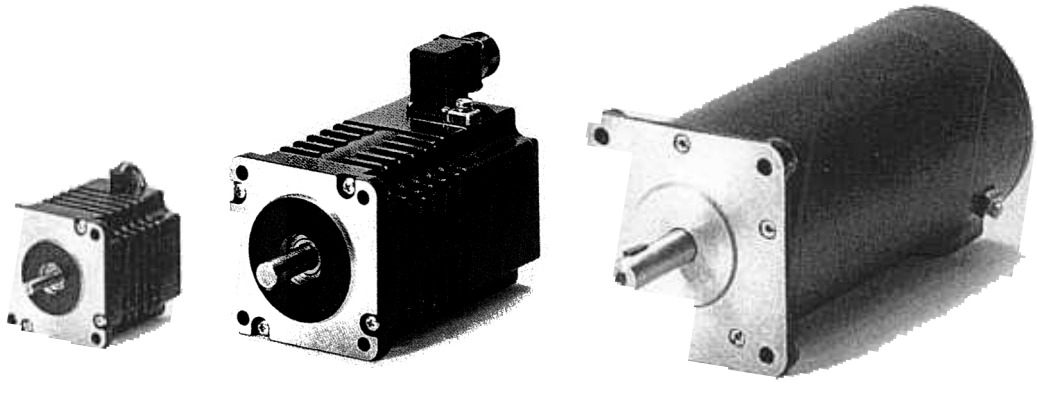
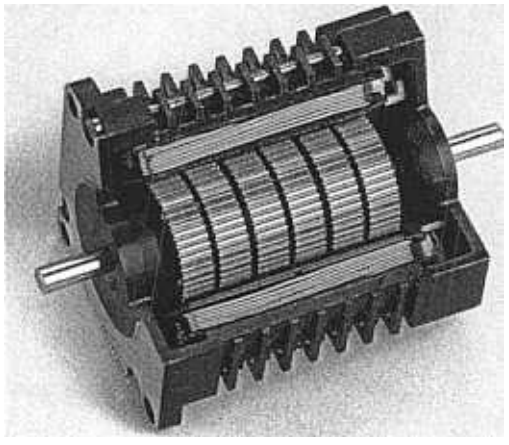
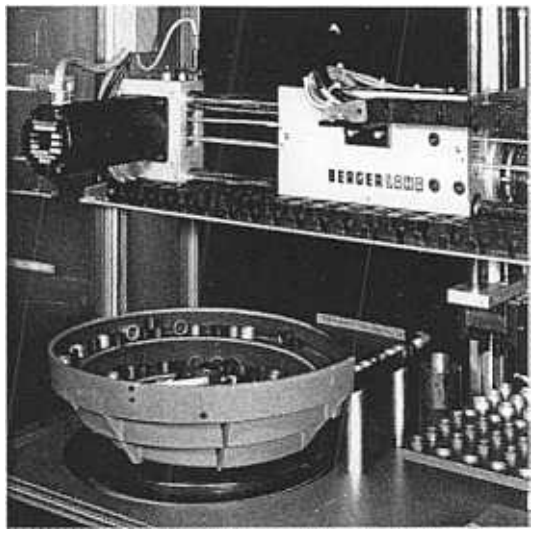
Berger Lahr – System Solutions







5-Phase Stepping Motors
with a 10 Stranded Wire Technology

BERGER LAHR

SIG

A member of the SIG group of companies

BERGER LAHR System Solutions

BERGER LAHR

Before you order

BERGER LAHR offers more than simply product information

- careful analyses of your particular tasks
- adaptation of the software to your solution
- comprehensive system consulting
- optimization of motor data.

This is what we consider comprehensive service to ensure that the solution we provide is your solution.

Product and application seminars

New technologies require the constant updating of your knowledge. The dialogue with our specialists at seminars provides you with the know-how, safety and support you need for the construction of your solution.

BERGER LAHR
has experience in your industry

We know your specific problems since we have been cooperating with specialists from all industries for many years. This background is just as important to us as our product knowledge.

After you have opted for a BERGER LAHR system

You are in good hands with BERGER LAHR

In all important industrial nations, our world-wide service organization is available to all our customers at any time - even years after the purchase. Our service technicians speak your language. They are not only familiar with our products but with your machines and equipment as well. They know what is important.

Service training

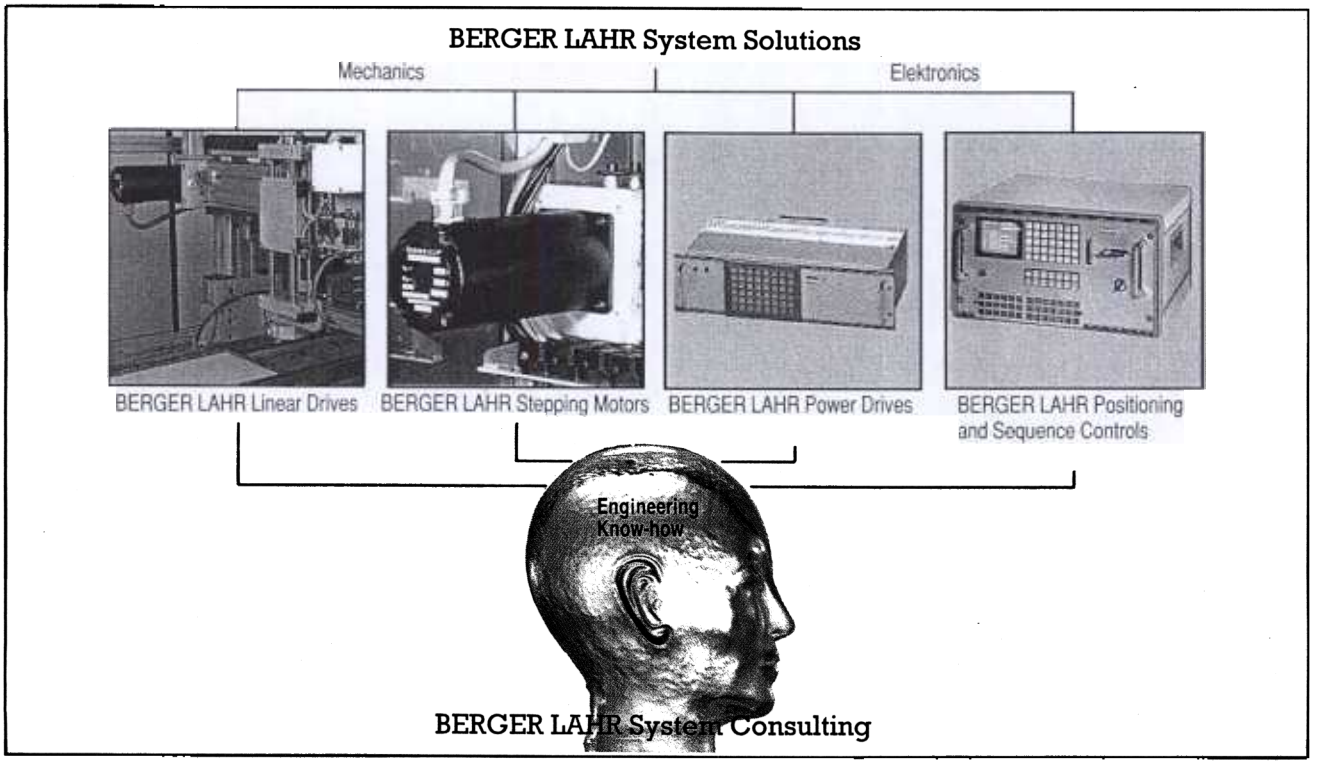
We train your staff so that they know exactly how our products work. We offer seminars, workshops and individual training, inhouse or at our premises. This training is so thorough that you can be sure that your employees are familiar with your new BERGER LAHR product and know how to safely operate it.

BERGER LAHR offers quality

One of our mottos is competitive edge through quality. We make a point of doing everything a little better than the others-something we take very seriously. We spend a great deal of time on quality control since we know just as well as you do: quality means reliability, durability and efficiency. Things that are worth the initial investment.

Take a close look at this catalogue

Again and again, you will notice that the BERGER LAHR products offer the decisive advantage in numerous details. Read through the descriptions and see for yourself. Please feel free to contact us with any question you may have. We will be glad to furnish you with additional information and help you find your optimum solution.



BRENDA GRAHAM

Contents

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Stepping Motors

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The typical property of the stepping motor is the step-by-step rotation of the motor shaft. A full motor shaft revolution is composed of an exactly defined number of individual steps. This is particularly advantageous in view of the requirement for direct processing of digital control signals. Thus, the stepping motor is the linking element between digital information and incremental mechanical movement.

Stepping motors are available in various designs. The motor type with permanently magnetized rotor is the most commonly used motor.

These motors offer the following advantages:

- high efficiency
- high torques at small sizes
- high self-holding moment when electrically not energized.

Positioning systems with stepping motors may be operated without feedback elements, i. e. as open oop control systems. They are reliable, maintenance-free and easy to handle. There is no need for complicated adjustment and balancing during set-up. Due to the simple mechanical construction, stepping motor systems are cost-effective both in terms of the initial investment and the actual operation.

Stepping motor system

Simple, cost-effective, robust, maintenance-free.
Power range up to approx. 1 kW.

Stepping motor with rotation monitoring

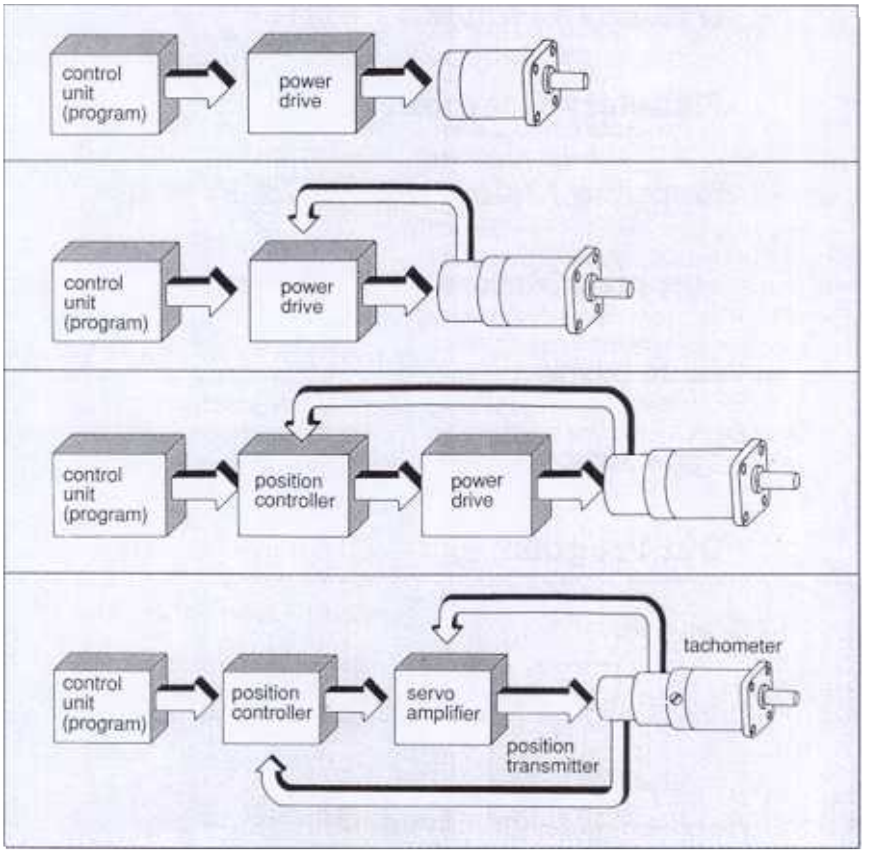
Simple, cost-effective, robust, maintenance-free.
Power range up to approx. 1 kW.

Controlled stepping motor system

Similar to stepping motor system, but with closed positioning loop and the characteristics of a servo system.

Servo system

Accurate, reliable, higher dynamics. Interesting and widely spread in higher power ranges.



Advantages of driving systems with stepping motors

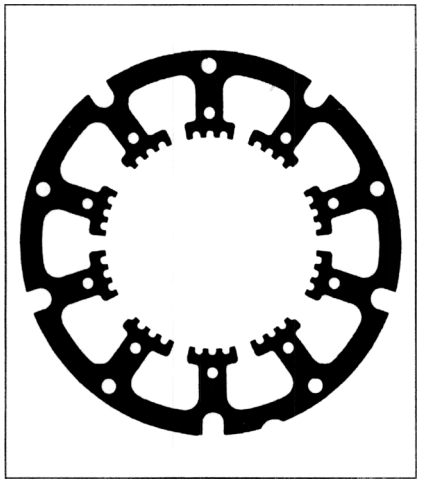
- Brushless system, i. e. maintenance-free.
- High torque at slow angle speeds, even at individual steps.
- High holding moment in energized rest state.
- Accurate positioning without feedback through isomorphous step/control pulse ratio.
- Cost-effective due to simple mechanical construction.

The 5-phase stepping motor was developed for high-precision positioning systems. As compared to other stepping motor types, the 5-phase motor has a considerably improved operating behaviour. Its main features and advantages are described on the following pages.

Design of 5-phase stepping motors

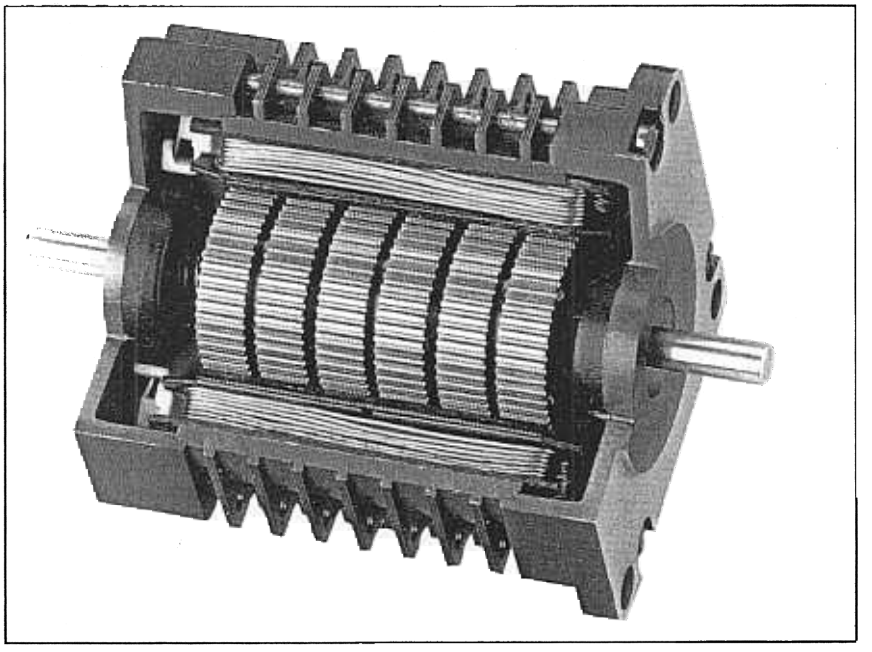
Like many 2-phase stepping motors, BERGER LAHR 5-phase stepping motors are designed as hybrid stepping motors and work on the basis of the homopolar principle.

The 5 windings of the stator are distributed over 10 main poles,



Cross section of stator packet

each of which is subdivided into 4 teeth by means of 3 grooves. Between 2 toothed pole wheels with 50 teeth each, the rotor contains a permanent magnet which is magnetized axially. This arrangement yields 500 full steps or 1,000 half steps per revolution, depending on the type of operation. This corresponds to step angles of 0.72° or 0.36°, respectively. The cross section of the stator shows the design principle. Motors of this type have excellent dynamic properties and are suitable for applications in which 2-phase stepping motors cannot be used.



View of VRDM motor

Function

Current flowing through the winding generates a magnetic field at the stator poles. As opposed to the synchronous motor, the pole pairs are individually excited with DC current.

When current is applied to a stator winding, the rotor is affected by the torque until the stator and rotor teeth face each other at the excited stator poles. In this position, the rotor is magnetically latched. When current is applied to the next stator winding, the rotor moves by 1 step. With each step pulse, the magnetic field of the stator and thus the rotor turn by an additional step. In practice, not only a single but 4 or 5 stator windings are energized simultaneously in order to increase the torque. The required switching sequence will be explained on the following page.

Advantages of 5-phase stepping motors

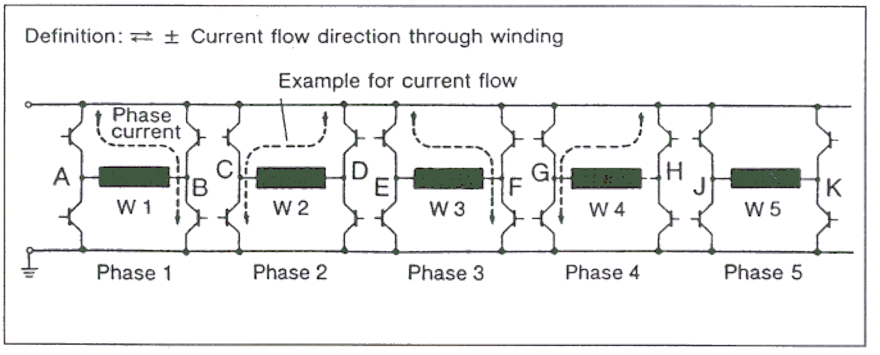
- Step angle 0.72°/0.36° (full step/ half step)
- High resolution of 500 or 1,000 steps per revolution
- High start/stop frequencies
- Small step angle tolerance
- High holding moment
- High system dampling due to precise electrical input (extra damping elements are not required)
- Almost identical holding moment in full step and half step mode
- Step frequency up to 100,000 steps/s (6,000 rpm)
- Torque range from approx. 30 to 1100 Ncm

Circuit Types for 5-phase stepping motors

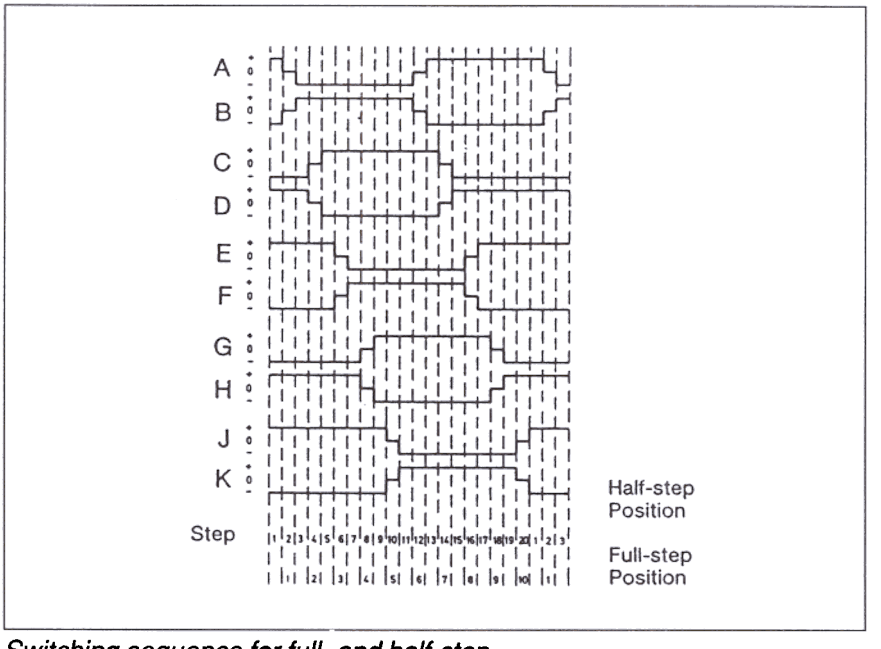
The BERGER LAHR power drives operate in the bipolar mode, using the so-called H-bridge, one for each phase. We control the current flow from the start to the end of the winding or from the end to the start of the winding, or switch off the current through the winding (see schematic diagram). This circuit arrangement allows the activation of the different phase combinations and thus the realization of full and half step. This operation yields 500 or 1,000 steps per revolution. In full step operation 4 phases are activated for each step, whereas in half step operation 4 or 5 phases are switched alternatively from step to step. The sequence of activated phase combinations (switching sequence) is shown in the schematic diagram "Switching sequence in full- and half-step operation".

In addition to the full- and half-step operation, the so-called microstep operation can also be realized. With the DIVI-STEP Control Drive from BERGER LAHR the individual steps are subdivided into 10 micro-steps. In this case, the current flowing through the windings is not only reversed, but also varied in amplitude, giving a resolution of 10,000 steps per revolution.

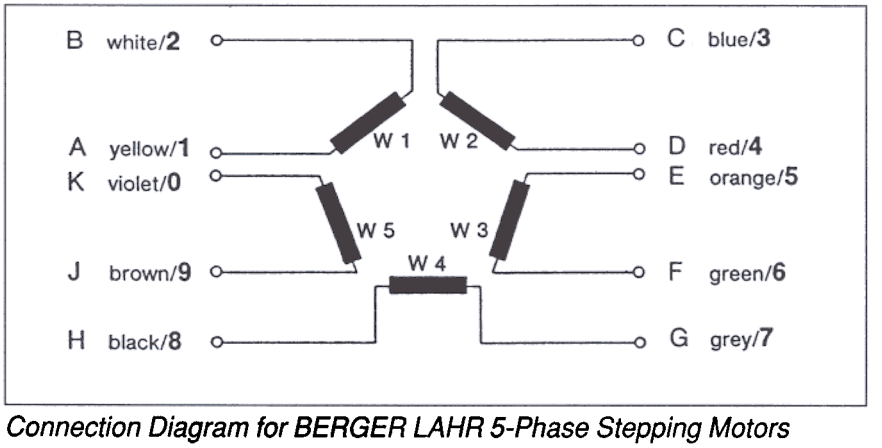
The letters in the connection diagram correspond to the schematic diagram (5H-drive circuit for 5-phase stepping motors) shown above.



The 5H-Switch Circuit for 5-Phase Stepping Motors



Switching sequence for full- and half-step

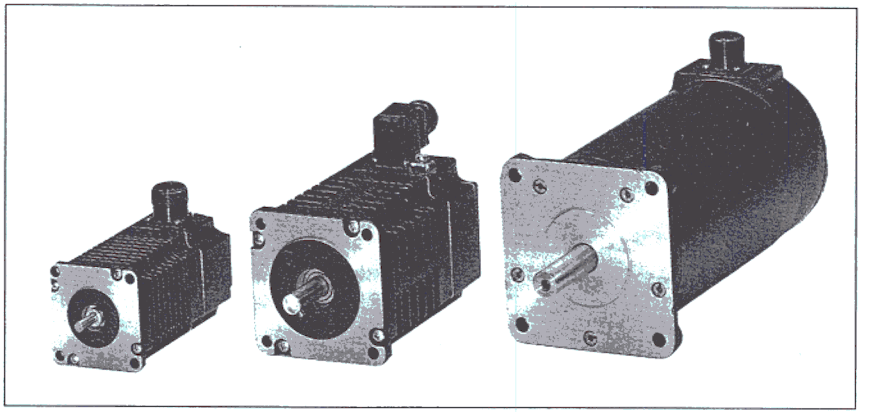


Connection Diagram for BERGER LAHR 5-Phase Stepping Motors

Important: Never dismantle 5-phase stepping motors as the permanently magnetized rotor would lose part of its magnetic power. A loss of motor performance would inevitably result!

The BERGER LAHR 5-phase stepping motor programme

The BERGER LAHR 5-phase stepping motors are available in three sizes, relating to the approximate motor diameter (60 mm, 90 mm, 110 mm). Motors of the same size also differ in length. Technical differences within the single motor types are listed in the Data Specifications on this page.



Examples from each of the three motor Sizes quoted from left to right: VRDM 568/50 (Motor Size 60); VRDM 5910/50 (Motor Size 90); RDM 51117/50 (Motor Size 110)

The size 60 and 90 motors can be delivered with:

- Leads
- Terminal box
- Connector box

Size 110 motors are available with terminal box and connector box. They have one shaft end, but they are also available with an optional second shaft end.

Please refer to pages 22ff for motor versions with planetary gearbox, attached holding brake and encoder.

The following specifications apply to all motors:

1) Test voltage according to VDE 0530.
2) Insulation class F for type VRDM motors; Insulation class B for type RDM motors.
3) Protection DIN VDE 0530 T5 (IEC 34-5) IP 41 at the shaft exit.
4) Protection DIN VDE 0530 T5 (IEC 34-5) (IP 41) IP 56 on the closed motor housing (not at the front shaft exit) for all motor sizes 60, 90, 110 with terminal box using a corresponding strain relief or for motors with a plug connection where the plug is secured by screws.
5) Run-out and perpendicularity as per DIN 42955 N.

Size			VRDM 60							VRDM 90							RDM 110	
Motor type			564		566			568		597			5910		5913			
			LN.	LH.	LT.	LN.	LH.	LN.	LH.	LN.	LH.	LS.	LN.	LH.	LT.	LN.		
Number of steps (FS/HS)	z		1,000/500							1,000/500								
Step angle (FS/HS)	α	°								0.36°/0.72°							0.36	
max. torque	Mm	Ncm	30					90		140			280		420		650	
Holding moment	M	Ncm	33		66			99		155			310		465			1,100
Moment of inertia of rotor	J	kgcm²	0.08		0.16			0.24		0.6			1.2		1.8			11.5
Positioning error per step	$\Delta\alpha_s$	°	3′										3′				3′	
max. start frequency (FS/HS)	f_{Aom}	kHz	8.0/4.0							6.0/3.0							4.4/2.2	
Nominal current/winding	Iw	A	0.95	1.50	0.95	1.20	1.90	1.50	2.40	1.40	2.00	2.80	2.00	2.80	2.00	2.80	3.60	4.00
Resistance/winding	Rw	Ω	1.70	0.75	2.80	1.80	0.80	1.60	0.70	1.70	0.90	0.43	1.4	0.7	2.00	1.0	0.55	0.57
Time constant of current rise	τ	ms	~4		~5			~6					~10		~11		~15	~20
Max. shaft load* axial		N	~7							~30							~60	
Max. shaft load* radial		N	~20							~100							~200	
Weight: approx.: Leads	G	kg	0.45		0.70			0.95		1.6			2.6		3.8			
Weight: approx.: other version	G	kg	0.53		0.78			1.03		1.9			3.0		4.1		9.7	12.5

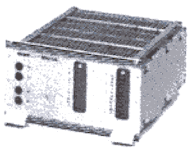
* at half shaft length (from mounting flage), please inquire about different loads

All information given in the above table (sizes, dimensions, descriptions and explanations) are in accordance with the DIN 42021 terminology. Please refer to the chapter "Parameters and characteristics of stepping motors" on the following pages.

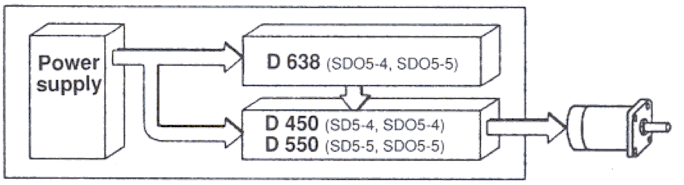
5-Phase Stepping Motor Systems

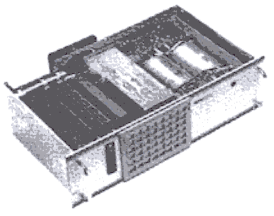
BERGER LAHR

Drive control Cards in BERGER LAHR-Units

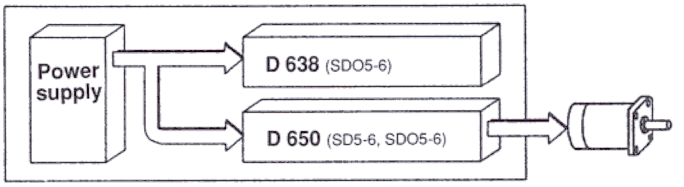


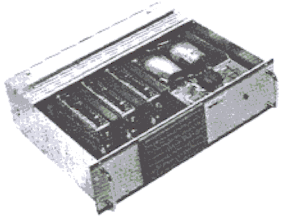
SD5-4
SD5-5
SDO5-4
SDO5-5



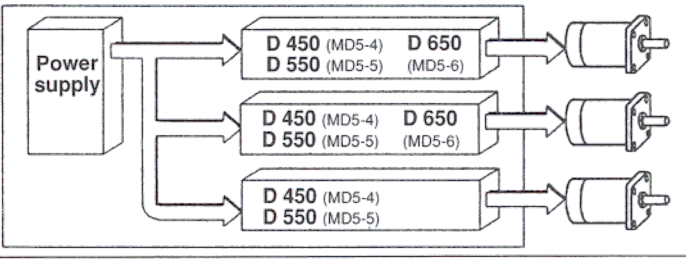


SD5-6
SDO5-6





MD 5-4
MD 5-5
MD 5-6



Recommended BERGER LAHR 5-Phase Stepping Motor and Power Drive combinations

The numbers in the symbols correspond to the numbers of the characteristic curves illustrated on the following pages.

△ Especially cost-effective combination for use mainly in the lower speed range or in start-stop operation with average system requirements.

○ Standard combination for exacting requirements of the system dynamic properties in the higher speed range. Continuos operation, normal heat dissipation.

□ Combination for the highest requirements of the system dynamic properies. To be used only for short-duty cycles with excellent heat dissipation.

Stepping Motor		Devices with Power Drive .			
		D225 U = 35 V $I_{max.}$= 1 A	D450 U = 35 V $I_{max.}$= 2.8 A	D550 U = 70 V $I_{max.}$= 2.8 A	D650 U = 130 V $I_{max.}$= 5 A
Size 60	VRDM 564 LN	△ 1	△ 2	□ 3	
	VRDM 564 LH		○ 4		
	VRDM 566 LN		△ 5	□ 6	
	VRDM 566 LT	△ 7			
	VRDM 566 LH		○ 8		
	VRDM 568 LN		△ 9	□ 10	
	VRDM 568 LH		○ 11		
Size 90	VRDM 597 LN			○ 12	
	VRDM 597 LH			○ 13	
	VRDM 597 LS		○ 14		
	VRDM 5910 LN			○ 15	
	VRDM 5910 LH		○ 16	□ 17	
	VRDM 5913 LN		△ 18	○ 19	
	VRDM 5913 LT			○ 20	
Size 110	RDM 51117 LT				○ 21
					○ 22

The table contains recommended combinations of 5-Phase Stepping Motors and BERGER LAHR Power Drives. Further combinations for special application requirements can be realized, but should be discussed with your BERGER LAHR technical consultant.

Parameters and Characteristics of Stepping Motors

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Parameters and characteristics of stepping motors

In order to rate and select a stepping motor, you need certain information in the form of parameters and characteristics (curves) as per (DIN 42021). Each combination of a stepping motor with the adequate power drive has it's specific characteristic shown in curves. For all combinations shown in the table (see page 8) you'll find overview curves on page 11 and 12 and detailed curves on page 13 to 18.

The following information will describe the use of these curves to make it easier for you to fully understand the meanings and implications.

The terminology printed in *italics* corresponds to DIN 42021 and is also used in the specification table on page 7.

Basic terms

A *step* is the process during which the motor shaft turns by the *step angle* α_s, caused by a control pulse. In each step position the rotor is arrested due to the electrical excitation (DC) of the windings, unless the holding moment M_H is exceeded at the motor shaft. There are two operating modes, *full-step* and *half-step operation*, The step-angles and thus the number of steps per revolution are different in these modes.

The criterion for the quality of the constructive design is the systematic angle tolerance (positioning error) per step $\Delta\alpha_s$. This value specifies by how many angle minutes a step may deviate from the nominal step angle.

With a continuous sequence of control pulses and a control frequency f_s, the motor shaft will also move by a sequence of steps with the (same) step frequency f_z. When a certain control frequency is reached (depending on the type of motor and the mechanical load), this step-by-step movement turns into continuous rotation. The following is then true of the speed of the motor:

$$n=\alpha/360° \cdot f_z \quad 60\ \text{min}^{-1}\ (f_z[\text{Hz}])$$

If you apply the load moment M_L to the rotating motor shaft, the motor will continue to be synchronous with the control frequency, unless this load moment exceeds a specific limit, the maximum operating torque M_{Bm}.
In this case, the motor can no longer follow the control frequency, i. e. it loses steps. Control frequency and step frequency are no longer identical. This will not happen if you select the motor suitable to your task.

Torque characteristics

Apart from the motor size, the maximum operating torque of a stepping motor also depends on the type of electrical drive and, particularly, the step frequency. This relationship is represented by means of a characteristic for each stepping motor system. The *maximum operating torque* M_{Bm} is available at low step frequencies: the higher the frequency, the lower the maximum operating torque. Trouble-free operation of a stepping motor is impossible at frequencies higher than the *maximum operating frequency* f_{BOM}.

The operating range determined by the maximum operating torque is divided into the *starting range* and the *acceleration range*. In the starting range, the motor can follow an abruptly starting or stopping control frequency without step errors. In the acceleration range, the control frequency must be changed continuously (frequency ramp) in order to prevent the motor from "losing steps".

The starting range is limited by the curve for the start frequency f_{Am} (start/stop-characteristic): Without load the motor can start at the *maximum start frequency* f_{AOM}, whereas the start frequency decreases with increasing load.

Influence of the mass moment of inertia of the load

The starting range also depends on the *mass moment of inertia* J_L effective at the motor shaft. As J_L increases, the start/stop characteristic indicates lower frequencies. A further motor characteristic represents this interdependency. This curve shows the relationship between the maximum start frequency and the moment of inertia of the load. If you have load inertia and load moment at the same time and want to determine the maximum start frequency, you must shift the start/stop-characteristic in the torque diagram in parallel to the left until the maximum start frequency corresponds to that determined in the J_L diagram (see illustration on next page).

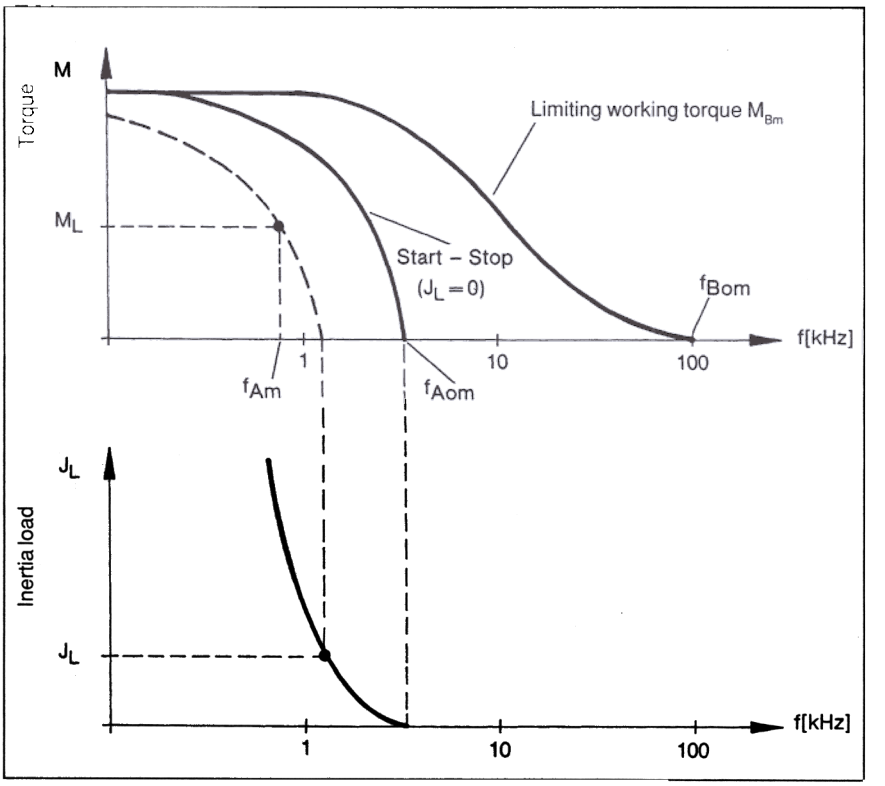
Parameters and Characteristics of Stepping Motors

BERGER LAHR

Structure and elements of detail characteristics

The illustration at the right shows a typical detail characteristic for a 5-phase stepping motor.
The physical parameters used are listed below:

M_{BM} = Maximum operating torque
M_L = Load moment
M_H = Holding moment
f_{AM} = Start frequency
f_{Aom} = Maximum start frequency
f_{Bom} = Maximum operating frequency
J_L = Moment of inertia of the load



Structure and elements of detail characteristics

General Characteristics

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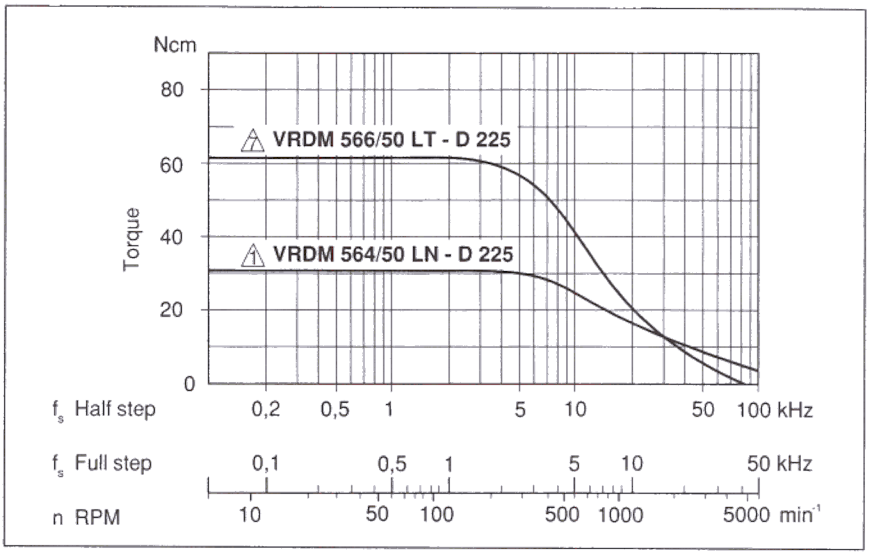
The general characteristics are provided to let you preselect a stepping motor positioning system in terms of the torque requirements.

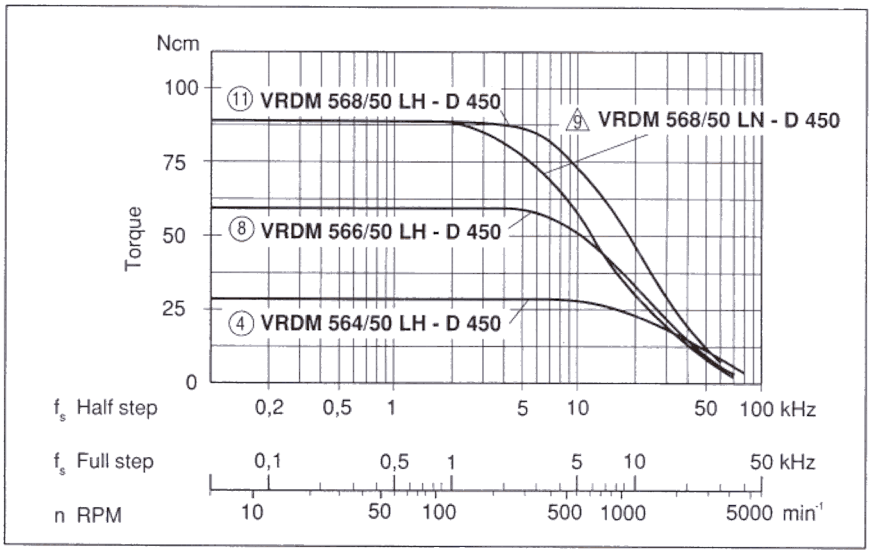
Power drive D 225 and 5-phase stepping motors, Size 60:

VRDM 564 LN
VRDM 566 LT



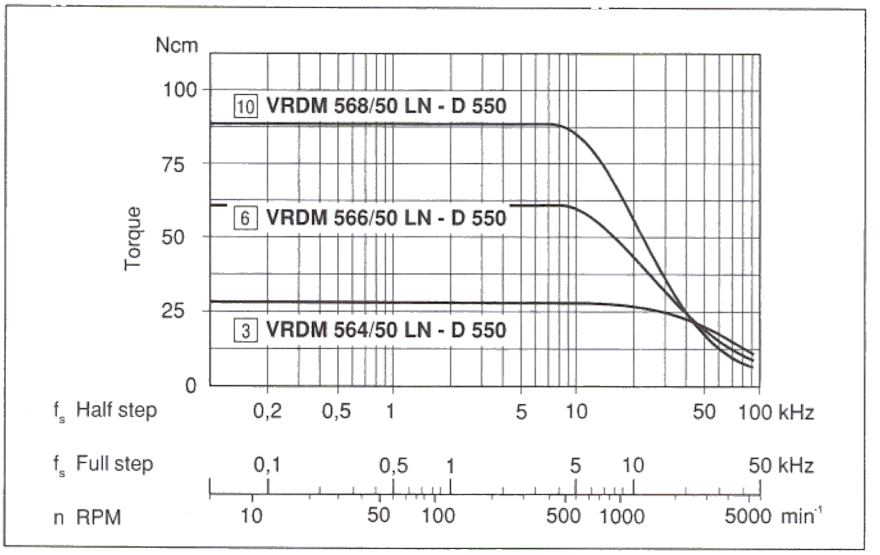
Power drive D 450 and 5-phase stepping motors, Size 60:

VRDM 564 LH
VRDM 566 LH
VRDM 568 LH
VRDM 568 LN



Power drive D 550 and 5-phase stepping motors, Size 60:

VRDM 564 LN
VRDM 566 LN
VRDM 568 LN

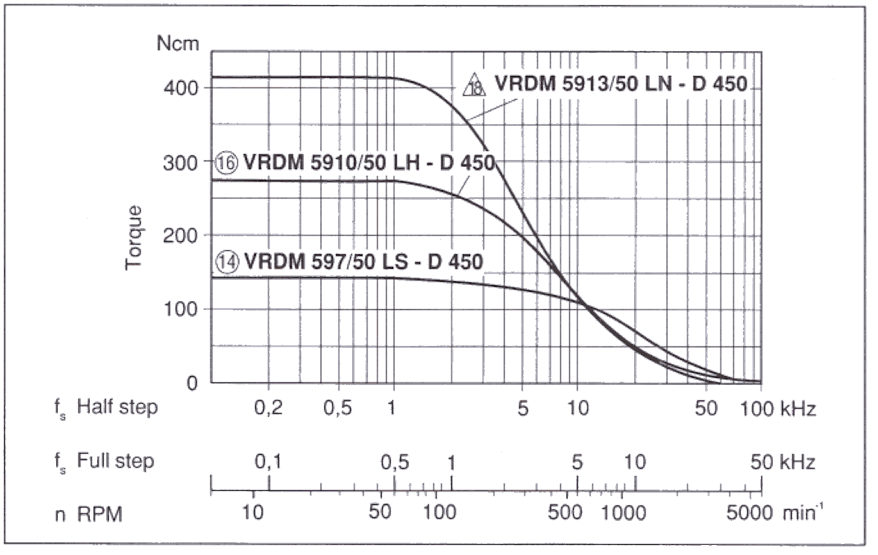


General Characteristics

BERGER LAHR

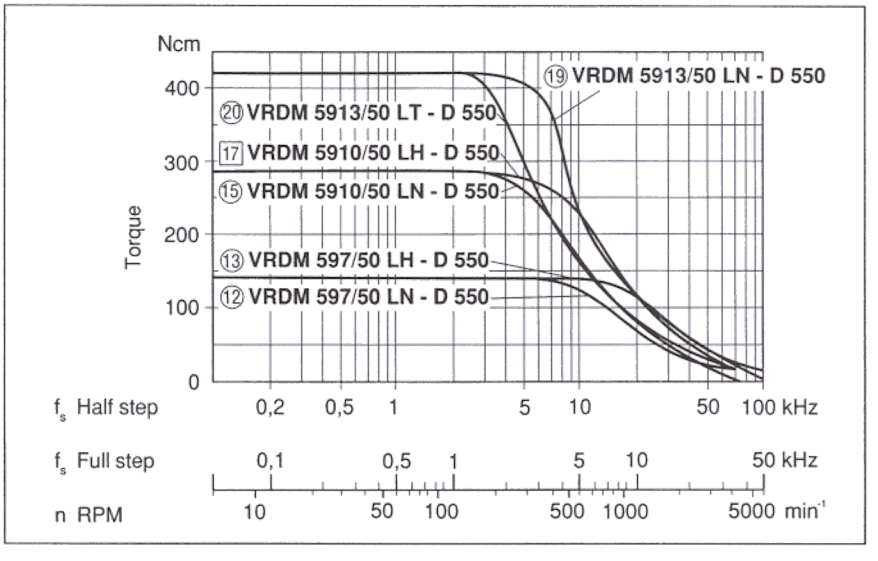
Power drive D 450
and 5-phase stepping motors,
Size 90:

VRDM 957 LS
VRDM 5910 LH
VRDM 5913 LN



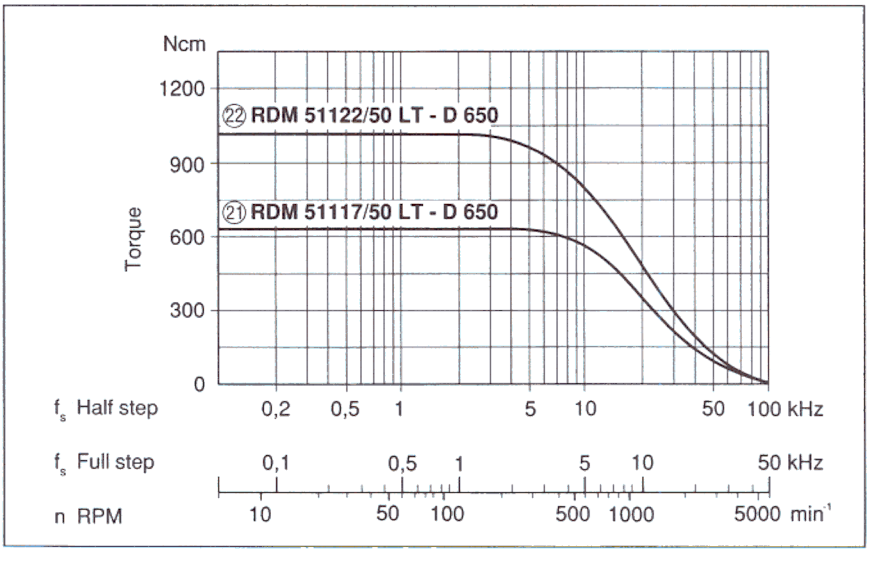
Power drive D 550
and 5-phase stepping motors,
Size 90:

VRDM 957 LN
VRDM 957 LH
VRDM 5910 LN
VRDM 5910 LH
VRDM 5913 LT
VRDM 5913 LN



Power drive D 650
and 5-phase stepping motors,
Size 110:

RDM 51117 LT
RDM 51122 LT



Detailed Characteristic Curves

BERGER LAHR

All characteristic curves are given for constant current operation. They refer to the BERGER LAHR controllers with the respective power drives D 225, D 450, D 550 and D 650 as shown in the overview on page 8. Apart from the motor type and the power drive, the nominal winding current and the chopper voltage are indicated with each of the following characteristic curves:

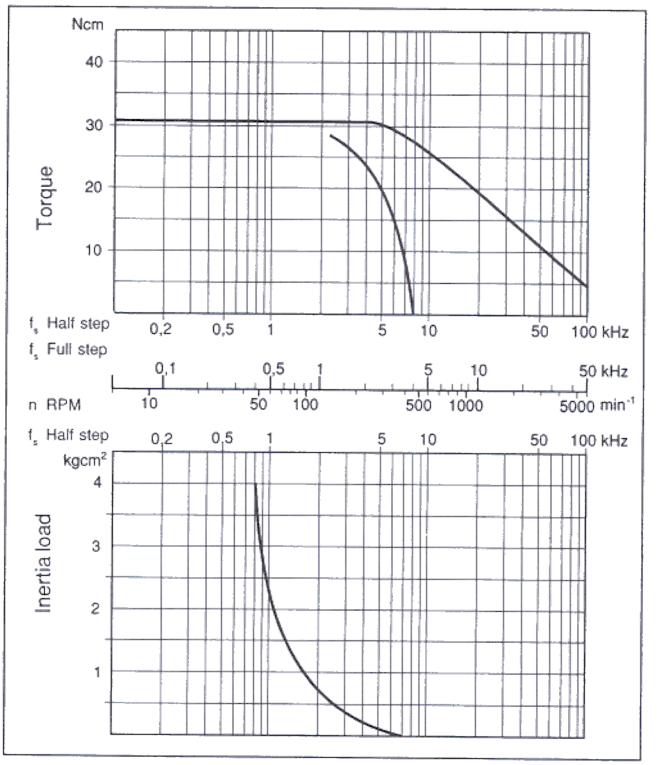
Torque-Stepping frequency characteristic
(characteristic curve of the limiting operation torque)

Start/stop frequency characteristic
(stepping frequency at which the motor can start at a given load)

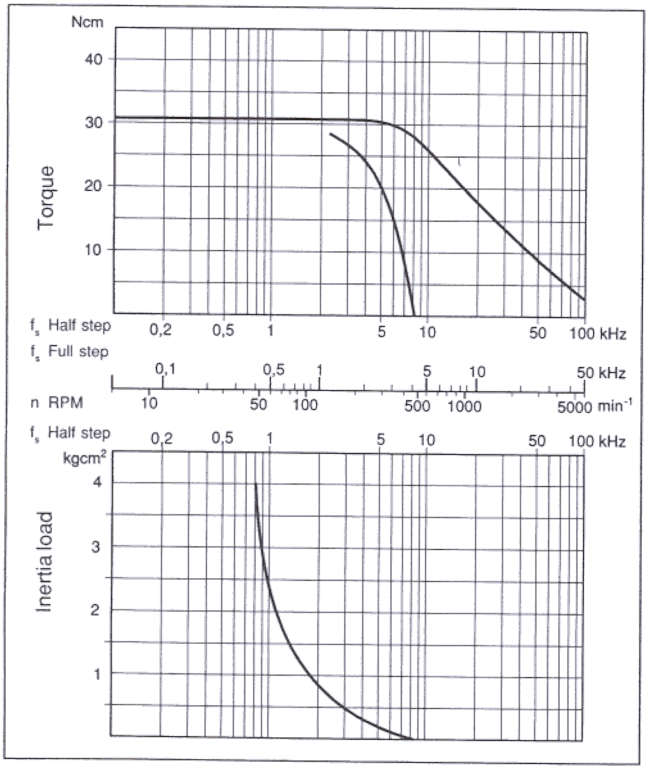
Permissible load torque or inertia in start/stop operation (limiting start frequency dependent on the mass moment of inertia of the load)

More detailed information on the meaning and use of the characteristic curves on page 9 and 10.
The characteristic curves are valid for both, the full and half step operation. Reading of values with the help of the cooresponding frequency scale.

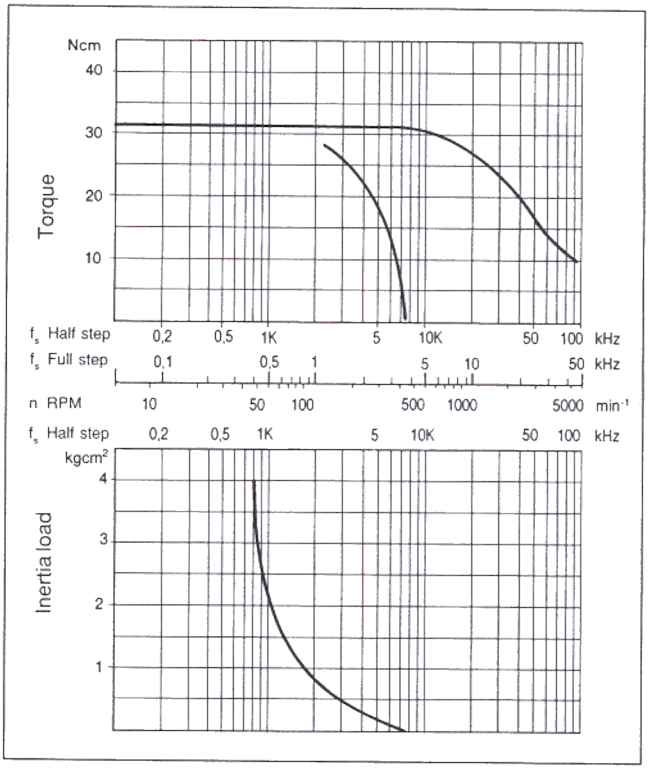
The basic for the calculations carried out to be able to select the appropriate stepping motor for your drive tasks can be found in our documentation no. 265 "Formulas & Calculations for Optimum Selection of a Stepping Motor".



5-Phase Stepping Motor **VRDM 564/50 LN** △ 2
Power drive **D 450**, I_W/U_{ch} 0.95 A / 35 V



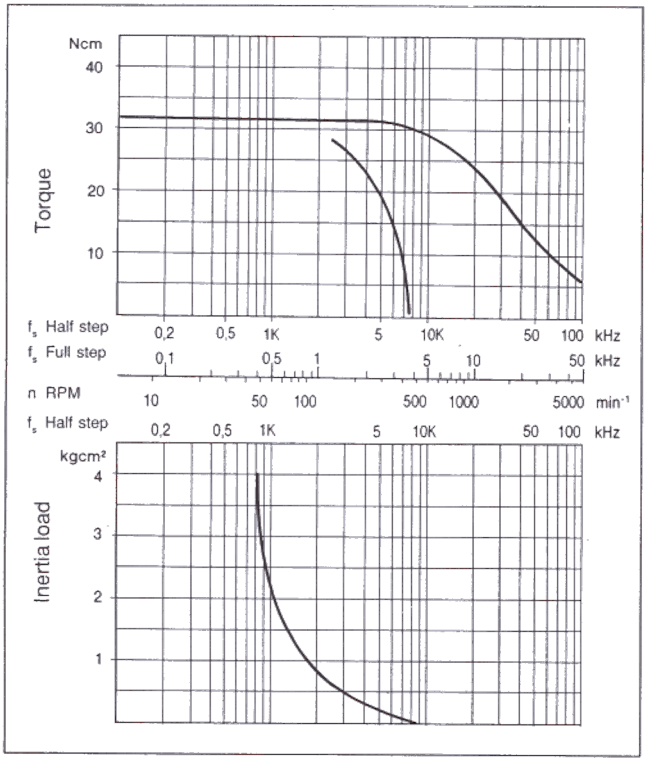
5-Phase Stepping Motor **VRDM 564/50 LN** △
Power drive **D 225**, I_W/U_{ch} 0.95 A / 35 V



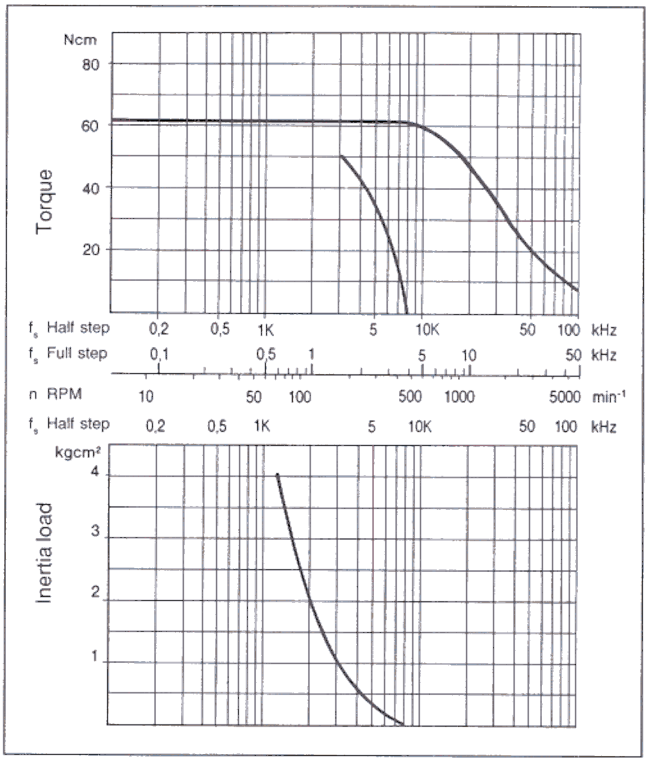
5-Phase Stepping Motor **VRDM 564/50 LN** □ 3
Power drive **D 550**, I_W/U_{ch} 0.95 A / 70 V

Detailed Characteristic Curves

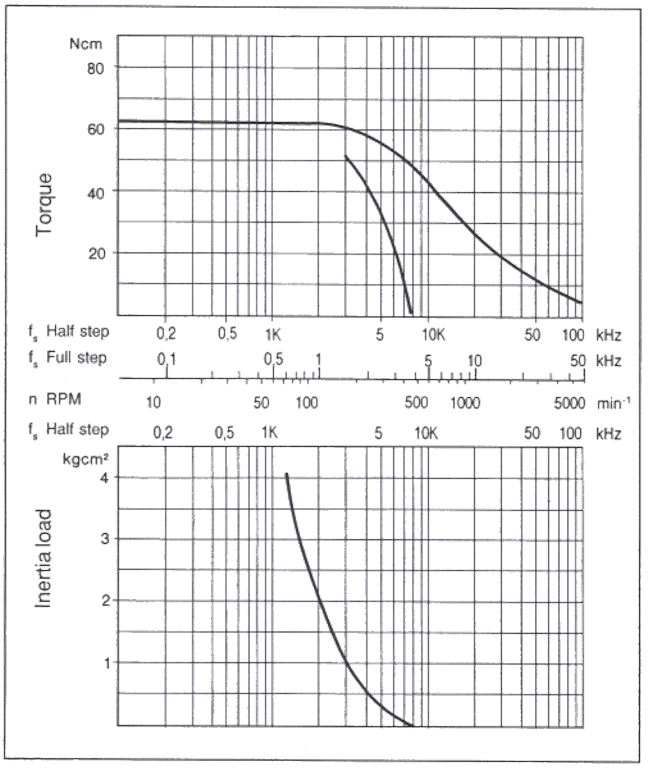
BERGER LAHR



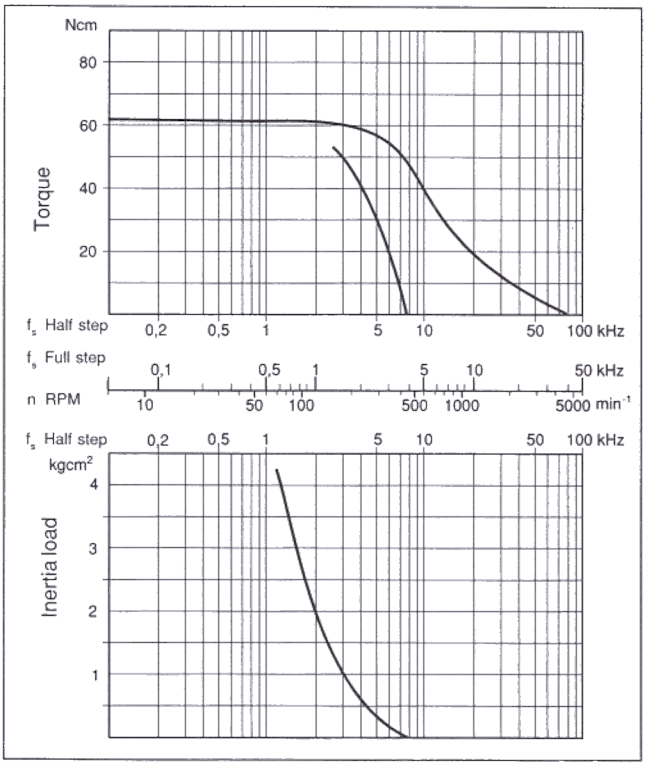
5-Phase Stepping Motor **VRDM 564/50 LH** ○ 4
Power drive **D 450**, I_W/U_{ch} 1.5 A / 35 V



5-Phase Stepping Motor **VRDM 566/50 LN** □ 6
Power drive **D 550**, I_W/U_{ch} 1.2 A / 70 V



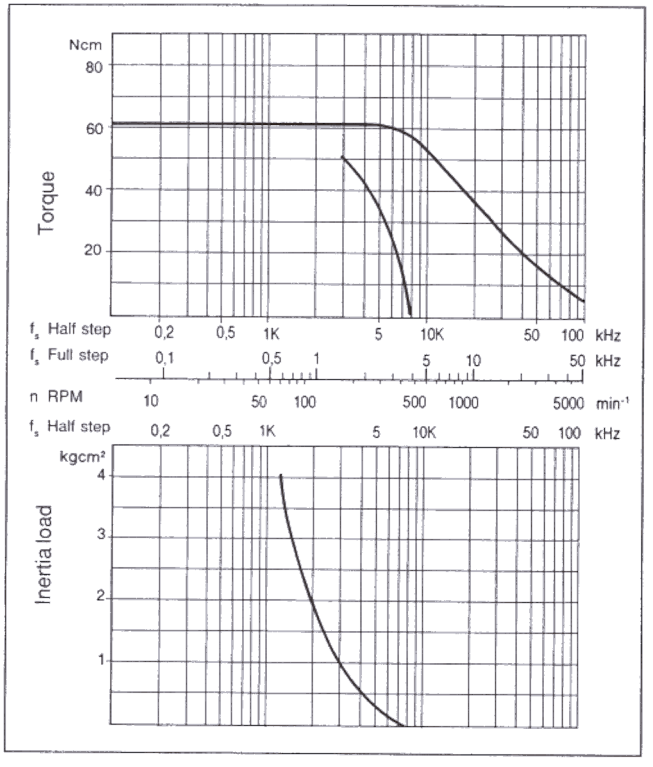
5-Phase Stepping Motor **VRDM 566/50 LN** △ 5
Power drive **D 450**, I_W/U_{ch} 1.2 A / 35 V



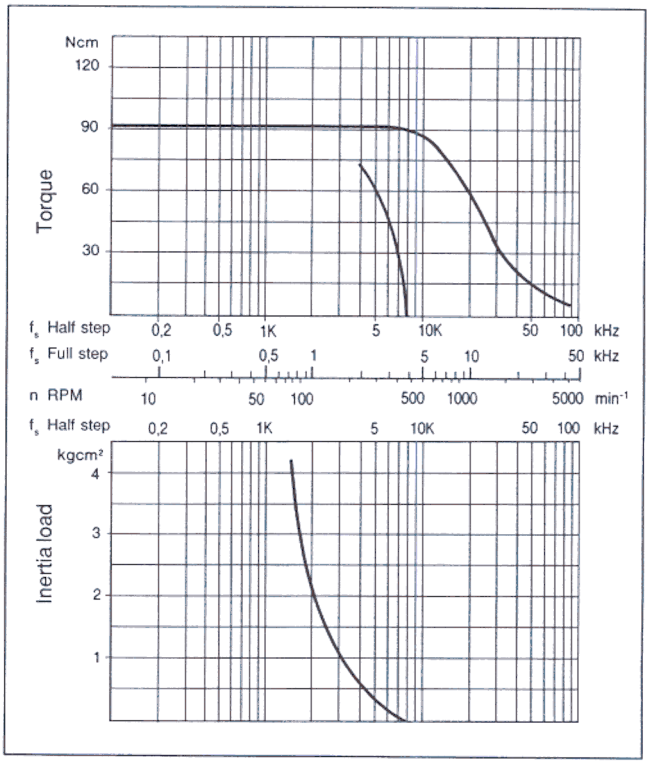
5-Phase Stepping Motor **VRDM 566/50 LT** △ 7
Power drive **D 225**, I_W/U_{ch} 0.95 A / 35 V

Detailed Characteristic Curves

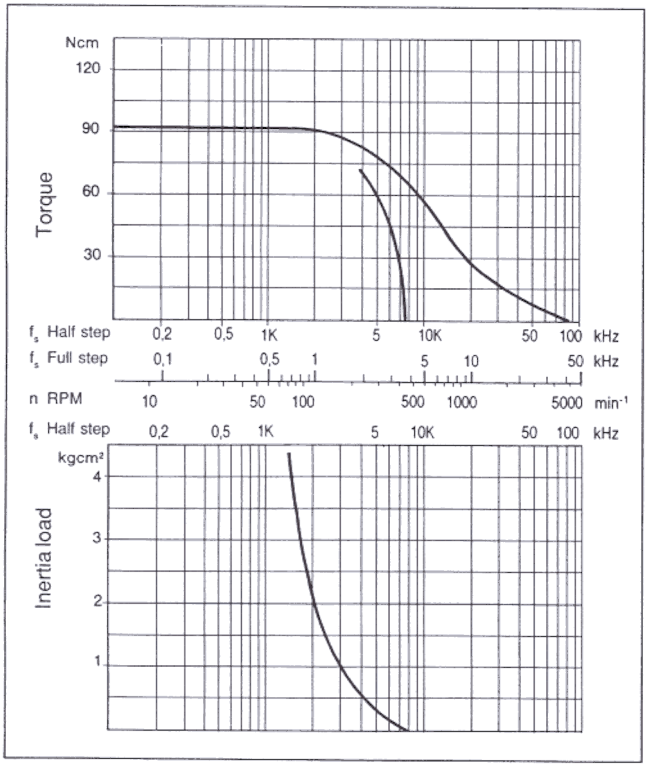
BERGER LAHR



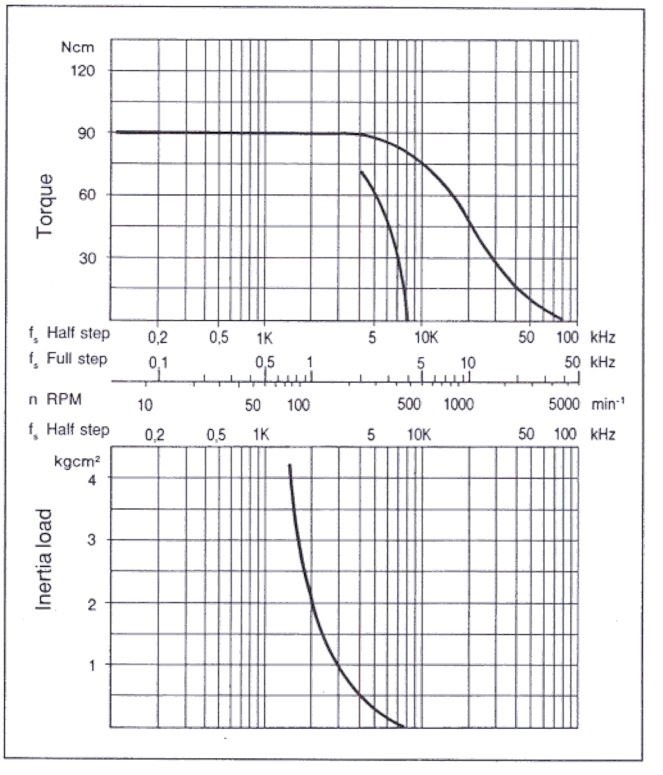
5-Phase Stepping Motor **VRDM 566/50 LH** ○ 8
Power drive **D 450**, I_W/U_{ch} 1.9 A / 35 V



5-Phase Stepping Motor **VRDM 568/50 LN** □ 10
Power drive **D 550**, I_W/U_{ch} 1.5 A / 70 V



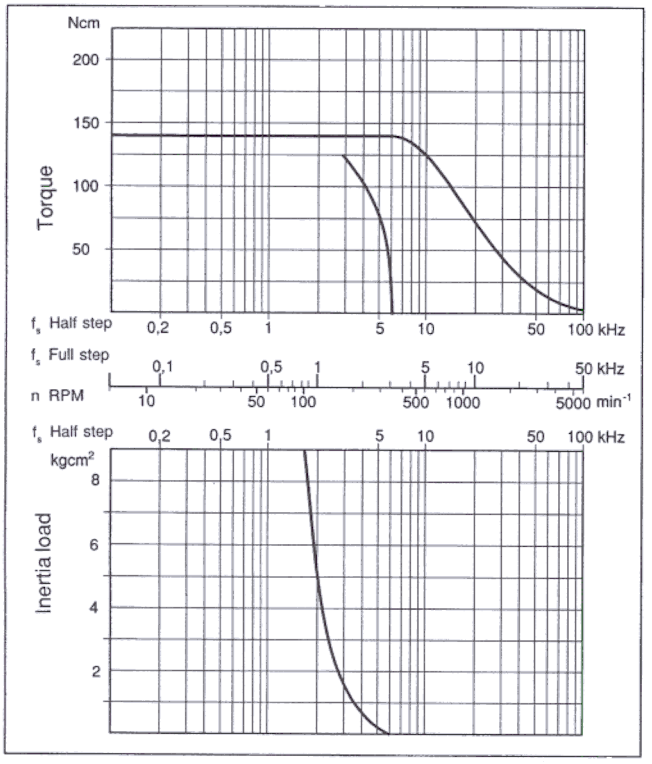
5-Phase Stepping Motor **VRDM 568/50 LN** △ 9
Power drive **D 450**, I_W/U_{ch} 1.5 A / 35 V



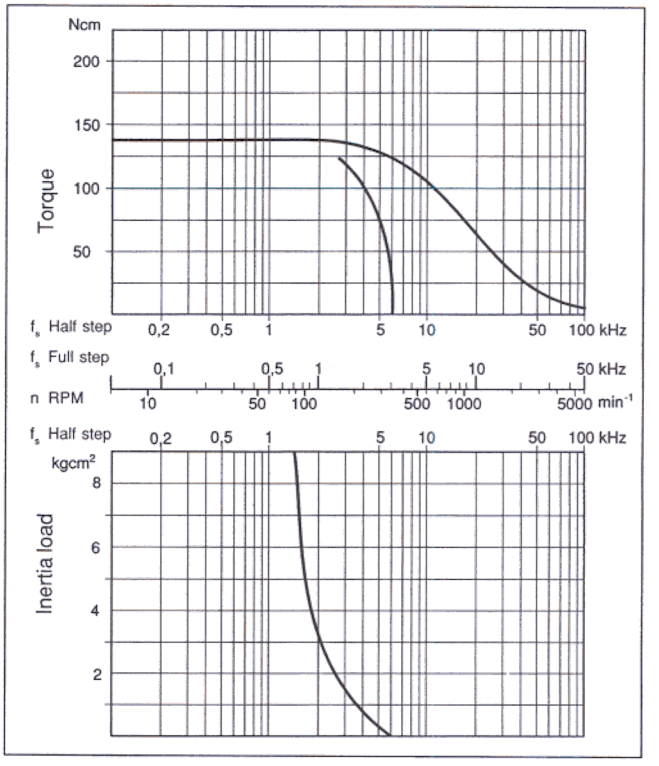
5-Phase Stepping Motor **VRDM 568/50 LH** ○11
Power drive **D 450**, I_W/U_{ch} 2.4 A / 35 V

Detailed Characteristic Curves

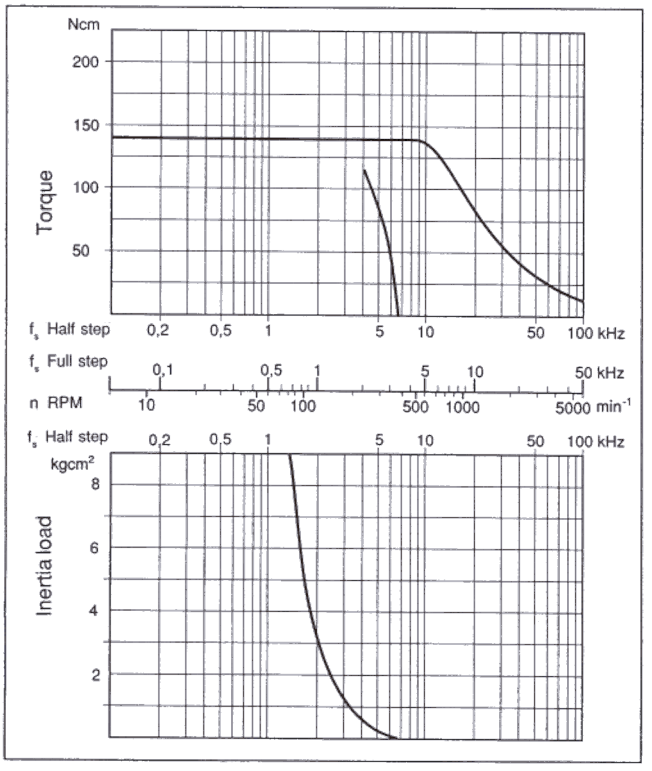
BERGER LAHR



5-Phase Stepping Motor **VRDM 597/50 LN** ○ 12
Power drive **D 550**, I_W/U_{ch} 1.45 A / 70 V



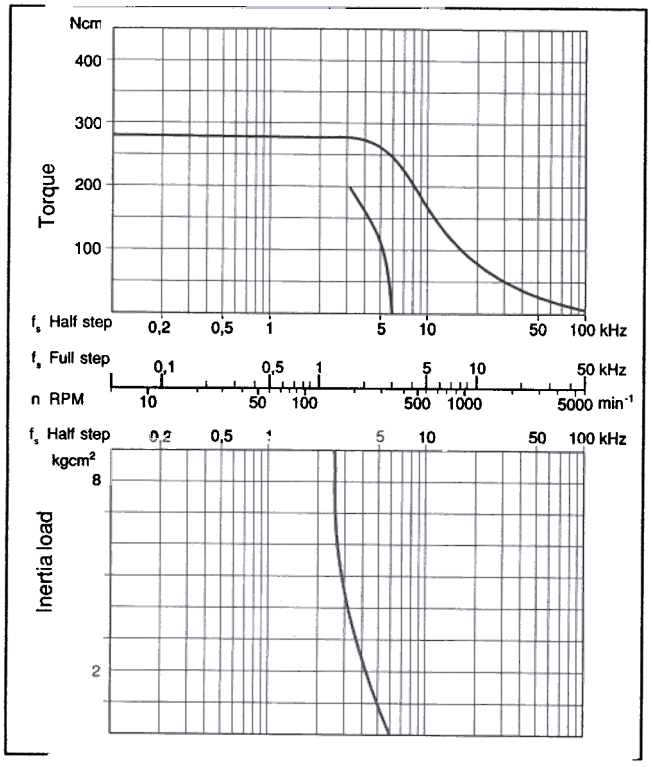
5-Phase Stepping Motor **VRDM 597/50 LS** ○14
Power drive **D 450**, I_W/U_{ch} 2.8 A / 35 V



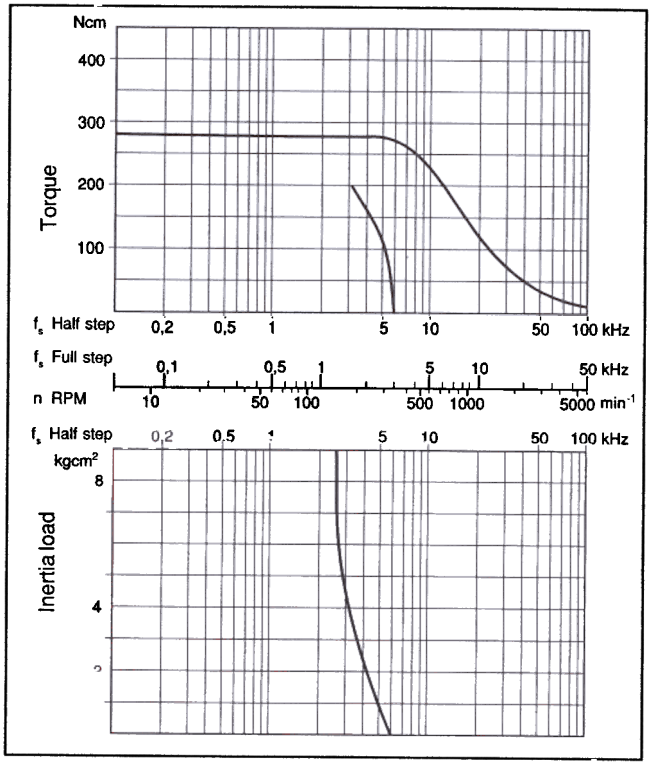
5-Phase Stepping Motor **VRDM 597/50 LH** ○13
Power drive **D 550**, I_W/U_{ch} 2.05 A / 70 V

Detailed Characteristic Curves

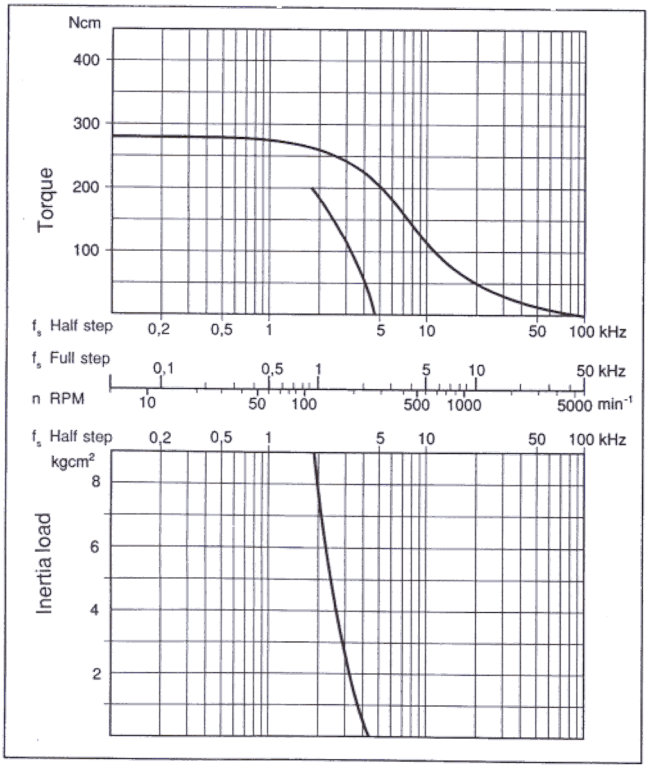
BERGER LAHR



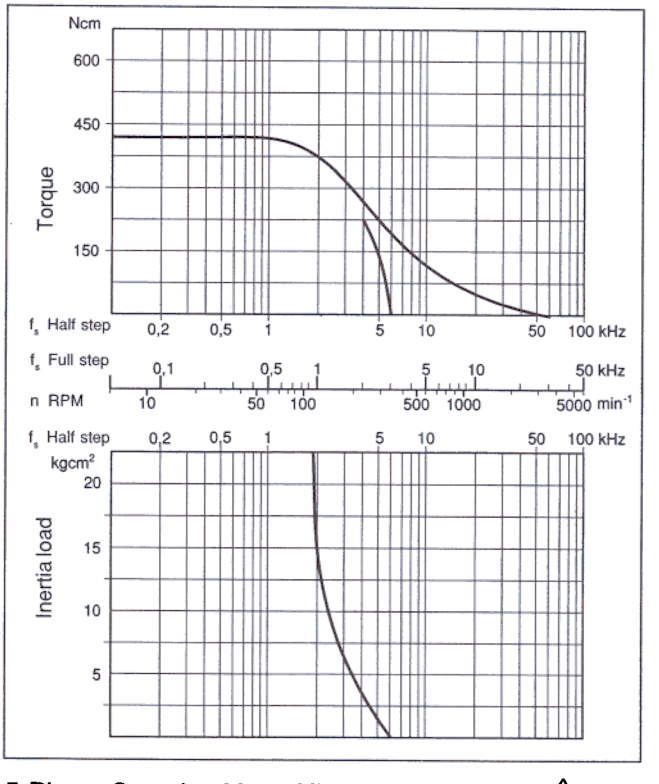
5-Phase Stepping Motor **VRDM 5910/50 LN** ○15
Power drive **D 550**, I_W/U_{ch} 2.05 A / 70 V



5-Phase Stepping Motor **VRDM 5910/50 LH** □17
Power drive **D 550**, I_W/U_{ch} 2.8 A / 70 V



5-Phase Stepping Motor **VRDM 5910/50 LH** ○16
Power drive **D 450**, I_W/U_{ch} 2.8 A / 35 V



5-Phase Stepping Motor **VRDM 5913/50 LN** △18
Power drive **D 450**, I_W/U_{ch} 2.8 A / 35 V

Detailed Characteristic Curves

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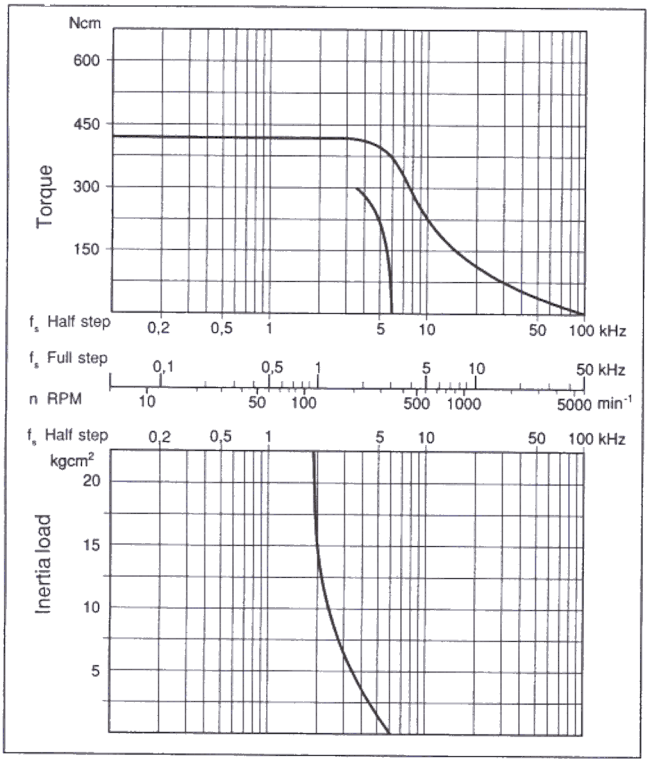
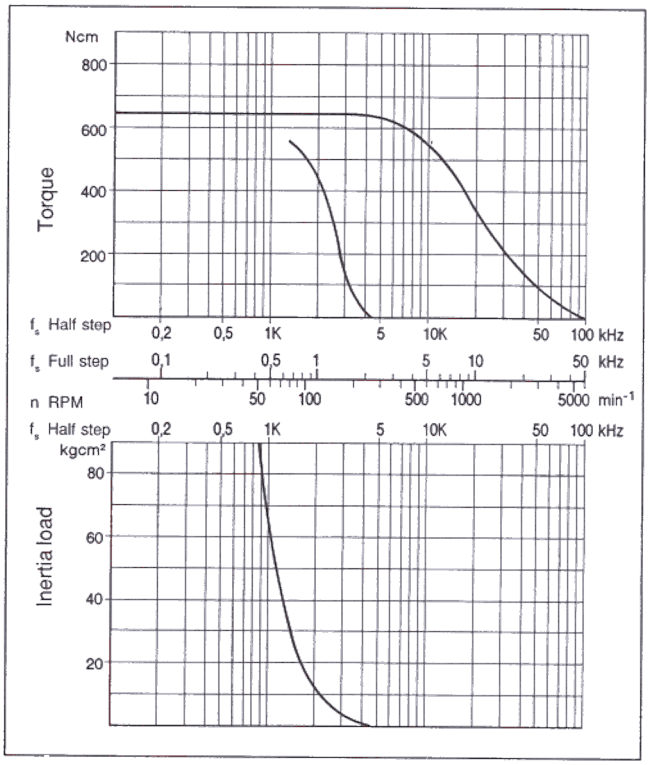
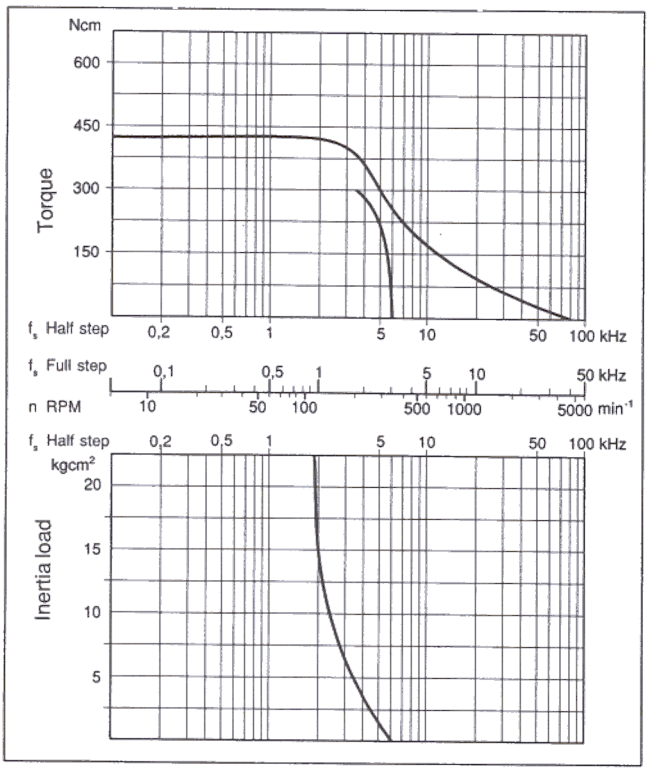


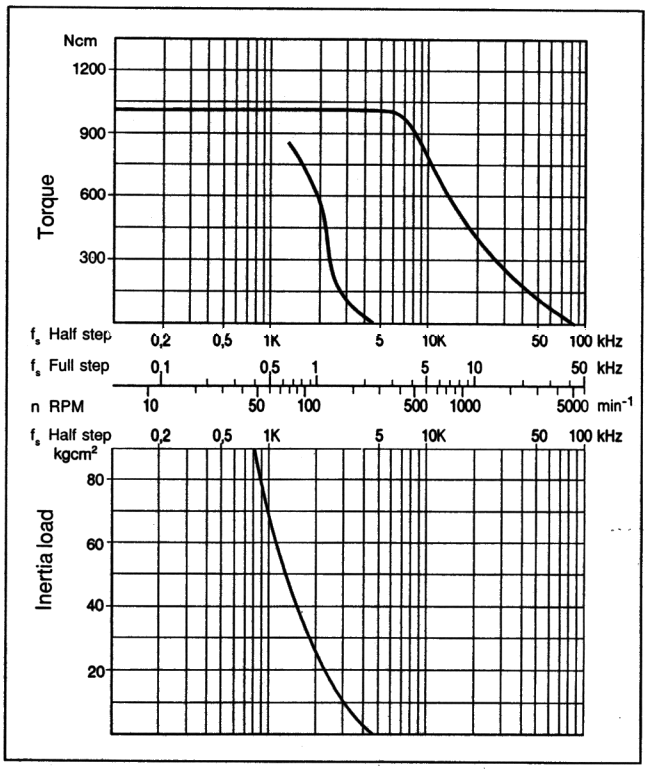
5-Phase Stepping Motor **VRDM 5913/50 LN** ○19
Power drive **D 550**, I_W/U_{ch} 2,8 A / 70 V



5-Phase Stepping Motor **RDM 51117/50 LT** □21
Power drive **D 650**, I_W/U_{ch} 3,6 A / 130 V



5-Phase Stepping Motor **VRDM 5913/50 LT** ○20
Power drive **D 550**, I_W/U_{ch} 2,05 A / 70 V



5-Phase Stepping Motor **RDM 51122/50 LT** □22
Power drive **D 650**, I_W/U_{ch} 4,0 A / 130 V

Outline Drawings

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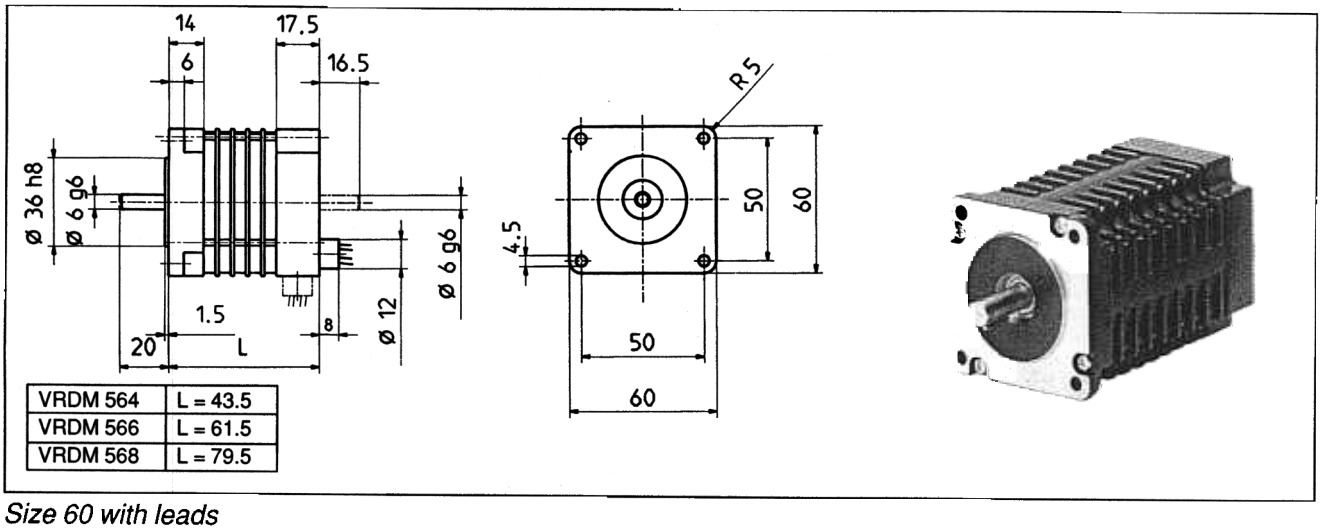
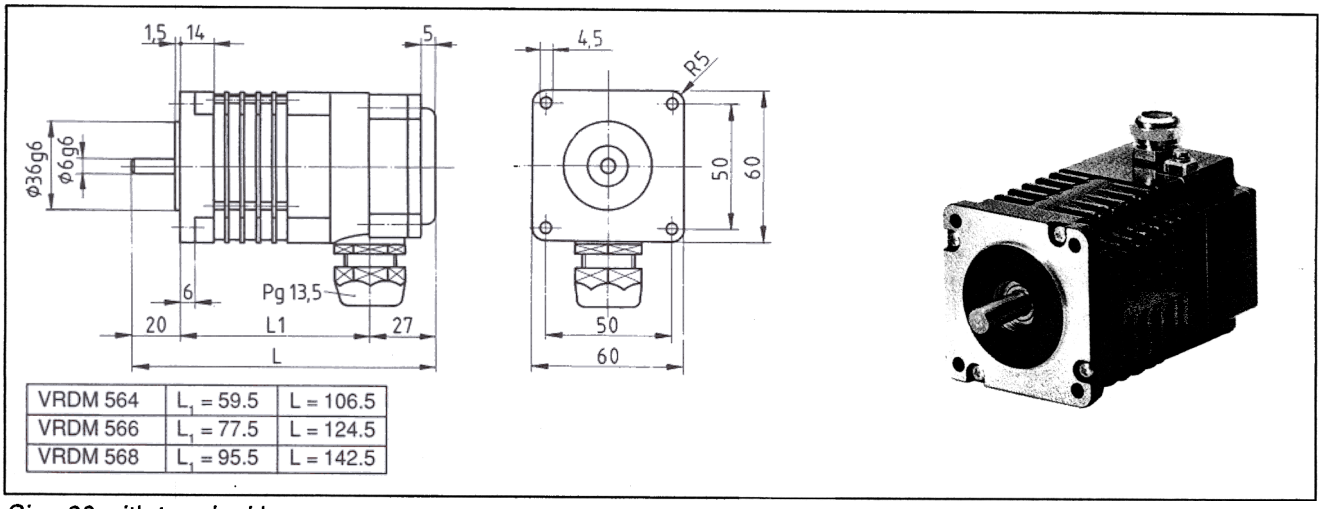
5-Phase Stepping Motors Size 60 (VRDM 56./50)



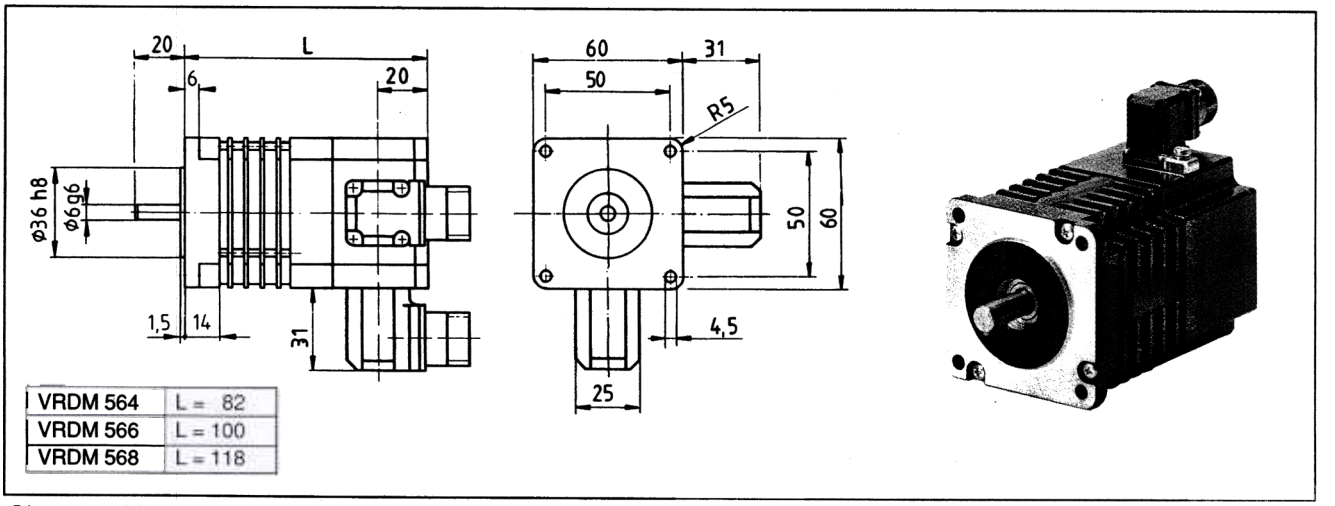
VRDM 564	L = 43.5
VRDM 566	L = 61.5
VRDM 568	L = 79.5

Size 60 with leads



VRDM 564	L_1 = 59.5	L = 106.5
VRDM 566	L_1 = 77.5	L = 124.5
VRDM 568	L_1 = 95.5	L = 142.5

Size 60 with terminal box



VRDM 564	L = 82
VRDM 566	L = 100
VRDM 568	L = 118

Size 60 with connector box

Outline Drawings

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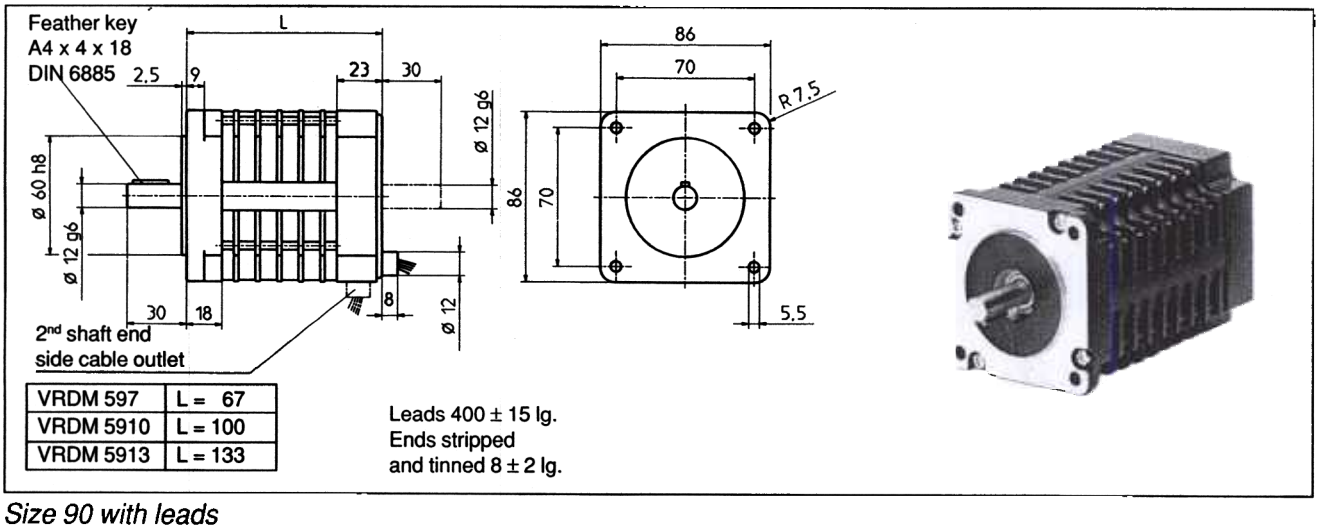
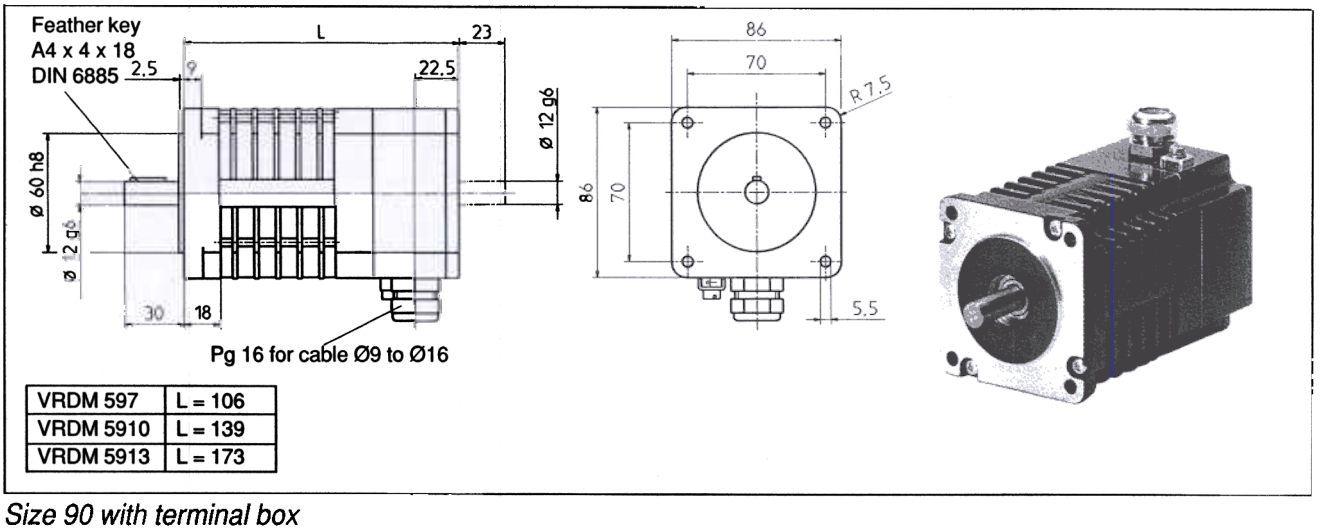
5-Phase Stepping Motors Size 90 (VRDM 59./50)



VRDM 597	L = 67
VRDM 5910	L = 100
VRDM 5913	L = 133

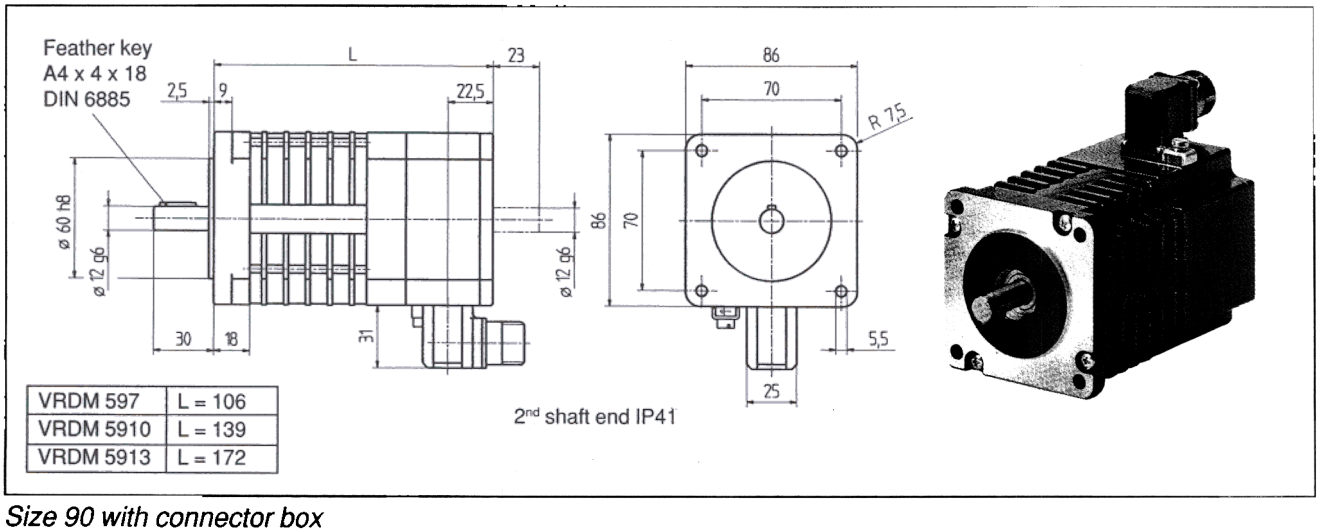
Leads 400 ± 15 lg.
Ends stripped
and tinned 8 ± 2 lg.

Size 90 with leads



VRDM 597	L = 106
VRDM 5910	L = 139
VRDM 5913	L = 173

Size 90 with terminal box



VRDM 597	L = 106
VRDM 5910	L = 139
VRDM 5913	L = 172

Size 90 with connector box

Outline Drawings

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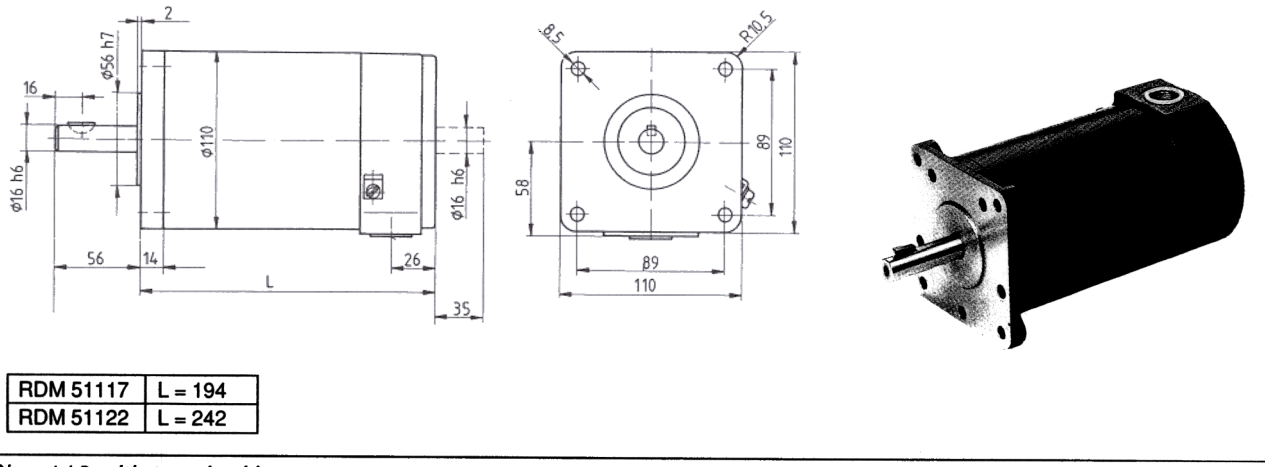
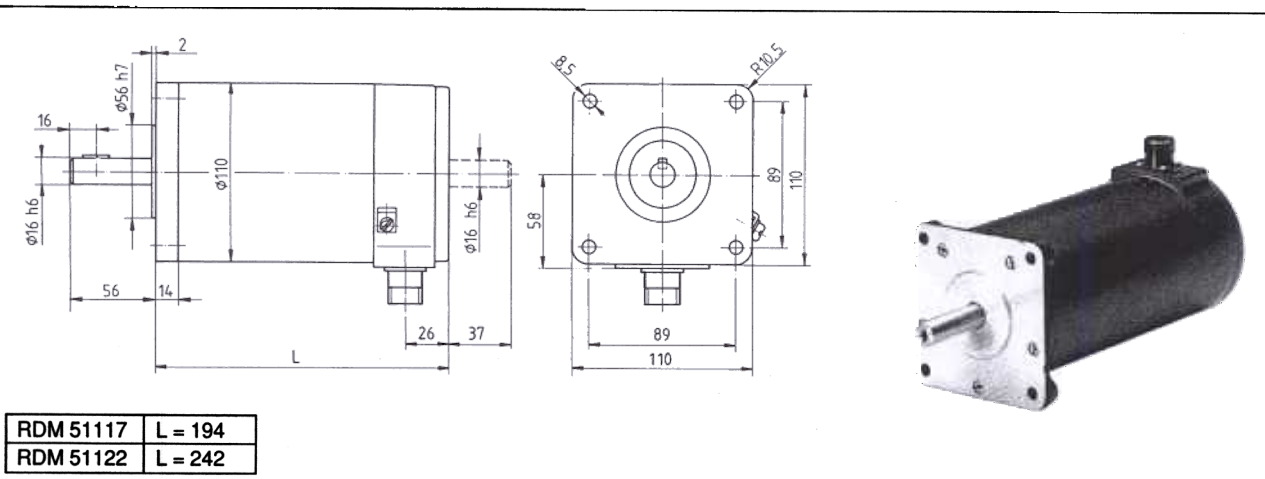
5-Phase Stepping Motors Size 110 (RDM 511../50)



RDM 51117	L = 194
RDM 51122	L = 242

Size 110 with terminal box



RDM 51117	L = 194
RDM 51122	L = 242

Size 110 with connector box

VRDM Size 60
with Planetary Gearbox

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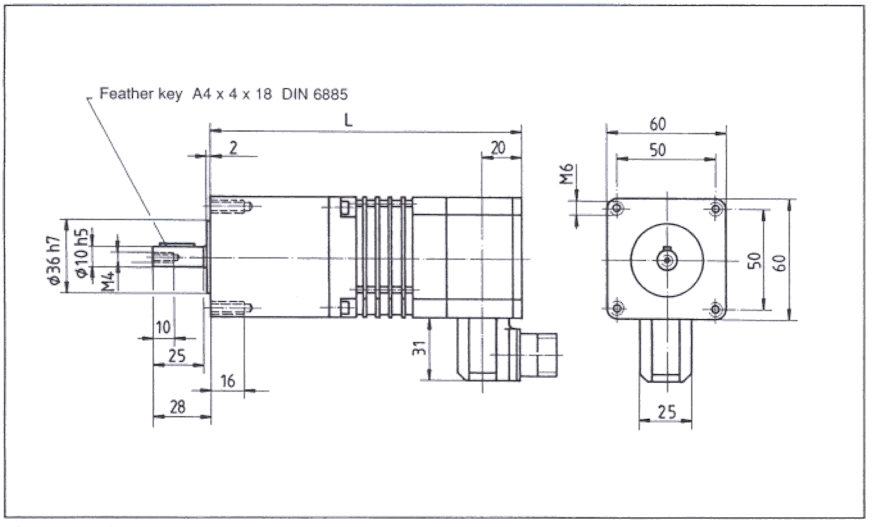
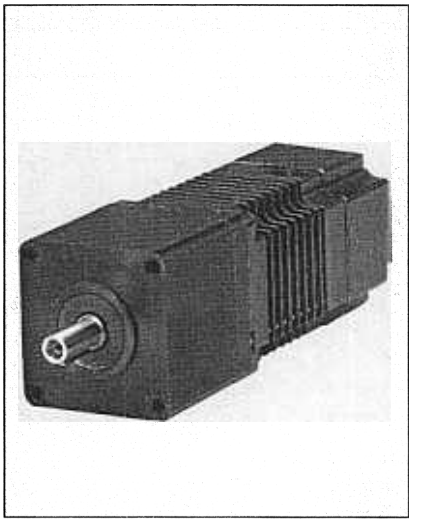


Outline drawing and specifications 5-phase stepping motor VRDM 56../50 with planetary gearbox PL 10



5-phase stepping motor VRDM 568/50 with planetary gearbox PL 10

Stepping motor with planetary gearbox PL 10 specifications

5-phase stepping motor Size 60 with Planetary gearbox PL 10 VRDM...	Gear ratio i	Dimension L for Version B [mm]	Dimension L for Version C [mm]	Moment of inertia of gear at motor side JG [kg cm²]	Max. torque* [Ncm]
564/50 L.B / C	3:1	145	140.5	0.08	76.5
566/50 L.B / C		163	158.5		153.5
568/50 L.B / C		181	176.5		229.5
564/50 L.B / C	5:1	145	140.5	0.03	127.5
566/50 L.B / C		163	158.5		225.0
568/50 L.B / C		181	176.5		382.5
564/50 L.B / C	10:1		143.5	0.01	255.0
566/50 L.B / C			161.5		510.0
568/50 L.B / C			179.5		765.0
	25:1		155.5	0.03	562.5
			173.5		1000.0 **
			191.5		1000.0 **
564/50 L.B / C	40:1	160	155.5	0.01	900.0
566/50 L.B / C		178	173.5		1000.0 **
568/50 L.B / C		196	191.5		1000.0 **

* The torques available during operation depend on the motor drive and the step frequency. They may be determined on the basis of the torque characteristic and the gear ratio.
** Under consideration of the maximum permissible permanent load.

Planetary gearbox PL 10 – specifications

Gear type:	planetary gearbox, single-stage or double-stage	Efficiency:	single-stage ~ 0.85 double-stage ~ 0.75
Max. continuous load:	10 Nm	Housing material:	aluminium
Max. radial load:	150 N	Surface:	black eloxed
Max. axial load:	90 N	Shaft material:	C 45
Standard circumferential backlash motor shaft/gear output shaft:	< 15'	Bearings:	Roller bearings
		Sealing at shaft:	shaft sealing ring
		Lubrication:	life-time lubrication
Standard gear reductions:	single-stage 3:1, 5:1, 10:1 double-stage 25:1, 40:1	Weight:	single-stage 0.75 kg double-stage 0.96 kg
		Protection system:	IP 56

VRDM Size 90
with Planetary Gearbox

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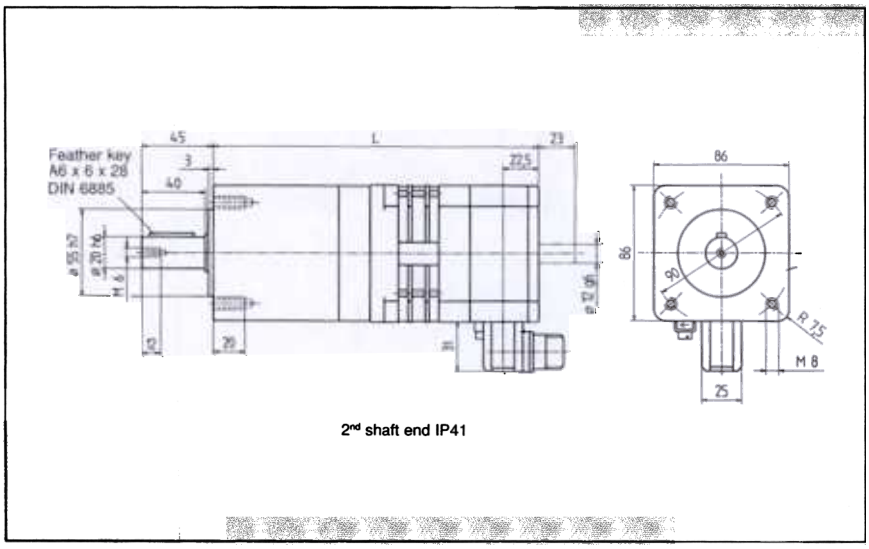
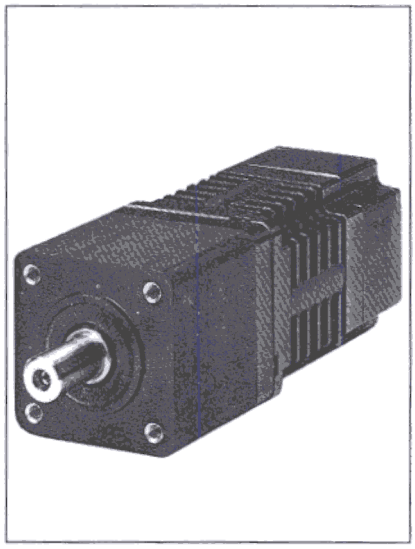


Outline drawing and specifications 5-phase stepping motor VRDM 59../50 with planetary gearbox PL 50



5-phase stepping motor VRDM 59../50 with planetary gearbox PL 50

Stepping motor with planetary gearbox PL 50 – specifications

5-phase stepping motor Size 90 with Planetary gearbox PL 50 VRDM...	Gear ratio i	Dimension L for Version B [mm]	Dimension L for Version C [mm]	Moment of inertia of gear at motor side JG [kg cm²]	Max. torque* [Nm]
597/50 L.B / C	3:1	206	206	0.33	3.5
5910/50 L.B / C		239	239		7.0
5913/50 L.B / C		272	272		10.5
597/50 L.B / C	5:1	206	206	0.21	6.0
5910/50 L.B / C		239	239		12.0
5913/50 L.B / C		272	272		18.0
597/50 L.B / C	10:1	206	206	0.16	12.0
5910/50 L.B / C		239	239		24.0
5913/50 L.B / C		272	272		36.0

The torques available during operation depend on the motor drive and the step frequency. They may be determined on the basis of the torque characteristic and the gear ratio.

Planetary gearbox PL 50 – specifications

Gear type:	planetary gearbox, single-stage	Efficiency:	~ 0.85
Max. continuous load:	50 Nm	Housing material:	aluminium
Max. radial load:	500 N	Surface:	black eloxed
Max. axial load:	250 N	Shaft material:	C 45
Standard circumferential backlash motor shaft/gear output shaft:	< 15'	Bearings:	Roller bearings
		Sealing at shaft:	shaft sealing ring
		Lubrication:	life-time lubrication
Standard gear reductions:	3:1, 5:1, 10:1	Weight:	2.1 kg
		Protection system:	IP 56

RDM Size 110
with Planetary Gearbox

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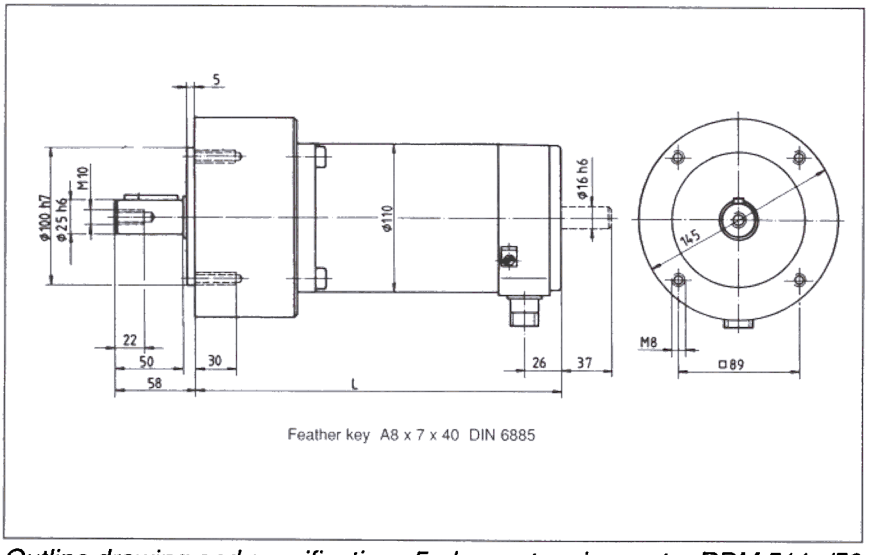
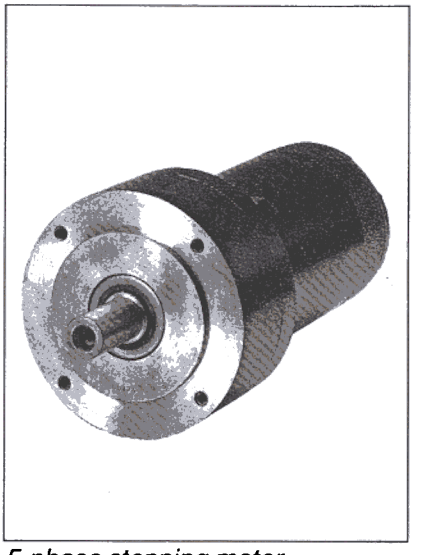


Outline drawing and specifications 5-phase stepping motor RDM 511../50 with planetary gearbox PL 100



5-phase stepping motor RDM 511../50 with planetary gearbox PL 100

Stepping motor with planetary gearbox PL 100 – specifications

5-phase stepping motor Size 110 with Planetary gearbox PL 100 RDM...	Gear ratio i	Dimension L for Version B [mm]	Dimension L for Version C [mm]	Moment of inertia of gear at motor side JG [kg cm²]	Max. torque * [Nm]
51117/50 L.B / C 51122/50 L.B / C	3:1	270 318	270 318	1.5	18 26
51117/50 L.B / C 51122/50 L.B / C	5:1	270 318	270 318	0.7	30 43
51117/50 L.B / C 51122/50 L.B / C	10:1	270 318	270 318	0.5	60 85

* The torques available during operation depend on the motor drive and the step frequency. They may be determined on the basis of the torque characteristic and the gear ratio.

Planetary gearbox PL 100 – specifications

Gear type:	planetary gearbox, single-stage	Efficiency:	~ 0.85
Max. continuous load:	100 Nm	Housing material:	steel
Max. radial load:	1500 N	Surface:	black eloxed
Max. axial load:	400 N	Shaft material:	C 45
Standard circumferential backlash motor shaft/gear output shaft:	< 15'	Bearings:	Roller bearings
		Sealing at shaft:	shaft sealing ring
		Lubrication:	life-time lubrication
Standard gear reductions:	3:1, 5:1, 10:1	Weight:	8.5 kg
		Protection system:	IP 56

5-Phase Stepping Motors with Holding Brake

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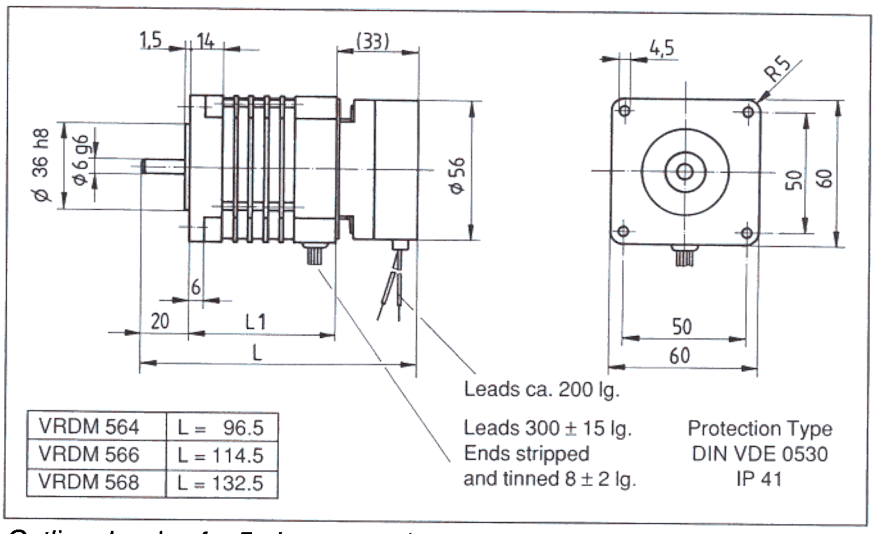
Purpose of the brakes

The holding brakes are used to hold the motor in position when the motor current has been switched off. In cases of emergency, e. g. power failure or EMERGENCY OFF, they stop the drive, thus contributing to the safety of the system. The brakes are required for applications in which gravity forces act on Z axes, e. g. in handling systems.

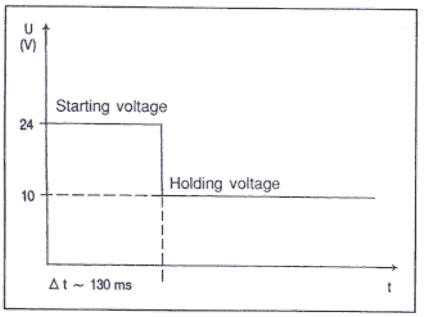


VRDM 564	L = 96.5
VRDM 566	L = 114.5
VRDM 568	L = 132.5

Outline drawing for 5-phase stepping motor VRDM 56../50 with holding brake

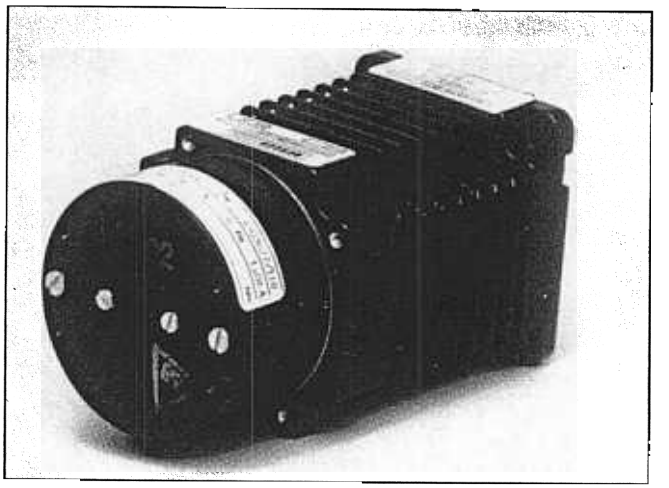
Function

The holding brakes are designed as electromagnetic spring pressure brakes. In order to disengage the brake, it must be electrically excited when the motor current is switched on. To avoid the risk of overheating, the current for the brake is reduced to holding voltage when the brake is still disengaged (see chart).



Curve of brake voltage

This current reduction can be effected by means of a switching device supplied by
Binder Magnete GmbH
P.O. Box 1220
D-78002 Villingen-Schwenningen
(order no. 34-902-03A07).



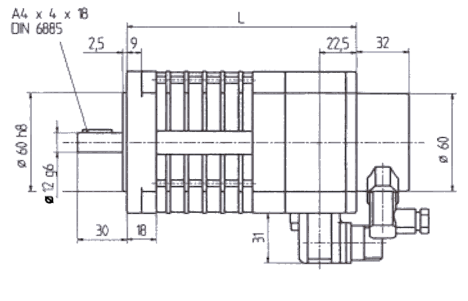
5-phase stepping motor Size 60 with holding brake

Performance Data of the holding brake	
Size 60 Leads version	
Nominal voltage	24 V
Holding torque	1 Nm
Power consumption	12 W
Inertial load	0.021 kgcm³
Switching times	
On (disengage brake)	35 ms
Off (engage brake)	15 ms

5-Phase Stepping Motors with Holding Brake

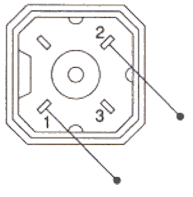
BERGER LAHR

Performance Data of the holding brake	
Size 90	
Nominal voltage	24 V
Holding torque	1.2 Nm
Power consumption	11 W
Inertial load	0.1 kgcm³
Switching times	
On (disengage brake)	35 ms
Off (engage brake)	15 ms

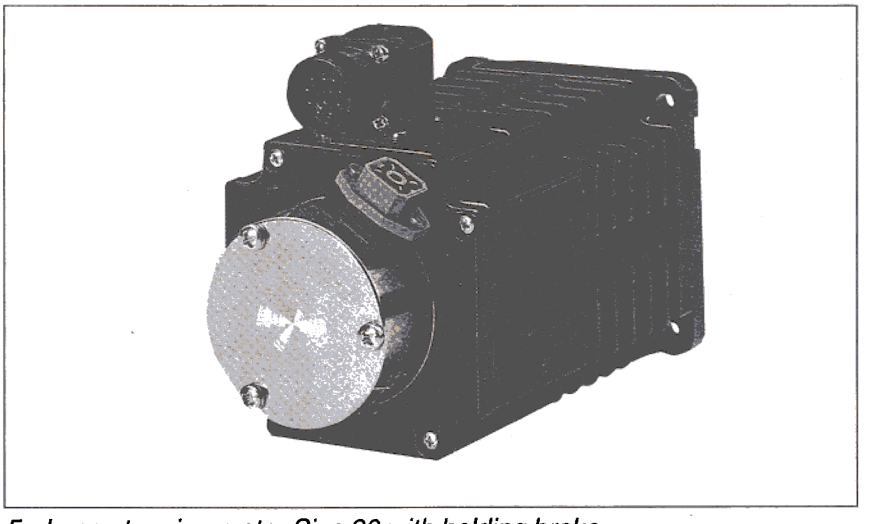


VRDM 597/50..C	L = 106
VRDM 5910/50..C	L = 139
VRDM 5913/50..C	L = 172

Outline drawing for 5-phase stepping motor VRDM 59../50 with holding brake

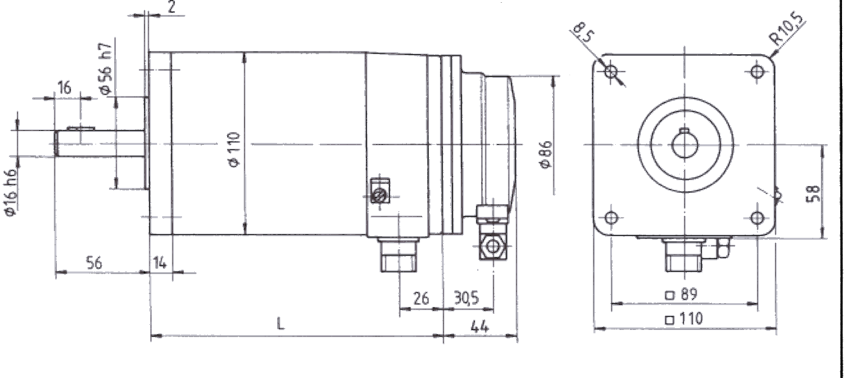


A cable with two leads is required for the brake connection. This cable is not supplied by BERGER LAHR.



5-phase stepping motor Size 90 with holding brake

Performance Data of the holding brake	
Size 110	
Nominal voltage	24 V
Holding torque	4 Nm
Power consumption	20 W
Inertial load	0.25 kgcm³
Switching times	
On (disengage brake)	65 ms
Off (engage brake)	15 ms

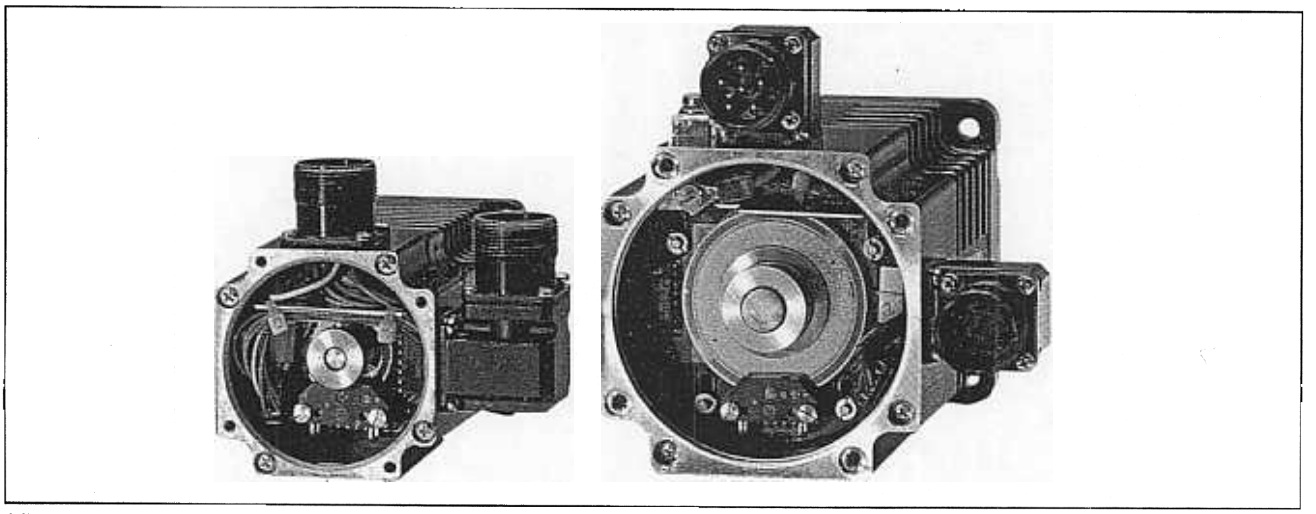


VRDM 51117/50..C	L = 194
VRDM 51122/50..C	L = 242

Outline drawing for 5-phase stepping motor RDM 511../50 with holding brake

Motors with Integrated Encoders

BERGER LAHR



View of encoder disc in the motors VRDM 568/50 and VRDM 5910/50

5-phase stepping motors can be factory-fitted with a BERGER LAHR encoder system. The encoder is integrated in the connector box so that there is no need for installation. Such motors are used together with the BERGER LAHR rotation monitoring system or the servo stepping motor system. The encoders for 5-phase stepping motors are equipped with a thermal relay (opener). The signal is on pin 11 of the encoder plug. The switching point is 95° C (+-3° C). Below the switching point there are + 5 V at pin 11.

Encoder system – specifications

Encoder system	25-500[1)]	50-500[1)]
Resolution with single evaluation of signal edge	500	500
Resolution with quadruple evaluation of signal edge	2000	2000
Output	2-channels	
Signals	A, B, $\overline{A}$, $\overline{B}$	
Pulse shape	square wave	
Supply voltage	5 V +- 10 %	
Supply current	0.15 A	

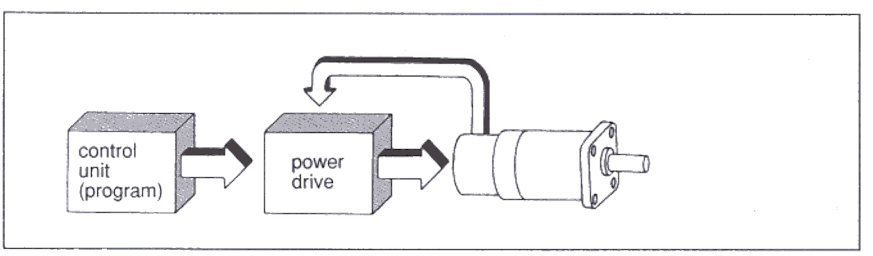
[1)] for rotation monitoring

Plugs and connections

Please refer to the chapter "Accessories" (page 32) for information on the required connection cables.

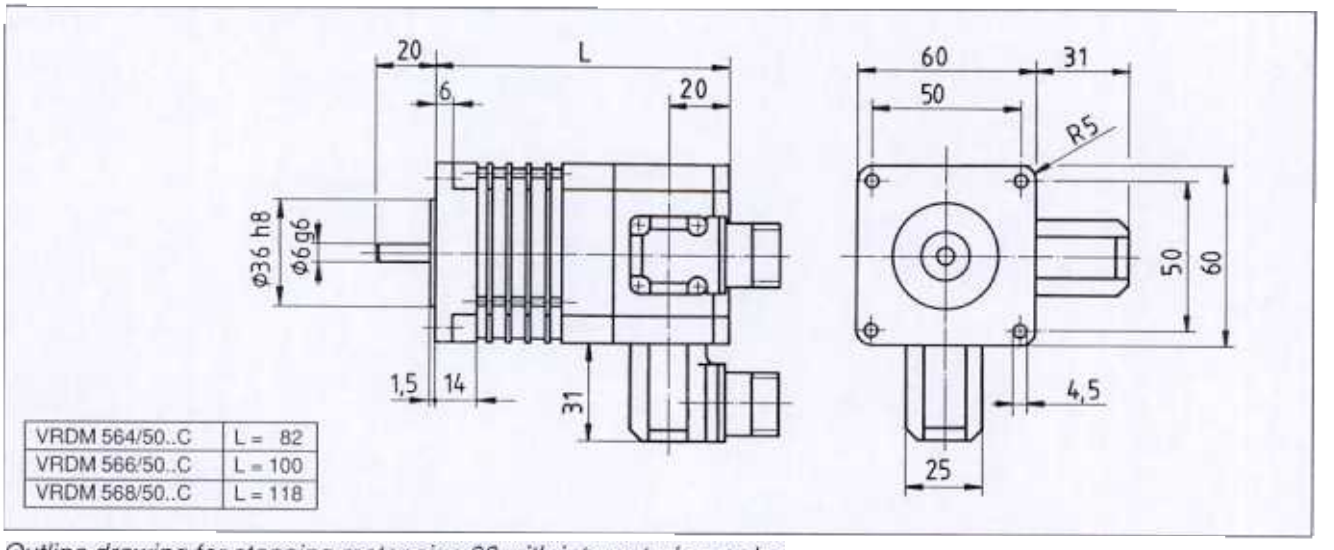
The chapter "Connections" (page 31) will provide you with details on pin and connector assignments.

Stepping motor with rotation monitoring
Simple, cost-effective, robust maintenance-free.
Power range up to approx. 1 kW



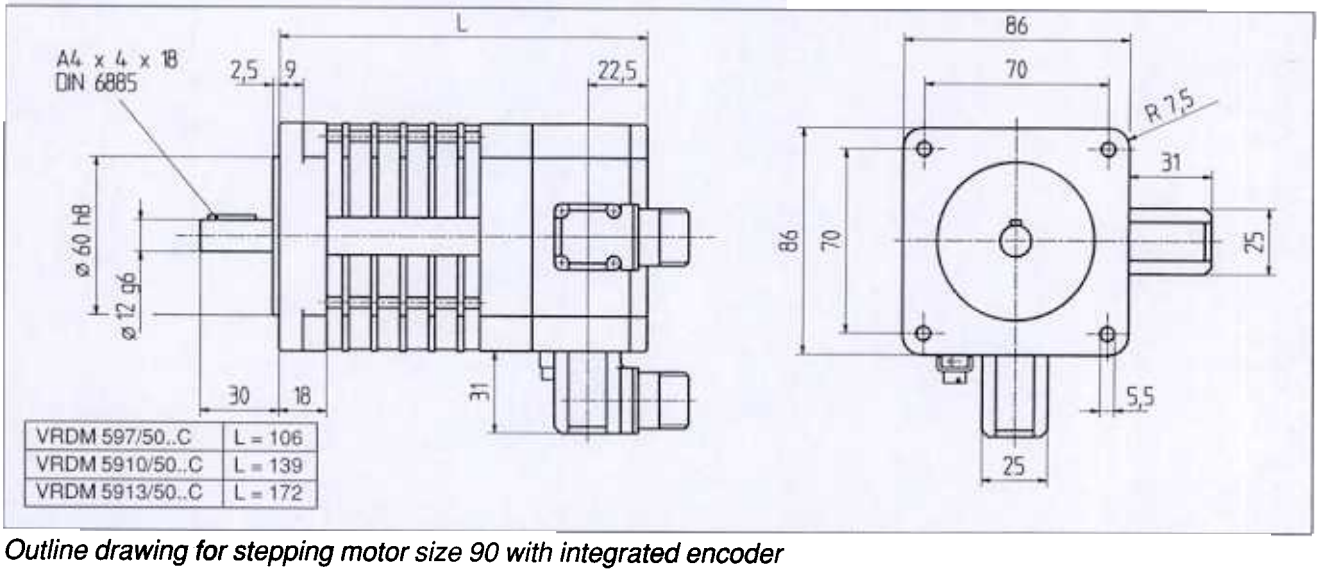
Motors with
Integrated Encoders

BERGER LAHR



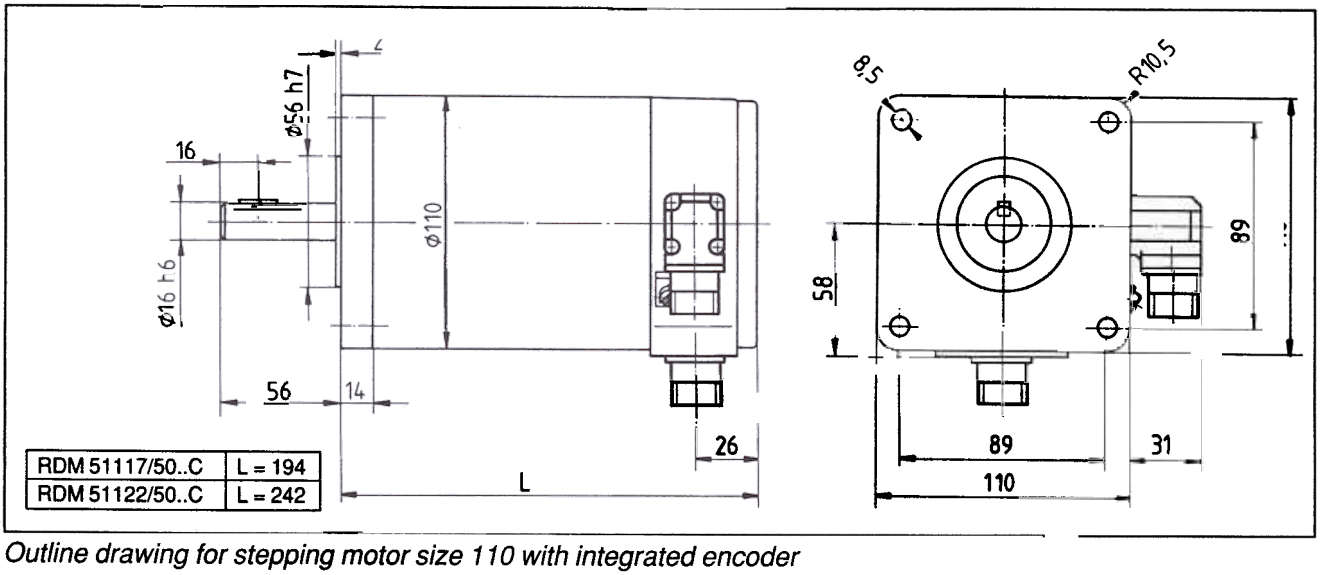
VRDM 564/50..C	L = 82
VRDM 566/50..C	L = 100
VRDM 568/50..C	L = 118

Outline drawing for stepping motor size 60 with integrated encoder



VRDM 597/50..C	L = 106
VRDM 5910/50..C	L = 139
VRDM 5913/50..C	L = 172

Outline drawing for stepping motor size 90 with integrated encoder

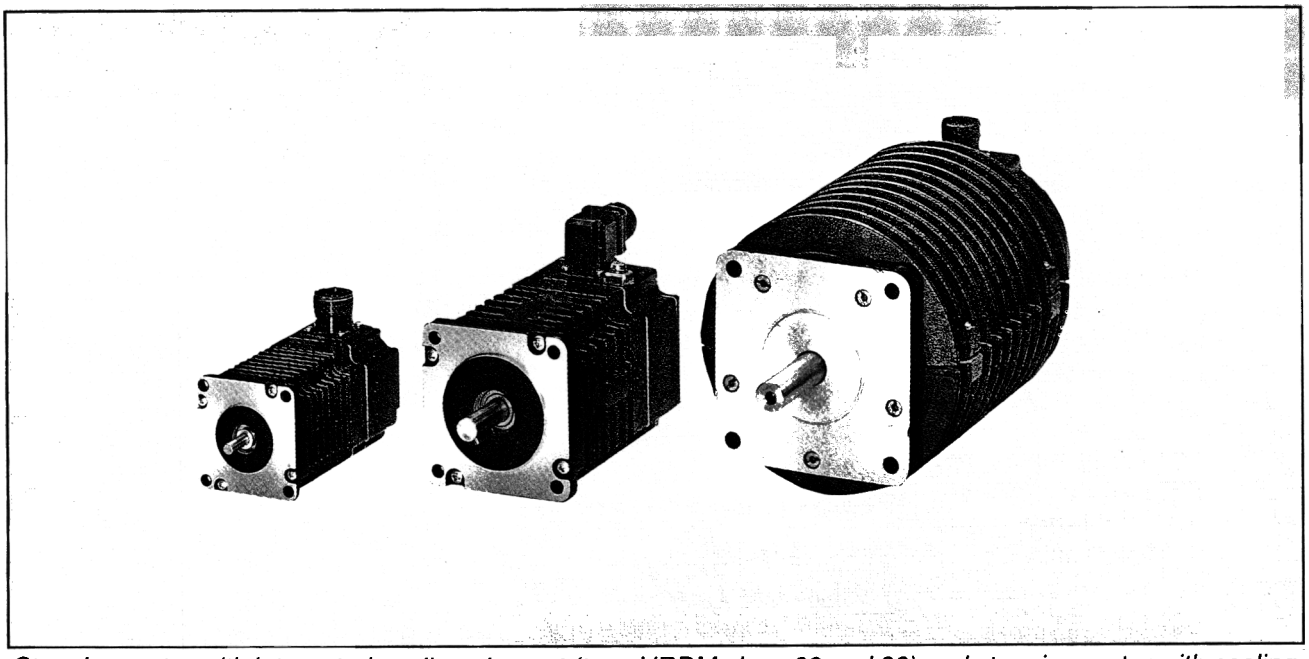


RDM 51117/50..C	L = 194
RDM 51122/50..C	L = 242

Outline drawing for stepping motor size 110 with integrated encoder

Cooling Elements for 5-Phase Stepping Motors

BERGER LAHR



Stepping motor with integrated cooling element (type VRDM sizes 60 and 90) and stepping motor with cooling element kit (type RDM 511../50)

The temperature rise in a stepping motor depends on its electric drive and on the mode of operation. Maximum heat develops at medium step frequency. Therefore, heat dissipation is an important factor. Usually, the major amount of heat is carried off via the front flange, while the remaining heat is dissipated into the ambient air. This latter portion may be considerably increased by means of cooling elements. Depending on the application and the mounting position of the motor, these specially designed elements have a dissipation capacity of approx. 10 K. The actual motor temperature build-up must be determined by means of experiments. Temperatures of 90°to 100°C at the motor housing approximately correspond to the maximum temperature as per insulation material class B in the motor inside (130° C).

VRDM 56../50 and VRDM 59../50 motors are equipped with integrated cooling ribs at the stator unit. These motors comply with insulation materials class F (155° C).

Cooling element for stepping motors RDM...	Cooling element	
	Outside diameter	Length
51117/50	approx. 145	(medium)
51122/50	approx. 145	(long)

Table cooling elements for RDM 51117 and RDM 51122

Mechanical Coupling

BERGER LAHR

Information on coupling of 5-phase stepping motors and loads to be driven

The type of mechanical connection between the motor shaft and the load to be driven has considerable impact on the operating behaviour of a stepping motor system.
For this reason a coupling should be employed to compensate for misalignment of the shafts.

We reccomend using torsion-resistant couplings (such as bellow-type or multiple-disc couplings) for high-resolution positioning systems.

Flexible couplings may be used in case of less exacting demands on the positioning accuracy.
These also have the advantage of functioning as shock absorbers

Couplings with slackness are not suitable. Oscillations during step operation at low speeds always cause considerable noise and may even damage the coupling.
A frictional connection between shaft and coupling should always be used (clamp or collet system).
Other types of connection such as contraction, gluing or pins can also be useful.

The square key at the motor shaft must never transmit the torque! If you require an easily dismountable connection, we suggest using plugtype couplings.

If axial or radial forces affect the motor shaft (e. g. pulley or pinion of a gearbox), the maximum permissible values must not be exceeded (see table on page 7).
Please consult your BERGER LAHR representative in case of higher loads.

Recommended couplings (examples):

Torsion-resistant couplings for driving systems with high demands on positioning accuracy and dynamics.

- Bellow-type coupling (Gerwah, Großwallstadt, phone 0 49 - 60 22 / 2 20 40)
- Thomas coupling (Rexnord, Dortmund, phone 0 49 - 2 31 / 82 10 65)
- Spring-pin-coupling (Überlastungs- und Verbindungssysteme, Obernburg, phone 0 49 - 60 22 / 3 81 08)

Flexible couplings for less exacting demands on positioning accuracy but with shock absorbing qualities:

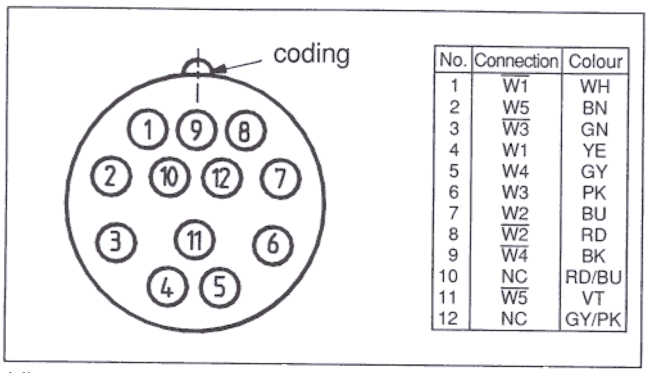
- Control-Flex coupling (Schmidt, Wolfenbüttel, phone 0 49 - 53 31 / 4 60 05)
- Rotex coupling (Kupplungstechnik, Rheine, phone 0 49 - 59 71 / 79 81)
- Serie-S coupling (Tschan, Antriebstechnik, Neunkirchen-Saar, phone 0 49 - 68 21 / 86 60)

DIN 740, section 2, as well as the above-mentioned manufacturers will supply you with additional information on determining the type of coupling you need.

Stepping motors - plug versions

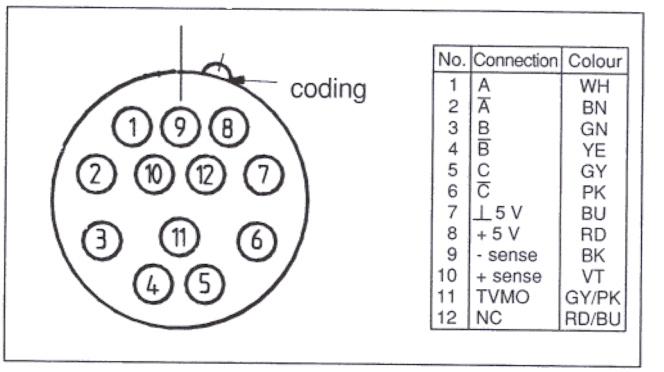
Please order our ready-to-use cable (refer to page 32).

The ready-to-use cable is connected to the motor or encoder by means of plugs.



No.	Connection	Colour
1	$\overline{W1}$	WH
2	W5	BN
3	$\overline{W3}$	GN
4	W1	YE
5	W4	GY
6	W3	PK
7	W2	BU
8	$\overline{W2}$	RD
9	$\overline{W4}$	BK
10	NC	RD/BU
11	$\overline{W5}$	VT
12	NC	GY/PK

View of motor plug



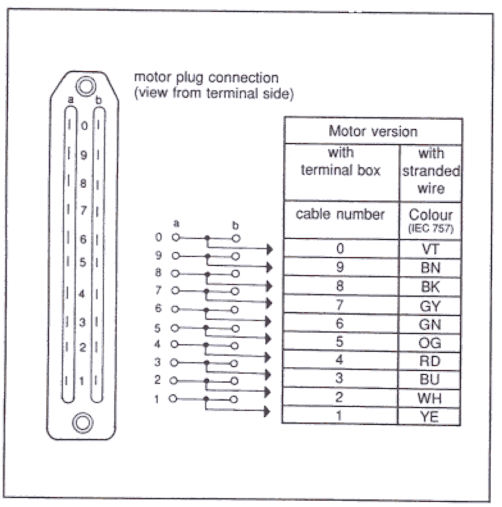
No.	Connection	Colour
1	A	WH
2	$\overline{A}$	BN
3	B	GN
4	$\overline{B}$	YE
5	C	GY
6	$\overline{C}$	PK
7	⊥ 5 V	BU
8	+ 5 V	RD
9	- sense	BK
10	+ sense	VT
11	TVMO	GY/PK
12	NC	RD/BU

View of encoder plug

Stepping motors with terminal box

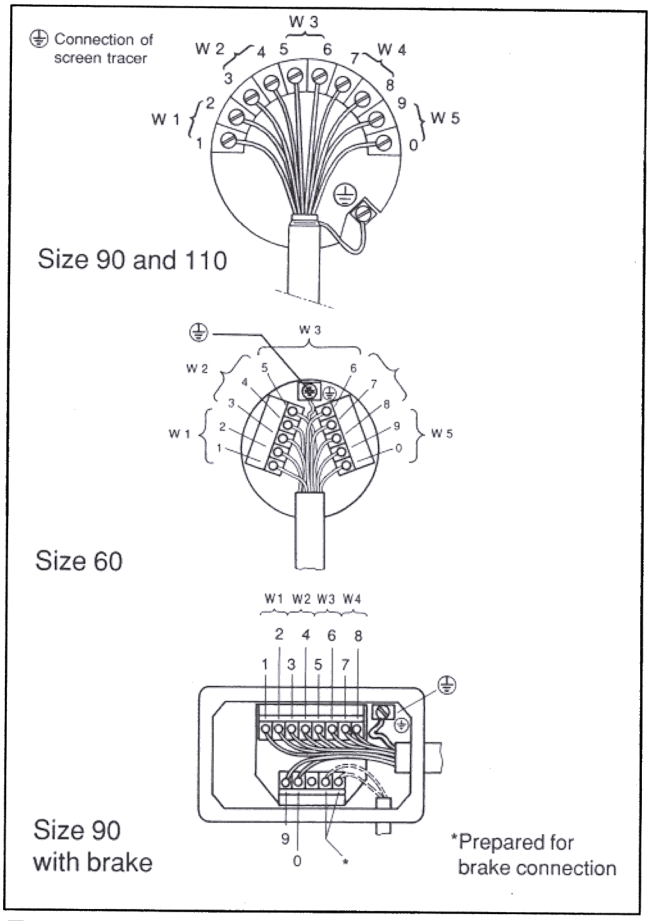
Preparing the cable
Both cable ends of cables for 5-phase stepping motors are prepared in the same way. The individual wires are designated by means of numbers from 0 to 9.

Connection in the motor terminal box
Connection to the protective conductor is usually made via the motor fastening device.
If this connection is not sufficient, you can use the external protective conductor connection.
When connecting the cable, connect each stranded wire to the terminal with the corresponding number in the motor terminal box.



Motor version	
with terminal box	with stranded wire
cable number	Colour (IEC 757)
0	VT
9	BN
8	BK
7	GY
6	GN
5	OG
4	RD
3	BU
2	WH
1	YE

Connection diagram of motor plug for single-axis device



Terminal box of stepping motors

Stepping motors with stranded wires

Please refer to the left illustration for connection to the power drive.

Ordering key for accessories

Accessories for size		60	90	110
Cooling element (kit)	medium long			98139 1004 70 98139 1004 80
Cable fitting	PG 16 for motors with terminal box	PG 13.5 supplied along with motor	98050 0100 57	98050 0100 45

In order to facilitate the connection of the motors to the control system, we offer **motor plugs** or **ready-to-use motor cables** and **ready-to-use encoder cables** for motors with encoders.

Ready-to-use cables are available in various lengths.

Please note:
Accessories have to be ordered separately. They are not automatically supplied along with the motors.

Properties of our motor and encoder cables
- flexible, suitable for use in follower chains
- due to the polyurethane coating, resistant to mechanical and chemical actions
- free of halogen
- colored lead insulation
- shielded and equipped with accompanying wire strand

Recommended cable length
50 metres for phase currents up to 3 A; a cable length up to 30 metres for 5 A phase current. The torque will drop by up to 10 % when using the max. cable length.

Technical data for cables
Diameter: 10 mm
Cross section:
Motor cable 12 x 0.75 mm²
Encoder cable
5 pairs of leads à 0.25 mm²
1 pair of leads à 0.50 mm²
(bound in pairs)
Bending radius for alternating bending: minimum 150 mm
Chemical resistance:
100 % oil resistant, conditionally resistant to acids and alkaline solutions
Temperature range:
in motion: -30° to + 70° C
stationary: -40° to + 80° C
Rated voltage::
Motor cable 500 V
Encoder cable 350 V

Plugs / cables	Ordering number	Length [m]
BERGER LAHR motor plug 12 poles	62 501 502 001	
BERGER LAHR encoder plug 12 poles	62 501 501 001	
Ready-to-use motor cable [1]	62 500 509 005 62 500 509 010 62 500 509 015 62 500 509 020 62 500 509 050	5 10 15 20 50
Ready-to-use encoder cable [1]	62 500 602 005 62 500 602 010 62 500 602 015 62 500 602 020 62 500 602 050	5 10 15 20 50
Ready-to-use motor cable (for controls SDP; MDP; MD5-6) [2]	62 500 508 005 62 500 508 010 62 500 508 015 62 500 508 020 62 500 508 050	5 10 15 20 50
Ready-to-use motor cable (for controls MD5-4; MD5-5) [2]	62 500 507 005 62 500 507 010 62 500 507 015 62 500 507 020 62 500 507 050	5 10 15 20 50
Cable, not prepared, for motor	98 078 305 099	running meter
Cable, not prepared, for encoder	98 078 305 100	running meter

1) = **without** plug at device end 2) = **with** plug at device end

Type Key
5-Phase Stepping Motors

BERGER LAHR

Code	Size
6	60 mm
9	90 mm
11	110 mm

Size

Code	Length (only basic unit)
4	43.5 mm (Size 60)
6	61.5 mm (Size 60)
7	67 mm (Size 90)
8	80 mm (Size 60)
10	100 mm (Size 90)
13	130 mm (Size 90)
17	194 mm (Size 110)
22	242 mm (Size 110)

Length of the basic unit (without terminal box or connector box)

Code	magnetic version
L	Standard rotor (lamitated)

magnetic version

Code	electrical version
H	High current winding
N	Standard current
T	Low current winding
S	Special winding

electrical version

Code	Connection type
A	Leads version
B	Terminal box
C	Connector box

Connection type

Design:
V=reinforced

(V)RDM 5 □ □ / 50 □ □ □

Reversible
Digital **M**otor

fifty pairs
of rotor poles

(V)RDM 5 □ □ / 50 □ □ □ **Your order**

VRDM 5 9 10 / 50 L H C **Example of motor type**

Ordering Key

BERGER LAHR

Motor type with stranded wires	1 shaft end	2 shaft ends	with attached holding brake
wihout encoder			
VRDM 564/50 LNA	12070 0150 00	12170 0151 00	12870 0150 00
VRDM 564/50 LHA	12070 0250 00	12170 0251 00	12870 0250 00
VRDM 566/50 LNA	12071 0150 00	12171 0151 00	12871 0150 00
VRDM 566/50 LTA	12071 0350 00		
VRDM 566/50 LHA	12071 0250 00	12171 0251 00	12871 0250 00
VRDM 568/50 LNA	12072 0150 00	12172 0151 00	12872 0150 00
VRDM 568/50 LHA	12072 0250 00	12172 0251 00	12872 0250 00
VRDM 597/50 LNA	12073 0150 00	12173 0150 00	
VRDM 597/50 LHA	12073 0250 00	12173 0250 00	
VRDM 597/50 LSA	12073 0450 00	12173 0450 00	
VRDM 5910/50 LNA	12074 0150 00	12174 0150 00	
VRDM 5910/50 LHA	12074 0250 00	12174 0250 00	
VRDM 5913/50 LTA	12075 0350 00	12175 0350 00	
VRDM 5913/50 LNA	12075 0150 00	12175 0150 00	

Motor type with terminal box	1 shaft end	2 shaft ends	with attached holding brake
without encoder			
VRDM 564/50 LNB	12670 0150 00		
VRDM 564/50 LHB	12670 0250 00		
VRDM 566/50 LNB	12671 0150 00		
VRDM 566/50 LTB	12671 0350 00		
VRDM 566/50 LHB	12671 0250 00		
VRDM 568/50 LNB	12672 0150 00		
VRDM 568/50 LHB	12672 0250 00		
VRDM 597/50 LNB	12673 0150 00	12973 0150 00	
VRDM 597/50 LHB	12673 0250 00	12973 0250 00	
VRDM 597/50 LSB	12673 0450 00	12973 0450 00	
VRDM 5910/50 LNB	12674 0150 00	12974 0150 00	
VRDM 5910/50 LHB	12674 0250 00	12974 0250 00	
VRDM 5913/50 LTB	12675 0350 00	12975 0350 00	
VRDM 5913/50 LNB	12675 0150 00	12975 0150 00	
RDM 51117/50 LTB	12666 0250 00	12966 0250 00	12866 0250 00
RDM 51122/50 LNB	12667 0150 00		12867 0150 00
RDM 51122/50 LTB	12667 0250 00	12967 0250 00	12867 0250 00

short term delivery

All motor versions shown in this catalogue are listed on the following pages. Each version has a special ordering number. Please use the ordering key in the following way when ordering a motor:

1) Select the correct ordering table
- table for stepping motors with stranded wire connection
- table for stepping motors with terminal box
- table for stepping motors with plug connection

2) From the ordering table, select the correct ordering number for a motor with the options you need.

3) Does your application require a reduction gearbox? If so, select the ordering number suffix for the gearbox from the table on the next page.

4) Check the selected **type number** in the motor type key (previous page).

5) Also check the encoder type number in the encoder type key (next page).

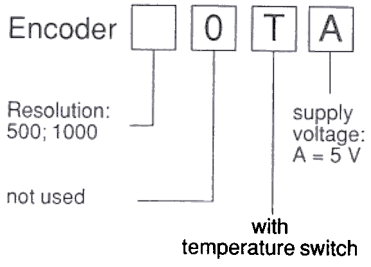
Ordering Key

BERGER LAHR

Motor type with connector box	1 shaft end	2 shaft ends	with attached holding brake
without encoder			
VRDM 564/50 LNC	12270 0152 00		
VRDM 564/50 LHC	12270 0250 00		
VRDM 566/50 LNC	12271 0151 00		
VRDM 566/50 LHC	12271 0250 00		
VRDM 568/50 LNC	12272 0150 00		
VRDM 568/50 LHC	12272 0250 00		
VRDM 597/50 LNC	12273 0150 00	12273 0151 00	12873 0150 00
VRDM 597/50 LHC	12273 0250 00	12273 0251 00	
VRDM 597/50 LSC	12273 0450 00	12273 0	450 00
VRDM 5910/50 LNC	12274 0150 00	12274 0 51 00	150 00
VRDM 5910/50 LHC	12274 0250 00	12274 0251 00	12874 0250 00
VRDM 5913/50 LTC	12275 0350 00	12275 0351 00	12875 0350 00
VRDM 5913/50 LNC	12275 0150 00	12275 0151 00	12875 0
RDM 51117/50 LNC	12266 0150 00	12266 0151 00	12866 0151 00
RDM 51117/50 LTC	12266 0250 00	12266 0251 00	
RDM 51122/50 LNC	12267 0150 00	12267 0151 00	12867 0151 00
RDM 51122/50 LTC	12267 0250 00	12267 0251 00	12867 0251 00
with encoder 500 00A			
VRDM 564/50 LNC	12570 0150 00		
VRDM 564/50 LHC	12570 0250 00		
VRDM 566/50 LNC	12571 0150 00		
VRDM 566/50 LHC	12571 0250 00		
VRDM 568/50 LNC	12572 0150 00		
VRDM 568/50 LHC	12572 0250 00		
VRDM 597/50 LNC	12573 0150 00		12373 0150 00
VRDM 597/50 LHC	12573 0250 00		12373 0250 00
VRDM 597/50 LSC	12573 0450 00		12373 0450 00
VRDM 5910/50 LNC	12574 0150 00		12374 0150 00
VRDM 5910/50 LHC	12574 0250 00		12374 0250 00
VRDM 5913/50 LTC	12575 0350 00		12375 0350 00
VRDM 5913/50 LNC	12575 0150 00		12375 0150 00
RDM 51117/50 LNC	12566 0152 00		12366 0150 00
RDM 51117/50 LTC	12566 0250 00		
RDM 51122/50 LNC	12567 0150 00		12367 0150 00
RDM 51122/50 LTC	12567 0250 00		

short term delivery

Type key for encoder



Gear suffix for motor ordering number

Gear ratio	Suffix for ordering number of motor size		
	60	90	110
3:1	.../03	.../03	.../03
5:1	.../05	.../05	.../05
10:1	.../10	.../10	.../10
25:1	.../25		
40:1	.../40		

The technical descriptions of the products described in this catalogue allow for a great theoretical number of versions. However, not all technically possible versions and combinations (for example, with brake, gearbox, encoder) are actually available. Please inquire if you are not sure.

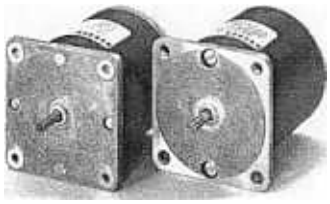
From Movement to System Solutions

BERGER LAHR

We make things move. Through extensive research and development, BERGER LAHR has established standards in motor technology which are acknowledged all over the world and oriented towards the future. Yet the motor is only part of the control task. Our customers can expect much more from us: complete system solutions which meet their requirements. BERGER LAHR offers the experience, engineering know-how and service capabilities of an innovative manufacturer. On the basis of market studies and problem analyses, concepts are developed together with our customers for realizing logical, time-saving, and thus and economical work processes. Microprocessor-controlled positioning drives and advanced stepping motor technology are the logical complements for an optimum system solution. The superior quality standard of all BERGER LAHR products is assured by highly qualified personnel with many years of experience. All are engaged in upholding competitiveness with innovative ideas to secure the future - for us, and for our customers.

We make things move. Our high-tech, prime quality motors set the standards for our competitors. We have pioneered in the field of 5-phase stepping motors. Perfectly engineered electronic control systems are the logical extension to these motors. Our extensive line of control units allows you to select the perfect combination of motor and controller. Our POSAB 2000 lets you implement a complete system solution for positioning tasks. Modular handling systems are the logical consequence of our philosophy which is geared towards system solutions for optimum efficiency. BERGER LAHR products may be combined in a whole variety of ways, providing numerous integrated solutions. Today's innovative technology will stand strong tomorrow only if it leads to reduced costs, shorter cycle times, increased efficiency - in short: rationalization. If you opt for BERGER LAHR systems today, you can be sure that you have invested in the future.

We would be glad to furnish you with detailed information on BERGER LAHR
- **5-phase stepping motors**
- **positioning and process controls**
- **modular handling systems**
- **2-phase stepping motors**
- **synchronous and gear motors**
- **servo motors**

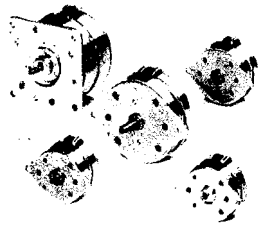


Synchronous Motors

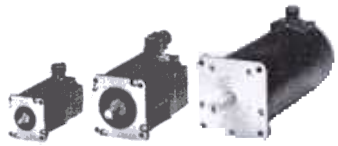
Synchronous Motors

Gear Motors

Positioning Motors

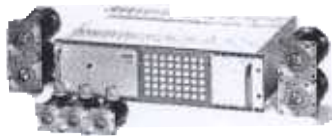


2-Phase Stepping Motors

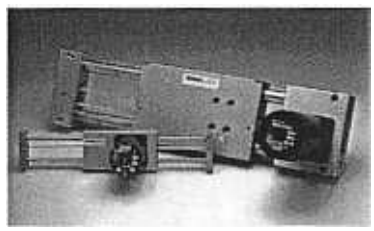


5-Phase Stepping Motors

Single Axis Power Drive

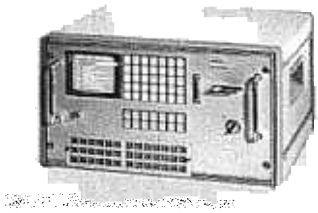


3 Axes Power Drive

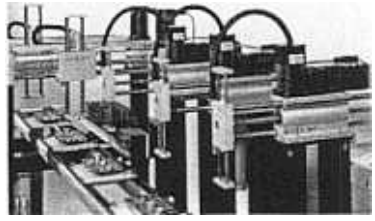


Linear and Rotary Module:

Positioning and Power Drive



Positioning and Sequence Controller Posab 2000



Modular Handling Systems

Always close to our Customers

In addition to first-rate products, responsive consulting and customer service are the cornerstones of a satisfying and lasting business relationship.

We work close together with you to find your motion solution.

Talk to your BERGER LAHR technical consultant!

D Büro Nord
Lönsweg 23
D-29313 Hambühren
Tel. (0 50 84) 93 00-0
Fax (0 50 84) 43 80
Zuständig für die Postleitzonen 1, 2 plus 30, 31, 37, 38

Büro West 1
Hansastraße 6
D-59557 Lippstadt
Tel. (0 29 41) 28 09-0
Fax (0 29 41) 2 26 40

Büro West 2
Siemensstraße 20
D-40885 Ratingen
Tel. (0 21 02) 3 18 45
Fax (0 21 02) 3 72 06
Zuständig für die Postleitzone 4 plus 50, 51, 52, 53, 57, 58, 59, 32, 33

Büro Mitte
Maybachstraße 14
D-63456 Hanau
Tel. (0 61 81) 6 65 80
Fax (0 61 81) 66 58 18
Zuständig für die Postleitzone 6 plus 34, 35, 36, 54, 55, 56, 97

Büro Baden-Württemberg 1
Breslauer Straße 7
D-77933 Lahr
Tel. (0 78 21) 946-330
Fax (0 78 21) 946-372

Büro Baden-Württemberg 2
Europastraße 12
D-72622 Nürtingen
Tel. (0 70 22) 3 40 81
Fax (0 70 22) 3 95 55
Zuständig für die Postleitzone 7 plus 88, 89

Büro Bayern
Bretonischer Ring 15
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Tel. (0 89) 46 30 14
Fax (0 89) 46 38 88
Zuständig für die Postleitzonen 80 bis 87 plus 90 bis 94

Büro Ost
Roscherstraße 31
D-04105 Leipzig
Tel. (03 41) 5 64 72 95-96
Fax (03 41) 5 64 72 97
Zuständig für die Postleitzone 0 plus 39, 95, 96, 98, 99

A BERGER LAHR Ges. mbH
Lohnergasse 7
A-1210 Wien
Tel. (02 22) 2 78 75 45
Fax (02 22) 2 78 75 44 33
Telex 135 738 (Panel a)

B Automotion N. V.
Immogranit Building
Industriepark 2 J
B-9031 Drongen
Tel. (09) 281 11 30
Fax (09) 281 11 65

CH SIG POSITEC
Antriebe und Automation AG
Seebleichestraße 60
Postfach 65
CH-9400 Rorschach-Ost
Tel. (0 71) 42 75 75
Fax (0 71) 42 75 91

DK HANO Elektroteknik A/S
Kallerupvej 60
DK-5230 Odense M
Tel. (45) 66 19 06 00
Fax (45) 66 19 07 00

E Forn Valls S.A.
Milanesado no. 2-tda.
E-08017 Barcelona
Tel. (93) 2 03 41 33
Tel. (93) 2 04 05 44
Fax (93) 2 05 54 67
Telex 52 491

F BERGER LAHR SARL
BP 194
5, Rue Charles Michels
F-95106 Argenteuil Cedex
Tel. (16/1) 39 80 60 26
Fax (16/1) 39 82 78 15
Telex 609 299

GB SIG POSITEC UK Ltd.
Deseronto Estate
St. Mary's Road, Langley, Slough
Berkshire, SL3 7 EW
Tel. (07 53) 54 16 13
Fax (07 53) 58 15 24

H BERGER LAHR Ges. mbH
Lohnergasse 7
A-1210 Wien
Tel. (02 22) 2 78 75 45
Fax (02 22) 2 78 75 44 33
Telex 135 738 (Panel a)

I BERGER LAHR S.r.l.
Via Mezzenile, 3
I-10138 Torino
Tel. (0 11) 4 33 36 36-38
Fax (0 11) 4 47 62 98

IND Pace Elcot Automation Ltd.
Khaleeli Centre
II Floor, 149 Montieth Road
Madras - 600 008, India
Tel. (44)47 73 11 / 47 94 05 / 86 87 78
Fax (44) 47 81 48
Telex (41) 67 31

N BERGER LAHR AB
Sabelgatan 4
S-25467 Helsingborg
Tel. (0 42) 16 22 30
Fax (0 42) 16 00 35

NL ELECTRO ABI B.V.
Aandrijf- en Besturingstechniek
A. Hofmanweg 60
NL-2031 BL Haarlem
Tel. (0 23) 31 92 92
Fax (0 23) 32 65 99

S BERGER LAHR AB
Sabelgatan 4
S-25467 Helsingborg
Tel. (0 42) 16 22 30
Fax (0 42) 16 00 35

SF EL-Fresta Oy Ab
Kiviaidankatu 3
SF-00210 Helsinki
Tel. (3 58-0) 67 30 87
Fax (3 58-0) 6 92 43 87

USA BERGER LAHR Motion Technology Inc.
41170 Joy Rd.
Plymouth, MI 48170
Tel. (3 13) 4 59-83 00
Fax (3 13) 4 59-86 22

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BERGER LAHR

we make things move