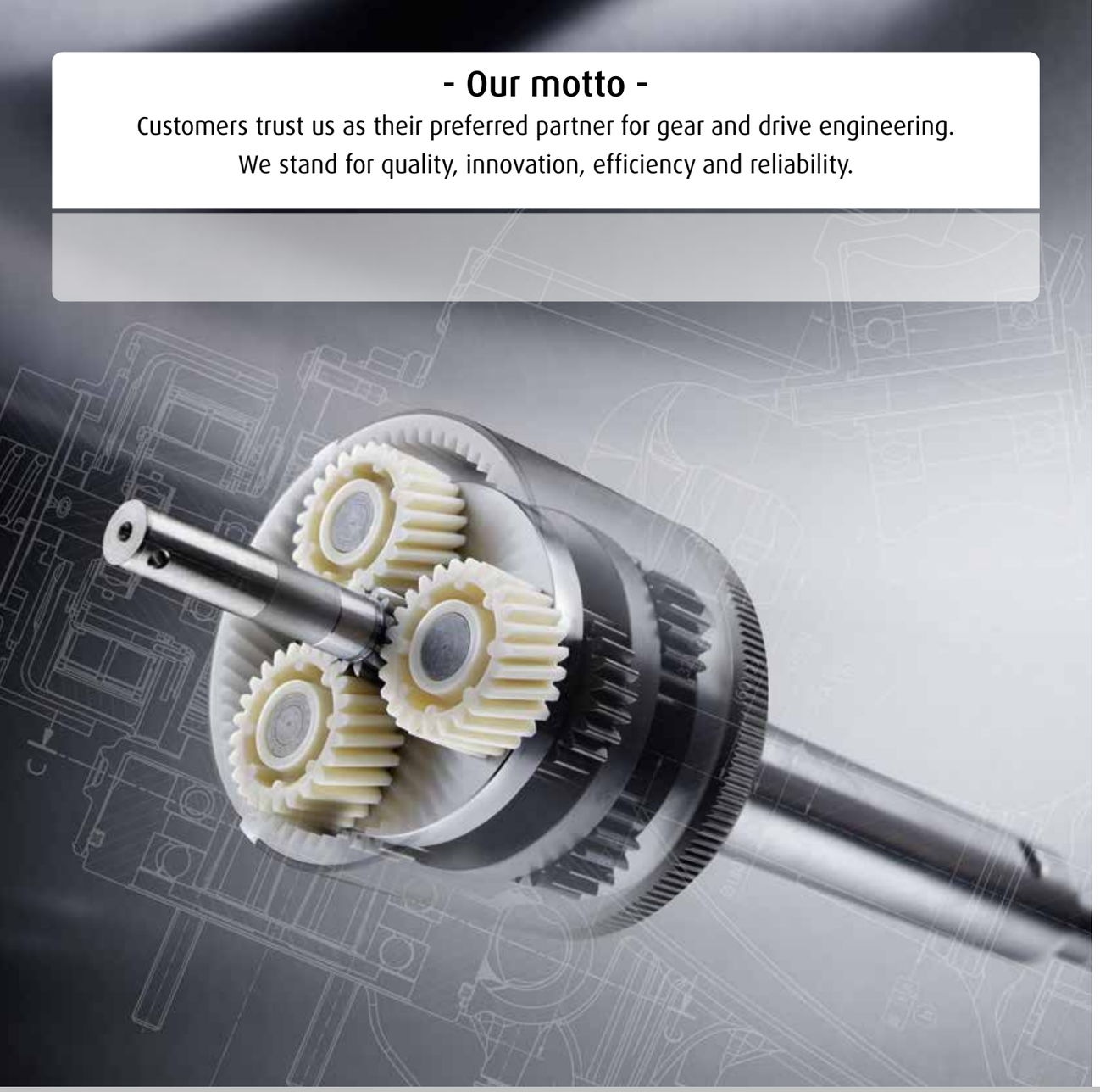
Planetary gears.

Standard series & custom engineered solutions.

FramoMorat
Franz Morat Group



- Our motto -

Customers trust us as their preferred partner for gear and drive engineering.
We stand for quality, innovation, efficiency and reliability.

Your satisfaction is our ultimate goal.

Our services in every aspect of the planetary gear.

Framo Morat is not only known for its comprehensive manufacturing expertise. Our customers also revere us as experienced partners in drive technology. This expertise is the foundation of our planetary gear series.

We place great importance on your flexibility in the configuration and application of our planetary gears. Being faithful to our motto customer satisfaction is always a priority.

Quality

Our high quality standards apply to all our planetary gearbox series. These include especially high gearing quality, low backlash and long service life.

Innovation

Fast response to customer requests and constant further development of our planetary gears is our driving force. Do you have special requirements? We will gladly elaborate with you innovative solutions and drive concepts.

Profitability

Planetary gears are known for their high efficiency. Owing to the high manufacturing quality of our gearbox series we offer you an excellent price-performance ratio.

Reliability

Our planetary gears accomplish reliable performance in their numerous applications. Being your reliable partner and supplier is our constant driving force.

Flexibility

We offer you the highest form of flexibility in motor integration through our versatile product range with mounting flanges and reduction sleeves. The results are drive solutions for industries like mechanical engineering, medical technology, energy generation or building technology.

Or do you require an individual solution? Together we will develop innovative drive solutions of tomorrow.

What can we do for you?

We are glad to be personally there for you and we look forward to common challenges and projects:

Phone **+49 7657 88 303**

E-Mail **drives@framo-morat.com**

For further information visit **www.framo-morat.com**

Design

The selection of an appropriate planetary gear for your individual application. Contact us by phone or via the inquiry form on www.framo-morat.com

Short delivery time

Small quantities available on short notice. Delivery time for larger quantities or special requests has to be checked individually

Custom engineered solutions

We will accompany you from the specification to the series! We will employ decades of experience in development of custom engineered drives

Repair service

We will take over inspection and maintenance for you

CAD drawings

Drawings for all series are available on request

Flexibility

For customized solutions we draw from a large range of single components. Depending on demand they may be combined for you in a flexible way

Production

Do you have individual requirements?
We integrate the entire process chain - metalworking, quality control & assembling - on our own premises

Personal contacts

We support you internationally! We look forward to receiving questions about planetary gears via phone or email

Planetary gears • Overview

		High-End			High-End Economy	
Diameter Gearbox (mm)		GSD 47 / 64 / 90 / 110 / 140	GSB 44 / 62 / 90 / 120 / 142 / 180	GSBL 44 / 62 / 90 / 120 / 142 / 180	GSN 60 / 80 / 115	GFE 50 / 70 / 90 / 120 / 145 / 180 / 220
Nominal output torque (Nm)		17 - 683	14 - 1266	14 - 1266	26 - 182	13 - 1562
Acceleration torque (Nm)		30 - 1229	25 - 2279	25 - 2279	47 - 327	24 - 2812
Emergency stop torque (Nm)		50 - 2048	41 - 3799	41 - 3799	79 - 545	40 - 4686
Transmission	1-st.	4, 5, 7, 10	3, 4, 5, 7, 8, 10	3, 4, 5, 7, 10, 16, 20	3, 4, 5, 7, 10	3, 4, 5, 7, 10
	2-st.	20, 25, 35, 40, 50, 70, 100	15, 20, 25, 30, 35, 50, 60, 70, 100	25, 30, 50, 70, 100, 140, 180, 200	15, 20, 25, 30, 35, 40, 50, 70, 100	15, 20, 25, 30, 35, 40, 50, 70, 100
Backlash (arcmin)	1-st.	<=3 (opt. <=1)	<=3 (opt. <=1)	<=4 (opt. <=2)	<=7	<=7
	2-st.	<=5 (opt. <=3)	<=5 (opt. <=3)	<=7 (opt. <=4)	<=10	<=10

Customer-specific planetary gears
...individually developed for you in accordance with the following parameters:
▪ Gearbox sizes ▪ Gear stages ▪ Gear ratios ▪ Gear types ▪ Bearings ▪ Materials ▪ Lubrication ▪ Interfaces ▪ etc.

GSD

- Compact design
- Highest torsional rigidity
- High permissable radial & axial forces

GSB

- Low backlash for high precision, standard up to <=3 arcmin, optional up to <= 1arcmin
- High torque level
- Best corrosion protection for complete housing including output side

GSBL

- Right angle version for space restricted applications
- High torque level
- Up to ratio i = 200 in 2-stage version

GSN

- Low noise level due to ground helical gearing
- High power density
- Protection class IP65

GFE

- Big housing sizes up to 220 mm
- Max. input speed up to 10,000 rpm
- 30,000 h life time

Customer-specific planetary gears

- Individualized design of material, diameter, bearing, tooth width, etc. on each planetary carrier
- Error-free connection to all interfaces
- Drive integration into your entire system taking into account the mechanics, electronics and control technology

Selection criteria

Gearbox characteristics	GSD	GSB	GSBL	GSN	GFE	Custom
Rotational speed	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓
Torque	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓	✓ ✓	✓ ✓ ✓
Range of transmission ratios	✓ ✓	✓ ✓	✓ ✓ ✓	✓ ✓	✓ ✓	✓ ✓ ✓
Backlash	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓	✓ ✓	✓ ✓ ✓
Lifetime	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓
Protection class	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓
Radial force	✓ ✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓ ✓
Axial force	✓ ✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓ ✓
Noise	✓ ✓ ✓	✓ ✓ ✓	✓ ✓	✓ ✓ ✓	✓ ✓	✓ ✓ ✓
Weight	✓ ✓	✓ ✓	✓	✓ ✓	✓	✓ ✓ ✓

The G-series.

Low-backlash planetary gears - compact and highly precise.

Bearing system

Standard use of maximum preloaded deep groove ball bearings. Optionally, the GSD line is also available with taper roller bearings to accommodate higher radial and axial forces.

One-piece planetary carrier

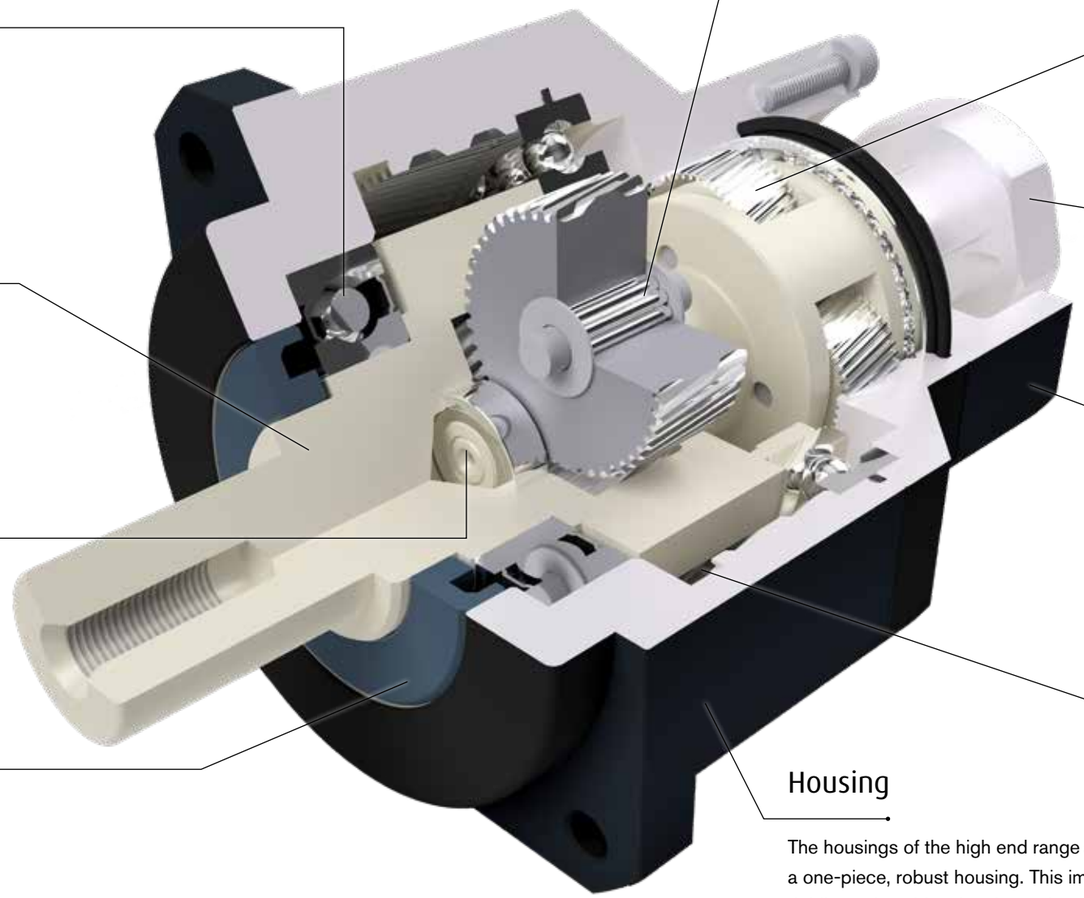
All planetary carriers are manufactured as a cage made from solid material. This increases quiet operating characteristics while at the same time improving positioning accuracy and reducing backlash.

Sun pinion bearing system

In the high-end gearbox range, the sun pinions are fitted with an additional bearing system in order to ensure quieter operating behavior.

Sealing

An additional shaft sealing ring ensures maximum dust and splash water protection in accordance with protection class IP65 in all lines.



Full needle bearing

All lines have a full needle bearing, which has been especially designed for high torques.

Housing

The housings of the high end range are designed from a one-piece, robust housing. This improves the gear rigidity and enables the absorption of higher loads.

Helical cut components

All lines are equipped with ground, helical-cut precision components, which ensure low operating noise, very quiet operating characteristics and above-average torque absorption.

Slotted hollow input shaft

Due to the high surface pressure, the slotted, two-piece hollow input shaft represents the ideal connection between the motor shaft and gearbox.

Space-optimized 2 stage design

The GSD, GSB & GSBL high-end gearbox lines are constructed in a space-optimized, two-stage design. Due to the lower torque values, the input stage is dimensionally smaller than the output stage.

Lubrication

The use of a synthetic fluid grease for optimal service life lubrication renders a grease refill unnecessary.

G-series - High-End & High-End Economy range

The G-series includes the high-end gearbox lines GSD (flange gear), GSB (inline) and GSBL (angle gear) as well as the high-end economy GSN and GFE lines.

Particularly suitable applications for the G-series are those which place the highest demands on positioning accuracy, operating noises, running smoothness, bending rigidity and transmitted torque. The G-series is designed to meet the highest production requirements—all planetary gear sets are equipped with precision ground helical gearing, single-piece planetary carriers and full needle bearings. Resolutely applied quality assurance measures consistently ensure that all high quality requirements are fulfilled at all times.

Particularly in the case of medium and large-volume projects, custom adaptations can also be made. We would be happy to develop your customized gearbox in accordance with your individual specifications.

Definition of serial number

Internal Group No.		Type	Size	Bearing		Backlash level		Input hollow shaft		Ratio
3	-	GSD	090	T	-	1	-	11	-	100
3	-	GSB	090		-	1	-	19	-	005
3	-	GSBL	120		-	1	-	28	-	010
3	-	GSN	060		-		-	14	-	025
3	-	GFE	090		-		-	19	-	005

Bearing: with T = Tapered bearing; without T = Ball bearing
Backlash level: 1 = Standard; 0 = Reduced backlash
Input hollow shaft diam. = Max. motorshaft diam. = D9 in gearbox dimensions

Planetary gears GSD

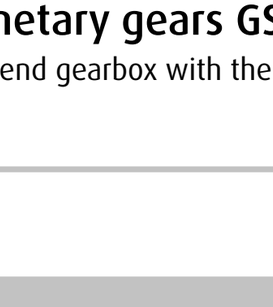
High-end gearbox with the highest positioning precision for dynamic applications.

Its short design makes the GSD line the ideal high-end gearbox for space restricted applications. The flange output produces highest torsional rigidity. The low standard backlash of the GSD line makes it the perfect fit for highly dynamic applications where highest positioning and speed accuracy is required.

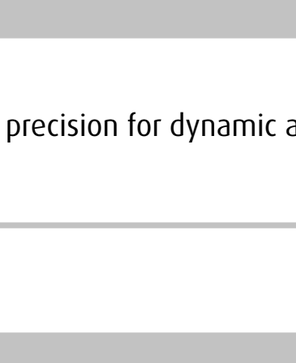
You benefit from:

- Short construction
- Highest torsional rigidity
- High permissible radial and axial forces
- Low backlash,
  standard up to <=3 arcmin, optional up to <= 1 arcmin
- Low noise level
- Protection class IP 65

Output flange for robotics
Short design and stiff connection.



Taper roller bearing
Accommodation of particularly high axial loads, optional for 90 mm diameter or higher.



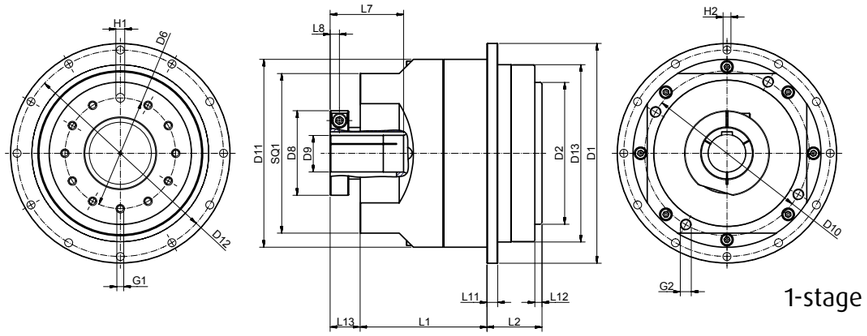
One-piece output flange / planetary carrier
High torsional rigidity and exact positioning precision.

Typical application example

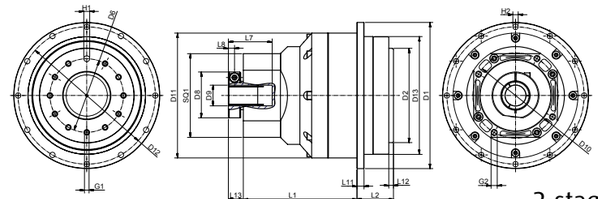
Wheel hub drive for AGVs

Automated guided vehicles (AGV) distribute picked goods in roomy warehouse and trucking company halls. They usually work self-sufficiently. The AGVs are especially productive and economical if they are allowed to reach long travel distances and travel times without requiring repeated recharging of the energy storage units. This places special demands on construction and design. In particular, the vehicles and the installed components in it have to be lightweight and compact. Thanks to high bending rigidity, the high absorption of axial and radial loads and the compact design, the GSD line offers numerous advantages.

ISO-projection metric



1-stage



2-stage

Planetary gears GSD • Dimensions

Gearbox characteristics			Stage	GSD047	GSD064	GSD090	GSD110	GSD140
Housing diameter	D_1			72	86	118	146	179
Centering diameter output	D_2	h7		28	40	63	80	100
Hole circle diameter output	D_6			20	31.5	50	63	80
Clamping system diameter	D_8		1	27	40	49	67	80
			2	27	29	40	49	67
Input hollow shaft diameter	D_9	F7	1	11	19	24	28	38
			2	11	14	19	24	32
Hole circle diameter input	D_{10}		1	42	60.5	90	120	143
			2	42	42	60.5	90	120
Housing diameter input	D_{11}	h7		59	70	98	125	156
Hole circle diameter (2) output	D_{12}			67	79	109	135	168
Output flange diameter	D_{13}	h7		47	64	90	110	140
Housing length	L_1		1	33.5	46.5	69.5	80.5	103
			2	61.5	68.5	94	125.5	161
Shaft length output	L_2			23.5	24.5	37	37	40
Max. input length motor shaft	L_7		1	27	28	49.5	57	100
			2	21	25.5	27.5	50	57
Distance to center of screw	L_8		1	4.5	6	7	9	10.5
			2	4.5	5	6	7	9
Flange thickness output	L_{11}			4	5	7	8	10
Flange length output	L_{12}			1.5	4	6	6	6
Distance clamping ring - housing	L_{13}		1	10	15.5	18	25.5	25.5
			2	10	11.5	15.5	18	25.5
Square housing	SQ_1		1	44	62	98	126	156
			2	44	44	62	90	120
Min. mounting thread x depth	G_1			4 x M3 x 6.5	7 x M5 x 8	7 x M6 x 12	11 x M6 x 12	11 x M8 x 16
Min. mounting thread x depth	G_2		1	M4 x 8	M5 x 10	M5 x 10	M8 x 16	M8 x 16
			2	M4 x 8	M4 x 8	M5 x 10	M6 x 12	M8 x 16
Hole bore	H_1	H7		3 x 4	5 x 6	6 x 6	6 x 7	8 x 8
Hole bore	H_2			8 x 3.4	8 x 4.5	8 x 5.5	8 x 5.5	12 x 6.6

Find more information regarding flanges and reduction sleeves for all common motor types on pages 48-50.

			GSD047	GSD064	GSD090	GSD110	GSD140	Stage
Service lifetime*1	t_L	h	30000					
Nominal input speed	n_1	rpm	5000	4500	4500	4000	3500	
Max. input speed	$n_{1\,max.}$	rpm	10000	10000	8000	8000	6500	
Standard backlash	j_t	arcmin	<= 3 (opt. <=1)					1
			<= 5 (opt. <=3)					2
Noise level*2	Q_g	dB (A)	<= 56	<= 58	<= 60	<= 63	<= 65	
Efficiency	η	%	>= 97					1
			>= 94					2
Protection class			IP65					
Torsional rigidity	c_t	Nm/arcmin	6	14	30	86	155	
Max. radial force (ball bearing)*3	F_{2r}	N	1530	1890	6345	9540	10550	
Max. axial force (ball bearing)*3	F_{2a}	N	1020	1260	4230	6360	7035	
Max. radial force (tapered bearing)*3	F_{2r}	N	-	-	6345	9540	10550	
Max. axial force (tapered bearing)*3	F_{2a}	N	-	-	7330	11500	18600	
Operating temperature	T_B	°C	-25°C - +90°C					
Lubrication			Synthetic grease (lifetime-lubricated)					
Weight with flange*4	m_g	kg	0.7	1.4	4.2	7.4	13.9	1
			1	1.9	4.8	9.4	16.7	2
Mounting position			Any					

Output torques			GSD047	GSD064	GSD090	GSD110	GSD140	Ratio	Stage
Nominal output torque*5	T_{2N}	Nm	23	63	168	352	683	4	1
			21	53	163	350	649	5	1
			20	49	149	324	602	7	1
			17	45	143	309	576	10	1
			23	63	168	352	683	20	2
			21	53	163	350	649	25	2
			20	49	149	324	602	35	2
			23	63	168	352	683	40	2
			21	53	163	350	649	50	2
			20	49	149	324	602	70	2
			17	45	143	309	576	100	2
Max. acceleration torque*6	T_{2B}	Nm	42	113	302	633	1229	4	1
			38	95	293	629	1168	5	1
			36	89	268	584	1083	7	1
			30	81	257	556	1038	10	1
			42	113	302	633	1229	20	2
			38	95	293	629	1168	25	2
			36	89	268	584	1083	35	2
			42	113	302	633	1229	40	2
			38	95	293	629	1168	50	2
			36	89	268	584	1083	70	2
			30	81	257	556	1038	100	2
Emergency stop torque*7	T_{2Not}	Nm	69	189	504	1055	2048	4	1
			63	158	488	1049	1947	5	1
			60	148	447	973	1805	7	1
			50	135	428	926	1729	10	1
			69	189	504	1055	2048	20	2
			63	158	488	1049	1947	25	2
			60	148	447	973	1805	35	2
			69	189	504	1055	2048	40	2
			63	158	488	1049	1947	50	2
			60	148	447	973	1805	70	2
			50	135	428	926	1729	100	2

Mass moment of inertia			GSD047	GSD064	GSD090	GSD110	GSD140	Ratio	Stage
Mass moment of inertia*8	J_1	kgcm²	0.03	0.13	0.47	2.75	7.46	4	1
			0.03	0.12	0.45	2.7	7.41	5	1
			0.03	0.12	0.45	2.64	7.12	7	1
			0.03	0.12	0.43	2.56	7.01	10	1
			0.03	0.03	0.15	0.45	2.7	20	2
			0.03	0.03	0.15	0.45	2.7	25	2
			0.03	0.03	0.15	0.45	2.7	35	2
			0.03	0.03	0.15	0.45	2.7	40	2
			0.03	0.03	0.14	0.4	2.6	50	2
			0.03	0.03	0.14	0.4	2.6	70	2
			0.03	0.03	0.14	0.4	2.6	100	2

*1 Load factor K_A=1, n_2=100 rpm ,at room temperature T=20°C in new condition
*2 Sound pressure level at 1 m distance, measured for an input speed of 3000 rpm without load
*3 On the center of the output shaft
*4 Deviation of up to 10 % possible
*5 Service life: 30,000 h, n_2=100 rpm
*6 Max 1000 cycles per hour. Acceleration torque proportion < 5% of the total operation time
*7 Max 1000 cycles over the gear service life
*8 Related to the input shaft

Planetary gears GSB

Low-backlash high-end gears set new standards in torque.

Our GSB line stands for high performance in combination with low backlash and high precision. Helical gears ensure a minimum noise level and smooth running. The GSB line aligns economic efficiency with flexibility and is your perfect fit for a multitude of applications.

You benefit from:

- Low backlash for high precision, standard up to <=3 arcmin, optional up to <= 1 arcmin
- High torque level
- Best corrosion protection also for output side
- Low noise level up to <56 dB (A)
- Long product lifetime up to 30,000 h
- High torsional rigidity

Precision ground helical gearing

Maximum precision and smoothness as well as minimization of operating noises.

Full needle bearing

Torques that beat the competition for units of the same size.

One-piece housing

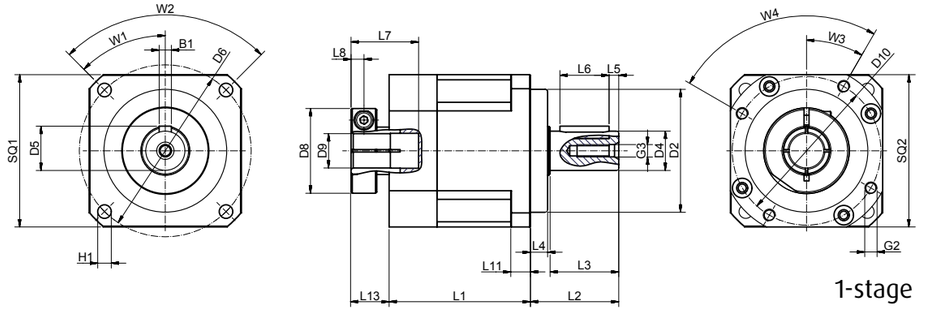
High gearbox rigidity and absorption of high radial and axial loads.

Typical application example

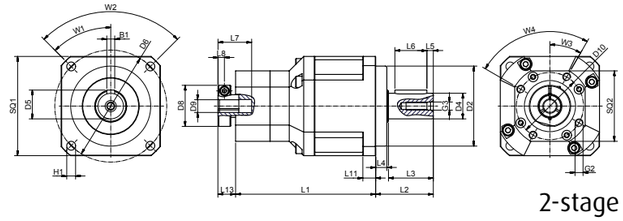
Axis drive for laser cutting machines

The GSB090 planetary gear, with a gear ratio of i=10, is used as a machine axis drive (x- and y-axis) in laser cutting machines. A servo motor and a rack and pinion complete the unit. Thanks to the nominal input speed of 4,000 rpm and the maximum input speed of 8,000 rpm, the gearbox is ideally suited for use in fast, dynamic laser cutting machines. Due to the high positioning accuracy and high dynamic driveability, the GSB line is the ideal choice for applications of this sort.

ISO-projection metric



1-stage



2-stage

Planetary gears GSB • Dimensions

Gearbox characteristics			Stage	GSB044	GSB062	GSB090	GSB120	GSB142	GSB180
Centering diameter output	D_2	h7		35	50	80	110	130	160
Output shaft diameter	D_4	h6		13	16	22	32	40	55
Shaft height including feather key	D_5			15	18	24.5	35	43	59
Hole circle diameter output	D_6			50	70	100	130	165	215
Clamping system diameter	D_8		1	27	40	49	67	80	107
			2	27	27	40	49	67	80
Max. motor shaft diameter	D_9	F7	1	11	19	24	28	35	55
			2	11	11	19	24	28	35
Hole circle diameter input	D_{10}		1	42	60.5	90	120	145	186
			2	42	42	60.5	90	120	145
Housing length	L_1		1	53	65.5	90	104.5	133	172
			2	79	87.5	111	149.5	171	217
Shaft length output	L_2			26	36	48	65	92	106
Shaft length from shoulder	L_3			21	29	38	53	77	86
Centering depth output	L_4			5	7	10	12	15	20
Distance from shaft end	L_5			2.5	4	3	5	5	6
Feather key length	L_6			15	20	30	40	65	70
Max. input length motor shaft	L_7		1	21	27.5	50	57	74.5	103
			2	21	21	27.5	50	57	74.5
Distance to center of screw	L_8		1	4.5	6	7	9	10.5	11
			2	4.5	4.5	6	7	9	10.5
Flange thickness output	L_{11}			5	8	10	12	15	16
Distance clamping ring - housing	L_{13}		1	11	15.5	17.5	25.5	25.5	34
			2	11	11	15.5	17.5	25.5	25.5
Square housing output	SQ_1			44	62	90	120	142	180
Square housing input	SQ_2		1	44	62	90	120	142	180
			2	44	44	62	90	120	142
Feather key width	B_1	h9		5	5	6	10	12	16
Min. mounting thread x depth	G_2	4 x	1	M4 x 8	M5 x 11	M6 x 12	M8 x 16	M10 x 20	M12 x 24
			2	M4 x 8	M4 x 8	M5 x 11	M6 x 12	M8 x 16	M10 x 20
Min. mounting thread x depth	G_3			M4 x 11	M5 x 14	M8 x 20	M10 x 23	M12 x 28	M14 x 32
Hole bore	H_1	4 x		4.5	5.5	6.8	9	11	13
Angle in °	W_1			45	45	45	45	45	45
x times angle in °	W_2			4 x 90	4 x 90	4 x 90	4 x 90	4 x 90	4 x 90
Angle in °	W_3			30	30	30	30	30	30
x times angle in °	W_4			4 x 90	4 x 90	4 x 90	4 x 90	4 x 90	4 x 90

Find more information regarding flanges and reduction sleeves for all common motor types on pages 48-50.

			GSB044	GSB062	GSB090	GSB120	GSB142	GSB180	Stage
Service lifetime*1	t_L	h	30000						
Nominal input speed	n_1	rpm	5000	5000	4000	4000	3000	3000	
Max. input speed	$n_{1\,max.}$	rpm	10000	10000	8000	8000	6000	6000	
Standard backlash	j_t	arcmin	<= 3 (opt. <= 1)						1
			<= 5 (opt. <= 3)						2
Noise level*2	Q_g	dB (A)	<= 56	<= 58	<= 60	<= 63	<= 65	<= 67	
Efficiency	η	%	>= 97						1
			>= 94						2
Protection class			IP65						
Torsional rigidity	c_t	Nm/arcmin	3	7	14	27	60	145	
Max. radial force*3	F_{2r}	N	780	1530	3250	6800	9400	15600	
Max. axial force*3	F_{2a}	N	390	765	1625	3700	4700	7800	
Operating temperature	T_B	°C	-25°C - +90°C						
Lubrication			Synthetic grease (lifetime-lubricated)						
Weight with flange*4	m_g	kg	0.6	1.28	3.6	8	14.3	28.3	1
			0.6	1.73	4.6	9.42	17.2	34.1	2
Mounting position			Any						

Output torques			GSB044	GSB062	GSB090	GSB120	GSB142	GSB180	Ratio	Stage
Nominal output torque*5	T_{2N}	Nm	20	62	173	352	656	1266	3	1
			17	54	153	315	583	1122	4	1
			17	50	168	350	649	1248	5	1
			16	47	156	324	602	1163	7	1
			15	45	150	313	581	1124	8	1
			15	45	148	309	576	1112	10	1
			20	62	173	352	656	1266	15	2
			17	54	153	315	583	1122	20	2
			17	50	168	350	649	1248	25	2
			16	47	159	327	612	1174	30	2
			16	47	156	324	602	1163	35	2
			17	50	168	350	649	1248	50	2
			16	47	159	327	612	1174	60	2
			16	47	156	324	602	1163	70	2
			15	45	148	309	576	1112	100	2
Max. acceleration torque*6	T_{2B}	Nm	36	112	312	633	1181	2279	3	1
			30	96	276	567	1049	2020	4	1
			30	91	302	629	1168	2247	5	1
			28	85	282	584	1083	2094	7	1
			26	81	270	563	1045	2022	8	1
			26	81	266	556	1038	2002	10	1
			36	112	312	633	1181	2279	15	2
			30	96	276	567	1049	2020	20	2
			30	91	302	629	1168	2247	25	2
			28	85	285	588	1102	2113	30	2
			28	85	282	584	1083	2094	35	2
			30	91	302	629	1168	2247	50	2
			28	85	285	588	1102	2113	60	2
			28	85	282	584	1083	2094	70	2
			26	81	266	556	1038	2002	100	2
Emergency stop torque*7	T_{2Not}	Nm	60	186	520	1055	1969	3799	3	1
			50	161	460	945	1748	3367	4	1
			50	151	504	1049	1947	3745	5	1
			47	142	469	973	1805	3490	7	1
			44	135	450	939	1742	3371	8	1
			44	135	444	926	1729	3336	10	1
			60	186	520	1055	1969	3799	15	2
			50	161	460	945	1748	3367	20	2
			50	151	504	1049	1947	3745	25	2
			47	142	476	980	1836	3522	30	2
			47	142	469	973	1805	3490	35	2
			50	151	504	1049	1947	3745	50	2
			47	142	476	980	1836	3522	60	2
			47	142	469	973	1805	3490	70	2
			44	135	444	926	1729	3336	100	2

Mass moment of inertia			GSB044	GSB062	GSB090	GSB120	GSB142	GSB180	Ratio	Stage
Mass moment of inertia*8	J_1	kgcm²	0.03	0.16	0.61	3.25	9.21	28.98	3	1
			0.03	0.14	0.48	2.74	7.54	23.67	4	1
			0.03	0.13	0.47	2.71	7.42	23.29	5	1
			0.03	0.13	0.45	2.62	7.14	22.48	7	1
			0.03	0.13	0.44	2.58	7.07	22.59	8	1
			0.03	0.13	0.44	2.57	7.03	22.51	10	1
			0.03	0.03	0.14	0.46	2.63	7.3	15	2
			0.03	0.03	0.14	0.46	2.63	7.3	20	2
			0.03	0.03	0.14	0.46	2.63	7.1	25	2
			0.03	0.03	0.14	0.46	2.43	7.1	30	2
			0.03	0.03	0.14	0.44	2.43	7.1	35	2
			0.03	0.03	0.14	0.44	2.43	6.92	50	2
			0.03	0.03	0.14	0.43	2.39	6.72	60	2
			0.03	0.03	0.14	0.43	2.39	6.72	80	2
			0.03	0.03	0.14	0.4	2.39	6.72	100	2

*1 Load factor K_A=1, n_2=100 rpm ,at room temperature T=20°C in new condition
*2 Sound pressure level at 1m distance, measured for an input speed of 3000 rpm without load
*3 On the center of the output shaft
*4 Deviation of up to 10 % possible
*5 Service life: 30,000 h, n_2=100 rpm
*6 Max 1000 cycles per hour. Acceleration torque proportion < 5% of the total operation time
*7 Max 1000 cycles over the gear service life
*8 Related to the input shaft

Planetary gears GSBL

Low-backlash high-end angular gearboxes - powerful performance in a small space.

Just like the GSB line, our GSBL line combines high performance with low backlash and high precision. Helical gears secure a minimum noise level and smooth running. The right angle shape makes the GSBL line the perfect match for all dynamic applications where space is limited.

You benefit from:

- Right angle version for space restricted applications
- High torque level
- Up to ratio i = 200 in 2-stage version
- Best corrosion protection also for output side
- Low noise level up to <56 dB (A)
- Long product life time up to 30,000 h

Precision ground bevel gearbox

Maximum positioning accuracy and excellent quiet operating characteristics.

Precision ground helical gearing

Maximum precision and smoothness as well as minimization of operating noises.

One-piece planetary carrier

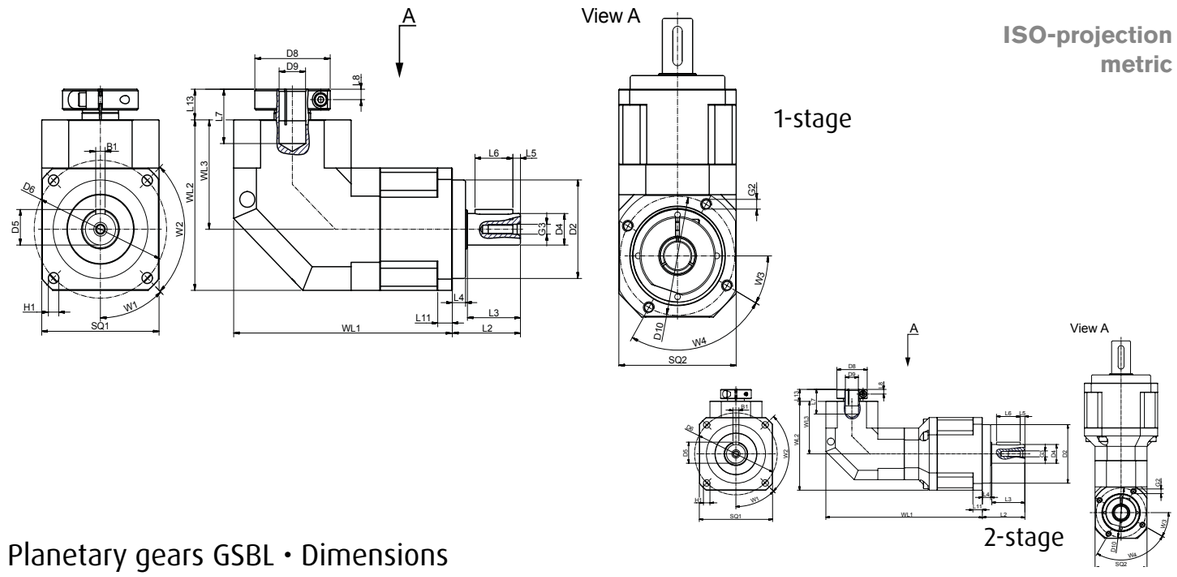
Highest positioning accuracy and high torsional rigidity.

Typical application example

Angle gearbox for rotary tables

The GSBL070 angular gearboxes with gear ratios i=5 and i=10 are often utilized in rotary tables due to their design, their exceptionally high performance and their high input speeds. The angle design enables optimum utilization of tight installation spaces. The high-end angular gearboxes of the GSBL line, for example, shine particularly in the case of rotary tables with high precision requirements.

ISO-projection metric



Planetary gears GSBL • Dimensions

Gearbox characteristics			Stage	GSBL044	GSBL062	GSBL090	GSBL120	GSBL142	GSBL180
Centering diameter output	D_2	h7		35	50	80	110	130	160
Output shaft diameter	D_4	h6		13	16	22	32	40	55
Shaft height including feather key	D_5			15	18	24.5	35	43	59
Hole circle diameter output	D_6			50	70	100	130	165	215
Clamping system diameter	D_8		1	27	40	49	67	80	107
			2	27	27	40	49	67	80
Max. motor shaft diameter	D_9	F7	1	11	19	24	28	35	55
			2	11	11	19	24	28	38
Hole circle diameter input	D_{10}		1	42	60.5	90	120	145	180
			2	42	42	60.5	90	120	145
Housing length (1)	WL_1		1	98	115.5	167.1	208	236.5	313.6
			2	124	132.5	161	226.6	274.5	320.5
Housing length (2)	WL_2		1	67	86.5	134	165.5	209.5	279
			2	67	67	86,5	134	165.5	209.5
Housing length (3)	WL_3		1	45	55.5	89	105.5	138.5	189.5
			2	45	45	55.5	89	105.5	138.5
Shaft length output	L_2			26	36	48	65	92	106
Shaft length from shoulder	L_3			20	28	36	50	74	82
Centering depth output	L_4			5	7	10	12	15	20
Distance from shaft end	L_5			2.5	4	3	5	5	6
Feather key length	L_6			15	20	30	40	65	70
Max. input length motor shaft	L_7		1	21	27.5	44	57	75	104.5
			2	21	21	27.5	44	57	75
Distance to center of screw	L_8		1	4.5	6	7	9	10.5	11
			2	4.5	4.5	6	7	9	10.5
Flange thickness output	L_{11}			5	8	10	12	15	16
Distance clamping ring - housing	L_{13}		1	10	15.5	17.5	25.5	25.5	33
			2	10	10	15.5	17.5	25.5	25.5
Square housing output	SQ_1			44	62	90	120	142	180
Square housing input	SQ_2		1	44	62	90	120	142	180
			2	44	44	62	90	120	142
Feather key width	B_1	h9		5	5	6	10	12	16
Min. mounting thread x depth	G_2	4 x	1	M4 x 8	M5 x 11	M6 x 12	M8 x 16	M10 x 20	M12 x 24
			2	M4 x 8	M4 x 8	M5 x 11	M6 x 12	M8 x 16	M10 x 20
Min. mounting thread x depth	G_3			M4 x 11	M5 x 14	M8 x 20	M10 x 23	M12 x 28	M14 x 32
Hole bore	H_1	4 x		4.5	5.5	6.8	9	11	13
Angle in °	W_1			45	45	45	45	45	45
x times angle in °	W_2			4 x 90	4 x 90	4 x 90	4 x 90	4 x 90	4 x 90
Angle in °	W_3			30	30	30	30	30	30
x times angle in °	W_4			4 x 90	4 x 90	4 x 90	4 x 90	4 x 90	4 x 90

Find more information regarding flanges and reduction sleeves for all common motor types on pages 48-50.

			GSBL044	GSBL062	GSBL090	GSBL120	GSBL142	GSBL180	Stage
Service lifetime*1	t_L	h	30000						
Nominal input speed	n_1	rpm	5000	5000	4000	4000	3000	3000	
Max. input speed	$n_{1\,max.}$	rpm	10000	10000	8000	8000	6000	6000	
Standard backlash	j_t	arcmin	<= 4 (opt. <=2)						1
			<= 7 (opt. <=4)						2
Noise level*2	Q_g	dB (A)	<= 65	<= 68	<= 70	<= 72	<= 70	<= 76	
Efficiency	η	%	>= 95						1
			>= 92						2
Protection class			IP65						
Torsional rigidity	c_t	Nm/arcmin	3	7	14	27	60	145	
Max. radial force*3	F_{2r}	N	780	1530	3250	6800	9400	15600	
Max. axial force*3	F_{2a}	N	390	765	1625	3700	4700	7800	
Operating temperature	T_B	°C	-25°C - +90°C						
Lubrication			Synthetic grease (lifetime-lubricated)						
Weight with flange*4	m_g	kg	1	2.2	6.6	13.2	22.3	50	1
			1	2	5.5	12.5	23.2	44.4	2
Mounting position			Any						

Output torques			GSBL044	GSBL062	GSBL090	GSBL120	GSBL142	GSBL180	Ratio	Stage
Nominal output torque*5	T_{2N}	Nm	20	62	173	352	656	1266	3	1
			17	54	153	315	583	1122	4	1
			17	50	168	350	649	1248	5	1
			16	47	156	324	602	1163	7	1
			15	45	148	309	576	1112	10	1
			15	45	150	313	581	1124	16	1
			15	45	148	309	576	1112	20	1
			17	50	168	350	649	1248	25	2
			16	47	159	327	612	1174	30	2
			17	50	168	350	649	1248	50	2
			16	47	156	324	602	1163	70	2
			15	45	148	309	576	1112	100	2
			16	47	156	324	602	1163	140	2
			14	46	152	292	542	1043	180	2
			15	45	148	309	576	1112	200	2
Max. acceleration torque*6	T_{2B}	Nm	36	112	312	633	1181	2279	3	1
			30	96	276	567	1049	2020	4	1
			30	91	302	629	1168	2247	5	1
			28	85	282	584	1083	2094	7	1
			26	81	266	556	1038	2002	10	1
			26	81	270	563	1045	2022	16	1
			26	81	266	556	1038	2002	20	1
			30	91	302	629	1168	2247	25	2
			28	85	285	588	1102	2113	30	2
			30	91	302	629	1168	2247	50	2
			28	85	282	584	1083	2094	70	2
			26	81	266	556	1038	2002	100	2
			28	85	282	584	1083	2094	140	2
			25	83	274	525	975	1877	180	2
			26	81	266	556	1038	2002	200	2
Emergency stop torque*7	T_{2Not}	Nm	60	186	520	1055	1969	3799	3	1
			50	161	460	945	1748	3367	4	1
			50	151	504	1049	1947	3745	5	1
			47	142	469	973	1805	3490	7	1
			44	135	444	926	1729	3336	10	1
			44	135	450	939	1742	3371	16	1
			44	135	444	926	1729	3336	20	1
			50	151	504	1049	1947	3745	25	2
			47	142	476	980	1836	3522	30	2
			50	151	504	1049	1947	3745	50	2
			47	142	469	973	1805	3490	70	2
			44	135	444	926	1729	3336	100	2
			47	142	469	973	1805	3490	140	2
			41	139	457	876	1625	3128	180	2
			44	135	444	926	1729	3336	200	2

Mass moment of inertia			GSBL044	GSBL062	GSBL090	GSBL120	GSBL142	GSBL180	Ratio	Stage
Mass moment of inertia*8	J_1	kgcm²	0.09	0.36	2.28	6.85	23.5	68.2	3	1
			0.09	0.36	2.28	6.85	23.5	68.2	4	1
			0.09	0.36	2.28	6.85	23.5	68.2	5	1
			0.09	0.36	2.28	6.85	23.5	68.2	7	1
			0.09	0.36	2.28	6.85	23.5	68.2	10	1
			0.03	0.08	1.88	6.2	21.8	65.5	16	1
			0.03	0.08	1.88	6.2	21.8	65.5	20	1
			0.09	0.09	0.36	2.28	6.85	23.1	25	2
			0.09	0.09	0.36	2.28	6.85	23.1	30	2
			0.09	0.09	0.36	2.28	6.85	23.1	50	2
			0.09	0.09	0.36	2.28	6.85	23.1	70	2
			0.09	0.09	0.36	2.28	6.85	23.1	100	2
			0.03	0.03	0.1	1.88	6.2	21.2	140	2
			0.03	0.03	0.1	1.88	6.2	21.2	180	2
			0.03	0.03	0.1	1.88	6.2	21.2	200	2

*1 Load factor K_A=1, n_2=100 rpm ,at room temperature T=20°C in new condition
*2 Sound pressure level at 1 m distance, measured for an input speed of 3000 rpm without load
*3 On the center of the output shaft
*4 Deviation of up to 10 % possible
*5 Service life: 30,000 h, n_2=100 rpm
*6 Max 1000 cycles per hour. Acceleration torque proportion < 5 % of the total operation time
*7 Max 1000 cycles over the gear service life
*8 Related to the input shaft

Planetary gears GSN

The high-end economy gearbox distinguishes itself by excellent quiet operating characteristics and low noise emission.

The GSN line is the perfect match for applications where a backlash of 10 arcmin or better is required. Its helical gears secure a minimum noise level and a smooth running. The GSN line is used for various applications with regard to precision and efficiency.

You benefit from:

- Low noise level due to ground helical gearing up to <=58 dB (A)
- High power density
- Protection class IP 65
- High torsional rigidity
- Lifetime of 30,000 h
- Lifetime lubrication

Full needle bearing

Torques that beat the competition for units of the same size.

Precision ground helical gearing

Extremely quiet operating characteristics and minimization of operating noise.

Shaft seal for protection class IP 65

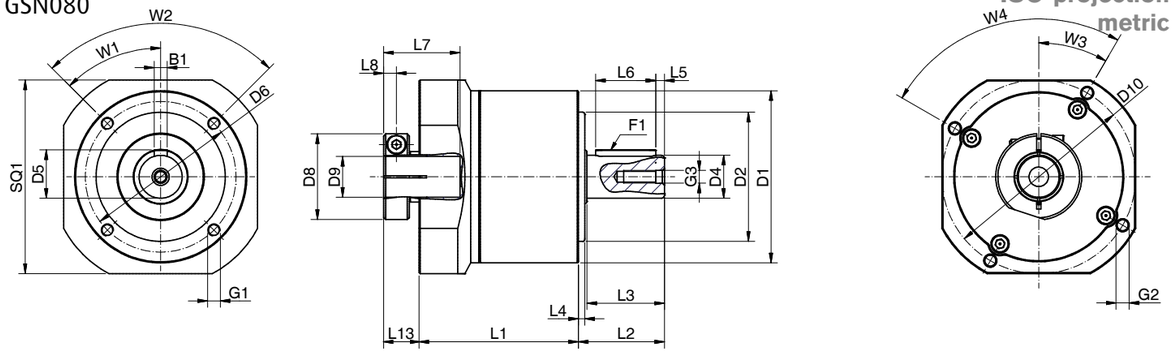
Optimal protection against dust particles and splash water.

Typical application example

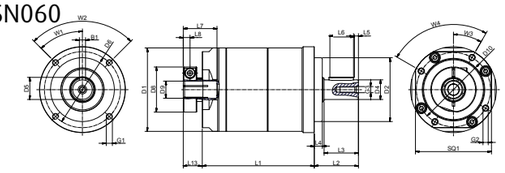
Industrial dough mixer

As an example, the GSN060 planetary gear is used in the food industry. The decisive advantages in the application of this industrial kneading machine are the protection class IP65 and excellent quiet operating characteristics. By means of precision ground, helical cut gears, operating noise is reduced to a minimum with the GSN gearbox line.

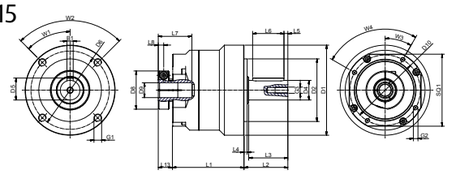
GSN080



GSN060



GSN115



Planetary gears GSN • Dimensions

Gearbox characteristics			GSN060	GSN080	GSN115
Housing diameter	D_1		60	80	115
Centering diameter output	D_2	h7	40	60	80
Output shaft diameter	D_4	h6	14	20	25
Shaft height including feather key	D_5		16	22.5	28
Hole circle diameter output	D_6		52	70	100
Clamping system diameter	D_8		29	40	49
Max. motor shaft diameter	D_9	F7	14	19	24
Hole circle diameter input	D_{10}		42	90	90
Housing length 1-stage	L_1		58	74	91
Housing length 2-stage	L_1		84	109	134.5
Shaft length output	L_2		34	40	56
Shaft length from shoulder	L_3		30	36	50
Centering depth output	L_4		3	3	4
Distance from shaft end	L_5		2.5	4	5
Feather key length	L_6		25	28	40
Max. input length motor shaft	L_7		27.5	35.5	43
Distance to center of screw	L_8		5	6	7
Distance clamping ring - housing	L_{13}		11.5	16.5	18.5
Square housing	SQ_1		44	90	92
Feather key width	B_1	h9	5	6	8
Min. mounting thread x depth	G_1	4 x	M5 x 10	M6 x 12	M10 x 20
Min. mounting thread x depth	G_2	4 x	M4 x 8	M6 x 12	M6 x 12
Min. mounting thread x depth	G_3		M4 x 11	M6 x 15	M8 x 20
Angle in °	W_1		45	45	45
x times angle in °	W_2		4 x 90	4 x 90	4 x 90
Angle in °	W_3		30	30	30
x times angle in °	W_4		4 x 90	4 x 90	4 x 90

Find more information regarding flanges and reduction sleeves for all common motor types on pages 48-50.

			GSN060	GSN080	GSN115	Stage
Service lifetime*1	tl	h		30000		
Nominal input speed	n_1	rpm	4500	4000	4000	
Max. input speed	n_1 max.	rpm	8000	7000	7000	
Standard backlash	j_t	arcmin		<=7		1
				<=10		2
Noise level*2	Q_g	dB (A)	<=58	<=60	<=65	
Efficiency	η	%		>=97		1
				>=94		2
Protection class				IP65		
Torsional rigidity	c_t	Nm/arcmin	4	12	14	
Max. radial force*3	F_{2r}	N	1030	1570	3590	
Max. axial force*3	F_{2a}	N	515	785	1795	
Operating temperature	T_B	°C		-25°C - +90°C		
Lubrication				liquid grease (lifetime-lubricated)		
Weight with flange*4	mg	kg	0.99	2.1	4.98	1
			1.46	3.2	6.92	2
Mounting position				Any		

Output torques			GSN060	GSN080	GSN115	Ratio	Stage
Nominal output torque*5	T_{2B}	Nm	29	118	182	3	1
			40	116	161	4	1
			42	113	176	5	1
			37	110	164	7	1
			26	105	155	10	1
			29	118	182	15	2
			40	116	161	20	2
			42	113	176	25	2
			29	118	182	30	2
			37	110	164	35	2
			40	116	161	40	2
			42	113	176	50	2
			37	110	164	70	2
			26	105	155	100	2
Max. acceleration torque*6	T_{2N}	Nm	53	212	327	3	1
			72	208	289	4	1
			76	204	317	5	1
			66	198	295	7	1
			47	189	279	10	1
			53	212	327	15	2
			72	208	289	20	2
			76	204	317	25	2
			53	212	327	30	2
			66	198	295	35	2
			72	208	289	40	2
			76	204	317	50	2
			66	198	295	70	2
			47	189	279	100	2
Emergency stop torque*7	T_{2Not}	Nm	88	353	545	3	1
			120	347	482	4	1
			126	340	528	5	1
			110	331	492	7	1
			79	315	465	10	1
			88	353	545	15	2
			120	347	482	20	2
			126	340	528	25	2
			88	353	545	30	2
			110	331	492	35	2
			120	347	482	40	2
			126	340	528	50	2
			110	331	492	70	2
			79	315	465	100	2

Mass moment of inertia			GSN060	GSN080	GSN115	Ratio	Stage
Mass moment of inertia*8	J_1	kgcm²	0.06	0.48	0.6	3	1
			0.06	0.38	0.45	4	1
			0.06	0.38	0.45	5	1
			0.06	0.38	0.45	7	1
			0.06	0.35	0.41	10	1
			0.06	0.41	0.45	15	2
			0.06	0.38	0.45	20	2
			0.06	0.38	0.45	25	2
			0.06	0.38	0.45	30	2
			0.06	0.38	0.45	35	2
			0.06	0.38	0.45	40	2
			0.06	0.38	0.45	50	2
			0.06	0.38	0.45	70	2
			0.06	0.38	0.45	100	2

*1 Load factor K_A=1, n_2=100 rpm ,at room temperature T=20°C in new condition
*2 Sound pressure level at 1 m distance, measured for an input speed of 3000 rpm without load
*3 On the center of the output shaft
*4 Deviation of up to 10 % possible
*5 Service life: 30,000 h, n_2=100 rpm
*6 Max 1000 cycles per hour. Acceleration torque proportion < 5% of the total operation time
*7 Max 1000 cycles over the gear service life
*8 Related to the input shaft

Planetary gears GFE

The flexible high-end economy gearbox features impressively high torque.

Our GFE line is available in seven sizes ranging from 50 mm to 220 mm. Ground helical gears ensure a minimum noise level and smooth running. The GFE line stands for economic efficiency and fits perfectly for applications with high torques.

You benefit from:

- Big housing sizes up to 220 mm
- Max. input speed up to 10,000 rpm
- 30,000 h lifetime
- Nominal output torques up to 1,562 Nm
- Protection class IP 65
- Lifetime lubrication

One-piece housing

High gearbox rigidity and absorption of high radial and axial loads.

Full needle bearing

Torques that beat the competition for units of the same size.

Shaft seal for protection class IP 65

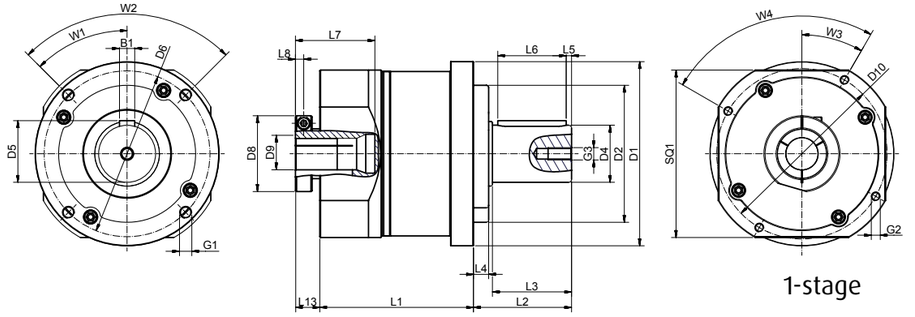
Optimal protection against dust particles and splash water.

Typical application example

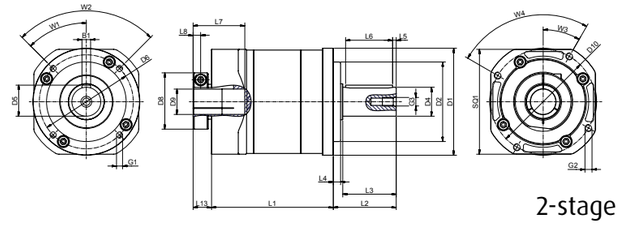
Height adjustment of operating tables

For height adjustment of OP tables, two aspects play an especially decisive role. Use in the direct vicinity of the patient means that high positioning accuracy and smoothness are indispensable. The planetary gears of the GFE line fulfill the noise minimization requirements through precision ground, helical cut gears.

ISO-projection metric



1-stage



2-stage

Planetary gears GFE • Dimensions

Gearbox characteristics			GFE050	GFE070	GFE090	GFE120	GFE145	GFE180	GFE220
Housing diameter	D_1		50	70	93	122	148	205	242
Centering diameter output	D_2	h7	35	50	70	90	110	160	180
Output shaft diameter	D_4	h6	13	16	22	32	40	55	75
Shaft height including feather key	D_5		15	18	24.5	35	43	59	79.5
Hole circle diameter output	D_6		42	60	80	105	130	184	218
Clamping system diameter	D_8		27	40	49	67	80	100	107
Max. motor shaft diameter	D_9	F7	11	19	24	28	38	48	55
Hole circle diameter input	D_{10}		42	60	80	105	145	186	224
Housing length 1-stage	L_1		59.5	85	100	132	168.5	173.5	202
Housing length 2-stage	L_1		86	119	140	186	232.5	243	289
Shaft length output	L_2		25	34	44	60	87	106	129
Shaft length from shoulder	L_3		20	28	36	50	74	82	104
Centering depth output	L_4		4	5	6	8	10	20	20
Distance from shaft end	L_5		2.5	4	3	5	5	6	7
Feather key length	L_6		15	20	30	40	65	70	90
Max. input length motor shaft	L_7		21	27.5	42	53	71.5	102	114.5
Distance to center of screw	L_8		4.5	6	7	9	10.5	11	11
Distance clamping ring - housing	L_{13}		11	15.5	17.5	25.5	25.5	32.5	32.5
Square housing	SQ_1		45	62	90	120	145	180	220
Feather key width	B_1	h9	5	5	6	10	12	16	20
Min. mounting thread x depth	G_1	4 x	M4 x 8	M5 x 10	M6 x 12	M8 x 16	M10 x 16	M12 x 22.5	M16 x 31
Min. mounting thread x depth	G_2	4 x	M4 x 7	M5 x 10	M6 x 12	M8 x 16	M10 x 20	M12 x 24	M12 x 24
Min. mounting thread x depth	G_3		M4 x 10	M5 x 13	M6 x 20	M10 x 23	M12 x 27	M14 x 33	M16 x 36
Angle in °	W_1		45	45	45	45	45	45	45
x times angle in °	W_2		4 x 90	4 x 90	4 x 90	4 x 90	4 x 90	4 x 90	4 x 90
Angle in °	W_3		30	30	30	30	30	30	30
x times angle in °	W_4		4 x 90	4 x 90	4 x 90	4 x 90	4 x 90	4 x 90	4 x 90

Find more information regarding flanges and reduction sleeves for all common motor types on pages 48-50.

			GFE050	GFE070	GFE090	GFE120	GFE145	GFE180	GFE220	Stage
Service lifetime*1	tl	h	30000							
Nominal input speed	n_1	rpm	5000	4000	4000	4000	3000	2500	2000	
Max. input speed	n_1 max.	rpm	10000	7000	7000	7000	6000	4000	3000	
Standard backlash	j_t	arcmin	<=7							1
			<=10							2
Noise level*2	Q_9	dB (A)	<=62	<=62	<=65	<=68	<=70	<=70	<=70	
Efficiency	η	%	>=97							1
			>=94							2
Protection class			IP65							
Torsional rigidity	c_t	Nm/arcmin	2.3	5	15	45	69	140	220	
Max. radial force*3	F_{2r}	N	810	1900	3000	6500	9100	11150	35000	
Max. axial force*3	F_{2a}	N	700	590	1900	3250	6000	5575	17500	
Operating temperature	T_B	°C	-25°C - +90°C							
Lubrication			liquid grease (lifetime-lubricated)							
Weight with flange*4	mg	kg	0.63	1.57	3.22	8	16	33	54	1
			0.9	2.24	4.59	11.22	22.5	46.4	75	2
Mounting position			Any							

Output torques			GFE050	GFE070	GFE090	GFE120	GFE145	GFE180	GFE220	Ratio	Stage
Nominal output torque*5	T_{2B}	Nm	19	55	138	295	530	1034	1562	3	1
			17	50	122	262	469	946	1430	4	1
			15	46	114	245	441	1018	1397	5	1
			14	43	108	229	410	869	1298	7	1
			13	41	101	218	392	836	1254	10	1
			19	55	138	295	530	1034	1562	15	2
			17	50	122	262	469	946	1430	20	2
			15	46	114	245	441	919	1397	25	2
			19	55	138	295	530	1034	1562	30	2
			14	43	108	229	410	869	1298	35	2
			17	50	122	262	470	946	1430	40	2
			15	46	114	245	442	919	1397	50	2
			14	44	108	229	410	869	1298	70	2
			13	41	101	218	393	836	1210	100	2
Max. acceleration torque*6	T_{2N}	Nm	34	99	248	531	954	1861	2812	3	1
			30	89	220	471	843	1703	2574	4	1
			28	83	206	442	794	1832	2515	5	1
			26	77	194	412	739	1564	2336	7	1
			24	73	182	392	705	1505	2257	10	1
			34	99	248	531	954	1861	2812	15	2
			30	89	220	471	843	1703	2574	20	2
			28	83	206	442	794	1653	2515	25	2
			34	99	248	531	954	1861	2812	30	2
			26	77	194	412	739	1564	2336	35	2
			30	89	220	471	845	1703	2574	40	2
			28	83	206	442	796	1653	2515	50	2
			26	79	194	412	739	1564	2336	70	2
			24	73	182	392	707	1505	2178	100	2
Emergency stop torque*7	T_{2Not}	Nm	56	165	413	884	1591	3102	4686	3	1
			50	149	366	785	1406	2838	4290	4	1
			46	139	343	736	1323	3053	4191	5	1
			43	129	323	686	1231	2607	3894	7	1
			40	122	304	653	1175	2508	3762	10	1
			56	165	413	884	1591	3102	4686	15	2
			50	149	366	785	1406	2838	4290	20	2
			46	139	343	736	1323	2756	4191	25	2
			56	165	413	884	1591	3102	4686	30	2
			43	129	323	686	1231	2607	3894	35	2
			50	149	366	785	1409	2838	4290	40	2
			46	139	343	736	1327	2756	4191	50	2
			43	132	323	686	1231	2607	3894	70	2
			40	122	304	653	1178	2508	3630	100	2

Mass moment of inertia			GFE050	GFE070	GFE090	GFE120	GFE145	GFE180	GFE220	Ratio	Stage
Mass moment of inertia*8	J_1	kgcm²	0.04	0.14	0.61	3.25	8.75	24.63	50.67	3	1
			0.04	0.11	0.47	2.74	6.84	20.12	46.21	4	1
			0.04	0.11	0.47	2.74	6.84	19.8	45.28	5	1
			0.04	0.11	0.44	2.58	6.78	19.21	43.32	7	1
			0.04	0.11	0.47	2.74	6.84	19.13	42.98	10	1
			0.04	0.14	0.61	3.25	8.75	24.63	50.67	15	2
			0.04	0.13	0.48	2.74	7.16	20.12	46.21	20	2
			0.04	0.11	0.47	2.74	6.84	19.8	45.28	25	2
			0.04	0.14	0.61	3.25	8.75	24.63	50.67	30	2
			0.04	0.11	0.44	2.58	6.78	19.21	43.32	35	2
			0.04	0.11	0.48	2.74	7.16	20.12	46.21	40	2
			0.04	0.11	0.47	2.74	6.84	19.8	45.28	50	2
			0.04	0.11	0.44	2.58	6.78	19.21	43.32	70	2
			0.04	0.11	0.47	2.74	6.84	19.13	42.98	100	2

*1 Load factor K_A=1, n_2=100 rpm ,at room temperature T=20°C in new condition
*2 Sound pressure level at 1 m distance, measured for an input speed of 3000 rpm without load
*3 On the center of the output shaft
*4 Deviation of up to 10 % possible
*5 Service life: 30,000 h, n_2=100 rpm
*6 Max 1000 cycles per hour. Acceleration torque proportion < 5% of the total operation time
*7 Max 1000 cycles over the gear service life
*8 Related to the input shaft

Custom engineered planetary gears.

Individually designed for your application.

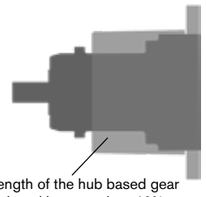
“Your idea – our drive”: our drive solutions have set standards for numerous applications and sectors according to this motto. Our customers appreciate us as experienced development partners who deliver a technically and commercially convincing result.
Many innovative special systems based on planetary gears have already been created in this way – for example our hub gearbox systems for the intralogistics sector.
You benefit from our experience: Because no application is so special that we would not have the right solution – whether a complete custom engineered new development or an easy adption of our standard planetary gears.

Framo Morat – your engineering partner with systems competence:

- Individual choice of material, diameter, mounting, tooth width, etc. for each planetary stage
- Perfect linkage at every interface
- Integration of the drive in your complete system, taking into account mechanics, electronics and control technology

Hub gearbox systems

Planetary gears with taper roller bearings are frequently used in applications in which high radial loads occur. With its longtime experience in gear and drive engineering, Framo Morat has developed a hub drive system based on a standard planetary gear.
The custom design, which permits higher radial loads, reduces the total length of the gearbox by more than 40%. The use of standardized ball bearings contributes to cost-effectiveness.
The wheel hub drive is based on a planetary gear with a 40 mm diameter and a gear ratio of 5:1. Taking account of the application-specific loads and requirements, as well as the desired gearbox ratios, almost all standard planetary gears can be used for such a drive system.
The efficient and compact wheel hub drive is used in numerous intralogistics applications, for example in warehouse shuttle systems or automated guided vehicles (AGV).

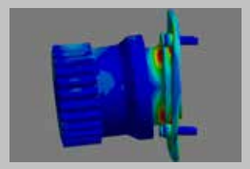


Length of the hub based gear reduced by more than 40%.

Planetary gears and more – your application is our priority.

Project development

Based on your specifications, we develop the optimum technical and cost-effective solution for the defined application.



Application expertise

We have already developed and produced countless drive solutions – from worm, spur or planetary gears to complex drive systems – for a variety of applications.

Systems competence

You benefit from our experience gained from the technical implementation of drive solutions for many different industries.

Quality assurance

We ensure reproducible results at the highest quality level by means of inline measurements and visual inspections.

Depth of production

Turning, milling, gear cutting, squaring up, countersinking, hardening, grinding – we produce all components, from the individual gearwheel to the complete drive, in our own workshops.

Serial production

After successful quality inspections, we mount the components in separate assembly cells – ready for delivery.

Customer-specific planetary gears.

Individualized design for your requirements.

There are many ways to influence the technical and economical properties of a gearbox. It is here that an old engineering rule of thumb applies: "Not as good as possible, but as good as is necessary!" At Framo Morat, we have been working in accordance with this motto for decades when it comes to designing and developing individual drive solutions.

Gear types, materials, bearings, lubricants and, not least, the installation dimensions are essential factors with which the performance data of the planetary gears can be adapted to the respective application requirement profiles.

The options given here serve as an overview of the different adjusting screws and their effects.

In the design of your customized planetary gear, you will benefit from our expertise in gear technology, our know-how in combination with tried-and-tested materials, as well as our decades-long experience in developing customer-specific drive solutions. We would be glad to speak with you. Contact us directly with any wishes or requests.

Phone +49 7657 88-173 ▪ e-mail pe@framo-morat.com

Gearing

Spur gearing
+ Cost-effective use for moderate noise emission and operational behavior requirements

Precision ground spur gearing
+ Optimized operational noise
+ Improved operational behavior

Helical gearing
+ Higher torque transfer
+ Improved operational behavior

Output flange

B14 flange connection

B5 flange connection

Customized flange

Output shaft

Output shaft with feather key groove

Output shaft without feather key groove
+ Clamp with lower circumferential backlash possible

Output shaft as hollow shaft
+ Improved connection of shafts as a counterpart

Output shaft as robot flange
+ Optimized torsional rigidity

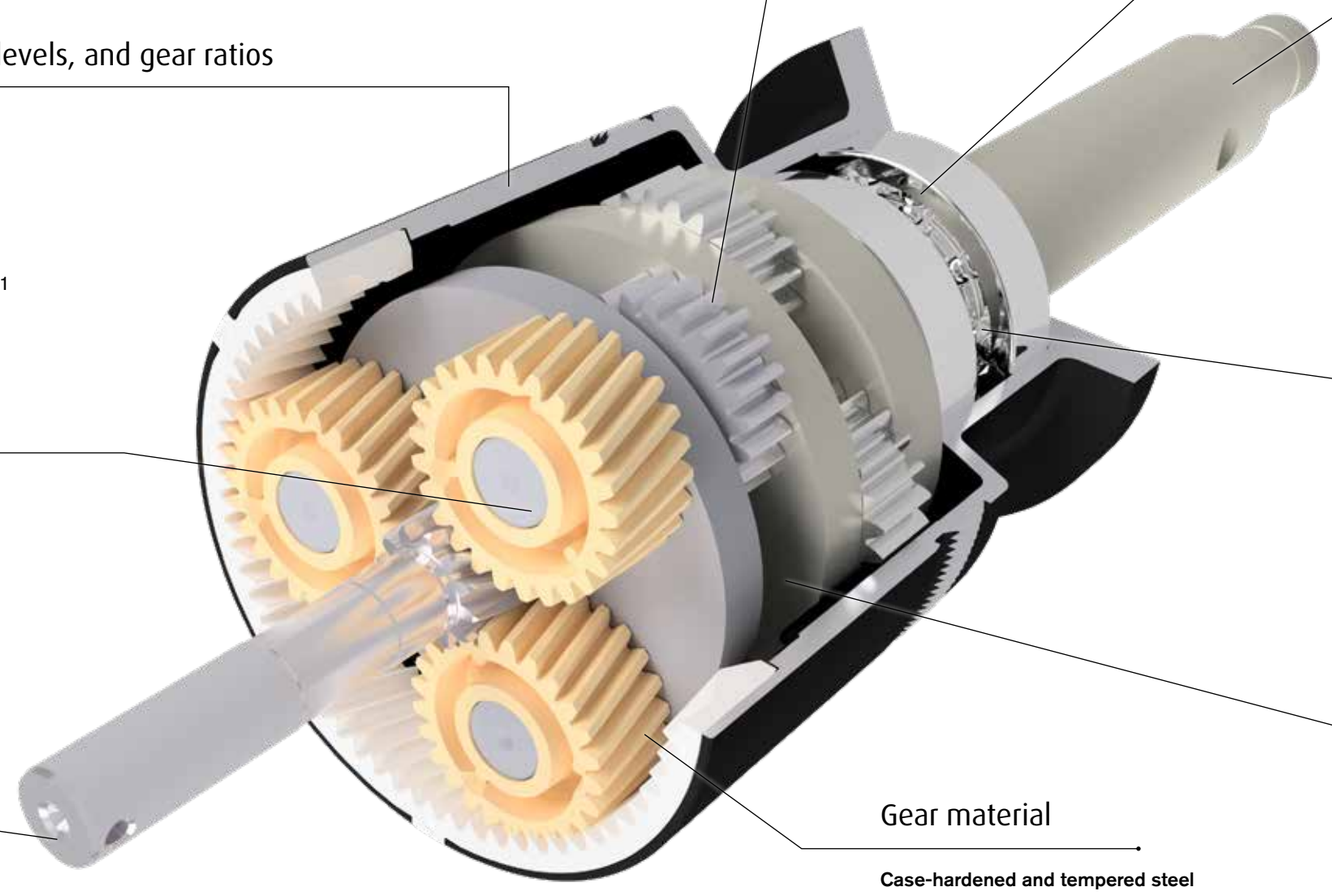
Output using internal geared wheel
+ More compact design

Gearbox installation dimensions, levels, and gear ratios

Common gear diameters to 155 mm
+ Field-tested gear teeth

Alternative sizes to 250 mm
+ Optimal installation space

Gear stages: 1-stage, 2-stage, 3-stage, 4-stage
Common gear ratios per planetary carrier 3:1 to 10:1
any overall gear ratio is possible



Planetary gear bearing

Pin cage
+ Standardized components

Fully acicular planetary gear bearing
+ Higher torques can be transmitted
+ Improved gear service life

Sliding bearing
+ Simplified gear structure

Bearing on the input and output sides

Deep grooved ball bearing
+ Cost-effective and sufficient for moderate loads

Taper roller bearing
+ Higher axial and radial loads possible

Simple bearing
+ For separate output shaft bearing only one bearing may be necessary

Input shaft

Hollow shaft with optional reduction sleeve

Hollow shaft fitted to motor shaft
+ Omission of reduction sleeve

Direct connection to motor
+ Omission of hollow input shaft
+ Improved operational behavior

Lubrication

Synthetic fluid grease
+ No relubrication necessary

Food-grade grease
+ Particularly usable in the food industry

Low temperature-grade grease
+ For very low outdoor and operating temperatures

Oil
+ Increased degree of efficiency

Gear material

Case-hardened and tempered steel
+ Precision ground surface material possible

Non-ferrous metals

Plastic
+ Optimized operational noise during lower torques
+ Using injection molding, low unit costs possible with high quantities

Custom engineered planetary gears in use.

The driving force in many sectors.

Underwater unwinding systems for swimming pools

Unwinding systems for pool covers are installed underwater and must therefore be absolutely watertight for years to come. For this demanding application, Framo Morat developed a special tubular motor that is doubly sealed using AQUASEAL technology and thus offers long-term corrosion resistance and is maintenance-free. The integrated 3-stage planetary gears consist of differing materials and supply a transmission of 1000:1 with an output torque of 300 Nm.

Application examples

Curved stair lifts

A substantial component of a curved stairlift's main drive is the planetary gear. It is built to be much more compact than other gearbox variants due to its coaxial design. Another advantage is that the aesthetics and the noise behavior of the system are improved. In fast-rotating gearbox stages, gear parts made from technical thermoplastics are used for noise reduction, while steel components are used in slowly rotating but powerfully loaded stages.

Conveyor systems

Planetary gears are an indispensable element in drum motors for conveyor belts and rollers. The selection of 2-stage planetary gears made of plastic was mainly influenced by the need to keep noise generation as low as possible. The conveyors are driven forward by means of the friction between the drum motor and the belt.

Machine construction

Planetary gears that are used in machine construction must meet maximum demands regarding precision and durability. Three single-stage planetary gears with a transmission of 7:1 directly connected to three hydraulic motors turn the rollers in sheet-metal bending machines.

Application examples

Automated guided vehicles (AGV)

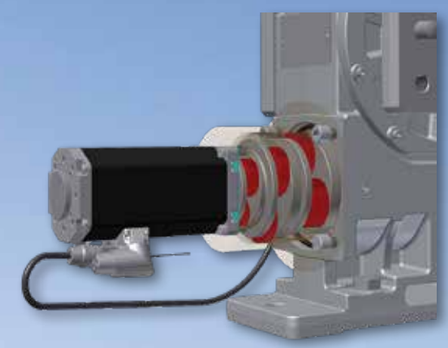
Customer-specific planetary gears are frequently used in automated guided vehicles (AGV) - whether in intra-logistics, medical device technology or agricultural technology. The gearboxes are used in wheel hub drives, as they enable a compact design in narrow spaces. The three-stage planetary gears with optimized bearings reach a high output torque of up to 300 Nm and a radial load of up to 12 kN.

Mobile satellite receivers

Positioning accuracy is a basic requirement for mobile satellites, especially for receiver systems. This two-stage planetary gear from Framo Morat uses the gear's internal tension to reduce the circumferential backlash of the entire system. High quality signals can be received through manual control adjustments in the form of micromovements.

High ratio gearbox systems for valve adjustments

Transmissions that have high gear ratios often take up a lot of space—especially with coaxial variants. In order to reduce installation space while at the same time operating at the required gear ratios, Framo Morat combines a worm gear stage and a planetary stage in a single gearbox. Thanks to the modular system and the high power density of the planetary gearbox series, as well as decades of experience in the manufacture of standard worm gear sets, Framo Morat offers a fast and low-cost solution. For medium to large quantities, complete custom designs and developments are also employed.



Tracking drive for mirror reflectors

This custom engineered drive is used to enable the tracking of mirror reflectors. During its development, great attention was paid to achieving minimum backlash and maximum torque. The drive achieves a maximum output torque of 5.000 Nm and consists of a servomotor, a 3-stage planetary gear, a worm gear, a position tracking system and two adapter plates.
A single drive moves a total mirror area of 330 m². One special aspect of this development was the adapted size of the various planetary gear stages. The planetary gears achieve a transmission of 729:1.

Configuration guide

Step-by-step configuration of your planetary gear.

1. Transmission ratio	Unit	Formula	Legend	Explanation
		$i = \frac{n_{1(A)}}{n_{2(A)}}$	i = transmission ratio	

2. Speed	Unit	Formula	Legend	Explanation
Output speed	rpm	$n_{2(A)} = \frac{n_{1(A)}}{i}$	n_2 = Output speed	
	rpm	$n_{1(A)} = n_{2(A)} \cdot i$	n_1 = Input speed	
Input speed	rpm	$n_1 \geq n_{1(A)}$	$n_{1\,max.}$ = max. Input speed	
	rpm	$n_{1max.} \geq n_{1(A)max.}$		

3. Torque	Unit	Formula	Legend	Explanation
Nominal output torque	Nm	$T_{2N} \geq T_{2N(A)} \cdot \eta$	T_{2N} = Nominal output torque	Load factor K_A (Standard = 1.0)
Max. acceleration torque	Nm	$T_{2B} \geq T_{2B(A)} \cdot K_a \cdot b_B \cdot S$	T_{2B} = Max. acceleration torque	Operational ratio b_B (Standard = 1.0)
Emergency stop torque	Nm	$T_{2NOT} \geq T_{2max.(A)} \cdot \eta$	$T_{2\,NOT}$ = Emergency stop torque	S (Standard = 1.0) η = see power tables

Drive	Load type of the driven machine		
	steady	medium shocks	heavy shocks
steady	1.0	1.25	1.75
medium shocks	1.25	1.5	2.0
heavy shocks	1.5	1.75	2.25

Operational time	4-8 h	8-12 h	>=12h
Operational time factor	1.00	1.20	1.35

4. Operation mode / Duty cycle	Unit	Formula	Legend	Explanation
Operation mode		*S1 or S5*	S_1: Continuous operation: ED > 60% and ED > 20 min S_s: Cyclic operation: ED <= 60% and ED <= 20 min	
	min	$ED(t) = t_a + t_c + t_{d(min.)}$	t_b, t_c, t_d, t_e = Cyle times see table page 47	
Duty cycle			ED (t) = Duty cycle in min	
	%	$ED(\%) = \frac{ED_{(t)}}{ED_{(t)} + t_e} \cdot 100(\%)$	ED (%) = Duty cycle in %	

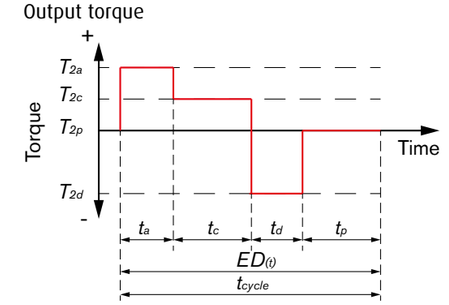
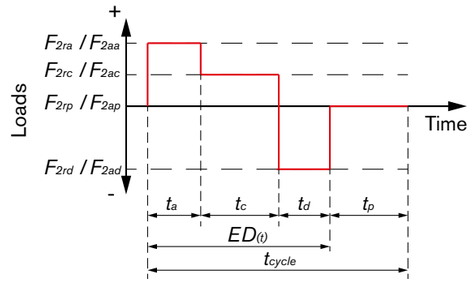
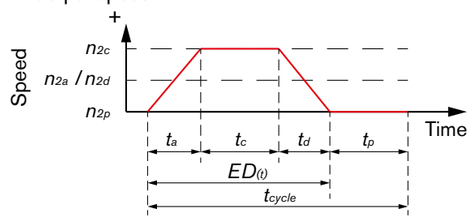
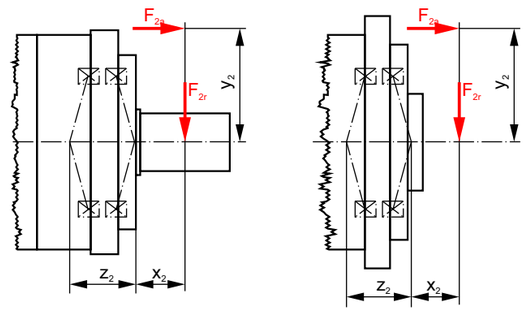
5. Backlash	Unit	Formula	Legend	Explanation
	arcmin	$j_t \leq j_{t(A)}$	j_t = Backlash $j_{t(A)}$ = Backlash of your application	

6. Noise	Unit	Formula	Legend	Explanation
	dB (A)	$Q_g \leq Q_{g(A)}$	Q_g = Noise level $Q_{g(A)}$ = Noise level of your application	

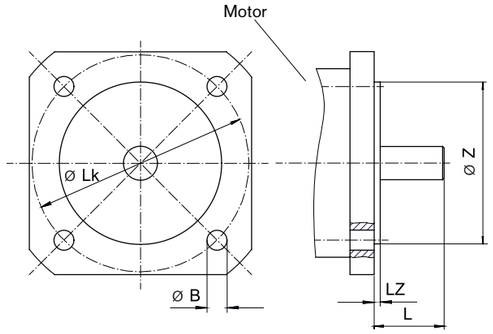
7. Motor	Unit	Formula	Legend	Explanation
	Nm	$T_{2B} \geq T_{mB} \cdot i \cdot \eta \cdot K_S$	T_{mB} = Motor-acceleration torque Compare motor shaft diameter with input hollow shaft diameter Exception: PL line (< motor shaft diameter)	Service factor K_S (Standard = 1.0)

K_S	No. of cycles / h
1.0	0 - 1000
1.1	1000 - 1500
1.3	1500 - 2000
1.6	2000 - 3000
1.8	3000 - 5000

Configuration guide

8. Loads	Unit	Formula	Legend	Explanation
Max. radial force	N	$F_{2r} \leq F_{2rm(A)} = \sqrt[3]{\frac{n_{2a} \cdot t_a \cdot F_{2ra}^3 + n_{2c} \cdot t_c \cdot F_{2rc}^3 + n_{2d} \cdot t_d \cdot F_{2rd}^3}{n_{2a} \cdot t_a + n_{2c} \cdot t_c + n_{2d} \cdot t_d}}$	F_r = Radial force F_{2rm} = Average radial force $F_{2arm(A)}$ = Max. radial force F_{2ra} = Acceleration radial force F_{2rc} = Holding radial force F_{2rd} = Deceleration radial force t_a = Acceleration time t_c = Holding time t_d = Deceleration time n_{2a} = Average acceleration output speed n_{2c} = Holding output speed n_{2d} = Average deceleration output speed n_{2p} = Pause = 0 t_p = Pause F_{2rp} = Pause = 0 F_{2ap} = Pause = 0 t_{cycle} = Cycle time	Output torque  Loads on output shaft  Output speed 
Max. axial force	N	$F_{2a} \leq F_{2am(A)} = \sqrt[3]{\frac{n_{2a} \cdot t_a \cdot F_{2aa}^3 + n_{2c} \cdot t_c \cdot F_{2ac}^3 + n_{2d} \cdot t_d \cdot F_{2ad}^3}{n_{2a} \cdot t_a + n_{2c} \cdot t_c + n_{2d} \cdot t_d}}$	F_a = Axial force F_{2am} = Average axial force $F_{2rm(A)}$ = Max. axial force F_{2aa} = Acceleration axial force F_{2ac} = Holding axial force F_{2ad} = Deceleration axial force t_a = Acceleration time t_c = Holding time t_d = Deceleration time n_{2a} = Average acceleration output speed n_{2c} = Holding output speed n_{2d} = Average deceleration output speed n_{2p} = Pause = 0 t_p = Pause F_{2rp} = Pause = 0 F_{2ap} = Pause = 0 t_{cycle} = Cycle time	

9. Life time	Unit	Formula	Legend	Explanation
	h	The service life of the gears depends on many different factors. Specifically, the service life can be defined through two different methods of calculation: Tooth system service life and bearing service life. Speed, gear ratio and torque are especially important influencing factors. The lower the output speed, the higher the service life. The lower the torque, the higher the service life.		

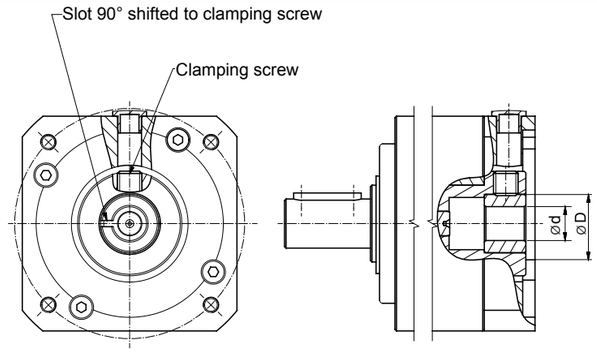


Definition of serial number

	Internal Group No.		Type	Size		Center diam.		Counting
G-series	3	-	G	090	-	090	-	001
G-series	3	-	G	120	-	110		003

Motorflanges

Gearboxes	Article - No.	Center diameter Z	Bore hole diam. LK	Max. center depth LZ	Max motor shaft length L	Mounting thread B
GSD047 GSD064 2st. GSB044 GSB062 2st. GSBL044 GSBL062 2st. GSN060 GFE050	3-G044-030-001	30	46	4	25	M4
	3-G044-040-002	40	63	4	25	M4
	3-G044-050-002	50	70	3	25	M5
	3-G044-050-004	50	70	3	30	M4
	3-G044-060-001	60	75	4	25	M5
GSD064 1st. GSD090 2st. GSB062 1st. GSB090 2st. GSBL062 1st. GSBL090 2st. GFE070	3-G062-030-001	30	46	5	30	M4
	3-G062-050-001	50	70	5	30	M5
	3-G062-050-002	50	70	5	30	M4
	3-G062-050-004	50	95	5	30	M6
	3-G062-060-001	60	75	5	30	M6
	3-G062-060-002	60	75	5	30	M5
	3-G062-070-002	70	90	5	40	M6
	3-G062-070-003	70	90	5	30	M5
	3-G062-080-001	80	100	5	30	M6
GSD090 1st. GSD110 2st. GSB090 1st. GSB120 2st. GSBL090 1st. GSBL120 2st. GSN080 GSN115 GFE090	3-G090-070-001	70	90	8	50	M6
	3-G090-070-002	70	90	8	50	M5
	3-G090-080-001	80	100	8	50	M6
	3-G090-095-002	95	115	8	50	M8
	3-G090-095-003	95	130	8	50	M8
	3-G090-095-006	95	115	13	55	M8
	3-G090-110-001	110	145	8	50	M8
	3-G090-110-002	110	145	22	65	M8
	3-G090-110-003	110	130	8	50	M8
	3-G090-130-001	130	165	8	50	M10
GSD110 1st. GSD140 2st. GSB120 1st. GSB142 2st. GSBL120 1st. GSBL142 2st. GFE120	3-G120-070-001	70	90	9	63	M6
	3-G120-095-002	95	115	9	63	M8
	3-G120-110-001	110	145	9	63	M8
	3-G120-110-003	110	130	9	63	M8
	3-G120-110-005	110	165	9	63	M10
	3-G120-130-001	130	165	9	63	M10
GSD140 1st. GSB142 1st. GSB180 2st. GSBL142 1st. GSBL180 2st. GFE145	3-G142-114-001	114.3	200	8	80	M12
	3-G142-180-001	180	215	8	80	M12
	3-G142-200-101	200	235	8	80	M12
GSB180 1st. GSBL180 1st. GFE180	3-G180-114-001	114.3	200	13	115	M12
	3-G180-200-001	200	235	13	115	M12



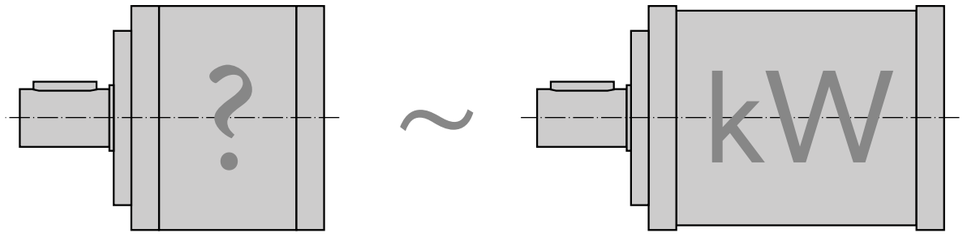
Definition of serial number

	Internal Group No.		Type	Size		Input hollow shaft diam.		Motor shaft diam.	Counting
G-series	3	-	G		-	035	-	028	
G-series	3	-	G		-	019	-	014	000 - 071

Reduction sleeves

Gearbox type	Size	Stages	Internal diam. D	Motor shaft diameter d in mm																	
				6	8	9	10	11	12	12.7	14	16	19	22	24	28	32	35	38	42	48	55
GSD	47	1 / 2	11	✓	✓	✓		(✓)														
	64	1	19				✓	✓	✓	✓	✓	✓	(✓)									
		2	14	✓	✓	✓	✓	✓	✓	✓	(✓)											
	90	1	24								✓	✓	✓	✓	(✓)							
		2	19				✓	✓	✓	✓	✓	✓	(✓)									
	110	1	28										✓	✓	✓	(✓)	(✓)*	(✓)*				
		2	24								✓	✓	✓	✓	(✓)							
	140	1	38														✓	✓	(✓)			
		2	35												✓	✓	✓	(✓)				
GSB / GSBL	44	1 / 2	11	✓	✓	✓		(✓)														
	62	1	19				✓	✓	✓	✓	✓	✓	(✓)									
		2	11	✓	✓	✓		(✓)														
	90	1	24								✓	✓	✓	✓	(✓)							
		2	19				✓	✓	✓	✓	✓	✓	(✓)									
	120	1	28										✓	✓	✓	(✓)	(✓)*	(✓)*				
		2	24								✓	✓	✓	✓	(✓)							
	142	1	35												✓	✓	✓	(✓)				
		2	28										✓	✓	✓	(✓)	(✓)*	(✓)*				
	180	1	55																			(✓)
		2	35												✓	✓	✓	(✓)				
GSN	60	1 / 2	14	✓	✓	✓	✓	✓	✓	✓	(✓)											
	80	1 / 2	19				✓	✓	✓	✓	✓	✓	(✓)									
	115	1 / 2	24								✓	✓	✓	✓	(✓)							
GFE	50	1 / 2	11	✓	✓	✓		(✓)														
	70	1 / 2	19				✓	✓	✓	✓	✓	✓	(✓)									
	90	1 / 2	24								✓	✓	✓	✓	(✓)							
	120	1 / 2	28										✓	✓	✓	(✓)	(✓)*	(✓)*				
	145	1 / 2	38														✓	✓	(✓)			
	180	1 / 2	48																	✓	(✓)	
	220	1 / 2	55																			(✓)

✓ = Reduction sleeve available; (✓) = no reduction sleeve necessary;
(✓)* = Possible as a specially designed model. Further diameters can also be provided. Please contact us directly.



Gear selection based on performance data

Gearbox type	Size	Stages	Power in kW													
			0.1	0.2	0.4	0.75	1	1.5	2.2	3.75	5.5	7.5	11	15	22	30
GSD	47	1 / 2	✓	✓												
	64	1			✓	✓										
		2			✓	✓										
	90	1				✓	✓	✓								
		2				✓	✓	✓								
	110	1						✓	✓	✓						
		2						✓	✓	✓						
	140	1							✓	✓	✓					
		2							✓	✓	✓					
GSB / GSBL	44	1 / 2	✓	✓												
	62	1			✓	✓										
		2			✓											
	90	1				✓	✓	✓								
		2			✓	✓										
	120	1						✓	✓	✓						
		2				✓	✓	✓								
	142	1							✓	✓	✓					
		2						✓	✓	✓						
	180	1									✓	✓	✓	✓	✓	✓
		2									✓	✓	✓	✓	✓	
GSN	60	1 / 2	✓	✓	✓											
	80	1 / 2			✓	✓										
	115	1 / 2				✓	✓	✓								
GFE	50	1 / 2	✓	✓												
	70	1 / 2			✓	✓										
	90	1 / 2				✓	✓	✓								
	120	1 / 2						✓	✓	✓						
	145	1 / 2								✓	✓	✓				
	180	1 / 2									✓	✓	✓	✓	✓	
	220	1 / 2											✓	✓	✓	✓

The table displays guidelines for a simplified preselection. The actual selection of the motor is to be carried out on the basis of the required gear output torque.

Your idea – Our drive.

For us, everything revolves around you.

With 100+ years of experience in the areas of gearwheel technology, worm gear sets and drive systems, Framo Morat supplies a comprehensive range of products that cover a wide spectrum of applications. In addition to our complete range of standard products, we also design and implement custom engineered drive solutions.

Framo Morat is your reliable partner for worm, spur or planetary gears; complete gearmotors; and complex drive systems – and for your drive concept too!

Gear technology

Gearwheels with internal or external tooth systems, rotor shafts, pinions and chain pulleys according to individual customer requirements.

Worm gear sets

Framo Morat is a leading international supplier – manufacturing over 1 million gear sets a year, a major proportion of which are produced to customer specifications.

Plastic injection molding technology

In the field of precision injection molding technology, we produce gear parts, plastic/metal connections or technical parts for individual tasks.

Drive technology

Our innovative standard drives such as planetary gears, linear or rotary actuators, as well as complete custom engineered drive solutions, are in use in numerous applications.

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