6.1 Overview

Quattro-Power for maximum power density

Technical data

i	5.5 – 600
M_{2acc}	84 – 22000 Nm
$\Delta\varphi_2$	3 arcmin
η	≤ 90 – 96 %

Features

Power density	★★★★★
Backlash	★★★★☆
Price category	€€€€
Shaft load	★★★★★
Smooth operation	★★★★☆
Torsional stiffness	★★★★★
Mass moment of inertia	★★★★★
Helical gearing	✓
Maintenance-free	✓
Any installation position (single/two stage)	✓
High power density (four-stage planetary system)	✓
Continuous operation without cooling (FKM sealing ring at the input)	✓
Pretensioned angular contact bearings at the output in an O-arrangement, ideally suited for helical-geared rack and pinion drives	✓
Compact and highly dynamic due to direct motor attachment	✓

Key: ★☆☆☆☆ good | ★★★★★ excellent

6.2 Selection tables

The technical data specified in the selection tables applies to:

- Installation altitudes up to 1000 m above sea level
- Surrounding temperatures from 0 °C to 40 °C
- Drives with convection-cooled motors (e.g. EZ401**U**)

You can calculate the technical data for drives with forced ventilated motors (for example EZ401**B**) at http://products.stoeber.de.

Formula symbol	Unit	Explanation
a_{th}	–	Parameter for calculating $K_{mot,th}$
C_2	Nm/ arcmin	Torsional stiffness of gear unit (final stiffness) relative to the gear unit output
$\Delta\varphi_2$	arcmin	Backlash at the output shaft with a blocked input
η	%	Efficiency
i	–	Gear ratio
i_{exakt}	–	Mathematically exact gear ratio
J_1	$10^{-4}kgm^2$	Mass moment of inertia relative to the gear unit input
m	kg	Weight
$M_{2.0}$	Nm	Stall torque on the gear unit output
M_{2acc}	Nm	Maximum permitted acceleration torque on the gear unit output
$M_{2acc,max}$	Nm	Maximum permitted acceleration torque of a group of geared motors whose size and nominal torque n_{1N} are the same
M_{2N}	Nm	Nominal torque on the gear unit output (relative to n_{1N})
M_{2NOT}	Nm	Gear unit emergency-off torque on the gear unit output for max. 1000 load changes
n_{1maxDB}	min^{-1}	Maximum permitted input speed of the gear unit in continuous operation
		(at surrounding temperature of 20 °C)
n_{1maxZB}	min^{-1}	Maximum permitted input speed of the gear unit in cyclic operation
		(at surrounding temperature of 20 °C)
n_{1N}	min^{-1}	Nominal speed at the gear unit input
n_{2N}	min^{-1}	Nominal speed at the gear unit output
S	–	Load value: Quotient of gear unit and motor nominal torque without regard to the thermal performance limit. Represents a value for the reserve of the geared motor.

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n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1max} DB [rpm]	n_{1max} ZB [rpm]	J_1 [10^{-4} kgm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
PHQ4 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 170 Nm)															
55	48	49	0.6	2.5	PHQ422F0550 EZ301U	140	300	55.00	55/1	4500	8000	0.21	3	35	5.3
55	81	86	1.0	1.5	PHQ422F0550 EZ302U	170	300	55.00	55/1	4500	8000	0.31	3	35	5.9
55	106	112	1.4	1.1	PHQ422F0550 EZ303U	170	300	55.00	55/1	4500	8000	0.42	3	35	6.4
78	33	34	0.7	3.6	PHQ422F0390 EZ301U	100	300	38.50	77/2	4500	8000	0.24	3	37	5.3
78	57	60	1.3	2.1	PHQ422F0390 EZ302U	170	300	38.50	77/2	4500	8000	0.34	3	37	5.9
78	74	78	1.6	1.6	PHQ422F0390 EZ303U	170	300	38.50	77/2	4500	8000	0.45	3	37	6.4
78	100	107	2.2	1.2	PHQ422F0390 EZ401U	170	300	38.50	77/2	4500	8000	0.98	3	37	7.8
109	41	43	1.5	3.0	PHQ422F0280 EZ302U	130	300	27.50	55/2	4000	7000	0.38	3	37	5.9
109	53	56	1.9	2.3	PHQ422F0280 EZ303U	170	300	27.50	55/2	4000	7000	0.49	3	37	6.4
109	72	77	2.6	1.7	PHQ422F0280 EZ401U	170	300	27.50	55/2	4000	7000	1.0	3	37	7.8
109	110	120	4.0	1.1	PHQ422F0280 EZ501U	170	300	27.50	55/2	4000	7000	3.0	3	37	8.8
136	33	34	1.7	3.7	PHQ422F0220 EZ302U	100	300	22.00	22/1	3700	6500	0.44	3	37	5.9
136	42	45	2.2	2.8	PHQ422F0220 EZ303U	140	300	22.00	22/1	3700	6500	0.55	3	37	6.4
136	57	61	2.9	2.1	PHQ422F0220 EZ401U	170	300	22.00	22/1	3700	6500	1.1	3	37	7.8
136	88	96	4.5	1.4	PHQ422F0220 EZ501U	170	300	22.00	22/1	3700	6500	3.1	3	37	8.8
136	96	106	4.9	1.2	PHQ422F0220 EZ402U	170	300	22.00	22/1	3700	6500	1.8	3	37	8.9
545	23	25	4.8	4.2	PHQ421F0055 EZ501U	84	300	5.500	11/2	2000	6000	3.2	3	42	7.5
545	36	45	7.7	2.6	PHQ421F0055 EZ404U	150	300	5.500	11/2	2000	6000	3.2	3	42	9.7
545	39	42	8.2	2.4	PHQ421F0055 EZ502U	160	300	5.500	11/2	2000	6000	5.5	3	42	9.0
545	51	59	11	1.9	PHQ421F0055 EZ503U	170	300	5.500	11/2	2000	6000	7.8	3	42	11
545	71	84	15	1.3	PHQ421F0055 EZ505U	170	300	5.500	11/2	2000	6000	12	3	42	13
PHQ4 (n_{1N} = 6000 rpm, $M_{2acc,max}$ = 170 Nm)															
109	46	49	0.6	2.4	PHQ422F0550 EZ301U	140	300	55.00	55/1	4500	8000	0.21	3	35	5.3
109	77	86	1.1	1.4	PHQ422F0550 EZ302U	170	300	55.00	55/1	4500	8000	0.31	3	35	5.9
109	100	115	1.4	1.1	PHQ422F0550 EZ303U	170	300	55.00	55/1	4500	8000	0.42	3	35	6.4
156	32	34	0.7	3.8	PHQ422F0390 EZ301U	100	300	38.50	77/2	4500	8000	0.24	3	37	5.3
156	54	60	1.2	2.2	PHQ422F0390 EZ302U	170	300	38.50	77/2	4500	8000	0.34	3	37	5.9
156	70	81	1.5	1.7	PHQ422F0390 EZ303U	170	300	38.50	77/2	4500	8000	0.45	3	37	6.4
156	82	100	1.8	1.5	PHQ422F0390 EZ401U	170	300	38.50	77/2	4500	8000	0.98	3	37	7.8
218	38	43	1.4	3.1	PHQ422F0280 EZ302U	130	300	27.50	55/2	4000	7000	0.38	3	37	5.9
218	50	58	1.8	2.4	PHQ422F0280 EZ303U	170	300	27.50	55/2	4000	7000	0.49	3	37	6.4
218	59	72	2.1	2.0	PHQ422F0280 EZ401U	170	300	27.50	55/2	4000	7000	1.0	3	37	7.8
218	87	113	3.2	1.4	PHQ422F0280 EZ501U	170	300	27.50	55/2	4000	7000	3.0	3	37	8.8
218	90	125	3.3	1.3	PHQ422F0280 EZ402U	170	300	27.50	55/2	4000	7000	1.7	3	37	8.9
273	31	34	1.6	3.9	PHQ422F0220 EZ302U	100	300	22.00	22/1	3700	6500	0.44	3	37	5.9
273	40	46	2.0	3.0	PHQ422F0220 EZ303U	140	300	22.00	22/1	3700	6500	0.55	3	37	6.4
273	47	57	2.4	2.6	PHQ422F0220 EZ401U	170	300	22.00	22/1	3700	6500	1.1	3	37	7.8
273	70	90	3.5	1.7	PHQ422F0220 EZ501U	170	300	22.00	22/1	3700	6500	3.1	3	37	8.8
273	72	100	3.6	1.7	PHQ422F0220 EZ402U	170	300	22.00	22/1	3700	6500	1.8	3	37	8.9
1091	18	23	4.8	4.2	PHQ421F0055 EZ501U	84	300	5.500	11/2	2000	6000	3.2	3	42	7.5
1091	27	41	7.3	2.8	PHQ421F0055 EZ502U	160	300	5.500	11/2	2000	6000	5.5	3	42	9.0
1091	31	44	8.1	2.5	PHQ421F0055 EZ404U	150	300	5.500	11/2	2000	6000	3.2	3	42	9.7
1091	33	56	8.7	2.3	PHQ421F0055 EZ503U	170	300	5.500	11/2	2000	6000	7.8	3	42	11
PHQ5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 430 Nm)															
55	143	153	0.9	1.9	PHQ522F0550 EZ401U	430	800	55.00	55/1	4000	7000	0.97	3	87	11
55	220	240	1.4	1.3	PHQ522F0550 EZ501U	430	800	55.00	55/1	4000	7000	2.9	3	87	12
55	240	266	1.5	1.2	PHQ522F0550 EZ402U	430	800	55.00	55/1	4000	7000	1.7	3	87	12
78	100	107	1.0	2.8	PHQ522F0390 EZ401U	300	800	38.50	77/2	4000	7000	1.0	3	92	11
78	154	168	1.6	1.8	PHQ522F0390 EZ501U	430	800	38.50	77/2	4000	7000	3.0	3	92	12
78	168	186	1.8	1.7	PHQ522F0390 EZ402U	430	800	38.50	77/2	4000	7000	1.7	3	92	12
78	247	308	2.6	1.1	PHQ522F0390 EZ404U	430	800	38.50	77/2	4000	7000	3.1	3	92	14
78	265	286	2.8	1.1	PHQ522F0390 EZ502U	430	800	38.50	77/2	4000	7000	5.3	3	92	13
109	72	77	1.2	3.9	PHQ522F0280 EZ401U	220	800	27.50	55/2	3700	6500	1.1	3	94	11
109	110	120	1.9	2.5	PHQ522F0280 EZ501U	410	800	27.50	55/2	3700	6500	3.1	3	94	12
109	120	133	2.1	2.3	PHQ522F0280 EZ402U	410	800	27.50	55/2	3700	6500	1.8	3	94	12
109	176	220	3.1	1.6	PHQ522F0280 EZ404U	430	800	27.50	55/2	3700	6500	3.2	3	94	14
109	189	205	3.3	1.5	PHQ522F0280 EZ502U	430	800	27.50	55/2	3700	6500	5.4	3	94	13
109	189	212	3.3	1.5	PHQ522F0280 EZ701U	430	800	27.50	55/2	3700	6500	8.7	3	94	15
109	248	284	4.3	1.1	PHQ522F0280 EZ503U	430	800	27.50	55/2	3700	6500	7.8	3	94	15

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1max} DB [rpm]	n_{1max} ZB [rpm]	J_1 [10^{-4} kgm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
PHQ5 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 430 Nm)															
136	57	61	1.4	4.9	PHQ522F0220 EZ401U	170	800	22.00	22/1	3300	6000	1.2	3	95	11
136	88	96	2.1	3.2	PHQ522F0220 EZ501U	330	800	22.00	22/1	3300	6000	3.2	3	95	12
136	96	106	2.3	2.9	PHQ522F0220 EZ402U	330	800	22.00	22/1	3300	6000	1.9	3	95	12
136	141	176	3.4	2.0	PHQ522F0220 EZ404U	430	800	22.00	22/1	3300	6000	3.3	3	95	14
136	151	164	3.7	1.8	PHQ522F0220 EZ502U	430	800	22.00	22/1	3300	6000	5.5	3	95	13
136	151	170	3.7	1.8	PHQ522F0220 EZ701U	410	800	22.00	22/1	3300	6000	8.8	3	95	15
136	198	227	4.8	1.4	PHQ522F0220 EZ503U	430	800	22.00	22/1	3300	6000	7.9	3	95	15
136	246	295	6.0	1.1	PHQ522F0220 EZ702U	430	800	22.00	22/1	3300	6000	14	3	95	18
136	276	327	6.7	1.0	PHQ522F0220 EZ505U	430	800	22.00	22/1	3300	6000	12	3	95	18
545	63	76	6.4	3.5	PHQ521F0055 EZ702U	220	800	5.500	11/2	2500	5500	15	3	107	15
545	71	84	7.2	3.1	PHQ521F0055 EZ505U	350	800	5.500	11/2	2500	5500	13	3	107	15
545	87	110	8.8	2.6	PHQ521F0055 EZ703U	340	800	5.500	11/2	2500	5500	22	3	107	17
545	112	159	11	2.0	PHQ521F0055 EZ705U	430	800	5.500	11/2	2500	5500	35	3	107	23
PHQ5 (n_{1N} = 4500 rpm, $M_{2acc,max}$ = 430 Nm)															
205	194	313	4.7	1.4	PHQ522F0220 EZ505U	430	800	22.00	22/1	3300	6000	12	3	95	18
818	50	81	5.8	3.9	PHQ521F0055 EZ505U	350	800	5.500	11/2	2500	5500	13	3	107	15
818	64	106	7.3	3.0	PHQ521F0055 EZ703U	340	800	5.500	11/2	2500	5500	22	3	107	17
818	87	158	10	2.2	PHQ521F0055 EZ705U	430	800	5.500	11/2	2500	5500	35	3	107	23
PHQ5 (n_{1N} = 6000 rpm, $M_{2acc,max}$ = 430 Nm)															
109	118	143	0.9	1.9	PHQ522F0550 EZ401U	430	800	55.00	55/1	4000	7000	0.97	3	87	11
109	174	225	1.4	1.3	PHQ522F0550 EZ501U	430	800	55.00	55/1	4000	7000	2.9	3	87	12
109	179	251	1.4	1.2	PHQ522F0550 EZ402U	430	800	55.00	55/1	4000	7000	1.7	3	87	12
156	82	100	0.9	3.4	PHQ522F0390 EZ401U	300	800	38.50	77/2	4000	7000	1.0	3	92	11
156	122	158	1.3	2.3	PHQ522F0390 EZ501U	430	800	38.50	77/2	4000	7000	3.0	3	92	12
156	125	175	1.3	2.2	PHQ522F0390 EZ402U	430	800	38.50	77/2	4000	7000	1.7	3	92	12
156	186	279	1.9	1.5	PHQ522F0390 EZ502U	430	800	38.50	77/2	4000	7000	5.3	3	92	13
156	208	301	2.2	1.3	PHQ522F0390 EZ404U	430	800	38.50	77/2	4000	7000	3.1	3	92	14
218	59	72	1.0	4.8	PHQ522F0280 EZ401U	220	800	27.50	55/2	3700	6500	1.1	3	94	11
218	87	113	1.5	3.2	PHQ522F0280 EZ501U	410	800	27.50	55/2	3700	6500	3.1	3	94	12
218	90	125	1.6	3.1	PHQ522F0280 EZ402U	410	800	27.50	55/2	3700	6500	1.8	3	94	12
218	133	199	2.3	2.1	PHQ522F0280 EZ502U	430	800	27.50	55/2	3700	6500	5.4	3	94	13
218	133	202	2.3	2.1	PHQ522F0280 EZ701U	430	800	27.50	55/2	3700	6500	8.7	3	94	15
218	148	215	2.6	1.9	PHQ522F0280 EZ404U	430	800	27.50	55/2	3700	6500	3.2	3	94	14
218	159	271	2.7	1.8	PHQ522F0280 EZ503U	430	800	27.50	55/2	3700	6500	7.8	3	94	15
273	70	90	1.7	4.0	PHQ522F0220 EZ501U	330	800	22.00	22/1	3300	6000	3.2	3	95	12
273	72	100	1.7	3.9	PHQ522F0220 EZ402U	330	800	22.00	22/1	3300	6000	1.9	3	95	12
273	106	160	2.6	2.6	PHQ522F0220 EZ502U	430	800	22.00	22/1	3300	6000	5.5	3	95	13
273	106	162	2.6	2.6	PHQ522F0220 EZ701U	410	800	22.00	22/1	3300	6000	8.8	3	95	15
273	119	172	2.9	2.4	PHQ522F0220 EZ404U	430	800	22.00	22/1	3300	6000	3.3	3	95	14
273	127	217	3.1	2.2	PHQ522F0220 EZ503U	430	800	22.00	22/1	3300	6000	7.9	3	95	15
273	147	293	3.6	1.9	PHQ522F0220 EZ702U	430	800	22.00	22/1	3300	6000	14	3	95	18
PHQ7 (n_{1N} = 2000 rpm, $M_{2acc,max}$ = 950 Nm)															
364	231	349	9.5	2.8	PHQ721F0055 EZ805U	950	1700	5.500	11/2	2200	5000	135	3	235	55
PHQ7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 950 Nm)															
14	554	594	0.2	1.2	PHQ723F2200 EZ401U	950	1700	220.0	220/1	4000	7000	0.99	3	202	19
16	485	520	0.2	1.3	PHQ723F1930 EZ401U	950	1700	192.5	385/2	4000	7000	1.0	3	203	19
19	388	416	0.3	1.7	PHQ723F1540 EZ401U	950	1700	154.0	154/1	4000	7000	1.0	3	203	19
19	596	651	0.4	1.1	PHQ723F1540 EZ501U	950	1700	154.0	154/1	4000	7000	3.0	3	203	20
22	347	371	0.3	1.9	PHQ723F1380 EZ401U	950	1700	137.5	275/2	3700	6500	1.2	3	204	19
22	532	582	0.4	1.2	PHQ723F1380 EZ501U	950	1700	137.5	275/2	3700	6500	3.1	3	204	20
22	582	644	0.5	1.1	PHQ723F1380 EZ402U	950	1700	137.5	275/2	3700	6500	1.9	3	204	20
27	277	297	0.3	2.3	PHQ723F1100 EZ401U	840	1700	110.0	110/1	3300	6000	1.3	3	204	19
27	426	465	0.5	1.5	PHQ723F1100 EZ501U	950	1700	110.0	110/1	3300	6000	3.3	3	204	20
27	465	515	0.5	1.4	PHQ723F1100 EZ402U	950	1700	110.0	110/1	3300	6000	2.0	3	204	20
34	222	238	0.3	2.9	PHQ723F0880 EZ401U	670	1700	88.00	88/1	3300	6000	1.3	3	204	19
34	341	372	0.5	1.9	PHQ723F0880 EZ501U	950	1700	88.00	88/1	3300	6000	3.3	3	204	20
34	372	412	0.6	1.7	PHQ723F0880 EZ402U	950	1700	88.00	88/1	3300	6000	2.0	3	204	20
34	546	681	0.9	1.2	PHQ723F0880 EZ404U	950	1700	88.00	88/1	3300	6000	3.4	3	204	22
34	586	634	0.9	1.1	PHQ723F0880 EZ502U	950	1700	88.00	88/1	3300	6000	5.6	3	204	22

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n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1max} DB [rpm]	n_{1max} ZB [rpm]	J_1 [10^{-4} kgm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
PHQ7 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 950 Nm)															
34	586	657	0.9	1.1	PHQ723F0880 EZ701U	950	1700	88.00	88/1	3300	6000	8.9	3	204	23
55	220	240	0.7	2.9	PHQ722F0550 EZ501U	820	1700	55.00	55/1	3700	6500	3.1	3	195	18
55	379	409	1.2	1.7	PHQ722F0550 EZ502U	950	1700	55.00	55/1	3700	6500	5.4	3	195	19
55	379	425	1.2	1.7	PHQ722F0550 EZ701U	950	1700	55.00	55/1	3700	6500	8.7	3	195	21
55	496	568	1.6	1.3	PHQ722F0550 EZ503U	950	1700	55.00	55/1	3700	6500	7.8	3	195	21
78	154	168	0.8	4.2	PHQ722F0390 EZ501U	570	1700	38.50	77/2	3700	6500	3.3	3	203	18
78	265	286	1.4	2.5	PHQ722F0390 EZ502U	950	1700	38.50	77/2	3700	6500	5.6	3	203	19
78	265	297	1.4	2.5	PHQ722F0390 EZ701U	720	1700	38.50	77/2	3700	6500	8.9	3	203	21
78	347	397	1.9	1.9	PHQ722F0390 EZ503U	950	1700	38.50	77/2	3700	6500	8.0	3	203	21
78	430	516	2.3	1.5	PHQ722F0390 EZ702U	950	1700	38.50	77/2	3700	6500	14	3	203	23
78	483	573	2.6	1.3	PHQ722F0390 EZ505U	950	1700	38.50	77/2	3700	6500	13	3	203	23
109	189	205	1.7	3.4	PHQ722F0280 EZ502U	790	1700	27.50	55/2	3500	6000	5.9	3	206	19
109	189	212	1.7	3.4	PHQ722F0280 EZ701U	510	1700	27.50	55/2	3500	6000	9.2	3	206	21
109	248	284	2.2	2.6	PHQ722F0280 EZ503U	950	1700	27.50	55/2	3500	6000	8.3	3	206	21
109	307	368	2.8	2.1	PHQ722F0280 EZ702U	950	1700	27.50	55/2	3500	6000	14	3	206	23
109	345	409	3.1	1.9	PHQ722F0280 EZ505U	950	1700	27.50	55/2	3500	6000	13	3	206	23
109	422	532	3.8	1.5	PHQ722F0280 EZ703U	950	1700	27.50	55/2	3500	6000	22	3	206	25
136	151	164	1.9	4.3	PHQ722F0220 EZ502U	630	1700	22.00	22/1	3000	5000	6.4	3	207	19
136	151	170	1.9	4.3	PHQ722F0220 EZ701U	410	1700	22.00	22/1	3000	5000	9.7	3	207	21
136	198	227	2.5	3.3	PHQ722F0220 EZ503U	880	1700	22.00	22/1	3000	5000	8.8	3	207	21
136	246	295	3.1	2.6	PHQ722F0220 EZ702U	840	1700	22.00	22/1	3000	5000	15	3	207	23
136	276	327	3.5	2.4	PHQ722F0220 EZ505U	950	1700	22.00	22/1	3000	5000	13	3	207	23
136	338	426	4.2	1.9	PHQ722F0220 EZ703U	950	1700	22.00	22/1	3000	5000	23	3	207	25
136	436	618	5.5	1.5	PHQ722F0220 EZ705U	950	1700	22.00	22/1	3000	5000	35	3	207	31
545	118	196	5.6	4.8	PHQ721F0055 EZ802U	530	1700	5.500	11/2	2200	5000	61	3	235	36
545	140	254	6.6	4.0	PHQ721F0055 EZ803U	770	1700	5.500	11/2	2200	5000	86	3	235	42
PHQ7 (n_{1N} = 4500 rpm, $M_{2acc,max}$ = 950 Nm)															
117	340	548	1.8	1.9	PHQ722F0390 EZ505U	950	1700	38.50	77/2	3700	6500	13	3	203	23
117	433	716	2.3	1.5	PHQ722F0390 EZ703U	950	1700	38.50	77/2	3700	6500	22	3	203	25
164	243	391	2.2	2.7	PHQ722F0280 EZ505U	950	1700	27.50	55/2	3500	6000	13	3	206	23
164	309	512	2.8	2.1	PHQ722F0280 EZ703U	950	1700	27.50	55/2	3500	6000	22	3	206	25
205	194	313	2.4	3.3	PHQ722F0220 EZ505U	950	1700	22.00	22/1	3000	5000	13	3	207	23
205	215	706	2.7	3.0	PHQ722F0220 EZ802U	950	1700	22.00	22/1	3000	5000	59	3	207	39
205	248	409	3.1	2.6	PHQ722F0220 EZ703U	950	1700	22.00	22/1	3000	5000	23	3	207	25
205	336	614	4.2	1.9	PHQ722F0220 EZ705U	950	1700	22.00	22/1	3000	5000	35	3	207	31
PHQ7 (n_{1N} = 6000 rpm, $M_{2acc,max}$ = 950 Nm)															
22	569	693	0.2	1.1	PHQ723F2750 EZ401U	950	1700	275.0	275/1	4000	7000	0.99	3	202	19
27	455	554	0.2	1.4	PHQ723F2200 EZ401U	950	1700	220.0	220/1	4000	7000	0.99	3	202	19
31	398	485	0.2	1.6	PHQ723F1930 EZ401U	950	1700	192.5	385/2	4000	7000	1.0	3	203	19
39	319	388	0.2	2.0	PHQ723F1540 EZ401U	950	1700	154.0	154/1	4000	7000	1.0	3	203	19
39	471	610	0.3	1.4	PHQ723F1540 EZ501U	950	1700	154.0	154/1	4000	7000	3.0	3	203	20
39	485	679	0.3	1.3	PHQ723F1540 EZ402U	950	1700	154.0	154/1	4000	7000	1.7	3	203	20
44	285	347	0.2	2.3	PHQ723F1380 EZ401U	950	1700	137.5	275/2	3700	6500	1.2	3	204	19
44	421	545	0.3	1.5	PHQ723F1380 EZ501U	950	1700	137.5	275/2	3700	6500	3.1	3	204	20
44	433	606	0.3	1.5	PHQ723F1380 EZ402U	950	1700	137.5	275/2	3700	6500	1.9	3	204	20
55	228	277	0.3	2.9	PHQ723F1100 EZ401U	840	1700	110.0	110/1	3300	6000	1.3	3	204	19
55	337	436	0.4	1.9	PHQ723F1100 EZ501U	950	1700	110.0	110/1	3300	6000	3.3	3	204	20
55	347	485	0.4	1.9	PHQ723F1100 EZ402U	950	1700	110.0	110/1	3300	6000	2.0	3	204	20
68	182	222	0.3	3.6	PHQ723F0880 EZ401U	670	1700	88.00	88/1	3300	6000	1.3	3	204	19
68	269	348	0.4	2.4	PHQ723F0880 EZ501U	950	1700	88.00	88/1	3300	6000	3.3	3	204	20
68	277	388	0.4	2.3	PHQ723F0880 EZ402U	950	1700	88.00	88/1	3300	6000	2.0	3	204	20
68	412	618	0.6	1.6	PHQ723F0880 EZ502U	950	1700	88.00	88/1	3300	6000	5.6	3	204	22
68	412	626	0.6	1.6	PHQ723F0880 EZ701U	950	1700	88.00	88/1	3300	6000	8.9	3	204	23
68	459	665	0.7	1.4	PHQ723F0880 EZ404U	950	1700	88.00	88/1	3300	6000	3.4	3	204	22
109	174	225	0.7	2.9	PHQ722F0550 EZ501U	820	1700	55.00	55/1	3700	6500	3.1	3	195	18
109	266	399	1.1	1.9	PHQ722F0550 EZ502U	950	1700	55.00	55/1	3700	6500	5.4	3	195	19
109	266	404	1.1	1.9	PHQ722F0550 EZ701U	950	1700	55.00	55/1	3700	6500	8.7	3	195	21
109	317	542	1.3	1.6	PHQ722F0550 EZ503U	950	1700	55.00	55/1	3700	6500	7.8	3	195	21
109	368	731	1.5	1.4	PHQ722F0550 EZ702U	950	1700	55.00	55/1	3700	6500	14	3	195	23

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1max} DB [rpm]	n_{1max} ZB [rpm]	J_1 [10^{-4} kgm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
PHQ7 (n_{1N} = 6000 rpm, $M_{2acc,max}$ = 950 Nm)															
156	186	279	1.0	3.5	PHQ722F0390 EZ502U	950	1700	38.50	77/2	3700	6500	5.6	3	203	19
156	186	283	1.0	3.5	PHQ722F0390 EZ701U	720	1700	38.50	77/2	3700	6500	8.9	3	203	21
156	222	380	1.2	2.9	PHQ722F0390 EZ503U	950	1700	38.50	77/2	3700	6500	8.0	3	203	21
156	258	512	1.4	2.5	PHQ722F0390 EZ702U	950	1700	38.50	77/2	3700	6500	14	3	203	23
218	133	199	1.2	4.9	PHQ722F0280 EZ502U	790	1700	27.50	55/2	3500	6000	5.9	3	206	19
218	133	202	1.2	4.9	PHQ722F0280 EZ701U	510	1700	27.50	55/2	3500	6000	9.2	3	206	21
218	159	271	1.4	4.1	PHQ722F0280 EZ503U	950	1700	27.50	55/2	3500	6000	8.3	3	206	21
218	184	366	1.7	3.5	PHQ722F0280 EZ702U	950	1700	27.50	55/2	3500	6000	14	3	206	23
PHQ8 (n_{1N} = 2000 rpm, $M_{2acc,max}$ = 2600 Nm)															
73	1118	1691	4.1	1.5	PHQ822F0280 EZ805U	2600	4000	27.50	55/2	3000	5500	135	3	656	82
91	894	1352	4.6	1.9	PHQ822F0220 EZ805U	2600	4000	22.00	22/1	2500	4500	137	3	661	82
PHQ8 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 2600 Nm)															
7.8	1490	1629	0.1	1.1	PHQ823F3850 EZ501U	2600	4000	385.0	385/1	3700	6500	3.1	3	635	46
11	1064	1163	0.1	1.6	PHQ823F2750 EZ501U	2600	4000	275.0	275/1	3700	6500	3.1	3	643	46
14	851	931	0.1	2.0	PHQ823F2200 EZ501U	2600	4000	220.0	220/1	3700	6500	3.1	3	641	46
14	1465	1584	0.2	1.2	PHQ823F2200 EZ502U	2600	4000	220.0	220/1	3700	6500	5.4	3	641	47
14	1465	1643	0.2	1.2	PHQ823F2200 EZ701U	2600	4000	220.0	220/1	3700	6500	8.7	3	641	49
16	745	814	0.1	2.3	PHQ823F1930 EZ501U	2600	4000	192.5	385/2	3700	6500	3.3	3	645	46
16	1282	1386	0.3	1.3	PHQ823F1930 EZ502U	2600	4000	192.5	385/2	3700	6500	5.6	3	645	47
16	1282	1438	0.3	1.3	PHQ823F1930 EZ701U	2600	4000	192.5	385/2	3700	6500	8.9	3	645	49
16	1681	1923	0.3	1.0	PHQ823F1930 EZ503U	2600	4000	192.5	385/2	3700	6500	8.0	3	645	49
19	596	651	0.2	2.9	PHQ823F1540 EZ501U	2220	4000	154.0	154/1	3700	6500	3.3	3	645	46
19	1026	1109	0.3	1.7	PHQ823F1540 EZ502U	2600	4000	154.0	154/1	3700	6500	5.6	3	645	47
19	1026	1150	0.3	1.7	PHQ823F1540 EZ701U	2600	4000	154.0	154/1	3700	6500	8.9	3	645	49
19	1344	1538	0.4	1.3	PHQ823F1540 EZ503U	2600	4000	154.0	154/1	3700	6500	8.0	3	645	49
19	1663	1996	0.5	1.0	PHQ823F1540 EZ702U	2600	4000	154.0	154/1	3700	6500	14	3	645	51
22	532	582	0.2	3.2	PHQ823F1380 EZ501U	1980	4000	137.5	275/2	3500	6000	3.6	3	646	46
22	916	990	0.3	1.9	PHQ823F1380 EZ502U	2600	4000	137.5	275/2	3500	6000	5.9	3	646	47
22	916	1027	0.3	1.9	PHQ823F1380 EZ701U	2480	4000	137.5	275/2	3500	6000	9.2	3	646	49
22	1200	1374	0.4	1.4	PHQ823F1380 EZ503U	2600	4000	137.5	275/2	3500	6000	8.3	3	646	49
22	1485	1782	0.5	1.1	PHQ823F1380 EZ702U	2600	4000	137.5	275/2	3500	6000	14	3	646	51
22	1671	1980	0.6	1.0	PHQ823F1380 EZ505U	2600	4000	137.5	275/2	3500	6000	13	3	646	51
27	426	465	0.2	4.0	PHQ823F1100 EZ501U	1580	4000	110.0	110/1	3000	5000	4.1	3	647	46
27	733	792	0.3	2.3	PHQ823F1100 EZ502U	2600	4000	110.0	110/1	3000	5000	6.4	3	647	47
27	733	822	0.3	2.3	PHQ823F1100 EZ701U	1980	4000	110.0	110/1	3000	5000	9.7	3	647	49
27	960	1099	0.4	1.8	PHQ823F1100 EZ503U	2600	4000	110.0	110/1	3000	5000	8.8	3	647	49
27	1188	1426	0.6	1.4	PHQ823F1100 EZ702U	2600	4000	110.0	110/1	3000	5000	15	3	647	51
27	1337	1584	0.6	1.3	PHQ823F1100 EZ505U	2600	4000	110.0	110/1	3000	5000	13	3	647	51
34	341	372	0.2	5.0	PHQ823F0880 EZ501U	1270	4000	88.00	88/1	3000	5000	4.2	3	647	46
34	586	634	0.4	2.9	PHQ823F0880 EZ502U	2460	4000	88.00	88/1	3000	5000	6.5	3	647	47
34	586	657	0.4	2.9	PHQ823F0880 EZ701U	1580	4000	88.00	88/1	3000	5000	9.8	3	647	49
34	768	879	0.5	2.2	PHQ823F0880 EZ503U	2600	4000	88.00	88/1	3000	5000	8.9	3	647	49
34	950	1140	0.6	1.8	PHQ823F0880 EZ702U	2600	4000	88.00	88/1	3000	5000	15	3	647	51
34	1069	1267	0.7	1.6	PHQ823F0880 EZ505U	2600	4000	88.00	88/1	3000	5000	13	3	647	51
34	1307	1647	0.8	1.3	PHQ823F0880 EZ703U	2600	4000	88.00	88/1	3000	5000	23	3	647	53
55	379	425	0.6	3.7	PHQ822F0550 EZ701U	1020	4000	55.00	55/1	3300	6000	9.2	3	615	44
55	614	737	1.0	2.3	PHQ822F0550 EZ702U	2100	4000	55.00	55/1	3300	6000	14	3	615	47
55	844	1064	1.4	1.6	PHQ822F0550 EZ703U	2600	4000	55.00	55/1	3300	6000	22	3	615	49
55	1089	1545	1.8	1.3	PHQ822F0550 EZ705U	2600	4000	55.00	55/1	3300	6000	35	3	615	54
55	1141	1898	1.8	1.2	PHQ822F0550 EZ802U	2600	4000	55.00	55/1	3300	6000	59	3	615	63
78	430	516	1.0	4.0	PHQ822F0390 EZ702U	1470	4000	38.50	77/2	3300	6000	15	3	643	47
78	591	745	1.3	2.9	PHQ822F0390 EZ703U	2330	4000	38.50	77/2	3300	6000	23	3	643	49
78	763	1081	1.7	2.2	PHQ822F0390 EZ705U	2600	4000	38.50	77/2	3300	6000	35	3	643	54
78	798	1328	1.8	2.1	PHQ822F0390 EZ802U	2600	4000	38.50	77/2	3300	6000	59	3	643	63
109	422	532	1.6	4.0	PHQ822F0280 EZ703U	1660	4000	27.50	55/2	3000	5500	24	3	656	49
109	545	772	2.0	3.1	PHQ822F0280 EZ705U	2600	4000	27.50	55/2	3000	5500	37	3	656	54
109	570	949	2.1	3.0	PHQ822F0280 EZ802U	2560	4000	27.50	55/2	3000	5500	61	3	656	63
109	680	1233	2.5	2.5	PHQ822F0280 EZ803U	2600	4000	27.50	55/2	3000	5500	86	3	656	69
136	436	618	2.3	3.9	PHQ822F0220 EZ705U	2130	4000	22.00	22/1	2500	4500	38	3	661	54

STÖBER

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1max} DB [rpm]	n_{1max} ZB [rpm]	J_1 [10^{-4} kgm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
PHQ8 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 2600 Nm)															
136	456	759	2.4	3.7	PHQ822F0220 EZ802U	2050	4000	22.00	22/1	2500	4500	63	3	661	63
136	544	986	2.8	3.1	PHQ822F0220 EZ803U	2600	4000	22.00	22/1	2500	4500	88	3	661	69
PHQ8 (n_{1N} = 4500 rpm, $M_{2acc,max}$ = 2600 Nm)															
33	1176	1893	0.4	1.4	PHQ823F1380 EZ505U	2600	4000	137.5	275/2	3500	6000	13	3	646	51
41	941	1515	0.4	1.8	PHQ823F1100 EZ505U	2600	4000	110.0	110/1	3000	5000	13	3	647	51
41	1198	1980	0.6	1.4	PHQ823F1100 EZ703U	2600	4000	110.0	110/1	3000	5000	23	3	647	53
51	752	1212	0.5	2.3	PHQ823F0880 EZ505U	2600	4000	88.00	88/1	3000	5000	13	3	647	51
51	958	1584	0.6	1.8	PHQ823F0880 EZ703U	2600	4000	88.00	88/1	3000	5000	23	3	647	53
82	537	1765	1.0	2.3	PHQ822F0550 EZ802U	2600	4000	55.00	55/1	3300	6000	59	3	615	63
82	619	1023	1.1	2.0	PHQ822F0550 EZ703U	2600	4000	55.00	55/1	3300	6000	22	3	615	49
82	839	1535	1.5	1.4	PHQ822F0550 EZ705U	2600	4000	55.00	55/1	3300	6000	35	3	615	54
117	376	1235	0.8	4.5	PHQ822F0390 EZ802U	2600	4000	38.50	77/2	3300	6000	59	3	643	63
117	433	716	1.0	3.9	PHQ822F0390 EZ703U	2330	4000	38.50	77/2	3300	6000	23	3	643	49
117	587	1074	1.3	2.9	PHQ822F0390 EZ705U	2600	4000	38.50	77/2	3300	6000	35	3	643	54
164	419	767	1.6	4.1	PHQ822F0280 EZ705U	2600	4000	27.50	55/2	3000	5500	37	3	656	54
PHQ8 (n_{1N} = 6000 rpm, $M_{2acc,max}$ = 2600 Nm)															
16	1178	1525	0.1	1.4	PHQ823F3850 EZ501U	2600	4000	385.0	385/1	3700	6500	3.1	3	635	46
22	842	1089	0.1	2.0	PHQ823F2750 EZ501U	2600	4000	275.0	275/1	3700	6500	3.1	3	643	46
22	1287	1931	0.2	1.3	PHQ823F2750 EZ502U	2600	4000	275.0	275/1	3700	6500	5.4	3	643	47
22	1287	1955	0.2	1.3	PHQ823F2750 EZ701U	2600	4000	275.0	275/1	3700	6500	8.7	3	643	49
27	673	871	0.1	2.5	PHQ823F2200 EZ501U	2600	4000	220.0	220/1	3700	6500	3.1	3	641	46
27	1030	1544	0.2	1.7	PHQ823F2200 EZ502U	2600	4000	220.0	220/1	3700	6500	5.4	3	641	47
27	1030	1564	0.2	1.7	PHQ823F2200 EZ701U	2600	4000	220.0	220/1	3700	6500	8.7	3	641	49
31	589	762	0.1	2.9	PHQ823F1930 EZ501U	2600	4000	192.5	385/2	3700	6500	3.3	3	645	46
31	901	1351	0.2	1.9	PHQ823F1930 EZ502U	2600	4000	192.5	385/2	3700	6500	5.6	3	645	47
31	901	1369	0.2	1.9	PHQ823F1930 EZ701U	2600	4000	192.5	385/2	3700	6500	8.9	3	645	49
31	1074	1836	0.2	1.6	PHQ823F1930 EZ503U	2600	4000	192.5	385/2	3700	6500	8.0	3	645	49
39	471	610	0.1	3.6	PHQ823F1540 EZ501U	2220	4000	154.0	154/1	3700	6500	3.3	3	645	46
39	721	1081	0.2	2.4	PHQ823F1540 EZ502U	2600	4000	154.0	154/1	3700	6500	5.6	3	645	47
39	721	1095	0.2	2.4	PHQ823F1540 EZ701U	2600	4000	154.0	154/1	3700	6500	8.9	3	645	49
39	859	1469	0.2	2.0	PHQ823F1540 EZ503U	2600	4000	154.0	154/1	3700	6500	8.0	3	645	49
39	998	1982	0.3	1.7	PHQ823F1540 EZ702U	2600	4000	154.0	154/1	3700	6500	14	3	645	51
44	421	545	0.1	4.0	PHQ823F1380 EZ501U	1980	4000	137.5	275/2	3500	6000	3.6	3	646	46
44	644	965	0.2	2.6	PHQ823F1380 EZ502U	2600	4000	137.5	275/2	3500	6000	5.9	3	646	47
44	644	978	0.2	2.6	PHQ823F1380 EZ701U	2480	4000	137.5	275/2	3500	6000	9.2	3	646	49
44	767	1312	0.3	2.2	PHQ823F1380 EZ503U	2600	4000	137.5	275/2	3500	6000	8.3	3	646	49
44	891	1770	0.3	1.9	PHQ823F1380 EZ702U	2600	4000	137.5	275/2	3500	6000	14	3	646	51
109	266	404	0.5	4.1	PHQ822F0550 EZ701U	1020	4000	55.00	55/1	3300	6000	9.2	3	615	44
109	368	731	0.7	3.0	PHQ822F0550 EZ702U	2100	4000	55.00	55/1	3300	6000	14	3	615	47
PHQ9 (n_{1N} = 2000 rpm, $M_{2acc,max}$ = 6000 Nm)															
28	2832	4283	1.2	1.3	PHQ933F0720 EZ805U	6000	12000	72.00	72/1	2200	4500	139	3	1205	127
33	2438	3688	1.4	1.6	PHQ932F0600 EZ805U	6000	12000	60.00	60/1	2800	4500	135	3	1149	119
48	1707	2582	1.6	2.2	PHQ932F0420 EZ805U	6000	12000	42.00	42/1	2800	4500	138	3	1195	119
67	1219	1844	1.9	3.1	PHQ932F0300 EZ805U	5720	12000	30.00	30/1	2500	4000	143	3	1214	119
83	975	1475	2.1	3.9	PHQ932F0240 EZ805U	4580	12000	24.00	24/1	2200	3500	150	3	1225	119
PHQ9 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 6000 Nm)															
7.1	2797	3137	0.1	1.4	PHQ933F4200 EZ701U	6000	12000	420.0	420/1	3300	6000	9.1	3	1184	90
10	1998	2241	0.1	1.9	PHQ933F3000 EZ701U	5400	12000	300.0	300/1	3300	6000	9.1	3	1196	90
10	3240	3888	0.2	1.2	PHQ933F3000 EZ702U	6000	12000	300.0	300/1	3300	6000	14	3	1196	92
13	1598	1793	0.1	2.4	PHQ933F2400 EZ701U	4320	12000	240.0	240/1	3300	6000	9.2	3	1198	90
13	2592	3110	0.2	1.5	PHQ933F2400 EZ702U	6000	12000	240.0	240/1	3300	6000	14	3	1198	92
13	3564	4493	0.2	1.1	PHQ933F2400 EZ703U	6000	12000	240.0	240/1	3300	6000	22	3	1198	94
14	1399	1569	0.1	2.7	PHQ933F2100 EZ701U	3780	12000	210.0	210/1	3300	6000	9.8	3	1200	90
14	2268	2722	0.2	1.7	PHQ933F2100 EZ702U	6000	12000	210.0	210/1	3300	6000	15	3	1200	92
14	3119	3931	0.3	1.2	PHQ933F2100 EZ703U	6000	12000	210.0	210/1	3300	6000	23	3	1200	94
18	1119	1255	0.1	3.4	PHQ933F1680 EZ701U	3020	12000	168.0	168/1	3300	6000	9.9	3	1204	90
18	1814	2177	0.2	2.1	PHQ933F1680 EZ702U	6000	12000	168.0	168/1	3300	6000	15	3	1204	92
18	2495	3145	0.3	1.5	PHQ933F1680 EZ703U	6000	12000	168.0	168/1	3300	6000	23	3	1204	94
18	3221	4566	0.4	1.2	PHQ933F1680 EZ705U	6000	12000	168.0	168/1	3300	6000	35	3	1204	100

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1max} DB [rpm]	n_{1max} ZB [rpm]	J_1 [10^{-4} kgm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
PHQ9 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 6000 Nm)															
20	999	1121	0.1	3.8	PHQ933F1500 EZ701U	2700	12000	150.0	150/1	3000	5500	11	3	1202	90
20	1620	1944	0.2	2.3	PHQ933F1500 EZ702U	5540	12000	150.0	150/1	3000	5500	16	3	1202	92
20	2228	2808	0.3	1.7	PHQ933F1500 EZ703U	6000	12000	150.0	150/1	3000	5500	24	3	1202	94
20	2876	4077	0.4	1.3	PHQ933F1500 EZ705U	6000	12000	150.0	150/1	3000	5500	37	3	1202	100
25	799	896	0.2	4.8	PHQ933F1200 EZ701U	2160	12000	120.0	120/1	2500	4500	13	3	1203	90
25	1296	1555	0.3	2.9	PHQ933F1200 EZ702U	4430	12000	120.0	120/1	2500	4500	18	3	1203	92
25	1782	2246	0.4	2.1	PHQ933F1200 EZ703U	6000	12000	120.0	120/1	2500	4500	26	3	1203	94
25	2300	3262	0.5	1.7	PHQ933F1200 EZ705U	6000	12000	120.0	120/1	2500	4500	38	3	1203	100
25	2408	4007	0.5	1.6	PHQ933F1200 EZ802U	6000	12000	120.0	120/1	2500	4500	62	3	1203	108
31	1037	1244	0.3	3.7	PHQ933F0960 EZ702U	3540	12000	96.00	96/1	2500	4500	18	3	1207	92
31	1426	1797	0.4	2.7	PHQ933F0960 EZ703U	5620	12000	96.00	96/1	2500	4500	26	3	1207	94
31	1840	2609	0.5	2.1	PHQ933F0960 EZ705U	6000	12000	96.00	96/1	2500	4500	39	3	1207	100
31	1927	3205	0.5	2.0	PHQ933F0960 EZ802U	6000	12000	96.00	96/1	2500	4500	63	3	1207	108
31	2298	4164	0.6	1.7	PHQ933F0960 EZ803U	6000	12000	96.00	96/1	2500	4500	88	3	1207	114
42	778	933	0.3	4.9	PHQ933F0720 EZ702U	2660	12000	72.00	72/1	2200	4500	20	3	1205	92
42	1069	1348	0.5	3.6	PHQ933F0720 EZ703U	4210	12000	72.00	72/1	2200	4500	28	3	1205	94
42	1380	1957	0.6	2.8	PHQ933F0720 EZ705U	6000	12000	72.00	72/1	2200	4500	41	3	1205	100
42	1445	2404	0.6	2.6	PHQ933F0720 EZ802U	6000	12000	72.00	72/1	2200	4500	65	3	1205	108
42	1724	3123	0.7	2.2	PHQ933F0720 EZ803U	6000	12000	72.00	72/1	2200	4500	90	3	1205	114
50	1244	2070	0.7	2.8	PHQ932F0600 EZ802U	5580	12000	60.00	60/1	2800	4500	61	3	1149	100
50	1484	2690	0.9	2.4	PHQ932F0600 EZ803U	6000	12000	60.00	60/1	2800	4500	86	3	1149	106
71	871	1449	0.8	4.4	PHQ932F0420 EZ802U	3910	12000	42.00	42/1	2800	4500	63	3	1195	100
71	1039	1883	1.0	3.7	PHQ932F0420 EZ803U	5660	12000	42.00	42/1	2800	4500	89	3	1195	106
PHQ9 (n_{1N} = 4500 rpm, $M_{2acc,max}$ = 6000 Nm)															
19	2614	4320	0.2	1.5	PHQ933F2400 EZ703U	6000	12000	240.0	240/1	3300	6000	22	3	1198	94
21	2287	3780	0.2	1.7	PHQ933F2100 EZ703U	6000	12000	210.0	210/1	3300	6000	23	3	1200	94
27	1830	3024	0.2	2.1	PHQ933F1680 EZ703U	6000	12000	168.0	168/1	3300	6000	23	3	1204	94
27	2480	4536	0.3	1.5	PHQ933F1680 EZ705U	6000	12000	168.0	168/1	3300	6000	35	3	1204	100
30	1634	2700	0.2	2.3	PHQ933F1500 EZ703U	6000	12000	150.0	150/1	3000	5500	24	3	1202	94
30	2214	4050	0.3	1.7	PHQ933F1500 EZ705U	6000	12000	150.0	150/1	3000	5500	37	3	1202	100
38	1134	3726	0.2	3.4	PHQ933F1200 EZ802U	6000	12000	120.0	120/1	2500	4500	62	3	1203	108
38	1307	2160	0.3	2.9	PHQ933F1200 EZ703U	6000	12000	120.0	120/1	2500	4500	26	3	1203	94
38	1771	3240	0.3	2.1	PHQ933F1200 EZ705U	6000	12000	120.0	120/1	2500	4500	38	3	1203	100
47	907	2981	0.2	4.2	PHQ933F0960 EZ802U	6000	12000	96.00	96/1	2500	4500	63	3	1207	108
47	1045	1728	0.3	3.6	PHQ933F0960 EZ703U	5620	12000	96.00	96/1	2500	4500	26	3	1207	94
47	1417	2592	0.4	2.7	PHQ933F0960 EZ705U	6000	12000	96.00	96/1	2500	4500	39	3	1207	100
63	784	1296	0.3	4.8	PHQ933F0720 EZ703U	4210	12000	72.00	72/1	2200	4500	28	3	1205	94
63	1063	1944	0.4	3.6	PHQ933F0720 EZ705U	6000	12000	72.00	72/1	2200	4500	41	3	1205	100
PHQ9 (n_{1N} = 6000 rpm, $M_{2acc,max}$ = 6000 Nm)															
10	2808	4266	0.1	1.4	PHQ933F6000 EZ701U	6000	12000	600.0	600/1	3300	6000	9.1	3	1145	90
14	1966	2986	0.1	1.9	PHQ933F4200 EZ701U	6000	12000	420.0	420/1	3300	6000	9.1	3	1184	90
20	1404	2133	0.1	2.7	PHQ933F3000 EZ701U	5400	12000	300.0	300/1	3300	6000	9.1	3	1196	90
20	1944	3861	0.1	2.0	PHQ933F3000 EZ702U	6000	12000	300.0	300/1	3300	6000	14	3	1196	92
25	1123	1706	0.1	3.4	PHQ933F2400 EZ701U	4320	12000	240.0	240/1	3300	6000	9.2	3	1198	90
25	1555	3089	0.1	2.4	PHQ933F2400 EZ702U	6000	12000	240.0	240/1	3300	6000	14	3	1198	92
29	983	1493	0.1	3.9	PHQ933F2100 EZ701U	3780	12000	210.0	210/1	3300	6000	9.8	3	1200	90
29	1361	2703	0.1	2.8	PHQ933F2100 EZ702U	6000	12000	210.0	210/1	3300	6000	15	3	1200	92
36	786	1194	0.1	4.8	PHQ933F1680 EZ701U	3020	12000	168.0	168/1	3300	6000	9.9	3	1204	90
36	1089	2162	0.1	3.5	PHQ933F1680 EZ702U	6000	12000	168.0	168/1	3300	6000	15	3	1204	92
PHQ10 (n_{1N} = 2000 rpm, $M_{2acc,max}$ = 10000 Nm)															
17	4720	7139	0.6	1.4	PHQ1033F1200 EZ805U	10000	20000	120.0	120/1	2200	3500	150	3	2062	166
21	3776	5711	0.6	1.7	PHQ1033F0960 EZ805U	10000	20000	96.00	96/1	2200	3500	152	3	2068	166
PHQ10 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 10000 Nm)															
14	4215	7012	0.2	1.5	PHQ1033F2100 EZ802U	10000	20000	210.0	210/1	2800	4500	63	3	2059	147
18	3372	5610	0.3	1.9	PHQ1033F1680 EZ802U	10000	20000	168.0	168/1	2800	4500	64	3	2064	147
18	4022	7288	0.3	1.6	PHQ1033F1680 EZ803U	10000	20000	168.0	168/1	2800	4500	89	3	2064	153
20	3011	5009	0.3	2.2	PHQ1033F1500 EZ802U	10000	20000	150.0	150/1	2500	4000	69	3	2061	147
20	3591	6507	0.3	1.8	PHQ1033F1500 EZ803U	10000	20000	150.0	150/1	2500	4000	94	3	2061	153
25	2408	4007	0.3	2.7	PHQ1033F1200 EZ802U	10000	20000	120.0	120/1	2200	3500	76	3	2062	147

n_{2N} [rpm]	M_{2N} [Nm]	$M_{2,0}$ [Nm]	a_{th}	S	Type	M_{2acc} [Nm]	M_{2NOT} [Nm]	i	i_{exakt}	n_{1max} DB [rpm]	n_{1max} ZB [rpm]	J_1 [10^{-4} kgm²]	$\Delta\varphi_2$ [arcmin]	C_2 [Nm/ arcmin]	m [kg]
PHQ10 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 10000 Nm)															
25	2873	5206	0.4	2.3	PHQ1033F1200 EZ803U	10000	20000	120.0	120/1	2200	3500	101	3	2062	153
31	1927	3205	0.3	3.4	PHQ1033F0960 EZ802U	8640	20000	96.00	96/1	2200	3500	77	3	2068	147
31	2298	4164	0.4	2.8	PHQ1033F0960 EZ803U	10000	20000	96.00	96/1	2200	3500	102	3	2068	153
PHQ10 (n_{1N} = 4500 rpm, $M_{2acc,max}$ = 10000 Nm)															
19	2268	7452	0.1	2.9	PHQ1033F2400 EZ802U	10000	20000	240.0	240/1	2800	4500	61	3	2055	147
21	1985	6521	0.1	3.3	PHQ1033F2100 EZ802U	10000	20000	210.0	210/1	2800	4500	63	3	2059	147
27	1588	5216	0.1	4.1	PHQ1033F1680 EZ802U	10000	20000	168.0	168/1	2800	4500	64	3	2064	147
PHQ11 (n_{1N} = 2000 rpm, $M_{2acc,max}$ = 22000 Nm)															
8.3	9439	14278	0.2	1.4	PHQ1133F2400 EZ805U	22000	40000	240.0	240/1	2800	4500	136	3	3497	276
9.5	8259	12493	0.2	1.6	PHQ1133F2100 EZ805U	22000	40000	210.0	210/1	2800	4500	139	3	3506	276
12	6607	9994	0.3	2.0	PHQ1133F1680 EZ805U	22000	40000	168.0	168/1	2800	4500	140	3	3520	276
13	5900	8924	0.3	2.2	PHQ1133F1500 EZ805U	22000	40000	150.0	150/1	2500	4000	145	3	3510	276
17	4720	7139	0.3	2.8	PHQ1133F1200 EZ805U	22000	40000	120.0	120/1	2200	3500	153	3	3514	276
21	3776	5711	0.3	3.4	PHQ1133F0960 EZ805U	17710	40000	96.00	96/1	2200	3500	156	3	3533	276
PHQ11 (n_{1N} = 3000 rpm, $M_{2acc,max}$ = 22000 Nm)															
10	6021	10017	0.1	2.2	PHQ1133F3000 EZ802U	22000	40000	300.0	300/1	2800	4500	61	3	3491	257
10	7182	13014	0.1	1.8	PHQ1133F3000 EZ803U	22000	40000	300.0	300/1	2800	4500	87	3	3491	263
13	4817	8014	0.1	2.7	PHQ1133F2400 EZ802U	21600	40000	240.0	240/1	2800	4500	62	3	3497	257
13	5746	10411	0.1	2.3	PHQ1133F2400 EZ803U	22000	40000	240.0	240/1	2800	4500	87	3	3497	263
14	4215	7012	0.1	3.1	PHQ1133F2100 EZ802U	18900	40000	210.0	210/1	2800	4500	64	3	3506	257
14	5027	9110	0.1	2.6	PHQ1133F2100 EZ803U	22000	40000	210.0	210/1	2800	4500	90	3	3506	263
18	3372	5610	0.1	3.9	PHQ1133F1680 EZ802U	15120	40000	168.0	168/1	2800	4500	65	3	3520	257
18	4022	7288	0.2	3.2	PHQ1133F1680 EZ803U	21920	40000	168.0	168/1	2800	4500	91	3	3520	263
20	3011	5009	0.1	4.3	PHQ1133F1500 EZ802U	13500	40000	150.0	150/1	2500	4000	71	3	3510	257
20	3591	6507	0.2	3.6	PHQ1133F1500 EZ803U	19580	40000	150.0	150/1	2500	4000	96	3	3510	263
25	2873	5206	0.2	4.5	PHQ1133F1200 EZ803U	15660	40000	120.0	120/1	2200	3500	104	3	3514	263
PHQ11 (n_{1N} = 4500 rpm, $M_{2acc,max}$ = 22000 Nm)															
15	2835	9315	–	4.6	PHQ1133F3000 EZ802U	22000	40000	300.0	300/1	2800	4500	61	3	3491	257

6.3 Dimensional drawings

In this chapter you can find the dimensions of the geared motors.

There is a dimensional drawing for every possible shaft/housing design, each with the tables for gear unit dimensions, motor dimensions and geared motor dimensions.

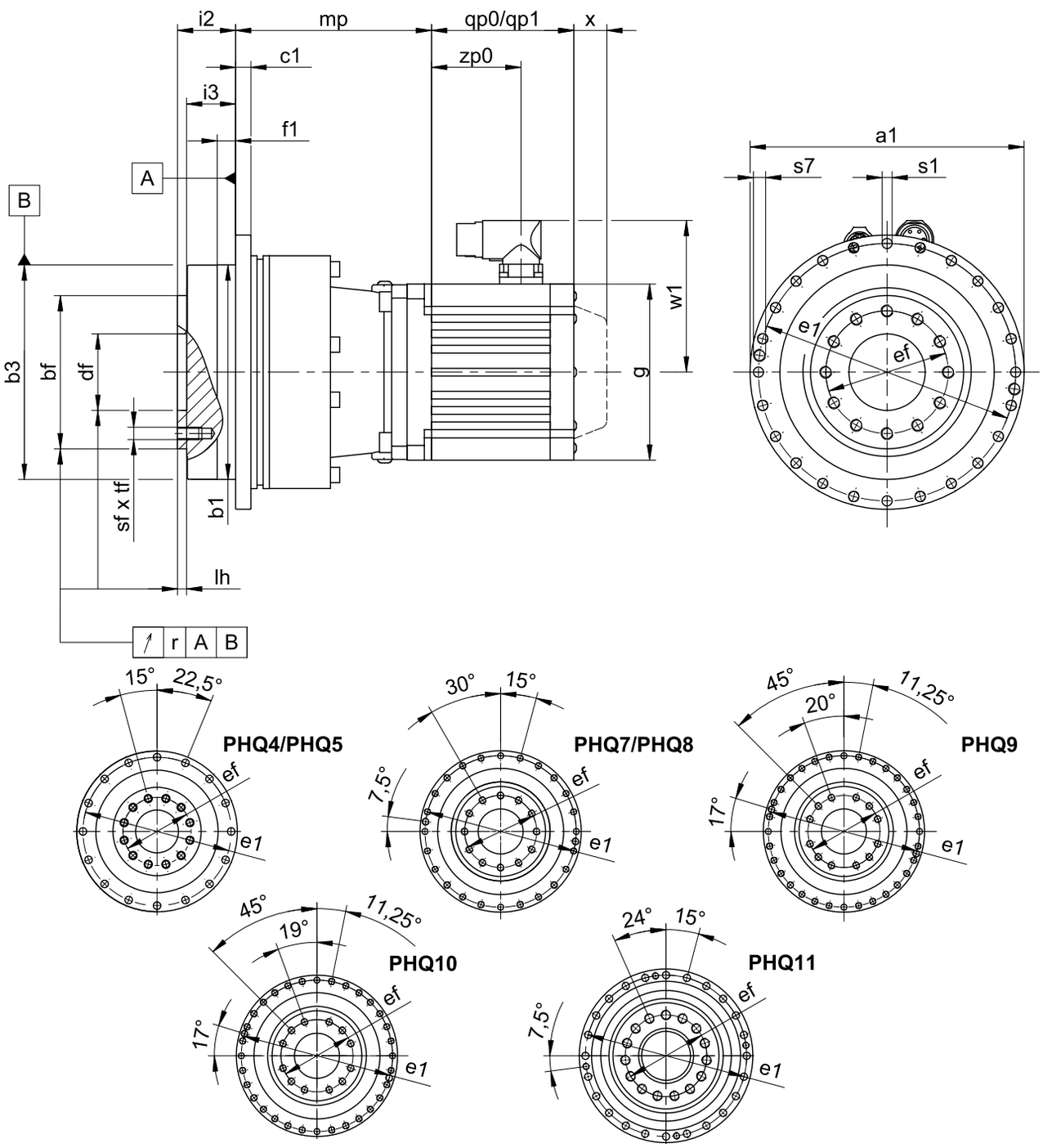
Dimensions can exceed the specifications of ISO 2768-mK due to casting tolerances or accumulation of individual tolerances.

We reserve the right to make dimensional changes due to ongoing technical development.

You can download CAD models of our standard drives at http://cad.stoeber.de.

Combination options and the dimensions of forced ventilated geared motors can be found at http://cad.stoeber.de.

6.3.1 F shaft design (flange shaft)



qp0	Applies to motors without brake.	qp1	Applies to motors with brake.
x	Applies to encoders using an optical measuring concept.	w1	For variation for One Cable Solution (OCS), see Chapter [▷ 22.4]

Dimensions of gear units

Type	Øa1	Øb1	Øb3	Øbf	c1	Ødf	Øe1	Øef	f1	i2	i3	lh	r	Øs1	s7	sf	tf
PHQ421	118_{h7}	90_{h7}	–	63_{h7}	7	31.5^{H6}	109	50	10	30	24	6	0.020	5.5	–	M6	11.0
PHQ422	118_{h7}	90_{h7}	–	63_{h7}	7	31.5^{H6}	109	50	10	30	24	6	0.020	5.5	–	M6	11.0
PHQ521	145_{h7}	110_{h7}	–	80_{h7}	8	40.0^{H6}	135	63	10	29	23	6	0.020	5.5	–	M8	11.0
PHQ522	145_{h7}	110_{h7}	–	80_{h7}	8	40.0^{H6}	135	63	10	29	23	6	0.020	5.5	–	M8	11.0
PHQ721	179_{h7}	140_{h7}	–	100_{h7}	10	50.0^{H6}	168	80	12	38	32	6	0.025	6.6	–	M10	16.0
PHQ722	179_{h7}	140_{h7}	–	100_{h7}	10	50.0^{H6}	168	80	12	38	32	6	0.025	6.6	–	M10	16.0
PHQ723	179_{h7}	140_{h7}	–	100_{h7}	10	50.0^{H6}	168	80	12	38	32	6	0.025	6.6	–	M10	16.0
PHQ822	247_{h7}	200_{h7}	–	160_{h7}	12	80.0^{H6}	233	125	15	50	42	8	0.030	9.0	M10	M12	17.0
PHQ823	247_{h7}	200_{h7}	–	160_{h7}	12	80.0^{H6}	233	125	15	50	42	8	0.030	9.0	M10	M12	17.0
PHQ932	300_{h7}	255_{h7}	–	180_{h7}	18	90.0^{H6}	280	145	20	66	55	12	0.030	13.5	M8	M20	28.0
PHQ933	300_{h7}	255_{h7}	–	180_{h7}	18	90.0^{H6}	280	145	20	66	55	12	0.030	13.5	M8	M20	28.0
PHQ1033	330_{h7}	285_{h7}	–	200_{h7}	20	95.0^{H6}	310	166	20	75	60	10	0.040	13.5	M10	M24	35.0

Dimensions of motors

Type	□g	qp0	qp1	w1	x	zp0
EZ301U	72	90	130.0	55.5	21	54.5
EZ302U	72	112	152.0	55.5	21	76.5
EZ303U	72	134	174.0	55.5	21	98.5
EZ401U	98	98	146.5	91.0	22	56.0
EZ402U	98	123	171.5	91.0	22	81.0
EZ404U	98	173	221.5	91.0	22	131.0
EZ501U	115	93	147.5	100.0	22	58.5
EZ502U	115	118	172.5	100.0	22	83.5
EZ503U	115	143	197.5	100.0	22	108.5
EZ505U	115	193	247.5	100.0	22	158.5
EZ701U	145	102	161.0	115.0	22	64.0
EZ702U	145	127	186.0	115.0	22	89.0
EZ703U	145	152	211.0	115.0	22	114.0
EZ705U	145	207	266.0	134.0	22	165.0
EZ802U	190	197	274.0	156.5	22	143.0
EZ803U	190	238	315.0	156.5	22	184.0
EZ805U	190	320	397.0	156.5	22	266.0

Dimensions of geared motors

Type	EZ3	EZ4	EZ5	EZ7	EZ8
	mp	mp	mp	mp	mp
PHQ421	–	51.0	53.5	–	–
PHQ422	103.0	99.5	102.0	–	–
PHQ521	–	–	57.0	63.0	–
PHQ522	–	112.5	115.0	121.0	–
PHQ721	–	–	–	–	77.0
PHQ722	–	–	128.0	134.0	149.0
PHQ723	–	183.5	186.0	192.0	–
PHQ822	–	–	–	169.0	184.0
PHQ823	–	–	229.0	235.0	–
PHQ932	–	–	–	–	249.5
PHQ933	–	–	–	319.0	334.0
PHQ1033	–	–	–	–	384.0

6.4 Type designation

In this chapter, you can find an explanation of the type designation with the associated options.

Additional ordering information not included in the type designation can be found at the end of the chapter.

Sample code

PHQ	7	2	3	F	0880	EZ401U

Explanation

Code	Designation	Design
PHQ	Type	Planetary gear unit
7	Size	7 (example)
2 3	Generation	Generation 2 Generation 3
1 2 **3**	Stages	Single-stage Two-stage Three-stage
F	Shaft	Flange shaft
0880	Transmission ratio (i x 10)	i = 88 (example)
EZ401U	Motor	EZ synchronous servo motor

In order to complete the type designation, also specify:

- A detailed type designation of the motor, see Chapter [▸ 22]
- The installation position (for three-stage gear units), see Chapter [▸ 6.5.2]
- Radial shaft seal rings at the output made of FKM or NBR, see Chapter [▸ 6.6.3]
- For reverse operation of the output shaft at ± 20° to ± 90° and horizontal installation, note Chapter [▸ 6.6.4]

6.5 Product description

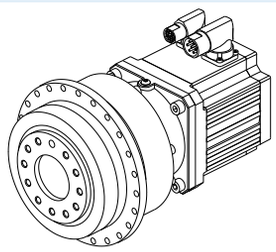
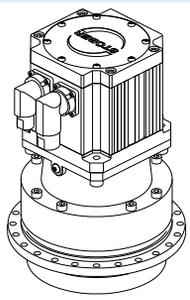
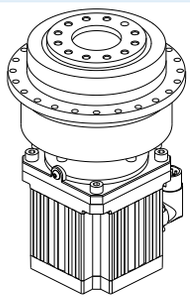
6.5.1 Installation conditions

The specified torques and forces only apply when attaching gear units on the machine side using screws of quality 12.9. In addition, the gear housing must be adjusted at pilot Øb1 and also at pilot Øb3 for size PHQ11 (H7).

6.5.2 Installation positions

The following table shows the standard installation positions.

Please indicate the installation position when ordering three-stage geared motors.

EL1	EL5	EL6
		
Horizontal output	Vertical downward output	Vertical upward output

6.5.3 Lubricants

STOBER fills the gear units with the amount and type of lubricant specified on the nameplate. The filling volume and the structure of the gear units depend on the installation position.

Only install the gear units in the intended installation position! Reposition the gear units only after consulting STOBER. Otherwise, STOBER assumes no liability for the gear units.

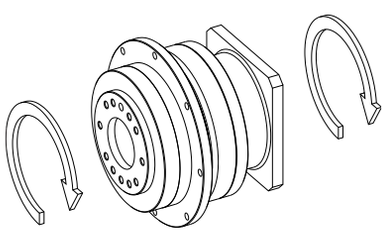
Lubricant filling quantities for gear units, document ID 441871, can be found online at http://www.stoeber.de

6.5.4 Other product features

Feature	Value
Max. permitted gear unit temperature (on the surface of the gear unit)	≤ 90 °C
Paint	Black RAL 9005
(ATEX) Directive 2014/34/EU	Not suitable
Protection class: [1] Gear unit Motor	 IP65 IP56, optionally IP66

6.5.5 Direction of rotation

The input and output rotate in the same direction.



6.6 Project configuration

Project your drive using our SERVOsoft designing software. You can receive SERVOsoft for free from your adviser at one of our sales centers. Observe the limit conditions in this chapter to ensure a safe design for your drives.

The formula symbols for values actually present in the application are marked with *.

[1] Observe the protection class of all the components.

Formula symbol	Unit	Explanation
a_{th}	–	Parameter for calculating $K_{mot,th}$
ED	%	Duty cycle relative to 20 minutes
fB_{op}	–	Operating mode operating factor
fB_t	–	Run-time operating factor
fB_T	–	Temperature operating factor
F_{2ax*}	N	Actual axial force at the gear unit output
$F_{2ax,eq*}$	N	Actual equivalent axial force on the gear unit output
F_{2ax100}	N	Permitted axial force at the gear unit output for $n_{2m*} \leq 100$ rpm
F_{2axN}	N	Permitted nominal axial force at the gear unit output
$F_{2rad,acc}$	N	Permitted radial acceleration force at the gear unit output
$F_{2rad,acc*}$	N	Actual radial acceleration force at the gear unit output
$F_{2rad,acc,1*}$	N	Actual radial acceleration force at the gear unit output in the first time segment
$F_{2rad,acc,n*}$	N	Actual radial acceleration force at the gear unit output in the n-th time segment
$F_{2rad,eq*}$	N	Actual equivalent force at the gear unit output
$F_{2rad100}$	N	Permitted radial force at the gear unit output for $n_{2m*} \leq 100$ rpm
F_{2radN}	N	Permitted nominal radial force at the gear unit output
i	–	Gear ratio
$K_{mot,th}$	–	Factor for determining the thermal limit torque
l	mm	Length of the output shaft
L_{10h}	h	Bearing service life
M_{op}	Nm	Torque of motor at the operating point from the motor characteristic curve at n_{1m*}
$\|M_2\|$	Nm	Amount of torque on the output
$M_{2,1*} – M_{2,6*}$	Nm	Actual torque in the respective time segment (1 to 6)
$M_{2,n*}$	Nm	Actual torque in the n-th time segment
M_{2acc}	Nm	Maximum permitted acceleration torque on the gear unit output
M_{2acc*}	Nm	Actual acceleration torque on the gear unit output
M_{2eff*}	Nm	Actual effective torque on the gear unit output
M_{2eq*}	Nm	Equivalent torque present on the gear unit output
M_{2k100}	Nm	Permitted breakdown torque on the gear unit output for $n_{2m*} \leq 100$ rpm
M_{2kN}	Nm	Permitted nominal breakdown torque on the gear unit output
M_{2k*}	Nm	Actual breakdown torque on the gear unit output
$M_{2k,acc}$	Nm	Permitted acceleration breakdown torque on the gear unit output
$M_{2k,acc*}$	Nm	Actual acceleration breakdown torque on the gear unit output
$M_{2k,acc,1*}$	Nm	Actual acceleration breakdown torque on the gear unit output in the first time segment
$M_{2k,acc,n*}$	Nm	Actual acceleration breakdown torque on the gear unit output in the n-th time segment
$M_{2k,eq*}$	Nm	Actual equivalent breakdown torque on the gear unit output
M_{2N}	Nm	Nominal torque on the gear unit output (relative to n_{1N})

Formula symbol	Unit	Explanation
M_{2NOT}	Nm	Gear unit emergency-off torque on the gear unit output for max. 1000 load changes
M_{2NOT*}	Nm	Actual emergency off torque for the gear unit on the gear unit output
M_{2th}	Nm	Thermal limit torque on the gear unit output
n_{1m*}	rpm	Actual average input speed
n_{1max*}	rpm	Actual maximum input speed
n_{1maxDB}	min^{-1}	Maximum permitted input speed of the gear unit in continuous operation
n_{1maxZB}	min^{-1}	Maximum permitted input speed of the gear unit in cyclic operation
$\|n_2\|$	rpm	Value of output speed
n_{2m*}	rpm	Actual average output speed
$n_{2m,1*} – n_{2m,6*}$	rpm	Actual average output speed in the respective time segment (1 to 6)
$n_{2m,n*}$	rpm	Actual average output speed in the n-th time segment
t	s	Time
$t_{1*} – t_{6*}$	s	Duration of the respective time segment (1 to 6)
t_{n*}	s	Duration of the n-th time segment
S	–	Load value: Quotient of gear unit and motor nominal torque without regard to the thermal performance limit. Represents a value for the reserve of the geared motor.
x_2	mm	Distance of the shaft shoulder to the force application point
y_2	mm	Distance of the shaft axis to the axial force application point
z_2	mm	Distance of the shaft shoulder to the middle of the output bearing

6.6.1 Calculation of the operating point

Check the following conditions for operating points other than the nominal point M_{2N} specified in the selection tables.

$$n_{1m*} \leq \frac{n_{1maxDB}}{fB_T}$$

$$n_{1max*} \leq \frac{n_{1maxZB}}{fB_T}$$

$$M_{2eff*} \leq M_{2th}$$

$$M_{2acc*} \leq M_{2acc}$$

$$M_{2NOT*} \leq M_{2NOT}$$

$$M_{2eq*} \leq M_{2N} \cdot \frac{S}{fB_{op} \cdot fB_t}$$

The values for n_{1maxDB}, n_{1maxZB}, M_{2acc}, M_{2NOT}, M_{2N} and S can be found in the selection tables.

The values for fB_T, fB_{op} and fB_t can be found in the corresponding tables in this chapter.

Calculate the thermal limit torque M_{2th} for a duty cycle > 50%.

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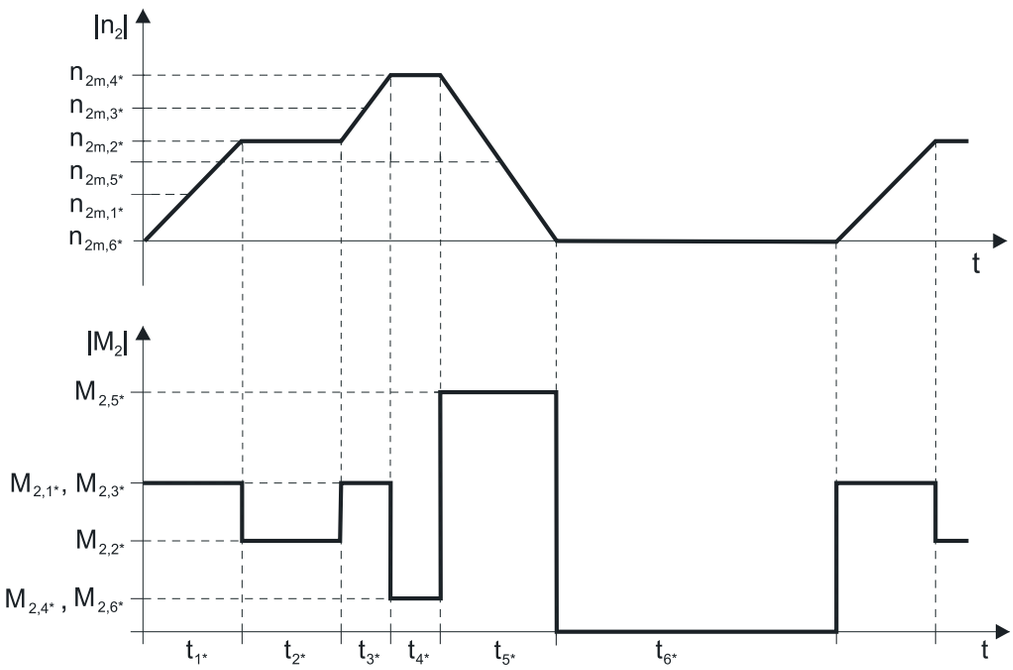
Example of cycle sequence

The following calculations are based on a representation of the power taken from the output based in accordance with the following example:



Calculation of the actual average input speed

$$n_{1m^*} = n_{2m^*} \cdot i$$

$$n_{2m^*} = \frac{\left|n_{2m,1^*}\right| \cdot t_{1^*} + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*}}{t_{1^*} + \ldots + t_{n^*}}$$

If $t_{1^*} + \ldots + t_{5^*} \geq 20$ min, calculate n_{2m^*} without the rest phase t_{6^*}.

The values for the ratio i can be found in the selection tables.

Calculation of the actual effective torque

$$M_{2eff^*} = \sqrt{\frac{t_{1^*} \cdot {M_{2,1^*}}^2 + \ldots + t_{n^*} \cdot {M_{2,n^*}}^2}{t_{1^*} + \ldots + t_{n^*}}}$$

Calculation of the actual equivalent torque

$$M_{2eq^*} = \sqrt[3]{\frac{\left|n_{2m,1^*}\right| \cdot t_{1^*} \cdot \left|{M_{2,1^*}}^3\right| + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*} \cdot \left|{M_{2,n^*}}^3\right|}{\left|n_{2m,1^*}\right| \cdot t_{1^*} + \ldots + \left|n_{2m,n^*}\right| \cdot t_{n^*}}}$$

Calculation of the thermal limit torque

Calculate the thermal limit torque M_{2th} for a duty cycle ED > 50% and the actual average input speed n_{1m^*}. (At $K_{mot,th} \leq 0$ you must reduce the average input speed n_{1m^*} accordingly or select another geared motor size.)

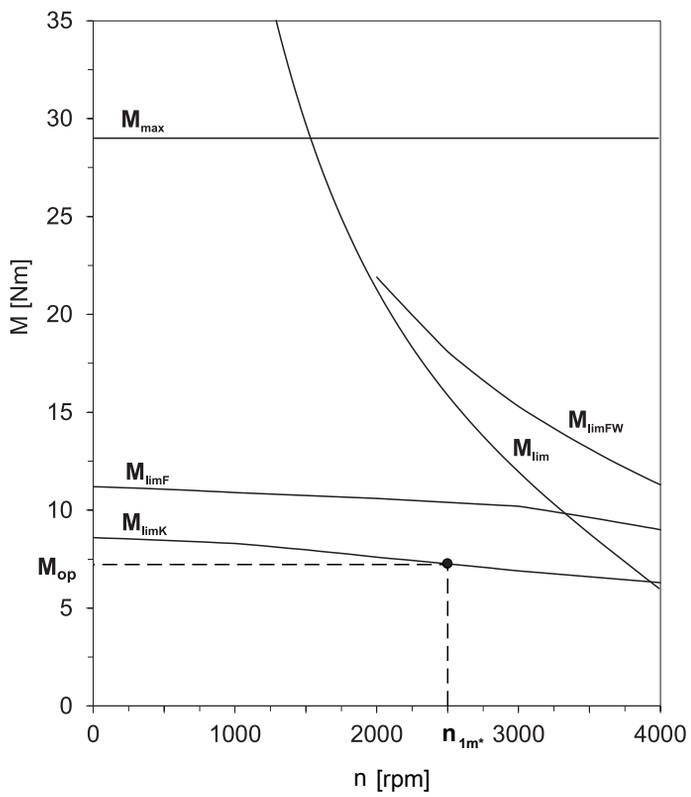
$$M_{2th} = M_{op} \cdot i \cdot K_{mot,th}$$

$$K_{mot,th} = 0{,}93 - \frac{a_{th}}{1000} \cdot fB_T \cdot \left(\frac{n_{1m^*}}{1000}\right)^3$$

The values for i and a_{th} can be found in the selection tables.

The values for fB_T can be found in the corresponding table in this chapter.

The value for the torque of the motor at operating point M_{op} with the determined average input speed n_{1m*} can be found in the motor curve of Chapter [▶ 22.3]. Note the size, nominal speed n_N and cooling type of the motor. The figure below shows an example of reading the torque M_{op} of a motor with convection cooling at the operating point.



Operating factors

Operating mode	fB_{op}
Uniform continuous operation	1.00
Cyclic operation	1.00
Reversing load cyclic operation	1.00

Run time	fB_t
Daily run time ≤ 8 h	1.00
Daily run time ≤ 16 h	1.15
Daily run time ≤ 24 h	1.20

Temperature		fB_T
Motor cooling	**Surrounding temperature**	
Motor with forced ventilation	≤ 20 °C ≤ 30 °C ≤ 40 °C	0.9 1.0 1.15
Motor with convection cooling	≤ 20 °C ≤ 30 °C ≤ 40 °C	1.0 1.1 1.25

Notes

- The maximum permitted gear unit temperature (see the "Other product features" chapter) must not be exceeded. Doing so may result in damage to the geared motor.
- For braking from full speed (for example when the power fails or when setting up the machine), note the permitted gear unit torques (M_{2acc}, M_{2NOT}) in the selection tables.

6.6.2 Permitted shaft loads for the output shaft

The values specified in the tables apply to the permitted shaft loads:

- For shaft dimensions in accordance with the catalog
- For output speeds $n_{2m*} \leq 100$ rpm ($F^{2axN} = F_{2ax100}$; $F_{2radN} = F_{2rad100}$; $M_{2kN} = M_{2k100}$)
- Only if transverse forces on the gear unit are supported via its pilots (housing, flange shaft)

Permitted shaft loads

Type	z_2 [mm]	F_{2ax100} [N]	$F_{2rad100}$ [N]	$F_{2rad,acc}$ [N]	M_{2k100} [Nm]	$M_{2k,acc}$ [Nm]
PHQ4	84.0	2150	3095	3929	260	330
PHQ5	97.0	4150	4536	4897	440	475
PHQ7	88.0	6150	17045	17045	1500	1500
PHQ8	126.0	10050	27778	33333	3500	4200
PHQ9	155.0	33000	48387	70968	7500	11000
PHQ10	171.0	50000	51462	73099	8800	12500
PHQ11	231.0	60000	47619	60606	11000	14000
PHQ12	281.0	70000	53380	71040	15000	20000

For other output speeds, download diagrams at http://products.stoeber.de.

The following applies to output speeds $n_{2m*} > 100$ rpm:

$$F_{2axN} = \frac{F_{2ax100}}{\sqrt[3]{\frac{n_{2m*}}{100\,\text{rpm}}}} \qquad F_{2radN} = \frac{F_{2rad100}}{\sqrt[3]{\frac{n_{2m*}}{100\,\text{rpm}}}} \qquad M_{2kN} = \frac{M_{2k100}}{\sqrt[3]{\frac{n_{2m*}}{100\,\text{rpm}}}}$$

The values for F_{2ax100}, $F_{2rad100}$ and M_{2k100} can be found in the table "Permitted shaft loads" in this chapter.

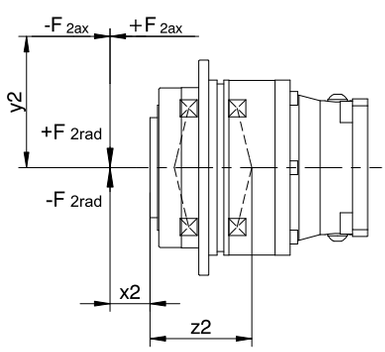


Fig. 1: Force application points

The permitted transverse forces can be determined from the permitted breakdown torque M_{2kN} and $M_{2k,acc}$. The actual transverse forces must not exceed the permitted transverse forces. The permitted transverse forces are based on the end of the hollow shaft (x2 = 0).

$$M_{2k,acc^*} = \frac{2 \cdot F_{2ax^*} \cdot y_2 + F_{2rad,acc^*} \cdot (x_2 + z_2)}{1000} \leq M_{2k,acc}$$

For applications with multiple axial and/or radial forces, you must add the forces as vectors.

In the event of EMERGENCY OFF operation (max. 1000 load changes), you can multiply the permitted forces and torques for F_{2ax100}, $F_{2rad100}$ and M_{2k100} by a factor of two.

Also note the calculation for equivalent values:

$$M_{2k,eq^*} = \sqrt[3]{\frac{|n_{2m,1^*}| \cdot t_{1^*} \cdot |M_{2k,acc,1^*}{}^3| + \ldots + |n_{2m,n^*}| \cdot t_{n^*} \cdot |M_{2k,acc,n^*}{}^3|}{|n_{2m,1^*}| \cdot t_{1^*} + \ldots + |n_{2m,n^*}| \cdot t_{n^*}}} \leq M_{2kN}$$

$$F_{2rad,eq^*} = \sqrt[3]{\frac{|n_{2m,1^*}| \cdot t_{1^*} \cdot |F_{2rad,acc,1^*}{}^3| + \ldots + |n_{2m,n^*}| \cdot t_{n^*} \cdot |F_{2rad,acc,n^*}{}^3|}{|n_{2m,1^*}| \cdot t_{1^*} + \ldots + |n_{2m,n^*}| \cdot t_{n^*}}} \leq F_{2radN}$$

$$F_{2ax,eq^*} \leq F_{2axN}$$

The following apply to the bearing service life L_{10h} (duty cycle ≤ 40%):

L_{10h} > 10000 h with 1 < M_{2kN}/M_{2k^*} < 1.25

L_{10h} > 20000 h with 1.25 < M_{2kN}/M_{2k^*} < 1.5

L_{10h} > 30000 h with 1.5 < M_{2kN}/M_{2k^*}

For different duty cycles:

$$L_{10h} > L_{10h(ED=40\%)} \cdot \frac{40\%}{ED}$$

6.6.3 Recommendation for radial shaft seal rings

For a duty cycle > 60%, we recommend radial shaft seal rings made of FKM.

Properties:

- Excellent temperature resistance
- High chemical stability
- Very good resistance to aging
- Excellent resistance to mineral oils and greases
- For use in the food, beverage and pharmaceutical industries

Leak-proofness

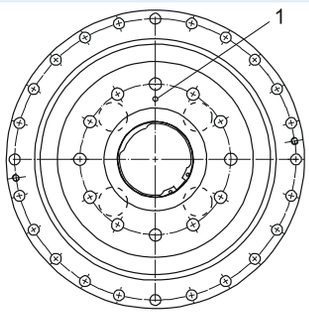
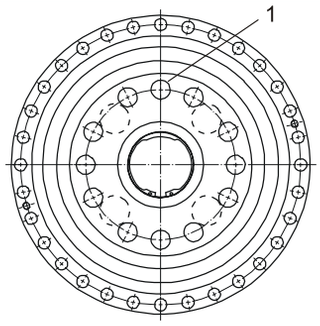
Our gear units are equipped with high-quality radial shaft seal rings and checked for leak-proofness. However, a leak cannot be fully ruled out over the length of use of the gear unit. If you use the gear unit with goods incompatible with the lubricant, you must take measures to prevent direct contact with the gear unit lubricant in case of a leak.

6.6.4 Reverse operation

To ensure lubrication of circulating geared parts during cyclic reverse operation from ± 20° to ± 90°, pay careful attention to the position of the output shaft if the gear unit is installed horizontally as shown in the images below.

The images show the center position of reverse operation.

Cyclic reverse operation ≤ ± 20° on request.

PHQ4 – PHQ8, PHQ11, PHQ12	PHQ9 – PHQ10
	
1 Position of the mark: top	1 Position of the fastening thread: as shown in the image

6.7 Additional documentation

Additional documentation related to the product can be found at http://www.stoeber.de/en/download

Enter the ID of the documentation in the Search... field.

Documentation	ID
Operating manual for planetary gear units and motors	441957
Lubricant filling quantities for gear units	441871