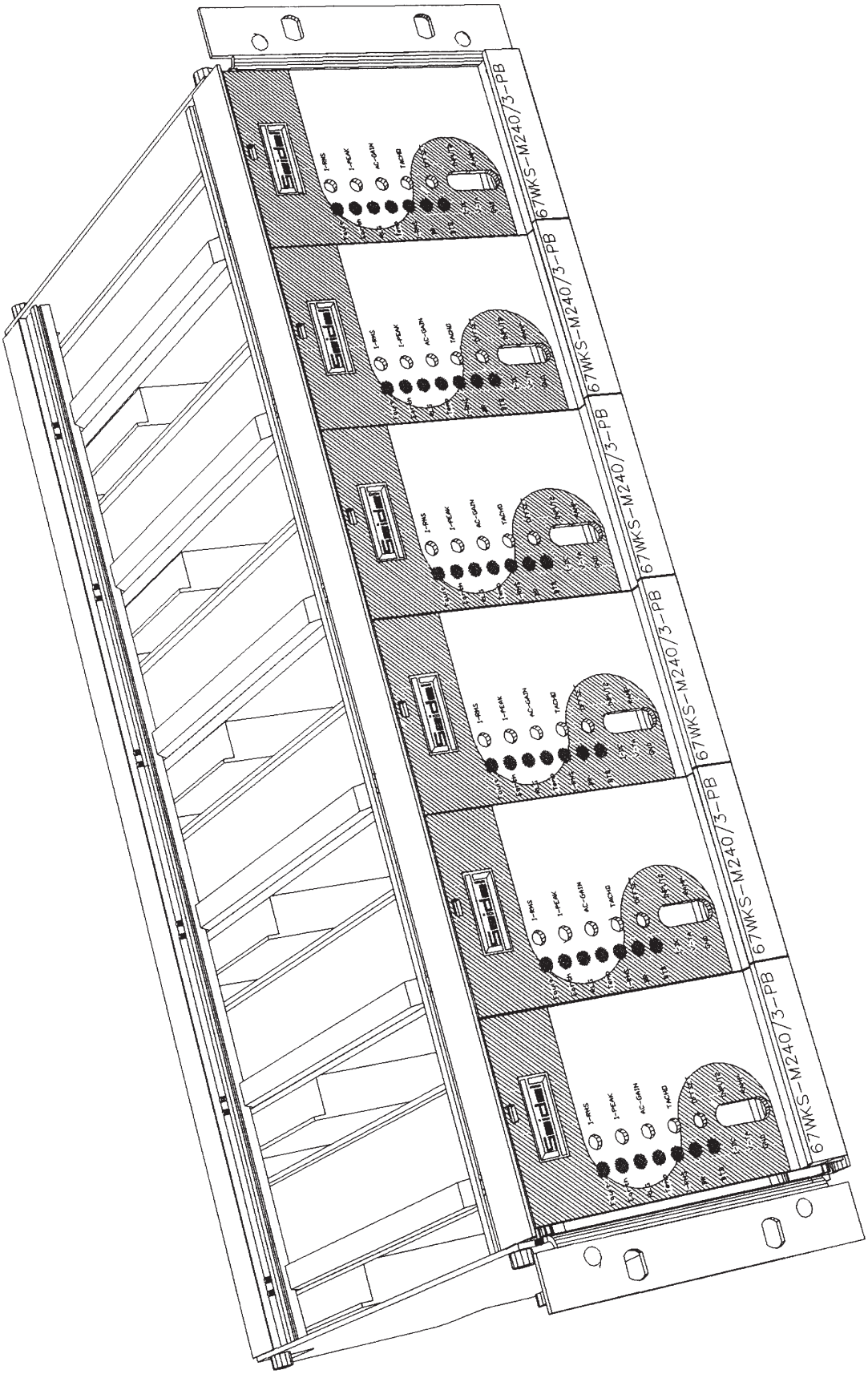


V.11 Backplane R67WKSMB

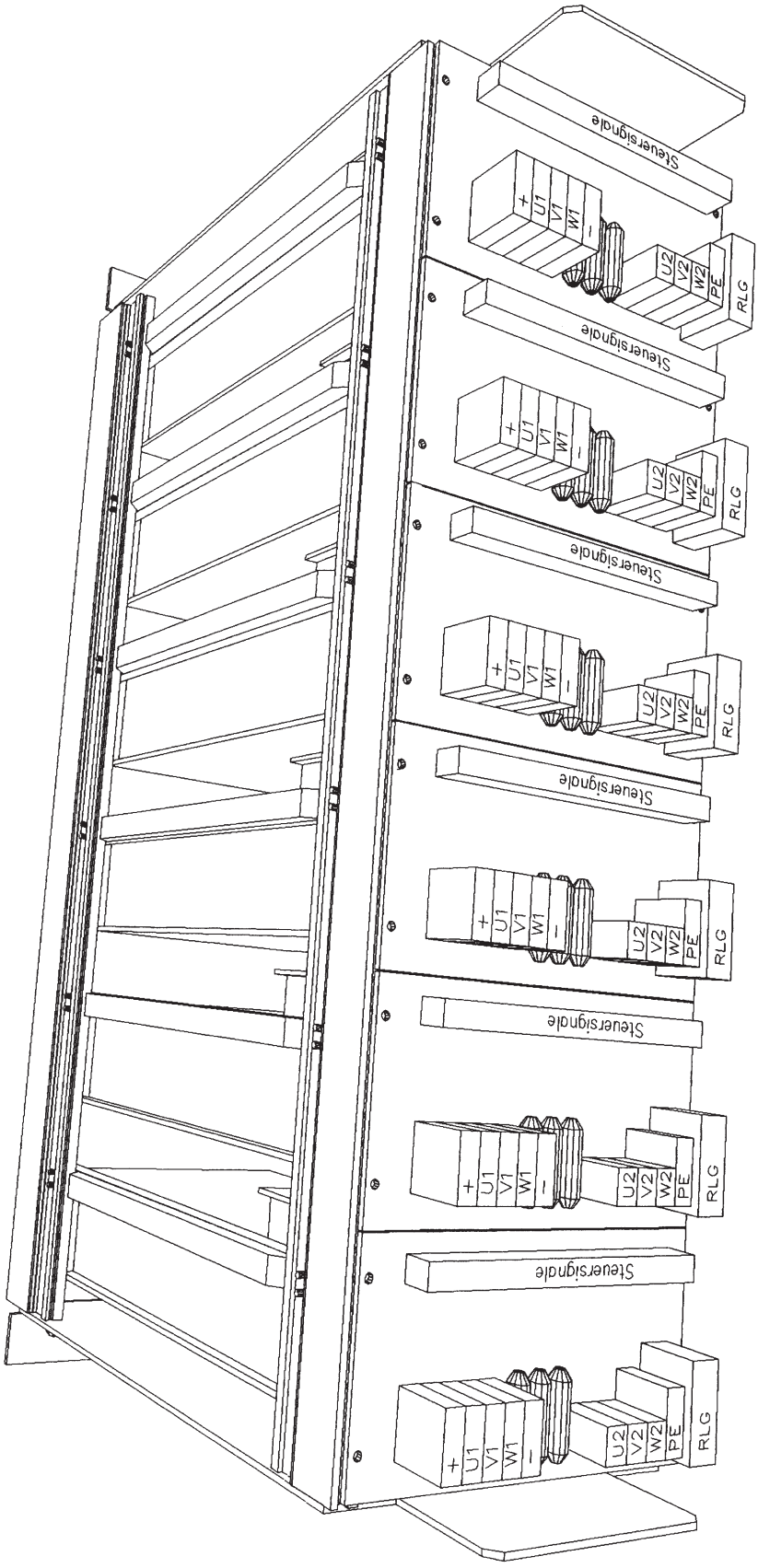


M1:1,5
1TE=5,08mm
Drills for mounting ø2,8 mm

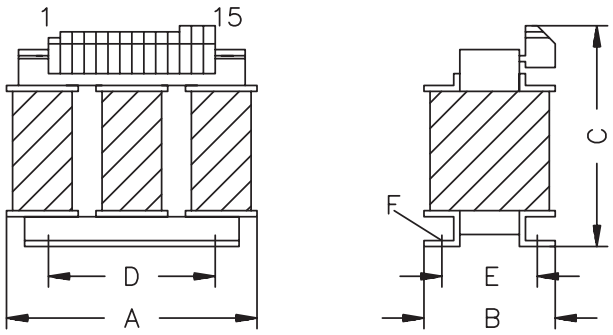
V.12 19" shelf comprising 67WKS, front view



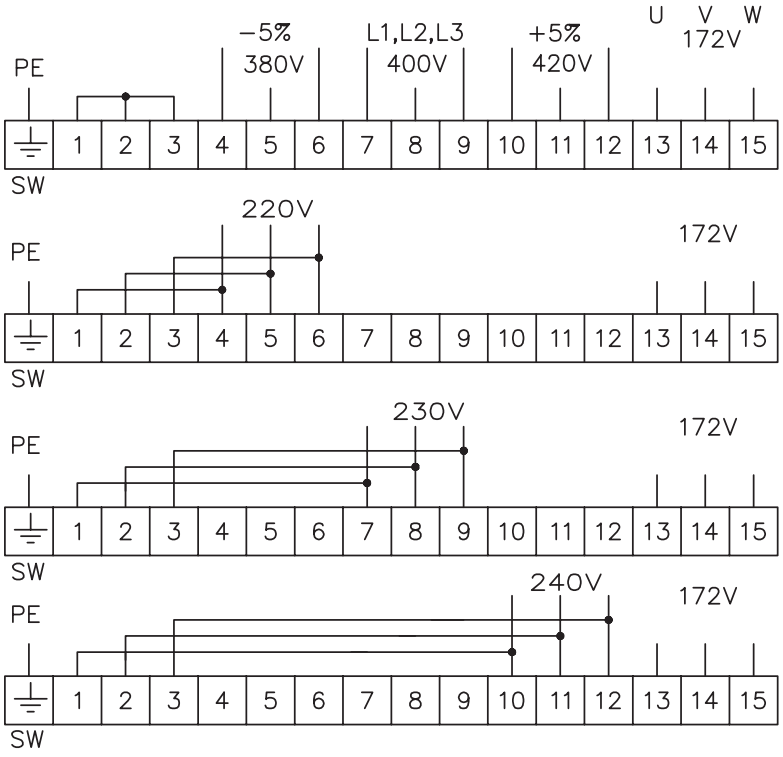
V.13 19" shelf comprising 67WKS, rear view



V.14 3-phase isolating transformers for 67WKS



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
3T3,0K-240	3	300	155	310	200	92	10x15	35,0



Other primary voltages available on special order

Ordering informations

3T 3,0K-240

- 3T — 3-phase Isolating transformer with shielding, Uk=4%
- 3,0 — Power in kVA
- K-240 — DC-voltage in intermediate circuit 240 means 172V secondary voltage

VI Appendix

VI.1 Ordering information

Name, part	Order No. Material No	Equipment, description
Transistor inverter		
67WKS-M240/3-PB	71927	Power supply, ballast circuit, 1 ferrite core
67WKS-M240/3-P0	72195	Power supply, no ballast circuit, 1 ferrite core
### Please quote the motor type used when ordering equipment.		
Backplanes		
F67WKSMB	71928	Short backplane, rear terminals
R67WKSMB	71929	Long backplane, front terminals
### Combicon connector (XST404) is part of the scope of supply		
Cable		
RPE cable for SM35	70597	Length 5 m, completely terminated
RPE cable for SM35	71662	Length 10 m, completely terminated
Power cable for SM35	71597	Length 5 m, terminated
Power cable for SM35	71675	Length 10 m, terminated
RPE cable for SM45	67405	Length 5 m, completely terminated
RPE cable for SM45	68004	Length 10 m, completely terminated
Power cable for SM45	67429	Length 5 m, terminated
Power cable for SM45	70707	Length 10 m, terminated
### other lengths on request		
Connectors		
Sub-D, 9-pin (XST401)	63626	Mating connector (pins), shell, solder contacts
RPE connector for SM35	70283	Type Souriau, solder contacts
Power connector for SM35	71598	Type Souriau, solder contacts
RPE connector for SM45	66627	Type Interconnectron, solder contacts
Power connector for SM45	66626	Type Interconnectron, solder contacts

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