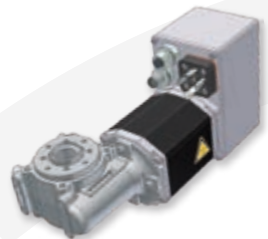


TR-Electronic Intelligent Compact Drives Overview EncoTRive



TR-Electronic – Your Partner in Automation

TR-Electronic can look back on more than 25 years of success, and is represented worldwide with an export share of more than 40 %. The core business comprises the development and manufacture of industrial angular and position measuring technology, as well as compact drive technology with integrated position control and measurement. The company is divided into three Business Units (BU) and is thus well positioned for further growth in the future.

Products in the **Rotary Encoder Business Unit** with optical or magnetic scanning precisely acquire position in steel production, wind power plants, cranes and ships as well as in explosion-proof versions in painting lines. Miniature versions ensure the correct position in medical technology. SIL3 approved absolute rotary encoders ensure the necessary safety.

In the **Linear Encoders Business Unit** magnetostrictive position sensors position injection molding machines, for example, or are directly integrated into hydraulic cylinders. Cascadable distance measurement sensors position parting units. With their high precision, glass scales on machine tools ensure precise position. Laser sensors based on phase difference measuring techniques position aisle stackers in warehousing and materials handling technology.

In the **Drives Business Unit** angle sensors are combined with compact drives: no external electronics are required, position, speed and torque controllers, power electronics and absolute rotary encoders are compactly integrated into the drive and thus bring intelligence directly to the drive shaft via the field bus. Compact drives are used for diverse applications in the printing and packaging industry and on palletizers.

The portfolio is supplemented by the affiliated **TRsystems** with customized controls, industrial PCs, hydraulic controls as well as control units and sensors for punching and forming.

An essential factor for the success of **TR-Electronic** are the now more than **300 employees** who actively help to shape the product portfolio with innovations and successfully implement customer projects. Through its commitment to the regional colleges, TR-Electronic supports the high quality training of young employees and thus guarantees the highest level of innovation and quality at its Trossingen location.

A high degree of vertical integration allows customer-specific requirements to be responded to very quickly. The constantly new requirements on the mechanical design of sensors, on innovative new operating interfaces and new plug connectors result in a rapidly increasing product diversity. With **TR-Electronic** you have a partner who can fulfil these requirements.

encoTRive

Progress - Decentralized and Intelligent

A wide variety of products, smaller batch sizes and the individualization of production are the main requirements of progressive machines. In order to fulfill these demands, while market prices are static or even shrinking, and personnel costs are rising, automation technology must be used exhaustively. It must go beyond

the actual production process and enter secondary functions such as setup and material supply tasks. encoTRive fills the gap between fieldbus and drive technology. It is a compact device containing motor, power electronics, fieldbus communication, closed-loop controller and an absolute measuring system as well as optional I/O and brake.

Content

Drive Technology – Our lines

Processing drive – encoTRive MD
Positioning drive – encoTRive MP
Actuating drive – encoTRive MA

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General

Information about drive technology – overview of our drives
Interfaces – PROFIBUS, CANopen, PROFINET
Notes – space for ideas
Product overview – TR-Electronic - Your Partner in Automation
Distribution addresses – Germany/International

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Performance

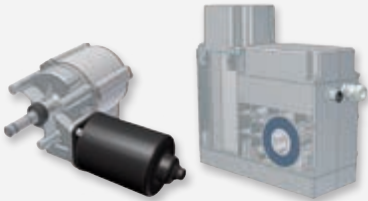
Actuating Drive

As auxiliary drive for adjusting ...

- _ dimensions
- _ guide rails
- _ stops
- _ valves, dampers and sliders

To use in ...

- _ folding machines
- _ thermoforming machines
- _ cardboard gluing machines
- _ component mixing systems



MA 025

MA 120

page 14 ff

Positioning Drive

As auxiliary or main drive for ...

- _ cyclic format adjustments
- _ dynamic rough settings
- _ fine adjustments
- _ speed

To use in ...

- _ wood working machines
- _ package ejection machines
- _ profile measuring machines
- _ X-ray analyzing devices



MP 060-180

MP 200

page 10 ff

Processing Drive

As main drive for ...

- _ precise positioning
- _ a synchronized and cyclic transfer
- _ sensor coupled position measurement
- _ application optimized portal systems

To use in ...

- _ accurate grinding machines
- _ inspection machines
- _ tool controlling modules
- _ tire testing facilities



MD 060-180

MD 300

page 6 ff

from ... up to ...

P	Controller structure	PID
1.000 min ⁻¹ per s	Dynamics	10.000 min ⁻¹ per s
20 ms	Real time	2 ms
1–2°	Accuracy	20 arcmin
without	Inputs and outputs	programmable
1.000 h	Life time	30.000 h

TR-Electronic – Helps You to Face the Challenges of Market

Knowing and reacting to the demands of the market is the key to success. Today, innovative drive technology has to transfer technology trends and specific user requirements into new products. Aspects like mechatronics, electronics and software must be custom-fit and industry-sector-specific. The challenges is to increase machine productivity, while simplifying the design and operation. In combination with automation technology, the encoTRive intelligent positioning and actuating drives maximise the innovative potential of modern machinery or retrofitting. Our encoTRive integrates and tunes all important required electrical, electronic and mechanical components. encoTRive is a fully functional drive unit ready to be connected.

The advantage of using decentralized drive technology is felt when realizing modular concepts, retrofits, making acquisitions or when used in machines and equipment where large measurements occur. Both aspects of innovation – automation and integration – enable progressive machine concepts. Besides the already automated main processes, the auxiliary functions

have to be electromotive automated. This demands new and integrated drive technology concepts. Standardization and fieldbus systems play a dominant role.

To create a perfect combination of innovation, increased performance and flexibility, you have to be able to choose from a variety of multiple drive configurations and you must be able to make optimal changes between those configurations.

For this purpose, we designed and adapted the variety of the individual encoTRive models. The wide range of applications go from simple tasks for the actuating drives up to complex highly accurate tasks for positioning drives.

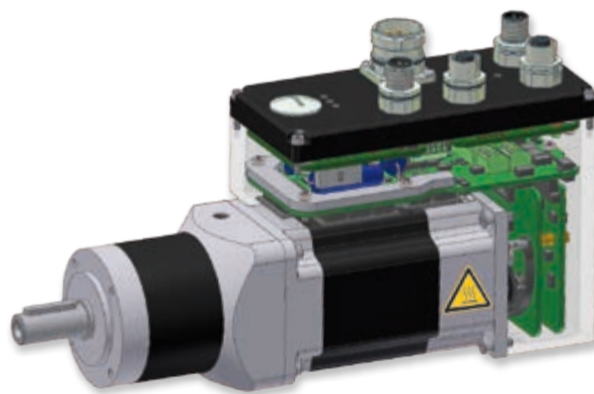
Decentralized Drive Technology with encoTRive

The name **encoTRive** is the brand for our complete drive technology product line. It is derived from the two components "absolute **Encoder** and **Drive**", modified and exchanged with our company abbreviation "TR".

Integration is the first trademark. Enclosed are the power and positioning electronics, zero voltage safe encoder, fieldbus technology and gear. It is also available with optional holding brake and different I/O.

Variety Diversity is the second trademark. This is due to the diverse electronic functionality, numerous gear ratios and a wide range of gear types. Further options include radial or axial shaft, solid or hollow shaft, a moderate backlash or backlash-free. This is accomplished by using a planetary, worm or special gears.

Cross-Range Compatibility is the third trademark. All series are based on a common software platform. Only the MD and MP series differ in their absolute encoder and electronics. However, they use an identical platform and use the same electric motor and gear box.



MD 300, Version PROFIBUS

Individual models are constructed for application categories. For automation tasks with different requirements we offer drives with optimal performance levels.

- _ **Actuating Drive MA** (Stellantriebe)
- _ **Positioning Drive MP** (Positionierantriebe)
- _ **Drive in Core Process MD** (Prozessantriebe)

This structure is supported by a standard platform in the implementation of firmware, interfaces and bus. In practice this means,

there is considerably less effort in engineering and maintenance. System costs and installation times decrease as well.

Available bus systems are: PROFIBUS, PROFINET and CANopen, enhanced through busses based on newer EtherNet technologies.

The encoTRive series opens with its standard decentralized concept, a new level of automation technology that applies all mechanical engineering applications, in particular in industries like packaging, press, wood, glass, print, plastics, textile and machine tools.

Series Features

- + design according to application classification
- + implementing software platform
- + position measurement with fail-safe multi turn absolute encoder
- + integration into a mechatronic system
- + variant diversity through modularity
- + operating modes, positioning and speed control
- + control completely decentralized within the drive

Working Features

- + high resolution, 1.024 or 4.096 steps per revolution
- + long range, 4.096 or 65.536 revolutions
- + precise positioning up to ±2 increments
- + smooth running even at low speed
- + limitable with software limit switch
- + set parameters according to bus standards

Structure of MD and MP Series

Along with standard products, TR also modifies and develops customer and application-specific drives with individually fitted equipment.

MD series Electronics Structure

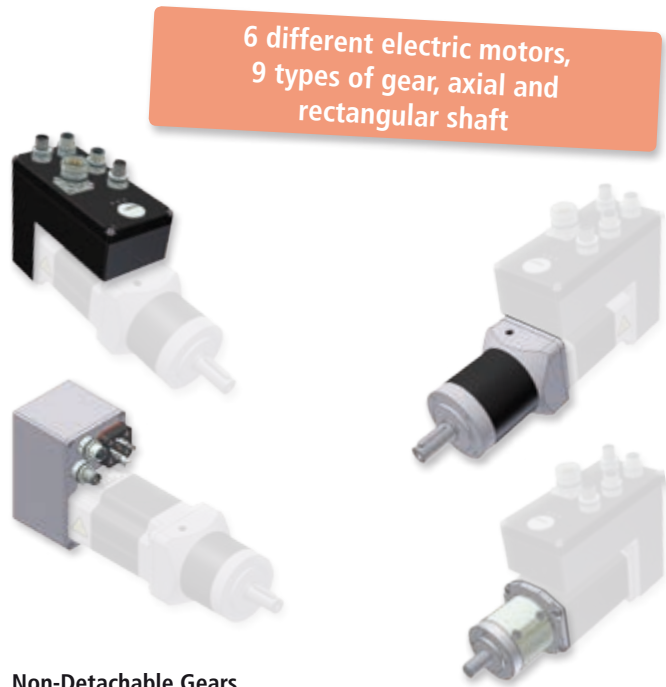
The absolute encoders and the electronics are in line with the motors axis and mounted laterally to the motor. The power electronic is also mounted in a lateral position. Inside the exchangeable connector cover plate, there is an interface and application module for PROFIBUS and PROFINET. It can also be rotated by 180° and mounted. Standard connections are 1 × M23 for supply for power, logic and brake, as well as 4 × M12 for bus IN/OUT and digital I/O. The fifth connection is for the communication with a PC over RS-232.

MP Series Electronics Structure

Absolute encoders and electronics are in line with the motor axis. Like the bus version, there is a ± 10 V DC analog version for pure speed control. This version is particularly suitable for operating at a modest speed without using PLC control. The supply for power, logic and brake are attached with a valve plug, optional with 1 × M23. In comparison to the MD, the electronic is scaled downwards and has less functionality.

Detachable Gears with Coupling and Clamping Hub

All precision gears are detachable. This is the most flexible option for the combination of electric motors and gears. These drives are particularly suitable for special engineering, midsize production or special projects. The range of gear types goes from planetary gears, low backlash servo gears up to highly precise special gears.



Non-Detachable Gears

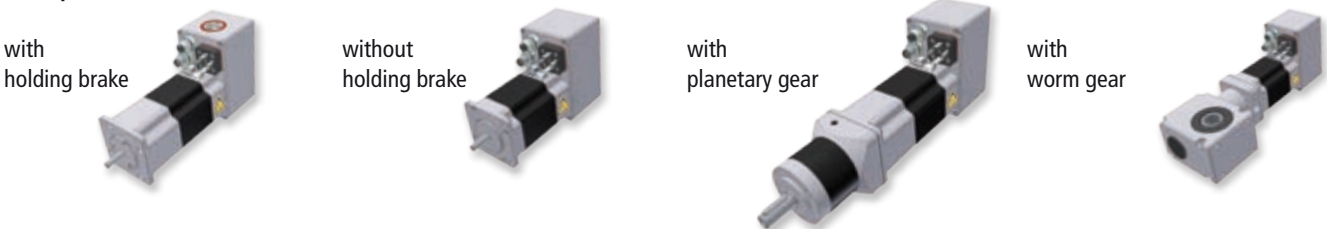
The shaft of the electric motor has a pinion or applied gearing that goes directly into the first stage of the gear box. Therefore, other parts like coupling, clamping hub, gear flange and gearbox bearing do not apply. Gear types mounted according to this principle are planetary gears or worm gears. The drive shaft of the worm gear can be adjusted into four different possible outlet directions of 90°.

Example Configuration of the MP Model

Six different electric motors and nine gear types define the limits of the available motor / gear combinations. The number of gear ratios goes from a minimum of four up to a maximum of 22 per gear type. With planetary gears having the smallest steps of gear ratios, the torque and speed can be fitted precisely to the requirement of an individual application. The design options can be finished with options like holding brake, PROFIBUS or CANopen, analog operation, adjustment

of the outlet direction of an angular gear, special forms of connection technology and customer specific adjustments. Examples of adjustments are: protective coating against aggressive media, increasing the protection class through shaft seals or sealing against oils in machine tools. The pictures displayed below are only a few variations of configuration possibilities.

Example MP 200



Example MP 060-180



Processing Drive encoTRive MD 300

The MD 300 is a drive with extensive electronic functions and high quality gears. It offers flexible configuration. There is a wide variety of gear types and ratios. The MD 300 fits perfectly into special engineering with permanently changing machine configurations from quantities of one up to a running series. It is similarly useful as a superior positioning drive or as an auxiliary drive for peripheral machine functions with special requirements.






Features

- + voltage range 24 ... 48 V DC, with reversal protection
- + gear up to 70 Nm, enhanced up to 192 Nm
- + planetary gear with 22 different gear ratios
- + worm gear with 8 different gear ratios
- + PROFIBUS DP VO/V1, PROFIdrive V3.0, PROFINET
- + absolute encoder, multi turn
- + I/O module, brake chopper, optional brake

Ideal for Applications

- ... for precision positioning
- ... for cyclic positioning
- ... for coupled usage of decentralized I/O functions
- in**
- ... machine tools
- ... inspection machines
- ... special machines

Technical Data

		MD 300		
Rated voltage	V DC	24	36	48
Rated torque S1 (S3)	Nm	0,60 (1,10)	0,60 (1,10)	0,60 (1,10)
Rated power S1 (S3)	W	136 (178)	205 (267)	273 (357)
Rated speed S1 (S3)	min ⁻¹	2.175 (1.550)	3.260 (2.325)	4.350 (3.100)
Rated current S1	A	8,0	7,8	7,6
Moment of inertia	g cm ²	512		
Electric motor - Technology - Protection class - Bearing type - Bearing force		EC, electrical commutated motor IP 54, motor shaft IP 41 ball bearing max. 30 N axial, 80 N radial		
Encoder - Technology - Position resolution - Position range - Position accuracy		absolute encoder, multi turn 1.024 steps/revolution (10 Bit) 65.536 revolutions (16 Bit) ±2 steps		
Gear - Type - Gear ratio - Bearing force		planetary gear / worm gear 3 ... 512/5 ... 50 max. 600 N axial, 500 N radial, planetary gear PLE 60		
Interfaces		 (V0/V1)   (402) RS-232, logical I/O module, limit switch		
Options		holding brake, hand-held control		

Definition

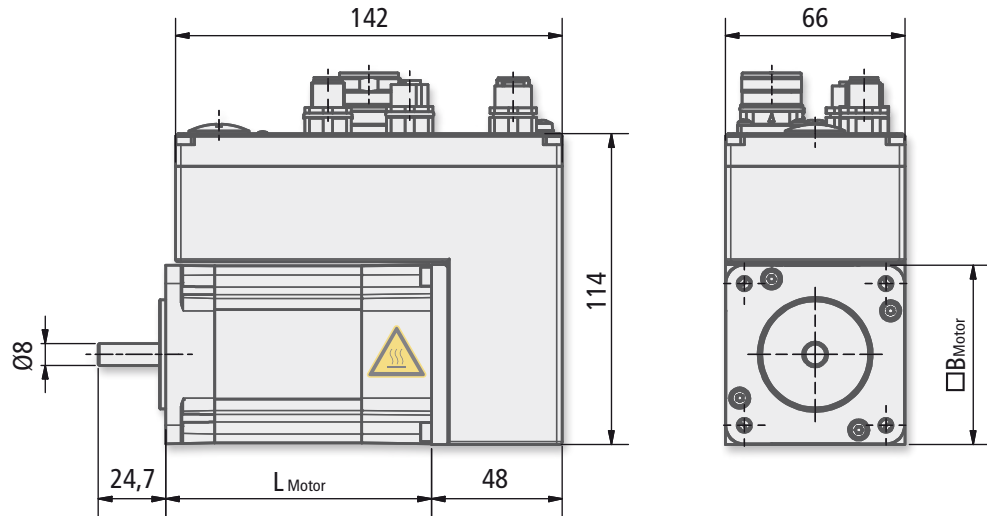
S1
permanent operation

S3
periodic duty
25 %, 10 min
duty cycle 2,5 min
cycle time 10 min
max. torque 1,10 Nm

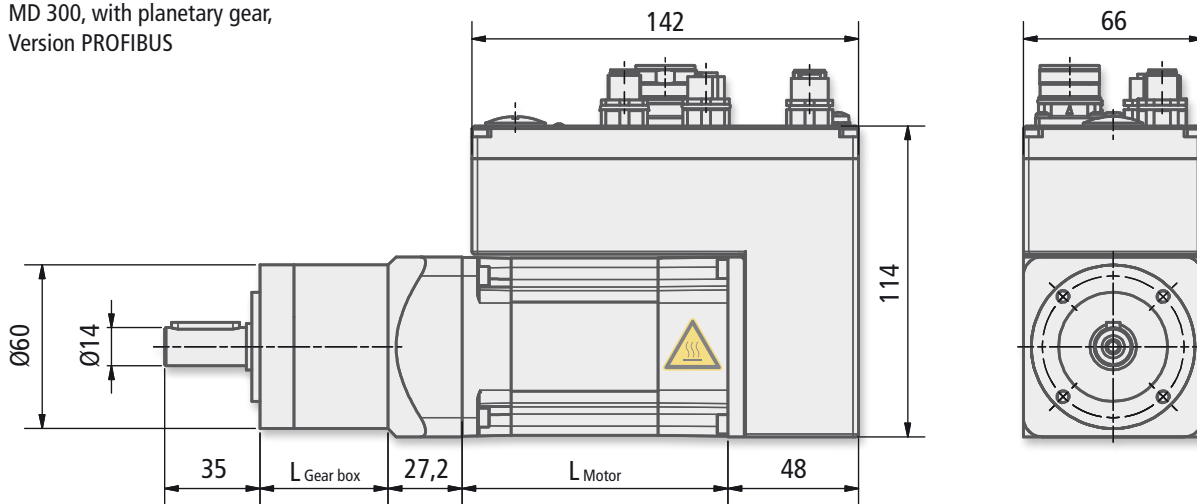
True absolute encoder
Fail-safe position information
through electromechanical
principle of measurement.

Drawings

MD 300, without gear,
Version PROFIBUS



MD 300, with planetary gear,
Version PROFIBUS



Motor version

holding brake	L _{Motor} (mm)	B _{Motor} (mm)
no	97,6	□66
yes	132	□67

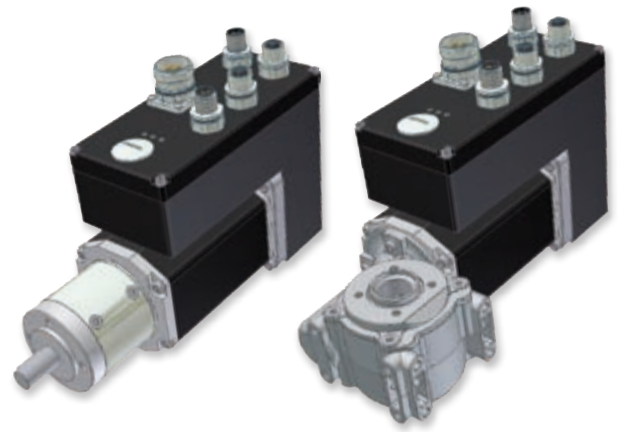
Gear version PLE 60

Gear stages	L _{Gear box} (mm)
1	47
2	59,5
3	72

Processing Drive encoTRive MD xxx

The MD xxx drive series stands for extensive electronic functions and simple gears. You can choose your drive with a planetary gear or worm gear, alternatively with a hollow shaft or a solid shaft. The drive has flexible configuration with a great choice of gear ratios.

The MD xxx is perfect for large production series. They are similarly useful as main drives for original machine processes, or as an auxiliary drive for peripheral functions with special electronic requirements.






Features

- + voltage range 24/42 V DC, with reversal protection
- + gear up to 24 Nm
- + planetary gear with 16 different gear ratios
- + worm gear with 7 different gear ratios
- + PROFIBUS DP V0/V1, PROFIdrive V3.0, PROFINET
- + absolute encoder, multi turn
- + I/O module, brake chopper

Ideal for Applications

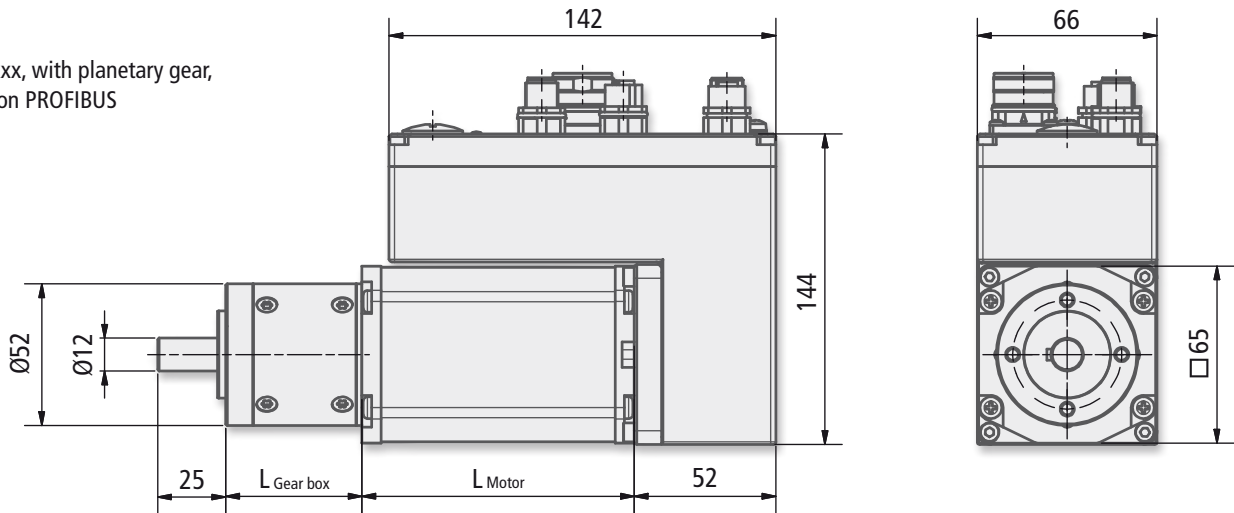
- ... for mechanical simple positioning
 - ... for cyclic and periodic positioning
 - ... for coupled use of decentralized I/O functionality
- in**
- ... handling units
 - ... installation devices
 - ... special machines

Technical Data

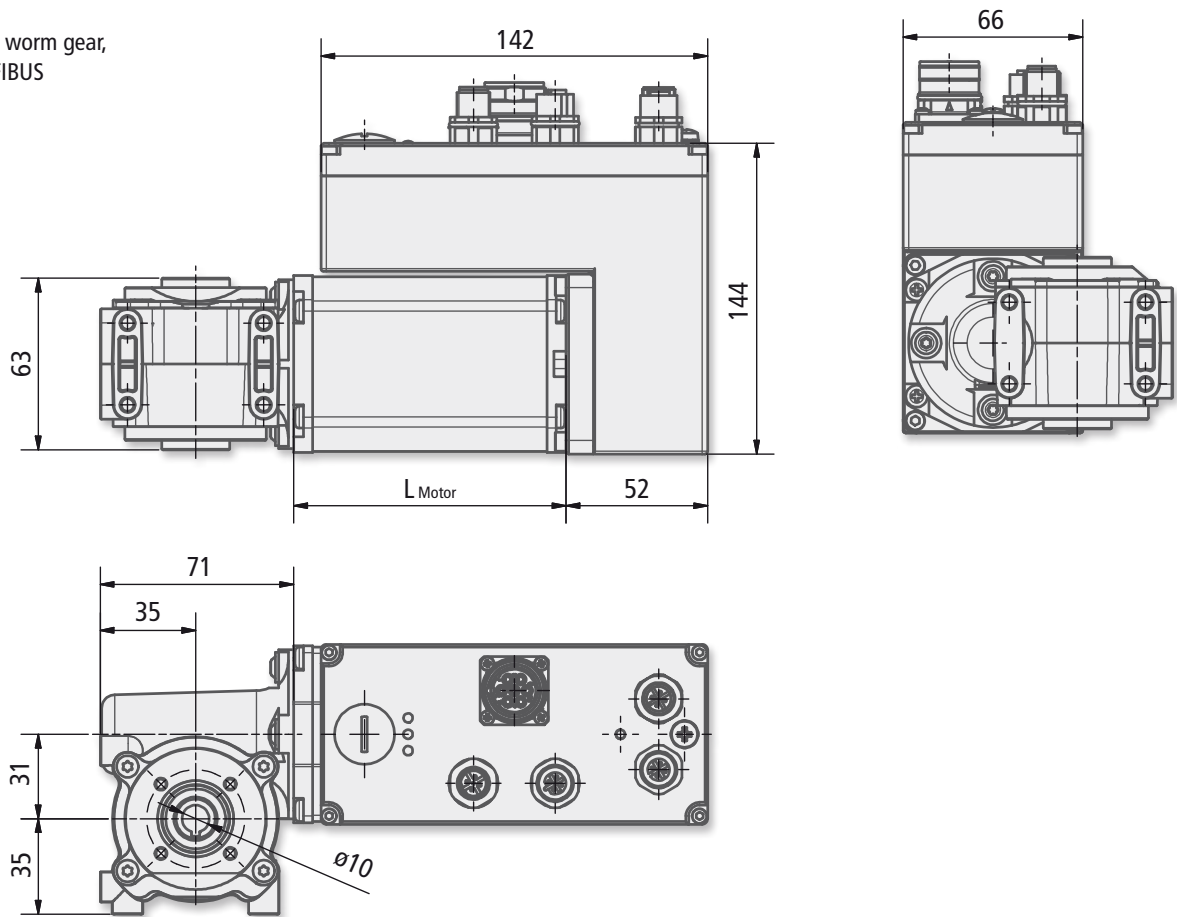
		MD 060	MD 95	MD 100	MD 140	MD 180
Rated voltage	V DC	24	24	24	42	24
Rated torque S1	Nm	0,17 (0,21)	0,28 (0,34)	0,26 (0,31)	0,40 (0,47)	0,49 (0,53)
Rated power S1	W	55 (67)	87 (106)	84 (100)	120 (140)	166 (180)
Rated speed S1	min ⁻¹	3.080	2.980	3.090	2.860	3.240
Rated current S1	A	4,0	4,8	5,6	4,5	9,0
Moment of inertia	g cm ²	72	73	128	130	172
Electric motor - Technology - Protection class - Bearing type - Bearing force		EC, electrical commutated motor with neodymium magnet IP 54, motor shaft IP 41 ball bearing max. 150 N axial, 150 N radial				
Encoder - Technology - Position resolution - Position range - Position accuracy		absolute encoder, multi turn 1.024 steps/revolution (10 Bit) 65.536 revolutions (16 Bit) ±2 steps				
Gear - Type - Gear ratio - Bearing force		planetary gear / worm gear 4,5 ... 512/5 ... 75 max. 500 N axial, 350 N radial, planetary gear PLG 52				
Interfaces		 (V0/V1)   (402) RS-232, logical I/O module, limit switch				
Options		alternative rated voltage in special versions for high-volume, hand-held control				

Drawings

MD xxx, with planetary gear,
Version PROFIBUS



MD xxx, with worm gear,
Version PROFIBUS



Motor version

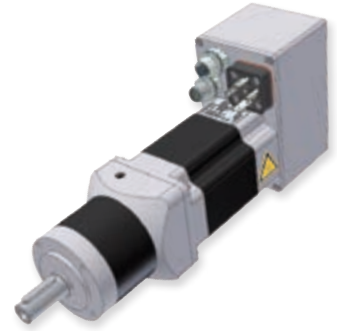
Baureihe	L _{Motor} (mm)	B _{Motor} (mm)
MD 060	75	□ 65
MD 095	90	□ 65
MD 100	100	□ 65
MD 140	125	□ 65
MD 180	115	□ 65

Gear version PLG 52

Gear stages	L _{Gear box} (mm)
1	50
2	65,5
3	80,5

Positioning Drive encoTRive MP 200

The MP 200 drive has standardized electronic functions and high quality gears. It has flexible configuration. There is a wide variety of gear types and ratios. The MP 200 is perfect for special engineering with permanently changing machine configurations from quantities of one up to a running series. It is similarly usable as a positioning drive or as an auxiliary drive for peripheral machine functions with special requirements.





Features

- + voltage range 24 ... 48 V DC
- + gear up to 70 Nm, enhanced up to 192 Nm
- + planetary gear with 22 different gear ratios
- + worm gear with 8 different gear ratios
- + PROFIBUS DP V0/V1, PROFIdrive V3.0
- + absolute encoder, multi turn
- + optional: analog interface, brake

Ideal for Applications

- ... for demanding positioning
 - ... for precise format adjustment
 - ... for periodic positioning with higher precision
- in**
- ... transfer lines
 - ... test devices
 - ... special machines

Technical Data

		MP 200		
Rated voltage	V DC	24	36	48
Rated torque S1 (S3)	Nm	0,40 (1,10)	0,40 (1,10)	0,40 (1,10)
Rated power S1 (S3)	W	91 (178)	136 (267)	182 (357)
Rated speed S1 (S3)	min ⁻¹	2.175 (1.550)	3.260 (2.325)	4.350 (3.100)
Rated current S1	A	5,2	5,0	4,8
Moment of inertia	g cm ²	512		
Electric motor - Technology - Protection class - Bearing type - Bearing force		EC, electrical commutated motor IP 54, motor shaft IP 41 ball bearing max. 30 N axial, 80 N radial		
Encoder - Technology - Position resolution - Position range - Position accuracy		absolute encoder, multi turn 4.096 steps / revolution (12 Bit) 4.096 revolutions (12 Bit) ±8 steps		
Gear - Type - Gear ratio - Bearing force		planetary gear / worm gear 3 ... 512/5 ... 50 max. 600 N axial, 500 N radial, planetary gear PLE 60		
Interfaces		 (V0/V1)  (402) optional: ±10 V DC driving speed, without bus		
Options		holding brake		

Definition

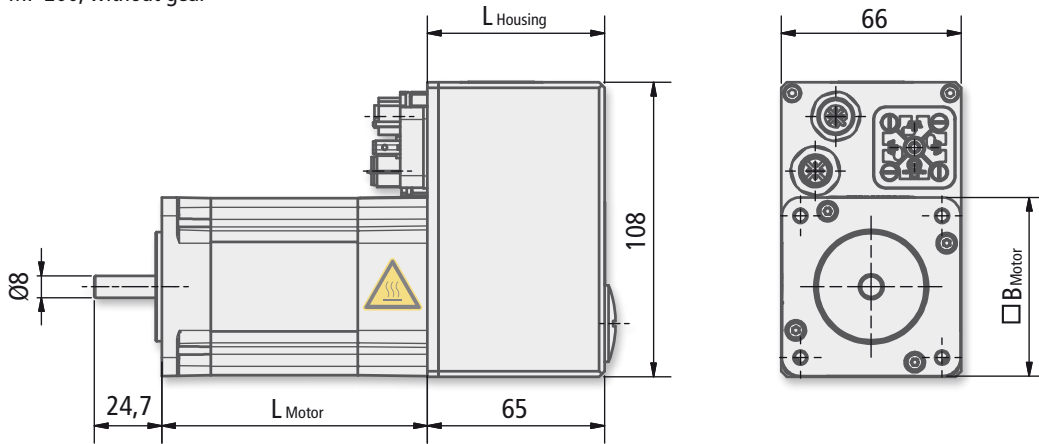
S1
permanent operation

S3
periodic duty
25 %, 4 min
duty cycle 1 min
cycle time 4 min
max. torque 1,10 Nm

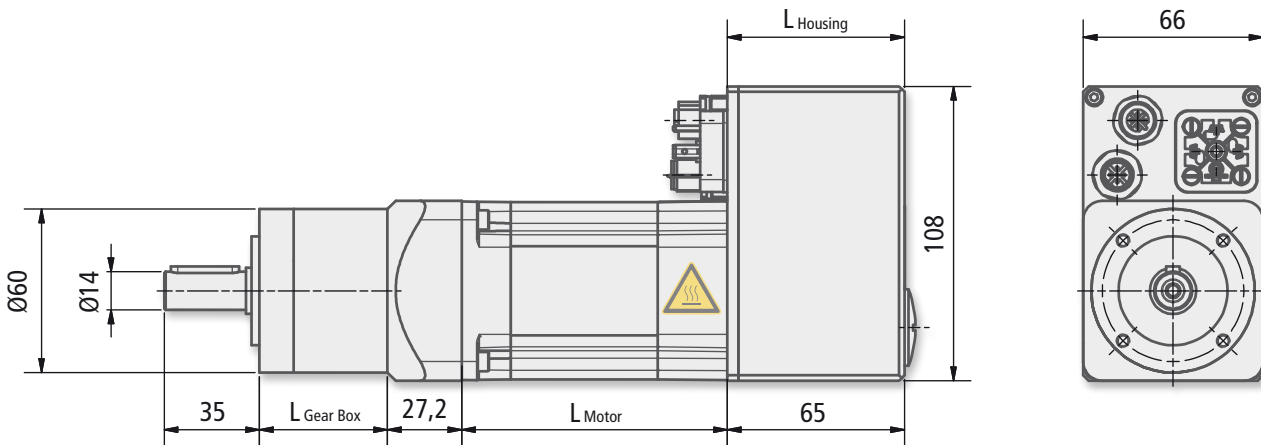
True absolute encoder
Fail-safe position information
through electromechanical
principle of measurement.

Drawings

MP 200, without gear



MP 200, with planetary gear



Housing length

Bus	L _{Housing} (mm)
CANopen	50
PROFIBUS	65

Motor version

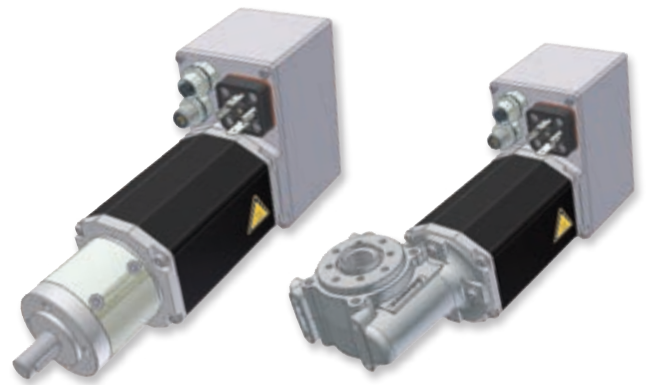
Holding brake	L _{Motor} (mm)	B _{Motor} (mm)
no	97,6	□ 66
yes	132	□ 67

Gear version PLE 60

Gear stages	L _{Gear box} (mm)
1	47
2	59,5
3	72

Positioning Drive encoTRive MP xxx

The MP xxx drive series stands for standardized electronic functions and simple gears. You can choose your drive with a planetary gear or worm gear. You can choose your worm gear with a hollow shaft or a solid shaft. It has flexible configuration with a great choice of gear ratios. The drives are perfect for large production series and for the use as positioning drives or as auxiliary drive for peripheral machine functions with moderate machine requirements.





Features

- + voltage range 24/42 V DC
- + gear up to 24 Nm
- + planetary gear with 16 different gear ratios
- + worm gear with 7 different gear ratios
- + PROFIBUS DP VO/V1, PROFIdrive V3.0
- + absolute encoder, multi turn
- + optional: analog interface

Ideal for Applications

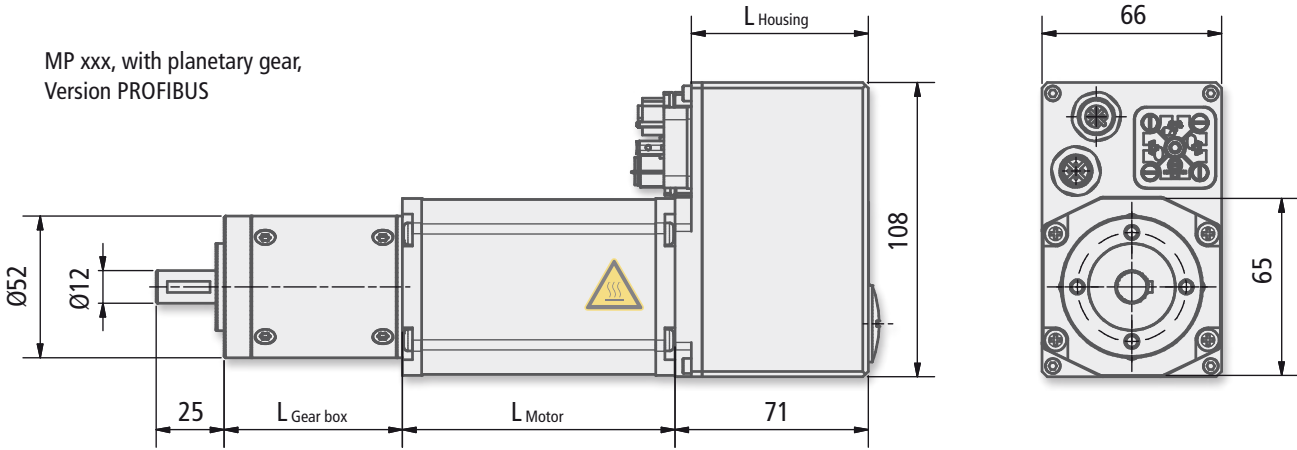
- ... for simple positioning
 - ... for rough format setting
 - ... for constant speed of high precision
- in**
- ... handling units
 - ... installation devices
 - ... special machines

Technical Data

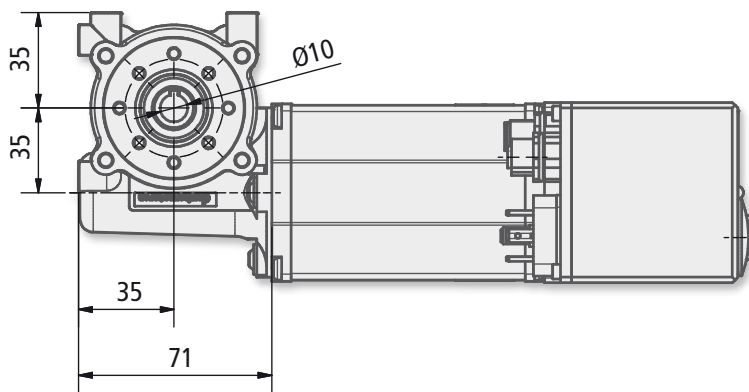
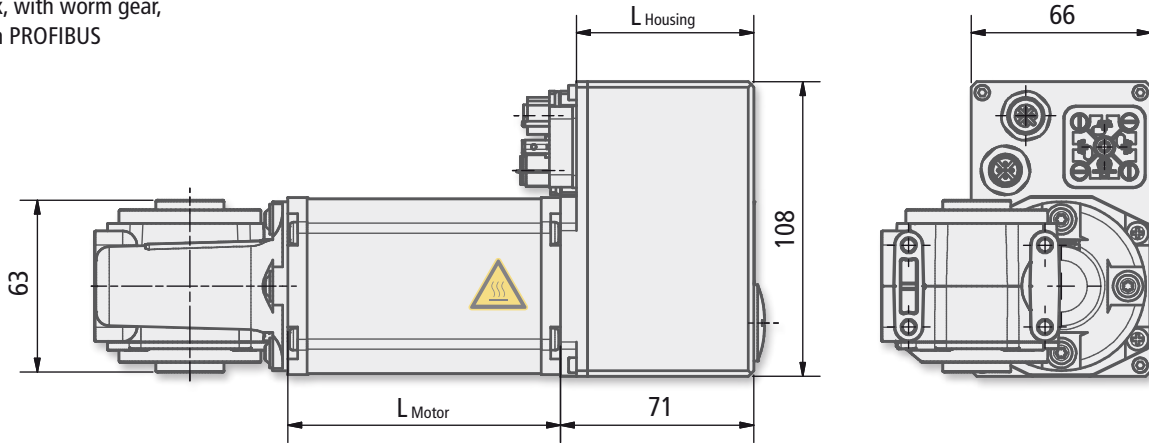
		MP 060	MP 095	MP 100	MP 140	MP 180
Rated voltage	VDC	24	24	24	42	24
Rated torque S1	Nm	0,17 (0,21)	0,28 (0,34)	0,26 (0,31)	0,40 (0,47)	0,49 (0,53)
Rated power S1	W	55 (67)	87 (106)	84 (100)	120 (140)	166 (180)
Rated speed S1	min ⁻¹	3.080	2.980	3.090	2.860	3.240
Rated current S1	A	4,0	4,8	5,6	4,5	9,0
Moment of inertia	g cm ²	72	73	128	130	172
Electric motor - Technology - Protection class - Bearing type - Bearing force		EC, electrical commutated motor with neodymium magnet IP 54, motor shaft IP 41 ball bearing max. 150 N axial, 150 N radial				
Encoder - Technology - Position resolution - Position range - Position accuracy		absolute encoder, multi turn 4.096 steps/revolution (12 Bit) 4.096 revolutions (12 Bit) ±8 steps				
Gear - Type - Gear ratio - Bearing force		planetary gear / worm gear 4,5 ... 512/5 ... 75 max. 500 N axial, 350 N radial, planetary gear PLG 52				
Interfaces		 (V0/V1)  (402) optional: ±10 V DC driving speed, without bus				
Options		alternative rated voltage in special versions for high-volume				

Drawings

MP xxx, with planetary gear,
Version PROFIBUS



MP xxx, with worm gear,
Version PROFIBUS



Housing length

Bus	L _{Housing} (mm)
CANopen	50
PROFIBUS	65

Motor version

Model	L _{Motor} (mm)	B _{Motor} (mm)
MP 060	75	□ 65
MP 095	90	□ 65
MP 100	100	□ 65
MP 140	125	□ 65
MP 180	115	□ 65

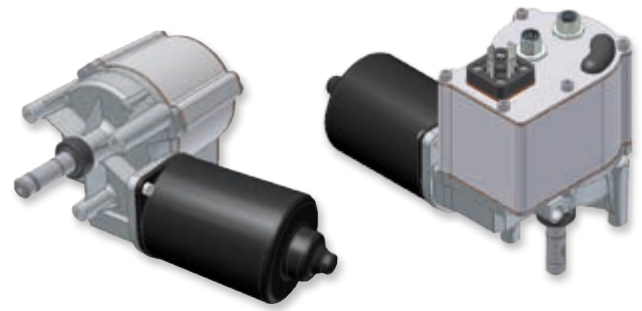
Gear version PLG 52

Gear stages	L _{Gear_box} (mm)
1	50
2	65,5
3	80,5

Actuating Drive encoTRive MA 025

The MA 025 is the optimal drive for occasional and format machine adjustments. It is perfect as an actuating drive for automating adjustment tasks that have previously been manual, or as an auxiliary drive for peripheral functions with no special requirements in dynamic, run time or life time.

A temporary overload is possible. It comes with a non-volatile position measurement at the gear output. The MA 025 comes in two basic versions ready for connection with 2 Nm and 4 Nm output torques.



Features

- + voltage 24 V DC
- + gear motor with worm gear
- + absolute encoder, multi turn
- + absolute measurement at the output shaft
- + PROFIBUS DP VO/V1, PROFIdrive V3.0
- + CANopen 402
- + connection bus 2 × M12 IN/OUT



Ideal for Applications

- ... for the adjustment of stops
- ... for the positioning of guide rails
- ... or the control of valves, dampers and sliders

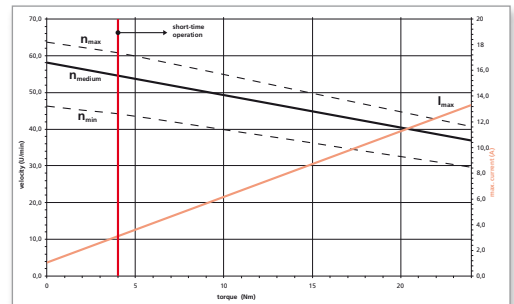
for example in

- ... folding machine
- ... thermal form machines
- ... component mixing systems

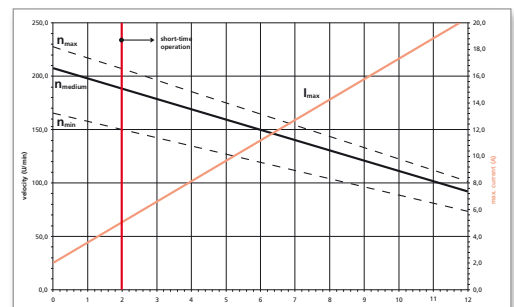
Technical Data

		2 Nm	4 Nm
Rated voltage	V DC	24	24
Rated torque S1 (S3)	Nm	2,0	4,0
Rated power S1 (S3)	W	39	27
Rated speed S1 (S3)	min ⁻¹	187	54
Rated current S1	A	5,5	4,0
Moment of inertia	g cm ²	780	
Electric motor - Technology - Protection class - Bearing type - Bearing force		DC, brushed motors IP 42 ball bearing (complete gear motor)	
Encoder - Technology - Position resolution - Position range - Position accuracy		absolute encoder, multi turn 4.096 steps/revolution (12 Bit) 256 revolutions (8 Bit) ±8 steps	
Gear - Type - Gear ratio - Bearing force		worm gear 17,5 at 2 Nm, 65 at 4 Nm 10 N axial, 80 N radial	
Interfaces		 	

Characteristic curves



4 Nm

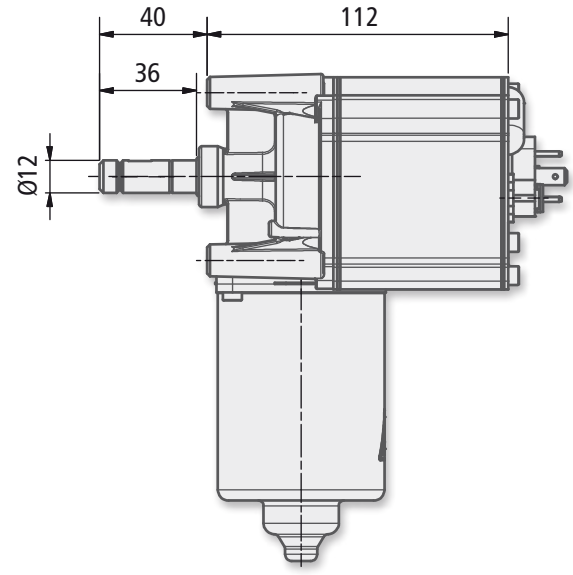
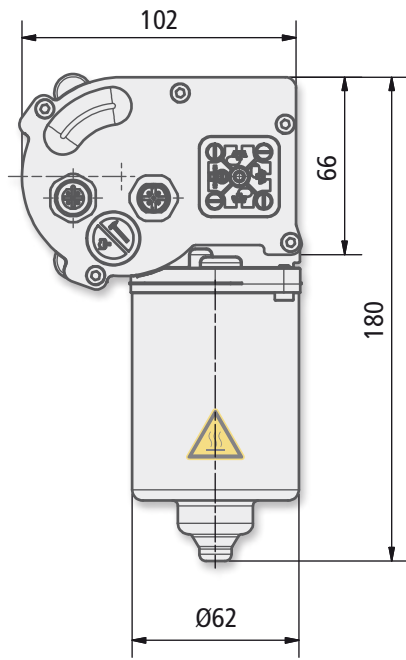


2 Nm

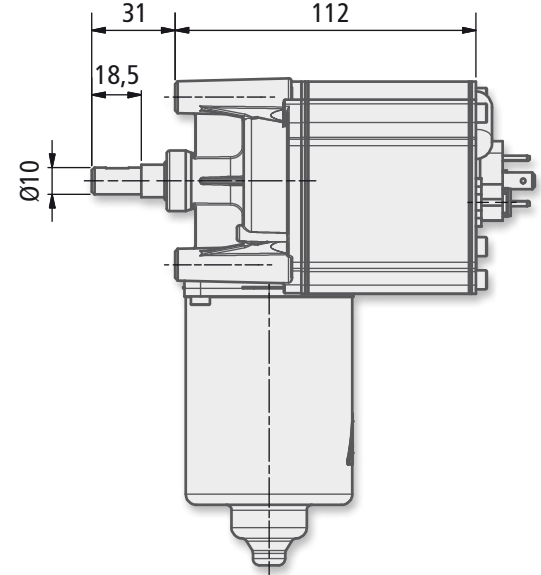
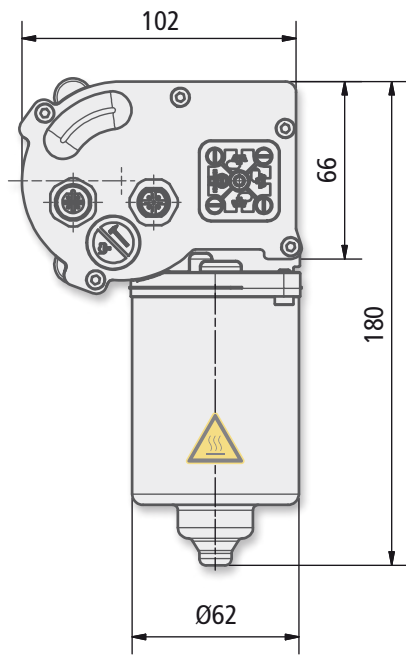
The number of rotations slightly differ in both rotational directions of the driving shaft. Therefore, there are boundary lines drawn into the characteristic curve to show the range of tolerance. The bearing of the driving shaft is a slide bearing. The admissible values for the forces of the shaft are standard values and they should not be exceeded.

Drawings

MA 025, 4 Nm,
Version PROFIBUS



MA 025, 2 Nm,
Version PROFIBUS

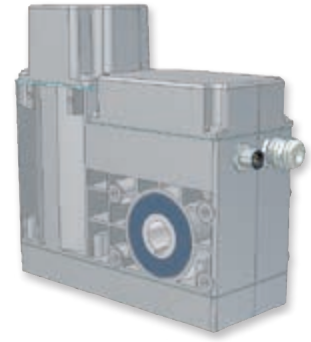


Housing length

Bus	L _{Housing} (mm)
CANopen	45
PROFIBUS	65

Actuating Drive encoTRive MA 120

The actuating drive MA 120 is optimal for short-time altering of machine adjustments with a high torque and low speed. It is constructed in an aluminum housing that has an enormous torsion stiffness. It is perfect as a slim actuating drive for plug-in assembly. Temporarily, the MA 120 can be overloaded and measures non-volatile position at the gear. The basic version with a gear ratio up to 160:1 is available with an optional spring-activated brake.




Features

- + voltage 24 V DC
- + compact housing with worm gear
- + absolute encoder multi turn
- + absolute measurement at the worm shaft
- + CANopen 402
- + optional: PROFIBUS DP V0/V1
- + connection bus M12

Ideal for Applications

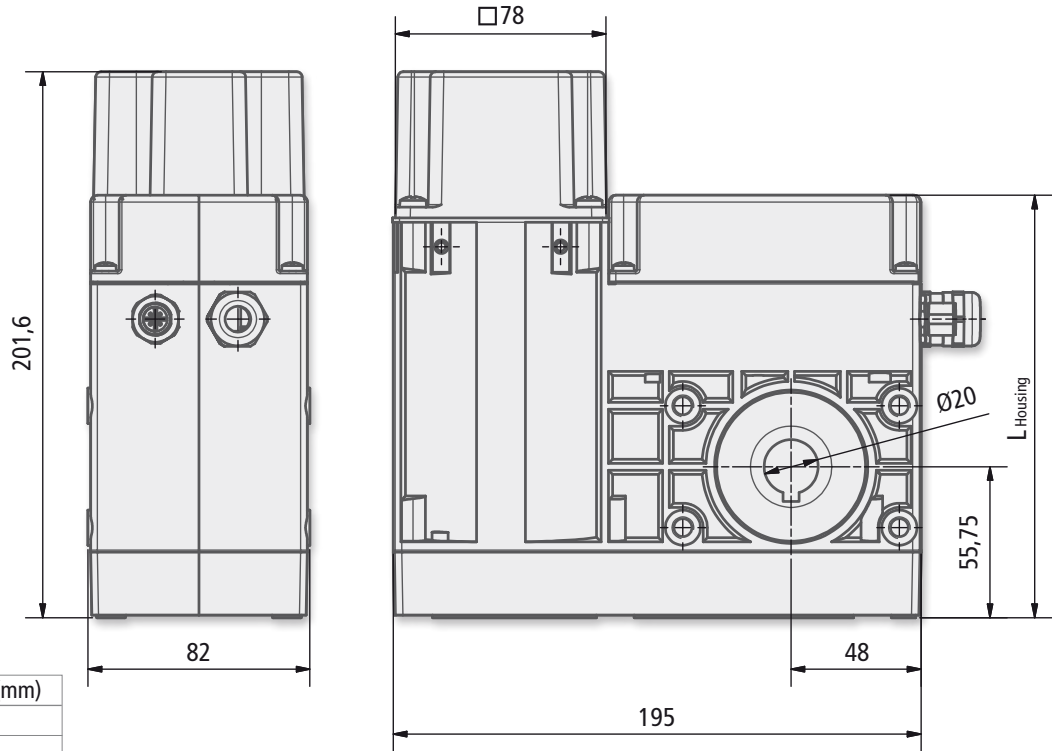
- ... for format settings
- ... for periodic positioning with low processing angles
- ... for a soft motion of vibration sensitive parts
- for example in
 - ... sorting machines in printing post-production
 - ... solar tracking systems in solar power plants
 - ... lighting and stage arrangements

Technical Data

		27:1	40:1	50:1	80:1	160:1
Rated voltage	V DC	24	24	24	24	24
Rated torque S3 (20 %)	Nm	7	10	12	16,5	24,5
Rated power S3 (20 %)	W	47	46	44	38	28
Rated speed S3 (20 %)	min ⁻¹	65	44	35	22	11
Rated current S3 (20 %)	A	10,5	10,5	10,5	10,5	10,5
Self-locking		-	-	-	-	static
Electric motor - Technology - Protection class - Bearing type - Bearing force		DC, brushed motor IP 54 ball bearing (gear motor)				
Encoder - Technology - Position resolution - Position range - Position accuracy		absolute encoder, multi turn, fail-safe 4.096 steps/revolution (12 Bit) 256/i revolutions (8 Bit/i) ±8 steps				
Gear - Type - Gear ratio - Overloaded factor		helical worm gear min. 27:1, max. 160:1 (optional up to 450:1) 1,5				
Interfaces		CANopen (402) optional:  (V0/V1)				
Options		alternative gear reduction for high volume, PROFIBUS DP				

Drawings

MA 120



Housing height

Bus	H _{Housing} (mm)
CANopen	156
PROFIBUS	176

The compact model and the low weight are achieved through a helical worm gear embedded in a die-cast aluminum housing combined with a high performance optimized DC motor. Due to its small size and the hollow shaft standard, applications for confined mounting spaces can be realized. Further, to its specific design, it is running extremely smooth and quiet. The drives are mainly used for short-time operations or intermittent services with an effective duty cycle of under 20 percent.

Typical applications are situated in different branches:

- _ in lighting and stage arrangements due to its smooth running and low noise development
- _ in sheet-metal working in mechanical press brakes due to its robustness
- _ in solar technology in modular tracking systems due to its precision
- _ in building service engineering for adjusting devices due to its high protection class

Compared to MD 300/MP 200 and MD xxx/MP xxx

			MA 120	SR 031 with MD 300/MP 200	SG 80 with MD xxx/MP xxx
Gear type			helical worm gear	worm gear	worm gear
Backlash		arcmin	12–25	6	60
Rated torque	min.	Nm	7	7	10
	max.		37	18	10
Rated speed	min.	min ⁻¹	11	43	40
	max.		65	435	600
Bearing force, radial		N	middle	high	low 350
Rated life time		h	low 3.000	high 15.000	middle 10.000
Gear ratio	min.		27	5	5
	max.		160	50	75

Precision Gears: MD 300, MP 200

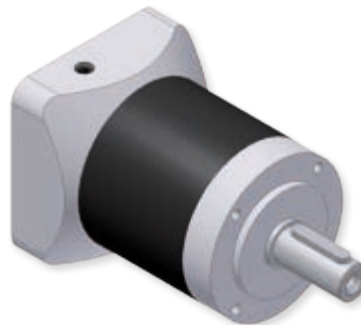
Planetary Gear PLE 60

Permanent Operation / Periodic Duty up to 44/70 Nm

The PLE 60 is the perfect economical alternative to servo planetary gears. The motor and gear are connected with a detachable coupling and clamping hub. Friction losses are negligible. The gear is suitable for all applications in where it is adequate to have a backlash of approximately 20 arcmin.

Features

- + 22 different gear ratios, $i=(3 \dots 512)$
- + low backlash (16-20-22 arcmin), (1-2-3)-stage
- + high level of efficiency (96-94-90 %), (1-2-3)-stage
- + high admissible shaft forces (600 ... 500 N), axial-radial
- + coaxial shaft output
- + high short-term overload factor 1,60
- + arbitrary mounting position
- + lifetime lubrication



up to 44/70 Nm

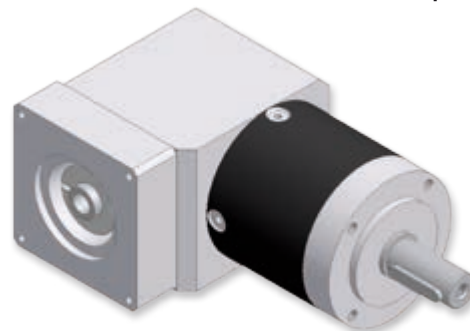
Angular Planetary Gear WPLE 60

Permanent Operation / Periodic Duty up to 44/70 Nm

The WPLE 60 is the 90° angle version to the PLE 60. The motor and gear are connected with a detachable coupling and clamping hub. Friction losses are negligible. A bevel gear 1:1 is in front of the PLE 60. The gear backlash increases by an angle part of 6 arcmin.

Features

- + 22 different gear ratios, $i = (3 \dots 512)$
- + low backlash, (22-26-28 arcmin), (1-2-3)-stage
- + high level of efficiency (94-92-88 %), (1-2-3)-stage
- + high admissible shaft forces (600 ... 500 N), axial-radial
- + no axial offset shaft output
- + high short term overload factor 1,60
- + arbitrary mounting position
- + lifetime lubrication



up to 44/70 Nm

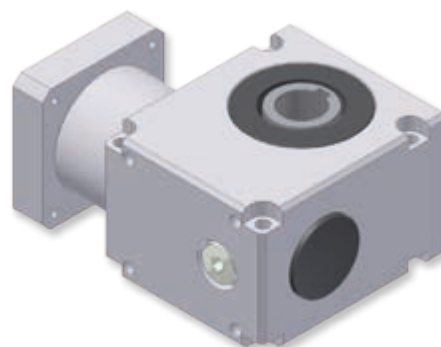
Precision Worm Gear SR 031

Permanent Operation / Periodic Duty up to 18/28 Nm

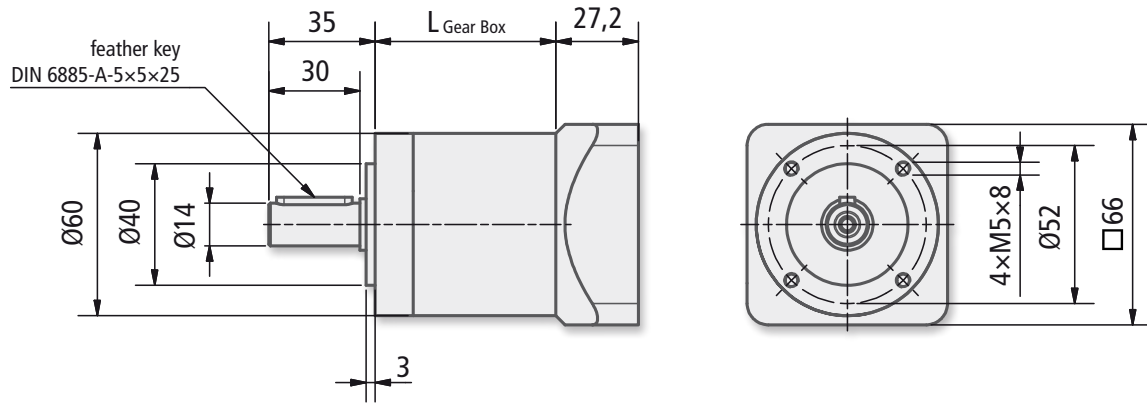
The SR 031 has a hollow shaft and is equipped with a robust bearing. The motor and gear are connected with a detachable coupling and a clamping hub. Friction losses cannot be neglected. The gear is ideal for applications with confined installation spaces and with high shaft forces.

Features (partly dependent on reduction and speed)

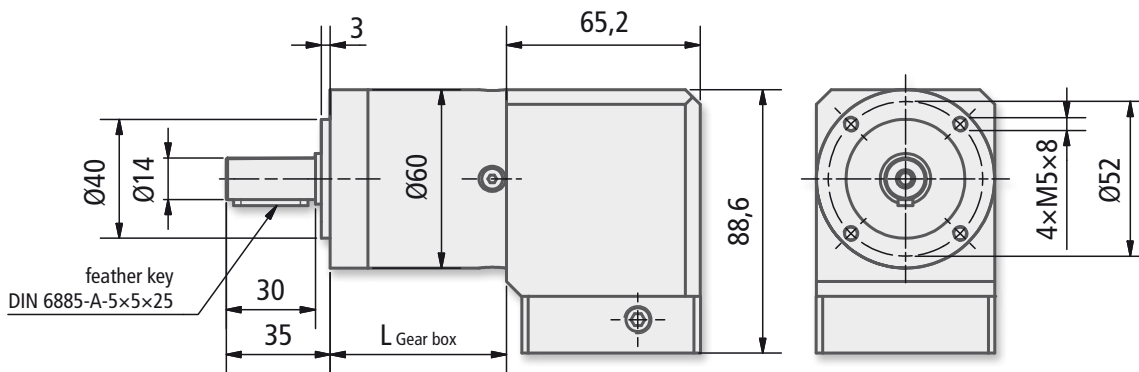
- + 8 different gear ratios, $i = (5 \dots 50)$
- + low backlash (6 arcmin)
- + high level of efficiency (82 ... 50 %), at 1.500 min⁻¹
- + high admissible radial shaft forces, 500 ... 2.000 N
- + axial offset shaft output of 31 mm
- + high short term overload factor 1,60
- + arbitrary mounting position
- + lifetime lubrication



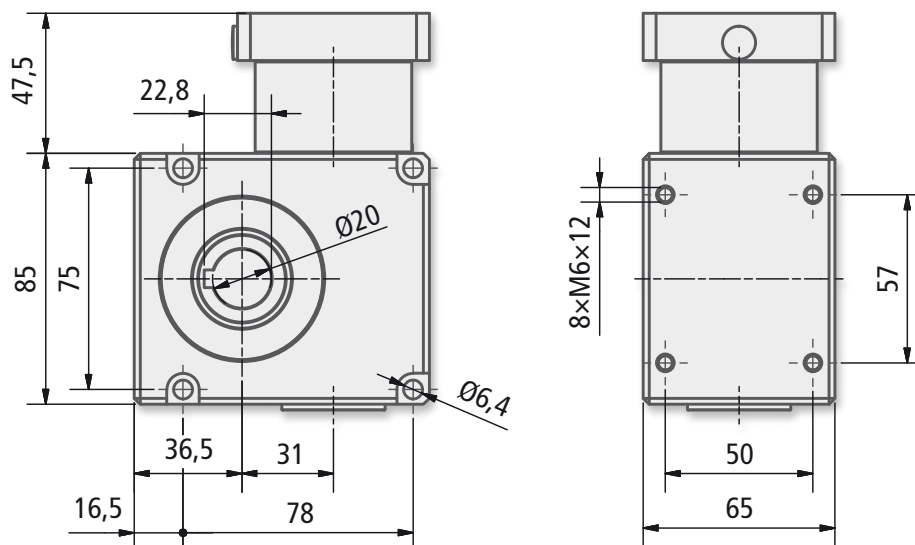
up to 18/28 Nm



Gear stages	L _{Gear box} (mm)
1	47
2	59,5
3	72



Gear stages	L _{Gear box} (mm)
1	47
2	59,5
3	72



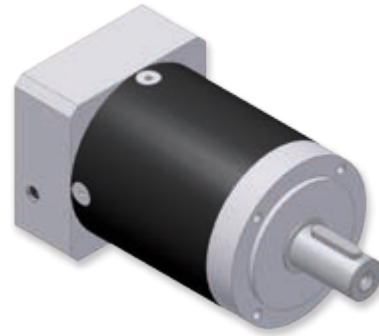
Special Gears: MD 300, MP 200

Planetary Gear PLE 80

Permanent Operation / Periodic Duty up to 130/208 Nm

The PLE 80 is the perfect economical alternative to servo planetary gears. The motor and gear are connected with a detachable coupling and clamping hub. Friction losses cannot be neglected. The gear is suitable for all applications where it is adequate to have a backlash of approximately 15 arcmin.

up to 130/208 Nm



Features

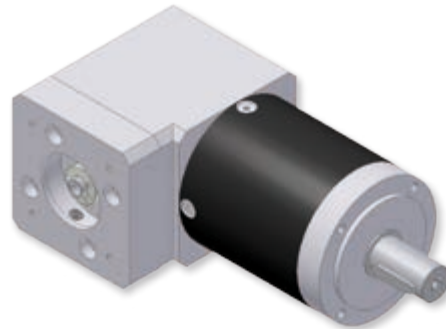
- + 22 different gear ratios, $i = (3 \dots 512)$
- + low backlash (9-14-16 arcmin), (1-2-3)-stage
- + high level of efficiency (96-94-90 %), (1-2-3)-stage
- + high admissible shaft forces, 1.200 ... 950 N, axial-radial
- + coaxial shaft output
- + high short term overload factor 1,60
- + arbitrary mounting position
- + lifetime lubrication

Angular Planetary gear WPLE 80

Permanent Operation / Periodic Duty up to 130/208 Nm

The WPLE 80 is the 90° angle version to the PLE 80. The motor and gear are connected with a detachable coupling and clamping hub. Friction losses can not be neglected. A bevel gear 1:1 is in front of the PLE 80. The gear backlash increases by an angle part of 6 arcmin.

up to 130/208 Nm



Features

- + 22 different gear ratios, $i = (3 \dots 512)$
- + low backlash (15-19-21 arcmin), (1-2-3)-stage
- + high level of efficiency (94-92-88 %), (1-2-3)-stage
- + high admissible shaft forces, 1.200 ... 950 N, axial-radial
- + no axial offset shaft output
- + high short term overload factor 1,60
- + arbitrary mounting position
- + lifetime lubrication

Harmonic-Drive-Gear HFUC-14

Permanent Operation / Periodic Duty up to 7,8/28 Nm

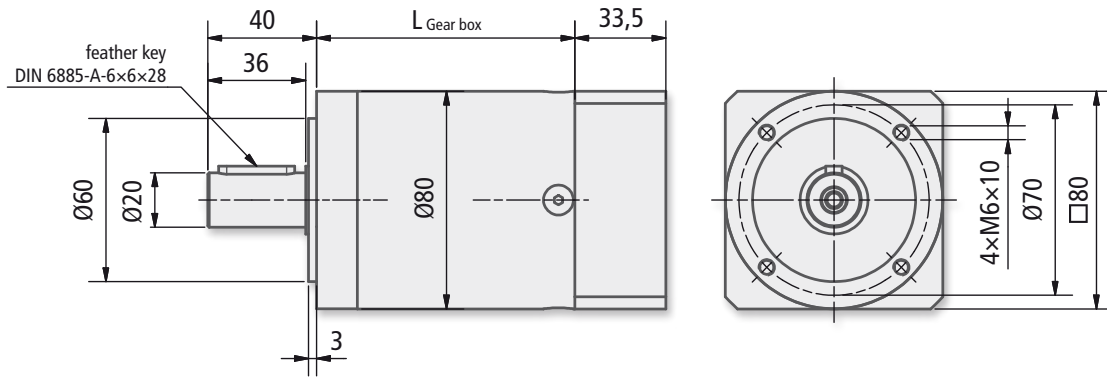
The HFUC-14 is a backlash free precision gear. Angular tolerances are determined by the torsional stiffness. The motor and gear are non-detachable and connected to one another. The efficiency is strongly load-dependent. The gear is ideal for applications where a backlash of a servo gear is insufficient.

backlash-free

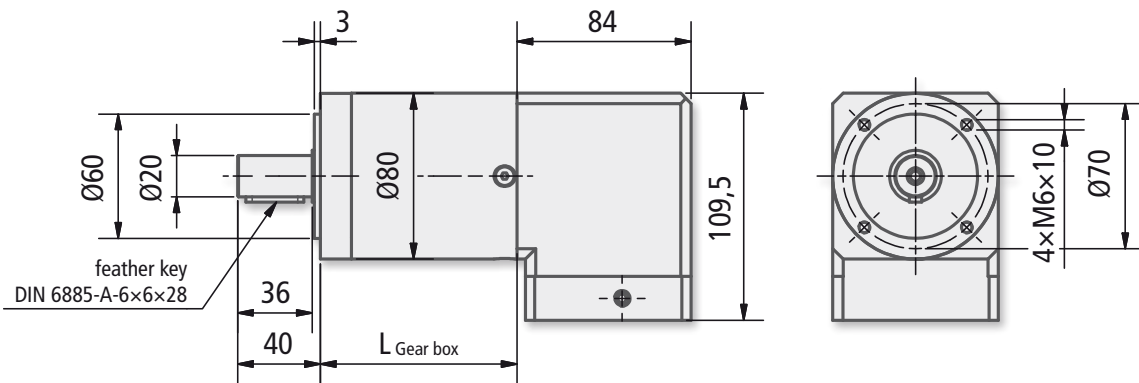


Features

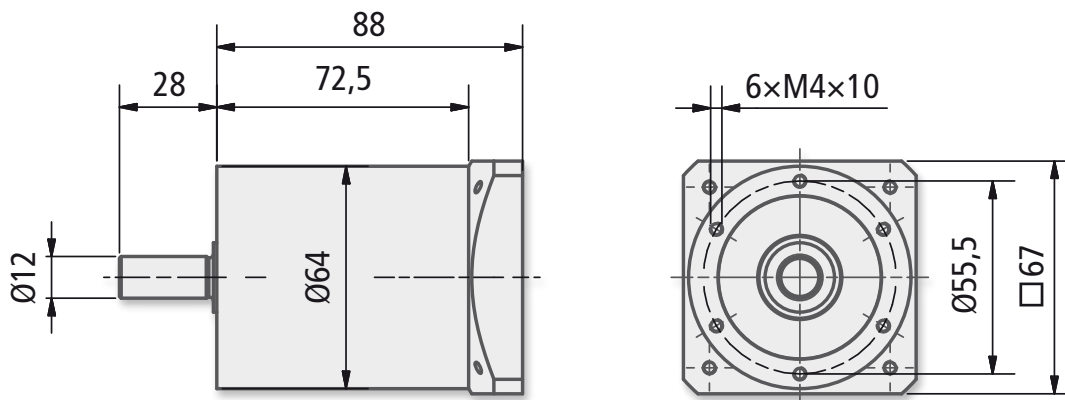
- + 4 different gear ratios, $i = (30 \dots 100)$
- + backlash-free
- + high load-dependent level of efficiency
- + high admissible radial force 1.500 N
- + coaxial shaft output
- + high short term overload factor approximately 2
- + arbitrary mounting position
- + lifetime lubrication



Gear stages	L _{Gear box} (mm)
1	60
2	77,5
3	95



Gear stages	L _{Gear box} (mm)
1	60
2	77,5
3	95



Simple Gears: MD xxx, MP xxx (060/095/100/140/180)

Planetary Gear PLG 52

Permanent Operation up to 24 Nm

The PLG 52 is a gear with low-end backlash. The motor and gear are connected and non-detachable. The gear is suitable for all applications where a backlash of approximately 1° arcmin is sufficient and in which the frequency of startups is moderate.

up to 24 Nm

Features

- + 16 different gear ratios, $i=(4,5 \dots 512)$
- + backlash ($1-1-1\frac{1}{2}^\circ$), (1-2-3)-stage
- + level of efficiency (90-81-73 %), (1-2-3)-stage
- + admissible shaft forces, 300 ... 350 N, axial-radial
- + coaxial shaft output
- + output shaft double ball bearing
- + arbitrary mounting position
- + lifetime lubrication



Worm Gear SG 80, with Solid Shaft

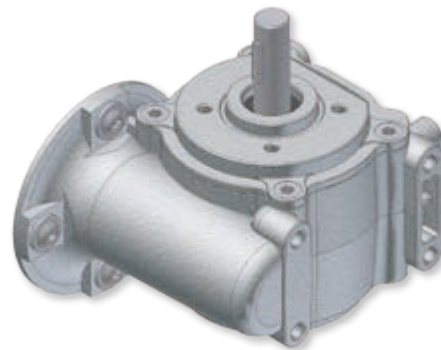
Permanent Operation up to 10 Nm

The SG 80 is an angular gear with one-sided shaft. A two way shaft is optional. The motor and gear are non-detachable and connected to one another. Friction losses are negligible. The gear is ideal for applications with confined installation spaces and low backlash requirements.

up to 10 Nm

Features (partly dependent on reduction and speed)

- + 7 different gear ratios, $i = (5 \dots 75)$
- + backlash 1°
- + level of efficiency (70 ... 25 %), at 1.500 min⁻¹
- + admissible shaft forces, 300 ... 350 N, axial-radial
- + axial offset shaft output of 31 mm
- + one-sided shaft
- + arbitrary mounting position
- + lifetime lubrication



Precision Worm Gear SG 80 H

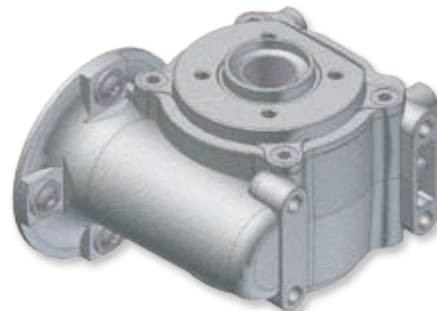
Permanent Operation / Periodic Duty up to 18/28 Nm

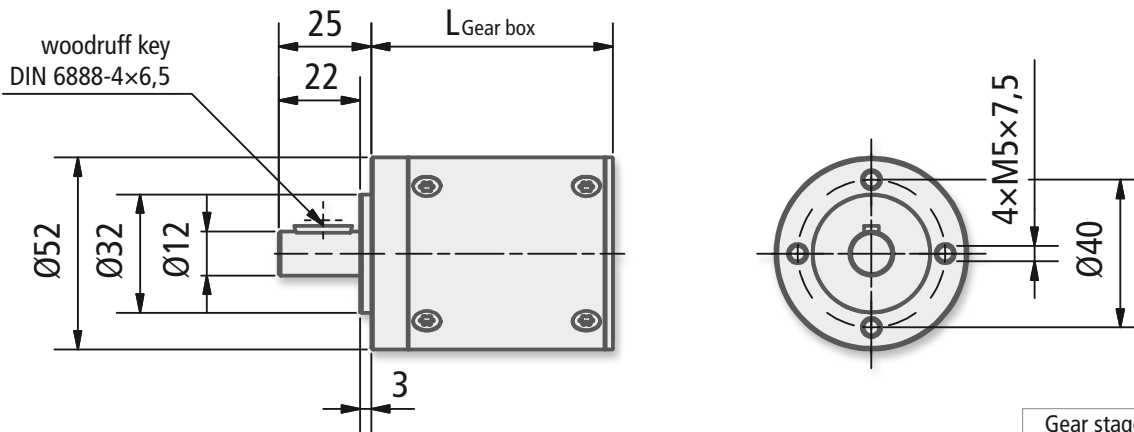
The SG 80 H is a hollow shaft version of the SG 80. The motor and gear are non-detachable and connected to one another. Friction losses are negligible. The gear is as an attachment installation ideal for applications with confined installation spaces and low backlash requirements.

up to 18/28 Nm

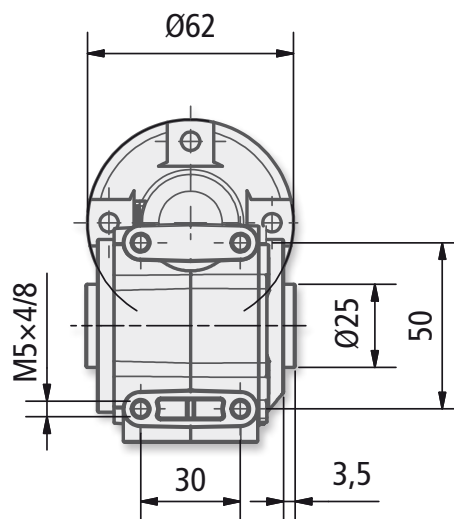
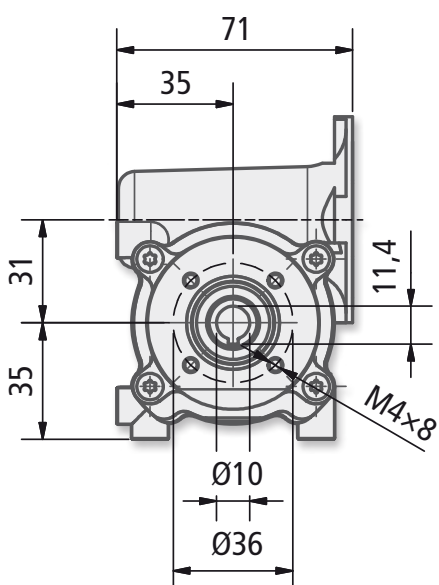
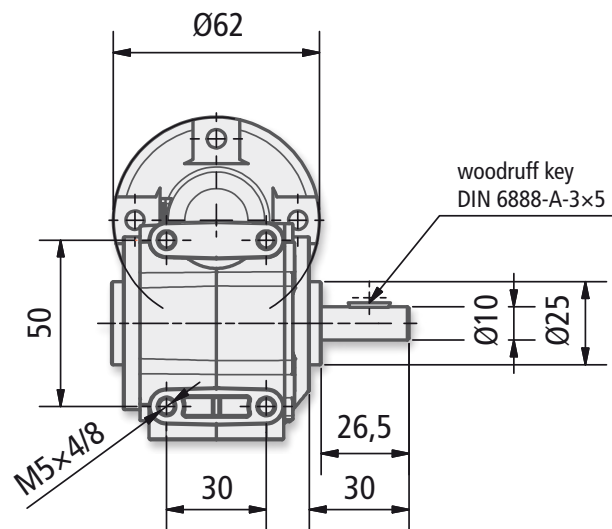
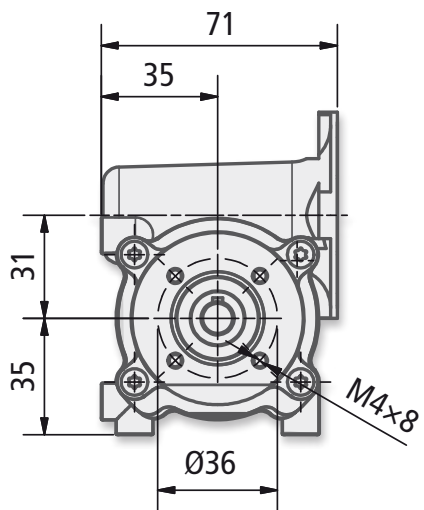
Features

- + 7 different gear ratios, $i = (5 \dots 75)$
- + backlash 1°
- + level of efficiency (70 ... 25 %), at 1.500 min⁻¹
- + admissible shaft forces, 300 ... 350 N, axial-radial
- + axial offset shaft output of 31 mm
- + one-sided shaft
- + arbitrary mounting position
- + lifetime lubrication





Gear stages	L _{Gear box} (mm)
1	50
2	65,5
3	80,5



Interfaces

PROFIBUS

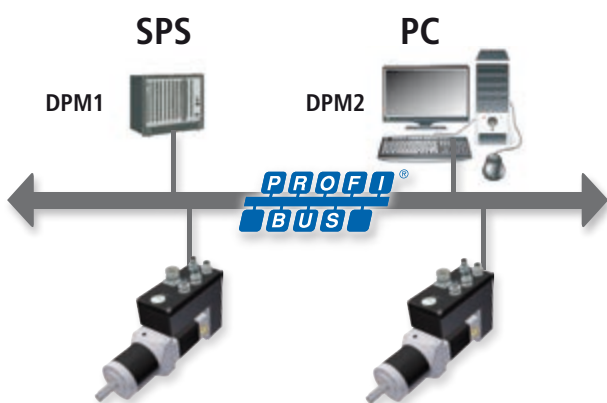


The drive version with PROFIBUS DP is based on the device profile PROFIdrive V3.0 and is assigned to application class 3 - position drive with decentralized positioning control (single axis point-to-point). The device profile V3.0 allows free configuration of process data telegrams as an essential enhancement to V2.0 with a fixed pre-defined telegram structure.

The appropriate communication profile is PROFIBUS DP V0/V1 with

Features

- + positioning and speed control
- + cyclic and acyclic communication according to PROFIBUS DP V0/V1
- + free configurable process data telegrams according to device profile PROFIdrive V3.0
- + voltage failure-safe update possibility



cyclic and acyclic data traffic. All common bit rates are accessible and get adjusted automatically based on a bus analysis. In the case a drive has a digital input, a hand-held device can be connected. Simple processing operations are possible without any bus connection. If the bus is in operation, the input is for connecting hardware limit switches, or together with digital output, they serve as logical I/O module at the PROFIBUS.

Technical Communication Data

Communication profile	PROFIBUS-DP
Device profile	PROFIdrive 3.0
Address range	3 ... 99
Address adjustment	hardware, DIP-switch
Bitrates	9,6/19,2/93,75/187,5/500/1.500/ 3.000/6.000/12.000 kBit/s
Process data configuration	free or over standard protocols
Terminating resistance	MD: internal MP/MA: external
Transfer	cyclic (V0) acyclic (V1)

CANopen



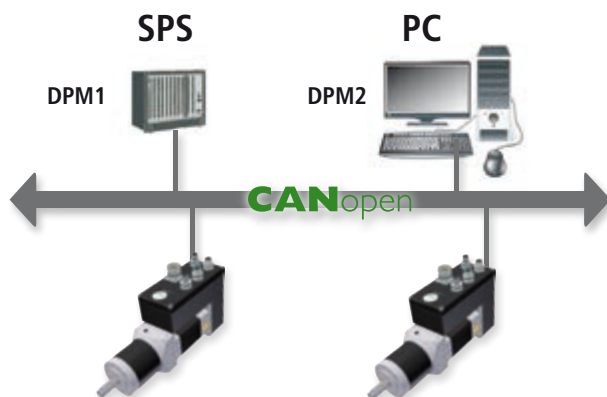
The drive version with CANopen is based on the device profile CiA DSP 402 – drives and motion control. The device profile permits a free configuration of process telegrams through PDO mapping of application objects. Available are 4 RxPDO and 4 TxPDO.

The associated communication profile is CiA DS 301 – CANopen application layer and communication profile. CANopen defines, for distri-

buted industrial automation systems, a standardized protocol based on CAN. All common bit rates are accessible and set over a DIP-switch. The fast exchange of process data uses a process data object (PDO), the access to the entries within the object directory happens over service data object (SDO). All drive specific information is summed up within the object directory.

Features

- + positioning and speed control
- + cyclic and acyclic communication with PDO/SDO
- + free configurable process data telegram according to the communication profile CiA DS 301
- + each transmission direction with up to 4 PDOs



Technical Communication Data

Communication profile	CiA DS 301-DP
Device profile	CiA DSP 402
Address range	0 ... 127
Address adjustment	hardware, DIP-switch
Bitrates	10/20/50/100/125/250/ 500/800/1.000 kBit/s
Process data configuration	free or over standard protocols
Terminating resistance	MD: internal MP/MA: external
Transfer	cyclic (PDO) acyclic (SDO)

PROFINET



The encoTRive drives with PROFINET use the same device profile PROFIdrive V3.0 as PROFIBUS DP. When migrating from PROFIBUS to PROFINET, the control logic and the PZD configuration remain the same. Logical programming adjustments do not occur. The range of PROFIBUS functions is fully integrated into PROFINET. PROFINET offers some additional functions. There is an alarm telegram in case of trouble when the cycle times are too low and there are more addressable nodes. The projecting is carried out with the same tools used for PROFIBUS. Together with the identical program and processing logic, the change from PROFIBUS to PROFINET is solely a matter of the communication technology.

- + no bus termination necessary
- + address assignment via software
- + the protocol analysis can be done with freely available Ethernet tools (for example with Wireshark™)
- + the topology is simplified by star, lines, tree and ring structures as well as arbitrary hybrid forms

Putting in Operations with Function Blocks

The PROFIBUS written programs are compatible with PROFINET and can be fully integrated. The function block guarantees easy access into the world of PROFINET.

- _ installation of the GSD (ML) file within the projecting tool
- _ allocation of a device name
- _ projecting the drive within the PROFINET network
- _ selection of the telegram for the cyclic transfer (identical to PROFIBUS-DP)
- _ direct control over the variable table or with a demo program

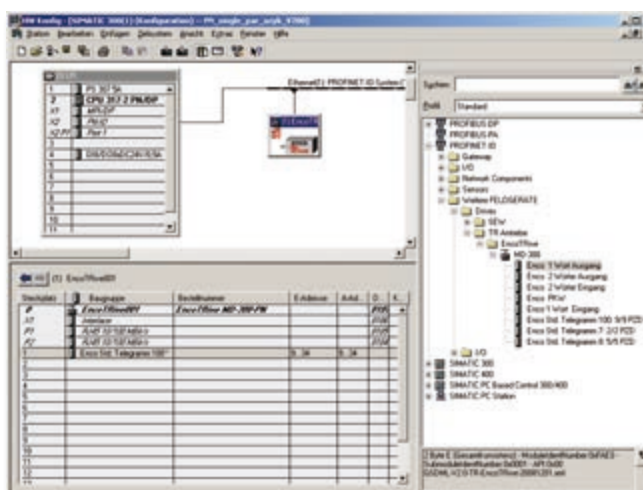
Installations of the MD 300 PROFIBUS can be converted to PROFINET by changing the connector module and vice versa. It is solely a mechanical exchange process without modifications to the settings of the drive.

PROFINET – Starter Kit

- _ MD 300 PN
- _ supply cable 24/48 V DC
- _ PROFINET cable
- _ serial cable for the communication with the encoTRive device tool
- _ CD with content (documentation, GSD/ML-file, PLC function modules with demo program, encoTRive device tool EDT, pin assignment, CAD data)

Technical Communication Data

	MD 300
Range of functions	PROFINET IO (PNIO) Conformance Class A Real Time Class 1
Data cycle	< 10 ms RT
Max. participants	> 1.000
Transfer	cyclic (process data) acyclic (alarm and time uncritical parameters)
Process data configuration	free or over standard protocols



General/Definition

Drives

Gear

Interfaces

Accessories

Electrical and Mechanical Accessories

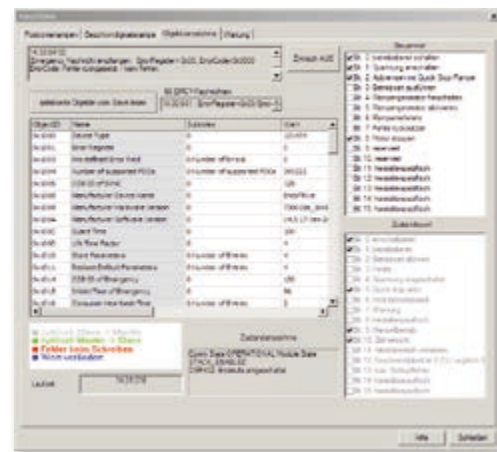
EncoTRive-Device-Tool (EDT)

EDT is the parameterization and diagnosis tool for all drives of the encoTRive product family. It can be accessed over various pre-defined interfaces such as PROFIBUS with Hilscher Master Class 1/2, Siemens CP5xx or CANopen with a converter PC-USB to CANopen. For the MD series drives, there is an alternative direct access via a RS-232 interface to an integrated interface converter on the drive electronics. The elements of the user interface are arranged into logical subgroups. This makes the user interface intuitively operable. Editing, monitoring, administration and use takes place on several independent windows. Two menu items for the "positioning" and "speed control" operating

types make it possible to easily start a simple moving operation and at the same time monitor the actual values. For example, the actual position and the actual speed.

A window for the object directory allows the access to all objects in tabular form. Cyclically transferred data is colored to distinguish it from the static parameters.

Within the same window, the control word and status word in the table are broken down into individual bits. Conditions can be pointedly reconstructed and analyzed at the level of the state machine, as well as all state conditions in arbitrary order and individual steps.



Converter PC-USB to CANopen for the EDT

The PC-USB to CANopen converter enables the connection to CANopen networks via an USB interface. The converter is ideal for mobile use due to its compact plastic housing.



Technical Data

- + transmission rate up to 1 Mbit/s
- + connection to PC over USB 1.1, compatible to USB 2.0
- + connection to CAN-Bus over D-Sub, 9-pole according to CiA® 102
- + voltage supply over USB
- + CAN specification 2.0A (11-Bit-ID) and 2.0B (29-Bit-ID)
- + time-stamp resolution approx. 42 µs

Hand-Held Control PROFIBUS for Drives MD

With the hand-held device, simple drive functions are executable with the connection to the digital I/O - also without any bus connection. An implemented logic ensures that the main control is assigned to either only the PROFIBUS master or the hand-held device. If the PROFIBUS communication is interrupted or the hand-held device is connected, the hand-held device will take over the main control. An automatic control transfer onto the master is not possible and

requires a fault acknowledgment or a reset. Long distance installations are possible with the 5 m connection cable.

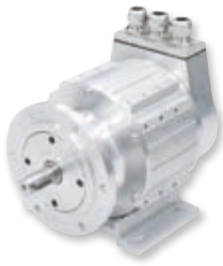
Features

- + jog into positive or negative direction up to the software limit switch
- + setting a reference point
- + fault acknowledgement
- + open internal holding brake manually



TR-Electronic – Your Partner in Automation

General/Definition



Programmable rotary encoder

The standard of automation technology, available with all current fieldbus systems: PROFIBUS, Interbus, CANopen, DeviceNet and Industrial Ethernet. Including TR-Electronic's variety of mechanics, interfaces and functions.



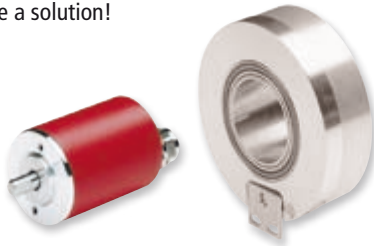
Drives



Gear

Incremental rotary encoder

From 24 mm external diameter up to 55 mm hollow shaft – we always have a solution!



Interfaces

Motor feedback systems

Feedback encoder for modern positioning drives. Optional integrated or directly mounted on the drive shaft via hollow shaft.



Accessories

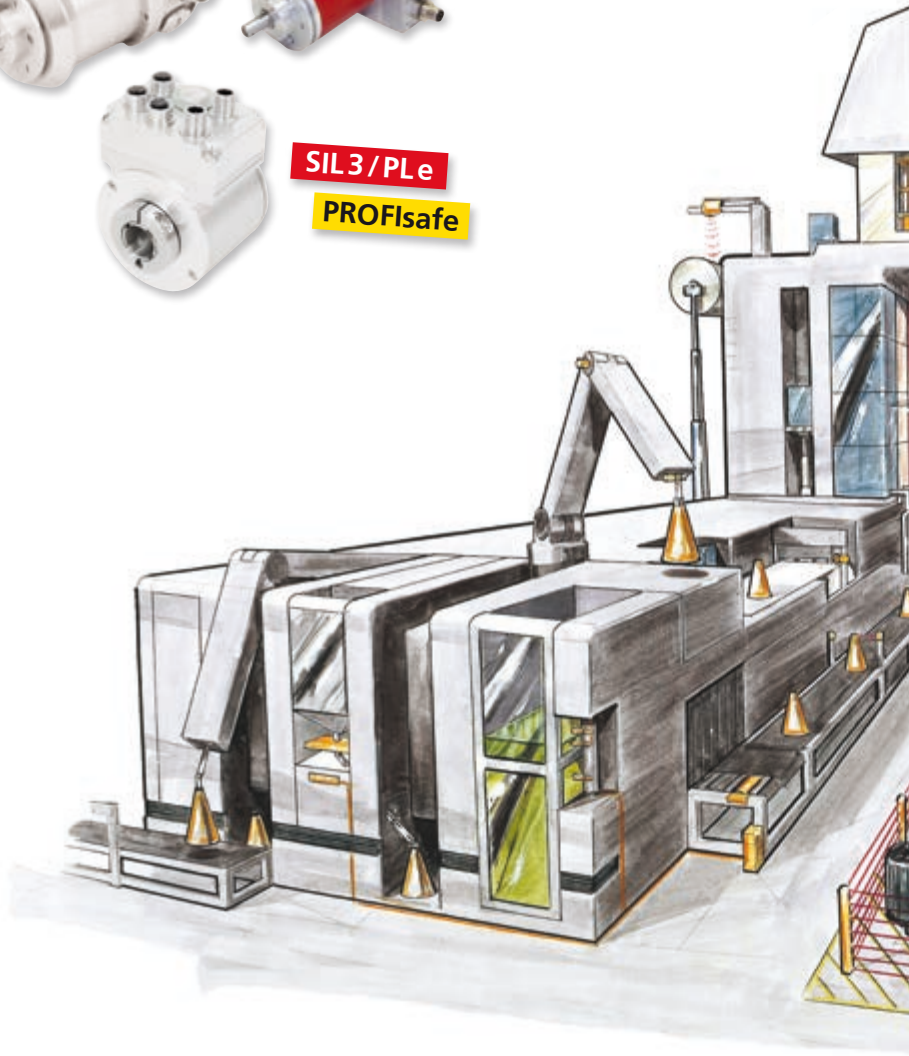
Linear absolute displacement sensors

The compact class for linear absolute measurement. Directly bus-ready, suitable for harsh environmental conditions and for installation in hydraulic cylinders.



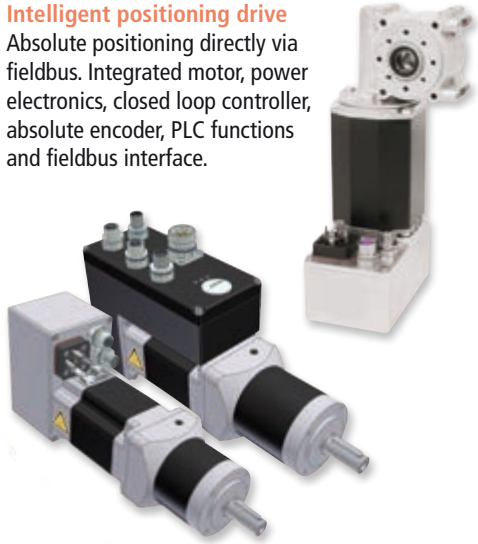
Absolute high resolution linear measurement systems

Linear measurement with absolute sub-micron resolution without referencing.



Intelligent positioning drive

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Double shock proof mounted housing isolates the electronics from vibration, while front access (MIPC) simplifies configuration and start up. Choose from our wide selection of housings.



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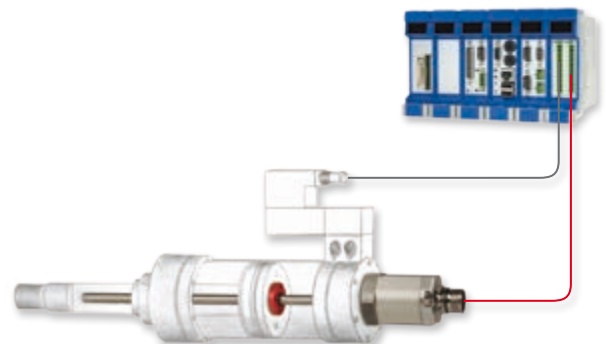
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Modular, rugged fieldbus node system I/O-node, small-scale PLC, decentralized axis controller, high performance cam controller, DIN-rail mounted industrial PC, servo controller for the hydraulic ... with commercial fieldbus systems, such as Profibus-DP, CANopen, DeviceNet, LightBus ... and ETH-ERNET as option!



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