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Project name:

Technical Support for the Fabrication and Deployment of the Radiometer ELBARA-III in Budnow (Poland)

TN 1 "Advices on the implementation of system components under the responsibility of IA-PAS"

4000113360/15/NL/FF/gp

Technical Note (TN 1):

"Advices on the implementation of system components under the responsibility of IA-PAS"

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Authors:

Mike Schwank GAMMA REMOTE SENSING

Andreas Wiesmann GAMMA REMOTE SENSING

1. INTRODUCTION

This technical note (TN) is the result of **WP 1300** under the responsibility of GAMMA, as well as the result of parts of **WP 1600** under the responsibility of IA-PAS. According to the contractual obligations these two WP's include the following ***tasks*** and ***outputs***:

WP 1300: "Consulting and provision of mechanical drawings from ELBARA II with adaptations":

Tasks:	Provide scaffold drawings of ELBARA II to IA-PAS
	Provide item list of elevation tracker and gears to IA-PAS
	Consulting IA-PAS for scaffold manufacture
Outputs:	Drawings of the ELBARA II scaffold
	Item list, ELBARA II elevation tracker and gear specifications

WP 1600: "Construction, production, assembly and test of the azimuth tracker"

Tasks:	Design of azimuth tracker
Outputs:	Azimuth tracker device

The subsequent advices are the result of developments along with the construction of earlier ELBARA systems developed by GAMMA. Emphasize is given to the clear definition of interfaces crucial to ensure the smooth assembly of components produced by the project partners GAMMA and IA-PAS.

In section 2 ideas to build up an azimuth tracker to be sandwiched between the ELBARA system and the tower platform is outlined (part of WP 1600). The later sections 3 and 4 provide the instructions to be used by IA-PAS to manufacture the scaffold and the elevation tracker, respectively (WP 1300). Finally, the item list (section 0) and the data-sheets (section 6) of all the components used to implement the elevation tracker by IA-PAS are provided.

2. CONCEPT OF AZIMUTH TRACKER (WP 1600)

In this section we provide input for the development of the azimuth tracker within WP 1600. The conceptional input provided is based on developments performed by the Faculty of Earth- and Life Sciences, Vrije Universiteit Amsterdam, (the Netherlands) which were conveyed by Mike Schwank (GAMMA) [1]. Of course the ideas provided need adaptations and further concretization by IA-PAS to accommodate their specific requirements for the use at the test-site Bubnow (Poland).

The biaxial tracker mechanism could be realized by mounting an additional azimuth tracker beneath the ELBARA-III system, which already allows for pointing the antenna in elevation. The azimuth-tracker requires a new construction consisting for example of a space framework attached to a driving mechanism. The two axis positions (in elevation and azimuth) will be controlled by two individual control-units (RS 232) provided by the ELBARA-III computer. To facilitate the control of the motor used to drive the additional azimuth tracker, we strongly propose to use the same motor as is used for driving the elevation tracker (JVL, type MAC141-A3AACA with MAC00-B4 extension module).

The azimuth tracker could be constructed as a rotating platform to be mounted beneath the base of the ELBARA-III system. The realization of the azimuth mechanism for rotating the entire system around the vertical axis could be adopted from the design shown below and applied in one of our earlier field experiments [1, 2]. A similar principle could be used as a starting point for the construction and for the implementation of the azimuth tracker under the responsibility of IA-PAS.

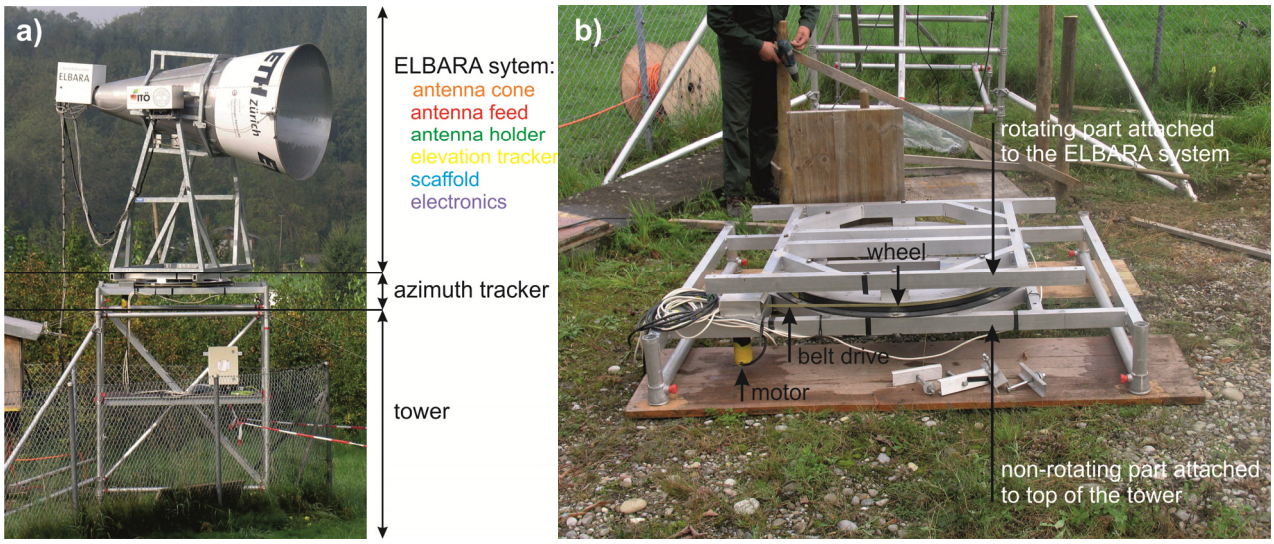


Figure 1: a) ELBARA attached to the beneath azimuth tracker and mounted on a small tower. ELBARA system components indicated correspond with Figure 3. b) Close-up of the azimuth tracker used in the earlier experiments [1, 2].

Just as it will be implemented in the elevation tracker of the ELBARA-III system, the azimuth tracker to be sandwiched between the ELBARA-III system and the tower platform must be driven by the same motor (JVL, type MAC141-A3AACA with MAC00-B4 extension module) as is used to drive the elevation tracker. Furthermore, the azimuth tracker will require some kind of position sensors to control a number of predefined azimuth directions adapted to experimental requirements. These sensors will be attached directly to the motor. Accordingly the sensors must be the same as used for the elevation tracker (inductive switches Contrinex, Typ DW-AS-703-M12). The consideration of these similarities is important to ensure the compatibility of the resultant azimuth tracker constructed and implemented by IA-PAS (WP 1600: Construction, production, assembly and test of the azimuth tracker) with the software developed by GAMMA used to control the azimuth tracker (WP 1400: Software development related to azimuth-tracker and travel to Poland to assemble it).

The mechanical interface between the azimuth tracker and the bottom of the ELBARA scaffold to be mounted above becomes apparent from the plane-view of the scaffold drawn in Figure 5. The bottom interface of the azimuth tracker sandwiched between the ELBARA system and the tower (Figure 1a) depends on the layout of the tower. Ideally this will be designed to allow for plugging the entire system on-top of the tower as is illustrated with Figure 2.

Figure 2: Installation of ELBARA on the tower at the Valencia Anchor Station (VAS). A mechanical interface (vertical tubes) pluggable to the tower structure (vertical rods) was attached to the bottom of the scaffold to facilitate the installation with the aid of a crane.

3. SCAFFOLD (WP1300)

Sketches of the ELBARA system are shown with Figure 3 to define major mechanical components and to ensure the fitting of the components produced by GAMMA and by IA-PAS and assembled in Poland.

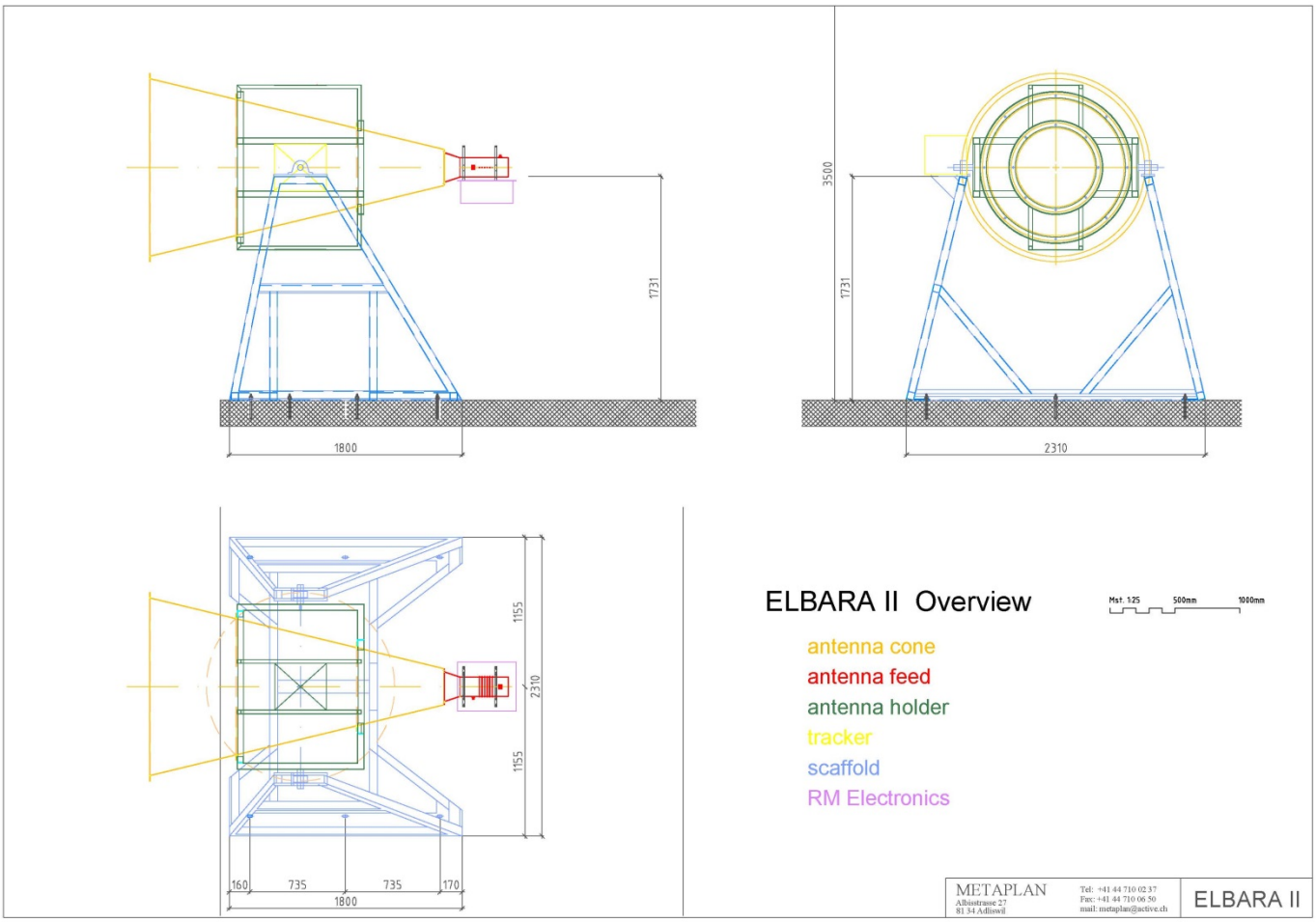


Figure 3: Drawings of the entire ELBARA system (without the beneath azimuth tracker) showing its major mechanical components produced by GAMMA (antenna cone, antenna feed, antenna holder, electronics) and IA-PAS (scaffold, elevation tracker).

Gamma will provide the following system components: Radiometer (RM) electronics, antenna cone, antenna feed, and antenna holder. IA-PAS is responsible for the implementation of the scaffold (using the information provided in this section), for the elevation tracker (using the information provided in section Figure 4), as well as for the construction and implementation of an azimuth tracker (using ideas outlined in section 0). Figure 4 shows an earlier scaffold during its production at a metal construction company.

Figure 4: Earlier scaffold produced at a metal construction company in Switzerland.

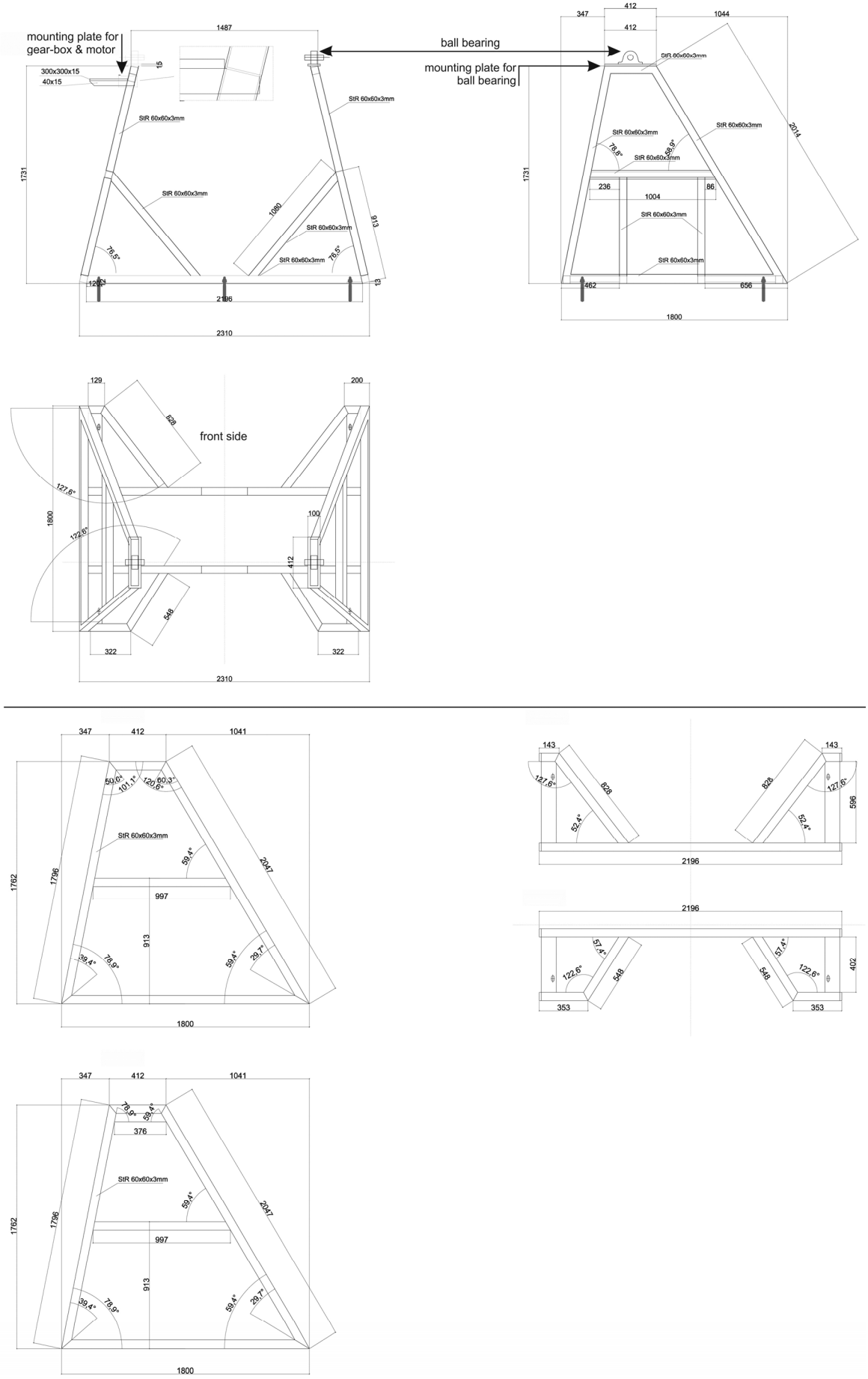


Figure 5: Detailed mechanical drawings of the scaffold to be used for its production by IA-PAS. The top mounting plate of the scaffold is the mechanical interface relevant for the assembly of the components produced by GAMMA and IA-PAS in Poland.

The construction of the scaffold shown with Figure 5 will be made of a space framework of rectangular hollow steel (EN 10219 S355J2H) sections welded together and hot-dip galvanized for corrosion protection. The lower part of Figure 5 shows the plane-views of the two side sections of the scaffold, as well as the two horseshoe-shaped structures making up the base of the scaffold. These drawings may be the most practical for the production of the scaffold by a metal construction company. However, the technical drawing shown in Figure 5 is also provided in the AutoCAD format, it can be accessed at https://www.dropbox.com/s/r1mkz2i7356qo51/ELBARA_scaffold.dwg?dl=0.

The cross beams with the most loads have cross-sections of 60 mm × 60 mm and thickness 3 mm, whereas the stabilizing cross beams have smaller dimensions (30 mm × 30 mm). The entire radiometer system, including the scaffold, the elevation tracker, the antenna (cone, feed, holder), and the radiometer electronics, weights approximately 500 kg. The corresponding load on the tower and on the azimuth tracker must of course be considered in their construction.

Elevation angles in the range 30° to 330° are supported (180° is the zenith direction), enabling the observation of two diametrical footprints without rotating the system around its vertical axis. This is achieved by placing the suspension sufficiently high (front view of mechanical drawing shown in Figure 5) and by using a double horseshoe-shaped base (plan view shown in Figure 5). However, if it is believed that this feature is not necessary because of the availability of an azimuth tracker, the shape of the base of the scaffold could be simplified to a horseshoe-shape to the front side only.

The elevation tracker (yellow in Figure 3 and outlined in the subsequent Section 4) includes the ball bearing (Figure 6a) and the gear-box (Figure 6b) driven by the motor. These components, under the responsibility of IA-PAS, act as the pivotal point of the rotation axes (Figure 7) attached to the antenna holder (Figure 3). The gear-box and ball bearing (Medias, PASE50-N, http://medias.schaeffler.de/medias/de!hp.ec.br.pr/PASE*PASE50-N;aoFmVxLFpRIe) shown in Figure 6 will be screwed to the respective mounting plates of the scaffold as is indicated in Figure 5. These mounting plates are the mechanical interfaces between the components produced by GAMMA and IA-PAS, respectively. The manufacturing precision of the scaffold (IA-PAS) is expected to be no better than a few millimeters. Accordingly, it is proposed to drill the holes in the mounting plates of the scaffold (Figure 5) used to screw the ball bearing (Figure 6a) on the one side, and to fix the gear-box (Figure 6b) on the other side when putting together the components provided by GAMMA (antenna (cone, feed, holder), radiometer electronics) with the components produced by IA-PAS (scaffold, elevation tracker, azimuth tracker). This procedure is proposed to avoid problems arising from manufacturing tolerances mainly expected for the scaffold.

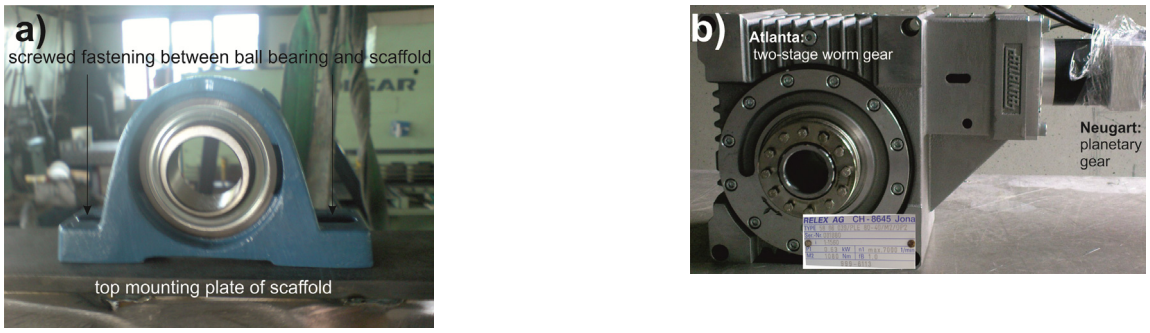


Figure 6: Fotos of the ball bearing (panel a) and of the gear-box (panel b) consisting of the Atlanta and the Neugart gear. The ball bearing and the gear-box are screwed on the top plate of the scaffold (Figure 4) during putting together the GAMMA components (antenna (cone, feed, holder), radiometer electronics) with the IA-PAS components (scaffold and elevation tracker) in Poland.

4. ELEVATION TRACKER (WP1300)

The elevation tracker to be implemented by IA-PAS will consist of a gear-box (Figure 6b) attached to the rotation axes (Figure 7) of the antenna holder (Figure 3) and driven by a motor. The gear-box (Figure 6b) comprises of a two-stage worm gear (Atlanta, type 58 86 039, reduction 1:39, datasheet attached in Section 6.1) and a planetary gear (Neugart, type PLE 80-40/M2/OP2, reduction 1:40, datasheet attached in Section 6.2) connected in series. The motor is a AC servo motor (JVL, type MAC141-A3AACA with MAC00-B4 extension module, datasheet attached in Section 6.3) powered and controlled through the embedded servo-drive, comprising an RS-232 interface to connect with the ELBARA electronics. The massive Atlanta worm gear holds one of the two axes attached to the antenna holder (Figure 3 and Figure 7). The axes to the other side is pivoted by a ball bearing (Figure 6a). The series connection of the two gears (the gear-box) driven by the AC servo motor will result in the maximal mechanical torque of ≈ 1000 Nm, and features repeatable elevation positioning. The manufacturer of the gears rates the operational temperature range to be -20°C to +80°C.

The selected JVL motor is equipped with an encoder that keeps the antenna at a constant orientation even under windy conditions. Furthermore, an inductive switch (Contrinex, type DW-AS-703-M12, datasheet attached in Section 6.5) between the rotating part and the fixed scaffold is mounted to allow absolute positioning the antenna using its “home” position. The motor is powered and controlled through the embedded servo-drive, comprising an RS-232 interface that allows various state parameters also to be monitored, such as speed and torque. The motor conforms to IP67 and has a nominal operational temperature range of 0 °C to + 40 °C, and a storage temperature range of -20°C to +85 °C. The electrical power consumption is 140 W at 48 V AC for 4,000 min^{-1}. Because of the fact that the elevation tracker uses components from a number of manufacturers, we highly recommend to order the entire driving mechanism (consisting of the JVL motor and the Neugart and the Atlanta gear) as a pre-assembled unit which is for example already filled with the correct lubrication solvents. The company Omni Ray AG (Im Schörli 5, 8600 Dübendorf, Switzerland, tel.: 0041 44 802 28 80) already has concrete experience with this specific combination of gears and motor. Accordingly, purchasing the pre-assembled driving unit at Omni Ray AG would include an overall warranty for the entire driving mechanism. Furthermore, this approach would definitively reduce the risk of running into problems with the driving mechanism, and it also minimizes expenditure of work.

The dimensions and positions of the two rotation axes connecting the antenna holder (Figure 3) to the ball bearing and the gear-box screwed to the scaffold top mounting plate are shown in Figure 7.

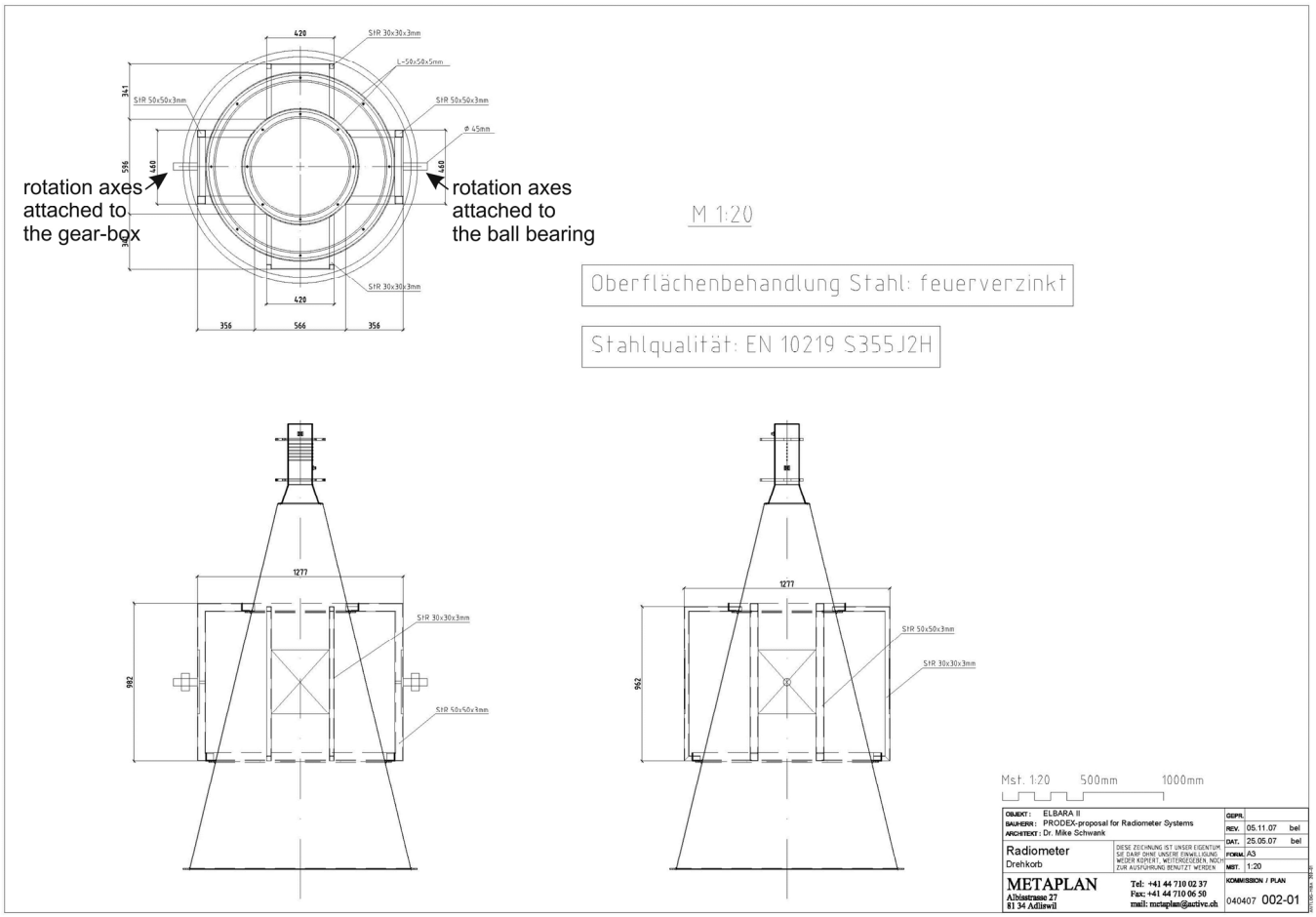


Figure 7: Mechanical drawings of the system components provided by GAMMA (antenna (cone, feed, holder), radiometer electronics) and IA-PAS (scaffold, elevation tracker). The ball bearing and the gear-box holding the rotation axes will be screwed to the top mounting plate of the scaffold during the assembly of the ELBARA system in Poland to avoid manufacturing tolerances.

5. ITEM-LIST OF ELEVATION TRACKER COMPONENTS (WP1300)

item name	description	order information	
motor	AC servo motor (datasheet Section 6.3)	JVL: type MAC141-A3AACA with MAC00-B4 extension module	Purchasing as a pre-assembled driving mechanism e.g. at the company: Omni Ray AG Im Schörli 5 8600 Dübendorf, Switzerland, tel.: +41 44 802 28 80 is highly recommended.
planetary gear	reduction 1:40 driven by the motor and attached to the Atlanta worm gear. (datasheet Section 6.2)	Neugart: type PLE 80-40/M2/OP2	
two-stage worm gear	reduction 1:39 driven by the Neugart planetary gear and holding the rotation axes. It is screwed to the top mounting plate of the scaffold (Figure 5). (datasheet Section 6.1)	Atlanta: type 58 86 039	
ball bearing	holding the rotation axes and screwed to the top mounting plate of the scaffold (Figure 5).	Medias: type PASE50-N	Datasheet in Section 6.4
inductive switch	used as position sensor in the elevation- and azimuth tracker. (datasheet Section 6.5)	Contrinex: type DW-AS-703-M12	Datasheet in Section 6.5

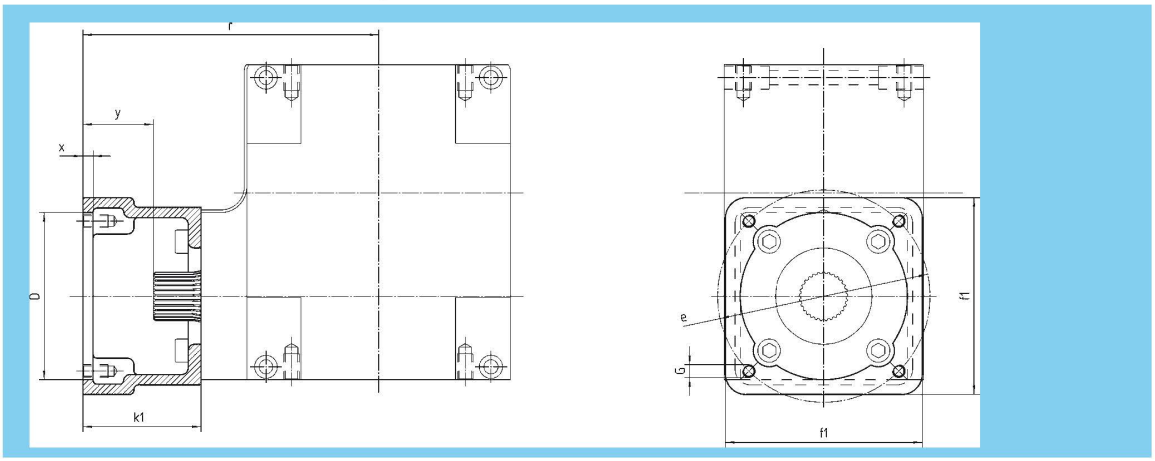
Table 1: Components of the elevation tracker to build up by IA-PAS.

6. DATA-SHEETS OF ELEVATION-TRACKER COMPONENTS (WP1300)

6.1. ATLANTA GEAR, TYPE 58 86 039, REDUCTION 1:39

E-Servo-Schneckengetriebe mit < 6' Zahnspiel
E-servo worm gear units with < 6' backlash

Mit Motorflansch / With motor flange



Achsabstand / Centre distance a_o = 80 mm

Best.-Nr. Übers. i Order code	Ratio i	D^{G7}	k_1	r	x	y	f_1	e	G	kg	J_{red} 10^{-4} kg m²
59 45 0... / 59 85 0... = 59 05 ... + 65 59 501 / 59 15 ... + 65 59 501											
59 45 005 / 59 85 005	4,75										6,0680
59 45 007 / 59 85 007	6,75										6,0910
59 45 009 / 59 85 009	9,25										4,7650
59 45 015 / 59 85 015	14,50										5,3080
59 45 020 / 59 85 020	19,50	110	92	230	5	55	140	165	M10	23,5	3,9350
59 45 029 / 59 85 029	29,00										4,0500
59 45 039 / 59 85 039	39,00										4,1800
59 45 052 / 59 85 052	52,00										3,7140

Best.-Nr. Übers. i Order code	Ratio i	D^{G7}	k_1	r	x	y	f_1	e	G	kg	J_{red} 10^{-4} kg m²
59 45 7... / 59 85 7... = 59 05 ... + 65 59 504 / 59 15 ... + 65 59 504											
59 45 705 / 59 85 705	4,75										6,0680
59 45 707 / 59 85 707	6,75										6,0910
59 45 709 / 59 85 709	9,25										4,7650
59 45 715 / 59 85 715	14,50	180	127	265	6	90	192	215	M12	25,0	5,3080
59 45 720 / 59 85 720	19,50										3,9350
59 45 729 / 59 85 729	29,00										4,0500
59 45 739 / 59 85 739	39,00										4,1800
59 45 752 / 59 85 752	52,00										3,7140

Best.-Nr. Übers. i Order code	Ratio i	D^{G7}	k_1	r	x	y	f_1	e	G	kg	J_{red} 10^{-4} kg m²
59 45 1... / 59 85 1... = 59 05 ... + 65 59 503 / 59 15 ... + 65 59 503											
59 45 105 / 59 85 105	4,75										6,0680
59 45 107 / 59 85 107	6,75										6,0910
59 45 109 / 59 85 109	9,25										4,7650
59 45 115 / 59 85 115	14,50	180	122	260	5	85	193	215	M12	25,0	5,3080
59 45 120 / 59 85 120	19,50										3,9350
59 45 129 / 59 85 129	29,00										4,0500
59 45 139 / 59 85 139	39,00										4,1800
59 45 152 / 59 85 152	52,00										3,7140

Best.-Nr. Übers. i Order code	Ratio i	D^{G7}	k_1	r	x	y	f_1	e	G	kg	J_{red} 10^{-4} kg m²
59 45 8... / 59 85 8... = 59 05 ... + 65 59 505 / 59 15 ... + 65 59 505											
59 45 805 / 59 85 805	4,75										6,0680
59 45 807 / 59 85 807	6,75										6,0910
59 45 809 / 59 85 809	9,25										4,7650
59 45 815 / 59 85 815	14,50										5,3080
59 45 820 / 59 85 820	19,50	180	112	250	5	75	193	215	M12	24,5	3,9350
59 45 829 / 59 85 829	29,00										4,0500
59 45 839 / 59 85 839	39,00										4,1800
59 45 852 / 59 85 852	52,00										3,7140

Best.-Nr. Übers. i Order code	Ratio i	D^{G7}	k_1	r	x	y	f_1	e	G	kg	J_{red} 10^{-4} kg m²
59 45 2... / 59 85 2... = 59 05 ... + 65 59 502 / 59 15 ... + 65 59 502											
59 45 205 / 59 85 205	4,75										6,0680
59 45 207 / 59 85 207	6,75										6,0910
59 45 209 / 59 85 209	9,25										4,7650
59 45 215 / 59 85 215	14,50	130	92	230	5	55	140	165	M10	23,5	5,3080
59 45 220 / 59 85 220	19,50										3,9350
59 45 229 / 59 85 229	29,00										4,0500
59 45 239 / 59 85 239	39,00										4,1800
59 45 252 / 59 85 252	52,00										3,7140

Best.-Nr. Übers. i Order code	Ratio i	D^{G7}	k_1	r	x	y	f_1	e	G	kg	J_{red} 10^{-4} kg m²
59 45 9... 59 85 9... = 59 05 ... + 65 59 506 / 59 15 ... + 65 59 506											
59 45 905 / 59 85 905	4,75										6,0680
59 45 907 / 59 85 907	6,75										6,0910
59 45 909 / 59 85 909	9,25										4,7650
59 45 915 / 59 85 915	14,50	130	112	250	5	75	193	215	M12	25	5,3080
59 45 920 / 59 85 920	19,50										3,9350
59 45 929 / 59 85 929	29,00										4,0500
59 45 939 / 59 85 939	39,00										4,1800
59 45 952 / 59 85 952	52,00										3,7140

Best.-Nr. Übers. i Order code	Ratio i	D^{G7}	k_1	r	x	y	f_1	e	G	kg	J_{red} 10^{-4} kg m²
59 45 4... / 59 85 4... = 59 05 ... + 65 59 507 / 59 15 ... + 65 59 507											
59 45 405 / 59 85 405	4,75										6,0680
59 45 407 / 59 85 407	6,75										6,0910
59 45 409 / 59 85 409	9,25										4,7650
59 45 415 / 59 85 415	14,50	130	112	250	5	75	155	165	M10	26,0	5,3080
59 45 420 / 59 85 420	19,50										3,9350
59 45 429 / 59 85 429	29,00										4,0500
59 45 439 / 59 85 439	39,00										4,1800
59 45 452 / 59 85 452	52,00										3,7140

Tabellenwerte basieren auf der Verschleiß- bzw. Flankengrenzleistung bei 12 000 h Vollast und dem Einsatz im Servo-Betrieb. Bei Vollast-Dauerbetrieb muss u.U. die Temperatur-Grenzleistung berücksichtigt werden! (Gegebenenfalls bitte Rücksprache)
$T_{2max.}$ = statisches Drehmoment gegen Zahnbruch, P_1 = Antriebsleistung in kW, T_2 = Abtriebsmoment in Nm.

The values in the tables are based upon wear or maximum flank load at 12,000 h full load and on servo-operation. With continuous full-load operation it may be necessary to consider temperature limits! (Please ask us, if in doubt.)

$T_{2max.}$ = static torque to avoid tooth fracture, P_1 = driving power in kW, T_2 = output torque in Nm.

Bestell-Nr. Order code		a_0	i	$T_{2\,max.}$	**Antriebsdrehzahl** / Driving speed n_1 **in min^{-1}** 500		750		1000		1500		3000		4000		5000		η
					P_1	T_2	P_1	T_2	P_1	T_2	P_1	T_2	P_1	T_2	P_1	T_2	P_1	T_2	bei
		(mm)			(kw)	(Nm)	(kw)	(Nm)	(kw)	(Nm)	(kw)	(Nm)	(kw)	(Nm)	(kw)	(Nm)	(kw)	(Nm)	1500
59 41 _05	**59 81 _05**	**32**	4,75	135	0,17	16	0,28	16	0,40	17	0,61	17	1,21	17	1,72	18	2,15	18	0,92
59 41 _07	**59 81 _07**		6,75	100	0,13	14	0,19	15	0,28	16	0,43	17	0,85	17	1,21	18	1,52	18	0,91
59 41 _09	**59 81 _09**		9,25	65	0,08	12	0,13	13	0,18	14	0,28	15	0,63	17	0,89	18	1,12	18	0,89
59 41 _15	**59 81 _15**		14,5	85	0,07	14	0,10	15	0,14	16	0,21	17	0,42	18	0,58	18	0,72	18	0,84
59 41 _20	**59 81 _20**		19,5	55	0,04	12	0,06	12	0,09	13	0,13	14	0,29	16	0,40	16	0,50	16	0,82
59 41 _29	**59 81 _29**		29,0	70	0,03	12	0,05	13	0,07	14	0,10	15	0,21	17	0,29	17	0,37	17	0,77
59 41 _39	**59 81 _39**		39,0	50	0,03	13	0,04	14	0,06	15	0,09	16	0,18	18	0,24	18	0,29	18	0,73
59 41 _50	**59 81 _50**		50,0	35	0,02	11	0,03	11	0,04	12	0,06	13	0,12	15	0,17	16	0,23	18	0,70
59 43 _05	**59 83 _05**	**50**	4,75	550	0,81	65	1,20	65	1,70	70	2,52	70	5,00	70	6,20	65	7,30	61	0,92
59 43 _07	**59 83 _07**		6,75	400	0,50	56	0,77	59	1,10	63	1,75	69	3,50	69	4,40	65	5,20	61	0,91
59 43 _09	**59 83 _09**		9,25	275	0,32	48	0,50	51	0,70	54	1,10	58	2,55	70	3,55	70	4,10	65	0,89
59 43 _15	**59 83 _15**		14,50	350	0,26	57	0,40	60	0,57	65	0,89	70	1,82	75	2,50	75	3,15	75	0,83
59 43 _20	**59 83 _20**		19,50	250	0,16	45	0,25	48	0,34	50	0,55	55	1,20	65	1,65	65	2,10	65	0,81
59 43 _29	**59 83 _29**		29,00	300	0,14	48	0,20	52	0,29	55	0,44	60	0,93	70	1,23	70	1,41	65	0,75
59 43 _39	**59 83 _39**		39,00	200	0,12	53	0,17	56	0,24	60	0,37	65	0,77	75	1,00	75	1,25	75	0,70
59 43 _50	**59 83 _50**		50,00	150	0,08	42	0,12	44	0,16	47	0,25	50	0,51	60	0,72	60	0,90	60	0,64
59 44 _05	**59 84 _05**	**63**	4,75	1000	2,10	170	3,30	180	4,40	180	6,11	170	10,30	145	13,20	135			0,92
59 44 _07	**59 84 _07**		6,75	750	1,50	170	2,35	180	3,10	180	4,25	170	7,20	145	9,30	135			0,91
59 44 _09	**59 84 _09**		9,25	500	0,74	115	1,18	125	1,63	130	2,52	135	4,93	135	6,35	126			0,90
59 44 _15	**59 84 _15**		14,50	600	0,74	165	1,19	180	1,54	180	2,45	180	4,18	170	5,25	160			0,84
59 44 _20	**59 84 _20**		19,50	500	0,39	115	0,61	125	0,85	130	1,28	135	2,98	165	3,83	155			0,83
59 44 _29	**59 84 _29**		29,00	650	0,48	175	0,75	190	1,04	205	1,55	220	2,57	195	3,22	185			0,77
59 44 _39	**59 84 _39**		39,00	450	0,30	140	0,44	150	0,61	160	0,97	175	1,88	190	2,55	190			0,73
59 44 _52	**59 84 _52**		52,00	300	0,16	95	0,25	105	0,35	115	0,55	125	1,20	150	1,63	160			0,68
59 45 _05	**59 85 _05**	**80**	4,75	2000	5,20	420	6,90	380	8,53	360	11,60	330	19,50	280					0,94
59 45 _07	**59 85 _07**		6,75	1400	3,60	420	4,86	380	6,14	360	8,44	330	14,01	280					0,91
59 45 _09	**59 85 _09**		9,25	1100	2,38	370	3,53	370	4,53	360	6,22	330	10,30	280					0,90
59 45 _15	**59 85 _15**		14,50	1300	1,98	450	2,90	450	3,57	420	4,60	370	7,00	295					0,87
59 45 _20	**59 85 _20**		19,50	1000	1,24	370	2,00	400	2,60	400	3,60	380	5,73	320					0,86
59 45 _29	**59 85 _29**		29,00	1200	1,38	520	2,04	550	2,52	530	3,32	490	5,42	420					0,80
59 45 _39	**59 85 _39**		39,00	850	0,87	430	1,35	460	1,85	490	2,51	480	4,03	410					0,77
59 45 _52	**59 85 _52**		52,00	600	0,38	240	0,57	260	0,80	275	1,22	300	2,46	330					0,74

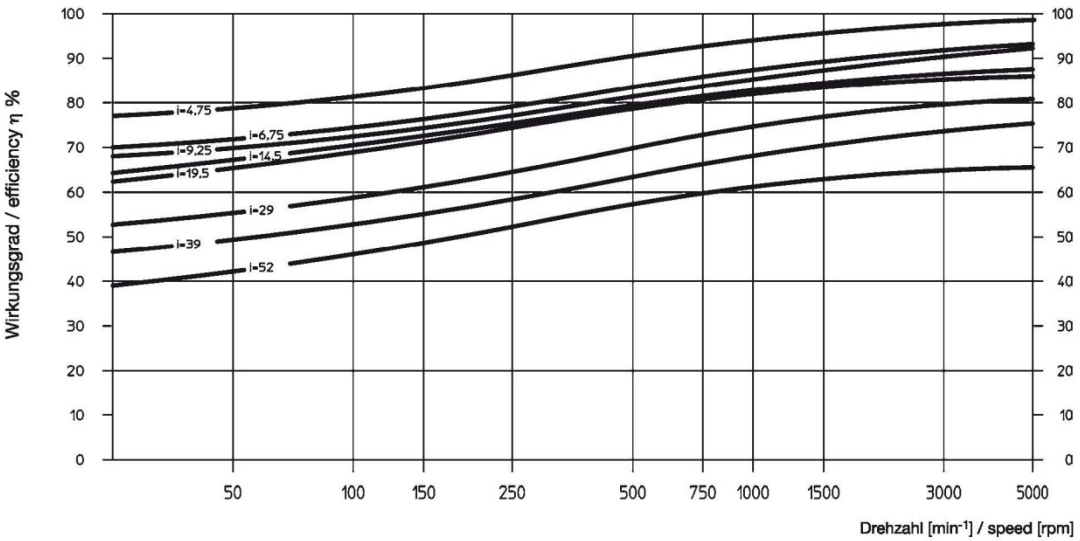
Tabellenwerte basieren auf der Verschleiß- bzw. Flankengrenzleistung bei 12 000 h Vollast und dem Einsatz im Servo-Betrieb. Bei Vollast-Dauerbetrieb muss u.U. die Temperatur-Grenzleistung berücksichtigt werden! (Gegebenenfalls bitte Rücksprache)
$T_{2max.}$ = statisches Drehmoment gegen Zahnbruch, P_1 = Antriebsleistung in kW, T_2 = Abtriebsmoment in Nm.

The values in the tables are based upon wear or maximum flank load at 12,000 h full load and on servo-operation. With continuous full-load operation it may be necessary to consider temperature limits! (Please ask us, if in doubt.)

$T_{2max.}$ = static torque to avoid tooth fracture, P_1 = driving power in kW, T_2 = output torque in Nm.

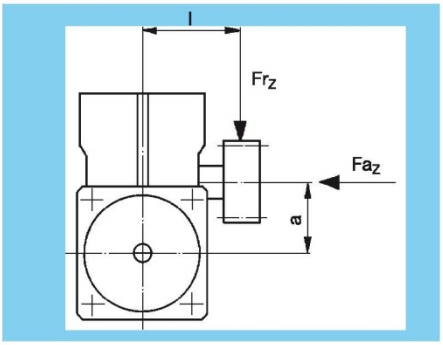
Bestell-Nr. Order code		a_0	i	$T_{2\,max.}$	**Antriebsdrehzahl** / Driving speed n_1 **in** min^{-1} 500		750		1000		1500		3000		4000		5000		η
					P_1	T_2	P_1	T_2	P_1	T_2	P_1	T_2	P_1	T_2	P_1	T_2	P_1	T_2	bei
		(mm)			(kw)	(Nm)	(kw)	(Nm)	(kw)	(Nm)	(kw)	(Nm)	(kw)	(Nm)	(kw)	(Nm)	(kw)	(Nm)	1500
59 41 _05	**59 81 _05**	**32**	4,75	135	0,17	16	0,28	16	0,40	17	0,61	17	1,21	17	1,72	18	2,15	18	0,92
59 41 _07	**59 81 _07**		6,75	100	0,13	14	0,19	15	0,28	16	0,43	17	0,85	17	1,21	18	1,52	18	0,91
59 41 _09	**59 81 _09**		9,25	65	0,08	12	0,13	13	0,18	14	0,28	15	0,63	17	0,89	18	1,12	18	0,89
59 41 _15	**59 81 _15**		14,5	85	0,07	14	0,10	15	0,14	16	0,21	17	0,42	18	0,58	18	0,72	18	0,84
59 41 _20	**59 81 _20**		19,5	55	0,04	12	0,06	12	0,09	13	0,13	14	0,29	16	0,40	16	0,50	16	0,82
59 41 _29	**59 81 _29**		29,0	70	0,03	12	0,05	13	0,07	14	0,10	15	0,21	17	0,29	17	0,37	17	0,77
59 41 _39	**59 81 _39**		39,0	50	0,03	13	0,04	14	0,06	15	0,09	16	0,18	18	0,24	18	0,29	18	0,73
59 41 _50	**59 81 _50**		50,0	35	0,02	11	0,03	11	0,04	12	0,06	13	0,12	15	0,17	16	0,23	18	0,70
59 43 _05	**59 83 _05**	**50**	4,75	550	0,81	65	1,20	65	1,70	70	2,52	70	5,00	70	6,20	65	7,30	61	0,92
59 43 _07	**59 83 _07**		6,75	400	0,50	56	0,77	59	1,10	63	1,75	69	3,50	69	4,40	65	5,20	61	0,91
59 43 _09	**59 83 _09**		9,25	275	0,32	48	0,50	51	0,70	54	1,10	58	2,55	70	3,55	70	4,10	65	0,89
59 43 _15	**59 83 _15**		14,50	350	0,26	57	0,40	60	0,57	65	0,89	70	1,82	75	2,50	75	3,15	75	0,83
59 43 _20	**59 83 _20**		19,50	250	0,16	45	0,25	48	0,34	50	0,55	55	1,20	65	1,65	65	2,10	65	0,81
59 43 _29	**59 83 _29**		29,00	300	0,14	48	0,20	52	0,29	55	0,44	60	0,93	70	1,23	70	1,41	65	0,75
59 43 _39	**59 83 _39**		39,00	200	0,12	53	0,17	56	0,24	60	0,37	65	0,77	75	1,00	75	1,25	75	0,70
59 43 _50	**59 83 _50**		50,00	150	0,08	42	0,12	44	0,16	47	0,25	50	0,51	60	0,72	60	0,90	60	0,64
59 44 _05	**59 84 _05**	**63**	4,75	1000	2,10	170	3,30	180	4,40	180	6,11	170	10,30	145	13,20	135			0,92
59 44 _07	**59 84 _07**		6,75	750	1,50	170	2,35	180	3,10	180	4,25	170	7,20	145	9,30	135			0,91
59 44 _09	**59 84 _09**		9,25	500	0,74	115	1,18	125	1,63	130	2,52	135	4,93	135	6,35	126			0,90
59 44 _15	**59 84 _15**		14,50	600	0,74	165	1,19	180	1,54	180	2,45	180	4,18	170	5,25	160			0,84
59 44 _20	**59 84 _20**		19,50	500	0,39	115	0,61	125	0,85	130	1,28	135	2,98	165	3,83	155			0,83
59 44 _29	**59 84 _29**		29,00	650	0,48	175	0,75	190	1,04	205	1,55	220	2,57	195	3,22	185			0,77
59 44 _39	**59 84 _39**		39,00	450	0,30	140	0,44	150	0,61	160	0,97	175	1,88	190	2,55	190			0,73
59 44 _52	**59 84 _52**		52,00	300	0,16	95	0,25	105	0,35	115	0,55	125	1,20	150	1,63	160			0,68
59 45 _05	**59 85 _05**	**80**	4,75	2000	5,20	420	6,90	380	8,53	360	11,60	330	19,50	280					0,94
59 45 _07	**59 85 _07**		6,75	1400	3,60	420	4,86	380	6,14	360	8,44	330	14,01	280					0,91
59 45 _09	**59 85 _09**		9,25	1100	2,38	370	3,53	370	4,53	360	6,22	330	10,30	280					0,90
59 45 _15	**59 85 _15**		14,50	1300	1,98	450	2,90	450	3,57	420	4,60	370	7,00	295					0,87
59 45 _20	**59 85 _20**		19,50	1000	1,24	370	2,00	400	2,60	400	3,60	380	5,73	320					0,86
59 45 _29	**59 85 _29**		29,00	1200	1,38	520	2,04	550	2,52	530	3,32	490	5,42	420					0,80
59 45 _39	**59 85 _39**		39,00	850	0,87	430	1,35	460	1,85	490	2,51	480	4,03	410					0,77
59 45 _52	**59 85 _52**		52,00	600	0,38	240	0,57	260	0,80	275	1,22	300	2,46	330					0,74

Verzahnungswirkungsgrad für Servo-Schneckengetriebe bei treibender Schnecke und unter Volllast.
Gearing efficiency of servo worm gear units with driving worm and under full load.



Zusatzbelastungen Abtrieb
Die Angaben sind Richtwerte. Aus der Verzahnung sich ergebende Werte sind zu berücksichtigen. Der Kraftangriff wurde auf Mitte Wellenzapfen angenommen. Treten neben hohen Radialkräften gleichzeitig zusätzliche Axialkräfte auf, bitten wir Sie, bei uns rückzufragen.

Additional loads on output drive
The data given are reference values. You should consider the values arising from the choice of the tooth system. It is assumed that the point of action of the force is the centre of the shaft. In cases where additional axial forces occur, over and above high transverse forces, please ask for advice.



Achsabbstand Centre distance a (mm)		32		50		63		80	
Maße Mitte Gehäuse/ Mitte Verzahnung Dimensions centre casing/ centre teeth									
l (mm)		70	100	90	140	110	160	125	175
Max. Zusatzbelastung Max. additional load									
radial Fr_z	[N]	2250	1600	3600	2300	5000	3500	8400	6000
axial Fa_z	[N]	1500	1500	1800	1800	2500	2500	4000	4000

Kurzbeschreibung

ATLANTA-E-Servo-Schneckengetriebe sind speziell zum Einsatz mit Dreh- und Gleichstrom-Servomotoren der neuen Generation entwickelt worden. Sie sind, ebenso wie alle anderen Artikel dieses Kataloges, in der Regel ab Lager bzw. kurzfristig lieferbar.

Folgende Merkmale zeichnen unsere E-Servo-Getriebe aus:

- gleiche Abmessungen wie unsere bewährten Servo-Getriebe der 58 Reihe
- spielarme Verzahnung (Spiel < 6')
- gleiche Belastungswerte wie unsere Getriebe der 58er Reihe
- Gehäuse aus Leichtmetall für optimale Wärmeabfuhr
- robuste Lagerung der Abtriebs-Hohlwelle für hohe Zusatzkräfte

Bei den Achsabständen, den Übersetzungen und den Verzahnungen haben wir uns an DIN 3975/76 orientiert. Der Einsatz geschliffener, rechtssteigender Schnecken, eines Schneckenrades aus Spezial-Schneckenradbronze in Verbindung mit einer Tauchschmierung (synthetisches Spezialöl) gewährleistet neben einem hohen Wirkungsgrad einen ruhigen Lauf in beiden Drehrichtungen und eine lange Lebensdauer. Das Gehäuse mit seinen vielen Befestigungs- und Gewindebohrungen erlaubt die Montage in jeder beliebigen Einbaulage.

Der Antrieb bzw. die Verbindung mit dem Antriebsmotor erfolgt durch eine Spezialkupplung, deren Innenverzahnung, zusammen mit der längsballig verzahnten Antriebswelle unserer Schneckengetriebe, einen spielfreien Kraftfluss gewährleistet.

Für den Abtrieb steht eine ganze Reihe von Abtriebswellen mit Gerad- und Schrägverzahnung, jeweils mit verschiedenen Zähnezahlen, zur Verfügung. Neben verzahnten Ritzelwellen kann darüber hinaus eine Vielzahl von weiteren Zähnezahlen aus unserem S & L-Zahnradprogramm mit passenden Spezial-Abtriebswellen kombiniert und eingesetzt werden.

Short description

ATLANTA E-servo worm gear units have been specially developed for use with the latest three-phase and DC servomotors. Like all other components in this catalogue, they are usually available ex stock or, at least, within a very short time.

The following are typical features of our e-servo-performance gear units:

- the same dimensions as our servo worm gear units serie 58
- low-clearance gearing (back lash < 6'),
- the same load values as our servo worm gear units serie 58
- casing of light metal for optimal heat dissipation
- robust bearings for the output drive hollow shaft, permitting greater additional forces.

Centre distances, gear ratios and tooth systems have been chosen in accordance with DIN 3975/76.

The use of ground, right-hand worms, a worm gear of special worm-gear bronze and dip-feed lubrication (synthetic special oil) ensures a high degree of efficiency and also smooth running in both directions and a long service life. The casing with its many fixing bores and tapped holes permits mounting in any position.

The drive, i.e. the connection with the driving motor, is achieved with a special clutch. Its internal gearing, together with the barrelled profile of the driving shaft of our worm gear unit ensures transmission of the power with no free play.

For the output drive you can choose from quite a number of output drive shafts with straight and helical tooth systems and various numbers of teeth. Apart from toothed pinion shafts there is a multitude of gearwheels with different numbers of teeth from our S & L gearwheel program which can be combined and used together with suitable special output drive shafts.

Montageanleitung

Schneckengetriebe
Es stehen 5 bearbeitete Anbauflächen mit ausreichend dimensionierten Befestigung- und Gewindebohrungen für eine verspannungsfreie Montage in allen Einbaulagen zur Verfügung. Bei voller Ausnutzung der Zusatzkräfte (s. Seite GC-12) empfehlen wir die Montage an den größten Anlageflächen, d.h. an einer der beiden Deckelseiten vorzunehmen. Die günstigste Einbaulage für die Schmierung wird bei seitlicher bzw. untenliegender Schneckenwelle (Eintriebswelle) erreicht. Bei obenliegender Welle ist zu beachten, dass sich dadurch die Antriebsleistung um ca. 10 % vermindert.

Kupplung
Die Kupplung wird vormontiert geliefert. Vor Befestigung auf der Motorwelle müssen sämtliche Kontaktflächen sauber gereinigt und durch leichten Ölfilm geschützt sein. Für die Montage ist das Maß „X1" wichtig (vergleiche Seite GC – 10).
Empfohlener Arbeitsablauf:
- Kontaktflächen sauber reinigen und durch leichten Ölfilm schützen
- Kupplung im Abstand des Maß „X1" (vergleiche Seite GC – 10) auf die Motorwelle aufsetzen, zur Ermittlung des Maßes ist ein Tiefenmaß hilfreich
- Spannschrauben leicht anziehen und Kupplung auf Rundlauf prüfen
- Schrauben abwechselnd gleichmäßig anziehen
- Anzugsmoment lt. nebenstehender Tabelle einhalten und hierbei beachten, dass der Spalt in der Kupplung auf beiden Seiten gleich breit bleibt
- Eine nochmalige, abschließende Rundlaufkontrolle am dafür vorgesehenen Prüfbund ist zu empfehlen!

Gewinde Thread-holes	Anzugsmoment Torque
M5	7 Nm
M6	12 Nm
M8	25 Nm

Motor
mit montierter Kupplung in die Getriebezentrierung einschieben und mit Getriebegehäuse verschrauben.

Abtriebs-(Ritzel)Welle
Sofern die Abtriebsritzelwelle nicht bereits bei der Lieferung montiert ist, empfehlen wir folgenden Arbeitsablauf:
Ritzelwelle und Getriebe-Abtriebshohlwelle säubern und anschließend einfetten oder ölen.

Abtriebswelle für Schrumpfscheiben-Verbindung
Schrumpfscheibe auf Getriebe-Hohlwelle aufschieben (Schrauben vorher bitte nicht anziehen!). Abtriebswelle von der gewünschten Seite bis auf Anschlag in die Hohlwelle einschieben. Herstellen der Querpressverbindung durch gleichmäßiges Anziehen der Spannschrauben. Schrauben der Reihe nach in mehreren Umläufen auf Drehmoment nach Tabelle anziehen (nicht überkreuz).

Abtriebswelle für Passfeder-Verbindung
Der mit der Abtriebswelle mitgelieferte Sicherungsring, die Scheibe und Schraube dienen der axialen Befestigung der Abtriebswelle. Dazu wird der Sicherungsring in den entsprechenden Einstich der Getriebe-Hohlwelle montiert, die Abtriebswelle von der gewünschten Seite bis auf Anschlag in die Hohlwelle eingeschoben. Die Scheibe und Schraube werden von der anderen Getriebeseite mit der Abtriebswelle verschraubt. Der Sicherungsring muss zwischen Scheibe und Ritzelwelle eingespannt sein.

Mounting instructions

Worm gear units
Five mounting faces with sufficiently dimensioned tapped holes are provided for mounting in any position. In order to accommodate all supplementary forces (see page GC-12) we recommend mounting at the largest contact faces., i.e. at one of the two cap sides. Putting the worm shaft (input shaft) in a lateral or inferior position is ideal for lubrication. Mounting the shaft in a top position will reduce the driving capacity by about 10 %.

Coupling
The coupling is supplied pre-assembled. All contact surfaces must be cleaned and protected by a thin oil film before attaching it to the motor shaft. An important dimension for mounting is the value „X1" (compare page GC – 10).
Recommended procedure:
- Carefully clean the contact surfaces and protect them with a thin oil film.
- Place the coupling onto the motor shaft at the distance given by the measurement "X1" (see page GC – 10); a depth gauge is helpful for determining the measurement.
- Slightly tighten the clamping screws and check the clutch for true running
- Tighten the screws alternately and uniformly.
- The correct tightening torque can be seen from the opposite table. The gap in the coupling must be equally wide on both sides.
- It is recommended to make another final check for true running at the appropriate reference diameter!

Motor
Insert the motor with coupling mounted into the gear centering piece and bolt it to the gearbox.

Output drive (pinion) shaft
Unless the output pinion shaft comes already fully assembled, we recommend to proceed as follows:
Clean pinion shaft and hollow shaft extension and then grease or oil them.

Output drive shaft for shrink-disc connection
Slide shrink disc onto the hollow shaft extension of the gear unit (please do not tighten the screws beforehand!).Insert the output shaft from the desired side into the hollow shaft fully up to the stop. Make the transverse pressure connection by evenly tightening the clamping screws. Tighten the screws one after the other (not crosswise) in several passes to the torque indicated in the table.

Output drive shaft for key connection
The retaining ring, the disc and the screw supplied with the output drive shaft serve for locking the output shaft in axial direction. For this purpose insert the retaining ring in the applicable recess of the hollow shaft and slide the output drive shaft from the desired side into the hollow shaft up to the stop. Disc and screw are screwed to the output shaft from the other side of the gear unit. The retaining ring must be clamped between disc and pinion shaft.

Wartung

Schmierstoffwechsel
ATLANTA Servo-Schneckengetriebe sind mit synthetischem Polyglykol-Öl befüllt.
Dies ist unter folgenden Voraussetzungen eine Lebensdauerschmierung:
Die Auslegung des Getriebes erfolgte ausschließlich nach den im ATLANTA-Katalog vorgegebenen Richtlinien und das Getriebe wird ausschließlich innerhalb der zulässigen Kenn- und Grenzwerte betrieben. Der Betreiber kontrolliert das Getriebe regelmäßig (alle 4 Wochen) auf Ölverlust. Oberflächentemperatur max. 80°C. Bei Servo-Betrieb (Aussetzbetrieb) wird diese Temperatur erfahrungsgemäß nicht erreicht.
Bei einem Betrieb mit überwiegend kleinen Eintriebsdrehzahlen (Umfangsgeschwindigkeit der Schnecke v < 0,5 m/s) empfehlen wir einen Schmierstoffwechsel im zweijährigen Turnus.

Maintenance

Lubricant change
ATLANTA servo-assisted worm-gear units are filled with synthetic polyglycol oil.
Under the following conditions this means lifetime lubrication:
The layout of the gear unit is made strictly in conformance with the guidelines specified in the ATLANTA catalogue and the gear unit is operated exclusively within the permissible characteristic values and limits. The operator checks the gear unit regularly (every 4 weeks) for oil leakage. The surface temperature does not exceed max. 80° C. Experience has shown that this temperature is not reached with servo-operation (intermittent operation).
In the case of an operation with mainly low input speeds (circumferential speed of the worm
v < 0.5 m/s) we recommend to change the lubricant every two years.

Wir empfehlen folgenden synthetischen Getriebeschmierstoff:
Klübersynth GH 6 - 220
Bestell-Nr. 65 90 010 (1 Liter)

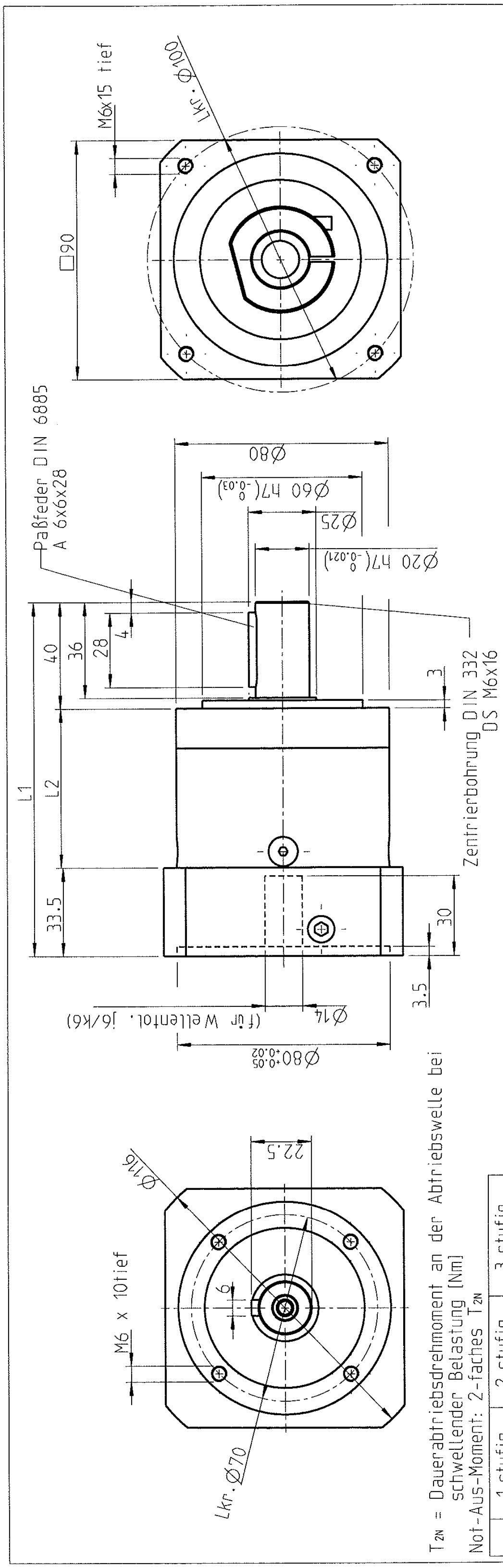
alternativ:
SHELL Tivela S 220, BP Energol SG-XP 220, ARAL Degol GS 220

Achsabstand Centre distance	Ölmenge Oil quantity
a = 32 mm	0,1 l
a = 50 mm	0,3 l
a = 63 mm	0,5 l
a = 80 mm	1,2 l

We recommend the following synthetic gear lubricant:
Klübersynth GH 6 - 220
Order code: 65 90 010 (1 litre)

alternative:
SHELL Tivela S 220, BP Energol SG-XP 220, ARAL Degol GS 220

6.2. Neugart Gear, type PLE 80-40/M2/OP2, reduction 1:40



T_{2N} = Dauerabtriebsdrehmoment an der Abtriebswelle bei schwellender Belastung [Nm]
Not-Aus-Moment: 2-faches T_{2N}

	1.stufig		2.stufig		3.stufig	
L1	133.5		151		168.5	
L2	60		77.5		95	
	i	T_{2N} ⓐ	i	T_{2N}	i	T_{2N}
	3	85	9	130	60	110
	4	115	12	120	80	120
	5	110	15	110	100	120
	8	50	16	120	120	110
			20	120	160	120
			25	110	200	110
			32	120	256	120
			40	110	320	110
			64	50	512	50

<u>Technische Daten</u>
Planetengetriebe: geradverzahnt
Lebensdauer: 30.000h
Abtriebswellenlager: Rillenkugellager
- max. zul. Axiallast: 1200N bei n2=100 1/min /Fr=0 /Lh=10.000h
- max. zul. Radiallast: 950N bei n2=100 1/min /Fa=0 /Lh=10.000h
- max. zul. Axiallast: 900N bei n2=100 1/min /Fr=0 /Lh=30.000h
- max. zul. Radiallast: 650N bei n2=100 1/min /Fa=0 /Lh=30.000h
- bezogen auf Wellenmitte / T=30 °C

Getriebespiel: 1.stufig<=9 arcmin / 2.stufig<=14 arcmin
- 3.stufig<=16 arcmin, bezogen auf Abtriebswelle

max. Antriebsdrehzahl: n1=7000 1/min[1]

Schmierung: Lebensdauerfettschmierung
Betriebstemperatur: -25 °C ...+90 °C
Wirkungsgrad: bei Nennlast (übersetzungsabhängig)
- ca.96% 1.stufig/ ca.94% 2.stufig / ca.90% 3.stufig

Dauerabtriebsdrehmoment: bei n2=100 1/min
Abdichtung: Rillenkugellager 2RS
Motoranbau: M2 (gelagertes Antriebsritzel)
- Anzugsmoment der Klemmschraube: 9.5Nm

Betriebsart: S1
Betriebsfaktor: cB=1
Schutzart: IP 54
max. zul. Motorgewicht: statisch 9kg

max. mittlere[1] Antriebsdrehzahl bei normalen Bedingungen und S1 Betrieb ⓑ

i	n_1 bei 50% T_{2N}	n_1 bei 100% T_{2N}	i	n_1 bei 50% T_{2N}	n_1 bei 100% T_{2N}	i	n_1 bei 50% T_{2N}	n_1 bei 100% T_{2N}
3	3900	2400	9	4000	2700	60	4000	4000
4	3650	2150	12	4000	3450	80	4000	4000
5	4000	2650	15	4000	4000	100	4000	4000
8	4000	4000	16	4000	4000	120	4000	4000
			20	4000	4000	160	4000	4000
			25	4000	4000	200	4000	4000
			32	4000	4000	256	4000	4000
			40	4000	4000	320	4000	4000
			64	4000	4000	512	4000	4000

<u>Werkstoffe:</u>
Gehäuse: Stahl - Oberfläche schwarz
Antriebsflansch: Aluminium - unbehandelt
Abtriebsflansch: Aluminium - unbehandelt

[1] Betriebstemperatur darf nicht überschritten werden!

Montageanweisungen beachten!
Änderungen vorbehalten!

NEUGART

Zust.	Änderung	Datum	Nam		Datum	Name
h						
g				Bear.	27.06.06	Ille
f				Gepr.	27.06.06	Cihlar
e				Freig.	27.06.06	Cihlar
d						
c						
b	hinzu	27.06.06	SI/JS			
a	Wertkorrektur	27.06.06	SI/JS			

Neugart GmbH
Keltenstrasse 16
D - 77971 Kippenheim
(Urspr.)

Massstab: 1:1.5 | DIN A3 | ISO

Maßblatt PLE 80
Standardflansch

Zchg-Nr.: MB - 906
Sach-Nr.:
Blatt
Bl.
(Ers.f.:) 21.09.01 (Ers.d.:) Schaberger

6.3. JVL MOTOR, TYPE MAC141-A3AACA WITH MAC00-B4 EXTENSION MODULE

Product Data

JVL ...when motors must be controlled

The MAC motor®. AC-servo motor with Integrated driver MAC50, 95, 140 and 141

The MAC series of brushless servo motors with integrated electronics represents a major step forward. All the necessary electronics in a servo system are integrated in the motor itself.

In the past, a traditional motor system has typically been based on a cen ller unit located remote from the motor. This configuration however has the negative effect that installation costs are a major part of the total expense of building machinery.

The basic idea of the MAC motors is to minimize these costs but also to make a component that is much better protected against electrical noise which can be a typical problem when using long cables between the controller and motor.

The servo motor, hall sensor, encoder and electronics are specially developed by JVL so that together they form a closed unit in which the power driver and controller are mounted inside the motor in a closed section.

The advantages of this solution are:

- De-central intelligence.
- Simple installation. No cables between motor and driver.
- EMC safe. Switching noise remains within motor.
- Compact. Does not take space in cabinet. Typically a 3/5 core cable is used from PLC or similar to MAC motor.
- 12-48VDC power.
- Low price.

Interface possibilities to the MAC motor:

- From PC/PLC with drive-commands via RS232/RS485/ RS422
- Pulse/direction or quadrature inputs.
- 10 bit ±10V input for speed or torque control. A+B en coder output.
- Register mode via 4 inputs or serial commands
- Option for µPLC built-in with IF THEN ELSE commands.
- Option for Fieldbus. Profibus DP, Canbus, Devicenet,

The MAC motor can be controlled with ±10V for speed or torque control with encoder feedback to one master motion controller.

Furthermore the MAC motor can replace an arbitrary step or servo system, being based on pulse and direction signals. There is a built-in electronic gear so that the MAC motor can simulate all possible step resolutions.

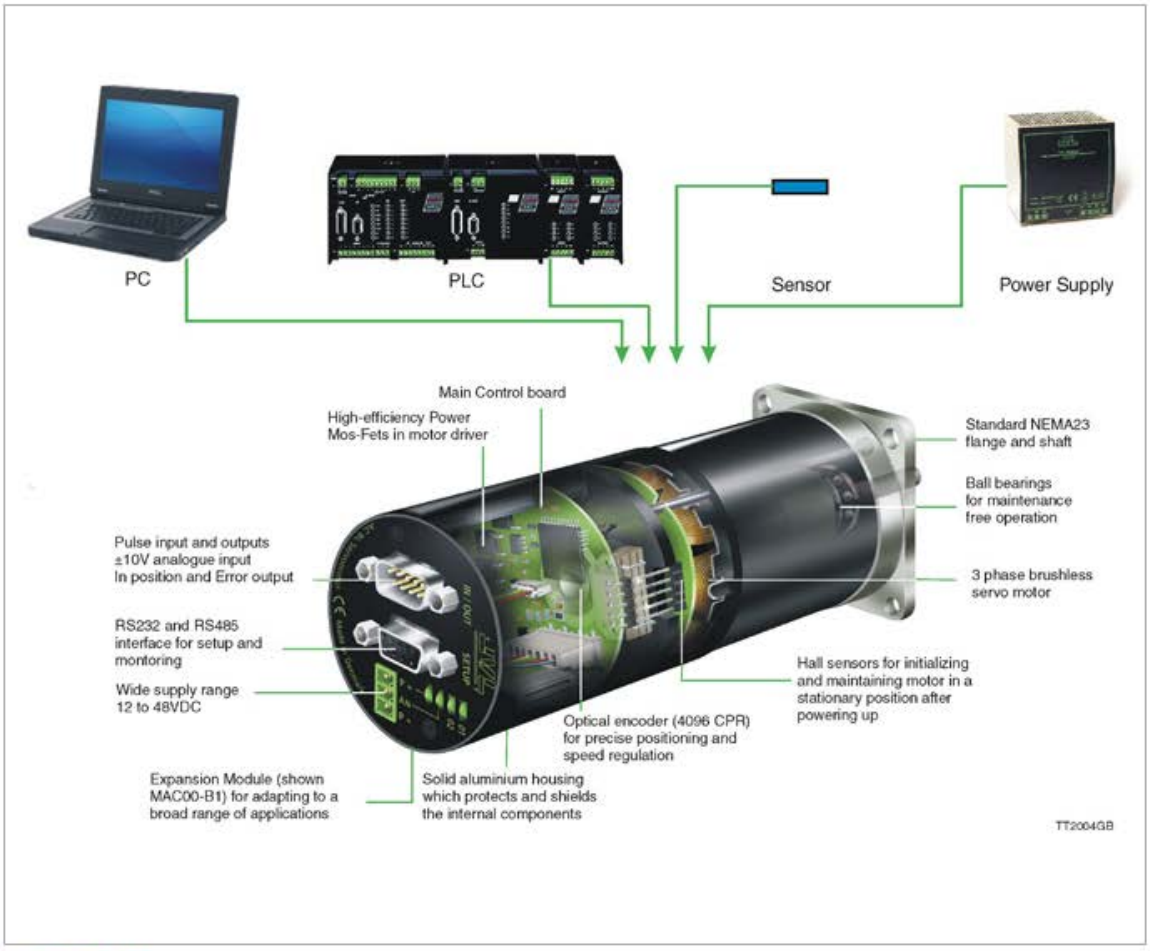
The MAC motor can thus replace all step- and servo-systems without change in the PLC/PC/ controller software. Adaptation/ replacement of existing step motor/servo systems can therefore be achieved quickly.

Parameters are set up via the RS232 port from a Windows program.
The supply voltage is 24VDC which is industry standard.

The motor can be delivered in 3 models: 46, 92 or 134W. A NEMA23 flange is standard so that the MAC motor can replace a step motor directly without mechanical changes.

The connector can be chosen as DSUB, Phoenix connector, Military plug or cable out. Backlash free and planetary gears in ratios of 3, 5, 10, 20, 100 can be delivered from stock.

System and feature overview



Modes of Operation (Basic Motor)

Gear Mode

In this mode the MAC motor functions as in a step motor system. The motor moves one step each time a voltage pulse is applied to the step-pulse input. Velocity, acceleration and deceleration are determined by the external frequency. Use of an encoder enables monitoring and adjustment during motor operation – a feature that is not possible with a standard step motor system. In addition, the MAC motor also provides a facility for electronic gearing at a keyed-in ratio with analogue speed offset.

Positioning Mode

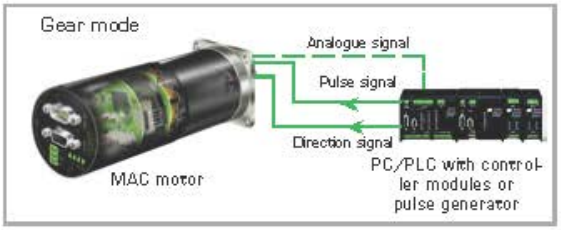
In this mode the MAC motor positions the motor via commands sent over the RS422 or serial interface. Various operating parameters can be changed continuously while the motor is running. This mode of operation is used primarily in systems where the Controller is permanently connected to a PC/PLC via the interface. This mode is also well suited for setting up and testing systems.

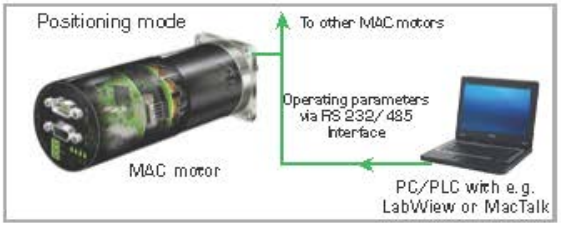
Serial Mode (FastMac)

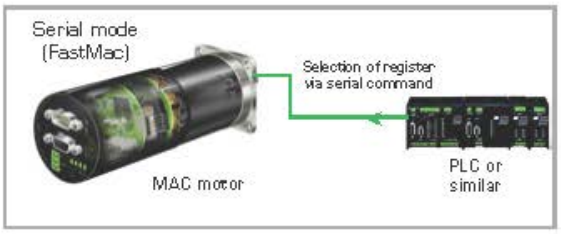
In this mode the MAC motor's registers contain the parameter sets, positions, velocities, etc., required for the actual system. The registers can be selected and executed by a single byte sent via the serial interface. This mode provides maximum utilisation of the MAC motor's features since the MAC motor itself takes care of the entire positioning sequence.

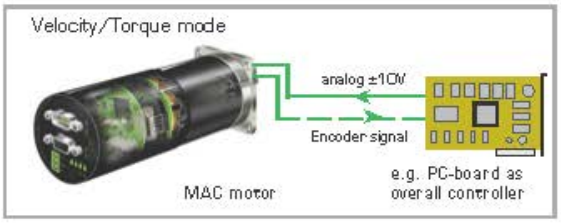
Velocity / Torque Mode

In this mode the MAC motor controls the motor velocity/torque via the analogue input. This mode is typically used for simple tasks or for applications in which an overall unit, such as a PC-board or PLC, controls velocity and positioning. Encoder A and B signals can be connected to the overall controller to close the servo loop.

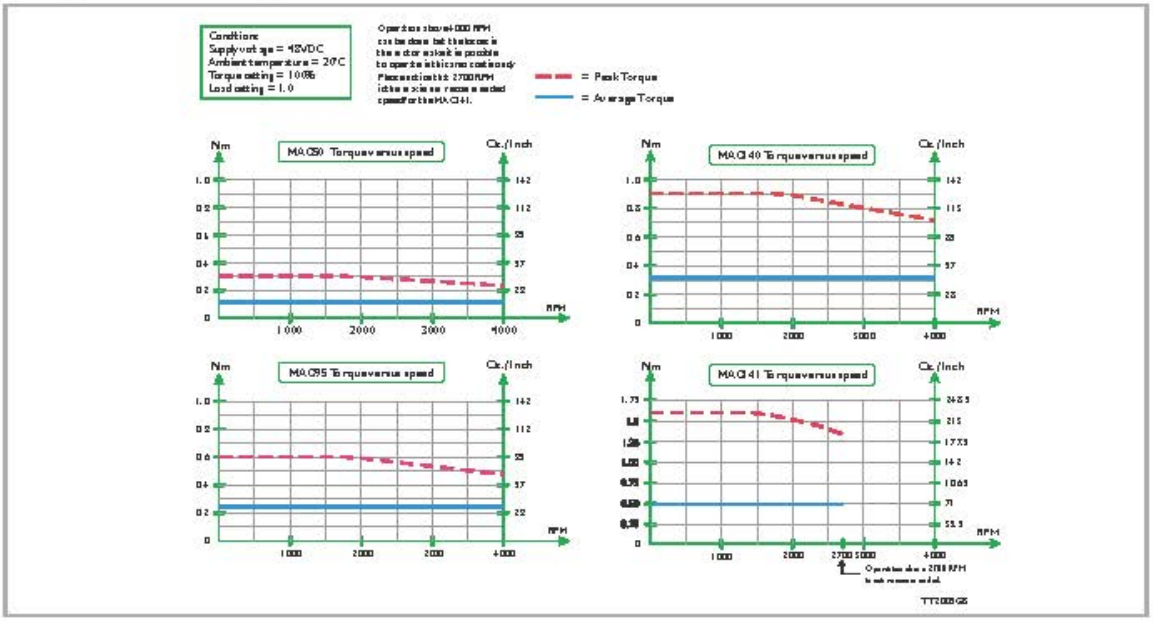








Torque versus speed



Software, MacTalk

Setup save/open
The complete setup can be either saved or reloaded from a file using these buttons

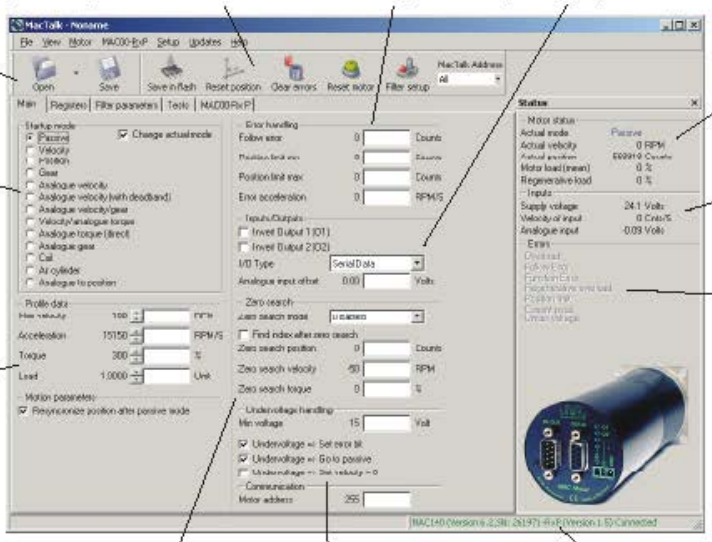
Startup mode
The basic functionality of the MAC motor is setup in this field.

ProfileData
All the main parameters for controlling the motor behaviour are setup in this field.

System control
Use these buttons to save data permanently, reset the motor etc.

Error Handling
Use these fields to define error limits for the position range etc.

Input/Outputs
The functionality of the I/O's is specified here



Motor status
This field shows the actual motor load, position and speed etc.

Inputs
This field shows the actual supply voltage, the speed at the pulse input and the voltage at the analogue input

Errors
If a fatal error occurs, information will be displayed here.

Zero Search
All the parameters regarding the position zero search can be specified here.

Undervoltage handling
Determine what must happening if the supply voltage gets too low..

MAC motor connection information Always shows if the motor is on line or not.

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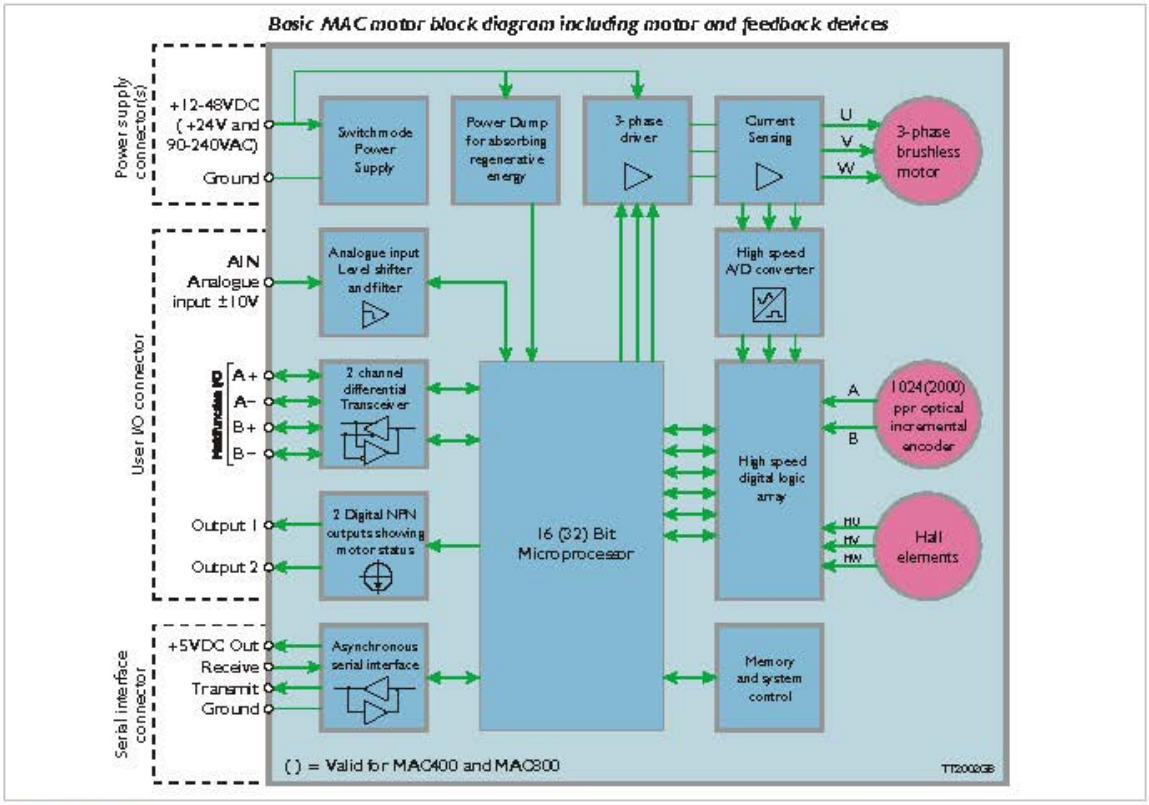
Block diagram



Expansion modules

The JVL Integrated motors utilizes the unique module concept. Plug in expansion modules adapt the motor to the application. You can choose connector type, D-Sub., cable glands or M12 connectors and you can choose freely between Profibus, DeviceNet, CANopen or nano PLC communication. A High Speed and wireless module add to the possibilities. This means that you have possibilities as with no other motors on the market, and also important, you only pay for what you need. Moreover, if you do not find the feature you need, please contact us, and we will develop your own module. All modules can be delivered with or with cables of up to 20m length.

Basic Modules

MAC00-CS

Low cost module, connection directly to basic motor, serial communication not RS232.

- Low cost module
- Cable connected directly to basic motor connector
- User I/O connection
- 10 or 20 meter cable
- NPN outputs

MAC00-B1

General purpose module w/ Sub-D connectors:

- Ideal for pulse/direction, ±10V input or RS232/422/485 interface
- Standard D-Sub conn.
- Home switch input
- LEDs to indicate status, Home switch status, Input power status
- PNP outputs

MAC00-B2

General purpose module w/Cable Glands: otherwise same as -B1, but with IP67 protection.

MAC00-B4

General purpose module w/M12 connectors: otherwise same as -B1, but with IP67 protection and USB interface.

- Dual supply support for MAC50-141

Programmable Modules

MAC00-R1

Nano-PLC Module w/Sub-D connectors: Stand-alone operation with 8 DI + 4 DO, RS232/485.

- Ideal for stand-alone operation with sequential program execution
- 8/4 Opto isolated in-/out. 5-30VDC
- Outputs up to 200mA. 10-30VDC
- LEDs to indicate output status Home+power status
- RS232/RS485 interface

MAC00-R3

Nano-PLC Module w/Cable Glands: otherwise same as -R1.

- IP67

MAC00-R4

Nano-PLC Module w/M12 connectors: otherwise same as -R1.

- IP67

Bus Modules

MAC00-FC4

CAN bus Module w/M12 connectors: Bus, 4 DI/DO and RS232.

- Control and setup
- Logic I/O for high speed start/stop
- CANbus/CANopen DS301/DSP402
- Optional with cable bushes (MAC00-FC2)
- End limit inputs
- Dual supply support for MAC50-141

MAC00-FD4

DeviceNet Module w/M12 connectors: Bus, 4 DI/DO and RS232.

- End limit inputs
- Dual supply support for MAC50-141

MAC00-FP2

Profibus Module w/ Cable Glands: Bus, 6 DI + 2 DO and RS232.

- Control and setup through 12Mbit/s profibus-DP
- Logic I/Os for High speed start/stop In position indication Home switch
- LEDs to indicate status
- End limit inputs
- Dual supply support for MAC50-141

MAC00-FP4

Profibus Module w/M12 connectors: Bus, 4 DI/DO and RS232.

- End limit inputs
- Dual supply support for MAC50-141

High Speed Multi-Axis Modules

MAC00-FS1

High Speed Multi-axis Module w. D-Sub connectors and opto-isolated RS485.

- 9.6 - 460.8kbit
- Up to 255 axes (with repeaters)
- Command broadcast
- Pulse input or output
- Dual supply support for MAC50-141

MAC00-FS4

As module FS1 but with M12 connectors

MAC00-FR4

High Speed Multi-axis Module w. M12 connectors: RS485 bus w/up to 255 axes.

- Multiaxis operation
- Compatible with SMCopen IEC 61131-3 automation software
- Advanced motion profiles for robot and xyz tables
- 4I/4O for user purposes
- Open hardware with PIC18F6520 for own s w.
- Dual supply support for MAC50-141

Wireless Modules

MAC00-FB4

Bluetooth Module w/M12 connectors. Controlled from PC, PDA, Cellphone or PLC with Bluetooth

- Standard Bluetooth SPP profile
- Pulse input or output
- External connector for antenna
- Dual supply support for MAC50-141

Technical Data

GENERAL					
Technology	AC-servomotor with built-in 1024 PPR encoder, hall sensor and 3 phase servo amplifier/controller.				
Controller capacity		MAC50	MAC95	MAC140	MAC141
	Rated output @ 4000 RPM	46W	92W	134W	134W
	Rated Torque RMS (Nm)	0.11Nm	0.22Nm	0.32Nm	0.48Nm
	Peak Torque (Nm)	0.32Nm	0.62Nm	0.90Nm	1.59Nm
	Torque @ 200 RPM with 20:1 gear	2.0 Nm	4.1 Nm	6.0Nm	9.0Nm
	Inertia (kgcm²)	0.075	0.119	0.173	0.227
	Length (mm)	112	131	153	172
	Weight (kg) (without expansion module)	0.6	0.85	1.1	1.33
Speed range	0 -4000 RPM with full torque @ 48VDC. Max 4000 RPM (0-2700 RPM for MAC141)				
Amplifier control system	Sinusoidal wave PWM control. 15.7kHz switching.				
Filter	4th order filter with only one inertia load factor parameter to be adjusted. Expert tuning also available				
Feedback	Incremental A and B encoder 4096 CPR. (Physical 1024 PPR)				
Input power supply	Single supply 12 -48VDC. (absolute max. 50 VDC) Active/not active (no load) = 3.7W/3.1W				
Control mode	"±10 V Speed and Torque. A+B encoder outputs "Pulse/direction and 90 "phase shifted A+B (Incremental). "RS422 or RS232 (SV) position and parameter commands "Gear mode with analog input speed offset + various options "Sensor zero search or mechanical zero search. "Analogue to position.				
Flange and shaft dimension	NEMA23 compatible. Front: 58mm*58mm. Rear: Ø58. Shaft Ø6,35mm				
POSITION (pulse inputs)					
Command input pulse	Pulse/direction or 90 "phase shifted A+B. RS422. Logic 0 ≤2.0V. Logic 1≥3.0 V. Max. voltage at A+, A-, B+, B- = 5.5V.				
Input frequency	0 -2.5 MHz or 0 -150kHz with input filter				
Electronic gear	A/B: A= -10000 to 10000, B=1 to10000. Simulation of all step resolutions for easy replacement of step motor systems				
Following error register	32 bit				
In position width	0 -32767 pulse				
Position range	32 bit. Infinity, Flip over at $\pm 2^{31}$ pulses.				
POSITION (serial communication)					
Communication facility	From PLC, PC etc via RS422 or asynchronous serial port RS232 with special cable. MacTalk JM. commands, special commands with high security.				
Communication baud rate	19200 bit/sec. (19.2kBaud)				
Position range	±67 000 000				
Speed range	0 -4000 RPM. Digital resolution 0.477 RPM				
Acceleration range	248 – 397364 RPM/sec				
Addressing	Point to point on RS422. Up to 32 units on the same serial RS232/RS485 interface with built-in expansion module. Address range 1 -254				
Number of parameters.	Standard 85. With MacRegIO software 156 (Only for experts)				
Speed variance	Max ±4 RPM variance between command and actual speed.				
SPEED/TORQUE					
Analogue speed/torque input.	12 bit. ±10 V. 10kOhm input resistance. Voltage range max. -10 to +32VDC. Offset typical ±50 mV				
Analogue input tolerance.	Typical ±1%. Max. 5% (Possible to make software adjustment to minimize gain and offset errors)				
Sampling rate at analogue input	521 Hz				
Encoder output signals	A+, A-, B+, B-, RS422. Line driver 5V outputs (SN75176). 90 " Phase shifted.				
Analogue speed input	+voltage -> CW rotation. Shaft view				
Zero speed determination.	0 - rated speed.				
Speed variance at rated speed	Initial error @20 °C: ±0.5%	Power Supply: ±10%: 0.0%			
	Load 0 -300%: ±0.0% Ambient temperature 0 -40 °C: ±0.1%				
Torque limit in speed mode	0 -300% by parameter				
Analogue torque input	+voltage (positive torque) -> CW rotation. Shaft view				
Torque control accuracy	±10% @ 20°C (Reproducibility)				
VARIOUS					
Fatal error brake	Controlled deceleration by fatal error.				
Regenerative	Integrated power dump. 3W can be absorbed continuously. External attachment is possible				
Protective functions.	Error trace back. Overload (I^2t), follow error, function error, regenerative overload (over voltage), software position limit. Abnormality in flash memory, undervoltage, over current				
LED functions	Power (Green LED), Error (Red LED)				
Output signals	2 general purpose NPN 30V/25 mA outputs. Error and In position.				
Zero search	1: Automatic zero search with sensor connected to input (2 formats) 2: Mechanical zero search without sensor. (Torque controlled)				
Shaft load maximum	Radial load: 75N (20 mm from flange). Axial load: 15N.				
Standards	CE approved. UL pending				
Protection	IP42 or IP67 (IP55 on request)				
Usage / Storage Temperature	Ambient 0 to +40 °C / -20 to +85 °C (Humidity 90%)				
Basic motor connector: (Other functions available with expansion modules)	RS232 serial interface	IN/OUT: User I/O connector			Power
	1: +5VDC out	1: Ground	5: A+ Multifunction I/O		1: P+
	2: Receive Rx (5V)	2: Analog in	6: A- Multifunction I/O		2: P-
	3: Transmit Tx (5V)	3: Output1 (Error)	7: B+ Multifunction I/O		
	4: Ground	4: Output2 (In pos.)	8: B- Multifunction I/O		

MAC motor selection chart

MAC Motors feature overview including expansion modules

Feature / Type	Unbalanced async. serial interface. Reset/pulse/ding commands	Balanced async. serial interface. Reset/pulse/ding commands	±10V Analogue input for controlling speed/torque. Also used for zero search	Pulse inputs. Accepts pulse and direction or quadrature encoder signal	Pulse outputs. 90 degree phase shifted outputs from internal encoder	Digital user inputs. For control of program flow or motor start/stop	Digital user outputs. For indicating the motor status or as output from the program	Ext. connector type	Protection class	Integrated brake
Basic MAC motors										
MAC50,95,140,141-A1 Basic MAC motors IP42	5V TTL 18.2 kbaud Full Duplex	RS422 3] 18.2 kbaud Full Duplex	✓	RS422 3] 2.5MHz or 1604Hz [LR]	RS422 3] 4088 ppr	No	Motor start 2 x NPN 25mA	PMP Molex JST	IP42	
MAC50,95,140,141-A3 Basic MAC motors IP67	5V TTL 18.2 kbaud Full Duplex	RS422 3] 18.2 kbaud Full Duplex	✓	RS422 3] 2.5MHz or 1604Hz [LR]	RS422 3] 4088 ppr	No	Motor start 2 x NPN 25mA	PMP Molex JST	IP67 1]	
MAC800-D2/D5 Basic MAC motors IP55	5V TTL 18.2 kbaud Full Duplex	RS422 3] 18.2 kbaud Full Duplex	✓	RS422 3] 2.5MHz or 1604Hz [LR]	RS422 3] 8000 ppr	No	Motor start 2 x NPN 25mA	PMP Molex JST	IP55	
MAC800-D3/D6 Basic MAC motors IP55	5V TTL 18.2 kbaud Full Duplex	RS422 3] 18.2 kbaud Full Duplex	✓	RS422 3] 2.5MHz or 1604Hz [LR]	RS422 3] 8000 ppr	No	Motor start 2 x NPN 25mA	PMP Molex JST	IP55	✓
Expansion modules										
MAC00-CS Conn. module w/cable glands No electronic features added	5V TTL 18.2 kbaud Full Duplex	RS422 3] 18.2 kbaud Full Duplex	✓	RS422 3] 2.5MHz or 1604Hz [LR]	RS422 3]	No	Motor start 2 x NPN 25mA	Cable Gland	IP67 1]	
MAC00-B1 Connector module w/DSUB connectors	RS232 18.2 kbaud Full Duplex	RS422 3] 18.2 k Full Duplex	✓	RS422 3] 2.5MHz or 1604Hz [LR]	RS422 3]	No	Motor start PNP 10-32V 100mA	DSUB	IP42	
MAC00-B2 Connector module w/cable glands 2]	RS232 18.2 kbaud Full Duplex	RS422 3] RS485 18.2 k Full Duplex	✓	RS422 3] 2.5MHz or 1604Hz [LR]	RS422 3]	No	Motor start PNP 10-32V 100mA	Cable Gland	IP67 1]	
MAC00-B4 Connector module w/M12 connectors	RS232 18.2 kbaud Full Duplex	RS422 3] RS485 18.2 k Full Duplex	✓	RS422 3] 2.5MHz or 1604Hz [LR]	RS422 3]	No	Motor start PNP 10-32V 100mA	M12	IP67 1]	
MAC00-R1 Nano PLC w/ DSUB connect	RS232 18.2 kbaud Full Duplex	RS485 18.2 kbaud Half Duplex	✓	No	No	8 Inputs: Opto isol. 6-30V	6 Outputs: PNP 10-30V 300mA	DSUB	IP42	
MAC00-R3 Nano PLC w/cable glands 2]	RS232 18.2 kbaud Full Duplex	RS485 18.2 kbaud Half Duplex	✓	No	No	8 Inputs: Opto isol. 6-30V	6 Outputs: PNP 10-30V 300mA	Cable Gland	IP67 1]	
MAC00-R4 Nano PLC w/ M12 connectors	RS232 18.2 kbaud Full Duplex	RS485 18.2 kbaud Half Duplex	✓	No	No	8 Inputs: Opto isol. 6-30V	6 Outputs: PNP 10-30V 300mA	M12	IP67 1]	
MAC00-FS1 High speed serial RS485 Multiaxis	RS232 18.2 kbaud Full Duplex	RS485 d80 kBaud Opto isol	✓	RS422 3] 2.5 MHz or 1604Hz	RS422 3]	4 Inputs: Opto isol 6-30V	2 Outputs: PNP 10-32V 25mA	DSUB	IP42	
MAC00-FR4 High speed serial RS485 Multiaxis. Interf. to IEC61131-1	No	RS485 230kbaud Opto isol.	✓	No	No	4 Inputs: Opto isol. 6-30V	4 Outputs: PNP 10-30V 300mA	M12	IP67 1]	
MAC00-FP2 Profibus DP w/cable glands 2]	RS232 18.2 kbaud Full Duplex	No	✓	No	No	8 Inputs: Opto isol. 6-30V	Motor status: PNP 10-32V 25mA	Cable Gland	IP67 1]	
MAC00-FP4 Profibus DP w/M12 connectors	RS232 18.2 kbaud Full Duplex	No	✓ 4]	No	No	4 Inputs: Opto isol. 6-30V 4]	Motor status: PNP 10-32V 25mA 4]	M12	IP67 1]	
MAC00-FC4 CANopen w/M12 connectors	RS232 18.2 kbaud Full Duplex	No	✓ 4]	No	No	4 Inputs: Opto isol. 6-30V 4]	2 Outputs: PNP 10-32V 25 mA 4]	M12	IP67 1]	
MAC00-FD4 DeviceNet w/M12 connectors	RS232 18.2 kbaud Full Duplex	No	✓ 4]	No	No	4 Inputs: Opto isol. 6-30V 4]	2 Outputs: PNP 10-32V 25 mA 4]	M12	IP67 1]	
MAC00-FB4 Bluetooth module	RS232 18.2 kbaud Full Duplex	RS422 3] RS485 18.2 k Full Duplex	✓	RS422 3] 2.5 MHz or 1604Hz [LR]	RS422 3]	No	Motor start PNP 10-32V 100mA	M12	IP67 1]	

1] IP67 protection class is only possible if the basic MAC motor also offers IP67
2] Can be ordered without cable (eg. MAC00-CS) or with cable in metre: 2, 10 or 20 (eg. MAC-CS-10).
3] Either pulse input, pulse output or serial must be chosen. Not all of the must the same time.
4] Only a total of 4 I/O terminals are available.

TT201208

Planetary and cycloidal gearheads

- Sealed Ball Bearings
- High Reliability, High Efficiency Design
- NEMA Mounting Standards
- High Shaft Loading Capacity
- Low Backlash Design
- Strong, Caged Roller Bearings
- Precision Input Pinion with Balanced Clamp Collar

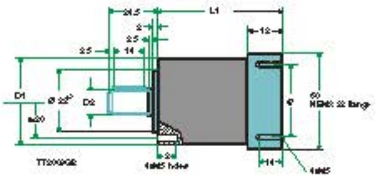
Model	Back-lash [arc min]	Gear ratio	Effi-ciency [%]	Rated torque >10000 Hours [Nm]	Emerg stop Torque [Nm]	Inertia at motor shaft [kg*cm²]	Noise [dB(A)]	Radial load @ 12 mm [N]	Axial load [N]	Weight [kg]	L1 [mm]	D1 [mm]	D2 [mm] (h7)
HTRG05N003MHN2310ol	15	3	97	12	40	0.28	<70	500	600	1.0	68	55	12
HTRG05N005MHN2310ol	15	5	97	15	45	0.17	<70	500	600	1.0	68	55	12
HTRG05N012MHN2310ol	15	12	94	20	60	0.16	<70	500	600	1.2	84.8	55	12
HTRG05N020MHN2310ol	15	20	94	20	60	0.16	<70	500	600	1.2	84.8	55	12
HTRG05N100MHN2310ol	15	100	90	20	60	0.11	<70	500	600	1.5	98.6	55	12
HSPG60-15-SAA-N23	<1	15	>90	37	74	0.006	-	2.600	17.00	1.14	71.8	60	14
HSPG80-07-SAA-N23	<1	07	>90	78	156	0.027	-	4800	6900	2.10	78.8	80	16

L1: Gear length incl. flange, D2: Gear housing diameter, D2:Output shaft diameter

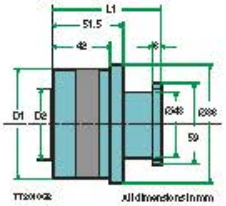
PSU00-PD1
Power Supply

Power supply and power dump resistor
Large capacitor which absorbs energy returned during deceleration so that it can be reused.
If the voltage nevertheless increases to more than about 50VDC, the energy will be dissipated in a built- in power dump resistor.
The Power Supply can feed several MAC motors, up to 1000 W total. An external transformer must be connected. (hxd: 105 x 65mm)

HTRG type gears:



HSPG type gears:



All dimensions in mm

AC servo motors MAC50, 95, 140 and 141

Ordering information

MAC140 - A1

Motor Type
AC-brushless

Rated Output
50: 46W
95: 92W
140:134W
141:134W

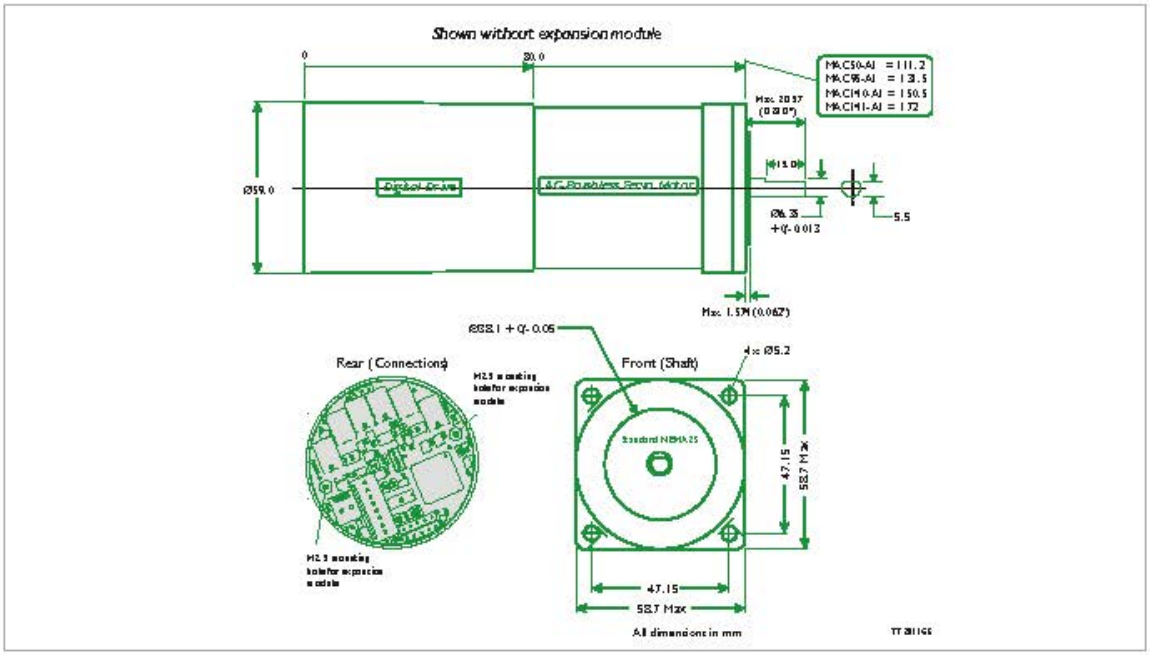
A: Standard, max. 4000 rpm

Protection
1: IP42
3: IP67 (Stainless steel flange+shaft)

Accessories

RS232-9-1	Cable for PC
RS232-9-1-Mac	Cable for PC with built in RS232 converter
MacTalk	Software for set-up of Mac motor
MacRegI0	Software for experts
MAC00-00	End cover IP42 without holes
MAC00-01	End cover IP67 with 2 cable bushes
MAC00-02	End cover IP67 with 4 cable bushes
PSU00-PD1	Power dump/Power supply
PSU40-4	Power supply, 40VDC/400W, 19"rack
TF0001	Transformer 35VAC/400W
PSU24-024	Power supply, 24V/1A
PSU48-240	Power supply, 48V/240W

Mechanical dimensions



Get started quickly!

Starter Kit (MAC140-A1-KIT): Contains all neccessary parts to get started

The kit consists of: Motor, Expansion Module, Software, PC Cable and Power Supply

MAC 140-A1
MAC00-B1
MacTalk
RS232-9-1
PSU24-024

JVL Industri Elektronik A/S
Blokken 42
DK-3460 Birkerød, Denmark
Tel: +45 4582 4440
Fax: +45 4582 5550
E-mail: jvl@jvl.dk www.jvl.dk

6.4. BALL BEARING

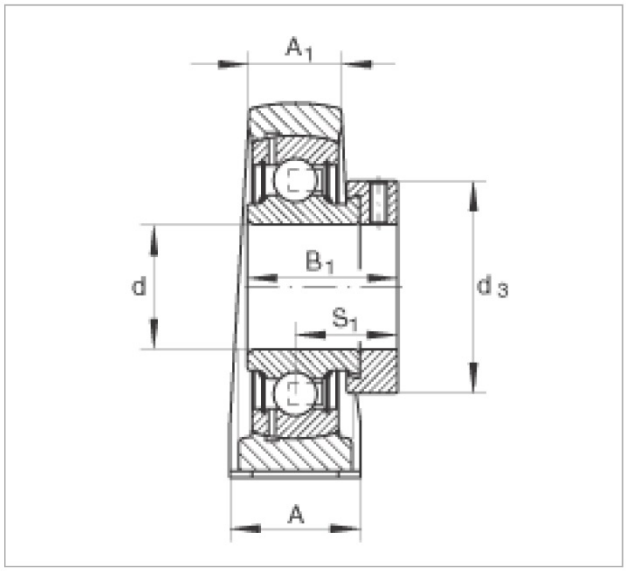
Stehlager-Gehäuseeinheiten

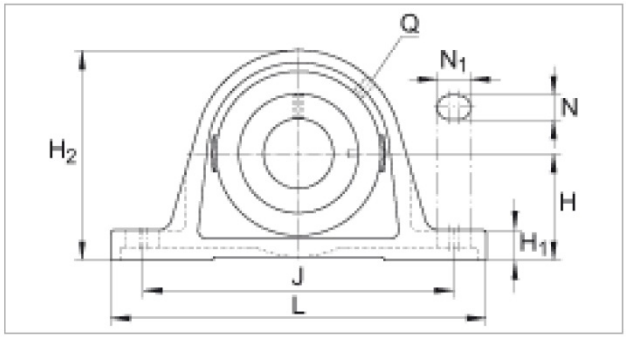
PASE50-N (Baureihe PASE)

Graugussgehäuse, Spannlager mit Exzenterspannring, P-Dichtung

Das vorliegende Datenblatt ist nur eine Übersicht über Maße und Tragzahlen zum gewählten Produkt. Bitte beachten Sie unbedingt alle Hinweise in diesen Übersichtsseiten. Weiterführende Informationen finden Sie für viele Produkte unter dem Menüpunkt "Beschreibung". Außerdem können Sie umfangreiches Informationsmaterial auch über die Katalogbestellung (http://www.ina.de/content.ina.de/de/mediathek/library/library.jsp) oder Telefon +49 (91 32) 82 - 28 97 bestellen.

d	50 mm	
L	200 mm	
H_2	115 mm	
A	54 mm	
A_1	34 mm	
B_1	43,8 mm	
d_3 max	69 mm	
H	57,2 mm	
H_1	21,5 mm	
J	158 mm	
N	18 mm	
N_1	23 mm	
Q	Rp1/8	
S_1	32,8 mm	
m	2,59 kg	Gewicht
C_r	37500 N	dynamische Tragzahl, radial
C_{0r}	23200 N	statische Tragzahl, radial
	GG.ASE10-N	Bezeichnung Gehäuse
	GRAE50-NPP-B	Bezeichnung des Lagers
	KASK10	Lagerschutzkappe, geschlossene Ausführung. Separat bestellen.
		Nut für Lagerschutzkappe


A1
d
B1
S1
d3
A


Q
N1
N
H2
H
H1
J
L

6.5. INDUCTIVE SWITCH

CONTRINEX data sheet

Induktiver Näherungsschalter
Détecteur de proximité inductif
Inductive proximity switch

DW - A□ - 70□ - M12

Durchmesser / Diamètre / Diameter	Schaltabstand / Portée / Operating distance	Einbau / Montage / Mounting
M12	**6 mm**	**bündig / noyable / embeddable**

Ausführung mit grossem Schaltabstand auf die meisten Metalle

Wichtigste Eigenschaften:
- Grosser Schaltabstand: 6 mm auf Stahl und Aluminium
- Extrem robust: Edelstahlgehäuse aus einem Stück, inklusive Stirnfläche
- Betriebsspannung 10 ... 30 VDC, Ausgangsstrom 200 mA
- PNP- und NPN-Ausführung, Schliesser und Öffner
- Anschluss über PUR-Kabel oder Stecker S12

Appareil à longue portée sur la plupart des métaux

Caractéristiques principales:
- Portée élevée: 6 mm sur acier et aluminium
- Extrêmement robuste: boîtier en acier inox en une seule pièce, face avant incluse
- Tension de service 10 ... 30 VDC, courant à la sortie 200 mA
- Disponibles en PNP, NPN, à fermeture et à ouverture
- Raccordement par câble PUR ou par connecteur S12

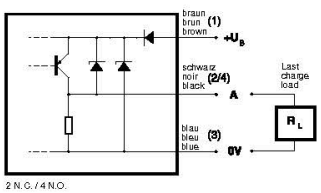
Device with long operating distance on most metals

Main features:
- Long operating distance: 6 mm on steel and aluminum
- Extremely robust: one-piece stainless steel housing, including sensing face
- Supply voltage 10 ... 30 VDC, output current 200 mA
- PNP and NPN, N.O. and N.C. executions
- PUR cable and S12 connector versions

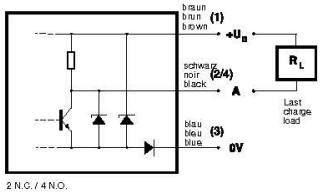
Technische Daten: (gemäss IEC 60947-5-2)	**Caractéristiques techniques:** (selon CEI 60947-5-2)	**Technical data:** (according to IEC 60947-5-2)	
Bemessungsschaltabstand s_n	Portée nominale s_n	Rated operating distance s_n	6 mm
Hysterese	Hystérèse	Hysteresis	≤ 15 % s_r
Normmessplatte	Cible normalisée	Standard target	18 x 18 x 1 mm, FE 360
Wiederholgenauigkeit	Reproductibilité	Repeat accuracy	0,3 mm (U_B = 20 ... 30 VDC, T_A = 23 °C ± 5 °C)
Betriebsspannungsbereich U_B	Tension de service U_B	Supply voltage range U_B	10 ... 30 VDC
Zulässige Restwelligkeit	Ondulation admissible	Max. ripple content	≤ 20% U_B
Ausgangsstrom	Courant de sortie	Output current	≤ 200 mA
Spannungsabfall an Ausgängen	Chute de tension aux sorties	Output voltage drop	≤ 2,0 V bei / à / at 200 mA
Leerlaufstrom	Courant hors-charge	No-load supply current	≤ 12 mA
Sperrstrom der Ausgänge	Courant résiduel	Leakage current	≤ 0,1 mA
Schaltfrequenz	Fréquence de commutation	Switching frequency	≤ 400 Hz
Bereitschaftsverzögerung	Retard à la disponibilité	Time delay before availability	≤ 10 msec.
LED	LED	LED	eingebaut / intégrée / built-in
Umgebungstemperaturbereich T_A	Plage de température ambiante T_A	Ambient temperature range T_A	-25 ... + 70 °C
Temperaturdrift von s_r	Dérive en température de s_r	Temperature drift of s_r	≤ 10%
Druckfestigkeit im Bereich "P"	Résistance à la pression, zone "P"	Pressure resistance in "P" area	80 Bar / bars / bars
Kurzschlussschutz	Protection contre les courts-circuits	Short-circuit protection	eingebaut / intégrée / built-in
Verpolungsschutz	Protection contre les inversions	Voltage reversal protection	eingebaut / intégrée / built-in
Induktionsschutz	Protection contre tensions induites	Induction protection	eingebaut / intégrée / built-in
Schocks und Schwingungen	Chocs et vibrations	Shocks and vibration	IEC 60947-5-2 / 7.4
Leitungslänge	Longueur du câble	Cable length	300 m max.
Gewicht (Kabel / Stecker)	Poids (câble / connecteur)	Weight (cable / connector)	90 g / 28 g
Schutzart (Stecker / Kabel)	Protection (connecteur / câble)	Degree of protection (connector/cable)	IP 67 / IP 68
EMV-Schutz:	Protection CEM:	EMC protection:	
IEC 60255-5	CEI 60255-5	IEC 60255-5	5 kV
IEC 61000-4-2	CEI 61000-4-2	IEC 61000-4-2	Level 2
IEC 61000-4-3	CEI 61000-4-3	IEC 61000-4-3	Level 3
IEC 61000-4-4	CEI 61000-4-4	IEC 61000-4-4	Level 2
Material Gehäuse und aktive Fläche	Matériel du boîtier et de la face sensible	Housing and sensing face material	Edelstahl / acier inox / stainless steel (V2A / 1.4305 / AISI 303)
Wandstärke der aktiven Fläche	Epaisseur paroi de la face sensible	Sensing face thickness	0,4 mm
Anschlusskabel (andere Längen auf Anfrage)	Câble de raccordement (autres longueurs sur demande)	Connection cable (other lengths on request)	PUR 2 m 3 x 0,34mm² /180 x 0,05mm Ø

Anschlussschemen / Schémas de raccordement / Wiring diagrams

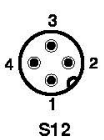
PNP



NPN



Steckerbelegung (Gerät)
Attribution des pins (appareil)
Pin assignment (device)



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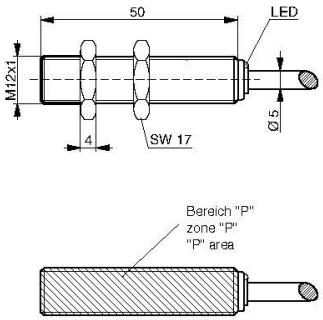
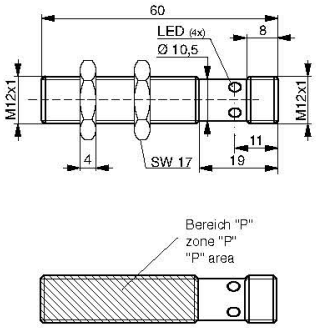
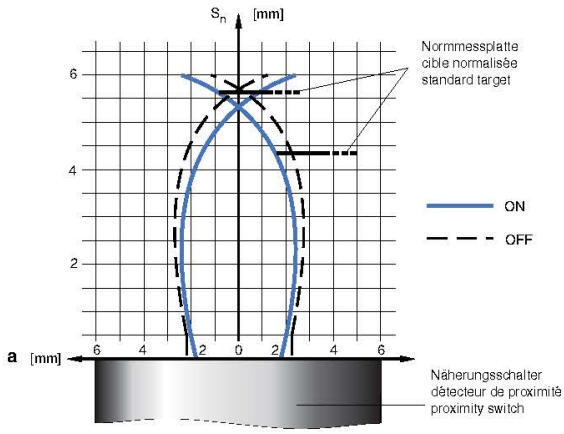


DW-AD-70#-M12

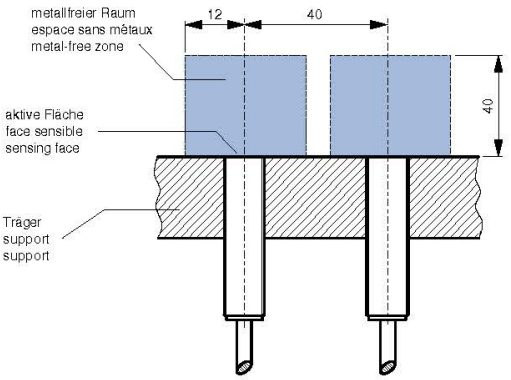


DW-AS-70#-M12

Ansprechkurve* / Courbe de réponse* / Response diagram*:



Einbau / Montage / Installation ($\Delta s < 10\% s_r$):



* typische Werte / valeurs typiques / typical values

Reduktionsfaktoren* / Coefficients de réduction* / Correction factors*

Stahl FE 360 Acier FE 360 Steel FE 360	**1,0**	Kupfer cuivre copper	**0,85**	Aluminium aluminium aluminum	**1,0**	Messing laiton brass	**1,3**	Edelstahl 1mm / 2mm dick acier INOX épaisseur 1mm / 2mm stainless steel 1mm / 2mm thick	**0,45 / 0,9**

Typenspektrum / Types disponibles / Available types:

Artikelnummer Numéro d'article Part number	Typenbezeichnung désignation part reference	Schaltung polarité polarity	Anschluss raccordement connection	Ausgang sortie output
320 020 201	DW-AD-701-M12	NPN	Kabel / câble / cable 2 m PUR	Schliesser / à fermeture / N.O.
320 020 202	DW-AD-702-M12	NPN	Kabel / câble / cable 2 m PUR	Öffner / à ouverture / N.C.
320 020 203	DW-AD-703-M12	PNP	Kabel / câble / cable 2 m PUR	Schliesser / à fermeture / N.O.
320 020 204	DW-AD-704-M12	PNP	Kabel / câble / cable 2 m PUR	Öffner / à ouverture / N.C.
320 020 206	DW-AS-701-M12	NPN	Stecker / connecteur / connector S12	Schliesser / à fermeture / N.O.
320 020 207	DW-AS-702-M12	NPN	Stecker / connecteur / connector S12	Öffner / à ouverture / N.C.
320 020 208	DW-AS-703-M12	PNP	Stecker / connecteur / connector S12	Schliesser / à fermeture / N.O.
320 020 209	DW-AS-704-M12	PNP	Stecker / connecteur / connector S12	Öffner / à ouverture / N.C.

Der Einsatz dieser Geräte in Anwendungen, wo die **Sicherheit von Personen** von deren Funktion abhängt, ist **unzulässig**. Änderungen und Liefermöglichkeiten vorbehalten. Ces détecteurs **ne peuvent être utilisés** dans des applications où la **protection** ou la **sécurité de personnes** est concernée. Sous réserve de modifications et de possibilités de livraison. These proximity switches **must not be used** in applications where the **safety of people** is dependent on their functioning. Terms of delivery and rights to change design reserved.

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Induktiver Näherungsschalter
Détecteur de proximité inductif
Inductive proximity switch

DW - A□ - 71□ - M12

Durchmesser / Diamètre / Diameter	Schaltabstand / Portée / Operating distance	Einbau / Montage / Mounting
M12	**10 mm**	**nicht bündig / non noyable / non-embeddable**

Ausführung mit grossem Schaltabstand auf die meisten Metalle

Wichtigste Eigenschaften:
- Grosser Schaltabstand: 10 mm auf Stahl und Aluminium
- Extrem robust: Edelstahlgehäuse aus einem Stück, inklusive Stirnfläche
- Betriebsspannung 10 ... 30 VDC, Ausgangsstrom 200 mA
- PNP- und NPN-Ausführung, Schliesser und Öffner
- Anschluss über PUR-Kabel oder Stecker S12

Appareil à longue portée sur la plupart des métaux

Caractéristiques principales:
- Portée élevée: 10 mm sur acier et aluminium
- Extrêmement robuste: boîtier en acier inox en une seule pièce, face avant incluse
- Tension de service 10 ... 30 VDC, courant à la sortie 200 mA
- Disponibles en PNP, NPN, à fermeture et à ouverture
- Raccordement par câble PUR ou par connecteur S12

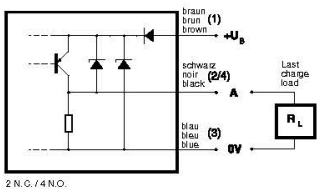
Device with long operating distance on most metals

Main features:
- Long operating distance: 10 mm on steel and aluminum
- Extremely robust: one-piece stainless steel housing, including sensing face
- Supply voltage 10 ... 30 VDC, output current 200 mA
- PNP and NPN, N.O. and N.C. executions
- PUR cable and S12 connector versions

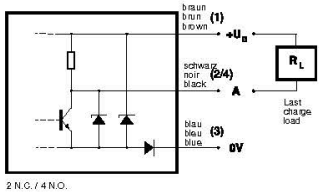
Technische Daten: (gemäss IEC 60947-5-2)	**Caractéristiques techniques:** (selon CEI 60947-5-2)	**Technical data:** (according to IEC 60947-5-2)	
Bemessungsschaltabstand s_n	Portée nominale s_n	Rated operating distance s_n	10 mm
Hysterese	Hystérèse	Hysteresis	≤ 15 % s_r
Normmessplatte	Cible normalisée	Standard target	30 x 30 x 1 mm, FE 360
Wiederholgenauigkeit	Reproductibilité	Repeat accuracy	0,5 mm (U_B = 20 ... 30 VDC, T_A = 23 °C ± 5 °C)
Betriebsspannungsbereich U_B	Tension de service U_B	Supply voltage range U_B	10 ... 30 VDC
Zulässige Restwelligkeit	Ondulation admissible	Max. ripple content	≤ 20% U_B
Ausgangsstrom	Courant de sortie	Output current	≤ 200 mA
Spannungsabfall an Ausgängen	Chute de tension aux sorties	Output voltage drop	≤ 2,0 V bei / à / at 200 mA
Leerlaufstrom	Courant hors-charge	No-load supply current	≤ 12 mA
Sperrstrom der Ausgänge	Courant résiduel	Leakage current	≤ 0,1 mA
Schaltfrequenz	Fréquence de commutation	Switching frequency	≤ 400 Hz
Bereitschaftsverzögerung	Retard à la disponibilité	Time delay before availability	≤ 10 msec.
LED	LED	LED	eingebaut / intégrée / built-in
Umgebungstemperaturbereich T_A	Plage de température ambiante T_A	Ambient temperature range T_A	-25 ... + 70 °C
Temperaturdrift von s_r	Dérive en température de s_r	Temperature drift of s_r	≤ 10%
Druckfestigkeit im Bereich "P"	Résistance à la pression, zone "P"	Pressure resistance in "P" area	80 Bar / bars / bars
Kurzschlussschutz	Protection contre les courts-circuits	Short-circuit protection	eingebaut / intégrée / built-in
Verpolungsschutz	Protection contre les inversions	Voltage reversal protection	eingebaut / intégrée / built-in
Induktionsschutz	Protection contre tensions induites	Induction protection	eingebaut / intégrée / built-in
Schocks und Schwingungen	Chocs et vibrations	Shocks and vibration	IEC 60947-5-2 / 7.4
Leitungslänge	Longueur du câble	Cable length	300 m max.
Gewicht (Kabel / Stecker)	Poids (câble / connecteur)	Weight (cable / connector)	94 g / 28 g
Schutzart (Stecker / Kabel)	Protection (connecteur / câble)	Degree of protection (connector/cable)	IP 67 / IP 68
EMV-Schutz:	Protection CEM:	EMC protection:	
IEC 60255-5	CEI 60255-5	IEC 60255-5	5kV
IEC 61000-4-2	CEI 61000-4-2	IEC 61000-4-2	Level 2
IEC 61000-4-3	CEI 61000-4-3	IEC 61000-4-3	Level 3
IEC 61000-4-4	CEI 61000-4-4	IEC 61000-4-4	Level 2
Material Gehäuse und aktive Fläche	Matériel du boîtier et de la face sensible	Housing and sensing face material	Edelstahl / acier inox / stainless steel (V2A / 1.4305 / AISI 303)
Wandstärke der aktiven Fläche	Epaisseur paroi de la face sensible	Sensing face thickness	0,4 mm
Anschlusskabel (andere Längen auf Anfrage)	Câble de raccordement (autres longueurs sur demande)	Connection cable (other lengths on request)	PUR 2 m 3 x 0,34mm² /180 x 0,05mm Ø

Anschlussschemen / Schémas de raccordement / Wiring diagrams

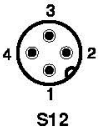
PNP



NPN



Steckerbelegung (Gerät)
Attribution des pins (appareil)
Pin assignment (device)



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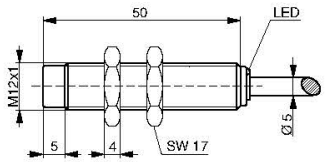
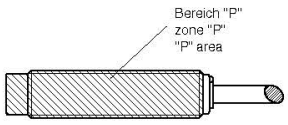
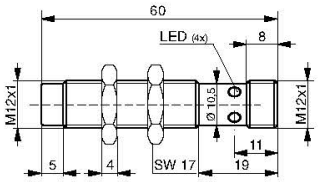
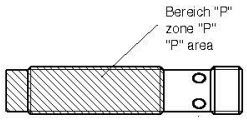


DW-AD-71#-M12

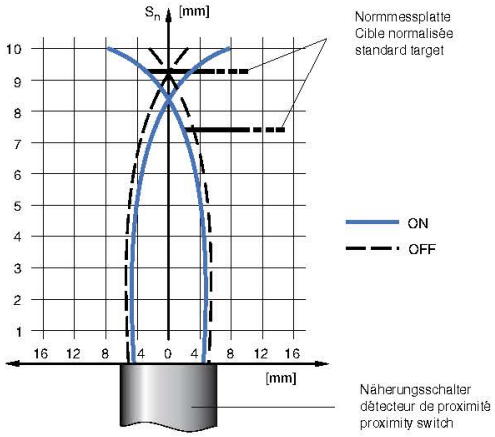




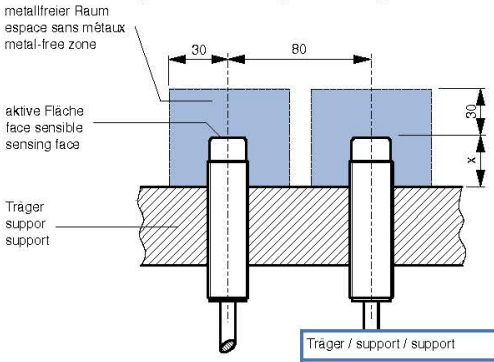
DW-AS-71#-M12



Ansprechkurve* / Courbe de réponse* / Response diagram*:



Einbau / Montage / Installation ($\Delta s < 10\% s_r$):



Träger / support / support	x
Aluminium/ aluminium / aluminum	13 mm
Stahl / acier / steel	20 mm
Messing / laiton / brass	15 mm
Edelstahl / acier INOX / stainless steel	20 mm

* typische Werte / valeurs typiques / typical values

Reduktionsfaktoren* / Coefficients de réduction* / Correction factors*

Stahl FE 360 Acier FE 360 Steel FE 360	**1,0**	Kupfer cuivre copper	**0,8**	Aluminium aluminium aluminum	**1,0**	Messing laiton brass	**1,3**	Edelstahl 1mm / 2mm dick acier INOX épaisseur 1mm / 2mm stainless steel 1mm / 2mm thick	**0,5 / 0,9**

Typenspektrum / Types disponibles / Available types:

Artikelnummer Numéro d'article Part number	Typenbezeichnung désignation part reference	Schaltung polarité polarity	Anschluss raccordement connection	Ausgang sortie output
320 020 211	DW-AD-711-M12	NPN	Kabel / câble / cable 2 m PUR	Schliesser / à fermeture / N.O.
320 020 212	DW-AD-712-M12	NPN	Kabel / câble / cable 2 m PUR	Öffner / à ouverture / N.C.
320 020 213	DW-AD-713-M12	PNP	Kabel / câble / cable 2 m PUR	Schliesser / à fermeture / N.O.
320 020 214	DW-AD-714-M12	PNP	Kabel / câble / cable 2 m PUR	Öffner / à ouverture / N.C.
320 020 216	DW-AS-711-M12	NPN	Stecker / connecteur / connector S12	Schliesser / à fermeture / N.O.
320 020 217	DW-AS-712-M12	NPN	Stecker / connecteur / connector S12	Öffner / à ouverture / N.C.
320 020 218	DW-AS-713-M12	PNP	Stecker / connecteur / connector S12	Schliesser / à fermeture / N.O.
320 020 219	DW-AS-714-M12	PNP	Stecker / connecteur / connector S12	Öffner / à ouverture / N.C.

Der Einsatz dieser Geräte in Anwendungen, wo die **Sicherheit von Personen** von deren Funktion abhängt, ist **unzulässig**. Änderungen und Liefermöglichkeiten vorbehalten. Ces détecteurs **ne peuvent être utilisés** dans des applications où la **protection** ou la **sécurité de personnes** est concernée. Sous réserve de modifications et de possibilités de livraison. These proximity switches **must not be used** in applications where the **safety of people** is dependent on their functioning. Terms of delivery and rights to change design reserved.

CONTRINEX AG Industrial Electronics
route André Piller 50 - CH 1762 Givisiez - Switzerland - **Tel:** ++41 26 460 46 46 - **Fax:** ++41 26 460 46 40 - **Internet:** www.contrinex.ch - **E-mail:** headoffice@contrinex.ch

7. REFERENCES

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