

Manual

Classic P3

1 Quadrant
Thyristor Drive

60 to 150A

P3 60-150A

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Ausgabe
0705

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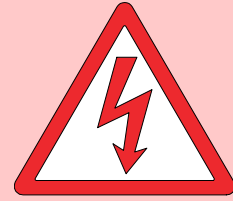
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1 Basic Information

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

ATTENTION ! High voltage



Before installation or commissioning begins, this manual must be thoroughly read and understood by the technical staff involved.

If any uncertainty arises, the manufacturer or dealer should be contacted.

P3 devices are power electric parts used for regulating energy flow.

Protection rating IP00.

Standards and guidelines

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

EU Guidelines 89/392/EWG, 84/528/EWG, 86/663/EWG, 72/23/EWG

EN60204, EN50178, EN60439-1, EN60146, EN61800-3

IEC/UL IEC364, IEC 664, UL508C, UL840

VDE Regulations VDE100, VDE110, VDE160

TÜV Regulations

Trade body guidelines VGB4

The user must ensure that in the event of:

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

the axis will be safely de-activated.

It must also be ensured that the machine or equipment are fitted with device independent monitoring and safety features.

Setting adjustments

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

Assembly

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

QS

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

CE

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

Attention

This device description MANUAL must be read in conjunction with a control manual (e.g. REG).

The following control units for 1 quadrant control are available:
analogue control REG

General information

In conjunction with a control board (e.g. REG) the Classic P3 range of thyristor drives act as current controllers (moment of inertia controllers). A 26-pin connector, common to all boards, is used to connect the power section and the control electronics. Using this interface it is possible for any external control arrangement including third party equipment to drive the power section.

Q2 drives are used to control the speed, voltage or moment of inertia of dc motors in 1 or 2 quadrant mode of operation with an invariant direction of the moment (crane operation).

Characteristics

- The thyristor current controllers are designed for switch cabinet mounting acc. to the VDE regulations
- Galvanic isolation between the control electronics and the power section
- The distances of air gaps and leakage paths are superior to 8mm
- Comfortably over-dimensioned power semi-conductors
- Only components customary in trade and industrially standardised are used
- High quality bases for the ICs
- LED display for the main operating states
- The PI-adjustment of the current controllers is effected through the use of one 4-position switches
- Protection cover against contact with the unit
- Front mounting of the control electronics
- As far as possible plug-in terminals are used for the connection
- High power connections have to be connected across threaded bolts
- The output stage is a completely controlled three-phase bridge circuit.

1 Basic Information

P3 400/450-x

Power connection 360 ... 440V~
 Auxiliary voltage connection 360 ... 440V~oder 200 ... 250V~
 Output voltage max. +450V=

P3 400/450-		60	120	150
Input current	A~	48	96	120
Output current	peak	120	240	300
	continuous	60	120	150
El. power	kW	27	54	67.5
Input fuses (fast acting) input	A	63	125	160
Power chokes (1pc. Per device)	Type	KD3-75	KD4-100	KD4-150
	mH	0.3	0.25	0.16
Armature chokes	Type	UI150B-75	UI180B-150	UI180B-150
	mH	5.5	4.2	4.2
Armature chokes are necessary only for special applications !				
Cooling		Self cooling	Ventilation fan	Ventilation fan
Dimensions wxhxd	mm	290x210x170	290x210x170	290x210x170

P3 500/550-x

Power connection 500 ... 550V~
 Auxiliary voltage connection 360 ... 440V~
 Output voltage max. +550V=

P3 500/550-		60	120	150
Input current	A~	48	96	120
Output current	peak	120	240	300
	continuous	60	120	150
El. power	kW	33	66	82.5
Input fuses (fast acting) input	Aff	63	125	160
Power chokes (1pc. Per device)	Type	KD3-75	KD4-100	KD4-150
	mH	0.3	0.25	0.16
Armature chokes	Type	UI150B-75	UI180B-150	UI180B-150
	mH	5.5	4.2	4.2
Armature chokes are necessary only for special applications !				
Cooling		Self cooling	Ventilation fan	Ventilation fan
Dimensions wxhxd	mm	290x210x170	290x210x170	290x210x170

Specification	
Mains frequency	50 or 60 Hz ± 5%
Protection rating	IP 00
Format	VDE 0100 group C VDE 0160
Humidity rating	Class F acc. to DIN 40040
Site of installation	< 1000m above sea level
Operating temperature range	0 ... 45°C
Extended operating temperature range	Up to 60° C reduced 2%/ °C
Storage temperature range	-30°C up to + 80°C
Amplification	
Input signal	0 ... +10 Volt=
Output	0 ... +200% Type current
Enable	> +10 Volt
Currnt control loop cir	
Control precision (without actual value error)	± 2%
Control range	1: 50
Speed control loop circuit with REG	
Control precision (without actual value error)	± 0.1%
Control range	1: 300

Function

Connector no.

+ 24V	±10%	X3: 1 and 2
+ 15V	±2%	X3: 3 and 4
- 24V	±10%	X3: 5 and 6
- 15V	±2%	X3: 7 and 8
Device GND	0	X3: 9, 10, 11, 12, 13, 14
I command value (GND)	0	X3: 15
I command value (signal)	+10V=	X3: 16
Current controller enable	+10V=	X3: 17
Drive disable 1	+10V=	X3: 18
Drive disable 2	+10V=	X3: 19
N (speed) actual	+10V=	X3: 20
I (current) actual	+10V=	X3: 21
Over-current power section	n/a	X3: 22
Trigger angle 1	+10V=	X3: 23
Trigger angle 2	+10V=	X3: 24
Drive ready BTB	+10V=	X3: 25
not assigned	n/a	X3: 26

2 Electrical Installation

CE Advice

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

- The device, the power choke, and the filter capacitors are mounted on a 500x500x2 mm mounting plate.
- The mounting plate must be connected to ground using a 10mm² wire.
- The motor housing must be connected to ground using a 10mm² wire.
- The device ground X1:8 must be connected to the mounting plate using a 2.5mm² wire.
- Device PE screw must be connected to the mounting plate using a 4mm² wire, l = 50mm.

Connection:

Power choke type: see technical details

Filter capacitors: 3 x 0.5mF/600V~ 3 x 1mF (x) + 1 x 0.5mF (y)

Conductor length between the device and the power choke <250mm

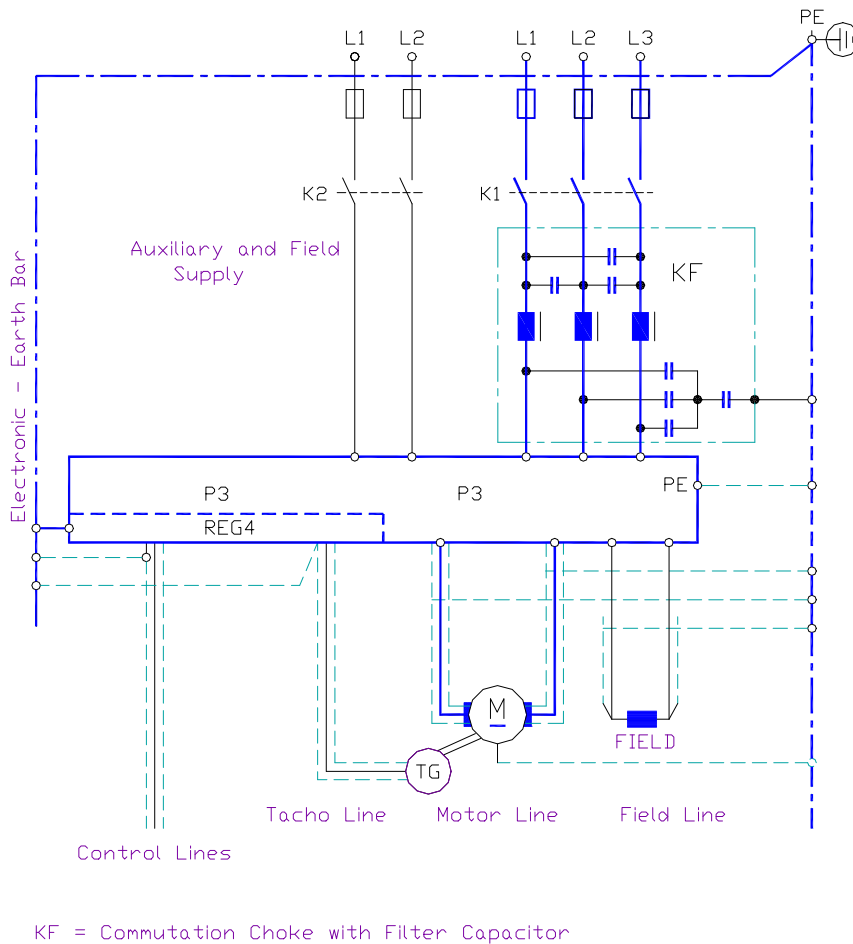
Motor connection:

Motor conductors l = 1.5m, shielded

Tacho and all control lines l = 1.5m, shielded

Shielding connected to PE

Connection diagram



Power connections

The power connections must be protected by means of fast acting fuses. The power choke inductance must be $>80\mu\text{H}$.

The phases of the power connection and the auxiliary voltage do not have to be equal. There is an internal watchdog for the power connection. If the power supply or the fuses fail, the device switches off and the BTB contact opens.

L1, L2, L3 right rotating field

An auto-transformer can be used. For motors with a weak voltage steadiness isolating transformers have to be used.

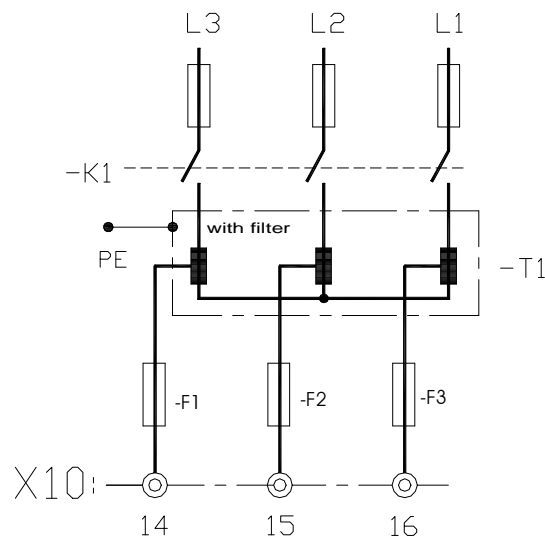
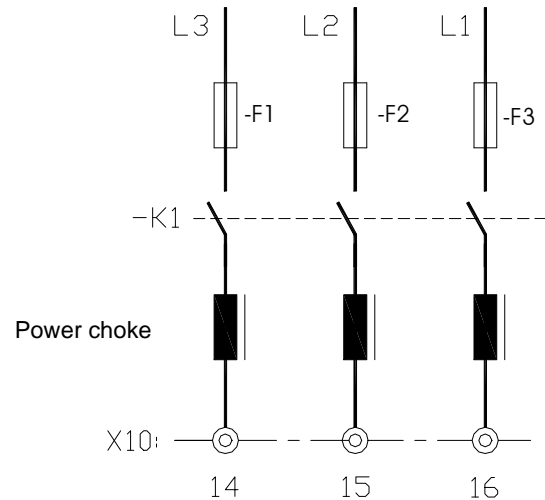
The transformer performance is determined by the permanent current and the secondary voltage.

Fast acting fuses must be installed between the transformer and the control unit.

Attention:

If the secondary voltages produced by the transformer are inferior to 60% of the device type voltage, the voltage watchdog has to be adapted. These fuses are monitored for drop-out by the power supply watchdog. The phases of the secondary voltage of the transformer and the auxiliary voltage do not have to be equal.

It has to be ensured that the contacts of the contactors on the input side of the transformer are sufficiently rated for the switch-on current of the transformer. The transformer has to be protected by means of slow acting fuses.



4 Electrical Installation

Motor connection

Armature chokes are necessary only for a few applications, e.g. quiet motor operation (stage technique).

The motor is connected to the terminals 10 and 13 via an armature choke.

Min. armature choke inductance:

$$-L 4[\text{mH}] = U_A/I_A \times 0.8$$

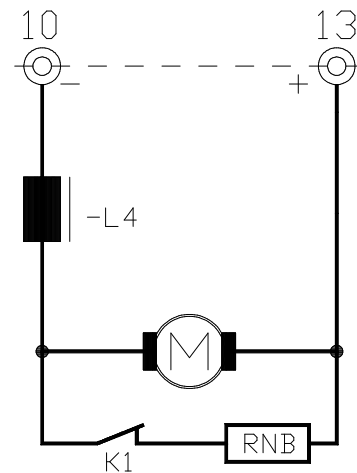
(Motor voltage divided by armature current. times 0.8)

The motor lines should only be switched during a current-free state.

Warning:

Switching off under current will create arcing across the switch contacts.

Switching on while the drive is enabled will cause the fuse to fail.



RNB resistors (brake resistors in case of power supply failure) are to be connected in parallel directly to the motor armature without isolating the motor from the control unit.

At the output of the armature choke the motor line is protected against short-circuits.

Conductor cross-section (min.)				
Type current	A	60	120	150
AC power supply	mm ²	6	16	25
Motor line	mm ²	10	25	35

The conductor cross-sections must be rated for continuous motor current. The power lines and motor lines are to be routed separately from sensitive measuring and control lines.

Compared to transistor chopper amplifiers the thyristor servo drives have little electro-magnetic and electro-static interferences which can easily be filtered.

Actual value connection

The actual value is connected to the control electronics (e.g. REG) as ta-cho signal or as armature voltage signal.

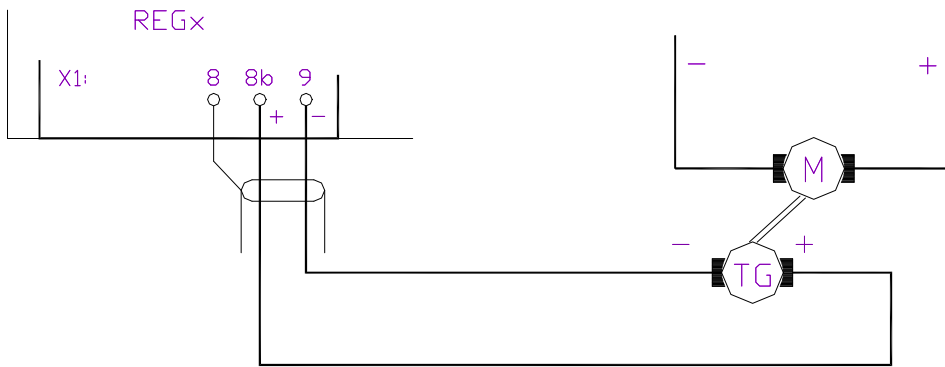
The quality of the actual value signal determines the control range and the control accuracy. Best results can be achieved through the use of dc tacho generators.

Three-phase tacho generators with rotor position evaluation or digital ac-tual value encoders as well as ac or three-phase tachos with rectification are suitable for 1 quadrant operation.

Tacho lines should be properly shielded and routed separately from po-
wer lines.

Shield to be connected to the device.

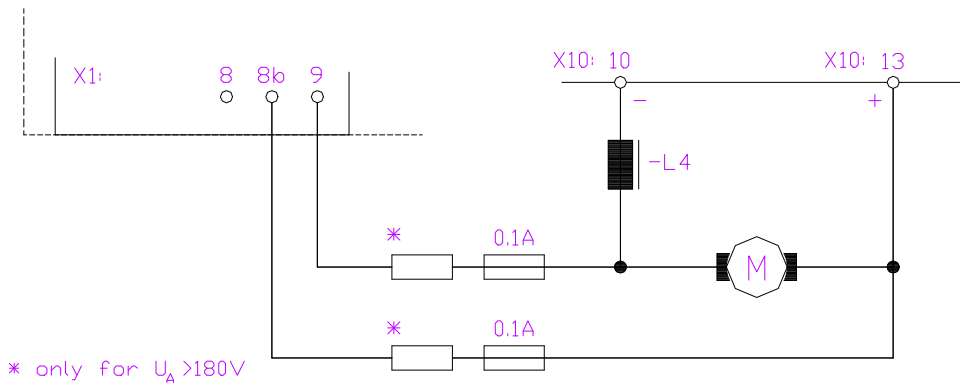
Pls. observe the tacho adjustment instructions in the Manual of the con-
trol electronics (e.g. REG)



For 1 quadrant controls with small control ranges (up to 1:50) and little demands on accuracy and dynamic the armature voltage can be used as actual value signal.

The actual value lines must be protected by two fuses of 0.1A/500V instal-
led directly in the armature voltage.

For armature voltages superior to 180V two additional drop resistors must be pre-connected, thus, the module EXZU-UA (additional equipment) can be used (two fuses and two resistors in an insulated housing).



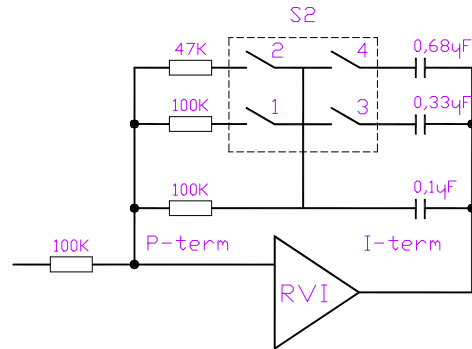
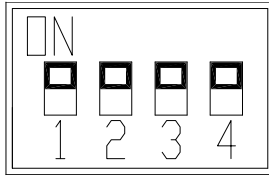
* only for $U_A > 180V$

5 Adjustments

Adjustments

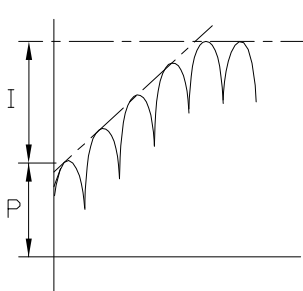
The current control characteristics of the power sections can be adjusted. The PI characteristics of the controller RVI is adjusted by the 4-position DIP switch S2.

Switch position

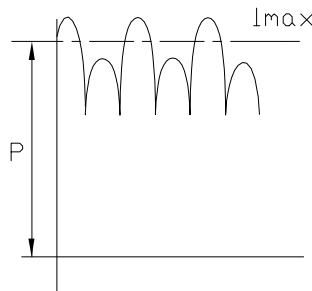


All switches are closed on delivery of the devices. This corresponds to the position for the lowest armature circuit inductance. For a higher inductance the proportional amplification can be changed via the contacts 1 and 2 and the integral time constant can be changed via the contacts 3 and 4.

Oscilloscope - Current adjustment

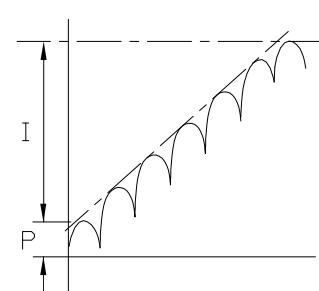


Optimal adjustment



P-amplification too high

(Operation not permissible)



P-amplification too low

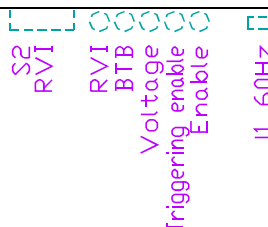
For 60Hz operation the Jumper J1 must be plugged in.

Displays

Some important functions are indicated by LEDs:

- drive ready (BTB)
- auxiliary voltage watchdog (voltage)
- current controller enable (RVI)
- triggering enable (Z)
- current controller output (RVI)

The green LEDs indicate the active states.



Die Thyristor- Leistungsteile werden intern überwacht.

Die BTB- Meldung liefert im fehlerfreien Zustand eine Spannung von $>+10V$.

Mit dem Kontrollausgang X3:25 wird das BTB- Relais auf der Regelelektronik angesteuert.

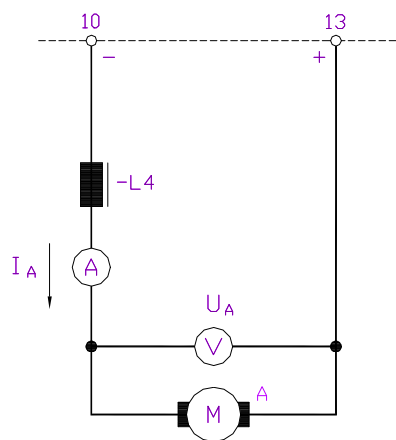
Bei folgenden Fehlern ist die BTB- Spannung $<2V$.

Hilfsspannungsversorgung: $+24V$, $+15V$, $-15V$

Leistungsanschluss : Sicherungsausfall, Anschlussreihenfolge
Unterspannung

Bei Fehler wird das Leistungsteil intern unverzüglich gesperrt.

Die Regelgrößen Strom und Spannung können mit Vielfach- Instrumenten im Lastkreis (Motorkreis) gemessen werden.



Bei der Gleichstrommessung tritt zwischen den mittelwertanzeigenden und den echten Effektivwert anzeigenden Messgeräten ein vom Formfaktor bestimmter Messfehler auf.

Bei Gerätenennstrom und den richtigen Motordrosseln ist der Effektivwert 1 - 5% höher als der Mittelwert.

Die Motorspannung wird als Gleichspannung gemessen.

Die maximale Gleichspannung darf nicht größer als $1,12x$ Leistungsanschluss sein.

Bei positivem Drehzahlswert an X1:6 (REG) bzw. positivem Stromswert an X3:16 oder X4:15 ist die Spannung an der Klemme 10 negativ gegen Klemme 13.

Die Messsignale für Strom und Drehzahl können an der Regeleinheit REG an den Klemmen X2:109 und X2:111 gemessen werden.

Der Drehzahlmesswert an X2:109 ist $-5V$ für $+100%$ Drehzahl.

Der Strommesswert an X2:111 ist $+5V$ für $+200%$ Typenstrom.

Commissioning

1. Connection advice

Connect the drive in accordance with the P3 manual and the control electronics manual (e.g. REG).

Please observe in particular:

- Check the power supply voltage with that specified on the type plate.
- Insert the correct fuses according to the technical data (rf. to page 5)
- Check the field voltage connection and the motor and tacho connections!
- For 60Hz applications insert the Jumper S1 on the power section

2. Commissioning

Basic connections:

Mains supply, field, tacho, or armature feedback, drive enable, command value.

For armature voltage control the tacho watchdog must be switched off.

2.1 Drive enable switch open or drive enable voltage 0V

Command value		0V
Switch S9		adjust to tacho voltage
for armature voltage control		adjust to 0
Switch S4		position 2
Switch S5		position 6
Potentiometer I _{max1}		left full scale
Potentiometer I _{max2}		adjust to approx. 10% of full scale
Potentiometer	XP	adjust to 50%
Potentiometer	ID	= 100%
Potentiometer	I _{xR}	= left full scale
Potentiometer	n _{max}	= left full scale
Potentiometer	INT	= left full scale
DS1:K1, DS2:K4	ON	

Bridges R13 and R16 soldered in (only tacho)

2.2 Apply the voltage

The LEDs L3 (BTB) and L7 (stationary) **must** light.

All other LEDs are off.

2.3 Close the switch 'drive enable' or apply a drive enable voltage of >10V

The LEDs L1 and L2 must also light

The drive must be at a standstill or turn slowly (offset).

If the drive accelerates in the correct direction, the polarity of the tacho voltage and the armature voltage feedback must be changed.

If the drive accelerates in the wrong direction, the polarity of the armature or the field must be changed.

2.4 Increase the command value voltage to approx. 10%

The drive must accelerate to approx. 10% of the speed.'

If the rotation direction is wrong, change the polarity of the tacho and the field **or** the polarity of the tacho and the armature.

2.5 Current controller amplification

(Switch S2 on the power section)

The current amplification is adjusted to a low armature circuit inductance (all switches "On")

High inductance values can lead to motor oscillation which cannot be influenced by means of the speed controller. In this case, first set switch S2-2 to "Off". If the drive still does not run smoothly, set the switch S2-1 to "Off".

The current response can be measured by means of an oscilloscope across the test point X4:20 (see page 13).

2.6 Speed controller amplification

Adjust on the REG board.

Adjust the P-term to the lowest possible setting from 1 to 5 (switch S4).

Adjust the I-term to match the axis momentum (switch S5):

large axis momentum - high adjusted value

small axis momentum - low adjusted value

With the command value set to 10% speed, increase the amplification by turning the potentiometer XP clockwise. When the drive begins to oscillate, reduce the amplification by turning the potentiometer anti-clockwise by approximately 10%.

For the fine adjustment of the amplification the control response should be measured by means of an oscilloscope across the test point X4:15.

2.7 Further adjustments

such as speed, peak current, continuous current, etc. (rf. to the manual REG)

2.8 Switching Off

If the switch 'drive enable' is opened, or the drive enable voltage is switched to 0V, LED L1 and L2 will extinguish and the drive decelerates.

After approx. 2s the thyristor triggering circuit is disabled.

2.9 Commissioning adjustments

The adjustments should be documented in the protocol and the adjustment potentiometers should be sealed with a suitable lacquer.

Customer: **Machine no.**

Device: **Serial no.**

Control voltage [V~]

Power supply voltage [V~]

Field voltage [V=]

Inputs

Enable contact ? voltage [V=].....

Comm.value type voltage [V=]

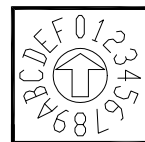
Comm.value, additional type voltage [V=]

Current comm.value I_{max2} external voltage [V=]

Speed controller settings

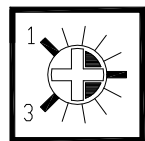
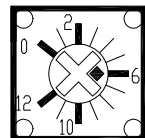
Switches

Tacho adjustment	S9	Position	...
P - term	S4	Position	...
I - term	S5	Position	...
D - term	S8	Position	...



Potentiometers

Speed	n_{max}	P4	Position	...
Peak current	I_{max2}	P6	Position	...
Continuous curr.	I_D	P7	Position	...
Integrator	INT	P1	Position	...
Amplification	XP	P3	Position	...
I_xR compensation		P2	Position	...



DIP switches

ON **no.**

OFF **no.**

Current controller settings

Switches

Switches S2	open	(off)
	closed	(on)
Jumper J1	60 Hz	plugged-in
	50 Hz	open

Measured data

Armature voltage	max.	[V=]
Armature current	peak	[A=]
Armature current	continuous	[A=]
DC tacho voltage	max.	[V=]
Acceleration	X4:16	[V/ms]	. . .
Integrator	X4:14	[V/ms]	. . .

Motor data

Type plate data

Manufacturer

Type Serial no.

Motor voltage [V=] Motor current [A=]

Tacho voltage [V/min-1]. Tacho type

Brake [V] Fan [V]

Guarantee

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

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

During the warranty period, UNITEK will, at its option, either repair or replace products that prove to be defective, this includes guaranteed functional attributes. UNITEK specifically disclaims the implied warranties or merchantability and fitness for a particular purpose. For warranty service or repair, this product must be returned to a service facility designated by UNITEK.

For products returned to UNITEK for warranty service, the Buyer shall prepay shipping charges to UNITEK and UNITEK shall pay shipping charges to return the product to the Buyer.

However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to UNITEK from another country.

The foregoing warranty shall not apply to defects resulting from:

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

All further claims on transformation, diminution, and replacement of any kind of damage, especially damage, which does not affect the UNITEK device, cannot be considered. Follow-on damage within the machine or system, which may arise due to malfunction or defect in the device cannot be claimed.

This limitation does not affect the product liability laws as applied in the place of manufacture (i. e. Germany).

UNITEK reserves the right to change any information included in this MANUAL. All connection circuitry described is meant for general information purposes and is not mandatory.

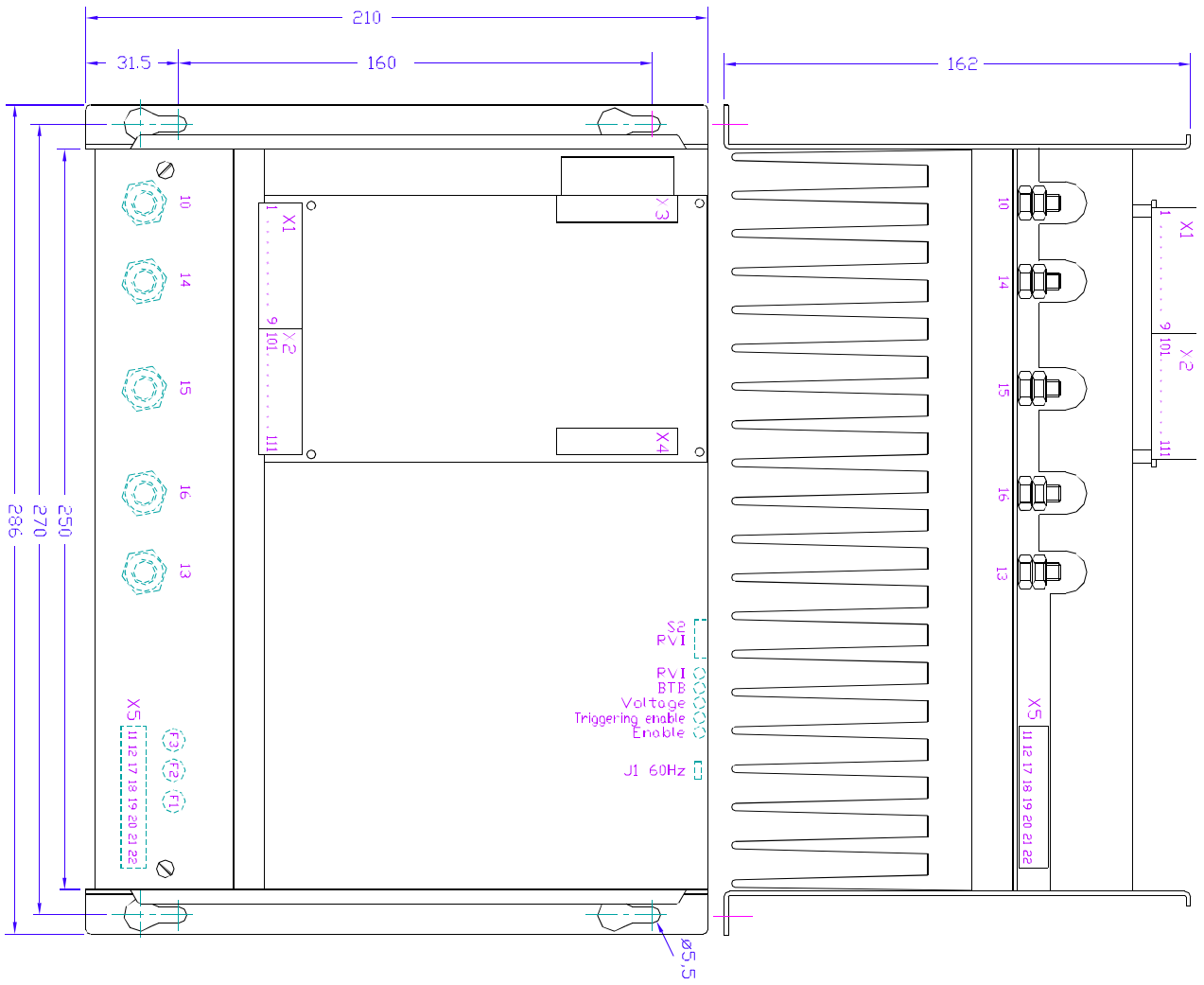
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P3 x/x - 60 - 150A



P3 60-120-150A

P3-M060

9 Drawings

