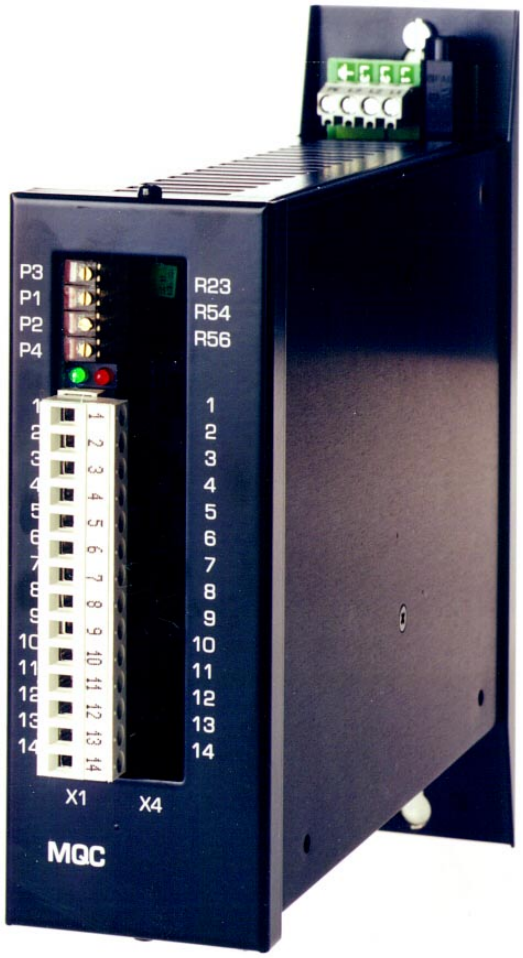


PWM SERVO

CONTROLLERS

SERIES MQC

Operating Manual

Issue September 05

RECEIVING AND HANDLING

Upon delivery of the equipment, inspect the shipping containers and contents for indications of damages in curried in transit. If any of the items specified in the bill of lading are damaged, or the quantity is incorrect, do not accept them until the freight or express agent makes an appropriate notation on your freight bill or express receipt.

Claims for loss or damage in shipment must not be deducted from your invoice, nor should payment be withheld pending adjustment of any such claims.

Store the equipment in a clean , dry area. It is advisable to leave the equipment in its shipping container until ready fore use. Each amplifier is checked carefully before shipment. However, upon receipt, the user should make sure that the amplifier corresponds to or is properly rated in terms of rated voltage and current for the type of motor which is to be driven. The descriptive label affixed to the amplifier specifies electrical ratings.

Safety and application information

According to the enclosure the Amplifiers Motors and Power supplies may have live, uninsulated or rotating parts or hot surfaces during operation.
The inadmissible removing of the required cover, in proper application, wrong installation or operation may lead to personal or material damages.
For further information please refer to the manual.
Only qualified personal are permitted to install or operate the equipment.
IEC 364, CENELEC HD 384, DIN VDE 0100,0105,0110 and national regulations must be observed
According to these general safety information a qualified person is someone who is familiar with installation, assembly, commissioning and operation of the equipment. These person must have the appropriate qualifications.

1 Technical specifications for MQC

Power stage

Input voltage	Chapter 1.1 Basis models
Over voltage protection	85 VDC (U_A=60 V) 160 VDC (U_A=120 V), 190 VDC (U_A=150 V)
Chopper frequency	8 kHz (to GND)
Form factor at nominal ratings	1.01 (Rated current)
Power stage protection	short circuit
Fault signalling red LED	ϑ_{max} , - $\hat{I}_{max}$;- U_{max}
Braking module	page 12/10.4

Speed controller

Input command	Differential ± 10 V Ri = 20 kΩ
Tacho reference signal	Differential ± 5V ... ± 60 V Ri = 54 kΩ
Compensation network	PI (D) correction with potentiometer or components
Speed control range	1:20000
static Error	30...3000 rpm ± 0,1 % 1...30 rpm ± 2,0 % < 1 rpm ± 5,0 %

Current controller

Band width	1 kHz
Compensation network	PI
Current limitation 1	I_{Arms}
Current limitation 2	max. output current I_{Amax}

Enable	X1/PIN5 connect to 0 V, (optional + 24 V)

signals

Drive healthy (relay contact)	X1/PIN6 connect to X1/PIN7
Contact ratings	160 VDC/20 mA
"OK“	LED green on
"error"	LED red on
„Braking“	LED red + green on

other Data

Operating temperature ϑ_u	0...45 °C derating 2 %/ K from 45 °C to 60 °C
Storage temperature	-10...+70°C,
Cooling	by air convection, or fan
rel. humidity	65 %, without condensation
Protection class	IP 20
Isolation group	C /VDE 0110
Size	Chapter 9.5

1.1 Basis models

TYPE	U_A	I_{max}	I_{NRMS}	U_{CCN}	U_N	U_{min} [1)]	U_{max} [1)]	
	(V)	(A)	(A)	(V DC)	(V AC)	(V AC)	(V AC)	
MQC 0506	48	12	6	55	24 -48 V DC	**16 V DC**	**65 V DC**	
MQC 0510	48	20	10	55	24 -48 V DC	**16 V DC**	**65 V DC**	
MQC 0606	60	12	6	65	46	20	51	
MQC 0608	60	16	8	65	46	30	51	
MQC 0610	60	20	10	65	46	30	51	
MQC 1206	120	12	6	125	90	30	98	
MQC 1208	120	16	8	125	90	30	98	
MQC 1210	120	20	10	125	90	30	98	
MQC 1510	150	20	10	155	113	30	125	
MQC 1515	150	30	15	155	113	30	125	

U_A: Output voltage U_{CCN} ; I_{max} : max. Output current ; I_{Nrms} : rated current 1) max. rating!

1.2 Order example

A) Standard without option **MQC 1208** (M 99)

Mesanor Compact-DC-Drive

Modification
Rated current I_{Nrms} 8A
Output voltage U_A = 120 V

B) Limit switch OPT.E and 0 V Logic (Enable and Opt.)
MQC 0606 OPT. E (-)

2 General conditions

The MQC servo modules are extremely compact PWM servo amplifiers that provide 4 quadrant speed control of any DC servo motors with Tacho or with BEMF feedback. MQC amplifiers are conceived for regulation of brush DC motors. The MQC is equipped with an internal power supply. From dc voltage the amplifier is producing the current for the motor. Output current is PWM controlled and due to high chopper frequency a large bandwidth and dynamic are granted.

Relations for the operation of the motor:

- torque is proportional to output current
- speed is proportional to output voltage
- direction of rotation corresponds to sense of the output voltage

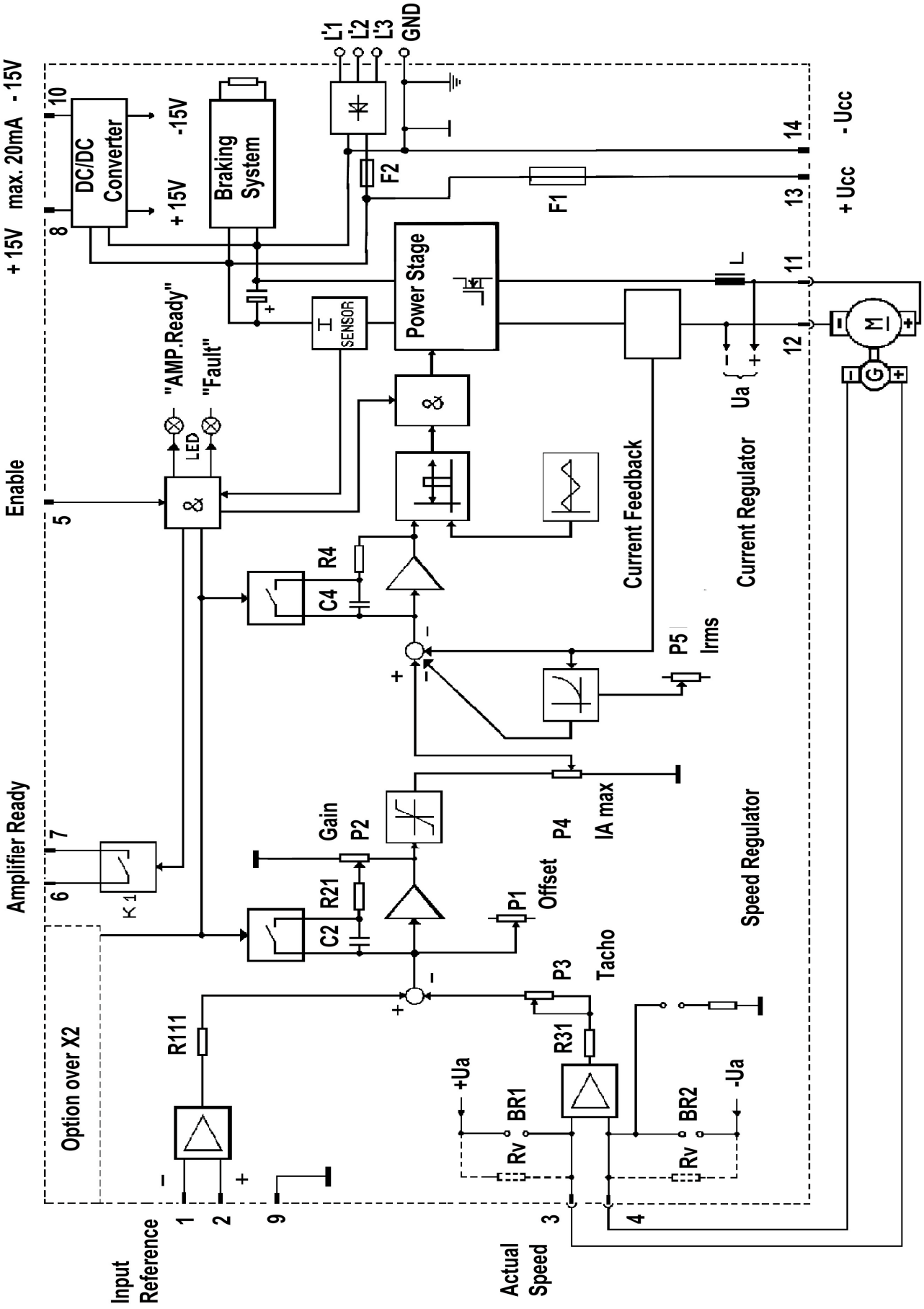
For limit values, please look the specifications. Inadmissible working conditions or wrong application of the amplifiers should be avoided.
Never plug in or unplug any connectors on the amplifier when power is applied. A time of discharge of 3 minutes must be considered
The Mesanor-Amplifiers series MQC are designed for stand alone application :

Mounting:	Front connector upright
Cooling:	natural cooling or forced cooling (Chap.1.1) ambient temperature less then 45°C .
Electronic supply:	Internal DC/DC converter ± 15 V, max external charge with 20 mA
Supply from net:	Isolation transformer required

Attention !

The MQC 05 XX Version are for 24 /48 V DC Battery supply . The input terminals L1',L2'L3' are used for DC input with or without Reverse-diode.

3 Block diagram



3.1 Subprint OPT E Limit switch

By connection of GND (OPT E -) or 24 V signal (OPT E +) to the terminals for negative and positive direction the limit switch can be deactivated. If the limit switch is active, the motor will stop in these direction. The limit switch logic level (OPT E += positive, OPT E (-)= negative logic) is set by factory. R 111 must be removed, otherwise option B;C and E will not work.

3.2 Subprint MSM-OPT

Other Options are available by using MSM-OPT Subprint- please ask for more information.
- external current limiting, positive and negative Output current separate (Opt.A)
- Speed controlled current limiting (Opt. L) - programmable Limit-Switch (Opt. KE)
- Ramp generator (Opt. B) - Limit switch (Opt. C) only available with negative logic

4 POWER SUPPLY

4.1 Electronic supply ± 15 V

Electronic (+/-15V) of the amplifier is supplied from power voltage.

4.2 Power transformer

Transformers with galvanic separated primary an secondary winding are used for adjustment of supply voltage to the existing net. The Transformers have to correspond to VDE 0550. One and three phase transformers can be used.
If the transformer used has a star point in its secondary winding then this should be isolated and NOT connected to earth.
A three phase transformer is recommended for current higher than 10 A continuos overall.
The factory or your dealer should be consulted to specify the proper size and secondary voltage.

5 Setting up the amplifier

The adjustment of Tacho, output current, Irms is made by factory. An adjustment of an amplifier for another motor is possible
In order to achieve best performance for the system motor/amplifier, optimisation of speed circuit is necessary. The following components are used:

- P 2 /R21: P- Gain
- C2: I - Gain
- P3/R31: tachometer signal
-

5.1 Tacho adjustment: P3

As a general rule, amplifiers driving servo motors are designed such that the continuously rated speed of the motor corresponds to an input command to the amplifier of 10 V.

- apply a 10 V signal to the command input and measure the motor speed. The Tacho pot. P3 can now be adjusted until the correct maximum speed is reached. If unable to obtain the speed over range of P3, then consult factory for modifications.

Standard-range:

Left side: 5 V Tacho input voltage correspond to 10 V Set value
Right side: 60 V Tacho input voltage correspond to 10 V Set value
adjustment of the standard range with R31
Components can be adjusted in factory or by service.

5.2 Offset: P1

If an input of exactly 0 V is applied to the command input then the motor shaft should be stationary. Any creep may be eliminated with P 1.

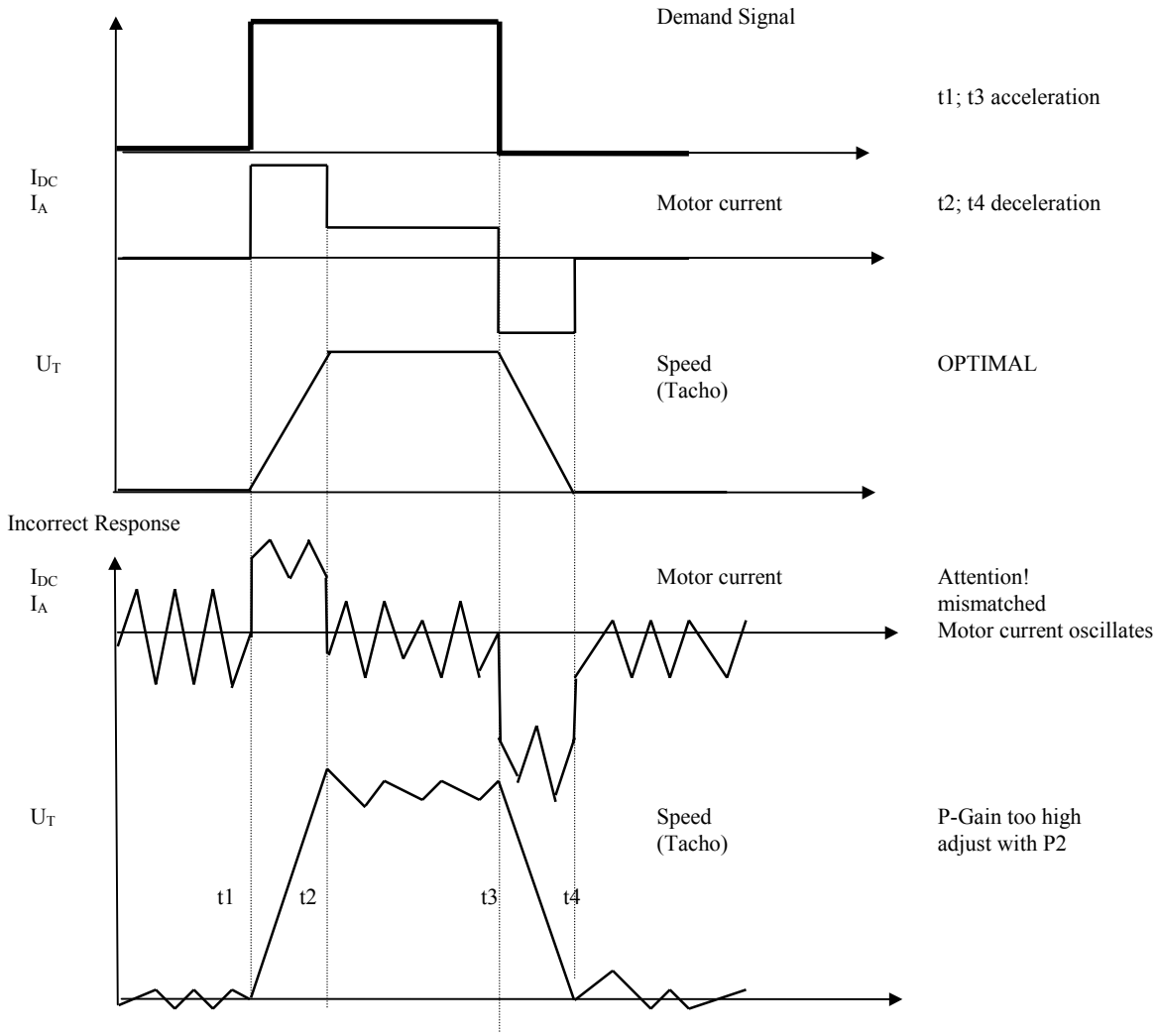
5.3 Adjustment of the speed controller gain

Amplifiers are equipped with a standard optimisation and can be adapted by P2. Is this adjustment not possible, PI on the Personality card must be checked.

P-Gain: P2

Standard range: Right side: 160
Left side: 8
adjustment of the standard range with R21

A) Response when correctly adjusted



5.4 Armature Current Measurement

Armature current is measured by means of a shunt placed in series with the armature circuit. The voltage produced can be measured at the „I Monitor“ test point. 10 Volts output corresponds to the maximum current of the amplifier.

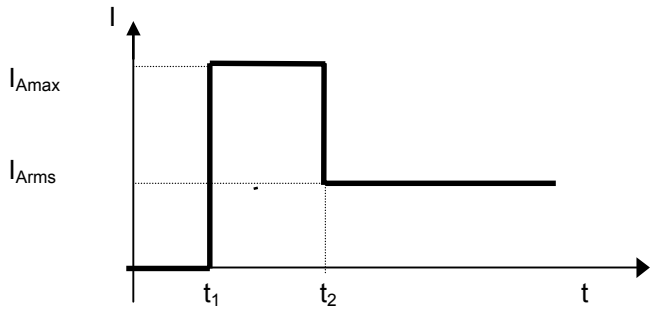
Max. Output current I_{Amax}: P4
The amplifier is capable of supplying twice is rated current for 1.5-5 seconds. Peak current will be adjusted by P4.

Standard-Range:	Right side:	$I_{Amax} = 1 \times I_{max}$ = Type-max. current
	Left side:	$I_{Amax} = 0{,}03 \times I_{max}$

Current balance: P7
Adjustment of the internal Current measurement! Set by factory, do not change !

5.5 RMS - Function I_{Arms}

Momentary current is processed into an I rms. Value by a squarer network and is negatively feed back to the armature current control point via a threshold value switch. The I rms. Current is adjusted with P5 and is maintained irrespective of the curve shape of the armature current actual value.



t_1= acceleration pick-up

t_2= limitation

$\tau = t_2 - t_1$ (without pre charge)

RMS output current I_{Arms}: P5
Follow the procedure given above for adjustment of I_{Amax}. The I_{Arms} pot P 5 can be adjusted and is value read from the monitor after about 5 seconds.

Standard-Range	Right side:	$I_{Arms} = 1 \times I_{Nrms}$ = Type rated current
	Left side:	$I_{Arms} = 0{,}1 \times I_{Nrms}$

5.6 BEMF feedback Speed control with I x R-compensation

Application without Tacho feedback are possible with lower accuracy of the speed controller
the use of an compensation resistor R12 gives an increase of accuracy.

Attention:
Solder jumper Br1, Br2 close for BEMF operation, in this case BR 3 must be open !
For amplifiers with more then 60 V output voltage never close direct BR1 + Br2 use two additional resistors R_V (R211/212)

5.7 Variable components

Set value adjustment:	R111	Standard:	10 k Ω
Tacho adjustment:	R31	Standard:	1,8 kΩ
IxR compensation:	R12	Standard:	not used

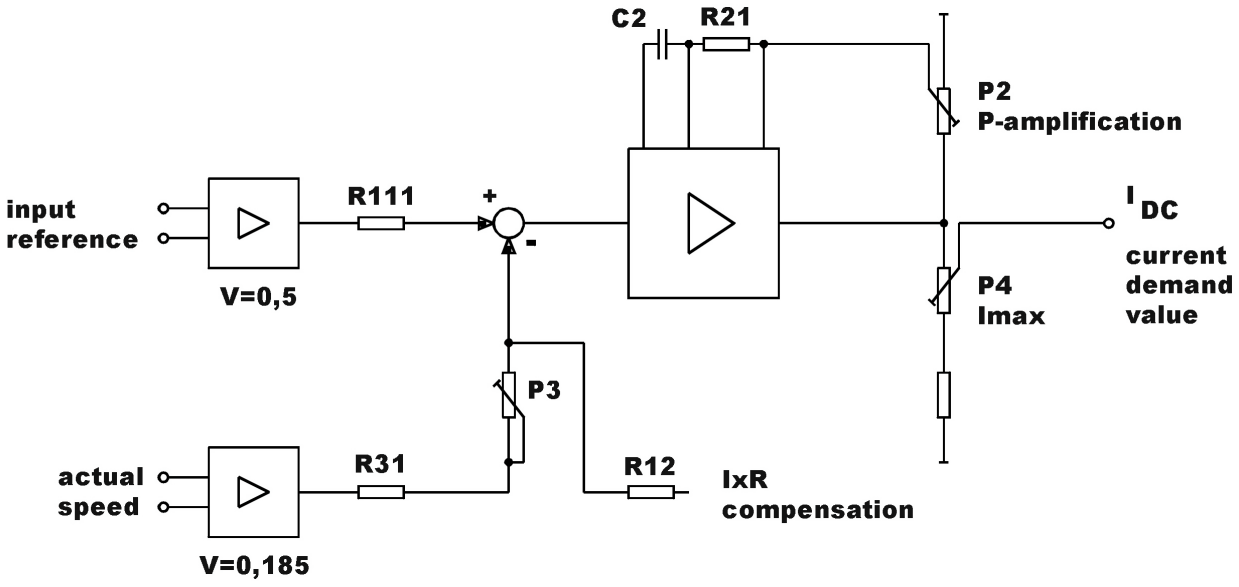
5.8 Speed controller components, Block diagram

Integral part C2 Standard: C2 = 0,1 µF **Proportional part P2 / R 21 Standard**: R21 = 82 kΩ

T_N = R21 x C2
K_{NS} = R21/R111 x K (command gain)
K_N = R21/(P3 + R31) x K (error gain)

K factor is the result of P2 adjustment : Right side: K = 20
Left side: K = 1

Block diagram Speed control



5.9 Current control

The controller is optimised by factory, do not change !

6 Protection and fault signalling

The green LED indicates the proper function of the unit. In case of a fault, a signal is given by the front red LED (H1), power stage will be disable and the „ready/drive healthy" relay contact will be open.
Reset the amplifier: supply voltage off-/-on

Monitoring ground fault
Over currents due to ground fault causes the safety switching circuit to respond the same way as an over current fault.

Monitoring over voltage
If over voltage occurs in the DC Bus voltage, a fault is signalled.

Monitoring under voltage
The +/- 15 V will drop to 0V DC and disables the amplifier.

Monitoring over temperature of the power stage
Monitoring of the heat sink temperature up to 90 °C or 190 °F

7 Wiring suggestions

- It is important that the amplifier (Rack or stand-alone) is properly earthed. If the amplifier is not earthed then if an earth fault occurs in the motor circuit the output of the amplifier will be destroyed.
- Each motor must be wired separately (cable should be shielded)
- Motor cable may be shielded if there is a requirement for reduced electrical noise.
- Speed demand and tacho circuits should be individually shielded (twisted) pairs.
- Speed demand inputs are differential inputs consequently either polarity can be used. It is Important that if a single ended input is used then one of the amplifier inputs must be connected to ground. The controller and the amplifier must operate with the same GND reference potential.
- All control inputs (for example: limit switch, speed demand) have to be twisted and shielded pairs.
- If cables with two outside shields (better EMV security) are used, the outside shield must be connected to earth on both sides, the inside shield must be connected to the rack. GND contacts of amplifiers are not suited to be connected with the shield circuit.

8 Faultfinding and remedy

Fault	Cause	Remedy
The motor will not start	supply voltage missing	check all fuses are good and supply voltage are present
there is no current	drive not enable	Terminal X1/Pin5 should be connected to 0VDC (optional +24V) for power stage enable
	Motor wiring open	check the wiring for the armature circuit
The motor runs at an uncontrollably high speed after switching on.	The control circuit is polarised	Change the polarity of the tachometer or the motor.
The motor will not start although current is present	The motor is blocked (mechanically)	Release the brake, if there is one; if necessary dismantle the motor and run no-load test.
	Shorted motor circuit	Check the wiring of the armature circuit
The motor runs unevenly	P-portion too high	Turn P2 counter clockwise
	I-portion too small	Increase C8
	Wiring fault at control leads or tachometer leads	Check the shielding and check wiring
After enable the amplifier	Choke are not wired in the armature	check wiring
the red fault LED is lit	choke and/or motor inductance too low	the value must amount to, at least, the value for the corresponding amplifier
	short circuit in the motor, wiring or chokes	check wiring, motor and chokes
After turn on amplifier the red LED is lit without enable amplifier	power stage is defective	exchange amplifier
the red LED is on after a long running time	power stage overheat	let the module cool down
Red LED goes on when the motor is decelerating	over voltage caused by high system inertia	A braking regulator board needs to be added to insure proper amplifier use
Red LED goes on immediately after power up	Over voltage caused by high bus voltage	check transformer and net

9 Commissioning and terminal description

9.1 Front connector X 1

PIN	Signal direction	Function	Remark
1 2	- IN + IN	Set value	differential , Ri = 20 KΩ , max. input voltage 20 V ,max. input Voltage to GND +/- 30 V
3 4	+ IN - IN	Tacho input	differential, Ri = 54 KΩ , max. input voltage 65 V , max. input voltage to GND +/- 70 V Att. BEMF control for output voltage higher then 60V
5	IN	Enable	negative Logic: open Drive disable 0V (GND) Drive enable Attention! do not connect to source positive Logic: open or 0V(GND) Drive disable + 24 V Drive enable
6 7	OUT OUT	drive healthy signal	relay contact closed if Drive OK
8	OUT (IN)	+ 15 V (Limit switch)	Auxiliary Voltage max. load with 20 mA, not available if using OPT E input for OPT E Limit switch Logic level set by factory
9		$0V_E$ (GND)	Electronic ground
10	OUT (IN)	- 15 V (Limit switch)	see PIN 8
11 12	+ OUT - OUT	Motor A1 Motor A2	notice diameter , never short to ground or A2 or power input
	ATTENTION !		**Apply no Voltage**
13 14	IN IN	+ Ucc - Ucc/	

9.2 Solder jumper

Solder jumper	Function (closed)	Remark
BR 1	Drive output to Tacho input	BEMF control
BR 2	Drive output to Tacho input	BEMF control
BR 3	Tacho input to GND	disturbance reduction
BR 4	P-connector	R= 1,8 KΩ
BR 5	Enable logic level + 24 V	set by factory

9.3 Test points connector X2

Test point X2 /PIN	Remark	
2	Speed controller output/ current command	
3	Tacho signal	
4	current monitor +/- 10V = Imax	
6	current command (Pot. P4)	
10	Speed control junction	
12	-15 V	
14	0VE (GND)	
18	Speed command	
19	+15 V	
20	Enable	CMOS level 15 V
21	Error over voltage	0 = Error
22	Error over current	1 = OK
23	Error over temperature	
24	Error input from Option subprint	

Attention ! All test points refer to 0VE/GND power and logic ground direct connected

9.4 Top- Screw terminal – power input

Type	PIN 1	PIN 2	PIN 3	PIN 4	Supply
MQC 0506	Housing / GND	-Ucc	+ Ucc direct	+ Ucc via reverse diode	DC
MQC 0510	Housing / GND	-Ucc	+ Ucc direct	+ Ucc via reverse diode	DC
MQC 0606	Housing / GND	L'3 (AC)	L'2 (AC)	L'1 (AC)	AC
MQC 0610	Housing / GND	L'3 (AC)	L'2 (AC)	L'1 (AC)	AC
MQC 1206	Housing / GND	L'3 (AC)	L'2 (AC)	L'1 (AC)	AC
MQC 1208	Housing / GND	L'3 (AC)	L'2 (AC)	L'1 (AC)	AC
MQC 1210	Housing / GND	L'3 (AC)	L'2 (AC)	L'1 (AC)	AC
MQC 1510	Housing / GND	L'3 (AC)	L'2 (AC)	L'1 (AC)	AC
MQC 1515	Housing / GND	L'3 (AC)	L'2 (AC)	L'1 (AC)	AC

9.5 Technical Dates - Drive Braking module

Type	$U_{BR\ ON}$ (V DC)	$U_{BR\ OFF}$ (V DC)	P_{MAX} (W)	$P_{cont.}$ (W)	
MQC 0506	77	74	530	10	
MQC 0510	77	74	530	10	
MQC 0606	77	74	530	10	
MQC 0610	77	74	530	10	
MQC 1206	140	137	1800	10	
MQC 1208	140	137	1800	10	
MQC 1210	140	137	1800	10	
MQC 1510	180	175	2200	10	
MQC 1515	180	175	2200	10	

Attention : Never overload the braking system, calculate before the max. power.

9.6 Additional Dates

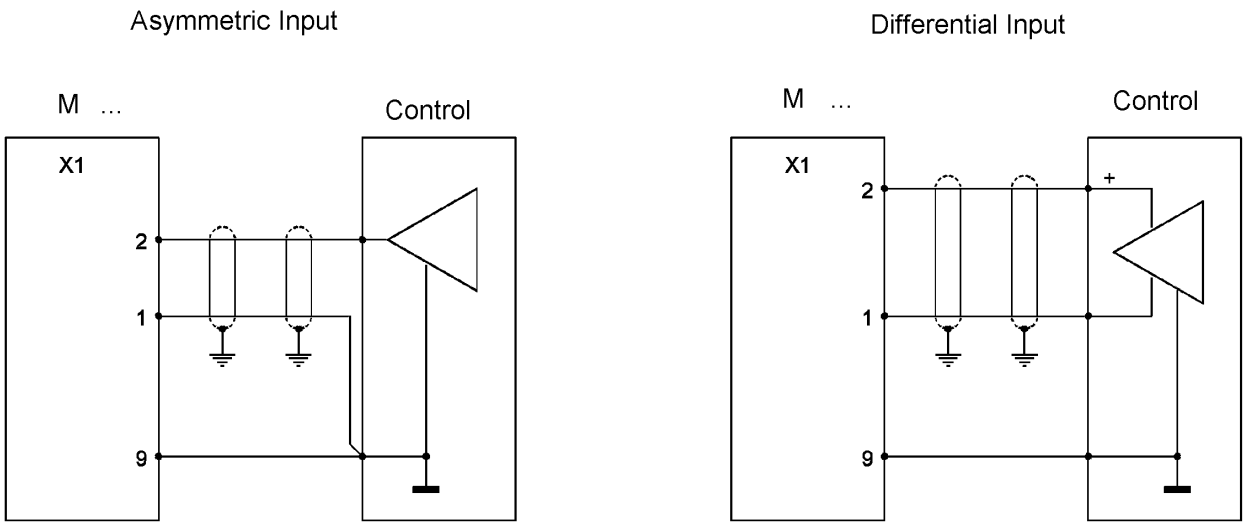
Type	Fuse F2 (A)	internal choke (mH)	L_{min}	FAN	Size (mm)	Min. distance (mm)	Wight (Kg)	R_V in KΩ 0,25 W/1% (R211/212)
MQC 0506	6,3	1,1			50	80/30	1,3	.....
MQC 0510	10	0,5			50	80/30	1,3	.....
MQC 0606	6,3	1,1	1		50	30	1,3	-
MQC 0608	8	0,5	0,5		50	30	1,3	-
MQC 0610	10	0,5	0,5		50	30	1,3	-
MQC 1206	6,3	1,1	1		50	30	1,3	64,9
MQC 1208	8	1,1	1		50	30	1,3	64,9
MQC 1210	10	0,5	0,5		75	30	1,7	64,9
MQC 1510	10	0,5	0,5		75	50	1,7	100
MQC 1515	16	no	0,5	yes	75	50	1,9	100

Lmin : minimum Inductance

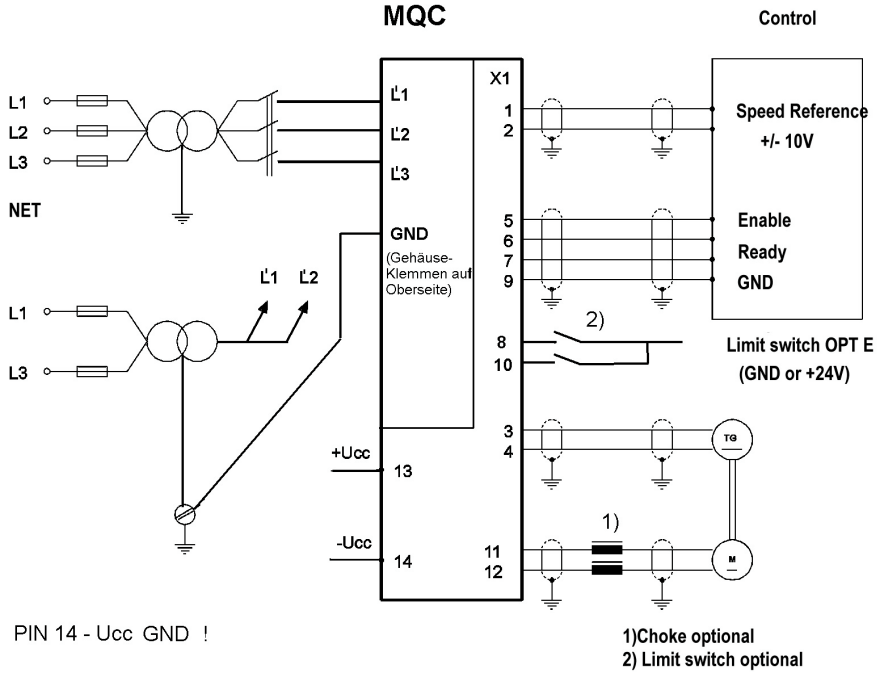
Please note all necessary information and drive adjustments for service and order.

10 Drawings

10.1 Amplifier input



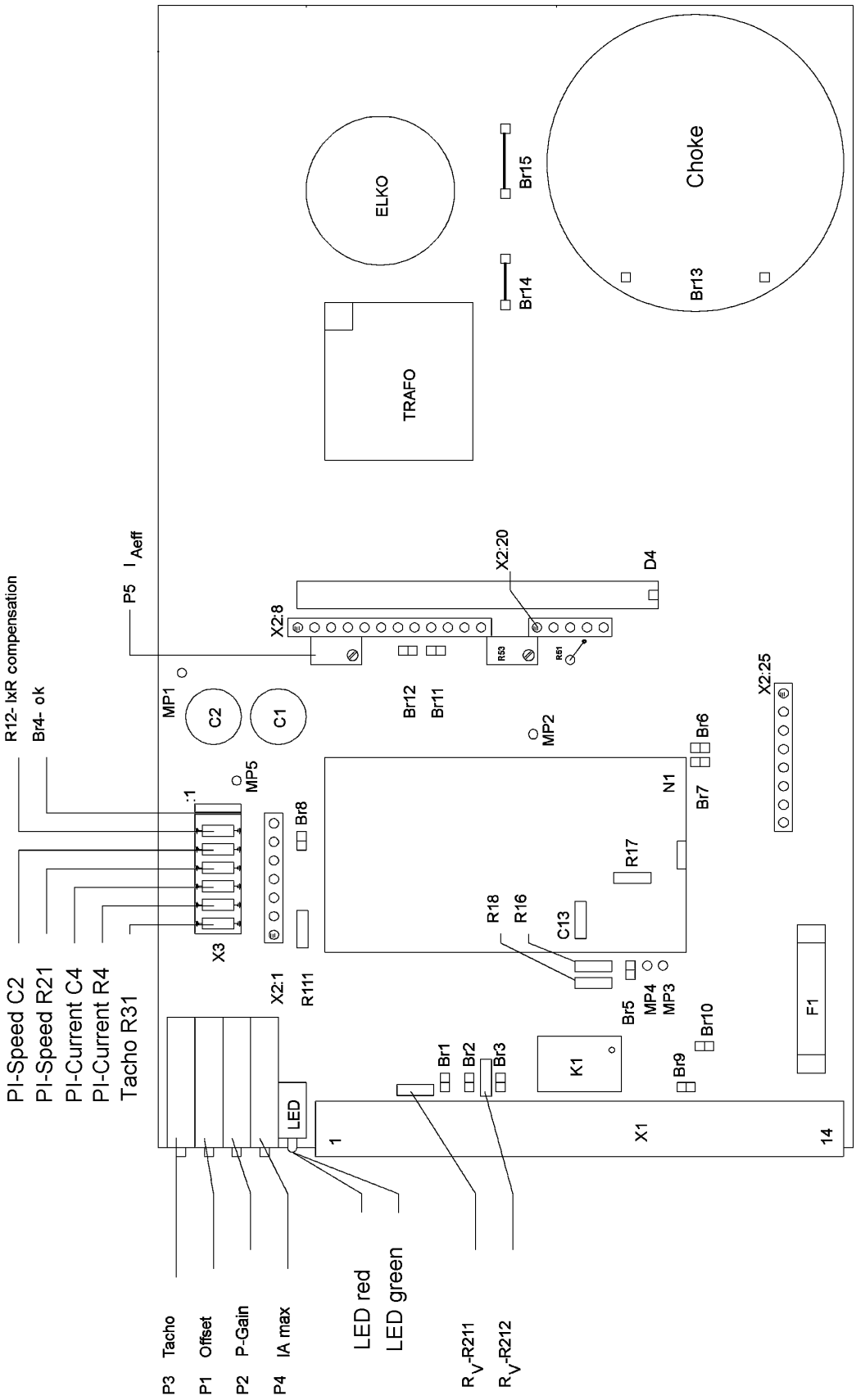
10.2 DC-Power supply



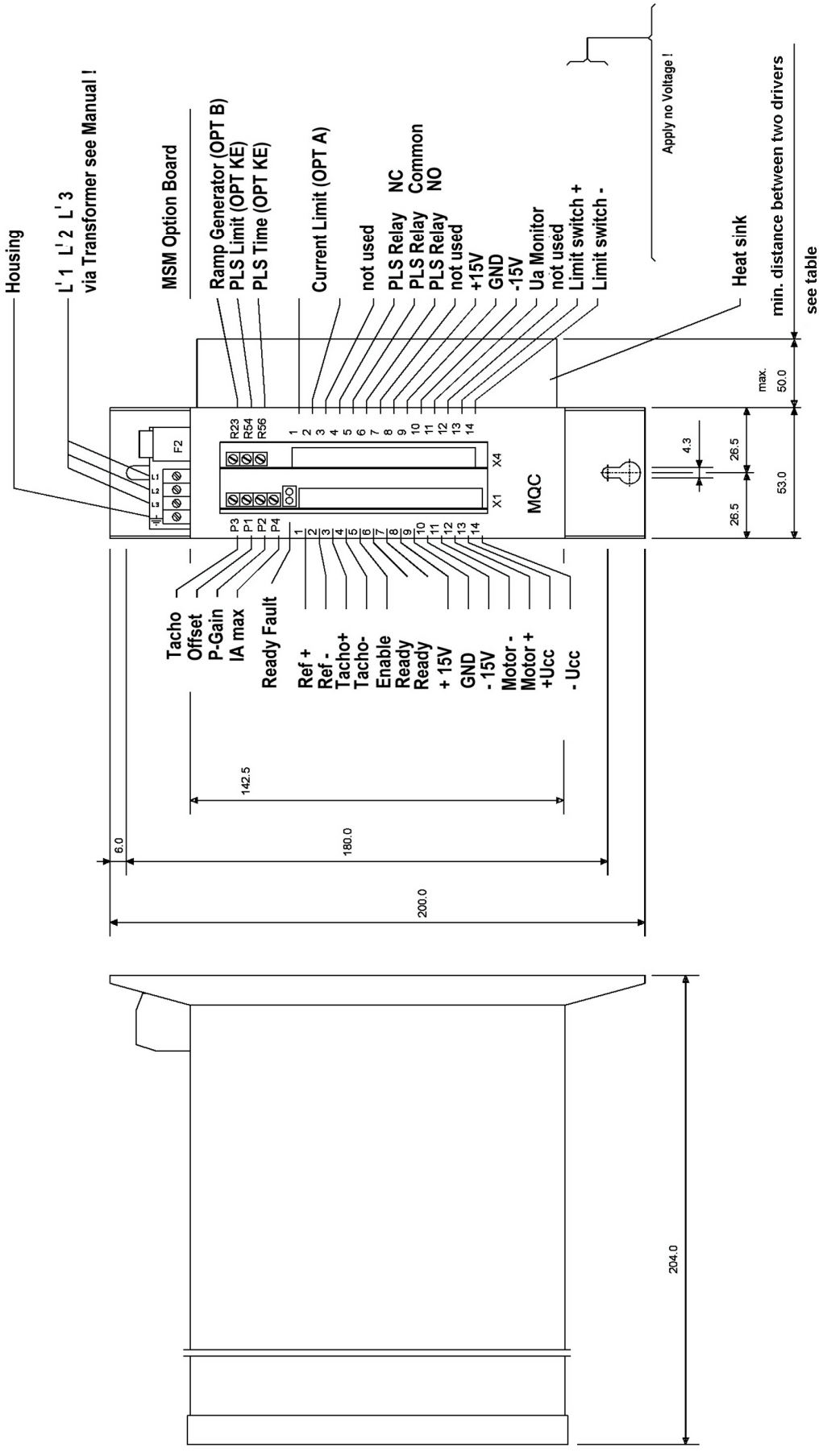
Attention ! Do not ground the secondary winding !

MQC 05 XX L1';L2';L2' DC Input !

10.3 Components location



10.4 Mechanical style



The manual is subject to modifications or misprint.

Please call our service for further technical questions.

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