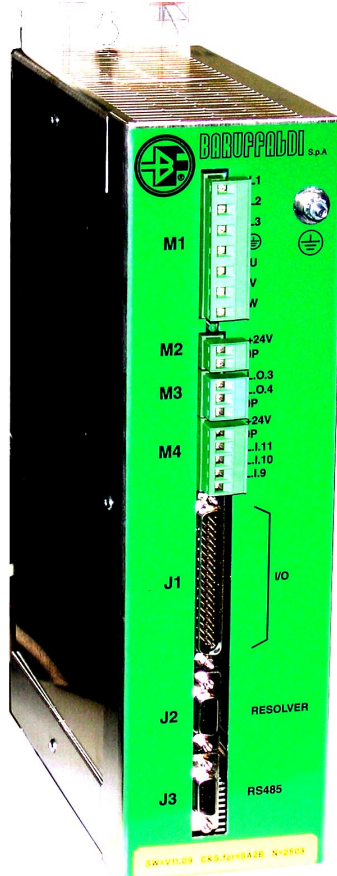


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**DRIVE INSTRUCTIONS  
MANUAL  
SA.02A.TB**





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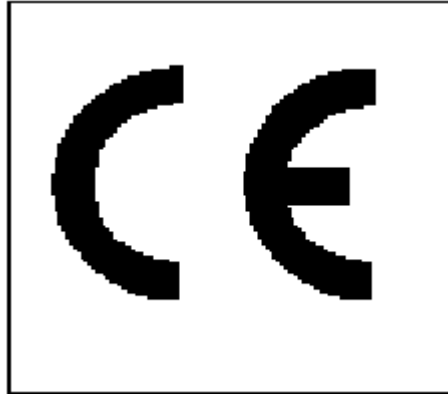


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## **1. GENERAL SAFETY INFORMATION**

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The Servo amplifier module complies with Low Voltage Directive CEE 73/23, modified by Directive CEE 93/98, and with relevant national reception laws.



Its design and manufacture are made according to articles of armonised regulation **EN60204-1**.

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### **1.1 Important Safety Rules**

System design and installation (start-up, maintenance and checks of the Servo amplifier module) must conform to accident prevention and safety regulations applicable to the specific case of application. In particular, among others, they must conform to:

CEI 64.8

consuming electrical plants with nominal voltage not higher than 1000V AC – 1500V DC

CEI EN 60204-1

Machinery Safety, Machine Electrical Equipment

CEI EN 60146-1-1



## 1.2 Cautions

- Read carefully the manual prior to installing and using the equipment
- The Company accepts no responsibility in case of improper uses of the equipment different from those prescribed by the manual
- No modifications or operations not foreseen by the manual are allowed without Manufacturer's express approval, which must be carried out by qualified personnel only. Failing that, Manufacturer accepts no responsibility on possible consequences, and warranty becomes void.
- Start-up and installation are allowed to qualified personnel only, who will be responsible for compliance to safety rules required by law.
- Within the specific use, applicable accident prevention rules must be complied with. Installation, wiring and opening of the Servo amplifier module must be performed in complete absence of power.
- The Servo amplifier module must be installed in contact-proof device with adequate IP protection level as required by regulations.
- The Servo amplifier module must be positioned so that maintenance can be easily performed, and so that danger of collision with moving parts is avoided.
- Sufficient ventilation must be guaranteed so as to allow venting of leakages.
- In case of fire nearby the Servo amplifier module, never use water based extinguishers.
- Prevent water and other fluids from seeping into the Servo amplifier module.
- Any intervention into the Servo amplifier module must be carried out after disconnecting from power supply.
- Due to the presence of condensers, allow at least 8 minutes before accessing the Servo amplifier module for interventions.
- Peel off protecting film before using the Servo amplifier module.



### 1.3 Anti-interference Tricks

Electric or electronic devices can interfere due to net or direct metallic connections. In order to reduce or eliminate interference, it is necessary to install the Servo amplifier together with adequate anti-interference devices.

If net is jammed, adequate measures must be taken in order to reduce jam: it is not possible anyway to give general instructions in this case.

Following warnings only refer to power mains free from interferences.

- Ensure that all devices within the panel are correctly grounded using short star connected wires. It is particularly important that all control devices connected to Servo amplifier, i.e. PLC, are connected to the same ground with short wires
- Servo amplifier must be fastened with screws and toothed gaskets in order to guarantee good electrical connection between external box and the metallic base which is connected to panel ground; if required, remove paint in order to guarantee good connection.
- For motor connection only use shielded wires and connect shield to earth both on Servo amplifier module side and on motor side. If use of shielded wires is not possible, motor wires should be laid into a metallic raceway connected to earth.
- Keep motor, Servo amplifier module and control connection wires well apart from each other.
- Lay control cables at least 10 metres away from any power cables running alongside. Also in this case, the use of a separate and earthed metallic raceway. If control cables have to cross power cables, keep a 90° crossing angle.
- In case RC or diode-flywheel groups for contactors coils, relays or other electromechanical switches are installed in the same cubicle as of Servo amplifier module, they must be installed on the connections of the coils themselves.
- Make all external connection, measurement and setting controls with shielded cables.
- Cables that can propagate interferences must be laid separately and at distance from Servo amplifier control cables.

If Servo amplifier module must operate in a noise-sensible environment, following measures must be taken in order to reduce transmitted interferences:

- adopt every available measure that may stop radiating emissions from cubicle such as earthing of metallic parts, limitation of holes on external surface, use of conductive gaskets.

## 2. INSTALLATION

### 2.1 Instructions for Servo amplifier module Installation

- Servo amplifier module must be installed in **vertical** position only. Sideways or horizontal placement should not be made, as in this way correct heat exhaustion is not guaranteed, and failures would occur.
- Good accessibility must be guaranteed to all controls.
- Smooth operations and life of Servo amplifier module rely on keeping temperature at all times within the operating range of 0°C to +45°C . Temperature should then regularly be checked.
- Relative air humidity must be kept below 90%, with no condensation.
- Servo amplifier module must be installed in a dust free and airy place. Avoid environmental conditions where aggressive gases are present as abrasive dusts, vapour, oil sprays or salty air can reduce device lifetime.

Fig. 1-Minimum distance (mm) to respect .

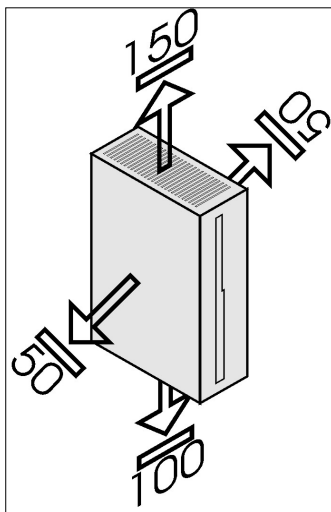
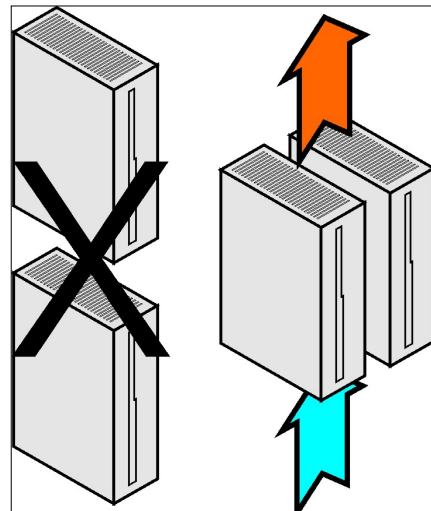


Fig. 2-The servo amplifiers must not be install in the venting flow of other devices.




Servo amplifier module must not be installed in a highly vibrating environment. Effective anti-vibration devices should be installed in case Servo amplifier module is placed onto a mobile equipment. In case of indoor installation, as cubicle, inner temperature should never exceed +45°C. Area should be adequately vented in order to eliminate excess heat originating from Servo amplifier module and other components.



## 2.2 Connection to Power net

In order to satisfy safety rules, connection to power net should be made in compliance with applicable electrical regulations. Connection to Servo amplifier module must be permanent and with cables of suitable section for the three phases, with clamps bearing

“L1-L2-L3-()” captions (screw).


**Connection to power net can be made using transformer or self-transformer. Triphase transformer/self-transformer must guarantee a 220V AC (+10% -15%) output and must have a power of 2KVA.**

In case of use of an existing transformer with Pmax higher than 6KVA or self-transformer with Pmax higher than 3.8KVA, it is necessary to add an external reactance capable of keeping an overall value of 1mH.

Example: if transformer power is 10KVA, its short-circuit impedance is approximately 0.6mH, therefore an external reactance of at least 0.4÷0.5mH should be added.

**WARNING: reactance must be dimensioned on a thermic current of 5A. Saturation current of reactance is 50A.**

## 2.3 Connection of Motor

- Connections must be made as shown in paragraph 3.3 and following. Choice of power cable must take into account motor absorbed power (see nameplate data) and current required by single Servo amplifier module calculated based on required power multiplied by 1.1 (current form factor) and on input voltage.
- Motor must be connected to clamps bearing U, V, W signs with earth cable connected to clamp bearing  symbol. A short-circuit of U, V, W causes stoppage of Servo amplifier module.
- In case of disconnection between motor and Servo amplifier module through electromagnetic switches (contactors, thermic relays, etc.), Servo amplifier module must be disabled before motor- Servo amplifier module connection is interrupted.
- Advance of Servo amplifier module stop?? can be simply obtain by simply setting opening delay of electromechanical devices; a minimum time of 30 ms is anyway required.

For protections choice it is required to refer to CEI 64-8/3 regulation requirements.

## 2.4 Servo amplifier module Grounding

Leaked current is that discharged by Servo amplifier module through grounding. Quantity of such current depends on wire length, on shielding, on motor and on PWM frequency value. Anti-interference filters can also increase current leakage. In order to avoid compatibility problems with other electromechanical equipment, grounding of Servo amplifier module should be made, wherever possible, with a dedicated cable having a section suited to nominal currents. Automatic cut-out device must be properly set. Servo amplifier module cannot operate without permanently earthed protection conductor.



## 2.5 Conductors and Fuses Selection

Selection of proper conductors sections and of fuses has been carried out following CEI EN 60204-1 rules, materials for copper conductors, B1 installation class. All data relevant to conductors sections and fuses sizes are recommended only. Local regulations must always be complied with.

**Fuses must be of quick or ultra-quick type only.**

Fuses (recommended size)		
Quick Fuses	A	10-20
Power Cables Diameter		
Power and Motor Cables	mm <sup>2</sup>	1.5
PE Protection Cables	mm <sup>2</sup>	1.5







**3. TECHNICAL CHARACTERISTICS OF SERVO AMPLIFIERS**

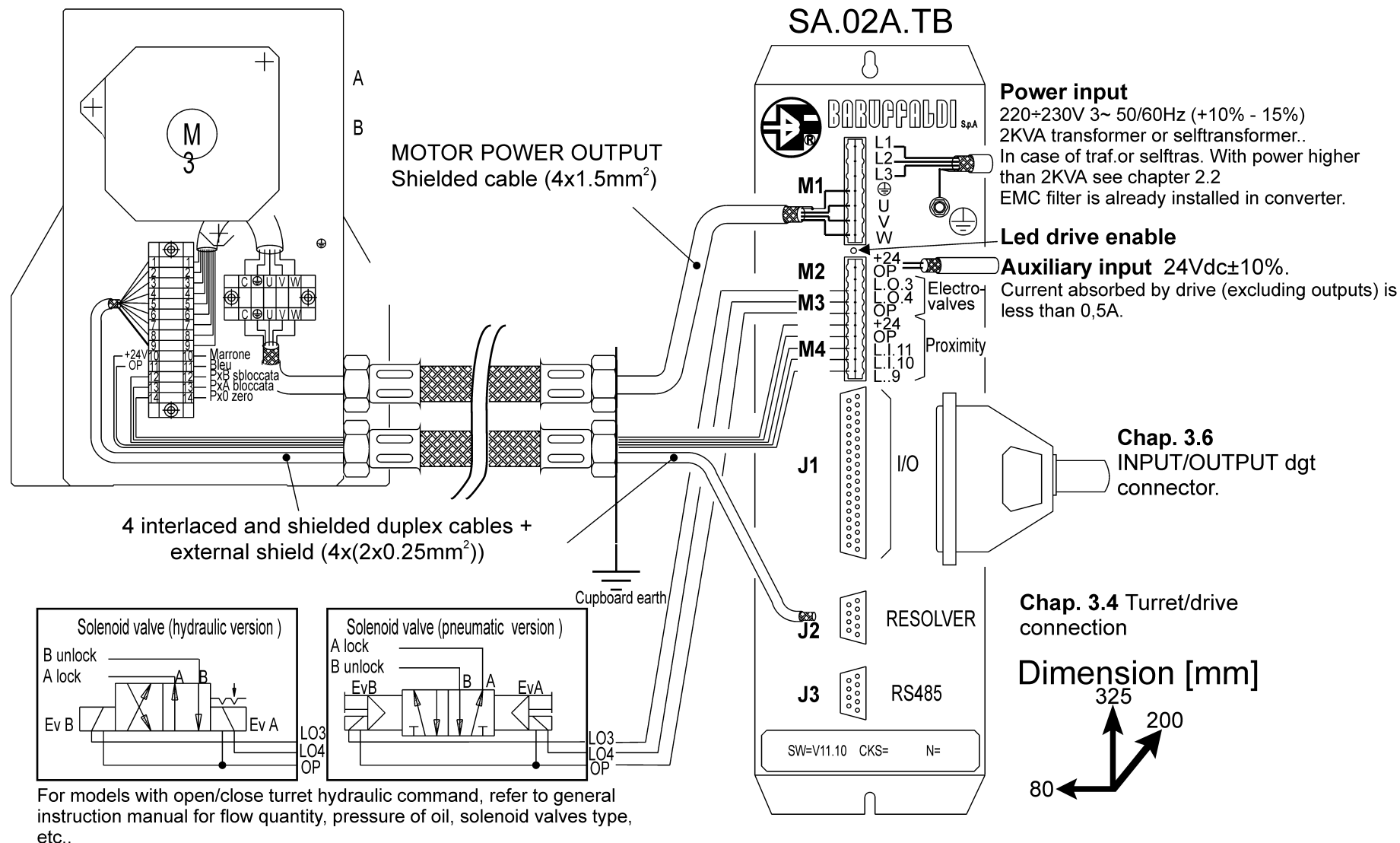
**3.1 Datasheet**

<b>Model</b>	<b>SA.02A.TB (GREEN)</b>	
<b>Dimension</b>		
Width	L	325
Height	H	200
Depth	D	80
Weight	Kg	~2Kg
<b>Motor side output</b>		
Nominal current	Arms	7
Effective peak current	Arms	14
Output voltage	V	$V_i \times 0.9$ (input tension $\times 0.9$ )
Output frequency	Hz	0 ÷ 400 Hz
Operating mode		Four quadrants (with integrated braking chopper)
<b>Power input</b>		
Triphase voltage	V	3X180÷240 Vac +10% / -15%
Power frequency	Hz	45 ÷ 65 ± 5%
Auxiliary voltage	V	24 Vdc ± 10%
<b>Environmental conditions</b>		
Working temperature	°C	0 ÷ 45
Storing temperature	°C	-10 ÷ +60
Humidity	%	Less than 90% with no condensation
Protection level	IP	20
<b>Coupled brushless motor</b>		
Model		B5602P – 01101 (resolver 5KHz) B5602P – 01102 (resolver 10KHz)
Output nominal current	Arms	3.4
Peak effective current	Arms	16.1



### 3.2 Configuration

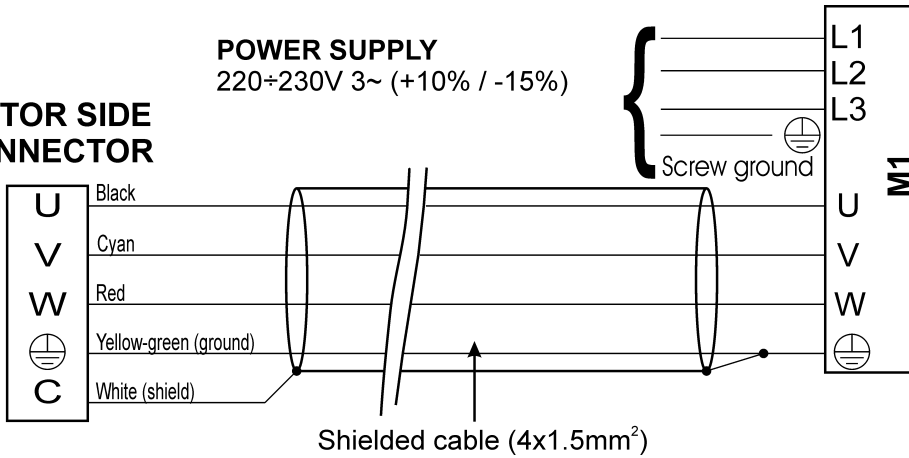
<b>M1</b>	<b>Power connector</b>		
	Power input	L1 – L2 – L3 –  (screw)	
	Motor power	U – V – W – 	
<b>M2</b>	<b>Auxiliary power connector</b>		
	Power input	+24Vdc OP	
<b>M3</b>	<b>Solenoid valves connector</b>		
	Unlocking command	LO 3	
	Locking command	LO 4	
	Common 0Vdc	OP	
<b>M4</b>	<b>Proximity switch connector</b>		
	Power +24Vdc	+24V	
	Common 0Vdc	OP	
	Proximity turret unlock	LI 11	
	Proximity turret lock	LI 10	
	Proximity ZERO	LI 9	
<b>J1</b>	<b>Logical I/O connector</b>		
	<b>Inputs</b>		
	Auxiliary power (secondary input)	Pin: 3(+24V) 5(OP)	
	Turret type selection	Pin: 19 37 18 12 30 36 Dec: 1 2 4 8 16 32	
	Operative mode selection	Pin: 17 35 16 Dec: 1 2 4	
	Position code	Pin: 33 14 32 13 31 Dec: 1 2 4 8 16	
	Parity check	Pin 34	
	Start command	Pin 15	
	<b>Outputs</b>		
	Turret in position	Pin 28	
	Turret lock	Pin 9	
	Alarms	Pin: 27 8 26 7 Dec: 1 2 4 8	
	<b>J2</b>	<b>Resolver connector</b>	
		Motor thermal switch	Pin: 1 – 2
Ref		Pin 3	
0 ref		Pin 4	
0 Cos		Pin 5	
Cos		Pin 6	
Sin		Pin 7	
0 Sin		Pin 8	
	Shield	Pin 9	
<b>J3</b>	<b>RS485 serial connector</b>		

**3.3 Topographical scheme of Turret/ Servo amplifier module /Solenoid Valves**




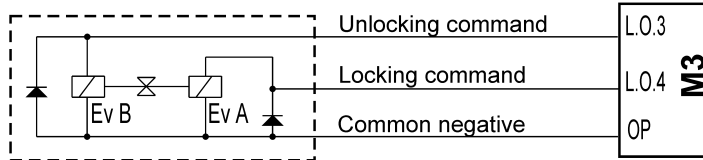
### 3.4 Turret / Servo amplifier connection

#### MOTOR SIDE CONNECTOR



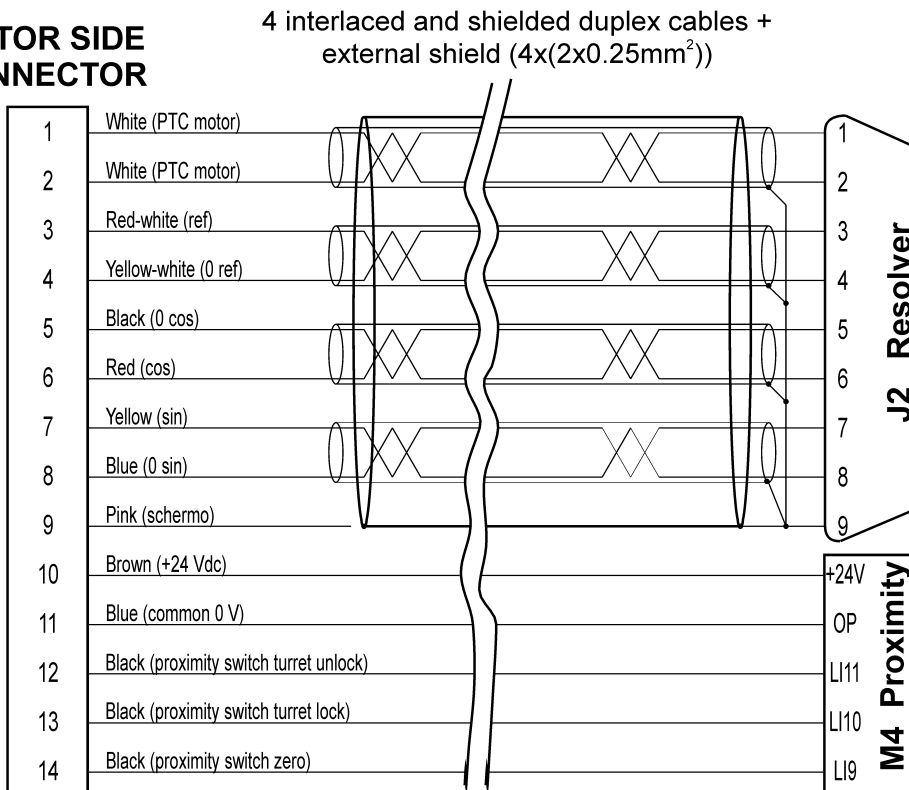
**WARNING!**  
Inversion of power input with motor output severely damages converter.

Solenoid valves  
Hydraulic or  
pneumatic  
circuit



24Vdc max 2.5A  
solenoid command  
outputs are  
protected from short  
circuit.

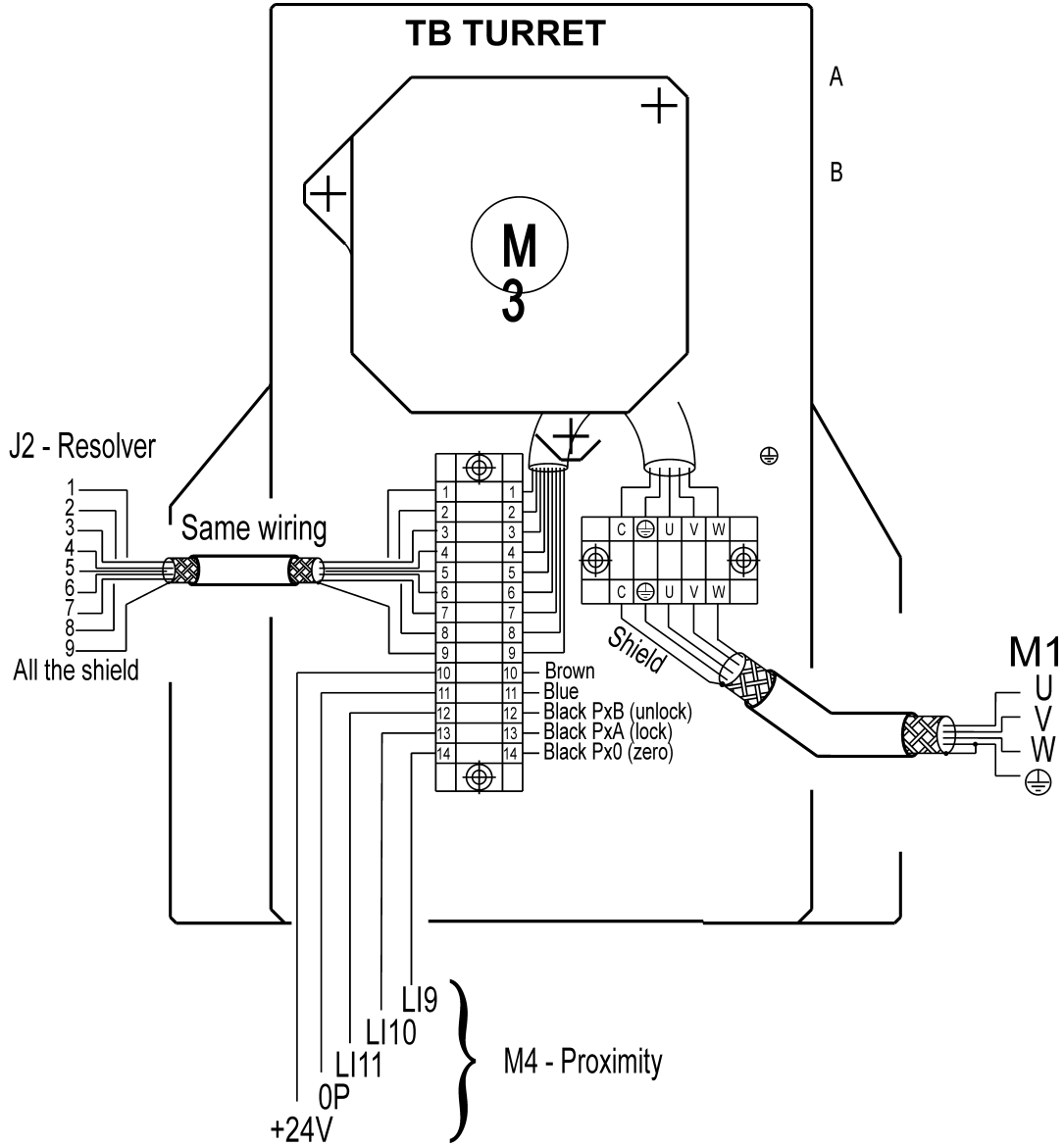
#### MOTOR SIDE CONNECTOR



\*Colour of motor wires are indicative only: identification numbers on wires are valid.



**3.5 On board turret electrical connections**

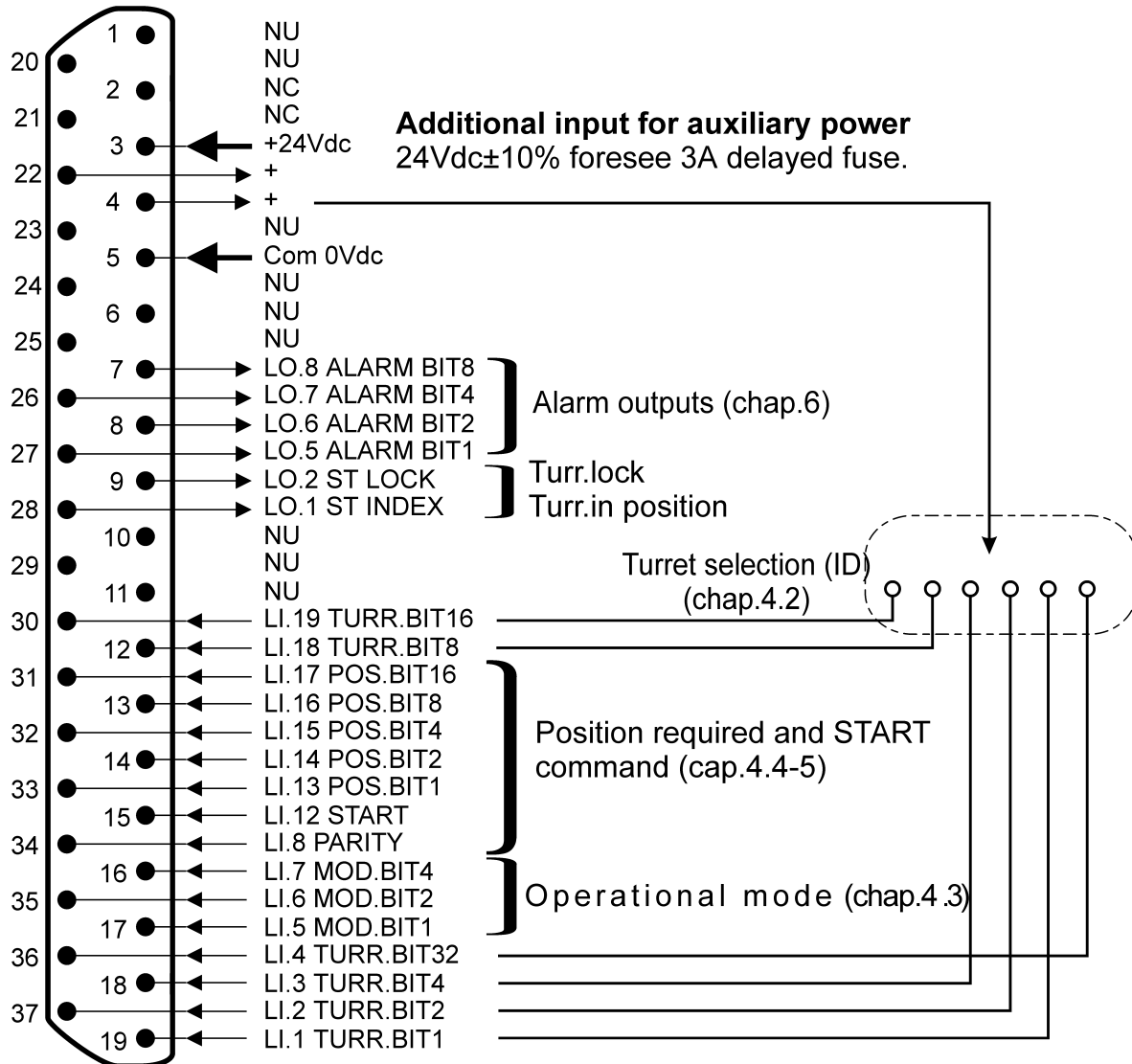


### 3.6 Digital INPUT/OUTPUT connector

Secondary input of auxiliary power (PIN3-5) can be used instead of primary input.

**Only use one single auxiliary power input:** it is suggested to use primary input (M2 connector) which also supplies +24V DC to pins 3-22-4 for turret selection.

#### J1-DB37



NC = not connected

NU = not use

24V ← LI.1÷19 DIGITAL INPUT

24V → LO.1÷8 DIGITAL OUTPUT

Optoisolated by internal regulation 24Vdc-max 100mA

All digital I/O are optoisolated and protected from short circuit.  
After a short circuit it is necessary to power off auxiliary supply in order to reset to working condition.



**4. PRINCIPLES OF OPERATIONS**

**4.1 Glossary**

For a better text comprehension, it is necessary to clarify the meaning of some terms:

**BINARY LOGICS:**

through female connector DB37 all information required to control the turret are transmitted in binary logics. The type of notation qualified as BINARY can represent any number using only two values, ZERO and ONE, for each digit. Position of digit indicates the power of 2 (1, 2, 4, 8, 16, 32, etc.) that it represents. If digit is not zero, represented number contains such power of 2; on the contrary, it does not.

Example, how no. 5 is represented in binary logics:

Decimal digit	5				
Dec value of 5 bit	$2^4=16$	$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$
Bit activation	0=OFF	0=OFF	1=ON	0=OFF	1=ON
Result	0+	0+	4+	0+	1

**BIT:**

is the smallest digital entity. It corresponds to a single binary digit and can only assume ZERO or ONE value. This reflects the state of the pins existing on the female connector, which can be powered or unpowered

**PARITY:**

This bit is used in order to guarantee that turret position called by CNC is actually the one received by servo amplifier module

**RESOLVER POSITION ACQUISITION:**

This procedure stores in the actuator the position of resolver in which turret is in mechanical position ONE.

**ZERO SEARCH (HOMING):**

This procedure sets turret in mechanical position ONE.

**CONSENT TO WORK:**

Servo amplifier transmits to CNC that called position is reached through outputs existing on connector J1:

ST INDEX – turret positioned

ST LOCK – turret locked

**CW (clock wise):**

Turret turns in the same direction as watch hands

**CCW (counterclock wise):**

Turret turns in opposite direction as of watch hands



### 4.2 Selection of Turret type

Turret type selection must be performed before switching the machine on, as actuator, once powered on, shall load all parameters relevant to the turret and to the dynamic profile (**ID**) suitable for the toolholder disk and tools used. Selection is performed by setting TURRET BITS existing in the female connector J1-DB37:

TURRET BIT						
Decimal value	1	2	4	8	16	32
PIN	19	37	18	12	30	36

After turret identification (if necessary refer to the plate placed on one side of the turret housing), make a jumper between +24V DC supply (taken from one of pins 3, 4, 22) and the TURRET BITS so that the sum of their decimal values represents turret type and required dynamic profile (**ID**).





**Selection of dynamic profile**

For each turret, different dynamic profiles (ID) can be set according to applicable inertia (number of positions foreseen, type of toolholder and tools used). Available dynamic profiles are shown in following table (values represent sums of turret bit).

For selection of correct profile please refer to table on following page.

<b>TB 120/160... MA/MR</b>				
POSITION	ESTIMATED INERTIA [Kgm <sup>2</sup> ]			
	0.15÷0.5	0.4÷1	0.15÷1	0.15÷1.5
8	1	5	33	37
12	0	4	32	36
16	9	13	41	45
24	8	12	40	44

} ID

<b>TB 200/250... MA/MR</b>				
POSITION	ESTIMATED INERTIA [Kgm <sup>2</sup> ]			
	0.4÷2.5	1.5÷3.5	1÷6	2÷8
8	3	35	7	39
12	2	34	6	38
16	11	43	15	47
24	10	42	14	46

} ID

<b>TB 320... MA/MR</b>		
POSITION	ESTIMATED INERTIA [Kgm <sup>2</sup> ]	
	7-25	10-40
8	17	49
12	16	48
16	19	51
24	18	50

} ID

<b>TB 400... MA/MR</b>		
POSITION	ESTIMATED INERTIA [Kgm <sup>2</sup> ]	
	20-70	30-100
8	21	53
12	20	52
16	23	55
24	22	54

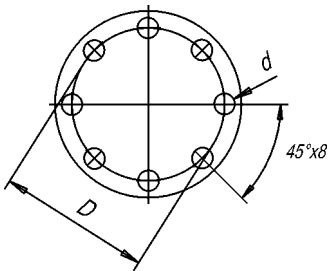
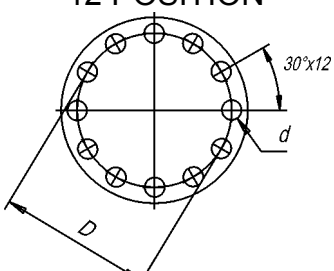
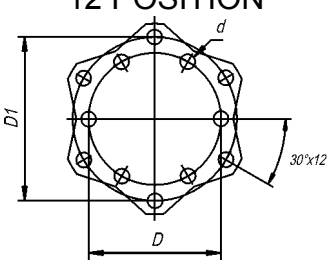
} ID

For applied inertia conditions sensibly different from those indicated in above table, it is possible to release customizations (please refer to BARUFFALDI representatives)



**Suggested Profile**

Pin field indicates the **PIN** number on female connector J1 that must be jumped with pin 4 (+24V DC) in order to select turret type and dynamic profile. **ID** field is result of sum of turret bits.

CONFIGURATION	TB-TBMA 120/160				TB-TBMA 200/250					
	D mm	d mm	PIN	ID	D mm	d mm	PIN	ID		
<b>8 POSITION</b> 	225	20	19	1	340	40	19+37	3		
	225	30	19	1	340	50	19+37+36	35		
	240	20	19	1	380	40	19+37+36	35		
	240	30	19+18	5	380	50	19+37+18	7		
	270	30	19+18	5	400	50	19+37+18	7		
	270	40	19+18+36	37	445.5	50	19+37+18	7		
<b>12 POSITION</b> 	D mm	d mm	PIN	ID	D mm	d mm	PIN	ID		
	225	20	---	0	340	40	37	2		
	240	20	---	0	380	40	37+36	34		
	270	30	18	4	400	50	37+18	6		
300	30	18+36	36	445.5	50	37+18+36	38			
<b>12 POSITION</b> 	D mm	D1 mm	d mm	PIN	ID	D mm	D1 mm	d mm	PIN	ID
	225	305	20	18	4	340	400	40	37	2
	270	335	30	18+36	36	400	460	40	37+18	6
						400	460	50	37+18	6



CONFIGURATION	TB-TBMR 120/160				TB-TBMR 200/250			
	CH mm	d mm	PIN	ID	CH mm	d mm	PIN	ID
<b>8 POSITION</b> 	224	20	19	1	320	40	19+37	3
					380	50	19+37+18	7
<b>12 POSITION</b> 	224	20	---	0	320	40	37	2
	270	30	18+36	36	380	50	37+18	6
					420	50	37+18+36	38



CONFIGURATION	TB- TBMA - TBMR 320				TB- TBMA - TBMR 400					
	CH mm	d mm	PIN	ID	CH mm	d mm	PIN	ID		
<b>8 POSITION</b> 	490	60	19+30	17	500	60	19+18+30	21		
	490	80	19+30+36	49	620	80	19+18+30+36	53		
<b>12 POSITION</b> 	490	60	30	16	500	60	30+18	20		
	620	80	30+36	48	620	80	30+18+36	52		
	490	570	60	30	16	490	570	60	30+18	20
	620	720	80	30+36	48	620	720	80	30+18+36	52



### 4.3 Descriptions of Operational Modes

Mode selection is performed through setting MOD BITS existing on female connector J1.

MODALITY BIT			
Decimal value	1	2	4
PIN	17	35	16

Foreseen operational modes are following:	N° PIN		
	17	35	16
	1	2	4
0 – Reset/Emergency	0	0	0
1 – Automatic positioning in shortest way	1	0	0
2 – Automatic positioning with forced rotation CW	0	1	0
3 – Automatic positioning with forced rotation CCW	1	1	0
4 – Recall of next / previous tool	0	0	1
5 – Service operations	1	0	1
6 – Self test	0	1	1
7 – Resolver position acquisition	1	1	1

0=OFF / 1=ON (+24Vdc)

### Automatic Positioning Modes

Only after performing ZERO SEARCH it is possible to call a position choosing among modes of rotation available:

- Mode 1 – shortest way
- Mode 2 – forced CW rotation
- Mode 3 – forced CCW rotation
- Mode 4 – rotation to next position CW or CCW

For turrets type TB320 and TB400, rotation is inverted.

Minimum time between two positions called is 4 seconds.

Changing positioning operational mode it is not necessary to execute a new ZERO SEARCH.

During the change of operational mode ensure that MOD BITS are not kept powered off for a ≥200ms interval; otherwise a RESET would be made and ZERO reference would be lost (see example in par. 5.4).

Reaching of called position is transmitted to CNC by activating following outputs:

- Turret positioned ST INDEX (J1-PIN28)
- Turret locked ST LOCK (J1-PIN9)



### **Mod. 0 – Reset/Emergency**

When all MOD BITS are disabled, zero operational mode is performed. It can have two different meanings depending on situation:

**RESET** – resets active alarm.

For signal validation all bits must be disabled for 300ms.  
The output ST INDEX and ST LOCK are disabled.

**EMERGENCY** – stops immediately turret rotation.

After executing a RESET/EMERGENCY, ZERO SEARCH is required in order to call new position.

### **Mod. 1 – Zero Search and Quick Automatic Positioning**

Setting pin 17 to +24V DC an automatic operational mode is selected which allows to:

- Execute a ZERO SEARCH
- Reach a position in the shortest possible way

ZERO SEARCH is needed in order to call a position

It must be performed:

- Upon machine power-on
- Anytime actuation auxiliary power (24 V DC) is interrupted
- Following a RESET/EMERGENCY mode

After performing a ZERO SEARCH, outputs ST INDEX and ST LOCK are activated, and turret will be positioned at mechanical position ONE.

### **Mod. 2 – Automatic Positioning with CW Forced Rotation**

After a ZERO SEARCH, setting pin 35 to +24V DC forced rotational mode is selected: turret will be positioned as required through counterclockwise rotation

### **Mod. 3 – Posizionamento automatico con rotazione forzata CCW**

After a ZERO SEARCH, setting pin 17 and 35 to +24V DC forced rotational mode is selected: turret will be positioned as required through counterclockwise rotation.

### **Mod. 4 – Call for Next/Previous Tool**

After a ZERO SEARCH, setting pin 16 to +24V DC operational mode FOUR is selected, which allows to recall next/previous position. Following each START command, turret will move to next position in the rotational direction as determined by:

- Setting of position ONE: next CW position will be reached
- Setting of position TWO: next CCW position will be reached



**Mod. 5 – Service Operations (no Zero Search executed)**

Setting pins 17 and 16 to +24V DC a multi purpose operational mode is selected.

Different operations can be obtained through activation of positioning bits as follows:

		POS BIT				DESCRIPTION
PIN	33	14	32	13		
BIT	1	2	4	8		
STATE	1	0	0	0	Continuous rotation CW - fast	
	0	1	0	0	Continuous rotation CCW - fast	
	0	0	1	0	Turret locking command	
	0	0	0	1	Turret unlocking command	
	1	0	1	0	Continuous rotation CW - slow	
	0	1	1	0	Continuous rotation CCW - slow	

0=OFF / 1=ON

**Continuous rotation**

Following a START command, turret will unlock and start to rotate quickly and continuously in the direction as determined by position setting:

- ONE, quick CW rotation
- TWO, quick CCW rotation
- FIVE, slow CW rotation
- SIX, slow CCW rotation

In order to stop rotation, Mode 0 – EMERGENCY must be set.

**Turret locking/unlocking**

Locks and unlocks turret.

**Mod. 6 – Self-Test**

Setting pins 16 and 35 to +24V DC, self-test mode is set. Simulation of a continuous working cycle in accordance to selected turret is performed.

Sequence of operations to be carried out in order to launch self-test is:

- Set Mode 6
- Input a START command

Will automatically follow:

- RESET
- ZERO SEARCH
- Sequential call of several positions with 5 second pause gaps.

Stop the cycle by setting Mod.0-Reset.

In case of alarm, the cycle will automatically interrupt.

## Mod. 7 – Resolver Position Acquisition

Setting pins 16, 17 and 35 to +24V DC, resolver position acquisition mode is selected. This procedure stores in the actuator the position of resolver in which turret is in mechanical position ONE. If this mode is not correctly executed, it will not be possible to call any position.

**This operation is implemented in factory and is to be repeated only in following cases:**

- Replacement / disassembly of brushless motor
- Replacement of servo-amplifiers

Operations to be carried out in order to execute this procedure are:

- Set all MOD BITS to ON
- Input one START command  
[turrets unlocks]
- Manually move turret to mechanical position 1
- Input one START command  
[turrets locks]

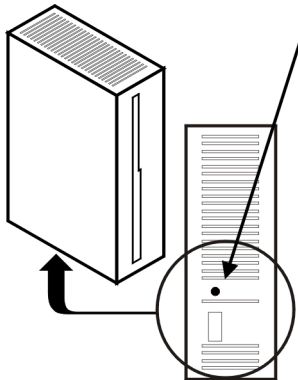
After about 5 seconds, in case operation is successfully completed, ST LOCK output is activated.

Then:

- Switch machine off or execute a RESET command
- Verify correct operations with a ZERO SEARCH command

## Alternative procedure for acquisition of resolver position through button

The drive is built with a button, located on the bottom side, which allows to execute manually the acquisition of resolver position.



### Resolver position acquisition button

1. The turret must be connected with the motor and no alarms should be active.
2. Manually move the turret to mechanical position 1 and check correct locking.
3. Power on drive +24Vdc.
4. Push button for at least 10 seconds.
5. Verify if operation is successfully completed executing a ZERO SEARCH.

View of drive bottom side





### 4.4 Selection of Required Position

Selection of required position is performed by setting POS BITS on J1 (DB37) connector with parity bit as safety feature.

POSITION BIT + PARITY						
Decimal value	1	2	4	8	16	PARITY
PIN	33	14	32	13	31	34

PIN	33	14	32	13	31	34
Rif.Dec	1	2	4	8	16	P
0	0	0	0	0	0	0
1	1	0	0	0	0	1
2	0	1	0	0	0	1
3	1	1	0	0	0	0
4	0	0	1	0	0	1
5	1	0	1	0	0	0
6	0	1	1	0	0	0
7	1	1	1	0	0	1
8	0	0	0	1	0	1
9	1	0	0	1	0	0
10	0	1	0	1	0	0
11	1	1	0	1	0	1
12	0	0	1	1	0	0

PIN	33	14	32	13	31	34
Rif.Dec	1	2	4	8	16	P
13	1	0	1	1	0	1
14	0	1	1	1	0	1
15	1	1	1	1	0	0
16	0	0	0	0	1	1
17	1	0	0	0	1	0
18	0	1	0	0	1	0
19	1	1	0	0	1	1
20	0	0	1	0	1	0
21	1	0	1	0	1	1
22	0	1	1	0	1	1
23	1	1	1	0	1	0
24	0	0	0	1	1	0

0=OFF / 1=ON

### 4.5 START Command and Signals Sequence

Every action is started by START command.

START signal (pin 15 on J1 connector) must be:

- Of impulsive kind
- With duration of 50 to 200ms (100ms recommended)
- dato Given with a delay of at least 50ms from required position setting.

### 4.6 Recall of Same Position

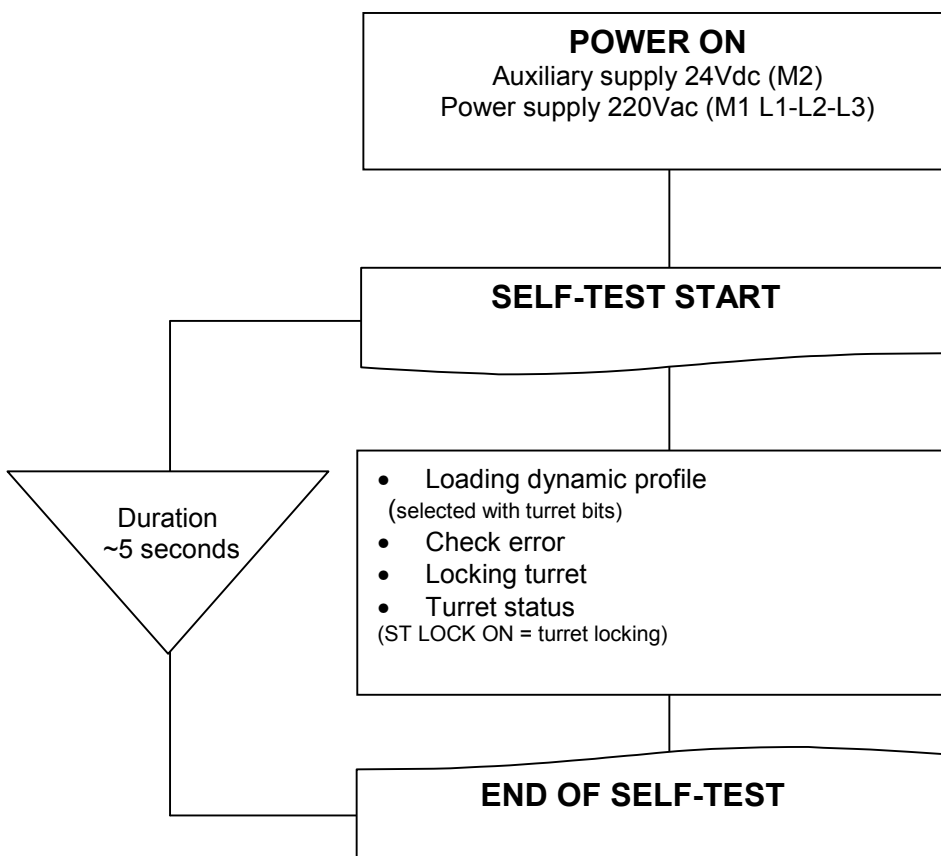
When actual position of the turret is again called, ST INDEX and ST LOCK outputs are reset for 500ms (turret is not unlocked).

## 5. EXAMPLES ON SERVO AMPLIFIER CONTROL

### 5.1 Switch on

Turret selection must be performed before switching the machine on.

Upon switch on (+24V DC) Servo amplifier performs self-test for about 5 seconds: during this phase, it is convenient that MOD BITS are all kept deactivated. During self-test, turret locking solenoid valve is activated and turret state is indicated by ST LOCK output.



### WARNING

During this phase it is convenient that MOD BITS are set to 0Vdc (RESET condition)

In case after the test ST LOCK is OFF and the turret is unlocked or not completely locked, check the correct operation and wiring of hydr/pneum. Circuit and the correct alignment of the turret.



### 5.2 ZERO Search

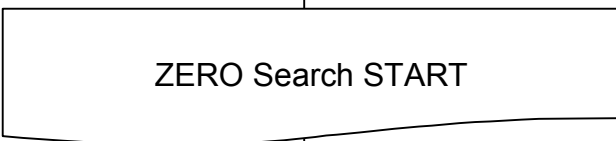
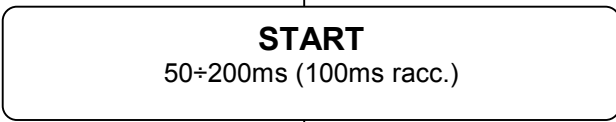
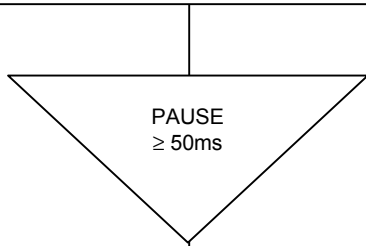
After completion of power on phase, before calling a position it is necessary to execute a ZERO SEARCH.

ZERO SEARCH can be performed by setting:

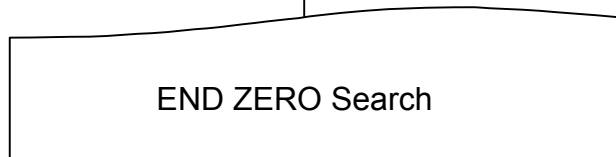
- Operational mode      MOD BIT 1=ON
- ZERO position          all POS BITS=OFF
- PARITY                  OFF

After ZERO SEARCH, the turret will be in mechanical position 1.

ZERO Search	
MOD BIT	1 → ON
	2 ----- OFF
	4 ----- OFF
POS BIT	1 ----- OFF
	2 ----- OFF
	4 ----- OFF
	8 ----- OFF
PARITY	----- OFF



- Signal checking
- Turret unlocking sequence
- Rotation
- Turret locking sequence
- Position check
- **CONSENT (ST INDEX and ST LOCK ON)**



### WARNING

**It is possible to execute ZERO SEARCH with unlocked turret too.**

Failing to observe pauses or signal durations can compromise the correct execution of ZRO SEARCH.

Detailed process:

SIGNAL CHECK

-Defence from electromagnetic interferences

-Check of position code

TURRET UNLOCKING/LOCKING

Solenoid valve unlocking and locking commands last until activation of relevant proximity sensor.

ROTATION(\*)

Firstly in counterclockwise (CCW) rotation up to ZERO proximity sensor, then inversion and stop in ZERO position

During search, turret rotate at reduced speed. In mechanical position ONE, ZERO proximity sensor is off.

POSITION CHECK

During this phase, angular position is checked through reading of resolver.

Following turret locking, final position reached is checked again.

POSITIONING OUTCOME

ST INDEX and ST LOCK outputs indicate the reaching of respectively called position and turret locking. ST INDEX is activated after rotation and turret locking command is simultaneously sent to solenoid valve. ST LOCK is activated with locked turret, after final check of reached position.

(\*)For TB320 and TB400 sizes rotation is inverted.



### 5.3 Recall a position in Mode-1

After execution of ZERO SEARCH, it is possible to call a position by selecting the appropriate mode. Most commonly used mode is Mode 1-Auomatic shortest way.

TURRET STATE AFTER ZERO SEARCH	
MOD BIT	1 → ON
	2 ----- OFF
	4 ----- OFF
POS BIT	1 ----- OFF
	2 ----- OFF
	4 ----- OFF
	8 ----- OFF
PARITY	----- OFF
ST INDEX	→ ON
ST LOCK	→ ON

**WARNING**

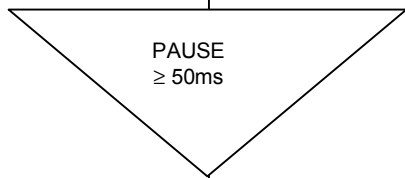
Both the output ST INDEX and ST LOCK are reset after 30ms from START command

When the same position is called again ST INDEX and ST LOCK are reset for 500ms and then activated again.

Setting of operational mode and the next position code can be made simultaneously.

(\*For TB320 and TB400 sizes rotation is inverted.

NEXT POSITION REQUIRED	
MOD BIT	1 → ON
	2 ----- OFF
	4 ----- OFF
POS BIT	1 → ON
	2 → ON
	4 → ON
	8 ----- OFF
PARITY	→ ON



**START**  
50÷200ms (100ms racc.)

START SEQUENCE

- Signal checking
- Turret unlocking sequence
- Rotation
- Turret locking sequence
- Position check
- **CONSENT (ST INDEX and ST LOCK ON)**

END POSITIONING



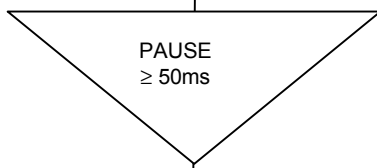
### 5.4 Recall of a Position Changing Operational Mode

According to following chart, selection of operational mode 2 is performed after ZERO SEARCH, indicating the correct sequence of operations.

TURRET STATE AFTER ZERO SEARCH	
MOD BIT 1	→ ON
2	----- OFF
4	----- OFF
POS BIT 1	----- OFF
2	----- OFF
4	----- OFF
8	----- OFF
PARITY	----- OFF
ST INDEX	→ ON
ST LOCK	→ ON

OPERATIVE MODE 2	
ON	mod bit 2 [+24Vdc pin35]
OFF	mod bit 1 [0Vdc pin17]

NEXT POSITION REQUIRED	
MOD BIT 1	----- OFF
2	→ ON
4	----- OFF
POS BIT 1	→ ON
2	→ ON
4	→ ON
8	----- OFF
PARITY	→ ON



**START**  
50÷200ms (100ms racc.)

START SEQUENCE

- Signal checking
- Turret unlocking sequence
- Rotation
- Turret locking sequence
- Position check
- **CONSENT (ST INDEX and ST LOCK ON)**

END POSITIONING

### WARNING

#### CHANGE OPERATIVE MODE

In case of reach of called position should be obtained with forced rotation (Mod-2 and 3) or "Jog" (Mod-4) is to be used, **during mode setting phase it is necessary that mode bits are not left at 0Vdc for a time ≥ 200ms**; in this case a reset would be performed.

Within the sequence shown, Mod bit 1 is reset (OFF) only after activation (ON) of Mod bit 2.

(\*)For TB320 and TB400 sizes rotation is inverted.



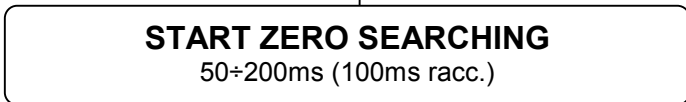
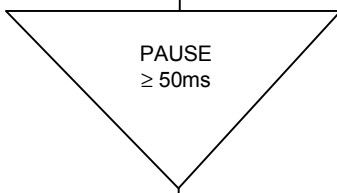
### 5.5 Alarm Condition

Following example indicates the correct operations to be carried out in presence of an alarm.

TURRET ALARM STATE	
MOD BIT	1 ----- OFF
	2 ----- → ON
	4 ----- OFF
AL BIT	1 ----- → ON
	2 ----- OFF
	4 ----- → ON
	8 ----- OFF
<b><u>ALL.5 – LOCKING ERROR</u></b>	
ST INDEX	----- OFF
ST LOCK	----- OFF

RESET	
MOD BIT	1 ----- OFF
	2 ----- OFF
	4 ----- OFF
<b><u>LENGHT ≥300ms</u></b>	
AL BIT	1 ----- OFF
	2 ----- OFF
	4 ----- OFF
	8 ----- OFF

ZERO SEARCH SETTING	
MOD BIT	1 ----- → ON
	2 ----- OFF
	4 ----- OFF
POS BIT	1 ----- OFF
	2 ----- OFF
	4 ----- OFF
	8 ----- OFF
PARITY	----- OFF
OUTOUT STATUS	
AL BIT	1 ----- OFF
	2 ----- OFF
	4 ----- OFF
	8 ----- OFF
ST INDEX	----- OFF
ST LOCK	----- OFF



### WARNING

Turret has reached position but has not completed locking sequence because, after 9.5" from solenoid valve closing command, proximity sensor signal of locked turret (LI.10) is not present, then the alarm is activated.

In case of alarm, situation must be kept as is, that is mode bit must not reset or otherwise alarm would be reset making failure detection impossible.

In case of alarm ST INDEX and ST LOCK outputs are disabled.

Anytime an alarm occurs, in order to restart it is necessary to execute a "RESET" Mod bit under 0Vdc for at least 300ms.

Setting all MOD BITS to 0Vdc, all active alarms are reset.

The alarm activation disables the motor supply: motor stop could not be prompt because the bus is still charged.

## 6. TROUBLESHOOTING

### 6.1 Coded Alarms

The 9 alarms foreseen by actuator are transmitted to CNC in binary logics through the 4 pins existing in J1 connector:

ALARM BIT				
Decimal value	1	2	4	8
PIN	27	8	26	7

Alarm	Description	Possible reasons
<b>1</b>	Power is no connected to L1-L2-L3 inputs of Servo amplifier (unlocked turret).	Check with multimeter that voltage at L1-L2-L3 is 190÷230V AC and that connector is correctly inserted
Power fault	Alarm becomes inactive during rotation.	Undervoltage can occur when power of transformer is not enough to support loads
<b>2</b>	Voltage in intermediate circuit has raised sweeply because of an eccessive regenerative energy originating from motor, for example during breaking.	Check the setting of correct turret. Check with multimeter that voltage at L1-L2-L3 is within indicated range (220 +10%/-15%). If problem continues check Manufacturer.
Maximum voltage		
<b>3</b>	Motor temperature gauge (PTC gauge) signals an excess temperature of coils.	Be sure that temperature in motor area falls within the range allowed by technical specifications. If everything is right and still the alarm persists, check gauge wiring (J2)
Motor PTC		
<b>4</b>	-After 9.5" from unlocking command (LO3), unlocked turret signal from proximity sensor (LI11) is not present -Both proximity sensors are present -Lost of signal during rotation	Check with multimeter that proximity sensor outputs are not in short circuit and that voltage is present between <b>LI11</b> and <b>OP</b> . Lift turret upper cover and check that switching has occurred. Check hydraulic/Pneumatic circuit integrity. Ascertain that solenoid valve receives command
Unlocking error		
<b>5</b>	- After 9.5" from locking command (LO4), locked turret signal from proximity sensor (LI10) is not present - Both proximity sensors are present - Lost of proximity sensor signal during operations	Check with multimeter that proximity sensor outputs are not in short circuit and that voltage is present between <b>LI10</b> and <b>OP</b> . Lift turret upper cover and check that switching has occurred. Check hydraulic/Pneumatic circuit integrity. Ascertain that solenoid valve receives command
Locking error		
<b>6</b>	After positioning, turret position is different from called one. The same in case of ZERO SEARCH.	Check that turret setting (turret bit) corresponds to size and number of positions foreseen by your turret. Contact Manufacturer
Positioning error		
<b>7</b>	Turret has not reached called position within 30" from calling. The same in case of ZERO SEARCH	Check correct operation of ZERO proximity sensor. Check wiring of power cables (M1: U-V-W and J2: resolver). Contact Manufacturer
Time out rotation		
<b>8</b>	Incoherent reading of resolver.	Check that reselver connector is well connected, that wires are not interrupted and that connection is carried out according to layout.
Resolver failure		
<b>9</b>	Position call is wrong. A non-existing position has been called or parity code is not handled properly.	Check correct setting of position code (position bit and parity). Check connection J1 – LI8 pin 34
Parity error		



## 6.2 Troubleshooting

MALFUNCTIONING	POSSIBLE REASONS		CHECKS AND SOLUTION
<b>Turret doesn't lock/unlock</b>	No or low pressure in the circuit.		Verify hidraulic/pneumatic circuit integrity
	Solenoid valve damaged		Verify correct operation
	No command is sent by solenoid valve		After input of command, check on M2 voltage between L0.3 and OP and L0.4 and OP. Check wiring.
	Alarm is shown		See previous page.
<b>Motor does not rotate</b>	No correspondence between U-V-W servo amplifiers and U-V-W motor		Check the state of contactors placed downstream the servo amplifier wich may cut supply to motor
	Resolver cable is not correctly wired		Check wiring
	Alarm is shown		See previous page.
<b>During ZERO search motor continues to rotate</b>	The drive does not recognize zero proximity sensor signal		Check correct operation of proximity sensor between Li.9 and OP on M3. Check wiring.
	Alarm is shown		See previous page.
<b>After rotation turret stops in wrong position</b>	During ZERO search	Zero proximity sensor has lost its setting	Make new setting of proximity sensor and cam referring to <i>general Tb manual" chapter 3.12-13</i>
		Resolver position is not correctly.	Make again resolver position acquisition procedure (chapter. 4 page.19)
		Alarm is shown	See previous page.
	During positioning	Turret selection is wrong	Check turret type setting (ID) chapter.4.2
		Resolver position is not correctly	Make again resolver position acquisition procedure (chapter. 4 page.19)
		Alarm is shown	See previous page.