

## DC Rotary Solenoid

# 6

Product Group

# GDA

### Function

- increasing torque characteristic
- pure rotary operation, angles up to 95°
- with or without adjustable spring return
- left or right hand operation

### Construction

- no axial linear shaft movement, shaft supported in enclosed ball races
- free leads are standard
- class B coil insulation and protection classification IP 20 - DIN VDE 0470/EN 60529
- mounting provided by tapped holes in solenoid faces (also used for attaching spring return)
- round form - 6 sizes (type GDC for square form version)

### Applications

- shutters, office machines, reject mechanisms, optical, packaging, textile machines
- general purpose, high endurance for arduous service

### Options

- proportional, high torque, double acting type - list GDR
- plug base version to suit ZKBX/ZKBG plug connectors
- modifications and special designs on request

### Standards

- designed and tested to VDE 0580
- manufactured to ISO 9001



Fig.1 GDA with return spring

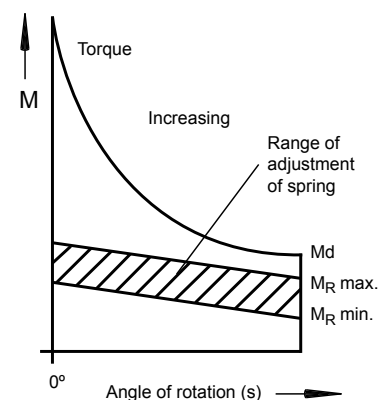


Fig.2 Rotary solenoid characteristic with spring return



**Technical data GDAX and GDAY without spring return**

<b>GDAX...X20 B01</b>		<b>025</b>					<b>035</b>					<b>050</b>				
Rotation angle* (°)		95 <sup>+3</sup>					95 <sup>+3</sup>					95 <sup>+3</sup>				
Operating mode		S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%
Torque M <sub>d</sub> (Ncm) at Δ	0°	0.63	0.95	1.05	1.15	1.10	1.68	2.00	2.15	2.20	2.00	9.00	10.00	10.20	10.00	8.40
	30°	0.22	0.50	0.70	0.85	1.15	0.73	1.45	1.75	2.00	2.45	3.90	6.55	8.10	9.50	11.00
	60°	0.10	0.25	0.40	0.55	0.85	0.34	0.80	1.20	1.45	2.00	1.50	3.25	4.80	6.60	8.90
	95°	0.065	0.17	0.27	0.40	0.80	0.22	0.58	0.90	1.30	2.25	0.77	1.70	2.55	4.10	7.40
Rated power P <sub>20</sub> (W)		4.2	10.9	16.6	24.3	57.6	7.0	16.2	24.2	38	105	13.3	27.2	41.5	75	168
Moment of inertia (kgm <sup>2</sup> )		0.102 x 10 <sup>-6</sup>					0.314 x 10 <sup>-6</sup>					1.903 x 10 <sup>-6</sup>				
Time constant τ (ms)		6.0					6.5					9.2				
Solenoid weight m <sub>M</sub> (kg)		0.07					0.16					0.42				

<b>GDAY...X20 B01</b>		<b>025</b>					<b>035</b>					<b>050</b>				
Rotation angle* (°)		65 <sup>+3</sup>					65 <sup>+3</sup>					65 <sup>+3</sup>				
Operating mode		S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%
Torque M <sub>d</sub> (Ncm) at Δ	0°	0.98	1.50	1.65	1.80	1.80	2.40	2.90	3.00	3.00	3.00	13.90	15.30	15.70	15.70	14.30
	20°	0.46	1.00	1.30	1.55	1.85	1.50	2.35	2.75	3.10	3.60	8.80	12.90	14.60	15.80	17.10
	40°	0.25	0.60	0.85	1.15	1.60	0.85	1.70	2.10	2.50	3.25	4.30	7.90	10.50	12.90	15.60
	65°	0.16	0.40	0.60	0.85	1.50	0.57	1.26	1.80	2.50	3.60	2.40	5.00	7.20	10.00	14.40
Rated power P <sub>20</sub> (W)		4.2	10.9	16.6	24.3	57.6	7.0	16.2	24.2	38	105	13.3	27.2	41.5	75	168
Moment of inertia (kgm <sup>2</sup> )		0.115 x 10 <sup>-6</sup>					0.366 x 10 <sup>-6</sup>					2.04 x 10 <sup>-6</sup>				
Time constant τ (ms)		9.0					8.0					15.5				
Solenoid weight m <sub>M</sub> (kg)		0.07					0.16					0.42				

<b>GDAY...X20 B03</b>		<b>025</b>					<b>035</b>					<b>050</b>				
Rotation angle* (°)		35 <sup>+3</sup>					35 <sup>+3</sup>					35 <sup>+3</sup>				
Operating mode		S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%
Torque M <sub>d</sub> (Ncm) at Δ	0°	1.05	1.60	1.90	2.00	2.10	2.50	3.30	3.60	3.90	4.30	14.40	17.70	19.20	20.00	20.40
	10°	0.84	1.55	1.90	2.15	2.55	2.10	3.10	3.50	3.95	4.60	12.30	16.20	18.00	19.80	21.80
	20°	0.66	1.35	1.80	2.20	2.90	1.80	2.90	3.50	4.10	5.20	10.00	15.40	18.00	20.70	24.30
	35°	0.38	0.90	1.30	1.70	2.60	1.20	2.40	3.00	3.70	5.10	5.90	10.60	13.60	16.90	21.70
Rated power P <sub>20</sub> (W)		4.2	10.9	16.6	24.3	57.6	7.0	16.2	24.2	38	105	13.3	27.2	41.5	75	168
Moment of inertia (kgm <sup>2</sup> )		0.140 x 10 <sup>-6</sup>					0.358 x 10 <sup>-6</sup>					2.11 x 10 <sup>-6</sup>				
Time constant τ (ms)		9					12					20				
Solenoid weight m <sub>M</sub> (kg)		0.07					0.16					0.42				

**Table Basis**

The terms used are defined in Technical Definitions GXX

Magnetic forces stated are based on

- 24V / 5-100% duty coil
- 35°C ambient temperature
- 90% of the rated voltage
- heat-insulated mounting
- working in the hot condition
- armature in horizontal attitude

Duty Rating ED, % of energised time/cycle:

$$\frac{t(\text{on})}{t(\text{on}) + t(\text{off})} \times 100$$

Max. energised time/cycle: 100% continuous: 40% - 120 secs, 25% - 75 secs, 15% - 45 secs, 5% - 15 secs

Rated Power P<sub>20</sub> stated with coil at 20°C

Values given may vary up to 10% owing to inherent and manufacturing tolerances



**Technical data GDAX and GDAY without spring return**

<b>GDAX...X20 B01</b>		<b>060</b>					<b>075</b>					<b>100</b>				
Rotation angle* (°)		95 <sup>+3</sup>					95 <sup>+3</sup>					95 <sup>+3</sup>				
Operating mode		S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%
Torque M <sub>d</sub> (Ncm) at $\Delta$	0°	19.50	22.30	22.60	22.30	17.90	34.00	33.00	31.00	28.50	19.00	68.00	68.00	65.00	59.00	37.00
	30°	7.50	14.20	17.00	19.60	23.40	19.40	30.00	33.50	35.50	39.00	51.00	66.00	72.00	77.00	83.00
	60°	3.00	6.40	9.70	13.00	18.90	8.10	17.50	22.50	27.50	33.00	28.00	47.00	57.00	65.00	78.00
	95°	1.30	3.40	5.00	7.60	14.00	4.40	11.10	16.20	20.50	35.00	16.00	38.00	52.00	66.00	89.00
Rated power P <sub>20</sub> (W)		16.8	40	61	96	262	23.5	55	82	124	303	32	78	123	195	514
Moment of inertia (kgm <sup>2</sup> )		4.88 x 10 <sup>-6</sup>					14.45 x 10 <sup>-6</sup>					51.20 x 10 <sup>-6</sup>				
Time constant $\tau$ (ms)		18					25					50				
Solenoid weight m <sub>M</sub> (kg)		0.74					1.48					3.40				

<b>GDAY...X20 B01</b>		<b>060</b>					<b>075</b>					<b>100</b>				
Rotation angle* (°)		65 <sup>+3</sup>					65 <sup>+3</sup>					65 <sup>+3</sup>				
Operating mode		S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%
Torque M <sub>d</sub> (Ncm) at $\Delta$	0°	28.50	33.00	34.00	34.00	31.00	48	50	49	47	39	93	97	97	91	67
	20°	15.00	25.40	29.10	31.90	35.70	37	48	53	55	58	82	102	109	113	117
	40°	7.90	16.80	21.60	26.00	34.60	19	37	44	48	57	56	86	99	108	119
	65°	3.90	9.30	13.40	18.40	29.30	11	25	35	42	59	37	73	97	113	136
Rated power P <sub>20</sub> (W)		16.8	40	61	96	262	23.5	55	82	124	303	32	78	123	195	514
Moment of inertia (kgm <sup>2</sup> )		5.14 x 10 <sup>-6</sup>					15.25 x 10 <sup>-6</sup>					54.60 x 10 <sup>-6</sup>				
Time constant $\tau$ (ms)		22.5					30					75				
Solenoid weight m <sub>M</sub> (kg)		0.74					1.48					3.40				

<b>GDAY...X20 B03</b>		<b>060</b>					<b>075</b>					<b>100</b>				
Rotation angle* (°)		35 <sup>+3</sup>					35 <sup>+3</sup>					35 <sup>+3</sup>				
Operating mode		S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%
Torque M <sub>d</sub> (Ncm) at $\Delta$	0°	31.00	38.00	41.00	43.00	46.00	60	67	68	69	64	127	136	137	135	121
	10°	25.00	35.50	39.50	43.00	49.00	54	66	71	73	75	119	140	147	150	149
	20°	18.50	32.00	38.00	43.00	53.00	47	65	73	79	88	118	152	165	176	191
	35°	10.80	21.50	28.00	34.50	46.00	30	51	63	70	87	81	136	156	172	195
Rated power P <sub>20</sub> (W)		16.8	40	61	96	262	23.5	55	82	124	303	32	78	123	195	514
Moment of inertia (kgm <sup>2</sup> )		5.39 x 10 <sup>-6</sup>					15.92 x 10 <sup>-6</sup>					57.90 x 10 <sup>-6</sup>				
Time constant $\tau$ (ms)		30					42.5					100				
Solenoid weight m <sub>M</sub> (kg)		0.74					1.48					3.40				

\*Other rotation angles on request

**Table notes**

0° is completion of energised rotation.

Torque figures M<sub>d</sub> (Ncm) are gross. To obtain net values deduct spring torque figures. See page 4.

**Supply voltage**

Standard voltage: 24V DC. Other voltages upon request. For voltages of ≥ 42V DC a protective earth connection to VDE0580 must be used. A 3-pin plug-base version is available for this purpose - contact our technical department for details.

These devices are manufactured to protection class III and are suitable for operation on low voltage protection circuits only, as per IEC60449.



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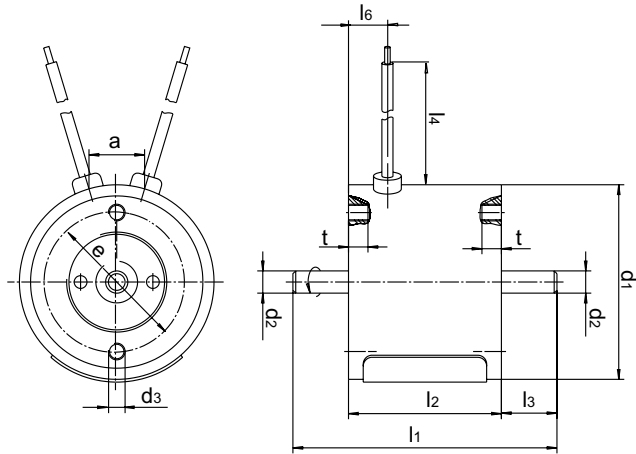


Fig.3 GDAX 025 to 050 and GDAY 025-050  
(mounting holes: 2 x 180°)

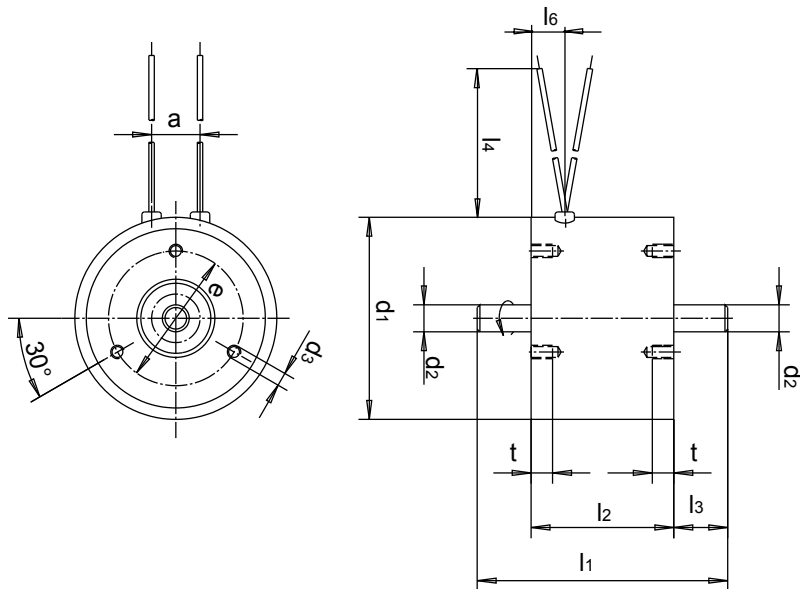
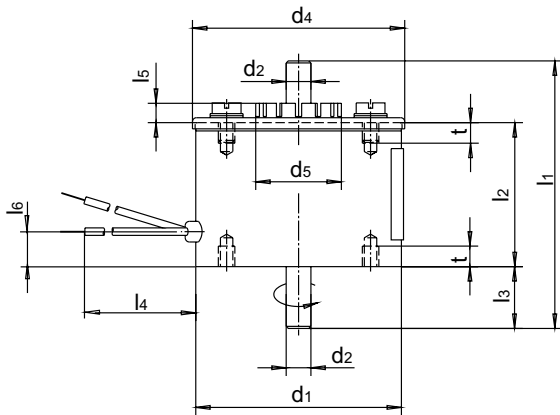
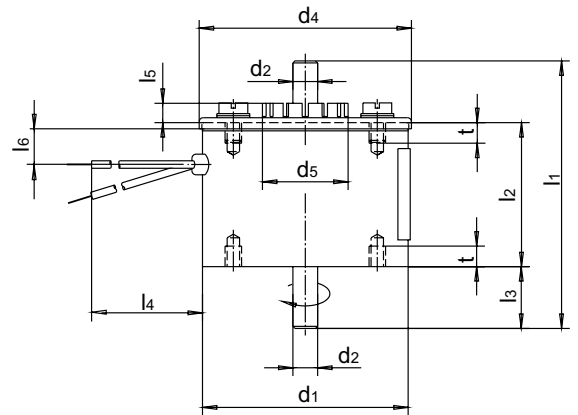


Fig.4 Type GDAX 060 to 100 and G DAY 060 to 100  
(mounting holes: 3 x 120°)



**Clockwise, ...B21, ...B23**



**Anti-clockwise, ...B25, ...B27**

Fig.5 Type GDAX 025 to 100 and G DAY 035 to 100 (with spring return)

GDAX and GDAY						
size	025	035	050	060	075	100
Dim.	Dimensions in mm					
a	---	10	11	11	18	17
d <sub>1</sub>	25	35	50	60	75	100
d <sub>2</sub>	3	4	6	8	10	12
d <sub>3</sub>	M3	M3	M4	M4	M5	M6
d <sub>4</sub>	26.2	36.4	51.6	61.6	76.2	102
d <sub>5</sub>	11.4	14.6	20.8	24	29.5	32
e	18	25	35	40	50	70
l <sub>1</sub>	55	47.5	65	78	93	118
l <sub>2</sub>	25	27.5	35	42	53	68
l <sub>3</sub>	15	10	15	18	20	25
l <sub>4</sub>	100	100	150	150	200	260
l <sub>5</sub>	3.2	4.5	4.7	6	8.5	10
l <sub>6</sub>	5.5	7	8.5	10	12.5	16
t	3	3.5	5	6	8	9

Do **not** exceed the thread depth 't' by use of over-length screws as this may cause damage to the coil.

The position of the flat on the shaft (return spring retainer) with reference to the mounting threads is not to a controlled dimension.



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## Technical data GDAX and GDAY with spring return

Please note: Size 025 and 035 with operating mode S1 are not available with spring

GDAX...X20 B21 B25	(clockwise)					(anti-clockwise)										
	025					035					050					
Rotation angle* (°)	95 <sup>+3</sup>															
Operating mode	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	
Self-aligning torque of the spring M <sub>R</sub> (Ncm)	min.	---	0.1	0.1	0.1	0.1	---	0.14	0.14	0.14	0.14	0.3	0.3	0.3	0.3	0.3
	max.	---	0.1	0.2	0.3	0.5	---	0.18	0.34	0.74	0.74	0.30	0.60	1.25	2.40	3.00
Spring constant (Ncm/°)	0.00206					0.0065					0.016					

GDAY...X20 B21 B25	(clockwise)					(anti-clockwise)										
	025					035					050					
Rotation angle* (°)	65 <sup>+3</sup>															
Operating mode	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	
Self-aligning torque of the spring M <sub>R</sub> (Ncm)	min.	0.1	0.1	0.1	0.1	0.1	0.14	0.14	0.14	0.14	0.14	0.3	0.3	0.3	0.3	0.3
	max.	0.1	0.3	0.4	0.6	0.6	0.27	0.72	1.00	1.40	1.60	0.75	2.16	3.40	3.50	3.50
Spring constant (Ncm/°)	0.00206					0.0065					0.016					

GDAY...X20 B23 B27	(clockwise)					(anti-clockwise)										
	025					035					050					
Rotation angle* (°)	35 <sup>+3</sup>															
Operating mode	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	
Self-aligning torque of the spring M <sub>R</sub> (Ncm)	min.	0.1	0.1	0.1	0.1	0.1	0.14	0.14	0.14	0.14	0.14	0.3	0.3	0.3	0.3	0.3
	max.	0.3	0.6	0.6	0.6	0.6	0.68	1.60	1.80	1.80	1.80	2.4	4	4	4	4
Spring constant (Ncm/°)	0.00206					0.0065					0.016					

GDAX...X20 B21 B25	(clockwise)					(anti-clockwise)										
	060					075					100					
Rotation angle* (°)	95 <sup>+3</sup>															
Operating mode	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	
Self-aligning torque of the spring M <sub>R</sub> (Ncm)	min.	0.56	0.56	0.56	0.56	0.56	1.1	1.1	1.1	1.1	1.1	2	2	2	2	2
	max.	0.6	1.0	2.0	4.0	5.6	1.8	5.0	8.4	11	11	12.5	20	20	20	20
Spring constant (Ncm/°)	0.026					0.05					0.1					

GDAY...X20 B21 B25	(clockwise)					(anti-clockwise)										
	060					075					100					
Rotation angle* (°)	65 <sup>+3</sup>															
Operating mode	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	
Self-aligning torque of the spring M <sub>R</sub> (Ncm)	min.	0.56	0.56	0.56	0.56	0.56	1.1	1.1	1.1	1.1	1.1	2	2	2	2	2
	max.	1.5	4.0	6.2	6.5	6.5	4.65	11.7	12.5	12.5	12.5	22.5	22.5	22.5	22.5	22.5
Spring constant (Ncm/°)	0.026					0.05					0.1					

GDAY...X20 B23 B27	(clockwise)					(anti-clockwise)										
	060					075					100					
Rotation angle* (°)	35 <sup>+3</sup>															
Operating mode	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	S1 100%	S3 40%	S3 25%	S3 15%	S3 5%	
Self-aligning torque of the spring M <sub>R</sub> (Ncm)	min.	0.56	0.56	0.56	0.56	0.56	1.1	1.1	1.1	1.1	1.1	2	2	2	2	2
	max.	4.8	7	7	7	7	14	14	14	14	14	25	25	25	25	25
Spring constant (Ncm/°)	0.026					0.05					0.1					

\*Other rotation angles on request

Data may be changed without notice - dimensions not guaranteed. Subject to our Standard Conditions



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## Spring return

The spring return performance table details the maximum and minimum torques obtainable by spring adjustment. The spring rates enable intermediate settings to be calculated in relation to requirements and solenoid performance at various duty ratings and with over-voltage.

### Spring return - Adjustment and handing

The spring return force may be varied by location of the spring tail in the castellations for coarse setting and rotation of spring housing for fine adjustment. The mechanism is interchangeable to either left or right hand - both shaft-ends are provided with slots for assembly of the spring return, which may be changed by:

Removing screws, lifting spring from castellation, removing plastic housing, disengaging spring from shaft flat with knife, sliding spring up and off shaft.

Refitting plastic housing, screws and spring at opposite and reversing spring direction (Fig. 6).

Sliding spring down shaft engaging in shaft flat.

Rotating and engaging spring in castellation for torque required, finally adjusting by screws and slots.

There is no linear movement of the output shafts, which are supported in two enclosed ball-race assemblies.

The load forces should be applied radially and not axially to obtain maximum life of the bearings and protection of the internal components, which are position fitted to the splined shaft for correct torque performance.

Two solenoids may be coupled together to provide a double-acting unit.

Plain stainless steel output shafts are provided. Alternative shaft arrangements including keyways are available to special order (details on request).

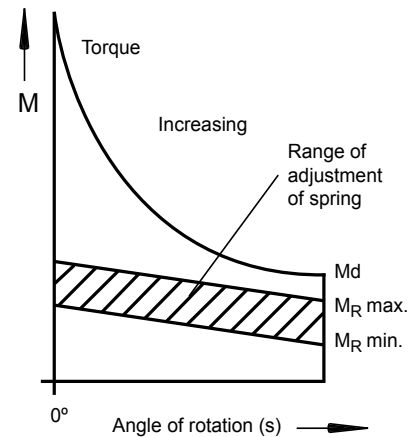


Fig.6 Rotary solenoid characteristic with spring return

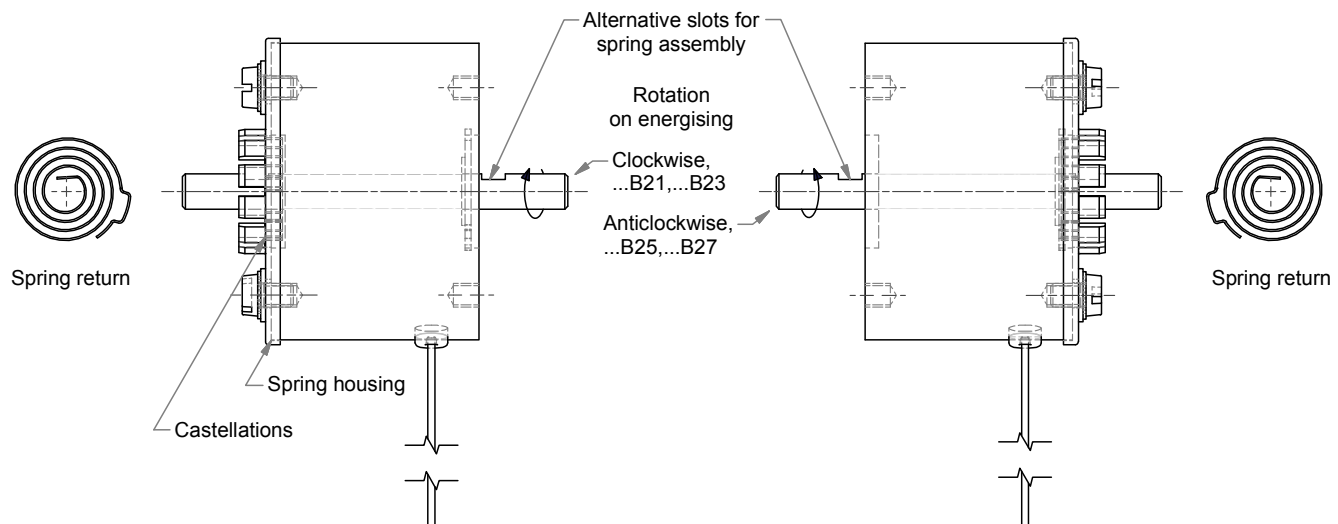


Fig.7 Spring return handing

## Safety

It is important that the user selects equipment that is suitable for the application, especially if safety would otherwise be compromised. We supply Technical Explanation documents to help users understand our products and assistance is always available from our technical department.



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### Installation guidelines

Rotary solenoids may be used in every mounting position. To ensure a long service life and to maintain their proper function, please make sure that shocks and higher pressure on the rotation axis in axial direction are avoided.

In case of vertical mounting, the support of added masses should be effected outside the solenoid. Furthermore, it is advisable to support bigger masses which are connected to the shaft outside the solenoid and not with the stops inside the solenoid.

For connection via plug connector Z KB X resp. Z KB G, please pay attention to the max. continuous current of the plug.

### Arrangement

The range comprises 6 sizes, each with 3 alternative maximum rotation angles: 35°, 65°, 95° (other rotation angles to special order - details on request).

The solenoids may be stalled at any angle without electrical or mechanical harm. External stops are desirable for high inertia applications.

Reduced angle should be used from completion of the energised stroke (0°) to obtain maximum torque.

The standard solenoids are provided with free leads. Alternative arrangements with terminal block or plug are available.

### Function Principle

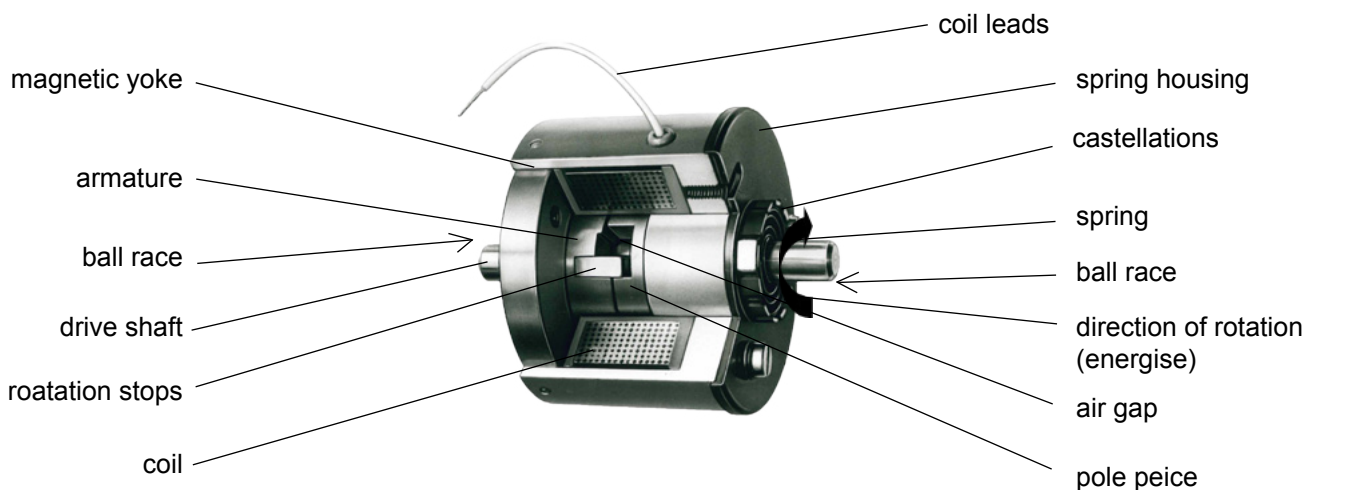


Fig.8 Schematic function  
Rotary solenoid type GDA with spring return

The coil's magnetic field attracts, via the fixed magnetic yoke and pole piece, the armature, fixed to the splined shaft, through the air gap formed by their inclined surfaces. This force provides rotary, (without linear) movement on the shaft, within the stop limits.

### Special

Special solenoids are available to meet the requirements of specific applications, such as short duty rating, high ambient temperature, special voltages, double acting etc., for which full operating, application and working conditions as well as environment should be specified in accordance with Technical Definitions- GXX.

### Directives

A statement on compliance with European Directives is available on our website under "Our Technology".



**Order example: GDAX 050 X20 B21 24V 100%**

**Order Codes Table:**

Order Example	GDA	X	050	X20	B21	24V 100%
Group Basic Construction	GDA					
Modification code		X= 95° Y= 65°, 35°				
Size			025 035 <b>050</b> 060 075 100			
Arrangement & Basic protection				X20		
Design number					<u>95°</u> : B01 (without spring) <b>B21</b> (with spring - page 6) B25 (with spring - page 6)  <u>65°</u> : B01 (without spring) B21 (with spring - page 6) B25 (with spring - page 6)  <u>35°</u> : B03 (without spring) B23 (with spring - page 6) B27 (with spring - page 6)	
Voltage & Duty Rating						<b>24V, 205V</b> <b>100%, 40%, 25%, 15%, 5%</b>

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