LINEAR SERVOACTUATORS

SA (SA, SA-IL, SA-PD Versions)
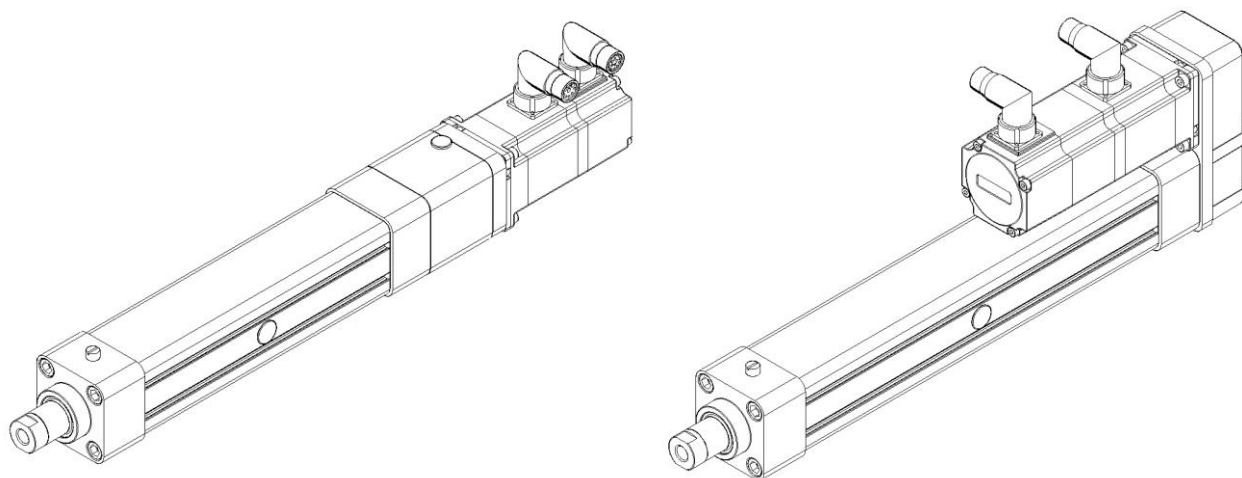
Installation, Use and Maintenance Manual

⚠ WARNINGS

This manual should be considered as product element; it includes information for a proper actuator installation, set and maintenance.

Servomech S.p.A. does not assume responsibility for actuator misuse, not complying performances and limits indicated on our catalogue.

Any operation for actuator installation, use and maintenance done not fulfilling all prescription mentioned on this manual, voids warranty conditions and Servomech S.p.A. cannot be held liable for injuries and damages.

What follows affect product safety, leading to risks for goods damages and people injuries:

- Any product modifications;
- Any part integration on our product, not previously studied and agreed with Servomech S.p.A.;
- Non-original spare parts use.

This voids warranty conditions and responsibility of Servomech S.p.A. immediately decays.

Servomech S.p.A. and its authorized distributors are at customer's disposal to provide, during design process, the technical support for proper actuator selection and application.

Servomech S.p.A. reserves the right to make changes and/or improvements in products, catalogs and manuals without notice.

SA LINEAR SERVOACTUATORS (SA, SA-IL, SA-PD versions)
Installation, Use and Maintenance Manual

Contents

1   MODELS COVERED BY THIS DOCUMENT

This manual covers following products:

- Actuators series SA: SA0, SA1, SA2, SA3, SA4, SA5, SA6
- Servo-actuators SA IL series: SA 0 IL, SA 1 IL, SA 2 IL, SA 3 IL, SA 4 IL, SA 5 IL, SA 6 IL
- Servo-actuators SA PD series: SA 0 PD, SA 1 PD, SA 2 PD, SA 3 PD, SA 4 PD, SA 5 PD, SA 6 PD

2   MANUFACTURER AND PRODUCT IDENTIFICATION

2.1   Manufacturer identification

SERVOMECH S.p.A. S.U.

Via Monaldo Calari, 1
40011 Anzola dell'Emilia (BO)
ITALIA
Tel. +39 051 6501 711
Fax. +39 051 7345 74
Website: www.linearmech.com
e-mail: sales@linearmech.com

2.2   Product identification

All servo actuators are identified by a label as follows.

Figure 2.1 – Servo actuator identification label

On servo-actuator label following data are printed:

- CODE: article code;
- DESCR: product description (the mining of symbols and their sequence are indicated on the catalogue);
- S/N: production serial number (gives the full traceability of products);
- WK/YEAR: week and year of manufacturing of the product.

All servo-motors are identified by a label as follows.
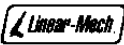
Figure 2.2 – Motor identification label

On servo-motor label following data are printed:

- CODE: article code;
- B/N: production batch number (gives the full traceability of products);
- WK/YEAR: week and year of manufacturing of the motor;
- T_0 : stall torque [Nm];
- I_0 : stall current [A];
- U_n : motor windings power supply [V];
- N_{nom} : nominal speed [rpm];
- k_E : motor voltage constant [V/1000rpm];
- Encoder: motor feedback resolution [ppr];
- IP54: motor IP enclosure;
- I.CL.F: motor insulation thermal class (F);
- U_{BR} : brake power supply [V];
- T_{BR} : brake nominal torque [Nm];
- P_{BR} : brake power consumption [W].

2.3 Identification labels positioning

Following pictures show label positioning on servo-actuator, servo-motor and assembled products.

2.3.1 Label positioning – SA Servo-actuator
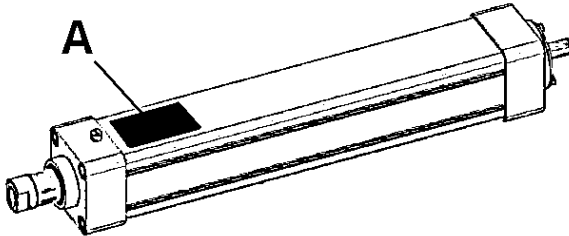
A = servo-actuator label

2.3.2 Label positioning – SA-IL Servo-actuator
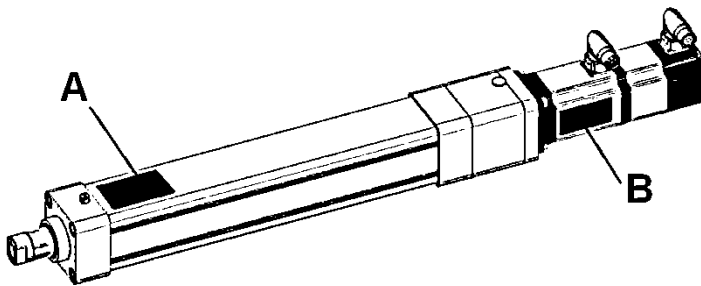
A = servo-actuator label
B = servo-motor label

2.3.3 Label positioning – SA-PD Servo-actuator
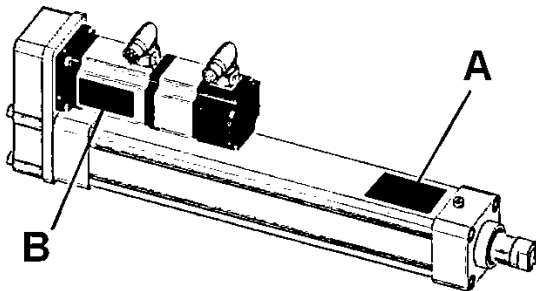
A = servo-actuator label
B = servo-motor label

3 TRANSPORT AND HANDLING

⚠ It is recommended to pay attention and care during the handling and transport of linear actuators not to damage mechanical parts and / or accessories and to prevent risks for the personnel in charge of this activity.

• The packaging must be lifted and moved with care and in a safe way.

• For lifting and transporting the linear actuator, the push rod must be in <u>retracted position</u>.

• Lift the actuator from the housing and outer tube, supporting the motor during transport.

• DO NOT lift the actuator from the push rod and / or the motor.

⚠ The ball screw inside the actuator is NOT self-locking. Never lift the linear actuator upright from the push rod as the actuators could be back driven by its own weight.
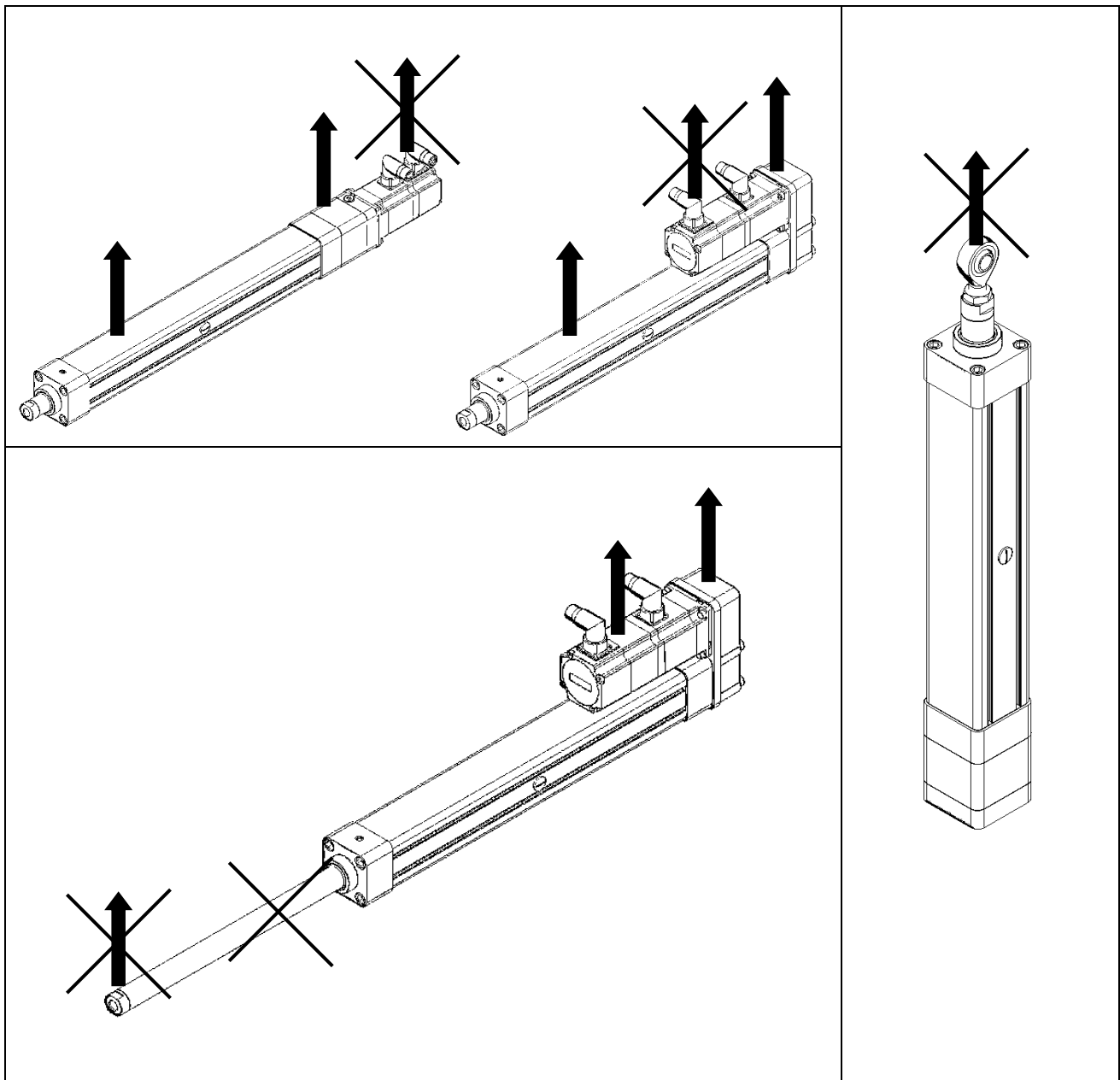
Figure 3.1 – Transport and handling

4   PRODUCT USE LIMITS

Here important prescriptions are provided to operate safely along all the product life phases.

Not complying with these prescriptions leads to operate in risky conditions that may cause operators injuries or machine damages.

4.1   Intended use

Servo-actuators can perform very different functions in machinery. It is responsibility of machinery manufacturer the machine design in accordance with laws in force in their specific field and in accordance with specific machinery safety laws, following the guidelines provided in our catalog and in this manual.

4.1.1   Servo actuator use

Servo actuators are designed and built to drive moving parts of various types, form and construction, as described and within the limits set out in the descriptions and tables of technical data shown in our catalog and in this manual.

A purely axial load (push and pull) must be applied on servo-actuators.

Servo-actuators must be subjected to loads, speed and duty limits provided in our catalog.

In loads assessment:

* all the external loads,
* all inertial loads generated by the servo-actuator moving masses,
* all inertial loads generated by external masses connected to the servo-actuator must be considered, as indicated on the product catalog.

The accelerations and consequent inertial loads, in addition to external loads, strongly affect the product selection and its lifetime.

Modifications of servo-actuator parts or replacements with non-original spares are not admitted. Original spares replacement must be done by Servomech S.p.A. only.

Any other use is improper and therefore potentially dangerous for operators safety, as well as it voids the warranty.

In event of special needs, please consult our sales office.

Any modifications of servo-actuators must be authorized by Servomech S.p.A. by written documents.

⚠   ANY OTHER DIFFERENT USE IS NOT ADMITTED BY MANUFACTURER.

4.1.2   Use restrictions

Servo-actuators can not be used for unforeseen applications.

Any utilization of this device beyond its intended purpose may lead to potentially hazardous situations.

Therefore is strictly forbidden:

* the servo-actuator use in a constructive configuration different than the one provided by Servomech S.p.A.;
* the servo-actuator outdoor use;
* the servo-actuator use in places with explosions and/or fire risks (servo-actuator is not CE ATEX directive compliant);
* the servo-actuator use in locations with chemically aggressive atmospheres;
* the servo-actuator use in locations where particular electrical protections are required;
* the servo-actuator use in locations where particular protection enclosures are required;
* integrate systems and/or equipments not considered by Servomech S.p.A. in servo-actuator design;
* the servo-actuator use with partially removed part, tampered parts or differently wired;
* connect the servo-actuator with energy sources different than the ones provided by Servomech S.p.A.
* ⚠   THE USE OF THE SERVO ACTUATOR IN ABOVE CONDITIONS MUST BE PREVIOUSLY DECLARED AND AGREED WITH SERVOMECH, SINCE A SPECIAL EQUIPMENT OF THE PRODUCT MUST BE PROVIDED.

4.1.3 Environmental conditions

The servo-actuator must be used with the environmental conditions prescribed by Servomech S.p.A.

All works necessary to obtain and maintain such environmental conditions are in charge by the machinery manufacturer and, if occur, by the end user.

The servo-actuator must be installed and used indoor only, in dry area with following environmental conditions:

- Air temperature   +0°C ÷ +40°C
- Relative atmospheric humidity   5% ÷ 85%
- No build up of condensation

Servo-actuator must be installed and used in a room with a constant illumination of 500lux at least, complaining the norm UNI EN 1837:2009, or complaining specific norms related to specific application fields.

⚠ THE USE OF THE SERVO ACTUATOR IN DIFFERENT CONDITIONS THAN JUST DESCRIBED MUST BE PREVIOUSLY DECLARED AND AGREED WITH SERVOMECH, SINCE A SPECIAL EQUIPMENT OF THE PRODUCT MUST BE PROVIDED.

4.2 Operators qualifications

This manual must be provided to different operators assigned to installation, use and maintenance.

It is responsibility of the machine manufacturer:

- to assign the servo-actuator installation and commissioning to qualified operators;
- to verify assigned operators qualifications periodically;
- to verify that assigned operators are aware about the contents of this manual.

5 STORAGE

- Do not store outside.
- Storage should be dry and dust-free.
- Keep away from any aggressive media.
- Protect from UV radiation.
- Avoid mechanical vibrations.
- Storage temperature: 0 to +50 °C.
- Relative atmospheric humidity: max. 95% (no build up of condensation).

6   INSTALLATION, WIRING AND COMMISSIONING

The operations here described provide both mechanical and electrical connections, as well as servo actuator movement test at reduced speed and force.

So, obligations listed in following paragraph must be complied.

6.1   Safety warnings

⚠ BRUSHLESS SERVOMOTORS, BM SERIES, CANNOT BE CONNECTED TO THE POWER SUPPLY NETWORK DIRECTLY: SERVOMOTORS WILL BE DAMAGED.

⚠ BRUSHLESS SERVOMOTOR MUST BE CONNECTED TO A SERVO-DRIVE, PROPERLY SELECTED BY QUALIFIED PERSONNEL.

⚠ SERVOMECH S.P.A. IS AT CUSTOMER'S DISPOSAL TO GIVE THE NEEDED SUPPORT FOR SERVO-DRIVE SELECTION AND PROPER USE.

⚠ PLEASE READ CAREFULLY THE SERVO-DRIVE INSTRUCTION MANUAL TO COMMISSION, SET AND MAINTAIN THE DRIVES PROPERLY.

⚠ BEFORE PROCEED WITH ELECTRICAL WIRING OF BRUSHLESS SERVOMOTOR AND ITS DRIVE, BE SURE THAT POWER SUPPLY IS TURNED OFF.

⚠ BEFORE POWER ON THE BRUSHLESS SERVOMOTOR, CHECK ITS CONNECTORS: THEY MUST BE PROPERLY INSERTED AND TIGHTEN.

⚠ DO NOT DAMAGE BRUSHLESS SERVOMOTOR CABLES WHILE ASSEMBLING; CABLES MUST BE PLACED FAR FROM HEAT SOURCES AND MOVING PARTS.

⚠ WHILE RUNNING, THE BRUSHLESS SERVOMOTOR GENERATES ELECTRIC, MAGNETIC AND ELECTROMAGNETIC FIELDS. PEOPLE WITH "PACEMAKER" MUST KEEP LONG DISTANCE FROM RUNNING SERVOMOTORS, TO AVOID DANGEROUS INTERFERENCES.

⚠ DO NOT DISCONNECT CONNECTORS WHILE SERVOMOTOR IS RUNNING OR BEFORE SWITCHING OFF MAIN POWER SUPPLY.

⚠ BEFORE RUN BRUSHLESS SERVOMOTOR, CHECK ALL MECHANICAL COUPLINGS. COUPLINGS MUST BE STABLE AND UNDAMAGED.

⚠ WHILE COMMISSIONING UNATTENDED MOVEMENTS COULD HAPPEN, DUE TO:

- WIRING MISTAKES;
- ASSEMBLY ERRORS;
- DAMAGES ON CONNECTION CABLES;
- HW OR SW ERRORS
- DRIVE PARAMETER SET ERRORS
- OPERATING CONDITIONS OUT FROM SPECIFICATIONS HEREIN PROVIDED OR OUT FROM CHARACTERISTICS ON CATALOG

⚠ ALL SECURITY GUARDS AND ALL ELECTRICAL PROTECTIONS MUST BE ASSEMBLED AND ACTIVE TO PREVENT DAMAGES AND/OR INJURIES DUE TO UNATTENDED MOVEMENT AS ABOVE MENTIONED.

⚠ BRUSHLESS SERVOMOTOR OUTER SURFACES CAN REACH HIGH TEMPERATURES WHILE RUNNING (UP TO 100°C OR MORE).

⚠ DO NOT FASTEN OR PLACE NEAR THE MOTOR THERMO SENSITIVE COMPONENTS: DAMAGES MAY OCCUR.

⚠ DO NOT TOUCH THE BRUSHLESS SERVO MOTOR UNTIL ITS TEMPERATURE IS LOWER THAN 40°C.

6.2 Servo actuator limit switches: mounting and positioning

Servo actuators have two or more slots on the aluminium profile to fit the stroke limit switches. The profile shape is in compliance with ISO 15552 standard. Following drawings show these arrangements.

FTV sensor slot   FCM sensor slot
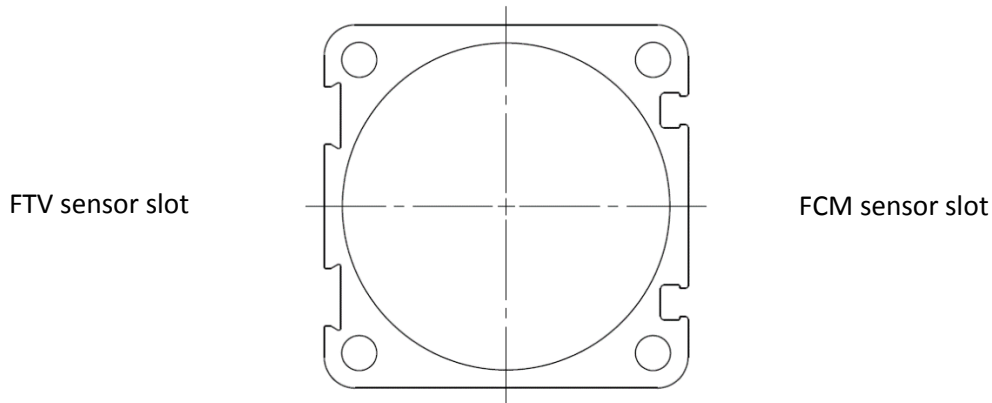
Both type of sensors can be fitted inside their slot from the top.

FTV sensor mounting

The **FTV** sensor consists of two elements held together by a screw: the sensor FTV and the fixing bracket. After fitting the sensor and the bracket from the top, it is necessary to align them and partially screw the fixing screw. The group can then be moved along the slot in the desired position and finally locked by tightening the screw.
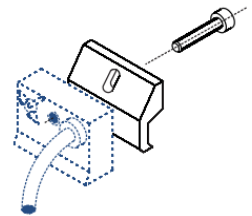
FCM sensor mounting

The **FCM** sensor is fitted from the top; when in the required position, they can be fixed by turning clockwise the screw until stroke end.
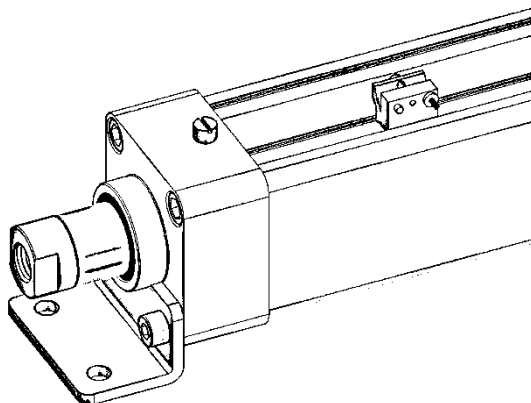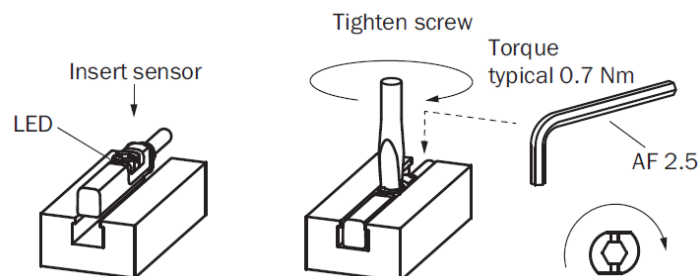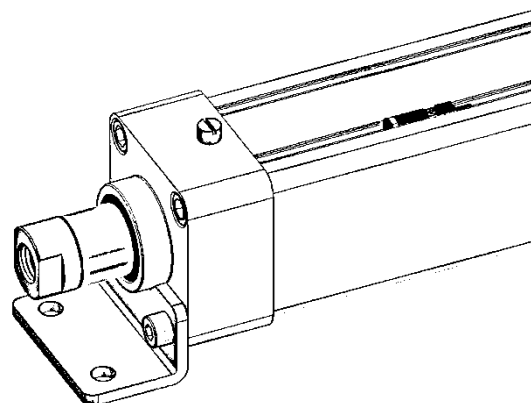
FTV Sensor   *FCM Sensor*

⚠ THE SENSORS PLACED ON THEIR LIMIT POSITIONS, WILL SWITCH WITH THE PUSH ROD IN POSITIONS "LC" AND "LA" INDICATED ON OUR CATALOG AND IN THIS MANUAL (SEE SECTION 6.10).

⚠ THE SENSORS PLACED BEYOND THE LIMIT POSITIONS CANNOT BE REACHED AND ACTIVATED BY THE MAGNET MOUNTED ON THE NUT BALL.

⚠ DO NEVER FIX THE SENSORS OVER THE LIMIT POSITIONS.

⚠ WITH NOT WORKING SENSORS, THE SERVO ACTUATOR MAY BREAK COLLIDING WITH ITS INTERNAL MECHANICAL STOPS.

FCM sensors

FTV sensors
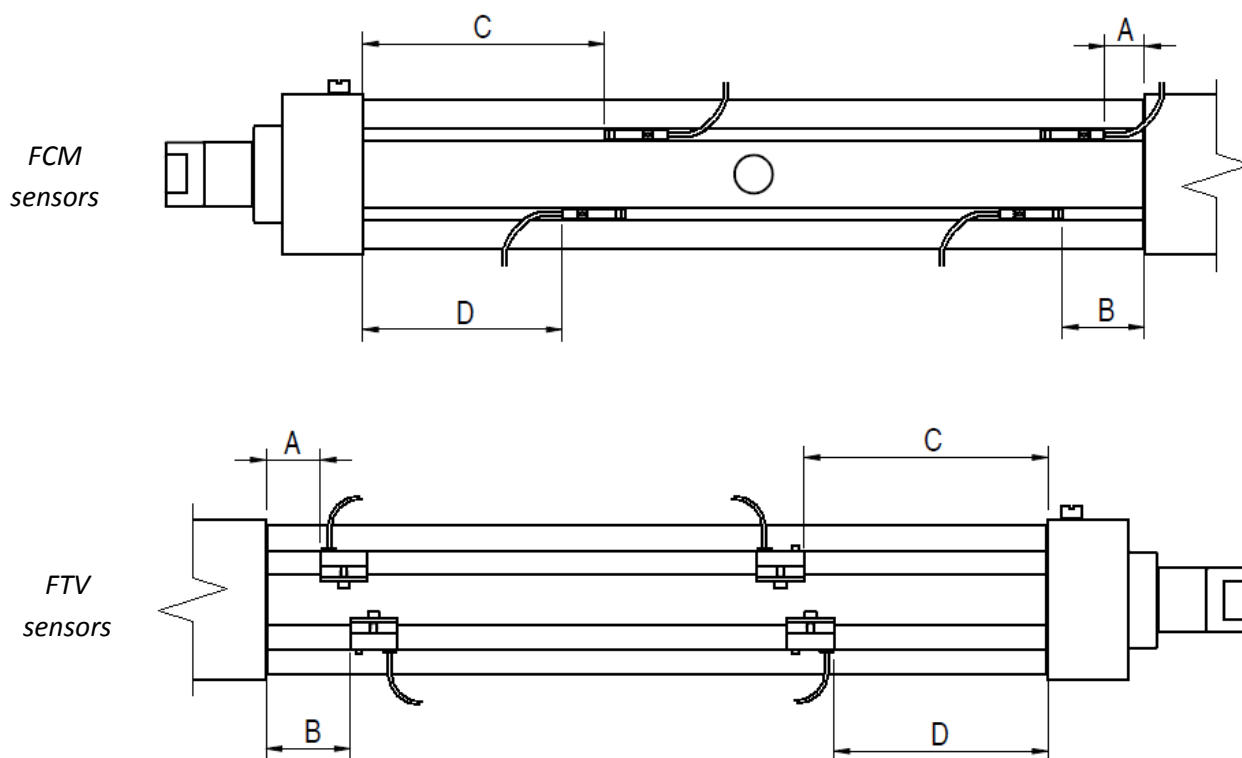
Figure 6.1 – Stroke end limit switches position

		Servo actuators sizes												
		SA0		SA1		SA2		SA3		SA4		SA5		SA6	
		FCM	FTV	FCM	FTV	FCM	FTV	FCM	FTV	FCM	FTV	FCM	FTV	FCM	FTV
Sensors limit positions	A	10.6	10.5	10.6	10.5	21.6	21.5	25.6	25.5	29.6	29.5	36.6	36.5	42.6	42.5
	B	16.9	24.5	16.9	24.5	27.9	35.5	31.9	39.5	35.9	43.5	42.9	50.5	48.9	56.5
	C	87.9	95.5§	96.9	104.5	84.9	92.5	106.9	114.5	120.9	128.5	146.9	154.5	171.9	179.5
	D	81.6	81.5*	90.6	90.5	78.6	78.5	100.6	100.5	114.6	114.5	140.6	140.5	165.6	165.5

Table 6.2 – Sensors limit positions

§: FTV sensor limit position - valid for strokes C≥150mm only

*: FTV sensor limit position - valid for strokes C≥100mm only

6.3 Limit switches wiring

Linearmech servo actuators can be provided with limit switches (sensors) in two different types; see characteristics on following table.
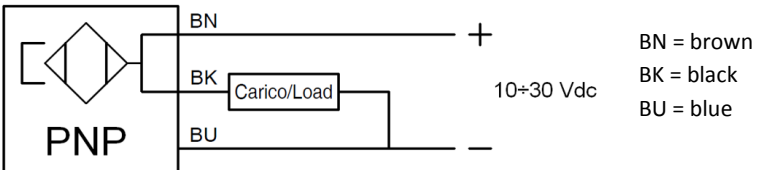
	FTV	FCM
Contact	NO	NC
Output signal	PNP	
LED signal	YES	
Power supply	10÷30 Vdc	
Voltage drop	0.8 V	≤ 2V
Max current	200 mA	100 mA
Switching delay OFF	20 ms (switching delay electronically obtained; it enables signal readout at high speed conditions)	-
Inverted-power supply polarity protection	YES	
Short circuit protection	YES	
Operating temperature	-20°C ÷ +70°C	-30°C ÷ +80°C
Enclosure rating	IP67	IP65
Housing material	ZA4	Plastic
Cable	PVC black 3x0.25mm² - L = 3m	PUR black 3x0.14mm² - L = 2m
Wiring diagram	BN + BK Carico/Load BU PNP 10÷30 Vdc	BN = brown BK = black BU = blue

Table 6.3 – Sensors technical data

6.4 Brushless motors BM

Following table shows servo-motors BM series technical data.

Brushless motor	BM 45 L - 30			BM 63 S - 30			BM 63 L - 30	
Drive rated volatage U_{nom} [V]	24Vdc	48Vdc	230Vac	24Vdc	48Vdc	230Vac	48Vdc	230Vac
Stall torque $T_{0,100K}$ [Nm]	0.35			0.7			1.35	
Continuous rated torque $T_{nom,100K}$ [Nm]	0.32			0.6			1.3	
Peak torque T_P [Nm]	1.05			2.1			4.2	
Rated speed n_{nom} [rpm]	3000			3000			3000	
Max speed n_{max} [rpm]	4000			4000			4000	
Pole numbers [#]	8			8			8	
Stall current $I_{0,100K}$ [A]	7.4 [1]	3.8 [1]	1.25	15.9 [1]	7.7 [1]	0.98	15.7 [1]	2.1
Peak current I_P [A]	24.4 [1]	12.5 [1]	3.95	50.8 [1]	25.8 [1]	3.7	53 [1]	7.1
Voltage constant k_E [V/1000rpm]	5 [1]	8.9 [1]	17.2	4.7 [1]	9.7 [1]	41	9.4 [1]	43
Torque constant k_T [Nm/A]	0.047 [1]	0.09 [1]	0.28	0.044 [1]	0.09 [1]	0.67	0.089 [1]	0.71
Thermal time constant t_{th} [min]	12			15			15	
Windings resistance R_{ph} [ohm]	0.38	1.4	9.7	0.13	0.5	17.4	0.2	7.1
Windings inductance L_D [mH]	0.69	2.4	16.7	0.39	1.5	53	0.8	30
Electric time constant t_{el} [ms]	1.8	1.7	1.7	3	3	3	4.2	4.2
Moment of inertia (W/O brake) J_{motore} [kgm²]	0.091×10^{-4}			0.156×10^{-4}			0.272×10^{-4}	
Moment of inertia (with brake) $J_{motore\,BR}$ [kgm²]	0.092×10^{-4}			0.174×10^{-4}			0.290×10^{-4}	
Rated braking torque T_{BR} [Nm]	0.8			2.5			2.5	
Brake supply voltage U_{BR} [V]	24Vdc +5% / -10%			24Vdc +5% / -10%			24Vdc +5% / -10%	
Brake supply power P_{BR} [W]	12.8			13.3			13.3	
Brake engagement delay time t_{BR} [ms]	40			40			40	
Brake disengagement delay time t_{-BR} [ms]	7			7			7	
Max radial load on motor shaft F_R [N]	150			230			230	
Max radial load on motor shaft F_N [N]	50			70			70	
Mass W/O brake / with brake m [kg]	0.9 / 1.2			1.25 / 1.90			1.85 / 2.50	

Table 6.4 – BM series servomotors

[1] The DC values in table are referred to trapezoidal switching.

Brushless motor	BM 82 L - 30		BM 102 S - L		BM 102 L6 - 30		BM 102 L8 - 30	
Drive rated volatage U_{nom} [V]	230Vac	400Vac	230Vac	400Vac	230Vac	400Vac	230Vac	400Vac
Stall torque $T_{0,100K}$ [Nm]	2.9		5.2		7.3		9.0	
Continuous rated torque $T_{nom,100K}$ [Nm]	2.5		4.1		6.4		6.7	
Peak torque T_p [Nm]	9.0		15.0		22.0		30.0	
Rated speed n_{nom} [rpm]	3000		3000		3000		3000	
Max speed n_{max} [rpm]	4000		4000		4000		4000	
Pole numbers [#]	8		8		6		8	
Stall current $I_{0,100K}$ [A]	4.6	2.3	6.5	3.5	9.8	6.1	11.5	5.8
Peak current I_p [A]	14.7	7.4	26.0	14.0	35.5	22.0	47.0	25.5
Voltage constant k_E [V/1000rpm]	39.5	78.0	48.6	90.0	47.7	77.0	47.7	94.0
Torque constant k_T [Nm/A]	0.64	1.28	0.8	1.48	0.8	1.2	0.8	1.55
Thermal time constant t_{th} [min]	16		35		45			
Windings resistance R_{ph} [ohm]	1.5	6.2	0.9	3.5	0.56	1.6	0.4	1.6
Windings inductance L_D [mH]	13.8	56	14.0	54.0	8.2	23.0	6.0	27.6
Electric time constant t_{el} [ms]	8.9	9	15.5	15.4	14.6	14.3	15.0	17.2
Moment of inertia (W/O brake) J_{motore} [kgm^2]	1.030 x 10^{-4}		2.88 x 10^{-4}		4.95 x 10^{-4}			
Moment of inertia (with brake) $J_{motore\,BR}$ [kgm^2]	1.160 x 10^{-4}		3.34 x 10^{-4}		5.41 x 10^{-4}			
Rated braking torque T_{BR} [Nm]	5		10		10			
Brake supply voltage U_{BR} [V]	24Vdc $^{+5\%}$ / $_{-10\%}$		24Vdc $^{+5\%}$ / $_{-10\%}$		24Vdc $^{+5\%}$ / $_{-10\%}$			
Brake supply power P_{BR} [W]	23.8		35.2		35.2			
Brake engagement delay time t_{BR} [ms]	45		50		50			
Brake disengagement delay time t_{-BR} [ms]	10		15		15			
Max radial load on motor shaft F_R [N]	400		500		500			
Max radial load on motor shaft F_N [N]	130		150		150			
Mass W/O brake / with brake m [kg]	3.3 / 5.0		5.2 / 7.4		7.8 / 10.0			

Table 6.4 – BM series servomotors

6.5 Feedback devices on BM brushless motors

The table below shows all feedback devices available on the brushless motors BM series.

E01: Optical incremental encoder		
Power supply	[V$_{dc}$]	5 $^{+5\%}$/$_{-5\%}$
Max current	[mA]	200
Resolution	[ppr]	2000
Output		Line Driver
Max frequency output signal	[kHz]	200
Incremental output signals (Line Driver)		A, A/ - B, B/ - Z, Z/
Hall output signals (Line Driver)		HU, HU/ - HV, HV/ - HW, HW/
Working temperature	[°C]	-20 ÷ +85
Max speed	[rpm]	6000
A01 (§): Absolute multiturn SSI Binary encoder		
Power supply	[V$_{dc}$]	5
Max current W/O load	[mA]	150 $^{+10\%}$/$_{-5\%}$
Single turn resolution	[bit]	13
Multiturn resolution	[bit]	12
Output code		SSI Binary
Drives		RS422 (Clock + Data)
Incremental signals		Sin Cos 1V$_{pp}$
Sin/Cos periods per revolution	[ppr]	2048
Working temperature	[°C]	-40 ÷ +120
Max speed	[rpm]	10000

(§) not available on BM45 brushless motor

Table 6.5 – Feedback devices

6.6 Thermal protections available on brushless motors

The table below shows all thermal protections available on the brushless motors BM series.

01: Thermistor PTC		
Suitable for sudden overloads; temperature monitoring not possible		
Output signal		Non-linear resistance
Nominal power supply	[V_{dc}]	7.5
Max power supply	[V_{dc}]	30
Rated insulation voltage	[kV]	2.5
Temperature threshold	[°C]	140
Resistance @ 135°C	[ohm]	<= 550
Resistance @ 145°C	[ohm]	>= 1330
Resistance @ 155°C	[ohm]	>= 4000
02: Bimetallic thermal protector PTO		
Suitable for long times overloads; temperature monitoring not possibl		
Output signal		NC contact
Operating temperature	[°C]	140
Resetting temperature	[°C]	110 $^{+15}/_{-15}$
Nominal power supply	[V]	250
Rated current	[A]	2.5
Insulation voltage	[kV]	2

Table 6.6 – Thermal protection

Following picture shows how each thermal protector works.
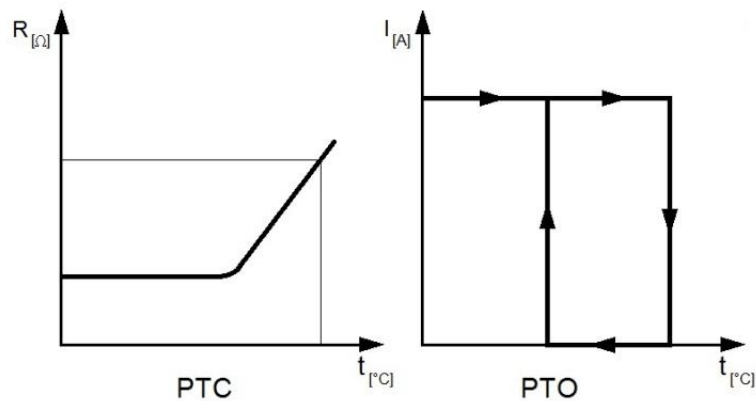
NOTE: THERMAL PROTECTIONS ARE NOT AVAILABLE IN CASE OF MOTOR EQUIPPED WITH BRAKE (B).

6.7   BM motor wirings

All servomotors BM series are provided with male connectors, for motor power supply and motor feedback.

Motor connectors can be rotate and have threaded locking system with cable connectors.

Depending on motor sizes, different connectors sizes are used.

6.7.1   BM45 e BM63 motor connectors

Following pictures show connectors pin-out; relevant tables show pins functions.
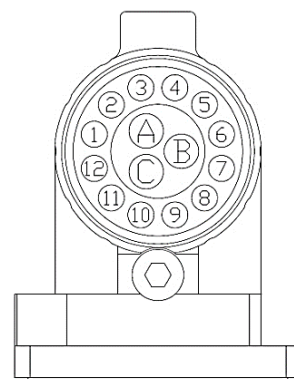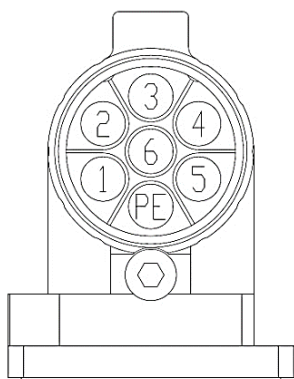
POWER M16 - 6 POLES + PE	
PIN	Function
1	Phase U
2	Phase V
3	-
PE	⏚
4	Brake +Vdc
5	Brake 0Vdc
6	Phase W

SIGNAL M16 - 12 + 3 POLES			
PIN	E01: Incremental encoder (W/O TP)	E01: Incremental encoder (with TP.)	A01 (§): Absolute encoder SSI Binary
1	Ch A	Ch A	DATA
2	Ch A/	Ch A/	DATA/
3	Ch B	Ch B	CLOCK
4	Ch B/	Ch B/	CLOCK/
5	Z	Z	-
6	Z/	Z/	-
7	HU	HU	-
8	HV	HV	-
9	HW	HW	-
10	HU/	TP (opt.)	TP (opt.)
11	HV/	TP (opt.)	TP (opt.)
12	HW/	-	-
A	+5V	+5V	+5V
B	0V	0V	0V
C	-	-	-

(§) not available on BM45

TP = thermal protector

6.7.2 BM82 e BM102 motor connectors

Following pictures show connectors pin-out; relevant tables show pins functions.
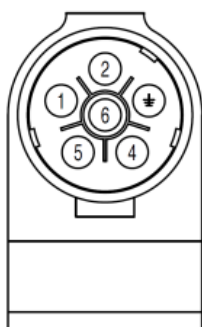
POWER M23 - 5 POLES + PE	
PIN	Function
1	Phase U
2	Phase V
⏚	PE
4	Brake +Vdc
5	Brake 0Vdc
6	Phase W
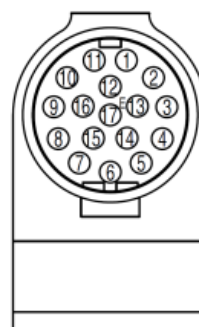
SIGNAL M23 - 17 POLES		
PIN	E01: Incremental encoder	A01: Absolute encoder SSI Binary
1	Ch B	DATA
2	Ch B/	DATA/
3	Z	-
4	HU	-
5	HW	+5V
6	-	-
7	0V	-
8	TP (optional)	TP (optional)
9	TP (optional)	TP (optional)
10	+5V	-
11	Ch A/	CLOCK/
12	Ch A	CLOCK
13	Z/	-
14	HU/	-
15	HV/	-
16	HV	-
17	HW/	0V

TP = thermal protector

6.8 Cables wiring

Connecting cables of BM series servomotor are provided with connector on the servomotor side and free wires on the drive side.

6.8.1 BM45 and BM63 motor power cable

Connector (motor side): M16 6 poles with PE

Article code: **9.65.CP.M16.xxC**

To complete the code, "xx" must be replaced with the cable length in meters.

Vista / View : A

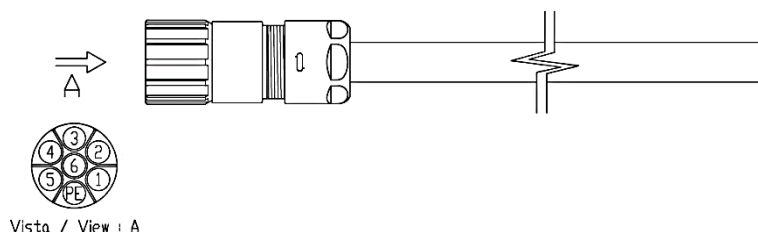| PIN	CABLE ID - FRX-ST [4G0.75+(2x0.5)ST]ST	FUNCTION
1	U/L1 - 0.75mm²	Phase U
2	V/L2 - 0.75mm²	Phase V
6	W/L3 - 0.75mm²	Phase W
PE	YELLOW/GREEN - 0.75mm²	PE
4	WHITE - 0.5mm²	+V Brake
5	BLACK - 0.5mm²	0V Brake
3	-	-
Connector body	SHIELD	-

6.8.2 BM45 and BM63 with encoder E01 w/o TP signal cable

Connector (motor side): M16 12+3 poles

Article code: **9.65.CSE01.M16.xxC2**

To complete the code, "xx" must be replaced with the cable length in meters.

Vista / View : A
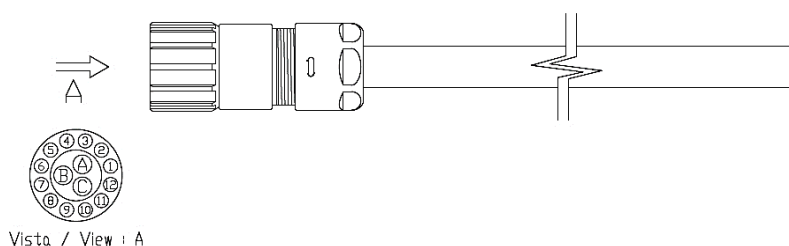
PIN	CABLE ID - FRX-ST [3x(2x0.14)SF/R+4x0.14+4x0.25+2x0.5]ST	FUNCTION
1	YELLOW - 0.14mm²	A
2	GREEN - 0.14mm²	A/
3	BLACK - 0.14mm²	B
4	BROWN - 0.14mm²	B/
5	ORANGE - 0.14mm²	Z
6	RED - 0.14mm²	Z/
7	BLUE - 0.14mm²	HU
8	WHITE/BLACK - 0.14mm²	HV
9	WHITE/YELLOW - 0.14mm²	HW
10	GREY - 0.14mm²	HU/
11	GREEN/RED - 0.25mm²	HV/
12	BROWN/GREY - 0.25mm²	HW/
A	BROWN/RED - 0.5mm²	+5V
B	BROWN/BLUE - 0.5mm²	0V
C	-	-
Connector body	SHIELD	-

6.8.3 BM45 and BM63 with encoder E01 and TP signal cable

Connector (motor side): M16 12+3 poles
Article code: **9.65.CSE01.M16.xxC**

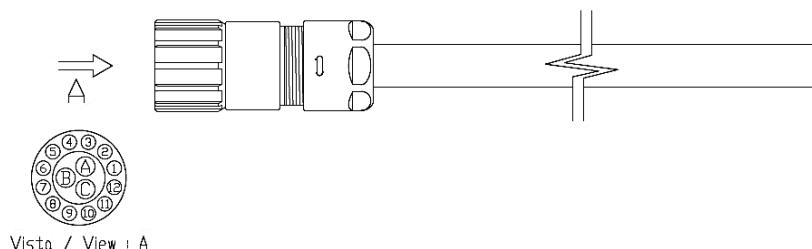To complete the code, "xx" must be replaced with the cable length in meters.

⚠ THE HALL SENSOR CHANNELS HU/, HV/, HW/ ARE NOT CONNECTED! COMPATIBILITY BETWEEN THE DRIVE AND CABLE CONFIGURATION MUST BE CHECKED.

Vista / View : A

PIN	CABLE ID - FRX-ST [3x(2x0.14)SF/R+4x0.14+4x0.25+2x0.5]ST	FUNCTION	FUNCTION HDT Note (*)
1	YELLOS - 0.14mm²	A	A/
2	GREEN - 0.14mm²	A/	A
3	BLACK - 0.14mm²	B	B
4	BROWN - 0.14mm²	B/	B/
5	ORANGE - 0.14mm²	Z	Z
6	RED - 0.14mm²	Z/	Z/
7	BLUE - 0.14mm²	HU	HV
8	WHITE/BLACK - 0.14mm²	HV	HU
9	WHITE/YELLOW - 0.14mm²	HW	HW
10	BROWN/YELLOW - 0.25mm²	PT	PT
11	GREEN/BLACK - 0.25mm²	PT	PT
12	-	-	-
A	BROWN/RED - 0.5mm²	+5V	+5V
B	BROWN/BLUE - 0.5mm²	0V	0V
C	-	-	-
Connector body	SHIELD	-	-

Note (*) – in case HDT Lovato drive is used, please refer to FUNCTION HDT column.

6.8.4 BM63 with encoder A01 signal cable

Connector (motor side): M16 12+3 poles.
Article code: **9.65.CSA01.M16.xxC**

To complete the code, "xx" must be replaced with the cable length in meters.

Vista / View : A

PIN	CABLE ID - FRX-ST [3x(2x0.14)SF/R+4x0.14+4x0.25+2x0.5]ST	FUNCTION
1	YELLOW - 0.14mm²	DATA
2	GREEN - 0.14mm²	DATA/
3	BLACK - 0.14mm²	CLOCK
4	BROWN - 0.14mm²	CLOCK/
5, 6, 7, 8, 9	-	-
10	BROWN/YELLOW - 0.25mm²	PT
11	GREEN/BLACK - 0.25mm²	PT
12	-	-
A	BROWN/RED - 0.5mm²	+5V
B	BROWN/BLUE - 0.5mm²	0V
C	-	-
Connector body	SHIELD	-

6.8.5 BM82 and BM102 motor power cable

Connector (motor side): M23 5 poles with PE.

Article code: **9.65.CP.M23.xxC**

To complete the code, "xx" must be replaced with the cable length in meters.

Vista / View : A
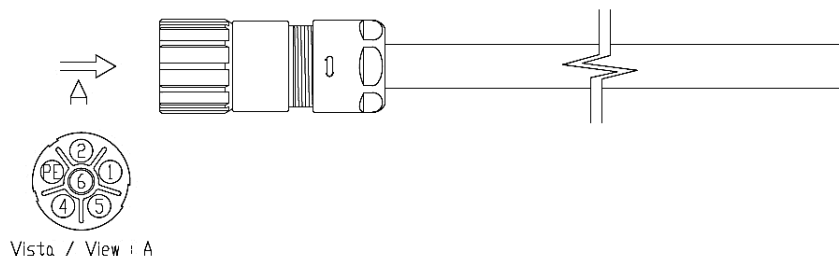
PIN	CABLE ID - FRX-ST [4G1.5+(2x1.0)ST]ST	FUNCTION
1	U/L1 - 1.5mm^2	Phase U
2	V/L2 - 1.5mm^2	Phase V
6	W/L3 - 1.5mm^2	Phase W
PE	YELLOW/GREEN - 1.5mm^2	PE
4	WHITE - 1.0mm^2	+V Brake
5	BLACK - 1.0mm^2	0V Brake
3	-	-
Connector body	SHIELD	-

6.8.6 BM82 and BM102 with encoder E01 signal cable

Connector (motor side): M23 17 poles

Article code: **9.65.CSE01.M23.xxC**

To complete the code, "xx" must be replaced with the cable length in meters.

Vista / View : A

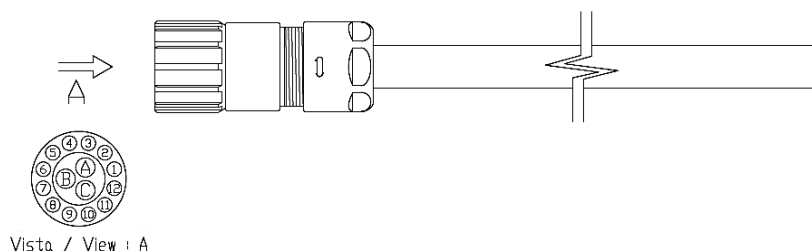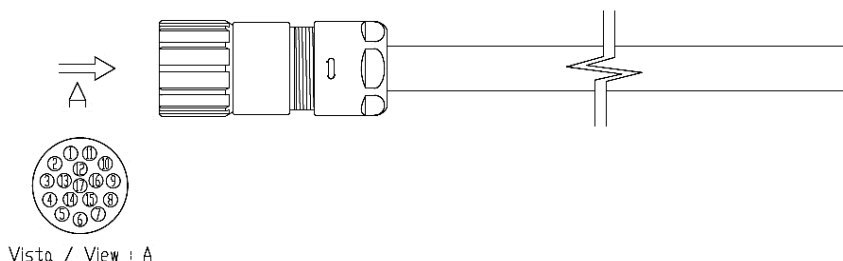| PIN	CABLE ID - FRX-ST [3x(2x0.14)SF/R+4x0.14+4x0.25+2x0.5]ST	FUNCTION	FUNCTION HDT *Note (*)*
12	YELLOW - 0.14mm^2	A	A/
11	GREEN - 0.14mm^2	A/	A
1	BLACK - 0.14mm^2	B	B
2	BROWN - 0.14mm^2	B/	B/
3	ORANGE - 0.14mm^2	Z	Z
13	RED - 0.14mm^2	Z/	Z/
4	BLUE - 0.14mm^2	HU	HV
16	WHITE/BLACK - 0.14mm^2	HV	HU
5	WHITE/YELLOW - 0.14mm^2	HW	HW
14	GREY - 0.14mm^2	HU/	HU/
15	GREEN/RED - 0.25mm^2	HV/	HV/
17	BROWN/GREY - 0.25mm^2	HW/	HW/
8	BROWN/YELLOW - 0.25mm^2	PT	PT
9	GREEN/BLACK - 0.25mm^2	PT	PT
10	BROWN/RED - 0.5mm^2	+5V	+5V
7	BROWN/BLUE - 0.5mm^2	0V	0V
6	-	-	-
Connector body	SHIELD	-	-

Note (*) – in case HDT Lovato drive is used, please refer to FUNCTION HDT column.

6.8.7 BM82 and BM102 with encoder A01 signal cable

Connector (motor side): M23 17 poles
Article code: **9.65.CSA01.M23.xxC**
To complete the code, "xx" must be replaced with the cable length in meters.
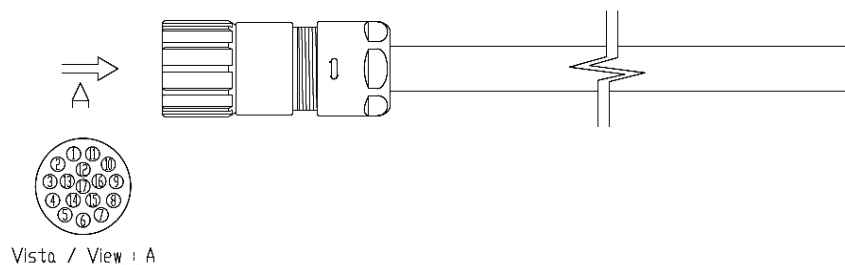
Vista / View : A

PIN	CABLE ID - FRX-ST [3x(2x0.14)SF/R+4x0.14+4x0.25+2x0.5]ST	FUNCTION
1	YELLOW - 0.14mm^2	DATA
2	GREEN - 0.14mm^2	DATA/
12	BLACK - 0.14mm^2	CLOCK
11	BROWN - 0.14mm^2	CLOCK/
3,4,5,13,14,15,16	-	-
8	BROWN/YELLOW - 0.25mm^2	PT
9	GREEN/BLACK - 0.25mm^2	PT
5	BROWN/RED - 0.5mm^2	+5V
17	BROWN/BLUE - 0.5mm^2	0V
6, 7	-	-
Connector body	SHIELD	-

6.9 Push rod shifting direction

The push-rod movement direction must comply all needs of machine command and control system; the push-rod movement direction and the motor rotation are related as follows.
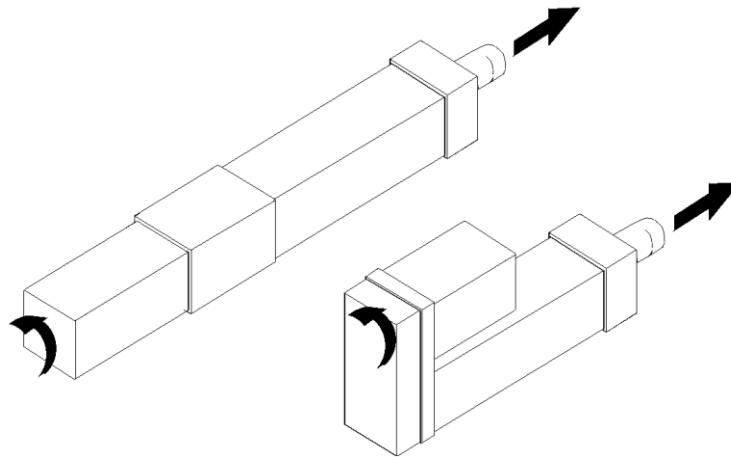

Figure 6.7 – Push rod shifting direction

6.10 Actuator mechanical installation

⚠ THE BALL SCREW LINEAR ACTUATOR SA SERIES IS NOT SELF-LOCKING. BEFORE TO APPLY ANY AXIAL LOAD ON THE PUSH ROD, LOCK THE INPUT SHAFT OR USE THE MOTOR BRAKE.

- Check that all fixing elements on the machine are well machined and clean; they must fit the dimensions of servo actuator coupling elements.

⚠ ALL OPERATIONS IN FOLLOWING MUST BE CARRIED OUT AFTER AN ADEGUATE PARAMETERIZATION OF DRIVE AND CONTROL SYSTEMS, AS WELL AS THE MOTOR FEEDBACK DEVICE SET, AND ACTUATOR HOME POSITIONING SET. EVERYTHING DONE ACCORDINGLY TO ALL PRESCRIPTIONS STATED ON INSTRUCTION MANUALS OF DRIVE AND CONTROL SYSTEMS MANUFACTURERS.

- If the length of the actuator should be varied (actuator push-rod more extended or retracted), the movement must be carried out at the minimum speeds and current possible, to minimize the kinetic energy and the load capacity, in the event of shocks against mechanical ends of actuator or mechanical ends of kinematics connected to actuator itself (JOG mode, following all requirements of manufacturers of drive and control system).

- The end stroke control devices (limit switches on servo actuator or on the machine) must be already activated and set.

⚠ All security guards and all electrical protections must be assembled and active to prevent damages and/or injuries.

⚠ DO NOT SET THE ACTUATOR LENGTH OUT OF ITS LIMITS:
  - "Lc" = retracted actuator length
  - "La" = extended actuator length

Dimensions "Lc" and "La" are indicated on following picture; custom product execution could have different lengths and are contractually defined.
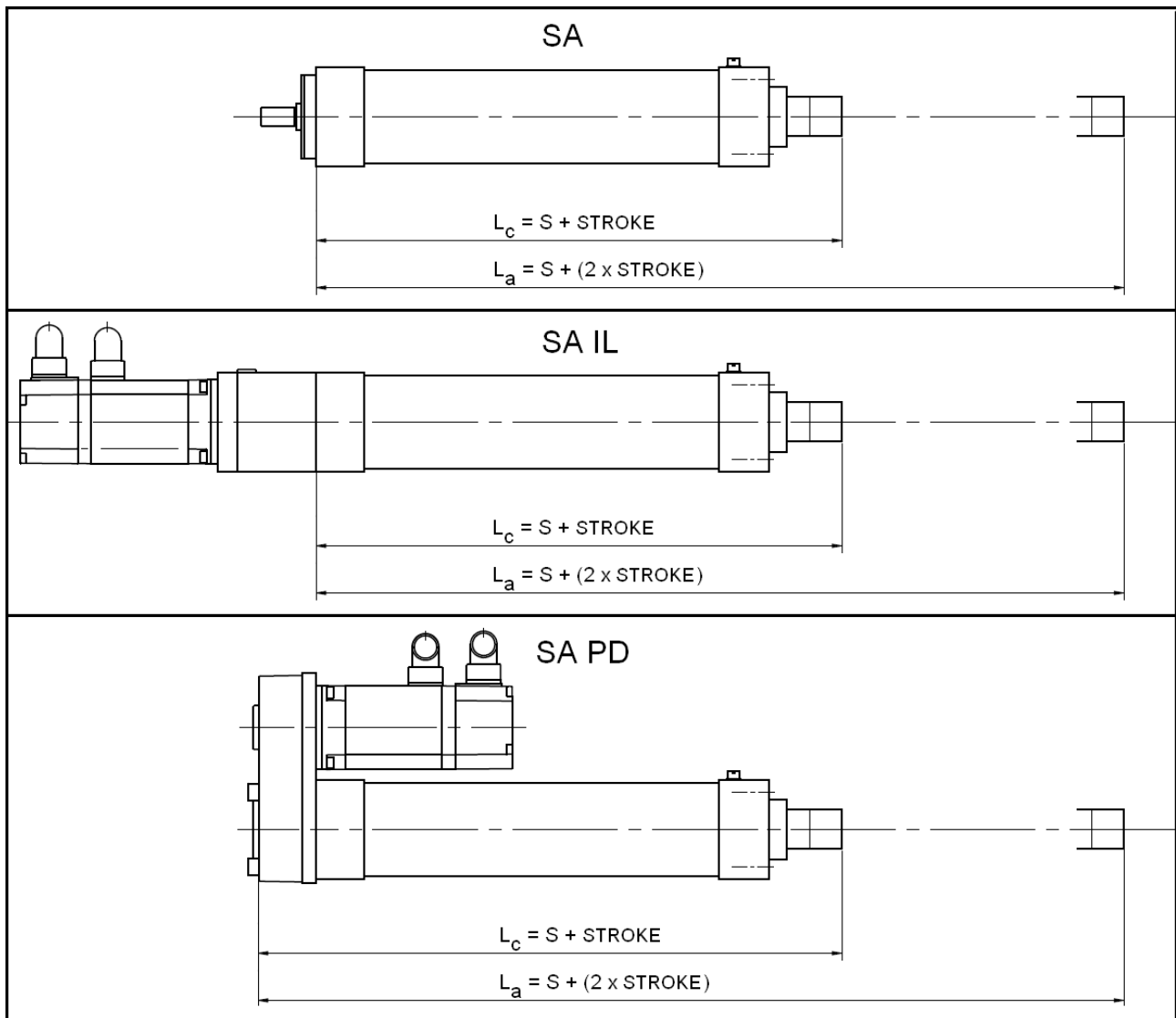
Figure 6.8 – "Lc" and "La" dimensions

"S" quote							
Servo actuator size	**0**	**1**	**2**	**3**	**4**	**5**	**6**
SA	229	246	264	296	330	453	538
SA IL							
SA PD	264	281	307	340	389	522	629

- Assemble the actuator in the machine in order to have ONLY axial load acting on actuator.
- Take care of alignments between the actuator and the elements connected to it.

⚠ ACTUATOR PERFORMANCES AND ITS CORRECT SERVICE ARE NOT GUARANTEED IF BENDING MOMENTS AND/OR NON AXIAL LOADS AND/OR MISALIGNMENTS ARE APPLIED.
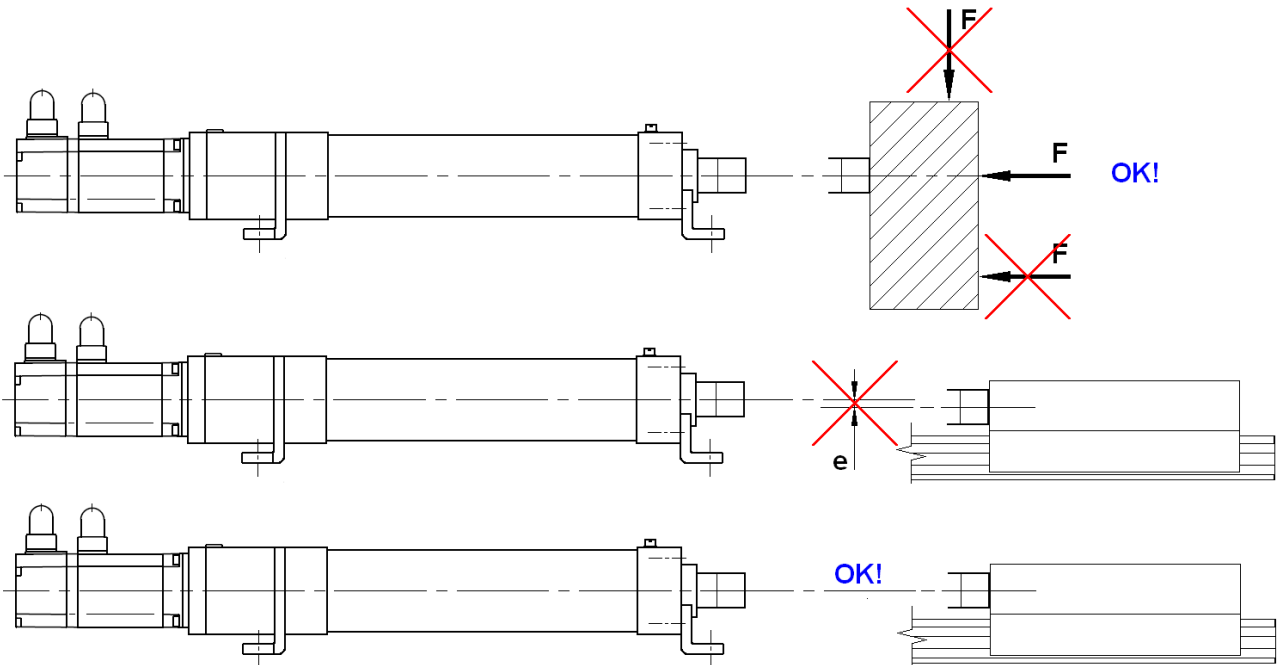
Figure 6.9 – Installation and load on actuator

6.10.1   Installation of rod end fitting elements

- To install a fitting element on the rod end threaded bore, use a wrench on the rod end to counterhold the locking torque.

⚠ The actuator is equipped with internal anti-rotation device: DO NOT TRANSFER ANY TORQUE TO THE PISTON ROD.

⚠ WARNING: in case of torque transfer into the actuator, the internal mechanical components can be damaged.
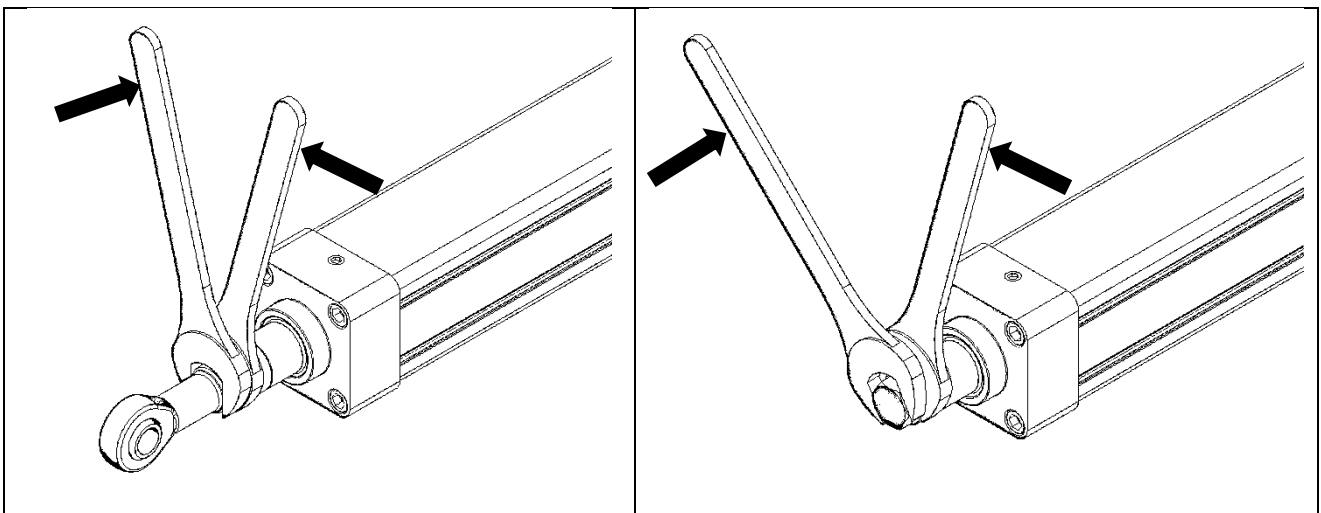
Figure 6.10 – Installation of rod end fitting elements

6.11 Start up

- SA servo actuators are supplied already lubricated and ready to be used.
- Perform a complete working cycle with reduced speed and current.
- Perform some working cycles, increasing by degrees speed and current, up to the values required.
- If necessary, adjust the previously set limit switches position (see Section 6.2), without travelling over the maximum stroke lengths (see Section 6.10).

7   MAINTENANCE
7.1   General controls

- Check periodically the actuator general conditions.
- Clean the servo actuator periodically.
- Check that the breather for internal pressure compensation is not chocked. The breather is made by sintered bronze: if necessary wash it with solvents or replace it.

7.2   Servo actuator lubrication

- SA servo actuators are supplied already lubricated and ready to be used.
- Thrust bearings are long-life lubricated.
- Ball screw must be periodically lubricated. The lubricating time interval is affected by servo actuator use conditions, in term of stroke, speed, accelerations, ambient temperature. In general, if vibrations/shocks are applied, a shorter lubrication interval is required.

To re-lube the ball screw, the grease must be put inside the ball nut through the M6×1 concave grease nipple (DIN 3405-A) fixed on the ball nut. The bore on the outer square profile must be aligned with the grease nipple on the ball nut.
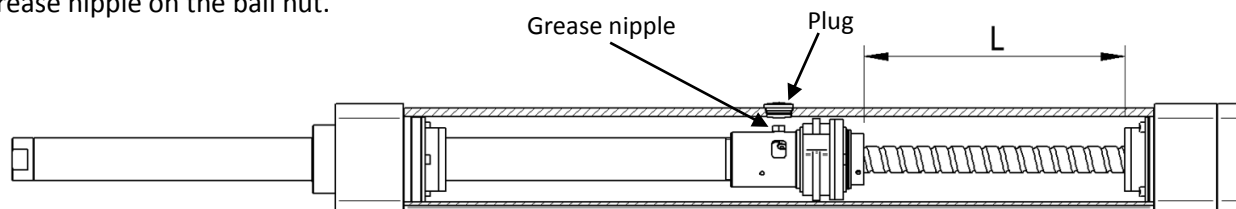
Figure 7.1 – Servo actuator lubrication

To relube the ball nut it is necessary to use LUB ferrule lubricators, specific for concave grease nipples.

⚠ OPERATIONS DESCRIBED IN FOLLOWING LIST MUST BE DONE IN MANUAL MODE (JOG MODE), AT REDUCED SPEED AND MOTOR TORQUE (~10÷15MM/S AND MINIMUM TORQUE TO MOVE THE PUSH-ROD, WITHOUT OR UNDER LIMITED EXTERNAL LOAD). PLEASE REFER TO DRIVE AND CONTROL USERS MANUALS PROVIDED BY MANUFACTURERS.

To access the grease nipple, please do as follows:
- run back the push-rod until contact with the rear shock absorber;
- move the push-rod forward for a stroke value *L*. The grease nipple should be then aligned with the bore on the external profile;
- take out the protective plug on the aluminium profile;
- insert the greaser with LUB ferrule for nut lubricating (about lubricant type and quantity see Sections 7.3 and 7.4).

The opening stroke length *L* is:

$$L = \frac{C}{2} + A$$

where:
L [mm] = linear distance for lubrication
C [mm] = servo actuator linear stroke
A = constant value specific for each size (see following table):

Servo actuator sizes	SA0	SA1	SA2	SA3	SA4	SA5	SA6
A	4.5	2.5	3	7	6	-3.5	-5.5

Table 7.2 – Lubrication position

7.3 Lubricant

SA servoatuator are supplied already lubricated, with lubricant indicated in the table below.

LUBCON Thermoplex® ALN 1001 - Technical data		
Characteristics		Reference norms
Colour	Light beige	
Thickener	Aluminium complex soap	
Base oil	PAO / Ester	
Consistency class (NLGI)	1	DIN 51818
Operating temperature range	-40 ÷ +140 °C	
Dropping point	> 200 °C	DIN ISO 2176
Density at 20°C	0.8382 g/cm^3	DIN 51757
Kin. viscosity of the base oil at 40°C	100 mm^2/s	DIN EN ISO 3104
Kin. viscosity of the base oil at 100°C	14 mm^2/s	DIN EN ISO 3104
Worked penetration	310 ÷ 340 mm/10	DIN ISO 2176

Table 7.3 – Lubricant

For further relubrication, it is recommended to use the same grease.

As alternative following lubricants could be used:
FUCHS: RENOLIT AX 2P
AGIP: AGIP GREASE AC 1
MOBIL: MOBIL GREASE FM 101
KLUBER: KLUBERSYNTH UH1 14-151

⚠ DO NOT USE GREASES DIFFERENT FROM THOSE ABOVE MENTIONED.

⚠ DO NOT MIX DIFFERENT GREASES: THEY LOSE THEIR EFFECTIVENESS IF NOT COMPATIBLE.

⚠ IF YOU SHOULD USE DIFFERENT GREASES, PLEASE CONTACT SERVOMECH BEFORE PROCEED.

⚠ IN CASE OF CUSTOM PRODUCT EXECUTION, THE LUBRICANTS COULD BE DIFFERENT FROM THE STANDARD ABOVE.

Standard lubricant is suitable for the whole speed range performable by the servo actuators, while operating with ambient temperature +0°C ÷ +40°C. In case of different operating temperature, we recommend to contact Servomech S.p.A. to evaluate the use of different lubricant.

⚠ PRECAUTIONS FOR GREASE STORAGE AND HANDLING MUST BE DONE IN COMPLIANCE WITH MSDS PROVIDED BY GREASES MANUFACTURERS.

7.4 Relubrication intervals

For a servo actuator use under nominal performances and standard environment conditions, the lubricating time interval is set to 10^7 ball screw rotations.

In case of heavier or particular working conditions, please contact Servomech S.p.a. to evaluate different lubrication interval.

Following table gives all lubricating information for all sizes and versions available.

Servo actuator size	Ball screw identification code	Lubricant quantity [cm^3]	Re-lubrication frequency [km]
SA0	BS1 (Ø12x5)	0.4	50
	BS2 (Ø12x10)	0.4	100
SA1	BS1 (Ø14x5)	0.9	50
	BS2 (Ø14x10)	0.7	100
SA2	BS1 (Ø16X5)	1.2	50
	BS2 (Ø16x10)	0.9	100
	BS3 (Ø16x16)	1.0	160
SA3	BS1 (Ø20x5)	1.8	50
	BS2 (Ø20x10)	1.3	100
	BS3 (Ø20x20)	1.2	200
SA4	BS1 (Ø25x5)	2.8	50
	BS2 (Ø25X10)	2.6	100
	BS3 (Ø25x25)	1.7	250
SA5	BS1 (Ø32x5)	4.9	50
	BS2 (Ø32x10)	8.8	100
	BS3 (Ø32x20)	6.1	200
	BS4 (Ø32x32)	6.4	320
SA6	BS1 (Ø40x5)	7.1	50
	BS2 (Ø40x10)	13.4	100
	BS3 (Ø40x20)	9.3	200
	BS4 (Ø40x40)	8.6	400

Table 7.4 – Maintenance

8 Removal and replacement

Servo actuator components may only be dismantled and replaced by Servomech.

The only exception to this rule is the disassembling of the motor. The disassembling procedures are described in following sections.

8.1 SA IL – Disassembly of the motor

Power transmission between motor and ball screw is made by a coupling. To disassemble the motor see the following work steps.
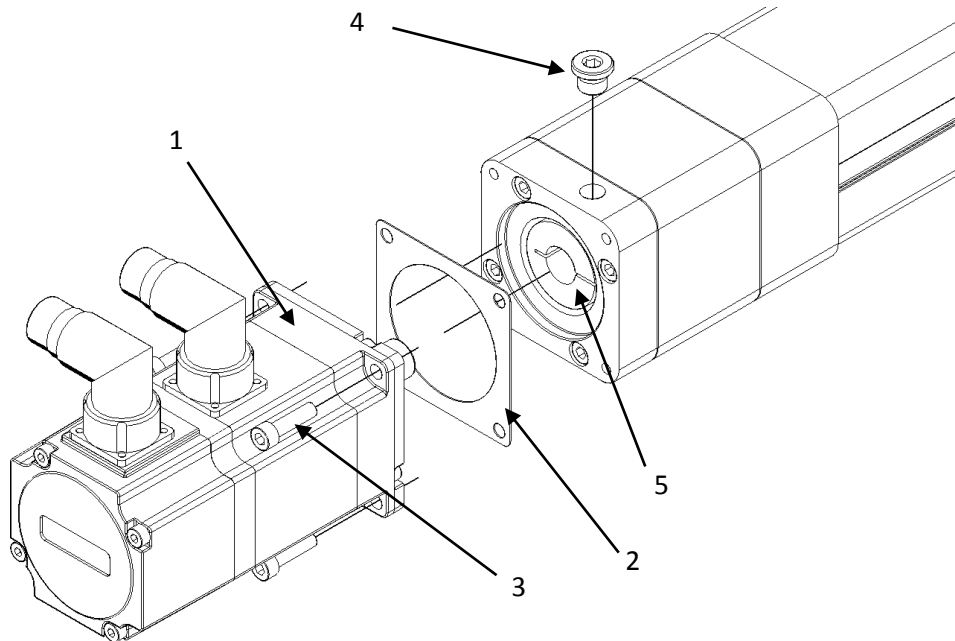

Figure 8.1 – SA IL disassembly of the motor

- Remove the plug (4) and align the locking screw of the coupling (5) with the bore.
- Loosen the coupling screw.
- Loosen and remove the motor flange screws (3).
- Remove the motor (1) and sealing (2) from the flange.

Reassembly of the motor can be carried out in reverse order. Check the correct alignment between the coupling screw and bore before to insert the motor.

Following table gives the tightening torque of the couplings.

Actuator size	SA0	SA1	SA2	SA3	SA4	SA5	SA6
Coupling screw	M3	M3	M4	M4	M4	M6	M8
Tightening torque[Nm]	2.3	2.3	4	4	4.5	15	40

Table 8.2 – Coupling tightening torque

8.2 SA PD – Disassembly of the motor

Power transmission between motor and ball screw is made with a timing belt. To disassemble the motor see the following work steps.
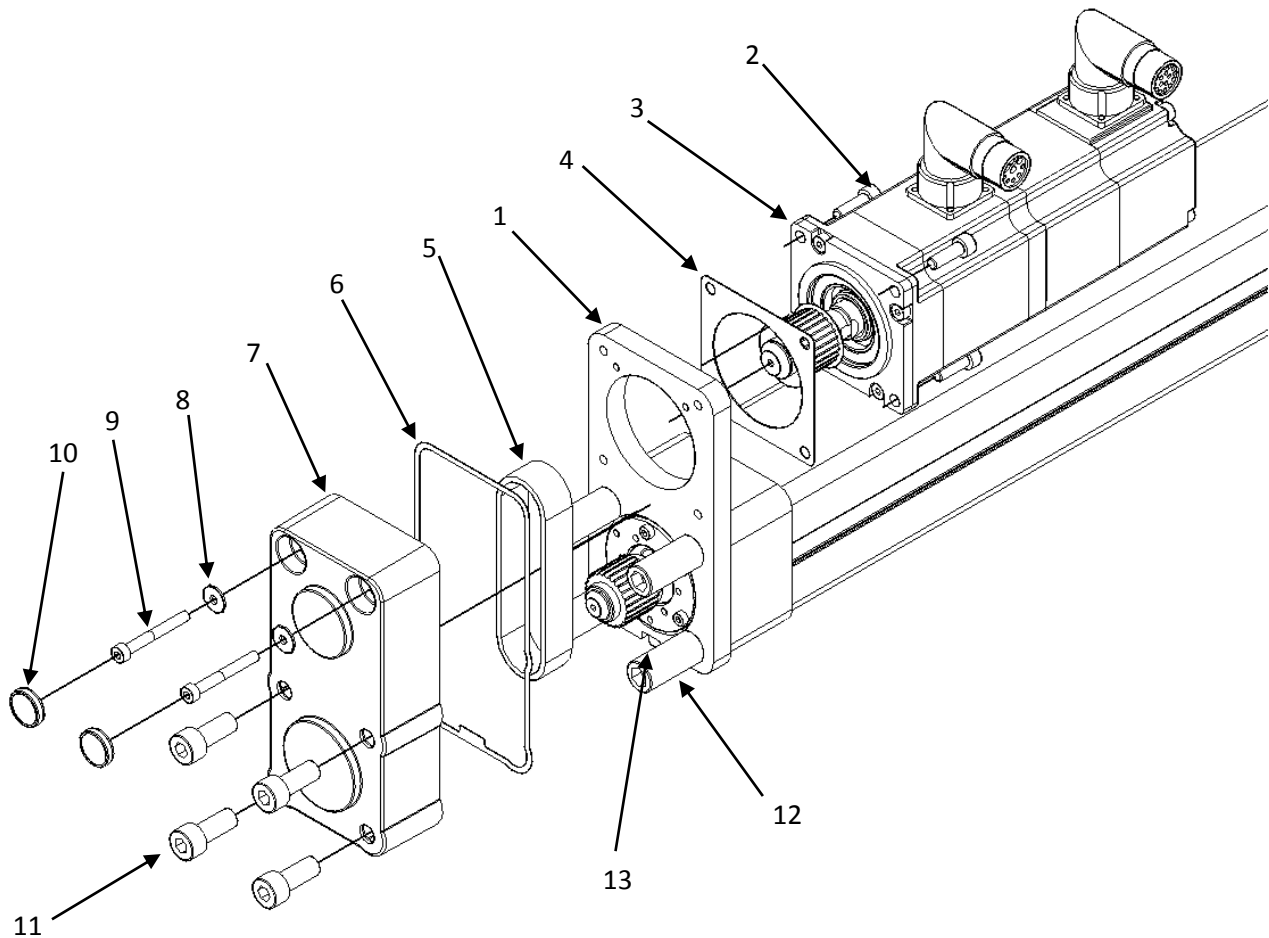

Figure 8.3 – SA PD disassembly of the motor

- Remove the plugs (10), the screws (9) and washers (8).
- Remove the four screws (11) that fix the belt drive cover (7).
- Remove the cover (7) and sealing (6).
- Loosen the four special screws (12) but do not remove them.
- Unscrew the adjusting screw (13) for belt tensioning, until the belt (5) is completely loose.
- Remove the motor screws (2) from the plate (1), then remove the motor (3) and sealing (4).

Reassembly of the motor can be carried out in reverse order. For the belt tensioning procedure see Section 8.3.

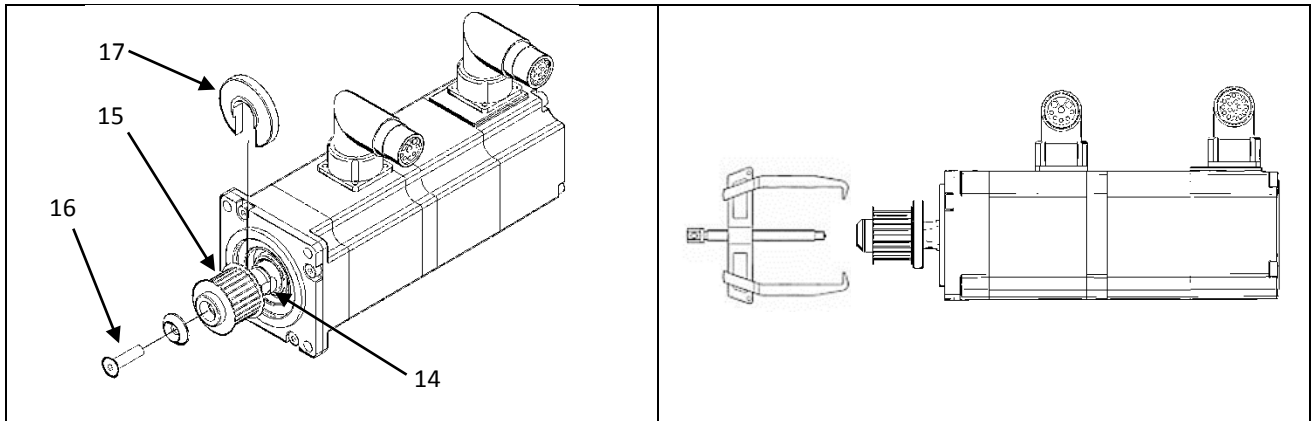To remove the motor pulley please see the following work steps.

Figure 8.4 – SA PD disassembling of the motor pulley

- Loosen the locking screw (16) of the pulley (15). React the torque using a wrench on the motor shaft in the area behind the pulley (14).
- ⚠ DO NOT use the motor brake to react the torque on the shaft.
- ⚠ DO NOT remove the screw (14), just unscrew it.
- Insert the puller flange (17) on the back of the pulley (15).
- NOTE: the puller flange is not included with the actuator, it must be separately ordered. Check the ordering code in Tab. 8.5.
- Remove the pulley from the motor shaft using a proper mechanical puller: put the bar of the puller onto the head of the screw (16) and the jaws on the flange (17).
- DO NOT put the jaws directly on the pulley, but always use the puller flange. If the mechanical puller is used directly on the pulley, this can be damaged.

Reassembly of the motor pulley can be carried out in reverse order. Tighten the locking screw of the pulley as indicated in Tab. 8.5.

Actuator size	SA0	SA1	SA2	SA3		SA4		SA5		SA6	
	RV	RV	RV	RN	RV	RN	RV	RN	RV	RN	RV
Belt drive ratio	16:16	21:21	26:26	30:38	32:34	36:48	44:48	30:44	36:36	32:48	40:40
Motor pulley tightening torque [Nm]	3	3	4	6	6	10	10	23	23	30	30
Puller flange code	40.00.M01	40.01.M01	40.02.M01	40.03.M01		40.04.M01		40.05.M01		40.06.M01	

Table 8.5 – SA PD motor pulley

8.3 SA PD – Belt tensioning
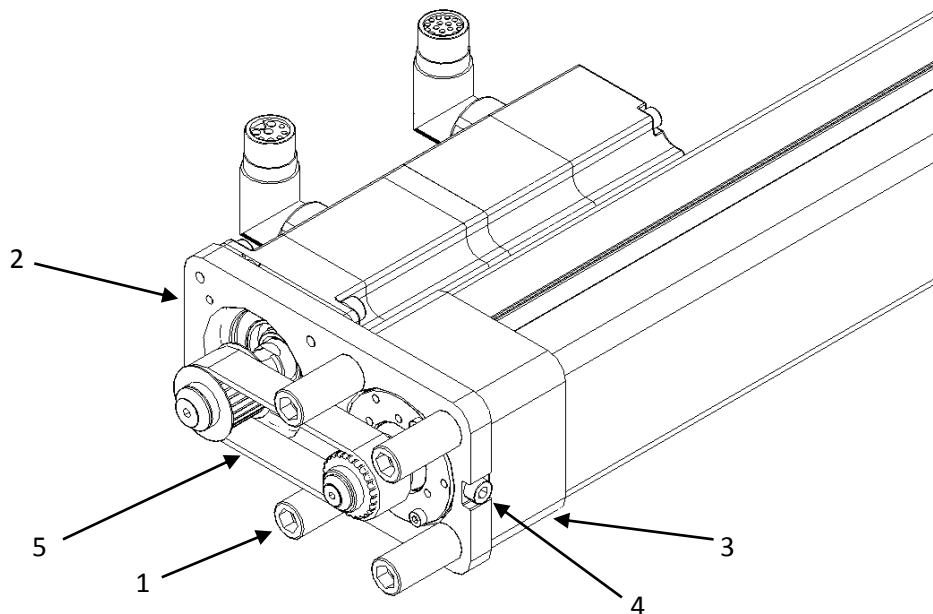
Belt tension is adjustable as described in following.

Figure 8.6 – Belt tensioning

- Loosen the four special screws (1) by ¼ ÷ ½ turn.
- ⚠ WARNING: during belt tensioning the plate (2) must be in contact with the actuator body (3); excessive loosening of the special screws (1) can lead to a wrong measurement of belt tension.
- Screw the adjusting screw (4) to increase the belt tension.
- Adjust the belt tension ad specified in Tab. 8.7, using the adjusting screw (turn the screw clockwise to increase the belt tension, turn it anticlockwise to decrease the belt tension).
- The correct tension of the timing belt can be measured using a suitable frequency measurement device. The device measures the natural frequency **fr** of the belt and must be applied at half of the straight line of the belt. As alternative, the tension of the timing belt can be detected by applying a force **F** at half of the straight line of the belt, then measuring at the point of force application, the resulting deflection **f**.
- ⚠ Excessive belt preloads can lead to increased wear in belt, bearing of the linear unit or motor due to radial loading.
- Tighten the special screws (1) to fix the plate (2).
- Check the belt tension and adjust it again if necessary.
- Once the belt tensioning procedure is completed, it is possible to reassemble the cover (see Section 8.2).

Actuator size	SA0	SA1	SA2	SA3		SA4		SA5		SA6	
	RV	RV	RV	RN	RV	RN	RV	RN	RV	RN	RV
Belt drive ratio	16:16	21:21	26:26	30:38	32:34	36:48	44:48	30:44	36:36	32:48	40:40
Natural frequency **fr** of the belt [Hz]	355 ± 10	284 ± 7	229 ± 7	258 ± 7	272 ± 7	249 ± 7	272 ± 7	173 ± 5	196 ± 5	169 ± 5	191 ± 5
Belt tension checking force **F** [N]	2.8	2.1	3.4	5.9	5.5	10.4	8.5	12.8	10.7	23.6	18.9
Belt deflection **f** [mm]	1.0	1.1	1.4	1.5	1.6	2.0	2.0	2.4	2.5	2.6	2.6

Table 8.7 – Belt tensioning