



It is user **RESPONSIBILITY** to check that this manual (in PDF format) refers to product model and version that will be used.

In any case, regarding installation, use and maintenance, the paper-made manual given together with the product **TAKES PRIORITY.**

R.T.A. srl



**MOTION CONTROL SYSTEMS**

# ***ADW SERIES***

## ***STEPPING MOTOR DRIVES***

# ***INSTRUCTION MANUAL***



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## Symbol meaning



The section marked with this symbol contains warnings regarding safety problems. If the directions indicated in these sections are not fulfilled, it could arise hazardous situations .



The section marked with this symbol contains information regarding operations which are strictly forbidden.

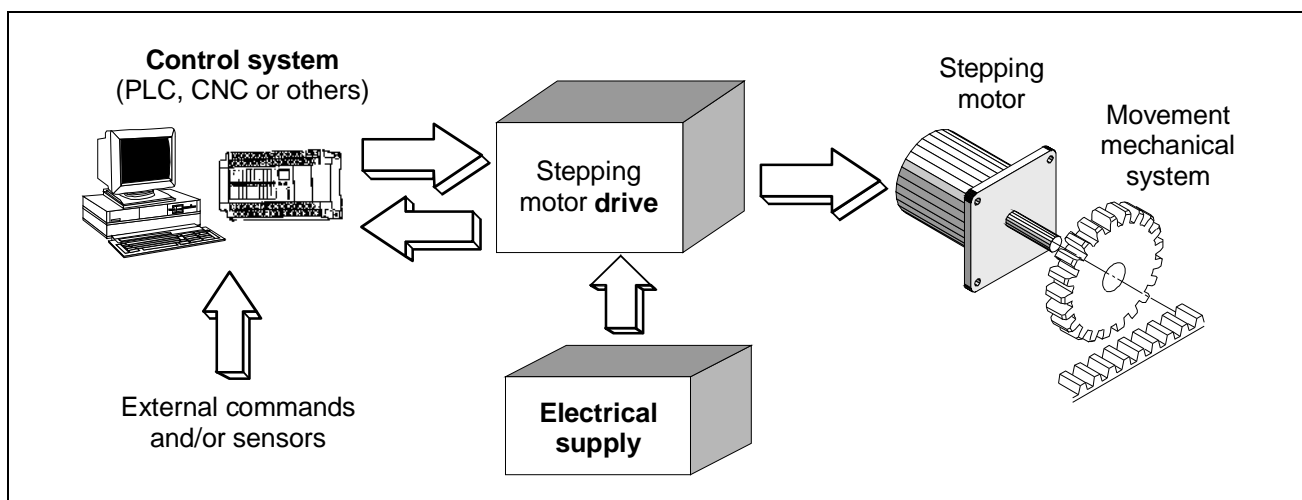


# 1 - NOTICES AND MANUAL STRUCTURE

1.1 - This manual covers the following items:

- ADW series stepping motor drives with analog input in all their standard versions.

1.2 - For the purposes of this manual the terms used assume the meaning below described (see fig. 1).



**Fig. 1**

- **Drive:** electronic part of an electromechanical motion system, which receives some digital or analog input signals from an external control system and gives to the stepping motor the suitable phase excitation sequences, in order to obtain the mechanical movements required by the control system. The drive can also communicate its status to the control system through some logic signals. In this manual we consider the drive as a BDM (EN 61800-3, chap.3, Fig.1).
- **Control system:** part of the machine which decides and controls all machine functions and gives to the drive all execution commands. It could be a numerical or programmable control, a personal computer or a specific control card. In the simplest machines it could also be a group of sensors and electromechanical switches.
- **Electrical supply:** all machine parts suitable to supply the drive in a correct way; usually filter capacitor, transformer separating from the main, anti-interference filter and all switches and protection systems.
- **Standard drives** are all models (see chapter 3 for identification) whose characteristics comply completely with those described in this manual. **Special versions** are all models in which some characteristics differ from the description given in this manual. For these models, some part of the manual does not apply and, in these cases, you must have the specific "variation sheet" which becomes an integral part of the manual itself.

1.3 - Products described in this manual (see list in chapter 1.1 and identification code in chapter 3) are CE marked and comply with the following directives:

- 1) Low Voltage (2006/95/CE and further modification).
- 2) Electromagnetic Compatibility (2004/108/CE and further modification).

1.4 - Remember that, as stated in all directives, compliance exists only when a product is used in accordance with its destination and following manufacturer prescriptions. Thereby, all relevant indications about use, cautions, installation and limitations here described must be followed by user in order to stay within compliance limits: from this point of view, chapter 2, 8 and 10 are particularly important, but the entire content of this manual has to be carefully read and considered in order to obtain the information necessary for a correct use.

1.5 - Conformity declaration regarding above mentioned products is kept by R.T.A. (as manufacturer residing in EEC country) together with technical construction file at authority disposal.



- 1.6 - This manual is conceived in a way to offer to the personnel involved in project and safety verification of a machine all information concerning characteristics, working conditions, application limits and cautions about ADW series stepping motor drives. The knowledge of this information is essential for a correct project of machines, apparatus and systems in which the drives are used, it is strongly recommended not to start any operation with the drives before you have completely read and understood the content of this manual. If you find some part of this manual not completely understandable or lacking regarding your particular application, do not hesitate to contact directly R.T.A. that can provide, if necessary, further information in order to make the user able to design his machine and the related safety systems in the best way. Take into account that an incorrect use or installation, a wrong dimensioning of external safety elements related with the drive could bring to economical damages and also to hazards for human life.
- 1.7 - Consider the fact that these are products with a very wide range of possible applications in many different working and environment conditions. For this reason this manual can only fix limits and general rules but cannot take in consideration every single possible application condition. If you have problems to understand some part of this manual or to meet its indications with your specific application, do not hesitate to contact R.T.A. for further information. Take into account that R.T.A. has twenty years of experience in any kind of applications, which cannot be condensed in a manual but can always be at customer disposal.
- 1.8 - The terms "user and customer" often used in this manual always indicate a skilled person as defined in chapter 2.9.
- 1.9 - This manual is considered valid at the moment of the selling of the product. It cannot be considered inadequate as a consequence of product or manual changes or improvements after the selling. R.T.A. reserves the right of products and manual revisions without notice neither obligation of previous products and manuals revision.

## 2 - LIMITATIONS, HAZARDS AND CAUTIONS

- 2.1 - ADW series drives are suitable to drive two phases stepping motors with 4, 6 or 8 terminals. Their use for different purposes is not allowed.
- 2.2 - It is not allowed the use of these drives for any purpose different from the one above indicated.
- 2.3 - It is also not allowed the use in any condition not complying with one or more specific limitations stated in this manual for electrical, mechanical and environmental quantity or characteristics.
- 2.4 - ADW series drives are classified as protection degree **IP00**. This means that they must be located inside a protective enclosure meeting requirements of standards applicable in the specific application in which they are used.
- 2.5 - ADW series drives have some dip-switches. They perform some adaptations (to the particular motor, to application, etc). **All these settings have to be made with the machine switched off, before putting it in service**; none of them requires the machine switched on.
- 2.6 - ADW series drives and related power supply contain capacitors able to store a certain amount of electrical energy. As a consequence, in some cases, according with application conditions and supply dimensioning, a dangerous voltage could remain on the drive, after switching off, for a time greater than 5 seconds. So it is recommended to wait an adequate time before working on the drive.
- 2.7 - The heatsink can reach high temperatures during normal working conditions (for example about 80 C). Do not touch this component for some minutes, after switching off, in order to avoid scald hazard.
- 2.8 - After a failure due to connection mistakes or others, in the drives could arise a temporary hot spot. For this reason avoid absolutely to install in explosive or flammable environments. **Avoid also to install near easily flammable materials and components**; we recommend to verify that all the components located in the enclosure are realized using self-extinguishing materials.



- 2.9 - All products considered in this manual are sub-assemblies without a direct function, foreseen to be integrated in a more complex machine. Only a professional assembler, expert in the field of motor drives and in their related problems, can install and put in service this component. It is exclusive responsibility of the designer of the complete machine or installation in which this component is used to take care of the safety and reliability of his project. It is forbidden to use this material in application covered from one or more EEC directives (for instance 2004/108/CE, 2006/42/CE, etc.) before the conformity to those directives has been declared. Regarding 2004/108/CE directive, see chapter 10.
- 2.10 - Use for safety related functions is forbidden (EN 60204-1). Moreover, when the application arrangement is in such way that a drive fault or failure could generate a dangerous condition, external independent safety protection system must be provided in the machine.
- 2.11 - In some case of drive failure, dangerous high voltage could appear at logic low voltage input and output terminals, even if this event is extremely rare. For this reason, from the point of view of evaluation of the machine safety during a single fault condition, the external control system, connected to these inputs, has to be considered potentially subjected to high voltage, unless an external separation is provided.
- 2.12 - Both CURRENT OFF input signal (see chapter 4) and internal electronic functional protections (see chapter 6) switch off the drive output power by means of semiconductor devices. They cannot be used to interrupt power in emergency stop function or in any function involving personnel safety.



### 3 - GENERAL CHARACTERISTICS AND IDENTIFICATION

#### 3.1 - GENERAL CHARACTERISTICS

ADW	ADW 04 ADW 04.V	ADW 06 ADW 06.V
V <sub>DC</sub> nom (V)	from 24 to 75	from 24 to 75
I <sub>NP</sub> min (A)	0.65	1.9
I <sub>NP</sub> max (A)	2	6
Dimensions (mm)	93.5 × 122 × 25	
Operating temperature	from + 5°C to + 40°C (see chapter 8)	

Table 1

#### Terms definition in Table 1:

V <sub>DC</sub> nom	Nominal value of DC voltage supply (range) at which the drive can operate without stabilized supply.
I <sub>NP</sub>	Nominal phase current (peak value) which flow in each motor winding, measurable with motor turning at low speed. This current can be selected by user among eight different values using DIP-SWITCHES. Automatic current reduction at motor standstill is 50% of value set using DIP-SWITCHES.
I <sub>NP</sub> min and max	Minimum and maximum value of nominal phase current setting.

#### 3.2 - IDENTIFICATION

The models identification of ADW series drives is as follows:

ADW 0X.Y

where:

- X can be: 4 or 6 and identifies a standard model, differing for current value.
- .Y is not present in standard models. If present Y can be a number or an alphanumeric character identifying a special version with some variations with respect to standard models.  
In this case V indicates the model with input screw connector.

Each sample is also identified with a serial number.



### 3.3 - DIMENSIONS

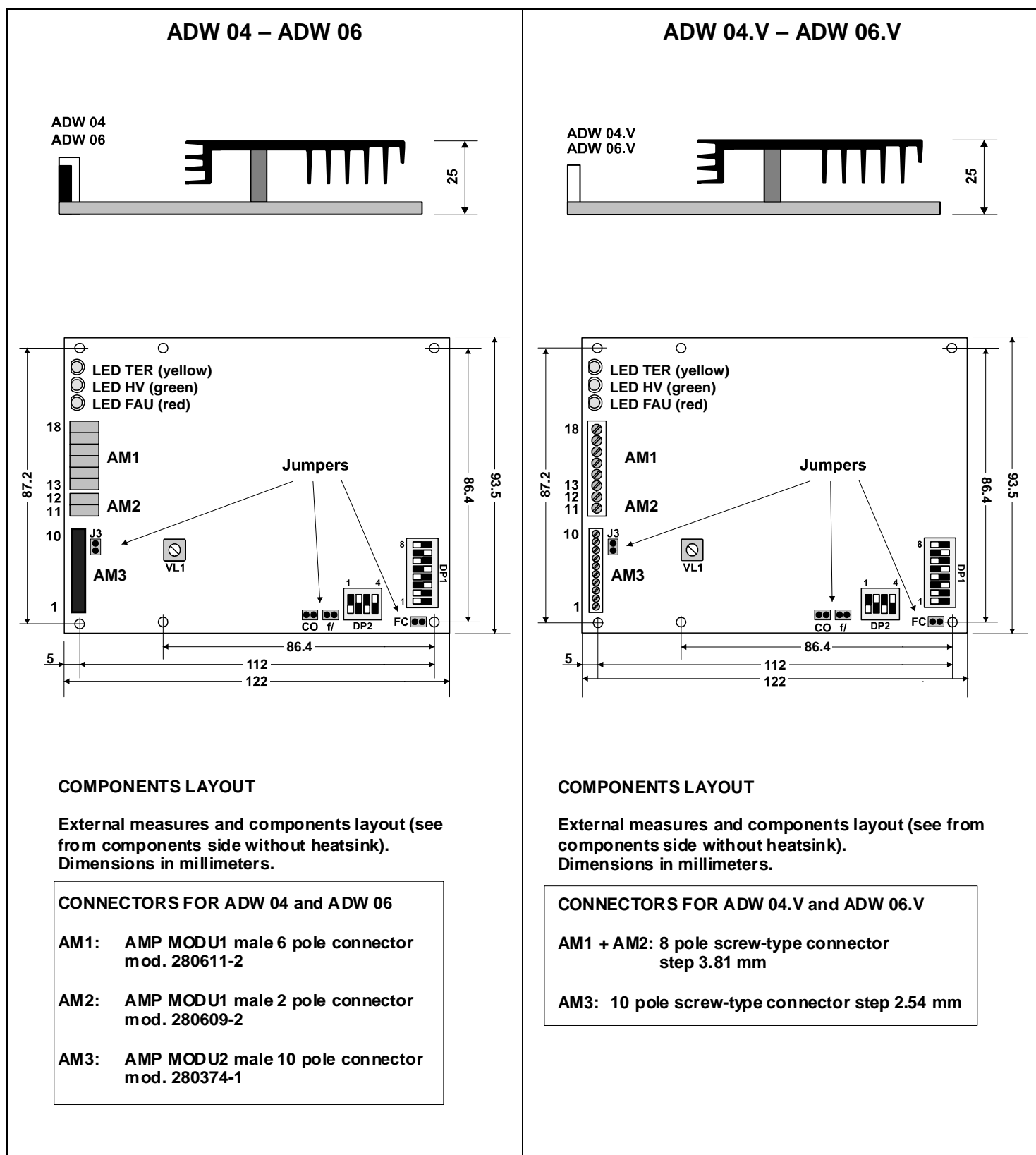


Fig. 2 – Dimensions: all measures in mm.





## 4 - OPERATION MODES DESCRIPTION

ADW series drives are characterized by its versatility thank to four different selectable operation modes and the different available settings. The speed of the motor can be set:

- By using an Analog Input: in this case the speed of the motor is proportional to the value of the analog input, respect to the full scale value of the selected range (ANALOG MODE).

or

- Pre-setting minimum and maximum speed through dip-switches configuration. The transition between minimum and maximum speed is realized through dedicated input (DIGITAL MODE).

The maximum speed of the motor is established by setting the dip-switches 4,5 and 6 of DP1 (as shown in Fig.2), while the minimum speed is fixed by dip-switches 7 and 8 of DP1. Moreover, the drives provides AUTOSTOP functionality, selectable with a specific dip-switch setting. Thank to this features, the motor stops automatically when reaches the minimum settled speed.

New *advanced microstepping* innovative feature ensures smoothness of the movement.

The complete list of the operation modes is reported below:

- **RUN:** in this operation mode the motor start and stop is controlled by an enable input. When enable input is ON the motor starts, when enable input is off the motor stops. The logic level of a second input allows to set the direction.
- **CW/CCW:** in this operation mode the motor runs clockwise (CW) or counterclockwise (CCW) depending on the logic state set to the two inputs.
- **START/STOP:** in this operation mode the motor starts only after a positive edge transition on a specific input. Thus, the motor is stopped only after a positive edge transition on another input. A third input allows to set the direction.
- **LIMIT SWITCH:** this operation mode is suitable for applications in which the stepping motor is used to drive a swing of forward and backward movements controlled by two limit switches placed at the ends of the course. This mode requires to use limit switches, realized with normally open contact, which in off state provides at output a high logic state. In this mode AUTOSTOP functionality is always active.

The drive has an open collector STEP output, that provides a square wave signal with frequency proportional to the motor speed with a fixed resolution of 800 step/rev. This output could be connected for example to a step input of an A-NDC slave drive.

When the analog input is disabled, **do not connect** corresponding pin 9.

Table 2 shows the position of dips 1 and 2 (DP2) related to different operation modes:

OPERATION MODE (DIP 1, 2 of DP2)			
	DIP 1	DIP 2	FUNCTION
►	OFF	OFF	RUN
	OFF	ON	CW/CCW
	ON	OFF	START - STOP
	ON	ON	LIMIT SWITCH

Table 2

► = default factory setting.



#### 4.1 - LOGIC INPUT AND OUTPUT SIGNALS (connectors AM3, see Fig. 2)

An input is ON when at its terminals is present a voltage within the following limits:

$$V_{in\_MIN} = 5 \text{ Volt}, V_{in\_MAX} = 24 \text{ Volt}$$

For each input signal, correspondent terminals numbers of connector AM3 are indicated.

All logic input signals are optically insulated (respect to internal power circuit). Analog input and STEP output are not optically insulated but are referred to A-GND (Pin 8 of AM3 connector).

**Driving an input with a slow signal (i.e relays) or with variable delay (i.e PLC output) can give precision problem or, worse, make the board do not work at all. If you have this type of signal, contact R.T.A.**

##### 1 COMMON OF INPUTS.

**2 CURRENT OFF INPUT:** When this signal is ON drive is active. When it is OFF drive is inhibited, thus motor current (and so holding torque) is turned to zero. **With jumper CO this input is always ON** (drive is always active).

**3 DIRECTION INPUT:** With this signal ON motor rotation direction is opposite to the one obtained with input OFF. This signal has to be valid at least 100  $\mu$ sec. before START or STOP signals transition and has to stay in this state for at least 100  $\mu$ sec. after last START or STOP signals transition. This input is not active in CW/CCW operation mode.

**4 START:** Start signal function is showed in TABLE 3, depending on the set of drive operation mode:

<i><b>PIN 4 (START) OPERATION MODE</b></i>		
<b>DRIVE OPERATION MODE</b>	<b>INPUT SIGNAL</b>	
<b>RUN</b>	<b>ON (Level Sensitive)</b>	<b>Run Start</b>
	<b>OFF</b>	<b>Run Stop</b>
<b>CW/CCW</b>	<b>ON (Level Sensitive)</b>	<b>CCW Enable</b>
	<b>OFF</b>	<b>Not Used</b>
<b>START - STOP</b>	<b>ON (Positive Edge Sensitive)</b>	<b>Motor Start</b>
	<b>OFF</b>	<b>Not Used</b>
<b>LIMIT SWITCH</b>	<b>ON (Negative Edge Sensitive)</b>	<b>CCW Stop</b>
	<b>OFF</b>	<b>Not Used</b>

Table 3

When the motor stops and after adjustment it keeps the load blocked with the torque at 50% of the set value (automatic current reduction). The maximum delay at enabling or disabling is lower than 1.5 millisc.

**NOTE:** In CW/CCW mode the motor stops when Pin 4 logic level is equal to Pin 5 logic level.

**5 STOP:** Stop signal function is showed in TABLE 4:

<i><b>PIN 5 (STOP) OPERATION MODE</b></i>		
<b>DRIVE OPERATION MODE</b>	<b>INPUT SIGNAL</b>	
<b>RUN</b>	<b>ON (Level Sensitive)</b>	<b>Not Used</b>
	<b>OFF</b>	<b>Not Used</b>
<b>CW/CCW</b>	<b>ON (Level Sensitive)</b>	<b>CW Enable</b>
	<b>OFF</b>	<b>Not Used</b>
<b>START - STOP</b>	<b>ON (Positive Edge Sensitive)</b>	<b>Motor Stop</b>
	<b>OFF</b>	<b>Not Used</b>
<b>LIMIT SWITCH</b>	<b>ON (Negative Edge Sensitive)</b>	<b>CW Stop</b>
	<b>OFF</b>	<b>Not Used</b>

Table 4

**NOTE:** In CW/CCW mode the motor stops when pin 4 logic level is equal to pin 5 logic level.



## 6 SPEED: Speed signal function is showed in TABLE 5:

PIN 6 (SPEED) OPERATION MODE		
DRIVE OPERATION MODE	INPUT SIGNAL	
RUN	ON	Motor rotate at maximum speed set in TABLE 9
	OFF	Motor rotate at minimum speed set in TABLE 10 or Autostop (if this function is selected)
CW/CCW	ON	Motor rotate at maximum speed set in TABLE 9
	OFF	Motor rotate at minimum speed set in TABLE 10 or Autostop (if this function is selected)
START - STOP	ON	Motor rotate at maximum speed set in TABLE 9
	OFF	Motor rotate at minimum speed set in TABLE 10 or Autostop (if this function is selected)
LIMIT SWITCH	ON	Motor rotate at maximum speed set in TABLE 9
	OFF	Autostop is always enabled independently from dip 4 of DP2 setting

Table 5

**NOTE 1:** The value of high speed of the motor is defined by the setting of Table 9. With Analog Input enabled, the maximum speed of the motor is proportional to the input voltage. In this case the maximum speed settled in Table 9 corresponds to the full scale range of input voltage (+ 5 Volt or 10 Volt depending on jumper J3).

Thus, the low speed of the motor is defined as the ratio between the maximum speed selected in Table 9 and the chosen "speed ratio" reported in Table 10.

On the contrary, when the digital mode is activated, the motor rotates at the maximum speed settled in Table 9 when the PIN 6 is ON.

**NOTE 2:** When positive edge transition is applied, the motor speed increases from the low to high value with an exponential ramp. **The time constant of exponential ramp can be tuned through trimmer VL1.** When negative edge transition is applied, the motor speed decreases from the high to low value always with the same exponential ramp.

**NOTE 3:** In START/STOP mode, after an AUTOSTOP, the motor is immediately ready to response to the input commands applied to pin 6 or to Analog Input as defined by operational settings. The motor definitively stops after a positive edge transition applied to pin 5 (STOP). After that, all the command applied to the inputs have no effect, until a next positive edge transition on pin 4 (START).

## 7 STEP OUT: This output provide a square wave signal with frequency proportional to the motor speed of master drive with a resolution of 800 step/rev.

This output could be connected to a step input of a step-direction slave drive. In this case, if the slave drive is set to 800 step/rev, both motors rotate at the same speed.

## 8 A-GND: Analog Input negative pole.

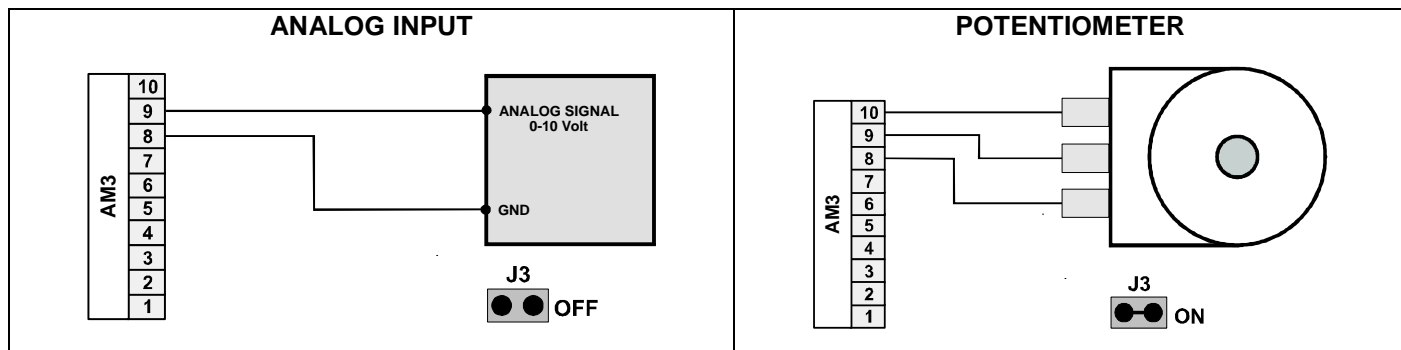
## 9 ANALOG INPUT: Speed Reference. This signal has a dynamic range from 0 to 5Vdc or from 0 to 10Vdc depending of the setting of jumper J3. At this input a potentiometer can be connected as showed in Figure 3b.

**NOTE:** A low noise line to drive the analog input is strongly recommended.



**10 V<sup>+</sup>:** Power Supply positive pole (5 Vdc). Use only to connect a Potentiometer (MIN 5 KOhm), as shown in Fig. 3b.

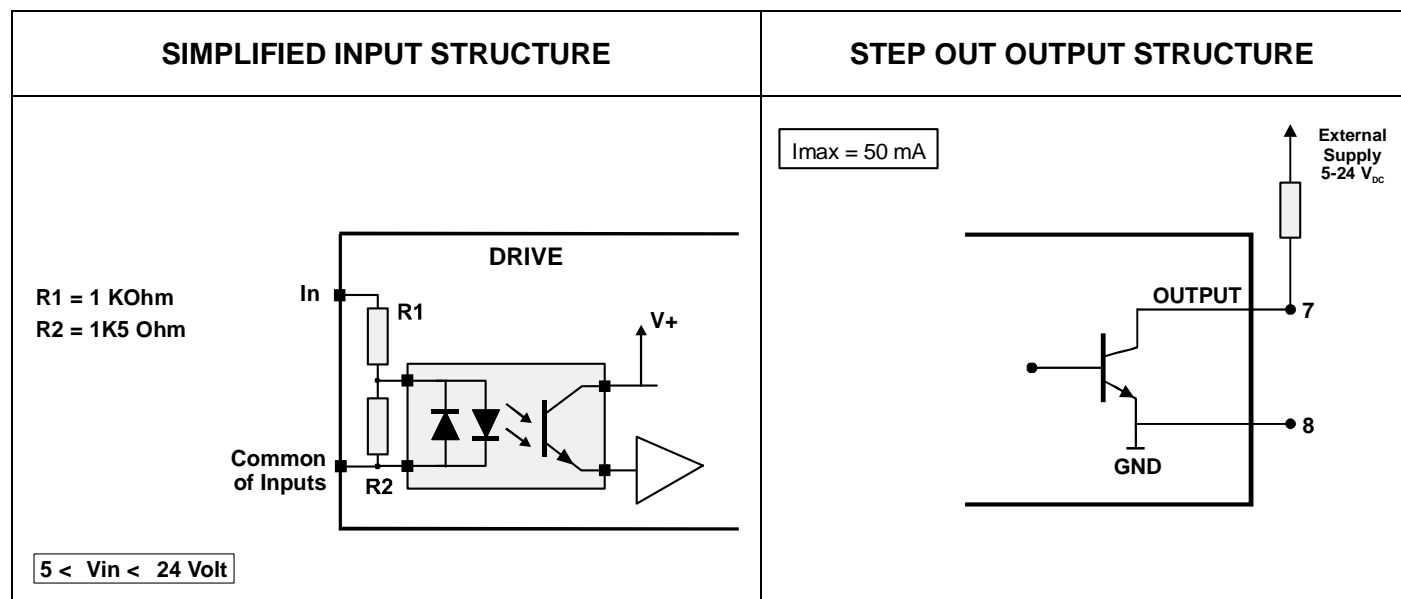
Figure 3a and 3b show connection scheme in ANALOG MODE.



**Figure 3a**

**Figure 3b**

Figure 4a and 4b show SIMPLIFIED INPUTS STRUCTURE (Analog Input excluded) and STEP OUT OUTPUT STRUCTURE.



**Figure 4a**

**Figure 4b**



## 4.2 - I/O SIGNAL SUMMARY

The following Table 6 resumes the configuration of the inputs for each operation mode.

Pin	OPERATION MODES				NOTE
	RUN	CW/CCW	START-STOP	LIMIT SWITCH	
<b>1</b>	Logic Input Common				
<b>2</b>	Current Off Input				
<b>3</b>	Direction Input	Not used	Direction Input	Direction Input	
<b>4</b>	Oscillator Enable Input	Enable Input CCW	Start Input	Limit Input CCW	
<b>5</b>	Not Used	Enable Input CW	Stop Input	Limit Input CW	
<b>6</b>	High/Low Speed Input or Autostop				Dip4 of DP2 enable AUTOSTOP
<b>7</b>	Step Out (Open collector)				Referred to Analog A-GND
<b>8</b>	Analog A-GND				
<b>9</b>	Analog Input or Not used (Internal Ref.)				Dip 3 of DIP2 enable/disable Analog Input
<b>10</b>	+ 5 V				

Table 6



## 5 -INPUTS AND OUTPUTS POWER LINES

In this chapter drive inputs and outputs power lines and the required power supply lines are described.

5.1-Drive power outputs are the four phase lines driving the stepping motor winding. Drive power inputs are the two connection lines to  $V_{DCnom}$ . Connector AM1 and AM2 terminals are listed in the following Table 7.

TABLE 7	
CONNECTOR AM1	DESCRIPTION
18	Shield of shielded motor cable
17	Motor winding terminal A
16	Motor winding terminal A-
15	Motor winding terminal B
14	Motor winding terminal B-
13	GROUND
CONNECTOR AM2	DESCRIPTION
12	- $V_{DC nom.}$
11	+ $V_{DC nom.}$

5.2-GROUND terminal has to be electrically connected to PE terminal of the machine in which the drive is installed.

5.3-The terminal indicated as GROUND is the point of motor-drive system that has to be connected to earth (PE terminal) in order to guarantee the correct operation of some drive protection systems. No other point at a different potential of logic circuit and of power circuit has to be connected to earth; in particular has not to be connected to earth transformer secondary winding. Other points at the same potential of GROUND could be connected to earth using the cautions suggested by well known techniques, to obtain a correct location of multiple earth connections. Shielded cables both of logic signals and motor outputs must be connected to points at the same potential as GROUND. Furthermore it is important to notice that GROUND terminal is internally connected to terminal 18 of AM1, to terminal 12 of AM2 and to terminal 8 of AM3. See connection schemes of Figure 7.



## 6. ⚠ DRIVE SETTING AND ALERT SIGNALS

6.1- ADW series drives are general purpose products which can be used to drive many different motor models in different kind of applications. For this reason they have two DIP-SWITCHES and four jumpers, suitable to adapt drive characteristics to the specific motor and/or application. **The setting of these dip-switches and jumpers, must be done by customer before putting in service the drive. Do not forget to do these settings: wrong setting could get application errors and also motor damages and hazard conditions.** Three led indicate the drive status.

### 6.2- MAIN SETTINGS DIP-SWITCH DP1

Table 8 shows the position of dips 1, 2 and 3 (**DP1**) and the related motor nominal current.

<b>NOMINAL CURRENT <math>I_{NP}</math> in Ampere (Dip 1, 2 and 3 of DP1)</b>					
	DIP1	DIP2	DIP3	Current $I_{NP}$	
				ADW 04 – ADW 04.V	ADW 06 – ADW 06.V
►	ON	ON	ON	0.65	1.9
	ON	ON	OFF	0.75	2.3
	ON	OFF	ON	0.9	2.7
	ON	OFF	OFF	1.0	3.1
	OFF	ON	ON	1.2	3.6
	OFF	ON	OFF	1.4	4.3
	OFF	OFF	ON	1.7	5.1
	OFF	OFF	OFF	2.0	6.0

Table 8

► = default factory setting.

Table 9 and 10 show the motor speed settings. In particular, Dips 4,5 and 6 (**DP1**) and f/ jumper set the high speed value, while dips 7 and 8 (**DP1**) fix the motor low speed value.

<b>TABLE OF MOTOR HIGH SPEED (Dip 4, 5 and 6 of DP1)</b>					
	f/ JUMPER	DIP 4	DIP 5	DIP 6	RPM
	OFF	OFF	OFF	OFF	2000
	OFF	OFF	OFF	ON	1500
	OFF	OFF	ON	OFF	1000
	OFF	OFF	ON	ON	750
	OFF	ON	OFF	OFF	600
	OFF	ON	OFF	ON	500
	OFF	ON	ON	OFF	400
►	OFF	ON	ON	ON	300
	ON	OFF	OFF	OFF	200
	ON	OFF	OFF	ON	150
	ON	OFF	ON	OFF	100
	ON	OFF	ON	ON	75
	ON	ON	OFF	OFF	60
	ON	ON	OFF	ON	50
	ON	ON	ON	OFF	40
	ON	ON	ON	ON	30

Table 9

► = default factory setting.



TABLE OF MOTOR LOW SPEED ( <i>DIP 7 and 8 of DP1</i> )			
	DIP 7	DIP 8	LOW /HIGH SPEED RATIO
►	OFF	OFF	1/9
	OFF	ON	1/18
	ON	OFF	1/27
	ON	ON	1/36*

Table 10

► = default factory setting.

(\*) **NOTE:** When Analog Input is used and AUTOSTOP is enabled, setting of 1/36 low/high speed ratio is forbidden.

Table 11 shows the settings of the four jumpers.

	JUMPER		
	FC	ON	Automatic current reduction disable
►	FC	OFF	Automatic current reduction active
►	CO	ON	Current off input forced to ON
	CO	OFF	Current off input available
►	J3	ON	Analog input range (from 0 to 5 V)
	J3	OFF	Analog input range (from 0 to 10 V)
	f/	ON	Division by 10 speed scale active
►	f/	OFF	Division by 10 speed scale disable

Table 11

► = default factory setting.

**NOTE 1:** When automatic current reduction is active, the current which flows in each motor winding at motor standstill is reduced to 50% of nominal current value.

**NOTE 2:** When a potentiometer is connected to pin 10 (5 Volt), jumper J3 must be set ON.

### 6.3-MAIN SETTINGS DIP-SWITCH DP2

Table 2 shows the position of dips 1 and 2 (DP2) related to different operation modes:

OPERATION MODE ( <i>DIP 1, 2 of DP2</i> )			
	DIP 1	DIP 2	FUNCTION
►	OFF	OFF	RUN
	OFF	ON	CW/CCW
	ON	OFF	START - STOP
	ON	ON	LIMIT SWITCH

Table 2

► = default factory setting.

Table 12 shows the position of dip 3 of **DP2** that activates or disables the analog input.

ANALOG INPUT ( <i>Dip 3 of DP2</i> )		
	DIP 3	FUNCTION
►	OFF	Analog input disable
	ON	Analog input enable

Table 12

► = default factory setting.





Table 13 shows the position of dip 4 of **DP2** that activates or disables the AUTOSTOP feature.

<b>AUTOSTOP (Dip 4 of DP2)</b>		
	<b>DIP 4</b>	<b>FUNCTION</b>
►	<b>OFF</b>	<b>Autostop disable.</b> Motor rotate at minimum speed set in TABLE 10
	<b>ON</b>	<b>Autostop enable</b>

**Table 13**

► = default factory setting.

#### 6.4-TRIMMER VL1

Through trimmer VL1 the user can tune the time constant of acceleration/deceleration ramp (see Chap. 4.1, INPUT 6).

#### 6.5-DRIVE STATUS BY LED

The following list shows the meaning of the alert LEDs.

- LED HV green:**      **ON**    = supply voltage value in working range.  
                              **OFF**    = no supply voltage or supply voltage out of working range
- LED FAU red:**        **ON**    = drive set in no working state by one of the following protection:  
                                     **a** – Thermal protection, if LED TER is ON  
                                     **b** - Max or Min voltage when LED HV is OFF  
                                     **c** - Short circuit or wrong connection at motor output when LED HV is ON  
                              **OFF**    = drive active provided that LED HV is ON
- LED TER yellow:**    **ON**    = drive set in no working state by thermal protection.  
                              **OFF**    = drive active provided that LED HV is ON.

All protection circuit and alarm reset itself when the alarm source disappears. Memory must be reset by removing power supply voltage.

## 7. DRIVE EXTERNAL CONNECTIONS

- 7.1- Design of the power transformer: the power of transformer has to be higher than the sum of the power requested from drive and motor (total power). This one can be calculated as the sum of the following terms:
- Mechanical power delivered to load: mainly depending on application characteristics like friction, inertia, efficiency of mechanical transmission etc.
  - Motor losses: mainly depending on motor type, drive voltage, speed and duty cycle.
  - Drive losses: mainly depending on drive model, current setting and duty cycle; according with these parameters these losses can approximately vary between 60 and 130 Watt. It is often very hard to estimate drive and motor losses; in this case an over-dimensioning of the supply elements proportional to the inaccuracy is recommended. To get more accurate information, contact R.T.A. and describe the particular application. Obviously if a single power supply is used for more than one drive, the total power is equal to the sum of the single drive powers.



7.2- Transformer must meet the following requirements:

- Supply the correct voltage through a transformer secondary winding. The  $V_{AC}$  voltage value is intended as measured at secondary terminals in no load condition and with primary voltage equal to the nominal value. Maximum voltage drop at full power load must be less than 5%.
- Ensure the galvanic insulation between the drive circuits and the main. **Remember that direct connection of drive circuits to the main is strictly forbidden. The use of autotransformer is strictly forbidden.**
- Ensure the galvanic insulation between the drive circuits and all other circuits of the same machine. **This means that the drive dedicated transformer secondary has to be used exclusively for the drive.**

7.3- The use of one secondary winding for more drives (max 3 drives) is allowed only if the total power required by the drives is less than 600VA.

7.4- **Branch circuit protection fuses F1 and F2 (see Figure 7) must be time delay of 10 Amp, at least 250 Volt with  $I^2t$  between 150 A<sup>2</sup>s and 400 A<sup>2</sup>s (for example Littelfuse 215010.P).**

7.5- The cross-section area of conductors used in power supply circuit must be chosen according with power dimensioning (see 7.1). The cross-section area of the four shielded conductors connecting motor to the drive must be chosen with regard to the nominal current which has been set in the drive.

## IMPORTANT NOTES

1)  $C \geq 10.000 \mu F$  with  
 $V_{DC} = 24 \text{ Volt}$   
 $C \geq 4.700 \mu F$  with  
 $V_{DC} = 75 \text{ Volt}$

2) Transformer power: from 100 to 300 VA depending on:

- Drive model
- Current setting
- Motor model
- Motor speed
- duty-cycle

3) Rectifier bridge type: according transformer power.

4) C capacitor must be near AM2 or C1 connector; max cables length = 1 meter.

5) The maximum motor cable length is 20 meters; Section according to phase current RMS value.

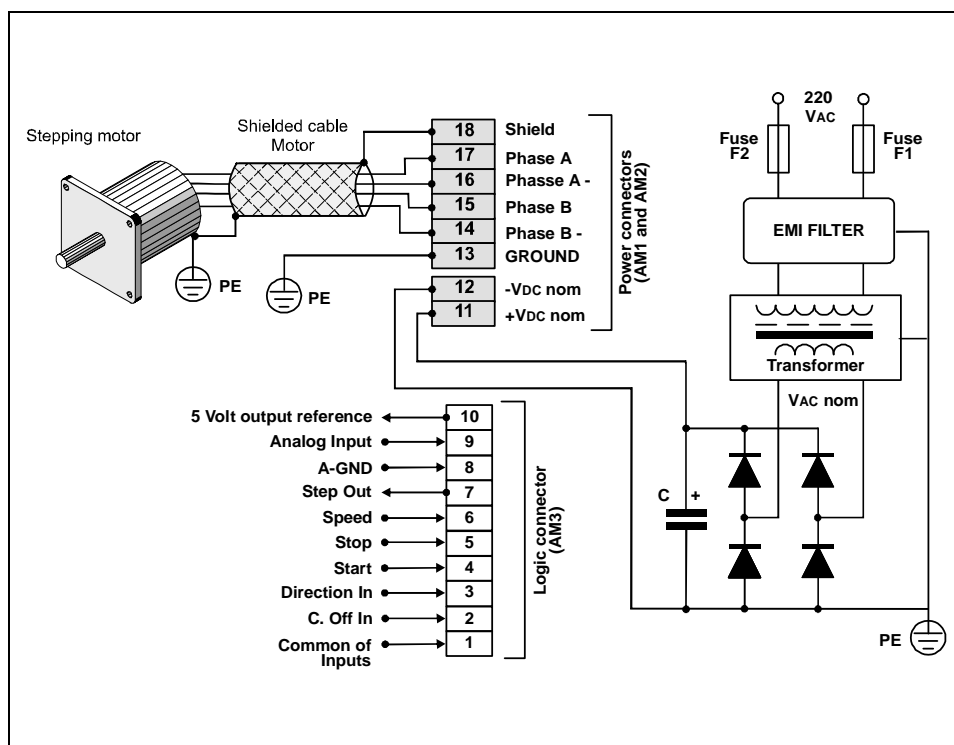


Figure 7 - Drive external connection scheme for ADW 04, ADW 04.V, ADW 06 and ADW 06.V drives.



## 8. ⚠️❌ INSTALLATION AND ENVIRONMENT LIMITS

All products described in this manual are subjected to the following characteristics:

8.1-IP00 protection degree: it is user responsibility to provide an adequate protection enclosure suitable to meet the standards regarding the specific application in which the products are used.

8.2-Direct connection with the main is not allowed. Transformer separation is mandatory.

8.3-Installation and work environment. Installation is allowed in a micro-environment with:

- **Environment conditions class 3K3** (IEC 721-3-3): it includes a working temperature from +5°C to +40°C and relative humidity from 5% to 85% non condensing.
- **Pollution degree 2**: it includes that installation in environments in which explosive and/or flammable and/or chemically aggressive and/or electrically conductive gas, vapor or dust could be present is strictly forbidden.
- **Mechanical conditions class 3M1** (IEC 721-3-3).

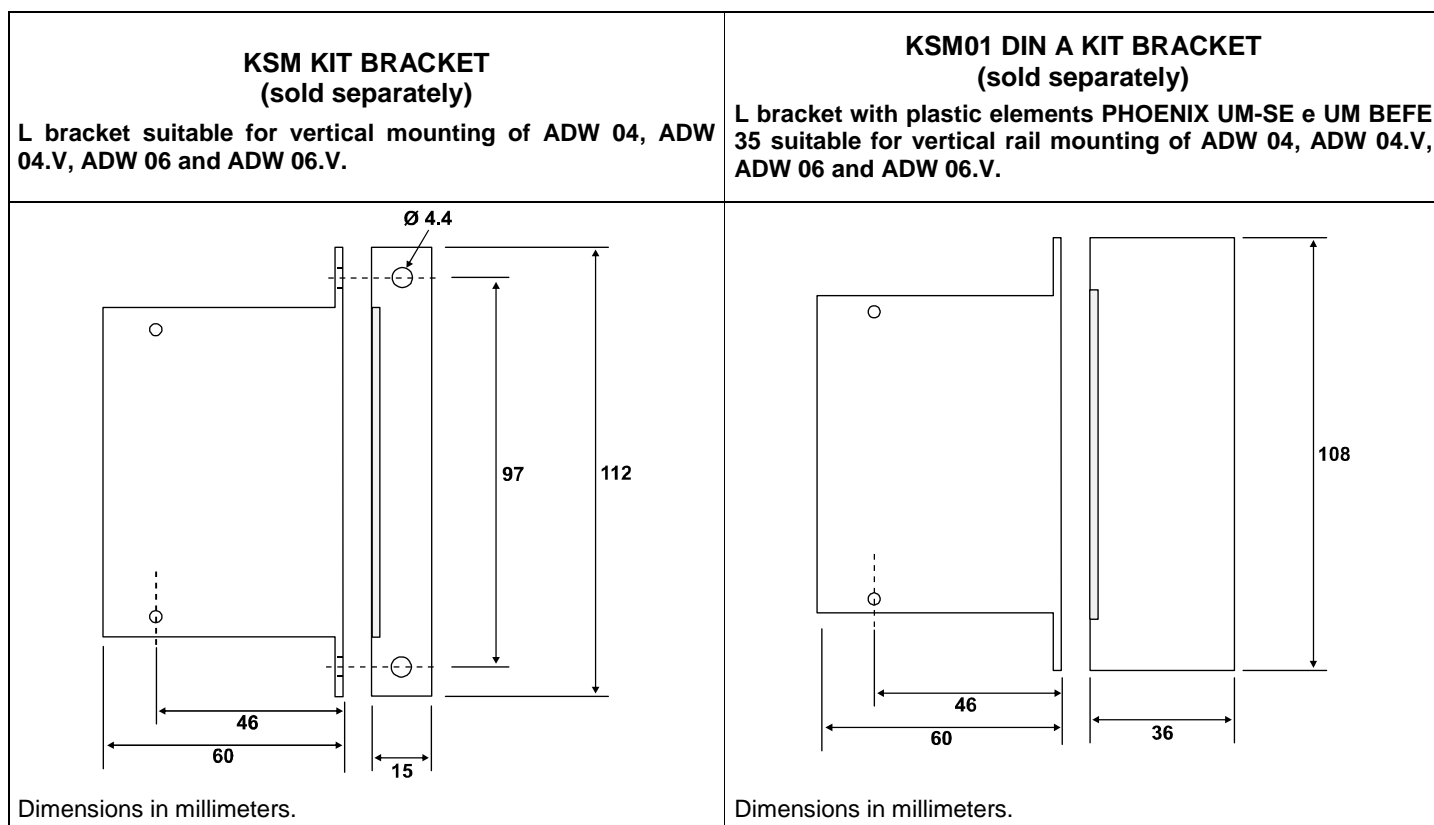
If the environment in which the machine is used does not satisfy these conditions, suitable conditioning system or suitable case have to be used.

8.4-Storage environment limits with drive in its original packaging:

- Temperature: from -25°C to +55°C. Relative humidity: from 5% to 95%.
- Environment conditions class 1K3 (IEC 721-3-1). Pollution degree 2.

8.5-The drive generates some amount of heat (see chap. 7.1). This must be considered during the global electrical cabinet design. In order to ease air flowing around the drive, install the drive vertically (not turned upside down) with at least 5 cm of free space over and under the drive and 1 cm on the left and on the right of the drive.

R.T.A. can provide specific brackets suitable for vertical mounting (see Figure 8).



**Figure 8**



## 9. APPLICATION NOTES

9.1- Drive (or drives) power supply can not be used to supply other machines.

9.2- Electromagnetic compatibility (directive 2004/108/CE). ADW series drives are BDM (Basic Drive Module), as defined in the EN 61800-3. Only a professional assembler, expert in the field of motor drives and in their EMC aspects, can install and put in service this component. R.T.A. has the responsibility to verify the products compatibility in some typical way of use in order to give correct installation information. In any cases, it is responsibility of the professional assembler, who installs this product, to verify the compatibility of the complete machine or system.

9.2.1- The set consisting of drive, motor, transformer and all related cablings are source of electromagnetic interferences. The assembler of installation must consider these problems during the project of the plant where the drive (or drives) will be installed in order to shield and/or reduce these interferences. Tests performed by R.T.A. show that the most effective measures able to reduce these interferences are the following:

- Shielding of cables for the connection between motor and drive. The shield of this cable has to be directly connected to ADW series drive terminal 18. This shielding can be avoided only in case of very small and compact machine where motor, drive and related connections are located in the same enclosure, showing adequate shield performance.
- Connect earth line to motor chassis. To reduce the radio-frequency emissions, the mechanical connection of motor to machine chassis (by means of mounting flanges and screws), is typically simple and effective solution. In this case, both screws and chassis must be of conductor material and the chassis must be connected to earth.
- Location of motor-drive set in the same cabinet shielded from electromagnetic interferences.
- Use a power supply transformer with a metallic shield, connected to earth, interposed between primary and secondary winding.
- Interpose a filter between the transformer primary and the main (220 or 380 V<sub>AC</sub>). The filter is used to reduce conducted electromagnetic interferences. Filter characteristics in a specific installation depend on the following factors:
  - The specific standard limits the machine (in which drive is used) is subjected to.
  - Power level of application (voltage and current setting of the drive).
  - Presence of other filtering systems in the general electrical machine connections.

In any case, the following filter types are recommended:

- CORCOM VDK series for single-phase power supply.
- CORCOM FCD10 series for three-phase power supply.

Different types of these series differ for current rating. Choose the specific model according to the power level of the specific installation.

- Consider that the position of the filter in the system is extremely important: no electromagnetic coupling must take place between electromagnetic source and circuits (and lines). To this end, filter and main must be kept as close as possible.
- All earth connections mentioned above have to be realized with the less possible inductance.

9.2.2- To improve the drive logic input signals immunity from external noise the following well known procedures, to manage the relatively fast signals treatment must be considered:

- Use shielded cables with shield connected to terminal 13.
- When cables length exceeds 5-6 meters, prefer "buffer" type driving signals instead of "open collector" type.
- Keep signal cables separate from power cables. In particular keep signal cables separate from motor output cables.
- Carefully verify logic level compatibility when interfacing drive with control system.



- 9.2.3- Following these procedures is essential to realize an installation which complies with the requirements of 2004/108/CE directive. The real specific standard compliance have to be proved in the complete installation. In fact the effectiveness of the suggested application notes depends also on machine topology and on the measurement setup. Test performed by R.T.A. simulating typical installations and following the mentioned above indications show that EN61800-3 standard compliance applications can be achieved.
- 9.2.4- In some cases, due to the characteristics of particular installations, conflicts between ground connections necessary for shielding purposes and ground connections necessary for safety reasons could arise. Remember that, in such cases, prescriptions regarding safety take priority, but remember also that, in almost all of the cases it is possible to find a solution meeting both prescriptions; R.T.A. is available for further information about these problems.

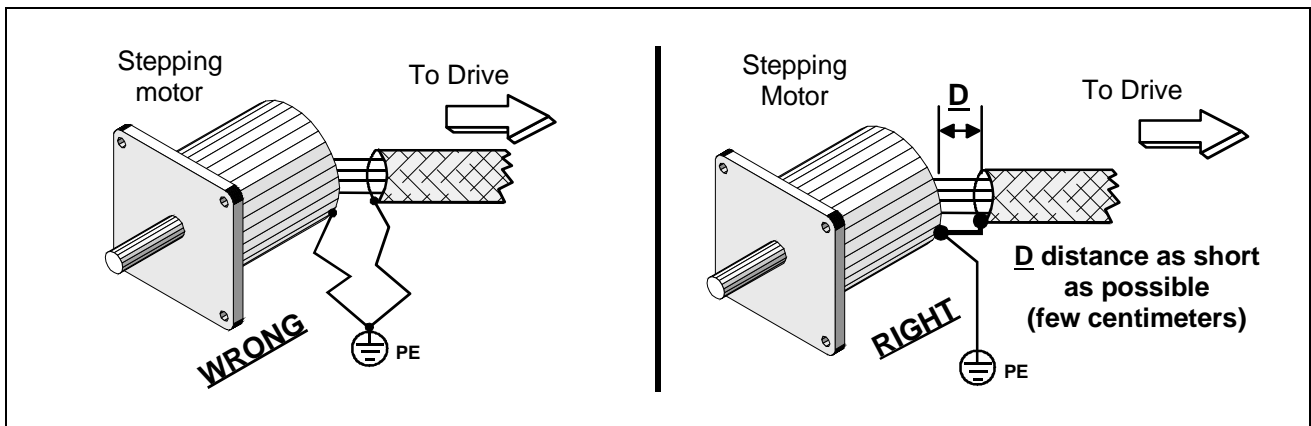


Figure 9 - Shielded connection at stepping motor side.