



PWM SERVO CONTROLLERS

SERIES

MRM



Operating Manual

Issue January 2005

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.



Waste Disposal

According to the EC-Directive 2002/06 all drive are provided with the opposite icon. That means that the drives cannot be put to the general rubbish or garbag.

Order No. 74.01575

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1 Technical specifications for MRM

Power stage

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

Speed controller

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

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

other Dates

Operating temperature ϑ_u	0...45 °C derating 2 %/ K from 45 °C
Storage temperature	-10...+70°C,
Cooling	by air convection, or fan if $I_{rms} > 6$ A
rel. humidity	65 %, without condensation
Protection class	IP 00
Isolation group	C /VDE 0110
Size	page 12/10.5

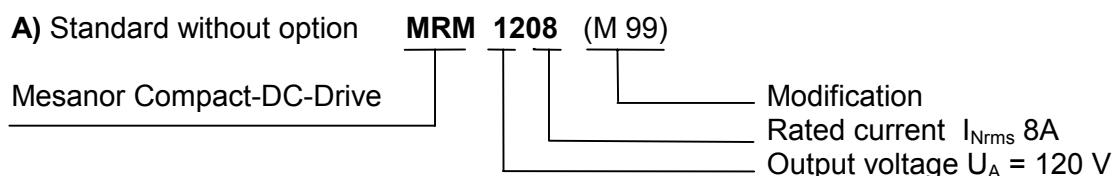
1.1 Basis models

TYPE	U_A	I_{\max}	I_{NRMS}	U_{CCN}	U_N -Transformer	τ	Fan	Input
	(V)	(A)	(A)	(V DC)	(V AC)	(s)		
MRM 0210	20	20	10	24	(18) Battery	4		DC
MRM 0510	44	20	10	48	(35) Battery	4		DC
MRM 0604	60	8	4	65	46	1		DC
MRM 0606	60	12	6	65	46	4		DC
MRM 0608	60	16	8	65	46	4		DC
MRM 0610	60	20	10	65	46	4	$I_A \geq 8,5 \text{ A}$	DC
MRM 1204	120	8	4	125	90	1	$I_A \geq 3,5 \text{ A}$	DC
MRM 1206	120	12	6	125	90	4	$I_A \geq 3,5 \text{ A}$	DC
MRM 1208	120	16	8	125	90	4	$I_A \geq 6 \text{ A}$	DC
MRM 1210	120	20	10	125	90	4	$I_A \geq 6 \text{ A}$	DC

U_A : Output voltage U_{CCN} ; I_{\max} : max. Output current; I_{NRMS} : rated current

τ : Time constant of RMS circuit

1.2 Order example



B) Limit switch OPT.C and 0 V Logic (Enable and Opt.)

MRM 0606 OPT. C

2 General conditions

The MRM 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. MRM amplifiers are conceived for regulation of brush DC motors. The MSMN... power supply transforms ac voltage into dc voltage. 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 dynamics 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 MRM are designed for Rack mounting in „Eurocard“ (3 U). : The Power supply MSMN/W and Sub print MSM OPT will complete the system.

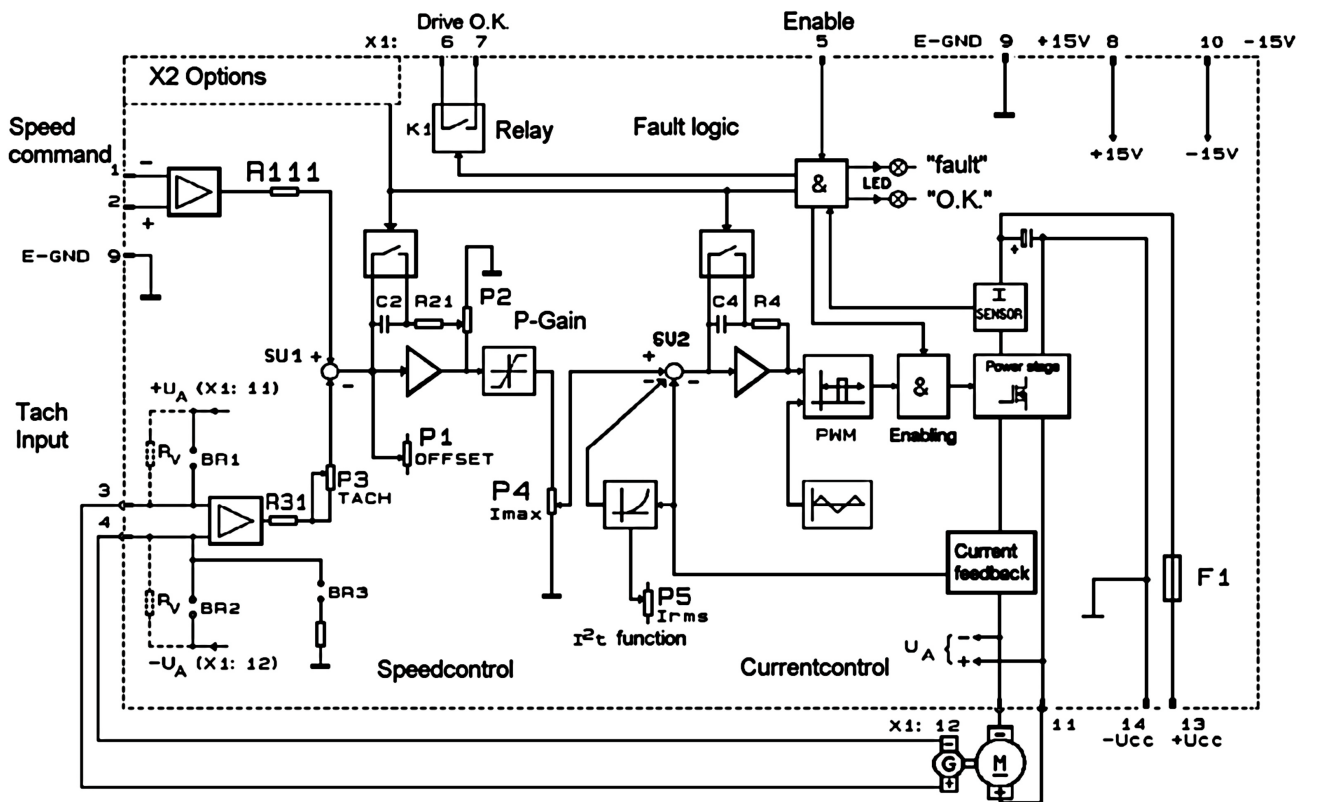
Mounting: Front connector upright

Cooling: natural cooling or forced cooling (Chap.1.1)
ambient temperature less then 45°C .

Electronic supply: $\pm 15 \text{ V}$

Supply from net: never use without Transformer

3 Block diagram



3.1 Subprint MSM-OPT

Other Options are available by using MSM-OPT Sub print- please ask for more information.

- external current limiting, positive and negative Output current separate (Opt.A)
- Speed controlled current limiting (Opt. L)
- Ramp generator (Opt. B)
- programmable Limit-Switch (Opt. KE)
- Limit switch (Opt. C)

4 POWER SUPPLY

Please use only the special Power supply Series MRMMN/W .

4.1 Aux. electronic supply $\pm 15\text{ V}$

Electronic ($\pm 15\text{V}$) of the amplifier is supplied from power supply MSMN/W.

4.2 Power transformer

Transformers with galvanic separated primary and 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 continuous 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, I_{rms} 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

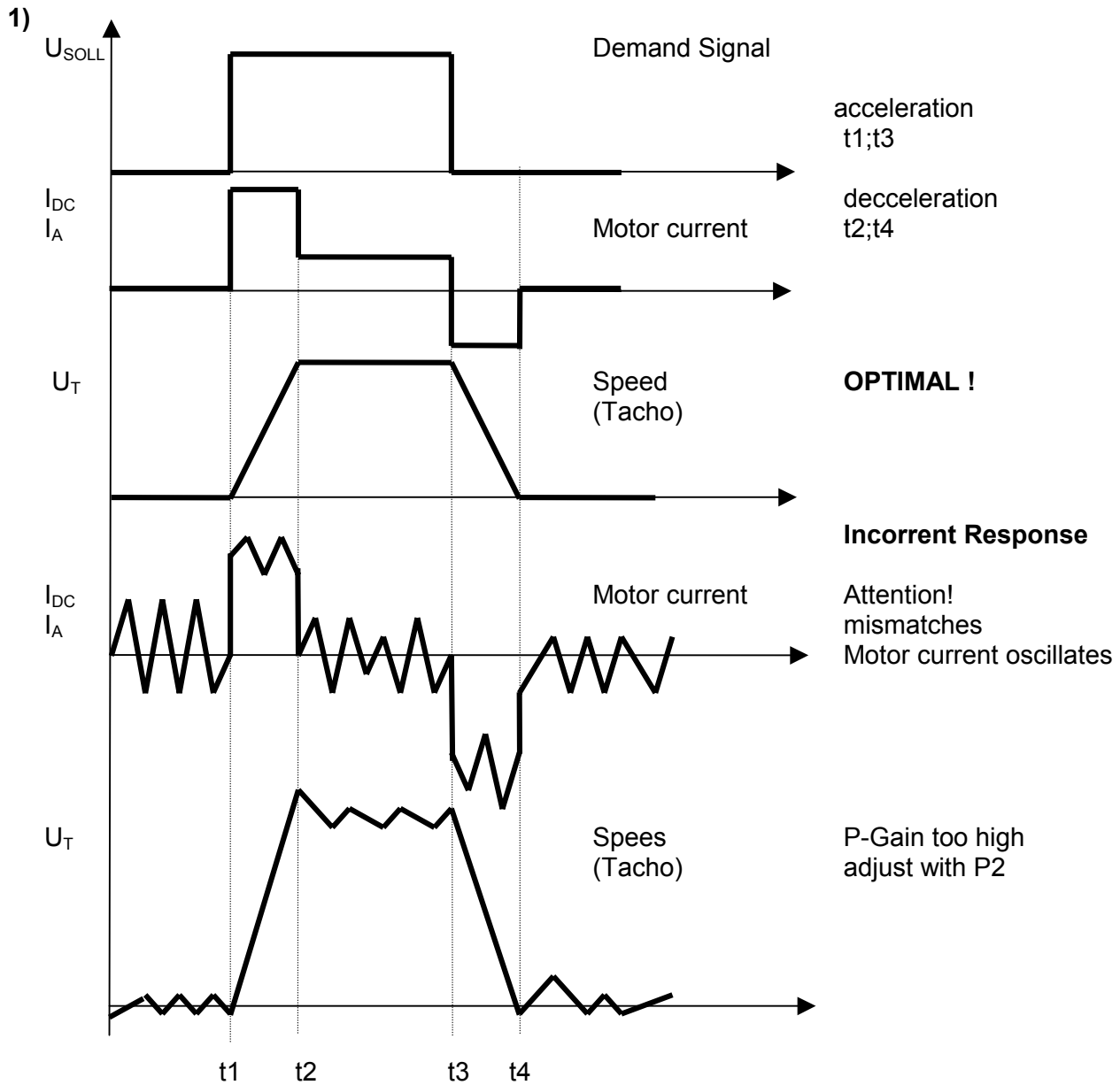
Amplifiers are equipped with a standard optimisation and can be adapted by P2. Is this adjustment not possible, PI on the Personality card must be checked.

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 its rated current for 1.5-5 seconds. Peak current will be adjusted by P4.

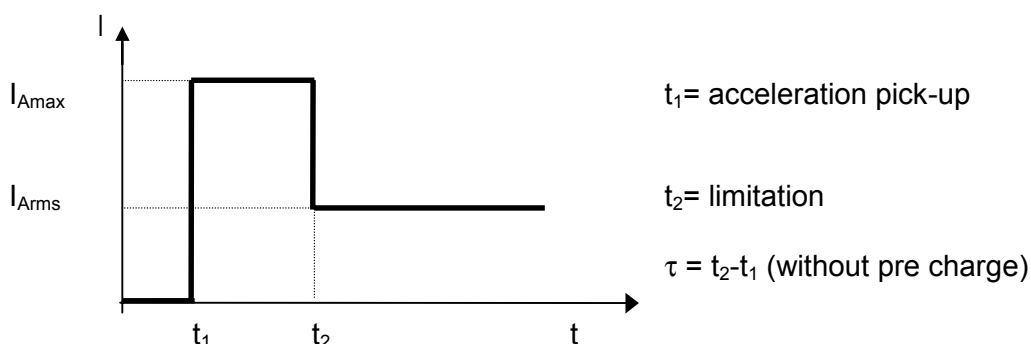
Standard-Range:	Right side:	$I_{Amax} = 1 \times I_{max} = \text{Type-max. current}$
	Left side:	$I_{Amax} = 0,03 \times I_{max}$

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.



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 its value read from the monitor after about 5 seconds.

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

5.6 BEMF feedback Speed control with $I \times R$ -compensation

Application without Tacho feedback are possible with lower accuracy of the speed controller the use of an compensation resistor R12 gives a 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 to additional resistors R_v (R211/212)

5.7 Variable components

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

5.8 Speed controller components, Block diagram

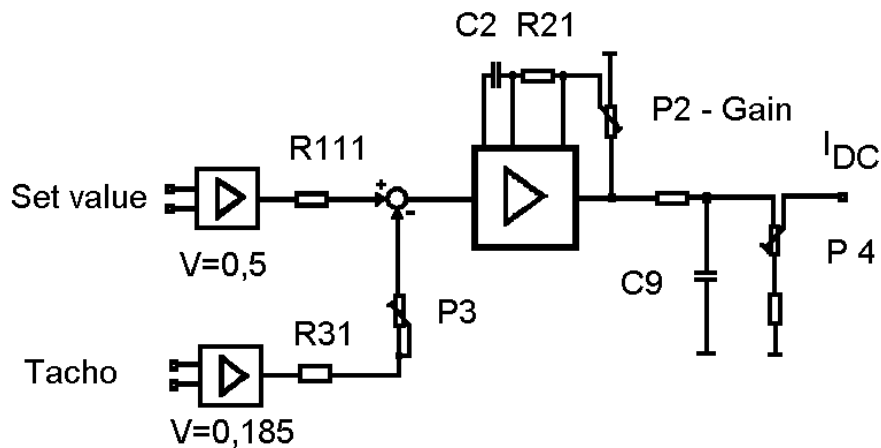
Integral part C2 Standard: C2 = 0,1 μ F Proportional part P2 / R 21 Standard: R21 = 82 k Ω

$$T_N = R21 \times C2$$

$$K_{NS} = R21/R111 \times K \quad (\text{command gain})$$

$$K_N = R21/(P3 + R31) \times K \quad (\text{error gain})$$

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 disable 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 MESANOR - Rack system

Especially racks are offered for the amplifiers are supplied with corresponding fans according to their performance. In order to grant high reliability of the system and security for the user the following regulations must be considered VDE 0100, VDE 01600, part 1 and 2 in relation with VDE 0660, part 5 and VDE 0113.

The rack MSMRA is useful for wall mounting, the MSMRS for swivel frames.

9 Faultfinding and remedy

Fault	Cause	Remedy
The motor will not start there is no current	supply voltage missing drive not enable Motor wiring open	check all fuses are good and supply voltage are present Terminal X1/Pin5 should be connected to 0VDC (optional +24V) for power stage enable check the wiring for the armature circuit
The motor runs at An uncontrollably high speed after switching on.	The control circuit is polarised The motor is blocked (mechanically)	Change the polarity of the tachometer or the motor. Release the brake, if there is one; if necessary dismantle the motor and run no-load test
The motor will not start although current is present	Shorted motor circuit	Check the wiring of the armature circuit
The motor runs unevenly	P-portion too high I-portion too small Wiring fault at control leads or tachometer leads	Turn P2 counter clockwise Increase C2 Check the shielding and check wiring
After enable the amplifier the red fault LED is lit	Choke are not wired in the armature choke and/or motor inductance too low short circuit in the motor, wiring or chokes	check wiring the value must amount to, at least, the value for the corresponding amplifier 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

10 Commissioning and terminal description

10.1 Front connector X 1

PIN	Signal direction	Function	Remark
1 2	- IN + IN	Set value	differential , Ri = 20 K Ω , max. input voltage 20 V ,max. input Voltage to GND +/- 30 V
3 4	+ IN - IN	Tacho input	differential, Ri = 54 K Ω , max. input voltage 65 V , max. input voltage to GND +/- 70 V Att. BEMF control for output voltage higher then 60V add. R211/212 s.table10.5 !
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	IN	+ 15 V	Auxiliary Voltage (max. consumption 160mA)
9		0V _E (GND)	Electronic ground
10	IN	- 15 V	Auxiliary Voltage (max. consumption 160mA)
11 12	+ OUT - OUT	Motor A1 Motor A2	notice diameter , never short to ground or A2 or power input
13 14	IN IN	+ Ucc/AC - Ucc/AC	DC Bus voltage

10.2 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 K Ω
BR 5	Enable logic level + 24 V	set by factory

10.3 Test points connector X2

Test point X2 /PIN	Remark	
2	Speed controller output/ current command	
3	Tacho signal	
4	current monitor +/- 10V = I _{max}	
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 0V_E/GND power and logic ground direct connected

10.4 Technical Power supply

Type	U _{BR ON} (V DC)	U _{BR OFF} (V DC)	P _{MAX} (W)	P _{cont.} (W)	I _{cc} (A)	input voltage range 1 phase AC or DC ¹⁾
Power supply						1 or 3-phasing (AC)
MSMN 06-1.0	76	74	1100	150/ 5,4Ω*)	20	18-50 V AC
MSMNW 06-1.0	76	74	500	50	20	18-50 V AC
MSMN 12-1.0	149	147	2200	150 /10,8Ω*)	20	30-100 V AC
MSMNW 12-1.0	149	147	1000	50	20	30-100 V AC

¹⁾ max. ratings!

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

10.5 Additional Dates

Type	Fuse (A)	Mechanical Style	L _{min} (mH)	Size in TE (1 TE=0,2“)	Size (mm)	Wight (Kg)	R _V in KΩ 0,25 W/1% (R211/212)
MRM 0210	10	2	0,2	10	44	0,45	-
MRM 0510	10	2	0,2	10	44	0,45	-
MRM 0604	4	2	1	10	44	0,45	-
MRM 0606	6,3	2	1	10	44	0,45	-
MRM 0608	8	2	0,5	10	44	0,45	-
MRM 0610	10	2	0,5	10	44	0,45	-
MRM 1204	4	2	1	10	44	0,45	64,9
MRM 1206	6,3	2	1	10	44	0,45	64,9
MRM 1208	8	3	0,5	12	51	0,65	64,9
MRM 1210	10	3	0,5	12	51	0,65	64,9

10.6 Rack size

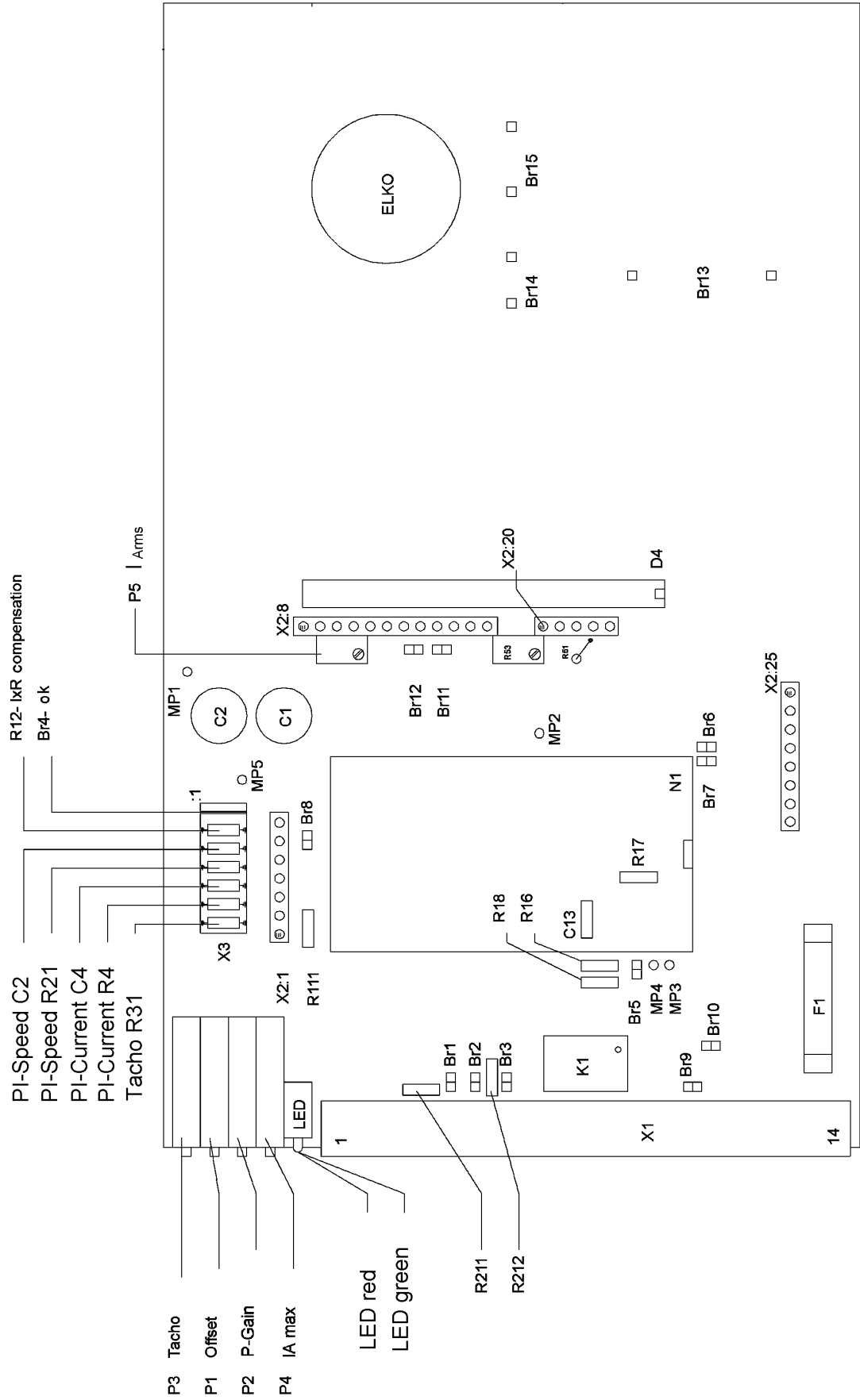
Rack type	Size a (mm)	Size b (mm)	Units (1TE=0,2“)	high
MSMR 24	160	127	25	3 U
MSMR 36	221	188	37	3 U
MSMR 48	282	249	49	3 U
MSMR 60	343	310	61	3 U
MSMR 72	404	371	73	3 U
MSMR 84	465	432	85	3 U

Rack DIN 41 494 , part 1 , 1 TE = 5,08 mm or 0,2“ ,
MSMR 84 19“ Standard rack

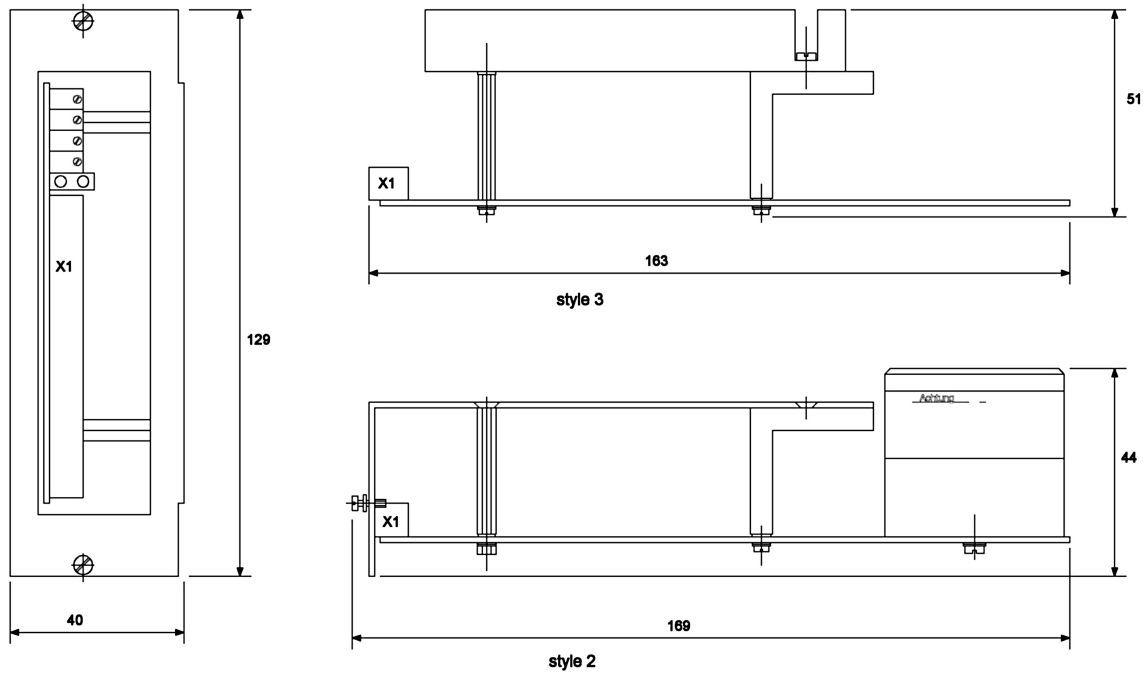
For more information please ask our service or your dealer.

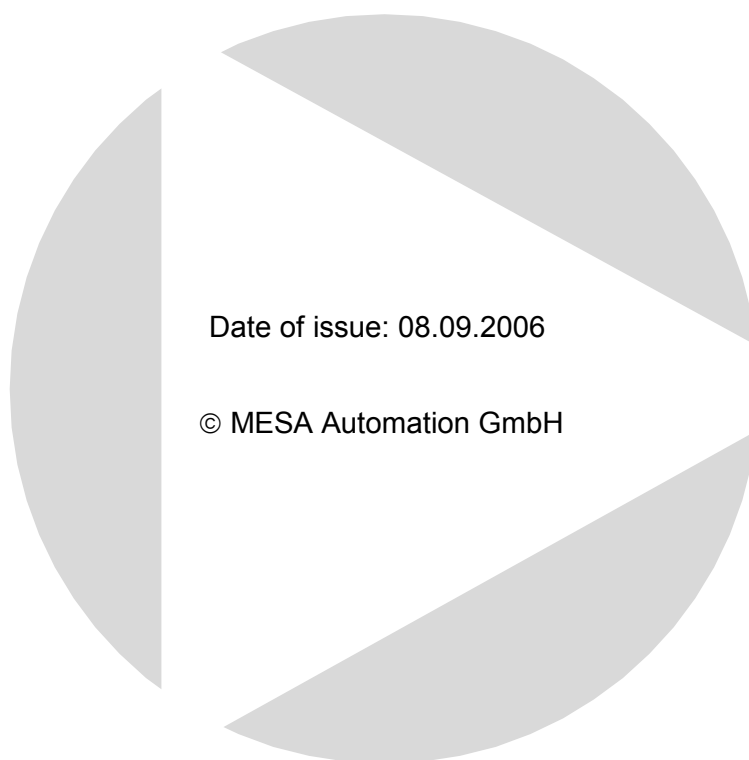
Please note all necessary information and drive adjustments for service and order.

11.3 Components location



11.4 Mechanical style





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