



Short Form Catalogue 2010

- Drive Electronics
- Electric Motors
- Motion Control
- Feedback Devices
- Power Transmission
- Mechanical Actuators





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About Us - History and Services

Motor Technology offers a wide range of servo and automation products, encompassing motion controllers, servo + stepper drives & motors, feedback devices, precision gearboxes, couplings and mechanical actuators.

Formed in 1985 we have been supplying UK industry with precision equipment for over 20 Years. The head office is located near Manchester, with our southern sales office based near Worcester. We are a self-financed, wholly management owned, UK Company.

The company is structured into three distinct areas Sales, Systems and Spares:

Sales is our main business area, primarily serving OEM customers and resellers. Drawing on components from suppliers dedicated to providing high performance, reliable and value for money products, these are backed by our sales and technical support team locally and at the manufacturers.

Systems describes our Value-Added activities which can range from a simple in-house modification or set-up, to a fully built drive or control system. This service allows the customer to specify a component or system “fit for purpose” saving time and costs.

Spares have been a significant part of our operation for over 20 years. Whether you are looking for a spare part or require an equivalent component, we are here to assist you. Drawing on our experience and knowledge of the servo and motion control market we can also source products from outside our standard product range.

At **Motor Technology** we work closely with customers and suppliers alike, allowing us to provide:

- High quality, reliable products and solutions
- Reliable supply chain
- Fast response and flexibility
- High level of support
- Good working relationship

Our success is largely due to developing long-standing relationships with our customers and building extensive knowledge of both their needs and capabilities.

Focusing, in particular, on the servo and motion control market has given our dedicated team of sales and application engineers extensive experience in providing the right component or system in areas such as:

- Robotics
- Materials handling and converting
- Packaging and printing
- Food and drink
- Chemicals and pharmaceuticals
- Metal, stone, wood, plastics and glass working
- Textiles
- Energy and Transport
- Medical, simulation and leisure equipment

This allows us to match the optimum components to the exact needs, backed by experienced sales and technical support at every stage of a project:

- Product sizing & specification
- Application support
- Design of complete drive and motion control systems
- Product training
- Programming
- Repairs & servicing
- Product sourcing

Although primarily involved with industry in the UK and Ireland, we have built up an international customer base with regular customers spread across Europe, Asia, Africa, North & South America and Australia.

Motor Technology – control in motion

The above is sample information on the product range. Please contact us for a full brochure . . .

About Us – Suppliers and Products

Motor Technology provide components and solutions based on products from the following Manufacturers:

	Lenord + Bauer offer a wide range of motion and process control components including controllers, drives, motors and feedback devices providing flexible, cost-effective solutions for single and multi-axis applications.
	Metronix specialise in digital servo drives and offer products for mounting in control cabinets or directly to the motor. Their outstanding feature is the easy of interfacing to different types of motors, feedback systems and control electronics.
	Motor Power Company offer a wide range of direct drive rotary and linear motors. These motors are particularly suited to applications where high precision or speed is required and power transmission components such as belts and pulleys, rack and pinion, gearboxes, etc are not desirable.
	Mattke offer a wide range of drive, motor and feedback components. Specialising in customer support and choice they can offer “old technology” DC and AC servo drives, digital AC servo drives and a wide range of motors, gearboxes, encoders and tacho-generators.
	Trio Motion Technology offers motion controllers for single and multi-axis applications. Stand-alone, PC based and “drive-in” controllers are available.
	Festo are a leading company in the field of handling and pneumatics. Concentrating on the fast growing E-Drive range of servo and stepper driven actuators, the range is complemented by of the shelf pick-and-place units, grippers, vacuum components, etc.
	Danaher-Motion offers a comprehensive range of servo drives and motors for rotary and linear applications where high resolution, high speed and precise positioning are required.
	LAM Technologies specialize in stepper drive technology offering micro-stepping and programmable units for system applications and OEM machines. The range is complemented with a range of performance stepper motors.
	Girard manufactures a wide range of worm gearboxes featuring low and adjustable backlash. They are most suited to speed and position critical servo applications.
	R+W supply a complete range of precision metal bellows couplings and intermediate shafts for power transmission applications. The range covers miniature, drive and safety couplings.
	Tramec produce a wide range of planetary gearboxes. Ranging from low cost to high precision units, suited to demanding servo applications they offer an efficient transmission solution.

In addition we supply and support a number of other servo and motion control products from:

	Acroloop Motion Control		MTS Automation / Custom Servo Motors
	Axor Drives & Motors		Prima Servo Drives
	Emilplanet Planetary Gearboxes		SMB Servo Motors
	Eurotherm / SSD Servo Drives and Motors		Kollmorgen-Seidel Servo Drives and Motors
	Zebotronics Stepper Drives and Motors		Stoegra Intelligent Stepper Drives
	Euroservo Servo drives and motors		AEG-Lafert Servo motors

The above is sample information on the product range. Please contact us for a full brochure . . .

Servo drives – Metronix ARS 2000, intelligent servo drives for AC brushless servo motors

The **Metronix ARS 2000** servo positioning controllers (ARS servo 2nd generation) are intelligent AC servo inverters with many parameter setting and extension options. They are flexible and can be easily adapted to a number of different applications.

The **ARS 2100** series includes types with single-phase supply and the **ARS 2300** series types with three-phase supply.

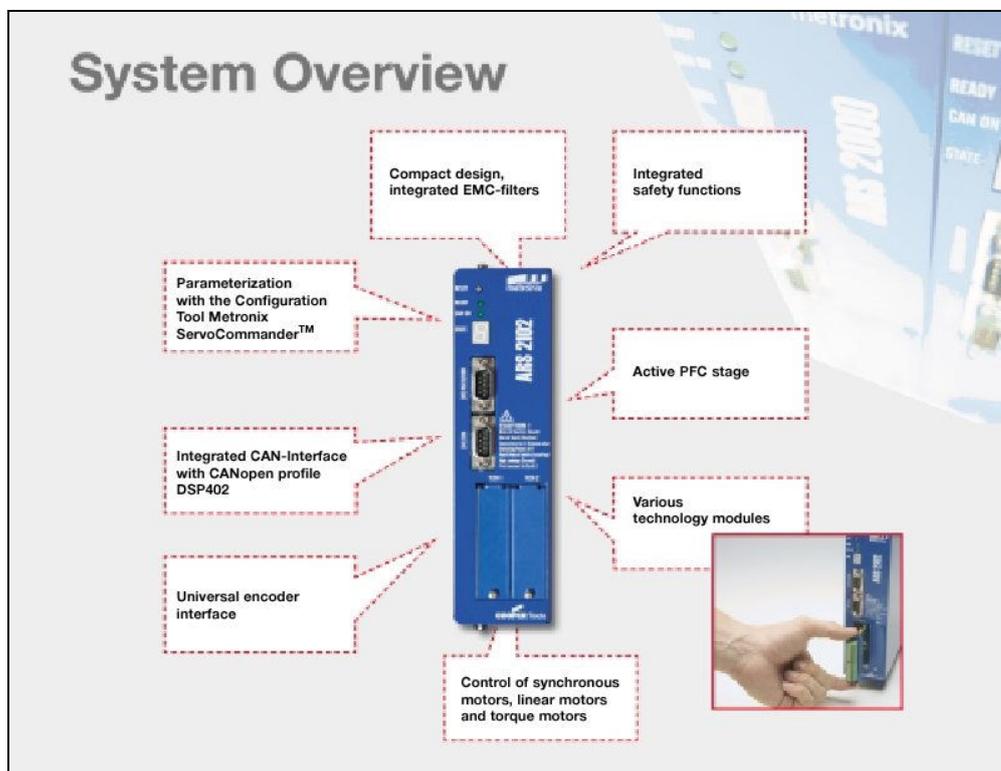
In addition to point-to-point positioning, speed and angle synchronization with electronic gearing, the CANopen protocol DSP402 allows the implementation of contouring controls with linear interpolation as well as time-synchronized multi-axis applications.

The **ARS 2000** communicates with a PLC via FieldBUS such as the integrated CAN Interface or the FieldBUS modules for PROFIBUS or SERCOS.

With the menu-driven configuration tool Metronix **ServoCommander™** and the automatic motor identification, the **ARS 2000** quickly and comfortably adapts to your requirements.

The **ARS 2000** servo-positioning controllers can be used universally since they can be connected to a variety of encoder systems and are suitable for operation with synchronous motors, linear motors and torque motors.

NEW – ARS2108 single phase drive with 8 Amps continuous and up to 32 Amps peak. Improved processor reduces cycle times down to 31.25µs.



- Features**
- Compact design with integrated EMC-filters
 - ServoCommander™ software tool with commissioning wizard and auto phasing
 - Integrated CAN-Interface with CANopen profile DSP402
 - Universal encoder interface for resolver, quadrature encoder, sine-cosine encoder, Hiperface and EnDat
 - Integrated safety functions including safe stop (EN 954-1 cat 3)
 - Active PFC stage on 1Ø drives (EN61000.3.2)
 - Various technology modules for ProfiBUS, Sercos, Ethernet, service and extended I/O
 - UL and cUL certification

Technical Data	2102	2105	2108	2302	2305	2310	2320	2340
Supply voltage (+/-10%)	1Ø, 100 to 230Vac			3Ø, 230 to 480Vac				
DC supply voltage	60 to 380V DC		60 to 320V DC	60 to 700V DC				
Rated current	2.5A	5A	8A	2.5A	5A	10A	20A	40A
Peak current (max. 5 sec)	5A	10A	16A (32A for 0.5s)	7.5A	15A	20A	41.5A	70A
Dimensions (W x H x D)	200 x 54.5 x 200	225 x 54.5 x 200	225 x 54.5 x 200	250 x 69 x 240			330 x 89 x 242	330 x 164 x 242

Metronix is part of the Cooper Power Tools division of Cooper Industries, with over 100 locations worldwide.

The above is sample information on the product range. Please contact us for a full brochure . . .

Servo drives – Metronix ServoCommander™ commissioning software for ARS 2000

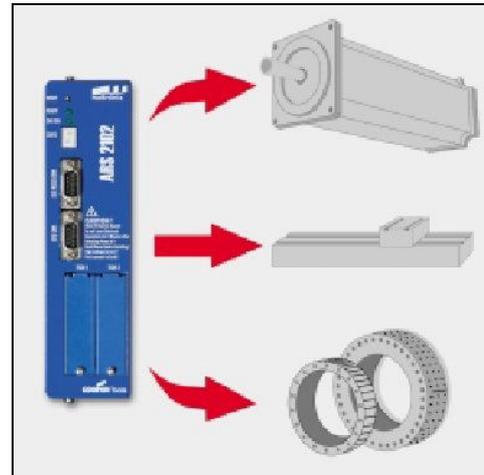
The **Metronix ServoCommander** is a user-friendly Windows based commissioning tool, to enable the swift adoption of the drive to your motor and application.

What differentiates **ServoCommander** from other drive commissioning tools is that it has been designed to allow the set-up with any motor.

The 1st Commissioning wizard gives the user, even a novice, the tools to get up and running in the shortest possible time.

The software features automatic motor identification, which recognises the number of motor poles, winding resistance and inductance during the process.

The same software platform is used for the entire **ARS** range, whether you are operating a synchronous, linear or torque motor.



Start the "1st commissioning" wizard

Plain text and graphic icons are used to guide you.

Configure your application assisted by the intuitive menus, supporting graphics and Online help.

- Features**
- ServoCommander™ software tool with commissioning wizard
 - Commission any motor in minutes
 - Automatic recognition of the connected ARS drive
 - Automatic motor phasing
 - Determines motor poles, winding resistance and inductance
 - Simultaneous indication of reference values and actual values
 - Offline parameter setting
 - Display of values in customer-specific units
 - Graphic display of structures
 - Extensive online help
 - Excellent navigation properties provided by Graphic buttons
 - Context-sensitive windows
 - 4 channel oscilloscope function
 - Multilingual
 - Loading and saving of parameter sets

A cut down version of the **ServoCommander™** software is also available for the **DIS-2 24/48V** DC servo drive.

The above is sample information on the product range. Please contact us for a full brochure . . .

Servo drives – Metronix DIS-2, for low voltage AC and DC servo motors

The **DIS-2** is a fully digital AC servo controller for three-phase synchronous and PM DC motors with a supply voltage of 24 to 48 V DC.

- Cost optimised especially for series applications
- Compact design with one PCB
- Direct mounting on the motor, or chassis
- High protection class up to IP67 when fitted to a motor
- Operation in industrial area without external EMC components
- Full 4Q operation with continuous control
- Integrated CAN-Bus Interface with DSP402
- Easy coupling to PLC via I/O or field-bus

The **DIS-2** can be used as a torque, speed or position controller with synchronization. It is controlled via the CAN bus or a serial interface.

Programming and diagnosis are possible via the RS232 or CAN bus port.

The setup software **DIS-2 ServoCommander™** allows a fast and very user-friendly controller configuration on the PC.

With this software it is also possible to set up the nominal current to 15A and maximum current to 40A (8/14A on DIS-2 24V unit).

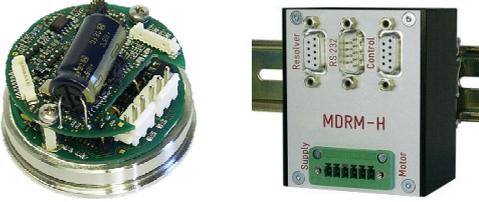
In positioning mode, 64 position sets can be stored as absolute or relative point-to-point values. It is also possible to teach-in up to 32 positions by moving to the real position.

The “Interpolated position mode” is also integrated via CAN bus. For reference positioning it is possible to use a digital input. The set point assignment can be realised either via the bus or via two analogue +/-10 V nominal inputs.

An analogue output 0...+10 V is programmable to one of the different set points or actual values. The last 6 errors are permanently stored in an error memory.

The universal encoder interface supports the most motor feedback standards.

Technical Data

	DIS-2 24/8 (MDRM-H)	DIS-2 48/10 (MDRM48)
		
Supply voltage	24 VDC; ± 10%	24 to 48 VDC; ± 20%
Control voltage	24 VDC; ± 10%	24 VDC; ± 20%
Rated current I_{Rate}	8 A _{RMS}	15 A _{RMS}
Maximum current I_{Max} for 2 sec	14 A _{RMS}	40 A _{RMS}
Rated power P_{Rate}	Approx. 120W	750VA at 48V DC
Maximum power P_{Max}	Approx. 180W	1500VA at 48V DC
Clock frequency f_{PWM}	10 kHz	10 kHz
Housing temperature	0° to +70°C	0° to +65°C
Enclosure	IP00	IP54, prepared for IP67
Dimensions in mm (W x H x D)	Motor Flange version Diameter 65mm, height 40mm	AMP Plug version 110 (with Plug 126) x 56 x 80
Dimensions in mm (W x H x D)	DIN-Rail version W = 65mm, H = 78mm, D = 68,5mm (without connector)	Phoenix Plug version 112 (with Plug 120) x 56 x 80
Encoder evaluation	Resolver Analogue hall sensors	Resolver, analogue hall sensors, Digital six-step-hall sensors with block commutation, SinCos encoder with HIPERFACE
Interfaces	RS 232 CAN bus to DSP402 / DS301	RS 232, CAN bus, Optional ProfiBus
Inputs (maximum)	2 x DIN 24V, ENABLE & DIR 2 x AIN, 0...10V, 12 Bit	8 x DIN, 24V 2 x AIN, ±10V differential, 12 Bit
Outputs (maximum)	2 x DOUT, 24V 1x OUT = Drive Ready 1 x ERR = Error state	3 x DOUT, 24V 1x brake, 24V, 500 mA 1 x AOUT, 0.05..10V, 8 Bit Additional incremental encoder output for synchronization

The above is sample information on the product range. Please contact us for a full brochure . . .

Servo drives from Mattke – Analogue for Permanent Magnet DC and Brushless Motors

Mattke have been manufacturing servo drives for over 40 years and have extensive facilities for providing drive modifications for specific applications as well as custom designs.

By working closely with customers **Mattke** have gained valuable experience in a wide range of industries including, medical, metrology, robotics, packaging, printing and textiles.

The products listed below form only a small part of **Mattke's** product range which includes:

- Linear Amplifiers
- Digital Drives
- Drives for Battery Applications
- Disc Armature Motors
- Transformers / Chokes

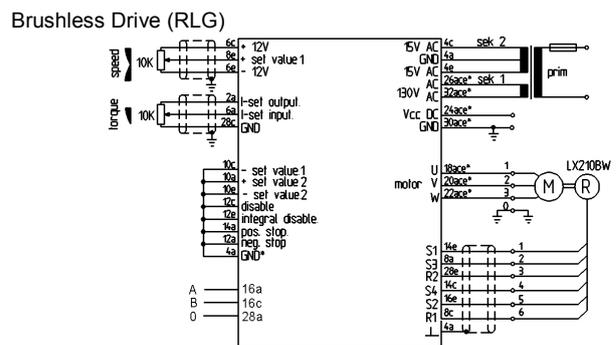
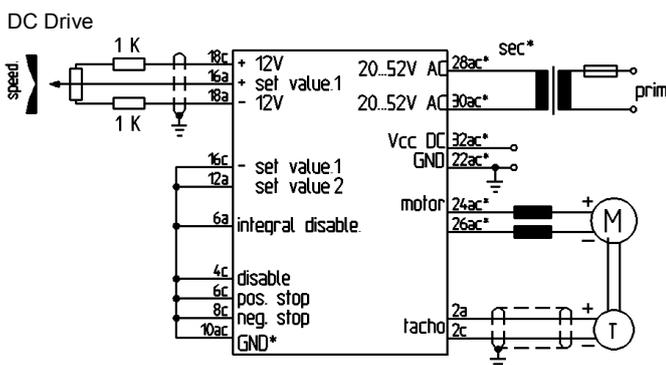
Features (vary depending on drive type)

- Armature Feedback
- IxR Compensation
- Hardware Limits
- Torque / Speed limiting
- Operating temperature range -20 °C ... +45 °C
- Fault Monitoring
- Current Loop Bandwidth 1kHz

Technical Data

Drive type		MTRF 25...61/5-15	MTR 24...105/10 2E	MTR 60/12-30 (150/8-20)	MTR 5000	MU3V 25...61/5-15	MU6V 300/15-30	MRS6V 300/15-30
	Units							
For Motor Type		DC	DC	DC	DC	BL-RLG	BL-RLG	BL-RES
Supply Voltage DC	V	24...60	na	60 (150)	na	24-60	100-310	100-310
Supply Voltage AC	V	1ph / 20...52	3ph / 20...85	1ph / 52 (1ph / 120)	3ph / 52-148	1ph / 22-52	3ph / 80-230	3ph / 80-230
DC bus Voltage		24...60	24...105	60 (150)	60-170	24-60	100-310	100-310
Nominal Current	A	5	10	12 (8)	6-40	5	15	15
Peak Current	A	15	20	30 (20)	18-120	15	30	30
Control		4Q	4Q	4Q	4Q	4Q	4Q	4Q
Switching Frequency (at output stage)	KHz	18	18	19	15	18	19	19
Load Inductivity (min)	MH	0.8	0.8	0.9 (3.5)	or	0.8		
Mounting		Rack Panel (opt)	Rack	Panel	Panel	Rack	Rack	Rack
Dimensions	mm	3HU W31	6HU W38	H166 W106 D200	H180 W145 D320	3HU W57	6HU W65	6HU W65
Comments			Twin drive module option	Bosch Mini-Pos Seidel STR 700 / 1200	Seidel STR 2800 / 5000	Hall/Tacho	Hall/Tacho	Resolver

Example control circuits



The above is sample information on the product range. Please contact us for a full brochure . . .

Servo drives – MS / MTS, for DC servo motors

Based on the **MS series** 19' Euro-card drives, the **MTS series** of drives is supplied in a stand-alone housing incorporating the power supply and regen circuitry.

The module can be back panel mounted and termination is to plug-in terminals. Units are suitable for motors up to 200Vdc with current ratings up to 14A continuous.

Features

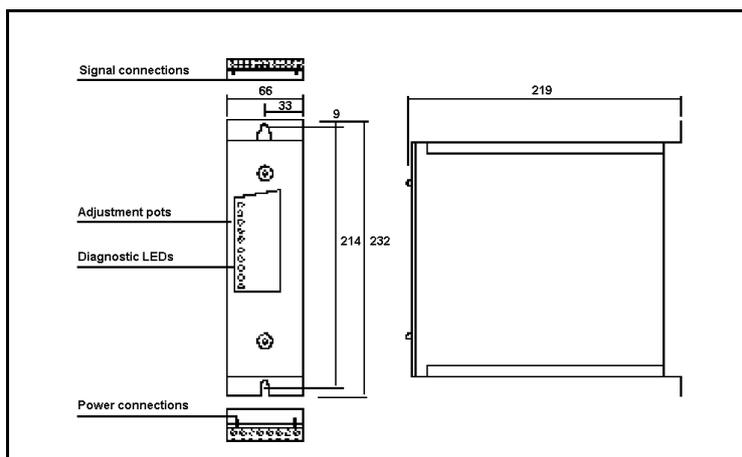
- Compact design
- Integral power supply and regen circuit
- Removable personality module
- No noise (20kHz switching frequency)
- Differential speed command (+/-10V)
- Tachometer, armature and encoder feedback possible
- CE conformity
- Acceleration and deceleration ramps

Adjustments

- Dynamic gain
- Derivative and integral adjustment
- Offset
- Fine speed pot

Diagnostics LEDs

- Drive-ok
- Over-current
- Over temperature
- I²t
- Tachometer loss



Range

Model	Supply Voltage (Vac)	Motor Voltage (Vdc)	Nominal Current (A)	Peak Current (A)
MTS 60-4/8	20 ... 40	27 ... 54	4	8
MTS 60-8/16	20 ... 40	27 ... 54	8	16
MTS 60-10/20	20 ... 40	27 ... 54	10	20
MTS 60-14/28	20 ... 40	27 ... 54	14	28
MTS 140-4/8	35 ... 95	47 ... 122	4	8
MTS 140-8/16	35 ... 95	47 ... 122	8	16
MTS 140-10/20	35 ... 95	47 ... 122	10	20
MTS 140-14/28	35 ... 95	47 ... 122	14	28
MTS 200-4/8	52 ... 145	70 ... 200	4	8
MTS 200-8/16	52 ... 145	70 ... 200	8	16
MTS 200-10/20	52 ... 145	70 ... 200	10	20
MTS 200-14/28	52 ... 145	70 ... 200	14	28

The above is sample information on the product range. Please contact us for a full brochure . . .

Stepper drives + motors

High reliability and performance, compact size and low cost are the requirements around which the **DS range** of stepper motor drives have been designed.

Using the latest electronic components and SMD technology it has been possible to produce a high power driver in a compact and smart case easy and quick to install on a DIN rail.

The connection to the motor, with the logical signals and to the power supply is through three different coloured terminal blocks; each one of them is removable, numbered and suitable for 2,5mm² wire size.

A wide range of setting options allows the drives to be configured for different motors and applications. Motor phase current, step resolution, etc can all be set in the graphic software *UDP Commander* which runs under Windows.



Features

- Resolution up to 25,600 step/rev
- STEP frequency to over 300kHz
- Wide power range up to 10A, 240Vdc
- Compact DIN-rail mounted unit
- Easy to install using removable terminal blocks
- Configuration via Windows based software

NEW - DS30 range with integrated controller!

Technical Data	DS1044	DS1048	DS1073	DS1076	DS1078	DS1084	DS1087	DS1098
Power supply voltage Vdc	20...50	20...50	24...90	24...90	24...90	45...160	45...160	45...240
Phase current, Arms (adjustable)	1...4	3...8	0.8...3	2...6	4...10	2...4	4...8.5	4...10
Dimensions, mm (H x W x D)	101x18x119	101x35x119	101x18x119	101x35x119	101x35x119	101x35x119	101x35x119	101x35x119

The **M-series** stepper motors are characterised by high torque, compact size and low rotor inertia.

The torque range covers from 0.28Nm up to 21Nm, with a phase current of between 0.6A and 12A.

These motors have a step angle of 1.8° and are optimised for the micro-stepping which ensures an accurate and smooth movement of the shaft.

Our drives are the natural companion for this family of motors and when used together they allow high positioning precision and repeatability to be achieved.

All the models are provided with a standard NEMA flange that makes installation easy, both on existing systems and on new applications. The motors with torque over 1.5Nm have the shaft with single or double plane face for a simple and safe fixing. On request we can provide versions with keyed shaft.



Features

- NEMA frame sizes 17, 23, 34 and 43
- Torque range from 0.28 to 21Nm
- Bipolar operation, size 34 and 43 also unipolar
- Low inertia
- Optional second shaft and custom windings

Technical Data	Torque Range (Nm)	Flying Lead cores	Phase Current min/max (A)	Motor Length (mm)	Shaft diameter (mm)
NEMA17	0.28 ... 0.5	4	1.3 ... 1.7	34 ... 48	5
NEMA23	0.55 ... 3.4	4	0.62 ... 6	41 ... 112	6.35
NEMA34	3.1 ... 12.1	8	5.6 ... 12	63 ... 150	14
NEMA 43	14.4 ... 21	8	12	115 ... 150	19

The above is sample information on the product range. Please contact us for a full brochure . . .

Servo drives - Servostar 300

The new **Servostar 300** range is a further development of the well-established Servostar 600 drive, offering higher performance in a smaller package.

The **Servostar 300** offers full single axis control with on-board power supply, filters and ballast resistor. They also features a RS232 port, CANopen interface (Profibus-DP, DeviceNet and Sercos optional), control for rotary and linear motors and feedback from resolver, high-resolution encoders or hall-sensors.

The drives also feature an integrated position controller for simple motion tasks. In addition the drives can accept a pulse / direction (stepper controller) input for added flexibility. Master / slave and electronic gearing is also standard.



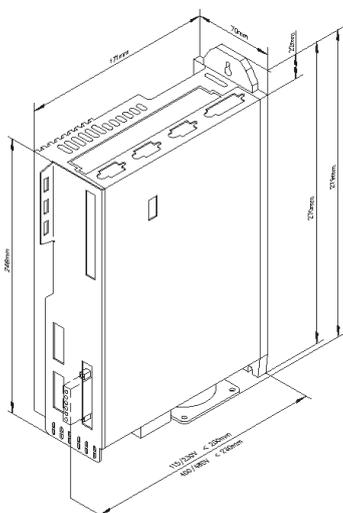
Options include the AS-Enable, restart lock for additional safety and the drive is also available with the Trio MC302-K Motion Coordinator (see page 4).

Technical Data	Dim	303	306*	310*	341	343*	346*
Rated supply voltage (+/-10%)	Vac	3 x 115V to 230V			3 x 208V to 480V		
Rated installed power for S1 operation	kVA	1.2	2.4	4	1.4	3.3	5
Rated DC link voltage	Vdc	145 ... 360			560 ... 675		
Rated output current (rms value, ± 3%) / Peak output current (max. 5s, ± 3%)							
At 1 x 110V mains voltage	Arms	3 / 5	3 / 5	3 / 5	-	-	-
At 1 x 230 / 240V mains voltage	Arms	3 / 9	4 / 9	4 / 9	-	-	-
At 3 x 115V mains voltage	Arms	3.5 / 9	8 / 15	10 / 20	-	-	-
At 3 x 235V mains voltage	Arms	3 / 9	6 / 15	10 / 20	2 / 4.5	5 / 7.5	6 / 12
At 3 x 400V mains voltage	Arms	-	-	-	1.5 / 4.5	4 / 7.5	6 / 12
At 3 x 480V mains voltage	Arms	-	-	-	1.5 / 4.5	3 / 7.5	6 / 12
Continuous internal regen power (RBint)	W	40	40	40	40	40	40
Continuous external regen power (RBext)	kW	0.25	0.25	0.25 to 0.75	0.4 to 1.5	0.4 to 1.5	0.4 to 1.5
Peak regen power (PRext), max.	kW	1.5 to 3	1.5 to 3	3	7 to 9.5	7 to 9.5	7 to 9.5

* requires fan unit

Dimensions

(in mm)



Connectivity options



The above is sample information on the product range. Please contact us for a full brochure . . .

Servo drives - Servostar 600

The **Servostar 600** combines a very fast 62 microsecond servo loop with feedback from either a resolver or sine/cosine encoders enabling tight positional accuracy and speed control equivalent to an analogue drive.

The **Servostar 600** drives are compact (14kVA Servostar 620 measures only 325 x 70 x 265mm) and are suitable for 300mm switch-gear cabinets. The range has now been extended to 50kVA continuous.

They are easy to install, with only two mounting screws required, and all internal connections are of the plug-in-and-screw type. Additionally, all CE filters are integrated on the range up to 14kVA.

With approx. 20,000 units produced per year, the Servostar 600 is an industry proven drive, offering reliability and cost-effectiveness.



Servostar 600 has been designed for simple operation and is supplied with powerful Motionlink and Windows software that has an oscilloscope function for displaying current and speed data.

The front panel is user-friendly with a straightforward two-key pad and a three-character LED display.

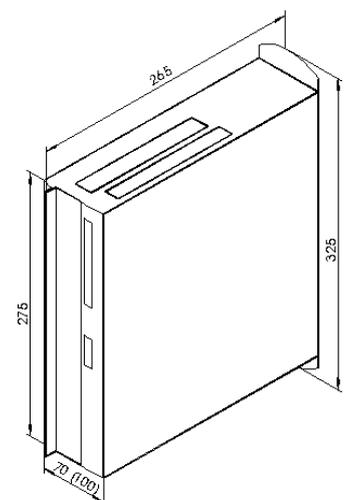
Technical Data

Data	Dim	601	603	606	610	610-30	614	620	640	670
Rated supply voltage (3ph)	Vac	3 x 208V(-10%) ... 480V(+10%), 50 ... 60Hz								
Rated installed power for S1 operation	kVA	1	2	4	7	7	10	14	30	50
Rated DC link voltage	Vdc	260 ... 675								
Rated output current (rms value, ± 3%)	Arms	1.5	3	6	10	10	14	20	40	70
Peak output current (max. 5s, ± 3%)	Arms	3	6	12	20	30 (2sec)	28	40	80	140
Continuous internal regen power (RBint)	W	80	80	200	200	200	200	200	-	-
Max. continuous external regen power (RBext)	kW	0.5	0.5	1.5	1.5	1.5	1.5	1.5	6	6
Peak external regen power (PRext), max.	kW	21	21	21	21	21	21	21	45	70

Highlights

- high speed current and velocity loops
- Encoder emulation - incremental (ROD426, dec./bin.) or absolute (SSI, Gray/Binary)
- Feedback from resolver (standard) or high resolution sine-cosine encoder (EnDat or HiperFace)
- Interface for stepper controllers integrated (PULSE CONNECT)
- CANopen integrated
- Fully programmable via RS232 interface
- Operation from a PC via Windows software
- Operation with 2 keys on the amplifier, with status monitoring via LED display
- CE- / UL- conformity
- Up to 180 high resolution motion tasks with definable S-curve profile, In-position window and 16 different homing routines
- Open architecture - ProfiBus L2/DP, DeviceNET, Ethernet, I/O-extension board, FireWire 1394 and SERCOS

Dimensions



Dimensions (mm) for:
 614 - h 275 / w 100 / d 265
 620 - h 275 / w 120 / d 265
 640/670 - h 345 / w 250 / d 300



The above is sample information on the product range. Please contact us for a full brochure . . .

Servo motors - SBL-T series AC brushless

The **SBL-T** range of three-phase AC brushless synchronous servomotors offer excellent performance combined with low-cost.

The motors have low inertia, good power density and IP65 protection. The motors have a 6-pole winding and are fitted with a 2-pole resolver.

The **SBL-T** motors are available with various connector configurations, shaft-seals and key / key-ways.

A wide range of feedback options is available including incremental, HiperFace and EnDat encoders.

The motors can be supplied with holding brakes, IP rating up to IP67 and vacuum rated. Special requirements such as encoders / adapters, special windings or short motors are also possible.



A range of low voltage 24, 48 and 60V motors are available on request.

For a full set of information, please request a copy of our **SBL-H/T/TC** motor catalogue.

Technical Data

Dimensions

Type	Stall / Nom Torque Mo / Mn	Nominal Speed nN	Stall Current 300V	Stall Current 600V	Inertia J	A	B	D	E	H	K	K1	P
	Nm	RPM	A	A	kgcm²								
SBL-T1	0.1 / 0.09 0.2 / 0.18 0.3 / 0.27	6000	0.58 0.97 0.95	na	0.06 0.08 0.1	25	32	6	16	37	81 96 111	111 126 141	na
SBL-T2	0.2 / 0.19 0.4 / 0.36 0.6 / 0.55 0.8 / 0.72 0.95 / 0.85	4500	0.59 0.93 1.21 1.56 1.82	0.47 0.54 0.73 0.91 1.15	0.06 0.08 0.11 0.13 0.18	40	63	9	24	55	98 113 128 143 158	131 146 161 176 191	74
SBL-T3	0.65 / 0.6 1.3 / 1.15 1.9 / 1.6 2.5 / 2.15 3 / 2.5	3000	1.06 1.67 2.50 3.00 3.50	0.65 1.01 1.42 1.80 2.08	0.5 0.65 0.92 1.4 1.5	80	100	14	30	88	109 127 145 163 181	142 160 178 196 214	115
SBL-T4	2.6 / 2.3 3.9 / 3.3 5.3 / 4.6 7.5 / 6.4 9.5 / 8.5	3000	3.15 4.80 6.50 9.10 11.3	1.92 2.90 4.10 4.80 6.6	1.9 2.25 2.65 4.14 6.05	95	115	19	40	105	146 161 176 221 276	178 193 208 253 308	130
SBL-T5	6.6 / 5.7 10.5 / 8.8 13.5 / 11 17 / 14.5 22 / 17	3000	7.7 12.2 17.4 21.2 25.6	4.5 7.3 11.2 11.4 16.4	4 62 7.3 9.5 11.7	130	165	24	50	142	185 219 236 270 304	228 262 279 313 347	188
SBL-T6	13.5 / 13 19 / 17 22 / 19 29 / 24 35 / 26	3000	14.6 20.5 22.9 31.3 na	8.2 11.5 14.6 17.2 23.5	13.1 18.7 21.5 32.8 46	180	215	24	50	190	201 235 252 310 378	254 288 305 356 424	250
SBL-T7	27 / 21 32 / 23 40 / 26	3000	28.1 32.8 44.0	16.0 19.0 24.7	36 39 45	180	215	28	58	190	242 257 287	296 311 341	250
SBL-T8	40 / 30 68 / 50 93 / 70 115 / 85	3000 3000 2000 2000	na	21.8 39.9 33.1 42.1	76 114 153 190	230	265	38 38 42 42	80 80 110 110	240	310 378 446 514	378 446 514 582	300

For dimensions refer to the drawing on page 13.

The above is sample information on the product range. Please contact us for a full brochure . . .

Servo motors - SBL-H series pole-wound AC Brushless

The **SBL-H** range of three-phase AC brushless synchronous servomotors offer excellent performance combined with low-cost.

The motors have very low inertia, high power density and IP65 protection. The motors have a 8-pole winding and are fitted with a 2-pole Resolver.

The **SBL-H** motors are available with various connector configurations, shaft-seals and key / key-ways.

A wide range of feedback options is available including incremental, HiperFace and EnDat encoders.

The motors can be supplied with holding brakes, IP rating up to IP67 and vacuum rated.



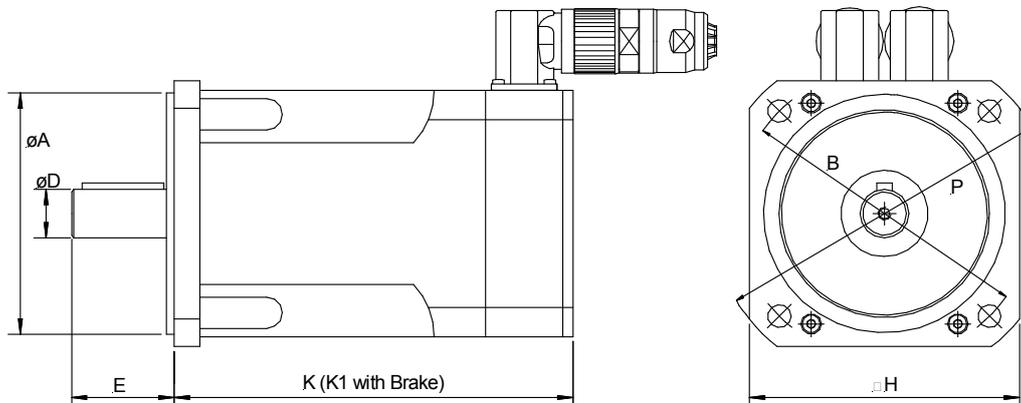
For a full set of information, please request a copy of our **SBL-H/T/TC** motor catalogue. Special requirements such as encoders / adapters, special windings or short motors are also possible.

Technical Data

Type	Stall / Nom Torque Mo / Mn	Nominal Speed nN	Stall Current 300V	Stall Current 600V	Inertia J	A	B	D	E	H	K	K1	P
	Nm	RPM	A	A	kgcm ²								
SBL-H2	0.26 / 0.24	4500	0.7	0.7	0.06	40	63	9	20	55	67	105	74
	0.53 / 0.45		1.26	0.73	0.08						82	120	
	0.74 / 0.67		1.66	0.95	0.1						97	135	
	0.95 / 0.84		2.09	1.31	0.12						112	150	
SBL-H3	0.95 / 0.86	3000	1.47	1.32	0.5	80	100	14	30	86	96	138	115
	1.9 / 1.6		2.75	1.66	0.7						114	156	
	3.25 / 2.9		4.25	2.45	1.1						150	192	
	4.2 / 3.1		4.8	2.95	1.5						186	228	
SBL-H4	4.1 / 3.2	3000	6	3.4	1.7	95	115	19	40	98	129	170	130
	6.3 / 4.6		9.2	4.75	2.6						159	200	
	8.6 / 6.1		11.2	6.4	3.5						189	230	
SBL-H5	11.6 / 8.4	3000	17.3	10.3	6.8	130	165	24	50	142	172	224	188
	14.9 / 10.9		20.2	12.5	8.3						200	252	
	18.7 / 14.3		27.9	16.4	11						230	282	
	27.3 / 21		32.4	19	15.3						290	342	

Dimensions

Drawing



The above is sample information on the product range. Please contact us for a full brochure . . .

Servo Motors - AC Brushless with integrated Servo Drive up to 2.3Nm

The **HDM82** range of drive-integrated three-phase AC Brushless synchronous servomotors offer excellent performance combined with low-cost and simplified installation.

The motors have low inertia, good power density and IP65 protection. The motors have a 8-pole winding and are fitted with a 2-pole Resolver.

Fitted to the motor is the **Metronix DIS-2** 48V servo drive (full details on page 8). The range covers 0.59 to 2.3Nm and speed ranges between 1000 and 5000rpm.

The motors can operate autonomous with only a 24-48Vdc supply.

The motors are available with the standard 2-pole Resolver, HiperFace absolute encoders and Renco incremental encoders with commutation tracks.

As standard the motors feature keyed-shaft, industry standard shaft and flange sizes, integrated temperature sensor and Class F insulation. An optional holding brake is available.



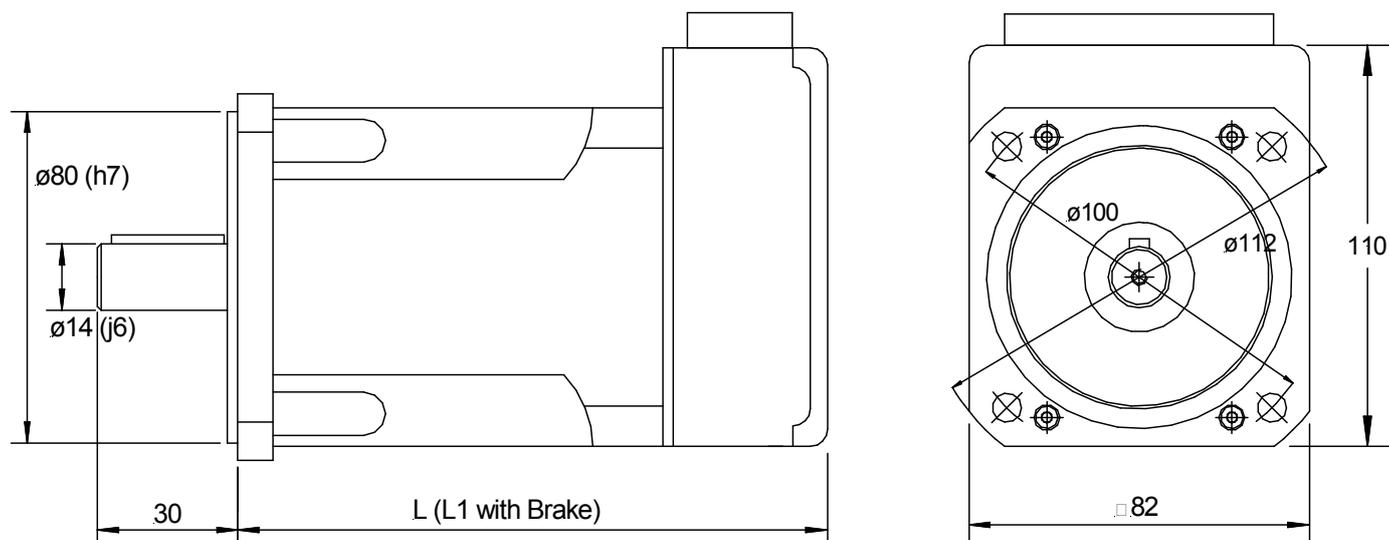
Operating Modes

- Autonomous
- PLC control via I/O
- RS232 serial communication
- CANbus interface
- Profibus DP (optional)
- EtherCAT (optional)

Technical Data

Type	Cont. Stall Torque Mo	Cont. Stall Current Io	Nominal Speed nN	Torque Constant KM	Peak Torque Mo	Peak Current Imax	Length L / L1
	Nm	A	RPM	Nm/A	Nm	A	mm
HDM82-A8-7S	0.59	7.2	5000	0.081	2.0	42	139 / 179
HDM82-A8-11.S	0.72	5.4	3000	0.13	2.2	29	139 / 179
HDM82-C8-14S	1.2	7.3	2400	0.17	3.9	42	157 / 197
HDM82-E8-19S	1.5	6.9	2000	0.22	5.3	42	175 / 215
HDM82-J8-30S	2.3	6.6	1000	0.35	8.4	42	211 / 251

Dimensions



The above is sample information on the product range. Please contact us for a full brochure . . .

Servo motors - EX series AC brushless, for explosive atmospheres

EX servomotors are group II, category 2, explosion-proof apparatus designed to operate in explosive atmospheres in accordance with EN 50014 standard.

These servomotors are certified according to ATEX 94/9/CE directive and are available as 2 models:

Gas version

- II2 G EEx d IIB T4, motor for gaseous atmospheres. This motor is not fitted with a lip seal at the customer shaft end.

Gas/Dust version

- II2 GD EEx d IIB T4, motor for dusty, gaseous atmospheres. This motor is fitted with a lip seal at the customer shaft end.

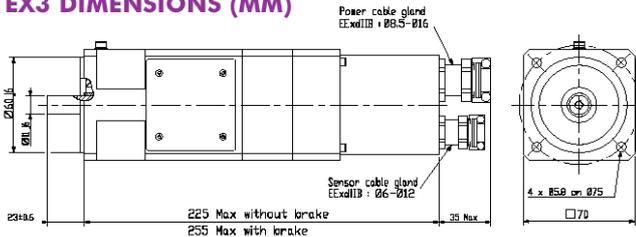


- "d" explosion-proof equipment in accordance with ATEX 94/9/CE directive
- Extremely compact, very well suited to spray paint
- High dynamic level
- Built-in resolver with no need for supplementary encoder
- Bearings greased for life, no maintenance necessary

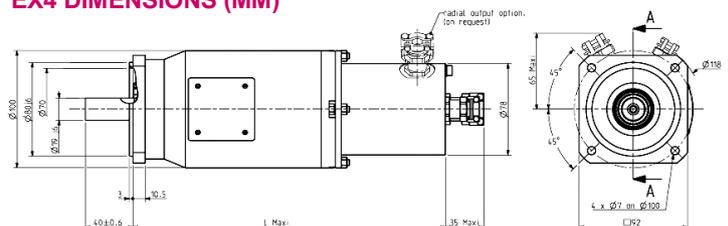
Motor 230V supply	Torque at low speed Nm	Current at low speed A	Maximum speed tr/min
EX310EAP	1.75	1.7	2300
EX310EAK	1.75	3.1	4000
EX420EAP	3.5	3.5	2300
EX420EAJ	3.5	6.0	4000
EX430EAJ	4.8	6.5	3200
EX430EAF	4.8	8.2	4000
EX620EAO	6.6	7.4	2500
EX630EAI	10.4	14.2	3000
EX820EAR	14	13.5	2200
EX820EAL	14	21.7	3600
EX840EAJ	24.5	23.4	2200
EX860EAD	35	39.9	2600

Motor 400V supply	Torque at low speed Nm	Current at low speed A	Maximum speed tr/min
EX310EAP	1.75	1.7	4000
EX420EAV	3.5	1.7	2000
EX420EAP	3.5	3.5	4000
EX430EAP	4.8	3.5	3000
EX430EAL	4.8	4.7	4000
EX620EAO	7.0	7.8	4300
EX630EAY	10.4	7.8	2900
EX630EAN	10.4	10.6	4000
EX820EAW	14	7.9	2200
EX820EAR	14	13.5	3600
EX840EAQ	24.5	12.5	2100
EX840EAK	24.5	20.8	3300
EX860EAJ	35	22.4	2600

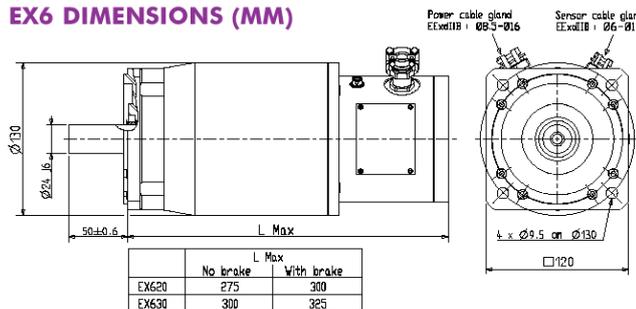
EX3 DIMENSIONS (MM)



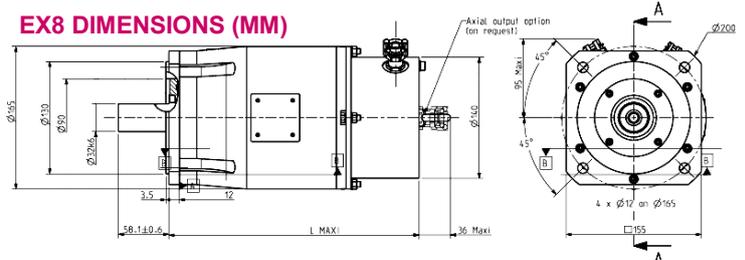
EX4 DIMENSIONS (MM)



EX6 DIMENSIONS (MM)



EX8 DIMENSIONS (MM)



The above is sample information on the product range. Please contact us for a full brochure . . .

Servo motors - Motor Power Company SKA direct drive rotary

Featuring an excellent nominal and peak torque capacity plus high acceleration and deceleration values, the **SKAddr** direct drive servomotors achieve efficiencies and precision positioning that are difficult to obtain with conventional systems.

Natural evolution of direct coupling between the motor and driven load, the conventional components of the kinematic chain have been totally eliminated from these servomotors.

Besides eliminating backlash and mechanical elasticity in the drive transmission, this type of configuration drastically speeds up servicing work and lowers maintenance costs while achieving appreciable energy savings through improved overall efficiency.

Two versions are available for the **SKAddr** series:

- Frameless, with the stator and rotor parts alone
- Power Pack, fully assembled and housed version includes the **SKAddr** torque motor with mounting flange, bearings and transducer, aluminium cover case and specific connections

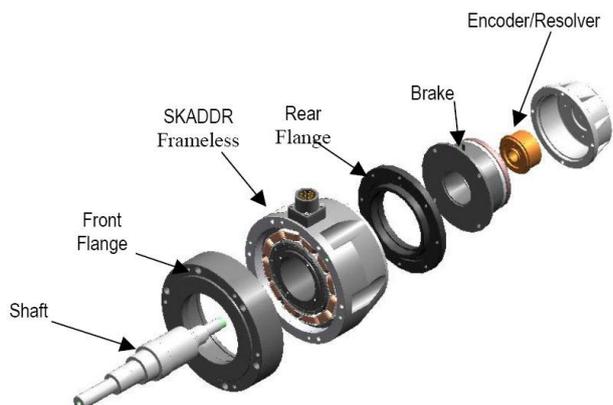


Features

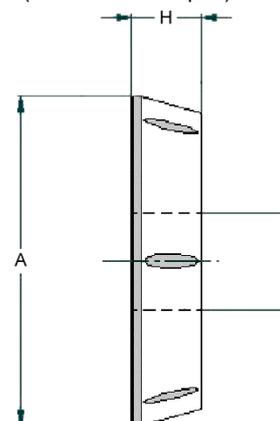
- 'Multi-pole' permanent magnet brushless synchronous servomotor
- 1.9 Nm to 770 Nm stall torque
- Thermal protector (clixon)
- Class F insulation
- IP65 protection (PP version)
- Wide range of transducers including, Resolver, Hall-effect sensors, incremental encoders, sine / cosine encoders, tape encoders, magnetic encoders
- Versions with hollow or solid shaft
- Supply voltage 145 to 460 Vac

Technical Data	Units	SKA DDR090	SKA DDR148	SKA DDR245	SKA DDR335	SKA DDR430
External Diameter (A)	(mm)	110	180	290	390	470
Hole Diameter (B)	(mm)	38	78	145	235	320
Length (H)	(mm)	60	60	60	60	60
		90	90	90	90	90
		120	120	120	120	120
			150	150	150	150
		180		180		180
						210
Number of Poles		14	14	28	42	56
Stall Torque	(Nm)	1.9	8.3	42	100	237
		3.2	13.7	67	160	368
		4.3	18.7	88	210	479
			23.3	109	260	580
					300	677
					770	
Speed Range	(rpm)	1700÷300	1200÷150	800÷90	500÷50	300÷50

Power Pack components



Dimensions (frameless stator part)



The above is sample information on the product range. Please contact us for a full brochure . . .

Servo motors - Motor Power Company SKA direct drive linear

The **SKAddl** iron core synchronous linear servomotors have a high force density and features high-energy NdFeB magnets, making them ideal for applications that need high reversal frequencies and positioning capacities.

The backlash and mechanical elasticity found in conventional systems have been completely eliminated.

Higher overall efficiency also achieves lower energy consumption, leading to cost efficiencies.

The **SKAddl** series permits a very wide range of configurations along the X, Y and Z-axes, such as vertical and horizontal gantries and cantilever systems.

SKAddl Compact combines the performance of direct drive technology (i.e. direct connection to the driven load) with easy assembly in a complete, plug-and-play system housed in an extruded aluminium body.



frameless



compact

The linear technology of the **SKAddl** series, now also ready assembled in an extruded aluminium body.

Features

- Power supply voltage: 145 Vac, 230 Vac, 460 Vac
- Transducers: sin-cos encoders, TTL (optical and magnetic)
- Plug and play structure made of aluminium. The temperature sensor, linear ball bearings, bellows, encoder, cables and cables carrier are already included in the motor

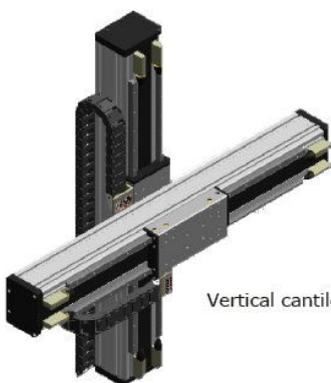
Technical Data

Servomotor type	Units	55HX	55HS	55HM	75HS	75HM	100HS	100HM	125HS	150HS
Peak force	(N)	450	825	1650	1980	2970	3600	4800	6000	7200
Continuous force	(N)	150	275	550	660	990	1200	1600	2000	2400
Maximum speed	(m/s)	5	5	5	5	5	5	5	5	5
Maximum theoretical acceleration	(m/s ²)	321	275	240	206	247	200	192	193	194

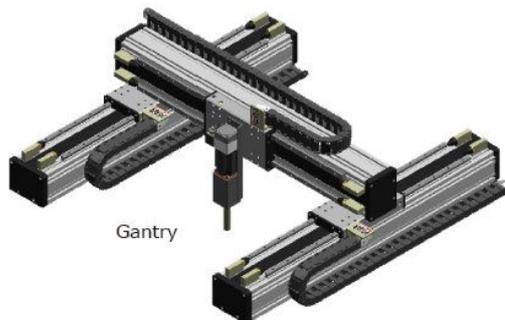
Dimensions

Coil length	(mm)	180	180	350	350	510	535	695	695	695
Coil width	(mm)	55	80	80	100	100	130	130	155	180
Coil height	(mm)	47.5	47.5	47.5	51	51	51	51	51	51
Coil weight	(Kg)	1.4	3	6.9	9.6	12	18	25	31	37
Magnet track width	(mm)	60	90	90	120	120	140	140	175	200
Magnet track height	(mm)	15	15	15	17	17	17	17	17	17
Magnet track weight	(Kg/m)	4.8	8.5	8.5	13	13	13	15.7	19	22
COMPACT version		YES	YES							

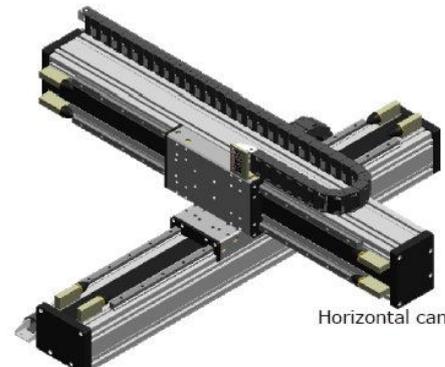
Application examples



Vertical cantilever



Gantry



Horizontal cantilever

The above is sample information on the product range. Please contact us for a full brochure . . .

Motion Control - Trio Motion Technology



Trio Motion Technology has been manufacturing and distributing high-quality motion control products since 1987.

The products can be found in virtually every servo and stepper application.

All controllers use the same **TrioBASIC** command set and are programmed and set-up using the industry-proven **MotionPERFECT** software.

With a dedicated in-house design team, customers can always be assured of the highest quality products.

The extensive product range covers all manner of applications from simple stepper-motor based requirements to high-end multi-axis servo driven systems.

A wide range of controller accessories are available including HMI's, encoder interface boards, CAN I/O modules, Fieldbus interfaces, etc.

Motor Technology enhances this offering with a wide selection of compatible servo and stepper drives and motors, and ancillary mechanical components such as linear actuators, gearboxes, couplings, etc.



MC302X

- » 2 axis stepper or 1.5 servo
- » Compact 94w x 56d x 105h.
- » Easy DIN rail mounting
- » Multi-tasking TrioBASIC system, maximum 3 tasks
 - » CAN Networking
 - » Individual Status LEDs



PCI 208

- » Short PCI Card
- » 2-8 Axes Stepper/Servo
- » High Speed Dual Port RAM
- » OCX Software Component eases application software
- » Opto-isolated IO (20 In/10Out) with CAN I/O expansion
 - » 100 Way MDR Connector
 - » 2 CAN Interfaces



MC206X

- » 1-4 axis Stepper/Servo
- » Compact 107h x 182w x 53d on DIN-rail
- » Pre-emptive multi-tasking Trio BASIC, max. 8 tasks
 - » CAN Networking
 - » Individual Status LEDs



Euro209

- » Ethernet Connectivity
- » High performance, low cost 1-4 Stepper/Servo axes
- » Up to 8 axes using SERCOS or CANopen
 - » Linear, circular and helical interpolation
 - » Electronic clutches, gears and cams
- » 160mm x 100mm Eurocard
 - » Registration inputs



MC464

- » Interpolates up to 64 axes in any combination.
- » Advanced Multi-tasking Trio BASIC with up to 20 simultaneous processes.
 - » 400Mhz, 64bit MIPS processor
 - » Ethernet Interface
 - » SD Card Slot
 - » Wide range of factory communications options
 - » Fully integrates with MotionPerfect 2
 - » Optional IEC61131-3



MC302-K

- » 95mm x 140mm x 20mm
 - » Plug-in card for Servostar S600/S300
- » Forward/Reverse Limit, Datum, Feedhold Assignable control inputs
- » Pre-emptive multi-tasking Trio BASIC
 - » Virtual axis for move superimposition
 - » 1.5 Axes: Servo + synchronisation encoder
 - » 12 opto-isolated inputs
 - » 8 opto-isolated outputs
 - » 2 x 16 bit analogue

The above is sample information on the product range. Please contact us for a full brochure . . .

Motion Control – Metronix / Trio MC2000

The **MC 2000** motion control module for the **ARS 2000** servo drive range enables coordinated motion for up to 4 servo axes.



Complex motion control requirements can be realised quickly and efficiently, such as:

- Electronic CAM and Gearing
- Synchronised Axes
- Point-to-point Positioning
- Interpolated Axes

The **MC 2000** is simply plugged-in to the **ARS 2000** drive. The controller then acts as the Master over the CANopen DS 402 field-bus controlling one, two, three or four servo drives.

Additionally an external encoder can be attached directly to the drive to give a further ½ axis of control.

The extensive I/O facilities of the ARS 2000 drive can be utilised in the controller. Furthermore the system can be extended using the plug-in I/O module EA88 or CAN I/O.

Fast

- 1ms cycle time with up to 4 axes
- Short commissioning times using the Trio ‘Motion Basic’ programming language, with extensive command set
- High-speed sampling input for fast actual value capture and evaluation.

Compact

- Controller plugs directly into the drive
- Coordination of up to 4 servo axes
- Easy cabling via CANbus

Easy

- Simplified application programming with the established Trio Motion software ‘Motion Perfect’
- Easy generation of complex motions such as CAM, gearing or multi-axis interpolation
- Clear cabling through the use of drive-internal interfaces and fast Dual Port RAM

System integration

HMI's can be connected to the controller via the RS485 interface. In addition the integrated RS232 port provides the link to the Trio ‘Motion Perfect’ multi-tasking software development environment.



Technical Data

Servo loop time	1000µs
Number of Axes	8 (4 servo, 1 encoder, 3 virtual)
Serial Connections	1 x RS232 for programming 1 x RS485 for HMI
CAN Ports	1 x Remote Drives 1MBaud 1 x Remote I/O 500KBaud
Multi-Tasking	2 x Fast tasks 5 x Normal tasks
Analogue Inputs	3 @ 0-10V, via ARS 2000 - 1 x 16bit - 2 x 10bit
Analogue Outputs	Two 9-bit via ARS 2000
Digital Inputs	5 x 24V via ARS 2000
Digital Outputs	3 x 24V via ARS 2000

EMC Standard	EN 61800-3
Current Usage	From the drive 150mA / 5v
Input Functions	Positive and negative limits, Homing and Feed hold
Expansion Ports	External I/O Module Service Module (via ARS 2000)
Additional Interface via Servo Drive	Incremental encoder / stepper output (line driver)
User Memory	512kBytes - 8 x digital IN - 8 x digital OUT
Table Memory	32000 Values
Dimensions (L x B x H)	92 x 65 x 19mm
Temperature Range	0-50°C

The above is sample information on the product range. Please contact us for a full brochure . . .

Encoders - Lenord+Bauer GEL207 / 208, magnetic incremental

The **GEL207 / 208** range of magnetic incremental encoders offer a reliable, robust and flexible alternative to conventional optical devices. Both units offer a wide selection of pulse numbers, output signals and additional protection options.

The **GEL207** is a servo-mounted unit suitable for mounting to a wide range of servo, AC and DC motors.

The **GEL208** is a flange-mounted unit and features a large diameter shaft 10mm, which is suitable for use with pulleys, measuring wheels etc.

Features

- Up to 136,192 ppr
- Optional vibration and humidity protection, condense-water outlet
- IP65 rating as standard
- Suitable for speed up to 10,000rpm



Other products

Magnetic Incremental Encoders - Up to 273,408 ppr.

Hollow-shaft Encoders - Up to 266,240 ppr.

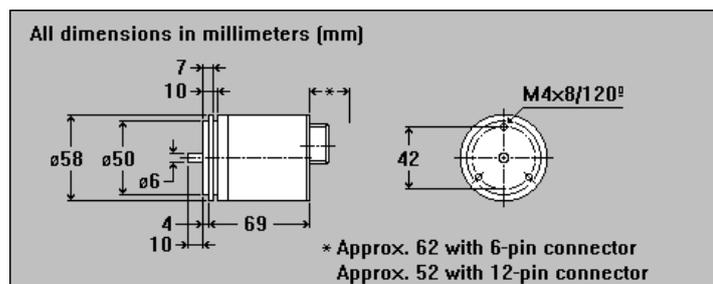
Absolute Encoders - Single / multi-turn up to 65536x4096.

Linear scales - Absolute up to 7.5m.

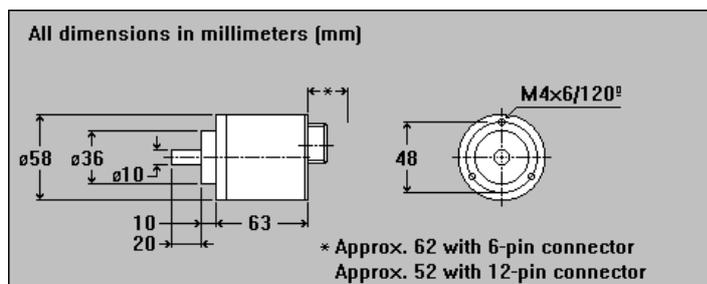
MiniCoder - Miniature incremental encoders in kit form.

Technical Data	GEL 207 / GEL208
Standard pulse numbers	50, 60, 90, 120, 125, 150, 180, 200, 250, 256, 300, 360, 400 500, 512, 600, 720, 750, 800, 900, 1000, 1024, 1200, 1250, 1500 1800, 2000, 2048, 2500, 3000, 3600, 4000, 4096, 5000
Output signals	T = Supply 5V, Output Signal 5V quadrature with inverse U = Supply 10...35V, Output Signal 5V quadrature with inverse V = Supply 10...35V, Output Signal 10...35V two channel X = Supply 10...35V, Output Signal 10...35V with inverse
Maximum operating rpm	10,000rpm
Maximum output frequency	200kHz
Operating temperature range	0...+70°C standard (optional -20...+85°C)
Protection class	IP65
Weight	Approx. 0.5kg
Rotor inertia	$7 \times 10^{-5} \text{ kgm}^2$

GEL 207



GEL 208



The above is sample information on the product range. Please contact us for a full brochure . . .

Encoders - Lenord+Bauer GEL235, magnetic absolute

The **GEL 235** range of magnetic absolute encoders offer a reliable, robust and flexible alternative to conventional optical encoders, making them suitable for harsh environments previously considered unsuitable for such high precision devices.

The **GEL 235** is able to achieve 16-bit single-turn resolution with a precision better than 0.1°, a record figure for magnetic absolute encoders. The **GEL 235's** multi-turn variant achieves 28 bit resolution overall on the basis of an additional mechanical gearing with 12 bit resolution.

Use of an entirely magnetic measuring principle means that this encoder is immune to ageing effects and unaffected by condensation. The metallic contour disk is also largely impervious to dirt, vibration or impacts, providing for markedly longer and more reliable system operation.

The encoder also delivers a sin/cos signal (1V_{PP}), about 64 periods per revolution.

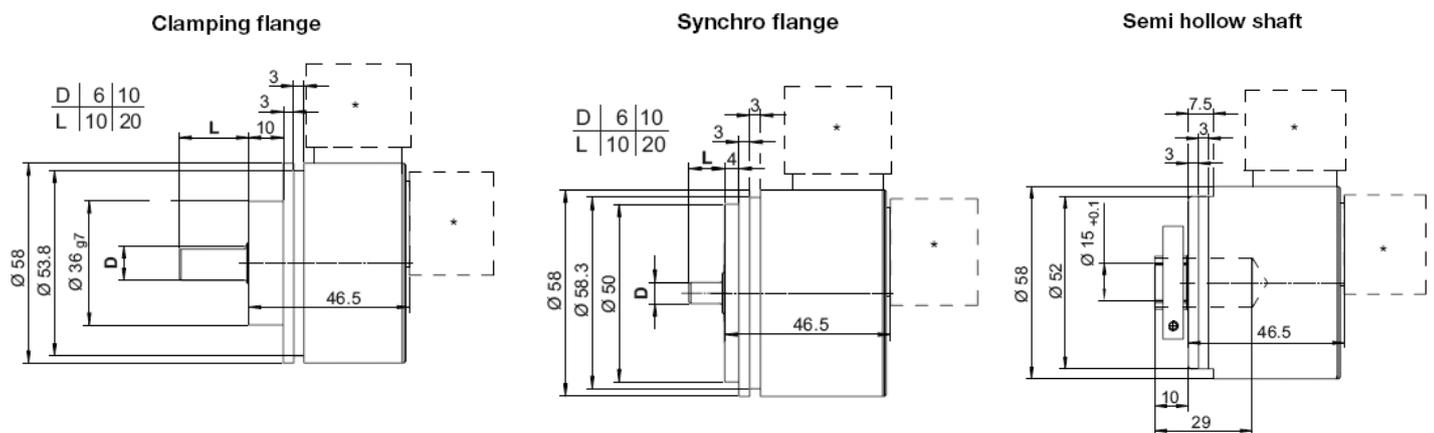


Features

- Compact dimensions (housing ø58mm, 46mm long)
- Three mechanical variants, clamping flange, synchro-flange and hollow-shaft
- SSI binary or grey code output, up to 2 MHz
- Optional user programmable version with PC-Software
- IP64 rating as standard, IP67 optional

Technical Data	GEL 235
Counts per revolution	8 to 16 bit, 256 to 65536 steps / revolution
Number of turns	Up to 12 bit, 4096 turns
Maximum operating rpm	Single turn to 12,000rpm Multi turn to 6,000rpm
Maximum output frequency	200kHz
Operating temperature range	-40...+85°C standard (+105°C in preparation)
Protection class	IP64, IP67 (optional)
Weight	Approx. 0.3kg
Shaft load (axial/radial)	50N / 50N

Dimensions



The above is sample information on the product range. Please contact us for a full brochure . . .

Encoders - Lenord+Bauer MiniCODER, magnetic incremental kit

MiniCODER's are designed for installation in drives as an alternative to the conventional encoders.

They are contact-less and are equipped with a magnetic scanning system, which, in conjunction with a toothed wheel as measuring scale, permit the measurement of rotary motion. This solution is exceptionally space saving.

The Lenord+Bauer **MiniCODER** has developed, over a number of years, into a range of magnetic and hall-effect kit encoders for applications as diverse as automatic wood cutters, speed sensors for rail vehicles and ships, and high-speed machine tool spindles to name a few.

The contact-free sensing principle allows for measurement of speed and position, without limiting performance due to bearings, housings, shaft seals, etc.

MiniCODER have been tried and tested in applications up to **70,000RPM**.

The sensor elements, the magnet and the integrated electronic system are incorporated in state-of-the-art micro system technology and are fully encapsulated.

The design together with subsequent circuitry ensures an electrically and mechanically robust product.

Features

- Robust system for harshest conditions
- Interpolation of each tooth up to 40 times.
- Maintenance-free, non wearing / ageing
- Dew-point-proof
- Insensitive to dirt, shock and vibration
- High IP rating
- High operating temperature range
- Installation on shafts with diameters ranging from 8 mm to more than 500 mm

Technical Data	GEL 243	GEL 244	GEL247 series	GEL 248
				
Motion detection	Rotary, linear	Rotary	Rotary	Rotary
Max. air gap	0.3 mm	Dependent on module 0.15 mm	Dependent on module 3 mm	Dependent on module 0.8 mm
Module M / pitch P	M = 0.5 up to 1 P = 1.0 / 1.6 / 2.0	M = 0.3 / 0.5	M = 1.0 ... 3.5	M = 1.0 up to 3.5
Frequency range	0...200 kHz	0...200 kHz	0...25 kHz	0...25 kHz
Measuring scale	Tooth-wheel, measuring rod or piston rod	Tooth-wheel	Tooth-wheel or slotted disk	Tooth-wheel
Temperature range	-20 ... + 85°C	-40 °C ... +120 °C	-40 °C ... +120 °C	-40 °C ... +120 °C
Protection class	IP 67	IP 68	IP 68	IP 68
Supply voltage	5V DC	5V DC	10 ... 20V DC	10 ... 30V DC
Output signals	Square-wave 5V Sin/Cos 1V _{pp}	Track A, B, N, A/, B/, N/, Sine-wave 1 V _{pp}	Square-wave	Square-wave 10 ... 30 V DC
Fields of application	Mounting in motors, gearboxes, and pneumatic & hydraulic cylinders.	Speed and position detection in high-speed spindles, angle measurement in radar equipment Safety integrated" for Siemens numeric controls	Rail vehicles, measurement of speed and positions in machines and motors	Automatic doors, escalators, forklift trucks, cranes and special vehicles

The above is sample information on the product range. Please contact us for a full brochure . . .

Gearboxes – EP 55...155, general purpose planetary

The **EP** gearboxes are general-purpose units suitable for use with servo, stepper and standard AC and DC motors. The robust construction using steel housings, shafts and gears offer high torsional stiffness and overload capability.

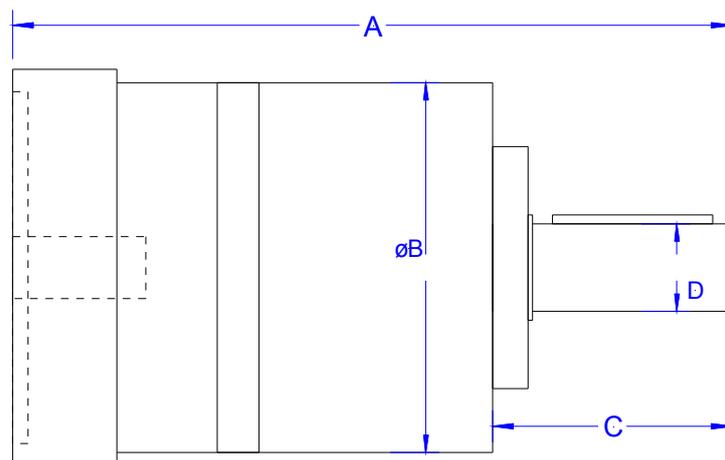
The **EP** gearboxes offer medium backlash, mathematically accurate ratios up to 100:1 and high efficiency.

Features

- Backlash less than 15' single and 20' two stage
- Input speeds up to 5000rpm
- Low noise (<70 dB(A) at 3000rpm)
- Minimal sensitivity to shock
- Available with keyed or clamp input
- High efficiency: 1 stage - 96% / 2 stage - 93%
- Single stage ratios - 3, 4, 5, 7, 10
- Two stage ratios – 9, 12, 15, 16, 20, 25, 28, 35, 40, 50, 70, 100
- Various output shaft and flange options
- Key / key-way
- Specials



Technical Data (20,000hrs bearing life)	Nominal Torque (Nm)	Input speed cont / .max (rpm)	Output loading in N radial (Fr) / axial (Fa)	Accepts motor shaft sizes (mm)
EP 55 - 1 stage	10 ... 16	4000 / 5000	300 / 450	6, 6.35, 7, 8, 9, 9.52, 11
EP 55 - 2 stage	12 ... 16			
EP 75 - 1 stage	20 ... 32	4000 / 5000	1800 / 1400	6, 6.35, 7, 8, 9, 9.52, 11, 12, 12.7, 14
EP 75 - 2 stage	22 ... 36			
EP 90 - 1 stage	50 ... 60	4000 / 5000	2600 / 2000	9, 9.52, 11, 12, 12.7, 14, 15.87, 16, 19
EP 90 - 2 stage	55 ... 75			
EP 120 - 1 stage	100 ... 180	3000 / 4000	4500 / 4000	12.7, 14, 15.87, 16, 19, 22, 24, 28
EP 120 - 2 stage	110 ... 220			
EP 155 - 1 stage	220 ... 380	3000 / 4000	AA flange – 6500 / 3250 TT flange – 5300 / 2650	15.87, 16, 19, 22, 24, 28, 32, 35, 38
EP 155 - 2 stage	250 ... 500			



Dimensions (in mm)	A (1 stage)	A (2 stage)	B	C	D
EP 55	87	106	55	23.5 ... 31	12
EP 75	114	137	72	34.5 ... 46	14 or 16
EP 90	144	173	90	43 ... 56	19 or 22
EP 120	180	200	115	57 ... 83	25 or 32
EP 155	250	280	140	70 ... 110	32 or 40

Note
Dimensions are approximate and vary depending on the output flange and motor adapter selected.

The above is sample information on the product range. Please contact us for a full brochure . . .

Gearboxes – REP 75...150, low backlash planetary

The **REP** gearboxes are built for servo applications where high demands are made on precision, performance and reliability.

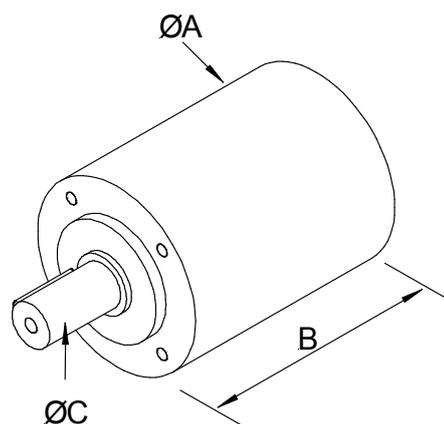
The robust construction using steel housings, shafts and gears offer high torsional stiffness and overload capability.

Features

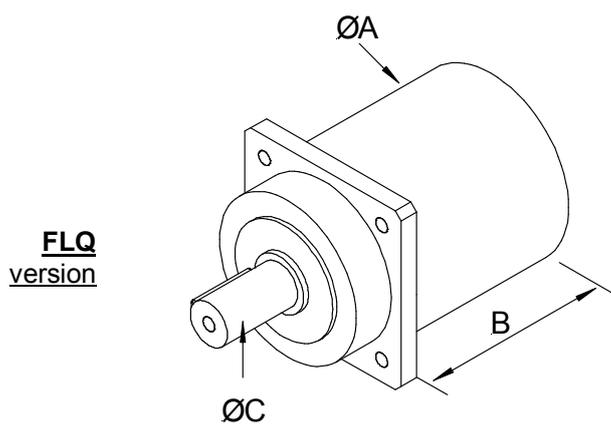
- Backlash less than 4' single, 6' two and 8' three stage
- Low noise (<70 dB(A) at 3000rpm)
- High efficiency: 1 stage - 96%, 2 stage - 93%, 3 stage – 91%
- High torsional stiffness and overload capability
- Minimal sensitivity to shock
- Wide range of shaft and flange options



Technical Data	Ratios	Output Torque cont. (Nm)	Nominal Input speed (rpm)	Max. Input speed (rpm)	Output load axial/radial (N)	Weight (kg)
REP 75/1	3, 4, 5, 6	30-45	4000	6000	1400 / 700	1.3
REP 75/2	9, 12, 16, 20, 24, 30, 36	35-50	4500			1.6
REP 75/3	27, 36, 48, 64, 80, 100, 120, 144, 180, 216	35-55	5000			1.9
REP 100/1	3, 4, 5, 6	75-110	4000	6000	2100 / 1050	2.7
REP 100/2	9, 12, 16, 20, 24, 30, 36	75-115	4500			3.5
REP 100/3	27, 36, 48, 64, 80, 100, 120, 144, 180, 216	80-120	5000			4.3
REP 125/1	3, 4, 5, 7	160-230	3000	5000	3700 / 1850	7.2
REP 125/2	9, 12, 16, 20, 28, 35, 49	180-260	3500			9.3
REP 125/3	36, 48, 64, 80, 100, 140, 196, 245, 343	200-280	4000			11.4
REP 150/1	3, 4, 5, 6	340-470	3000	5000	6600 / 3300	13
REP 150/2	9, 12, 16, 20, 28, 35, 49	370-560	3500			17
REP 150/3	36, 48, 64, 80, 100, 140, 196, 245, 343	450-600	4000			21



FLT
version



FLQ
version

Dimensions (mm / approx.)	ØA	B* 1-stage	B* 2-stage	B* 3-stage	ØC options	Accepts motor shaft sizes (mm)
REP 75	60	83	101	119	12, 14 or 16	6, 6.35, 7, 8, 9, 9.52, 11, 12, 12.7, 14
REP 100	80	102	127	153	19 or 22	9, 9.52, 11, 12, 12.7, 14, 15.87, 16, 19
REP 125	115	126	159	191	25 or 32	12.7, 14, 15.87, 16, 19, 22, 24, 28
REP 150	140	160	201	242	38 or 40	15.87, 16, 19, 22, 24, 28, 32, 35, 38

* Dependent on version and options.

The above is sample information on the product range. Please contact us for a full brochure . . .

Gearboxes - Dynabox and Dynabox XL, right-angled, low backlash

The **Dynabox** worm gearboxes are low backlash units suitable for demanding servo applications and can be specified in three backlash ranges:

- Basic - less than TEN arc minutes
- Medium - less than FIVE arc minutes
- Expert - less than ONE arc minute (adjustable)

Dynabox gearboxes have four mounting options:

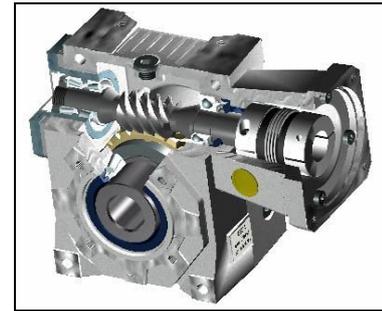
- Hollow shaft
- Robot flange (not XL)
- Dual output (not XL)
- Single output shaft

Gearboxes are supplied with a motor mounting flange and a choice of backlash free couplings if required.

They offer a space-saving design, are quiet / smooth running and maintenance free.

Available ratios on the **Dynabox** range are:

5.2, 7.25, 10.25, 14.5, 19.5, 30, 45, 60 and 90:1

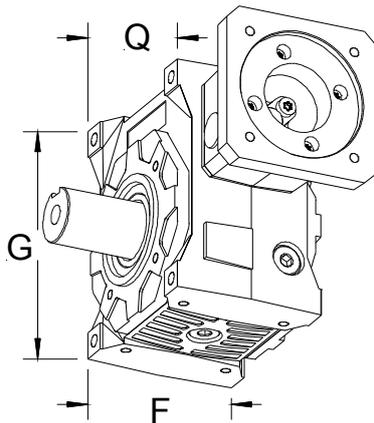


Continuous output torque to over 800Nm and peak torque up to 2300Nm, is achievable.

The new **Dynabox XL** extends the standard range to over 3000Nm continuous and 6000Nm peak.

Typical applications include: machine tools, rotary tables, industrial robots, pan-and-tilt systems, pick-and-place systems, tracking systems and semiconductor manufacturing.

The details below represent an extract of the range.



Dimensions (all approx in mm)	F	G	Q
Dynabox 35	86	126	110
Dynabox 45	100	153	135
Dynabox 55	112	175	150
Dynabox 63	127	197	168
Dynabox 75	148	232	208
Dynabox 90	170	264	229
Dynabox 110	182	306	264
Dynabox XL 125	222	360	270
Dynabox XL 160	246	450	350
Dynabox XL 200	374	576	432

Technical Data* (values are approximate)	Torque S1 (constant speed)	Torque S5 (start/stop)	E-stop torque	Loading radial (Fr)	Loading axial (Fa)
Dynabox 35	25	40	96	3800	2800
Dynabox 45	61	98	214	5800	4000
Dynabox 55	94	148	307	7000	4800
Dynabox 63	155	245	497	8800	8500
Dynabox 75	212	334	834	10500	10500
Dynabox 90	362	572	1543	15800	13000
Dynabox 110	688	1100	2289	21500	16000
Dynabox XL 125	731	1206	3295	22900	22000
Dynabox XL 160	1264	2086	6571	30000	34000
Dynabox XL 200	2410	3977	12277	63000	71000

*Note: Values given are for a gearbox with 30:1 ratio (29.5 on XL) operating at 3000rpm input speed. Values will vary with a change in ratio and/or speed.

The above is sample information on the product range. Please contact us for a full brochure . . .

Couplings - MK and EcoFlex miniature, metal bellows

The **MK** couplings set a high standard and are particularly suitable for use with:

- Shaft encoders
- Potentiometers
- Tacho-generators
- Small stepper & servo motors

All **MK** couplings are:

- Backlash free
- Torsionally stiff
- Compensate for lateral, axial and angular misalignment
- Maintenance free
- Infinite life (when installed to specification)



Available for continuous torque ratings up to 10Nm, the **MK** range can be used with shaft sizes from 1 – 28mm.

The **MK** range is also available with the **R+W press-fit** option, which provides easy installation and electrical & thermal insulation.

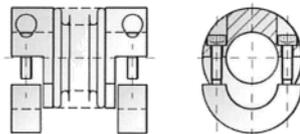
Technical Data

MK type	Units	MK1	MK2	MK3	EcoFlex
					
Connection to		Solid shaft	Solid shaft	Solid / hollow shaft	Solid shaft
Connection method		Set-screw	Clamping hub	Clamping hub / expanding shaft	Clamping hub
Rated Torque	(Nm)	0.05 to 10	0.5 to 10	0.5 to 10	3
Shaft diameters	(mm)	1 to 28	3 to 24	3 to 24	3 to 12.7 (1/4")
Coupling outer diameter	(mm)	6.5 to 40	15 to 40	15 to 40	25
Coupling length	(mm)	14 to 53	25 to 60	20 to 51 (excl. shaft)	32
Press-fit version available		Yes	Yes	Yes	No
Ex Stock availability		No	No	No	Yes

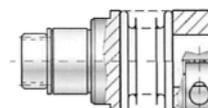
MK special designs



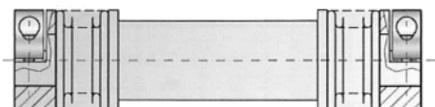
miniature bellows coupling with integrated spindle



miniature bellows coupling with split hubs



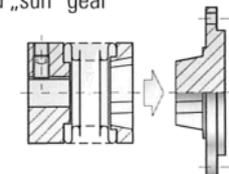
miniature bellows coupling with integrated „sun“ gear



miniature line shaft



miniature bellows coupling with special bellow



blind-mate coupling with special male segment

The above is sample information on the product range. Please contact us for a full brochure . . .

Couplings - BK precision, metal bellows

The **BK** range of couplings are a completely backlash free solution for connecting driving and driven shafts.

The bellows is made from highly flexible high-grade stainless steel. The hub is made from aluminium or steel, dependent on the size.

Features

- Backlash free
- High torsional stiffness
- Compensate for axial, lateral and angular misalignment
- Quiet, smooth operation
- Maintenance free
- Infinite life (if installed to specification)
- Optimised against resonance



The couplings can handle overloads up to 1.5 times nominal. The units are easy to mount and are suitable for space-restricted installations.

ATEX 95/137 approved units for zones 1/21 and 2/22 are available.

BK type	Units	BK1	BK2	BK3	BK7	BKL
						
Connection to		Flange	Solid shaft	Solid shaft	Solid / hollow shaft	Solid shaft
Connection method		Flange mount	Clamping hub	Conical clamp	Clamping hub / expanding shaft	Clamping hub
Rated Torque	(Nm)	15 to 10,000	15 to 1,500	15 to 10,000	15 to 300	3
Shaft diameters	(mm)	ID 25 to 190	8 to 80	10 to 180	8/13 to 60	3 to 12.7 (1/4")
Coupling outer diameter	(mm)	49 to 303	49 to 157	49 to 303	49 to 110	25
Coupling length	(mm)	30 to 150	59 to 166	48 to 217	45 to 98 (excl. shaft)	32
Split-hub version available		No	Yes	No	No	No
Press-fit version available		No	Yes	Yes	No	No
ATEX version available		Yes	Yes	Yes	Yes	No
Stainless Steel option		Yes	Yes	Yes	Yes	No

Other products

- Fanuc-motor compatible couplings with conical shaft
- Split-hub couplings for space restricted applications
- Servomax elastomer couplings
- Linear couplings

Details on request

The above is sample information on the product range. Please contact us for a full brochure . . .

Couplings - SK safety, torque limiting

Machine overload can be caused by a variety of factors such as operator error, electrical or electronic defects and broken or incorrect tooling. If unprotected, such torque overload would lead to a potentially destructive and dangerous crash.

The **SK series** of safety couplings, with the **PATENTED R+W torque limiter**, protect machinery and operators by separating the driving and driven components within a matter of milliseconds of an overload occurring.

The **SK** range includes four generic designs; all backlash free, to cater for a wide range of applications with torque ratings from 0.1 to 2,800Nm.

The bellows is made from highly flexible high-grade stainless steel. The hub is made from aluminium as standard, but can be supplied in steel.

Optimised against resonance typical applications include: machine tools, NC milling machines, woodworking machines, automated plant, textile machinery, industrial robots, sheet metal processing and printing machinery.

Each design is available with four variations to cater for different machine operating conditions:

1. **Single position** re-engagement, where the coupling can be re-engaged precisely 360° from the point of disengagement
2. **Multi-position**, where the coupling re-engages at the very next position
3. **Load holding**, where the drive and the driven face are not separated
4. **Freewheeling**, where permanent separation occurs in the event of an overload.

Features

- Overloads up to 1.5 times nominal
- Wide operating speed range
- Operating temperature range -30 °C ... +120 °C
- Compensates for axial, lateral and angular misalignment
- Maintenance free, infinite life
- Easy to mount, plug-in units also available
- Suitable for space-restricted installations

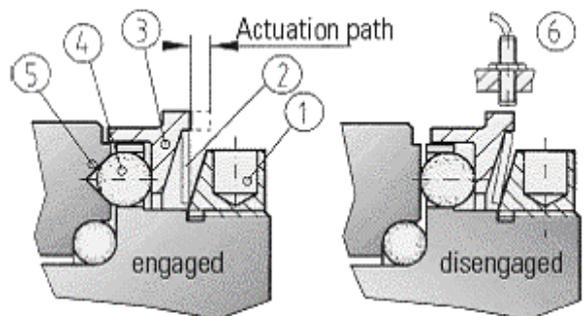
Technical Data

SK type	Units	SK1	SK2	SK3	SK5	ES2
						
Connection to		Pulley or sprocket gear	Shaft or spindle	Shaft or spindle	Shaft or spindle	Shaft or spindle
Connection method		Conical clamp, clamping hub or keyway	Clamping hub	Conical clamp	Clamping hub with plug-in connection	Clamping hub with elastomer spider connection
Rated Torque	(Nm)	1.5 to 2500	1.5 to 1500	1.5 to 2500	1.5 to 800	10 to 800
Shaft diameters	(mm)	4 to 100	3 to 80	10 to 100	3 to 75	5 to 80
Coupling outer diameter	(mm)	26 to 240	19 to 157	49 to 200	19 to 134	40 to 137

PATENTED R+W torque limiter (example of Single- / Multi-position operation)

R+W torque limiting couplings are ball detent style overload couplings. They protect drive and driven mechanical components from damage associated with torque overloads.

1. Backlash free torque transmission is accomplished by a series of steel balls (4) nested in hardened detents (5).
2. Disc springs push against an actuation ring (3) keeping the balls nested.
3. The disengagement torque is adjustable by means of an adjustment nut (1).
4. In the event of an overload, the actuation ring (3) moves axially allowing the balls to come off the detents separating the drive and driven elements.
5. The movement of the actuation ring (3) can be sensed by means of a mechanical switch or proximity sensor (6) triggering the drive to shut down.



The above is sample information on the product range. Please contact us for a full brochure . . .

Couplings – ZA line shafts

The **ZA line shafts** are flexible shaft couplings for spanning longer shaft distances. They consist of two, metal-bellow coupling hubs and one intermediate tube.

The metal bellows are made of corrugated stainless steel and compensate for lateral, axial and angular shaft misalignment. Torque transmission is backlash free and torsionally rigid (no wind-up).

Features

- Temperature range -30 to +120°C (3.6 to 270° F)
- Backlash free
- Fit tolerance on the hub/shaft connection 0.01 to 0.05 mm
- Maintenance-free and infinite life, if the tolerances are not exceeded
- Rated torque from 10 - 800 Nm
- Shaft diameter from 5 - 72 mm



Material

Bellows made of flexible stainless steel. Aluminium intermediate tube section, through size 200; size 300 and up have a steel tube. Optional composite CFK tube for high speeds. Clamping hubs through size 60 Aluminium, size 150 and up have steel hubs.

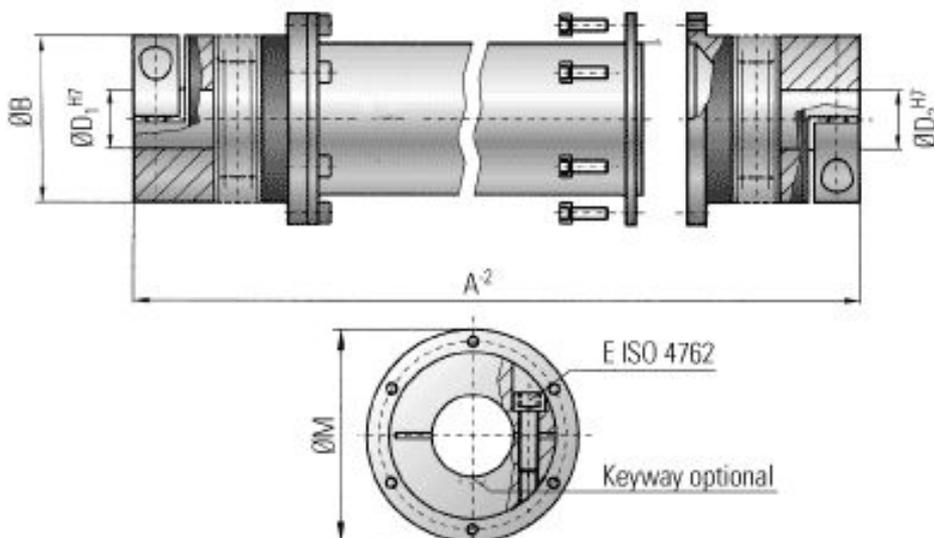
Non-standard application

Custom designs with varied tolerances, keyways, non-standard material and bellows are available upon request.

Technical Data

ZA range	Size	10	30	60	150	200	300	500	800	1500	4000
Clamping method		Clamping hub	Conical clamp	Conical clamp							
Rated Torque	(Nm)	10	30	60	150	200	300	500	800	1500	4000
Overall length (A)	(mm)	110 to 6000	140 to 6000	170 to 6000	190 to 6000	210 to 6000	250 to 6000	260 to 6000	260 to 6000	240 to 6000	280 to 6000
Outer diameter (B)	(mm)	40	55	66	81	90	110	123	134	157	200
Flange diameter (M)	(mm)	52	70	80	98	110	135	148	153	184	213
Shaft diameter possible (D)	(mm)	5 to 20	10 to 28	12 to 32	19 to 42	22 to 45	30 to 60	35 to 60	40 to 72	35 to 70	40 to 100

Dimensions



The above is sample information on the product range. Please contact us for a full brochure . . .

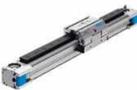
E-Drives – Electro Mechanical Actuators from FESTO

FESTO's modular handling system offers an optimal solution for every application. It comprises a core of handling axes as well as installation and basic components, which are harmonised to provide you with a quick, individual and optimal handling solution.

Listed below is an extract of the more than 20,000 components available from **FESTO**, all designed to work together, from belt and ball-screw driven actuators, through servo and stepper systems, to pneumatic manipulators, valve islands and controllers.

As System Integrator for the **FESTO E-Drives** product range, we draw on over 20 years experience in servo, stepper and motion control applications, to provide the customer with a bespoke solution, based on a wide range of standard.

Technical Data

Actuator type		DGE-ZR-KF	DGE-ZR-RF	DGE-ZR-HD	DMES-KF	DGE-SP-KF	DGEA-ZR-KF	SLTE
								
Drive Type		Belt	High-speed Belt	Heavy-Duty Belt	Trapezoidal Spindle	Ball-Screw	Boom-Axis	Mini-Slide
Guide Type		Recirculating ball bearing	Roller	Recirculating ball bearing	Recirculating ball bearing	Recirculating ball bearing	Recirculating ball bearing	Ball bearing
Frame Sizes		8, 12, 18, 25, 40, 63	25, 40, 63	18, 25, 40	18, 25, 40, 63	18, 25, 40, 63	18, 25, 40	10, 16
Nominal Stroke	mm	650-4500	5000	1000-4000	400-1800	500-2000	800-1000	80-150
Repetition Accuracy	mm	+/- 0.1	+/- 0.1	+/- 0.1	+/- 0.1	+/- 0.02	+/- 0.05	+/- 0.05
Max. working load	N	225-14050	150-600	1820-5600	480-6000	930-14050	2000-7300	40
Max. feed force	N	15-1500	260-1500	60-610	240-3000	140-1600	230-1000	10-30
Max. speed	m/s	1-5	10	2-5	0.05	0.2-1.2	3	0.17-0.21

By working closely with customers **Mattke** have gained valuable experience in a wide range of industries including, medical, metrology, robotics, packaging, printing and textiles.

E-Drives overview

- Belt driven Axes
- Spindle Axes
- Positioning Axes
- Boom Axes
- Handling Axes with Linear Motors
- Mini Slides with Integrated Motor
- Servo Motors and Drives
- Stepper Motors and Drives
- Multi-Axis Systems

Examples of system set-up and multi-axis systems:

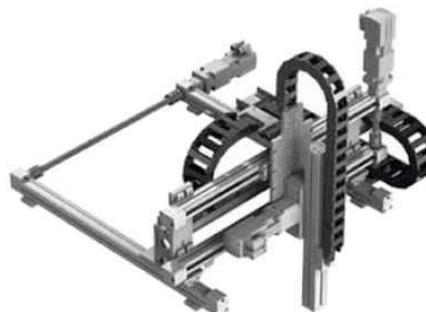
Motor Mounting



Boom-Axis



3D Gantry



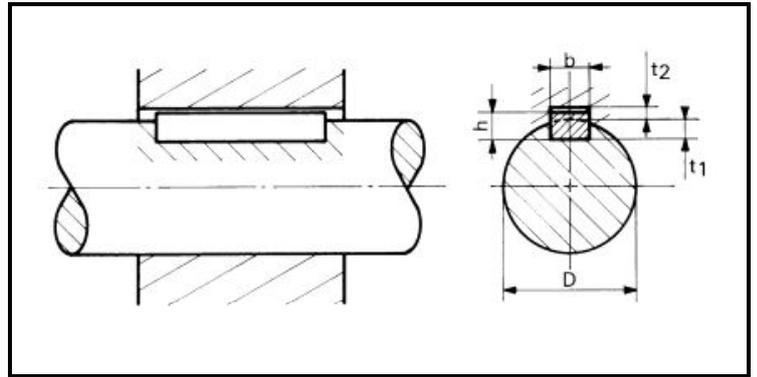
The above is sample information on the product range. Please contact us for a full brochure . . .

Helpful Notes - Shaft diameters and corresponding key and keyway dimensions

Below is a reference on shaft diameters and the corresponding keys / keyways according to the prevailing standards.

The table, to the best of our knowledge, complies with:

- DIN6885 Pt.1
- ISO R 773 and
- BS4235 Pt.1.



Shaft Outer Diameter (OD) in mm	Width b	Height h	Depth t1	Tolerance □t1	Depth t2	Tolerance □t2
over 6 to 8	2	2	1.2	+0.1	1	+0.1
over 8 to 10	3	3	1.8	+0.1	1.4	+0.1
over 10 to 12	4	4	2.5	+0.1	1.8	+0.1
over 12 to 17	5	5	3	+0.2	2.3	+0.2
over 17 to 22	6	6	3.5	+0.2	2.8	+0.2
over 22 to 30	8	7	4	+0.2	3.3	+0.2
over 30 to 38	10	8	5	+0.2	3.3	+0.2
over 38 to 44	12	8	5	+0.2	3.3	+0.2
over 44 to 50	14	9	5.5	+0.2	3.8	+0.2
over 50 to 58	16	10	6	+0.2	4.3	+0.2
over 58 to 65	18	11	7	+0.2	4.4	+0.2
over 65 to 75	20	12	7.5	+0.2	4.9	+0.2
over 75 to 85	22	14	9	+0.2	5.4	+0.2
over 85 to 95	25	14	9	+0.2	5.4	+0.2
over 95 to 110	28	16	10	+0.2	6.4	+0.2
over 110 to 130	32	18	11	+0.2	7.4	+0.2
over 130 to 150	36	20	12	+0.3	8.4	+0.3
over 150 to 170	40	22	13	+0.3	9.4	+0.3
over 170 to 200	45	25	15	+0.3	10.4	+0.3
over 200 to 230	50	28	17	+0.3	11.4	+0.3
over 230 to 260	56	32	20	+0.3	12.4	+0.3
over 260 to 290	63	32	20	+0.3	14.4	+0.3
over 290 to 330	70	36	22	+0.3	15.4	+0.3
over 330 to 380	80	40	25	+0.3	17.4	+0.3
over 380 to 440	90	45	28	+0.3	17.4	+0.3
over 440 to 500	100	50	31	+0.3	19.5	+0.3

Note

Motor Technology will not accept any liability for the accuracy of the data supplied. This sheet is meant as a guideline only.

The above is sample information on the product range. Please contact us for a full brochure . . .

Helpful Notes - Bore and shaft tolerances

Below is a reference on bore and shaft tolerances corresponding to a given bore or shaft diameter.

Diameter range	Bore Tolerances						Shaft Tolerances									
	H7		H8		f7		g6		k6		Clearance Fit	Transition Fit		Interference Fit		
Ø in mm	low	high	low	high	high	low	high	low	high	low	high	low	high	low	high	Low
over 0 to 3	0	+0.010	0	+0.014	-0.005	-0.016	-0.002	-0.008	+0.006	0	+0.010	+0.004	+0.012	+0.006	+0.020	+0.014
over 3 to 6	0	+0.012	0	+0.019	-0.010	-0.022	-0.004	-0.012	+0.009	+0.001	+0.016	+0.008	+0.020	+0.012	+0.027	+0.019
over 6 to 10	0	+0.015	0	+0.022	-0.013	-0.028	-0.005	-0.014	+0.010	+0.001	+0.019	+0.010	+0.024	+0.015	+0.032	+0.023
over 10 to 18	0	+0.018	0	+0.027	-0.016	-0.034	-0.006	-0.017	+0.012	+0.001	+0.023	+0.012	+0.029	+0.018	+0.039	+0.028
over 18 to 30	0	+0.021	0	+0.033	-0.020	-0.041	-0.007	-0.020	+0.015	+0.002	+0.028	+0.015	+0.035	+0.022	+0.048	+0.035
over 30 to 50	0	+0.025	0	+0.039	-0.025	-0.050	-0.009	-0.025	+0.018	+0.002	+0.033	+0.017	+0.042	+0.026	+0.059	+0.043
over 50 to 80	0	+0.030	0	+0.046	-0.030	-0.060	-0.010	-0.029	+0.021	+0.002	+0.039	+0.020	+0.051	+0.032	+0.072	+0.053
over 80 to 120	0	+0.035	0	+0.054	-0.036	-0.071	-0.012	-0.034	+0.025	+0.003	+0.045	+0.023	+0.059	+0.037	+0.093	+0.071

Helpful Notes – IP ratings

Below is a chart on the coding for Ingress Protection for solids and liquids.

Coding	Description	Coding	Description
0	No special protection.	0	No special protection.
1	Protected against touching dangerous parts with the back of the hand. ... Protected against solid foreign bodies ≥ ø50mm.	1	Protected against dripping water.
2	Protected against touching dangerous parts with a finger. ... Protected against solid foreign bodies ≥ ø12mm.	2	Protected against drips if the housing is bent at an angle of 15°.
3	Protected against touching dangerous parts with a tool. ... Protected against solid foreign bodies ≥ ø2.5mm.	3	Protected against spray water, sprayed at an angle of up to 60° on both sides of the perpendicular
4	Protected against touching dangerous parts with a wire. ... Protected against solid foreign bodies ≥ ø1mm.	4	Protected against splash water.
5	Dust-protected ... Dust may penetrate, but not to a degree that would effect operation of the device.	5	Protected against jet water.
6	Dust-proof ... No penetration of dust.	6	Protected against strong jet water.
		7	Protected against the effects of temporary submersion in water.
		8	Protected against the effects of permanent submersion in water.
IP			
	1st Digit		2nd Digit

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