engineering beyond imagination

Double axis pilot control valve
Differential area

ESJ02D

Rev. 03 • September, 2024

TECHNICAL CATALOGUE

Servocontrols

HISTORY OF REVISIONS

DATE	PAGE	CHANGED	REV.
December, 2018	-	First edition	00
January, 2019	18-19-20-26	Updated controls actuation and modified rod levers	01
November, 2019	18-19-29-30	Modified MV-MZ diagrams Added configurations handle	02
September, 2024	31-32-33-34-35	Spare parts list added	03

ABOUT THE MANUAL

This manual contains the technical instructions for the servocontrol ESJ02D.
All information given in this manual is current and valid according to the information available at the time of publication.
The data specified above only serve to describe the product. EBI Motion controls reserves to modify or revise the instructions without prior notice.

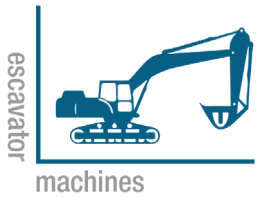
EBI Motion controls is not responsible for any damage caused by an incorrect use of the product.
Please visit www.ebimc.com for the most recent version of this manual.

CONTENTS

INTRODUCTION

SERVOCONTROLS

EBI motion controls servocontrols (joysticks and foot pedals) are used to control the work and drive hydraulics of modern mobile machines with high accuracy, safety and optimal performance. EBI motion controls servocontrols are maintenance free and have a long life cycle, are suited for specialized applications for a variety of mobile equipment such as:



ESJ02D

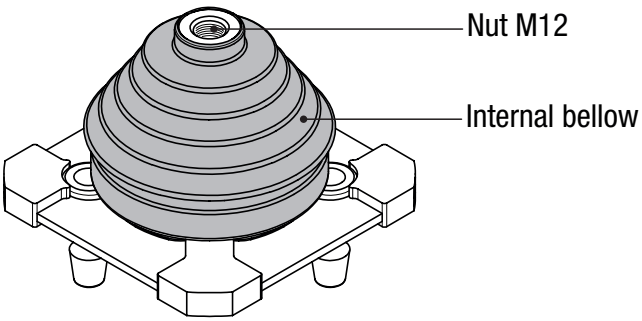
PILOT CONTROL DEVICE IN JOYSTICK DESIGN

2 AXIS SINGLE LEVER - DIFFERENTIAL AREA

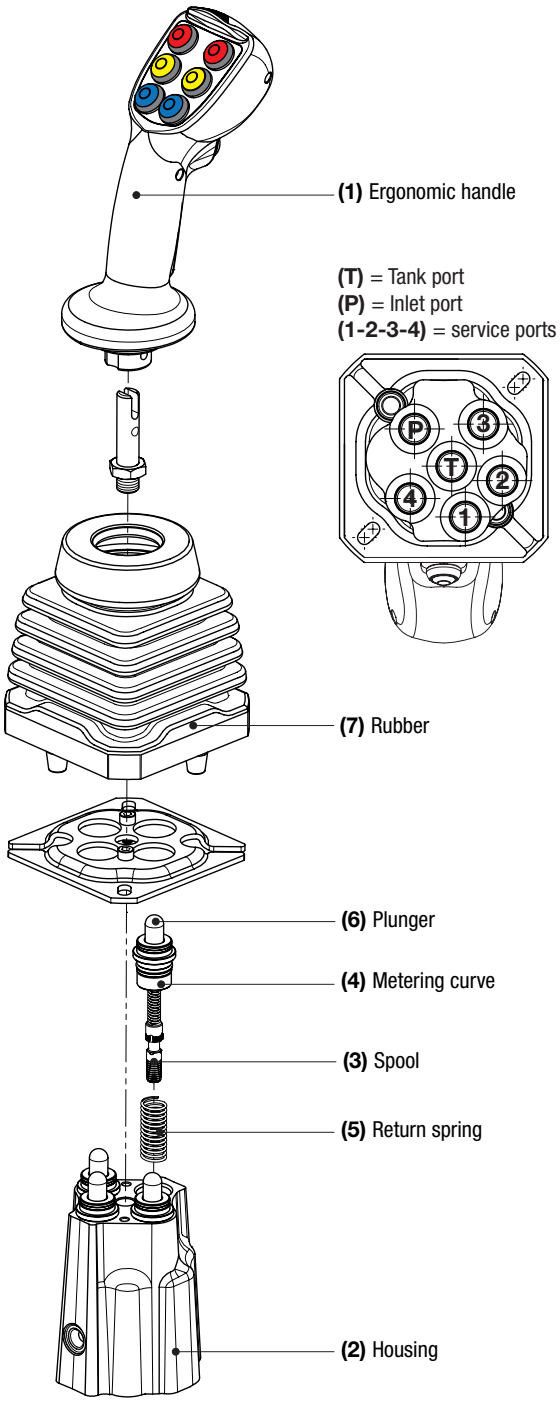
Small dimensions enable simple, compact installation.
Dual Area spool design enables light operation force.
Smooth response is achieved by internal dampening.
Precise control and precise metering.
Low operating effort.
Control element protected with rubber bellow.
High durability and Maintenance free.

BETTER PROTECTION

INTERNAL RUBBER BELLOW OPTION:
to better protect plungers from dirt and contamination.

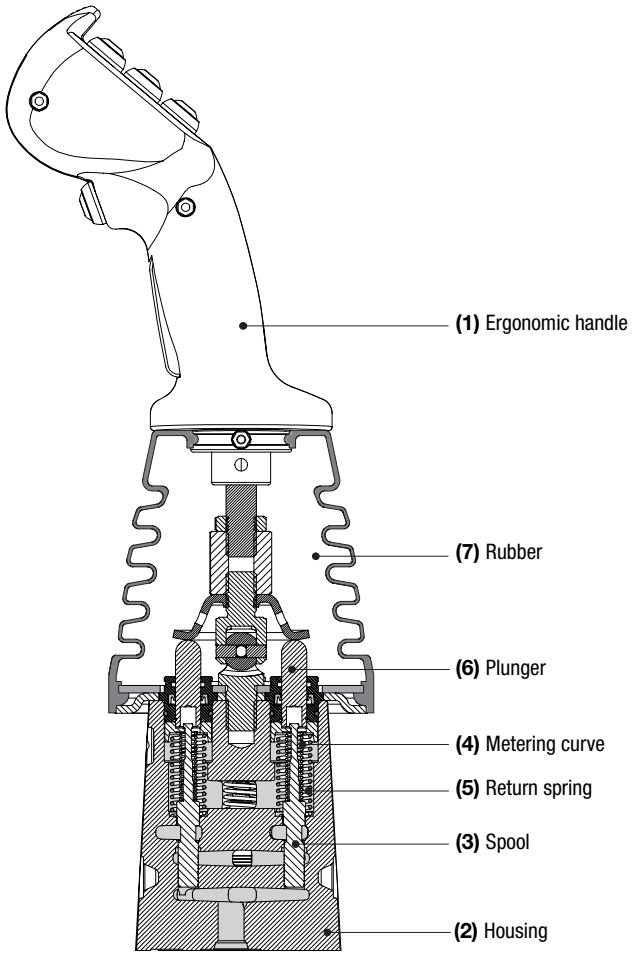


GENERAL INFORMATION



HYDRAULIC OPERATING PRINCIPLE

Pilot control device ESJ02D operates on the basis of direct operated pressure reducing valves.
ESJ02D basically comprises of an ergonomic handle (1), four pressure adjustment valves and a housing (2). Each pressure adjustment valve consists of a spool (3), a metering curve (4), a return spring (5) and a plunger (6).
When non actuated the ergonomic handle is held in the neutral position by the four return springs (5). Service ports (1, 2, 3, 4) are connected to tank port (T) via the drilling.



With deflection of the handle (1), the plunger (6) pushes against the return spring (5) and the metering curve (4). The metering curve firstly moves the spool (3) downwards and closes the connection between the appropriate port and tank port (T). At the same time the appropriate port is connected to the inlet port (P) via the drilling.
The control phase begins as soon as the spool (3) has found its balance between the force of the metering curve (4) and the force which results from the hydraulic pressure in the appropriate service port (1, 2, 3 or 4).
Through the interation of spool (3) and metering curve (4) the pressure in the appropriate ports is proportional to the stroke on the plunger (6) and thus the position of the handle (1).
A rubber bellow (7) protects the mechanical components in the housing (2) against contamination and ensures that the ESJ02D can also be used for the arduous applications.

GENERAL INSTRUCTIONS

INTENDED USE

Servocontrol ESJ02D is designed for industrial use.

WARRANTY

Check the package and the product for transport damage when receiving goods. The package is not meant for long term storage; protect the product appropriately.

Do not dismantle the product. The warranty is void if the product has been disassembled.

The manufacturer is not responsible for damages resulting from misinterpreted, noncompliance, incorrect, or improper use of the product that goes against the instructions given in this document.

GENERAL SAFETY INSTRUCTIONS

The following instructions apply to all procedures associated with the product. Read these instructions carefully and follow them closely.

- Use necessary personal protective equipment when working with the product.
- Support the product properly; make sure the product cannot fall over or turn around by accident.
- Use only appropriate equipment and attachments for lifting and trasferring the product.
- Always use the lifting equipment properly and check the load-bearing capacity.
- Prevent unintended use of the product during installation and maintenance procedures.

WARNING SYMBOL

The following symbols can be used in this manual:

Note:
Useful information

Danger:
Danger of death or injury

Attention:
May cause damage to the product

PRODUCT IDENTIFICATION

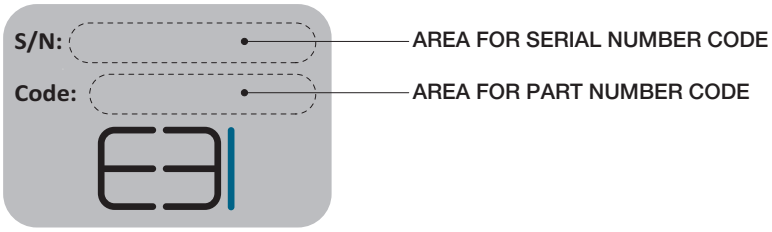
The product identification data can be found on the identification plate attached to the EBI product.

SERIAL NUMBER

all manufacturing data and all sales data can be found with the serial number

PART NUMBER CODE

It is a number univocally identifying the configuration and pressure setting of a valve



Note:

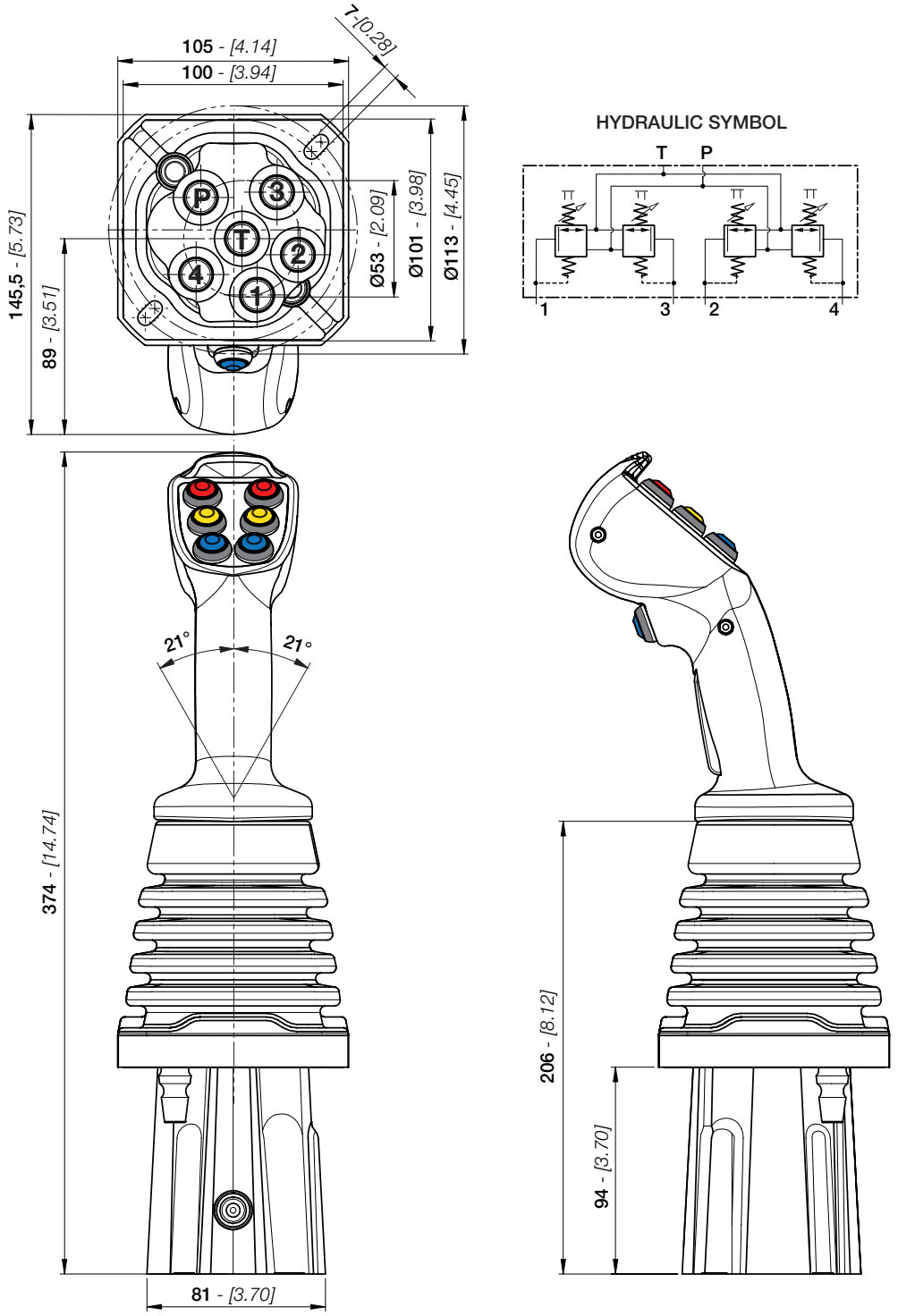
Serial number and part number code have 9 characters (letters and numbers).

UNITS OF MEASURE - CONVERSION FACTORS

LENGHT	FLOW RATE	MASS	FORCE WEIGHT	PRESSURE
1 mm = 0,0394 in	1 l = 0,2200 gal UK	1 kg = 2,205 lb	1 Nm = 0,1020 Kgf	1 bar = 100000 Pa
1 in = 25,4 mm	1 l = 0,2642 gal US	1 lb = 0,4536 kg	1 Kgf = 9,8067 Nm	1 bar = 14,5 psi
	1 gal UK = 4,546 l			1 Pa = 0,0001 bar
	1 gal UK = 1,2010 gal US			1 Pa = 0,00014 psi
	1 gal US = 3,785 l			1 psi = 0,0689 bar
	1 gal US = 0,8327 gal UK			1 psi = 6890 Pa

DIMENSIONS - HYDRAULIC SYMBOL

This drawing represents a ESJ02D, standard assembly and SAE configuration.

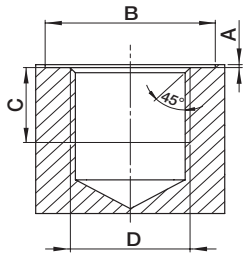


STANDARD CONNECTIONS

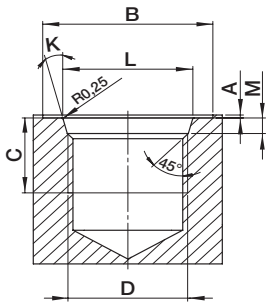
TYPE	BSP ISO 1179-1	UN-UNF ISO 11926-1
INLET - P	G 1/4	9/16-18 UNF
PORTS - A/B	G 1/4	9/16-18 UNF
OUTLET - T	G 1/4	9/16-18 UNF

PORT DETAILS

The connection port size is indicated by an ordering code common for all EBI products.
Following tables show all available connections.



BSP THREADS ISO 1179-1	D		C		B		A		CODE
UNI-ISO 228	mm	inc	mm	inc	mm	inc	mm	inc	
G 1/4	13	0.51	19	0.75	1	0.094	**1B**		
G 3/8	13	0.51	25	0.98	1	0.04	**2B**		
G 1/2	15	0.59	29	1.14	1.5	0.06	**3B**		
G 3/4	17	0.67	36	1.42	1.5	0.06	**4B**		
G 1	19	0.75	45	1.77	2	0.08	**5B**		



UN/UNF THREADS ISO 11926-1	D		C		B		L		M		K	A		CODE
ASA-B1-1	mm	inc	mm	inc	mm	inc	mm	inc	mm	inc		mm	inc	
9/16-18 UNF (SAE6)	13	0.51	26	1.02	15.6	0.61	2.5	0.098	12°	1	0.04	**1S**		
3/4-16 UNF (SAE8)	15	0.59	30	1.18	20.6	0.81	2.6	0.102	15°	1.5	0.06	**2S**		
7/8-14 UNF (SAE10)	17	0.67	34	1.34	23.9	0.94	2.6	0.102	15°	1.5	0.06	**3S**		
1”1/16-12 UNF (SAE12)	20	0.79	41	1.61	29.2	1.15	3.3	0.13	15°	1.5	0.06	**4S**		
1”5/16-12 UNF (SAE16)	20	0.79	50	1.97	35.5	1.40	3.3	0.13	15°	2	0.08	**5S**		

TECHNICAL DATA

All performances in this catalogue are obtained using mineral based hydraulic oil 46 cSt viscosity at 40°C (ISO VG 46 viscosity class). All ESJ02D go through functional testing at these conditions before shipment.

HYDRAULIC STANDARD SPECIFICATIONS

Maximum input pressure ..... **100 bar - [1450 psi]**
Maximum back pressure on tank line ..... **3 bar - [43,5 psi]**
Control max flow on ports..... **15 l/min - [4 GPM]**
Hysteresis ..... **< 1 bar - [< 14,5 psi]**
Hydraulic fluid ..... **Mineral Oil HL, HLP (DIN 51524)** phosphate ester (HFD-R)
Fluid temperature range ..... **-20°C +80°C [-4°F +176°F]**
Fluid viscosity range ..... **10 ÷ 380 cSt**
Max contamination level ..... **9 (NAS 1638)** - 20/18/15 (ISO 4406:1999)
Recommended filtration ..... **ß10 > 75** - (ISO 16889:20008)
Leakage (single port) ..... **3 cm^3/min** - (with 100 bar of pressure)

MATERIAL STANDARD SPECIFICATIONS

Body material ..... **Cast iron**
Plunger material ..... **Stainless steel**
Plunger guide material ..... **Brass**

GENERAL STANDARD SPECIFICATIONS

Type of connection ..... **BSP thead (ISO 1179-1) - SAE thead (ISO 11926-1)**

SEALS

O-Rings: **Buna N** (acrylonitrile butadiene), also named **NBR** (according to ASTM), compatible with fluids having mineral oil base, water in oil emulsions, and water glycol fluids.
These seals are standard for temperatures within the range -20°C and +80°C

Back-up rings and Slide rings: **strengthened PTFE** (Politetrafluoroetilene like Teflon®, Lubriflon®, Ecoflon®, or similar).
Special FPM (Viton®) seals are available on request.

Note: the seal materials are compatible with the fluids normally used in hydraulic systems; in case of special fluids, if you suspect incompatibility between the fluid used and the standard seals, contact the EBI motion controls service network.

HYDRAULIC FLUID

Mineral oil based hydraulic fluids suitable for hydraulic systems can be used; they should have physical lubricating and chemical properties as specified by:
MINERAL OIL BASED HYDRAULIC FLUIDS HL (DIN 51524 part 1)
MINERAL OIL BASED HYDRAULIC FLUIDS HLP (DIN 51524 part 2)
For use of environmentally friendly fluids (vegetable or polyglycol base), or other fluids, please contact EBI.

OIL AND SOLUTIONS - ISO 6743/4	(°C) MIN	(°C) MAX	COMPATIBLE SEAL
Mineral Oil HL, HM or HLP	-25	+80	NBR
Oil in water emulsion HFA	+5	+55	NBR
Oil in water emulsion HFB	+5	+55	NBR
Polyglycol-based aqueous solution HFC	-10	+60	NBR

Hydraulic fluids are available in different viscosity classes identified by the ISO VG number, which corresponds to the kinematic viscosity at 40°C. Here is a table showing typical viscosity changes between 0°C and 100°C for mineral oil based fluids having various viscosity classes. The fluid should be selected with the aim to achieve an appropriate operating viscosity at the expected working temperature.

VISCOSITY CLASS AND FILTRATION DATA			
Viscosity class	*kinematic viscosity (cSt)*		
	maximum (0° C)	*medium (40° C)*	*minimum (100° C)*
ISO VG 10	90	10	2.4
ISO VG 22	300	22	4.1
ISO VG 32	420	32	5.0
ISO VG 46	780	46	6.1
ISO VG 68	1400	68	7.8
ISO VG 100	2560	100	9.9

FLUID CLEANLINESS REQUIREMENTS

The cause of malfunctions in hydraulics is often found to be excessive fluid contamination. The hard contaminant particles in the fluid wear the hydraulic components and prevent the poppets from re-seating, with consequent internal leakage and system inefficiency. For the correct operation it is necessary to adopt filtration methods which guarantee for life the specified fluid cleanliness level. It is important to ensure that hydraulic fluids are brought to the appropriate cleanliness level prior filling up the systems, and, when in doubt, also to flush the hydraulic components prior to installation.

FILTRATION RATIO $BETA_x$:

It is the ratio between the number of particles before and after the filter with diameter larger than X micron.

ABSOLUTE FILTRATION RATIO ISO 4572:

It is the diameter X of the largest particle with $BETA_x \geq 75$.

CONTAMINATION CLASS ISO 4406:

It is expressed by 3 scale numbers representing respectively: the number of particles equal to or larger than 4µm, the number of particles equal to or larger than 6µm, the number of particles equal to or larger than 14µm contained in 1 ml of fluid.

CONTAMINATION CLASS NAS 1638:

It is expressed by one scale numbers representing the number of particles of different size ranges contained in 1 ml of fluid.

FILTRATION RECOMMENDATION

Type	Nominal filtration *(micron)*	Absolute filtation rating *ISO 4572 ($BETA_x \geq 75$)*	Contamination class	
			ISO 4406	*NAS 1638*
System/components operating at *HIGH PRESSURE > 250 bar* *HIGH DUTY CYCLE APPLICATIONS* Systems/components with *LOW* dirt tolerance	10	X = 10... 12	19/17/14	8
System/components operating at *MEDIUM HIGH PRESSURE* *HIGH DUTY CYCLE APPLICATIONS* Systems/components with *MODERATELY* dirt tolerance	15	X = 12... 15	20/18/15	9
System/components operating at *LOW PRESSURE < 100 bar* *LOW DUTY CYCLE APPLICATIONS* Systems/components with *GOOD* dirt tolerance	25	X = 15... 25	21/19/16	10

Attention:

If the filtration demands are not met, the valve poppets can jam in the open position, with the result that the valve remains actuated. It is not possible to force back jammed poppets mechanically.

APPLICATION AND SAFETY GUIDELINES

STORAGE OF NEW PRODUCTS

Encapsulated by a protective wrapping, the products shall not be exposed to direct sunlight nor to source of heat or ozone and kept in a dry place at a temperature between -20°C +50°C.

SAFETY GUIDELINES

During any operation on servocontrols, it is recommended to pay attention to components surfaces temperature.

The circuit functions are to be so designed that uncontrolled machine movements, caused by the application, are prevented and that it is possible to switch from one function to another.

Take into account all of the application limits, particularly those application limits stated within this technical catalogue.

It is recommended to follow these steps and only trained and competent personnel may carry out any work on EBI motion controls servocontrols:

- Do not direct the jet of a pressure washing unit directly to the unit.
- During operation protection via the rubber boot must be ensured.
- Ensure that all matching surfaces are clean, without contamination.
- Ensure that all seals and back-up rings for the matching surfaces are flawless and correctly placed.
- Do not put any sealing material other than the standard seals.
- During the assembly of the complete servocontrol and/or the group of servocontrol, refer to the hydraulic scheme and to the name assigned to each port.
- Do not hang the servocontrol and/or the group of servocontrol to the hydraulics pipes, but always use the specific fixing holes.
- Place in position the servocontrol, then, by hand, insert the fittings and the locating screws.
- Finally tighten with a calibrated torque wrench and torque up to the specifications shown in the catalogue.
- Use gloves in order to avoid accidental injuries during installation or maintenance.
- Do not grab / handle product from moving parts (i.e. cables, levers,...etc.)
- All servocontrols or groups of servocontrols are attributable to pressure vessels. It‘s always recommended to place the components in a closed but ventilated compartment, able to protect the environment and users in case of accidental ejection of material under pressure (fittings, pipes, plugs expander... etc.)
- Do not tamper with the servocontrol.
- Before removing or disassembling the complete servocontrol or allowed parts (as pressure gauge ports, purge plugs, …etc) it is strongly recommended to vent all hydraulic pressure from the system.
- During the first start of the machine, please ensure that the grounding system is connected and stay away from moving parts.
- In case of allowed adjustments on the valve, any maximum value indicated in catalogue must not be exceeded.

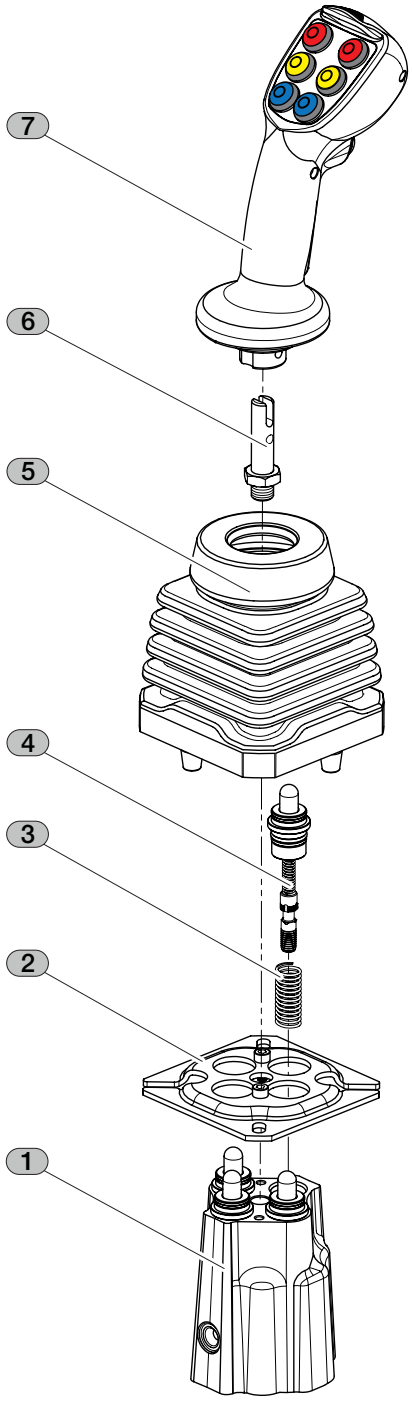
Attention:

These guidelines are not intended to be considered as complete

ORDERING CODES

The order code below provides an example of servocontrol ESJ02D with standard configuration.
This example represents a ESJ02D with ergonomic handle EHC1 and SAE configuration.
See pages 15 - 27 for more information about the different options available.

product	1	2	3	4	3	4	3	4	3	4	5	6	7
ESJ02D	BJD11S	FP1	S1	MA01	S1	MA01	S1	MA01	S1	MA01	C03	L1	EHC1 F06 R03 A



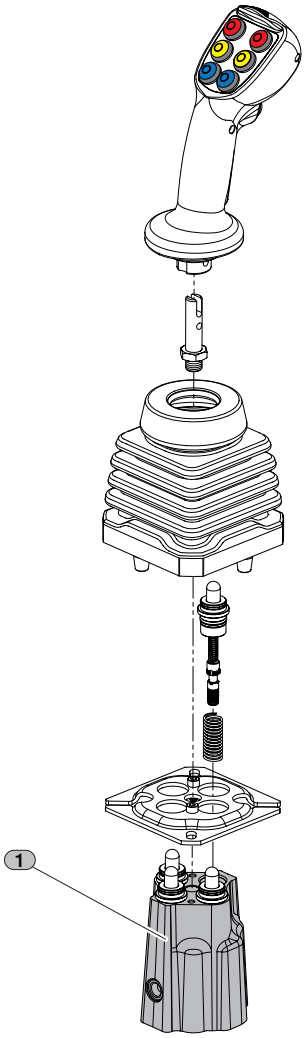
POSITION	CODE	DESCRIPTION	PAGE
1	BJD11S	Body classification	15
2	FP1	Fixing plate	16
3	S1	Return spring (port 1)	17
4	MA01	Metering curve (port 1)	18
5	S1	Return spring (port 2)	17
4	MA01	Metering curve (port 2)	18
5	S1	Return spring (port 3)	17
4	MA01	Metering curve (port 3)	18
5	S1	Return spring (port 4)	17
4	MA01	Metering curve (port 4)	18
3	C03	Control actuation	20
6	L1	Rod lever	23
7	EHC1	Control lever	24
	F06	Front buttons arrangement	
	R03	Rear buttons arrangement	
	A	Handle positions	

Note:

Ordering code for position 3 and 4 must be repeated for each port.

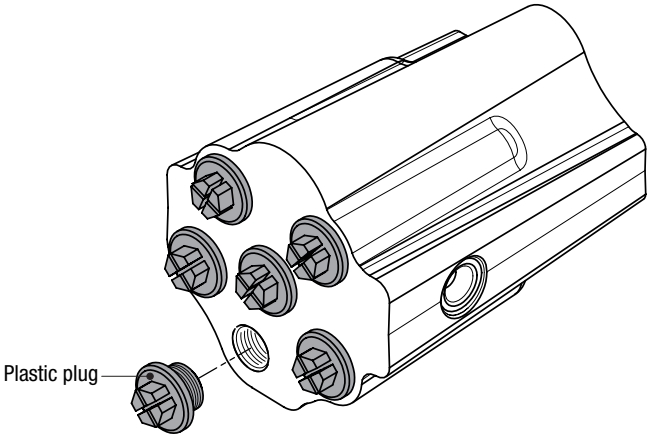
BODY CLASSIFICATION

product	1	2	3	4	3	4	3	4	3	4	5	6	7
ESJ02D	BJD11S	FP1	S1	MA01	S1	MA01	S1	MA01	S1	MA01	C03	L1	EHC1 F06 R03 A



ESJ02D arrangement body is available in two configurations: SAE thread or BSP thread.
For different applications, contact our Sales Office.

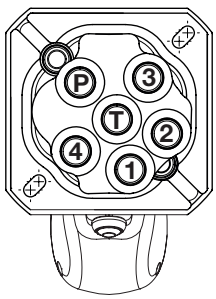
Example of arrangement body with BSP ports:



Note:

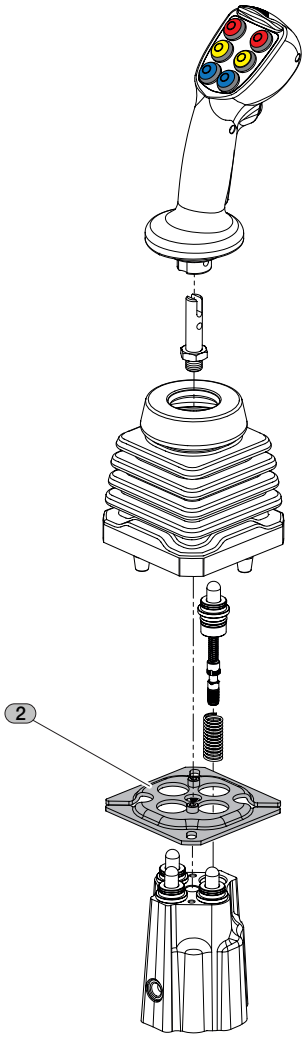
All arrangement bodies are equipped with 6 plastic plugs.

CODE	DESCRIPTION	DRAWING
BJD11S	Standard body with ports 9/16”-18 UNF (SAE6)	**(T)** = *Tank port* **(P)** = *Inlet port* **(1-2-3-4)** = *service ports*
BJD11B	Standard body with ports G 1/4	



FIXING PLATE

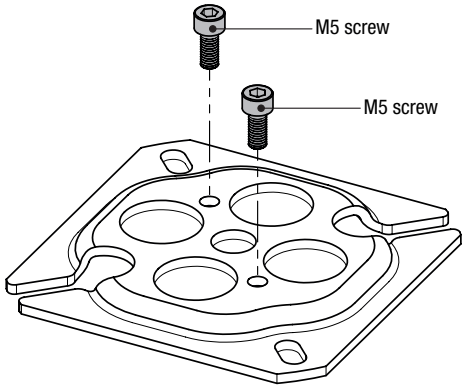
product	1	2	3	4	3	4	3	4	3	4	5	6	7
ESJ02D	BJD11S	FP1	S1	MA01	S1	MA01	S1	MA01	S1	MA01	C03	L1	EHC1 F06 R03 A



The fixing plate allows the correct installation of the ESJ02D servocontrol on the customer machine system.

The following is the standard fixing plate (FP1).

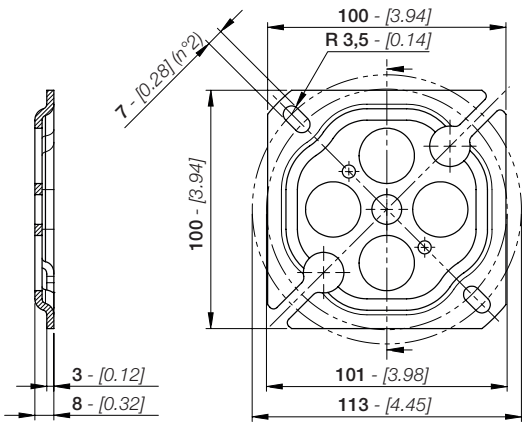
For different dimensions or different applications, contact our Sales Office.



Note:

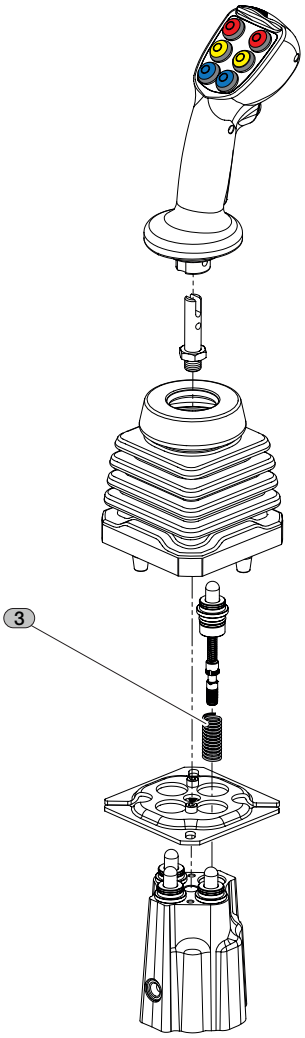
The fixing plate contains 2 screws which allow correct assembly with the body.

CODE	DESCRIPTION	DRAWING
FP1	Standard fixing plate	



RETURN SPRING

product	1	2	3	4	3	4	3	4	3	4	5	6	7
ESJ02D	BJD11S	FP1	S1	MA01	S1	MA01	S1	MA01	S1	MA01	C03	L1	EHC1 F06 R03 A



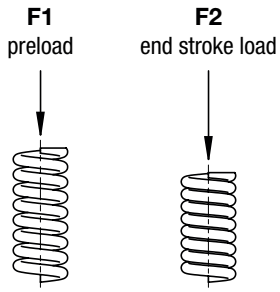
All ESJ02D servocontrols are equipped with 4 return springs (one spring each service port).

Two types of springs are available; the relative values are shown here below.

For different values or different applications please contact our Sales Office.

Note:

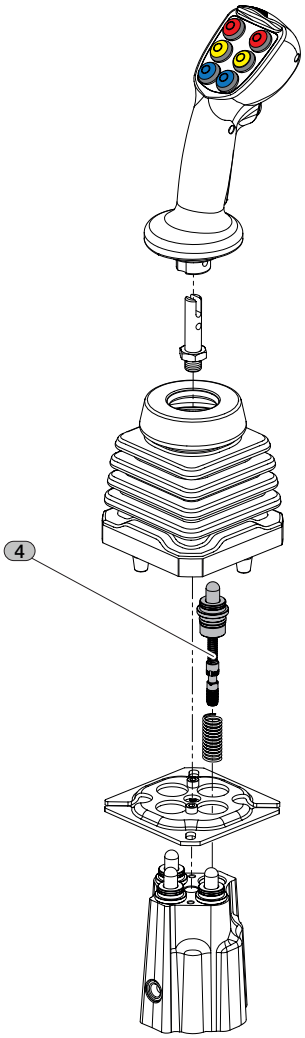
Ordering row 3 must be repeated for each port.



CODE	PRELOAD		END STROKE LOAD	
	Nm	*Kgf*	Nm	*Kgf*
S1	15	*1,53*	28	*2,86*
S2	24	*2,45*	40	*4,08*

METERING CURVE

product	1	2	3	4	3	4	3	4	3	4	5	6	7
ESJ02D	BJD11S	FP1	S1	MA01	S1	MA01	S1	MA01	S1	MA01	C03	L1	EHC1 F06 R03 A



All ESJ02D servocontrols are equipped with 4 metering curves (one metering curve each service port).

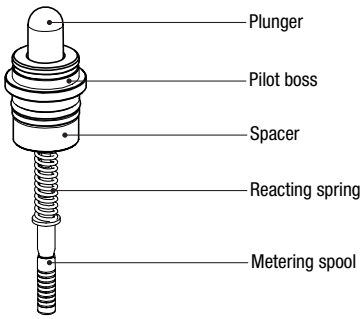
The metering curve classification depends on the control pressure (bar - *psi*) and stroke lenght (mm - *in*).

Currently two types of metering curves are available:

- **Linear curve for differential area with step (MA type)**
- **Linear curve for differential area without step (MB type)**

All metering curves are interchangeable.

For different values or different applications please contact our Sales Office.



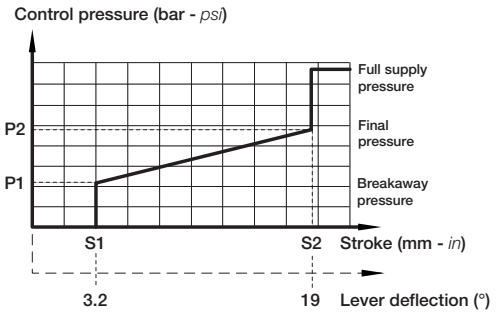
Note:

Ordering row 4 must be repeated for each port.

CODE	PRESSURE P1 bar	P1 psi	PRESSURE P2 bar	P2 psi	STROKE S1 mm	S1 in	S2 mm	S2 in
MA01	5	*72,5*	25	*362,5*	1.2	*0,05*	7.2	*0,28*
MA02	5.8	*84,1*	19.5	*282,7*	1.2	*0,05*	7.2	*0,28*
MA03	5	*72,5*	22	*319*	1.2	*0,05*	7.2	*0,28*
MA04	5	*72,5*	15	*217.5*	1.2	*0,05*	7.2	*0,28*
MA05	5	*72,5*	20	*290*	1.2	*0,05*	7.2	*0,28*
MA06	7.5	*108,8*	29	*420,5*	1.2	*0,05*	7.2	*0,28*
MA07	8	*116*	28	*406*	1.2	*0,05*	7.2	*0,28*
MA08	2	*29*	18	*261*	1.2	*0,05*	7.2	*0,28*

MA

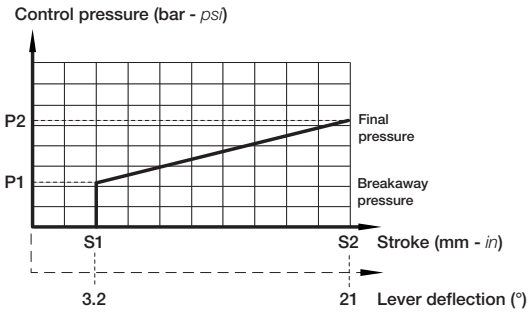
linear curve for differential area with step



CODE	PRESSURE				STROKE			
	P1		P2		S1		S2	
	bar	*psi*	bar	*psi*	mm	*in*	mm	*in*
MB01	5	*72,5*	25	*362,5*	1.2	*0,05*	8	*0,32*
MB02	5.8	*84,1*	19.5	*282,7*	1.2	*0,05*	8	*0,32*
MB03	5	*72,5*	22	*319*	1.2	*0,05*	8	*0,32*
MB04	5	*72,5*	15	*217.5*	1.2	*0,05*	8	*0,32*
MB05	5	*72,5*	20	*290*	1.2	*0,05*	8	*0,32*
MB06	7.5	*108,8*	29	*420,5*	1.2	*0,05*	8	*0,32*
MB07	8	*116*	28	*406*	1.2	*0,05*	8	*0,32*
MB08	2	*29*	18	*261*	1.2	*0,05*	8	*0,32*

MB

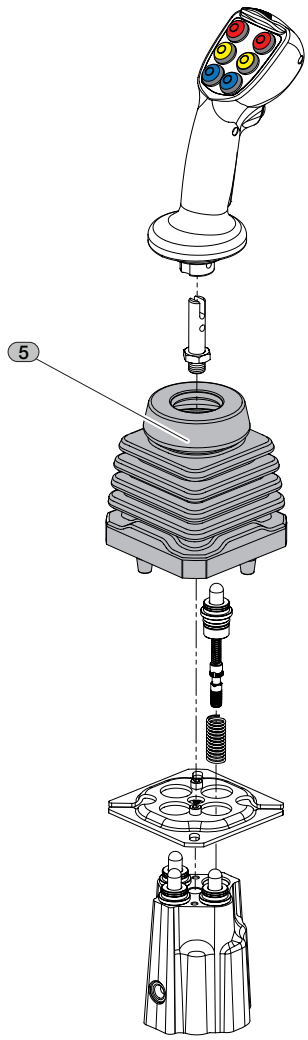
linear curve for differential area without step



On request are available broke line metering curves with step and broke line metering curves without step.
For different values or different applications please contact our Sales Office.

CONTROL ACTUATION

product	1	2	3	4	3	4	3	4	3	4	5	6	7
ESJ02D	BJD11S	FP1	S1	MA01	S1	MA01	S1	MA01	S1	MA01	C03	L1	EHC1 F06 R03 A



Several different types of controls actuation are available; the controls shown correspond to standard arrangement with bellows for bent lever rod.
All controls actuation type are interchangeable.
The choice of control actuation is directly linked to the choice of the rod levers and the relative handles.
In the tables on the next page all the available control actuation choices are shown.

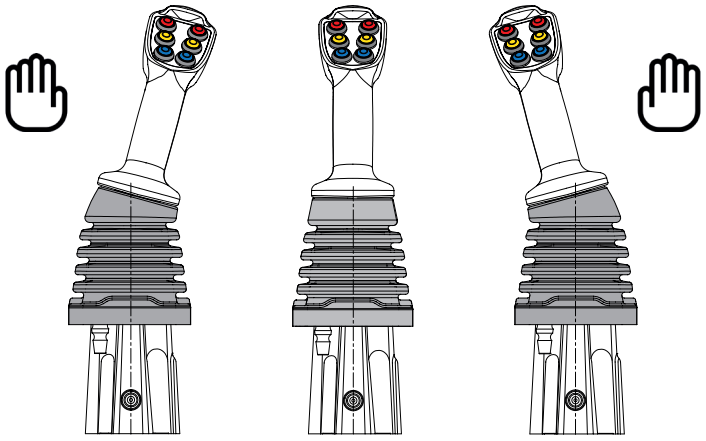
ESJ02D joystick is available in 3 configuration:

- **STANDARD CONFIGURATION WITH STRAIGHT LEVER**
- **CONFIGURATION FOR LEFT HAND WITH BENT LEVER**
- **CONFIGURATION FOR RIGHT HAND WITH BENT LEVER**

Each configuration uses the corresponding control actuation:

C01L = actuation for LEFT hand
C03 = actuation standard
C01R = actuation for RIGHT hand

The position of the handle, respect to the body, changes according to the type of actuation (see page 25).



Example with actuation **C01L**

Example with actuation **C01R**

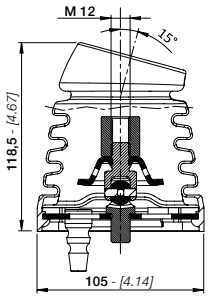
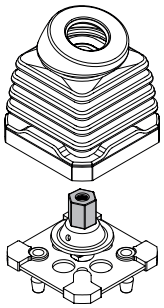
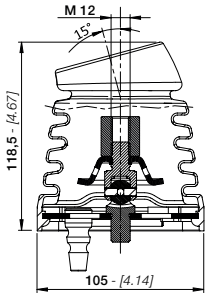
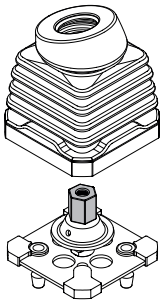
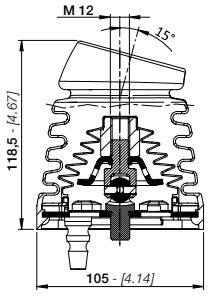
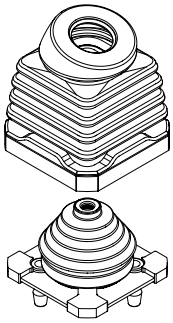
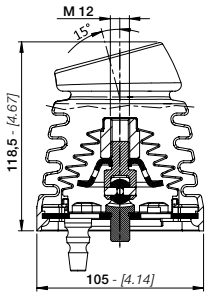
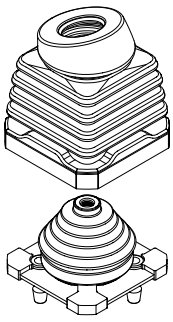
Example with actuation **C01R**

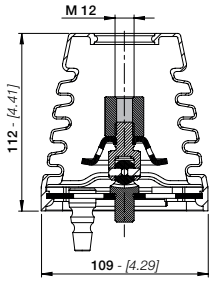
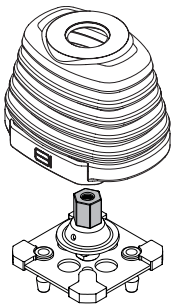
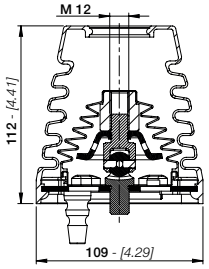
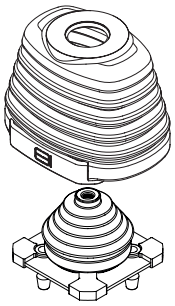
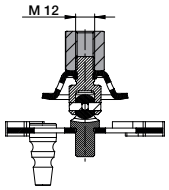
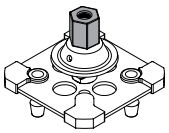
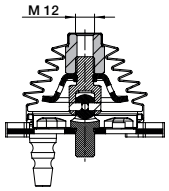
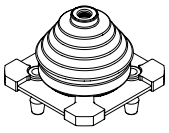
CONTROL ACTUATION FOR JOYSTICK ESJ02D

In this table are shown the control actuations available with straight and bent lever rod.
Each control actuation contains an M12 fastening nut.

Note:

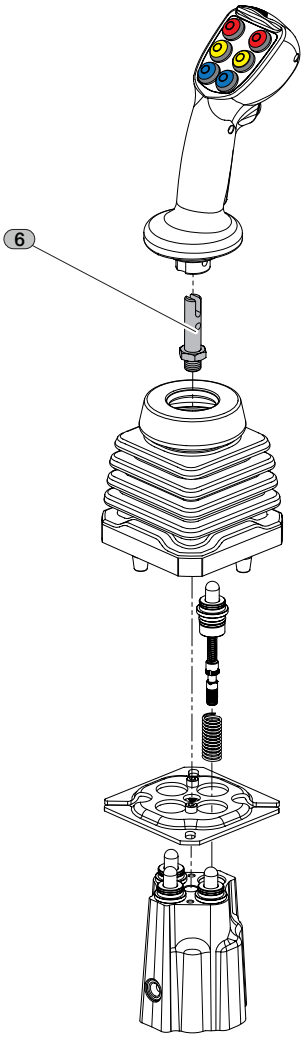
If your application requires a joystick without handle, you must choose one of the following controls actuation; In these case do not provide the assembly of the lever rod.

CODE	DESCRIPTION	DRAWING	CONFIGURATION
C01L	Control actuation with standard bellow for BENT lever rod **ONLY WITH ACTUATION FOR LEFT HAND**		
C01R	Control actuation with standard bellow for BENT lever rod **ONLY WITH ACTUATION FOR RIGHT HAND**		
C02L	Control actuation with double bellow for BENT lever rod **ONLY WITH ACTUATION FOR LEFT HAND**		
C02R	Control actuation with double bellow for BENT lever rod **ONLY WITH ACTUATION FOR RIGHT HAND**		

CODE	DESCRIPTION	DRAWING	CONFIGURATION
C03	Control actuation with standard bellow for STRAIGHT lever rod		
C04	Control actuation with double bellow for STRAIGHT lever rod		
C00	Control actuation without bellow		
C10	Control actuation with internal protection bellow		

ROD LEVER

product	1	2	3	4	3	4	3	4	3	4	5	6	7
ESJ02D	BJD11S	FP1	S1	MA01	S1	MA01	S1	MA01	S1	MA01	C03	L1	EHC1 F06 R03 A

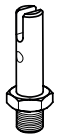
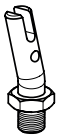


All ESJ02D servocontrols are equipped with a rod lever. The rod lever kit changes according to the type of control actuation lever and the type of handle. Straight and bent lever are available.
For different applications please contact our Sales Office.

Note:

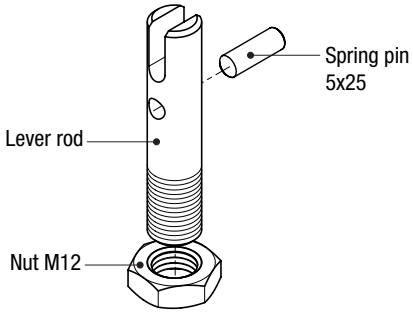
The choice of the rod lever kit is not provided in the joysticks configured without handle.

ROD LEVER FOR HANDLE - EHC1

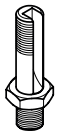
CODE	DESCRIPTION	DRAWING
L1	Straight lever kit *available with control: C03-C04*	
L2	Bent lever kit *(available with control: C01L-C01R-C02L-C02R*	

Note:

Each rod lever kit for EHC1, includes a rod lever, a M12 nut and a spring pin 5x25. This example shows a rod lever kit for a joystick with straight lever (code **L1**).

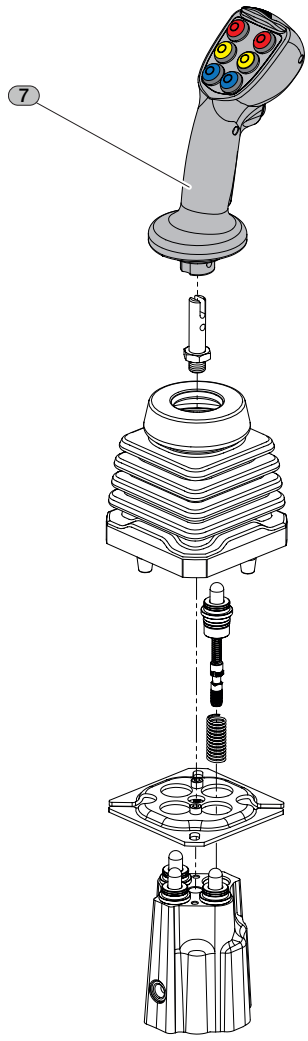


ROD LEVER FOR HANDLE - EHM1 / EHM2 / EHM3

CODE	DESCRIPTION	DRAWING
L3	Straight lever kit *available with control: C03-C04*	
L4	Bent lever kit *(available with control: C01L-C01R-C02L-C02R*	

CONTROL LEVER

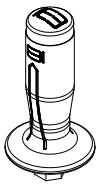
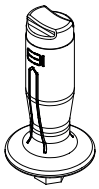
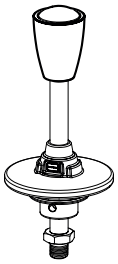
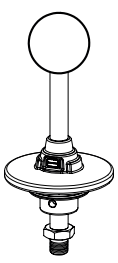
product	1	2	3	4	3	4	3	4	3	4	5	6	7
ESJ02D	BJD11S	FP1	S1	MA01	S1	MA01	S1	MA01	S1	MA01	C03	L1	EHC1 F06 R03 A



EBI handles are designed to guarantee flexibility and high level of customization. Each control levers are interchangeable.

The handle identified with EHM1, EHM2 and EHM3 have been designed to equip the vast range of earth-moving machines; these handles can be set up to have, or not, a micro-switch. EHC1 is a multifuntional configurable handle.

For different applications please contact our Sales Office.

CODE	DESCRIPTION	DRAWING
EHC1	Multifunctional configurable handle	
EHM1	Handle without micro-switch	
EHM2	Handle with one micro-switch	
EHM3	Handle with dual micro-switch	
EHS2	Handle with lens	
EHS4	Handle with knob	

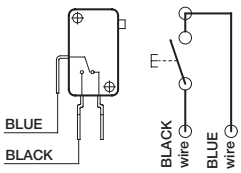
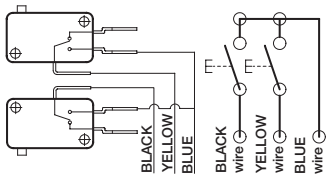
Note:

The handles can be set up with lever rod; this choice depends on the choice of the control actuation type (see page 20).

EHS2 and EHS4 handles do not require the choice of the lever rod kit. The lever rod is already included in the handle kit.

EHM HANDLES

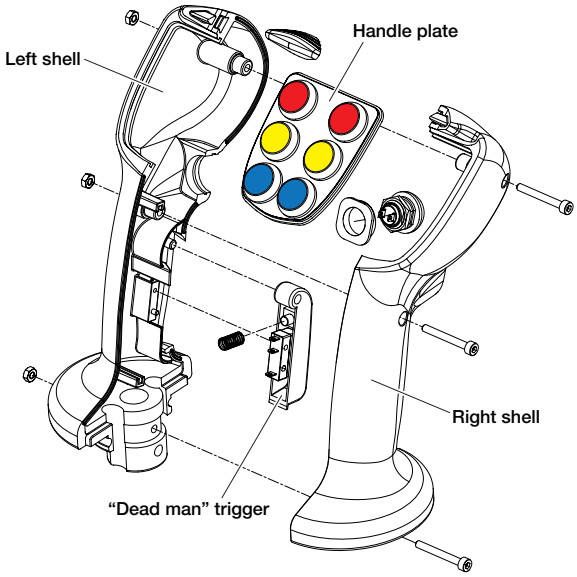
The handle families identified with EHM have been designed to equip the vast range of earth-moving machines including mini-excavators, mini-loaders, tractors, ets. These handles can be set up to have or not a microswitch.

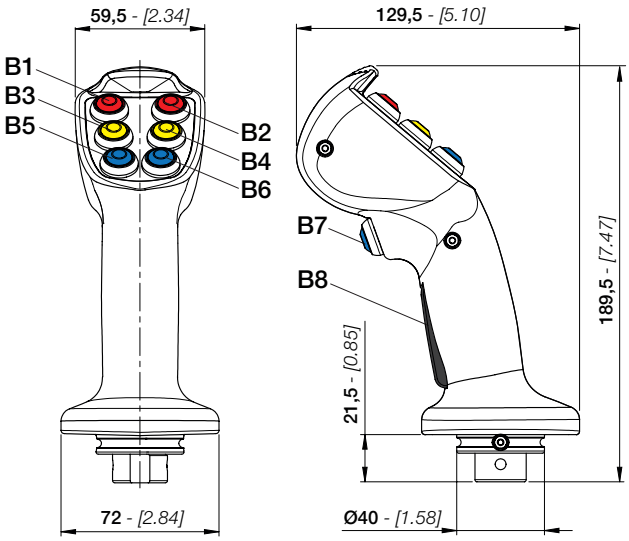
		ELECTRIC SCHEME		ELECTRIC SCHEME
EHM1 Handle without micro-switch	**EHM2** Handle with one micro-switch		**EHM3** Handle with dual micro-switch	

EHC1 HANDLE

EHC1 is a multifuntional configurable handle designed for EBI servocontrols.
It is designed to guarantee flexibility and high level of customization. The ergonomic shape allows long duty cycles and excellent comfort for the operator. A wide range of configurable options (buttons, rollers, switches, rockers) allow to fit various machines design in terms of shape, layout and color.

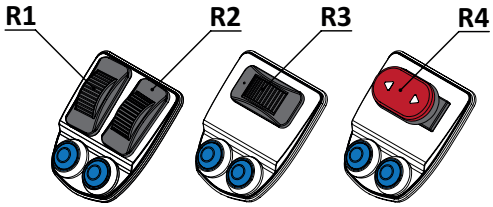
- Ergonomic handle
- ON/OFF and proportional functions
- Multiple Roller options
- Rocker switch
- Enable trigger control
- IP configuration driven
- Configurable options combination
- Color and logo personalization on request





BUTTONS COLOURS SPECIFICATIONS

Button **B1 - B2** ..... **red**
Button **B3 - B4** ..... **yellow**
Button **B5 - B6 - B7**..... **blue**
B8 (button for safety, "dead man") ..... **black**
Roller **R1** (vertical left) ..... **black**
Roller **R2** (vertical right) ..... **black**
Roller **R3** (horizontal) ..... **black**
Rocker **R4** (ON/OFF/ON) ..... **red**

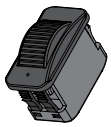


ELECTRIC DEVICE SPECIFICATIONS

SEALED PUSH BUTTON SWITCHES

Front panel sealing according to IEC 60529	IP67
Shock resistance	100 g according to IEC 512-4, test 6c
Vibration resistance	10-500 Hz - 10 g according to IEC 512-4, test 6d
Salt spray	IEC 512-4, test 11f
Operating temperature	-40°C to +85°C [-40°F +185°F]
Max. current/voltage rating with resistive load	5 A / 12 VDC - 5 A / 24 VDC
Initial contact resistance	50 mΩ max.
Insulation resistance	1 GΩ min. at 500 VDC
Dielectric strength	1.000 Vrms
Electrical life at full load	500.000 cycles
Typical operating force	4 N ± 3 N
Low level or mechanical life	1.000.000 cycles

ROLLER SWITCH



Sealing according to IEC 60529	IP67
Power supply	9 - 32 VDC
Power current consumption	24 mA
Power output current	1 mA
Operating temperature	-40°C to +85°C [-40°F +185°F]
Output signal range	0,5 - 4,5 V
Center output signal	2,5 V ± 0,1 V
Signal tolerance (center position / stroke end)	± 100 mV
Minimum load	10 Ω
Travel angle	± 30°
Typical operating force	2,4 N
Low level or mechanical life	5.000.000 cycles

ROCKER SWITCH

Sealing according to IEC 60529	IP67
Actuation type	direct
Switching function	SPDT - center OFF
Rating IEC	16 (4) A 250 V AC 1E4
Rating North America	16 A 125 V AC 1/3 HP - 16 A 250 V AC 1/2 HP
Operating temperature	-40°C to +85°C [-40°F +185°F]
Inrush peak current (capacitive)	120 A
Contact resistance	< 100 Ω (12 V, 1 A DC)
Insulation resistance	> 100 Ω (500 V DC between open contacts)
Insulation distance	≥ 8 mm
Plug force of the terminals	≤ 80 N
Mechanical life endurance	1.000.000 cycles

"DEAD MAN" PUSH BUTTON

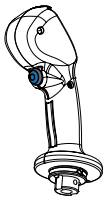
Rated amperage	up to 3 A inductive
Inlet protection rating (microswitch)	IP67
Version	Spring return
Contact type	NA
Mechanical life endurance	1.000.000 cycles
Electric life endurance	200x10^3 cycles

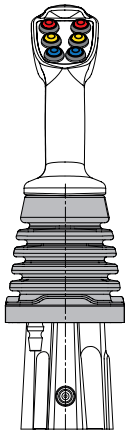
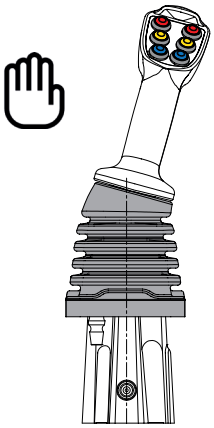
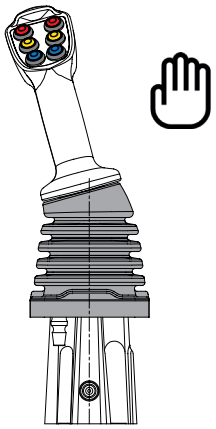
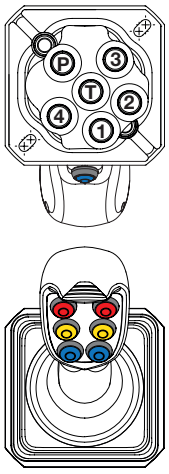
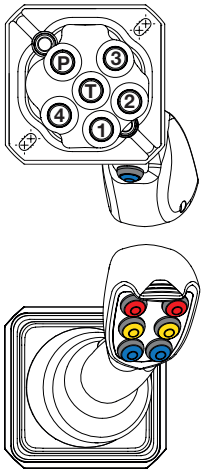
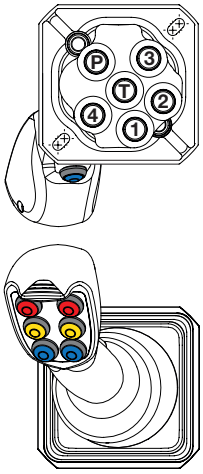
EHC1 ORDERING CODE

handle				1			2			3
E	H	C	1	F	0	6	R	0	3	A

POSITION	CODE	DESCRIPTION	PAGE
1	**F06**	Front electric device arrangement	27
2	**R03**	Rear electric device arrangement	27
3	**A**	Handle position (respect to the body)	28

FRONT ELECTRIC DEVICE ARRANGEMENT					
F00		**F05**		**F22**	
F01		**F06**		**F31**	
F02		**F11**		**F32**	
F03		**F12**		**F51**	
F04		**F21**		**F52**	

REAR ELECTRIC DEVICE ARRANGEMENT					
R00		handle WITHOUT button and “dead man”	**R02**		handle WITH “dead man”
R01		handle WITH button	**R03**		handle WITH button and “dead man”

HANDLE POSITION (RESPECT TO THE BODY)		
STRAIGHT LEVER	BENT LEVER (LEFT HAND)	BENT LEVER (RIGHT HAND)
		
A	**B**	**C**
		
Code A is available only with joystick assembled with STRAIGHT lever kit (**L1** or **L3**) and control actuation (**C03 - C04**).	Code B is available only with joystick assembled with BENT lever kit (**L2** or **L4**) and control actuation (**C01L - C02L**).	Code C is available only with joystick assembled with BENT lever kit (**L2** or **L4**) and control actuation (**C01R - C02R**).

CABLE SPECIFICATIONS

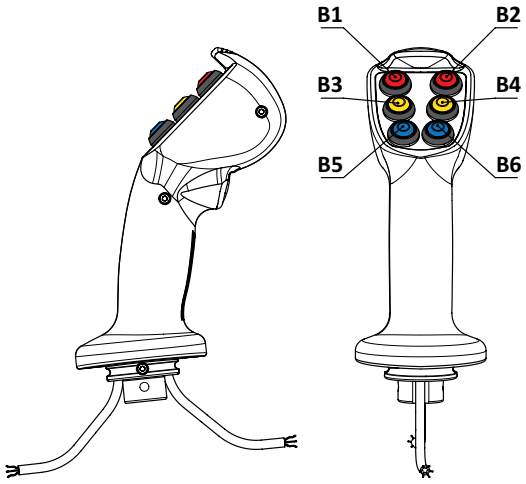
Number of conductors ..... **16 max**
Conductor material ..... **copper with tinned ends**
Conductor section ..... **AWG16 - AWG20**
Insulating material ..... **PVC**
Protective covering material ..... **fireproof polyurethane**
Useful cable lenght ..... **700 mm**

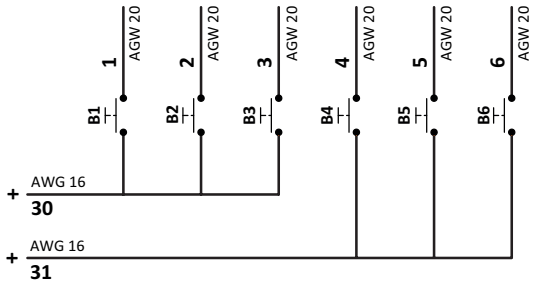
All EBI handles are wired with numbered cables.
Each position indicated on the handle (B1, B2, B3, B4, B5, B6, B7, B8, R1, R2, R3, R4) is characterized by a dedicated and unique cable number.

CONFIGURATIONS OF COMPLETE HANDLES

handle	front arrangement	rear arrangement
EHC1	F06	R00

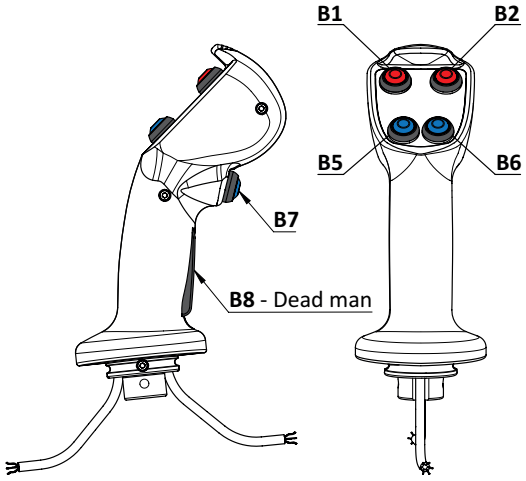
Handle with 6 push-buttons in the front arrangement (B1, B2, B3, B4, B5 and B6) and NO push-button in rear arrangement.

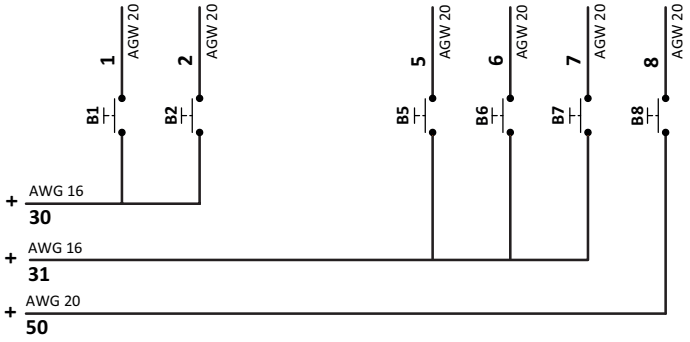




handle	front arrangement	rear arrangement
EHC1	F04	R03

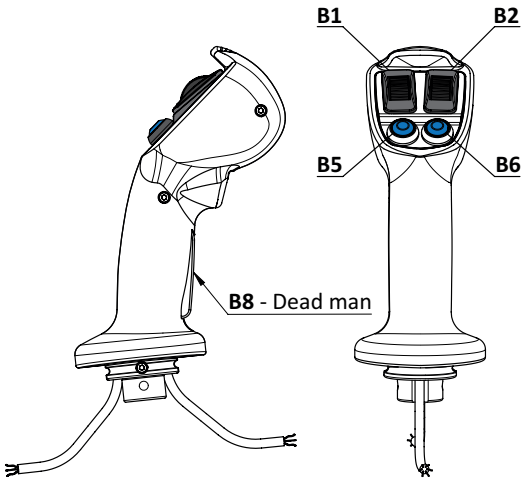
Handle with 4 push-buttons in the front arrangement (B1, B2, B5 and B6) and 2 push-button in rear arrangement (B7 and dead man, B8).

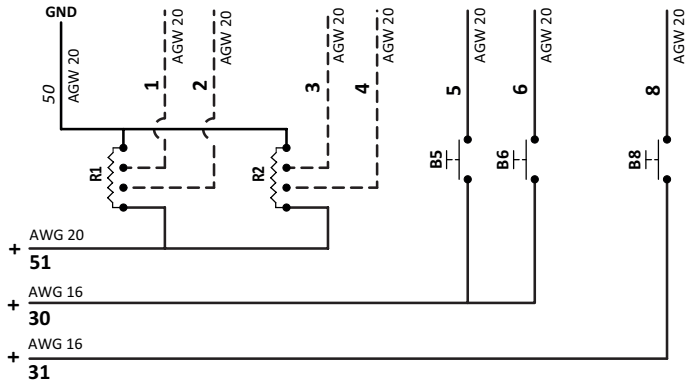




handle	front arrangement	rear arrangement
EHC1	F22	R02

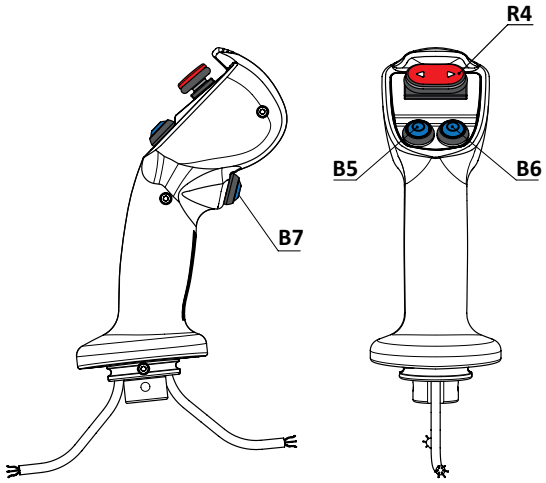
Handle with 2 push-buttons (B5 and B6) and 2 Rollers (R1 and R2) in the front arrangement and 1 push-button in rear arrangement (dead man, B8).

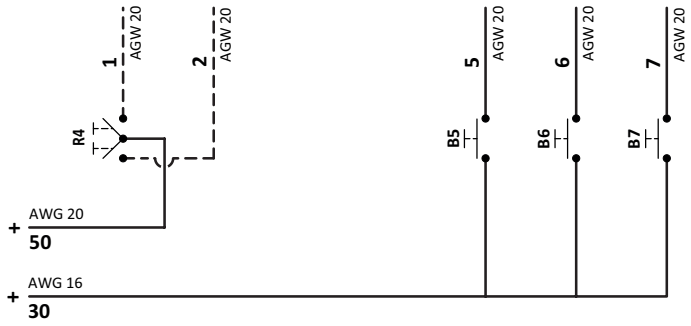




handle	front arrangement	rear arrangement
EHC1	F52	R01

Handle with 2 push-buttons (B5 and B6) and 1 Rocker ON/OFF/ON (R4) in the front arrangement and 1 push-button in rear arrangement (B7).

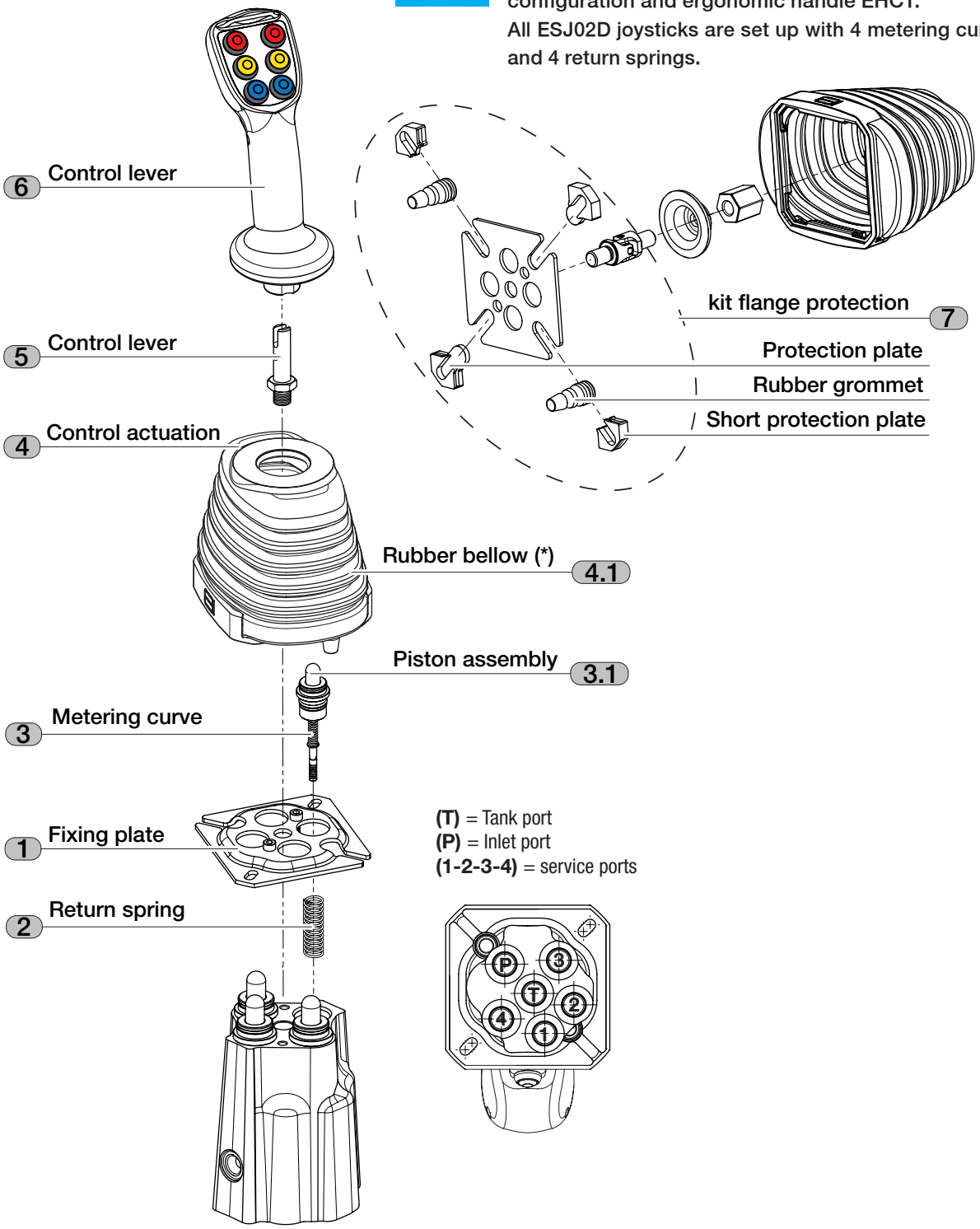




SPARE PARTS LIST

Note:

This example represents a ESJ02D with standard configuration and ergonomic handle EHC1.
All ESJ02D joysticks are set up with 4 metering curves and 4 return springs.



REFERENCE	CATALOGUE CODE	ORDER CODE	DESCRIPTION	NOTE
1	FP1	A01210006	Standard fixing plate	
2	S1	A01220001	Return spring (15 / 28 N) - *[1.53 / 2.45 kgf]*	Each ESJ02A contains 4 return springs
	S2	A01220002	Return spring (24 / 40 N) - *[2.86 / 4.08 kgf]*	

REFERENCE	CATALOGUE CODE	ORDER CODE	DESCRIPTION				NOTE
			P1 (bar-psi)	P2 (bar-psi)	S1 (mm-in)	S2 (mm-in)	
3	MA09	A01160007	6 - *87*	25 - *362.5*	1.2 - *0.05*	7.2 - *0.28*	Each ESJ02A contains 4 metering curves
3.1	A02050003		Piston assembly for metering curve With STEP				

REFERENCE	CATALOGUE CODE	ORDER CODE	DESCRIPTION	NOTE
4	C01L	A01250008	Control actuation with standard bellow for BENT lever rod	ONLY WITH ACTUATION FOR LEFT HAND
	C01R	A01250020		ONLY WITH ACTUATION FOR RIGHT HAND
	C02L	A01250025		ONLY WITH ACTUATION FOR LEFT HAND
	C02R	A01250021		ONLY WITH ACTUATION FOR RIGHT HAND
	C03	A01250036	Control actuation with standard bellow for STRAIGHT lever rod	
	C04	A01250037	Control actuation with double bellow for STRAIGHT lever rod	
	C00	A01250022	Control actuation without bellows	
	C10	A01250023	Control actuation with internal protection bellow	
4.1	EIM120019		Straight rubber bellow	(*) rubber bellow code only for STRAIGHT lever
	P01120005		Mounting plate rubber bellow	(*) rubber bellow code only for BENT lever
5	L1	A01170007	Straight lever kit	Rod lever for handle EHC1
	L2	A01170006	Bent lever kit	
	L3	A01170020	Straight lever kit	Rod lever for handle EHM1, EHM2 and EHM3
	L4	A01170022	Bent lever kit	
6	EHM1	A01270003	Handle without micro-switch	
	EHM2	A01270004	Handle with one micro-switch	
	EHM3	A01270005	Handle with dual micro-switch	
	EHS2	A01170019	Handle with lens	
	EHS4	A01170018	Handle with knob	

REFERENCE	CATALOGUE CODE	ORDER CODE	DESCRIPTION	NOTE
6	EHC1 F00 R00	A01270020	FRONT: No buttons REAR: No buttons	
	EHC1 F00 R01	A01270033	FRONT: No buttons REAR: 1 button	
	EHC1 F00 R02	A01270046	FRONT: No buttons REAR: Dead-man	
	EHC1 F00 R03	A01270013	FRONT: No buttons REAR: 1 button + dead-man	
	EHC1 F01 R00	A01270021	FRONT: 1 button REAR: No buttons	
	EHC1 F01 R01	A01270034	FRONT: 1 button REAR: 1 button	
	EHC1 F01 R02	A01270047	FRONT: 1 button REAR: Dead-man	
	EHC1 F01 R03	A01270012	FRONT: 1 button REAR: 1 button + dead-man	
	EHC1 F02 R00	A01270022	FRONT: 2 buttons REAR: No buttons	
	EHC1 F02 R01	A01270035	FRONT: 2 buttons REAR: 1 button	
	EHC1 F02 R02	A01270048	FRONT: 2 buttons REAR: Dead-man	
	EHC1 F02 R03	A01270010	FRONT: 2 buttons REAR: 1 button + dead-man	
	EHC1 F03 R00	A01270023	FRONT: 3 buttons REAR: No buttons	
	EHC1 F03 R01	A01270036	FRONT: 3 buttons REAR: 1 button	
	EHC1 F03 R02	A01270049	FRONT: 3 buttons REAR: Dead-man	
	EHC1 F03 R03	A01270010	FRONT: 3 buttons REAR: 1 button + dead-man	
	EHC1 F04 R00	A01270024	FRONT: 4 buttons REAR: No buttons	
	EHC1 F04 R01	A01270037	FRONT: 4 buttons REAR: 1 button	
	EHC1 F04 R02	A01270050	FRONT: 4 buttons REAR: Dead-man	
	EHC1 F04 R03	A01270009	FRONT: 4 buttons REAR: 1 button + dead-man	
	EHC1 F05 R00	A01270025	FRONT: 5 buttons REAR: No buttons	
	EHC1 F05 R01	A01270038	FRONT: 5 buttons REAR: 1 button	
	EHC1 F05 R02	A01270051	FRONT: 5 buttons REAR: Dead-man	
	EHC1 F05 R03	A01270008	FRONT: 5 buttons REAR: 1 button + dead-man	

REFERENCE	CATALOGUE CODE	ORDER CODE	DESCRIPTION	NOTE
6	EHC1 F06 R00	A01270026	FRONT: 6 buttons REAR: No buttons	
	EHC1 F06 R01	A01270039	FRONT: 6 buttons REAR: 1 button	
	EHC1 F06 R02	A01270052	FRONT: 6 buttons REAR: Dead-man	
	EHC1 F06 R03	A01270007	FRONT: 6 buttons REAR: 1 button + dead-man	
	EHC1 F11 R00	A01270027	FRONT: 1 roller + 1 button REAR: No buttons	
	EHC1 F11 R01	A01270040	FRONT: 1 roller + 1 button REAR: 1 button	
	EHC1 F11 R02	A01270053	FRONT: 1 roller + 1 button REAR: Dead-man	
	EHC1 F11 R03	A01270017	FRONT: 1 roller + 1 button REAR: 1 button + dead-man	
	EHC1 F12 R00	A01270028	FRONT: 1 roller + 2 buttons REAR: No buttons	
	EHC1 F12 R01	A01270041	FRONT: 1 roller + 2 buttons REAR: 1 button	
	EHC1 F12 R02	A01270054	FRONT: 1 roller + 2 buttons REAR: Dead-man	
	EHC1 F12 R03	A01270016	FRONT: 1 roller + 2 buttons REAR: 1 button + dead-man	
	EHC1 F21 R00	A01270029	FRONT: 2 roller + 1 button REAR: No buttons	
	EHC1 F21 R01	A01270042	FRONT: 2 roller + 1 button REAR: 1 button	
	EHC1 F21 R02	A01270055	FRONT: 2 roller + 1 button REAR: Dead-man	
	EHC1 F21 R03	A01270015	FRONT: 2 roller + 1 button REAR: 1 button + dead-man	
	EHC1 F22 R00	A01270030	FRONT: 2 roller + 2 buttons REAR: No buttons	
	EHC1 F22 R01	A01270043	FRONT: 2 roller + 2 buttons REAR: 1 button	
	EHC1 F22 R02	A01270056	FRONT: 2 roller + 2 buttons REAR: Dead-man	
	EHC1 F22 R03	A01270014	FRONT: 2 roller + 2 buttons REAR: 1 button + dead-man	
	EHC1 F31 R00	A01270031	FRONT: 1 roller (orr) + 1 button REAR: No buttons	
	EHC1 F31 R01	A01270044	FRONT: 1 roller (orr) + 1 button REAR: 1 button	
	EHC1 F31 R02	A01270057	FRONT: 1 roller (orr) + 1 button REAR: Dead-man	
	EHC1 F31 R03	A01270019	FRONT: 1 roller (orr) + 1 button REAR: 1 button + dead-man	

REFERENCE	CATALOGUE CODE	ORDER CODE	DESCRIPTION	NOTE
6	EHC1 F32 R00	A01270032	FRONT: 1 roller (orr) + 2 buttons REAR: No buttons	
	EHC1 F32 R01	A01270045	FRONT: 1 roller (orr) + 2 buttons REAR: 1 button	
	EHC1 F32 R02	A01270058	FRONT: 1 roller (orr) + 2 buttons REAR: Dead-man	
	EHC1 F32 R03	A01270018	FRONT: 1 roller (orr) + 2 buttons REAR: 1 button + dead-man	
	EHC1 F51 R00	A01270064	FRONT: 1 rocker + 1 button REAR: No buttons	
	EHC1 F51 R01	A01270078	FRONT: 1 rocker + 1 button REAR: 1 button	
	EHC1 F51 R02	A01270079	FRONT: 1 rocker + 1 button REAR: Dead-man	
	EHC1 F51 R03	A01270080	FRONT: 1 rocker + 1 button REAR: 1 button + dead-man	
	EHC1 F52 R00	A01270081	FRONT: 1 rocker + 2 buttons REAR: No buttons	
	EHC1 F52 R01	A01270059	FRONT: 1 rocker + 2 buttons REAR: 1 button	
	EHC1 F52 R02	A01270071	FRONT: 1 rocker + 2 buttons REAR: Dead-man	
	EHC1 F52 R03	A01270082	FRONT: 1 rocker + 2 buttons REAR: 1 button + dead-man	
7		A01000004	Kit flange protection	Each kit contains: n.2 rubber grommet n.2 protection plate n.2 short protection plate

engineering beyond imagination

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