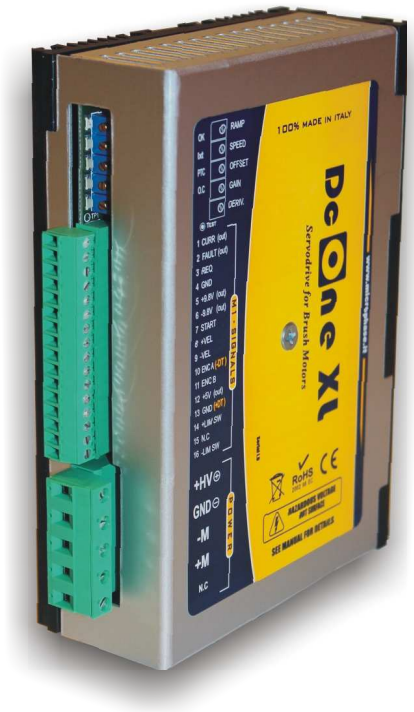
MICROPHASE
Technology & Performance

DC One XL

PRECISION SERVO DRIVE FOR DC MOTORS



CE

RoHS compliant

Servoamplifier

for

dc Motors

Service Manual

MICROPHASE 36051 Creazzo (Vicenza) Italy Phone (+39) 0444 - 14.40.137 e-mail: info@microphase.eu

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

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.

Print in Italy rev. 08/2017

Index

Chapter 1

Chapter 2

Chapter 3

Chapter 4

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.

Simbols security standard

Warning of dangerous current present
In case of doubt or in any case you don't know as to behave yourself, before access to the drive, power off the device and wait until all the leds are turned off.
May you have attention when you touch the drive because it may be hot.

Danger Sign
All the circuits in the Drive are potential sources of severe electrical shock, so follow these rules to avoiding possible personal injury.
- Power off the drive and wait until all the leds are turned off before touching, removing, connecting or any other critical action.
- Never disconnect any connectors before powering down the drive

1.2 Operation mode and feedback

Description

This is a drive capable to drive **DC brush** motors, up to 12Nm. 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.

Operation mode

DESCRIPTION		
SPEED CONTROL INPUT	It is speed piloting using an analogue reference (differential or common mode)	STANDARD
TORQUE CONTROL INPUT	It is torque piloting using an analogue reference. This function allows you to control the current from the drive.	STANDARD

General characteristic

DESCRIPTION		
START INPUT	Start input, enable the drive with range from ≥9Vdc to +30Vdc (min/max)	STANDARD
FAULT OUTPUT	Fault drive, open collector output 50mA max. (Normally closed, opens when in protection mode)	STANDARD
2 ANALOG OUTPUT	1 motor velocity monitor “TEST”, with range +/- 8 Vdc output 1 current monitor "CURR", with range +/-8 Vdc output	STANDARD
LED INDICATOR	Four LEDs are located just in front of the potentiometers and show the current state of the drive	STANDARD

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		
Model 12	8 - 28 Vdc*	12Vdc**
Model 65	20 - 84 Vdc*	65Vdc **
Model 145	39 - 184 Vdc*	145Vdc **
Model 205	55 - 275 Vdc*	205Vdc **
Model 305	60 - 320 Vdc*	250Vdc **
* Power supply min/max **Typical		

The power supply voltage has to be a transformer-isolated voltage

Size available

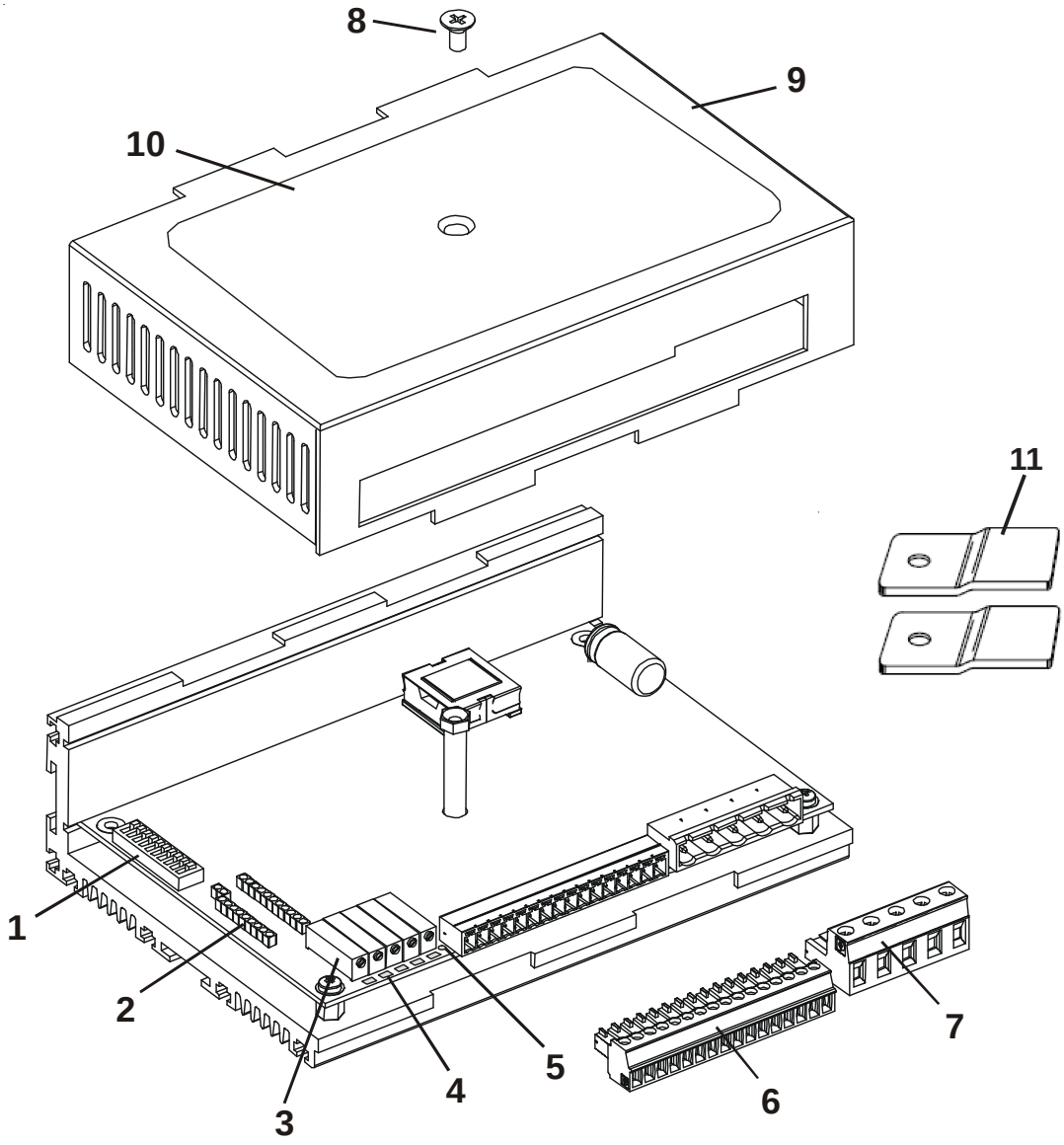
CURRENT		
Size	Rated current (A)	Peak current (A)*
2/4	2	4
4/8	4	8
7/14	7	14
10/20	10	20
14/28	14	28
20/40	20	40
30/60	30	60
*Peak current during 2 sec		

Specifications

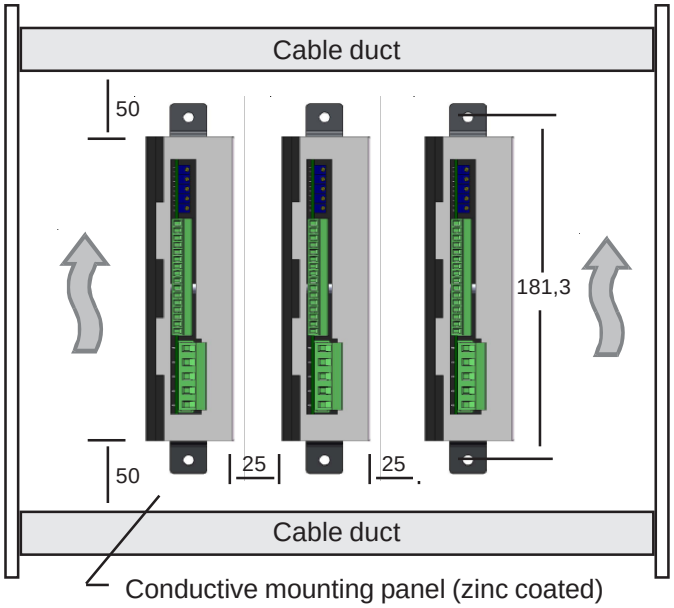
TECNICAL DATA CHARACTERISTICS	
Supply voltage output	0,9 Vdc Input
PWM frequency	20Khz
Operating temperature	0/+45℃
Storage temperature	-10/+70℃
Drift analog input	0,5uV/℃
Analog inputs (+/-VEL)	+/-10Vdc max, impedance 20Kohm cad.
Current monitor output (CURR)	+/- 8Vdc = Peak current
Velocity monitor output (TP1)	+/- 8Vdc = max velocity
Power supply output (+5V)	+5Vdc max 130 mA
Power supply output (+/-9.8V)	+/-9.8Vdc max. 4mA
Encoder max. frequency	300Khz with level ≥+2,8/24Vdc min/max
Fault drive output	NPN 50mA max.
Start input (Enable)	≥+9V/+30Vdc (min/max)
Band width (current)	2KHz
Band width (velocity)	150Hz
Minimum Inductance motor	200uH
Weight	0,6kg
Contaminants	2° or better (Norms EN60204 e EN50178)
Altitude	Up to 1000m without restrictions, from 1000 to 2000m power derating 1,5%/100m

1.4 View product

(1) Dip switch
(2) Adjustement zone
(3) Calibration Potentiometers
(4) Leds
(5) Test point TEST (Tacho test point)
(6) M1 Signal terminal 16 pins MC1,5/16-ST-3,81 (pitch 3,81)
(7) M2 Power Terminals 5 pins GMST 2.5/5-G-7,62 (pitch 7,62)
(8) Fixing screw
(9) Product Cover
(10) Product ID Label
(11) Fixing brackets



1.5 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.

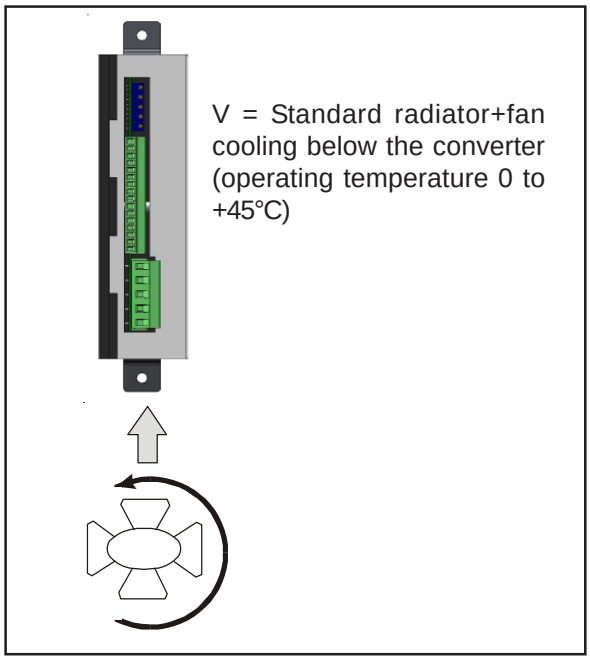
1.6 Ventilation

This servodrive are intended only for use in close locations. Ambient characteristics: operating temperature from 0 to +40°C. Humidity limit s between 5% to 95% non condensing (Pollution degree 2 or better). Supplementary ventilation may be requested in accordance to size. See the table below.

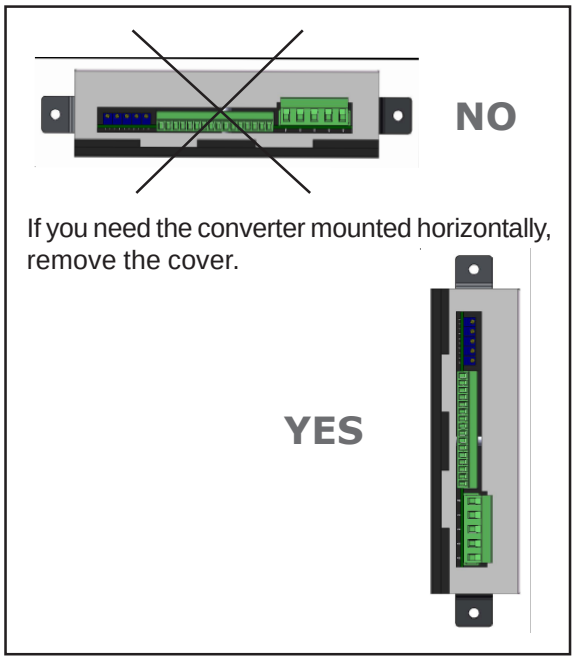
	SIZE						
MODEL	2/4	4/8	7/14	10/20	14/28	20/40	30/60
12	N	N	N	N	N	N	N
65	N	N	N	N	N	N	V
145	N	N	N	N	N2	V	V
205	N	N	N	N2	V	V	V
305	N	N	N	N2	V	V	V

N = Standard radiator (operating ambient temperature from 0 to 40°C)
N2 = Standard radiator (operating ambient temperature from 0 to 35°C)
V = Standard radiator + supplementary ventilation (operating ambient temperature from 0 to 45°C)

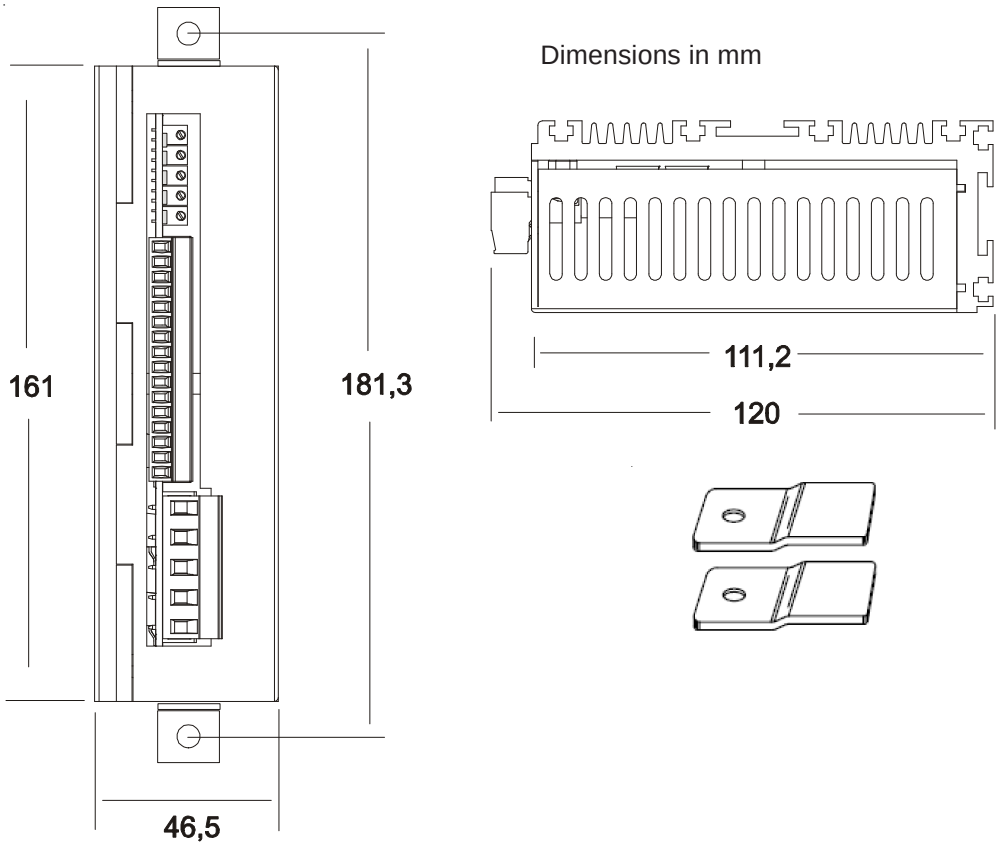
Supplementary ventilation



Mounting position



1.7 Mechanical dimensions



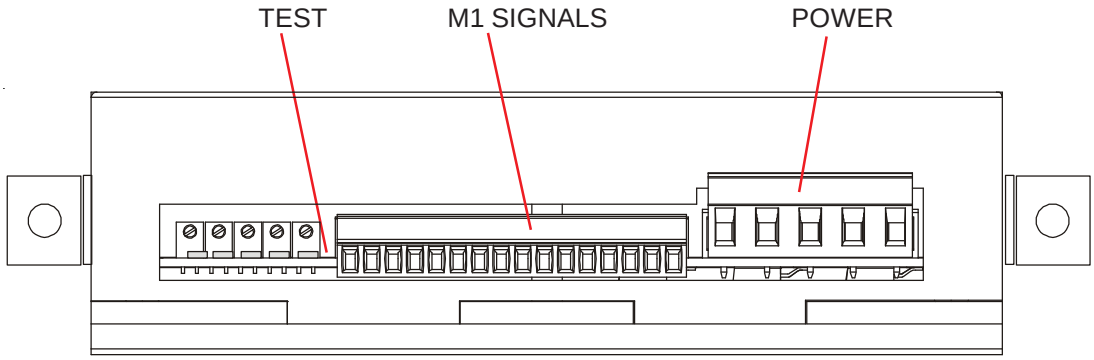
2.0 Signals input and output

The figure below shows the view of the converter terminals.

M1 Signal terminal 16 pins "type MC 1,5/16-ST-3,81"
POWER Terminals 5 pins "type GMST 2,5/7,62-G-7,62"

On the test point "TEST" you can see the signal of velocity speed. The output from 0 to + /-8V is from zero to maximum speed. At this point you can analyze the signal when you enable one of the following velocity feedback.

- Encoder
- Armature
- Tachogenerator



Power connector

POWER CONNECTOR	
+HV (IN)	Positive Power supply input
GND (IN)	Negative Power Supply input (GND)
-M (OUT)	Motor connection -M
+M (OUT)	Motor connection +M
N.C	*Don't use this terminal*

NOTE: See also the connection diagrams in Chapters 2.X

Signal inputs and outputs

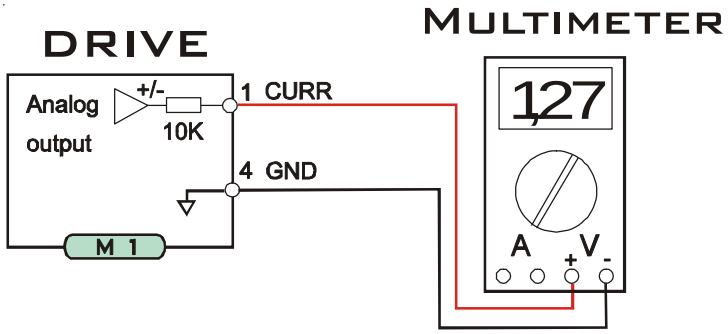
M1 CONNECTOR	
1 CURR	Current motor monitor (OUT): +/-4Vdc=Rated current, +/-8Vdc=Peak current output in Volts. This output may be used to monitor the torque the motor is producing (Standard setting)
2 FAULT (OUT)	Fault drive, open collector output max. 50mA Normally closed, opens when the drive in protection mode
3 REQ	REQ:, can be used in 2 distinct modes: 1) Motor Current limit mode (by REQ setting): A motor current limit mode connect an external resistor to GND reduces the maximun current. Connect a 1/4W o 1/8W resistor between the TPRC (pin 3) and GND (pin 4) terminals. A 47Kohm external resistor reduces the current by 50%. (Note: The drive velocity loop remains active) 2) Torque request (by REQ setting): Range: +/- 10V, which corresponds to the drives peak current output. In this mode the velocity loop is automatically disabled.
4 GND	Signal Common Ground Corrisponds to power supply's negative GND input
5 +9.8V (OUT)	Power supply +9.8Vdc max 4mA
6 –9.8V (OUT)	Power supply –9.8Vdc max 4mA
7 START (IN)	Positive drive enable with range ≥+9Vdc min. to +30Vdc max
8 +VEL (IN)	Reference Positive differential input (Velocity command)
9 -VEL (IN)	Reference Negative differential input (Velocity command)
10 ENC A (IN) or –DT (IN)	Encoder input Channel A (High logic level from ≥2,8V to +24Vdc max. Low logic level ≤1,5V). Is possible setting this terminal for **–DT tachogenerator input**
11 ENC B (IN)	Encoder input Channel B (High logic level from ≥2,8V to +24Vdc max. Low logic level ≤1,5V)
12 +5V (OUT)	Power supply +5V max. 130mA
13 GND	Signal Common Ground. Corrisponds to power supply's negative GND input.
14 +LSW	Positive Limit Switch input. See page 34
15 N.A	*Don't use this terminal*
16 -LSW	Negative Limit Switch input. See page 34

2.1 Current monitor output

(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 7/14A, 8V corresponds at 14A 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.



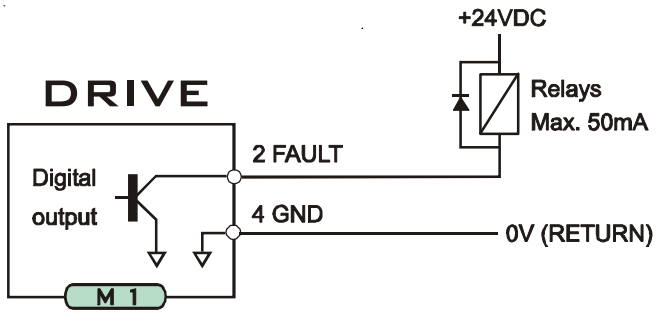
Note:

Standard product is set to the signal CURR on terminal 1 (reading of the current circulating on the motor) and the REQ input at terminal 3.

2.2 FAULT output

(Signal terminal pin 2)

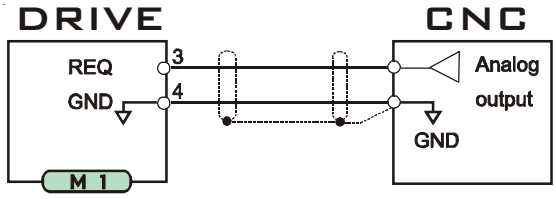
Fault drive, open collector output max. 50mA
Normally closed, opens when the drive in protection mode



2.3 Current request (REQ)

(Signal terminal pin 3)

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

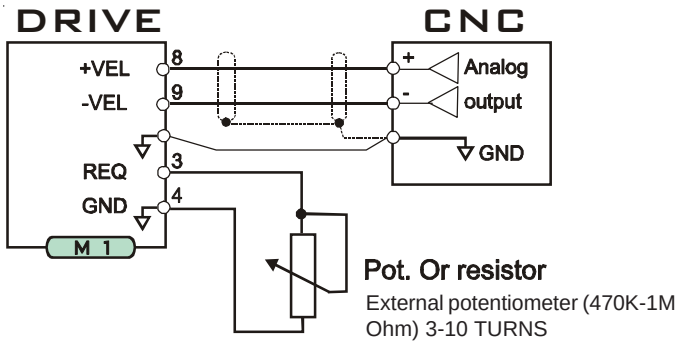
Example: (Drive size 10/20A, request current 8A)

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

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

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.

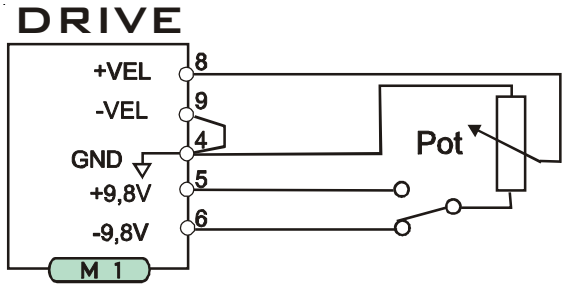


The speed loop remains active and uses the input reference signal +/-VEL.
Connect between terminal and GND terminal REQ a resistor 1/4W or 1/8W. (The figure is used a potentiometer). With external resistance tends to zero ohms, the output current tends to zero. Increasing the ohmic value of resistance,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

2.4 Ausiliary power supply +/-9.8V

(Signal terminal pin 5-6)

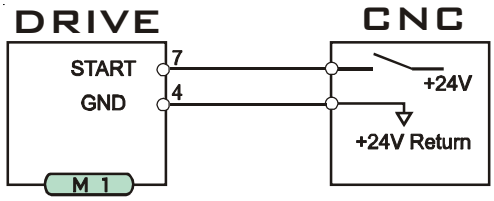
In the terminals 5 (+9.8V) and 6 (-9.8V) are available auxiliary supplies to power the potentiometer reference speed. In the attached drawing below is also added a switch that allows the reversal of the rotation motor speed .
The current capacity of the output is max + /-4mA
Output +9.8V can also be used to enable the converter



2.5 Start input

(Signal terminal pin 7)

The standard drive is furnished in this configuration.
Start enable input has logic range: ≥+9V to +30Vdc (min/max)



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

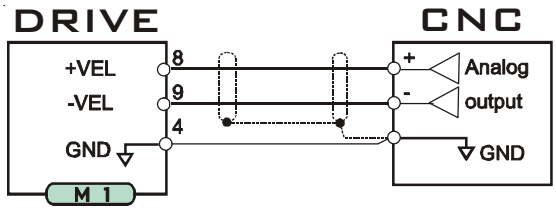
Is possible enable the drive connected the START input with +9.8V output "terminal 5"

2.6 Analog inputs (+/-VEL)

(Signal terminal pin 8-9)

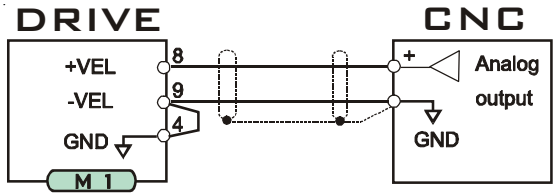
Differential reference

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.



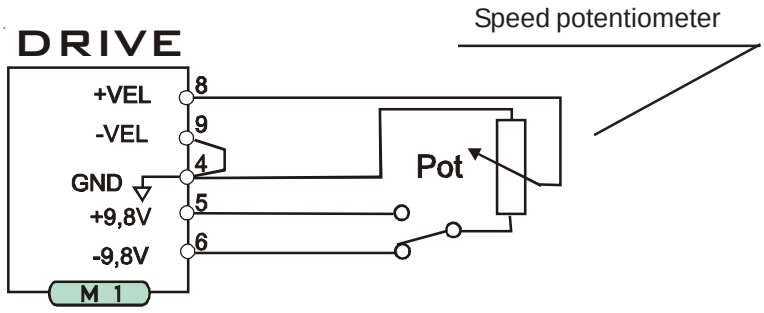
Common mode reference

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 +/-9.8V power supply.
The speed potentiometer must have an included value between >5 and <10Kohm.



2.7 Encoder inputs (or tacho input)

(Signal terminal pin 10-11)

In the terminals 10 and 11 can connect the inputs from an incremental encoder for the current feedback in response to encoder. signals can come from encoder powered from +5 V to +24 V).
Minimum high logic level> +2.8 V/24Vmax,
Minimum low logic level <1.5V
Encoder can be connected either push-pull (wires A, B and GND) or line-driver encoder type (wires + A + B and GND). Remember to connect the zero encoder with the GND power converter.
View the connections and settings from encoder in chapter 4.1

Tachogenerator input (Signal terminal pin 10)

When the motor have a tachogenerator you can use the terminal 10 as input for this feedback. Connect this terminal to the negative of tachometer. Do not exceed voltage as input from tacho value of 50V.
Example: If you use a 10V/KRPM no more than 5000rpm.
View the connections and settings from tachogenerator in chapter 4.2

2.8 Ausiliary power supply +5V

(Signal terminal pin 12)

On the terminal 12 (+ V) is available auxiliary power supply voltage +5 V (+12 V on request order). This output can be used to power the encoder on the motor. The capacity of the output current is 130mA max.

2.9 Signal common ground

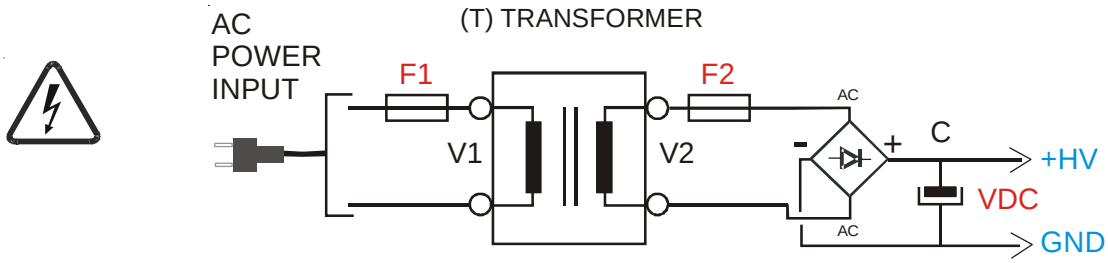
(Signal terminal pin 4-13)

Signal Common Ground. Corrisponds to power supply's negative GND input.

3.0 Power supply construction

Normally the power supply is built by a transformer, a bridge rectifier and a filter capacity. Alternatively, the power supply can also be of switching type, in this case refer factory by the appropriate sizing. The converter have to be supplied from an isolating rectified transformer secondary or a DC isolated power supply.

Transformer



Voltage:
The primary voltage depends on what is available locally for a single phase. The secondary voltage is calculated from the motor's voltage at the required operating speed.
The secondary voltage VDC is:

VDC = V2 * 1,41

Example: If the secondary transformer V2 is 45Vac, the VDC output is 45*1,41=64Vdc

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.

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.

Voltage motor

If the secondary voltage of power supply is VDC, the Vdc motor is calculated by the formula:

VDC = Vdc motor / 0,83

Where the Vdc motor is a sum of FCEM + the drop R*I for the winding resistance motor

Vdc motor = E+(Ri * In)

The FCEM of the motor "E", may be calculated by the formula:

E = Ke * N° / 1000

Power supply construction (continue)

Example: Brush motor with the following data:

In =5 (A)
Ri = 1 (Ohm)
E=48 (V) at nominal speed 3000 (RPM)

Vdc motor = 48 + (1 * 5) = 53V

VDC = 53 / 0,83 = 63,8V

63,8V is the **VDC** voltage request for the power supply. You'll use a transformer with the secondary **V2** = 64 / 1,41= 45Vac
When you use the transformer with V2= 44/45Vac, it is correct.

Misure unit:
E = Ke *n°/1000 (Vdc)
Im = I motor (A)
Ri = Winding resistance (Ohm)
Ke =Voltage constant (V/kRPM)
n° = MAX speed (RPM)

Capacitor filter (C)

In regards to the capacitor filter we suggest a working voltage of:
*100VDC for Model 65
*200VDC for Model 145
*300VDC for Model 205

Capacity above the filter effect, helps to recover energy during braking of the motor.
If the converter during braking has the green LED that flashes you must increase the value of the capacitor (eg. 10.000uF from a 20.000uF)

Fuses (F1) e (F2)

Fuses are required on both the primary and secondary of the transformer to protect against harm to the system and the transformer itself. They need to be of the slow blow type to handle current in-rush at power-up. Locate the primary fuse (F1) on the hot leg of the AC input power and the secondary fuse (F2) on the + side of the secondary output, before the rectifier.

Primary of the transformer: Use the formula below to calculate the correct values:

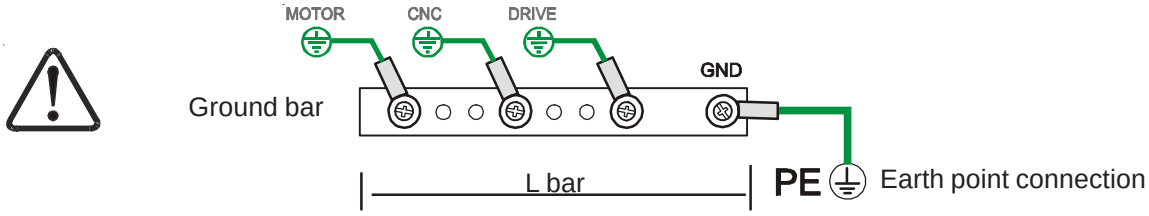
F1 (A) = P (VA) trasfo. / V1

Secondary of the transformer: Use the table below

FUSE F2 (A)	SIZE (A)
4	2/4
8	4/8
16	7/14
20	10/20
25	14/28
32	20/40
40	30/60

3.1 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 pin 4 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	2/4 4/8 7/14
2,5mm² / 13-14AWG	10/20 14/28 20/40
4mm² / 11-12AWG	30/60

Control signals cable (as norm EN60204)

SECTION
0,5mm² / 20AWG

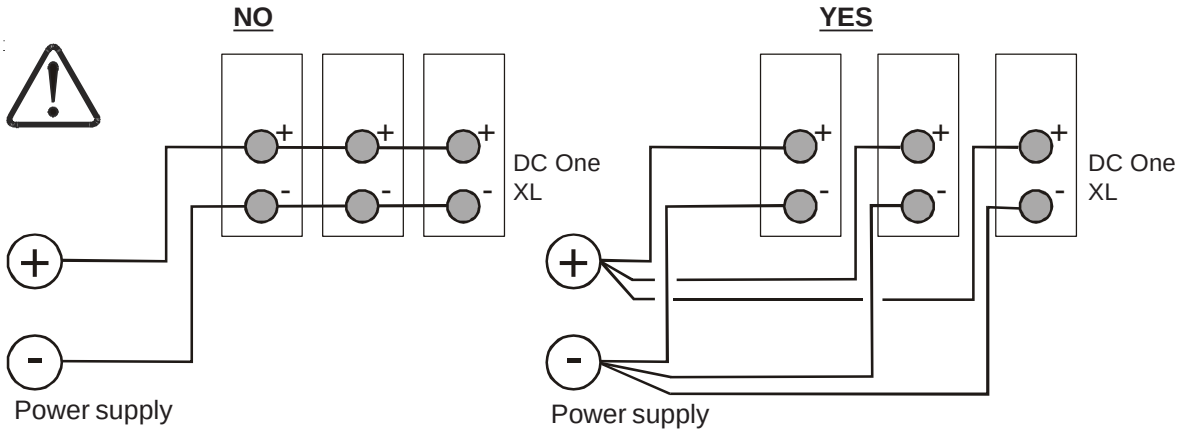
Feedback signals cable (as norm EN60204)

SECTION
0,25 - 0,35mm² / 22 -24AWG

3.2 Note about connections

Multiple connection

In the case of multiple servodrives on the same power supply, make connections-type stars, see drawing back. Connect also feed converters using the shortest cable possible. If the cable length exceeds 2m, twist the + and - leads together as twisted pairs.



The drives have to be supplied from an isolating rectified transformer secondary or a DC isolated power supply.

EMC note

The conformity is assured only if it is installed following the precise assembly criteria expressed below. The fundamental assembly characteristics are summarized below:

1) The correct ground connection of predisposed parts.

2) Using the division of cables technique. Separate power cables from signal cables.

3) Use of shielded cables, both for power connection (to the transformer and the motor), and for signal connection (also to the controller).

4) Use of appropriate network to filter the line (transformer input), from disturbances conducted or produced by the drive. (series of filters released are available for this purpose)

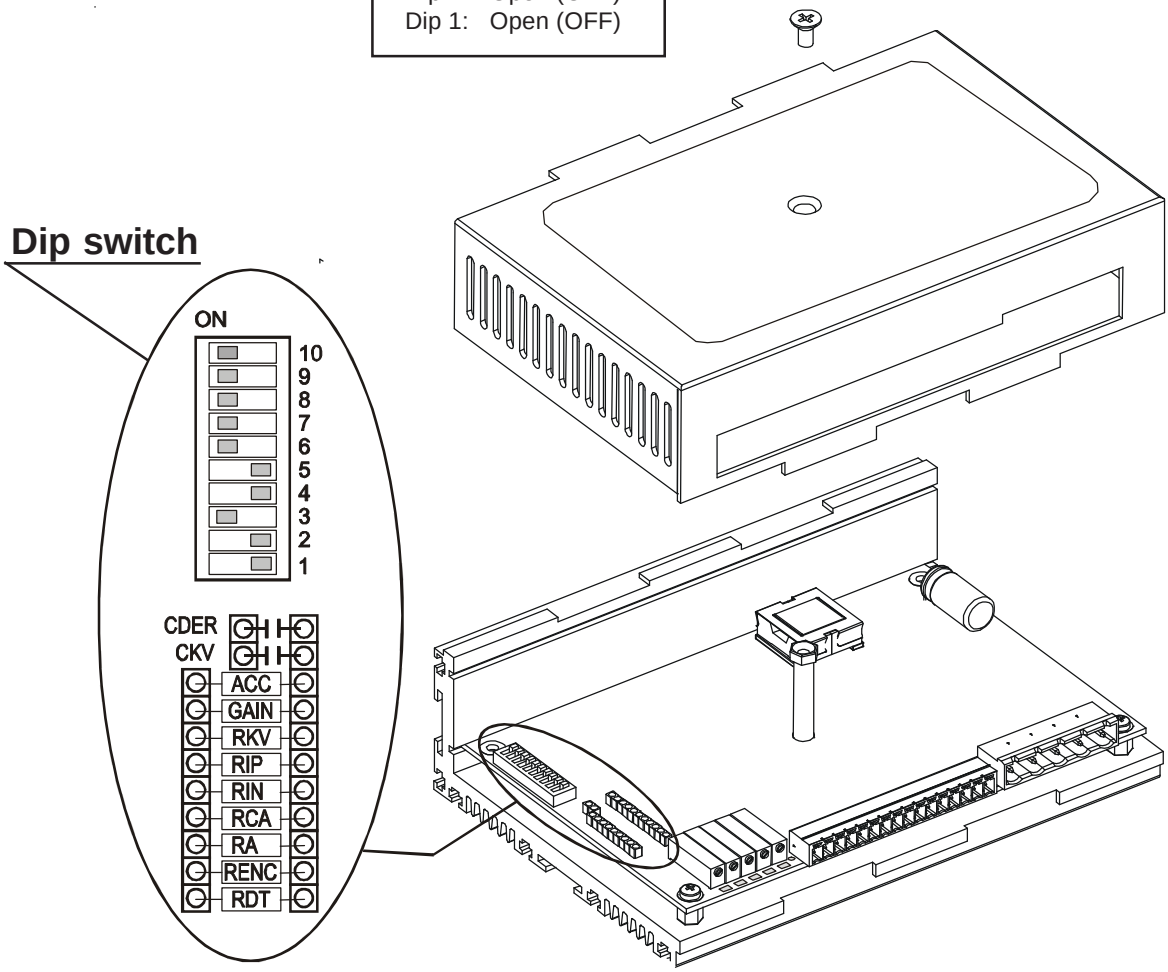
4.0 Internal adjustements

If changes need to made to the internal drive setting powering, please wait at least 30 seconds after the power has been removed and the OK LED is off.
All of the personalizations are located inside of the DRIVE. (See figure above)
To gain access to the adjustment pads and the Dip switch, unscrew and remove the cover.

Dip swicth standard configuration

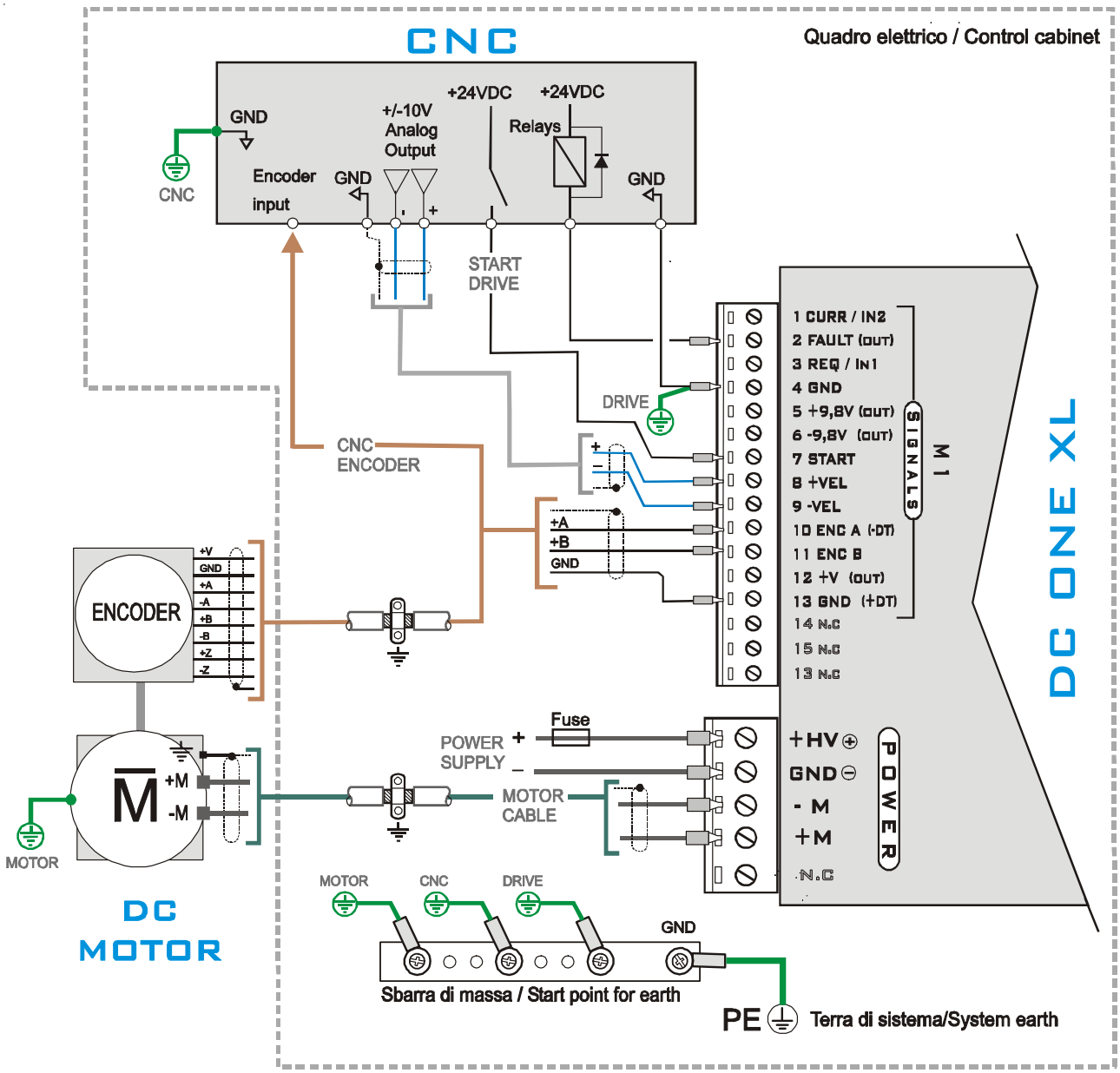
DIP SWITCH standard position are setting by factory for:
- Encoder feedback
- Ramp time disabled
- Standard Dynamic constant

Dip 10: Closed (ON)
Dip 9: Closed (ON)
Dip 8: Closed (ON)
Dip 7: Closed (ON)
Dip 6: Closed (ON)
Dip 5: Open (OFF)
Dip 4: Open (OFF)
Dip 3: Closed (ON)
Dip 2: Open (OFF)
Dip 1: Open (OFF)



In the left-hand page for each chosen velocity feedback, is shown a typical connection with the notes of wiring of the converter.

4.1 Brush motor with encoder feedback

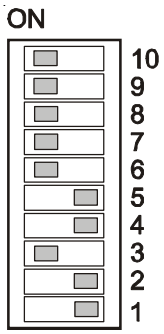


The following diagram shows an tipical application utilizing a Dc One with Brush motor. The + M and -M output are identified on the POWER connector of the product.
In this case the drive is feedback from encoder. The inputs signal encoder of the drive" ENC A and ENC B" are refer with the zero control signals of CNC.
To obtain good dynamic performance of the motor, we recommend the use of encoders with at least 2000/2048PPR. Acceptable performance is obtained anyway even with the use of encoders 500/512PPR.
Is possible to use the +5V output "terminal 12" for the supplies the encoder. Note: the maximum load on terminal +V is 130mA.
Note:
- Don't use terminal 15.
- For terminal input 14 (+Limit switch) and terminal input 16 (-Limit switch) see page 34.

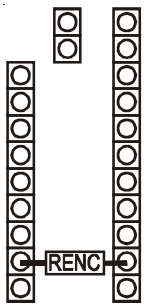
Setting for Brush motor with encoder feedback

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

The drive is standard set with solder bridge S8 closed and the resistance calibration speed RENC already mounted on board "27Kohm" (Calibration for speed = 3000rpm encoder with 10V reference and 500PPR line-count resolution encoder.)
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**

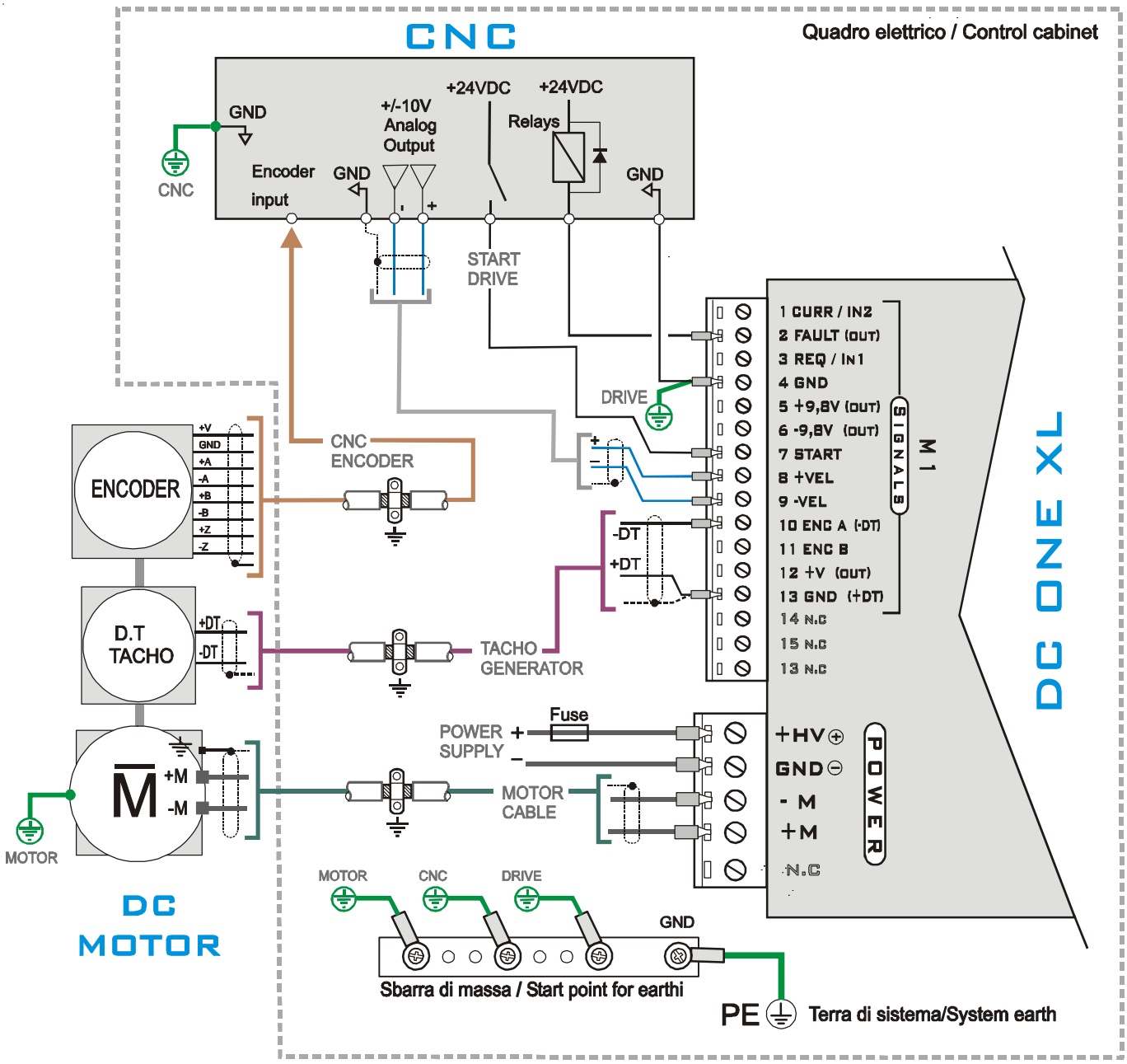
Example:
N° encoder (PPR) = 500
Motor max. speed 4000 rpm

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%.

4.2 Brush motor with tachogenerator



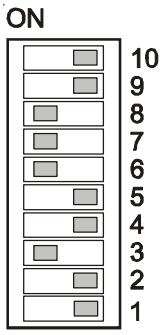
The following diagram shows an tipical application utilizing a Dc One with Brush motor. The speed loop velocity is by tachogenerator feedback.
Signals from the encoder are connected only to the CNC for the control of space loop.

This function is enabled through the following settings on the solder point, and the insertion of RDT resistance on the adjstustement zone.
Note:
- Don't use terminal 15.
- For terminal input 14 (+Limit switch) and terminal input 16 (-Limit switch) see page 34.

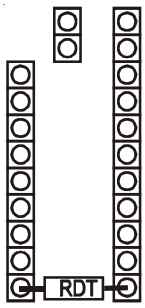
Setting for Brush motor with tachogenerator

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:

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

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

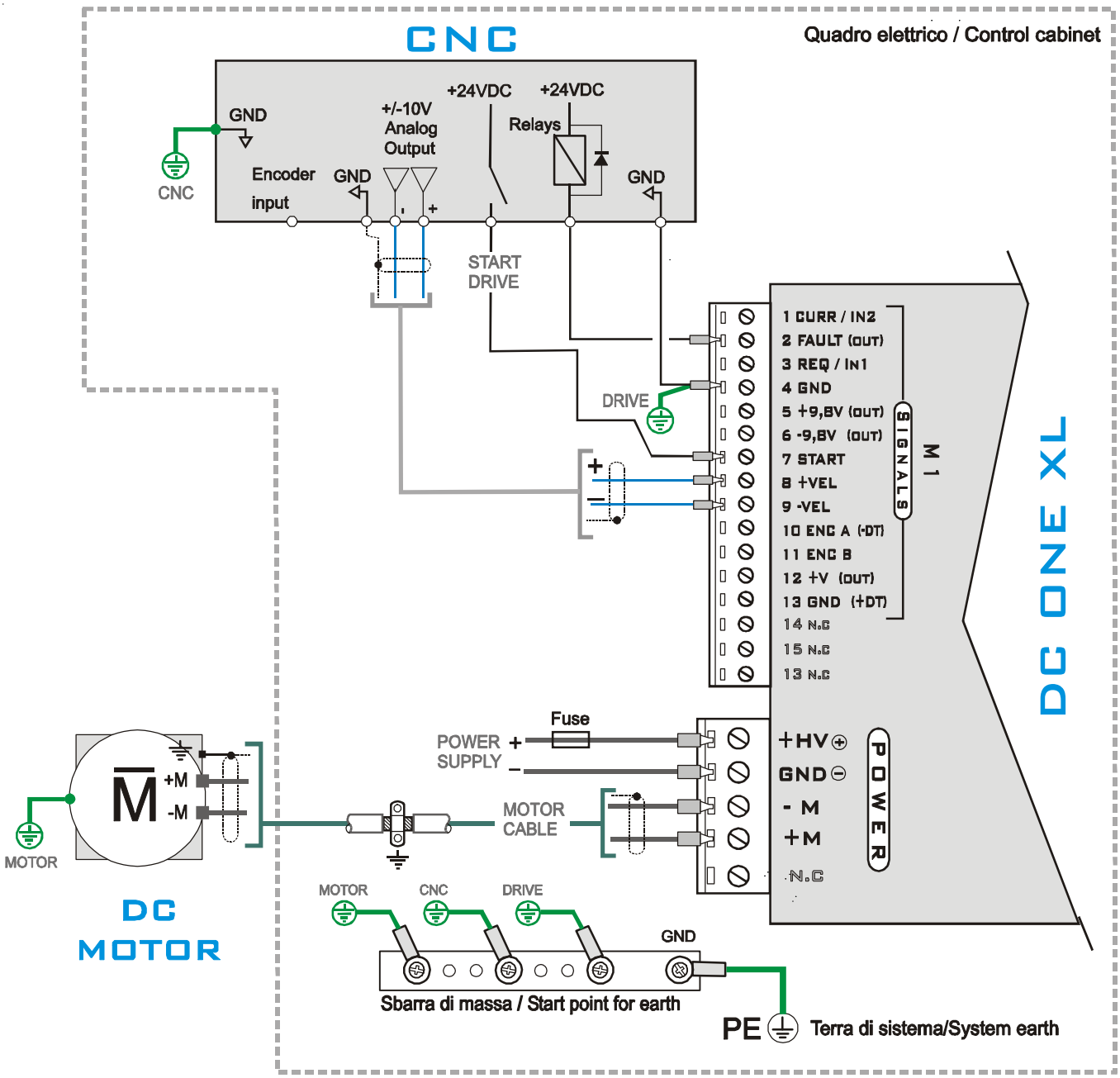
$$\text{RDT (Kohm)} = \frac{10 * 2500 * 9{,}8}{1000 * 10} - 7{,}9 = 16.6 \text{ Kohm}$$

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%.

4.3 Brush motor in armature feedback



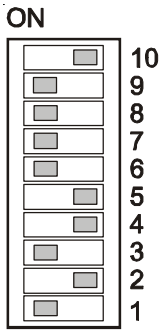
The following diagram shows an tipical application utilizing a Dc One with Brush motor. The speed loop velocity is by internal armature feedback.

In the armature voltage PWM converter is used as the internal feedback of speed, when the motor has not an encoder.
This function is enabled through the following settings on the solder point, and the insertion of RA and RCA resistance on the adjstustement zone.
Note:
- Don't use terminal 15.
- For terminal input 14 (+Limit switch) and terminal input 16 (-Limit switch) see page 34.

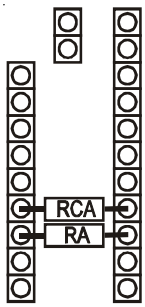
Setting for Brush motor with armature

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
65	57	53	49	45	42	38	34	28,5	23	20,5	16	12	10	5
145	121	113	105	97	88	81	72	60	50	43	33	26	20	10
205	206	193	178	165	151	138	123	103	86	74	57	44	35	18
305	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 145
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%.

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:

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

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 7/14A, Ri=0,3ohm, Vmot=36V, Reference=10V

Calculate:

$$\text{RCA (Kohm)} = \frac{0{,}49 * 1000 * 36}{10 * 14 * 0{,}3} = 420\text{K}$$

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

4.4 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

RIP value	*	470	390	220	150	120	100	82	68	56	47
2/4	4	3,7	3,5	3,2	3	2,8	2,6	2,5	2,3	2,1	2
4/8	8	7,4	7	6,48	6	5,6	5,3	5	4,8	4,2	4
7/14	14	13	12,2	11,3	10,5	9,9	9,3	8,7	8,4	7,5	7
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
20/40	40	37	35	32,4	30	28,2	26,4	25	24	21,4	20
30/60	60	55	52	48	45	42	39	37	36	32	30

Size drive (A)

Peak Current request (A)

Note * = No resistor mounted.

Example: on a converter 7/14A, inserting a resistance RIP 150Kohm the maximum output current will not be 14A, but 10.5A

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

RIN value	*	56	22	12	6,8	4,7	3,9	2,7	1,8	1,5	1
2/4	2	1,9	1,8	1,7	1,6	1,5	1,4	1,3	1,1	1	0,9
4/8	4	3,9	3,7	3,5	3,2	3	2,8	2,6	2,2	2,1	1,8
7/14	7	6,8	6,5	6	5,7	5,3	5	4,6	4	3,7	3,1
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
20/40	20	19,4	18,4	17,4	16,2	15,2	14,2	13	11,4	10,6	8,8
30/60	30	28	27	25	24	22	21	19	16,5	15	13

Size drive (A)

Rated Current request (A)

Note * = No resistor mounted.

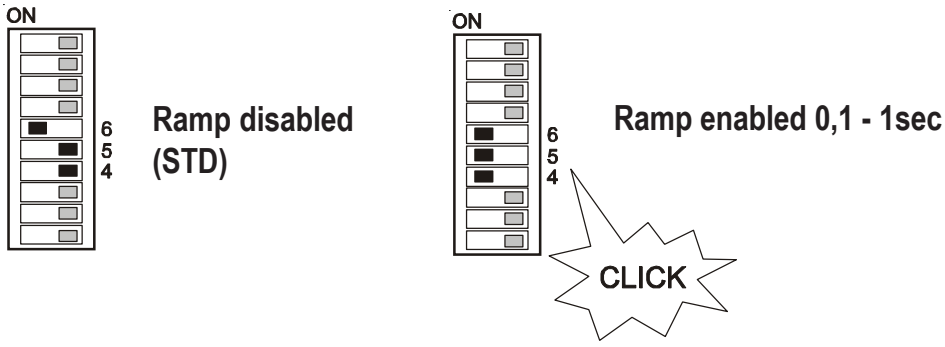
Example: on a converter 7/14A, inserting a resistance RIN 6.8Kohm the rated output current will not be 7A, but 5.7A

4.5 Ramp time adjustement

The product is standard setting with this feature is not enabled (dip switch 4 and 5 OFF)
To enable the ramp acceleration close the dip switch 4 and 5)

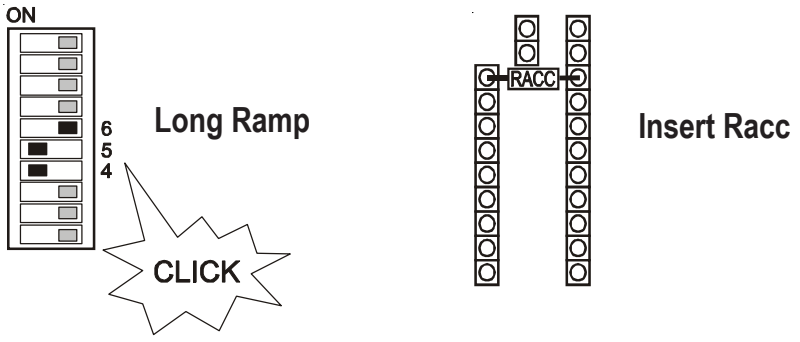
A

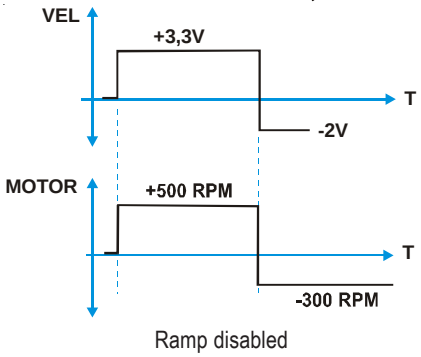
4	5	6	FUNCTION	RANGE	SETTING
OFF	OFF	ON	Ramp disabled	NO	SDT
ON	ON	ON	Ramp enabled	0,1 - 1sec	Variable with ramp trimmer
ON	ON	OFF	Long ramp	Insert RACC	Variable with ramp trimmer



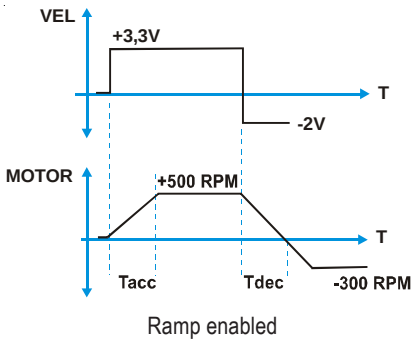
B

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





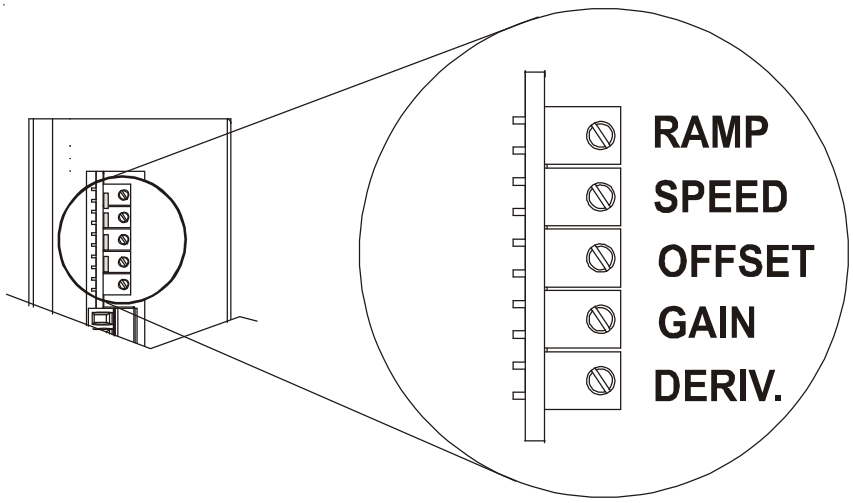
Ramp disabled



Ramp enabled

4.6 Potentiometer adjustements

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



	FUNCTION
RAMP	**Ramp adjustement.** The dip switch 4, 5 and 6 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).
GAIN	**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.

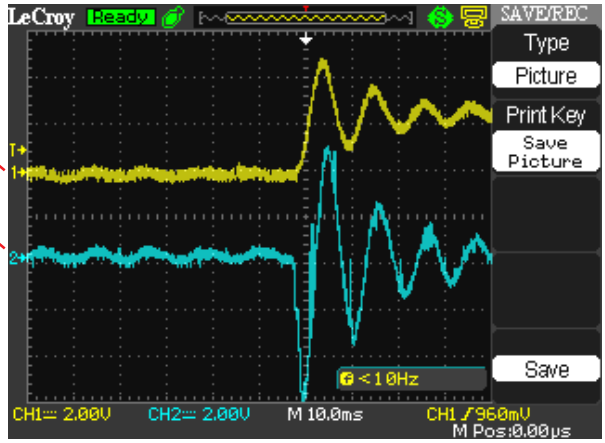
NOTE:
- In Chapter 4.7 explains how to dynamically tune the motor by acting on the 2 trimmer GAIN and DERIV.
- All potentiometers are disabled in Torque mode

4.7 Dynamic adjustement

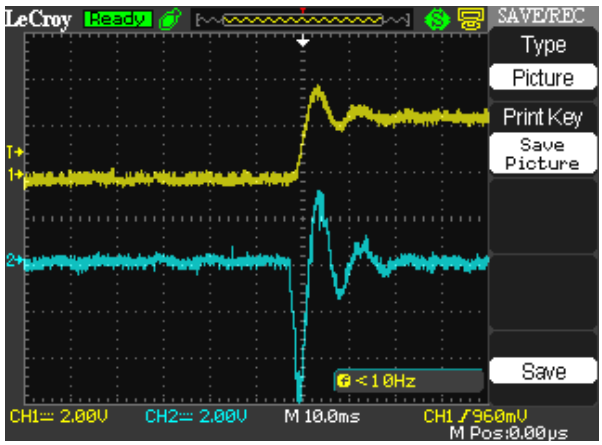
The multi-turn GAIN and DERIV trimmer allow to dynamically tune of the motor and its mechanics linked to it. These trimmers have full excursion from minimum to maximum, with 15 turns of rotation of the same.
The charts shown the track 1 "yellow" is the speed signal available in the point TEST. Track 2 blue highlights instead the current signal taken at terminal 1 (M1 signals connector pitch 3.81)
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 4 (M1 signals connector pitch 3.81)

Velocity of the motor

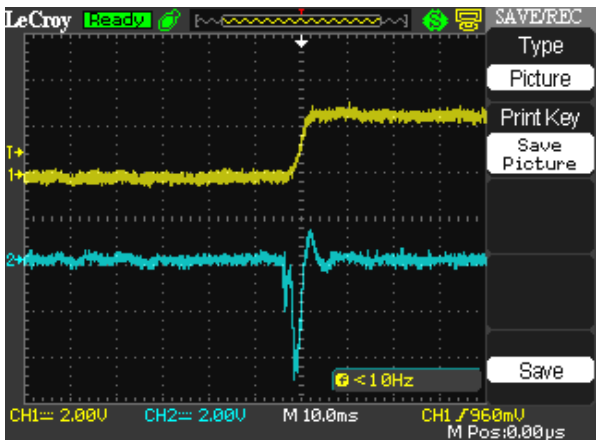
Current of the motor



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

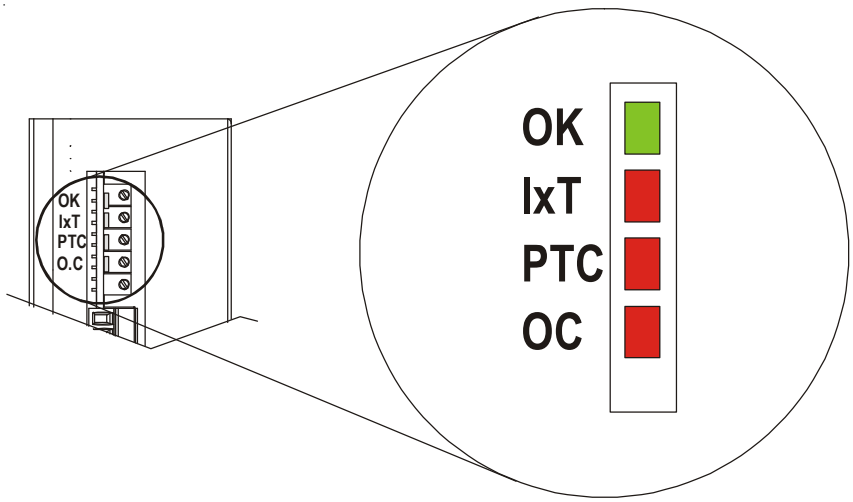


To further improve the behavior of the motor and mechanics related to it and the over all damping of the speed signal oscillation , act trimmer DERIV. turning it clockwise CW (4 / 5 turns). See chart at right

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

4.8 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.** Indicating the proper operation of all functions. It turns OFF in case of any anomaly "except protection intervention IxT". The faults that affect this LED are: Over/Under input voltage. Over temperature (PTC). Short Circuit (O.C), outputs shorted to each other or to ground.
IxT 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.
PTC RED	**Normally OFF.** This indicator is lit when the internal temperature of the drive reaches 75℃ . 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.
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.

Possible reason for the allarms of the drive

- When power supply is on the green OK LED doesn't come on. Check the voltage between +HV and -GND with a tester.
- During deceleration of the motor, the LED green blinks. Increase the capacity filter. (example from 10.000uF to 20.000uF)
- LED lights red O.C. Check the connections + M and-M can short circuit between these two wires, between one of these two wires and ground, or short circuit inside the motor.
- LED lights red ixt. Excessive mechanical load
- LED lights red PTC. Ambient temperature too high, or the converter does not have a minimum circulation of air cooling, ventilation or missing where expected from the size of the converter.
- With the green LED the motor will not start when you enable the drive with START
Check for the enable signal START. Also verify the presence of the speed signal between the terminals + /-VEL
- Motor goes out of control when enabled.
- Encoder signals incorrectly connected (ENC A and ENC B signals swapped, or encoder power supply missing, or tachogenerator signals swapped)

4.9 Limit switch input

t's possible to disable clockwise (CW) and counter-clockwise (CCW) motor rotation by connecting the +L.SW and -L.SW inputs. (See figure)
They may be used to block motor rotation when the machines overflow contact is intercepted.

Function:
- At closing (+Limit swicth) contact input (to zero voltage) you disable the CW motor rotation.
- At closing (-Limit swicth) contact input (to zero voltage) you disable the CCW motor rotation.

The Enable input in regards to this input always has priority.