



# SERVICE MANUAL

ENGLISH

AXOR INDUSTRIES®



## MASTERSPEED

Stand Alone DC Servodrive

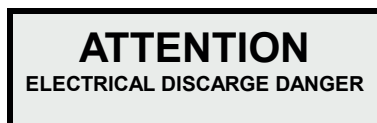
ver. 1

**CAUTION!**  
**ELECTRICAL AND CONTROL EQUIPMENT CAN BE  
DANGEROUS IF HANDLED IMPROPERLY.**

This manual show mechanical and electrical characteristics about  
**Masterspeed 60-140- 200** series.

It is important, that the installation procedure should be performed only by qualified personnel according with local safety rules. Who installs the equipment must follow the technical informations contained in this manual.

For other informations please contact AXOR technical dept.



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## Introduction

The masterspeed **"MTS 60","MTS 140","MTS 200"** series are four quadrant driver that brings on board power supply,braking circuit,heatsink and the ventilator when request.

It needs only an unique one or three phasis alternate feeding ,while all further voltage are obtained from internal flyback.

Dc bus + AT - AT connections are provided to which we can add an external capacitor for monophas feeding.

The output power stage (mosfet or IGBT)is controlled using the PWM technique (20 KHz).These amplifiers are designed for driving servomotors between 0,2-8 Nm, where dinamyc performance and fast response are requested.

The speed control is made by tachogenerator,armature or encoder feedback .

Faults are showed in front of the panel.

If an amplifier module is replaced,it is important to verify that the new amplifier module is calibrated as the one removed.

This is easily accomplished by simply installing the header from the removed amplifier module into the new one.

We can adapt dinamyc constant,respect standard,by new personality header.For to use various options avalaible on amplifier,we must open or close the solder bridges in "adjustment zone".

For take out this PC board please remove the driver plastic cover,push the PC board bicking device and take out the PC board internal.

## Technical specification

Power supply voltage and rated current for each model

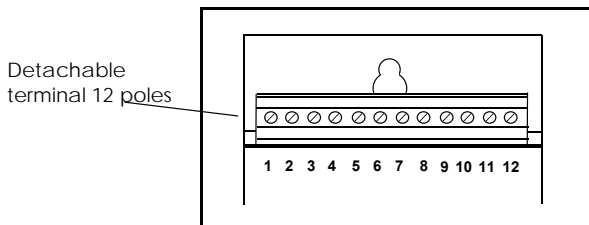
Model	Power s. (Vac)	Drive motor voltage(Vdc)	*Max min power supply value declared, are calculated for 10% tolerance in the net and referred to the transformer with
MTS 60	20 - 40 *	27 - 54	
MTS 140	35 - 95 *	47 - 122	
MTS 200	52- 145 *	70 - 200	

Sizes	Rated current	Peak current (A)	-Sizes available for all models. Rated current are declared until 45°C
4 / 8			
8 / 16	4	8	
10 / 20	8	16	
14 / 28	10	20	

- Rated current is adjustable between 40 % to 100% by **Rin**.
- Peak current is adjustable between 50 % to 100% by **Rip**.

Input reference	Differential +/- 10V (input impedance 20K Ohm)
Drift (referred to differential reference amplifier)	+/- 18 micro V/C° (max)
Drift (referred to differential speed amplifier)	+/- 18 micro V/C° (max)
Input-output demand current	+/- 10V (input impedance 23.5 K )
Enable signal	+10 / 30 VDC (input impedance 10K )
Minimum tacho signal at max speed	5V (Reference a 10V)
D.T. range regulation	0 / 5000
output voltage for external use	+10V, -10V (5mA max)
Motor current monitor	+/- 8V (correspond at peak current)
Operating Temperature	0 / 40 C
Humidity	80% max
Altitude	0 / 1000 m s.l.d.m.
Weight	

## Inputs and outputs (signal connectors)



**1** CONV (OK)  
Internal relay contact

**(OUTPUT)**



These contacts normally are closed.  
They open when active an internal protection.  
(Max load 48 Vdc 800 mA or 110 Vac 1A)

**2** CONV (OK)  
Internal relay contact

**(OUTPUT)**

**3** I MOTOR

**(OUTPUT)** This signal correspond to the motor current.  
+/- 8 V correspond to the peak current of the amplifier.  
Example: MTS140 8/16 .....8V Correspond to 16 A

**4** TPRC

**(INPUT-OUTPUT)**

It can use in two differents mode:

### 1 Current limitation.

We connect an external resistance to zero.(Internal speed loop is enabled).  
Example:with external resistor (value 47 K) current is limit to 50% respect max current of size.

### 2 Current reference: (torque input)

We apply +/- 10 V signal ,it correspond at peak current.  
In this case speed loop is disabled automatically.  
We can also disabled with solder bridge JP 7 located in the "adjustment zone". (see page 22).

Use instruments with impedance greater than 100 k.

**(OUTPUT)** Output voltage for external use -10Volt max curr.5mA.

**5** - 10 V

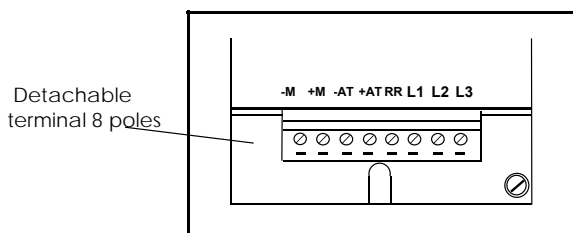
**(OUTPUT)** Output voltage for external use +10Volt max curr.5mA.

**6** + 10V

7	<b>ENABLE</b>	<b>(INPUT)</b> Logic signal for amplifier 10/30 vdc. If the signal is smaller than + 10 v the amplifier isn't enable
8	<b>ZERO SIGNAL</b>	Common zero signal <b>(INPUT)</b> Noninverting differential input +/-10V.
9	<b>SPEED REFER. +</b>	<b>(INPUT)</b> Inverting differential input +/-10V
10	<b>SPEED REFER. -</b>	<b>(INPUT)</b> Input tachogenerator signal
11	<b>TACHOGENER. -</b>	<b>(INPUT)</b> Input tachogenerator signal. This signal is connected at the zero amplifier.(Internal)
12	<b>TACHOGENER. +</b>	

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## Inputs and outputs (power connector)



**-M** **(OUTPUT)** Output servomotor -

**+M** **(OUTPUT)** Output servomotor +

**-AT** **(OUTPUT)** Internal negative power supply. (We can connect an external capacitor if request).

**+AT** **(OUTPUT)** Internal positive power supply. (We can connect an external capacitor if request).

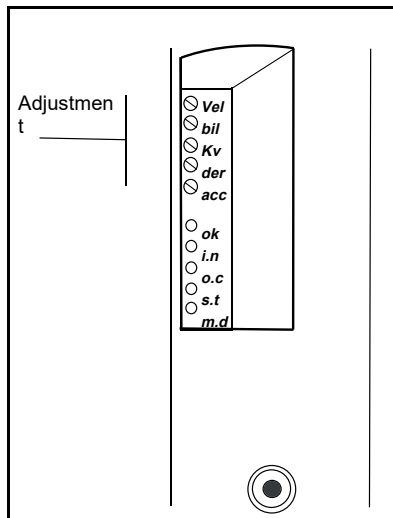
**RR** **(OUTPUT)** We can connect an external resistor for braking.

**L1** **(INPUT)** Phase 1 from transformer.

**L2** **(INPUT)** Phase 2 from transformer.

**L3** **(INPUT)** Phase 3 from transformer.

## Trimmer adjustment



### **VEL**

With this trimmer we can adjust the fine speed. It provides a range of +/- 20 % to fine tunes the velocity command input sensitivity ;for increase speed turn potentiometer clockwise and in anticlockwise sense for reduce itself.

### **BIL**

Offset calibration. This potentiometer allows offset calibration on the input reference.

Max reference correction +/- 200 mV

### **KV**

The dynamyc response of the motor depends from this trimmer; for increase the gain turn the KV potentiometer in clockwise sense.

### **DER**

Derivative adjustment.Turning the DER trimmer in clockwise the overshoot is reduced.

### **ACC**

The solder bridges allow insert the acc/dec function.(JP1-JP2-JP8 )

With anticlockwise turn(ccw)we increasing acc/dec function between 0.1/1 sec.(correspond 10 v reference)

We can increase or reduce max time of acc/dec opening JP1 solder bridge and inserting a resistance in the personality header.(see pag. 27)

N.B. Usually,the amplifier,is provided with the ACC/DEC function disabled.



# Cooling

**MASTERSPEED amplifiers should be installed to allow a proper heatsink cooling.**

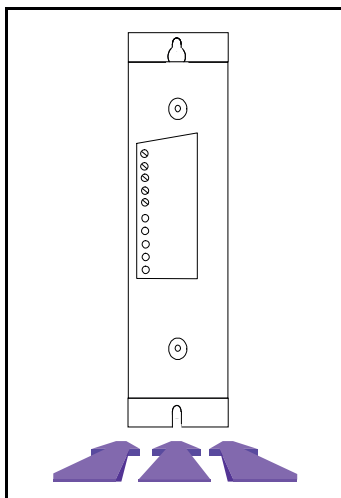
*Only position accepted in the*

**It is important,** for proper natural convection cooling, avoid to put other objects above the amplifier.

**Using the amplifier in dusty ambient,** it is important that the doors of boxes containing electronic equipment be kept closed and air must be filtered avoid the entry of contaminants and conductive particles wich can cause extensive damages.

Every amplifier is provided with a thermoswitch that opens when the temperature exceeds a safe operating level, S.T. protections will be memorized.

The fault can't be reset. We must wait until the heatsink temperature is lower. Max working temperature is 45°C.



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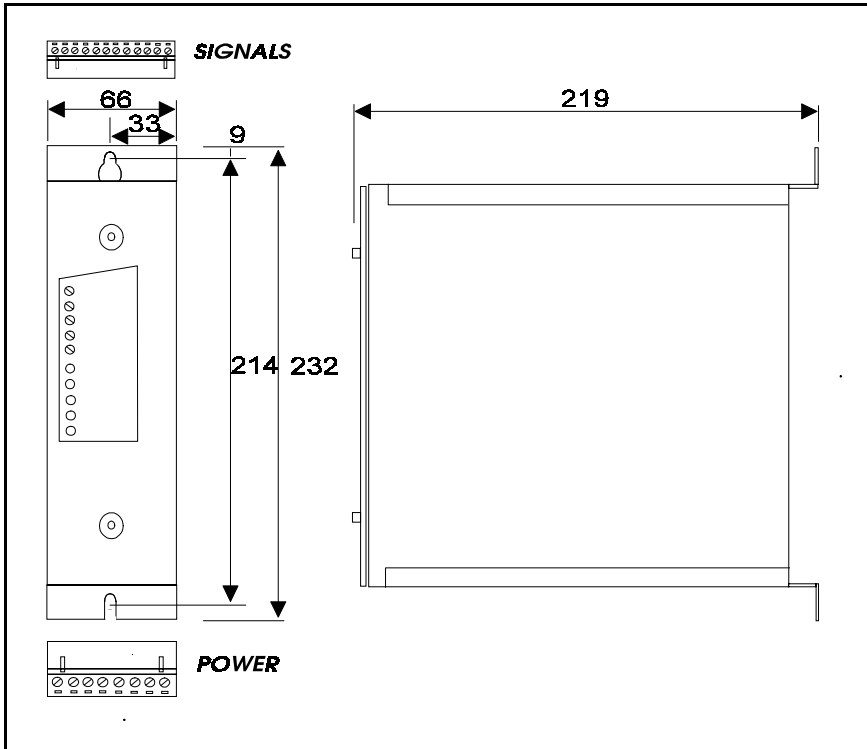
**MASTERSPEED table, for identify the type of ventilation**

	Natural convection	On board ventilation
MS60 4/8	○	
MS60 8/16	○	
MS60 10/20	○	
MS60 14/28	○	
MS60 20/40	○	
MS60 25/50		○
MS140 4/8	○	
MS140 8/16	○	
MS140 10/20	○	
MS140 14/28	○	
MS140 20/40		○
MS140 25/50		○
MS200 4/8	○	
MS200 8/16	○	
MS200 10/20	○	
MS200 14/28		○
MS200 20/40		○
MS200 25/50		○

**If we use intensively** the amplifier with high room temperature ambient and quick step we must provide for forced cooling.

**NOTE:** In case of forced cooling requirement the ventilator it should be installed at the bottom of the amplifier under the relative units.

## Overall dimensions



## Power supply dimesionality

**ATTENTION:** Follow the scheme and formulas below for dimensioning the power supply. The amplifier don't need auxiliary voltage, because it is provided internal fly-back.

### Transformer

**ATTENTION :** Amplifier have the internal zero connect with negative of power supply. AXOR advise against to use authotransformer.

**VOLTAGE:** Primary voltage value is the avaible voltage on secondary voltage to be calculated referred to motor max line voltage to be used.

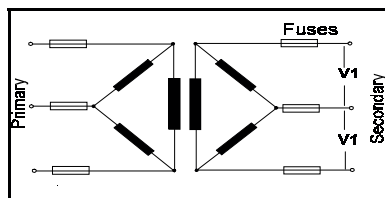
$$V1 = \frac{V_{motor}}{0,9 \times 1,36}$$

Where  $V_{motor} = E_{max} + R_i \times I_n$   
 $V_{motor}$ =Tensione misurabile ai morsetti motore alla velocità max. e alla piena coppia nominale.  
 $I_n$  = Rated current (motor)  
 $R_i$ =Armature motor resistance with brushes  
 $E_{max}$ =CEMF at max speed

Voltage range power supply accepted are reported at page 5. However these are max values accepted for each model:

V1=

20-40 Vac	.....	MTS 60
35-95 Vac	.....	MTS 140
52-145 Vac	.....	MTS 200



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**POWER:** We can supply it by a three phasis transformer. If the amplifiers are differents we can use a transformer with differents secondaries wiring. The secondaries of transformer must be connected triangle mode, while the primary may be connected triangle or star mode. The power of the transformer can be calculated with the following formula.

Power transformer:

$$P(VA) = (P_1 + P_2 + \dots + P_n) \times 1,25$$

Where (  $P_1 + P_2 + \dots + P_n$  ) is the sum of the rated power (motors) supply the transformer. In multiaxis application the power of the transformer could be declasssed due to medium duty cycle.

This is the formula for calculated rated power of the motor:

$$P_n \text{ Motor} = \frac{n}{9,55} \times C_n$$

Where  $n$  motor max speed (express in RPM)  
 $C_n$  motor rated torque (express in Nm)

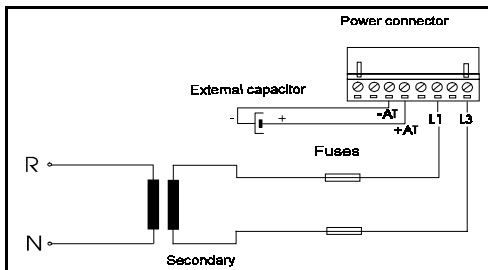
### Avoid to use transformer with power upper than 7 KVA.

The amplifiers could be damage caused overcurrent.

For all model are available, upon request, transformers for supply the Masterspeed amplifiers.

### Single phase power supply

(Particular application. Pls contact our technical dept. for dimensioning the external capacitor.)



Masterspeed may be supply also in single phase.

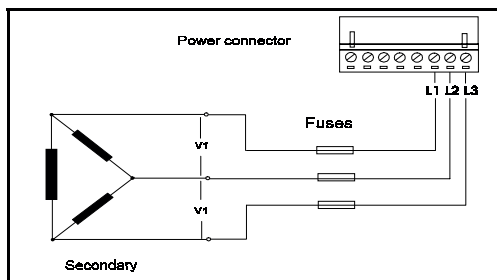
Power Supply voltage, must be connect as shows in picture, between L1-L3.

We must connect a capacitor between +AT and -AT on the power connector.

### Fuses

Masterspeed amplifiers aren't protect with fuses (input).

Each amplifier must be protected with a fuses on each line L1,L2 L3. (connect in series).



Insert three fuses (one for each phase), slow type. The values are reported below:

MTS..... 4 / 8	..... 10 A
MTS..... 8 / 16	..... 10 A
MTS..... 10 / 20	..... 10 A
MTS..... 14 / 28	..... 16 A
MTS..... 20 / 40	..... 20 A
MTS..... 25 / 50	..... 20 A

If, there are many amplifiers connect on the same transformer, we must put three fuses for each amplifier.

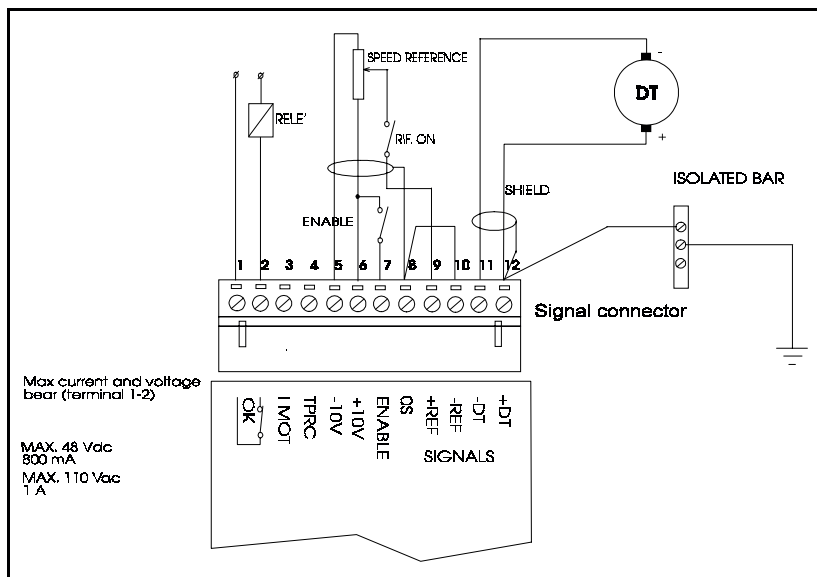
## Wiring

- Masterspeed amplifier has several wiring connection which must be made in order to ensure the correct operation for reduce interferences.
- Use shielded cable for analogue and tacho signal.(For wiring see page 16).
- Signals cables must be not together power wires signals cable output should be own
- upper side power wiring output twisted together should be on lower side.

**AXOR advise:**

- 0,5 / 1 mm<sup>2</sup>** for signal cables,
- 2 mm<sup>2</sup>** for power cables MTS 4/8A e 8/16A ,
- 2,5 mm<sup>2</sup>** for power cables MTS 10/20A and 14/28 ,
- 4 mm<sup>2</sup>** for power cables MTS 20/40A and 25/50.

### Example for input signal connection



**Drawing shown on upper side is an example for speed reference input connection using internal voltage from MASTERSPEED.**

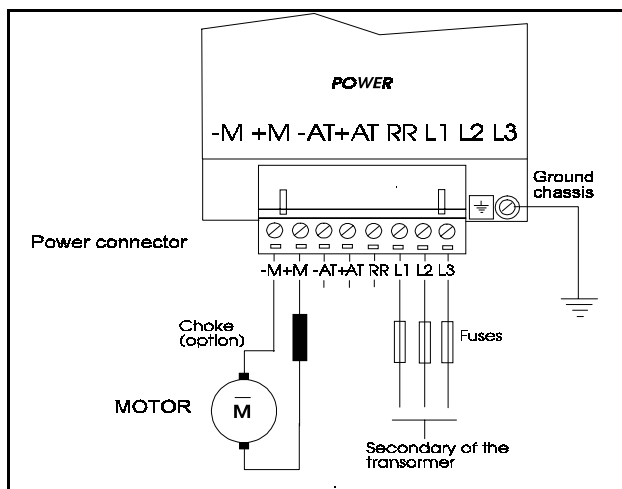
Speed potentiometer must have a value between 5k and 47kohm.

Speed reference input and tacho screen must be connected to driver 0 S.

With only a wire 0 S must be connected to ground bar of electrical box(see also ground connection page 16).

Speed potentiometer must have a value between 5k and 47k ohm.  
Speed reference input and tach screen must be connected to driver O S.  
With only a wire O S must be connected to ground bar of electrical box (see also ground connection page 16).

## Example for power connection



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The M+ and M- output can be connected directly on motor's terminal. These amplifiers need inductor connected in series to the servomotor only if it has an internal inductance lower than 0,7-0,8mH. Axor recommend to use external choke when using old motor. So we improve form factor and the servomotor don't over heating. NOTE: In the electric box, the inductance, must be connected with short wires between amplifier and inductance too.

## Ground cable connections

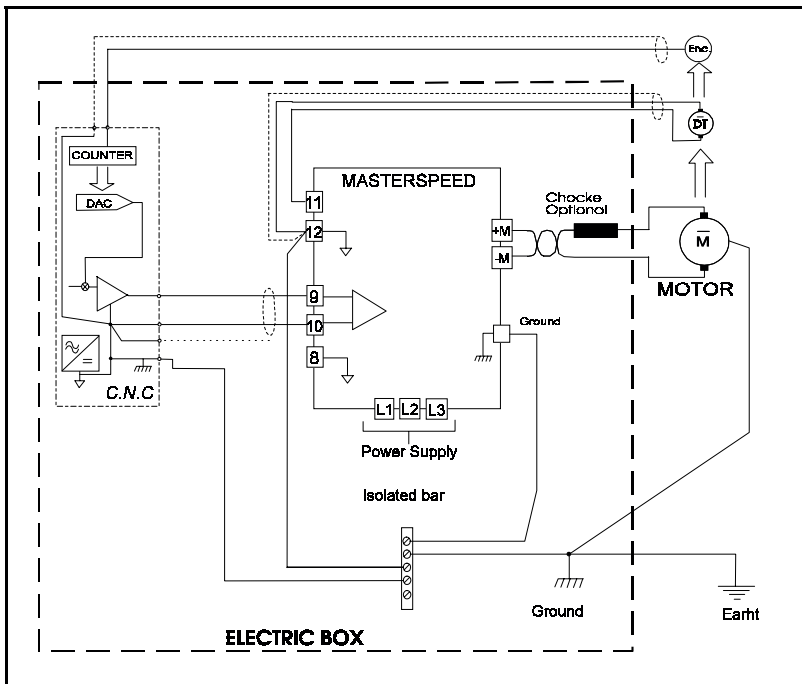
For avoid malfunctions on electrical box two separated wires are to be used for connect to an insulated ground bar, both the signal screw terminal (12), and the chassis screw of driver inside the electrical box.

The insulated ground bar will be connected with one only wire to the box ground connecting terminal, from which will start the earth wire (ground) of net.

Under written DWGS shows the best connections for a good noise reduction.

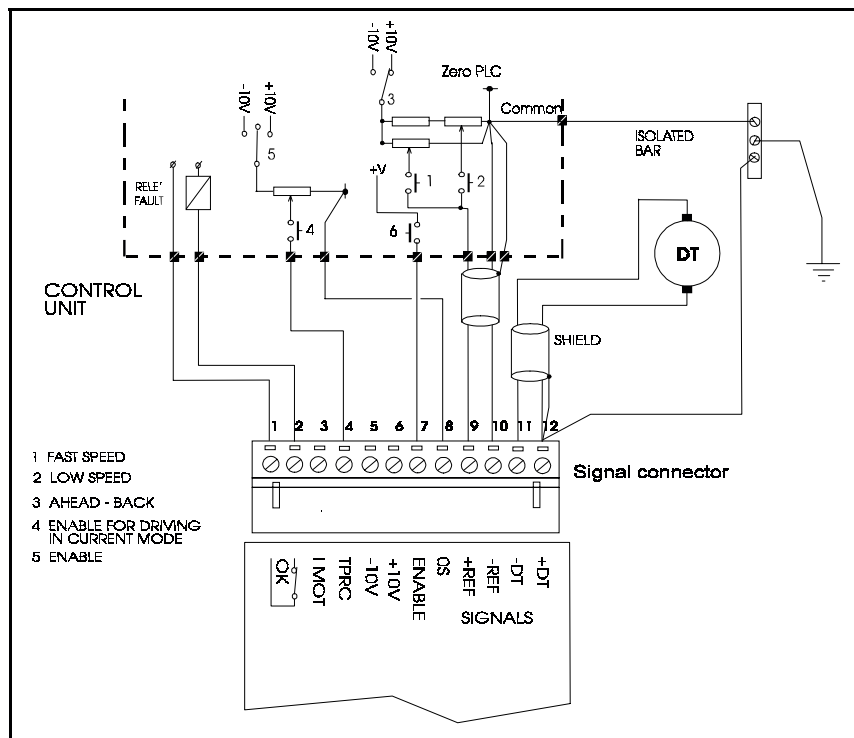


**:Don't make any bridge between the ground of the amplifiers, for avoid closed loop ground interferences**





### Example for driving connection, by external reference



***Drawing shown on upper side in an example for driving the amplifier in torque mode.***

Speed potentiometer must have a value between 5k and 47kohm.

Speed reference input and tacho screen must be connected to drive O S.

With only a wire O S must be connected to ground bar of electrical box (see also ground connection page 16).

## Preliminary checks

The standard amplifier is provided as follows:

- Nominal and peak current agree with amplifier's size.

Ex. MS 10/20 = 20A peak .....10A nominal

- Tachogenerator feedback.

Amplifier is provided with RDT resistance mounted on personality header. (22K 5% corresponds to 3000 rpm with 10/1000rpm ke).



Verify all screw clamp connections (power and signal) and control the proper wiring on the amplifier.  
For motor and tacho polarity we will obtain clockwise direction with positive speed reference.  
(Motor and tachogenerator polarity are those declared from factory).

Now, we have 2 cases for MATERSPEED starting procedure:

- 1** If the amplifier is adjusted for its motor, go on chapter "starting procedure"
- 2** If the amplifier isn't adjusted consult chapter "personalization" and go on

## Starting procedure

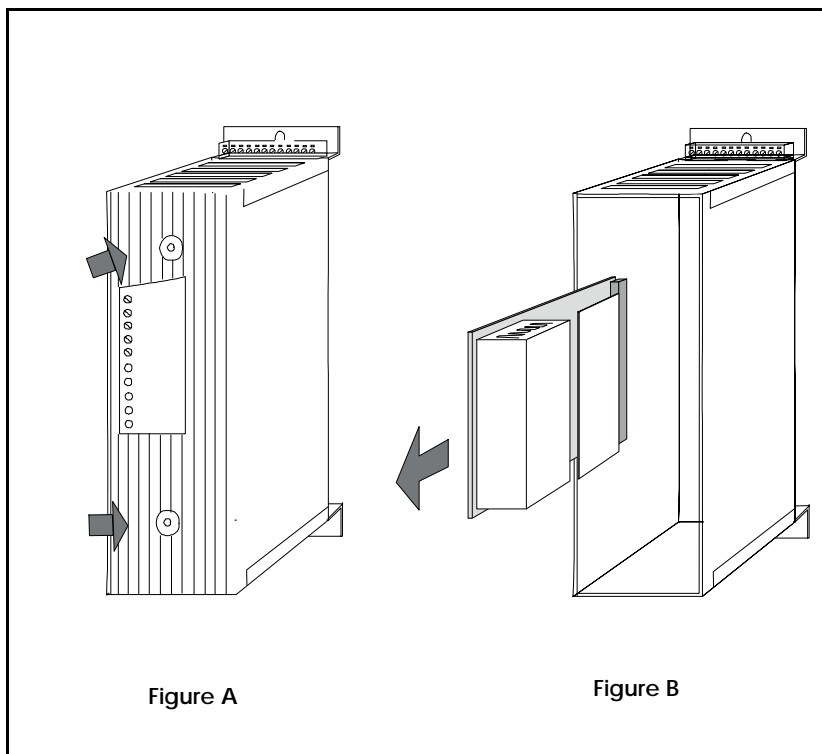
- 1 Keep the motor shaft free from load and be ready to switch off main power if necessary.
- 2 Take out signals connector (from 1 to 12 marked) leaving connected wire to flying female connector .Put in series fuses on alternate feeding.
- 3 Switch on the driver.  
After 1 second about, on normal operation mode green led on will light on .Motor must be stopped. If mentioned led don't light , please verify with a tester the choosen alternate feeding value. Switch off the three phases feeding.
- 4 Insert signal connector and be sure that reference input is zero=volt.  
ATTENTION: when a C.N.C. driver the motor please use manual mode and not activated the error connector of C.N.C.  
(Space loop not activated).
- 5 Switch on the three phasis power and after abilitate the regulation: PWM on activated. (Is good rule normally to give abilitation OK after the main power switch on of converter).
- 6 If motor stay on torque or it turn slittly, tacho polarity is correct.  
If tacho is inverted, after a low rotation, md protection is activated "tacho loss or inverted tacho", disabling the converter. (this appens obviously if JP10 is closed).Red led md light on shows the alarm situation (not restorable alarm).  
Switch off the amplifier, exchange tacho wires and start again. ATTENTION: a minimum amount of time has to be taken between a stop and start again in order to be sure of a real switch off of driver.
- 7 Increase speed value signal to a minimum value of 1 volt, and look to motor rotation direction. (If motor turns on wrong direction both polarity of tacho and motor must be inverted).
- 8 Now activate space loop of C.N.C., if one. If now we have the same working way as before closing loop of C.N.C. and if C.N.C don't gives "following position error", the driver is correctly regulated.
- 9 Now please make standard working cycles verifying that no protection will go on (red leds light on) and that the OK green led will not switch off.

## Personalization

**ATTENTION:** Following operations on drive must be done not before 15 minutes at least after switched off the power supply.

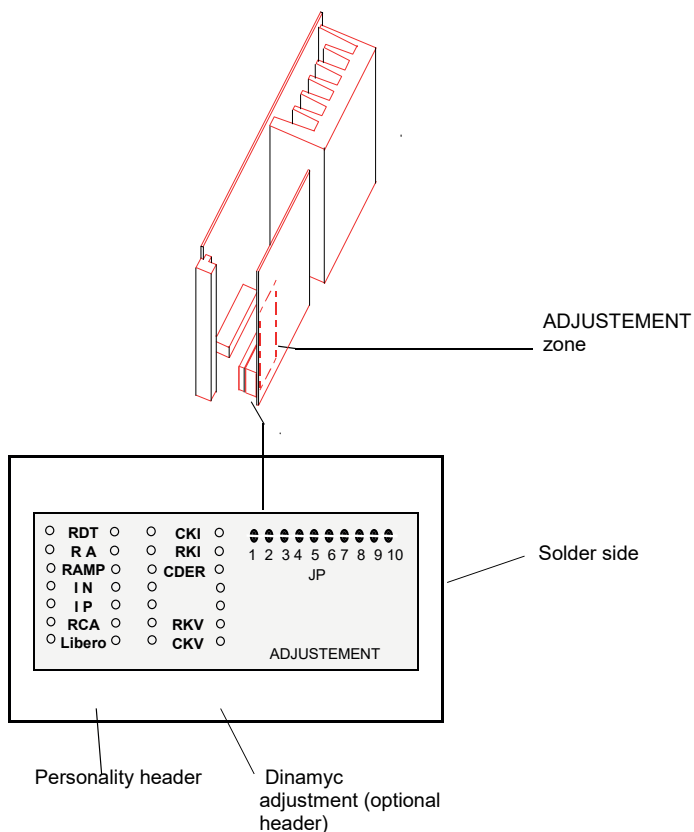
For approach to internal adjustment components we must do as follows:

- 1) Take out the plastic cover drawing out the two little buttons "see figure A".
- 2) Push the PC board device and take out the MINISPEED internal power PC board "see fig. B".



All the amplifier adjustment are present in the internal power PC board "**adjustment zone**". On this board we found a 7+7 pin header, where we mount personalities components.

If an amplifier is replaced, it is important to verify that the new amplifier is calibrated as the one removed. This is easily accomplished by simply installing the personality header from the removed amplifier into the new one and verify the solder bridges.



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In standard configuration the Masterspeed is provided with RDT resistance, mounted on the personality header, (value 22Kohm 5%) this value correspond to 3000 Rpm with DT 10v/1000 Rpm.

In the Adjustment zone these are ten solder bridges. With these are possible enable or disable functions located in 3.005.2 regulation board.

Control the proper closed of solder bridges.

In the next paragraph (called adjustment) are explained the correspondent the solder bridge.

The amplifiers are provided with standard solder bridges as follow:

Standard bridges		
	JP1	close
	JP2	open
	JP3	close
	JP4	close
	JP5	close
	JP6	open
	JP7	close
	JP8	open
	JP9	open
	JP10	close

*Below is explained the function, inserting by opening or closing the solder bridges. In the next paragraph "Adjustment " are explained the combination of solder*

**JP1 ,JP2, JP8** They allow obtain different ACC/DEC times.

**JP3** **Normally closed.** If it is open loop standard constants CKI-RKI are disabled.

**JP4** **Normally closed.** If it is open current loop standard constants CKV-RKV are disabled

**JP5** **Normally closed.** If it is open velocity loop static gain is disabled.

**JP6** **Normally open.** If it is close the armature feedback is enabled.

**JP7** **Normally closed.** We open it when we wish to drive the amplifier with external current reference. (velocity loop disabled)

**JP9** **Normally open.** If it is closed, thermic image IxT circuit activation don't stop the output transistor and the green led is switch off :(Drive ok)

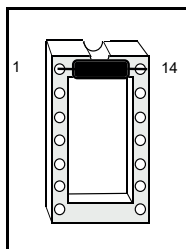
**JP10** **Normally close.** If it is opened, lost or reverse tacho circuit activation don't stop the driver working.  
It must be opened when armature feedback is used.

## Adjustment

### MAX TACHOGENERATOR FEEDBACK SIGNAL

The amplifiers are provided with RDT resistance mounted on board. (Speed Adjust for 3000rpm with KDT=10V/1000g 10V reference).

If you wish change this resistor use the formula explain below.



Insert RDT resistance between pin 1-14 on the personality header. It can be calculated with the following formula.

$$\text{RDT (Kohm)} = \frac{\text{Kdt} \times n \times 9.7}{1000 \times \text{Vref}} - 8$$

RDT value express in k (1/4 w)

Kdt tachogenerator constant (express in v/1000rpm)

n max speed express in RPM

Vref max voltage reference

## Example:

Kdt =10V  
n=3000 rpm  
Vref=10

$$\text{RDT} = \frac{10 \times 3000 \times 9.7}{1000 \times 10} - 8 = 21,1 \text{ Kohm}$$

We will use RDT= **22 Kohm**.

If the result from formula is zero make a bridge.

If the result from formula is negative you must change the tachogenerator with another with an higher kdt.

Adjustment vel potentiometer in clockwise sense, the speed increase.

Adjustment vel potentiometer in anticlockwise sense, the speed decrease.

Adjustment range +/-20%.

## Adjustement speed in armature feedback

Armature voltage can be used as velocity feedback, when motor has not tachogenerator .

The armature feedback system has less precision than a tachogenerator.(range 1/20 and when the motor is stopped it has no torque).

This function is enabled by solder bridge JP6 (closed), JP10 (open) and inserting RA and RCA in the personality header.

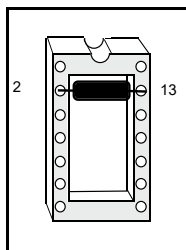


We recommend to not exceed with the dynamic gain of the velocity loop (kv potentiometer) for avoid control instability.

**Note !** It is also important the ratio between VDC power supply and V motor for the stability. Specially for armature feedback avoid reports VDC/V motor greater 1.5.

**Example:** MTS 140 armature feedback, supplied 130v with voltage motor at max speed 40 v.

$$\frac{130}{40} = 3,25 \quad \text{NO!}$$



**Insert RA** resistance between pin 2-13 of the header for adapt the system to the motor costant voltage.  
Formulas for calculate RA resistance for each model (Masterspeed series).

$$\text{MTS 60} \quad RA_{(k \text{ ohm})} = 166 \times \frac{V_{ref}}{E - 1,4 V_{ref}}$$

$$\text{MTS 140} \quad RA_{(k \text{ ohm})} = 159 \times \frac{V_{ref}}{E - 3,3 V_{ref}}$$

$$\text{MTS 200} \quad RA_{(k \text{ ohm})} = 158 \times \frac{V_{ref}}{E - 5 V_{ref}}$$

**Where:**

**Ke**=cemf at 1000rpm

**Vref**= max voltage reference

**n**= max desired speed expressed in rpm

$$E = n \times Ke$$



**Example:** motor with  $K_e=50$   $n=4000$  RPM  $V_{ref}=10$

$$E = \frac{4000 \times 50}{1000} = 200 \quad \text{MS 200} \quad R_{A(kohm)} = 158 \times \frac{10}{200 - 5 \times 10} = 10.5 \text{ Kohm}$$

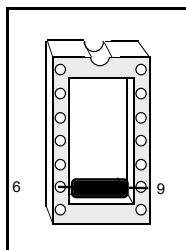
Use 10Kohm resistor.

Fine speed Adjustment calibrating by VEL trimmer in front of the panel.

Clockwise sense=speed increase

anticlockwise sense=speed decrease

Adjustment range: +/-20%.



**Insert RCA** resistance between pin 6-9 of the header for compensate internal RI of the motor and reduce loss of rights. Use the following formula for determining the value.

Calculating formula is:

$$RCA (k ohm) = 0,45 \times \frac{n \ K_e}{V_{ref} \ I_{pk} \ R_i}$$

**WHERE**

**n**= max speed expressed rpm

**Ri**=total motor resistance (cold)

**Ipk** =peak current size of amplifier

**Ke**=CEMF motor at 1000 Rpm

**Vref**=Max voltage reference

**Example:** Amplifier 10/20 A ,  $R_i=2.5$  ohm

$$RCA (kohm) = 0,45 \times \frac{4000 \times 50}{10 \times 20 \times 2.5} = 180 \text{ Kohm}$$

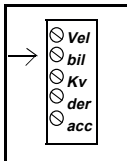
Use 180 Kohm resistance or a hit bigger.

If after this operation motor being instable, a bigger commercial resistor value must be choosen, changing the previous one.

## Offset speed calibration

The amplifier is provided with the offset speed calibration performed for tach feedback.

If necessary, retouch through bil potentiometer for correct offset. (until +/-200 mv can be compensated on analogue input). When we have zero input reference, turn potentiometer until servomotor is stopped.

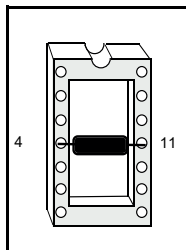


When you use amplifier in armature feedback please proceed with the offset calibration as follows:

-Insert RA and RCA resistance calculated (see page 24-25).

-Insert a voltmeter between Im test point and zero and turn bil trimmer to reach zero voltage respect to tach mode, bil trimmer has to be turned more times stop trimmer when motor shaft stops. But no loads are to be applied during this calibration.

## Rated Current Calibration



The amplifier is provided with standard calibration.

It corresponds at rated current of the size, Rin not mounted.

For reduce itself, insert RIN resistance between 4-11 pin of the personality header.

Typical values are reported below.

Is not suggest to use a lower value than the reported one of 820 ohm.

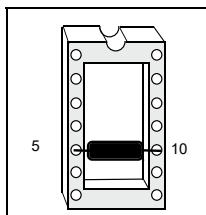
Value/ RIN(Kohm)	*	18	10	8.2	5.6	4.7	3.9	3.3	2.7	2.2	1.8	1.5	1.2	1	0.82
04/08	4	3.7	3.5	3.4	3.2	3.1	3	2.8	2.7	2.5	2.3	2.2	2	1.9	1.7
08/16	8	7.5	7.2	6.8	6.5	6.2	6	5.7	5.4	5	4.6	4.4	4	3.7	3.3
10/20	10	9.3	9	8.5	8	7.7	7.4	7.1	6.7	6.2	5.8	5.4	5	4.6	4.2
14/28	14	13	12.3	12	11.2	11	10.5	10	9.2	8.8	8.1	7.5	7	6.5	6
20/40	20	18.8	18	17.4	16.2	15.8	15	14.5	13.5	12.7	11.9	11	10.2	9.4	8.6
25/50	25	22	21	20.5	19	18.5	17	16	15	14	13	12	11	10	9.5

\* = Neither value mounted.

Minispeed amplifiers provide peak current for 2 sec.

If nominal current is lower then the current of amplifier, intervention time is lower than 2 sec on the same ratio.

## Peak Current Calibration

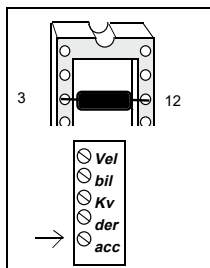


If we insert RIP resistance on the personality header between 5-10 pin, we can limit peak current.  
Below is reported a table with re-entry current.

Value/RIP(Kohm)	*	220	150	100	82	68	56	47	39	33	27	18
04/08	8	7.3	7.1	6.7	6.4	6.2	5.9	5.6	5.3	5	4.6	4
08/16	16	14.5	14	13.2	12.7	12.2	11.6	11	10.5	9.8	9.2	8
10/20	20	18	17.4	16.3	15.5	15	14.4	13.7	13	12.1	11.4	10
14/28	28	26	25	23.5	22.6	21.8	20.8	19.8	18.7	17.5	16.5	14
20/40	40	37.8	36	34.1	33	31.7	30	28.9	27.1	25.8	23.8	20
25/50	50	46.9	44	41.7	40.3	38.5	36.9	34.9	33	31	28.9	25

\* = Above are reported the value of resistances for obtain a correct current, you mustn't mount resistance lower than 18K $\Omega$ .

## RAMP TIME CALIBRATION



The solder bridges allow insert the acc/dec function. (JP2- JP8).  
With anticlockwise turn (ccw) we increasing acc/dec function between 0.1/1 sec. (correspond 10 v reference).  
We can increase or reduce max time of acc/dec opening JP1 solder bridge and inserting a resistance in the personality header. (Pin 3-12).  
(see table below).

JP1	JP2	FUNCTION	RANGE	NOTE
●	●	Acc/dec off	0 sec.	-
●	●	Acc/dec on	0,1 / 1 sec.	Adjustable with ACC trimmer
●	●	Acc/dec on	Use Res RAMP	Adjustable with ACC trimmer

Res RAMP	680K	820K	1Mohm	1,5Mohm	2,2Mohm	3,3Mohm
Time	0,2 s - 2,6s	0,3s - 3,2s	0,4s - 3,9s	0,6s - 5,7s	0,8s - 8,6s	1,4s - 13s

Ramp time showed above are referred with reference between 0 and 10v

## DYNAMIC CALIBRATION



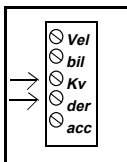
**Calibration for  
qualified  
personnel!**

**Usually, these Adjustment, are made from factory, and don't need modifies; but if need small adjustment use KV and DER trimmer.**

If we have very high load inertia (report 3:1 between inertia load and inertia motor) we must modified KV gain "KV" potentiometer and increasing the derivative function "der potentiometer". The calibration must be made with load, connected to the motor.

Apply square wave (0,5 hz +/- 1v) at the input reference.

Connect at tachogenerator input an oscilloscope with memory (ground probe must be connected at zero signal). Then turn the trimmer der in anticlockwise sense. Before look for safety space during alternative mote.



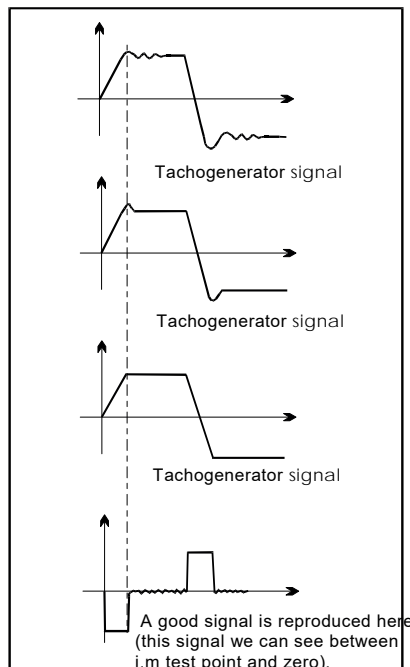
Apply power to the amplifier and enable it machine will move itself up and down. If possible increase voltage to +/- 2volt when the oscilloscope signals on monitor making a comparison with the wave shape on following page and do as suggested.

Proportional integral gain low

Increase gain turning in clockwise sense "KV" potentiometer until obtain a response similar as shown.

For reduce the overshoot turn in clockwise sense "DER" potentiometer until obtain a response similar as shown.

**Attention:** Do not exceed with gain, you can cause an useless motor heating the motor's due to swing following current oscillations.



## DYNAMIC COSTANT CALIBRATION



**Calibration for  
qualified  
personnel**

When complete information is supplied to AXOR, the amplifiers are calibrated from the factory for nominal motor performance. Field calibration may be necessary to optimize motor's performance for a particular applications, replacing internal constant (see also blocks schematic).

For replacement we insert new value in "ADJUSTMENT ZONE" opening solder bridges expected. (see pag. 22)

If is possible, order the amplifier with the personality header mounted.

### **CKI e RKI**

○	CKI	○
○	RKI	○
○		○
○		○
○		○
○		○

They describes respectively capacitor and resistance of the current loop. For replacement we must open the solder bridge JP3. (disabilitatio of standard constant)

### **C DER**

○		○
○		○
○	CDER	○
○		○
○		○
○		○

It allows to increase the velocity loop derivative constant. New value may be composed by 2 capacitor. We can insert these capacitor in the predisposed space. The obtained capacitor value is the sum of the two.

### **RKV - CKV**

○		○
○		○
○		○
○		○
○	RKV	○
○	CKV	○
○		○

They describe respectively resistance and capacitor of the velocity loop.

For replacement we must open the solder bridge JP4. (disabilitation of standard constant).

### **GAIN**

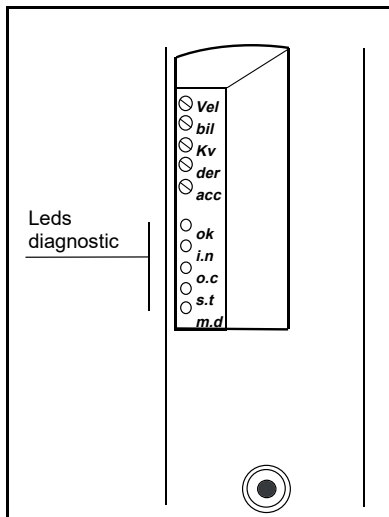
○		○
○		○
○		○
○		○
○		○
○		○
○	GAIN	○

It defines the velocity loop static gain.

We can insert new value by solder bridge JP5 (open).( disabilitation of standard constant).

**3**

## Led's diagnostic



### **LED OK (green normally light on)**

This led shows proper functioning of the amplifier.

It switch off when is activated a whatever protections shown also from red led light on. It switch off when over/under voltage protection is activated; in the same time the OK relay contact open.

### **I.n. LED (Red normally switch off)**

When this led is lighted protection IxT is activated, limit and max current provided is the rated current.

This "alarm" don't cause the disabilitation of the amplifier.

The amplifier return automatically to normal work when current consupcion goes to a normal value.

If the JP 9 solder bridge is closed is not activated the interdiction of the output transistor and the switching off of the green led (drive ok).

### **O.C. LED (RED normally switch off)**

Alarm of over current fault.

The power switching of the drive is continuously monitored, and circuit will disable power section if any of the following faults occur:

- Motor armature leads shorter
- Motor armature shorted to ground
- Motor armature shorted to power supply

This fault provoke the memorization of the alarm; can be reset by turning off the main power for several seconds, and then turning it on again.

### **S.T. LED (red normally switch off)**

Over temperature fault. The power switching bridge is provided with a thermoswitch which opens when the temperature exceeds a safe operating level.

This fault provoke the memorization of the alarm. It can't be reset. We must wait or a lower hestsink temperature and then turning on the main power.

### **M.D. LED (red normally switch off)**

Alarm of loss of tachogenerator signal or tachogenerator signal reverse.

This fault provoke the memorization of the alarm.

**Caution: Between a switch off and switch on need wait for minimum 10 sec.**

## Protection circuits

Masterspeed amplifier has protective circuits for safeguard the servomotor and the amplifier too. All protections are annunciated in front of the amplifier.

When a protections go on it provokes the memorization of the alarm, switch off of the green ok led and the internal contact of the relay opening (pin 1-2).

When in red led is on this don't provokes the memorization of the alarm (block of amplifier).

In this case contact of relay open only if the solder bridge JP9 is closed.

There are two types of faults: reversible or irreversible.

### Reversible protection:

The amplifier will enable as soon as the current or voltage returns to on acceptable operating level.

### Irreversible protection:

The amplifier won't enable. We must switch off the power supply, eliminate the fault cause and start again the amplifier after a minimum amount of time for be sure of complete capacitors discharge.

## REVERSIBLE FAULT

### Over under voltage

Is activated when the power supply come out from the table described below.

MODEL	UNDER VOLTAGE	OVER VOLTAGE
MS 60	20 V	84 V
MS 140	40 V	182 V
MS 200	58 V	275 V

### Limit of the current

Is activated when the IxT cycle of the amplifier is exceeded.

## IRREVERSIBLE FAULT

### Temperature (S.T.)

The power switching bridge is provided with a termoswitch wich opens when the temperature exceeds a safe operating level.

### Short Circuit

Is activated when there is a short circuit on the motor.

### Broken tacho generator

Is activated when tachogenerator is open, short circuited, or reversal, for preventing motor runaway.

## **Fault research**

1) When we applying power OK green led doesn't light.

**Supply voltage not correct**

- Control by instrument between R-S-T

2) OK green led is light, but servomotor don't start when we enable the amplifier.

**Velocity signal isn't present**

- Verify input signal

3) When we enable amplifier, OK green led doesn't light and O.C. red led is lighted.

**There is a short circuit on motor**

- Turn off the main power

- Verify the proper wiring

**Wire or servomotor winding is**

- Disconnect the servomotor and verify its insulation with a tester.

4) When we enable amplifier, red m.d. led is lighted.

**there isn't present tacho signal**

- Turn off the main power

**Motor cables or tacho cables are reversal**

- Verify with an instrument, the value directly on the amplifier's terminals.

**RDT resistor not mounted.**

- Invert motor or tacho cables

5) With armature feedback, when we enable *m.d.* red led is lighted

**Solder bridge JP 10 close**

- Open solder bridge

6) When we enable the servomotor is stop and *m.d.* red light is lighted

**Motor isn't connect**

- Verify the presence of connections

7) When we enable servomotor turn at high speed and m.d. red led doesn't light

**Potentiometer speed calibration isn't correct.**

- Verify the capacitor values



8) During the deceleration phase OK green led switch off.

**Foreseen external dump resistor more power ful**

- Reduce max Vel
- Increase ACC/DEC ramp
- Mount a bigger resistance.
- Reduce duty dumping cycle.

9) During the working phase S.T. red led lighted and servomotor stop.

**Happened max temperature thermoswitch**

- Room temperature is greater then 45°C.
- The amplifier is positioning not correctly, and can't have air

10) When the motor is stopped, with enable, the motor swing.

**Reversed tacho signal with over taken error corrector signal coming from CNC.**

- Proceed with start up using reference signal from CNC on manual mode (space loop excluded). Reverse the tacho signal and verify dinamically the good working functioning of machine. Only at the end of these tests ,correction signal coming from CNC will be activated.

## Options

### **Encoder feedback board**

#### **Pc board (3.015.1)**

This allows motor speed regulation, using an incremental bidirectional encoder. With this solution we save tachometer price using the same signal of positioning control. Performance quality at low speed is as better as bigger is encoder resolution 500 cycles/rev. encoder minimum is suggested. It is possible to multiply by 2 or 4 increasing quality performance. Using as example 1000cycles/rev encoder and choosing x 4 solution we have a final resolution of 4000 cycles/rev.  
Max input frequency=100 KHZ

### **External series choke**

These amplifiers need inductor connected in series to the motor only if the motor has a internal inductance lower then 0,7-0,8 mH.  
So we improve form factor and the servomotor don't over heating.

NOTE: In the electric box, the inductance, must be connected with short wires between amplifier and inductance too.





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