ANTRIEBSTECHNIK
tae

TA-1.1...8.1

Instruction and Operating Manual

CAUTION:

As with any form of electrical equipment, there is always a risk involved in the handling of electrical machinery. The greatest care must always be exercised during installation and maintenance, and it is recommended that service is performed by authorized personnel only.

Pikatron GmbH• division TAE Antriebstechnik • Raiffeisenstrasse 10 • D-61250 Usingen

Stand 25.01.2000 V-5 ETA-11-81.PMD The German text applies in cases of doubt

About This Instruction Manual

If you look for some definite topic you can use the table of contents at the beginning of these instruction and operation manual.
In these instructions is a row of symbols which shall provide you with a fast orientation and show the importants.

NOTE:

After production all units are subjected to a quality control and an extensive functional test, including a continuouse operation for 200 hours. Before delivery all units are again tested for their correct functioning.
These extensive tests will assure that all supplied units are in perfect functional condition. If these units are installed, adjusted and operated according to the instructions of this manual malfunctions are not to be expected.
Should despite of our preliminary tests any problems arise, please contact the manufacturer or one of his subsidiaries.

Table of content

1. Instructions of Safety 4
1.1 Instructions and Rules 4
1.2 Norms and Directives 4
1.3 EMC and SCR-Controller 6

2. Technical data 6
2.1 Equipment 6

3. Installation 7
3.1 Mechanical Installation 7
3.1.1 Type of housing enclosure 7
3.1.2 Instructions for mounting 7
3.1.3 Dimensions 7
3.2 Elektricaly Installation 9
3.2.1 Supply wiring 9
3.2.2 Motor supply and control wiring 9
3.2.3 Grounding requirements 10
3.2.4 Several control units 10
3.3 Connection of the drive control 11
3.3.1 Power connections 11
3.3.2 Control connections 12
3.3.3 Connection diagram Control board LP1 13

4. Layout of Control board LP1 14
4.1 LED-Indicators-Control board LP1 14

5. Setting the drive parameters 15

6. Layout of the Driver board LP2 17
6.1 Internal-Fuses 17

7. Configuration of the Controller 18
7.1 Configuration by using a PLC or manual controlling 18
7.2 Configuration by using blocking protector (option) 18
7.3 Configuration by armature feedback control 18
7.4 Configuration by tachometer feedback control 19

8. Functional tests and initial operation 20

9. Trouble shooting 21

1. Instructions of Safety

Notes and useful informations which shall make the operation easier.
Before you put the device into operation, please read this instruction and operation manual completely. The operation should only be done by qualified personnel.
The precautions and warnings must be observed at the operation of the device.

Caution - Danger !
Note, disregard means a danger for the operator
Disconnect unit from mains before making any repairs. After the installation make sure that the unit and motor is properly grounded in order to avoid electrical hazzards. Do not connect or disconnect the device when it has power.

1.1 Instructions and Rules

These guidelines for installation have been compiled with regard to the following standards:
DIN VDE 0100 Erection of power installations with nominal voltage up to 1000 V
VDE 0113 Electrical equipment for machines
VDE 0160 Electronic equipment to be used in electrical power installations
VDE 0470 (part 1) Protection by frame

1.2 Norms and Directives

Declaration of manufacturer

EMC directive

The EMC directive of November 9th 1992 concerning the electromagnetic compatibility with reference to the EMC directive EMCD 89/336/EWG is a national law. This directive distinguishes between two criteria: Product components and product distribution.

According to these criteria, our products are classified as follows:

- Product components: Parts from suppliers which are inoperative on their own.
- Product distribution: Not commonly available, sold to qualified persons.

The law states that an EC-declaration of conformity, as well as a CE-marking, is not required for such components.

In order to meet the requirements of the EMC-directive we supply the following:

- Productrelated documents which describe the interference radiation of our products. This information will enable the user to provide all necessary steps to meet the EMC-requirements during planning and installation.
- EMC-specific components such as filters, chokes, shielded wiring, metal enclosures and others are available from TAE. TAE will furthermore provide specific technical information concerning the proper use of such components for their products in order to meet the requirements of the harmonized standards.

It is the users responsibility to carry out our instructions and to use adequate provisions. The user is also responsible that his machine and installation meets the requirements of the EMC-standards.

Based on the EMC directive and its corresponding standards, we have carried out extensive measurements at our premises. These tests have included our complete product line. With the use of filters and proper wiring all our products meet the requirements of standard EN 50081-2 (sweep radiation) and standard EN 55011 class A for industrial use.

Low Voltage Directive
Referring to article 2 only those devices may be introduced which meet "the state of safety technique in the community".
Using a QM system, TAE is watching all steps from development to production of the device. So all norms and directives can be fulfilled referring to this aspect of safety.

Improper installation can lead to exceeding the maximum limits of EMC and to a malfunction of devices of other manufacturers.

CE-marking
The CE-marking indicates the conformity of the drive to the european norms and directives.
The fulfillment of the norms and directives is only guaranteed if:

The regulator is fitted out with a EMC filter which is tested by the manufacturer.

You exactly follow the Instructions for installation.

The instructions and safety rules in this manual have been compiled with regard to the following standards:

EN 60204-1 (VDE 0113: 1992-1)	Electrical equipment for machines
EN 60529:1991 (VDE 0470 Part 1)	Protection by frame
DIN EN 50178 (VDE 0160-1994-11)	Electronic equipment to be used in electrical power installations
DIN VDE 0100	Erection of power installations with nominal voltage up to 1000 V
DIN VDE 0110	Dimensioning of clearances and creepage distances
DIN 40050	(IP-International Protections)
EN 50081/50082	EMC general rules

1.3 EMC and SCR-Controller

If SCR-Control units are used, the following instructions must be regarded.
These instructions base on our EMC measurements and the instructions for installation must exactly be followed:
Line Filter (refer to chapter 3.2.1)
At all SCR-Controller are line filter necessary.
Line chokes (refer to chapter 3.2.1)
Smoothing chokes (refer to chapter 3.2.2)
At 6-pulse controllers (TA...6P) in armature circuit no smoothing choke is necessary.
Motor cable (refer to chapter 3.2.2)

2. Technical data

Controller	**TA-1.1**	**TA-2.1**	**TA-4.1**		**TA-6.1**		**TA-8.1**	
Line voltage	230VAC	230VAC	230VAC	400VAC	230VAC	400VAC	230VAC	400VAC
Semiconductor- Fuse	16A	25A	32A		40A		50A	
Power	1KW	2KW	3KW	4KW	4KW	6KW	5KW	8KW
Armature voltage	180V	180V	180V	280V	180V	280V	180V	280V
Armature current	max.10A	max.20A	max. 25A		max. 34A		max. 40A	
Field voltage	210V	210V	210V	370V	210V	370V	210V	370V
Field current	max. 2A							
L1 - N	external field supply							

Weight	1920g	1920g	2600g	3950g
Type of protection	IP 00 - for switch cabinet mounting			
ambient temp.	0-40°C			
Speed deviation	with armature-feedback 3%			
	with tachometer-feedback 1%			

2.1 Equipment

- ❒ Electronic circuit galvanically isolated if system tachometer-feedback
- ❒ Control board disconnects from driver board with multiconductor flat cable plug-in system
- ❒ Thyristor-control by puls-pack
- ❒ Control inputs (jog-speed and run) potential free
- ❒ Semicontrolled singel phase bridge utilizes
- ❒ Inner loop current regulator
- ❒ Acceleration and deceleration integrator
- ❒ Torque control
- ❒ Blocking Protector (option)

3. Installation

Our products are carefully designed and constructed in order to reduce outgoing and incomming radiation interferences. These guide lines should be carefully observed for a correct installation and to meet the EMC-standards. Incorrect installation may lead to malfunction and to exceed the EMC-limiting-values.

3.1 Mechanical Installation

3.1.1 Type of housing enclosure

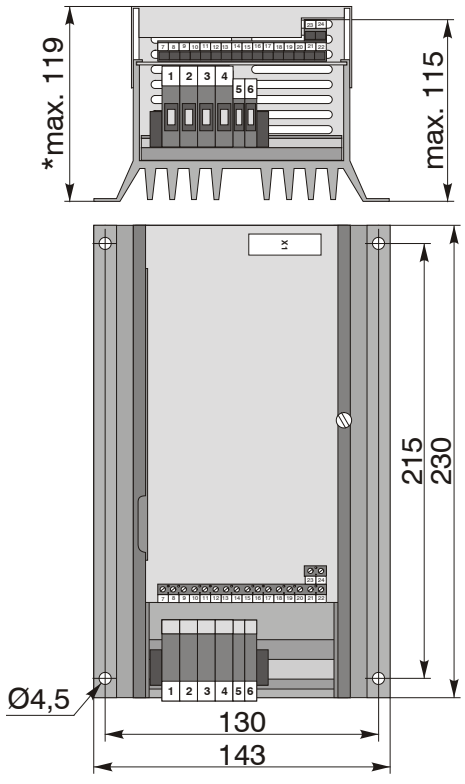
The TA-1.1...8.1 controllers are designed to enclosure class IP00 for switch cabinet mounting.

3.1.2 Instructions for mounting

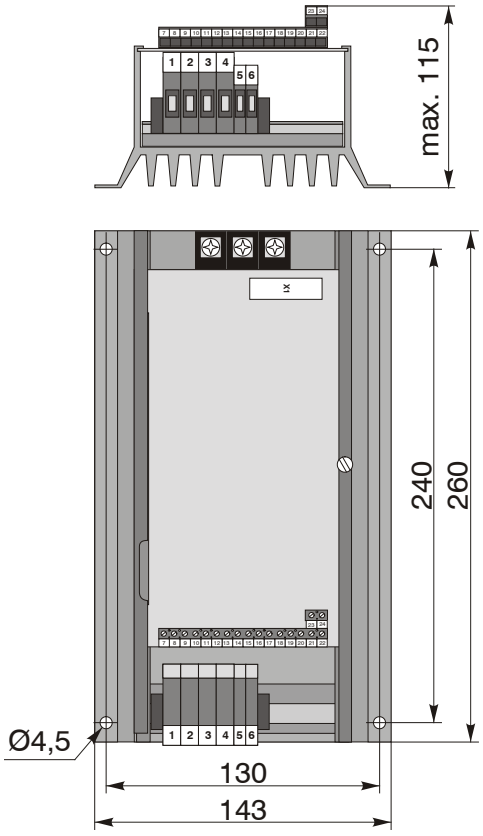
The control unit and the filter are to be installed on a common grounded panel. This panel should prefereably consist of a good conductive material and should not be laquered or painted. (galvanized)
All TA-1.1...8.1 controllers are to be mounted in a vertical position with 4 screws.
The location where the unit is mounted should be free of dust, moisture and aggressive vapours.
If the unit is installed in a switch cabinet, suitable ventilation for heat dissipation must be provided. The power data sheet shown in the technical data for the controller refer to a internal switch-cabinet-temperature of 0-40°C.

3.1.3 Dimensions

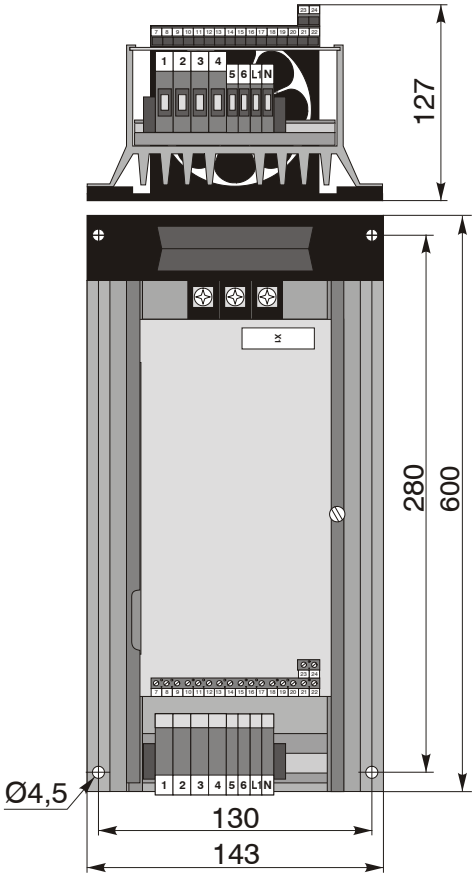
Unit dimensions TA-1.1...4.1
*Option with cover hood



Unit dimensions TA-6.1



Unit dimensions TA-8.1



3.2 Elektricaly Installation

3.2.1 Supply wiring

The installation of the supply wiring should provide interconnecting points on a possible large surface.
Single stranded conductors with simple clamp connections must be avoided. Prefereably are multi stranded conductors with squeeze-on connections. Also line bars with screw-on connections are suitable.
The wiring inside of the control box must be kept as short as possible. Short wiring from the supply line to the filter and from the filter to the control unit (refer to chapter 3.3.1) reduce feedback interferences into the supply line circuit.

Line chokes
By all SCR-Controllers are line chokes necessary. At single phase controllers are two line chokes also necessary.
The line chokes can be wound on the same core, but the inductivity at each single line choke must be keeped.

3.2.2 Motor supply and control wiring

One of the main reasons for radiated and line induced interference is caused by the connection between the control unit and the motor. The connection should be shielded and the wiring should be kept as short as possible (refer to chapter 3.2.3).
If SCR-Controls are used, two smoothing chokes must be installed in the motor supply line.
The distance between the chokes and controller should be kept as short as possible.(refer to chapter 3.3.1)
Control wiring for the motor, such as feedback wiring is very sensitive for interfereces. This wiring should not run parallel with the motor supply wiring. If this for some reasons cannot be avoided a minimum spacing of 20 cm between these wirings must be maintained in order to obtain a reasonable damping.

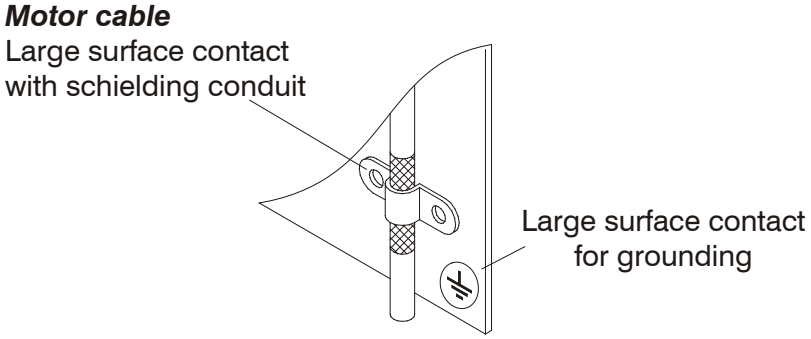
3.2.3 Grounding requirements

All conductive metal enclosures must be interconnected with suitable wiring. The safety requirements with regard to faults at 50Hz require certain minimum wire gauges which must be used for these interconnections.

In case of faults, such as loss of one phase or an extreeme unsymmetric three phase system it is possible that the filter can cause creepage currents up to 100 mA. For this reason filters and controls with integrated filters must be grounded before the system is switched on.

In addition to the above mentioned grounding conditions further steps must be observed in order to lead away high frequency currents:
All ground wiring must be kept as short as possible. Poor connections and wire loops act as aerials which could induce radions into the supply line and thus could cause malfunctions.

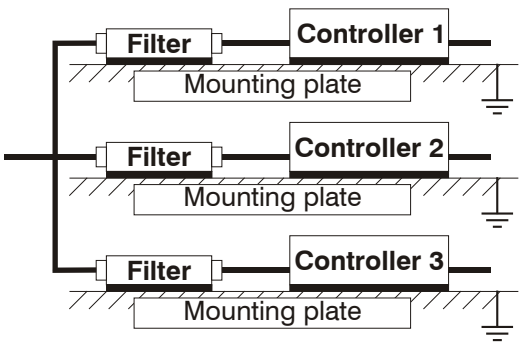
Shielding must cover large areas and provide a radial coverage. Shielding should not be extended by means of wiring. Shielding must also reach into the terminal box or the enclosure of the connectedoperating unit. The connection of the shield on the motor side could be directly at the PG-bolts. In this case the shield is wrapped over the bolts and then fastened with a clamp. On the control unit the shield is help with a metal clamp and pressed with a large contact surface against the conductive housing. (see picture)



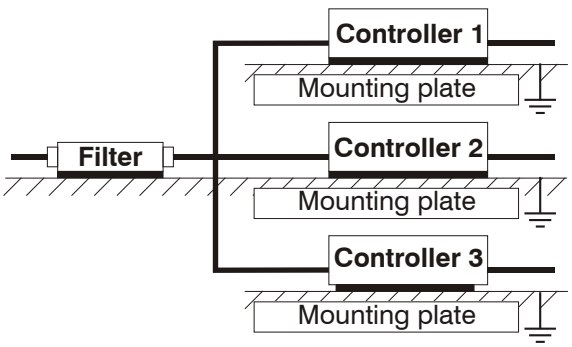
3.2.4 Several control units

If several control units are used it is necessary to use seperate filters for each control unit

Good example



Bad example



3.3 Connection of the drive control

Ensure that the voltage shown on the type-marking corresponds to your a.c. line voltage

3.3.1 Power connections

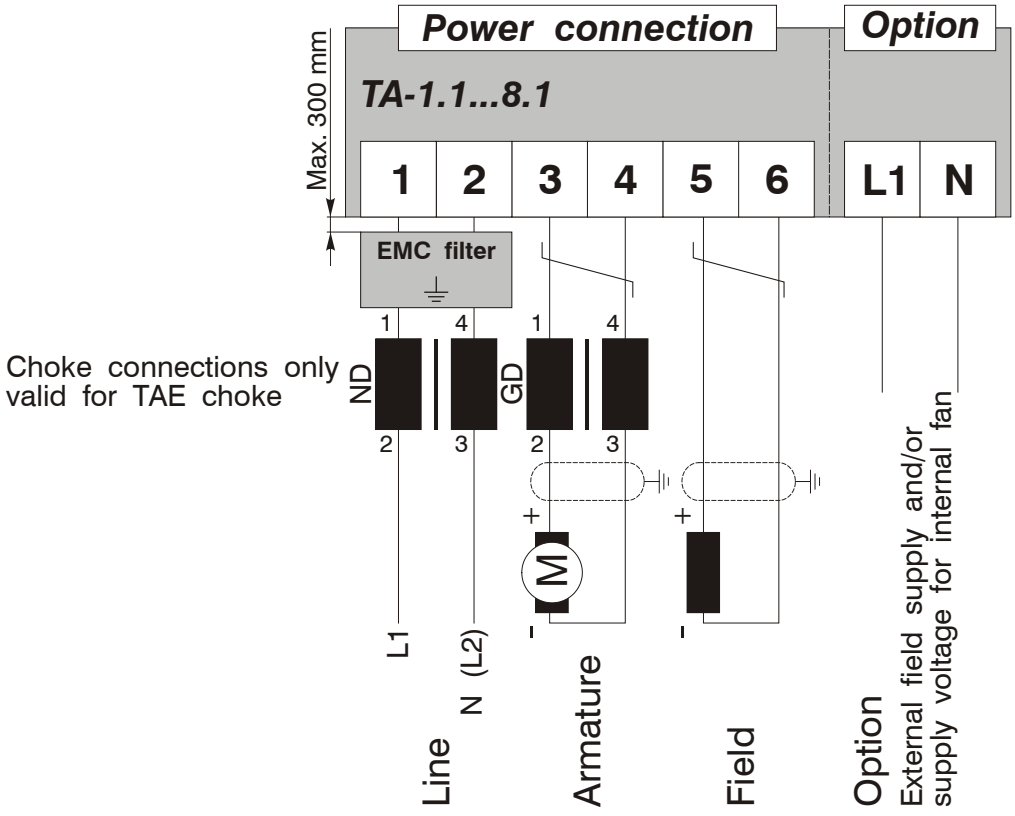
1 - 2 Input from mains - voltage according to type-marking

TA-1.1..TA-8.1 230VAC-50/60Hz	-	terminal 1	=	L1 (phase)
		terminal 2	=	N (MP)
TA-4.1..TA-8.1 400VAC-50/60Hz	-	terminal 1	=	L1 (phase)
		terminal 2	=	L2 (phase)

3 - 4 Armature connection.....terminal 3 = A+
terminal 4 = A-

5 - 6 Field connection.....terminal 5 = F+
terminal 6 = F-

L1 - N external field supply and/or supply voltage for internal fan
(Option "external field supply" only)



3.3.2 Control connections

Caution !
at armature voltage control, the control board have line potential

7	Output actual current (0-5V refers to 0-Imax)	terminal 7 =	positive
		terminal 15 =	negative

8 Jog-speed

9 Rated value input without accel.-/deceleration (positive) for slave-system Input voltage depends on rating of resistor R56, however max. voltage 200VDC. Input current approx. 1mA at max. motor speed

R56 (KΩ)=UE (Volt) - 8,2 — UE=Input voltage

Factory adjustment:
R56=1,8KΩ : Input voltage 10V

10 Connection for external Blocking Protector

11 Output - rated current
12 Input - rated current
for speed controlling terminals 11 and 12 must be jumpered.

13 - 14 AC-tachometer input

15 - 16	DC-tachometer input	terminal 15 =	positive
	Matching of tachometer refer to chapter 7.4	terminal 16 =	negative

17 - 18 - 19 Potentiometer for rated value
This potentiometer enables an infinite variable adjustment of the motor from minimum to maximum speed.

Potentiometer connection:	terminal 19 =	start
	terminal 17 =	end
	terminal 18 =	center

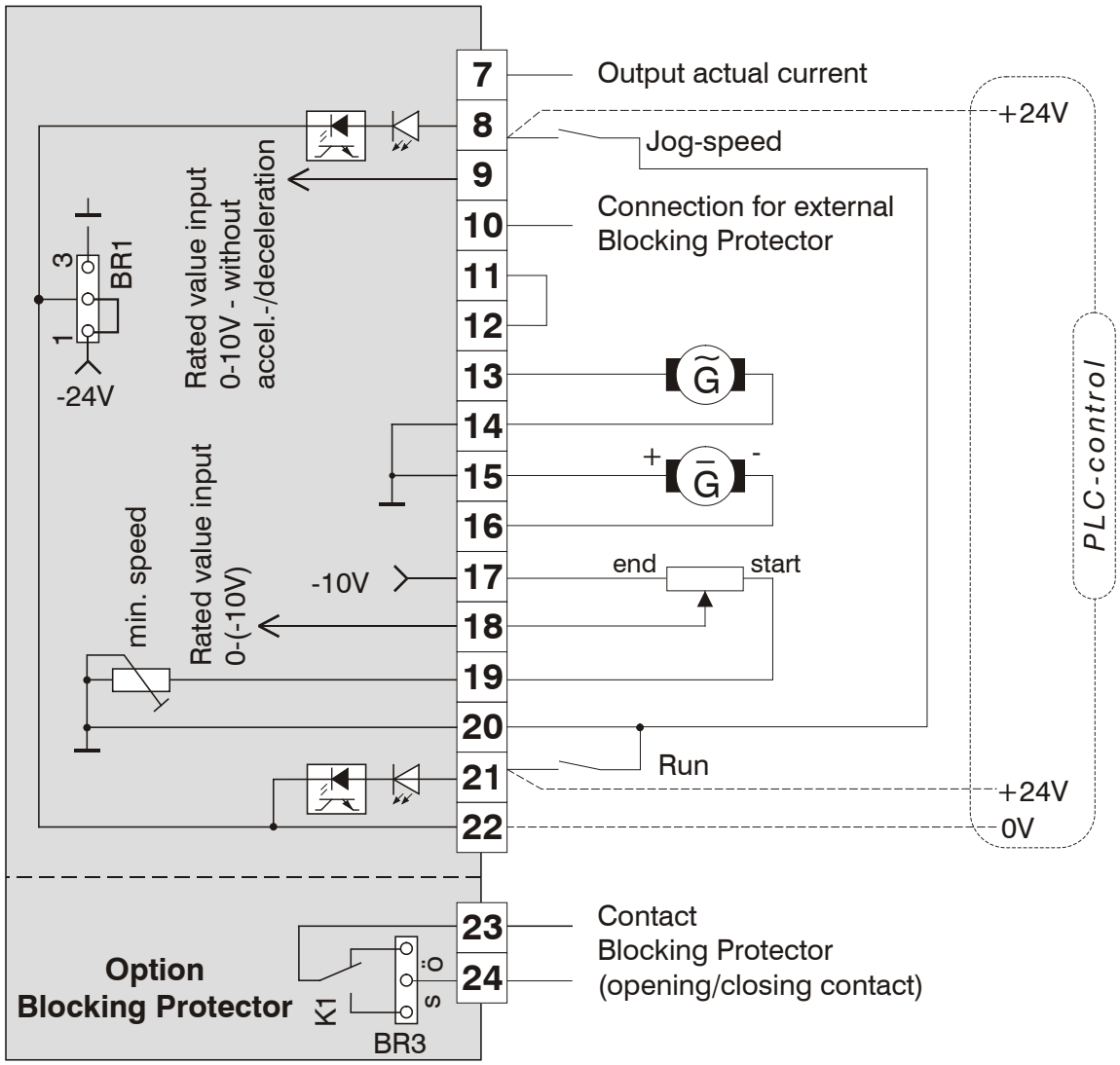
20 Electronic common

21 Run (contact closed = drive released)

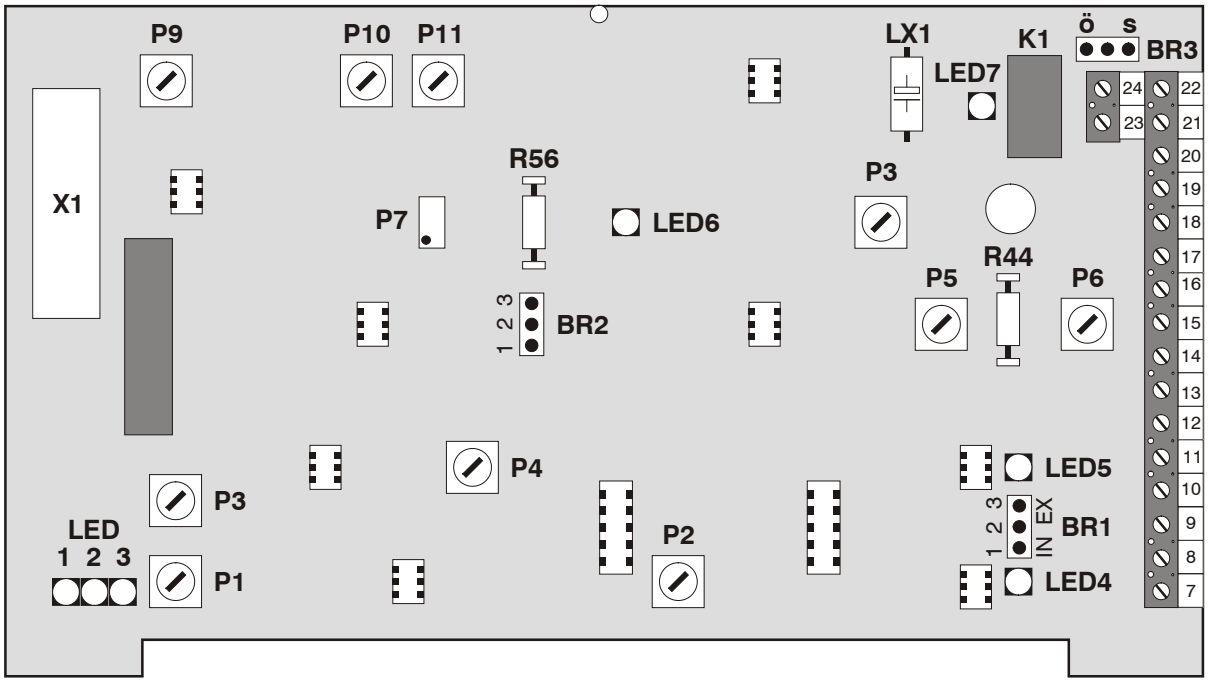
22 Common point for PLC-control (jog-speed & Run)

23 - 24 Blocking signal (alternatively opening/closing contact, refer to point 7.2)
(Option "Blocking Protector" only)

3.3.3 Connection diagram Control board LP1



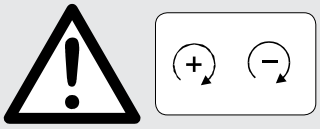
4. Layout of Control board LP1



4.1 LED-Indicators-Control board LP1

LED 1	green	Current supply +15VDC
LED 2	green	Current supply -15VDC
LED 3	clear	SCR triggering
LED 4	yellow	Run
LED 5	yellow	Jog-speed
LED 6	red	Current limit/over speed
LED7	green	Blocking signal (LED7 extinguish if a blocking signal exist)

5. Setting the drive parameters



These two symbols shows, if the value of the adjustable parameter will increase (+) or decrease (-) by turning the potentiometer in clockwise direction.

P1 (−) **Acceleration**
The adjustable range of the potentiometer P1 responds to an acceleration time of approximately 2 sec to 20 sec. The adjustable time advance for the linear acceleration is the time which is needed for the drive to accelerate from 0-speed up to the maximum speed.

P2 (+) **Jog-speed**
Adjustment of the requested jog-speed.

P3 (−) **Deceleration**
The adjustable time (2-20sec) for the linear deceleration is the time which is needed for the drive to decelerate from the maximum speed to 0-speed. The deceleration is only effective at change of rated value. At locked drive control the motor will decelerate at coast rate. The adjusted time cannot be less than the coasting time of the motor and the machine.

P4 (+) **Stability**
Adjustment of the dynamical amplification.

P5 (+) **Maximum speed by tachometer feedback (speed limit)**
The maximum speed for operation is adjusted with potentiometer P5 at rated value (-10V).

P6 (+) **Minimum speed**
Adjustment of the minimum speed during operation. (this adjustment is only possible if the potentiometer for the reference value is connected to terminal 19 on the control board LP1).

P7 **Zero-current**
Do not attempt to change the zero-current setting !!!
(This potentiometer is adjusted and sealed by the manufacturer)

P8 (−) **Triggering time of the Blocking Protector** *(Option "Blocking Protector" only)*
This potentiometer adjust the triggering time of the blocking signal, that means, that the drive have to block x seconds bevor the blocking signal on terminal 23/24 exist. The adjustable range of the potentiometer P8 responds to an triggering time of approximately 2 sec to 20 sec.

P9 (+) **I x R Kompensation**

This control enables to compensate for the voltage drop in the armature and in the supply line. When the potentiometer is turned clockwise, the speed under load will increase. Check for an approx. equal speed with and without motor load in the lower speed range. *If the compensation control is set too high, the drive will become unstable.*

When tachometer feedback is utilized, set this potentiometer fully counterclockwise.

P10 (+) **Current limit**

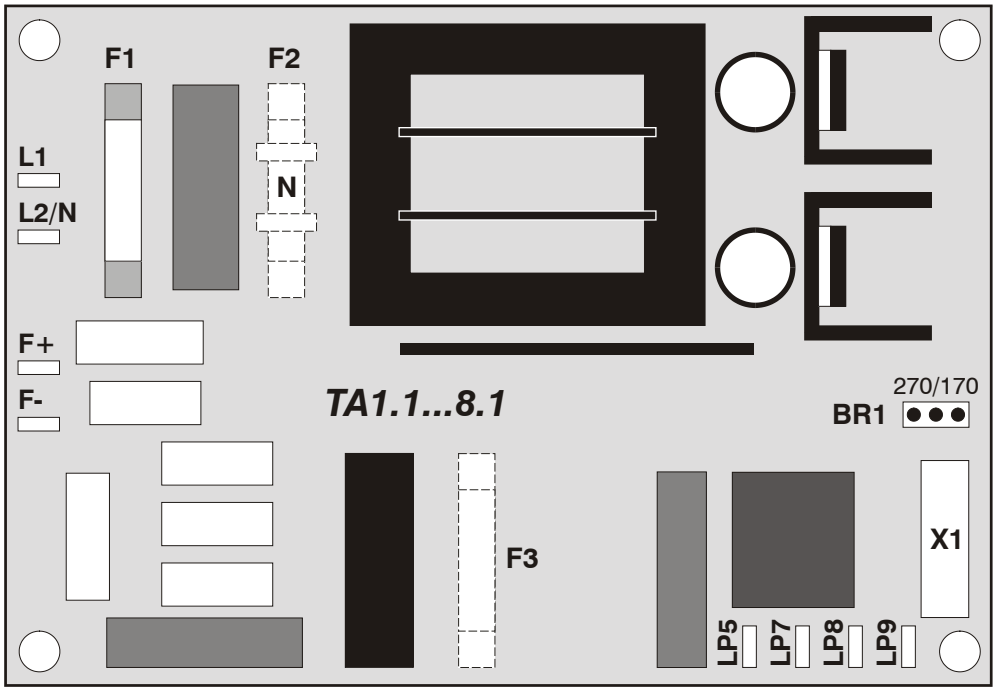
This potentiometer limits the armature current. The current limit is normally adjusted for the rated motor current. For checking the motor current limit disconnect the motor field and block the motor. Measure the current in the armature line at maximum rated value (-10V) and adjust the requested maximim current with potentiometer P10. The LED6-red-(current limit) must light up.

Caution: This adjustment must be performed within 10 secound otherwise damage to the commutator is possible.

P11 (+) **Maximum speed by armature feedback (speed limit)**

The maximum armature voltage (maximum speed) of the motor is adjusted with potentiometer P11 at rated value (-10V). Please note, that the armature voltage does not exceed 180V (mains 230V) respectively 280V (mains 400V) because if the voltage is set too high, a control from the drive unit is impossible.

6. Layout of the Driver board LP2



6.1 Internal-Fuses

F1 Fuse for phase L1 .....*30,0x5,0 fast 2,5A/500V~*

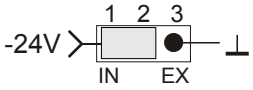
F2/N F2 - by TA-4.1...8.1 (2-phase) .....*30,0x5,0 fast 2,5A/500V~*
N - by TA-1.1...8.1 (1-phase) .....Soldering bridge

F3 Short ground fuse by armature feedback. By using tachometer feedback this fuse must not be .....installed. *30,0x5,0 fast 0,1A/250V~*

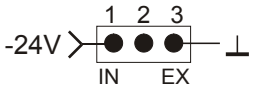
7. Configuration of the Controller

7.1 Configuration by using a PLC or manual controlling

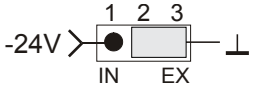
With jumper BR1 on the Control board LP1 you can realize following functions:

BR1/LP1 

RUN/Jog-speed enables with a switch

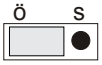
BR1/LP1 

RUN/Jog-speed enables with a SPS (potential free)

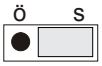
BR1/LP1 

RUN/Jog-speed enables with a SPS (not potential free)

7.2 Configuration by using blocking protector (option)

BR3/LP1 

blocking signal - relay contact as "opening contact"

BR3/LP1 

blocking signal - relay contact as "closing contact"

- By installing a Tantal-capacitor LX1 on the control board LP1, you get a additional delay in triggering time of the blocking signal. (refer to potentiometer P8, chapter 5.)

7.3 Configuration by armature feedback control

Caution !
at armature voltage control, the control board have line potential

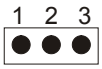
The position of jumper BR1 on the Driver board LP2 depend on the armature voltage that you use. Jumper BR2 on the Control board LP1 must not be installed.

BR1/LP2 

position of jumper by a armature voltage of 180V (230VAC mains)

BR1/LP2 

position of jumper by a armature voltage of 280V (400VAC mains)

BR2/LP1 

Jumper must not be installed by using armature feedback control.

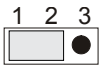
- Furthermor you have to install fuse F3 on the Driver board LP2.

7.4 Configuration by tachometer feedback control

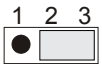
Jumper BR1 and fuse F3 on the Driver board LP2 must not be installed. Jumper BR2 on the Control board LP1 depend on the tachometer that you use.

BR1/LP2 

Jumper must not be installed by using tacho-feedback control.

BR2/LP1 

position of jumper by using an AC or DC-tachometer. The tachometer inputs (terminal 13-14 and 15-16) are bipolar.
To match the tachometer use ***formula A.***

BR2/LP1 

position of jumper by using an DC-tachometer. The tachometer input (terminal 15-16) is unipolar. To match the tachometer use ***formula B.***

Make sure, that potentiometer P9 (IxR compensation) is set fully counterclockwise.

Matching of tachometer
The tachometer is matched with resistor R44 and potentiometer P5. If the factory adjusment do not meet your requirements, you have to install the resistor R44 on the control board LP1 according to formula A or formula B (depend on jumper setting).
Please note, that the tachometer voltage must not exceed 250V.

Formel A -

$$R44\ (\text{in K}\Omega) = \text{tachometer voltage (volt)} - 40$$

Factory adjustment:
R44 = 100KΩ : tachometer voltage 115V...165V

Formel B -

$$R44\ (\text{in K}\Omega) = \frac{\text{tachometer voltage (volt)} - 40}{2}$$

Factory adjustment:
R44 = 100KΩ : tachometer voltage 215V...250V

8. Functional tests and initial operation

Do not use any Megohmmeter, buzzer or similar test-instruments. All measuring instruments must be galvanically separated from mains.

1) Install and interconnect the TA-1.1...8.1 drive unit with reference to points 10 and 3.

2) Check,...
   ... if your line voltage corresponds to the voltage indicated on the type-marking of the TA-1.1...8.1 drive unit.
   ... if the unit and the motor is properly grounded.
   ... if all mounting screws are properly tightened.
   ... all connections with an Ohmmeter for possible shorts to ground.
   ... the resistance of the field winding at terminal 5 (F+) and 6 (F-).

   Reading: min.100Ohm by 230V mains. (it might be necessary to revers the polarity of the Ohmmeter)
   Reading: min.200Ohm by 400V mains. (it might be necessary to revers the polarity of the Ohmmeter)

3) Configure the drive unit with reference to point 6 (page 9-10), so that it will suit your requirements.

4) Potentiometer P1 acceleration,.....center position
   Potentiometer P3 deceleration,.....center position
   Potentiometer P4 stability,.....fully counterclockwise and then turn back approximately 90°.
   Potentiometer P6 min. speed.....fully counterclockwise
   Potentiometer P9 IxR compensation .....fully counterclockwise

5) After the drive has been connected to mains, the LED1 *-green-* (+15V) and the LED2 *-green-* (-15V) must light up. LED3 *-clear-* (SCR triggering) will briefly light up.

6) Check the field voltage at terminals 5 (F+) and 6 (F-) with a Multimeter. It should read 210V by a line voltage of 230V and 370V by a line voltage of 400V. Furthermore check the potentiometer-voltage (-10V) between terminal 17 and 19. When measuring, potentiometer P6 (min.-speed) must be set fully counterclockwise.

7) Switch on the drive unit by closing contact "RUN" (terminal 21). LED4 *-yellow-* (RUN) must light up. Slowly increase a rated value until the motor starts rotating. This will cause the LED3 *-clear-* (SCR triggering) to light up.

8) If the drive operates up to this point according to your requirements then set the requested parameters for min.-speed, max.-speed, jog-speed, acceleration and deceleration time and if necessary the IxR compensation etc.
   This concludes the preliminary steps for the operation of the TA-1.1...8.1.

9. Trouble shooting

In order to speed up the search for defective components, the drive, motor etc. please check the drive for:

a) intermittent and loose connections
b) defective insulation of connecting leads
c) defective motor (brushes etc.)

Do not use any Megohmmeter, buzzer or similar test instruments. All measuring instruments must be galvanically separated from mains. The electronic circuit carries a voltage potential against ground when drive is armature voltage feedback controlled.

❍ **Fault location**

Symptom	possible causes
Drive does not release. LED6 -*yellow*- "RUN" does not light up.	a) check lead connection ("RUN" terminal 20 - 21) b) no control voltage +/- 24V, check supply. LED1 and/or LED2 +/-15V does not light up. c) fuse F1/F2 is defective.
Output voltage does not increase when speed-potentiometer is turned up.	a) motor load is too high, drive operates at current limit. LED6-red- "current limit" lights up. b) defective speed potentiometer. c) adjustment of current limit is set too low.
Drive is unstable.	a) I x R is set too high (when armature feedback controlled). b) improper adjustment of stability potentiometer P4. c) defective tachometer or tachometer leads. d) auxiliary series winding of DC-motor is wrong connected. e) defective SCR bridge.
Main fuse blows	a) shorted or grounded armature or field connections, SCR-bridge, check field-diodes. b) defective motor or armature.

Symptom	possible causes
Drive does not run.	a) defective power supply. b) jumper 11/12 missing. c) check funktion of relay and relay control. ("RUN"-contact on terminal 20-21) d) defective speed potentiometer. e) check motor and motor brushes. f) defective fuse F1 or F2.(F2 only in existence in TA-4.1 and up)
Drive runs after control release ("RUN") at max. speed, however speed control is set in zero position.	a) intermittent min.-speed potentiometer. b) intermittent speed potentiometer or intermittent wiring from terminal 19 to potentiometer.
Drive accelerate to max.-speed after control is released ("RUN)", however adjustment is set for low speed.	a) intermittent tachometer feedback or defective tachometer. b) defective potentiometer P11 and/or P5 max.-speed. c) defective fuse F3 (only when armature feedback controlled)
Motor starts without drive release ("RUN") when connected to mains.	a) grounded armature wiring. b) defective SCR - bridge.

ANTRIEBSTECHNIK tae

Pikatron GmbH
division TAE Antriebstechnik
Raiffeisenstrasse 10
D-61250 Usingen

Tel.: +49 6081 - 583 - 445
Fax.: +49 6081 - 583 - 123
E-mail: info@tae-antriebstechnik.de
Internet: http://www.tae-antriebstechnik.de