MICROPHASE
Technology & Performance

MASTERBOX

SERVO AMPLIFIER FOR BRUSH DC MOTORS

Service manual

rev 04-23

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www.microphase.eu

Declaration of conformity

DC & BLDC SERVODRIVES

Product name: DC1C-XXX
DC1L-XXX
SP1-XXX
SP1L-XXX
MCD1-XXX
TRXL/B-XXX
TRXL/C-XXX
MUDR-XXX
MTSB-XXX

Manufacturer: MICROPHASE s.a.s.

Address: Via Palladio 23
36051 Creazzo (VI) Italy

MICROPHASE s.a.s. assures that the drives listed above meet the following European Norms Standard:

in accordance with EC Directive 2014/30/EU (EMC Directive)

EN 55022, EN 61000-4-2

in accordance with EC Directive 2014/35/EU (Low Voltage Directive))

EN 61010-1

WARNING - Risk of damage and/or personal injury

This drives doesn't contain any user serviceable part. Attempting to replace any internal component, may result in damage to the unit and/or personal injury. This may also avoid the warranty.

rev. 10/21

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1.1 Safety and note

Caution

Users must keep well clear in mind that this motion control equipment is capable of producing high forces and rapid movement so they must be used with attention especially during the application program's development.

This motion control equipments are sold as end-users products to be installed only by practical staff in accordance with all local safety laws and regulations. The device have to be enclosed such that any part is not be accessible while the system is powered on.

We strongly reccomend to follow these recommendations in order to avoid wrong uses of the equipment that may be impaired all the protections provided by the device.

Please read these notes carefully before powering up the drive

It is very important meet all applicable safety requirements during installation and operating of any motion control equipment. Any installer has to assume the responsibility to ensure that he recognizes and complies all the relevant safety standards. Any installation, not meeting the safety requirements, may damage the equipment or injury the user.

This motion control equipment shoul be handled, installed, setted-up and maintenanced only by competent personnel expert and trained in the installation of motion control electronic equipment. Such technicians should be aware of potential electrical and mechanical hazards. Shall never beliable or have any responsability if the products have been improperly stored, installed, used or maintened, or if the costumer has permitted any unauthorized modifications, adjustments, and/or repairs to the products.

1.2 Operation mode and feedback

This is a drive capable to drive **DC brush** motors. It's a High Performance full four quadrant drive servo amplifier. The mosfet output power stage is controlled by a 20 Khz PWM (Pulse Width Modulation) signal that allows it to drive servo motors where high dynamic performance and precise speed is required.

Velocity feedback

Closing the velocity feedback loop to motor may be done in several different ways to accommodate most applications. This types of velocity feedback are available with DC brush motors.

- DC motor with encoder
- DC motor with internal PWM (Armature)
- DC motor with tachogenerator

1.3 Model and size

Model available

POWER SUPPLY (VAC)		
Model 60	30 - 50 VAC*	45VAC**
Model 140	35 - 110 VAC*	95VAC**
Model 200	45 - 160 VAC*	150VAC**
* Power supply min/max **Nominal		

Size available

CURRENT		
Size	Rated current (A)	Peak current (A)*
4/8	4	8
8/16	8	16
10/20	10	20
14/28	14	28
20/40	20	40
25/50	25	50
*Peak current during 2 sec		

The Size current 20 / 40A and 25 / 50A are available in the MAXI version. All models are available in the current sizes indicated.

Specifications

FUNCTION	VALUE
PWM frequency	20Khz
Operating temperature	0/+45°C
Storage temperature	-10/+70°C
Drift analog input	0,5uV/°C
Analog inputs (+/-VEL)	+/-10Vdc max, impedance 20Kohm cad.
Current monitor output (CURR)	+/- 8Vdc = Peak current
Power supply output (+/-10V)	+/-10Vdc max. 4mA
Output STATUS	Internal Relay 110Vac @ 1A
Minimum Inductance motor	400uH
Digital input (ENABLE)	+9V/+30Vdc (min/max)
Digital input (STOP)	+9V/+30Vdc (min/max)
Band width (current)	2KHz
Band width (velocity)	150Hz
Weight	2,4 kg
Altitude	Up to 1000m without restrictions, from 1000 to 2000m power derating 1,5%/100m
Contaminants	2° or better (Norms EN60204 e EN50178)
Flammability rating 94V-0	Cover material, the PCB and the electronic component meet 94V-0

1.4 Power supply construction

Power transformer (T)

The transformer's nominal power is calculated based upon the sum of power from the single motors driven:

P(VA)=Pn1+Pn2+..

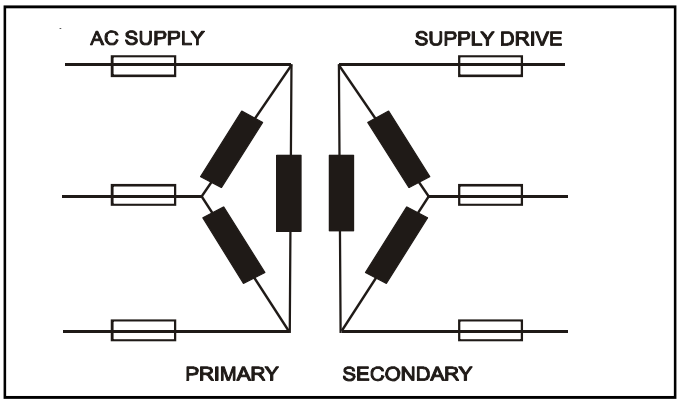
Pn Motor = N * Cn / 9,55

Where: **Pn Motor** = Power absorbed motor in (W)
N = Max. speed of motor in RPM.
Cn = Nominal torque of motor in (Nm).

Note: In multi-axis applications, the transformer's power can be downgraded by 30%. If the max. power transformer calculated is over 6KVA contact the factory.

PAY ATTENTION:
- The drive has zero signal GND in conjunction with the zero power GND, thereby preventing the following links:
- Use a standard heavy duty power transformer without center taps on the secondary as shown in the schematic above.
- DO NOT USE AN AUTO TRANSFORMER.

1.5 Protection fuses



Fuses are required on both the primary and secondary of the transformer to protect against harm to the system and the transformer itself.

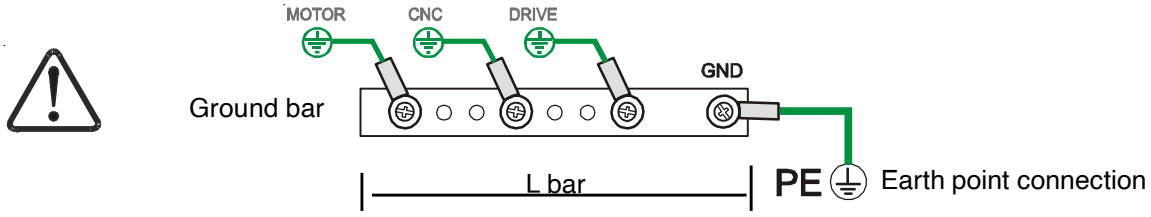
Secondary fuses: Use the table below. In the case of multiple converters connected on the same secondary, 3 fuses must be installed for each drive.

SECONDARY FUSES						
SIZE SERVODRIVE (A)	4/8	8/16	10/20	14/28	20/40	25/50
FUSES (A)	6A	10A	16A	16A	30A	30A

Use slow type (T) fuses.

1.6 Connections to earth and ground

Make sure that the servodrive and the motor are connected to earth in accordance with the current norms. This connection must be done by using a copper bar, mounted on insulating supports:



L bar	Bar's section
0,5 .. 1m	30 x 5 mm
1..2m	40 x 5 mm

then follow these indications:

1. Connect to the ground bar:
   - the GND 0V of the Dc One
   - the internal "0V" zero voltage of the CNC;
   - the earth terminals of the PLC/CNC frames;
   - the "0V" of the auxiliary supply;
2. Connect the ground bar to the zinced panel of the drive by using a screw, then connect that screw to earth.
3. Connect earth to the motor's

It suggests a conductive connection as much as possible to the chassis, or the heatsink, or the mounting panel of the electrical box.

It refers to the earth connection.

Motor and Power cable (as norm EN60204)

SECTION	SIZE (A)
1,5mm² / 15AWG	4/8 8/16
2,5mm² / 13-14AWG	10/20 14/28 20/40
4mm² / 11-12AWG	25/50

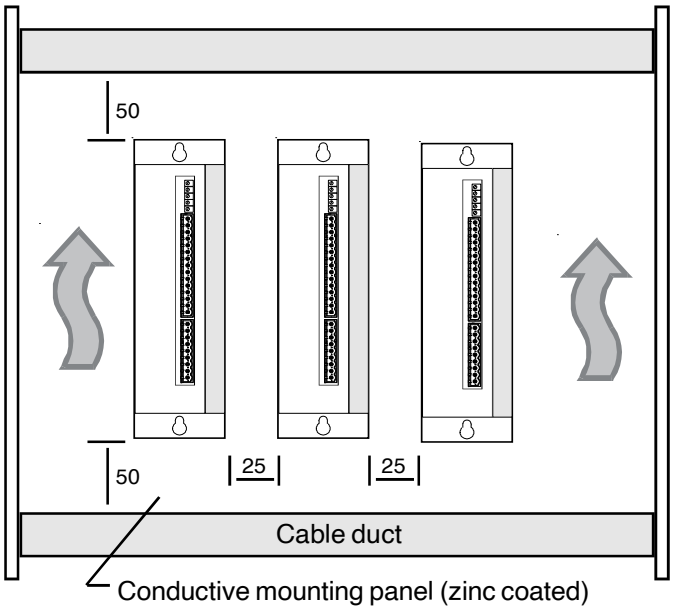
Control signals cable (as norm EN60204)

SECTION
0,5mm² / 20AWG

Feedback signals cable (as norm EN60204)

SECTION
0,25 - 0,35mm² / 22 -24AWG

1.7 Ambient conditions



Dimensions are expressed in millimeters.

Positioning in the electrical box

Follow the instructions in the positioning of the servodrive in the electrical box.
- The drive is natural convection air flow cooled.
- To ensure the drive cooling and make the installation easier for the operator it must be installed vertically leaving a free space of at least 25 mm on each side of the device. The converter must be mounted vertically on the electrical box. In case you want to mount it horizontally, remove the cover.
- The electrical box must have suitably filtered air vents.
- Leave the necessary space both above and below the converters.
- Keep the drive from excessive mechanical vibration

Notes during the assembly

Caution: during the wiring of the servodrive in the electrical box, make sure that do not enter leading wires of copper or iron chips through the slits. Before performing the work cover the holes with a piece of paper tape. Naturally finished work this tape is removed.

1.8 Ventilation

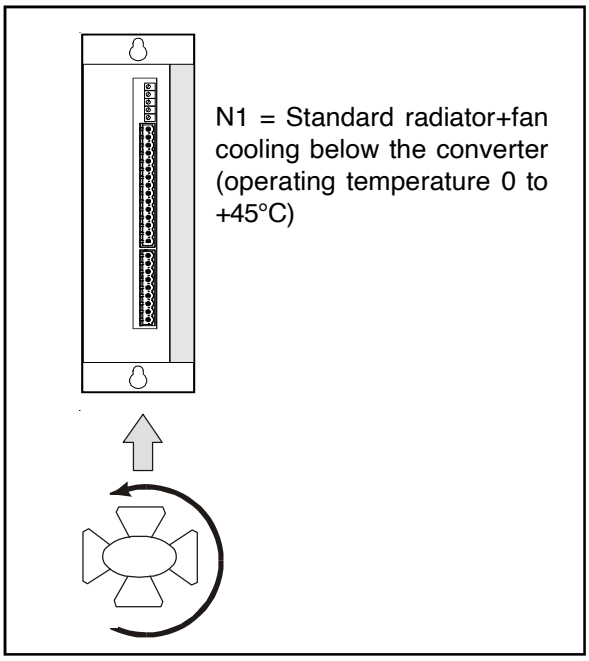
This servodrive are intended only for use in close locations. Ambient characteristics: operating temperature from 0 to +40°C. Humidity limits between 5% to 95% non condensing (Pollution degree 2 or better).

Supplementary ventilation may be requested in accordance to size. See the table below.

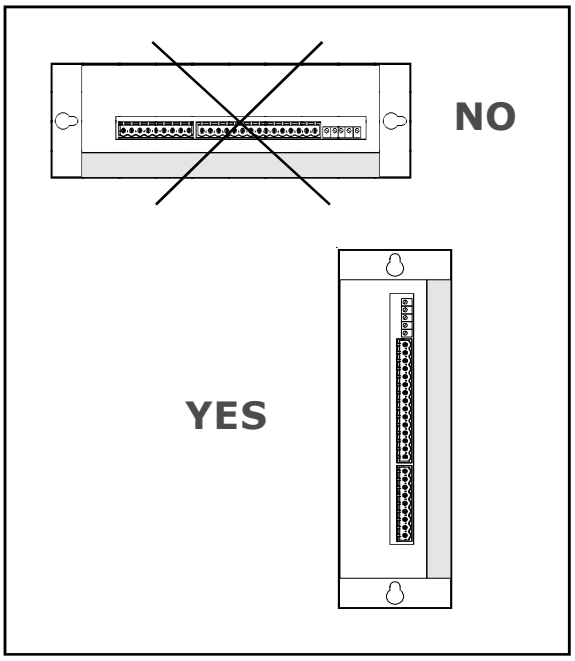
VENTILATION for MODEL & SIZE					
MODEL	4/8	8/16	10/20	14/28	20/40 e 25/50
60	N	N	N	N	N
140	N	N	N	N	N
200	N	N	N	N	N1

N = Standard radiator (operating ambient temperature from 0 to 40°C)
N1 = Standard radiator + supplementary ventilation (operating ambient temperature from 0 to 45°C)

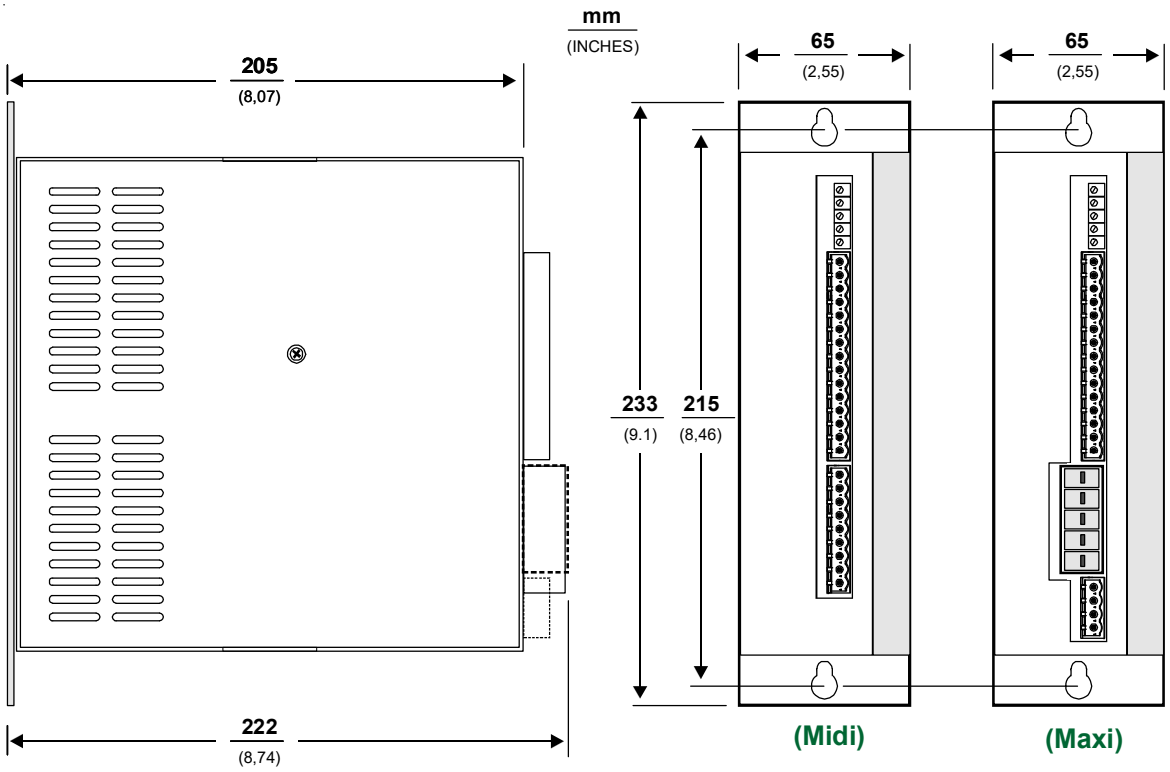
Supplementary ventilation



Mounting position



1.9 Mechanical dimensions

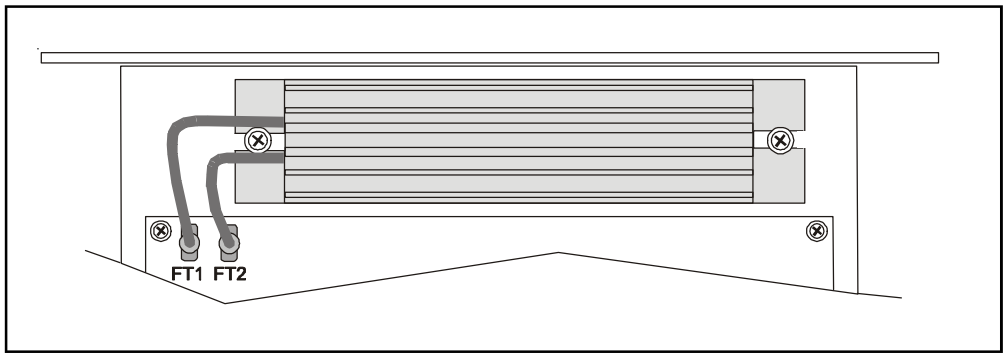


1.9 BRAKING RESISTOR

The product has a basic 200W braking resistor. If the application requires a higher braking power, it is possible to insert an external braking resistor up to a maximum power of 1KW.

- This resistor must be connected between terminal 24 and terminal 16 (Midi) version.
- On the (Maxi) version the resistor must be inserted on the 4-pole terminal block in the EXT.RR and + DC terminals.

When inserting an external resistor, the internal resistor must be disconnected. Open the product by removing the cover and remove the two female fastons FT1 and FT2 which connect the internal resistance to the printed circuit of the product.



Use suitable braking resistors, in case of doubts contact MICROPHASE.
The ohmic value to be used for the external resistance is:

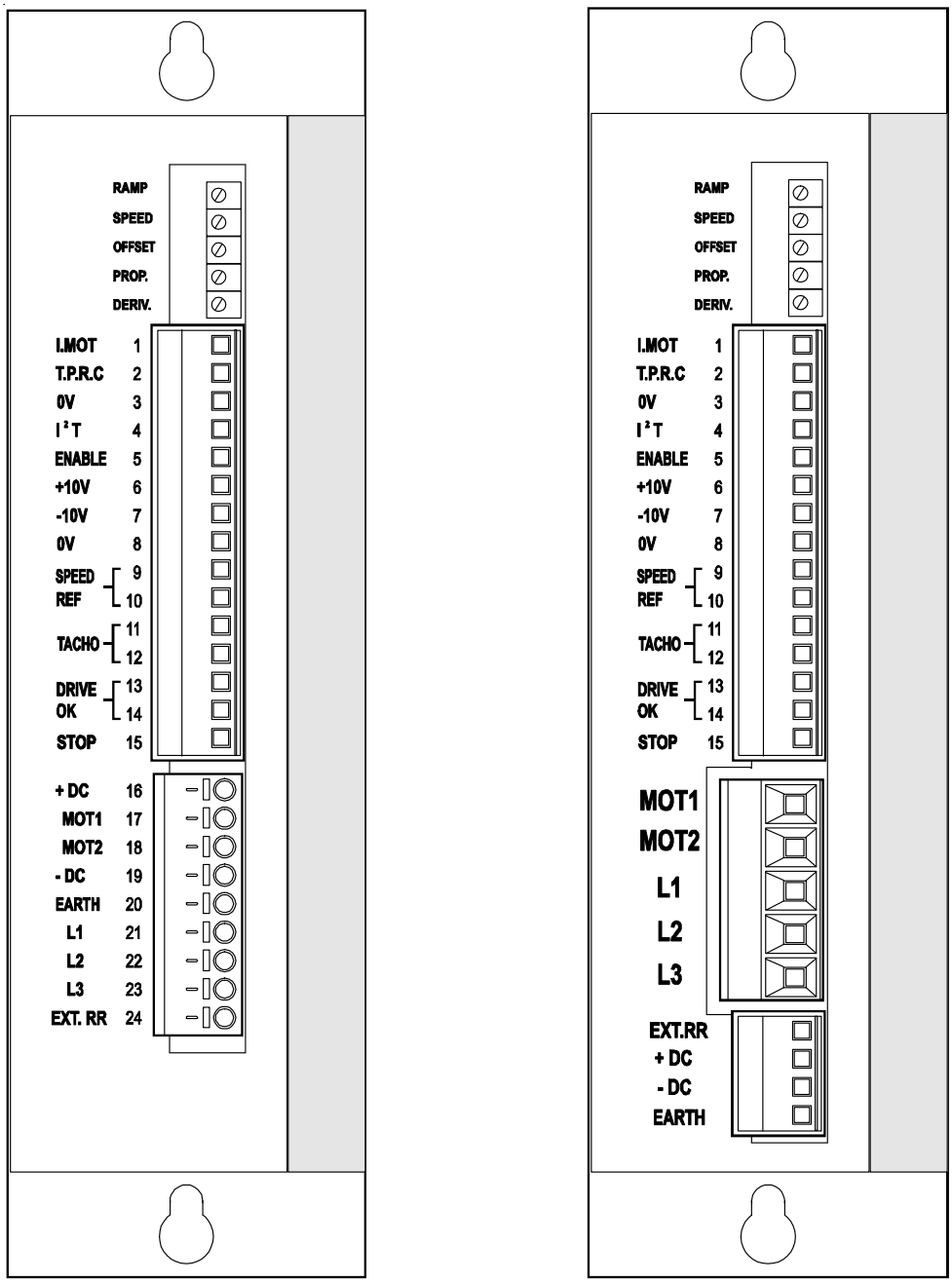
EXTERNAL BRAKING RESISTOR			
TYPE SERVODRIVE	60	140	200
RANGE RESISTOR (OHM)	3-5	9-10	13-15

The internal resistor is protected by a circuit that limits the maximum average power to 200W. The power limit is displayed by a yellow LED and a red LED positioned on the alarm zone:

P.A. YELLOW Normally off. It turns on when the internal braking module reaches 80% of the maximum dissipable power. This indicates a particularly heavy duty cycle. No blocking is activated.

M.REC RED Normally off. It lights up when the internal braking module reaches 100% of the maximum dissipable power. The intervention causes the braking module to be blocked and the alarm to be stored. The internal contact of the "Drive Status" relay opens communicating the FAULT.
To reset the alarm turn off the power, wait 3/5 seconds and turn on the servodrive again.

2.0 Terminal blocks view



Midi **Maxi**

The figure show the terminal view of the servodrives. The removable 15-pole 5mm pitch terminal block refers to the input and output signal points of the SIGNALS converter for both the Midi and Maxi models.
The Midi converter is equipped with a removable POWER 9-pole 5mm pitch terminal block.
The Maxi converter is equipped with a removable POWER 5-pole 7.62mm pitch terminal block with the addition of a 4-pole 5mm pitch terminal block

2.1 Power connector

Midi

9 POLE POWER TERMINAL BLOCK (MIDI)		
16 +DC	OUT	Internal power supply +DC BUS
17 MOT1	OUT	Output motor -M
18 MOT2	OUT	Output motor +M
19 - DC	OUT	Internal power supply –DC BUS
20 EARTH		Earth (Corresponds to the -DC BUS)
21 L1	IN	AC input phase from transformer
22 L2	IN	AC input phase from transformer
23 L3	IN	AC input phase from transformer
24 EXT.RR	OUT	Output for connection of external braking resistor

Maxi

5 POLE POWER TERMINAL BLOCK (MAXI)		
MOT1	OUT	Output motor -M
MOT2	OUT	Output motor +M
L1	IN	AC input phase from transformer
L2	IN	AC input phase from transformer
L3	IN	AC input phase from transformer

4 POLE POWER TERMINAL BLOCK (MAXI)		
EXT.RR	OUT	Output for connection of external braking resistor
+DC	OUT	Internal power supply +DC BUS
- DC	OUT	Internal power supply –DC BUS
EARTH		Earth (Corresponds to the -DC BUS)

- Use only three-phase transformers with secondary connected in delta. Do not use transformers with star secondary.
- Use only transformers isolated from the mains (Do not use autotransformers)
- If the transformer is three-phase use terminals L1, L2, L3. If the transformer is single-phase use terminals L1, L2.

2.2 Signals connector

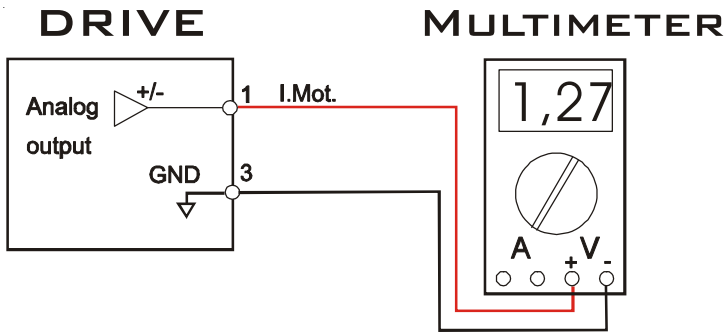
SIGNALS CONNECTOR	
1 MOT (OUT)	Motor current signal output. The value is +/- 8V referred to the peak value of the converter.
2 TPRC (I/O)	The functions available through this input are highlighted in the relative chapter.
3 0V	Signal Common Ground. Corrisponds to power supply's negative GND input.
4 I2T (OUT)	This output is normally closed ON, it opens OFF when the red I2T LED lights (Rated current limitation intervention). NPN output max. 100mA
5 ENABLE (IN)	Positive drive enable with range >+9Vdc min. to +30Vdc max). When the signal is removed the converter is disabled.
6 +10V (OUT)	Power supply +10V max 4mA
7 –10V (OUT)	Power supply –10V max 4mA
8 0V	Signal Common Ground. Corrisponds to power supply's negative GND input.
9 SPEED REF+ (IN)	Positive Differential speed analog input
10 SPEED REF- (IN)	Negative Differential speed analog input
11 TACHO - (IN)	Negative tachogenerator input
12 TACHO + (IN)	Positive tachogenerator input
13 DRIVE STATUS (OUT)	Drive output OK. Internal relay contact between pin 13 and pin 14. When the green OK LED turns off (due to the intervention of an alarm), the contact opens. The contact has a capacity of 30VDC @ 5A or 110VAC @ 1A
14 DRIVE STATUS (OUT)	Drive output OK. Internal relay contact between pin 13 and pin 14. When the green OK LED turns off (due to the intervention of an alarm), the contact opens. The contact has a capacity of 30VDC @ 5A or 110VAC @ 1A
15 STOP (IN)	If a logic signal is applied (Range between $\geq$ + 9Vdc and + 30Vdc) the motor stops at zero speed and remains in torque.

Signal connector description

2.21 (IMOT) signal terminal pin 1

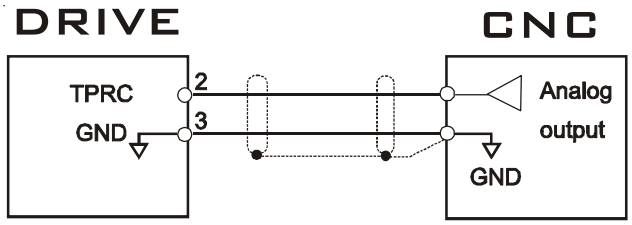
On this terminal is available analog output "current monitor of motor" with range 0V + /-8V. The value of 8V is the maximum current supplied by the drive. For example, if we have a size 8/16A, 8V corresponds at 16A circulating on the motor.
The signal can be positive or negative depending on the direction of rotation of the motor.

Output Impedance is 10Kohm. Consider the internal impedance in the case are linked external resistive divider.



2.22 (TPRC) signal terminal pin 2

With a voltage (example from a CNC output) you can command the drive in torque mode.



Applying a signal of +/-10V at TPRC, the Drive to supply positive or negative peak current.
The formula to determine the value of Voltage to apply in TPRC in order to obtain requested current is the following:

V(TPRC) = 10 * Request current / PKcurrent Drive

Example: (Drive size 10/20A, request current 8A)

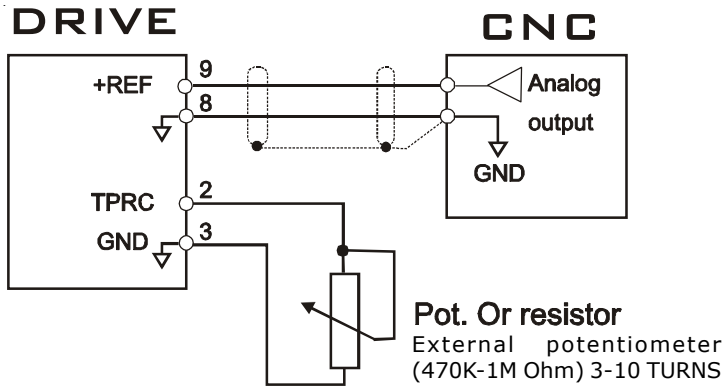
V(TPRC) = 10 * 8 / 20 = 4V

NOTE:
In current reference the loop of internal velocity automatically excludes itself .

2.23 (TPRC) signal terminal pin 2

Current output limitation

With an external potentiometer connected from GND and TPRC input, you have a limitation of output current (from zero to max. size) drive's.



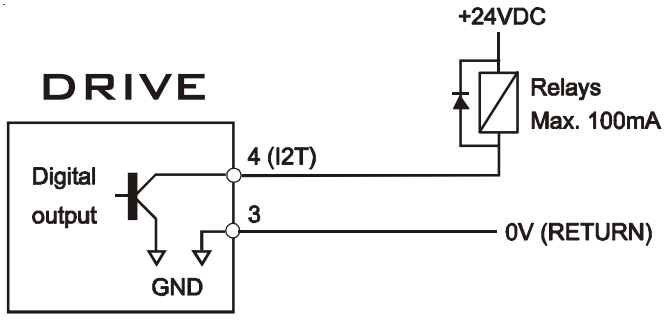
The speed loop remains active and uses the input reference signal +/-VEL.
Connect between terminal and GND terminal REQ a resistor 1/4W or 1/8W. (The figure is used a potentiometer). With external resistance tends to zero ohms, the output current tends to zero. Increasing the ohmic value of resistance, the value of current supplied increases. With 47K of the current is limited to 50% on the Maximum size. The loop motor speed remains active.

2.24 GND (OV) terminal pin 3 - 8

Terminals 3 and 8 (GND) are connected to the -DC and EARTH terminals of the converter.

2.25 (I2T) terminal pin 4

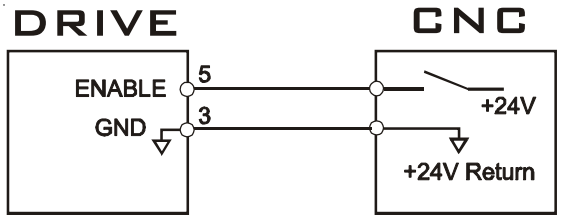
Intervention of the converter I2T protection. Open collector of a transistor with max. 100mA. This output is normally closed ON, it opens OFF when the red I2T protection LED turns on



Signal connector description

2.26 (ENABLE) terminal pin 5

Start enable input has logic range: ≥+9V to +30Vdc (min/max)

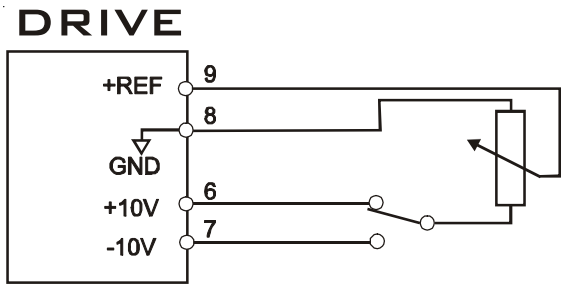


Unconnected Enable input = Drive Not Enabled
Enable Input +24Vdc = Drive Enabled

Is possible enable the drive connected the START input with +10V output "terminal 6"

2.27 (+/-10V) terminal pin 6 - 7

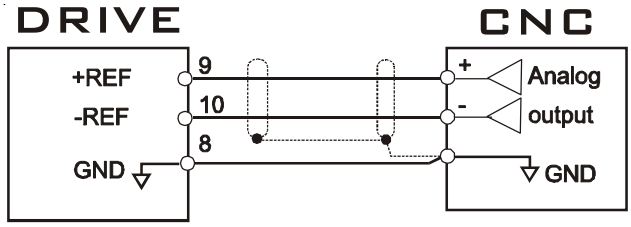
In the terminals 6 (+10V) and 7 (-10V) are available auxiliary supplies to power the potentiometer reference speed. In the attached drawing below is also added a switch that allows the reversal of the rotation motor speed .
The current capacity of the output is max + /-4mA
Output +10V can also be used to enable the converter



2.28 (+/-REF) terminal 9 - 10

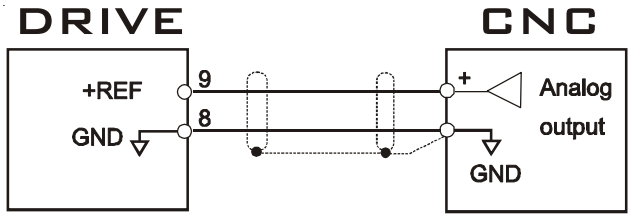
Differential reference

The following diagram shows an application utilizing a differential reference from a C.N.C
The +/-VEL in differential mode has a 40Kohm of impedance input.



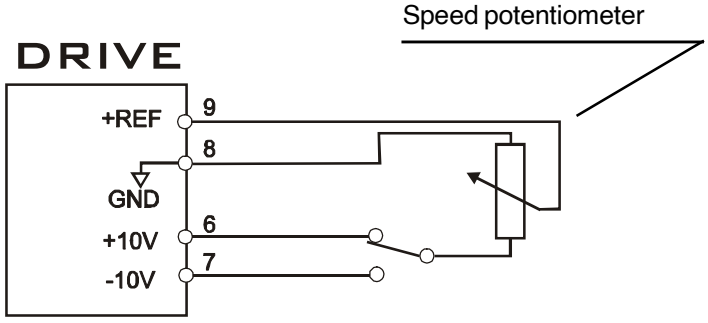
Common mode reference

The following diagram shows an application using speed reference connections from C.N.C in the Common Mode. This analog in common mode has a 20Kohm of impedance input.



Speed reference from external potentiometer

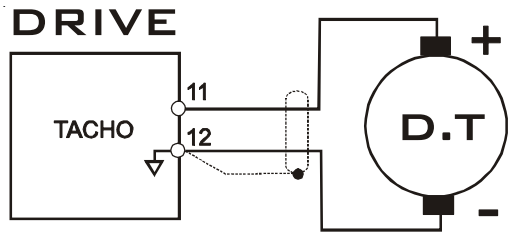
The following figure shows an application with speed reference connections using an internal +/-10V power supply.
The speed potentiometer must have an included value between >5 and <10Kohm.



Signal connector description

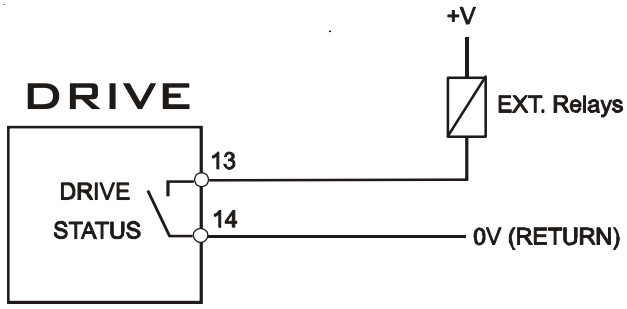
2.29 (TACHO) terminal 11 - 12

Feedback input from the tachogenerator. Terminal 12 refers to the internal GND.



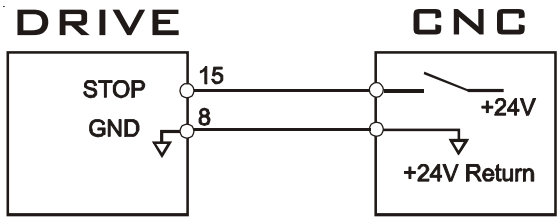
2.30 (DRIVE STATUS) terminal 13 - 14

In terminals 13 and 14 there is a contact of the internal DRIVE STATUS relay. This contact is normally closed when the converter is working (green OK led on). The contact opens due to the intervention of one of the converter protections (red O.C led, red PTC led).
The contact has a capacity of 1A @ 110Vac and 5A @ 30Vdc.



2.31 (STOP) terminal 15

Digital input for stopping the motor in STOP. The logic level min. + 9V Max. + 30Vdc



STOP input not connected = The motor, if enabled, can rotate normally.
STOP input from + 9V to + 24V = The motor remains stopped in torque at zero speed.

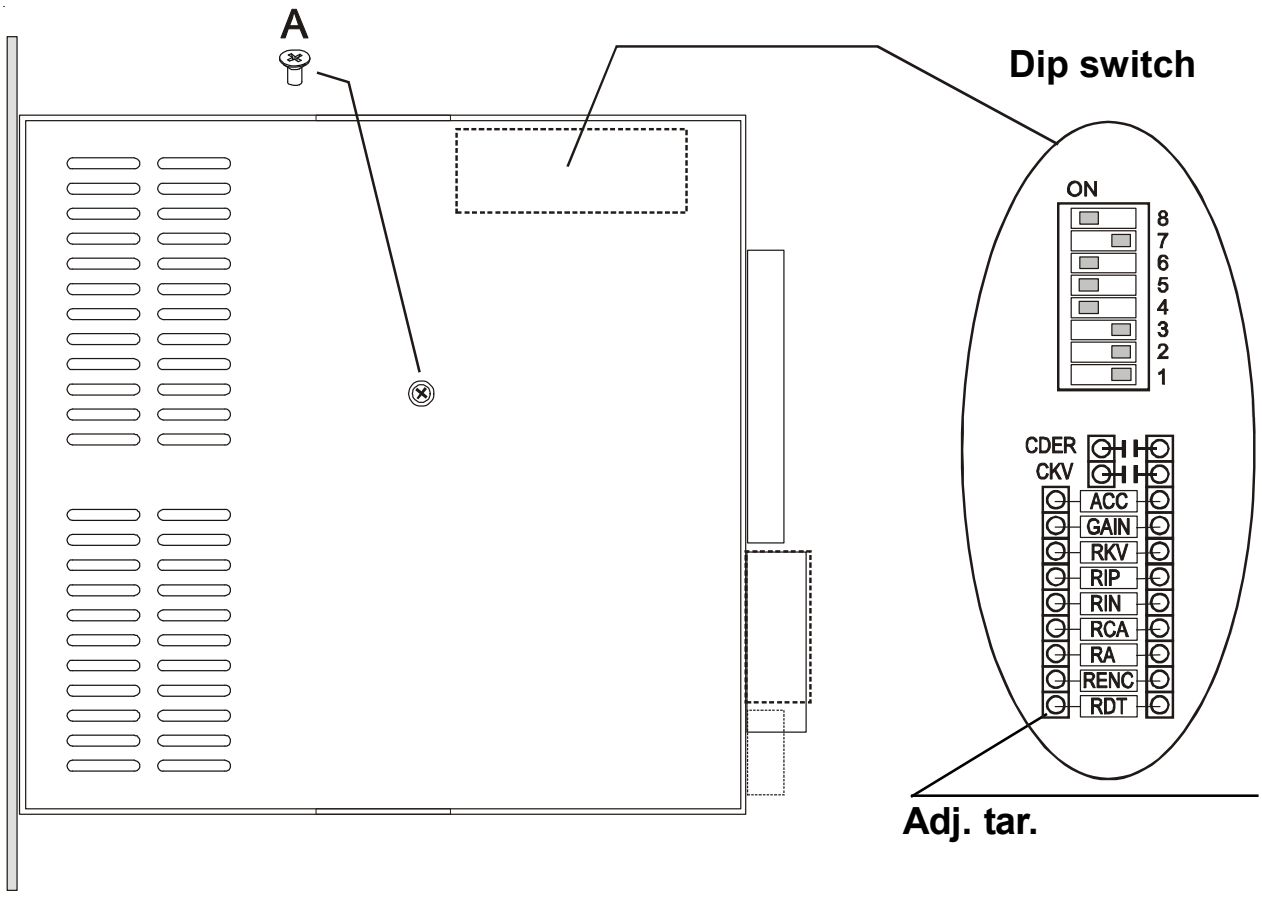
3.0 Internal adjustements

To access the internal calibration area, remove the upper screw and extract the cover (See figure).
Note: if the converter has been switched on, and you want to remove it to operate on the calibrations, switch off and wait at least 60 seconds.
All calibrations are located in the area (see figure). In this area there is a ADJ. TAR base where all the drive calibration components are located. The calibration resistances are 1/4W 5%, or preferably with 1% tolerance.
There are 8 Dip Switches, through which it is possible to enable or disable functions or parts of the converter. Check the correct correspondence in closing the Dip Switch according to the functions required by the converter.

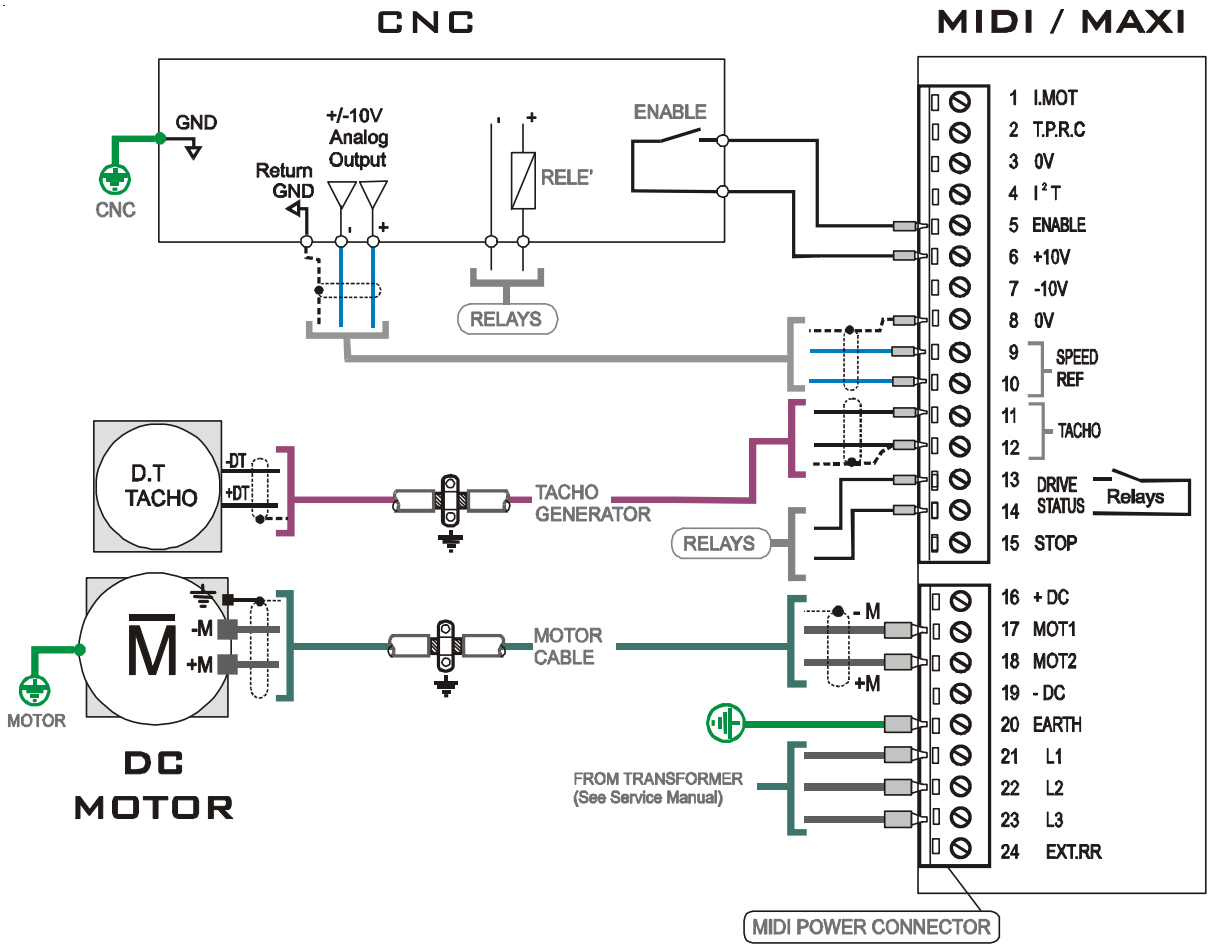
The converter in standard configuration is supplied with the following Dip switches closed ON/OFF (Feedback from tachogenerator).

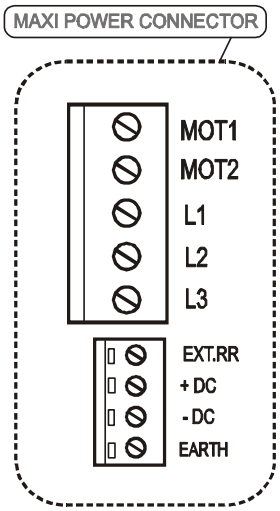
Dip 8: Closed (ON)
Dip 7: Open (OFF)
Dip 6: Closed (ON)
Dip 5: Closed (ON)
Dip 4: Closed (ON)
Dip 3: Open (OFF)
Dip 2: Open (OFF)
Dip 1: Open (OFF)

Note: See also the following pages, for the DIP SWITCH and ADJ. TAR settings.



3.1 Feedback with tachogenerator





The figure above shows a typical connection of the Midi-Master converter in combination with a D.C. motor. with feedback from tachogenerator.

In case of connection on the Maxi-master converter, respect the same connections on the signal connector. The 9-way power connector is replaced in the Maxi-master by a 7,62mm pitch 5-pole connector and a 5mm-pole pitch 4-pole connector

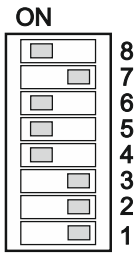
The feedback from the tachogenerator is enabled through the following settings (see page on the side) and by inserting the RDT resistance on the ADJ. TAR.

The converter is supplied as standard with a RDT resistance of 22Kohm, for a calibration of 30Vdt at +/- 10VREF of reference.

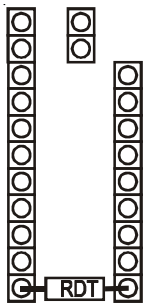
Setting with tachogenerator feedback

In this configuration, the drive must set with the following Dip Switch and below internal setting:

DIP SWITCH



ADJUSTEMENT



Dip Switch set for:
- Tachogenerator feedback
- Ramp time disabled
- Standard Dynamic constant

Note: On the adjustement zone are not considered here the other components used to determine other calibrations "for example. Calibration current rating etc.".

RDT resistor calculations

To calculate RDT resistor, please use the following formula:

$$\mathbf{RDT\ (Kohm) = \frac{Kdt * N * 9,7}{1000 * Vref} - 7,9}$$

Example: Brush DC motor with the tachogenerator costant Kdt=10V/KRPM, max. speed 2500RPM at 10V of speed reference. The result is below:

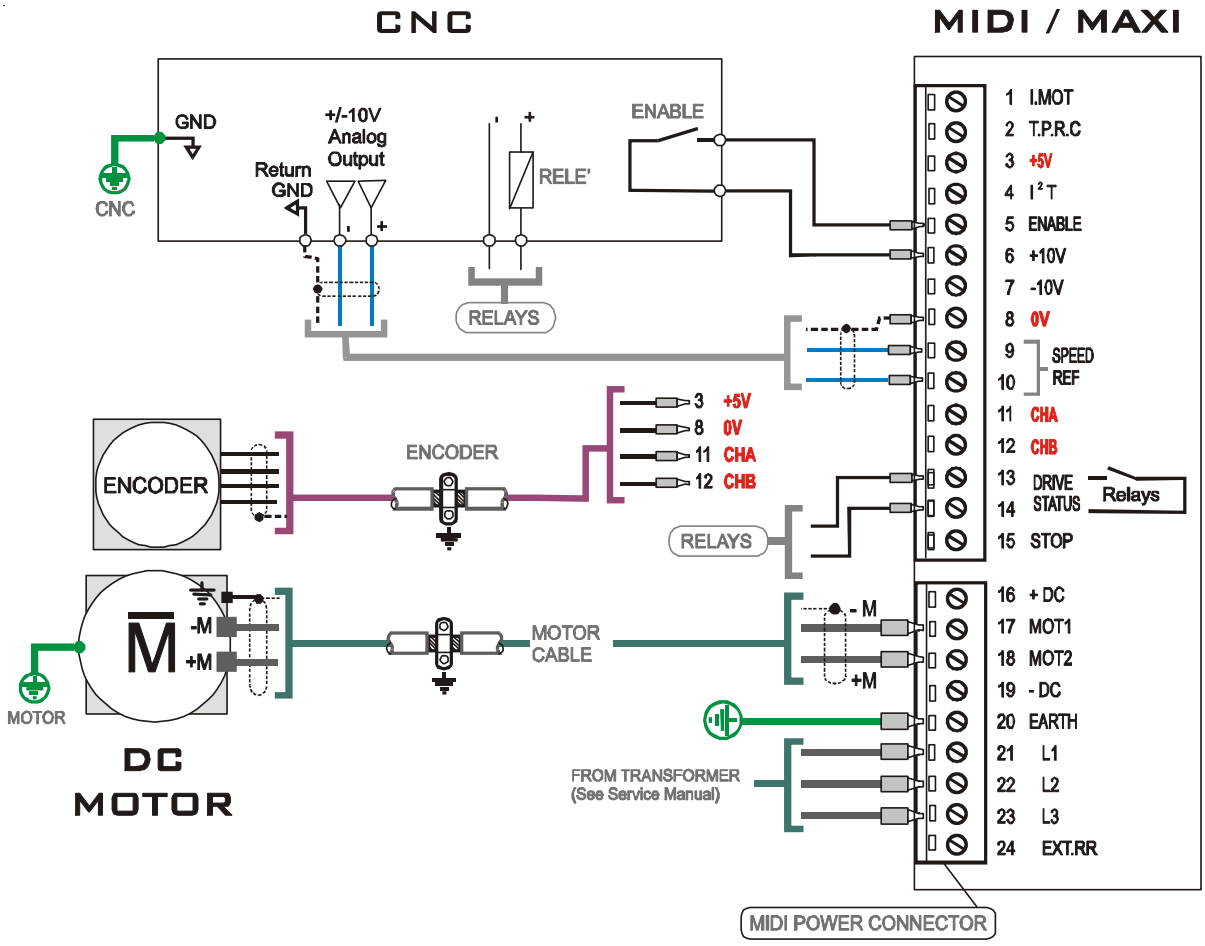
$$\mathbf{RDT\ (Kohm) = \frac{10 * 2500 * 9,8}{1000 * 10} - 7,9 = 16.6\ Kohm}$$

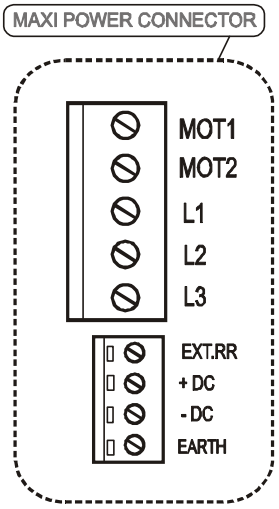
Insert the commercial value resistance 18Kohm. Prefer resistance with 1% tolerance.

Note:
RDT is the value of resistor expressed in Kohm with a power rating of 1/8 or 1/4w.
Kdt is the tachogenerator costant V/KRPM
N is the max speed express in RPM.
Vref is the max voltage +/-VEL reference express in Volts.

Once the resistor **RDT** is inserted, proceed with final speed adjustment.
Operate using trimmer SPEED on the front of the drive. With Clockwise Rotation the speed increases. With Counter Clockwise Rotation the speed decreases. The Range of regulation is about +/- 25%.

3.2 Feedback with encoder





The figure above shows a typical connection of the Midi-Master converter in combination with a D.C. motor. with encoder.

In case of connection on the Maxi-master converter, respect the same connections on the signal connector. The 9-way power connector is replaced in the Maxi-master by a 7,62 pitch 5-pole connector and a 5-pole pitch 4-pole connector

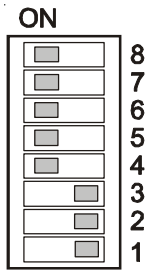
The encoder feedback is enabled through the following settings (see page on the side) and by inserting the RENC resistor on the customization ADJ.TAR

The version with encoder feedback should preferably be requested when ordering, or contact us for technical details.

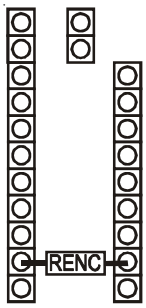
Setting with encoder feedback

In this configuration, the drive must set with the following Dip Switch and below internal setting:

DIP SWITCH



ADJUSTEMENT



Dip Switch set for:
- Encoder feedback
- Ramp time disabled
- Standard Dynamic constant

Note: On the adjustement zone are not considered here the other components used to determine other calibrations "for example. Calibration current rating etc.".

RENC resistor calculations

For change this resistance open the drive and calculation the following formula:

RENC = 681*1000 / Fenc

The resistor RENC determine what is the max. speed of the motor at 10V of reference.

Where: **Fenc = PPR * rpm / 60**

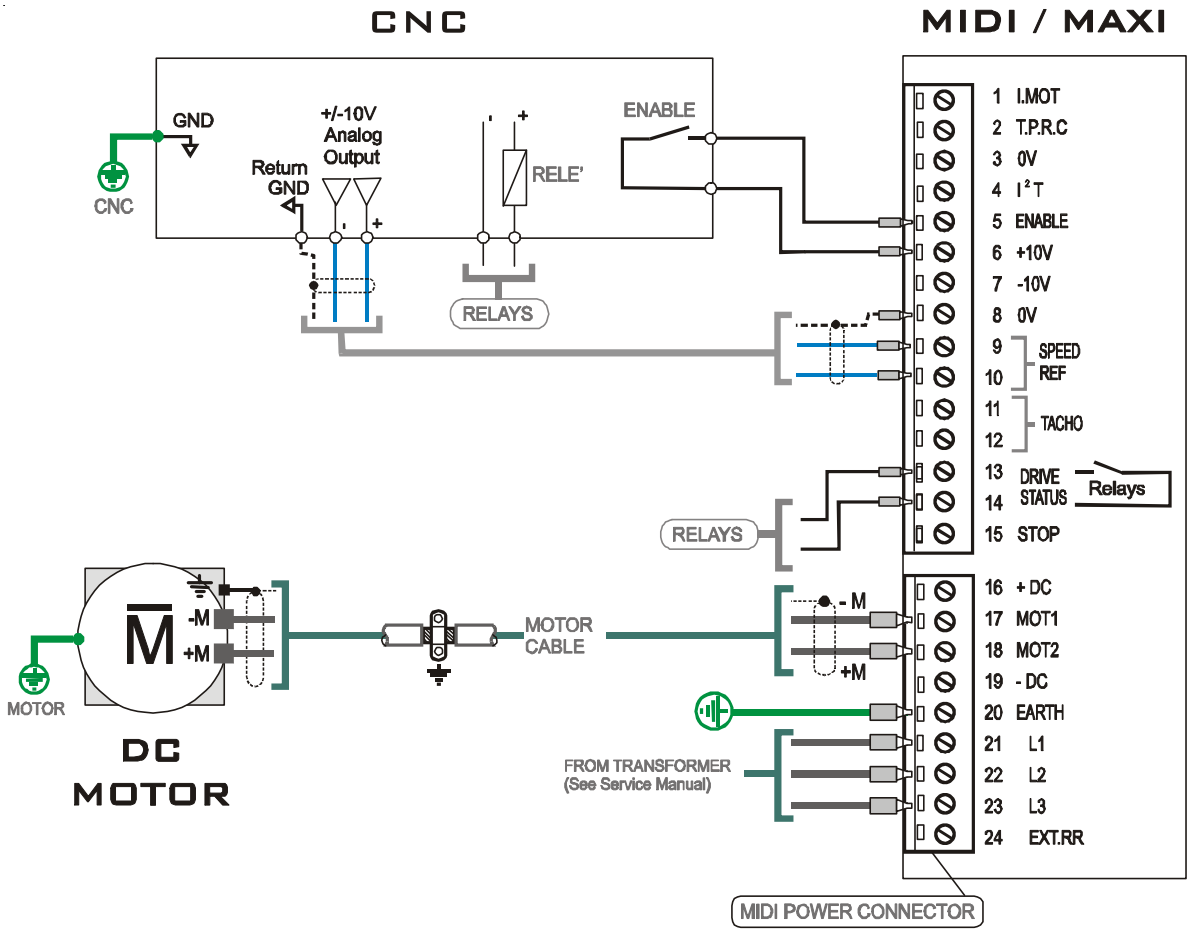
Example:
N° encoder (PPR) = 500
Motor max. speed 4000 rpm

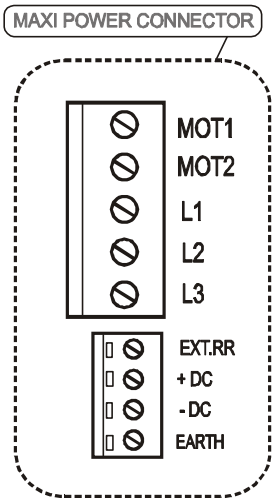
Fenc = 500 * 4000 / 60= 33.333
RENC = 681*1000 / 33.333 = 20,4 kohm

The result of RENC resistance is 20 or 22 Kohm. Prefer resistance with 1% tolerance.

Once the resistor RENC is inserted, proceed with final speed adjustment.
Operate using trimmer SPEED on the front of the drive. With Clockwise Rotation the *speed increases*. With Counter Clockwise Rotation the *speed decreases*. The Range of regulation is about +/- 20%.

3.3 Armature feedback





The figure above shows a typical connection of the Midi-Master converter in combination with a D.C. motor. without feedback (Armature).

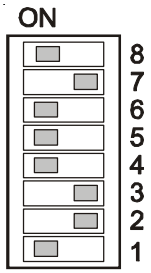
In case of connection on the Maxi-master converter, respect the same connections on the signal connector. The 9-way power connector is replaced in the Maxi-master by a 7,62 pitch 5-pole connector and a 5-pole pitch 4-pole connector

The armature feedback is enabled through the following settings (see page on the side) and by inserting the RA and RCA resistance on the ADJ. TAR.

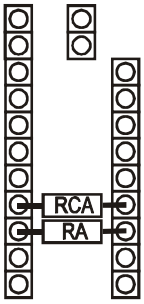
Setting with armature feedback

In this configuration, the drive must set with the following Dip Switch and below internal setting:

DIP SWITCH



ADJUSTEMENT



Dip Switch set for:
- Armature feedback
- Ramp time disabled
- Standard Dynamic constant

Note: On the adjustement zone are not considered here the other components used to determine other calibrations "for example. Calibration current rating etc.".

RA resistor calculations

Insert on base "RA" to adapt the system to use the motor voltage.

Where: Vdc = Vrms * 1,41

Table Vdc voltage — Value of RA in Kohm

RA	82	68	56	47	39	33	27	20	15	12	8,2	5,6	3,9	1
60	57	53	49	45	42	38	34	28,5	23	20,5	16	12	10	5
140	121	113	105	97	88	81	72	60	50	43	33	26	20	10
200	206	193	178	165	151	138	123	103	86	74	57	44	35	18

Model — Voltage output Vdc

EXAMPLE: **Brush DC motor** with Ke= 26V/Krpm (Vdc)
Drive model 140
Nominal speed N° =3000rpm
Risult: Vdc= 26*3000/1000= 78V

For the Example, risult Vdc=81V. The table shows a resistor with a value of 33Kohm.

Once the resistor **RA** is inserted, proceed with final speed adjustment.
Operate using trimmer SPEED on the front of the drive. With Clockwise Rotation the speed increases. With Counter Clockwise Rotation the speed decreases. The Range of regulation is about +/- 25%.

Continue..

Setting for Brush motor with armature (Continue)

RCA resistor calculations

Insert an RCA resistor on the header (ajustement zone) to compensate for voltage loss due to the motor resistance reducing the loss of RPM.
The formula is as follows:

$$\text{RCA (Kohm)} = \frac{0{,}49 * 1000 * Vmot}{Vref * Ipk * Ri}$$

Where:
Vmot= Nominal voltage of the motor
Ri=Max. cold motor resistance.
Ipk =Peak drive current.
Vref= max. applied reference voltage in VEL

Example: Drive 8/16A, Ri=0,3ohm, Vmot=36V, Reference=10V

Calculate:

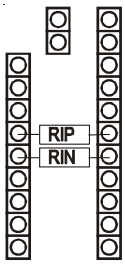
$$\text{RCA (Kohm)} = \frac{0{,}49 * 1000 * 36}{10 * 16 * 0{,}3} = 367{,}50K$$

Insert a 400-470Kohm resistance. If after insertion of the resistor the motor is unstable, increase the Resistance value of RCA.

3.4 Current adjustement

RIP resistor (Peak current adjustment)

RIP resistance limits the maximum current supplied by the converter. For the calculation see the following table:



Value of RIP in Kohm

Valore RIP	*	470	390	220	150	120	100	82	68	56	47
4/8	8	7,4	7	6,48	6	5,6	5,3	5	4,8	4,2	4
8/16	16	15	14	12,9	12	11,2	10,6	10	9,6	8,6	8
10/20	20	18,5	17,5	16,2	15	14,1	13,2	12,5	12	10,7	10
14/28	28	26	24,5	22,7	21	19,8	18,6	17,5	16,8	15	14
25/50	50	45,4	44,6	41,2	38	36	34	31,7	29	27	25

Size drive (A)

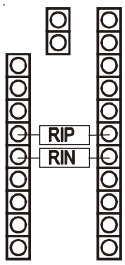
Note * = No resistor mounted.

Peak Current request (A)

Example: on a converter 8/16A, inserting a resistance RIP 150Kohm the maximum output current will not be 16A, but 12 A

RIN resistor (rated current adjustment)

Resistance RIN limits the value of the rated current supplied by the drive. Normally has the same value, of the stall current of DC motor. For the calculation see the following table:



Value of Rin in Kohm

Valore RIN	*	56	22	12	6,8	4,7	3,9	2,7	1,8	1,5	1
4/8	4	3,9	3,7	3,5	3,2	3	2,8	2,6	2,2	2,1	1,8
8/16	8	7,5	7,3	7	6,4	6	5,6	5,2	4,4	4,2	3,6
10/20	10	9,7	9,2	8,7	8,1	7,6	7,1	6,5	5,7	5,3	4,4
14/28	14	13,7	13	12,3	11,4	10,7	10	9,2	8	7,5	6,2
25/50	25	24	23	21,7	20	19	17,7	16,2	14,2	13,2	11

Size drive (A)

Note * = No resistor mounted.

Rated Current request (A)

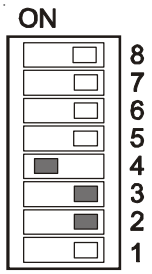
Example: on a converter 8/16A, inserting a resistance RIN 6.8Kohm the rated output current will not be 8A, but 6.4A

3.5 Ramp time adjustement

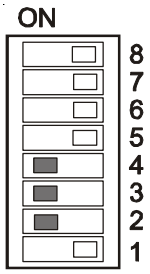
This function is activated by closing the Dip Switches 2, 3, 4.
By applying a step voltage to the speed reference signal "+ REF", with the ramp inserted or extended, the motor accelerates as shown in the figure.
By acting clockwise on the RAMP trimmer located on the front, the ramp time increases, variable from 0.1 to 1S "corresponding to 10V of reference REF (see table A)
It is possible to change the pre-set "ramp excursion range" by opening Dip Switch 4 and inserting a resistor (RACC) of the value indicated in the table below (see table B)

A

2	3	4	FUNCTION		RANGE SETTING
OFF	OFF	ON	Ramp disabled	NO	SDT
ON	ON	ON	Ramp enabled	0,1 - 1sec	Variable with ramp trimmer
ON	ON	OFF	Long ramp	Insert RACC	Variable with ramp trimmer



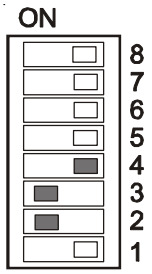
Ramp disabled (STD)



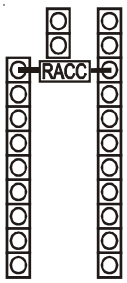
Ramp enabled 0,1 - 1sec

B

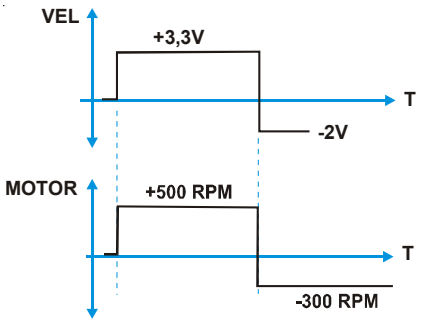
RACC resistance value	820 Kohm	1,2 Mohm	3 Mohm
TIME	0,3 - 3 sec	0,5 - 4 sec	1,1 - 12 sec



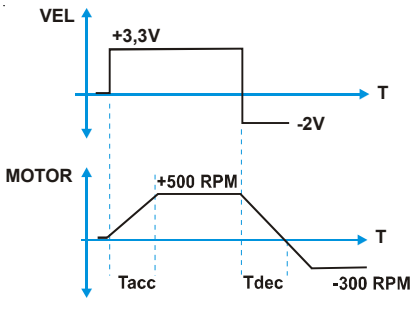
Long Ramp



Insert Racc



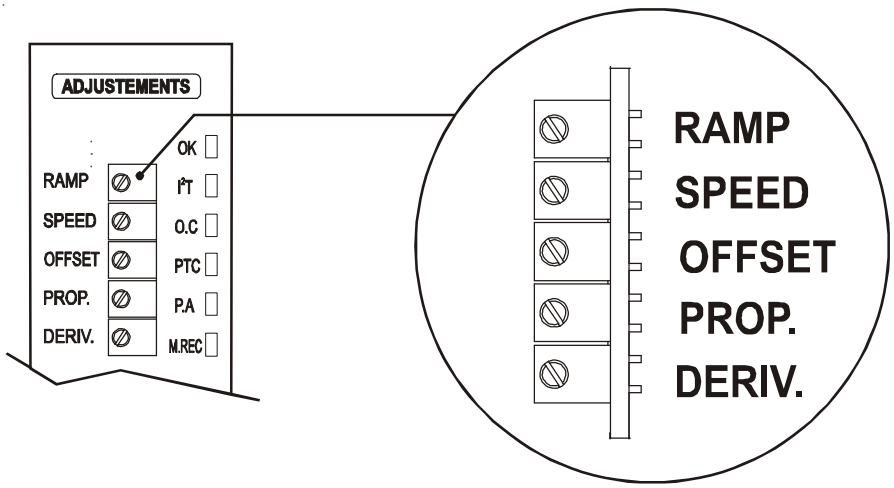
Ramp disabled



Ramp enabled

3.6 Potentiometer adjustements

The converter is equipped with five trimmer with the following meanings:



	FUNCTION
RAMP	**Ramp adjustement.** The dip switch 2, 3 and 4 select the acc/dec function (ramp). With this potentiometer we can adjust the slope of the acceleration and deceleration ramps. Turning the potentiometer clockwise (cw) increases the ramp time from 0,1 to 1 Sec (with 10 V input velocity).
SPEED	**Motor fine speed calibration.** With rotating clockwise (CW) or counterclockwise (CCW) is possible increase / decrease the speed of the motor with range + / -25%
OFFSET	**Offset adjustment.** Allows the balance to zero motor speed. Adjust this potentiometer to cancel any motor speed offset when the Velocity input is zero. (Max Velocity compensation +/- 250mV).
PROP.	**Gain potentiometer.** This adjustment improves the dynamic behavior of the motor. With a clockwise (CW) we increase the readiness and response of the motor. With a clockwise turn (CW) we increase the gain of the PI “internal speed loop”.
DERIV.	**Derivative potentiometer.** Acting in a clockwise (CW) can dampen any oscillations of the motor due to a high moment of inertia of the load.

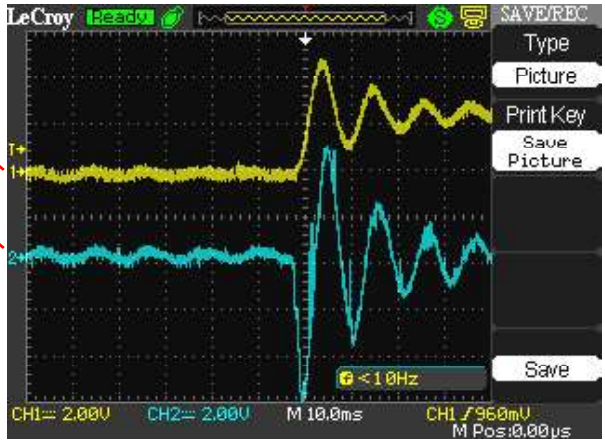
NOTE:
- In Chapter 3.7 explains how to dynamically tune the motor by acting on the 2 trimmer GAIN and DERIV.
- All potentiometers are disabled in Torque mode

3.7 Dynamic adjustement

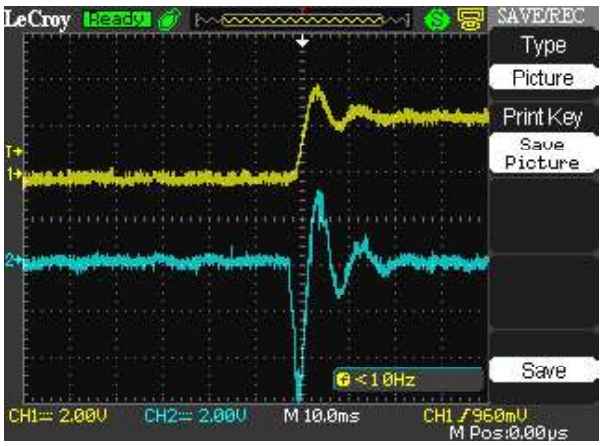
The multi-turn GAIN and DERIV trimmer allow to dynamically tune of the motor and its mechanics linked to it. These trimmers have full excursion from minimum to maximum, with 15 turns of rotation of the same.
The charts shown the track 1 "yellow" is the speed (tachogenerator). Track 2 blue highlights instead the current signal taken at terminal 1 (IMOT)
Signals are reported with a step voltage of the reference signal speed of about 2V.
These signals can be displayed by connecting the two probes of an oscilloscope at those points. The zero signal 0S (zero probes) can be connected by a wire to pin 3 (GND)

Velocity of the motor

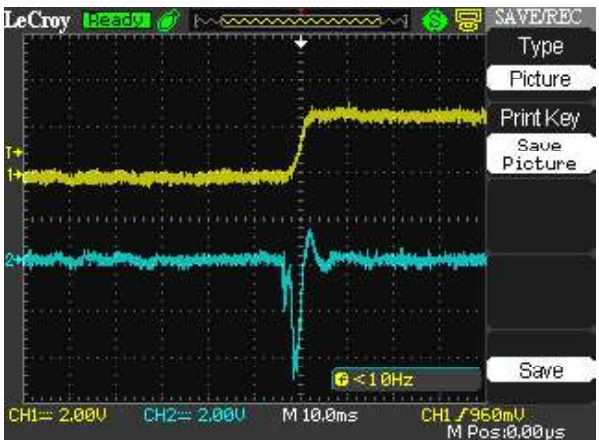
Current of the motor



Behavior of the motor with both GAIN and DERIVATIVES trimmer to a minimum of function (trimmer totally rotated counterclockwise CCW). The speed signal is unstable, idem for the current signal of the motor. See chart at right



Turning clockwise CW the trimmer GAIN (4 / 5 turns) the dynamic behavior improves, not to exceed with this adjustement are otherwise the motor will be vibrating. See chart at right

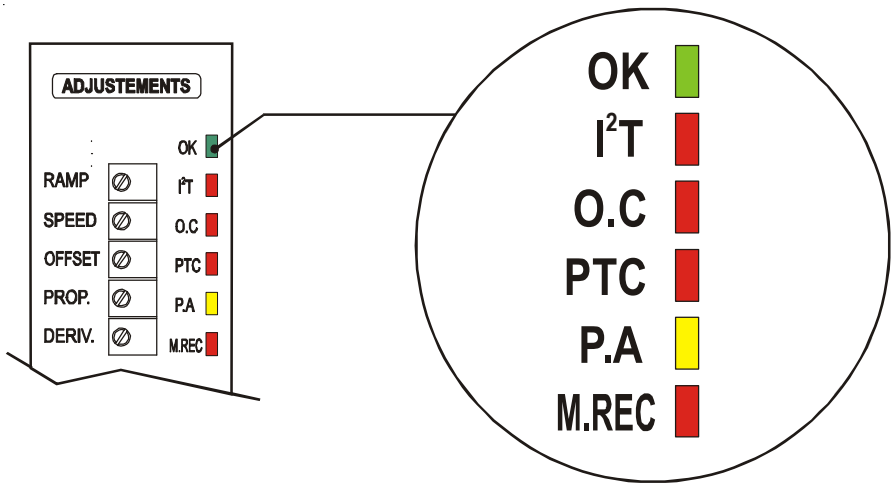


To further improve the behavior of the motor and mechanics related to it and the over all damping of the speed signal oscillation , act trimmer DERIV. turning it clockwise CW (4 / 5 turns). See chart at right

NOTE: The dynamic calibrations are performed using a reference speed (in + /-VEL) of about 1 or 2V. You can use the voltage output from the CNC control, paying attention to rule out the correction of space. Or use an external oscillator or a small battery 1.5 V

3.8 Indicator Leds and protections

The protections are all displayed by four LEDs on the front of the drive. It also comes with a series of protections designed to safeguard in case of malfunction, the drive and the motor.



	FUNCTION
OK GREEN	**Normally ON.** Presence of the converter power supply. Indicates the correct functioning of all functions. It turns off in the event of any anomaly "except for the intervention of the I2T protection"
I2T RED	**Normally OFF.** This indicator is lit if the converter exceeding the limit calibration of the rated current of the motor. When the current drawn back under the nominal pre-set, the alarm will auto resets and the LED turns off by itself.
O.C RED	**Normally OFF.** Indicates that between the motor terminals and/or ground, has been a short circuit. The operation causes the blocking of the drive and the storage of the alarm. Remove power supply and examine the motor connecting leads for shorts, before re-powering the converter to reset the alarm.
PTC RED	**Normally OFF.** This indicator is lit when the internal temperature of the drive reaches 75°C . Remove power and wait for the drive to cool before re-applying power. The operation causes the blocking of the drive and the storage of the alarm. NOTE: A fan, heat sink or air conditioner may be needed to remedy the problem.
P.A YELLOW	**Normally OFF.** It turns on when the internal braking module reaches 80% of the maximum dissipable power. This indicates a particularly heavy duty cycle. No blocking is activated.
M.REC RED	**Normally OFF.** It turns on when the internal braking module reaches 100% of the maximum dissipable power. The intervention causes the braking module to be blocked and the alarm to be stored. The internal contact of the “Drive Status” relay opens communicating the FAULT.

White page