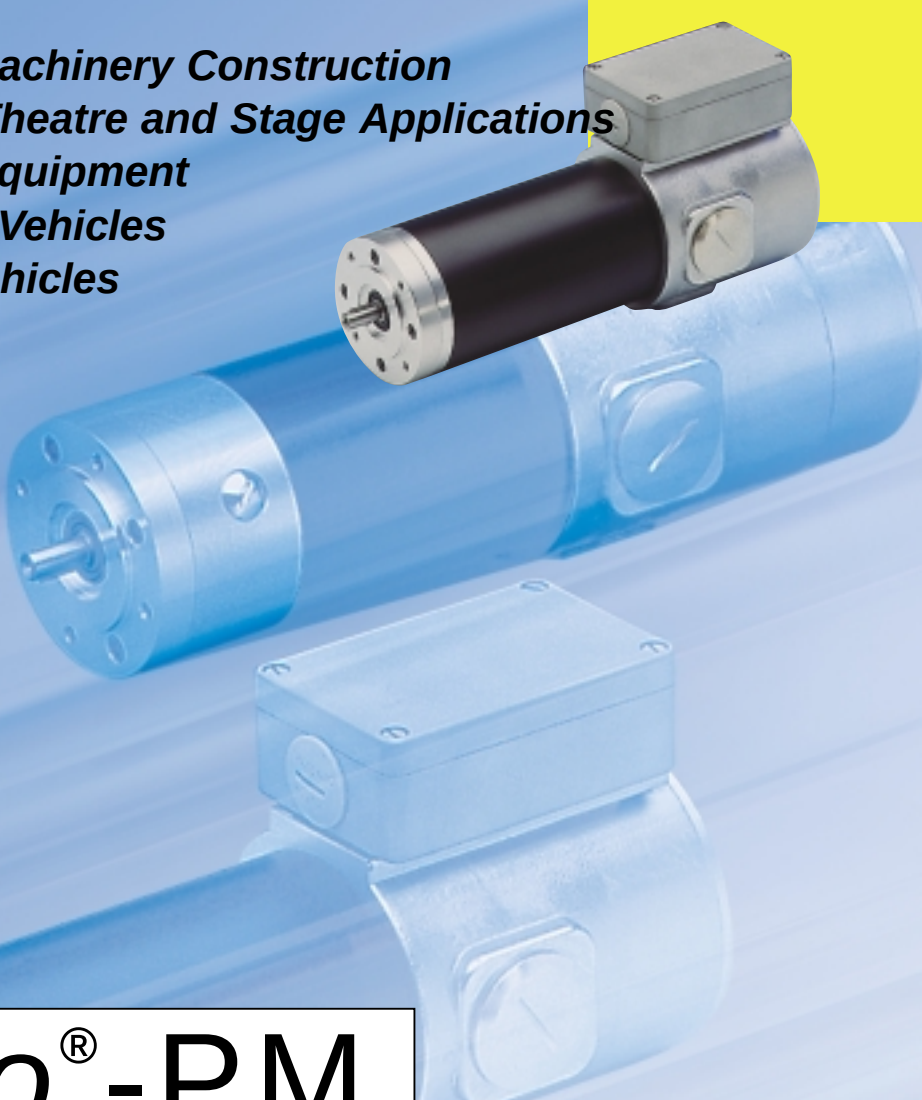


The perfect DC motor for

*General Machinery Construction
Elevator, Theatre and Stage Applications
Welding Equipment
Municipal Vehicles
Military Vehicles*



tendo[®]-PM

Permanent Magnet Motors and Servo Motors

- *Extremely quiet running*
- *Optimum protection (IP 65 optional)*
- *Highest reliability*
- *Custom designed for your application*

mayr[®]

Systeme

www.mayr.de

P.PM1.V00.GB

If in your machines

- simple „wind-screen wiper motors“ do not fulfil your requirements,
- brush service life and reliability a necessity,
- an open and unprotected design is inadequate,
- running noise and vibration is not required,
- a high value is placed on low maintenance expenditure,
- low backlash required,
- the gearbox must not only reduce speeds, but has to transmit appreciable torques,

then our *tendo*[®]-PM motors meet your application and specification.

We would be pleased to provide a motor enabling you to test it extensively and to convince yourself that our *tendo*[®]-PM motor is better than the standard generally available.

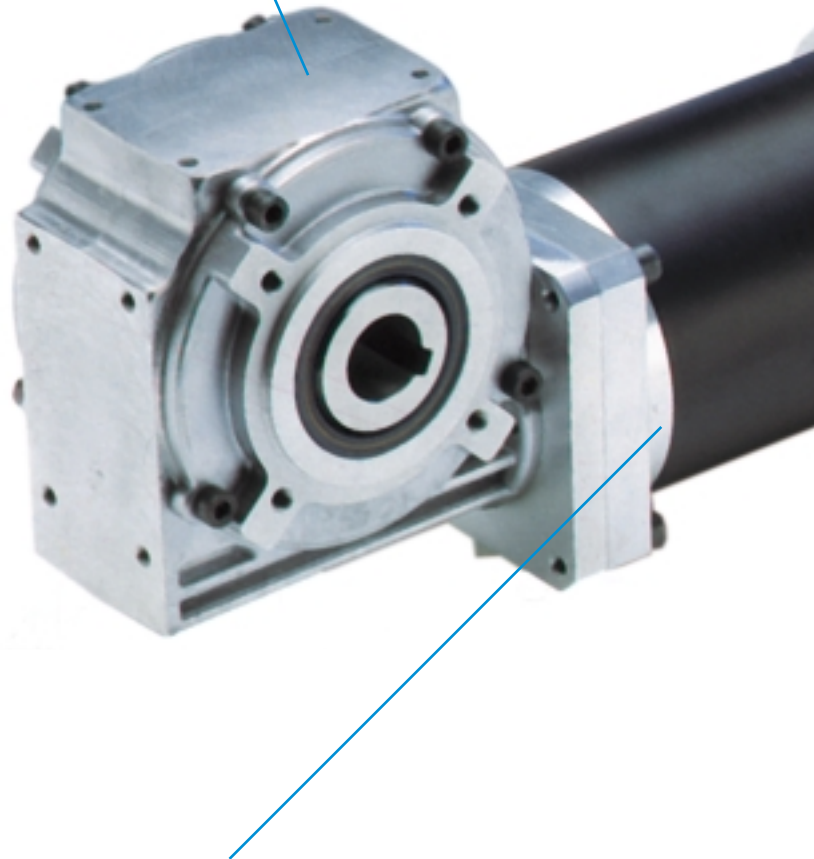
tendo[®]-PM DC Motors

the optimum drive

High performance gearboxes

Many gearboxes for DC motors are designed only to reduce speeds and are not suitable for transmission of high torques. *tendo*[®]-PM motors reliably transmit every torque which is possible based on motor power and gear ratio and run very quietly continuously:

- generously dimensioned gearboxes
- high gearing engagement
- low torsional backlash
- minimum gearbox tolerances



Support bearing with optimised ball race

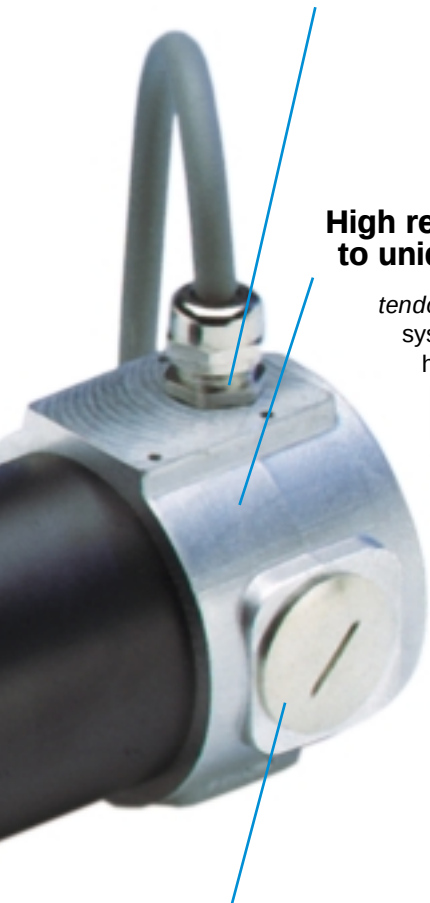
The optimised support bearing with its special grease packing located on the A-side of the motor makes a substantial contribution to the smooth running and low noise characteristics.

Many motor manufacturers have no fixed bearings with low backlash and consciously accept unnecessary noise, harmful vibration and premature failure.

The best protection

The largest deficiency of most DC motors are their open construction. They cannot be used in critical conditions. *tendo*®-PM motors also show their superiority with:

- Protection IP 54
- Protection IP 65 (up to IP 68 on request)



High reliability and security due to unique commutation

tendo®-PM motors have a remarkably commutation system a generously dimensioned commutator, a high number of commutator discs and brushes with a large surface area a corresponding wear volume. This technical „luxury“ distinguishes the *tendo*®-PM advantages which take it clearly away from the standard:

- service life of the brushes of 5000 up to 6000 hours (usual are 2000 up to 3000 hours)
- uniform operation by low torque ripple and high speed stability
- extremely silent

Nearly maintenance-free

With most DC motors the brushes must be replaced regularly and mostly the commutator must also be skimmed.

For the *tendo*®-PM removing the brush abrasion and the exchange of brushes are sufficient where maximum wear life is reached.

Application-optimised customer solutions

Apart from the standard designs the *tendo*®-PM modular system offers flexibility for solutions specifically tailored to your application.

Talk with us about your objective.

Our flexible team will develop an economic solution for you within a short time, including the manufacture of a suitable sample drive.



Technical support, service, supplying samples

Our service is as special as our motors:

- Detailed and competent technical support
- Fast technical preparation of an application-optimised and economic drive solution
- Quick availability of drives for your tests
- Support during assembly and initial commissioning
- Fast and reliable customer service

Application optimised drive solutions

The modular system of the *tendo*®-PM motors ensures a speedy, uncomplicated and economic drive solution custom-made for your application:

- 6 different motor sizes
- 2 types of gearboxes (worm gears and planetary gears)
- 2 different gearbox sizes per motor size
- Different tachogenerators and incremental encoders for positioning tasks and servo applications
- Working and holding brakes
- Various overload protection for protecting motors and gearboxes
- Single and multi quadrants controllers suitable for mains connections

The suitable motor for each application

The trade name *tendo®-PM* is used for a DC motor series which is distinguished by

- ❑ a modular concept,
- ❑ long service life,
- ❑ reliability,
- ❑ quality and
- ❑ protection IP 54 and IP 65

tendo®-PM - motors have excellent true running characteristics, even at the lowest speeds; good speed stability, also with large load changes and high efficiency. They also can be used as direct drives. As standard are available:

- ❑ Voltages 24 V and 160 V (60 V)
- ❑ Speeds 2000 rpm and 3000 rpm.

The *tendo®-PM* concept is modular. You select exactly what you need for your requirements:

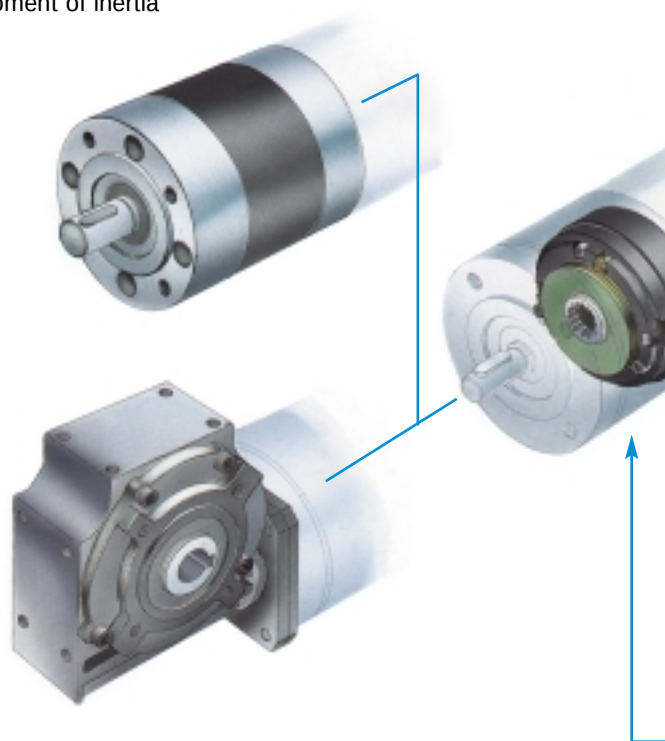
- ❑ A drive with adjustable speeds,
- ❑ Servo motors for drive solutions in the positioning range,
- ❑ Drives with gearboxes,
- ❑ Motors with brakes,
- ❑ Connection with cable, plug or terminal box.

Performance summary

Size	Power [Watt]	Nominal torque [Nm]	Continuous output torques up to [Nm]	
			With worm gears	With spur gears
<i>tendo®-PM</i> 41	63	0,22	6	30
<i>tendo®-PM</i> 42	115	0,4	12	30
<i>tendo®-PM</i> 52	160	0,55	18	80
<i>tendo®-PM</i> 53	235	0,79	25	80
<i>tendo®-PM</i> 61	190	0,6	20	80/150
<i>tendo®-PM</i> 62	350	1,15	40	80/150
<i>tendo®-PM</i> 63	500	1,7	50	80/150
<i>tendo®-PM</i> 9x	800	2,55 – in preparation		

Planetary gears

- ❑ Compact design
- ❑ Minimum backlash design, if required
- ❑ Co-axial output
- ❑ High impact loads possible
- ❑ High efficiency
- ❑ Low moment of inertia



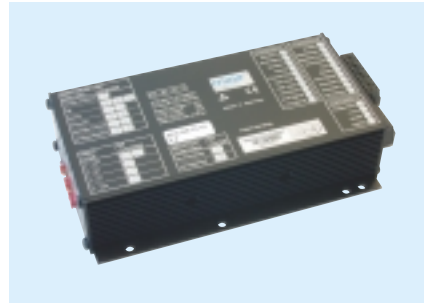
Worm gears

- ❑ Large reduction range
- ❑ Universal housing for multiple attachment possibilities
- ❑ Standard design hollow shaft output
- ❑ Plug-in shafts 1 or 2 sides possible
- ❑ Silent
- ❑ With integrated slip hub, or overload device, on request

Motor connection

In the standard design the motor and the components are connected via cable, by choice with terminal box or plug connection.

Control



Typical for *tendo*®-PM motors is that the speed follows linearly to the armature voltage and the torque to the armature current. Hence it follows that the motors can be controlled excellently without too much expenditure. For this task we offer you different DC supply units:

- ☐ 1Q transistor controller (drive in one direction)
- ☐ 4Q transistor controller (drive and braking in both directions)

Attachment variations

Tacho

Analogue speed measurement

DC tacho 15V/1000 rpm
suitable 1Q- and 4-Q operations,
in the range of control up 1:1000

Incremental encoder

Digital speed measuring/ positioning

Standard 1000 Imp./Udr; 5V TTL
Other pulse figures on request

Servo design

Combination of **DC tacho**
and **incremental encoder** for
exact positioning tasks in the
servo application

ROBA-stop®-positioning brake

Attachment of a brake for brake
motor tasks.
Standard voltage 24 VDC /
207 VDC (104 VDC)
Other voltages on request

The motor - core piece of application optimised drive solutions.

tendo®-PM permanent excited
DC motors correspond in their
performance during operation to a
shunt motor („shunt characteristic“),
i. e. the speed is only slightly
influenced by load changes.

ROBA-stop®-holding brake

Spring applied holding brake:

- ☐ Integrated into the motor housing
- ☐ Same protection as motor
- ☐ Standard voltages 24 VDC /
207 VDC (104 VDC)
- ☐ Minimum temperature rise due to
optimised coil capacity

		Motor size 41				Motor size 42				Motor size 52			
		160		24		160		24		160		24	
Nominal voltage	$U_N / V^{(1)}$												
Nominal speed	$n_N / \text{rpm}^{(1)}$	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000
Nominal torque	M_N / Nm	0,22	0,2	0,2	0,18	0,4	0,37	0,37	0,35	0,55	0,51	0,5	0,48
Rated output	P_N / W	46	63	42	57	83	115	77	110	115	160	105	150
Nominal current	I_{AN} / A	0,46	0,57	2,9	3,6	0,75	1,0	5,4	6,0	0,95	1,25	6,4	8,3
Form factor	$F_F^{(2)}$	1,05	1,05	1,05	1,05	1,05	1,05	1,05	1,05	1,05	1,05	1,05	1,05
Housing overtemperature	$\Delta v / K$	50	50	50	50	50	50	50	50	50	50	50	50
Therm. time constant	T_{th} / min	25	25	20	20	30	30	25	25	40	40	30	30
Max. perm. current	$I_{A \max} / A^{(3)}$	2,4	3,2	16,5	22	4,3	6,1	32	39	5,7	8,25	40	53
Max. torque	$M_{\max} / \text{Nm}$	0,9	0,9	0,9	0,9	1,8	1,8	1,8	1,8	2,8	2,9	2,7	2,6
Continuous-stall torque	M_O / Nm	0,3	0,3	0,3	0,3	0,5	0,5	0,5	0,5	0,6	0,6	0,6	0,6
Armature resistance (20 °C)	R_A / Ω	71	38	1,7	1,0	33	16,5	0,68	0,45	19	10	0,5	0,27
Terminal resistance	R_a / Ω	73	40	1,9	1,2	35	18,5	0,88	0,65	20,5	11,5	0,6	0,37
Armature inductance	L_A / mH	141	78	3,0	1,7	69	35	1,2	0,85	58	30	1,3	0,65
Electr. time constant	T_A / ms	1,9	2,0	1,6	1,4	20	1,9	1,4	1,3	2,8	2,6	2,2	1,8
Friction torque	M_R / Nm	0,032	0,035	0,032	0,035	0,05	0,055	0,05	0,055	0,06	0,08	0,06	0,08
EMK-constant	$K_E / \frac{V}{1000 \text{ rpm}}$	61	44,8	8,9	6,6	66,5	47	9,0	7,5	67,5	50,5	9,9	7,4
Torque	$K_T / \frac{\text{Nm}}{A}$	0,583	0,427	0,085	0,063	0,635	0,45	0,086	0,072	0,646	0,483	0,095	0,071
Mass moment of inertia	J_d / kgm^2	0,089 x 10 ⁻³				0,14 x 10 ⁻³				0,27 x 10 ⁻³			
Mech. time constant	T_m / ms	18	19	22	26	11,5	12	16	17	12,8	13	17	19
Weight	kg	1,75				2,5				3,4			

		Motor size 53				Motor size 62				Motor size 63			
		160		24		160		24		160		24	
Nominal voltage	$U_N / V^{(1)}$												
Nominal speed	$n_N / \text{rpm}^{(1)}$	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000	2000	3000
Nominal torque	M_N / Nm	0,79	0,75	0,74	0,7	1,15	1,1	1,1	1,0	1,7	1,6	1,6	–
Rated output	P_N / W	165	235	155	220	240	350	230	315	355	500	335	–
Nominal current	I_{AN} / A	1,3	1,85	8,8	11,5	2,0	2,8	12,5	18	2,85	3,85	17,0	–
Form factor	$F_F^{(2)}$	1,05	1,05	1,05	1,05	1,05	1,05	1,05	1,05	1,05	1,05	1,05	–
Housing overtemperature	$\Delta v / K$	50	50	50	50	55	55	55	55	55	55	55	–
Therm. time constant	T_{th} / min	50	50	40	40	45	45	35	35	50	50	40	–
Max. perm. current	$I_{A \max} / A^{(3)}$	8,4	12,3	60	80	9,5	13,5	65	95	14,5	21	95	–
Max. torque	$M_{\max} / \text{Nm}$	4,3	4,2	4,3	4,1	4,9	4,8	5,1	4,9	7,8	7,9	8,0	–
Continuous-stall torque	M_O / Nm	1,0	1,0	1,0	1,0	1,25	1,25	1,25	1,25	1,8	1,8	1,8	–
Armature resistance (20 °C)	R_A / Ω	12,2	5,5	0,29	0,15	7,05	3,50	0,171	0,078	3,55	1,76	0,098	–
Terminal resistance	R_a / Ω	13,7	7,0	0,40	0,25	8,05	4,50	0,28	0,18	4,6	2,8	0,2	–
Armature inductance	L_A / mH	40	18	0,8	0,45	28	14	0,64	0,30	16	8	0,39	–
Electr. time constant	T_A / ms	2,9	2,6	2,0	1,8	3,4	3,1	2,3	1,7	3,5	2,9	2,0	–
Friction torque	M_R / Nm	0,06	0,08	0,06	0,08	0,09	0,11	0,09	0,11	0,12	0,13	0,12	–
EMK-constant	$K_E / \frac{V}{1000 \text{ rpm}}$	69,7	49,8	10,0	7,5	72	51	10,8	7,2	72,0	50,0	11,0	–
Torque	$K_T / \frac{\text{Nm}}{A}$	0,666	0,476	0,095	0,071	0,69	0,49	0,1	0,069	0,69	0,48	0,10	–
Mass moment of inertia	J_d / kgm^2	0,38 x 10 ⁻³				0,14 x 10 ⁻³				0,27 x 10 ⁻³			
Mech. time constant	T_m / ms	11,6	12,4	16	18	15	17	24	34	13,3	16,5	25,0	–
Weight	kg	4,1				6,8				8,3			

Tolerance acc. to VDE 0530, otherwise $\pm 10 \%$

1) Varying nominal data on request

2) The output power must be reduced correspondingly with larger AC components
 $P_2 = 1,05 / F_F \cdot P_N$ ($F_F = I_{A \text{ eff}} / I_{A \text{ arith}}$)

3) Value must not be exceeded, also at short notice, as otherwise the magnets are demagnetised, partially (valid with temperature $\geq 0 \text{ °C}$).

We reserve the right to make dimensional and design alterations.

Mode of operation	S1
Protection	IP 54/IP65
Method of cooling IEC 34-6	IC 40 (not ventilated)
ISO-class	F
Max. ambient temperature RT/°C	40

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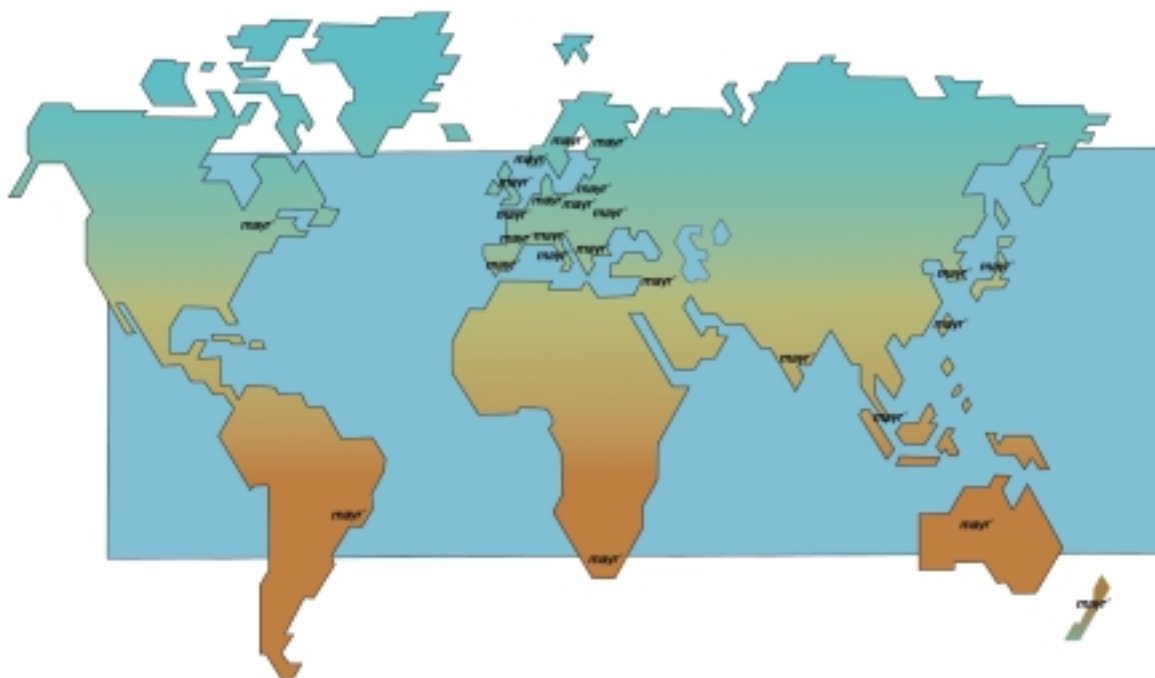
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Israel
Malaysia
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Philippines
Poland

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Slovakia
Slovenia
Spain
Sweden
Thailand
Turkey

Note:
If a country is not
shown, please refer
to headquarters or
our web site to be
advised of the
nearest responsible
agent.

mayr[®]
your reliable partner

Delivery Programme



Safety clutches/ torque limiters

- ☐ **EAS®-Compact®/EAS®-NC**
Positive, absolutely backlash-free torque limiter
- ☐ **EAS®-smartic®**
Economic torque limiters with fast assembly
- ☐ **EAS®-element clutch/EAS®-elements**
Load disconnecting protection for high torques
- ☐ **EAS®-axial**
Exact limitation of tensile and compressive forces
- ☐ **EAS®-Sp/EAS®-Sm/EAS®-Zr**
Residual torque free disconnecting torque limiter with ON/OFF function
- ☐ **ROBA®-slip hubs**
Load holding, friction type torque limiting clutch



Shaft couplings

- ☐ **smartflex®**
Perfect precision coupling for servo and stepper motors
- ☐ **ROBA®-ES**
Backlash-free and damping of vibration critical drives
- ☐ **ROBA®-DS/ROBA®-D**
Backlash-free, torsionally rigid all-steel coupling
- ☐ **EAS®-control-DS**
Low cost torque-measuring coupling



Electromagnetic brakes/clutches

- ☐ **ROBA-stop® Standard**
Multi-functionally all-round safety brake
- ☐ **ROBA-stop®-M motor brakes**
Robust, cost effective motor brake
- ☐ **ROBA-stop® high performance brake**
High duty „high-speed“ brake
- ☐ **ROBA-stop®-S**
Waterproof, robust monobloc brake
- ☐ **ROBA-stop®-Z/ROBA-stop®-silenzio®**
Double security elevator brake
- ☐ **ROBA®-diskstop®**
Compact quiet disk brake
- ☐ **ROBATIC®/ROBA®-quick/ROBA®-takt**
Energise to engage electromagnetic pole face clutches and brakes, CBU



Motion control, Servo Drives and Motors

- ☐ **primo®-motion control**
Modular automation control system for motion control and Soft-PLC applications
- ☐ **tendo®-DD4**
Digital servo drive for synchronous and asynchronous motors
- ☐ **tendo®-AC**
Robust, efficient synchronous servo motors
- ☐ **tendo®-PM**
Permanent-magnet D.C. motors



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