



SERVICE MANUAL

ENGLISH

AXOR INDUSTRIES®



MICROSPEED PLUS

DC Brushed Servodrive

ver.25/07/2002

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

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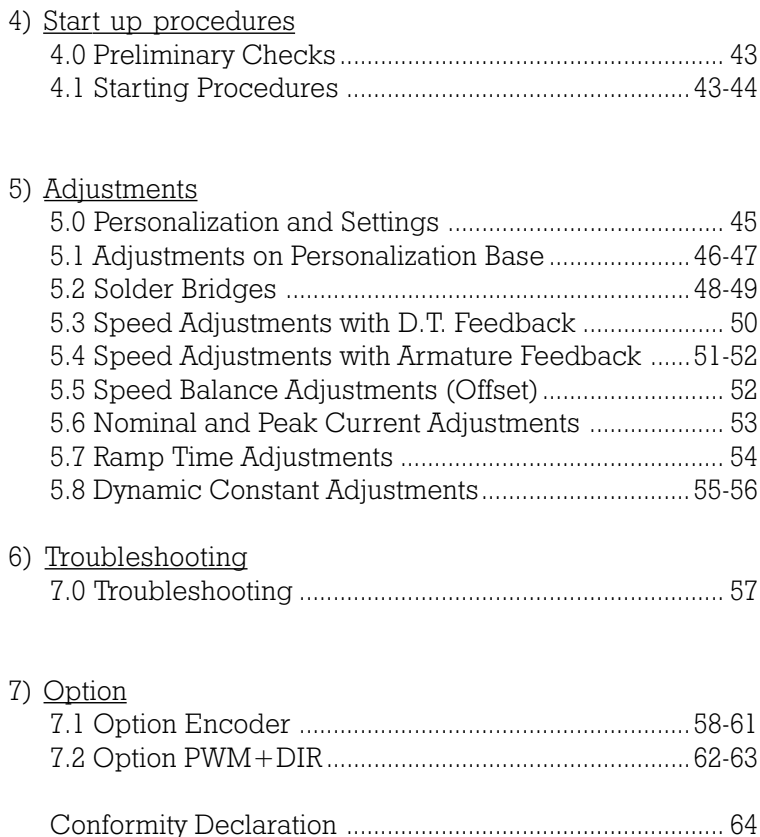
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1.0 Security standards



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 voltage (up to 270Vdc).

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.



General Description



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

Any intervention or modifications effected on Microspeed 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 deactivate 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 Microspeed Plus terminals must always be grounded as per the instructions in this manual.



1.1 Introduction

The Microspeed Plus 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 Microspeed 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:

- Tachogenerator
- Armature.
- Encoder (Option)
- Pwm + Direction (Option)

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.



The speed feedback present on the Microspeed Plus are highlighted.

Speed Feedback from Tachogenerator	●
Speed Feedback from Armature	●
Speed Feedback from Encoder	○
Running in torque mode or torque limiting	●
Current Reference (torque mode)	●
Pwm + Dir command	○
Version with Booster	□
Limit switch	●
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



1.2 Technical Data

MICROSPEED PLUS VOLTAGE			
Microspeed Plus 60	20 - 80 Vdc*	Note a)	
Microspeed Plus 140	40 - 180 Vdc*		
Microspeed Plus 200	60 - 270 Vdc*		

MICROSPEED PLUS CURRENT SIZES		
Size	I nom. (A)	I peak(A)
1/2	+/- 1	+/- 2
2.5/5	+/- 2.5	+/- 5
6/12	+/- 8	+/- 16
10/20	+/- 10	+/- 20
14/28**	+/- 14	+/- 28
20/40**	+/- 20	+/- 40

* Minimum and maximum voltage. Typical voltage are: 60Vdc, 140Vdc and 200Vdc.

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

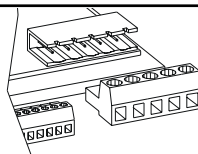
TECHNICAL DATA CHARACTERISTICS	
--PWM frequency	22Khz
--Operating Temperature	32°-104°F (0°+40°C)
--Storage Temperature	12°-158°F (-10°+70°C)
--Drift	+/-5uV Degree F
--Analog inputs	+/-10Vdc
--Current Monitor (Imot)	+/-7Vdc = (PK. curr.)
--Encoder and Hall Signal	
Power Supply (+V Optional)	+5/+12Vdc (220 mA Max)
--Auxiliary power supply	+/-10Vdc (4mA Max.)
--Encoder Max.Freq. (Optional)	250Khz Max.
--Band Width	2.5Khz
--Weight Microspeed P	26.45 oz (750 gr.)
--Weight Microspeed P w/booster	44.1 oz (1250 gr.)
--Humidity	10/95% non-condensing



The diagram shows an exploded view of the product cover assembly. The main component is the product cover (9), which is a rectangular plate with a notch on one side. It is secured by two fixing screws (10). Below the cover, the internal components are shown in their relative positions. These include a calibration area (1) with two potentiometers (2), a hexadecimal rotating switch (3), and a tachometer test point (13). There are also two sets of signal terminals: 10 poles 5.08 Phoenix Signal Terminals (4) and 10 poles 5.08 Extractable Phoenix Terminals (5), as well as 6 poles 3.81 Phoenix Signal Terminals (6) and 6 poles 3.81 Extractable Phoenix Terminals (7). Power terminals (8) and a serial number label (11) are also indicated.

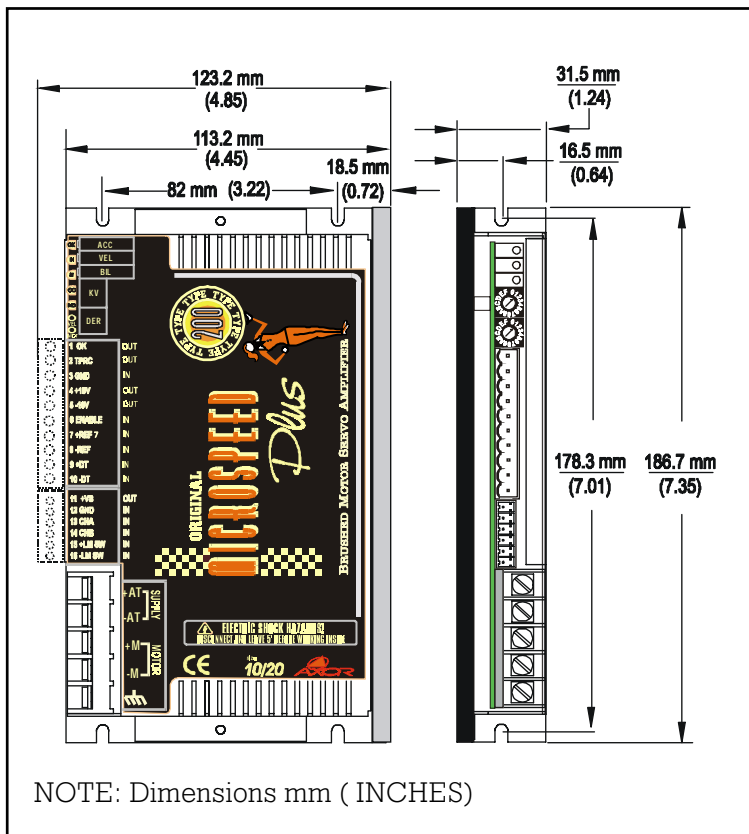
- 1 Calibration Area
- 2 Calibration Potentiometers
- 3 Hexadecimal Rotating Switch
- 4 10 poles 5.08 Phoenix Signal Terminals.
- 5 10 poles 5.08 Extractable Phoenix Terminals.
- 6 6 poles 3.81 Phoenix Signal Terminals.
- 7 6 poles 3.81 Extractable Phoenix Terminals.
- 8 Power Terminals AUGAT
- 9 Product Cover
- 10 Fixing screws
- 11 Serial Number
- 12 Product ID Label
- 13 Tacho Test point (Tachometric signal)

Power terminals "Phoenix GMSTB2,5/5-G" 7,62
for Microspeed Plus sizes 1/2 2,5/5 6/12 .





MICROSPEED PLUS

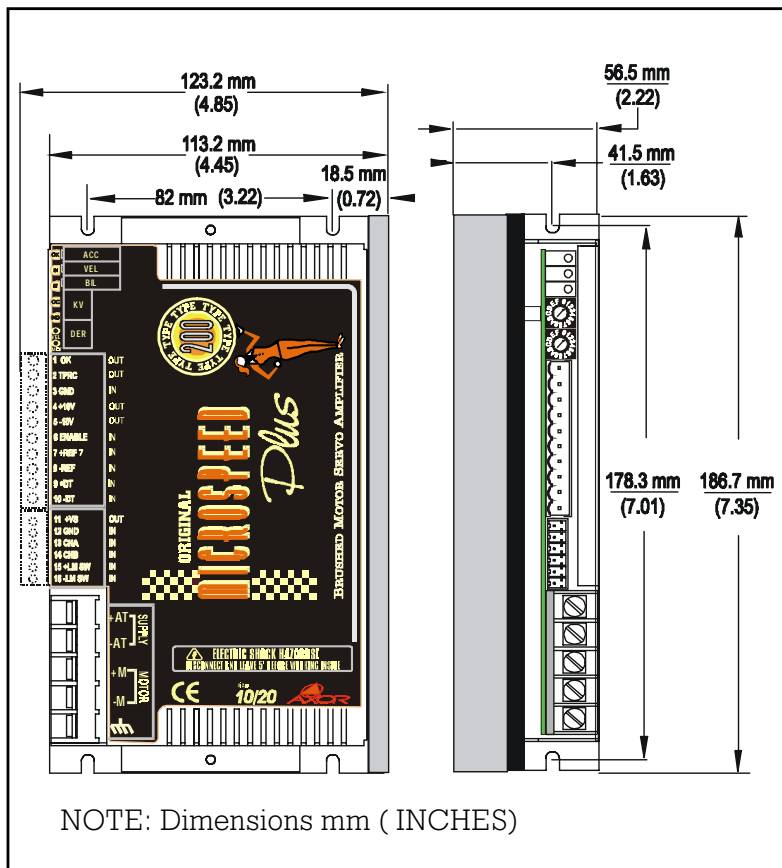




General Description



MICROSPEED PLUS WITH BOOSTER





1.5 Drive Label Description (example)



MCS PLUS-140-5/10-N-S-1000-T0-RD
ADJ 5/10A RA
Date 27/01/01 Ord. 365 /2001

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

ORDERING CODE

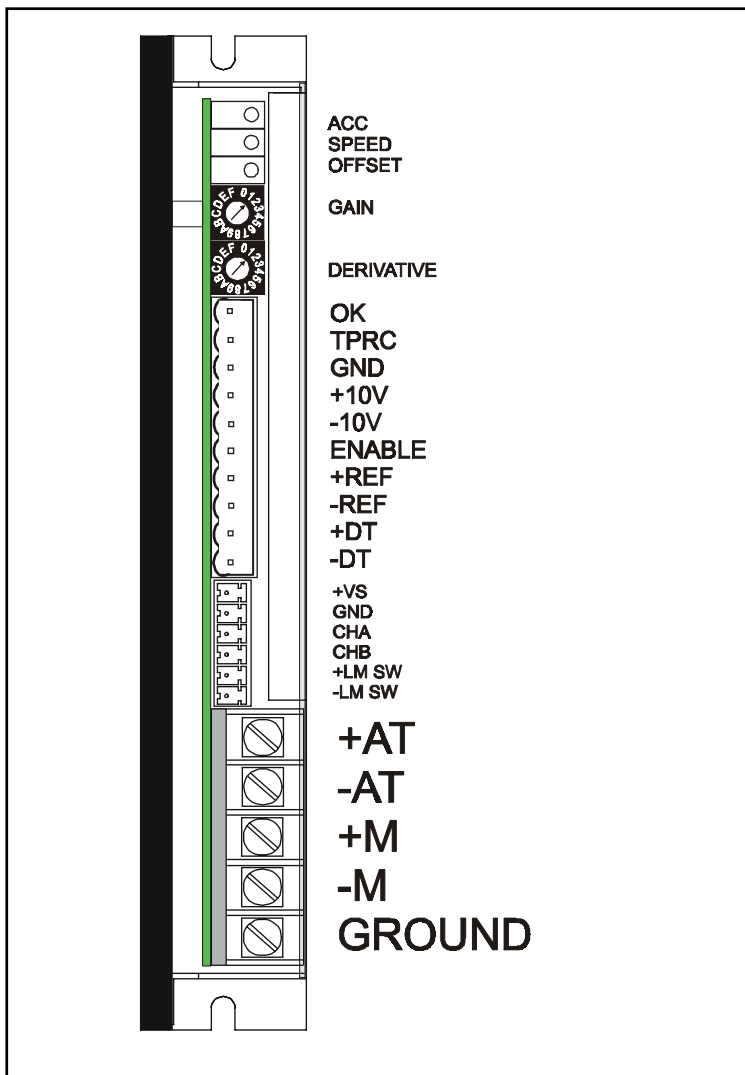
Name:	MCS PLUS
Model:	060-140-200
Size:	01/02- 2.5/5 -06/12 -10/20 -14/28 -20/40
Heatsink:	N=Normal, B=Booster
Protection:	S=Standard, T= Tropicalized
1000:	Axor identification number
Feedback:	T0= Tachogenerator, A0=Armature, E0=Encoder
Control mode:	RD= Rifferential mode, IO= Demand current, PD=Pwm+Dir

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.

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



1.6 Connections





The following is the Signal Connector Description.
(10 Poles 5.08 Phoenix signal Terminals)

1 OK(OUT)

Drive OK, Open Collector output 50mA Max. (Normally closed, opens when in protection mode)

2 TPRC(IN)

This signal can be used in 3 distinct modes:

A) Motor Current Limit Mode:

Soldering point S8 open S9 closed.

Applying a signal between zero and +10V you receive the current limitation output from zero to max. drive size.

Ex:

Mcs Plus10/20A.....+5V limits the current to +/-10A.

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

Note: The drive velocity loop remains active.

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

B) Motor Current Limit Mode:

S8 closed S9 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.



S8 open S9 closed.

Range: $\pm 10V$, which corresponds to the drives peak current output.

In this mode the velocity loop is automatically disabled.

3 GND

Drive Common Ground. Corisponds to power supply's negative -AT input.

4 +10V(OUT)

Power Supply +10Vdc 4mA Max.

5 -10V(OUT)

Power Supply -10Vdc 4mA Max.

6 ENABLE(IN)

Drive Enable. Range +8Vdc to +24Vdc.

7 +REF(IN)

Reference Positive differential input. (Velocity command)

8 -REF(IN)

Reference Negative differential input. (Velocity command)

9 +DT(IN)

PositiveTacho input + (Connect to internal GND)

10 -DT(IN)

Negative Tacho input -

Continued



1.7a Signal inputs and outputs (6 poles)

Note: The inputs 11-12-13-14, are enabled if the Encoder Option is present.

11 +V(OUT) Power supply encoder (Optional)

+5Vdc 250mA Max.=(Solder bridge S13 closed).

+12Vdc 250mA Max. = (Solder bridge S13 open).

12 GND

Drive Common Ground. Corisponds to power supply's negative -AT input.

13 CHA(IN) (Optional)

Encoder input Channel A

High logic level from +3,2V to +24Vdc.

Low logic level $< 1,5V$.

14 CHB(IN) (Optional)

Encoder input Channel B

High logic level from +3,2V to +24Vdc.

Low logic level $< 1,5V$.

15 +LM SW (IN)

Logic input that, disable with positive rotation (CW) of motor.(Motor limit).

Such a function is enabled, by open soldering point S10 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. See Chapter 3.10



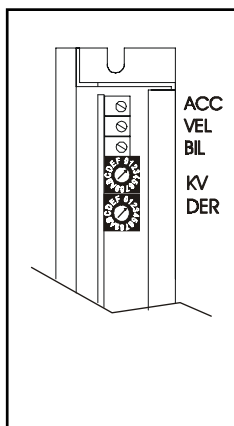
Such a function is enabled, by open soldering point S10 and connecting a positive Voltage (between +5Vdc e +24Vdc) on said input. When the current on said input is absent, motor rotation blockage intervenes in a counter-clockwise sense.
See Chapter 3.10

1.8 Power Supply Inputs and Outputs

+AT (Input).	Positive continuous power supply.
-AT (Input).	Negative Continuous power supply Common Zero Signal GND
+M (Output).	Motor connection +
-M (Output).	Motor connection -
GROUND (IN/OUT).	Ground drive



2.0 Potentiometer Adjustments



ACC

The solder bridges S2-S4 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).

It is also possible to increase or decrease the pre-set max acc/dec ramp time by opening solder bridge S3 and inserting resistance RAMP.

(See chapter RAMP TIME ADJUSTMENT)

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 +/-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 +/- 200mV).

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.



Derivative potentiometer. Turning this potentiometer clockwise decreases motor overshoot.



WARNING

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

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 MICROSPEED PLUS 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

MICROSPEED PLUS VOLTAGE Vdc	
Microspeed Plus 60	20 Min - 80 Max
Microspeed Plus 140	40 Min - 180 Max
Microspeed Plus 200	57 Min - 270 Max

----Irreversible Protection Intervention:

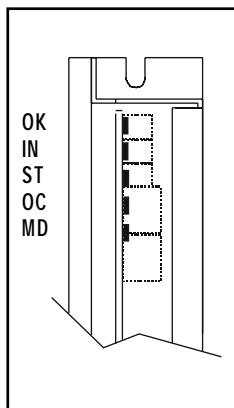
The drive is not reset/restarted. The power supply must be removed and the cause of intervention eliminated, then the power supply can be replaced. *Note: A minimum amount of time must pass in order to ensure that the drive is completely off prior to replacing the power supply.

-Short circuit

-Over temperature

-Missing or reversal tachogenerator/Encoder

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 Tachogenerator or Encoder

- IN (RED) Normally OFF.

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

- **ST (RED) Normally OFF.** This indicator is lit when the drives internal temperature reaches the max.value. 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.

- **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.

- **MD (RED) Normally OFF.** This indicator is lit for a loss of tachogenerator/Encoder signal, or tachogenerator/Encoder signal reverse.



- 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 Microspeed Plus.
- Maintain a distance of 80mm from the heat source.
- The electrical box must have a predisposition for opportune air filtering holes or passageways.

3.1 Ventilation

Model	1/2	2.5/5	6/12	10/20	14/28	20/40
60	n.a	n.a	n.a	n.a	NV	NV
140	N	N	N	N	NV	NV
200	N	N	N	NV	NV	BV

Combination table of dissipators present on Microspeed Plus.

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

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

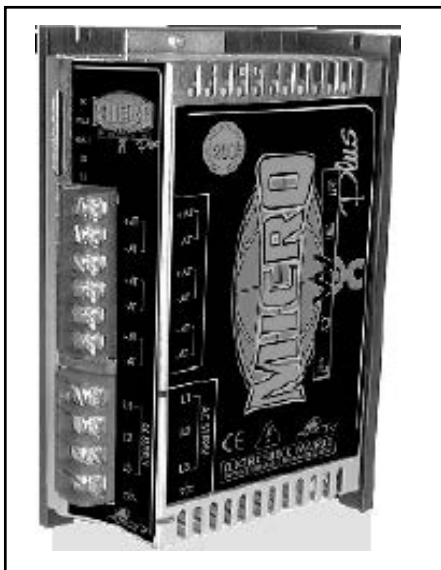
B = Microspeed Plus with added radiator Booster (See Chapter 1.4)

NV = Microspeed Plus + supplementary ventilation.

BV = MicrospeedPlus with added radiator Booster + supplementary ventilation.

Power Supply MicroPower Plus (optional)

An optional Power Supply MicroPower Plus is available with the Microspeed Plus amplifier. This Power Supply is complete with power bridges, capacity filters, and breaking modules with internal breaking resistors. The MicroPower Plus can power several amplifiers (typically 3). See relative Data Sheet.

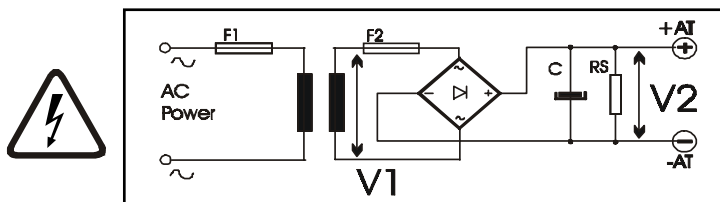




3.2 Power Supply Construction and Rating

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

The Microspeed Plus 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 Microspeed Plus, as short as possible.





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 MCSP	2,5/5	=3,16A
	X MCSP	5/10	=5A
	X MCSP	8/16	=10A
	X MCSP	10/20	=16A
	X MCSP	14/28	=20A
	X MCSP	20/40	=25A

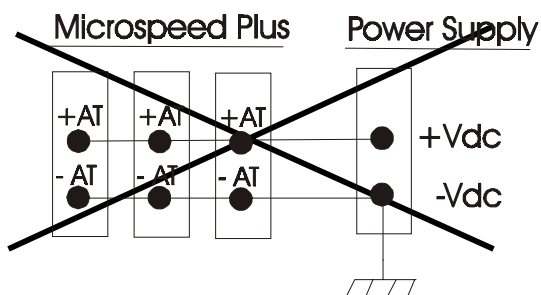
A separate fuse F2 is required for each drive in a multi-axis system.



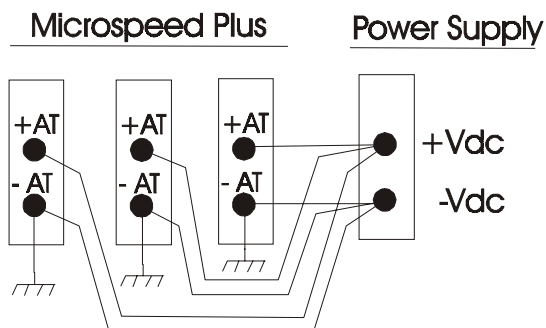
3.3 Multiple Connections

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).

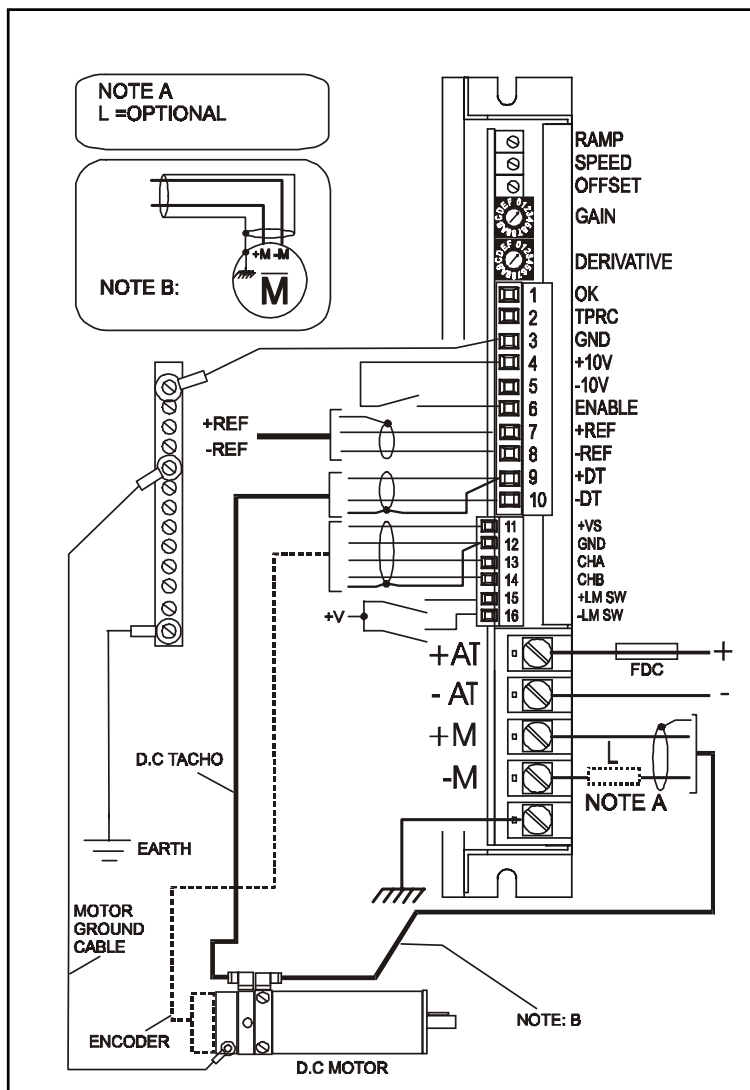
*Incorrect
Wiring
Technique*



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 mm² (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 +M and -M cables should be twisted together.

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



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

- A series of filters released by AXOR are available for this purpose.

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

- 4) The correct ground connection of predisposed parts.

Network Filters

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 Microspeed Plus.

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

Where:

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

V_{primary} = is the voltage of Transformer.

P_{tot} = is the motor's max. power absorption in watts (VA)

$$P_{\text{tot}} = VA = \text{Motor power 1} + \text{motor power 2} + \dots \text{ect.}$$

Continued





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.

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
SCHAFFNER FN2070	3(40°C)	0.4 (250V 50/60Hz)		0.55
TIMONTA FMW4	4(40°C)	<0.5 (400V 50/60Hz)	1	0.6
TIMONTA FSS2	3(40°C)	<0.5 (250V 50/60Hz)		0.6
TIMONTA FSS2	6(40°C)	<3 (250V 50/60Hz)		0.6

Working temperature: -25° +85°C



Max. current : 6A @ 40°C

Working temperature: -25° +85°C

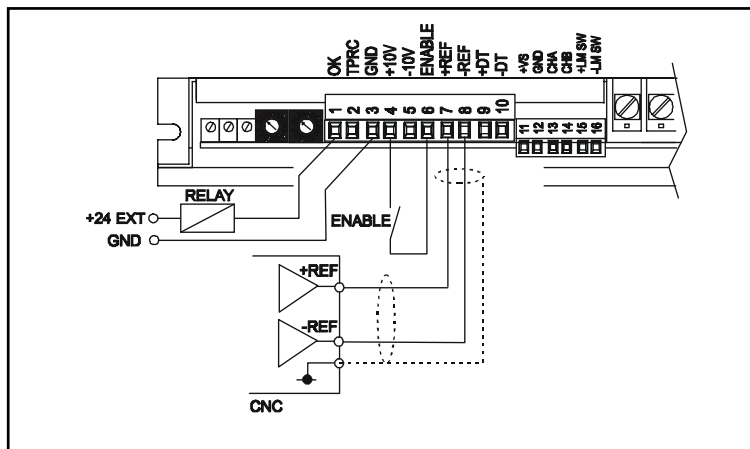
--Power and Command/Signal conductors should not be placed in the same channels (keep separate). Avoid twisting, crossing, etc. If crossing is inevitable, try to cross at a 90 degree angle. Where possible use metallic channels connected to ground.



3.6 Examples of Microspeed Plus Connections

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

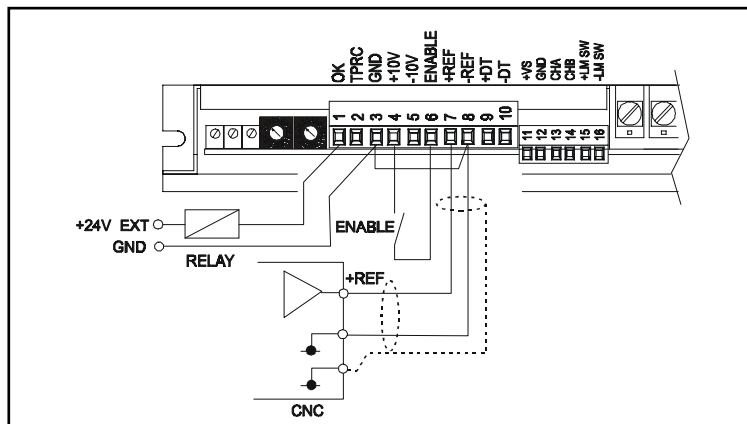
The drive is enabled using the Auxiliary power supply +10V (Connector 4). It is possible to use an external power supply for this function (24Vdc). Remember to also connect the GND of the power supply to Connector 3.



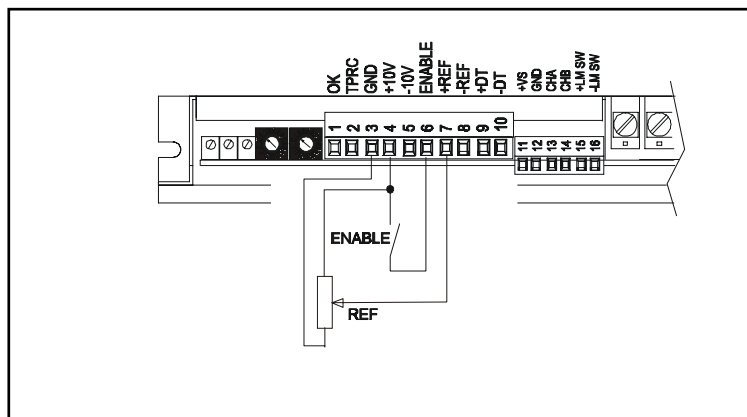
On connector 1 "OK" an external relay coil was connected. This output has a rating of 50mA Max. Do Not connect a supply exceeding 24Vdc. Connect the Power Supply GND externally using connector 3.

3.7 Common Mode 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 MICROSPEED PLUS power supply. The speed potentiometer must have an included value between >10 and $<47\text{Kohm}$.





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 MICROSPEED PLUS to supply positive or negative peak current. For this configuration soldering point S8 is closed , S9 and S12 is open.

The formula to determine the value of V_{ing} to apply in TPRC in order to obtain requested current is the following:

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

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

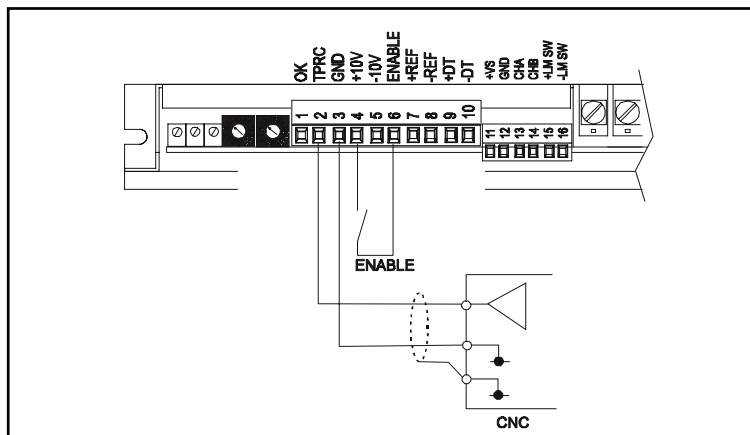
Other examples:

Mcs Plus $10/20\text{A} \dots\dots +5\text{V}$ gives current of -10A .

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

Mcs Plus14/28A.....+3.2V gives current of -9A.

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



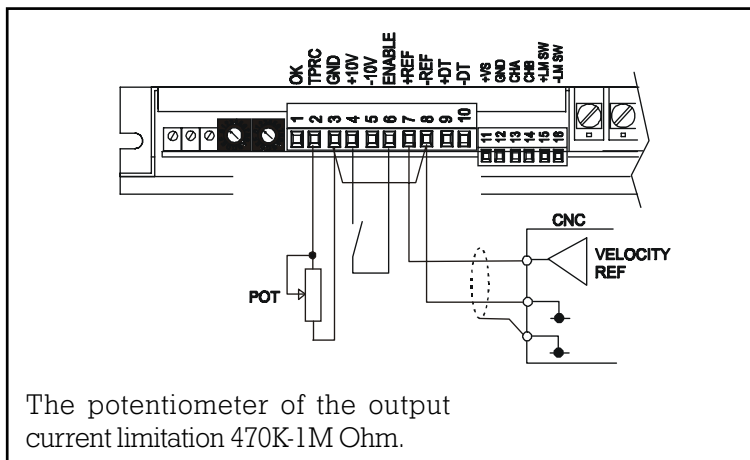
In this case the loop of internal velocity automatically excludes itself .



For this configuration soldering point S8 is closed, S9 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.

Example:

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



In this case the loop of internal velocity remains active.



3.10 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.

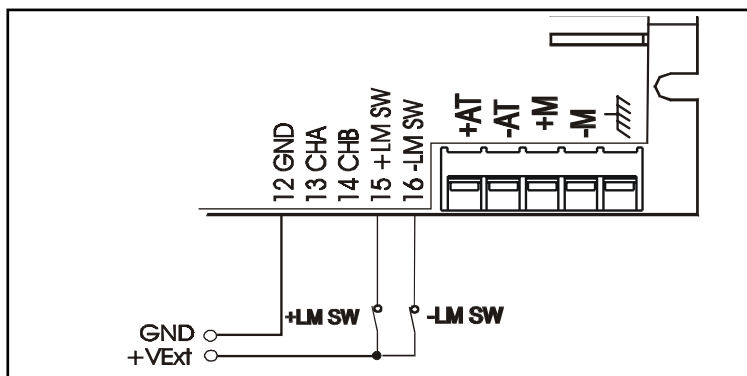
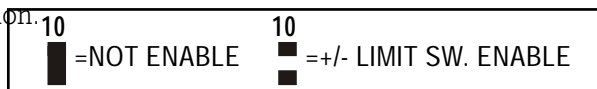
They may be used to block motor rotation when the machines overflow contact is intercepted.



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 S10
- Open soldering point S12 (disable a internal allarm for missing tachogenerator or encoder).
- 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 Microspeed Plus. Function: At opening one of the following contacts you enable the motor rotation in the corresponding direction.





3.11 Power Connections

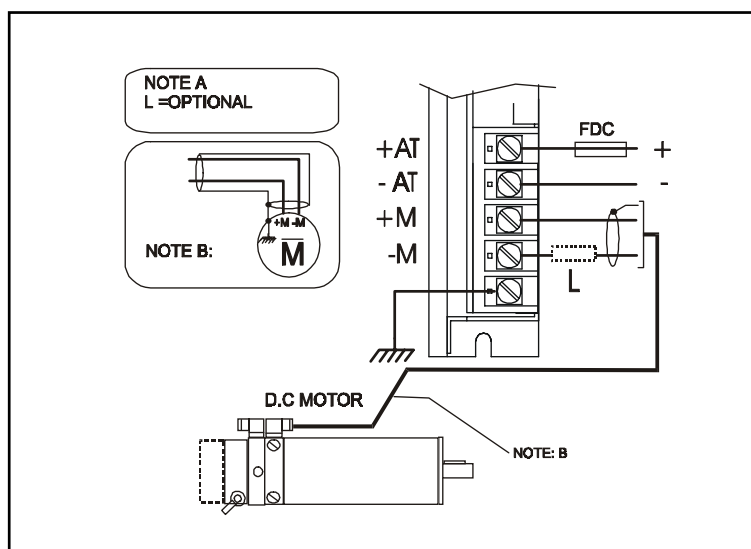
Power cable specification is recommended as follows:

1.5 square mm up to 6/12

2.5 square mm up to 10/20

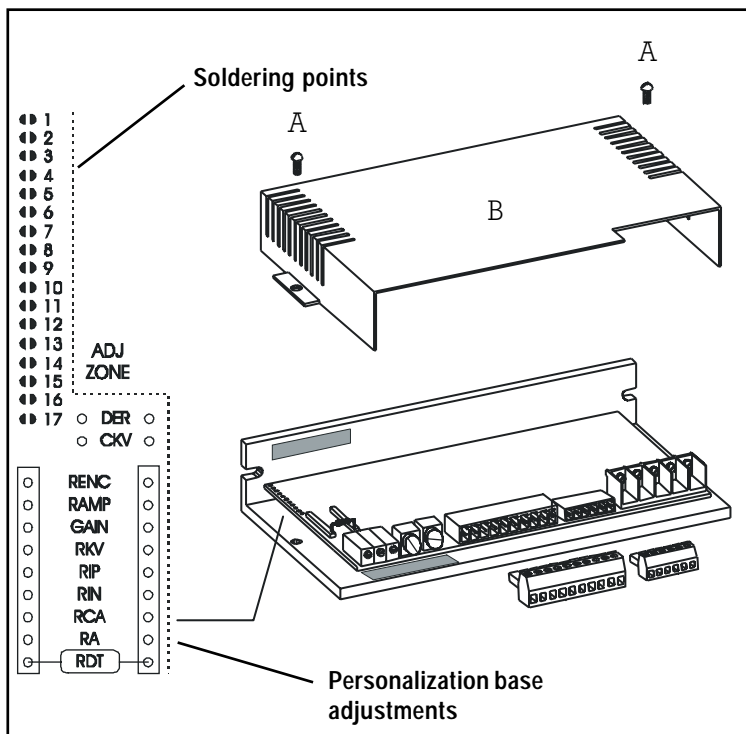
The +M and -M drive outputs can be connected directly to the motor terminals.

The minimum motor inductance value is 0.5 mH. In the case of motors driven with armature inductance lower than 0.5 mH, it is necessary to use a chokes connected in series with the motor.





5.0 Personalization and Settings



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 SPEED PLUS. To gain access to the adjustment pads and the solder bridges, unscrew (A), and remove the cover (B). (See figure above).



5.1 Adjustment components

RDT	If we insert this resistance, we adapt KE tachogenerator constant with input amplifier constant. If the KE constant is small, we can bridge this resistance (See chapter 5.3)
RA	Armature Feedback resistor. It permit adaptament at the constant motor tension. (See chapter 5.4)
RCA	Droop compensation for internal motor resistance (RI);Chapter 5.4 .
RIN	Nominal drive current resistor; Chapter 5.6
RIP	Peak drive current resistor ; Chapter 5.6
RKV	Resistor value that form the proportional/integral network of the velocity Loop gain. Standard values are 100 Kohm, there are disabled by opening Solder bridge S5.
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.
RAMP	It gives ACC/DEC time. (See chapter 5.7)
RENC	If we insert this resistance, we adapt Impuls Encoder constant with input amplifier constant. (Optional See chapter 7.1)



CKV	Capacitor value that form the proportional/integral network of the velocity Loop gain. Standard values is 47nF, there are disabled by opening Solder bridge S5.
-----	--

CDER	Derivative constant capacitor, increases the velocity loop derivative constant.
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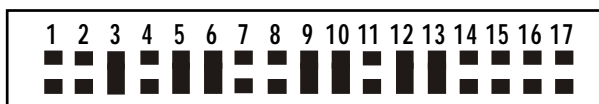




5.2 Solder Bridges

17 Solder Bridges located on the left hand side of the drive are used to change internal and external functions on the Microspeed 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 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.

S2-S4 Normally open. (See Chapter 5.7 "Ramp time adjustment").

S3 Normally closed. (See Chapter 5.7 “Ramp time adjustment”).

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 the New GAIN resistor. (Static Gain). Standard value= 22ohm

S7 Normally open. If closed enables Armature Feedback. See chapter 5.4



S9 Normally closed. (See chapter 3.8, 3.9, 3.9a)

S10 Normally closed. (If open predisposes input function +/-LM SW). Chapter 3.10

S11 Normally open. If closed enables Encoder Feedback. See chapter 7.1

S12 Normally closed. If open you disable a internal allarm for missing tachogenerator or Encoder.

S13 Normally closed. (Power supply on terminal +Vs=5Vdc.
If open configure +V= +12Vdc).
Only for Optional Encoder.

S14-S15 Normally open. If closed you insert for each encoder input a pull-up resistor of 3.3 Kohm to internal +14V.
Only for Optional Encoder.

S16- S17 Normally open.If closed you insert for PWM and DIR input a pull-up resistor of 3.3 Kohm to internal +14V.
Note: Closed only for Pwm+Dir Optional.

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



5.3 Speed adjustment with tacho feedback

The drives are provided with the RDT resistance mounted on board. The drive is adjusted for 3000 rpm with a tachometer constant 10v/1000 rpm referred to 10V reference.

If you desire to change this resistor, just open the cover of the drive, then change the value of the resistor.

To calculate it, please use the following equation:

$$RDT_{(Kohm)} = \frac{Kdt \times n \times 9,7}{1000 \times V_{ref}} - 8$$

Example: $KDT=10$, $n=3000$, $V_{ref}=10$

$$\boxed{\text{RDT (Kohm)} = \frac{10 \times 3000 \times 9,7}{1000 \times 10} - 8 = 21,8 \text{ Kohm}}$$

Where:

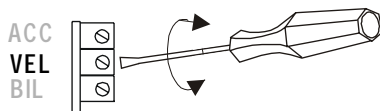
Rdt is the value expressed in Kohm with a power rating of 1/8 or 1/4w.

K_{dt} is the tachogenerator constant

n° is the max speed express ed in RPM.

Vref is the max voltage reference expressed in Volts.

When the RDT resistor is mounted adjust the fine speed by using the VEL potentiometer located in front of the drive.



Clockwise.....Increases the speed.

CounterClockwise..Decreases the speed.

The range adjustments are +/- 20 %.



5.4 Speed adjustment with Armature feedback

Armature feedback mode may be used as speed feedback when a tachogenerator is not fitted to the motor.

Speed control is then less precise (the regulation range is 1/20, and below this value the torque is reduced).

This function will be enabled by solder bridge S7 Closed, S12 open, and mounting in the socket RA and RCA resistors.

RA resistor It will be mounted on the personalization zone to adapt the system to the voltage motor constant.

To calculate it use this equation:

MCS PLUS 60

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

MCS PLUS 140

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

MCS PLUS 200

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

WHERE:

$$E = \frac{n \times K_e}{1000}$$

Ke= Servomotor BEMF at 1000 rpm

Vref= Max voltage reference.

n= max speed express in rpm.

Example: Servomotor with Ke=20 n=3000 RPM Vref=10 For MCS Plus 60.

$$E = \frac{3000 \times 20}{1000} = 60$$

$$RA_{(kohm)} = 166 \times \frac{10}{60 - 1,4 \times 10} = 36\ Kohm$$

Use the nearest commercial value, 33 Kohm.

CONTINUE



5.4 Speed adjustment with Armature feedback

RCA resistor It will be mounted on the socket , to compensate for the voltage drop due to the motor's internal resistance. To calculate it, use this equation:

$$RCA_{(k \text{ ohm})} = 0,5 \times \frac{n \cdot K_e}{V_{ref} \cdot I_{pk} \cdot R_i}$$

WHERE:

n= max. speed expressed in rpm.

 R_i = Total motor resistance with brushes.

I_{pk} = Peak current, (size) of the drive.

$$K_e = \text{Sevomotor BEMF at 1000 rpm.}$$

Vref= Max voltage reference.

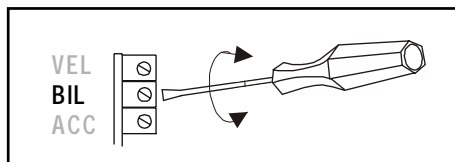
Example: Drive 10/20 A , $R_i=2.5$ ohm

$$R_{CA} \text{ (kohm)} = 0,5 \times \frac{4000 \times 50}{10 \times 20 \times 2,5} = 200 \text{ Kohm}$$

Use a resistor of 200 Kohm or the higher value.

If, after this procedure the motor is unstable increase the value by using the next (higher) commercial value available.

5.5 Adjusting Speed Balance (Offset)



The Microspeed Plus 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.



The Microspeed Plus 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

RIN Value in Kohn	*	33	22	15	10	6,8	4,7	3,3	2,2	1,5	1
MCS 1/2	1	0,96	0,92	0,86	0,78	0,71	0,63	0,55	0,46	0,39	0,32
MCS 2,5/5	2,5	2,3	2,2	2,1	1,9	1,7	1,5	1,3	1,2	1	0,8
MCS 6/12	6	5,8	5,6	5,2	4,8	4,3	3,8	3,3	2,7	2,3	2
MCS 10/20	10	9,6	9	8,4	7,8	7,1	6,5	5,5	4,4	3,8	3,1
MCS 14/28	14	12,5	11,8	10,5	10	9,2	8	7	6	5	4,3
MCS 20/40	20	18,3	17,4	16,4	15	13,5	12	10,4	8,8	7,4	6,2

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

RIP value Kohm	*	68	47	33	22	15	12	10	8,2	6,8	5,6
MCS 1/2	2	1,9	1,8	1,7	1,6	1,5	1,4	1,3	1,2	1,1	1
MCS 2,5/5	5	4,8	4,6	4,4	4	3,7	3,4	3,2	3	2,7	2,5
MCS 6/12	12	11,5	11,1	10,6	9,8	8,9	8,3	7,7	7,2	6,6	6
MCS 10/20	20	19,3	18,6	17,7	16,3	14,8	13,8	12,9	12	11	10
MCS 14/28	28	27	26	25	23	20,7	19,3	18	16,7	15,4	14
MCS 20/40	40	37,5	35	33	30	28	26	24	22	20	18

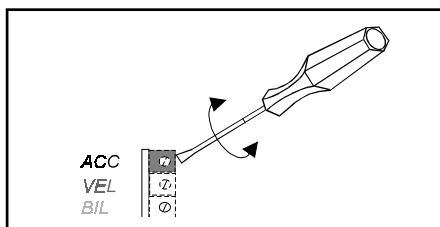
Note * = No resistor mounted.

5.7 Ramp time Adjustment

This function is enabled by solder bridges **S2, S4** (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 **S3** and mounting a resistor (RAMP) with the values shown in the table 2) below.

①

S3	S2	S4	FUNCTION	RANGE	NOTE
Closed	Open	Open	Ramp Disabled	0 Sec.	Standard
Closed	Closed	Closed	Ramp Enabled	0,1 - 1sec	adj by ACC
Open	Closed	Closed	Ramp Enabled	by RAMP	adj by ACC

②

Res. RAMP	680K	820K	1MOHM
TIME	0,2-2,6 Sec.	0,3-3,2 Sec.	0,4-3,9Sec



5.8 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).

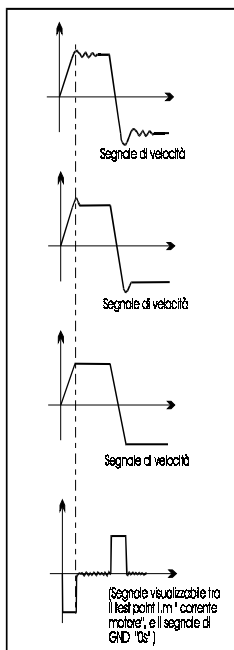
Adjust the "DER and KV potentiometers".

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.

5.8 Dynamic Constant Adjustments (Continue)

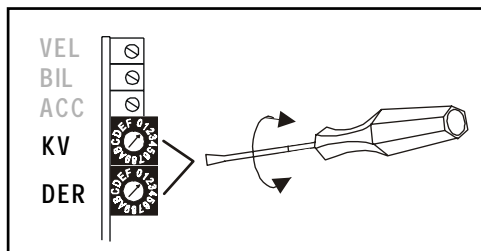


Insufficient proportional gain.

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.



- 1) When power is on -the green OK LED doesn't come on.
-Check the voltage between +AT and -AT with a multimeter
- 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) At Startup or Enabling the DT Led comes on.
-Missing Tachogenerator Signals or reversal.
-Missing Encoder Signal or reversal.



If the value is higher, please use an external power supply.

Technical specification

<u>Encoder inputs</u>	Push-Pull ,Line-driver, Open-C.
<u>Power supply levels</u>	From 0V to 5 min. 0V to 24V max.
<u>Max. frequency</u>	250 KHz
<u>Encoder power supply</u>	S13 Close $V_s = +5V$ Max 220 mA S13 Open $V_s = +12V$ Max.220 mA
<u>Operating temperature</u>	0 - 40 °C°

Terminals description

<u>Code</u>	<u>Description</u>	<u>Pin out</u>
11(+Vs)	Encoder power supply +5/12V	Output
12(GND)	GND Power supply	Input/Output
13(CHA)	Input channel A encoder	Input
14(CHB)	Input channel B encoder	Input

Solder bridge description

<u>Code</u>	<u>Description</u>	<u>Standard</u>
S11	Encoder Feedback Enable	Close
S13	Chose Power Supply	Close
S13	Insert internal res. pull-up (Inp.CHA)	Open
S14	Insert internal res. pull-up (Inp.CHB)	Open



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



CE CONFORMITY DECLARATION

The manufacturer: AXOR Industries
Address: Viale Stazione 15, 36054 Montebelluna
Vicentino (VI) ITALY

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

series **MICROSPEED 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, 19 December 2000 Management



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