# Series 5V vertical electromechanical axis

## Sizes 50, 65, 80



» High dynamics

» Easy to integrate in x-y-z systems

» Strokes up to 1500 mm

» Version with integrated shock absorbers

The 5V vertical electromechanical axis represents the ideal solution for applications that require vertical displacements as for example pick and place, dispensing, loading/unloading systems (plastic injection moulding, assembly, machining) or palletisers. Available in three sizes, 50, 65 and 80, it can be used as vertical axis of a x,y,z gantry system or cantilever in applications that require to move loads for long strokes quickly and thus optimise the machine cycle time.

The new Series 5V axes are mechanical linear actuators with toothed belt. Thanks to a specific pulley system with omega configuration, these axes allow to reduce to a minimum the inertia of the system. Furthermore, the presence of one or more recirculating ball guides (HS version) as well as of a special self-supporting square profile provides high stiffness and resistance to dynamic loads, ensuring a precise and fast displacement of heavy loads.

## GENERAL DATA

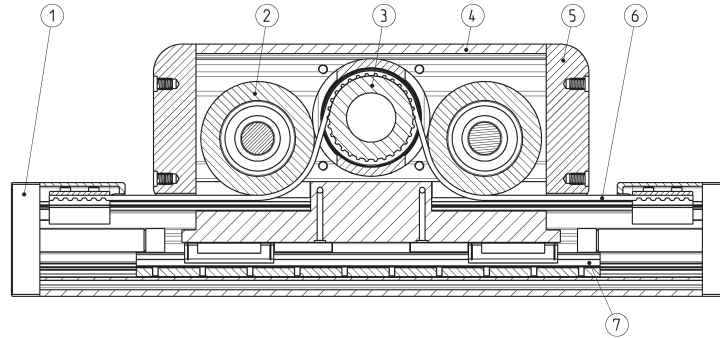| | |
|---|---|
| Construction | electromechanical axis with toothed belt |
| Design | open profile with protection plate |
| Operation | linear multi-position actuator |
| Sizes | 50, 65, 80 |
| Strokes | max 1500 mm |
| Type of guide | internal, with recirculating balls (cage type) |
| Fixing | by means of dedicated accessories |
| Mounting motor | on both sides |
| Operating temperature | -10°C ÷ +50°C |
| Storage temperature | -20°C ÷ +80°C |
| Protection class | IP 20 |
| Lubrication | centralized lubrification by means of internal channels |
| Repeatability | ± 0.05 mm |
| Duty cycle | 100% |
| Use with external sensors | CSH and CST magnetic switches by means of accessories Mod. SMS |

## CODING EXAMPLE

| 5V | S | 050 | TBL | 0200 | A | S | 1 | |
|----|---|-----|-----|------|---|---|---|---|

| | |
|------|-----------------------------------------------|
| **5V** | SERIES |
| **S** | PROFILE:<br>S = square section |
| **050** | FRAME SIZE:<br>050 = 50x50 mm<br>065 = 65x65 mm<br>080 = 80x80 mm |
| **TBL** | TRANSMISSION:<br>TBL = toothed belt |
| **0200** | STROKE [C]:<br>0050 ÷ 1500 mm |
| **A** | VERSION:<br>A = standard |
| **S** | TYPE OF SLIDER:<br>S = standard |
| **1** | NUMBER OF SLIDERS:<br>1 = 1 slider |
| | TYPE OF END CAP:<br> = standard<br>SA = shock absorber integrated |

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## █ MECHANICAL CHARACTERISTICS

(A) Value refers to a covered distance of 2000 Km with fully supported system.

| | Measuring unit | Size 50 | Size 65 | Size 80 |
|---|---|---|---|---|
| **RECIRCULATING BALL GUIDE (CAGE TYPE)** | | | | |
| Version | | A | A | A |
| Type of slider | | S | S | S |
| Number of RDS blocks | pcs | 2 | 2 | 2 |
| Dynamic load of RDS blocks (C) | N | 11640 | 28400 | 44600 |
| Max admissible load (Cmax z, Cmax y) | N | 3100(A) | 8300(A) | 13100(A) |
| Max admissible moment (Mmax x) | Nm | 22.44 | 96.00 | 216.60 |
| Max admissible moment (Mmax y, Mmax z) | Nm | 45.30 | 269.40 | 525.00 |
| Max linear speed of mechanics (Vmax) | m/s | 3 | 3 | 3 |
| Max linear acceleration of mechanics (amax) | m/s² | 30 | 30 | 30 |
| **PROFILE** | | | | |
| Moment of surface inertia Iy | mm4 | $1.89 \cdot 10^5$ | $4.94 \cdot 10^5$ | $1.23 \cdot 10^6$ |
| Moment of surface inertia Iz | mm4 | $2.48 \cdot 10^5$ | $6.97 \cdot 10^5$ | $1.68 \cdot 10^6$ |
| **TOOTHED BELT** | | | | |
| Type | | 25 AT 5 HP | 40 AT 5 HP | 45 AT 10 HP |
| Pitch | mm | 5 | 5 | 10 |
| Safe loads | N | See the diagram | See the diagram | See the diagram |
| **PULLEY** | | | | |
| Effective diametre of the pulley | mm | 47.75 | 57.30 | 76.39 |
| Number of teeth | z | 30 | 36 | 24 |
| Linear movement per pulley round | mm/round | 150 | 180 | 240 |

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# SERIES 5V MATERIALS



| COMPONENTS | MATERIALS |
|---|---|
| 1. End cap | Aluminium alloy |
| 2. Idler | Aluminium alloy |
| 3. Pulley | Steel |
| 4. Omega body | Aluminium alloy |
| 5. Cover | Aluminium alloy |
| 7. Belt | PU + Steel |
| 8. Recirculating ball guide | Steel |

## HOW TO CALCULATE THE LIFE OF THE AXIS 5V

The correct dimensioning of the axis 5V, used individually or in a cartesian system with several axes, you need to consider some facts, both static and dynamic. Among these, the most important are described on the following pages.

CALCULATION OF LIFE [km]

Leq  = Life of the axis [km]
Cma = Maximum admissible load [N]
Ceq  = Equivalent load [N]
fw    = safety coefficient according to
          the working conditions

$$L_{eq} = \left( \frac{C_{ma}}{C_{eq} \cdot f_w} \right)^3 \cdot 2000$$

CALCULATION OF EQUIVALENT LOAD

When compression/traction and side loads as well as bending or torque moments act on the system, you need to calculate the equivalent load acting on the system.

$$C_{eq} = |F_y| + |F_Z| + C_{ma} \cdot \left| \frac{M_x}{M_{x,ma}} \right| + C_{ma} \cdot \left| \frac{M_y}{M_{y,ma}} \right| + C_{ma} \cdot \left| \frac{M_z}{M_{z,ma}} \right|$$

Ceq  = Equivalent load [N]
Fy    = Force acting along the Y-axis [N]
Fz    = Force acting along the Z-axis [N]
Cma = Max admissible load [N]
Mx   = Moment along X-axis [Nm]
My   = Moment along Y-axis [Nm]
Mz   = Moment along Z-axis [Nm]
M(x,ma) = Max admissible moment along X-axis [Nm]
M(y,ma) = Max admissible moment along Y-axis [Nm]
M(z,ma) = Max admissible moment along Z-axis [Nm]

## HOW TO CALCULATE THE DRIVING TORQUE [Nm]

FA = Total force acting from outside [N]
FE = Force to be applied externally [N]
g = Gravitational acceleration [9.81 m/s2]
mE = Mass of the body to move [kg]
DP = Pulley pitch diameter [mm]
CM1 = Driving torque due to external agents [Nm]

$$C_{TOT} = C_{M1} + C_{M2} + C_{M3}$$

$$F_A = F_E + m_E \cdot (a \pm g)$$

$$C_{M1} = \frac{F_A \cdot D_P}{2}$$

JTOT= Moment of inertia of rotating components [kg·m2]
ω  = Angular acceleration [rad/s2]
a = Axis linear acceleration [m/s2]
CM2 = Driving torque due to rotating components [Nm]

$$\dot{\omega} = \frac{2 \cdot a}{D_P}$$

$$C_{M2} = J_{TOT} \cdot \dot{\omega}$$

FTT = Force needed to move translating components [N]
FTF = Force needed to move fixed-length translating components [N]
FTV = Force needed to move variable-length translating components [N]
mC1 = Mass of fixed-length translating components [kg]
KTV = Mass coefficient of variable-length translating components [kg/mm]
CM3 = Driving torque due to translating components [Nm]

$$F_{TT} = F_{TF} + F_{TV}$$

$$F_{TF} = m_{C1} \cdot (a \pm g)$$

$$F_{TV} = K_{TV} \cdot C \cdot (a \pm g)$$

According to the axis size and to the speeds chosen, force that can be transmitted from the toothed belt has these limits.

$$C_{M3} = \frac{F_{TT} \cdot D_P}{2}$$

## TRANSMISSIBLE FORCE

The force that can be transmitted from the toothed belt depends on the axis size and speeds chosen.



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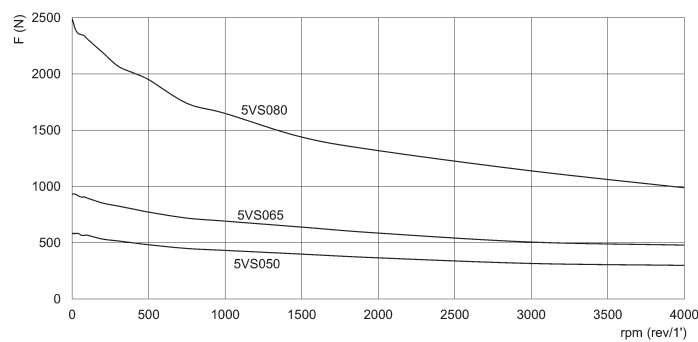
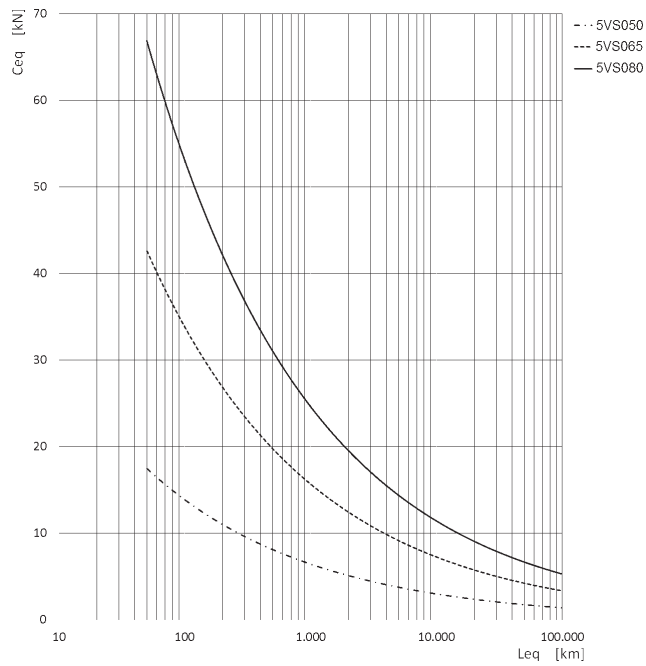## WEIGHT DISTINCTION

1 = fixed mass Mf
2 = moving mass with stroke zero mc1
3 = moving mass that varies according to the stroke Ktv
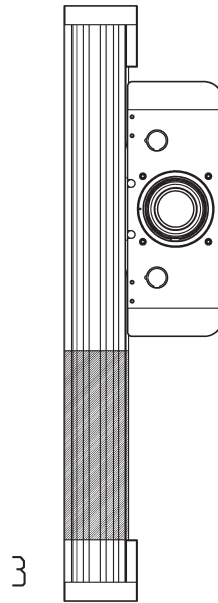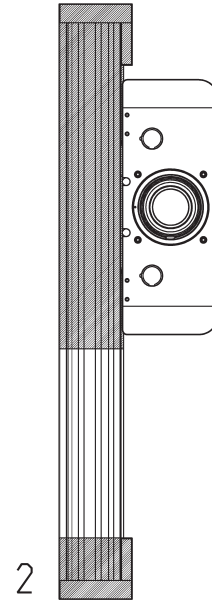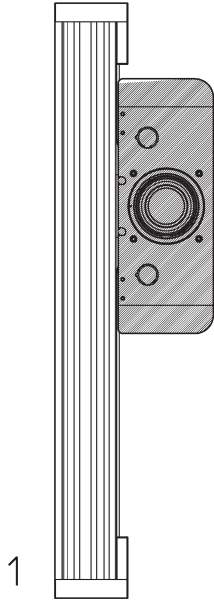


| Size | mc1 [ Kg ] | Ktv [ Kg/m ] | Mf [ Kg ] | tot weight stroke 0 [ Kg ] |
|------|-----------|--------------|-----------|----------------------------|
| 50 | 1.49 | 3.15 | 3.37 | 4.86 |
| 65 | 2.67 | 5.13 | 6.14 | 8.81 |
| 80 | 6.43 | 8.3 | 12.16 | 18.59 |

## LIFE OF THE SERIES 5V AXIS ACCORDING TO THE EQUIVALENT LOAD



Curves calculated with fw = 1

Ceq = Equivalent load applied on the axis [kN]
Leq = Life of the axis [km]

### EQUIVALENT LOAD

To determine the moment acting on the axis x, Mx, in an accurate way, refer to the following formula:

$$Mx = Fy \cdot ( K + K1 )$$

where:
Mx = Moment along X-axis [Nm]
Fy = Force acting along the Y-axis [N]
K = fixed distance for axis 5E [mm]
K1 = application arm [mm]

NOTE: here below, the "K" values for the three sizes
- K = 21 mm (5VS050)
- K = 28 mm (5VS065)
- K = 36 mm (5VS080)



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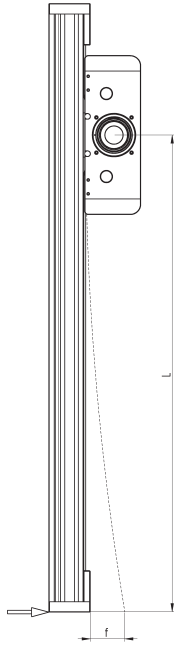58
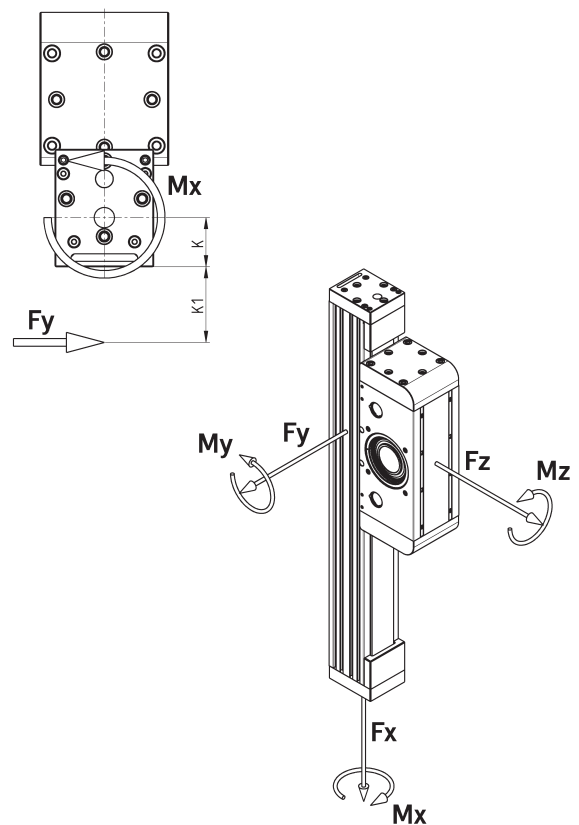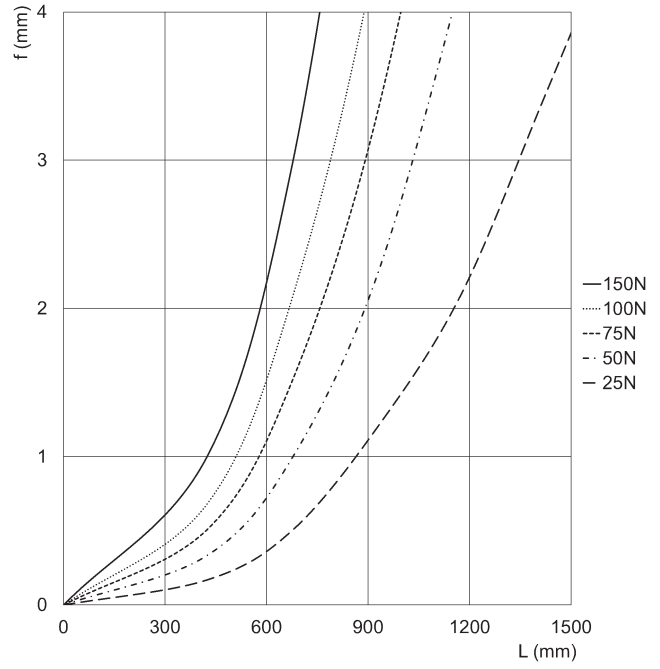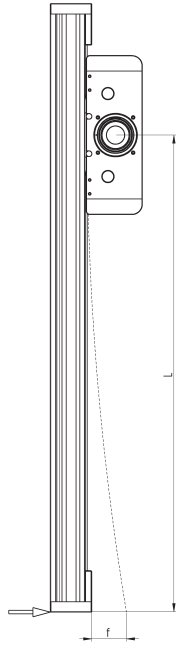
## DEFLECTION 5VS050

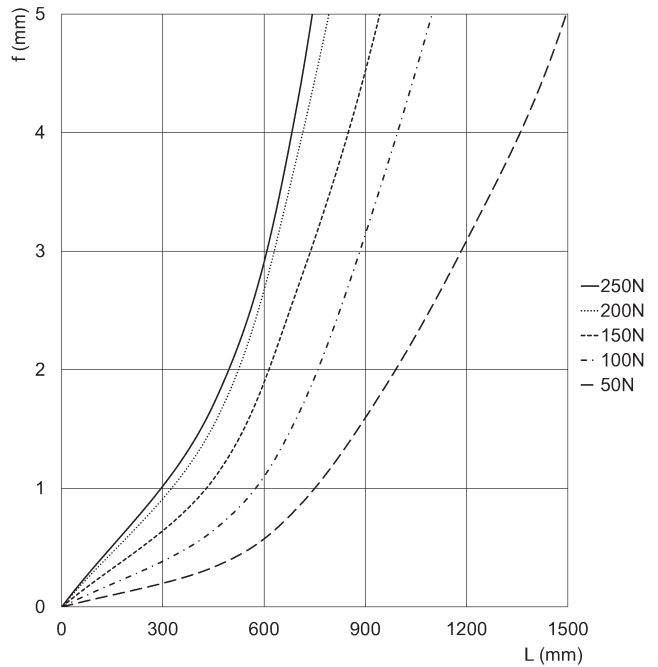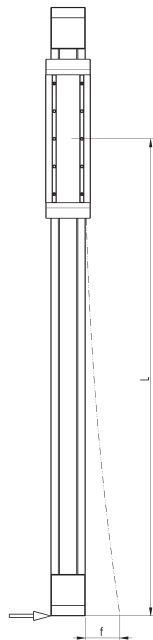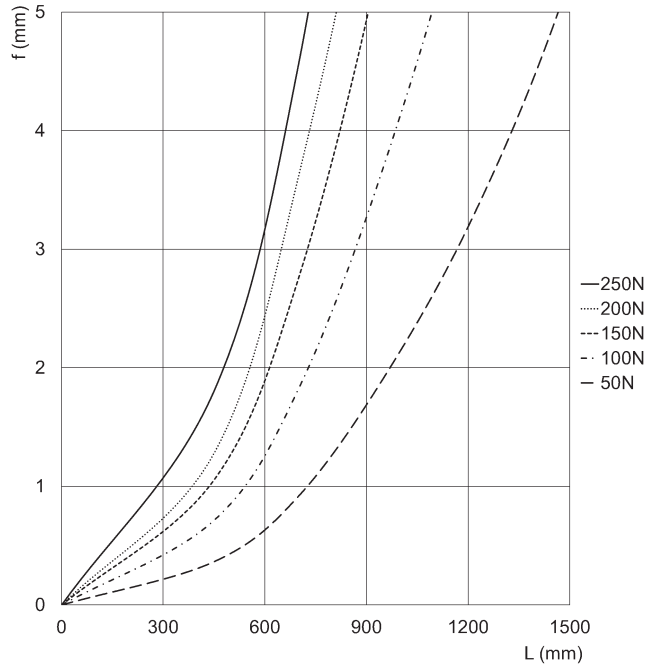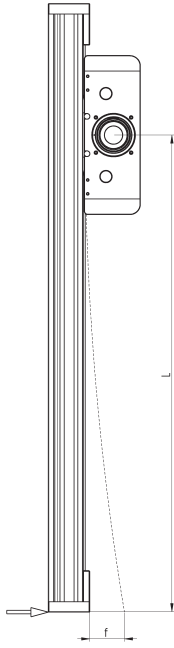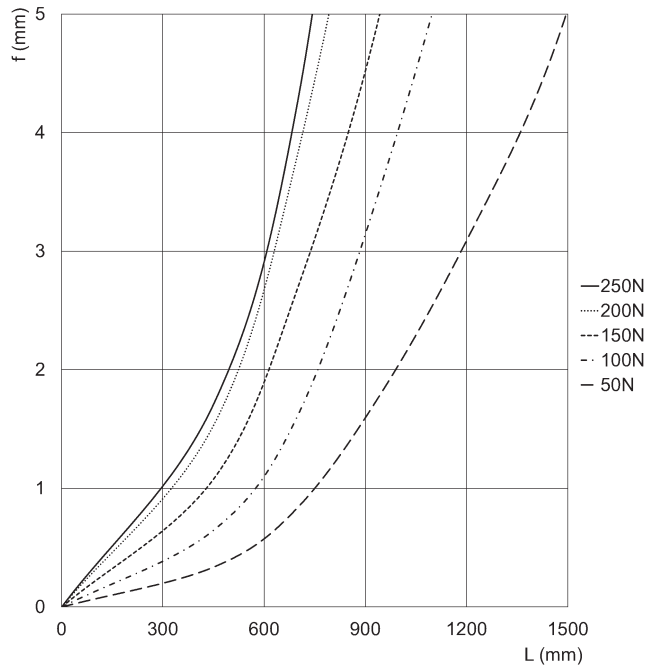f = generated deflection [mm]
L = arm length [mm]
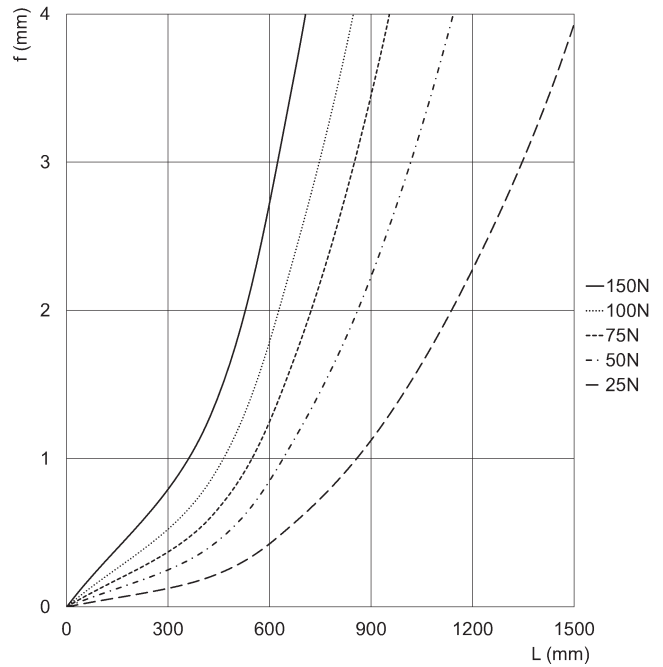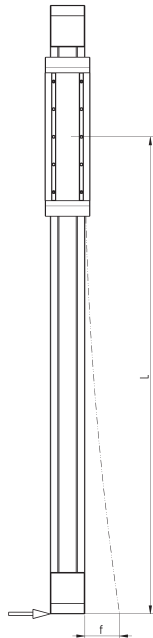


f = generated deflection [mm]
L = arm length [mm]

## DEFLECTION 5VS065
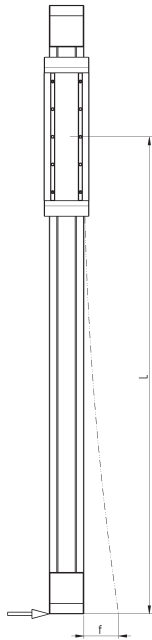


f = generated deflection [mm]
L = arm length [mm]



f = generated deflection [mm]
L = arm length [mm]

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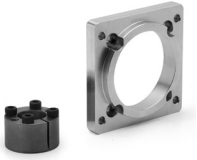
**DEFLECTION 5VS080**

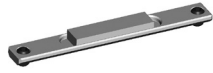f = generated deflection [mm]
L = arm length [mm]



f = generated deflection [mm]
L = arm length [mm]

## ACCESSORIES FOR SERIES 5V

Kit to connect the
gearbox

Magnet kit
Mod. SMS-5V-U
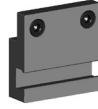
Sensor holder kit
Mod. SMS-5V

Centering ring
Mod. TR-CG

5E/5V connection flange

All accessories are supplied separately from the axis.
Together with the axis, a kit is supplied containing:
- covers to close the holes on the endcap
- centering bushings for the slider
- nipples for greasing

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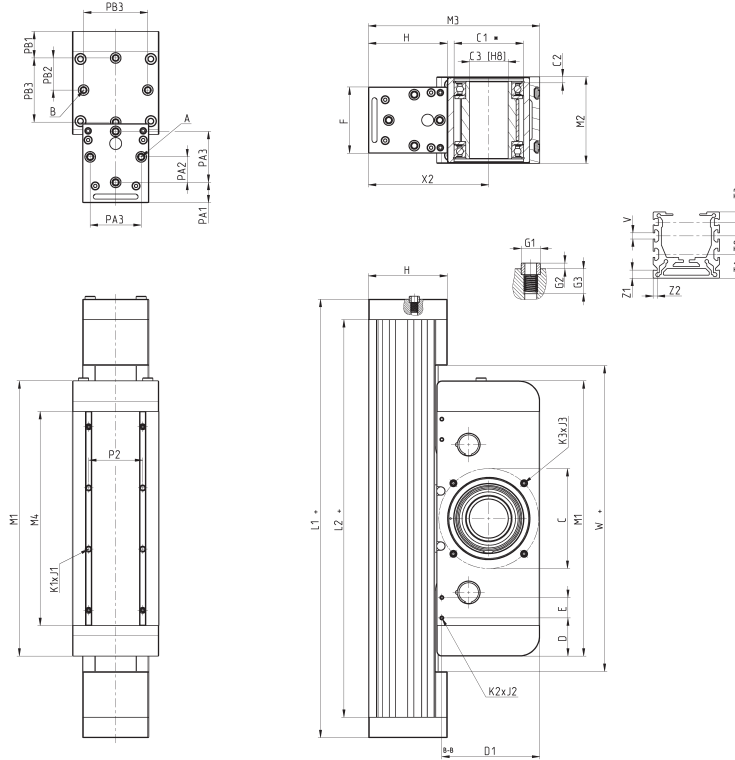## Electromechanical axis Mod. 5V...AS1

+ = add the stroke



| Size | A | B | øC | øC1 | C2 | øC3(h8) | D | E | F | H | L1 | L2 | M1 | M2 | M3 | M4 | P1 | PA1 | PA2 | PA3 | PB1 | PB2 | PB3 | X2 | W+ | K1xJ1 | K2xJ2 | K3xJ3 | Z1 | Z2 | V | T1 | T2 | T3 | øG1(H8) | G2 | G3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **50** | M5x7.5 | M5x7.5 | 72 | 52 | 4.5 | 26 | 30 | 20 | 50 | 60 | 380 | 350 | 230 | 65 | 133 | 185 | 40 | 14.5 | 20 | 40 | 21 | 25 | 50 | 94.3 | 260 | M4x4.7 | M3x6 | M5x7.5 | 8 | 4 | 6 | 20 | - | 10 | 8 | 3 | 9.5 |
| **65** | M6x9 | M6x9 | 98 | 68 | 4.5 | 38 | 37.5 | 20 | 65 | 77.5 | 430 | 390 | 270 | 85 | 168 | 210 | 60 | 20 | 25 | 50 | 26 | 31.5 | 63 | 118 | 300 | M5x4.7 | M3x6 | M6x10 | 8 | 4 | 6 | 23.5 | 18 | 10 | 10 | 3 | 12 |
| **80** | M8x12 | M8x12 | 133 | 80 | 5 | 47 | 37.5 | 20 | 80 | 97.5 | 635 | 585 | 365 | 100 | 205 | 305 | 60 | 24 | 32.5 | 65 | 37 | 35 | 70 | 144 | 395 | M6x5 | M3x6 | M8x18 | 8 | 4 | 8 | 25 | 25 | 10 | 12 | 3 | 15 |

| Size | WEIGHT STROKE ZERO [kg] | STROKE WEIGHT PER METER [kg/m] |
|---|---|---|
| **50** | 4.86 | 3.15 |
| **65** | 8.81 | 5.13 |
| **80** | 18.59 | 8.3 |

SERIES 5V ELECTROMECHANICAL AXIS
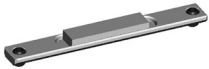
## Kit to connect the gearbox
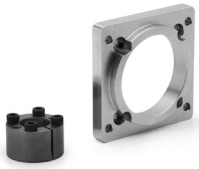


The kit includes:
1x connection flange
4x screws + 4x lock washers
to connect the flange
1x locking set
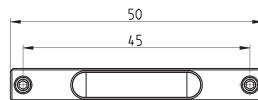4x screws + 4x lock washers
to connect the gearbox
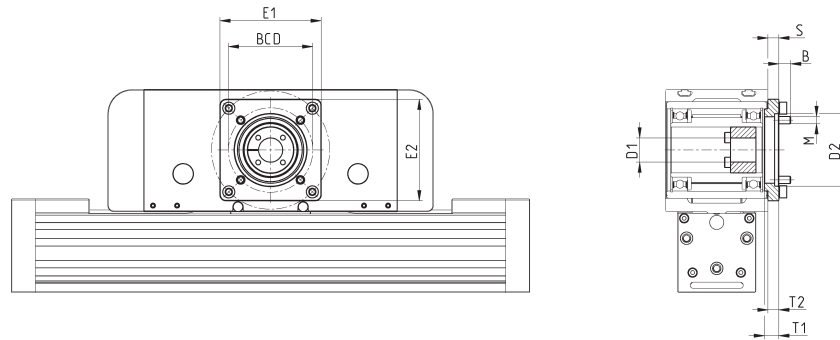


| Mod. | Size | Gearbox | E1 | E2 | S | BCD | ⌀D1 | ⌀D2(H7) | T1 | T2 | M | B | Weight (g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FR-5V-50** | 50 | GB-060 | 65 | 65 | 6 | 52 | 14 | 40 | 10 | - | 5 | 7.9 | 130 |
| **FR-5V-65** | 65 | GB-080 | 84 | 84 | 9 | 70 | 20 | 60 | 12 | 3.5 | 6 | 9.8 | 300 |
| **FR-5V-80** | 80 | GB-120 | 115 | 115 | 13 | 100 | 25 | 80 | 18 | 4.5 | 10 | 15.8 | 620 |

## Magnet kit Mod. SMS-5V-U



Supplied with:
1x plate
1x magnet
2x locking screws

| Mod. |
|---|
| **SMS-5V-U** |

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## Sensor holder kit Mod. SMS-5V

Supplied with:
1x plate
2x screws
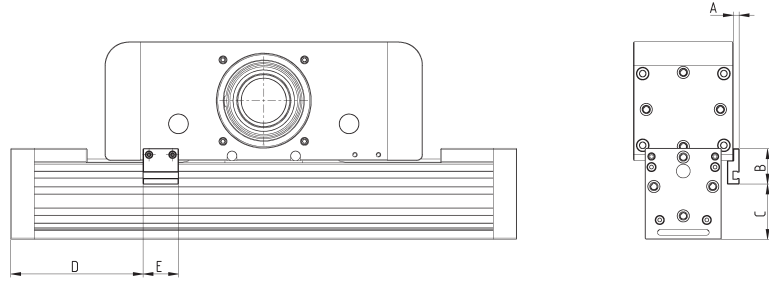
| Mod. | Size | A | B | C | D | E |
|---|---|---|---|---|---|---|
| **SMS-5V-50** | 50 | 7.5 | 30 | 32 | 100 | 30 |
| **SMS-5V-65/80** | 65 | 5 | 30 | 47 | 112.5 | 30 |
| **SMS-5V-65/80** | 80 | 5 | 30 | 63 | 167.5 | 30 |

## Centering ring Mod. TR-CG

Supplied with:
2x centering rings in steel
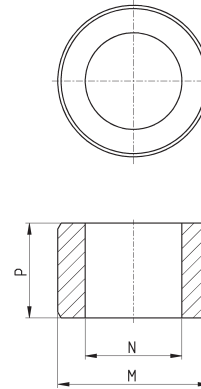
| Mod. | M (h8) | N | P |
|---|---|---|---|
| **TR-CG-04** | Ø4 | Ø2.6 | 2.5 |
| **TR-CG-05** | Ø5 | Ø3.1 | 3 |
| **TR-CG-06** | Ø6 | Ø4.1 | 4 |
| **TR-CG-08** | Ø8 | Ø5.1 | 5 |
| **TR-CG-10** | Ø10 | Ø6.1 | 6 |
| **TR-CG-12** | Ø12 | Ø8.1 | 6 |

## 5E/5V connection flange
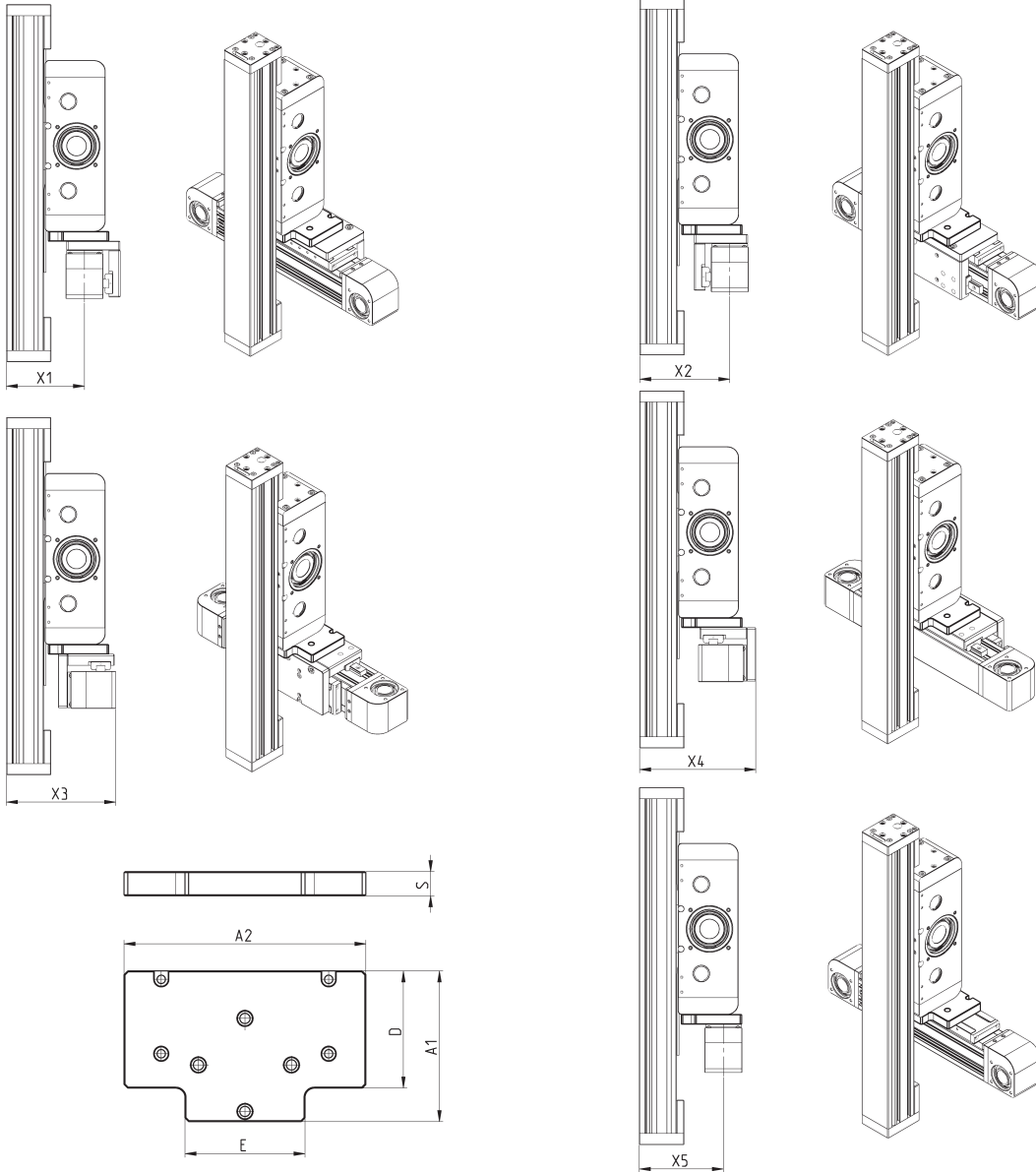
| Mod. | Size | X1 | X2 | X3 | X4 | X5 | A1 | A2 | E | D | S | Weight (g) |
|------|------|------|-------|-------|-------|-------|-------|-----|------|------|----|------------|
| YZ-50-5V50 | 50 | 105 | 121 | 147 | 156 | - | 81 | 130 | 64.5 | 63 | 13 | 335 |
| YZ-65-5V50 | 65 | 112.5 | 136.5 | 162 | 179 | 124.5 | 99.5 | 140 | 64.5 | 76.5 | 13 | 445 |
| YZ-65-5V65 | 65 | 130 | 154 | 179.5 | 196.5 | - | 101.5 | 140 | 84.5 | 76.5 | 13 | 460 |
| YZ-80-5V50 | 80 | 120.5 | 146.5 | 185.5 | 196.5 | 133.5 | 118 | 190 | 64.5 | 78 | 13 | 635 |
| YZ-80-5V65 | 80 | 157.5 | 163.5 | 202.5 | 213.5 | 150.5 | 118 | 190 | 84.5 | 78 | 15 | 770 |
| YZ-80-5V80 | 80 | 141 | 183.5 | 222.5 | 233.5 | - | 120 | 190 | 99.5 | 78 | 15 | 825 |

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