

ALTER

**ALTER ELETTRONICA S.R.L.
CASALE MONFERRATO (ITALY)**

4 QUADRANT

D.C. SERVOMOTOR DRIVE

SERIES PWM

MODEL

DCD

TECNICAL FEATURES

- Panel board fitting. IP20 Protection rating.
- Operating temperature: 0 to +65⁰C. (32 to 149⁰F).
- Storage temperature: -10 to +70⁰C (14 to 158⁰F).
- Relative humidity 95% max. without condensate.
- Maximum altitude: 1000 m. (3280 feet) a.s.l.
- Auxiliary supply:
Single-phase 220V $\pm 10\%$ - 50mA max. (protected by external fuses 250V-500mA).
- Power supply:
Three-phase 50V to 240V (protected by external fuses as TABLE 1).
- Supply frequency: 45 to 65Hz.
- Max. output voltage: 1.2 X Three-phase input voltage.
- Max. output current: as TABLE 1.
- Max. input Three-phase supply current: .75 X output current.
- Max. power dissipation: 5 X output rated current.
- Thermal time constant: 15'.
- Continuous power of clamp circuit: 160 W.
- External clamp resistance (OPTIONAL).
- Insulation between power and control circuits.
- Input over voltage built-in protections.
- Switching frequency: 16KHz.
- Min. load inductance: 1mH.
- Connections: Power to terminal board, Signals to connector.
- Speed feedback:
By Tachogenerator (T.G.) for Model DCD
By Incremental Encoder (5V supply) for Model DCD-E
- Switch to select the Tachogenerator voltage or the Encoder number of pulses per revolution.
- Speed reference differential input stage.
Differential and common mode max. input voltage: 10V. Input resistance: 100K Ω .
- Adjustable and cutting out acc./ dec. ramp (ramp time .15 to 1.5sec).
- Current limit reference input: +10V max. (circuit diagram at page 9).
- Speed monitor output: ± 10 V max. - output resistance 1K Ω .
- Current monitor output: ± 5 V max. - output resistance 1K Ω .
- Outputs: +24V - 50mA max., +10V and -10V - 5mA max.
- Output +5V – 100mA max to supply the Encoder (only for the Model DCD-E)
- Output ,by connector, of the Encoder channels (only for the Model DCD-E)
- Optocoupled logic controls: 15 to 30Vd.c. - 10mA max.
- Led DISPLAY for status and faults monitoring.
- Drive OFF in case of the following faults:
 - Auxiliary supply fault
 - Three-phase Power supply fault.
 - Bus Overvoltage.
 - Motor connections fault.
 - Overtemperature.
 - Motor overload.
 - Motor overcurrent.
 - Clamp overload.
- Reset input f or faults.
- DRIVE OK output contact (breaking capacity: 110Va.c. / 24Vd.c. - 50mA max).

DRIVE		THREE-PHASE SUPPLY FUSES [A]	CABLES CROSS SECTION AREA	
SIZE (**)	CURRENT (*) RATED /PEAK [A]		THREE-PHASE SUPPLY [mm ²]	MOTOR [mm ²]
1	6 / 12	6	2,5	2,5
1	10 / 20	10	2,5	4
1	15 / 30	16	2,5	4
2	20 / 40	20	6	10
2	30 / 60	32	10	16
2	40 / 80	40	10	16
2	50 / 100	50	10	16
2	60 / 120	63	10	16
(*)	With operating temperature 0°C to +40°C. (32 to 104°F) Derating: 4% every °C with operating temperature above +40°C.(104°F)			
	Running time at peak current: 2sec.			
(**)	Outline dimension at page 8			

TABLE. 1

OTHER CABLES CROSS SECTION AREA:

- External clamp resistance: 2.5 mm²
- Auxiliary supply: 1.5 mm²
- CN1 and CN4 connectors: 1.5 mm max.

INSTALLATION AND WIRING

- Accurately check that the drive underwent no damage while the transport.
- Standing installation and enough room for a good air circulation.
- Don't place side by side the size 1 drives but with more than 20mm air gap.
- Make use of galvanized sheet iron connected to ground.
- Connect to a good ground the terminal located on the right side of the terminal board.
- Accurately check that the connections corresponds to that indicated in this instruction book.
- Make use of shielded cable for both signal and power connections.
- Connect to ground the shield ends of some shielded cable.
- Don't make use of terminal board to connect shielded cables but shielded connectors only.
- Spikes suppressors (RC snubber for a.c. supply and diodes for d.c. supply) must be mounted in parallel to the coils of: remote control switches, relays, solenoid valves, clutches, brakes, and single or three-phase a.c. motors.

SETTING AT WORK

NOTE:

- **The common (0V) of all internal supply is connected to the frame.**
- **The negative probe of the voltmeter and the oscilloscope ground must be connected to the test point T.P. indicated by “GND” or to the frame.**
- **Make use of totally insulated screwdriver for the trimmer’s regulation.**

Accurately check that:

- Single-phase auxiliary voltage supply be: 220V a.c. $\pm 10\%$.
- Three-phase voltage supply be sufficient to supply the motor and included within the rating limits of the drive.

Carry out the following settings:

- To select the voltage range of the tachogenerator or the number of pulses per revolution of the Encoder (see at page 7).
- To enable or to disable the acc./dec. ramp. (see at page 7).
- To set the “SPEED” trimmer to the counterclockwise limit stop position.
- To switch on both single-phase and three-phase supply and check that the led “AUX SUPPLY” is lighted.
- To set on the T.P. “CURRENT” by the trimmer “CURRENT” the voltage correspondent to the motor peak current (see at page 5).
- To enable the drive by the “COEN” control.
- To set the max. speed reference to the drive and to adjust, by the “SPEED” trimmer, the max. working speed of the motor.
- If the motor shaft rotation is in opposite direction to that correct, to reverse the sign or the links of the speed reference (REFH - REFL). If the “FEEDBACK FAULT” led is lighted to see at page 4.
- To check that the max. armature voltage is not above the motor rating voltage.
- To adjust, by the “GAIN” trimmer, the quickness of the motor answer.
- To adjust the “OFFSET” trimmer to stop the slow rotation of the motor shaft with zero speed reference.
- To adjust, by the “RAMP” trimmer, the motor acc./dec. time (see at page 4).
- If some of the RED led is lighted to see at page 4.

START SEQUENCE

- Switch on the single-phase auxiliary supply.
- Switch on the three-phase power supply.
- Enable the drive by the “COEN” control.
- Supply the speed reference.

STOP SEQUENCE

- Remove the speed reference.
- Disable the drive by the “COEN” control.
- Switch off the three-phase power supply.
- Switch off the single-phase auxiliary supply.

FAULT LED's (RED)

The led lighted correspond to the drive fault.

UNDERVOLTAGE Three-phase supply is too much low or switched off.

**FEEDBACK
FAULT** Tachogenerator voltage output not existent or with reversed polarity
ENCODER channels A and B output not existent or reversed
(STORED WARNING).

With this fault please check:

- The Motor, the Tachogenerator, or the Encoder to drive connection cables.
- Exceeding the settled rated current in the motor.

**MOTOR
OVERLOAD**

(STORED WARNING).

With this fault please check:

- The MOTOR load.
- The MOTOR winding and the connection cables. (see at page 10)

**OVER
CURRENT**

Exceeding the settled peak current in the motor.
(STORED WARNING).

With this fault please check:

- The MOTOR winding and the connection cables.
- The MOTOR BRUSH sparking at high rotation speed.

**CLAMP
OVERLOAD**

Exceeding the max. working time of the clamp circuit (1.5 sec).
(STORED WARNING).

With this fault please check:

- The frequency and the time of the motor stop cycles.
- The three-phase voltage supply is not higher than the rating.
- The flickering of the motor speed generated by:
 - The Tachogenerator fault.
 - The speed reference flickering.

**OVER
TEMPERATURE**

Drive overtemperature. (STORED WARNING).
With this fault please check:

- The inner temperature of the electrical cabinet.
- The fan of the size 2 drives.

NOTE:

The reset of the STORED WARNINGS is possible by the control "RESET" or switching off the auxiliary single-phase supply.

SIGNALING LED's (GREEN)

AUX SUPPLY If this led is lighted all the supplies are OK.

If this led is not lighted please check:

- The single-phase auxiliary supply 220V a.c. $\pm 10\%$.
- If the +24V d.c output is shorted to ground.

COEN

If this led is lighted the external enable control is ON.
If this led is not lighted the motor shaft is idle.

NOTE:

The drive control the motor only when all the following conditions are satisfied:

- The green leds AUX SUPPLY and COEN are lighted.
- All the red leds are not lighted.

TEST POINTS (T.P.)

REF	Speed reference.
CURRENT	Voltage reference correspondent to the settled peak current in the motor (adjusted by 'CURRENT' trimmer). (10V on this T. P. correspond to the peak current of the drive) (The rated current in the motor is fixed at 50% of the settled peak current).
GND	Common (0V) of all internal supplies. (connected to the frame).

REGULATION TRIMMERS

OFFSET	Zero setting of the speed offset.
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NOTE: The clockwise rotation of the regulation screw of the following trimmers increase the adjusted value.

CURRENT	Peak current in the motor. (The settled value is available on the T.P. "CURRENT").
SPEED	Motor speed.
GAIN	Quickness of motor answer to the variations of the speed reference and of the motor load. The excess on the regulation bring to shaft vibrations.
RAMP	Setting of the acc./dec. time of the motor. Enable: SW3 settled ON - SW4 settled OFF (see at page 7). Time range: .15 to 1.5 sec. (with 10V speed reference). If the max. speed reference is less than 10V the time is correspondent shortest.

SUPPLY OUTPUTS

+24V	(CN4/1) External logic control supply (24Vd.c. -50mA max).
+10V	(CN4/6) +10V - 5 mA max.
-10V	(CN4/7) -10V - 5 mA max.
+5V	(CN3/6) +5V - 100 mA max (Encoder supply only for the Model DCD-E)
GND	(CN1/1 - CN1/4 – CN3/25 – CN4/8 – CN4/9) Common (0V) of all internal supplies (connected to the frame).

INPUT / OUTPUT DIGITAL CONNECTIONS

OKD 1-2	(CN4/4 - CN4/5) Relay contact which is closed when the drive is regularly working (NO WARNINGS). (Breaking capacity: 110Va.c. / 24Vd.c. - 50mA max). The contact is closed also if the three-phase supply is too much low or switched off (UNDERVOLTAGE led is lighted) but the external enable control (COEN) is OFF. To cut OFF the three-phase supply if the contact is open.
LOCO	(CN4/10) Common of the digital controls.
COEN	(CN4/2) Converter enable. (Control voltage: 15 to 30Vd.c. - 10mA max).
RESET	(CN4/3) Reset of the STORED WARNINGS. The reset happen during the rise slope of the control. (Control voltage: 15 to 30Vd.c. - 10mA max).

INPUT / OUTPUT ANALOG CONNECTIONS

TACH	(CN1/5) Tachogenerator input. (only for Model DCD)
REFL	(CN1/2) Cold input of the speed reference.
REFH	(CN1/3) Hot input of the speed reference. 10V max. input voltage between: REFH and GND, REFL and GND, REFH and REFL. Input resistance 100K Ω .
SPMO	(CN1/6) Output voltage correspondent to the motor speed. $\pm 10V$ max. Output resistance 1K Ω .
CUMO	(CN1/7) Output voltage correspondent to the motor current. $\pm 5V$ correspond to the peak output current of the drive. Output resistance 1K Ω .
EXCL	(CN1/8) Input of the external current limit reference. +10V correspond to the peak current of the drive. Circuit diagram at page 9.

ENCODER CONNECTIONS (only for Model DCD-E)

For the correct operation of the drive it is essential to connect on the connector CN3:
The supplies +5V (CN3/6) and 0V (CN3/25), the channel A (CN3/1) and the channel B (CN3/3).
On the connector CN3 they have to be connected also all the other channels that they have to be present on the connector CN2.

RAMP ENABLE / DISABLE

RAMP	ENABLE	DISABLED
SW3	ON	OFF
SW4	OFF	ON

NOTE: If the switches are otherwise settled the circuit have operation faults.

TACHOGENERATOR SETUP

- To set the driver according to the tachogenerator and to the speed reference is necessary:

- To calculate the parameter : $X = \frac{K_{tg} \cdot \omega \cdot 8}{V_{ref}}$

K_{tg} = tachogenerator voltage gradient.

ω = max. motor speed.

V_{ref} = max. speed reference.

- To set the SW1 and SW2 switches according with the following table:

X	0 ÷ 16	17 ÷ 40	41 ÷ 56	57 ÷ 80
SW1	OFF	ON	OFF	ON
SW2	OFF	OFF	ON	ON

If the parameter is greater than 80 is necessary to put a resistor between the tachogenerator cable head and the TACH terminal and to set ON the SW1 and SW2 switches.

The value and the power dissipation of the resistor are calculated as follow:

$$R[\Omega] = \frac{X - 80}{80} \cdot 100.000$$

$$P[Watt] = \frac{(X - 80)^2}{R}$$

If they are used more resistors, in series connected, the sum of the resistive values of the resistors must be equal to the calculated value and the power dissipation by each resistor is proportional to its resistive value.

ENCODER SETUP

To set the drive according to the encoder mounted on the motor, is necessary:

- To calculate the parameter: $X = \frac{PPR \cdot \omega \cdot 8}{V_{ref} \cdot 3000}$

PPR = number of Pulses Per Revolution of the Encoder.

ω = max. motor speed. [RPM].

V_{ref} = max. speed reference.

- To select by the SW1 and SW2 switches the value upper that calculated according with the following table:

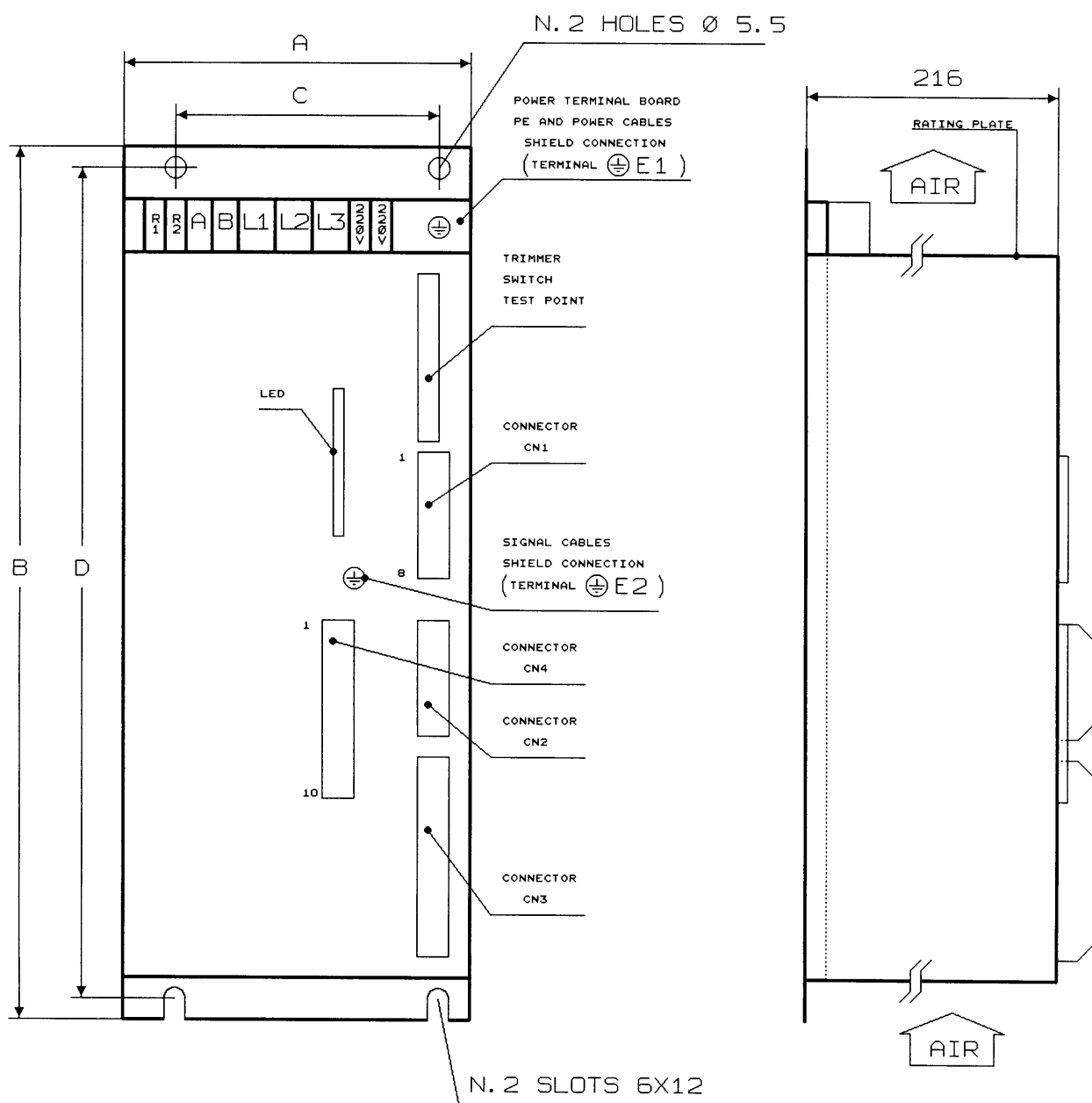
X	0 ÷ 1024	1025 ÷ 2048	2049 ÷ 4096	4097 ÷ 8192
SW1	ON	OFF	ON	OFF
SW2	ON	ON	OFF	OFF

ELETTROMAGNETIC COMPATIBILITY

About this subject please consult the instruction book 91/089.

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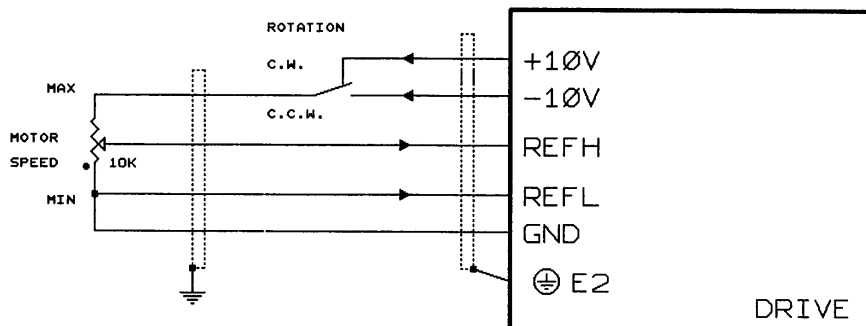
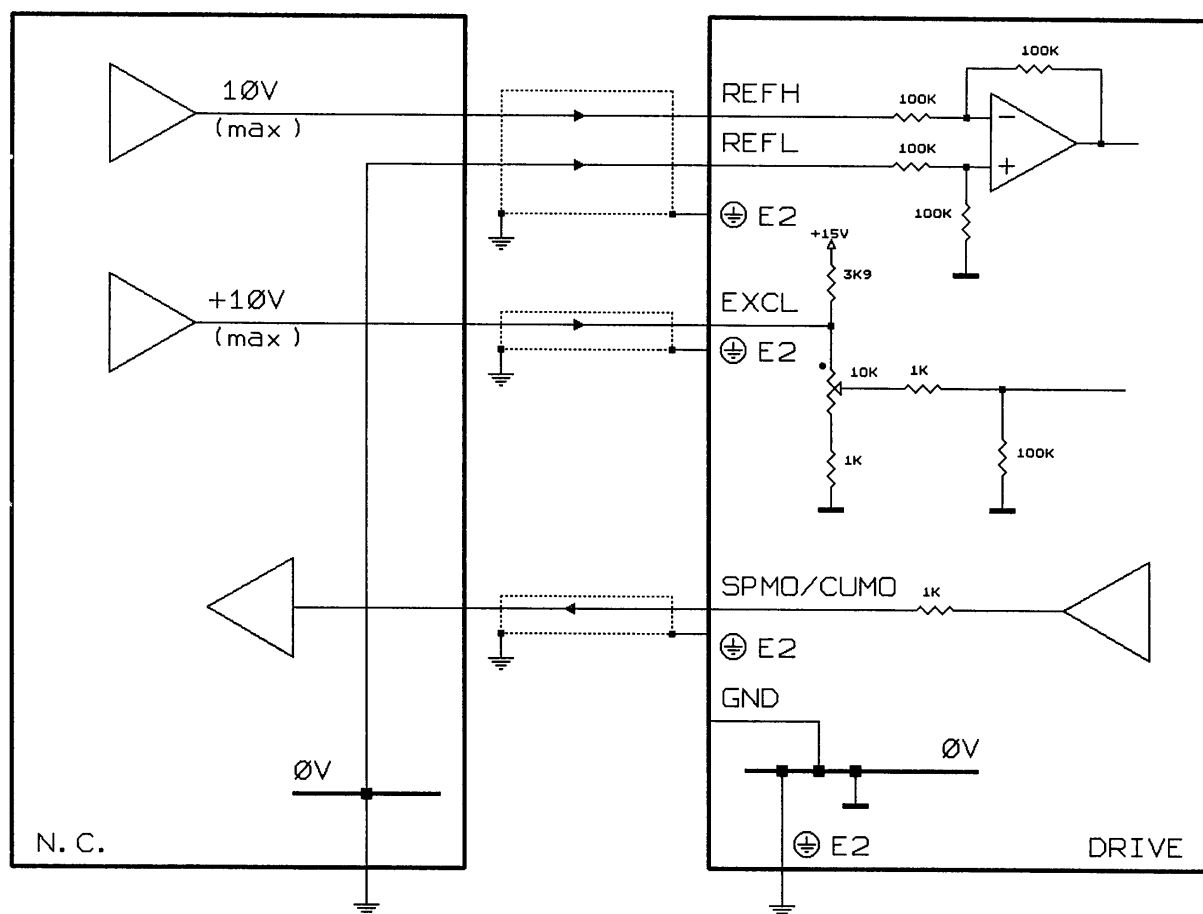
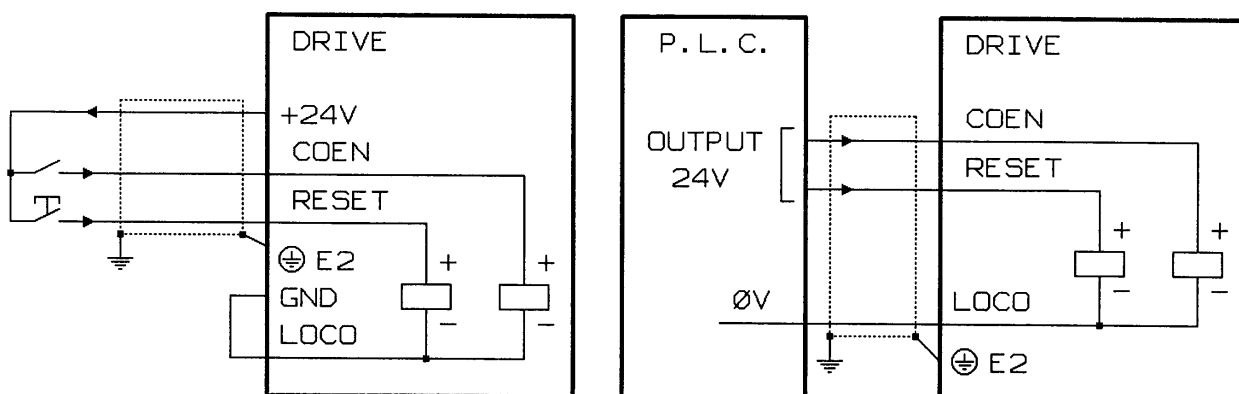
OUTLINE DIMENSIONS



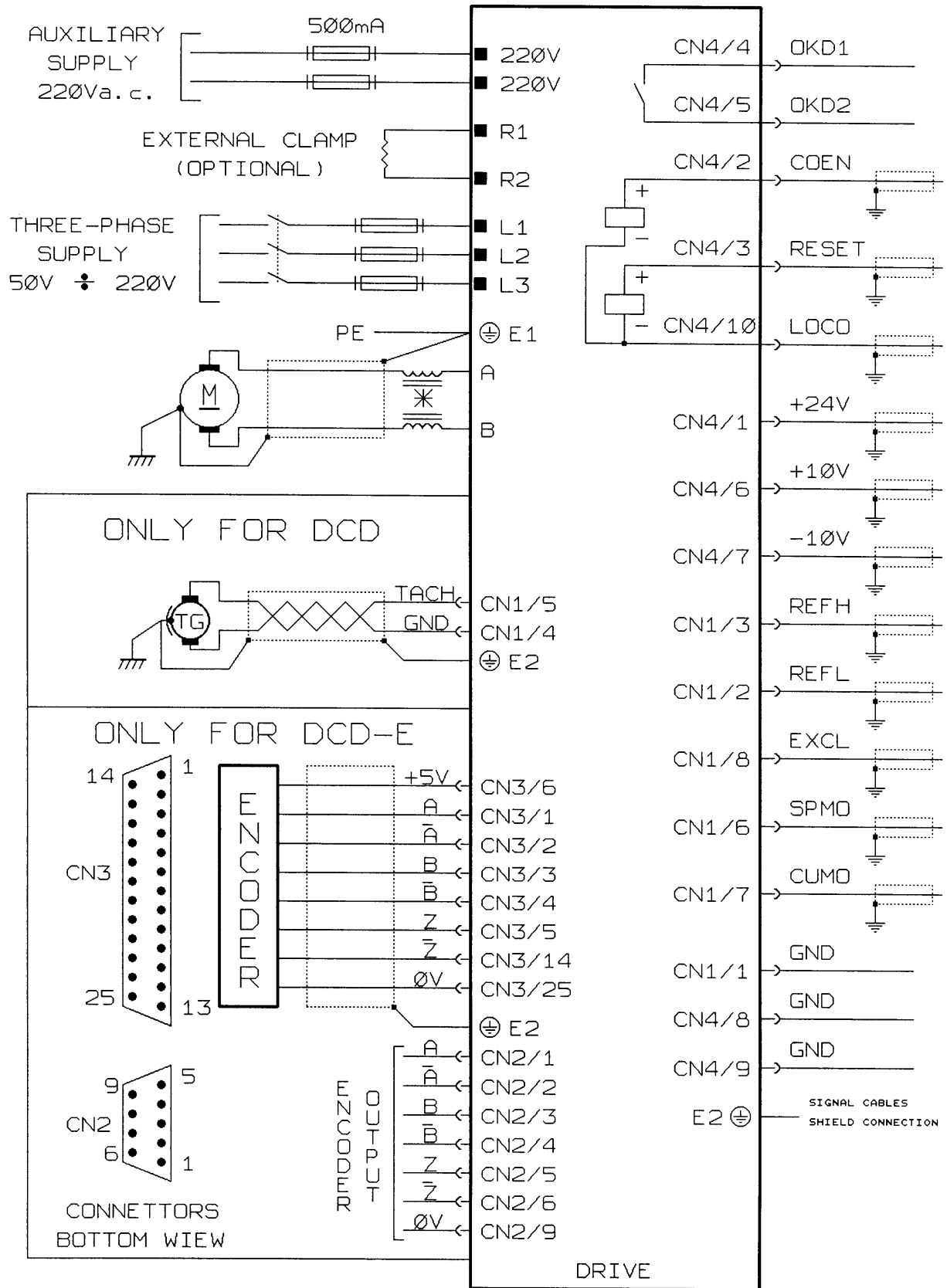
DIMENSION [mm]

SIZE	A	B	C	D	WEIGHT
1	95	310	72	297	4,5 Kg
2	150	383	110	370	8,5 Kg

CONNECTIONS EXAMPLES



OUTSIDE CONNECTIONS



* ONLY WITH MOTOR INDUCTANCE BELOW 1 mH