

COMBIVERT



Servo Systems

0.3... 70 Nm

0... 6000 rpm



Table of Contents

| | |
|---|----|
| Introduction | 3 |
| Features, Selection | 4 |
| Application Examples | 5 |
| Technical Data Control Circuit | 7 |
| Technical Data Power Part | 8 |
| Connection | 9 |
| Technical Data Motor | 10 |
| Dimensions Motor | 12 |
| Operator Panel, Field Bus Communication | 13 |
| Radio Interference Suppression, Cables | 14 |
| Braking Resistors | 15 |
| Gearbox | 16 |
| Technical Data LP Gearbox | 17 |
| Technical Data SP Gearbox | 18 |
| Catalogues at a Glance | 19 |



Introduction

„What must a drive be capable of ?”

That is a question design engineers are constantly faced with during their daily work. The selection of the most suitable power transmission equipment is of most importance for the performance of the machine or plant. **All in one** - this statement with appeal is one way to pick up the global slogan of the past years, but in operation it often results in concepts that are not cost effective.

Sensible use of material and capital is the basic principle of the **KEB COMBIVERT F4/S4** inverter series which makes fully digital drive controllers in various sizes available for the core areas of

- open loop and
- controlled loop applications
in combination with asynchronous and synchronous motors.



The Servo System KEB COMBIVERT comprises modern, industrial drive systems with high-dynamic synchronous motors of the latest generation.

The program is based on the design of KEB COMBIVERT F4 using the more than hundred thousandfold proven technical basis and in combination with the optimized DSP controller it provides an outstanding performance.

An parameter concept with two access levels with identical addresses of the parameters, the mechanical construction designed in a modular system and efficient tools for the operation ensure short planning, training and commissioning times.

Serial interfaces provide a versatile way for communication via

Profibus DP, INTERBUS, CAN, LON or DIN66019

UL/cUL - approval and CE - conformity show suitability for a global use.

Features

KEB COMBIVERT

- Combination of digital, preprogrammed **servo amplifier**, dynamically optimized **synchronous motor** with NdFeB-magnets, **resolver-**, **Sin/Cos-** or **multiturn SSI-encoder** and preassembled **connecting technique** for continuous standstill torque in the range of

0.3 ... 70 Nm


Easy operation with the CP basic menu comprising only 24 parameters for the essential adjustments of **ramp, speed, torque, regulator setting P- and I-part and conditions for outputs and jog-speed**.

The display of **status, actual speed and motor current** gives clear information.

The extensive functionality of the system is fully accessible in the password protected application level with **8 parameter sets** and features to use in tasks like **synchronous control, register functions, single-axis positioning**. **Free-to-program digital and analog in- and outputs** shift the PLC-tasks into the drive .

Plugin operator modules for operating, display and serial interfaces provide maximum flexibility for the adaption to individual requirements.

Selection

- As a result of the mechanical computation the average and maximum torque form the basis for an optimal selection of the KEB COMBIVERT  Servo System.
In addition to that the motor size is determined according to the tables on page 10 and 11 based on the data of the required standstill torque and rated speed.
- The available voltage class and the required peak torque of the drive axis is to be taken into account for the selection of the servo amplifier. The sizes listed in the tables on page 10 and 11 represent only a preselection based on practical experiences. The selection for different applications can be made with the aid of the current specification of the servo amplifier according to the table on page 8.
- In coordination with the overall planning of the machine the selection of
 - the radio interference suppression
 - the preassembled cables for encoder and power connection
 - as well as necessary braking resistorsis to be made (see page 14 and 15).

For more information as well as advice in solving your application contact our engineers and technicians within the KEB distribution network at the parent company Barntrup.

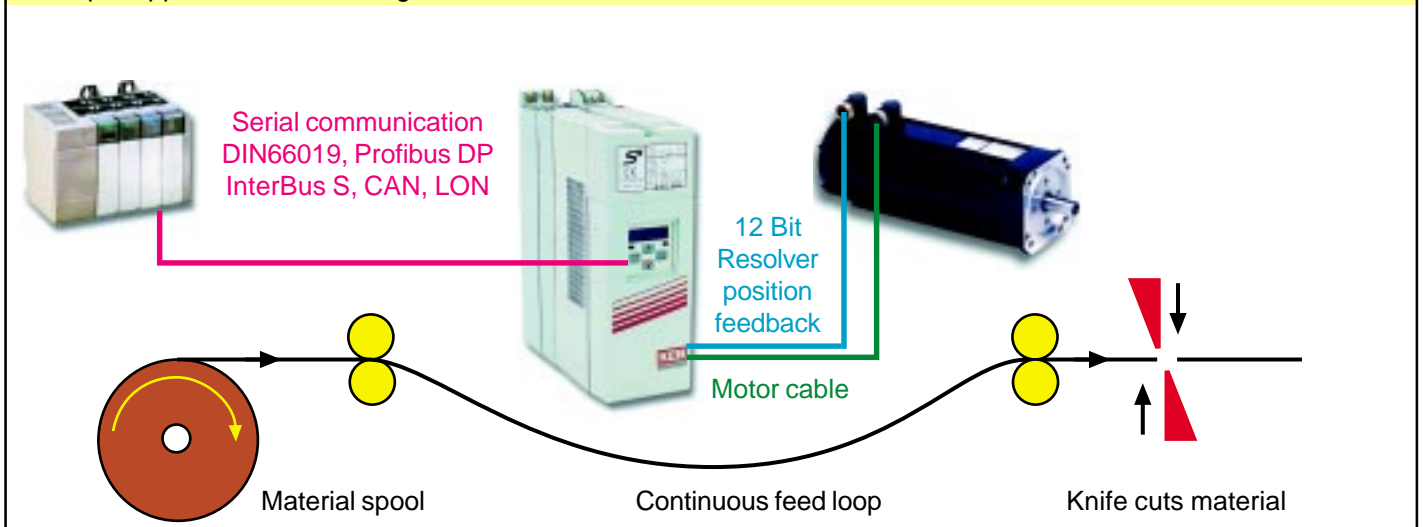
Positioning

The KEB COMBIVERT servo system is capable of operating as a „stand alone“ positioning system

The universal drive unit for

- Packaging machinery
- Thermalform machinery
- Polybag machinery
- Electronic cam-operated switches
- Pick and place systems
- Feed or cut to length
- Rotary tool changers
- Extruder and worm drives
- Automatic assembly machinery

Example Application - Cut to length



S4 Positioning System Features

- 8 internally stored positions
- Absolute or incremental feedback systems
- Drive profile with speed, ramps, s-curves
- Moves changed via serial communication or keypad
- Teach function
- Built-in limit functions
- Auto homing sequence
- Adjustable „in position“ signal
- Secondary position loop
- Absolute and relative positions

S4 Synchronizing and Conveying

KEB COMBIVERT  Servo Systems can also be used to synchronize one mechanical system to another

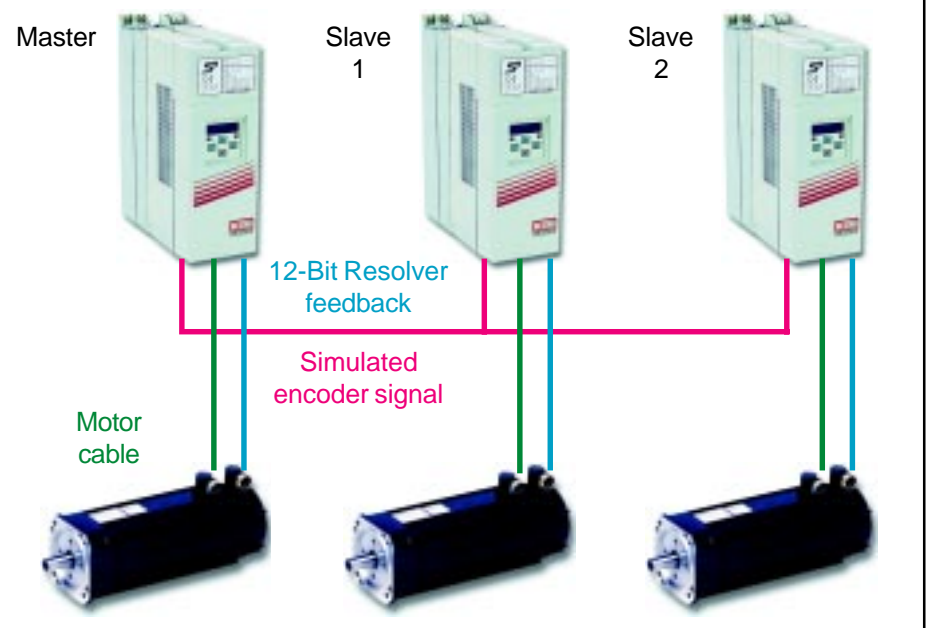
Applications

- Electronic line shaft
- Electronic gearbox
- Flying saws
- Merge mechanisms / Register functions
- Transfer lines


Features

- Programmable angular offsets
- Adjustable gear ratio

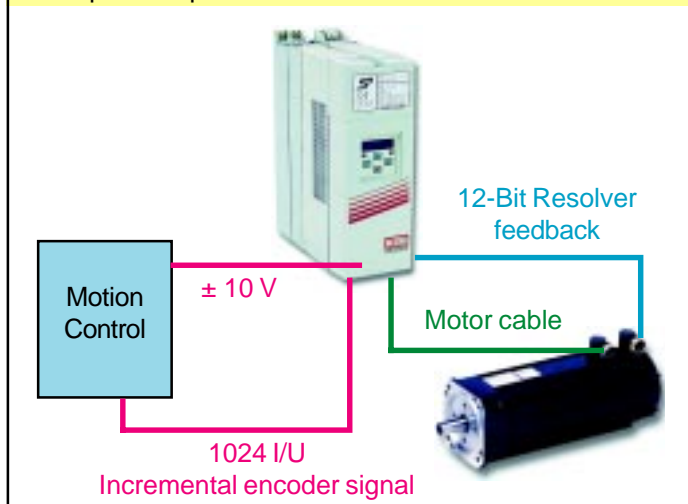
Example- Electronic line shaft



S4 Dynamic and Precise Controlling

KEB COMBIVERT  Servo Systems take over important parts of the plant and machine controlling

Example - Torque control



Applications

- Motion control
- $\pm 10V$ Speed control
- $\pm 10V$ Torque control
- Replacement of DC-drives

Features

- High speed current control circuit (64 μ s)
- up to 5 * T_N peak torque
- Motor protection IP65

Technical Data - Control Circuit

Hardware

| | |
|-------------------------------|--|
| Host microprocessor | 16-bit |
| DSP | 16-bit |
| Analog inputs (2) | 12-bit signed (11bit plus sign bit) ± 10V differential input scan time 128 µs |
| Analog outputs (2) | 8-bit ± 10V output sample rate 2ms |
| Digital inputs | PNP or NPN 13-30V DC $R_{in} = 2.7k\Omega$ Scan time 2ms (special software 128 µs) |
| Digital outputs | PNP / Relay 2-Transistor 13-30V DC $I_{Loadmax} = 20mA$ each output Relay 30V DC 1A NO and NC Scan time 2ms |
| Power supply | Internal 24V DC $I_{Loadmax} = 60mA$ External 24-30V DC $I_{Loadmax} = 100mA$ |
| Feedback | Resolver 12-bit optional sin/cos encoder |
| Auxiliary feedback connection | Simulated encoder output 1024 ppr or encoder input - 500-5000 ppr; optional SSI absolute encoder input 24-bit greyscale |

Controller


| | |
|------------------------------|--|
| Speed Control | |
| Accuracy | ± 0,5 rpm |
| Speed control sample rate | 128 µs |
| Current control sample rate | 64 µs |
| Synchronous Control | |
| Accuracy (1:1 gear ratio) | ± 0,15° |
| Gear ratio | 0,001 to 20,000 |
| Offset compensation | adjustable |
| Master speed signal | 5V RS485 A+, A- / B+, B- / C+, C-, quadrature 500 to 5000 ppr. adjustable |
| Position Control | |
| Internally stored positions | 8 selectable through i/O (new positions can be downloaded via serial bus) |
| Velocity profile adjustments | s-curve, ACC- and DEC-ramps, maximum run speed, nominal speed, target window, distance |
| Accuracy | ± 1 increment |
| Output signals | position reached, greater or less than preset position, speed limit, fault |

Base Parameters CP-Mode

| | |
|-------|---------------------------------|
| CP 0 | Password input |
| CP 1 | Actual speed indication |
| CP 2 | Inverter status |
| CP 3 | Apparent motor current |
| CP 4 | Max. apparent motor current |
| CP 5 | Actual torque |
| CP 6 | Set speed |
| CP 7 | Acceleration time |
| CP 8 | Deceleration time |
| CP 9 | Torque limit |
| CP 10 | Max. run speed |
| CP 11 | Jog speed |
| CP 12 | Proportion gain speed regulator |

| | |
|-------|---------------------------------------|
| CP 13 | Integral gain speed regulator |
| CP 14 | Incremental encoder pulses/revolution |
| CP 15 | External fault condition |
| CP 16 | Zero volt offset analog input 1 |
| CP 17 | Zero volt noise filter analog input 1 |
| CP 18 | Function analog output 1 |
| CP 19 | Amplification analog output 1 |
| CP 20 | Amplification analog output 2 |
| CP 21 | Switching condition digital output 1 |
| CP 22 | Switching condition digital output 2 |
| CP 23 | Torque level digital output 1 |
| CP 24 | Speed level digital output 2 |

Technical Data - Power Part

KEB COMBIVERT  is designed to operate from industrial voltages ranging from 180 to 264 V AC (200 V class) and 305 to 500 V AC (400 V class).

The ready-to-connect „stand alone“ units are listed with the values for rated output current, stall current and maximum output current and can drive different makes of synchronous motors.

| Size | 03 | 05 | 07 | 10 |
|---------------------------------------|---|------------|------------------|------------|
| Housing size | D | D | D | D |
| Supply voltage [V] | 180 ... 264 ± 0% | | 305 ... 500 ± 0% | |
| Line frequency [Hz] | 50/60 ± 2Hz | | 50/60 ± 2Hz | |
| Line phases | 1/3 | | 3 | |
| Rated input current (1/3-phase) [A] | 4.8 / 2.6 | 12.8 / 7 | 3 | 7 |
| Max. perm. line fuse [A] | 16 (1ph.) | 16 (1ph.) | 10 | 10 |
| Rated output current I_N [A] | 2.4 | 6.4 | 2.7 | 6.4 |
| Stall current I_{d0} [A] | 2.4 | 6.4 | 2.7 | 6.4 |
| Maximum output current I_{max} [A] | 9.7 / 1000ms | 16 / 500ms | 10.6 / 200ms | 22 / 200ms |
| Line cross section [mm ²] | 1.5 | 1.5 | 1.5 | 1.5 |
| Size | 12 | 16 | 18 | |
| Housing size | E | G | H | |
| Supply voltage [V] | 305 ... 500 ± 0% | | | |
| Line frequency [Hz] | 50/60 ± 2Hz | | | |
| Line phases | 3 | | | |
| Rated input current [A] | 18.2 | 24 | 57.5 | |
| Max. perm. line fuse [A] | 20 | 25 | 80 | |
| Rated output current I_N [A] | 16.5 | 21.5 | 50 | |
| Stall current I_{d0} [A] | 16.5 | 21.5 | 50 | |
| Maximum output current I_{max} [A] | 38 / 200ms | 50 / 600ms | 75 / 1000ms | |
| Line cross section [mm ²] | 2.5 | 4 | 10 | |
| Temperature range | Operation: -10° ... +45°C Storage: -25° ... +70°C | | | |
| Type of protection | IP 20 | | | |

When ordering please specify motor size, speed and voltage and we will match the amplifier.

Dimensions Servo Amplifier

| Housing | (Dimensions in mm) | | | | | Weight [kg] |
|-------------------------|--------------------|-----|-----|-----|-----|-------------|
| | A | B | B1* | C | C1* | |
| D with filter | 90 | 250 | - | 165 | - | 2.0 |
| | 90 | - | 265 | - | 210 | 2.5 |
| E with filter | 130 | 290 | - | 200 | - | 3.6 |
| | 130 | - | 352 | - | 250 | 4.6 |
| G with filter | 170 | 340 | - | 255 | - | 10 |
| | 181 | - | 415 | - | 311 | 13.2 |
| H with filter | 297 | 340 | - | 255 | - | 14 |
| | 300 | - | 445 | - | 321 | 19.1 |

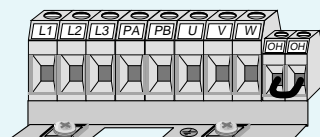
* optional with submount filter (page14)

Connection

| | | | | |
|--|---|--|---|-----------------------------------|
| | ① | | 9-pin Sub-D-socket, parameterization interface (option) | |
| | ② | | Terminal strip X1, connection of the control terminals | |
| | ③ | | AMP tab connector, shield connection / earth ground | |
| | ④ | | 9-pin Sub-D-socket X3, incremental encoder simulation | |
| | ⑤ | | 15-pin Sub-D-socket X4, resolver- / sin/cos-encoder input | |
| | ⑥ | | Terminal strip X2, motor connection, supply voltage connection, braking resistor connection | |
| | ⑦ | | Terminal OH / OH, PTC-connection | |
| | ⑧ | | GND connection | |
| | ⑨ | | 8-pin power connector, motor power connection, PTC, brake (option) | |
| | ⑩ | | 12-pin resolver connection | 17-pin sin/cos encoder connection |

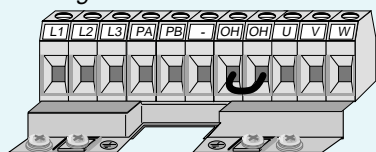
Power Part Terminals

Housing D



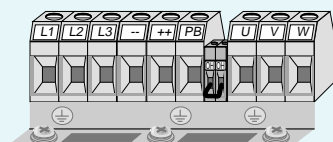
Servo amplifier
Size 03,05 (1/3 x 230V)
Size 07,10 (3 x 400V)

Housing E



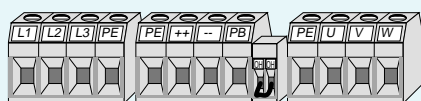
Servo amplifier
Size 12 (3 x 400V)

Housing G



Servo amplifier
Size 16 (3 x 400V)

Housing H



Servo amplifier
Size 18 (3 x 400V)

| | | |
|------------|---|-----------------------------|
| L1, L2, L3 | - | Power supply |
| PA/ ++, PB | - | Connection braking resistor |
| U, V, W | - | Motor connection |
| OH, OH | - | PTC - connection |
| PE | - | Ground connection |

Control Circuit Terminals X1

| | |
|----|--------------------------|
| 1 | Drive enable |
| 2 | Reset |
| 3 | Enable forward |
| 4 | Enable reverse |
| 5 | Jog-speed forward |
| 6 | Jog-speed reverse |
| 7 | Input external fault |
| 8 | Digital output 1 |
| 9 | Digital output 2 |
| 10 | +24 V voltage output |
| 11 | Digital ground +24V |
| 12 | +10 V reference voltage |
| 13 | Analog Common |
| 14 | Analog set value + |
| 15 | Analog set value - |
| 16 | Analog torque + |
| 17 | Analog torque - |
| 18 | Progr. analog output 1 |
| 19 | Progr. analog output 2 |
| 20 | Relay: NO contact |
| 21 | Relay: NC contact |
| 22 | Relay: switching contact |
| 23 | Ext. supply +24 V |

Technical Data - Servo Motors

| Motor Size | A1 | A2 | A3 | A4 | B1 | | B2 | | B3 | |
|--|------------------------------------|------------|-------------|------------|----------------|------|------------|------|----------------|------|
| Rated speed n_n [min ⁻¹] | 6000 | 6000 | 6000 | 6000 | 4000 | 6000 | 4000 | 6000 | 4000 | 6000 |
| Power rating [kW] | 0.2 | 0.3 | 0.375 | 0.5 | 0.25 | 0.31 | 0.54 | 0.62 | 0.83 | 0.94 |
| Rated torque T_N [Nm] | 0.32 | 0.48 | 0.6 | 0.8 | 0.6 | 0.5 | 1.3 | 1.0 | 2.0 | 1.5 |
| Stall torque T_{d0} [Nm] | 0.34 | 0.5 | 0.65 | 1.0 | 0.65 | | 1.5 | | 2.3 | |
| Pulse torque T_{ds} [Nm] | 1.6 | 2.4 | 3 | 4 | 3 | 2.5 | 6.5 | 5 | 10 | 7.5 |
| Rotor inertia torque (x10 ⁻⁴) [kg·m ²] | 0.17 | 0.24 | 0.31 | 0.45 | 0.22 | | 0.36 | | 0.57 | |
| Perm. radial load F_R (at $x=l_1/2$) [N] | 210 | | | | 300 | 270 | 300 | 270 | 300 | 270 |
| Perm. axial load F_A [N] | 140 | | | | 220 | 180 | 220 | 180 | 180 | 180 |
| Type of protection | IP64 (IP65 with shaft seal ring) | | | | | | | | | |
| Holding torque brake [Nm] | 2 | | | | 2.5 | | | | | |
| Rating of brake (24 V DC) [W] | 11 | | | | 12 | | | | | |
| Brake inertia torque (x10 ⁻⁴) [kg·m ²] | 0.67 | | | | 0.38 | | | | | |
| Suggested amplifier size | 03 / 07 | | | | 05 / 07 | | | | 05 / 10 | |
| Voltage [V] | 230 / 400 | | | | | | | | | |

| Motor Size | C1 | | | C2 | | | C3 | | | C4 | | |
|--|------------------------------------|------|------|------------|------|------|----------------|------|------|----------|------|------|
| Rated speed n_n [min ⁻¹] | 3000 | 4000 | 6000 | 3000 | 4000 | 6000 | 3000 | 4000 | 6000 | 3000 | 4000 | 6000 |
| Power rating [kW] | 0.25 | 0.31 | 0.44 | 0.75 | 0.92 | 1.25 | 1.22 | 1.47 | 1.76 | 1.57 | 1.88 | 1.88 |
| Rated torque T_N [Nm] | 0.8 | 0.75 | 0.7 | 2.4 | 2.2 | 2 | 3.9 | 3.5 | 2.8 | 5 | 4.5 | 3 |
| Stall torque T_{d0} [Nm] | 0.95 | | | 2.7 | | | 4.5 | | | 6 | | |
| Pulse torque T_{ds} [Nm] | 4 | 3.7 | 3.5 | 12 | 11 | 10 | 19.5 | 17.5 | 14 | 25 | 22.5 | 15 |
| Rotor inertia torque (x10 ⁻⁴) [kg·m ²] | 1.2 | | | 2.7 | | | 4.2 | | | 5.4 | | |
| Perm. radial load F_R (at $x=l_1/2$) [N] | 400 | 350 | 320 | 400 | 356 | 320 | 400 | 350 | 320 | 370 | 330 | 260 |
| perm. axial load F_A [N] | 310 | 260 | 220 | 310 | 260 | 220 | 310 | 260 | 220 | 280 | 240 | 200 |
| Type of protection | IP64 (IP65 with shaft seal ring) | | | | | | | | | | | |
| Holding torque brake [Nm] | 9 | | | | | | | | | | | |
| Rating of brake (24 V DC) [W] | 18 | | | | | | | | | | | |
| Brake inertia torque (x10 ⁻⁴) [kg·m ²] | 0.6 | | | | | | | | | | | |
| Suggested amplifier size | 05 / 07 | | | | | | 05 / 10 | | | | | |
| Voltage [V] | 230 / 400 | | | | | | | | | | | |

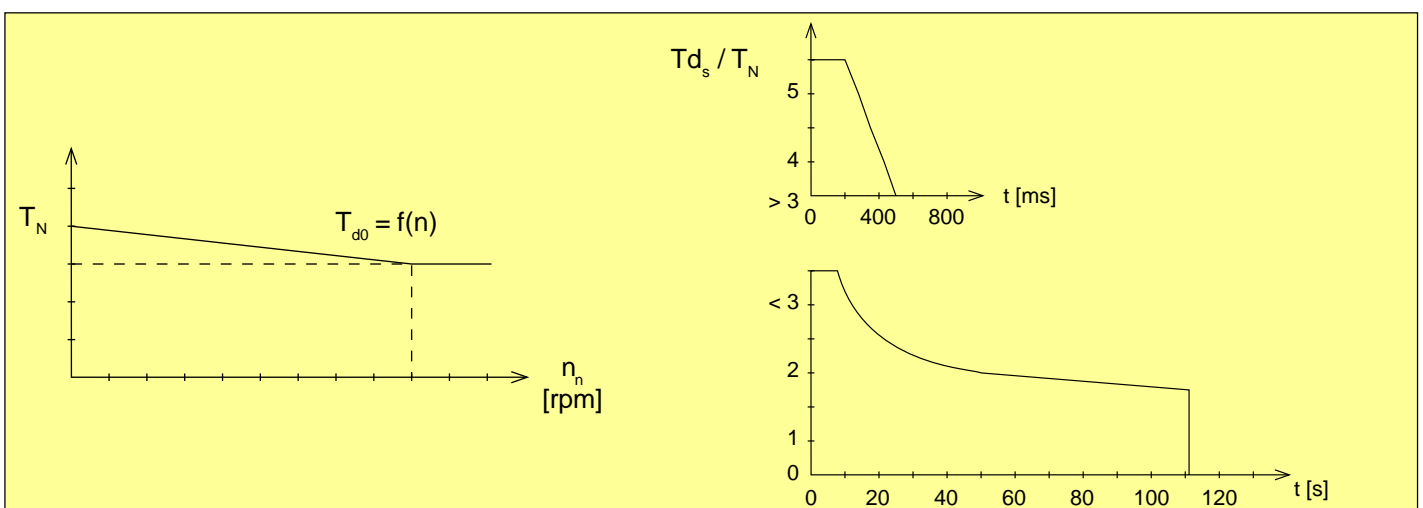
| Motor Size | D1 | | | D2 | | | D3 | | | D4 | |
|--|------------------------------------|------|------|----------|------|------|-----------|------|------|-----------|------|
| Rated speed n_n [min ⁻¹] | 3000 | 4000 | 6000 | 3000 | 4000 | 6000 | 3000 | 4000 | 6000 | 3000 | 4000 |
| Power rating [kW] | 1.2 | 1.5 | 1.9 | 1.9 | 2.4 | 2.4 | 2.6 | 3.2 | 3.1 | 3.1 | 3.6 |
| Rated torque T_N [Nm] | 3.7 | 3.5 | 3.0 | 6.1 | 5.8 | 3.8 | 8.4 | 7.6 | 5 | 9.9 | 8.6 |
| Stall torque T_{d0} [Nm] | 4.2 | | | 7 | | | 10 | | | 12 | |
| Pulse torque T_{ds} [Nm] | 18.5 | 17.5 | 15 | 30.5 | 29 | 19 | 42 | 36 | 25 | 49.5 | 43 |
| Rotor inertia torque (x10 ⁻⁴) [kg·m ²] | 4.8 | | | 7.4 | | | 9.8 | | | 12.7 | |
| Perm. radial load F_R (at $x=l_1/2$) [N] | 640 | 550 | 490 | 640 | 550 | 490 | 640 | 550 | 490 | 640 | 550 |
| Perm. axial load F_A [N] | 500 | 420 | 350 | 500 | 420 | 350 | 500 | 420 | 350 | 500 | 420 |
| Type of protection | IP64 (IP65 with shaft seal ring) | | | | | | | | | | |
| Holding torque brake [Nm] | 11 | | | | | | | | | | |
| Rating of brake (24 V DC) [W] | 21 | | | | | | | | | | |
| Brake inertia torque (x10 ⁻⁴) [kg·m ²] | 2.3 | | | | | | | | | | |
| Suggested amplifier size | 10 | | | | | | | | | | |
| Voltage [V] | 400 | | | | | | | | | | |

Technical Data - Servo Motors

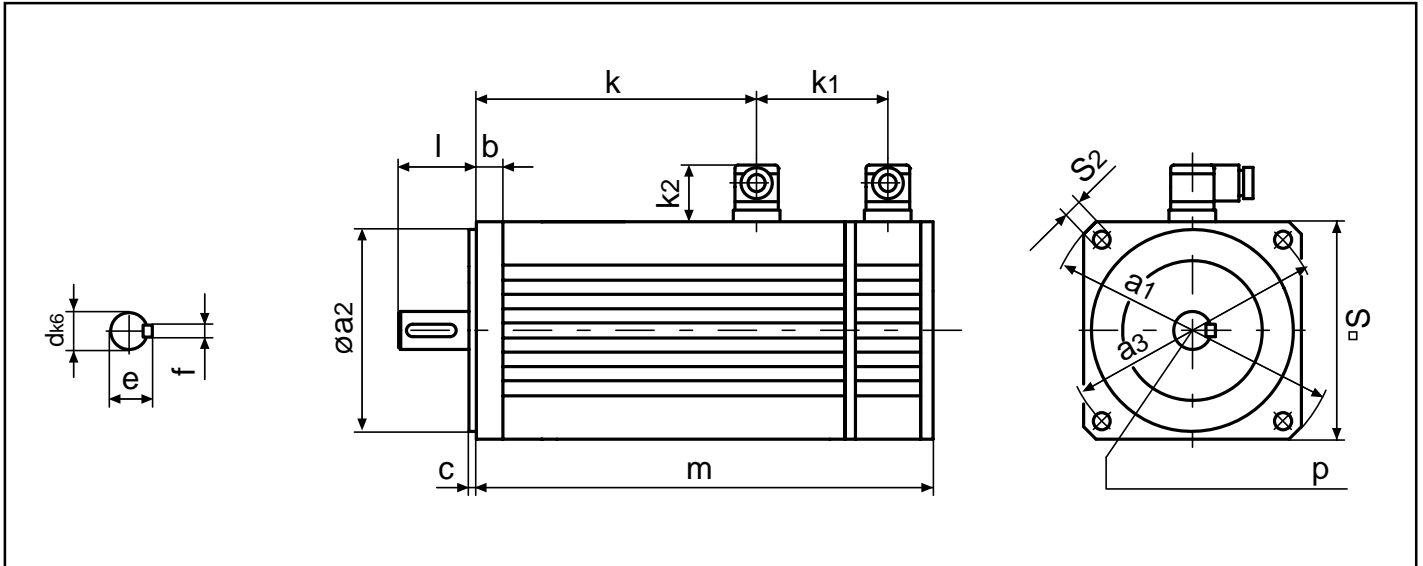
| Motor Size | E1 | | | E2 | | | E3 | | | E4 | |
|--|------------------------------------|------|------|-----------|------|------|-----------|------|------|-----------|------|
| Rated speed n_n [min ⁻¹] | 2000 | 3000 | 4000 | 2000 | 3000 | 4000 | 2000 | 3000 | 4000 | 2000 | 3000 |
| Power rating [kW] | 1.5 | 2.0 | 2.2 | 2.6 | 3.5 | 3.2 | 3.5 | 4.6 | 3.6 | 4.5 | 4.9 |
| Rated torque T_N [Nm] | 7 | 6.5 | 5.2 | 12.2 | 11 | 7.6 | 16.5 | 14.6 | 8.7 | 21.4 | 15.5 |
| Stall torque T_{d0} [Nm] | 8.5 | | | 14 | | | 19 | | | 27 | |
| Pulse torque T_{ds} [Nm] | 35 | 32.5 | 26 | 61 | 55 | 38 | 82.5 | 73 | 43.5 | 107 | 77.5 |
| Rotor inertia torque (x10 ⁻⁴) [kg·m ²] | 12.3 | | | 19.5 | | | 26.7 | | | 36 | |
| Perm. radial load F_R (at $x=l_r/2$) [N] | 1100 | 1000 | 850 | 1100 | 1000 | 850 | 1100 | 1000 | 850 | 1100 | 1000 |
| perm. axial load F_A [N] | 900 | 770 | 650 | 900 | 770 | 650 | 900 | 770 | 650 | 900 | 770 |
| Type of protection | IP64 (IP65 with shaft seal ring) | | | | | | | | | | |
| Holding torque brake [Nm] | | | | | | | 36 | | | | |
| Rating of brake (24 V DC) [W] | | | | | | | 26 | | | | |
| Brake inertia torque (x10 ⁻⁴) [kg·m ²] | | | | | | | 5.9 | | | | |
| Suggested amplifier size | 10 | | | 12 | | | 16 | | | | |
| Voltage [V] | | | | | | | 400 | | | | |

| Motor Size | F1 | | | | F2 | | | F3 | | |
|--|------------------------------------|------|-----------|------|-----------|------|-----------|-----------|------|------|
| Rated speed n_n [min ⁻¹] | 1500 | 2000 | 3000 | 4000 | 1500 | 2000 | 3000 | 1500 | 2000 | 3000 |
| Power rating [kW] | 3.5 | 4.5 | 6.3 | 6.7 | 6.6 | 7.9 | 9.7 | 9.6 | 10.9 | 10.4 |
| Rated torque T_N [Nm] | 22.5 | 21.5 | 20 | 16 | 42 | 38 | 31 | 61 | 52 | 33 |
| Stall torque T_{d0} [Nm] | 25 | | | | 50 | | | 70 | | |
| Pulse torque T_{ds} [Nm] | 112 | 84 | 82 | 69 | 147 | 110 | 112 | 219 | 166 | 109 |
| Rotor inertia torque (x10 ⁻⁴) [kg·m ²] | 84 | | | | 147 | | | 210 | | |
| Perm. radial load F_R (at $x=l_r/2$) [N] | 2500 | 2300 | 1900 | 1800 | 2500 | 2300 | 1900 | 2500 | 2300 | 1900 |
| Perm. axial load F_A [N] | 2000 | 1800 | 1500 | 1400 | 2000 | 1800 | 1500 | 2000 | 1800 | 1500 |
| Type of protection | IP64 (IP65 with shaft seal ring) | | | | | | | | | |
| Holding torque brake [Nm] | | | | | 85 | | | | | |
| Rating of brake (24 V DC) [W] | | | | | 36 | | | | | |
| Brake inertia torque (x10 ⁻⁴) [kg·m ²] | | | | | 17.6 | | | | | |
| Suggested amplifier size | 12 | | 16 | | | | 18 | | | |
| Voltage [V] | | | | | 400 | | | | | |

Load Characteristic of Servo Motors



Dimensions Motor



| Size | a ₁ | a ₂ [js6] | a ₃ | b | c | d [k6] | e | f | k | | k ₁ | k ₂ | l | m | | | | p | S | S ₂ | Weight [kg] * |
|------|----------------|-------------------------|----------------|----|-----|-----------|------|----|----------------|----------------|----------------|----------------|----|----------------|----------------|-----------------|-----------------|-----|-----|----------------|------------------|
| | | | | | | | | | k ₀ | k _B | | | | m _R | m _G | m _{RB} | m _{GB} | | | | |
| A1 | 74 | 40 | 63 | 11 | 2.5 | 9 | 10.2 | 3 | 72 | 97 | 33 | 37 | 20 | 121 | 149 | 145 | 173 | M3 | 55 | 5.8 | 1.0 / 1.2 |
| A2 | | | | | | | | | 85 | 109 | | | | 133 | 161 | 157 | 185 | | | | 1.2 / 1.4 |
| A3 | | | | | | | | | 97 | 121 | | | | 145 | 173 | 169 | 197 | | | | 1.4 / 1.6 |
| A4 | | | | | | | | | 121 | 146 | | | | 170 | 193 | 194 | 222 | | | | 1.8 / 2.0 |
| B1 | 87 | 60 | 75 | 14 | 2.5 | 11 | 12.2 | 4 | 81 | 109 | 33 | 37 | 23 | 135 | 167 | 163 | 195 | M4 | 70 | 5.3 | 1.5 / 1.8 |
| B2 | | | | | | | | | 105 | 133 | | | | 159 | 191 | 187 | 219 | | | | 2.1 / 2.4 |
| B3 | | | | | | | | | 141 | 169 | | | | 195 | 227 | 227 | 255 | | | | 2.9 / 3.2 |
| C1 | 116 | 80 | 100 | 8 | 3 | 14 | 16 | 5 | 86 | 132 | 46 | 37 | 30 | 156 | 193 | 192 | 229 | M4 | 92 | 7 | 2.7 / 3.2 |
| C2 | | | | | | | | | 110 | 156 | | | | 180 | 217 | 226 | 263 | | | | 3.9 / 4.4 |
| C3 | | | | | | | | | 144 | 190 | | | | 214 | 251 | 260 | 297 | | | | 5.2 / 5.7 |
| C4 | | | | | | | | | 178 | 224 | | | | 248 | 285 | 294 | 331 | | | | 6.6 / 7.1 |
| D1 | 136 | 95 | 115 | 10 | 3 | 19 | 21.5 | 6 | 138 | 145 | 52 | 37 | 40 | 218 | 248 | 226 | 256 | M6 | 110 | 9 | 6.3 / 7.1 |
| D2 | | | | | | | | | 168 | 175 | | | | 248 | 278 | 256 | 286 | | | | 7.9 / 8.7 |
| D3 | | | | | | | | | 198 | 205 | | | | 278 | 308 | 286 | 316 | | | | 9.6 / 10.4 |
| D4 | | | | | | | | | 228 | 235 | | | | 308 | 338 | 316 | 346 | | | | 11.2 / 12.0 |
| E1 | 187 | 130 | 165 | 17 | 3.5 | 24 | 27 | 8 | 142 | 187 | 55 | 37 | 50 | 231 | 263 | 276 | 308 | M8 | 140 | 11 | 10.2 / 11.8 |
| E2 | | | | | | | | | 172 | 217 | | | | 261 | 293 | 306 | 338 | | | | 12.3 / 13.9 |
| E3 | | | | | | | | | 202 | 247 | | | | 291 | 323 | 336 | 368 | | | | 15.5 / 17.1 |
| E4 | | | | | | | | | 247 | 292 | | | | 336 | 368 | 381 | 413 | | | | 20.4 / 22.0 |
| F1 | 237 | 180 | 215 | - | 4 | 32 | 35 | 10 | 254 | 254 | 60 | 55 | 58 | 348 | 386 | 348 | 386 | M12 | 190 | 14 | 30.5 / 34.3 |
| F2 | | | | | | | | | 334 | 334 | | | | 428 | 466 | 428 | 466 | | | | 44.0 / 47.8 |
| F3 | | | | | | | | | 414 | 414 | | | | 508 | 546 | 508 | 546 | | | | 57.5 / 61.3 |

All dimensions in mm

With keyway according to DIN 6885/1

Centring according to DIN 332/2

* with brake

| | |
|-----------------|----------------------------------|
| k ₀ | Without brake |
| k _B | With brake |
| m _R | With resolver |
| m _G | With encoder (sin/cos) |
| m _{RB} | With resolver and brake |
| m _{GB} | With encoder (sin/cos) and brake |

Display, Operation, Parameterization



- **Parameterizing unit**
MEMORY OPERATOR
00.F4.010-3009

(pluggable memory unit for the easy transfer of customer settings)

- in combination with the **COMBICARD-System**

00.F4.000-3009

prepared for **data management independent from a PC**

- The servo amplifiers KEB COMBIVERT are supplied as preprogrammed standard unit with cover, status display and fault indicator

- Plug-in modules are available for display and operation:

DIGITAL OPERATOR

00.F4.010-2009

(5 character display and keypad)

INTERFACE OPERATOR

00.F4.010-1009

(additionally with serial RS232/485 interface)



- **LCD TERMINAL** **00.58.022-0201 / 0202**

A combination of display and input station with 2x16 characters permits the representation of parameters as well as the management of unit settings. Using serial interfaces the serial communication of up to 256 KEB COMBIVERT inverters and amplifiers is possible.



Field Bus Communication

CAN - Operator
00.F4.010-5009

Fiber optic Operator
00.F4.010-A009

LON - Operator
00.F4.010-4009


InterBus-Loop - Operator
00.F4.010-8009

BUS - Operator
00.F4.010-7009

PROFIBUS - Operator
00.F4.010-6018



Radio Interference Suppression Filter

Optionally the servo amplifiers KEB COMBIVERT  are available with integrated radio interference suppression. The filters comply with EN 55011/B taken into account conducted interferences. This permits the use of the units in domestic and industrial districts. Besides the filters the radio interference suppression also incorporates effective grounding plates providing a large contact surface for the shield connection.



| Technical data radio interference suppression filter KEB COMBIVERT S4 | | | | |
|---|-------------|--------------------|-------------------|------------------------|
| Unit size | Voltage [V] | Filter designation | Rated current [A] | Discharge current [mA] |
| 03* | 230 | 09.E4.T60-0001 | 20 | 12 |
| 05* | 230 | 09.E4.T60-0001 | 20 | 12 |
| 07* | 400 | 10.E4.T60-1001 | 8 | 15 |
| 10* | 400 | 10.E4.T60-1001 | 8 | 15 |
| 12* | 400 | 14.E4.T60-1001 | 20 | 30 |
| 16* | 400 | 16.E4.T60-1001 | 50 | 30 |
| 18 | 400 | 18.E4.T60-1001 | 70 | 30 |

* available with built-on filter

Preassembled Cables



Motor cable

Shielded motor cables preassembled with connector on one end for motors up to size E, which incorporate separately shielded wires two each for the temperature sensor and the brake.

| | | |
|-------------------|------|----------------|
| Motor sizes A1-E1 | 5 m | 00.S4.019-0005 |
| | 10 m | 00.S4.019-0010 |
| | 15 m | 00.S4.019-0015 |
| | 20 m | 00.S4.019-0020 |
| Motor sizes E2-E4 | 5 m | 00.S4.119-0005 |
| | 10 m | 00.S4.119-0010 |
| | 15 m | 00.S4.119-0015 |
| | 20 m | 00.S4.119-0020 |



Encoder cable resolver



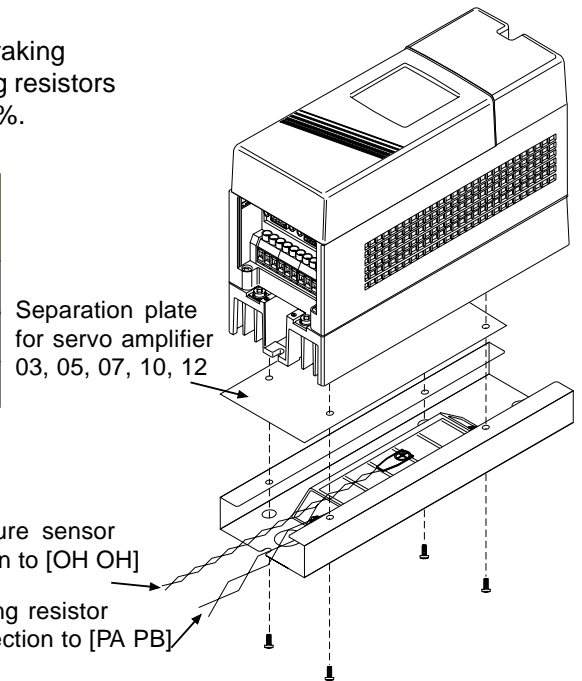
Shielded resolver cables preassembled with plug connector on one end for the motor and Submin 15-pin connector for the direct connection to the servo amplifier, encoder interface 1/ X4, on the other end.

| | | |
|-----------|------|----------------|
| All sizes | 5 m | 00.S4.109-0005 |
| | 10 m | 00.S4.109-0010 |
| | 15 m | 00.S4.109-0015 |
| | 20 m | 00.S4.109-0020 |

Pulse Braking Resistor

To take up short-time generative load pulses compact back mounted braking resistors are available designed with space savings in mind. The braking resistors are fitted with a thermal contact and are layed out for total on time of 5 %.

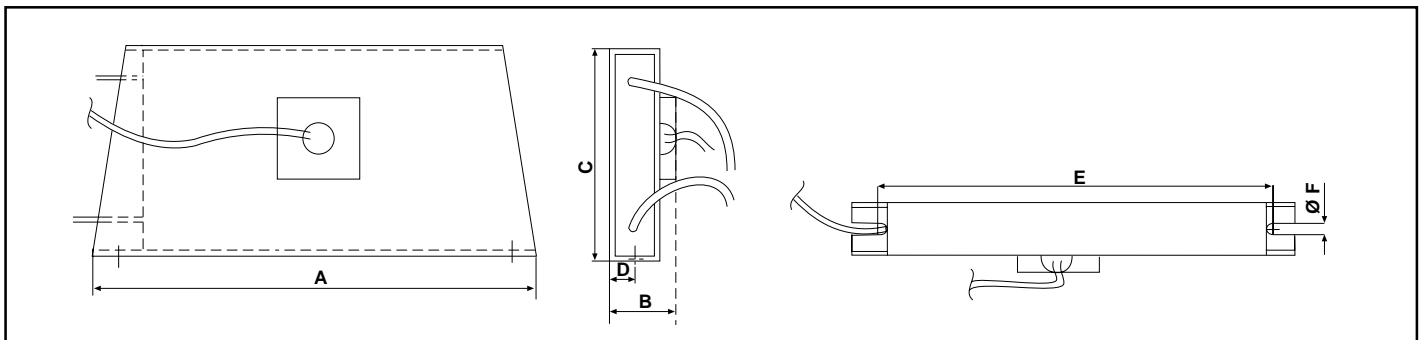
| Size | Part Number | Braking Resistor [Ω] | P _N (5% ED) [W] |
|-------------|----------------|----------------------|----------------------------|
| 03,05,07,10 | 12.F4.D50-4200 | 82 | 700 |
| 12 | 14.F4.E50-4200 | 60 | 1200 |
| 16 | 16.F4.G50-4200 | 25 | 3200 |



$$ED = \frac{\text{Braking Time}}{\text{Total Cycle Time}}$$

Braking Resistor for Continuous Load

To take up larger energies use either the braking resistors designed for continuous load or the feedback module KEB COMBIVERT R4 which is available on request.



| Amplifier Size | Part Number | R _B [Ohm] | P _D [W] | P _N 6 s / 120 s [kW] | A | B | C | D | E | Ø F |
|----------------|----------------|----------------------|--------------------|---------------------------------|--------------------|-----|-----|---------|-----|------|
| | | | | | [Dimensions in mm] | | | | | |
| 03, 05 | 09.BR.100-1100 | 100 | 82 | 1.5 | 160 | 28 | 40 | 10 | 145 | 6 |
| 07, 10 | 10.BR.100-6270 | 270 | 130 | 2.1 | 300 | 28 | 40 | 10 | 285 | 6 |
| 12 | 12.BR.100-6150 | 150 | 230 | 3.7 | 300 | 28 | 80 | 10 | 285 | 6 |
| 16 | 16.BR.110-6423 | 42 | 820 | 13.1 | 470 | 63 | 96 | 32 | 455 | 16,5 |
| 18 | 18.BR.226-6203 | 20 | 1700 | 27.4 | 625 | 270 | 120 | 176/240 | 526 | 6 |

Panetary Gearboxes

For the adaption of speed and torque different gearbox solutions are available in the classical design of inline helical gear, spur worm gear, shaftmounted helical gear and helical bevel gear.

With the low backlash planetary gearboxes of the series Alpha, available in two performance variants

- **LP = 12/15'** ● **SP = 6/8'**, you get an optimal combination for dynamic tasks.

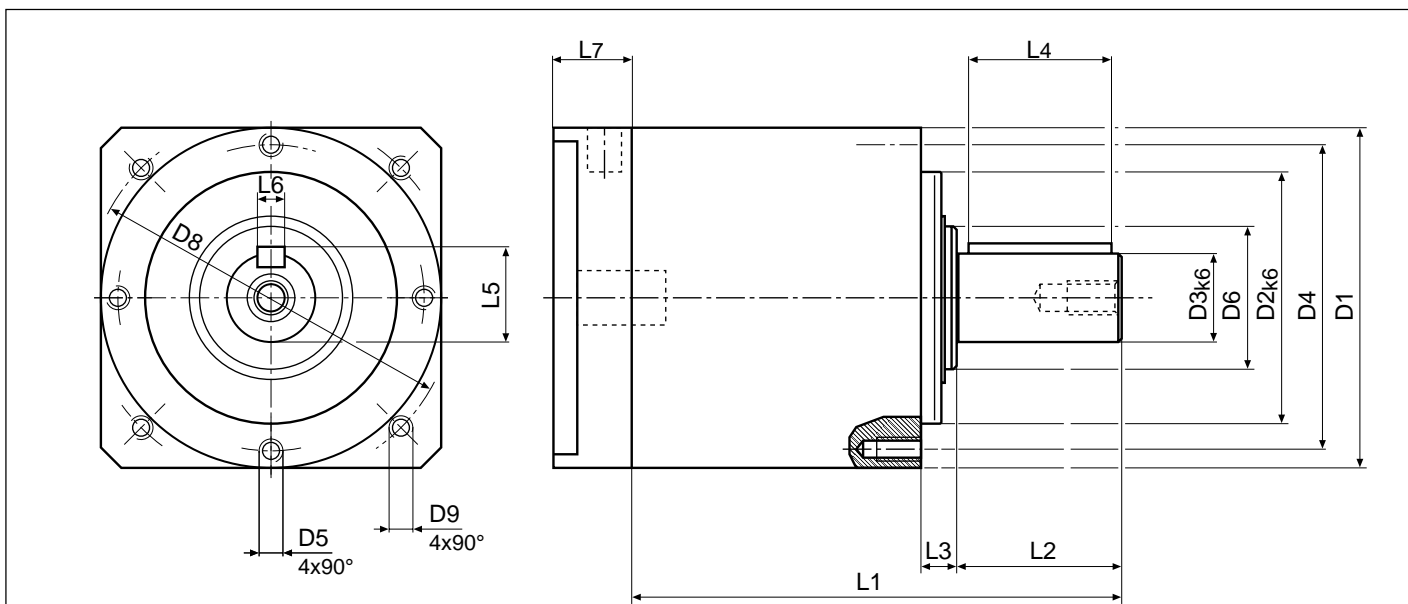
- **high reliability**
 - **high efficiency > 95%**
 - **maximum accuracy**
 - **thermal length compensation**



Assignment Motor Size / Gear Ratio

| Motor Size | n_N rpm | M_N Nm | LP 050 | LP 070 | LP 090 | LP 120 | LP 155 | SP 060 | SP 075 | SP 100 | SP 140 | SP 180 | SP 210 |
|------------|--------------|-------------|--------|--------|--------|--------|--------|--------|---------|---------|---------|----------|---------|
| A1.SM. | 6000 | 0.34 | 5...10 | 5...25 | | | | 4...40 | 4...100 | | | | |
| A2.SM. | 6000 | 0.5 | 5 | 5...10 | | | | 4...28 | 4...50 | | | | |
| A3.SM. | 6000 | 0.65 | 5 | 5...10 | | | | 4...20 | 4...16 | | | | |
| A4.SM. | 6000 | 1.0 | | 5...10 | | | | 4...16 | 4...40 | | | | |
| B1.SM. | 6000 | 0.65 | 5 | 5...10 | 5...25 | | | 4...40 | 4...100 | | | | |
| B2.SM. | 6000 | 1.5 | | 5...10 | 5...25 | 5...50 | | 4...10 | 4...40 | 4...100 | | | |
| B3.SM. | 6000 | 2.3 | | 5 | 5...10 | 5...25 | | 4...7 | 4...20 | 4...50 | | | |
| C1.SM. | 3000 | 1.0 | | 5...10 | 5...25 | 5...50 | | 4...10 | 4...40 | 4...100 | | | |
| C2.SM. | 3000 | 1.8 | | 5 | 5...10 | 5...25 | | 4...7 | 4...20 | 4...50 | | | |
| C3.SM. | 3000 | 2.8 | | | 5...10 | 5...25 | | 4...5 | 4...10 | 4...28 | | | |
| C4.SM. | 3000 | 4.8 | | | | 5...10 | | | 4...7 | 4...20 | | | |
| D1.SM. | 3000 | 3.4 | | | 5 | 5...10 | 5...25 | | 4...7 | 4...20 | 28...50 | 70...100 | |
| D2.SM. | 3000 | 5.6 | | | 5 | 5...10 | 5...25 | | 4...7 | 7...16 | 20...28 | 40...70 | |
| D3.SM. | 3000 | 7.5 | | | 5 | 5...10 | 5...25 | | 4...5 | 7...10 | 16...28 | 40...50 | |
| D4.SM. | 3000 | 9.6 | | | | 5...10 | 5...10 | | 4...5 | 7...10 | 16...20 | 28...50 | |
| E1.SM. | 3000 | 8.4 | | | | 5...10 | 5...10 | | | 4...10 | 16...20 | 28...40 | 50...70 |
| E2.SM. | 3000 | 12.0 | | | | 5 | 5...10 | | | 4...7 | 10...16 | 20...28 | 40...50 |
| E3.SM. | 3000 | 15.5 | | | | 5 | 5...10 | | | 4...7 | 4...10 | 16...28 | 40 |
| E4.SM. | 3000 | 20.5 | | | | 5 | 5...10 | | | 4...5 | 7...10 | 16...28 | 28...40 |

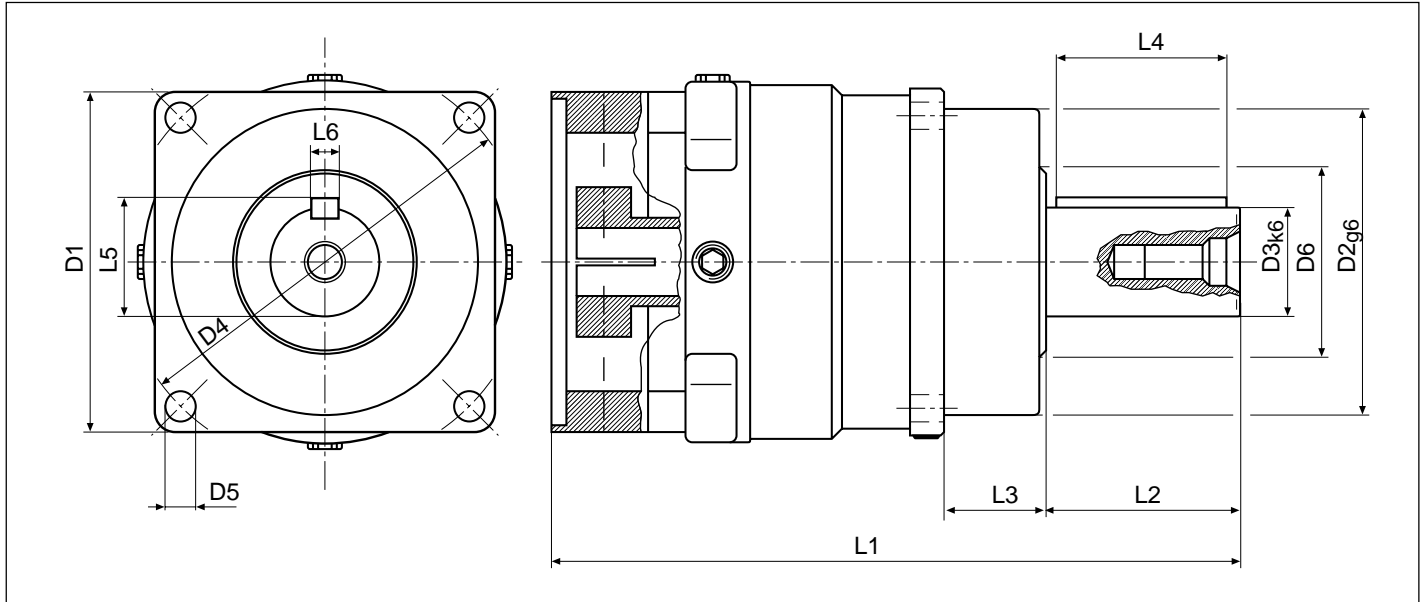
Technical Data LP Gearbox



| Size [mm] | D1 | D2 _{h6} | D3 _{k6} | D4 | D5 | D6 | L1 | | L2 | L3 | L4 | L5 | L6 | L7 |
|---------------|-----|------------------|------------------|-----|-----|----|---------|---------|----|-----|----|------|----|----|
| | Ø | | | | | | 1-stage | 2-stage | | | | | | |
| LP 050 | 50 | 35 | 12 | 44 | M4 | 17 | 75 | 91 | 18 | 6,5 | 14 | 13,5 | 4 | 20 |
| LP 070 | 70 | 52 | 16 | 62 | M5 | 25 | 104 | 124 | 28 | 8 | 25 | 18 | 5 | 22 |
| LP 090 | 90 | 68 | 22 | 80 | M6 | 40 | 126 | 152.5 | 36 | 10 | 32 | 24.5 | 6 | 28 |
| LP 120 | 120 | 90 | 32 | 108 | M8 | 50 | 172 | 204.5 | 58 | 12 | 50 | 35 | 10 | 38 |
| LP 155 | 155 | 120 | 40 | 140 | M10 | 62 | 219.5 | 250 | 82 | 15 | 70 | 43 | 12 | 45 |

| Technical Data Gearbox | | LP 050 | LP 070 | LP 090 | LP 120 | LP 155 |
|---------------------------------|--------------------------------|---------|---------|---------|---------|---------|
| Max. acceleration torque | T_{2B} [Nm] | 11.5 | 32 | 80 | 200 | 400 |
| Nominal torque | T_{2N} [Nm] | 5.2 | 15 | 35 | 90 | 170 |
| Max. radial load | F_{rmax} [N] | 650 | 1450 | 2400 | 4600 | 7500 |
| Max. axial load | F_{amax} [N] | 700 | 1550 | 1900 | 4000 | 6000 |
| Torsional backlash | jt [arcmin] | 12-15 | 12 - 15 | 12 - 15 | 12 - 15 | 12 - 15 |
| Torsional rigidity | Ct.21 [Nm/arcmin] | 0.9 | 3.3 | 9 | 24 | 55 |
| Max. input speed | m_{max} [min ⁻¹] | 8000 | 6000 | 6000 | 4800 | 3600 |
| Nominal input speed | m_{nom} [min ⁻¹] | 4000 | 3000 | 3000 | 2400 | 1800 |
| Output shaft | $d_{shaft} * l_{shaft}$ [mm] | 12 x 18 | 16 x 28 | 22 x 36 | 32 x 58 | 40 x 82 |

Technical Data SP Gearbox



| Size [mm] | D1 | D2 _{h6} | D3 _{k6} | D4 | D5 | D6 | L1 | | L2 | L3 | L4 | L5 | L6 |
|---------------|-----|------------------|------------------|-----|-----|-----|-------|-------|-----|----|----|------|----|
| | Ø | | | | | | 1st. | 2st. | | | | | |
| SP 060 | 62 | 60 | 16 | 68 | 5.5 | 30 | 129 | 149 | 28 | 20 | 25 | 18 | 5 |
| SP 075 | 76 | 70 | 22 | 85 | 6.6 | 38 | 156 | 182.5 | 36 | 20 | 32 | 24.5 | 6 |
| SP 100 | 101 | 90 | 32 | 120 | 9 | 55 | 202 | 234.5 | 58 | 30 | 50 | 35 | 10 |
| SP 140 | 141 | 130 | 40 | 165 | 11 | 70 | 256.5 | 296.5 | 82 | 30 | 70 | 43 | 12 |
| SP 180 | 182 | 160 | 55 | 215 | 13 | 90 | 297 | 315.5 | 82 | 30 | 70 | 59 | 16 |
| SP 210 | 212 | 180 | 75 | 250 | 17 | 120 | 350 | 397 | 105 | 38 | 90 | 79.5 | 20 |

| Technical Data Gearbox | | SP 060 | SP 075 | SP 100 | SP 140 | SP 180 | SP 210 |
|---------------------------------|--------------------------------|---------|---------|---------|---------|---------|----------|
| Max. acceleration torque | T_{2B} [Nm] | 40 | 100 | 250 | 500 | 1100 | 1900 |
| Nominal torque | T_{2N} [Nm] | 25 | 70 | 170 | 360 | 1050 | 1500 |
| Max. radial load | F_{rmax} [N] | 2600 | 3800 | 6000 | 9000 | 14000 | 18000 |
| Max. axial load | F_{amax} [N] | 1300 | 1900 | 3000 | 4500 | 7000 | 9000 |
| Torsional backlash | jt [arcmin] | < 6 | < 6 | < 4 | < 4 | < 4 | < 4 |
| Torsional rigidity | Ct.21 [Nm/arcmin] | 3 | 8 | 24 | 45 | 144 | 400 |
| Max. input speed | m_{max} [min ⁻¹] | 6000 | 6000 | 4500 | 4000 | 3500 | 3000 |
| Nominal input speed | m_{nom} [min ⁻¹] | 4000 | 3000 | 2500 | 2000 | 2000 | 1500 |
| Output shaft | $d_{shaft} * l_{shaft}$ [mm] | 16 x 28 | 22 x 36 | 32 x 58 | 40 x 82 | 55 x 82 | 75 x 105 |

KEB Drive Systems

COMBIVIS



people in motion



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