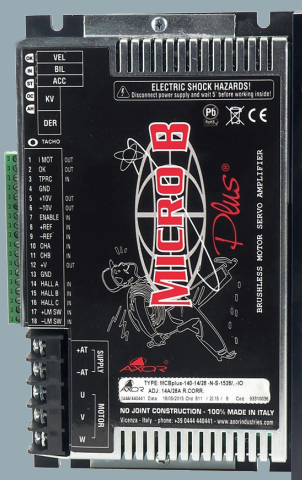




# SERVICE MANUAL

ENGLISH

AXOR INDUSTRIES®  
MOTORS  
& DRIVES



## MICRO B Plus

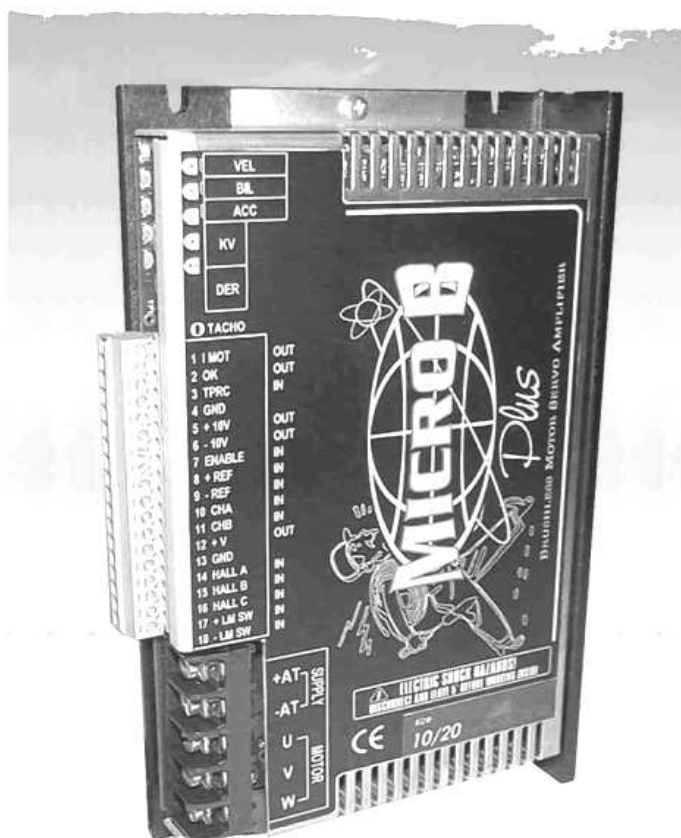
DC Brushless Servo Drive

**The MICROB PLUS series of amplifiers are marked CE because they conform to European Directives for Electromagnetic Compatibility and Low Voltage.**

***This manual describes the mechanical and electrical characteristics of the MicroB Plus servoamplifier series. It is important that the installation procedures are only performed by qualified personnel in accordance with local safety guidelines.***

**Whoever installs the equipment must follow all of the technical instructions printed in this manual.**

***For more information, please contact AXOR's technical department.***



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### 1.0 Security standards

#### Danger Sign



This symbol is used where security directives should be adhered to, where substantial risks are involved, and where life endangerment or injury could occur. **Installers must scrupulously adhere to prescribed directives and must communicate them to the users.**

#### Warning of Current being present



This symbol warns the user/installer to pay particular attention to the presence of dangerous current (up to 200Vdc).

It's recommended to always remove drive from the power supply net before working on the drive.



#### Warning

This symbol is present in all particularly important points.

It's used where the intent is to highlight useful considerations, prescriptions, indications, and the correct execution procedures of every type of intervention and prevention of damaging both systems and drives.

#### General Security Directives

**Along with what is prescribed in the manual, pay attention to the security directives for prevention of accidents and risks.**

Always remove the power supply (disable) from both the system and the drive prior to any type of intervention on electric or mechanical parts.

The Microb Plus must only be installed by trained, qualified and authorized personnel.

Any intervention or modifications effected on Microb Plus, and their components or accessories, constitutes loss of guarantee.

Isolate the drive from the power supply net before removing it (by removing fuses or turning off the principal power switch).

The drive is equipped with electronic protections that disactivate it in case of abnormalities, therefore the motor becomes uncontrolled; this could cause the stoppage or idle motor ( for a period determined by the type of system used).

In some cases the drive could restart automatically when the reason for blockage is corrected.

In this case, some systems could be damaged or destroyed endangering the welfare of personnel.

In this case the user must remove the drives' and systmes' power supply so that the motor cannot automatically restart or prevent such an event in the controller's program.

The Microb Pus' terminals must always be grounded as per the instructions in this manual.

### 1.1 Introduction

The MICRO B Brushless Servo Amplifier is a compact full DC four quadrant drive. The (MOSFET)output power stage is controlled by a 22 KHz PWM (Pulse With Modulation)signal that allows it to drive small to medium sized brushless servo motors (up to 6Nm) where high dynamic performance and precise speed is required.

The MICROB only requires a single power supply to operate and develops all needed voltages on board to make power supply design easy and convenient. The input voltage is from 20 to 270 Vdc max "See Technical Data". (Chapter 3 describes how to design a proper supply.)

Closing the velocity feedback loop to motor may be done in several different ways to accommodate most applications. Three types of velocity feedback are available with these drives. Refer to Chapter 5 for the setup procedures that will effect your application.

Feedback Types:

- Hall effect + encoder.
- Internal PWM (Armature).
- Hall effect
- Pwm+Direction

Two inputs are present for the disabling of clockwise and counter-clockwise motor rotation (+LM SW,-LM SW).

The possibility to completely adjust the Dynamic Constant exists by inserting new values "as opposed to the standard mounted values".

The insertion of various prearranged operational drive values are easily realized by opening and closing solder points. The intervention of drive protections are all visible with LEDs on the front of the drive.

The nominal current, as well as peak current is adjusted through resistance on the base.

The operating temperature is from 0 to +40 °C (32° to 104°F). In accordance with the current size and model, supplemental ventilation can be requested.

### Characteristic and Options

The speed feedback present on the Microb Plus are highlighted.

Speed Feedback from Encoder	●
Speed Feedback from Armature	●
Speed Feedback from Hall Effect Signals	●
Speed Feedback from Input (Pwm+Dir)	●
Speed Feedback from Resolver	○
Speed Feedback with Tachogenerator	○
Version with Booster	□

External Power Supply + Brake for plus .60	◇
External Power Supply + Brake for plus .140	◇
External Power Supply + Brake for plus .200	◇

● =Standard.

□ =Standard on sizes 14/28 ,20/40.

◇○=Optional (available from 02/2000).



## 1.2 Technical Data

MICROB PLUS VOLTAGE		
Microb 60	20 - 80 Vdc*	Note a)
Microb 140	40 - 180 Vdc*	
Microb 200	60 - 270 Vdc*	

MICROB PLUS CURRENT SIZES		
Size	I nom. (A)	I peak(A)
2.5/5	+/- 2.5	+/- 5
5/10	+/- 5	+/- 10
8/16	+/- 8	+/- 16
10/20	+/- 10	+/- 20
14/28**	+/- 14	+/- 28
20/40**	+/- 20	+/- 40

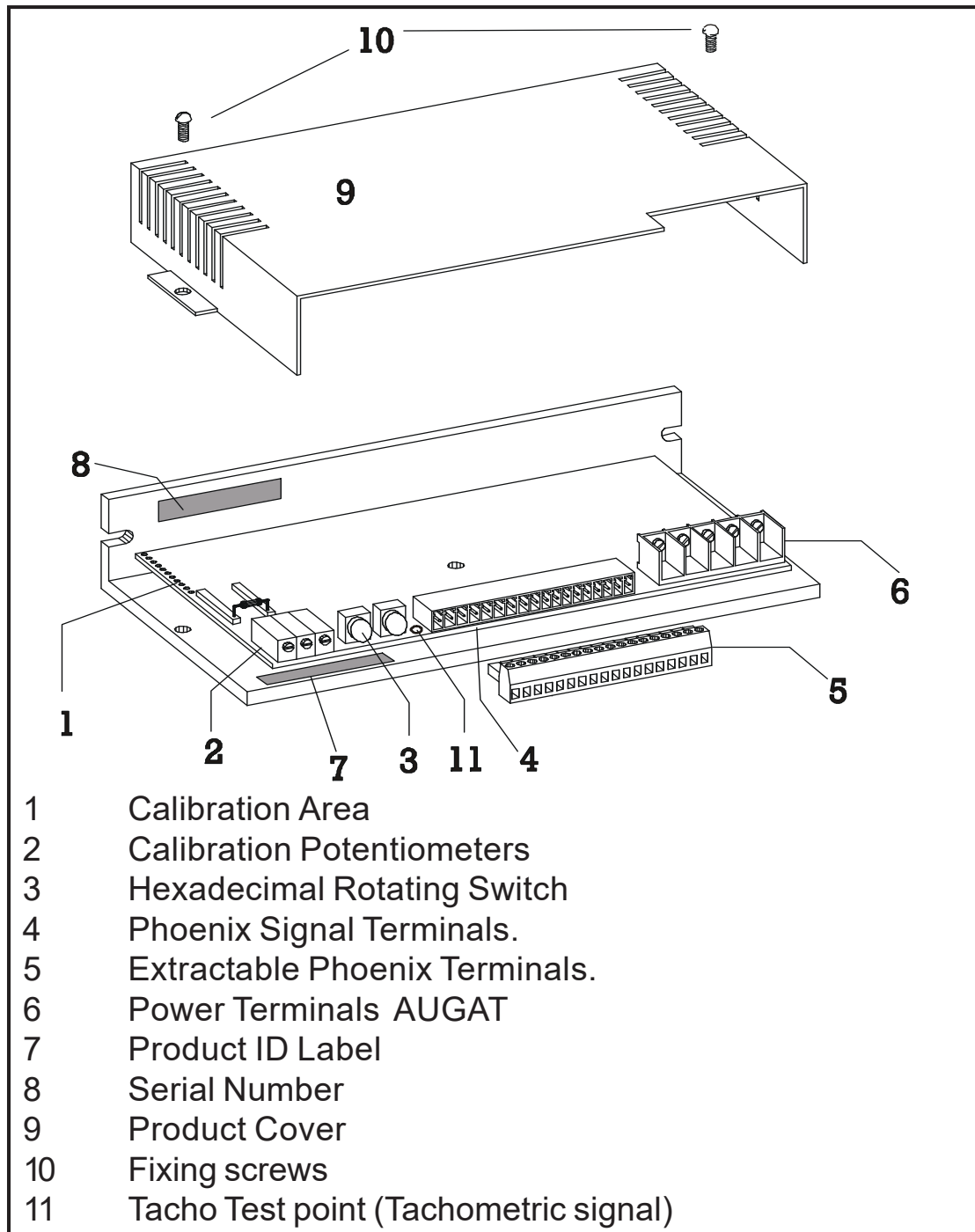
\* Minimum and maximum voltage.

\*\* Sizes 14/28 e 20/40 have an additional booster radiator.

Note a) The Microb plus 60 is produced only in sizes 14/28 e 20/40.

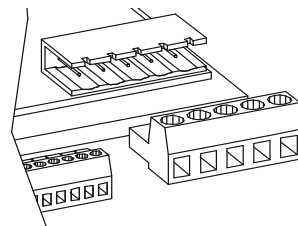
TECHNICAL DATA CHARACTERISTICS	
--PWM frequency	22Khz
--Operating Temperature	32°-104°F (0°+40°C)
--Storage Temperature	12°-158°F (-10°+70°C)
--Drift	+/-10uV Degree F
--Analog inputs	+/-10Vdc
--Current Monitor (Imot)	+/-7Vdc = (PK. curr.)
--Encoder and Hall Signal	
Power Supply (+V)	+5/+12Vdc ( 250 mA Max)
--Auxiliary power supply	+/-10Vdc ( 4mA Max.)
--Encoder Max.Freq.	250Khz Max.
-- Band Width	2.5Khz
--Weight Microb plus	26.45 oz (750 gr.)
--Weight Microb plus w/booster	44.1 oz (1250 gr.)
--Humidity	10/95% non-condensing

## 1.3 Microb Plus Description



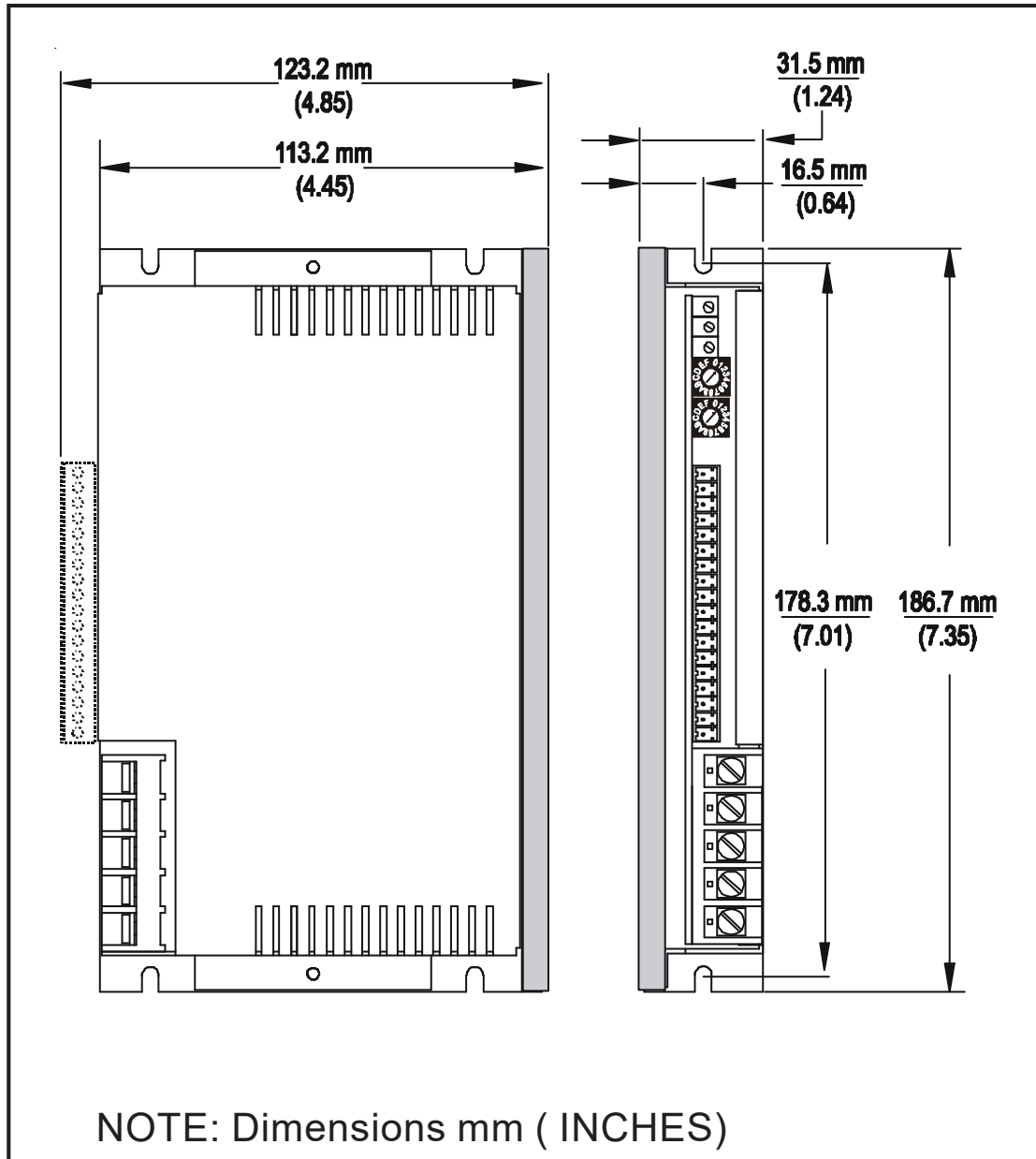
The power connector "AUGAT 6PCR-05" is used on sizes 10/20-14/28 e 20/40A.

Power terminals "Phoenix GMSTB2,5/5-G" 7,62 for Microb sizes 2,5/5 - 5/10 - 8/16 .

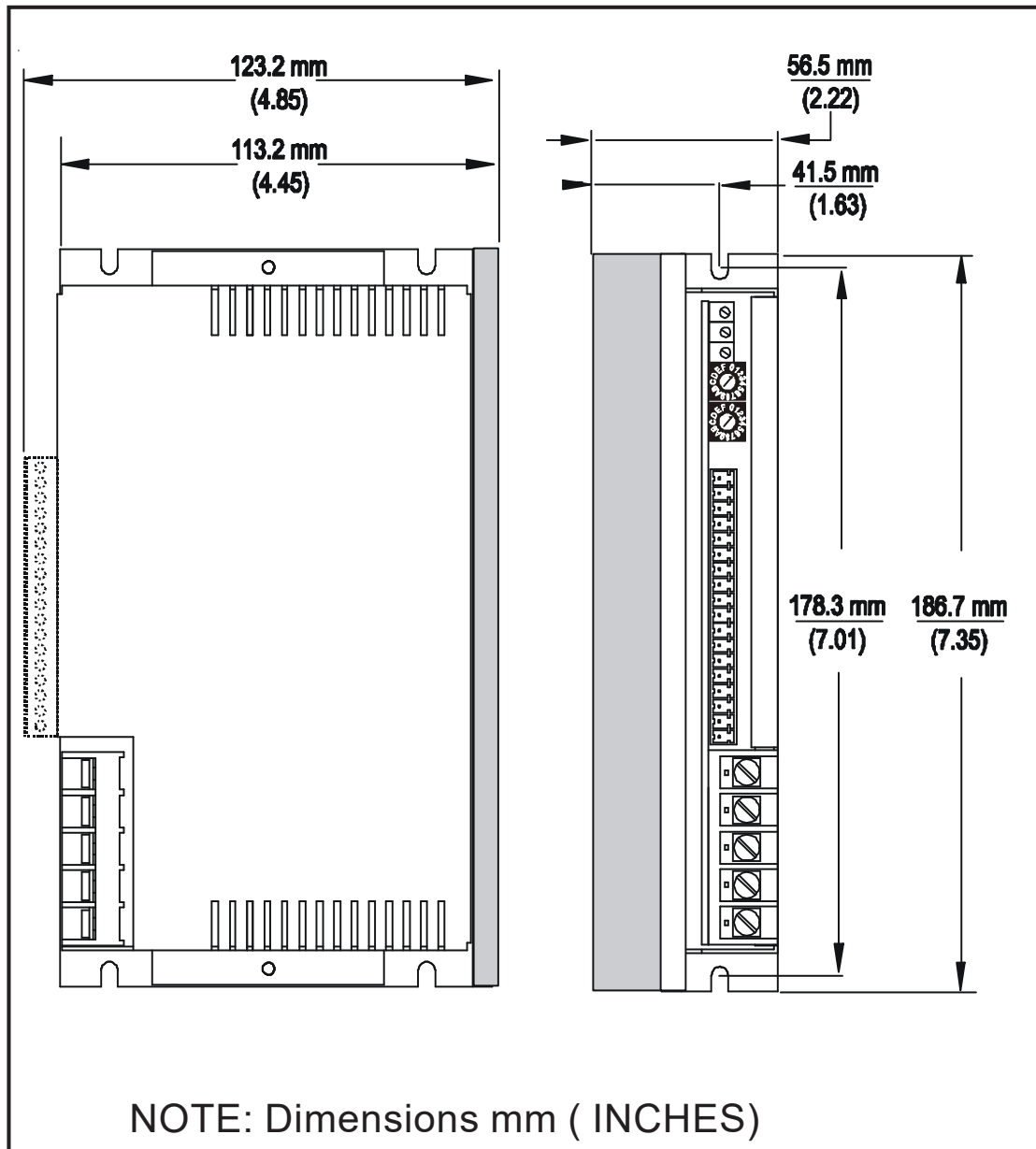


## 1.4 Drive Dimensions

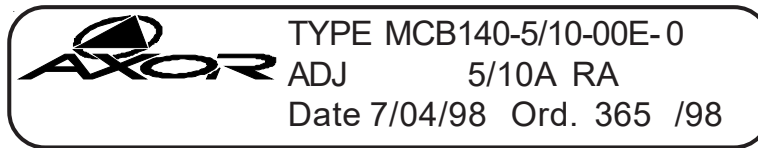
### MICROB PLUS



**MICROB PLUS WITH BOOSTER**



## 1.5 Drive Label Description



The Product Label is on all MICROB PLUSDrives. The Label printed above is a typical example. To identify the various options see below: Product type and Identification:

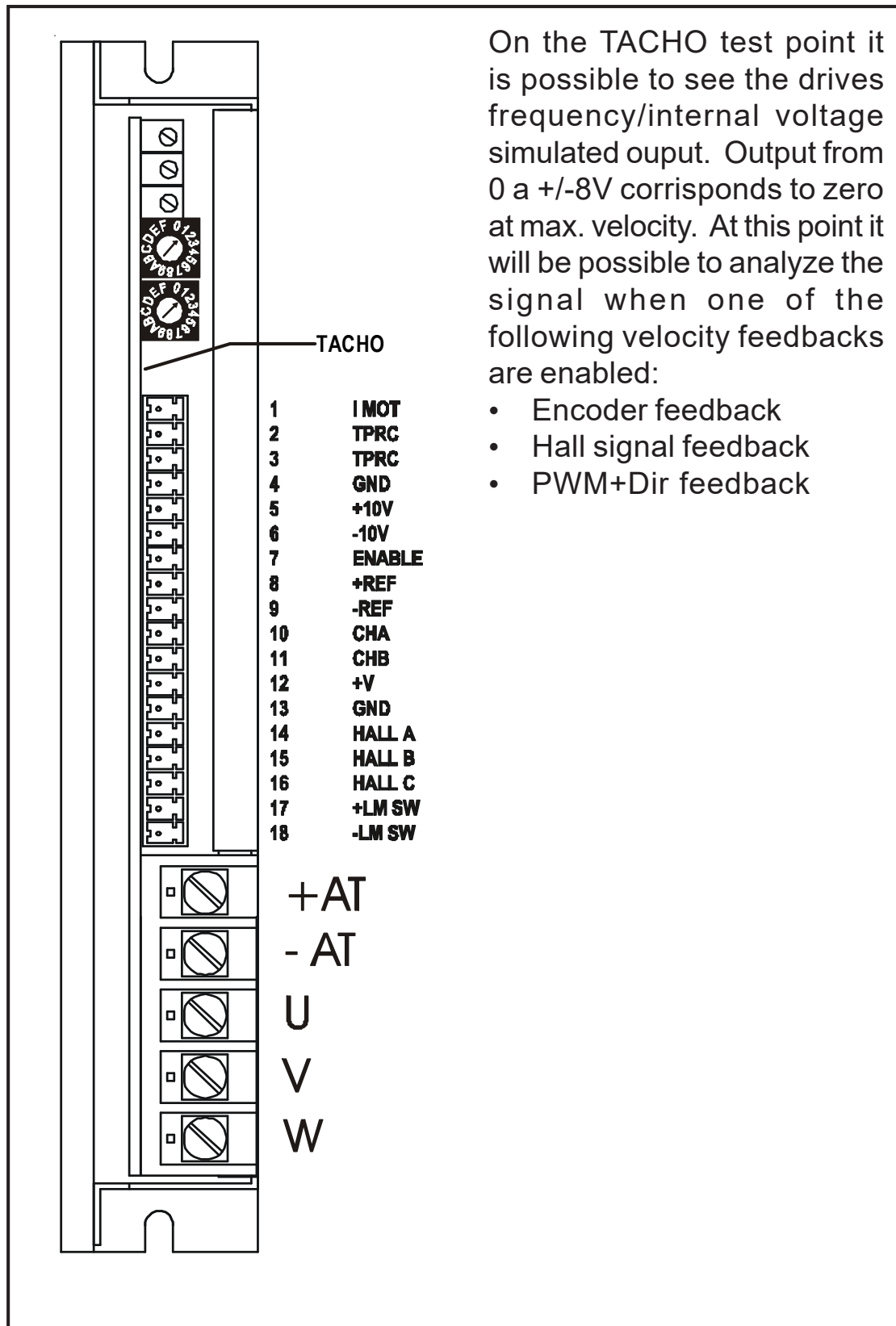
<u>TYPE</u>	MCB140	-5/10	-00E	- 0
	60	2,5/5		
	140	5/10		
	200	8/16		
Model		10/20	ARM=Open Loop	0
I nom/I Peak		14/28	HAL=Hall signals	1
Velocity feedback		20/40	00E=Encoder	2
Options			XXX=PWM+DIR	3
				4

ADJ is the identification of specific adjustments on the product for specific motors. If the product is furnished Standard, the ADJ will show the disbursed current.

<u>ADJ</u>	T29XX	1000I/g	3000RPM
Motor			
Imp. Encoder			
Nominal velocity			

**ORD** is AXOR's internal order number which relates to product distribution. Always quote this number when asking for technical assistance.

## 1.6 Connections



On the TACHO test point it is possible to see the drives frequency/internal voltage simulated output. Output from 0 a +/-8V corresponds to zero at max. velocity. At this point it will be possible to analyze the signal when one of the following velocity feedbacks are enabled:

- Encoder feedback
- Hall signal feedback
- PWM+Dir feedback

## 1.7 Signal inputs and outputs

The following is the Signal Connector Description.

1	<b>IMOT(OUT).</b>	Current Monitor, Range: +/-7 Vdc Output in Volts, the current in the motor windings. Since current is proportional to torque, this output may be used to monitor the torque the motor is producing. (+/-3.5Vdc=nominal current, +/-7Vdc=Peak current)
2	<b>OK(OUT)</b>	Drive OK, Open Collector output 50mA Max. (Normally closed, opens when in protection mode)
3	<b>TPRC(IN) (OUT)</b>	<p>This signal can be used in 3 distinct modes:</p> <p>A) <u>Motor Current Limit Mode:</u> Soldering point S15 open S16 closed. Applying a signal between zero and +10V you receive the current limitation output from zero to max. drive size. Ex: Mcb 10/20A.....+5V limits the current to +/-10A. Mcb 14/28A.....+3.2V limits the current to +/-9A.</p>

$$V_{ing} = \frac{10 \times I_{required}}{I_{peak}}$$

### B) Motor Current Limit Mode:

S15 closed S16 open.

A motor current Limit mode connect an external resistor to GND (pin 4) reduces the maximum current. Connect a 1/4W or 1/8W resistor between the TPRC and GND terminals.

A 47Kohm resistor reduces the current by 50%.

Note: The drive velocity loop remains active.

### C) Current Reference (Torque Input):

S15 closed, S16 open

Range: +/- 10V, which corresponds to the drive's peak current output.

In this mode the velocity loop is automatically disabled.

---

4	<b>GND</b>	Drive Common Ground. Corresponds to power supply's negative -AT input.
---	------------	--

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5	<b>+10V(OUT)</b>	Power Supply +10Vdc 4mA Max.
---	------------------	------------------------------

---

6	<b>-10V(OUT)</b>	Power Supply -10Vdc 4mA Max.
---	------------------	------------------------------

---

7	<b>ENABLE(IN)</b>	Drive Enable. Range +8Vdc to +24Vdc. It's also possible to enable the drive with negative logic by connecting a GND input (to enable such a function, close solder bridges S12-S13). Chapter 3.10
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8	<b>+REF(IN)</b>	Reference Positive differential input. (Velocity command)
9	<b>-REF(IN)</b>	Reference Negative differential input. (Velocity command)
10	<b>CHA(IN)</b>	Encoder input Channel A High logic level from +3,2V to +24Vdc. Low logic level <1,5V.
11	<b>CHB(IN)</b>	Encoder input Channel B High logic level from +3,2V to +24Vdc. Low logic level <1,5V.
12	<b>+V(OUT)</b>	Power Supply +5Vdc 250mA Max.=(Solder bridge S17 closed). Power Supply +12Vdc 250mA Max.=(Solder bridge S17 open).
13	<b>GND</b>	Drive Common Ground. Corrisponds to power supply's negative -AT input.
14-15-16	<b>HALL A-B-C (IN)</b>	Hall Sensor inputs from the motor. Each input has a pull-up resistor of 1 Kohm to +5V. High logic level>3,2V , Low logic level<1,5V.

---

**17     +LM SW (IN)** Logic input that , disable with positive rotation (CW) of motor.(Motor limit).  
Such a function is enabled, closing soldering point S18 and connecting a positive Voltage (between +5Vdc e +24Vdc)on said input. When the voltage on said input is absent, motor rotation blockage intervenes in a clockwise sense. Chapter 3.14

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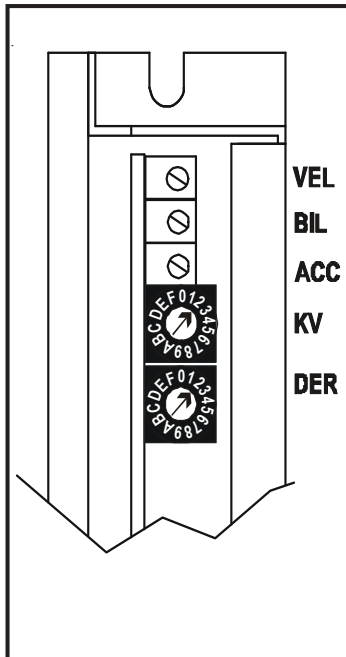
**18     -LM SW (IN)** Logic input that , disable with positive rotation (CW) of motor.(Motor limit).  
Such a function is enabled, closing soldering point S18 and connecting a positive Voltage (between +5Vdc e +24Vdc)on said input. When the current on said input is absent, motor rotation blockage intervenes in a counter-clockwise sense.Chapter 3.14

---

### 1.8 Power Supply Inputs and Outputs

<b>+AT</b> (Input).	Positive continuous power supply.
<b>-AT</b> (Input).	Negative Continuous power supply. Common Zero Signal GND
<b>U</b> (Output).	Motor connection U phase
<b>V</b> (Output).	Motor connection V phase
<b>W</b> (Output).	Motor connection W phase

## 2.0 Potentiometer Adjustments



### **VEL**

Motor speed adjustment. Use this potentiometer to adjust the maximum motor speed. Turn clockwise (cw) to increase the motor speed and counter-clockwise (ccw) to reduce the motor speed. The range of the adjustment is  $\pm 20\%$ . Note: Potentiometer is disabled in torque mode.

### **BIL**

Offset adjustment. Adjust this potentiometer to cancel any motor speed when the Ref. input is 0 Vdc. (Max ref. compensation  $\pm 200\text{mV}$ ).

### **KV**

Gain potentiometer. Use this potentiometer to increase or decrease the dynamic behavior of the motor.

With a clockwise turn (cw) we increase the gain of the PI "speed stage", therefore, improving the response. Note: Potentiometer is disabled in torque mode.

### **DER**

Derivative potentiometer. Turning this potentiometer clockwise decreases motor overshoot. Note: Potentiometer is disabled in torque mode.

### **ACC**

The solder bridges S1-S3 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 reference).

**Continued**

### ***Continued***

It is also possible to increase or decrease the pre-set max acc/dec ramp time by opening solder bridge S2 and inserting resistance RAMP.

(See chapter RAMP TIME ADJUSTMENT)



#### **NOTE:**

On the Microb Plus the KV and DER functions are constituted by Hexadecimal rotating switch identified with numbers from 0 to F.

With 0 you have the minimum function attainable, and with F you receive the maximum.

**WARNING:** Increase the gain of KV and DER in the progressive mode using the various intermediate positions 1-2-3-4 etc.

Therefore, "turning counter-clockwise from position 0 to position F" the motor could begin vibrating.

### 2.1 Protections



The MICRO B is equipped with protection circuits to safeguard both the motor and the drive, in case of faults malfunctions.

All faults are indicated by LEDs on the front of the drive. (See the next page).

The two types of interventions are Reversible and Irreversible.

#### ***----Reversible Protection Intervention:***

The drive is automatically reset/restarted when the cause of intervention has been corrected.

***-Over Current limitation***

***-Over/under voltage input***

#### ***----Irreversible Protection Intervention:***

The drive is not reset/restarted. The power supply must be removed and the cause of intervention eliminated, then the power supply can be replaced. \*Note: A minimum amount of time must pass in order to ensure that the drive is completely off prior to replacing the power supply.

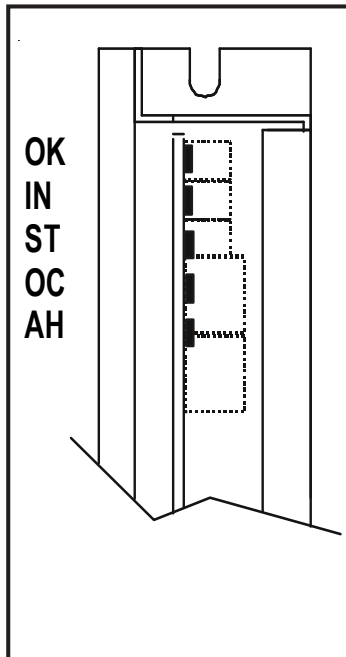
***-Short circuit***

***-Over temperature***

***-Missing Hall Signals***

***-Improper Hall Commutation***

## 2.2 L.E.D. indicators



Five LEDs are located just in front of the potentiometers and show the current state of the drive.

**-OK (GREEN) Normally ON.** This indicator shows that the drive is operating correctly. If this LED is Off, it is indicating at least one fault has been activated. The faults that affect this LED are:

- Over/Under input voltage.
- Over temperature, Over 104°F (40°C).
- Short Circuit, Outputs shorted to each other or to ground.--Missing Hall.

**- IN (RED) Normally OFF.**

This indicator is lit if the drive is in Over current mode.

**- OC (RED) Normally OFF.** This indicator is lit if there is a short circuit between the motor leads and/or ground. Remove power and examine the motor connecting leads for shorts before re-powering the drive.

**- ST (RED) Normally OFF.** This indicator is lit when the drives internal temperature reaches 104°F (40°C). Remove power and wait for the drive to cool before re-applying power. If operating temperatures are close to the Max operating temperature of the drive, a fan, heat sink or air conditioner may be needed to remedy the problem.

**- AH (RED) Normally OFF.** If lit it represents either missing Hall. Have a qualified technician check the Hall Effect signals with a voltmeter or an oscilloscope.

This fault is a latching fault. Refer Chapter 5.2 for correct procedure on changing this function.

## 3.0 Installation Notes

The Microb Plus is predisposed for mounting inside a box. The mounting hole measurements can be found in chapter 1.4 "Drive Dimensions". The Microb Plus must be fixed vertically on the bottom of the box to guarantee efficient cooling by the drive itself. The positioning inside the box must satisfy the following dispositions:

- For best results from drive guarantee that inside the electrical box a temperature between 0°C and +40°C with humidity between 10% and 95% without condensation..
- Keep the drive from excessive mechanical vibrations in the electrical box.
- During installation, insure avoiding any kind of metallic residue from falling inside of the Microb Plus.
- Maintain a distance of 80mm from the heat source.
- The electrical box must have a predisposition for oportune air filtering holes or passageways.

## 3.1 Ventilation

TheMicrob plus must be affixed vertically on the bottom to guarantee efficient cooling. The drives working temperature must be between +0° C and +40° C. Supplementary ventilation may be requested in accordance to size. See the table below.

Model	2,5/5	5/10	8/16	10/20	14/28	20/40
60	n.a	n.a	n.a	n.a	N	BV
140	N	N	N	N	B	BV
200	N	N	N	N	BV	BV

Combination table of dissipators present on Microb Plus.

n.a = Unavailable size with Microb Plus. (Available with Microb Case PM1)

N = Microb Plus with normal radiator (See Chapter 1.5)

B = Microb Plus with added radiator Booster (See Chapter 1.4)

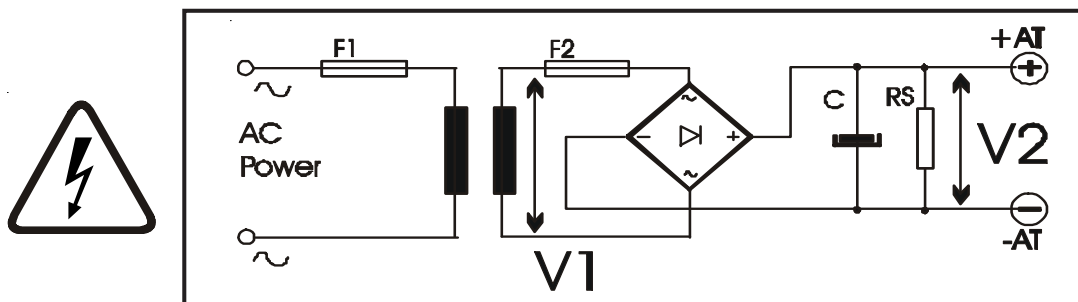
B/V = Microb Plus with added radiator Booster + supplementary ventilation.



## 3.2 Power Supply Construction and Rating

**WARNING:** Use only Un-regulated power supplies with the MicroB Drive. The power supply is used to absorb the motor's BEMF. Als, with this scheme, no braking resistor are needed.

The MicroBPlus was designed to generate all required supply voltages in the Drive, so only a simple single voltage power supply is needed. Use the schematic and formulas provided below to design a supply that will be trouble-free and handle the power needed by the drive.



**Transformer:** A single ground is used in the drive that is connected to -AT, so **DO NOT USE AN AUTO TRANSFORMER**. Use a standard heavy duty power transformer without center taps on the secondary as shown in the schematic above. The VA rating should be 10% greater than the power needed by the system to insure cool operation. **DO NOT CONNECT ANY TRANSFORMER PRIMARY, OR SECONDARY SIGNALS TO GROUND.**

Keep the +AT and -AT wires, between the power supply and the MicroB, as short as possible.

**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 V2 is:

$$V2(Dc) = \frac{VM}{0,8}$$

### **Power Supply Construction and Rating (continued)**

Where:

$V_M = E + (R \times I_m)$ ..... motor voltage

$E = K_e \cdot n^\circ / 1000$ ..... FCEM motor (Vdc)

$I_m = I$  motor (A)

$R_i$  = Winding resistance (Ohm)

$K_e$  = Voltage constant (V/kRPM)

$n^\circ$  = MAX speed (RPM)

Example: Brushless DC Motor with the following data:

$I_m = 3,8$  (A)

$$E = \frac{30 \times 3000}{1000} = 90 \text{ (V)}$$

$R_i = 2,5$  (Ohm)

$K_e = 30$  (V/kRPM)

$n^\circ = 3000$  (RPM)

$$V_M = 90 + (2,5 \times 3,8) = 99,5 \text{ (V)}$$

$$V_2 = \frac{99,5}{0,8} = 124,3 \text{ (V)}$$

$$V_1 = \frac{56}{1,41} = 88,1 \text{ (Vac)}$$

You'll use a transformer with the secondary  $V_1 = 88,1$  Vac  
When you use the transformer 95Vac, it is correct..

You'd choose MCB140- 5/10A Considering keeping margins for motor's braking phase it's recommended not to exceed the voltage of 95 Vac.

## Power Supply Construction and Rating (continued)

### Power Transformer:



- **POWER:** If the power of a transformer exceeds a determined value, the inserted straightening point could be damaged in the enabling phase, due to overcurrent from the capacitors.
- max. power per transformer is 7KVA;

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

Or Better:

$$P(VA) = \text{Power absorbed motor 1} + \text{Power absorbed motor 2} + \text{etc.....}$$

Note: In multi-axis applications, the transformer's power can be downgraded by 30%.

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

Where:

- Pn Motor** = nominal power each motor.  
**n** = max. speed of motor in RPM.  
**Cn** = nominal torque of motor in (Nm).

### Capacitor filter:

In regards to the capacitor filter we suggest a working voltage of:

- 100 Vdc for Microb plus 60
- 200 Vdc for Microb plus 140
- 300 Vdc for Microb plus 200

It's capacitor value is derived using the following formula:

$$C \text{ (uF)} = \frac{P \text{ (VA) transformer} \times 1000}{V^2}$$

## Power Supply Construction and Rating (continued)

Where  $V_2$  = DC voltage present on capacitor without load. Such a capacitor is used to filter the straightened voltage from the power supply and to recover energy during the motor's braking phase.

### Discharge resistor

The bleeder resistor is used to drain the charge from the filter capacitor when power is removed from the supply. This helps in bringing the supply voltage down quickly. This resistor is mounted directly across the filter capacitor. To calculate the correct value and wattage use the formula below.



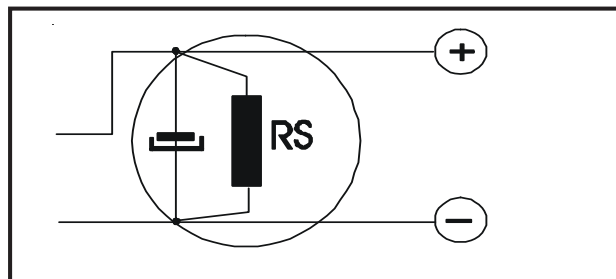
$$R_S (\text{Ohm}) = \frac{20.000.000}{C (\mu\text{F})}$$

$$P (\text{W}) = \frac{V_2^2}{R_S}$$

Where:

$R_S$  is the resistor value in Ohm

$P$  is the power of said resistor in Watt



## Power Supply Construction and Rating (continued)

### Fuses

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. Use the formula below to calculate the correct values for both fuses.

Where:

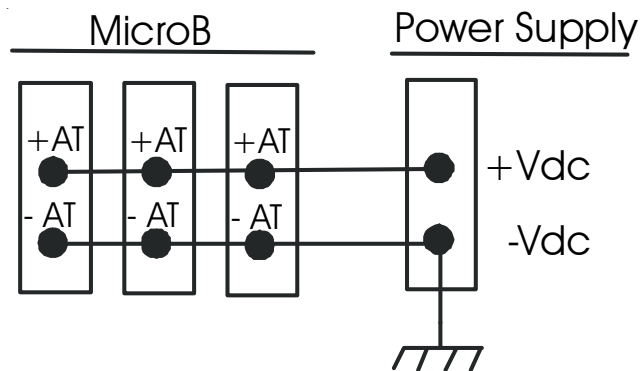
$F1 = \frac{(VA) \text{ transformer}}{V_{ac} \text{ (primary)}} \times 1,1$			
F2	X MCB	2,5/5	=3,16A
	X MCB	5/10	=5A
	X MCB	8/16	=10A
	X MCB	10/20	=16A
	X MCB	14/28	=20A
	X MCB	20/40	=25A

A separate fuse F2 is required for each drive in a multi-axis system.

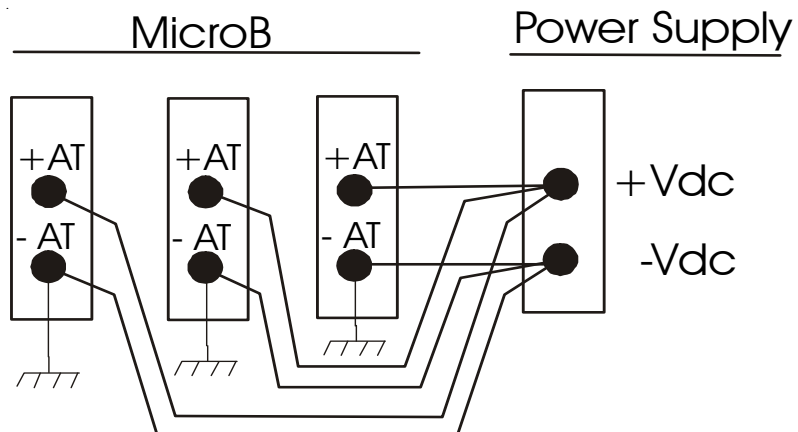
## 3.3 Multiple Connections

In case of connecting more than one axle to a single supply, always connect each drive **DIRECTLY** to the supply and keep the wires as short as possible, twist the + and - leads together as twisted pairs. (try not to exceed 1,5 feet (1m) in length).

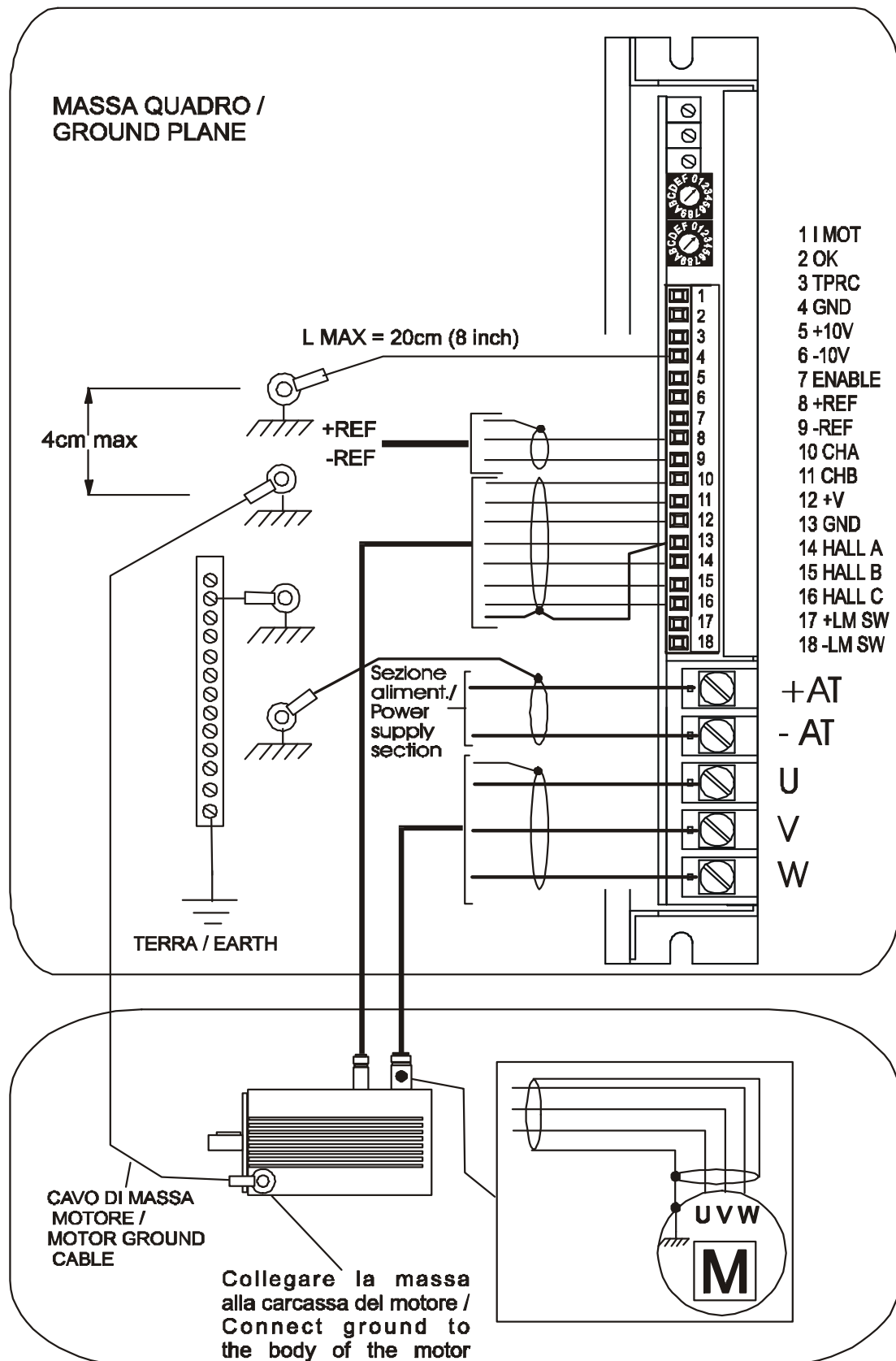
**Incorrect  
Wiring  
Technique**



**Use This**



## 3.4 Ground and Shield Connections



### Description:

It is important that the drive's ground connections are as short as possible and no longer than 8 inches (20 cm). The figure shows the connection using terminals fixed to the drive's base (bottom). This connection also reduces disturbances in the net.

The Motor ground cable has to be external (not inserted in a multipolar cable) with minimum section 1.5 mm<sup>2</sup> (0,059 square inch).

Drive power and signal cables must be shielded. The cable shields must be connected to the body of the motor.

Shielded cable is not required for the motor power cable, the U V W cables should be twisted together.

On the following page you'll find additional installation instructions in respect to EMC requirements.



### 3.5 Instructions for EMC Requirements

The regulated standard in accordance with conformity of electromagnetic is summarized in Regulation CEI EN 61800 (complete).

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

--1) Use of appropriate network to filter the line (transformer input), from disturbances conducted or produced by the drive. A series of filters released by AXOR are available for this purpose.

--2) Use of shielded cables, both for power connection (to the transformer and the motor), and for signal connection (also to the controller).

--3) Using the division of cables technique. Separate power cables from signal cables.

--4) The correct ground connection of predisposed parts.

#### Network Filters

Of all of the mentioned system, the use of network filters is without a doubt fundamental in suppressing disturbances.

Axor, after tests, has recognized some good solutions, about its products.

Concerning equipment where are mounted other sources, Axor can't evaluate the global equipment. In the following page, are reported some fundamental configurations, with the suggested filters.

We did an agreement with **Schaffner and Timonta** products. The market offers other product with the same characteristics, but not yet checked from Axor.

When other products will be checked and approved, it will be notified.

Follow reported an example about the noise level with and without filter as explained in the following pages.

### ***Instructions for EMC requirements (continued)***

The recommended filters for the product lines in some of the main configurations are shown in the table on page 34-35. These filters are produced by SCHAFFNER and TIMONTA.

Other products with the same characteristics may be sufficient, but have not been tested or evaluated by AXOR.

In choosing the filter, we also considered the current absorption of its connecting devices. AXOR recommends connecting the filter before the power supply transformer. This method, besides offering better disturbance suppression result, also allows for the use of filters capable of supporting a lot less current, consequently they're cheaper (takes advantage of the transformer's ratio).

Follow the formula below for the filter dimensions to be used with the MicroB Plus.

$$I(A) = \frac{P_{tot}}{1.73 \times V_{primary}}$$

Where:

I= is the nominal current in Amperes for the necessary filter.

V<sub>primary</sub>= is the voltage of Transformer.

P<sub>tot</sub>= is the motor's max. power absorption in watts(VA)

P<sub>tot</sub>=VA=Motor power<sub>1</sub>+motor power<sub>2</sub>+...ect.

**Continued**

## Instructions for EMC requirements (continued)

For filter connection (divert to building ground the unwanted frequency) considering such devices can produce small leakage current towards building ground (this current amounts to "some" of milliamperes). For these precautionary reasons, it is necessary to connect the filter to building ground prior to connecting the power supply.

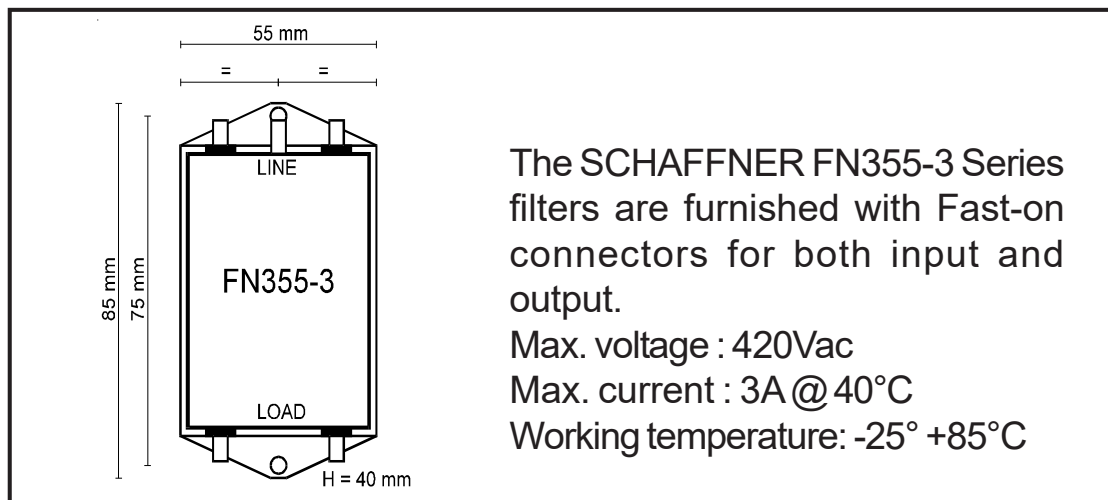
Regarding current leakage, remember that it must be considered when sizing differential devices, thus avoiding undesired interventions. The precise data relative to our filters can be found below.

### Mechanical and Electrical Characteristics

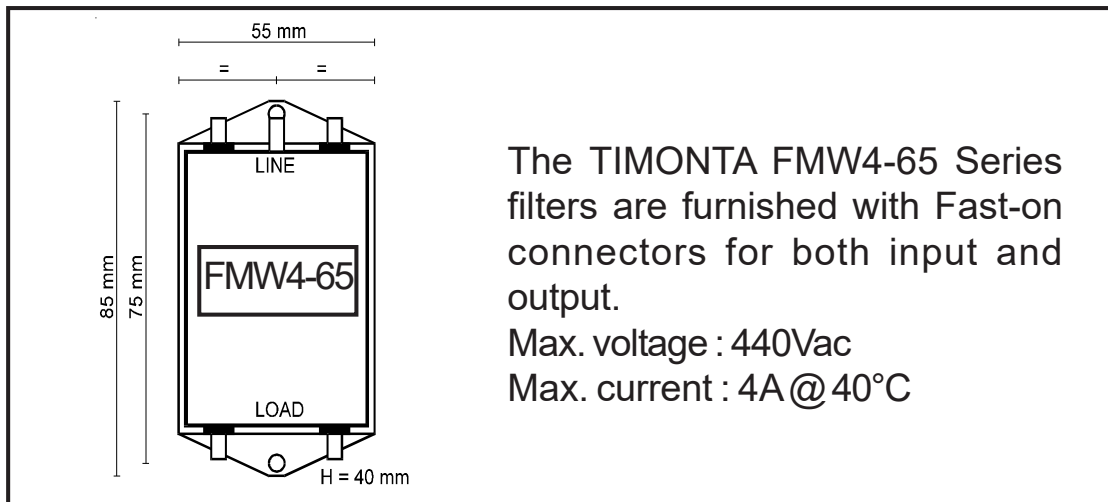
Below is a table showing the electrical characteristics of our recommended filters. Pay particular attention to leakage, differential adjustments, and nominal current in accordance with operational temperature.

Type	Current (A)	Leakage Curr. (mA)	Power Loss W	Weight Lb.
SCHAFFNER FN355	3(40°C)	0.07 (400V 50Hz)	1.5	0.55
TIMONTA FMW4	4(40°C)	<0.5 (400V 50Hz)		

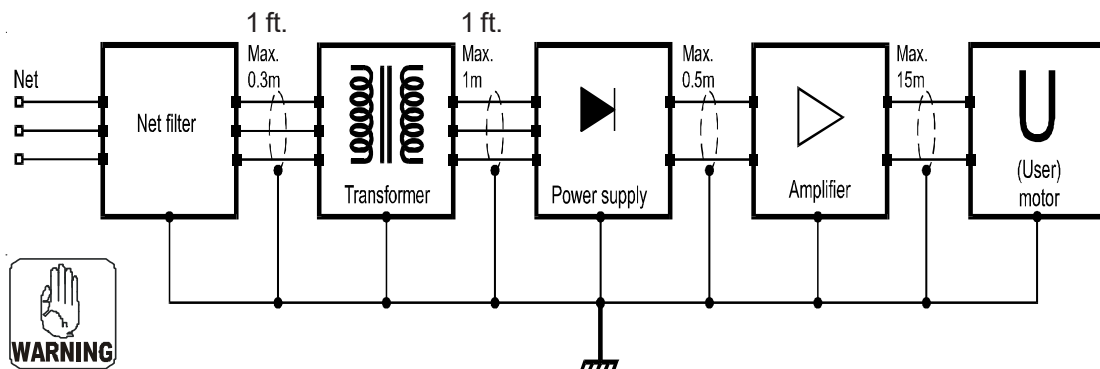
Below fundamental mechanical characteristics of the filters are shown.



## Instructions for EMC requirements (continued)



The wiring technique is important for gaining excellent results without disturbances. Shown below are connection schemes.



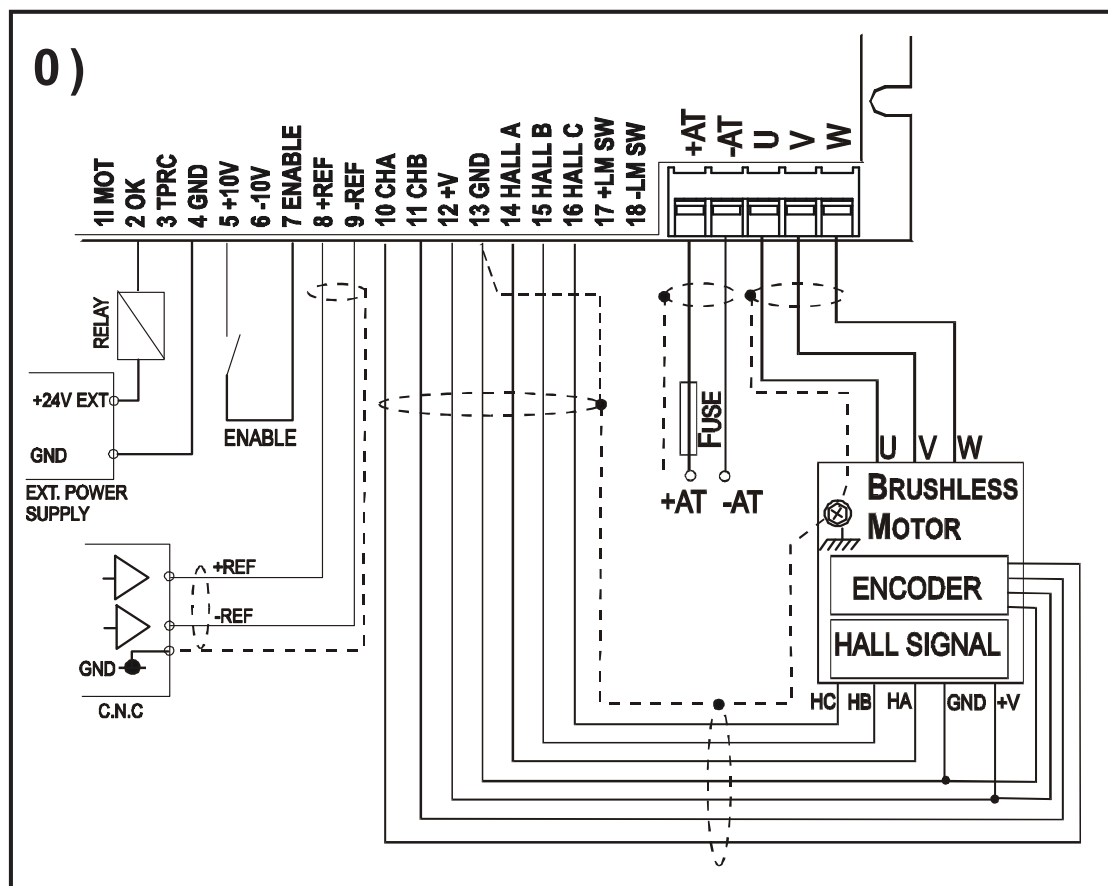
- As shown, the filter must be placed before the transformer.
- All connections of the Net filters must be shielded and shouldn't be longer than the length shown in the scheme.
- The cable shield must cover the entire length of the wire and be as close as possible to the connection terminals.
- Always use shielded cable (twisted) to connect the motor and the drive.
- Avoid passing signal and power cables through the same channels.
- It is very important that the panel where the filters are mounted is connected to ground.
- Power and Command/Signal conductors should not be placed in the same channels (keep separate). Avoid twisting, crossing, etc. If crossing is inevitable, try to cross at a 90 degree angle. Where possible use metallic channels connected to ground.

## 3.6 Examples of Microb Plus Connections

The following diagram shows an application utilizing a differential reference from a C.N.C.

The drive is enabled using the Auxiliary power supply +10V (Connector 5). It is possible to use an external power supply for this function (24Vdc). Remember to also connect the GND of the power supply to Connector 4.

It's also possible to Enable the drive using negative logic. See page 41.

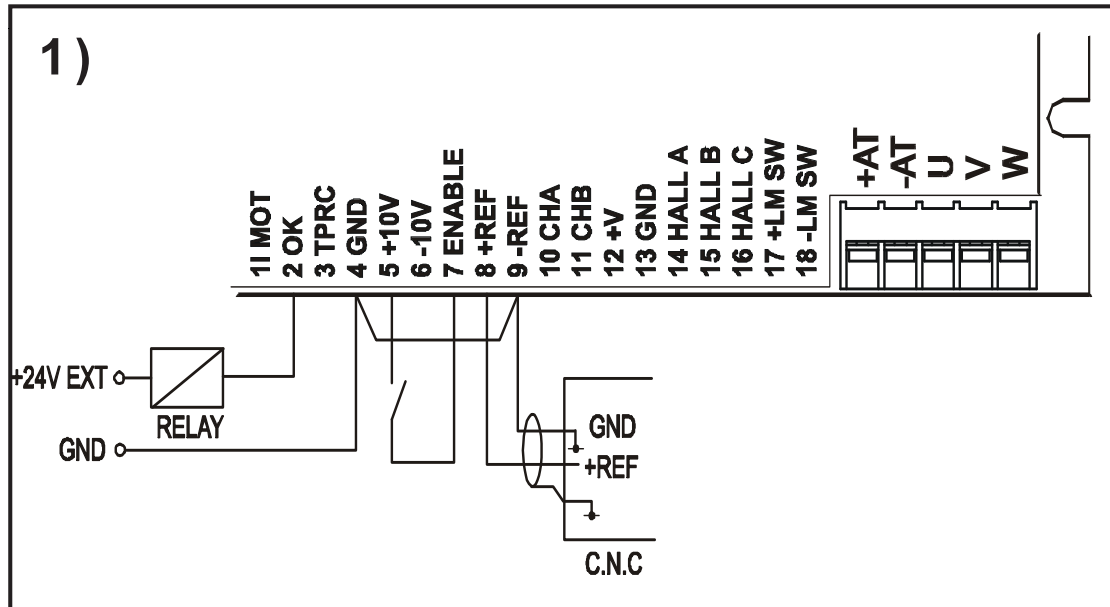


On connector 2 "OK" an external relay coil was connected. This output has a rating of 50mA Max.

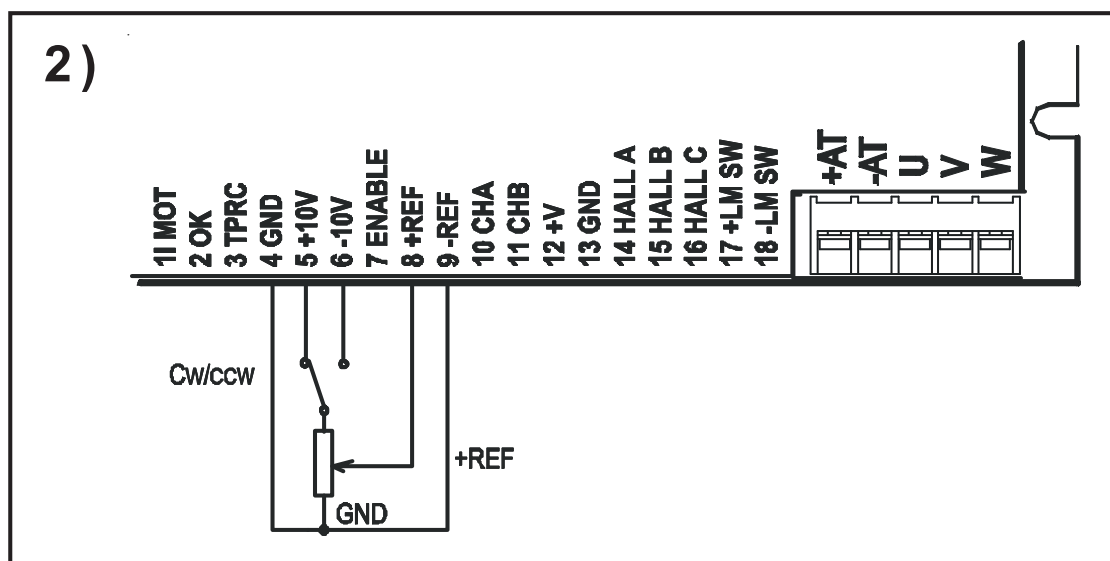
**Do Not** connect a supply exceeding 24Vdc. Connect the Power Supply GND externally using connector 4.

## 3.7 Speed Reference

The following diagram shows an application using speed reference connections in the Common Mode.



The following figure shows an application with speed reference connections using an internal MICRO B PLUS power supply. The speed potentiometer must have an included value between  $\geq 10$  and  $\leq 47$  Kohm.



## 3.8 Current Reference (Torque Mode)

With a voltage output (ex. from a CNC) you can command the drive in torque mode. Applying a signal of +/- 10V at TPRC, the MICROB to supply positive or negative peak current. For this configuration soldering point S15 is closed and S16 is open.

The formula to determine the value of Ving to apply in TPRC in order to obtain requested current is the following:

$$V_{ing} = \frac{10 \times I_{request}}{I_{pk} \text{ MCB}}$$

Ex:  $\frac{10 \times 9}{28} = 3,2V$

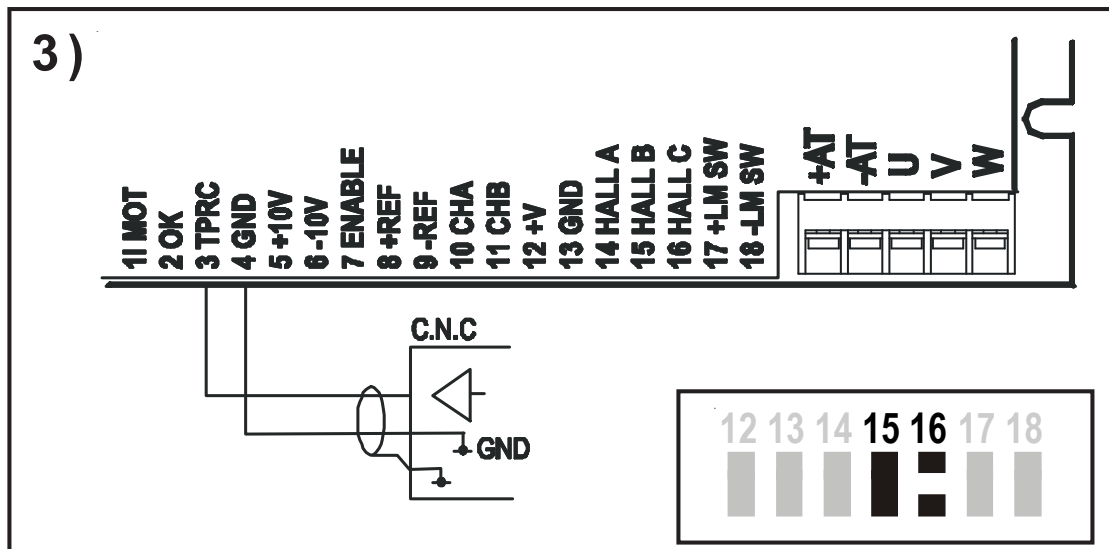
Other examples:

Mcb 10/20A.....+5V gives current of -10A.

..... - 5V gives current of +10A.

Mcb 14/28A.....+3.2V gives current of -9A.

..... - 3.2V gives current of +9A.



In this case the loop of internal velocity automatically excludes itself .

## 3.9 Current Output Limitation

With a voltage output (ex. from a CNC) **only positive** between 0V and +10Vdc, you have a limitation of output current (from zero to max. size) drive's.

For this configuration the soldering point S15 is open, S16 closed.

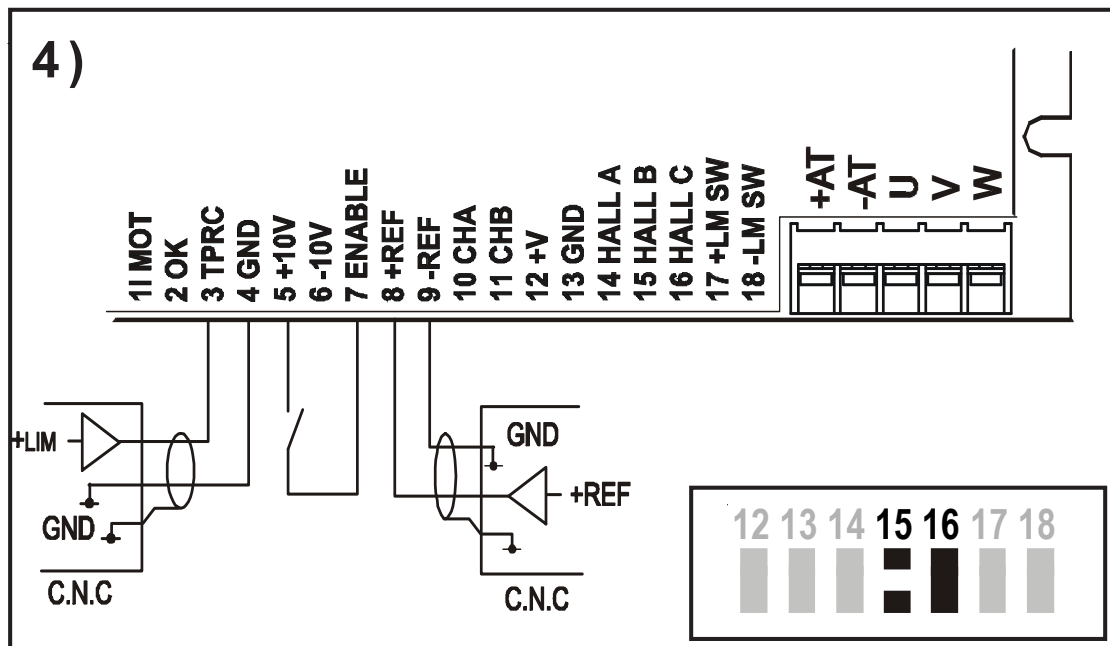
The speed ring remains active and uses the input reference signal.

Example:

Mcb 10/20A.....+5V limits the current to +/-10A.

Mcb 14/28A.....+3.2V limits the current to +/-9A.

The current polarity functions as speed ring output.



In this case the loop of internal velocity remains active.



### Current Output Limitation (continued)

By connecting a resistance load at TPRC (ex. a potentiometer), you'll obtain the limitation current output.

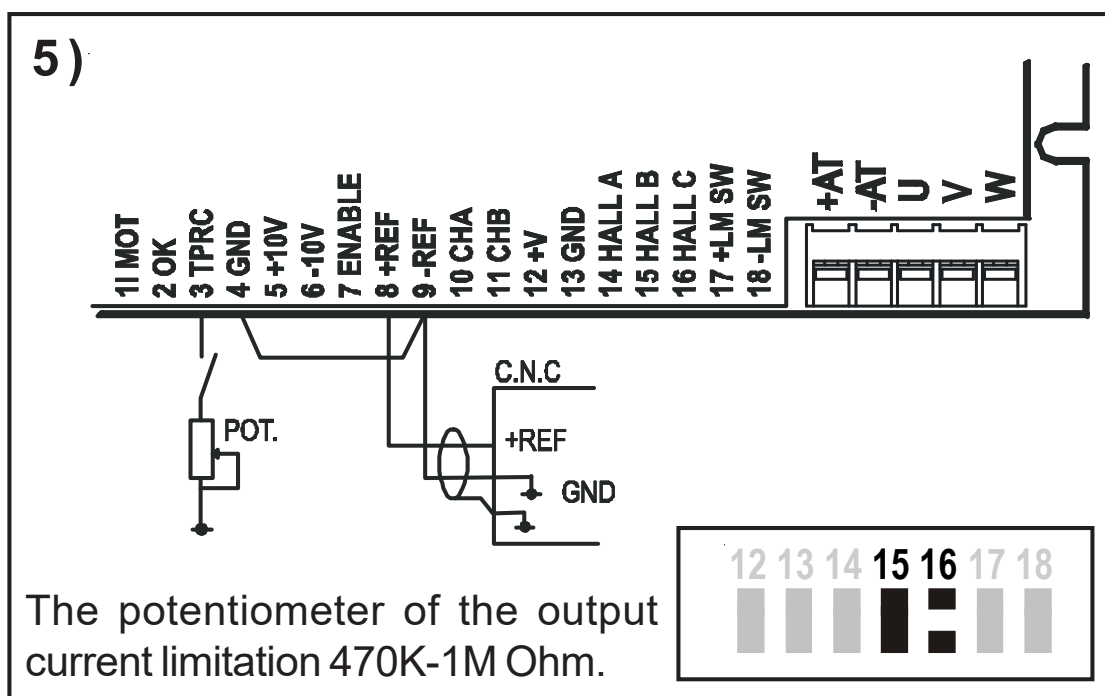
For this configuration soldering point S15 is closed , S16 is open.

Connect a resistance of 1/4W - 1/8W between the TPRC terminal and the GND terminal, or a potentiometer connected as in figure 5.

With external Resistance of 47K you limit the current at 50% of I Max. of size.

Example:

Mcb Plus 10/20A.....47Kohm limits the current to +/-10A



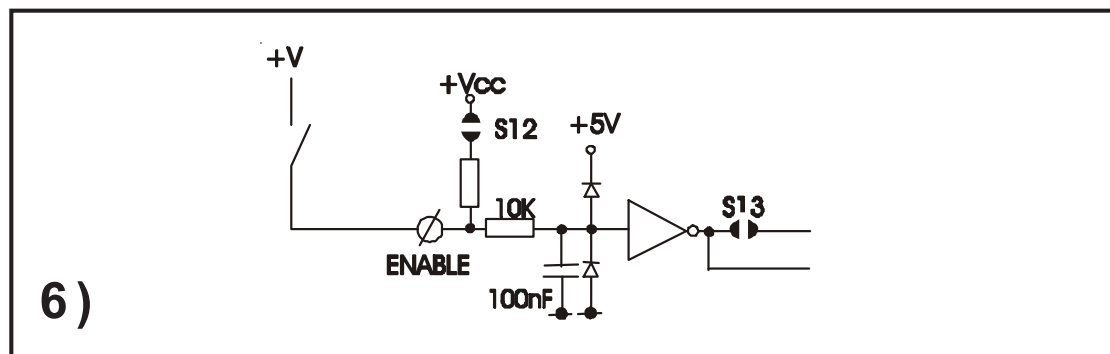
**In this case the loop of internal velocity remains active.**

## 3.10 Enabling Drive with Positive logic.

To enable the drive with positive logic. Solder Bridge S12 and S13 are open.

$V_{in} > 8V \leq 24V_{dc}$ .

Unconnected input	= Drive Not Enabled
Input to +V	= Drive Enabled

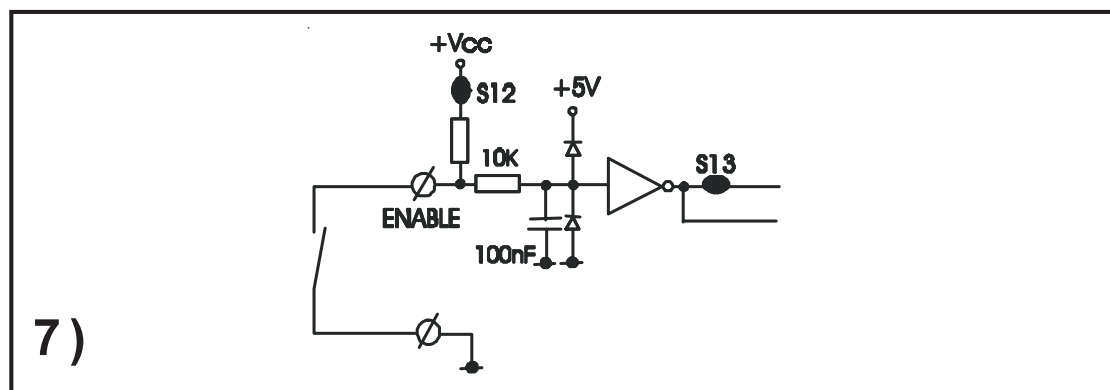


## Enabling Drive with Negative logic.

To enable the drive with negative logic, Solder bridges S12 and S13 are closed.

$V_{in} \leq 6V_{dc}$ .

Unconnected input	= Drive Not Enabled
Input to GND	= Drive Enabled

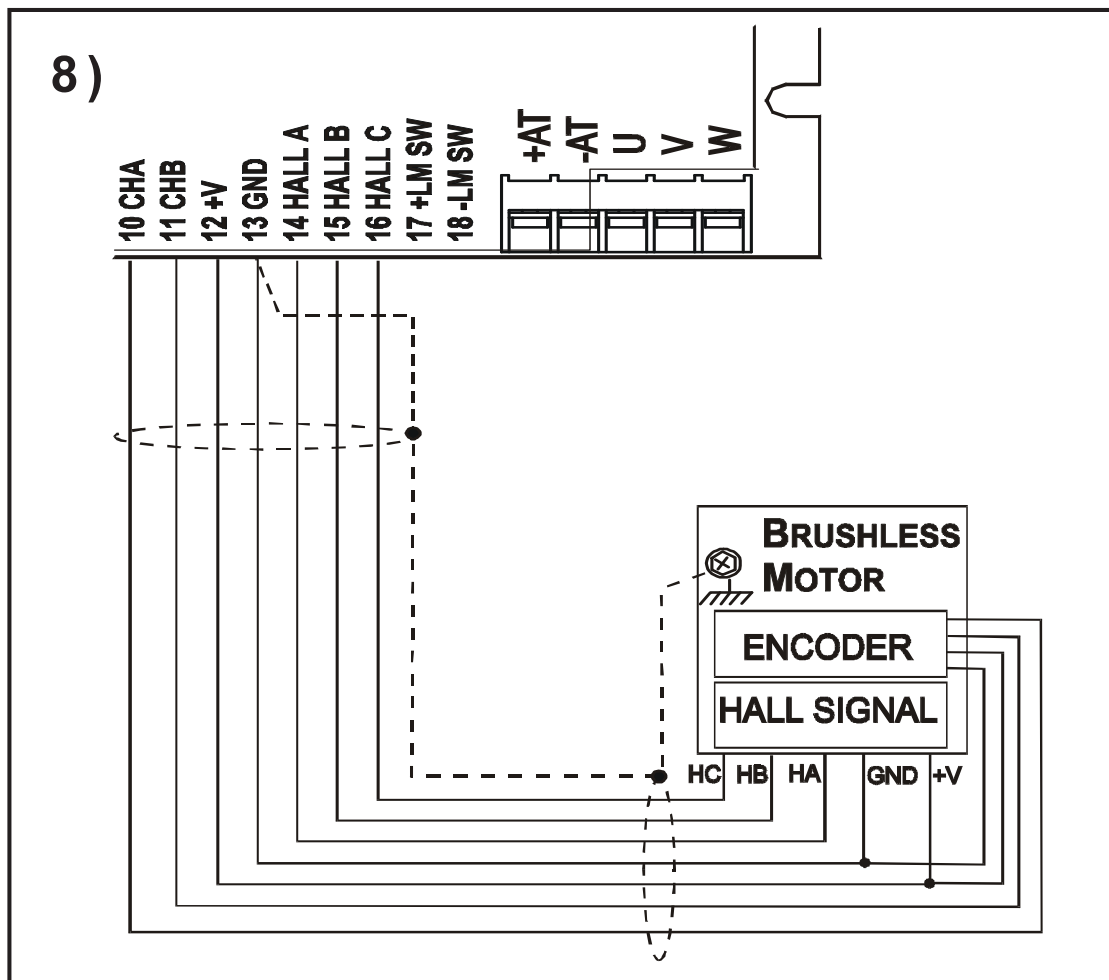


### 3.11 Hall Sensor + Encoder Connections

The following diagram shows typical connections between the drive and a brushless motor. In such a configuration, Hall effect + Incremental type Encoder A and B signals are used.

The Encoder and Hall Sensor power comes from the (+V), connector 12 .

**For speed adjustment in this configuration, see Chapter 5.3.**



The Encoder input on the MicroB is for incremental single ended, NPN or PUSH-PULL output type encoders, but it will work with a differential output type as well. Only connect the +A and +B outputs to the drive if using a differential output type encoder.

The drive can supply voltage to the connector +V equal to +5Vdc or +12Vdc.

### Encoder technical input data

Encoder input logic	Push-Pull ,Line-driver, Open-C.
Input accept. level From	0/+5Vdc To 0/+24Vdc max.
Encoder max. frequency	250 Khz

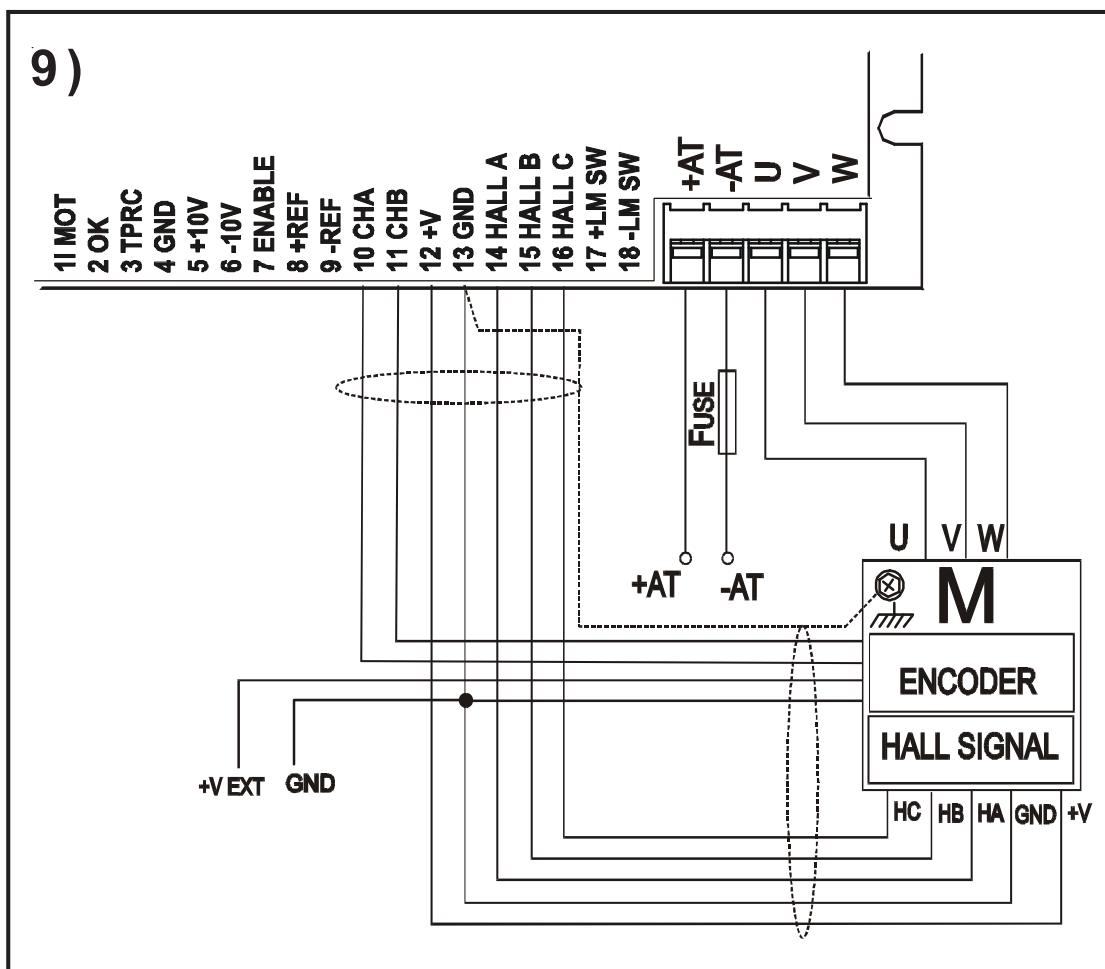


**WARNING!** If you insert a load resistor between channel A and A neg. or between B and B neg. of the Encoder Line Driver, understand consider that the supply voltage will decrease. It may not be enough to commutate the drive logic input A and B. (V High>3,2V ,low< 1,5V).

## ***Encoder Connection from External Power Supply***

The figure below shows a self-powered MICRO B with Hall signals while the Encoder signals are powered externally. The Ground of the external power supply must be connected to the drives GND.

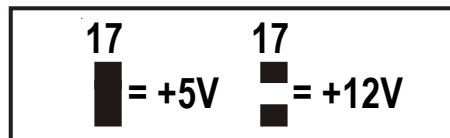
**For speed adjustment in this configuration, see Chapter 5.3.**



### **Power supply +V (terminal 12)**

The drive can supply voltage to the connector +V equal to +5Vdc with point S17 closed or +12Vdc with S17 open).

Setting predisposed by manufacturer :+ 5Vdc .



The drive's supply is able to supply 250 mA for the encoder and Hall effect sensors.

Care should be taken when using both, measure the current draw so as not exceed the 250mA limit. If powering both does exceed 250mA, then use the controllers +5Vdc output for the encoder. Be sure to also connect ground from the controller to the drive to complete the circuit. If isolation is required between the drive and controller, consult the factory for the correct wiring.



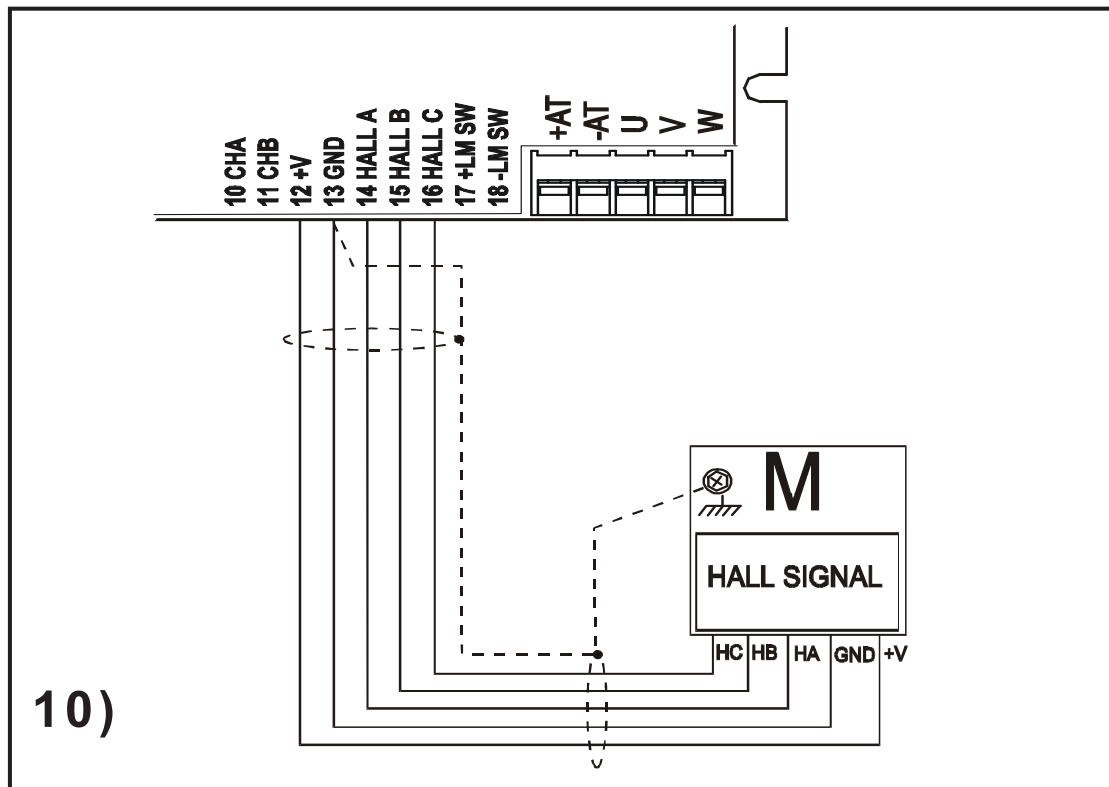
**WARNING:** Hall sensors must be supplied using the internal +V of the Microb (connector 12). If an external supply is used, open solder bridge S11.

## 3.12 Hall Signal Connections (ONLY)

The following diagram shows connections to the drive using Hall Effect Signals (only).

Such signals are used for processing current and for motor speed regulation.

Motor speed regulation is inferior to Encoder + Hall effect feedback, but sufficient for many applications.



There are 2 possible speed feedback options in this configuration:

- 1) Armature speed feedback or PWM.
- 2) Hall Effect speed feedback.

-- Armature feedback gives good speed control along with acceptable torque at low velocity (>5 RPM). This method consider that such a solution is sensitive to R x I dropping inside the motor. This can be compensated, however, by inserting a compensation resistor RCA.

**For Speed Adjustment in this configuration see pages 60 and 61.**

--If using Hall Effect feedback, speed control is good from 300 RPM up to max. velocity. The velocity doesn't drop due to the motor's internal  $R \times I$ .

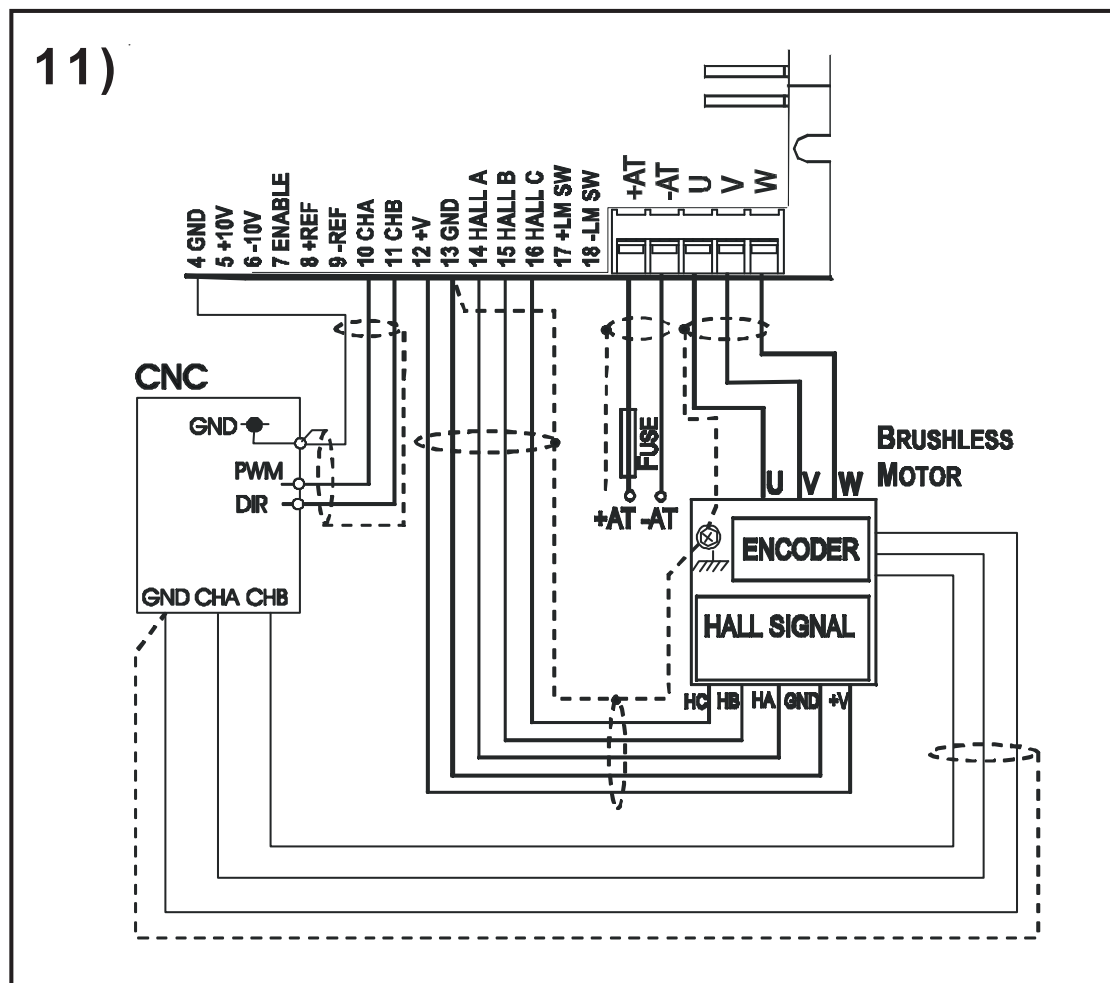
**For Speed Adjustment in this configuration see page 62.**

## 3.13 Command with PWM + Direction

It is possible to run the Microb Plus using digital PWM commands. (Frequency signal in PWM plus direction signal DIR) (see figure 9).

Such logic signals must be furnished to the Microb by a controller which must be able to elaborate the motor's speed ring and possibly the positioning ring.

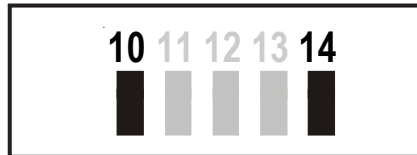
(The signals high logic level PWM and DIR must be between +5Vdc and 24Vdc max.).





## Command with PWM + Direction (continued)

To set the Microb for such signals you must close internal soldering points S10 and S14 (adjustment zone).

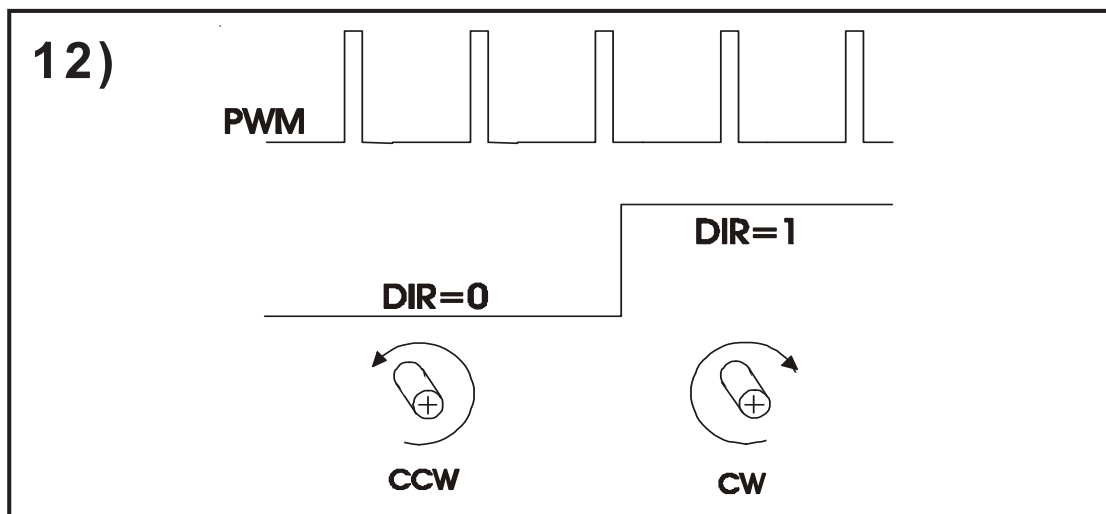


The Microb comes predisposed to function with supported logic signals, also highlighted in the figure below.

--With zero PWM logic signal and any DIR logic value you have zero output voltage between U-V-W. (Motor output terminal).

--With logic signal PWM = H and DIR = H you receive clockwise motor rotation.

--With logic signal PWM = H and DIR = L you receive counter-clockwise motor rotation.



### NOTE:

--The Hall signals and motor wiring must be connected correctly. (Consult the connections diagram furnished with the motor).

--On the drives internal F/V it's possible to modify the pre-existing gain to adapt to the PWM frequency that you intend to use (5-10-20 KHz etc.).

For additional information contact AXOR.

## 3.14 Limit Switch Input +/-

It's possible to enable clockwise (CW) and counter-clockwise (CCW) motor rotation by connecting the +LM SW and -LM SW inputs.

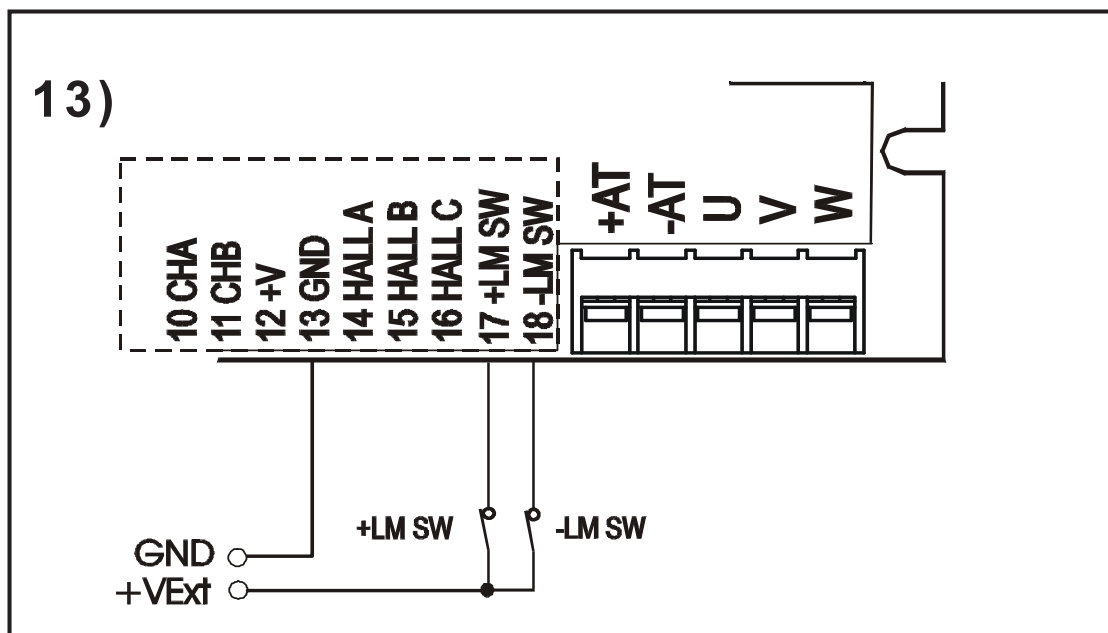
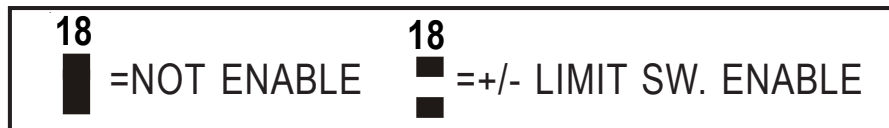
They may be used to block motor rotation when the machines overflow contact is intercepted.



Note - When one of these said contacts is intercepted the motor stops with the required inertia.

The Enable input in regards to this input always has priority. To enable such a function, you must:

- Open soldering point S18
- Then connect on said input a positive voltage (between +5Vdc and + 24Vdc) coming from -for example two N.C. contacts. You may connect an external supply "combining negative" as well as from one of the supplies furnished on the Microb Plus. Function: At opening one of the following contacts you enable the motor rotation in the corresponding direction.



## 3.15 Power Connections

Power cable specification is recommended as follows:

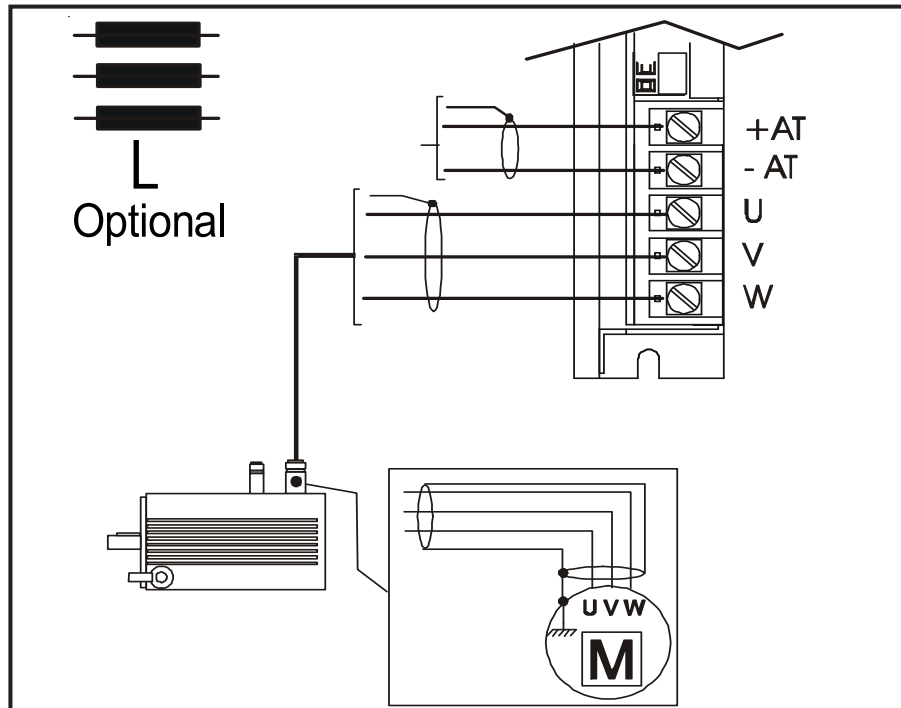
1.5 square mm up to 8/16

2.5 square mm up to 10/20

The U V and W drive outputs can be connected directly to the motor terminals.

The minimum motor inductance value is 200uH. In the case of motors driven with armature inductance lower than 200uH, it is necessary to use 3 chokes connected in series with the motor.

The amplifier itself is capable of driving motors with inductance between 200uH and 40mH.



For some motors it may be necessary to alter the drive current loop. This is done by opening solder bridge S7 and inserting a RKI resistor on the personalization zone and a CKI capacity in accordance to the table below.

Value	0,2-1,9	2-4,9	5-14,9	15-40	Motor Inductance Load (mH)
CKI	2.2nF	2.2nF	10nF	10nF	
RKI	47K	220K	470K	1M	

The factory configures the MICRO B PLUS for a (2-4,9 mH) inductance load.

### 4.0 Preliminary Checks

The standard drive is furnished with the following characteristics:

- Nominal and Peak current of drive corresponds to the drive size; "RIN and RIP resistors are not mounted".  
Ex.: Microb Plus 140 10/20A ; 20A peak for 2 seconds, 10A upon return.
- Encoder speed adjustment for 3000 rpm at 10V ref. with encoder of 1000 Imp/rev. "RENC resistor = 12Kohm".
- KV and DER positions are "1".

### How to proceed

Two ways to place the Microb Plus into function:

- If the drive has already been pre-adjusted for its motor and has accompanying connection sheet, proceed with chapter on "Starting procedures".
- If the drive hasn't been pre-adjusted for its motor, first consult the chapter on "Personalization and Settings" and Chapter 6.0

### What to check

Verify that all signal and power connection terminals are accurately closed/tightened and execute a visual check of the drive's cabling.

### 4.1 Starting Procedures

- Remove load from motor shaft and be prepared to quickly shut off power supply if required. (Warning: keep motor well fixed to the ground/floor or attached to a mechanical support).
- Insert the fuses in series with alternating power or insert the corresponding thermal magnet, insuring the available power value by measuring with a tester.

- Powering up the drive.

Under normal conditions the green L.E.D. comes on after approx. 1 second. If a Hall signal is missing or the Hall cells are not powered the red AH L.E.D. will come on. Verify the presence of said signals. **Attention:** Between shut down and the successive re-start you must wait until the drive is completely off before re-starting.

Prepare to power up the drive by first insuring that the reference signal is zero =0V.

ATTENTION: If possible, in the case of piloting motor with a C.N.C. controller, make sure the manual reference with the calculated error corrections of the same are not inserted. (Space ring not inserted).

- Power up the Enable input. (It's a good application norm to always supply the Enable command after the powering up the drive).

If the motor still has torque or rotates slightly, the encoder channels and the signals coming from the Hall cells are correct.

- Furnish the reference signal.

Increase the speed reference signal up to minimum value (approx. 1V) and observe the motors sense of rotation. If the motor rotates contrary to what you require, shutdown and invert the +REF and -REF,

- Reconnect the motor's shaft to the load and insert the space ring of eventual controller. If at this point you still have the same results as those verified before insertion and the controller doesn't show errors, the system is regulated correctly.

- Now execute standard working cycles verifying that no protections intervene.

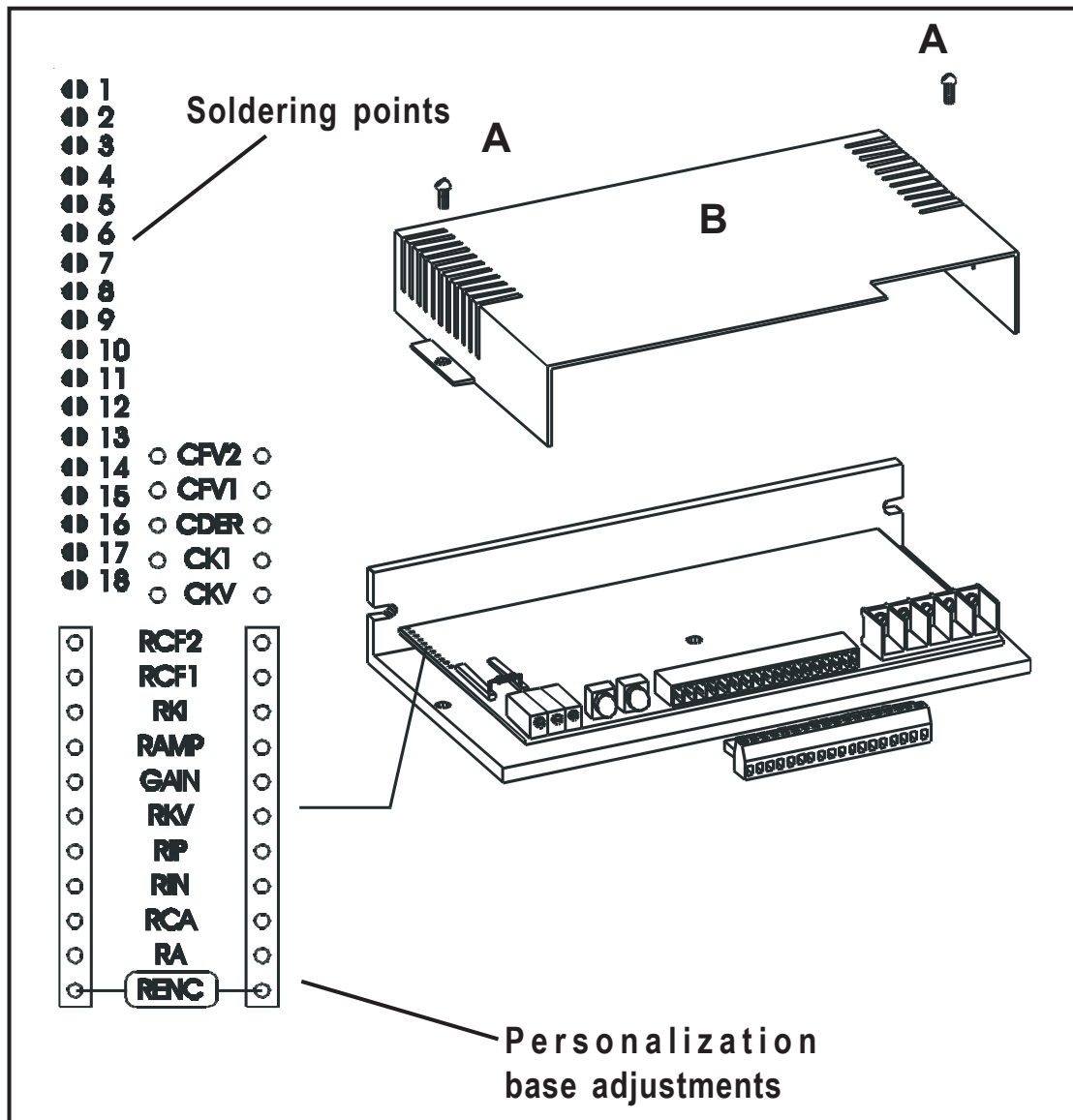


NOTE: The starting procedures require that you know the timing between the Hall signals and the microb Plus.

(Also see the connection sheet for Axor motors, or the phasing procedures in chapter 6.0).

## 5.0 Personalization and Settings

### Adjustment Zone (View)



If the drive isn't adjusted with the proper servomotor, follow these procedures. If changes need to be made to the internal drive setting powering, please wait at least 10 seconds after the power has been removed and the OK LED is off.

All of the personalizations are located inside of the MICRO B. To gain access to the adjustment pads and the solder bridges, unscrew (A), and remove the cover (B). (See figure above).

### ***Personalization and Settings (continued)***

All of the adjustments are located in the area behind the potentiometers . The resistors mount on headers spaced at 0.4" (10.16mm) pitch and the capacitors mount on headers spaced a 0.2" (5.08mm) pitch. Use 1/8 or 1/4 watt resistors and radial lead capacitors.

#### **5.1 Adjustement components**

RENC	Encoder or Hall Effect resistor; Chapter 5.3 .
RA	Armature Feedback resistor; Chapter 5.4 .
RCA	Droop compensation for internal motor resistance (RI);Chapter 5.4 .
RIN	Nominal drive current resistor; Chapter 5.7 .
RIP	Peak drive current resistor ; Chapter 5.7 .
GAIN	Changes static gain in the velocity loop. Open Solder bridge S6 and insert R GAIN if a change is required. Consult factory for the correct value.
CDER	Derivative constant capacitor, increases the velocity loop derivative constant. Consult factory for the correct value.

***Continued***

### **Adjustement components (Continued)**

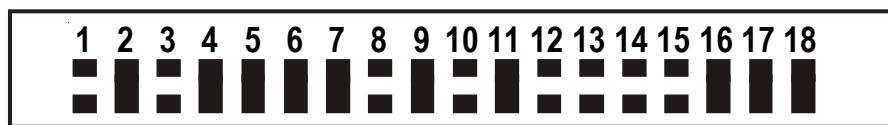
RKV-CKV	<p>Resistor and capacitor values that respectively form the proportional/integral network of the velocity Loop gain.</p> <p>Standard values are 100Kohm-47nF, there are disabled by opening Solder bridge S5.</p>
RKI-CKI	<p>Resistor and capacitor values that respectively form the proportional/integral network of the current Loop.</p> <p>Standard values are 220Kohm-2,2nF, they are disabled by opening Solder bridge S7.</p> <p>Also see chapter 3.15 .</p>
RCF1-RCF2	<p>Resistence adjustment values of drive frequency/current. The insertion of such values permits changing the gain of said stages.</p>
CFV1-CFV2	<p>Capacitor adjustment values of the drives integral frequency/current functions. The insertion of said values increases the ramp time constant of said stages.</p>



## 5.2 Solder Bridges

**18 Solder Bridges** located on the left hand side of the drive are used to change internal and external functions on the MicroB Plus. Below are the descriptions of each solder bridge functions. Verify the corresponding solder bridge closings required by the drive.

This Drive is factory set with the following solder bridge configuration.




---

**S1 e S3** Normally open.

(See chapter 5.8 “Ramp time adjustment”).

---

**S2** Normally closed. (See Chapter 5.8 “Ramp time adjustment”).

---

**S4** Normally closed. If Open - disable the Encoder or Hall Effect speed feedback if selected.

---

**S5** Normally closed. If Open , install components for the Dynamic velocity constant CKV and RKV. (Standard constant RKV=100Kohm , CKV= 47nF).Consult factory for proper use.

---

**S6** Normally closed. If Open - you must insert theNew GAIN resistor. (Static Gain). Standard value= 22ohm

---

**S7** Normally closed. If Open - you must insert the Dynamic Constant **CKI, RKI** on the personalization base.  
(Standard constant RKI=220 Kohm , CKI= 2,2nF)  
(Adjustments Reserved for Qualified Personnel Only!)

---

---

**S8** Normally open. If Closed, when the IN protection is lit the green **OK** LED goes off and is unable to allow the Drive OK LED to come on.

---

**S9** Normally closed. If open, disables Encoder feedback and enables Hall feedback. See Chapter 5.5 .

---

**S10** Normally open. (If closed the microb plus is predisposed for the PWM+DIR function. To enable such function also close S14). See Chapter 3.13 .

---

**S11** Normally closed. If Open, the alarm protection for missing Hall Effect Signals will not disable the drive.

---

**S12 - S13** Normally open. Drive Enable logic high (+8V/+24Vdc). Close for drive enable logic low≤6V.  
See Chapter 3.10

---

**S14** Normally open. (Should be closed with S10 to predispose for the PWM+DIR function). See Chapter 3.13 .

---

**S15** Normally open. **S16** Normally closed. (See Chapter 3.8 and 3.9)

---

**S17** Normally closed. (Power supply on terminal +V=5Vdc. If open configure +V=+12Vdc).

---

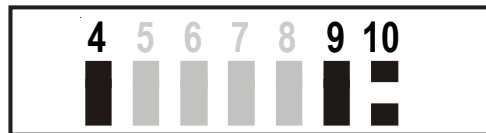
**S18** Normally closed. (If open predisposes input function +/-LM SW). Chapter 3.14

---

**NOTE:** Further along in the manual all desired speed feedback are highlighted the soldering points to close.

### 5.3 Speed Adjustment with Encoder Feedback

For this adjustment both Hall effect and Encoder signals are required from the motor as shown in Connections on Chapter 3.6



The MicroB Plus needs to be set up for the motor and Encoder used to ensure proper operation and speed control.

Use the following formula to determine the correct resistor value to place in RENC. The value placed in RENC is application dependent. Determine what the max. speed of the motor will be and find out what the line count (PPR) of the encoder is before using the formula. This is a two-part formula, the first part gives a factor based on rate, the second part determines the resistor value. Keep in mind when selecting the encoders line count that the Maximum encoder input frequency to the MicroB is 250Khz.

Find the rate factor:

$$F_{enc} = \frac{PPR \times RPM}{60}$$

Where:  $F_{enc}$  = the rate factor

PPR = encoder pulses per revolution (line count)

RPM = Motor Velocity Max.

Calculate RENC:

$$RENC = \frac{680000}{F_{enc}}$$

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

Example:            1000 PPR Encoder  
                         3000 RPM Motor Velocity Max.

$$F_{enc} = \frac{1000 \times 3000}{60} = 50000$$

$$R_{ENC} = \frac{680000}{50000} = 13.6 \text{ Kohm}$$

You will adapt to the nearest commercial value: 15 or 12Kohm value in 1/8 or 1/4W.

Once the resistor RENC is inserted, proceed with final speed adjustment.

Operate using trimmer VEL on the front of the drive.

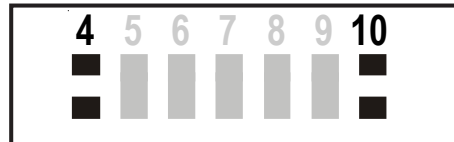
Clockwise Rotation.....Speed increases

Counter Clockwise Rotation.....Speed decreases

The Range of regulation is +/- 20%.

## 5.4 Armature Speed Feedback Adjustment

For this speed adjustment only Hall signals from the motor are sufficient, as shown in connections on page 46.



The voltage from the motor armature can be used as feedback when the motor doesn't have an Encoder.

This system gives less precise operation (1/20 field of regulation with a noticeable reduction in torque).

This function is enabled by opening solder bridge **S4** and inserting resistors **RA** and **RCA** on the personalization base.

**RA resistor calculations:** insert on base "RA" to adapt the system to use the motor voltage.

On the table below the motor voltage values are shown, therefore speed gained through RA value (in Kohm).

The VDC voltage values are refer to the peak BEMF with a 10V reference. If the motor manufacturer declares RMS voltage, the corresponding VDC value will be :

$$VDC = VRMS \times 1,41$$

Table VDC voltage for MCBPlus 60/140/200

RA	4,7	6,8	8,2	10	12	15	18	22	27	33
Mcb60	12	17	20	23	27	32	39	48	58	69
Mcb140	28	36	42	49	59	69	83	99	119	140
Mcb200	43	58	66	76	90	109	134	158	190	230

RA: Value in Kohm

Example:                    E = 96Vac RMS  
                                Nominal Speed = 4000Rpm

Consequently:          VDC will be 96VRMS x 1,41 = 135Vdc

For the **MicroB Plus 140**, the table on page 60 shows a resistor with a value of 33 Kohm. Inserting this resistor gives a motor scaling adjustment of 4000Rpm at 10V of speed reference.

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

$$RCA_{(k\ ohm)} = \frac{0,5 \times n^{\circ} \times Ke}{Vref \times Ipk \times Ri}$$

**WHERE:**

**n**= max. SPEED in rpm.

**Ri**=Max. cold motor resistance.

**Ipk** =Peak drive current.

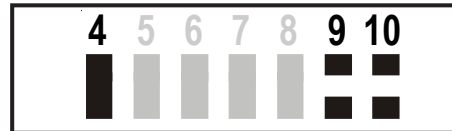
**Ke**=BEMF from motor at 1000 rpm

**Vref**= max. applied reference voltage

If after insertion of the resistor the motor is unstable, increase the Resistance value of RCA.

## 5.5 Hall Effect Sensor Speed Feedback

For this speed adjustment only Hall signals from the motor are required, as shown in connections on page 46.



Signals from the Hall Effect Sensors can be used as feedback when the motor doesn't have an Encoder.

This mode gives less precise operation, but is sufficient for many applications. **(Minimum speed of 300Rpm in this configuration)** For such a configuration open solder bridge S9, close S4 and insert a RENC resistor in accordance with the following formula:

$$\text{RENC} = \frac{478000}{F_{\text{Hall}}}$$

Where:

$$F_{\text{Hall}} = \frac{K \times \text{RPM}}{60}$$

K=1 For 2 Phase motor

K=2 For 4 Phase motor

K=3 For 6 Phase motor

K=4 For 8 Phase motor

Example: Motor with 4 Phase , RPM=4000 RPM

$$F_{\text{Hall}} = \frac{2 \times 4000}{60} = 133,3$$

$$\text{RENC} = \frac{478000}{133,3} = 3585 \text{ Kohm}$$

You may use a resistor equal to 3,3 Mohm or 3,9 Mohm.

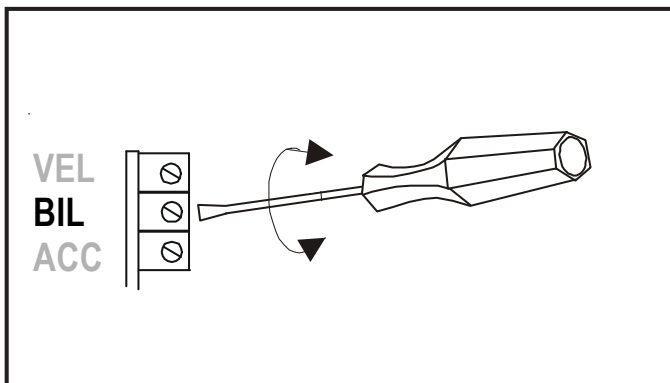


**WARNING:** Be sure to take the RENC resistor off (if present). This resistor is for adjusting the encoder scaling. This value is completely different from the formula used in Hall Effect Speed adjustment.

**WARNING:** Rotate the KV and DER trimmers counter-clockwise (ccw) when using Hall Effect Signal Feedback.

**Note:** The internal Frequency/Voltage constants are pre-set according to series, for the Encoder Feedback. It is possible that such constants require modifications. For additional information contact AXOR.

### 5.6 Adjusting Speed Balance (Offset)



The MicroB is provided with a **BIL** potentiometer that allows the motor to be adjusted to zero speed when 0.0 Vdc is applied to the +REF.

Re-adjust the Bil trimmer to correct eventual system offset. (You may compensate +/- 200mV from reference input)

With the reference input at Zero turn the **BIL** potentiometer until the motor stops moving.



## 5.7 Nominal and Peak Current Adjustment

The MicroB is pre-set to the nominal current rating of the drive, if a lower current is needed to match the motor used, refer to the chart below and select the correct resistor value to be fitted as RIN. Use the table below to select the correct value.

### Nominal Current

VALUE RIN in Kohm	*	56	33	18	10	6,8	4,7	3,3	2,2	1,5	1
Mcb 2,5/5(A)	2,5	2,3	2,2	2	1,8	1,6	1,4	1,2	1,1	0,9	0,7
Mcb 5/10(A)	5	4,6	4,4	4,1	3,6	3,3	2,9	2,5	2,1	1,8	1,5
Mcb 8/16(A)	8	7,4	7,1	6,6	5,9	5,3	4,7	4,1	3,4	2,9	2,4
Mcb 10/20(A)	10	9,2	8,8	8,2	7,3	6,6	5,8	5,1	4,2	3,6	3
Mcb 14/28(A)	14	13	12,4	11,5	10,3	9,2	8,2	7,1	5,9	5	4,2
Mcb 20/40(A)	20	18,5	17,7	16,5	14,7	13,2	11,7	10,2	8,5	7,2	6

Note \* = No resistor mounted.

To reduce the value of the peak motor current , it's necessary to mount RIP on the header located inside of the drive. Use the table below to select the correct value.

### Peak Current

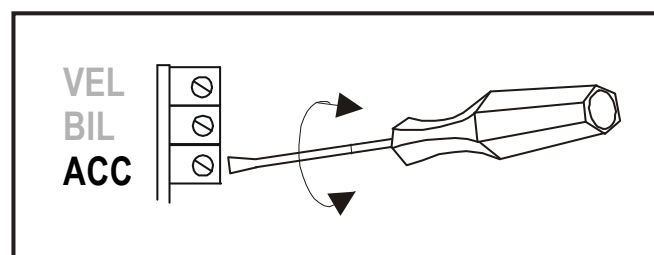
VALUE RIP in Kohm	*	68	56	33	22	18	15	12	10	8,2	6,8
Mcb 2,5/5(A)	5	4,8	4,6	4,3	4	3,8	3,5	3,3	3,1	2,8	2,5
Mcb 5/10(A)	10	9,7	9,3	8,7	8,1	7,6	7,1	6,6	6,1	5,6	5,1
Mcb 8/16(A)	16	15,5	15	14	13	12,2	11,5	10,6	9,8	9	8,2
Mcb 10/20(A)	20	19,2	18,7	17,5	16,2	15,2	14,3	13,2	12,2	11,2	10,2
Mcb 14/28(A)	28	26,8	26,1	24,5	22,6	21,2	20	18,4	17	15,6	14,2
Mcb 20/40(A)	40	38,7	37,5	35	32,5	30	28,7	26,5	24,5	22,5	20,5

Note \* = No resistor mounted.

## 5.8 Ramp time Adjustment










This function is enabled by solder bridges **S1**, **S3** (closed). It allows adjustment of the ramp slope during both acceleration and deceleration.

Adjusting the ACC potentiometer, located in front of the drive, clockwise (cw) increases the ramp time between 0,1 and 1S (It for a 10V reference). (See figure below)



It is also possible to modify the “range of the ramp” by opening solder bridge **S2** and mounting a resistor (**RAMP**) with the values shown in the table 2) below.

1)

S1	S2	S3	Function	Range	Note
			Ramp disabled	0 sec	Standard bridges
			Ramp enabled	0,1-1 sec	Adjusted by ACC pot
			Ramp enabled	By RAMP	Adjusted by ACC pot

2)

RAMP Resistor	680K	820K	1Mohm
TIME	0,2-2,6sec	0,3 -3,2sec	0,4 -3,9sec

### 5.9 Dynamic Constant Adjustments

*Usually, these settings are made by the factory and do not need to be changed.*

*Only re-tuning by KV and DER potentiometer is required.*

If high inertia loads are present (ratio 3:1 between load and motor), it is necessary to set the proportional gain "**KV potentiometer**" and the derivative gain "**DER potentiometer**".

The adjustment procedure must take place with the load connected to the motor.

Connect a square wave (0,5 hz, +/-1V) function generator to the input speed reference terminals.

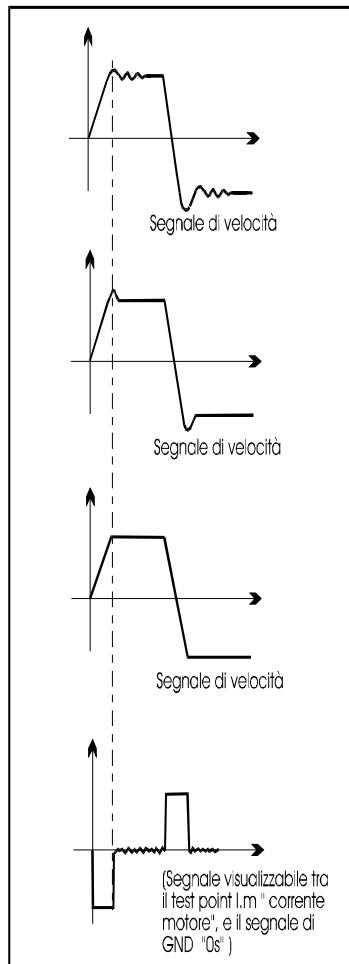
Connect the "channel A" probe of the memory oscilloscope to the test point TEST1. (The ground of the probe must be connected to the GND of the drive).

Adjust the "**DER and KV potentiometers**".

Be sure that the load's motion doesn't create a safety risk. Apply power to the drive and start it.

The load will begin to move alternatively; if possible increase the generator amplitude to +/-2V.

Check the signals in the oscilloscope; the waveforms should be as shown on the next page.

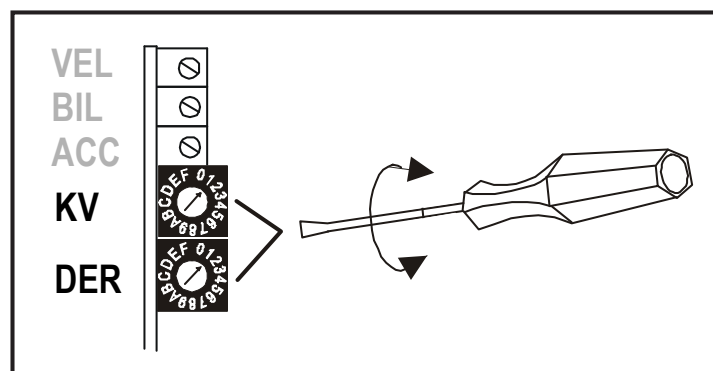


Insufficient proportional gain.

Increase the gain by turning clockwise (cw) using **"KV potentiometer"** until achieving a situation as shown on the left.

To reduce the overshoot adjust clockwise (cw) using **"Der potentiometer"** until achieving a situation as shown on the left.

**Caution:** Do not set KV too high : it can cause unnecessary motor heating caused from oscillating currents in the motor.



It's possible to increase the velocity loop derivative constant by inserting a capacitor CDER on the personalization adjustment. See Chapter 2.1

## **6.0 Unknown Motor Procedure.**

**A simple procedure to use if the motor is not supplied by AXOR.**

Since there is no hard standard between brushless servomotor manufactures and drive manufactures for the motor lead phasing, a simple procedure is needed to get the wiring correct. This procedure will help in getting your motor wired correctly, if it was not supplied by AXOR. The simple procedure below will use the most basic of parts of parts to get the motor operating as soon as possible. It may be expanded on once operation is confirmed to suit the intended application. This procedure needs to be performed by a qualified technician.

Initial parts needed:

- 1) A 60 Vdc unregulated power supply. Refer to chapter 3
- 2) A 10/47Kohm potentiometer to use as the speed reference, or a 1.5 - 3V battery. Refer chapter 3.6
- 3) A Brushless motor with +5Vdc Hall Effect commutation of 120° phasing.
- 4) A MicroB Plus suitable for the above motor.
- 5) An Enable switch (can be substituted by a wire bridge).

### **PROCEDURE:**

If the motor has an Encoder, do not connect it at this time, It is not needed to confirm Hall effect operation and phasing.

**Unknown Motor Procedure (continued)**

1) First wire the Hall sensor as shown in chapter 3, Hall signal connections. Do not wire the motor leads at this point.

2) Wire a switch or jumper between +10Vdc and Enable.

3) Apply power and check the OK LED, it should be ON.

4) Turn the motor shaft, if the OK LED stays on and the AH LED is off, the halls are operating and connected properly.

5) If the OK LED goes OFF and the AH LED goes ON, then the cause may be any or all of the following:

--a) The Hall effect sensor are not powered. Check with Voltmeter.

--b) A Hall effect sensor is missing. Check with Voltmeter.

6) Connect the encoder leads as shown in Chapter 3, Hall sensor+ Encoder.

7) Label the motor leads A, B and C and connect them to U, V and W as shown in Chapter 3, Motor Connections.

They are 6 possible combinations for the motor leads, each will produce a known type failure and one will make the motor turn correctly. Use the chart below as well as the descriptions to determine when the motors turn properly.

	U	V	W
1)	A	B	C
2)	A	C	B
3)	B	A	C
4)	B	C	A
5)	C	A	B
6)	C	B	A

### **Unknown Motor Procedure (continued)**

8) Connect the speed potentiometer wiper to +REF, one end of the potentiometer to +10V and the other end to -10V. Add a jumper from GND to -REF. Set the potentiometer to the mid point.

9) Power the MicroB Plus and turn the potentiometer a little, if the motor's speed follows the potentiometer and the motor shaft has torque, then the motor lead phasing is correct. If not, power down and swap the leads as per the chart above.

Five combinations will cause the motor to act strangely, here are the symptoms:

- a) The motor turns at max. speed with no control from the speed potentiometer.
- b) Erratic motor movement.
- c) No movement and bumps in the torque as felt by holding the shaft.

Upon finding the correct U V W combination, make a note of it and use this to connect the motor to the drive.

### 7.0 Troubleshooting

- 1) When power is on -the green OK LED doesn't come on.
  - Check the voltage between +AT and -AT with a multimeter  
 $20V \leq \text{voltage} \leq 60V$
- 2) With the green OK LED on the motor doesn't run when the drive is enabled.
  - Check input signal (Enable-reference)
- 3) When the drive is enabled the green OK LED goes off and the red O.C. LED comes on.
  - Short circuit between motor terminals or motor winding is connected to ground. Switch off and measure with tester.
- 4) During motor deceleration phase the green OK LED blinks.
  - You've exceeded max. consented voltage. Verify filter capacity value. (See Power Supply chapter).
- 5) During operation the motor stops and the S.T. LED comes on.
  - Drive operating temp. is too high (more than 40°C). Ventilation missing (where required).
- 6) Motor goes out of control when enabled.
  - Encoder signals incorrectly connected (CHA and CHB signals swapped, or encoder power supply missing).
- 7) At Startup or Enabling the AH Led comes on.
  - One or more missing Hall Signals.
  - Missing power supply to Hall Cells.



## CE CONFORMITY DECLARATION

The manufacturer: AXOR Industries

Address: Viale Stazione 5, 36054 Montebello  
Vicentino (VI) ITALY

DECLARE under their own responsibility that the following line of products:

series MICRO-B PLUS with the relative options and accessories installed in accordance with the operating instructions furnished by the manufacturer, conform to the provisions of the following directives, including the latest modifications and all relative national issued legislation:

*Machine Directive (89/392, 91/368, 93/44, 93/68)*

*Electromagnetic Compatibility Directive (89/336, 92/31, 93/68)* And that the following technical standards were applied:

*CEI EN 60204-1 Safety of machinery – Electrical equipment of machines – Part 1: General requirements.  
CEI EN 60439-1 Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies.*

*CEI EN 61800-3 Adjustable speed electrical power drive systems – Part 3: EMC product standard including specific test methods.*

*Recall: CEI EN 61000-4-2 CEI EN 60146-1-1.*

*CEI 28-6 Insulation co-ordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests.*

*CEI 64-8 Electrical system users of nominal voltage not exceeding a 1000V.alternate current and a 1500V continuous current.*

Montebello Vicentino, 21 September 1999 Management



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