SALCEDO BOSCH, MARTÍ

Grau en enginyeria en tecnologies industrials

Gener 2015

Treball de Fi de Grau

GRAU EN ENGINYERIA EN TECNOLOGIES INDUSTRIALS

Disseny del sistema de control d'una màquina automàtica per a soldar dolles

ANNEX A: Fulles de càlcul
ANNEX B: Fitxes tècniques
ANNEX C: Plànols

Autor: SALCEDO BOSCH, MARTÍ
Director: GRIÑO CUBERO, ROBERTO

Convocatòria: gener 2015

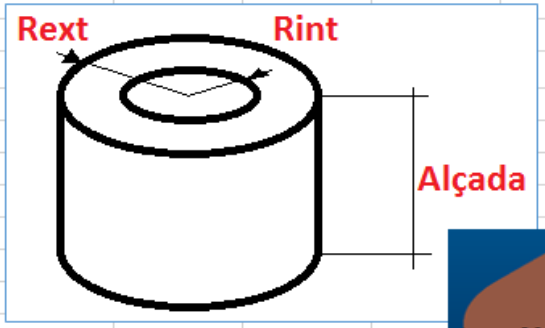
Escola Tècnica Superior
d'Enginyeria Industrial de Barcelona

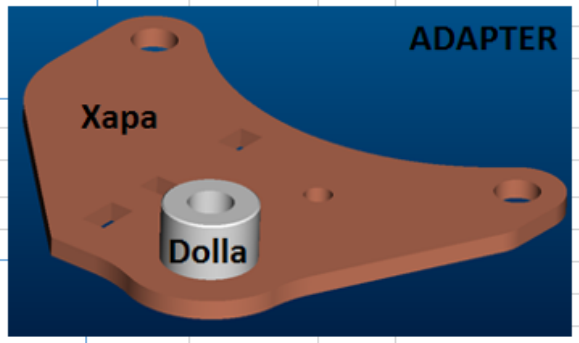
ANNEX A: Fulles de càlcul

Càlculs sistema motor-reductor-taula

VOLUM I PES ADAPTER MÉS GRAN

Densitat acer (UNE F-1120 = DIN ck25)	8000	kg/m^3		
Dolla				
Alçada màxima	50,00	mm	0,05000	m
Diàmetre exterior màxim	50,00	mm	0,05000	m
Radi exterior màxim	25,00	mm	0,02500	m
Diàmetre interior mínim	6,50	mm	0,00650	m
Radi interior mínim	3,25	mm	0,00325	m
Volum	96515,6168	mm^3	0,0000965156	m^3
Massa	0,772124934	Kg		
Inèrcia	0,000245367	Kg·m^2	$\left(I_{dolla} = \frac{1}{2} m(r_{ext}^2 + r_{int}^2)\right)$	
Xapa				
Diàmetre màxim	250	mm	0,25	m
Radi màxim	125	mm	0,125	m
Gruix màxim	10	mm	0,01	m
Volum	490873,8521	mm^3	0,000490874	m^3
Massa	3,926990817	Kg		
Inèrcia	0,030679616	Kg·m^2	$\left(I_{xapa} = \frac{1}{2} m r^2\right)$	





Inèrcies dels components giratoris

1. Moment d'inèrcia de l'adapter			S'estima el pitjor dels casos amb una xapa cilindrica de radi igual al de la taula (250mm) i de gruix màxim (10mm)
Moment d'inèrcia de la xapa	0,03067962	$Kg \cdot m^2$	
Moment d'inèrcia de la dolla	0,00024537	Kg·m2	
Total adapter	**0,03092498**	**Kg·m2**	
2. Moment d'inèrcia del conjunt giratori			S'han calculat numèricament amb el programa de disseny
Protector soldadura (00400-00982)	0,00249154	$Kg \cdot m^2$	
Taula giratòria (00400-00979)	0,01788000	$Kg \cdot m^2$	
Suport taula giratòria (00400-00980)	0,00005673	$Kg \cdot m^2$	
Eix motor (00400-00981)	0,00048093	$Kg \cdot m^2$	
Tapeta (00400-00973)	0,00004199	$Kg \cdot m^2$	
Boixa (00400-00972)	0,00016728	$Kg \cdot m^2$	
Acoblament metàl·lic (MKM7)	0,00001400	$Kg \cdot m^2$	
Total conjunt giratori	**0,02113247**	**$Kg \cdot m^2$**	
5. Moment d'inèrcia reductor	**0,00000007**	**$Kg \cdot m^2$**	En les especificacions
6. Moment d'inèrcia rotor	**0,00000359**	**$Kg \cdot m^2$**	En les especificacions

Parell de fregament

	Parell	
Coixinet Boixa	0,0571	N·m
Coixinet taula 1	0,0982	N·m
Coixinet taula 2	0,0982	N·m
Total	**0,2535**	**N·m**

Link calculadora: http://webtools3.skf.com/BearingCalc/selectProduct.action

Considerant que la càrrega es reparteix meitat i meitat en els coixinets de la taula (pitjor dels casos)

Considerant la velocitat màxima de 67 rpm

Pel coixinet de la boixa només s'ha de tenir en compte la força de l'embol

Força axial coixinets				
Força èmbol	-	kg	1131	N
Adapter més gran	3,85	kg	37,7685	N
Taula giratòria	3,384	Kg	33,19704	N
Total	**7,234**	**kg**	**1201,9655**	**N**

VELOCITATS DE SOLDADURA

Radi dolla més petita (r_{min})	0,00325	m	3,25	mm
Radi de dolla més gran (r_{max})	0,0250	m	25,0	mm

Velocitat de soldadura				
Velocitat de soldadura definida	0,0060	m/s	35,0	cm/min
Velocitat màxima de soldadura	1,8462	rad/s	17,629	rpm
Velocitat mínima de soldadura	0,2400	rad/s	2,292	rpm

S'agafa la dolla de diàmetre més petit (6,5mm) per tenir la velocitat angular de soldadura màxima i el diàmetre més (50mm) gran per trobar la velocitat angular de soldadura mínima

Acceleracions i velocitats Moviment adapter

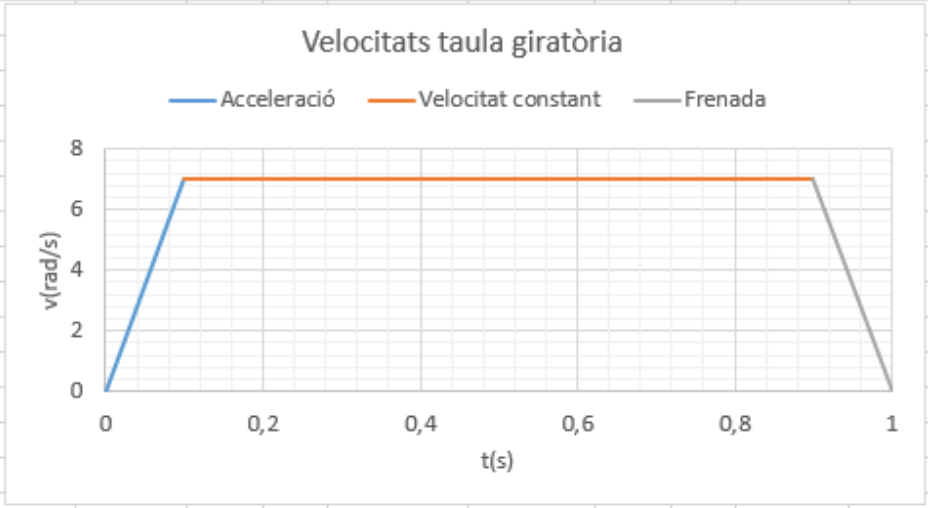
Temps		
t_1	0,0997	s
t_2	0,8006	s
t_3	0,0997	s
t_{tot}	1	s

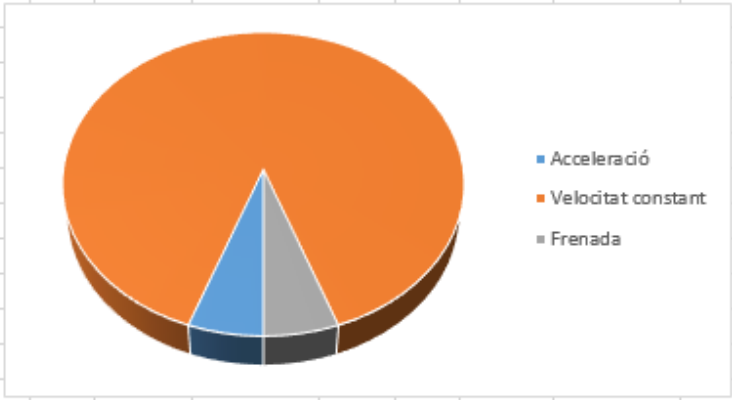
Recorregut		
θ_{tot}	6,283185	rad
	360	deg

1. Acceleració		
α_1	70	rad/s^2
θ_a	0,347902	rad
	19,93332	deg

2. Velocitat constant		
ω	6,97899	rad/s
	66,64444	rpm
θ_v	5,587381	rad
	320,1334	deg

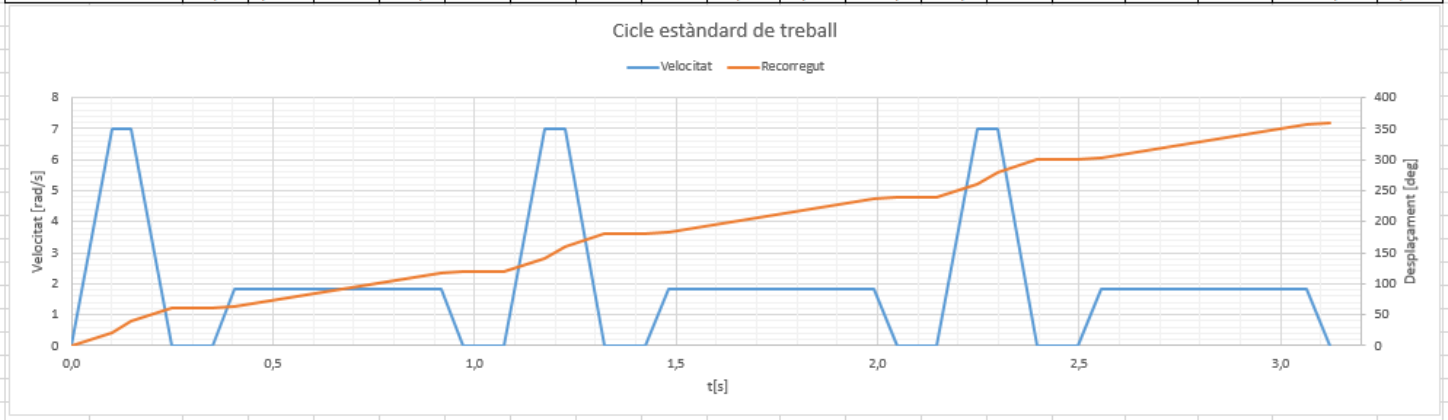
2. Frenada		
α_2	-70	rad/s^2
θ_f	0,347902	rad
	19,93332	deg





Cicle RMS

		Temps	T. Acum	Plat								Motor							
		s	s	deg	rad	rad/s	rpm	rad/s²	Nm	s·(rad/s)²	s·Nm²	deg	rad	rad/s	rpm	rad/s²	Nm	s·(rad/s)²	s·Nm²
Mov.	Acceleració	0,09987	0,00000	20,00	0,349	3,4953	33,378	70,00	3,8975	1,2201	1,5170	1580,00	27,58	276,13	2636,85	5530,00	0,10886	7614,6378	0,0012
	V. Constant	0,04993	0,09987	20,00	0,349	6,9907	66,756	0	0,2535	2,4402	0,0032	1580,00	27,58	552,26	5273,71	0,00	0,00550	15229,2756	2E-06
	Frenada	0,09987	0,14980	20,00	0,349	-3,4953	-33,378	-70,00	-3,3905	1,2201	1,1480	1580,00	27,58	-276,13	-2636,85	-5530,00	-0,09786	7614,6378	0,001
Repòs	Aturada	0,10000	0,24967	0	0,000	0	0	0	0,2535	0,0000	0,0064	0,00	0,00	0,00	0,00	0,00	0,00550	0,0000	3E-06
Sold.	Acceleració	0,05672	0,34967	3,00	0,052	0,9231	8,8147	32,55	1,9478	0,0483	0,2152	237,00	4,14	72,92	696,36	2571,19	0,05356	301,6412	0,0002
	V. Constant	0,51051	0,40639	54	0,942	1,85	17,629	0	0,2535	1,7400	0,0328	4266,00	74,46	145,85	1392,73	0,00	0,00550	10859,0842	2E-05
	Frenada	0,05672	0,91690	3,00	0,052	-0,9231	-8,8147	-32,55	-1,4408	0,0483	0,1178	237,00	4,14	-72,92	-696,36	-2571,19	-0,04256	301,6412	0,0001
Repòs	Aturada	0,10000	0,97362	0	0,000	0	0	0	0,2535	0,0000	0,0064	0,00	0,00	0,00	0,00	0,00	0,00550	0,0000	3E-06
Mov.	Acceleració	0,09987	1,07362	20,00	0,349	3,4953	33,378	70,00	3,8975	1,2201	1,5170	1580,00	27,58	276,13	2636,85	5530,00	0,10886	7614,6378	0,0012
	V. Constant	0,04993	1,17349	20,00	0,349	6,9907	66,756	0	0,2535	2,4402	0,0032	1580,00	27,58	552,26	5273,71	0,00	0,00550	15229,2756	2E-06
	Frenada	0,09987	1,22342	20,00	0,349	-3,4953	-33,378	-70,00	-3,3905	1,2201	1,1480	1580,00	27,58	-276,13	-2636,85	-5530,00	-0,09786	7614,6378	0,001
Repòs	Aturada	0,10000	1,32329	0	0,000	0	0	0	0,2535	0,0000	0,0064	0,00	0,00	0,00	0,00	0,00	0,00550	0,0000	3E-06
Sold.	Acceleració	0,05672	1,42329	3,00	0,052	0,9231	8,8147	32,55	1,9478	0,0483	0,2152	237,00	4,14	72,92	696,36	2571,19	0,05356	301,6412	0,0002
	V. Constant	0,51051	1,48001	54	0,942	1,85	17,629	0	0,2535	1,7400	0,0328	4266,00	74,46	145,85	1392,73	0,00	0,00550	10859,0842	2E-05
	Frenada	0,05672	1,99052	3,00	0,052	-0,9231	-8,8147	-32,55	-1,4408	0,0483	0,1178	237,00	4,14	-72,92	-696,36	-2571,19	-0,04256	301,6412	0,0001
Repòs	Aturada	0,10000	2,04724	0	0,000	0	0	0	0,2535	0,0000	0,0064	0,00	0,00	0,00	0,00	0,00	0,00550	0,0000	3E-06
Mov.	Acceleració	0,09987	2,14724	20,00	0,349	3,4953	33,378	70,00	3,8975	1,2201	1,5170	1580,00	27,58	276,13	2636,85	5530,00	0,10886	7614,6378	0,0012
	V. Constant	0,04993	2,24711	20,00	0,349	6,9907	66,756	0	0,2535	2,4402	0,0032	1580,00	27,58	552,26	5273,71	0,00	0,00550	15229,2756	2E-06
	Frenada	0,09987	2,29704	20,00	0,349	-3,4953	-33,378	-70,00	-3,3905	1,2201	1,1480	1580,00	27,58	-276,13	-2636,85	-5530,00	-0,09786	7614,6378	0,001
Repòs	Aturada	0,10000	2,39691	0	0,000	0	0	0	0,2535	0,0000	0,0064	0,00	0,00	0,00	0,00	0,00	0,00550	0,0000	3E-06
Sold.	Acceleració	0,05672	2,49691	3,00	0,052	0,9231	8,8147	32,55	1,9478	0,0483	0,2152	237,00	4,14	72,92	696,36	2571,19	0,05356	301,6412	0,0002
	V. Constant	0,51051	2,55363	54	0,942	1,85	17,629	0	0,2535	1,7400	0,0328	4266,00	74,46	145,85	1392,73	0,00	0,00550	10859,0842	2E-05
	Frenada	0,05672	3,06414	3,00	0,052	-0,9231	-8,8147	-32,55	-1,4408	0,0483	0,1178	237,00	4,14	-72,92	-696,36	-2571,19	-0,04256	301,6412	0,0001
Total		3,121	3,12086	360	6,28	-	-	-	-	20,1511	9,1342	28440,00	496,37	-	-	-	-	125762,7533	0,0073



Parell RMS a la taula	**1,7107987**	**Nm**
Velocitat RMS a la taula	**2,541**	**rad/s**
Parell RMS al motor	**0,0483052**	**Nm**
Velocitat RMS a la taula	**200,742**	**rad/s**

$$M_{RMS} = \sqrt{\frac{t_1 \cdot M^2_1 + t_2 \cdot M^2_2 + t_3 \cdot M^2_3 + t_4 \cdot M^2_4}{t_{tot}}}$$

RMS (Root mean square)
Mitjana quadràtica

Nota:
En el cas dels trams d'acceleració i frenada la velocitat que hi ha és la velocitat mitjana de cada tram.

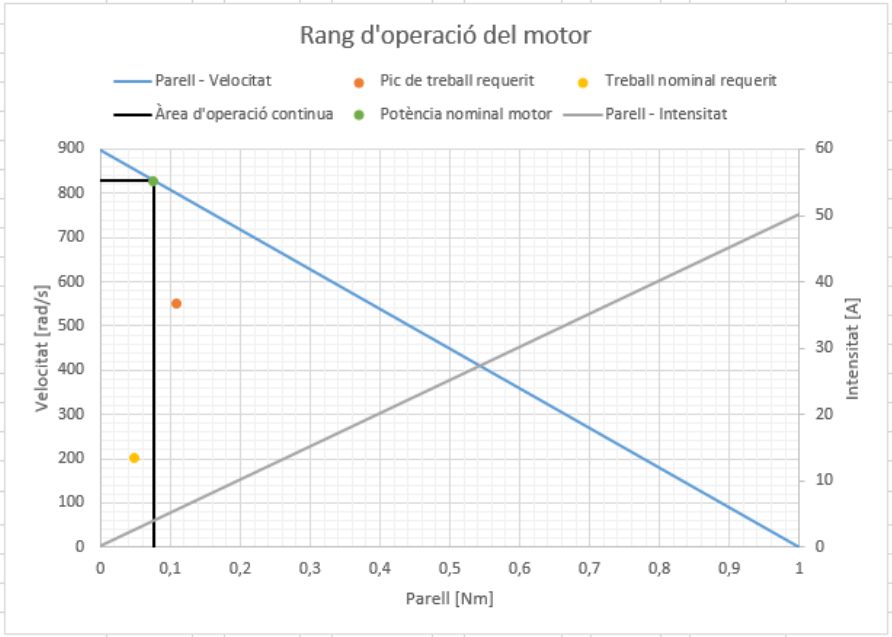
Requeriment		
V. màx soldadura	1,8461538	rad/s
Graus fins V. Sold.	3	deg
	0,0523599	rad
Acceleració min.	32,546715	rad/s²

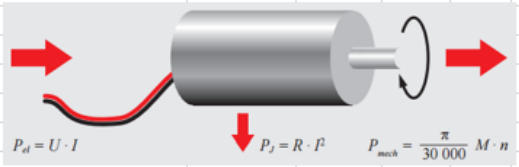
	Parells				Velocitats i Acceleracions					Potències			
		Pic	RMS								Pic	RMS	
Taula	Inèrcia adapter	0,03092		$Kg·m^2$	Acceleració màxima	70,00000	rad/s^2						
	Inèrcia conjunt giratori	0,02113		$Kg·m^2$	V. Soldadura mín.	0,2400	rad/s	2,2918	rpm				
	Inèrcia total	0,05206		$Kg·m^2$	V. Soldadura màx.	1,8462	rad/s	17,6295	rpm				
	Parell d'arrancada	3,64402	-	N·m	V. Moviment (pic)	6,9790	rad/s	66,6444	rpm				
	Parell de fregament	0,25350		N·m	V. RMS	2,54104	rad/s	24,2651	rpm				
	Parell total	3,89752	1,71080	N·m						Potència càrrega	27,200763	4,3472078	W
Reductor	Relació de transmissió	79		-	Acceleració màxima	5530	rad/s^2						
	Rendiment	0,7		-	V. Soldadura mín.	18,9600	rad/s	181,0547	rpm				
	Inèrcia reductor	7,00E-08		$Kg·m^2$	V. Soldadura màx.	145,8462	rad/s	1392,7282	rpm				
	Parell sortida reductor	0,07087	-	N·m	V. Moviment (pic)	551,3402	rad/s	5264,9108	rpm	Potència entrada reductor	39,071657	-	W
Motor	Inèrcia motor	3,59E-06		$Kg·m^2$	V. RMS	200,742	rad/s	1916,9464	rpm				
	Parell sortida motor	0,09072	-	N·m						Potència motor	50,017248	-	W
	Coeficient de seguretat	1,2		-									
	Inèrcia vista al motor	1,869E-05		$Kg·m^2$									
	Frec vist al motor	0,0055		N·m									
	Parell final	0,10886	0,04831	N·m						Potència motor ajustada	60,020697	9,6968925	W

Propietats motor		
Voltatge nominal	18	V
Velocitat al buit	8590	rpm
	899,54	rad/s
Intensitat al buit	0,213	A
Velocitat nominal	7910	rpm
	828,333	rad/s
Parell nominal	0,0755	Nm
Intensitat nominal	4	A
Parell en parada	1	Nm
Intensitat en parada	50,3	A
Màx. Eficiència	0,87	-

Resistència terminals	0,358	Ω
Inductància terminals	0,00007	H
Constant Parell	0,0199	Nm/A
Constant Velocitat	479	rpm/V
	50,161	(rad/s)/V
Constant velocitat/parell	8610	rpm/Nm
	901,64	(rad/s)/Nm
Constant de temps	0,00324	s

Potència nominal	60	W
Velocitat màxima	12000	rpm
	1256,64	rad/s





Treball			
	Pic	RMS	
Parell	0,109	0,04831	Nm
Velocitat	5264,91082	1916,95	rpm
	551	201	rad/s
P. Mecànica	60,021	9,697	W
P. Elèctrica	71,585	12,193	W
Intensitat	5,684	2,640	A
Rendiment del motor	0,84	0,80	-

Càlculs sistema eix vertical

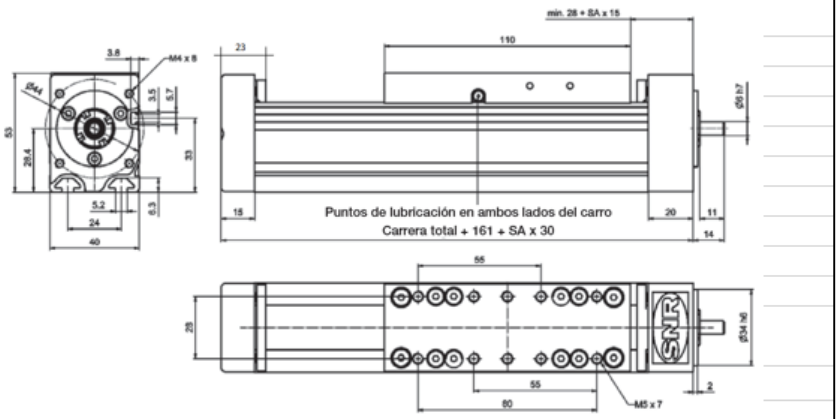
AXC40S NTN-SNR

Longitud		
Recorregut	100	mm
SA	0	unitats
Recorregut final	**261**	**mm**

Característiques		
Pas	0,01	m/rev
Capacitat dinàmica d'arrossegament	2500	N
Moment d'inèrcia transmissió	0,11	$Kgcm^2/m$
	0,000011	Kgm^2/m
Parell d'arrossegament en buit	0,3	Nm
Rendiment	0,98	-
Pes	1	Kg
Pes per 100mm de recorregut	0,3	Kg
Pes del carro	0,4	Kg

	Guía raíl-patín	
Tipo	B	
Longitud del carro [mm]	110	
Cargas [N]	din.	estát.
Fy	660	910
Fz	660	910
-Fz	660	910
Momentos [Nm]	din.	estát.
Mx	4,5	6
My	18	25
Mz	18	25

Las capacidades de carga dinámica de los sistemas de guiado se indican para una duración nominal de 27.000 km.



Elemento de accionamiento	S1205	S1210	T1203
Paso del husillo	5RH	10RH	3RH
Velocidad máxima [m/min]	30	60	5,5
Precisión del paso del husillo [µ/300mm]	52		200
Capacidad dinámica de arrastre del husillo [N]	3.600	2.500	-
Momento de inercia de la transmisión [$kgcm^2/m$]	0,11	0,11	0,10
Par de arrastre en vacío [Nm]	0,3		
Momento de inercia geométrico Iy (perfil) [cm^4]	9,251		
Momento de inercia geométrico Iz (perfil) [cm^4]	12,14		
Longitud total máx. [m]	2,5		3,0
Superficie portadora de la tuerca [mm^2]	-		400
Rendimiento	0,98	0,98	0,46

	Guía raíl-patín
Tipo	B
Peso de base (carro incluido) [kg]	1,0
Peso para 100 mm de carrera [kg]	0,3
Peso del carro solo [kg]	0,4

Inèrcies i masses que haurà de moure el motor

1. Masses			
Massa pistola	3	Kg	Se suposa una pistola de 3kg perquè es desconeix el pes real de la pistola que es farà servir.
Suport pistola	0,07	Kg	
Total sense carro	**3,07**	**Kg**	
Massa carro	0,4	Kg	
Total	**3,47**	**Kg**	

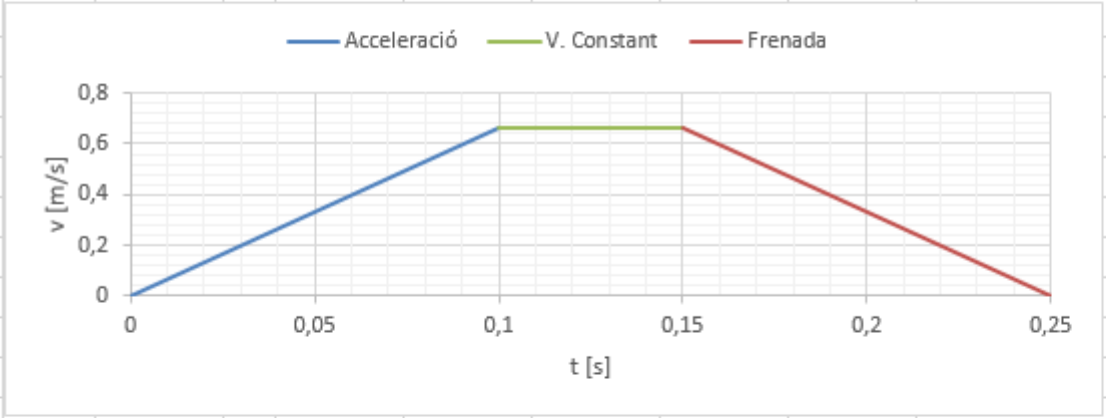
2. Inèrcies			
Inèrcia caragol sense fi	0,000002871	$Kg \cdot m^2$	En les especificacions dels productes
Inèrcia motor	0,000053600	$Kg \cdot m^2$	
Inèrcia acoblament	0,000002500	$Kg \cdot m^2$	

Moviment

Temps		
t_1	0,10	s
t_2	0,05	s
t_3	0,10	s
t_{tot}	0,25	s

Recorregut		
x_1	0,033333	m
x_2	0,033333	m
x_3	0,033333	m
x_{tot}	0,10	m

1. Acceleració	a_1	6,66667	m/s^2
2. V. Constant	v	0,66667	m/s
3. Frenada	a_2	-6,66667	m/s^2



Velocitats i acceleracions al motor			
4188,79	rad/s^2		
418,879	rad/s	4000	rpm
4188,79	rad/s^2		

Cicle RMS

		Temps	T. Acum.	Carro					Motor							
		s	s	mm	m	m/s	m/s^2	$s\cdot(m/s)^2$	deg	rad	rad/s	rpm	rad/s^2	Nm	$s\cdot(rad/s)^2$	$s\cdot Nm^2$
Baixada	Acceleració	0,10000	0,000	-33,3333	-0,033	-0,333	-6,67	0,0111	-1200,00	-20,94	-209,44	-2000,00	-4188,79	-0,63516	4386,48427	0,0403433
	V. Constant	0,05000	0,100	-33,3333	-0,033	-0,667	0	0,0222	-1200,00	-20,94	-418,88	-4000,00	0,00	-0,29366	8772,96853	0,00431182
	Frenada	0,10000	0,150	-33,3333	-0,033	0,333	6,67	0,0111	-1200,00	-20,94	209,44	2000,00	4188,79	0,04784	4386,48427	0,0002289
Soldadura	Aturada	0,74800	0,250	0	0,000	0	0	0,0000	0,00	0,00	0,00	0,00	0,00	0,00000	0,00000	0
Pujada	Acceleració	0,07027	0,998	11,1111	0,011	0,158	4,50	0,0018	400,00	6,98	99,35	948,68	2827,43	0,65685	693,56406	0,03031977
	V. Constant	0,03514	1,068	11,1111	0,011	0,316	0	0,0035	400,00	6,98	198,69	1897,37	0,00	0,42634	1387,12812	0,00638659
	Frenada	0,07027	1,103	11,1111	0,011	-0,158	-4,50	0,0018	400,00	6,98	-99,35	-948,68	-2827,43	0,19582	693,56406	0,00269478
Espera	Aturada	0,05000	1,174	0	0,000	0	0	0,0000	0,00	0,00	0,00	0,00	0,00	0,00000	0,00000	0
Baixada	Acceleració	0,07027	1,224	-11,1111	-0,011	-0,158	-4,50	0,0018	-400,00	-6,98	-99,35	-948,68	-2827,43	-0,52418	693,56406	0,01930813
	V. Constant	0,03514	1,294	-11,1111	-0,011	-0,316	0	0,0035	-400,00	-6,98	-198,69	-1897,37	0,00	-0,29366	1387,12812	0,00303003
	Frenada	0,07027	1,329	-11,1111	-0,011	0,158	4,50	0,0018	-400,00	-6,98	99,35	948,68	2827,43	-0,06315	693,56406	0,0002802
Soldadura	Aturada	0,67200	1,399	0	0,000	0	0	0,0000	0,00	0,00	0,00	0,00	0,00	0,00000	0,00000	0
Pujada	Acceleració	0,07027	2,071	11,1111	0,011	0,158	4,50	0,0018	400,00	6,98	99,35	948,68	2827,43	0,65685	693,56406	0,03031977
	V. Constant	0,03514	2,142	11,1111	0,011	0,316	0	0,0035	400,00	6,98	198,69	1897,37	0,00	0,42634	1387,12812	0,00638659
	Frenada	0,07027	2,177	11,1111	0,011	-0,158	-4,50	0,0018	400,00	6,98	-99,35	-948,68	-2827,43	0,19582	693,56406	0,00269478
Espera	Aturada	0,05000	2,247	0	0,000	0	0	0,0000	0,00	0,00	0,00	0,00	0,00	0,00000	0,00000	0
Baixada	Acceleració	0,07027	2,297	-11,1111	-0,011	-0,158	-4,50	0,0018	-400,00	-6,98	-99,35	-948,68	-2827,43	-0,52418	693,56406	0,01930813
	V. Constant	0,03514	2,367	-11,1111	-0,011	-0,316	0	0,0035	-400,00	-6,98	-198,69	-1897,37	0,00	-0,29366	1387,12812	0,00303003
	Frenada	0,07027	2,402	-11,1111	-0,011	0,158	4,50	0,0018	-400,00	-6,98	99,35	948,68	2827,43	-0,06315	693,56406	0,0002802
Soldadura	Aturada	0,74000	2,473	0	0,000	0	0	0,0000	0,00	0,00	0,00	0,00	0,00	0,00000	0,00000	0
Pujada	Acceleració	0,10000	3,213	33,3333	0,033	0,333	6,67	0,0111	1200,00	20,94	209,44	2000,00	4188,79	0,76784	4386,48427	0,05895832
	V. Constant	0,05000	3,313	33,3333	0,033	0,667	0	0,0222	1200,00	20,94	418,88	4000,00	0,00	0,42634	8772,96853	0,00908827
	Frenada	0,10000	3,363	33,3333	0,033	-0,333	-6,67	0,0111	1200,00	20,94	-209,44	-2000,00	-4188,79	0,08484	4386,48427	0,00071972
Total		3,463	3,463	0	0,00	-	-	0,1170	0,00	0,00	-	-	-	-	46188,89908	0,23768932

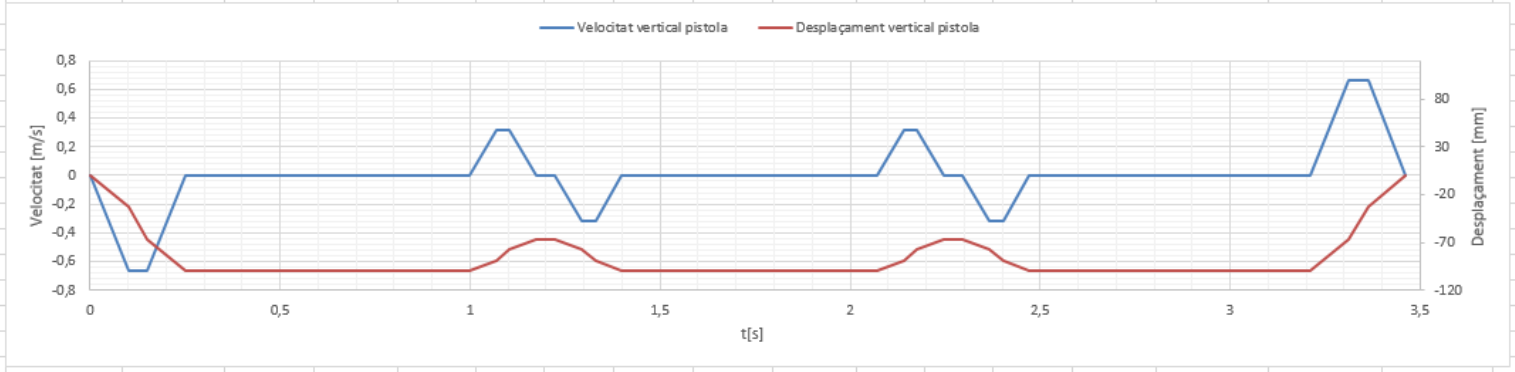
V RMS al carro	**0,184**	**m/s**
V RMS al motor	**115,494**	**rad/s**
Parell RMS al motor	**0,2620**	**Nm**

$$M_{RMS} = \sqrt{\frac{t_1 \cdot M_1^2 + t_2 \cdot M_2^2 + t_3 \cdot M_3^2 + t_4 \cdot M_4^2}{t_{tot}}}$$

RMS (Root mean square)

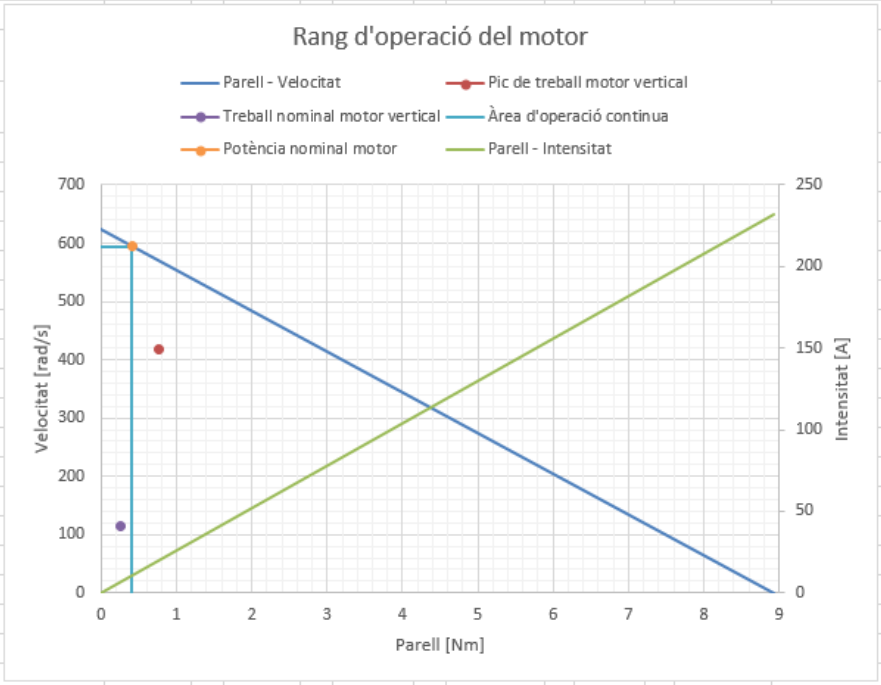
Mitjana quadràtica

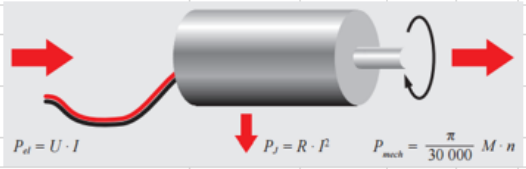
	V
Pujada	+
Baixada	-



	Forces i Parells					Velocitats i Acceleracions			Potències			
		Pujada (Pic)	Baixada	RMS						Pic	RMS	
Carro	Massa a moure	3,470			Kg	Acceleració màxima	6,667	m/s^2				
	Pes	34,041	34,041	-	N	Velocitat màxima	0,667	m/s				
	Força	23,133	-23,133	-	N							
	Total	57,174	10,907	-	N							
Sense fi	Pas	0,01			m/rev	Acceleració màxima	4188,790	rad/s^2				
	Rendiment	0,98			-	V. Màx	418,879	rad/s				
	Inèrcia sense fi + Acoblament	0,00000287			$Kg·m^2$		4000,000	rpm				
	Parell de fregament	0,30000			N·m	V. RMS	115,4941	rad/s				
	Parell sortida	0,404878	0,3297	-	N·m		1102,887	rpm				
Motor	Inèrcia motor + Acoblament	0,00005610			$Kg·m^2$							
	Parell sortida motor	0,6399	0,5647	-	N·m							
	Coef. de seguretat	1,2			-							
	Inèrcia vista al motor	8,1528E-05		-	$Kg·m^2$							
	Parell constant	0,4263	0,2937	-	N·m							
	Parell final	**0,7678**	0,6777	**0,26200**	N·m				Potència motor ajustada	321,63349	30,25905	W

Propietats motor		
Voltatge nominal	24	V
Velocitat al buit	5950	rpm
	623,08	rad/s
Intensitat al buit	0,236	A
Velocitat nominal	5680	rpm
	594,808	rad/s
Parell nominal	0,405	Nm
Intensitat nominal	10,8	A
Parell en parada	8,92	Nm
Intensitat en parada	232	A
Màx. Eficiència	0,94	-
Resistència terminals	0,103	Ω
Inductància terminals	7,2E-05	H
Constant Parell	0,0385	Nm/A
Constant Velocitat	248	rpm/V
	25,970	(rad/s)/V
Constant velocitat/parell	668	rpm/Nm
	69,95	(rad/s)/Nm
Constant de temps	0,00375	s
Potència nominal	200	W
Velocitat màxima	9500	rpm
	994,838	rad/s





Treball			
	Pic	RMS	
Parell	0,768	0,26200	Nm
Velocitat	4000	1102,89	rpm
	419	115	rad/s
P. Mecànica	321,633	30,259	W
P. Elèctrica	363,578	35,365	W
Intensitat	20,180	7,041	A
Rendiment del motor	0,88	0,86	-

Càlculs eix horitzontal

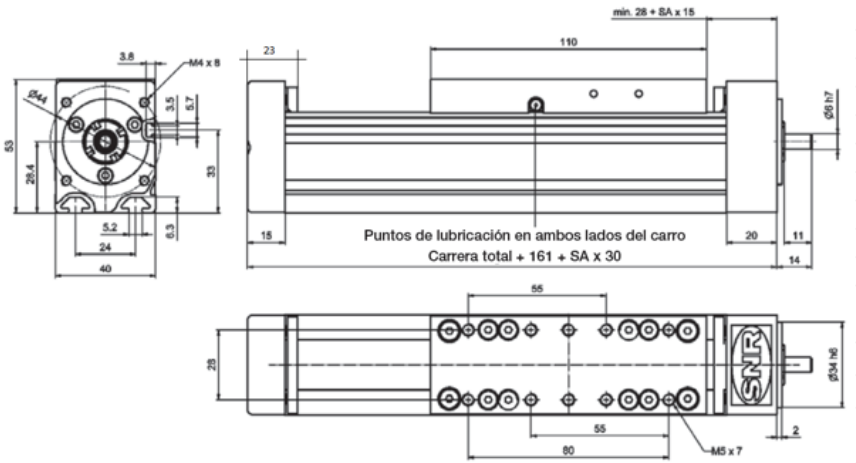
AXC40S NTN-SNR

Longitud		
Recorregut	165	mm
SA	0	unitats
Recorregut final	**326**	**mm**

Característiques		
Pas	0,01	m/rev
Capacitat dinàmica d'arrossegament	2500	N
Moment d'inèrcia transmissió	0,11	$Kgcm^2/m$
	0,000011	Kgm^2/m
Parell d'arrossegament en buit	0,3	Nm
Rendiment	0,98	-
Pes	1	Kg
Pes per 100mm de recorregut	0,3	Kg
Pes del carro	0,4	Kg

	Guía raíl-patín	
Tipo	B	
Longitud del carro [mm]	110	
Cargas [N]	din.	estát.
Fy	660	910
Fz	660	910
-Fz	660	910
Momentos [Nm]	din.	estát.
Mx	4,5	6
My	18	25
Mz	18	25

Las capacidades de carga dinámica de los sistemas de guiado se indican para una duración nominal de 27.000 km.



Elemento de accionamiento	S1205	S1210	T1203
Paso del husillo	5RH	10RH	3RH
Velocidad máxima [m/min]	30	60	5,5
Precisión del paso del husillo [µ/300mm]	52		200
Capacidad dinámica de arrastre del husillo [N]	3.600	2.500	-
Momento de inercia de la transmisión [$kgcm^2/m$]	0,11	0,11	0,10
Par de arrastre en vacío [Nm]	0,3		
Momento de inercia geométrico Iy (perfil) [cm^4]	9,251		
Momento de inercia geométrico Iz (perfil) [cm^4]	12,14		
Longitud total máx. [m]	2,5		3,0
Superficie portadora de la tuerca [mm^2]	-		400
Rendimiento	0,98	0,98	0,46

	Guía raíl-patín
Tipo	B
Peso de base (carro incluido) [kg]	1,0
Peso para 100 mm de carrera [kg]	0,3
Peso del carro solo [kg]	0,4

Inèrcies i masses que haurà de moure el motor

1. Masses			
Massa pistola	3	kg	Se suposa una pistola de 3kg perquè es desconeix el pes real de la pistola que es farà servir.
Mòdul vertical	1,3	kg	
Motor vertical	1,1	kg	
Suport pistola	0,07	kg	
Adaptador motor	0,12		
Total sense carro	**5,59**	**Kg**	
Massa carro	0,4	Kg	
Total	**5,99**	**Kg**	

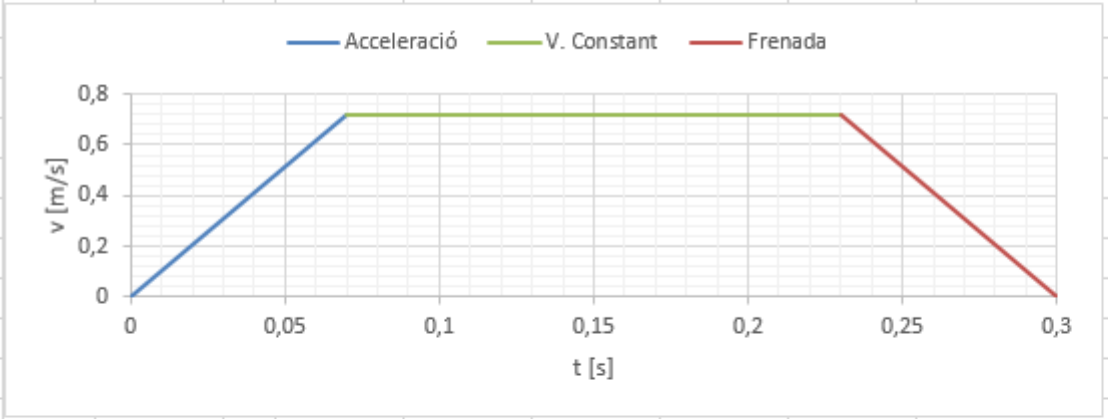
2. Inèrcies			
Inèrcia caragol sense fi	0,000003586	$Kg \cdot m^2$	En les especificacions dels productes
Inèrcia motor	5,42E-05	$Kg \cdot m^2$	
Inèrcia acoblament	0,000002500	$Kg \cdot m^2$	

Moviment

Temps		
t_1	0,07	s
t_2	0,16	s
t_3	0,07	s
t_{tot}	0,3	s

Recorregut		
x_1	0,025109	m
x_2	0,114783	m
x_3	0,025109	m
x_{tot}	0,165	m

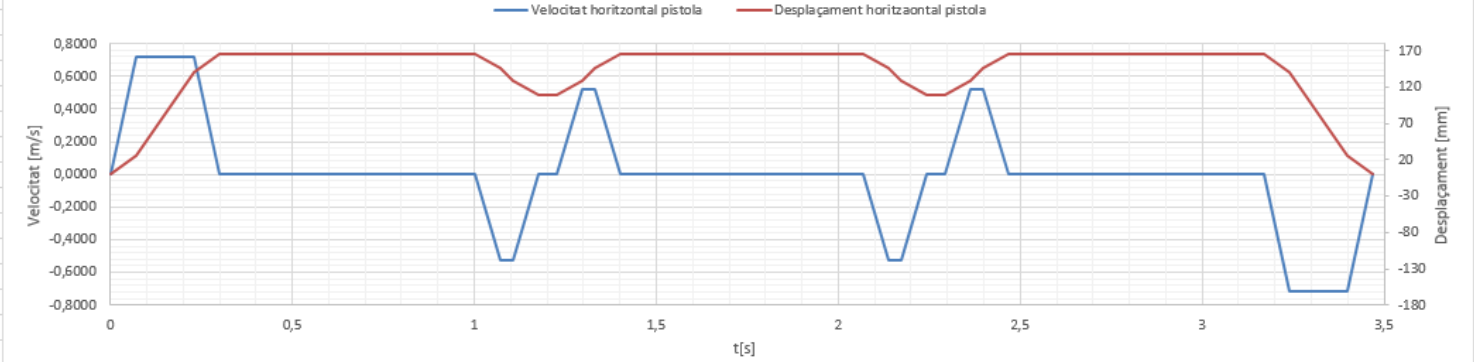
1. Acceleració	a_1	10,248	m/s^2
2. V. Constant	v	0,717	m/s
3. Frenada	a_2	-10,248	m/s^2



Velocitats i acceleracions al motor			
6439,289	rad/s^2		
450,7503	rad/s	4304,348	rpm
6439,289	rad/s^2		

Cicle RMS

		Temps	T. Acum.	Carro					Motor							
		s	s	mm	m	m/s	m/s^2	$s\cdot(m/s)^2$	deg	rad	rad/s	rpm	rad/s^2	Nm	$s\cdot(rad/s)^2$	$s\cdot Nm^2$
Apropar	Acceleració	0,07000	0,00000	25,109	0,025	0,359	10,25	0,0090	903,91	15,78	225,38	2152,17	6439,29	0,94547	3555,57629	0,06257452
	V. Constant	0,16000	0,07000	114,783	0,115	0,717	0	0,0823	4132,17	72,12	450,75	4304,35	0,00	0,36000	32508,12610	0,020736
	Frenada	0,07000	0,23000	25,109	0,025	-0,359	-10,25	0,0090	903,91	15,78	-225,38	-2152,17	-6439,29	-0,22547	3555,57629	0,00355871
Soldadura	Aturada	0,70000	0,30000	0	0,000	0	0	0,0000	0,00	0,00	0,00	0,00	0,00	0,00000	0,00000	0
Allunyar	Acceleració	0,06991	1,00000	-18,3300	-0,018	-0,262	-7,50	0,0048	-659,88	-11,52	-164,73	-1573,07	-4712,39	-0,78846	1897,22600	0,04346361
	V. Constant	0,03496	1,06991	-18,3300	-0,018	-0,524	0	0,0096	-659,88	-11,52	-329,46	-3146,14	0,00	-0,36000	3794,45200	0,00453044
	Frenada	0,06991	1,10487	-18,3300	-0,018	0,262	7,50	0,0048	-659,88	-11,52	164,73	1573,07	4712,39	0,06846	1897,22600	0,00032768
Espera	Aturada	0,05000	1,17479	0	0,000	0	0	0,0000	0,00	0,00	0,00	0,00	0,00	0,00000	0,00000	0
Apropar	Acceleració	0,06991	1,22479	18,3300	0,018	0,262	7,50	0,0048	659,88	11,52	164,73	1573,07	4712,39	0,78846	1897,22600	0,04346361
	V. Constant	0,03496	1,29470	18,3300	0,018	0,524	0	0,0096	659,88	11,52	329,46	3146,14	0,00	0,36000	3794,45200	0,00453044
	Frenada	0,06991	1,32966	18,3300	0,018	-0,262	-7,50	0,0048	659,88	11,52	-164,73	-1573,07	-4712,39	-0,06846	1897,22600	0,00032768
Soldadura	Aturada	0,67000	1,39957	0	0,000	0	0	0,0000	0,00	0,00	0,00	0,00	0,00	0,00000	0,00000	0
Allunyar	Acceleració	0,06991	2,06957	-18,3300	-0,018	-0,262	-7,50	0,0048	-659,88	-11,52	-164,73	-1573,07	-4712,39	-0,78846	1897,22600	0,04346361
	V. Constant	0,03496	2,13949	-18,3300	-0,018	-0,524	0	0,0096	-659,88	-11,52	-329,46	-3146,14	0,00	-0,36000	3794,45200	0,00453044
	Frenada	0,06991	2,17444	-18,3300	-0,018	0,262	7,50	0,0048	-659,88	-11,52	164,73	1573,07	4712,39	0,06846	1897,22600	0,00032768
Espera	Aturada	0,05000	2,24436	0	0,000	0	0	0,0000	0,00	0,00	0,00	0,00	0,00	0,00000	0,00000	0
Apropar	Acceleració	0,06991	2,29436	18,3300	0,018	0,262	7,50	0,0048	659,88	11,52	164,73	1573,07	4712,39	0,78846	1897,22600	0,04346361
	V. Constant	0,03496	2,36427	18,3300	0,018	0,524	0	0,0096	659,88	11,52	329,46	3146,14	0,00	0,36000	3794,45200	0,00453044
	Frenada	0,06991	2,39923	18,3300	0,018	-0,262	-7,50	0,0048	659,88	11,52	-164,73	-1573,07	-4712,39	-0,06846	1897,22600	0,00032768
Soldadura	Aturada	0,70000	2,46914	0	0,000	0	0	0,0000	0,00	0,00	0,00	0,00	0,00	0,00000	0,00000	0
Allunyar	Acceleració	0,07000	3,16914	-25,109	-0,025	-0,359	-10,25	0,0090	-903,91	-15,78	-225,38	-2152,17	-6439,29	-0,94547	3555,57629	0,06257452
	V. Constant	0,16000	3,23914	-114,783	-0,115	-0,717	0	0,0823	-4132,17	-72,12	-450,75	-4304,35	0,00	-0,36000	32508,12610	0,020736
	Frenada	0,07000	3,39914	-25,109	-0,025	0,359	10,25	0,0090	-903,91	-15,78	225,38	2152,17	6439,29	0,22547	3555,57629	0,00355871
Total		3,469	3,46914	0	0,00	-	-	0,2776	0,00	0,00	-	-	-	-	109594,17340	0,36702537



V. RMS al carro	**0,2828804**	**m/s**
V. RMS al motor	**177,73898**	**rad/s**
Parell RMS al motor	**0,3252647**	**Nm**

$$M_{RMS} = \sqrt{\frac{t_1 \cdot M^2_1 + t_2 \cdot M^2_2 + t_3 \cdot M^2_3 + t_4 \cdot M^2_4}{t_{tot}}}$$

RMS (Root mean square)

Mitjana quadràtica

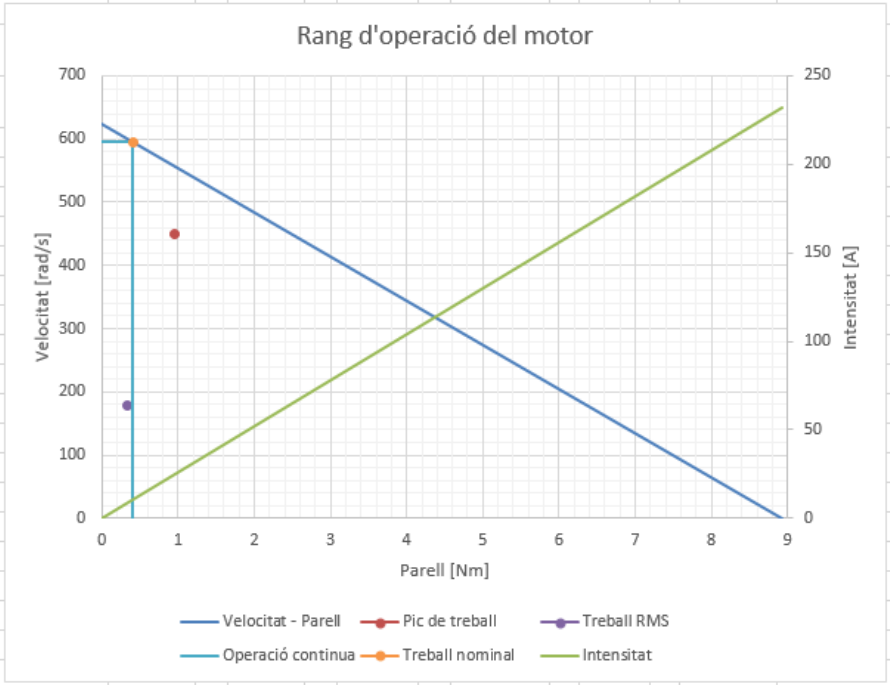
	V
Apropar	+
Allunyar	-

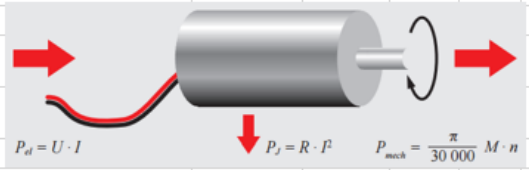
	Forces i Parells				Velocitats i Acceleracions			Potències			
		Pic	RMS						Pic	RMS	
Carro	Massa a moure	5,990		Kg	Acceleració màxima	10,248	m/s^2				
	Força	61,388	-	N	Velocitat màxima	0,717	m/s				
Sense fi	Pas	0,010		m/rev	Acceleració màxima	6439,289	rad/s^2				
	Rendiment	0,98		-	V. màx.	450,750	rad/s				
	Inèrcia sense fi + Acoblament	0,00000359		$Kg·m^2$		4304,348	rpm				
	Parell de fregament	0,30000		N·m	Velocitat RMS	177,739	rad/s				
	Parell sortida	0,422788	-	N·m		1697,282	rpm				
Motor	Inèrcia motor+acoblament	0,00005670		$Kg·m^2$							
	Parell sortida motor	0,7879	-	N·m							
	Coef. de seguretat	1,2		-							
	Inèrcia vista al motor	9,09222E-05		$Kg·m^2$							
	Parell constant	0,3600		N·m							
	Parell final	**0,9455**	**0,32526**	N·m				Potència motor ajustada	426,17279	57,812221	W

Propietats motor		
Voltatge nominal	24	V
Velocitat al buit	5950	rpm
	623,08	rad/s
Intensitat al buit	0,236	A
Velocitat nominal	5680	rpm
	594,808	rad/s
Parell nominal	0,405	Nm
Intensitat nominal	10,8	A
Parell en parada	8,92	Nm
Intensitat en parada	232	A
Màx. Eficiència	0,94	-

Resistència terminals	0,103	Ω
Inductància terminals	7,20E-05	H
Constant Parell	0,0385	Nm/A
Constant Velocitat	248	rpm/V
	25,970	(rad/s)/V
Constant velocitat/parell	668	rpm/Nm
	69,95	(rad/s)/Nm
Constant de temps	0,00375	s

Potència nominal	200	W
Velocitat màxima	9500	rpm
	994,838	rad/s

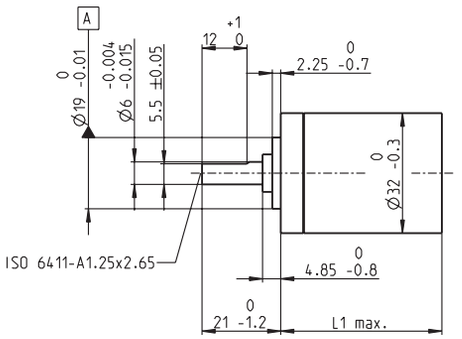


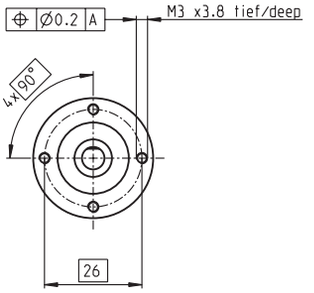


Treball			
	Pic	RMS	
Parell	0,945	0,32526	Nm
Velocitat	4304,34783	1697,28	rpm
	451	178	rad/s
P. Mecànica	426,173	57,812	W
P. Elèctrica	489,490	65,580	W
Intensitat	24,794	8,684	A
Rendiment del motor	0,87	0,88	-

ANNEX B: Fitxes tècniques

Planetary Gearhead GP 32 A ∅32 mm, 0.75–4.5 Nm





M 1:2

Technical Data

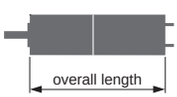
Planetary Gearhead	straight teeth
Output shaft	stainless steel
Shaft diameter as option	8 mm
Bearing at output	ball bearing
Radial play, 5 mm from flange	max. 0.14 mm
Axial play	max. 0.4 mm
Max. axial load (dynamic)	120 N
Max. force for press fits	120 N
Direction of rotation, drive to output	=
Max. continuous input speed	6000 rpm
Recommended temperature range	-40...+100°C

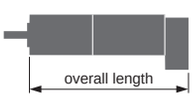
Number of stages	1	2	3	4	5
Max. radial load, 10 mm from flange	90 N	140 N	200 N	220 N	220 N

Option: Low-noise version

Stock program
Standard program
Special program (on request)

Part Numbers	166155	166158	166163	166164	166169	166174	166179	166184	166187	166192	166197	166202
Gearhead Data												
1 Reduction	3.7:1	14:1	33:1	51:1	111:1	246:1	492:1	762:1	1181:1	1972:1	2829:1	4380:1
2 Absolute reduction	$^{26}/_{7}$	$^{676}/_{49}$	$^{529}/_{16}$	$^{17576}/_{343}$	$^{13824}/_{125}$	$^{421824}/_{1715}$	$^{86112}/_{175}$	$^{19044}/_{25}$	$^{10123776}/_{8575}$	$^{8626176}/_{4375}$	$^{495144}/_{175}$	$^{109503}/_{25}$
3 Max. motor shaft diameter mm	6	6	3	6	4	4	3	3	4	4	3	3
Part Numbers	**166156**	**166159**		**166165**	166170	166175	**166180**	166185	166188	166193	166198	166203
1 Reduction	4.8:1	18:1		66:1	123:1	295:1	531:1	913:1	1414:1	2189:1	3052:1	5247:1
2 Absolute reduction	$^{24}/_{5}$	$^{624}/_{35}$		$^{16224}/_{245}$	$^{6877}/_{56}$	$^{101062}/_{343}$	$^{331776}/_{625}$	$^{36501}/_{40}$	$^{2425488}/_{1715}$	$^{536406}/_{245}$	$^{1907712}/_{625}$	$^{839523}/_{160}$
3 Max. motor shaft diameter mm	4	4		4	3	3	4	3	3	3	3	3
Part Numbers	166157	166160		166166	166171	**166176**	166181	166186	166189	166194	166199	166204
1 Reduction	5.8:1	21:1		79:1	132:1	318:1	589:1	1093:1	1526:1	2362:1	3389:1	6285:1
2 Absolute reduction	$^{23}/_{4}$	$^{299}/_{14}$		$^{3887}/_{49}$	$^{3312}/_{25}$	$^{389376}/_{1225}$	$^{20631}/_{35}$	$^{279841}/_{256}$	$^{9345024}/_{6125}$	$^{2066688}/_{875}$	$^{474513}/_{140}$	$^{6436343}/_{1024}$
3 Max. motor shaft diameter mm	3	3		3	3	4	3	3	4	3	3	3
Part Numbers		**166161**		**166167**	166172	166177	166182		166190	166195	166200	
1 Reduction		23:1		86:1	159:1	411:1	636:1		1694:1	2548:1	3656:1	
2 Absolute reduction		$^{576}/_{25}$		$^{14976}/_{175}$	$^{1587}/_{10}$	$^{359424}/_{875}$	$^{79488}/_{125}$		$^{1162213}/_{686}$	$^{7962624}/_{3125}$	$^{457056}/_{125}$	
3 Max. motor shaft diameter mm		4		4	3	4	3		3	4	3	
Part Numbers		166162		166168	166173	166178	166183		166191	166196	166201	
1 Reduction		28:1		103:1	190:1	456:1	706:1		1828:1	2623:1	4060:1	
2 Absolute reduction		$^{138}/_{5}$		$^{3588}/_{35}$	$^{12167}/_{64}$	$^{89401}/_{196}$	$^{158171}/_{224}$		$^{2238912}/_{1225}$	$^{2056223}/_{784}$	$^{3637933}/_{896}$	
3 Max. motor shaft diameter mm		3		3	3	3	3		3	3	3	
4 Number of stages	1	2	2	3	3	4	4	4	5	5	5	5
5 Max. continuous torque Nm	0.75	2.25	2.25	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
6 Max. intermittent torque at gear output Nm	1.1	3.4	3.4	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
7 Max. efficiency %	80	75	75	70	70	60	60	60	50	50	50	50
8 Weight g	118	162	162	194	194	226	226	226	258	258	258	258
9 Average backlash no load °	0.7	0.8	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10 Mass inertia gcm^2	1.5	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
11 Gearhead length L1 mm	26.5	36.4	36.4	43.1	43.1	49.8	49.8	49.8	56.5	56.5	56.5	56.5

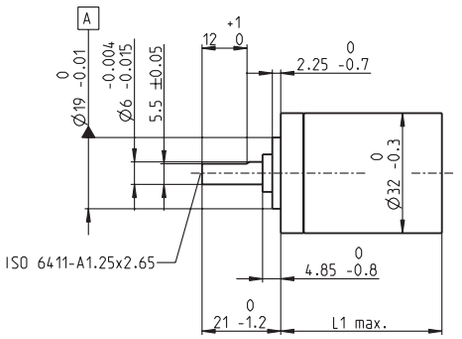


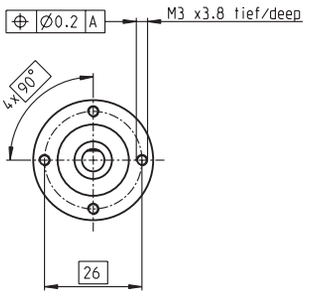


maxon Modular System

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm] = Motor length + gearhead length + (sensor/brake) + assembly parts											
RE 25	135/137			81.1	91.0	91.0	97.7	97.7	104.4	104.4	104.4	111.1	111.1	111.1	111.1
RE 25	135/137	MR	355	92.1	102.0	102.0	108.7	108.7	115.4	115.4	115.4	122.1	122.1	122.1	122.1
RE 25	135/137	Enc 22	361	95.2	105.1	105.1	111.8	111.8	118.5	118.5	118.5	125.2	125.2	125.2	125.2
RE 25	135/137	HED_ 5540	362/364	101.9	111.8	111.8	118.5	118.5	125.2	125.2	125.2	131.9	131.9	131.9	131.9
RE 25	135/137	DCT 22	373	103.4	113.3	113.3	120.0	120.0	126.7	126.7	126.7	133.4	133.4	133.4	133.4
RE 25, 20 W	136			69.6	79.5	79.5	86.2	86.2	92.9	92.9	92.9	99.6	99.6	99.6	99.6
RE 25, 20 W	136	MR	355	80.6	90.5	90.5	97.2	97.2	103.9	103.9	103.9	110.6	110.6	110.6	110.6
RE 25, 20 W	136	HED_ 5540	363/366	90.4	100.3	100.3	107.0	107.0	113.7	113.7	113.7	120.4	120.4	120.4	120.4
RE 25, 20 W	136	DCT22	373	91.9	101.8	101.8	108.5	108.5	115.2	115.2	115.2	121.9	121.9	121.9	121.9
RE 25, 20 W	136	AB 28	408	103.7	113.6	113.6	120.3	120.3	127.0	127.0	127.0	133.7	133.7	133.7	133.7
RE 25, 20 W	136	HED_ 5540/AB 28	363/408	120.9	130.8	130.8	137.5	137.5	144.2	144.2	144.2	150.9	150.9	150.9	150.9
RE 25, 20 W	137	AB 28	408	115.2	125.1	125.1	131.8	131.8	138.5	138.5	138.5	145.2	145.2	145.2	145.2
RE 25, 20 W	137	HED_ 5540/AB 28	362/408	132.4	142.3	142.3	149.0	149.0	155.7	155.7	155.7	162.4	162.4	162.4	162.4
A-max 26	161-168			71.3	81.2	81.2	87.9	87.9	94.6	94.6	94.6	101.3	101.3	101.3	101.3
A-max 26	162-168	MEnc 13	372	78.4	88.3	88.3	95.0	95.0	101.7	101.7	101.7	108.4	108.4	108.4	108.4
A-max 26	162-168	MR	355	80.1	90.0	90.0	96.7	96.7	103.4	103.4	103.4	110.1	110.1	110.1	110.1
A-max 26	162-168	Enc 22	361	85.7	95.6	95.6	102.3	102.3	109.0	109.0	109.0	115.7	115.7	115.7	115.7
A-max 26	162-168	HED_ 5540	363/365	89.7	99.6	99.6	106.3	106.3	113.0	113.0	113.0	119.7	119.7	119.7	119.7
RE-max 29	183-186			71.3	81.2	81.2	87.9	87.9	94.6	94.6	94.6	101.3	101.3	101.3	101.3
RE-max 29	184/186	MR	355	80.1	90.0	90.0	96.7	96.7	103.4	103.4	103.4	110.1	110.1	110.1	110.1

Planetary Gearhead GP 32 A ∅32 mm, 0.75–4.5 Nm





M 1:2

Technical Data

Planetary Gearhead	straight teeth
Output shaft	stainless steel
Shaft diameter as option	8 mm
Bearing at output	ball bearing
Radial play, 5 mm from flange	max. 0.14 mm
Axial play	max. 0.4 mm
Max. axial load (dynamic)	120 N
Max. force for press fits	120 N
Direction of rotation, drive to output	=
Max. continuous input speed	6000 rpm
Recommended temperature range	-40…+100°C

Number of stages	1	2	3	4	5
Max. radial load, 10 mm from flange	90 N	140 N	200 N	220 N	220 N

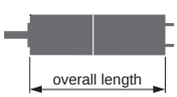
Option: Low-noise version

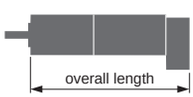
maxon gear

Stock program
Standard program
Special program (on request)

Part Numbers	166155	166158	166163	166164	166169	166174	166179	166184	166187	166192	166197	166202
Gearhead Data												
1 Reduction	3.7:1	14:1	33:1	51:1	111:1	246:1	492:1	762:1	1181:1	1972:1	2829:1	4380:1
2 Absolute reduction	26/7	676/49	529/16	17576/343	13824/125	421824/1715	86112/175	19044/25	10123776/8575	8626176/4375	495144/175	109503/25
3 Max. motor shaft diameter mm	6	6	3	6	4	4	3	3	4	4	3	3
Part Numbers	**166156**	**166159**		**166165**	166170	166175	**166180**	166185	166188	166193	166198	166203
1 Reduction	4.8:1	18:1		66:1	123:1	295:1	531:1	913:1	1414:1	2189:1	3052:1	5247:1
2 Absolute reduction	24/5	624/35		16224/245	6877/56	101062/343	331776/625	36501/40	2425488/1715	536406/245	1907712/625	839523/160
3 Max. motor shaft diameter mm	4	4		4	3	3	4	3	3	3	3	3
Part Numbers	166157	166160		166166	166171	**166176**	166181	166186	166189	166194	166199	166204
1 Reduction	5.8:1	21:1		79:1	132:1	318:1	589:1	1093:1	1526:1	2362:1	3389:1	6285:1
2 Absolute reduction	23/4	299/14		3887/49	3312/25	38976/1225	20631/35	279841/256	9345024/6125	2066688/875	474513/140	6436343/1024
3 Max. motor shaft diameter mm	3	3		3	3	4	3	3	4	3	3	3
Part Numbers		**166161**		**166167**	166172	166177	166182		166190	166195	166200	
1 Reduction		23:1		86:1	159:1	411:1	636:1		1694:1	2548:1	3656:1	
2 Absolute reduction		576/25		14976/175	1587/10	359424/875	79488/125		1162213/686	7962624/3125	457056/125	
3 Max. motor shaft diameter mm		4		4	3	4	3		3	4	3	
Part Numbers		166162		166168	166173	166178	166183		166191	166196	166201	
1 Reduction		28:1		103:1	190:1	456:1	706:1		1828:1	2623:1	4060:1	
2 Absolute reduction		138/5		3588/35	12167/64	89401/196	158171/224		2238912/1225	2056223/784	3637933/896	
3 Max. motor shaft diameter mm		3		3	3	3	3		3	3	3	
4 Number of stages	1	2	2	3	3	4	4	4	5	5	5	5
5 Max. continuous torque Nm	0.75	2.25	2.25	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
6 Max. intermittent torque at gear output Nm	1.1	3.4	3.4	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
7 Max. efficiency %	80	75	75	70	70	60	60	60	50	50	50	50
8 Weight g	118	162	162	194	194	226	226	226	258	258	258	258
9 Average backlash no load °	0.7	0.8	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
10 Mass inertia gcm²	1.5	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
11 Gearhead length L1* mm	26.5	36.4	36.4	43.1	43.1	49.8	49.8	49.8	56.5	56.5	56.5	56.5

*for EC 32 flat L1 is + 2.0 mm

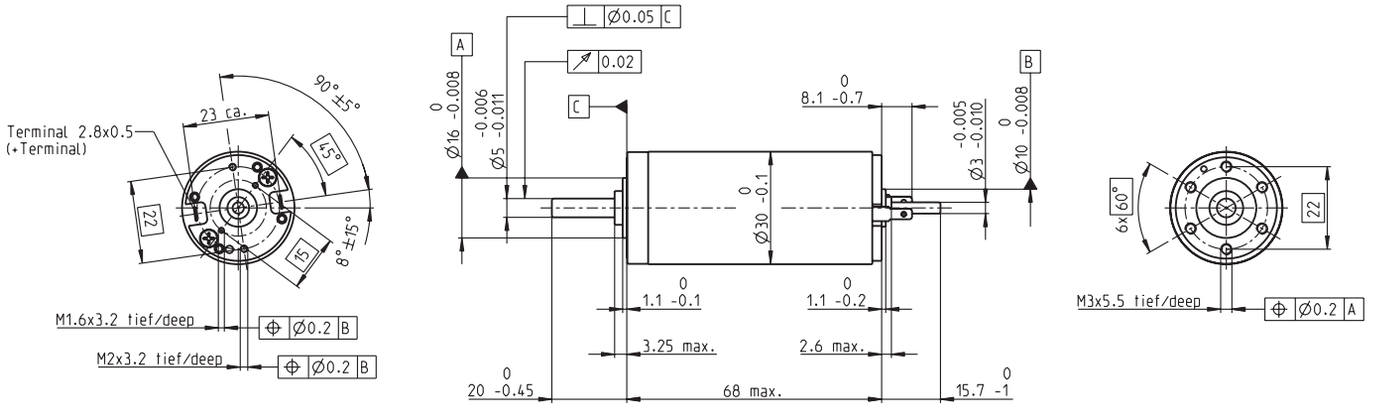




maxon Modular System

+ Motor	Page	+ Sensor/Brake	Page	Overall length [mm] = Motor length + gearhead length + (sensor/brake) + assembly parts												
RE 30, 15 W	138			94.6	104.5	104.5	111.2	111.2	117.9	117.9	117.9	124.6	124.6	124.6	124.6
RE 30, 15 W	138	MR	356	106.0	115.9	115.9	122.6	122.6	129.3	129.3	129.3	136.0	136.0	136.0	136.0
RE 30, 15 W	138	HED_ 5540	362/364	115.4	125.3	125.3	132.0	132.0	138.7	138.7	138.7	145.4	145.4	145.4	145.4
RE 30, 60 W	139			94.6	104.5	104.5	111.2	111.2	117.9	117.9	117.9	124.6	124.6	124.6	124.6
RE 30, 60 W	139	MR	356	106.0	115.9	115.9	122.6	122.6	129.3	129.3	129.3	136.0	136.0	136.0	136.0
RE 30, 60 W	139	HED_ 5540	362/364	115.4	125.3	125.3	132.0	132.0	138.7	138.7	138.7	145.4	145.4	145.4	145.4
RE 35, 90 W	140			97.6	107.5	107.5	114.2	114.2	120.9	120.9	120.9	127.6	127.6	127.6	127.6
RE 35, 90 W	140	MR	356	109.0	118.9	118.9	125.6	125.6	132.3	132.3	132.3	139.0	139.0	139.0	139.0
RE 35, 90 W	140	HED_ 5540	362/364	118.3	128.2	128.2	134.9	134.9	141.6	141.6	141.6	148.3	148.3	148.3	148.3
RE 35, 90 W	140	DCT 22	373	115.7	125.6	125.6	132.3	132.3	139.0	139.0	139.0	145.7	145.7	145.7	145.7
RE 35, 90 W	140	AB 28	408	133.7	143.6	143.6	150.3	150.3	157.0	157.0	157.0	163.7	163.7	163.7	163.7
RE 35, 90 W	140	HEDS 5540/AB 28	362/408	150.9	160.8	160.8	167.5	167.5	174.2	174.2	174.2	180.9	180.9	180.9	180.9
A-max 32	169/171			89.5	99.4	99.4	106.1	106.1	112.8	112.8	112.8	119.5	119.5	119.5	119.5
A-max 32	170/172			88.1	98.0	98.0	104.7	104.7	111.4	111.4	111.4	118.1	118.1	118.1	118.1
A-max 32	170/172	MR	356	99.3	109.2	109.2	115.9	115.9	122.6	122.6	122.6	129.3	129.3	129.3	129.3
A-max 32	170/172	HED_ 5540	363/365	108.9	118.8	118.8	125.5	125.5	132.2	132.2	132.2	138.9	138.9	138.9	138.9
EC 32, 80 W	214			86.6	96.5	96.5	103.2	103.2	109.9	109.9	109.9	116.6	116.6	116.6	116.6
EC 32, 80 W	214	HED_ 5540	363/366	105.0	114.9	114.9	121.6	121.6	128.3	128.3	128.3	135.0	135.0	135.0	135.0
EC 32, 80 W	214	Res 26	374	106.7	116.6	116.6	123.3	123.3	130.0	130.0	130.0	136.7	136.7	136.7	136.7
EC 32 flat, 15 W	258			44.5	54.4	54.4	61.1	61.1	67.8	67.8	67.8	74.5	74.5	74.5	74.5
EC 32 flat, IE, IP 00	259			54.6	64.5	64.5	71.2	71.2	77.9	77.9	77.9	84.6	84.6	84.6	84.6
EC 32 flat, IE, IP 40	259			56.3	66.2	66.2	72.9	72.9	79.6	79.6	79.6	86.3	86.3	86.3	86.3

RE 30 ∅30 mm, Graphite Brushes, 60 Watt



M 1:2

Stock program
Standard program
Special program (on request)

Part Numbers

according to dimensional drawing	310005	310006	**310007**	310008	**310009**
shaft length 15.7 shortened to 8.7 mm	268193	268213	268214	268215	268216

Motor Data

	Values at nominal voltage								
1	Nominal voltage	V	12	18	24	36	48		
2	No load speed	rpm	8170	8590	8810	8590	8490		
3	No load current	mA	301	213	165	106	78.6		
4	Nominal speed	rpm	7630	7910	8050	7840	7760		
5	Nominal torque (max. continuous torque)	mNm	51.6	75.5	85.6	86.6	89.7		
6	Nominal current (max. continuous current)	A	4	4	3.47	2.28	1.74		
7	Stall torque	mNm	853	1000	1020	1000	1050		
8	Stall current	A	61.1	50.3	39.3	25.2	19.6		
9	Max. efficiency	%	85	87	87	87	88		
	Characteristics								
10	Terminal resistance	Ω	0.196	0.358	0.611	1.43	2.45		
11	Terminal inductance	mH	0.034	0.07	0.119	0.281	0.513		
12	Torque constant	mNm/A	13.9	19.9	25.9	39.8	53.8		
13	Speed constant	rpm/V	685	479	369	240	178		
14	Speed / torque gradient	rpm/mNm	9.64	8.61	8.7	8.61	8.09		
15	Mechanical time constant	ms	3.4	3.24	3.05	2.98	2.94		
16	Rotor inertia	gcm²	33.7	35.9	33.5	33.1	34.7		

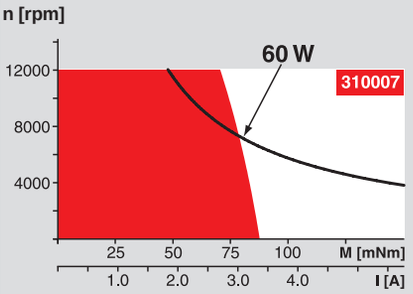
Specifications

	Thermal data	
17	Thermal resistance housing-ambient	6.0 K/W
18	Thermal resistance winding-housing	1.7 K/W
19	Thermal time constant winding	16.3 s
20	Thermal time constant motor	593 s
21	Ambient temperature	-30…+100°C
22	Max. winding temperature	+125°C
	Mechanical data (ball bearings)	
23	Max. speed	12000 rpm
24	Axial play	0.05 - 0.15 mm
25	Radial play	0.025 mm
26	Max. axial load (dynamic)	5.6 N
27	Max. force for press fits (static)	110 N
	(static, shaft supported)	1200 N
28	Max. radial load, 5 mm from flange	28 N
	Other specifications	
29	Number of pole pairs	1
30	Number of commutator segments	13
31	Weight of motor	260 g

Values listed in the table are nominal.
Explanation of the figures on page 107.

Option
Preloaded ball bearings

Operating Range



Comments

Continuous operation
In observation of above listed thermal resistance (lines 17 and 18) the maximum permissible winding temperature will be reached during continuous operation at 25°C ambient.
= Thermal limit.

Short term operation
The motor may be briefly overloaded (recurring).

Assigned power rating

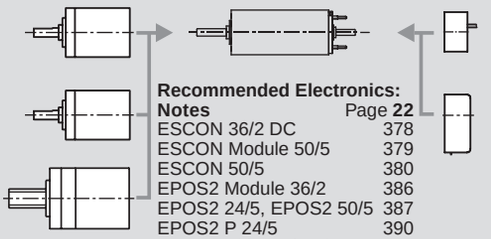
maxon Modular System

Overview on page 20–25

Planetary Gearhead
∅32 mm
0.75 - 6.0 Nm
Page 303–309

Koaxdrive
∅32 mm
1.0 - 4.5 Nm
Page 312

Spindle Drive
∅32 mm
Page 334–336



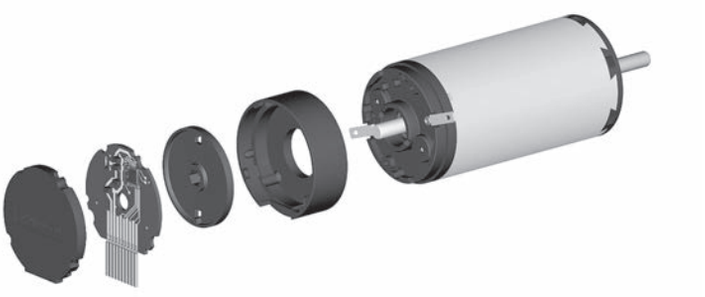
Recommended Electronics:

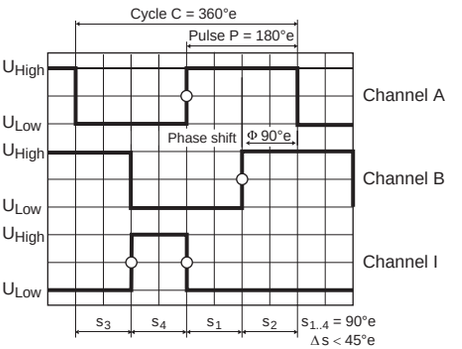
Notes	Page **22**
ESCON 36/2 DC	378
ESCON Module 50/5	379
ESCON 50/5	380
EPOS2 Module 36/2	386
EPOS2 24/5, EPOS2 50/5	387
EPOS2 P 24/5	390
EPOS3 70/10 EtherCAT	393
MAXPOS 50/5	396

Encoder MR
256 - 1024 CPT,
3 channels
Page 356

Encoder HED_ 5540
500 CPT,
3 channels
Page 362/364

Encoder MR Type L, 256–1024 CPT, 3 Channels, with Line Driver

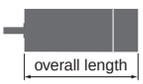


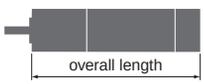


Direction of rotation cw (definition cw p. 106)

Stock program
Standard program
Special program (on request)

Part Numbers	225783	228452	225785	228456	225787
Type					
Counts per turn	256	500	512	1000	1024
Number of channels	3	3	3	3	3
Max. operating frequency (kHz)	80	200	160	200	320
Max. speed (rpm)	18750	24000	18750	12000	18750





maxon Modular System

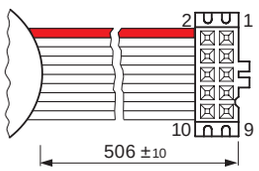
+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead				
RE 30, 15 W	138					79.4	79.4	79.4	79.4	79.4
RE 30, 15 W	138	GP 32, 0.75 - 4.5 Nm	305			●	●	●	●	●
RE 30, 60 W	139					79.4	79.4	79.4	79.4	79.4
RE 30, 60 W	139	GP 32, 0.75 - 4.5 Nm	303			●	●	●	●	●
RE 30, 60 W	139	GP 32, 0.75 - 6.0 Nm	305-309			●	●	●	●	●
RE 30, 60 W	139	GP 32 S	334-336			●	●	●	●	●
RE 35, 90 W	140					82.4	82.4	82.4	82.4	82.4
RE 35, 90 W	140	GP 32, 0.75 - 4.5 Nm	303			●	●	●	●	●
RE 35, 90 W	140	GP 32, 0.75 - 6.0 Nm	305-309			●	●	●	●	●
RE 35, 90 W	140	GP 32, 4.0 - 8.0 Nm	310			●	●	●	●	●
RE 35, 90 W	140	GP 42, 3 - 15 Nm	314			●	●	●	●	●
RE 35, 90 W	140	GP 32 S	334-336			●	●	●	●	●
RE 40, 25 W	141					82.4	82.4	82.4	82.4	82.4
RE 40, 150 W	142					82.4	82.4	82.4	82.4	82.4
RE 40, 150 W	142	GP 42, 3 - 15 Nm	314			●	●	●	●	●
RE 40, 150 W	142	GP 52, 4 - 30 Nm	318			●	●	●	●	●
A-max 32	170/172					72.7	72.7	72.7	72.7	72.7
A-max 32	170/172	GP 32, 0.75 - 6.0 Nm	305-308			●	●	●	●	●
A-max 32	170/172	GS 38, 0.1 - 0.6 Nm	313			●	●	●	●	●
A-max 32	170/172	GP 32 S	334-336			●	●	●	●	●
EC-max 40, 70 W	228					73.9	73.9	73.9	73.9	73.9
EC-max 40, 70 W	228	GP 42, 3 - 15 Nm	315			●	●	●	●	●
EC-max 40, 120 W	229					103.9	103.9	103.9	103.9	103.9
EC-max 40, 120 W	229	GP 52, 4 - 30 Nm	319			●	●	●	●	●

Technical Data

Supply voltage V_{CC}	5 V ± 5%
Output signal	TTL compatible
Phase shift Φ	90°e ± 45°e
Index pulse width	90°e ± 45°e
Operating temperature range	-25…+85 °C
Moment of inertia of code wheel	≤ 1.7 gcm²
Output current per channel	max. 5 mA

The index signal I is synchronized with channel A or B.

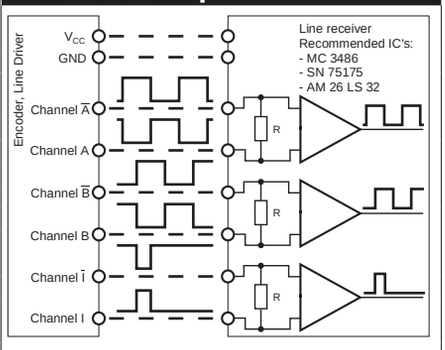
Pin Allocation



1	N.C.
2	V_{CC}
3	GND
4	N.C.
5	Channel $\overline{A}$
6	Channel A
7	Channel $\overline{B}$
8	Channel B
9	Channel $\overline{I}$ (Index)
10	Channel I (Index)

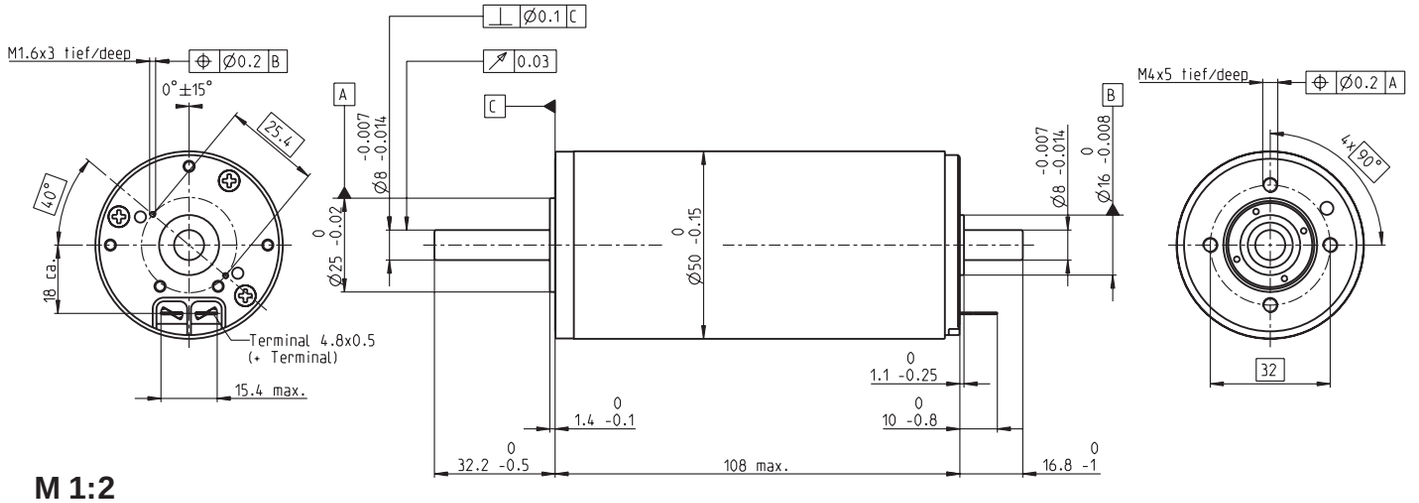
DIN Connector 41651/
EN 60603-13
flat band cable AWG 28

Connection example



Opt. terminal resistance R > 1 kΩ

RE 50 ∅50 mm, Graphite Brushes, 200 Watt



M 1:2

Stock program
Standard program
Special program (on request)

Part Numbers

	370354	370355	370356	370357
Industrial Version IP54*	389089	389090	389091	389092

Motor Data

	Values at nominal voltage					
1	Nominal voltage	V	24	36	48	70
2	No load speed	rpm	5950	5680	4900	2760
3	No load current	mA	236	147	88.4	27.4
4	Nominal speed	rpm	5680	5420	4620	2470
5	Nominal torque (max. continuous torque)	mNm	405	418	420	452
6	Nominal current (max. continuous current)	A	10.8	7.07	4.58	1.89
7	Stall torque	mNm	8920	8920	7370	4340
8	Stall current	A	232	148	78.9	17.9
9	Max. efficiency	%	94	94	94	92
	Characteristics					
10	Terminal resistance	Ω	0.103	0.244	0.608	3.9
11	Terminal inductance	mH	0.072	0.177	0.423	2.83
12	Torque constant	mNm/A	38.5	60.4	93.4	242
13	Speed constant	rpm/V	248	158	102	39.5
14	Speed / torque gradient	rpm/mNm	0.668	0.638	0.666	0.638
15	Mechanical time constant	ms	3.75	3.74	3.78	3.74
16	Rotor inertia	gcm²	536	560	542	560

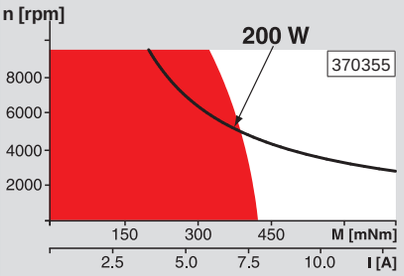
Specifications

	Thermal data		
17	Thermal resistance housing-ambient		3.8 K/W
18	Thermal resistance winding-housing		1.2 K/W
19	Thermal time constant winding		71.7 s
20	Thermal time constant motor		1370 s
21	Ambient temperature		-30…+100°C
22	Max. winding temperature		+125°C
	Mechanical data		
	(preloaded ball bearings)		
23	Max. speed		9500 rpm
24	Axial play at axial load	< 11.5 N	0 mm
		> 11.5 N	0.1 mm
25	Radial play		preloaded
26	Max. axial load (dynamic)		30 N
27	Max. force for press fits (static)		150 N
	(static, shaft supported)		6000 N
28	Max. radial load, 15 mm from flange		110 N
	Other specifications		
29	Number of pole pairs		1
30	Number of commutator segments		15
31	Weight of motor		1100 g

Values listed in the table are nominal.
Explanation of the figures on page 107.

* Industrial version with radial shaft seal ring (resulting in increased no load current). IP54 protection only if mounted on brush side, in compliance with maxon modular system.

Operating Range



Comments

Continuous operation
In observation of above listed thermal resistance (lines 17 and 18) the maximum permissible winding temperature will be reached during continuous operation at 25°C ambient.
= Thermal limit.

Short term operation
The motor may be briefly overloaded (recurring).

Assigned power rating

maxon Modular System

Overview on page 20–25

Planetary Gearhead
∅52 mm
4 - 30 Nm
Page 318

Planetary Gearhead
∅62 mm
8 - 50 Nm
Page 320

Recommended Electronics:

Notes	Page 22
ESCON Mod. 50/5	379
ESCON 50/5	380
ESCON 70/10	380
EPOS2 50/5	387
EPOS2 70/10	387
EPOS3 70/10 EtherCAT	393
MAXPOS 50/5	396

Encoder HEDS 5540
500 CPT,
3 channels
Page 363

Encoder HEDL 5540
500 CPT,
3 channels
Page 365

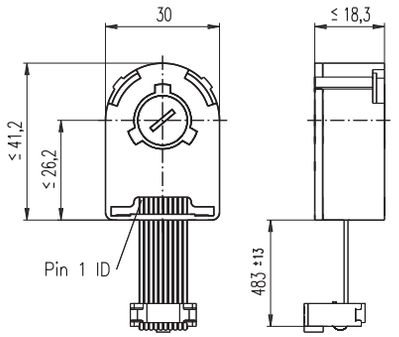
Industrial Version IP54*

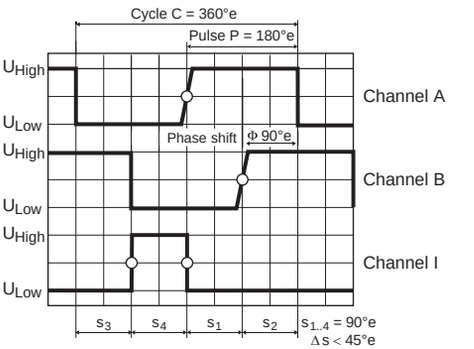
Encoder HEDL 9140
Page 369

Brake AB 44
Page 412

End cap
Page 413

Encoder HEDL 5540 500 CPT, 3 Channels, with Line Driver RS 422

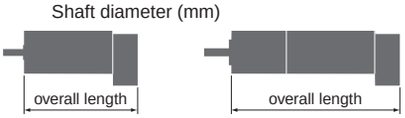




Direction of rotation cw (definition cw p. 106)

Stock program
Standard program
Special program (on request)

Part Numbers	110512	110514	110516
Type			
Counts per turn	500	500	500
Number of channels	3	3	3
Max. operating frequency (kHz)	100	100	100
Max. speed (rpm)	12000	12000	12000
Shaft diameter (mm)	3	4	6



maxon Modular System

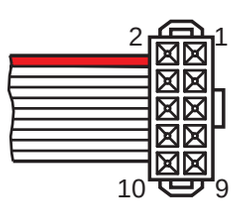
+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead					
RE 25	135/137					75.3					
RE 25	135/137	GP 26/GP 32	301/303			●					
RE 25	135/137	KD 32, 1.0 - 4.5 Nm	312			●					
RE 25	135/137	GP 32, 0.75 - 6.0 Nm	304/307			●					
RE 25	135/137	GP 32 S	334-336			●					
RE 25, 20 W	136					63.8					
RE 25, 20 W	136	GP 26/GP 32	301/303			●					
RE 25, 20 W	136	KD 32, 1.0 - 4.5 Nm	312			●					
RE 25, 20 W	136	GP 32, 0.75 - 6.0 Nm	304/307			●					
RE 25, 20 W	136	GP 32 S	334-336			●					
RE 25, 20 W	136			AB 28	408	94.3					
RE 25, 20 W	136	GP 26/GP 32	301/303	AB 28	408	●					
RE 25, 20 W	136	KD 32, 1.0 - 4.5 Nm	312	AB 28	408	●					
RE 25, 20 W	136	GP 32, 0.75 - 6.0 Nm	304/307	AB 28	408	●					
RE 25, 20 W	136	GP 32 S	334-336	AB 28	408	●					
RE 25, 20 W	137			AB 28	408	105.8					
RE 25, 20 W	137	GP 26/GP 32	301/303	AB 28	408	●					
RE 25, 20 W	137	KD 32, 1.0 - 4.5 Nm	312	AB 28	408	●					
RE 25, 20 W	137	GP 32, 0.75 - 6.0 Nm	304/307	AB 28	408	●					
RE 25, 20 W	137	GP 32 S	334-336	AB 28	408	●					
RE 30, 15 W	138					88.8					
RE 30, 15 W	138	GP 32, 0.75 - 4.5 Nm	305			●					
RE 30, 60 W	139					88.8					
RE 30, 60 W	139	GP 32, 0.75 - 6.0 Nm	303-309			●					
RE 30, 60 W	139	KD 32, 1.0 - 4.5 Nm	312			●					
RE 30, 60 W	139	GP 32 S	334-336			●					
RE 35, 90 W	140						91.7				
RE 35, 90 W	140	GP 32, 0.75 - 8.0 Nm	303-310				●				
RE 35, 90 W	140	GP 42, 3.0 - 15 Nm	314				●				
RE 35, 90 W	140	GP 32 S	334-336				●				
RE 35, 90 W	140			AB 28	408	124.3					
RE 35, 90 W	140	GP 32, 0.75 - 8.0 Nm	303-310	AB 28	408	●					
RE 35, 90 W	140	GP 42, 3.0 - 15 Nm	314	AB 28	408	●					
RE 35, 90 W	140	GP 32 S	334-336	AB 28	408	●					

Technical Data

Supply voltage V_{CC}	5 V ± 10%
Output signal	EIA Standard RS 422
driver used:	DS26LS31
Phase shift Φ	90°e ± 45°e
Signal rise time (typically, at C_L = 25 pF, R_L = 2.7 kΩ, 25 °C)	180 ns
Signal fall time (typically, at C_L = 25 pF, R_L = 2.7 kΩ, 25 °C)	40 ns
Index pulse width	90°e
Operating temperature range	-40...+100 °C
Moment of inertia of code wheel	≤ 0.6 gcm²
Max. angular acceleration	250000 rad s⁻²
Output current per channel	min. -20 mA, max. 20 mA
Option	1000 Counts per turn, 2 Channels

The index signal I is synchronized with channel A or B.

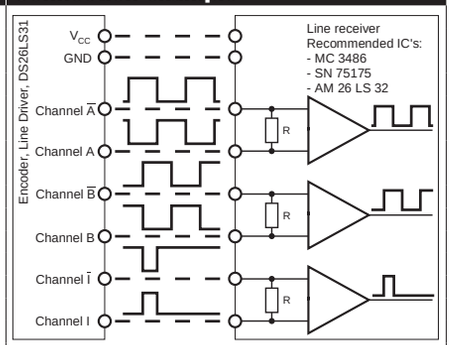
Pin Allocation



1	N.C.
2	V_{CC}
3	GND
4	N.C.
5	Channel $\overline{A}$
6	Channel A
7	Channel $\overline{B}$
8	Channel B
9	Channel $\overline{I}$ (Index)
10	Channel I (Index)

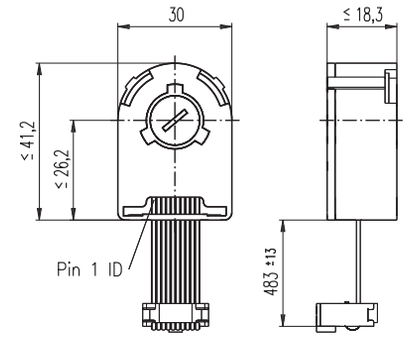
Pin type DIN 41651/
EN 60603-13
flat band cable AWG 28

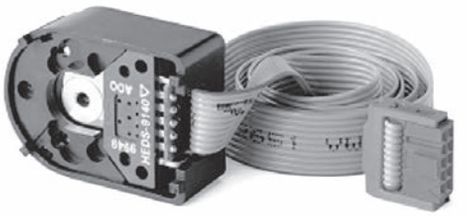
Connection example

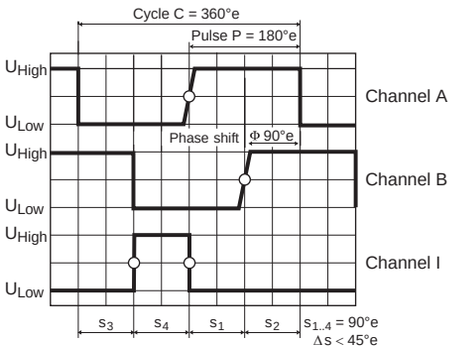


Terminal resistance R = typical 120 Ω

Encoder HEDL 5540 500 CPT, 3 Channels, with Line Driver RS 422



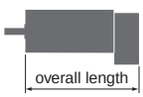


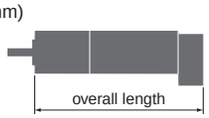


Direction of rotation cw (definition cw p. 106)

Stock program
Standard program
Special program (on request)

Part Numbers	110512	110514	110516	110518
Type				
Counts per turn	500	500	500	500
Number of channels	3	3	3	3
Max. operating frequency (kHz)	100	100	100	100
Max. speed (rpm)	12000	12000	12000	12000
Shaft diameter (mm)	3	4	6	8





maxon Modular System

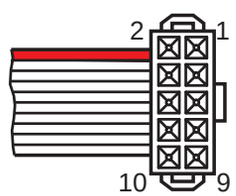
+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead			
RE 40, 25 W	141						91.7		
RE 40, 150 W	142						91.7		
RE 40, 150 W	142	GP 42, 3.0 - 15 Nm	314				●		
RE 40, 150 W	142	GP 52, 4.0 - 30 Nm	318				●		
RE 40, 150 W	142			AB 28	408	124.3			
RE 40, 150 W	142	GP 42, 3.0 - 15 Nm	314	AB 28	408	●			
RE 40, 150 W	142	GP 52, 4.0 - 30 Nm	318	AB 28	408	●			
RE 50, 200 W	143								128.7
RE 50, 200 W	143	GP 52, 4 - 30 Nm	319						●
RE 50, 200 W	143	GP 62, 8 - 50 Nm	320						●
RE 65, 250 W	144								157.3
RE 65, 250 W	144	GP 81, 20 - 120 Nm	321						●
A-max 26	162-168					63.1			
A-max 26	162-168	GP 26, 0.75 - 4.5 Nm	301			●			
A-max 26	162-168	GS 30/GP 32	302/305			●			
A-max 26	162-168	GP 32, 0.75 - 6.0 Nm	304/308			●			
A-max 26	162-168	GS 38, 0.1 - 0.6 Nm	313			●			
A-max 26	162-168	GP 32 S	334-336			●			
A-max 32	170/172						82.3		
A-max 32	170/172	GP 32, 0.75 - 6.0 Nm	303-308				●		
A-max 32	170/172	GS 38, 0.1 - 0.6 Nm	313				●		
A-max 32	170/172	GP 32 S	334-336				●		

Technical Data

Supply voltage V_{CC}	5 V ± 10%
Output signal	EIA Standard RS 422
driver used:	DS26LS31
Phase shift Φ	90°e ± 45°e
Signal rise time (typically, at C_L = 25 pF, R_L = 2.7 kΩ, 25 °C)	180 ns
Signal fall time (typically, at C_L = 25 pF, R_L = 2.7 kΩ, 25 °C)	40 ns
Index pulse width	90°e
Operating temperature range	-40…+100 °C
Moment of inertia of code wheel	≤ 0.6 gcm²
Max. angular acceleration	250000 rad s^{-2}
Output current per channel	min. -20 mA, max. 20 mA
Option	1000 Counts per turn, 2 Channels

The index signal I is synchronized with channel A or B.

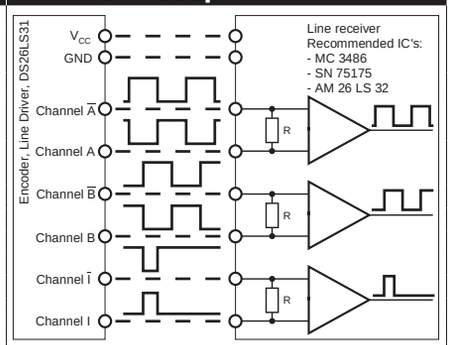
Pin Allocation



1	N.C.
2	V_{CC}
3	GND
4	N.C.
5	Channel $\overline{A}$
6	Channel A
7	Channel $\overline{B}$
8	Channel B
9	Channel $\overline{I}$ (Index)
10	Channel I (Index)

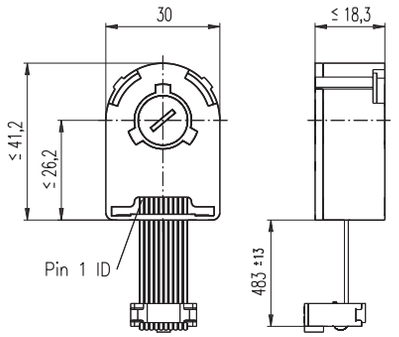
Pin type DIN 41651/
EN 60603-13
flat band cable AWG 28

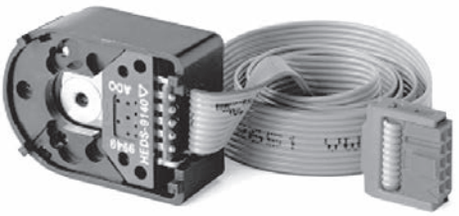
Connection example

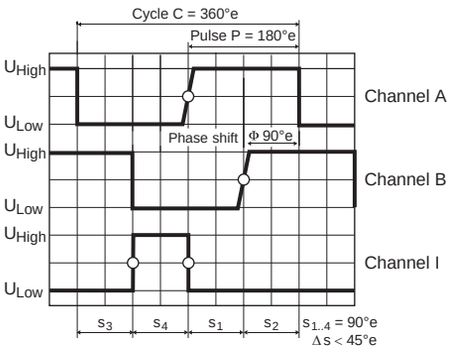


Terminal resistance R = typical 120 Ω

Encoder HEDL 5540 500 CPT, 3 Channels, with Line Driver RS 422



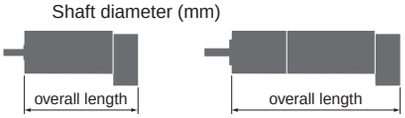




Direction of rotation cw (definition cw p. 106)

Stock program
Standard program
Special program (on request)

Part Numbers	110512	110514	110516
Type			
Counts per turn	500	500	500
Number of channels	3	3	3
Max. operating frequency (kHz)	100	100	100
Max. speed (rpm)	12000	12000	12000
Shaft diameter (mm)	3	4	6



maxon Modular System

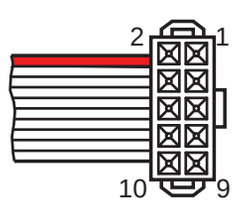
+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead		
EC 32, 80 W	214					78.4		
EC 32, 80 W	214	GP 32, 0.75 - 6.0 Nm	303-309			●		
EC 32, 80 W	214	GP 32 S	334-336			●		
EC 40, 170 W	215						103.4	
EC 40, 170 W	215	GP 42, 3.0 - 15 Nm	314				●	
EC 40, 170 W	215	GP 52, 4.0 - 30 Nm	318				●	
EC-max 30, 40 W	226					62.6		
EC-max 30, 40 W	226	GP 32, 1.0 - 8.0 Nm	308/310			●		
EC-max 30, 40 W	226	KD 32, 1.0 - 4.5 Nm	312			●		
EC-max 30, 40 W	226	GP 32 S	334-336			●		
EC-max 30, 40 W	226			AB 20	406	98.4		
EC-max 30, 40 W	226	GP 32, 1.0 - 8.0 Nm	308/310	AB 20	406	●		
EC-max 30, 40 W	226	KD 32, 1.0 - 4.5 Nm	312	AB 20	406	●		
EC-max 30, 40 W	226	GP 32 S	334-336	AB 20	406	●		
EC-max 30, 60 W	227					84.6		
EC-max 30, 60 W	227	GP 32, 1.0 - 8.0 Nm	308/310			●		
EC-max 30, 60 W	227	KD 32, 1.0 - 4.5 Nm	312			●		
EC-max 30, 60 W	227	GP 42, 3 - 15 Nm	315			●		
EC-max 30, 60 W	227			AB 20	406	120.4		
EC-max 30, 60 W	227	GP 32, 1.0 - 8.0 Nm	308/310	AB 20	406	●		
EC-max 30, 60 W	227	KD 32, 1.0 - 4.5 Nm	312	AB 20	406	●		
EC-max 30, 60 W	227	GP 42, 3 - 15 Nm	315	AB 20	406	●		
EC-max 40, 70 W	228						81.4	
EC-max 40, 70 W	228	GP 42, 3 - 15 Nm	315				●	
EC-max 40, 70 W	228			AB 28	407		110.7	
EC-max 40, 70 W	228	GP 42, 3 - 15 Nm	315	AB 28	407		●	
EC-max 40, 120 W	229						111.4	
EC-max 40, 120 W	229	GP 52, 4 - 30 Nm	319				●	
EC-max 40, 120 W	229			AB 28	407		140.7	
EC-max 40, 120 W	229	GP 52, 4 - 30 Nm	319	AB 28	407		●	

Technical Data

Supply voltage V_{CC}	5 V ± 10%
Output signal	EIA Standard RS 422
driver used:	DS26LS31
Phase shift Φ	90°e ± 45°e
Signal rise time (typically, at C_L = 25 pF, R_L = 2.7 kΩ, 25 °C)	180 ns
Signal fall time (typically, at C_L = 25 pF, R_L = 2.7 kΩ, 25 °C)	40 ns
Index pulse width	90°e
Operating temperature range	-40...+100 °C
Moment of inertia of code wheel	≤ 0.6 gcm²
Max. angular acceleration	250000 rad s⁻²
Output current per channel	min. -20 mA, max. 20 mA
Option	1000 Counts per turn, 2 Channels

The index signal I is synchronized with channel A or B.

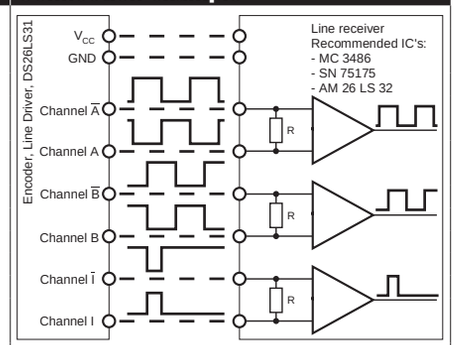
Pin Allocation



1	N.C.
2	V_{CC}
3	GND
4	N.C.
5	Channel $\overline{A}$
6	Channel A
7	Channel $\overline{B}$
8	Channel B
9	Channel $\overline{I}$ (Index)
10	Channel I (Index)

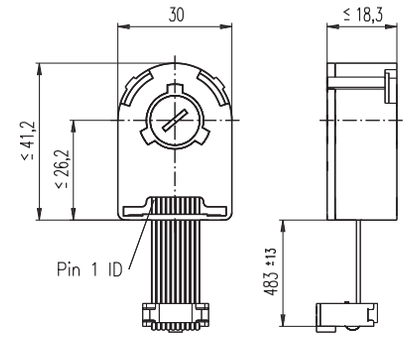
Pin type DIN 41651/
EN 60603-13
flat band cable AWG 28

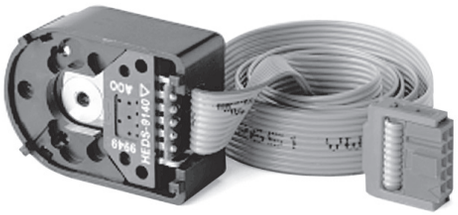
Connection example

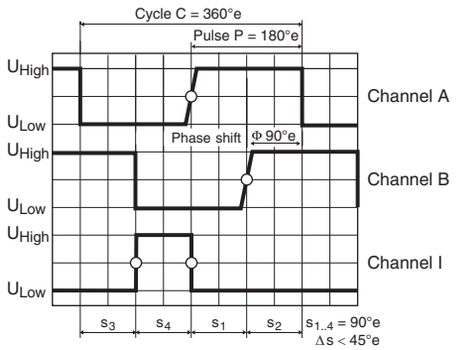


Terminal resistance R = typical 120 Ω

Encoder HEDL 5540 500 CPT, 3 Channels, with Line Driver RS 422



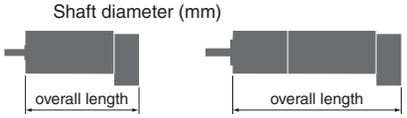




Direction of rotation cw (definition cw p. 106)

Stock program
Standard program
Special program (on request)

Part Numbers	110512	110514	110516	X drives
Type				
Counts per turn	500	500	500	500
Number of channels	3	3	3	3
Max. operating frequency (kHz)	100	100	100	100
Max. speed (rpm)	12000	12000	12000	12000
Shaft diameter (mm)	3	4	6	2–4



maxon Modular System

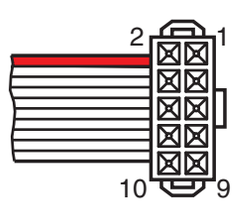
+ Motor	Page	+ Gearhead	Page	+ Brake	Page	Overall length [mm] / ● see Gearhead			
EC-4pole 22, 90 W	233					70.1			
EC-4pole 22, 90 W	233	GP 22/GP 32	297/308			●			
EC-4pole 22, 90 W	233	GP 32 S	334-336			●			
EC-4pole 22, 120 W	234					87.5			
EC-4pole 22, 120 W	234	GP 22/GP 32	297/308			●			
EC-4pole 22, 120 W	234	GP 32 S	334-336			●			
EC-4pole 30, 100 W	235						67.6		
EC-4pole 30, 100 W	235	GP 32, 4.0 - 8.0 Nm	310				●		
EC-4pole 30, 100 W	235	GP 42, 3 - 15 Nm	315				●		
EC-4pole 30, 100 W	235			AB 20	406		104.0		
EC-4pole 30, 100 W	235	GP 32, 4.0 - 8.0 Nm	310	AB 20	406		●		
EC-4pole 30, 100 W	235	GP 42, 3 - 15 Nm	315	AB 20	406		●		
EC-4pole 30, 200 W	237						84.6		
EC-4pole 30, 200 W	237	GP 32, 4.0 - 8.0 Nm	310				●		
EC-4pole 30, 200 W	237	GP 42, 3 - 15 Nm	315				●		
EC-4pole 30, 200 W	237			AB 20	406		121.0		
EC-4pole 30, 200 W	237	GP 32, 4.0 - 8.0 Nm	310	AB 20	406		●		
EC-4pole 30, 200 W	237	GP 42, 3 - 15 Nm	315	AB 20	406		●		
EC-i 40, 50 W	243/244							49.0	
EC-i 40, 50 W	243	GP 32, 1 - 6 Nm	308					●	
EC-i 40, 50 W	243/244	GP 42, 3 - 15 Nm	315					●	
EC-i 40, 50 W	243	GP 32 S	334-336					●	
EC-i 40, 70 W	245/246							59.0	
EC-i 40, 70 W	245	GP 32, 1 - 6 Nm	308					●	
EC-i 40, 70 W	245/246	GP 42, 3 - 15 Nm	315					●	
EC-i 40, 70 W	245	GP 32 S	334-336					●	
EC-i 40, 100 W	247							79.0	
EC-i 40, 100 W	247	GP 42, 3 - 15 Nm	315					●	
DCX 22 S	68-69								online
DCX 22 L	70-71								online
DCX 26 L	72-73								online
DCX 32 L	74								online
DCX 35 L	75								online

Technical Data

Supply voltage V_{CC}	5 V ± 10%
Output signal	EIA Standard RS 422
driver used:	DS26LS31
Phase shift Φ	90°e ± 45°e
Signal rise time (typically, at C_L = 25 pF, R_L = 2.7 kΩ, 25 °C)	180 ns
Signal fall time (typically, at C_L = 25 pF, R_L = 2.7 kΩ, 25 °C)	40 ns
Index pulse width	90°e
Operating temperature range	-40…+100 °C
Moment of inertia of code wheel	≤ 0.6 gcm²
Max. angular acceleration	250000 rad s^{-2}
Output current per channel	min. -20 mA, max. 20 mA
Option	1000 Counts per turn, 2 Channels

The index signal I is synchronized with channel A or B.

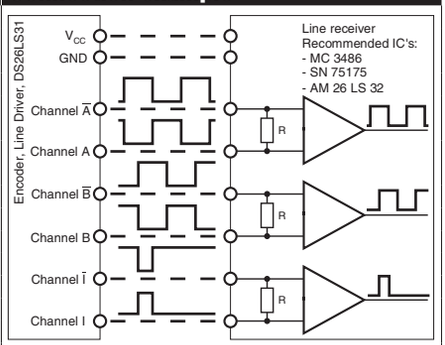
Pin Allocation



1	N.C.
2	V_{CC}
3	GND
4	N.C.
5	Channel $\overline{A}$
6	Channel A
7	Channel $\overline{B}$
8	Channel B
9	Channel $\overline{I}$ (Index)
10	Channel I (Index)

Pin type DIN 41651/
EN 60603-13
flat band cable AWG 28

Connection example



Terminal resistance R = typical 120 Ω

EPOS2 Positioning Controllers Summary

Online commanded

EPOS2 24/2
- Several device variations allows the operation of various maxon DC and EC micromotors up to 48 watts
- Point to point control (1 axis)
- Interpolated Position Mode (PVT)
- Combination of several drives via CAN Bus
- CANopen
- 6 digital inputs
- 2 digital outputs
- 2 analog inputs
- Miniaturized design

Details pages 384–386

Slave version (online commanded) using CAN Master (EPOS2 P, PC, PLC, SoftPLC, etc.) or PC via USB or RS232 interface

Typical applications:
- Small apparatus/appliances
- System automation tasks
- Drive technology

Part Numbers

EPOS2 24/2	**380264, 390003 390438**

Online commanded

EPOS2 Module 36/2
- DC and EC motors up to 72 W
- Point to point control unit (1 axis)
- Interpolated Position Mode (PVT)
- Combination of several drives via CAN Bus
- CANopen
- 6 digital inputs
- 3 digital outputs
- 2 analog inputs
- Miniaturized open electronics board (OEM)

Details pages 384–386

Slave version (online commanding) using CAN Master (EPOS2 P, PC, PLC, SoftPLC, µ-Processor, etc.) or PC via USB *) or RS232 interface

*) requires external transceiver

Typical applications:
- Small apparatus/appliances
- System automation tasks
- OEM customers

Part Number

EPOS2 Module 36/2	**360665**

Online commanded

EPOS2 24/5
- DC and EC motors up to 120 W
- Point to point control unit (1 axis)
- Interpolated Position Mode (PVT)
- Combination of several drives via CAN Bus
- CANopen
- 6 digital inputs
- 4 digital outputs
- 2 analog inputs
- Compact design

Details pages 384–387

Slave version (online commanding) using CAN Master (EPOS2 P, PC, PLC, SoftPLC, etc.) or PC via USB or RS232 interface

Typical applications:
- Tool building
- Production equipment
- System automation tasks

Part Number

EPOS2 24/5	**367676**

Online commanded

EPOS2 50/5
- DC and EC motors up to 250 W
- Point to point control unit (1 axis)
- Interpolated Position Mode (PVT)
- Combination of several drives via CAN Bus
- CANopen
- 11 digital inputs
- 5 digital outputs
- 2 analog inputs
- 1 analog output
- Compact design

Details pages 384–387

Slave version (online commanding) using CAN Master (EPOS2 P, PC, PLC, SoftPLC, etc.) or PC via USB or RS232 interface

Typical applications:
- Tool building
- Production equipment
- System automation tasks

Part Number

EPOS2 50/5	**347717**

Online commanded

EPOS2 70/10
- DC and EC motors up to 700 W
- Point to point control unit (1 axis)
- Interpolated Position Mode (PVT)
- Combination of several drives via CAN Bus
- CANopen
- 10 digital inputs
- 5 digital outputs
- 2 analog inputs
- Robust design

Details pages 384–387

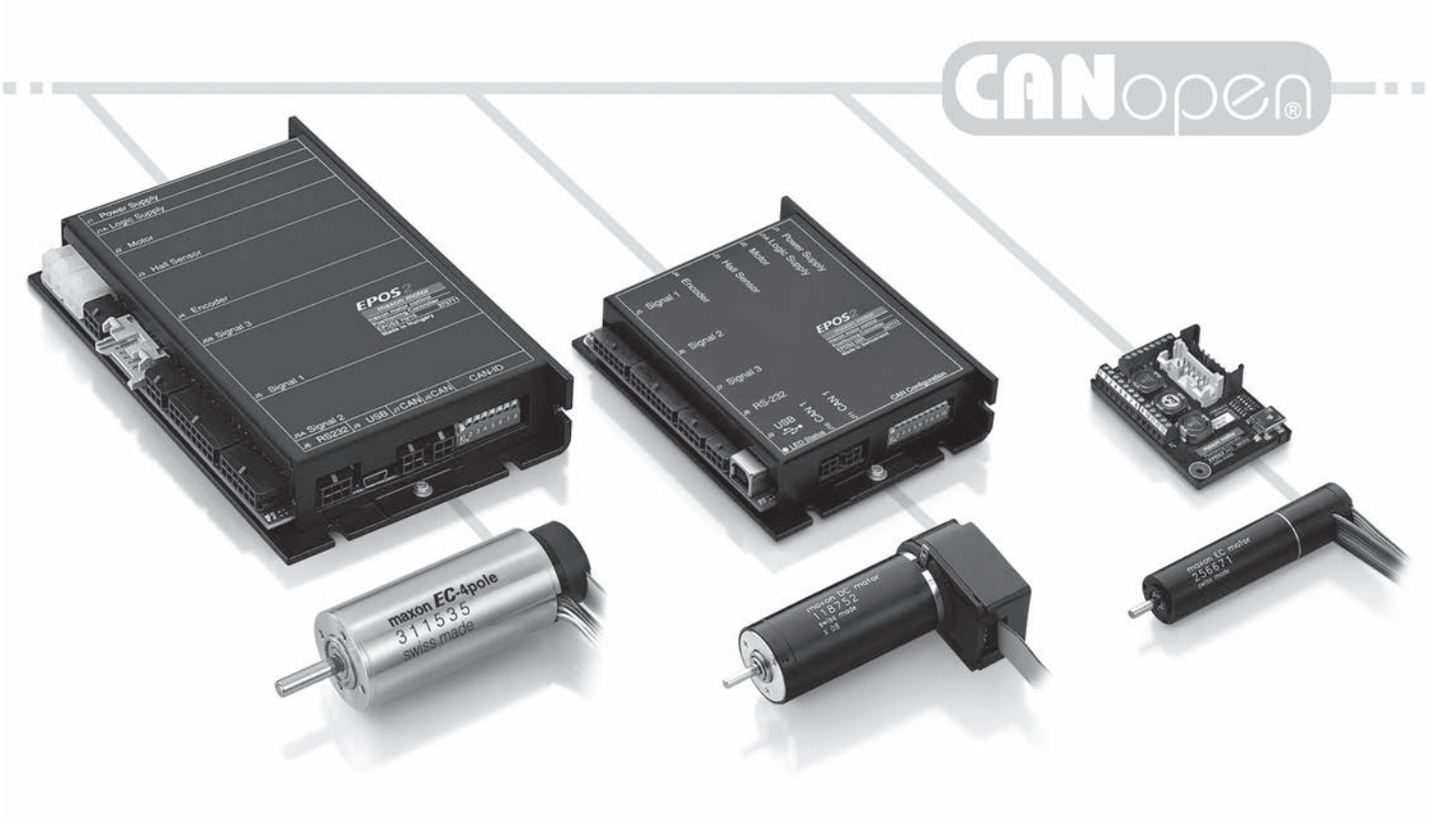
Slave version (online commanding) using CAN Master (EPOS2 P, PC, PLC, SoftPLC, etc.) or PC via USB or RS232 interface

Typical applications:
- Production equipment
- System automation tasks
- Plant construction

Part Number

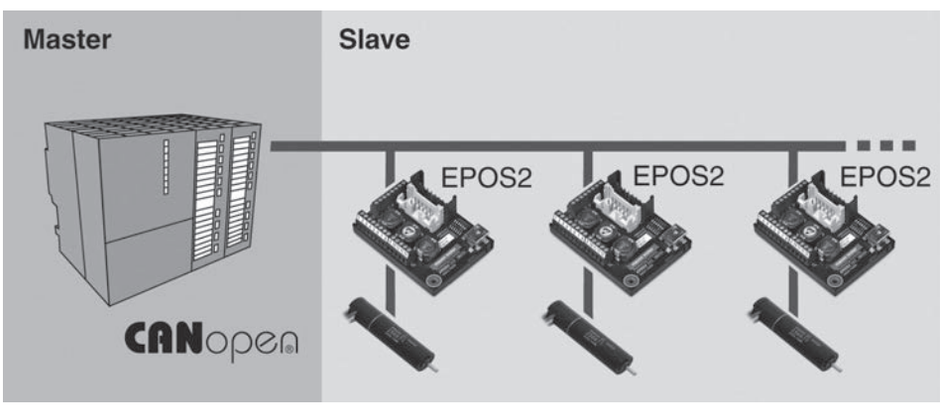
EPOS2 70/10	**375711**

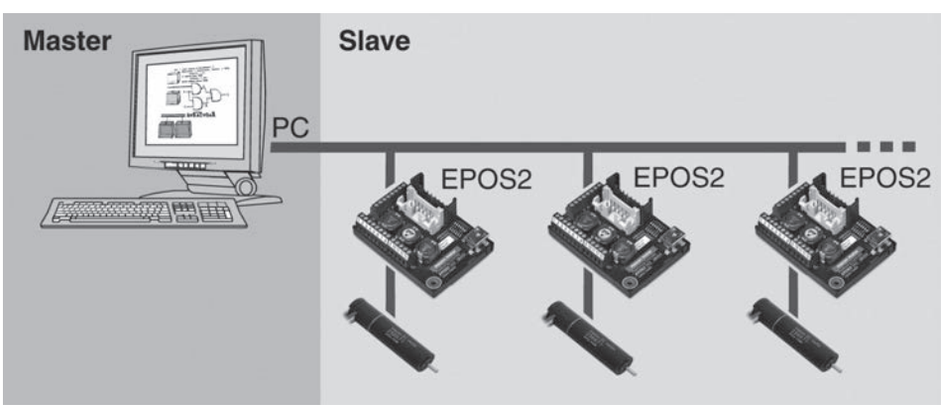
EPOS2 Positioning Controllers



CANopen Slave (online commanded)

Single motion and I/O commands from the process control are transmitted to the positioning control unit by a superior system (Master). For that purpose product specific commands are available.





EPOS2 is a modular constructed digital positioning controller. It is suitable for DC and EC motors with incremental encoder with a power range from 1 to 700 watts.
A number of operating modes provides flexible application in a wide range of drive systems in automation technology and mechatronics.

Point to point
The “CANopen Profile Position Mode” moves the position of the motor axis from point A to point B. Positioning is in relation to the axis Home position (absolute) or the actual axis position (relative).

Interpolated Position Mode (PVT)
Thanks to Interpolated Position Mode, the EPOS2 is able to synchronously run a path specified by interpolating points. With a suitable master, coordinated multi-axis movements as well as any profile in a 1-axis system can be carried out. (PVT = Position and Velocity versus Time)

Position and Speed control with Feed Forward
The combination of feedback and feed forward control provides ideal motion behavior. Feed forward control reduces control error. EPOS2 supports feed forward acceleration and speed control.

Speed control
In “CANopen Profile Velocity Mode”, the motor axis is moved with a set speed. The motor axis retains speed until a new speed is set.

Torque control
In “Current Mode”, a controlled torque can be produced on the motor shaft. The sinusoidal commutation used produces minimum torque ripple.

Homing
The “CANopen Homing Mode” is for referencing to a special mechanical position. There are more than 30 methods available for finding the reference position.

Electronic gearhead
In “Master Encoder Mode”, the motor follows a reference input produced by an external encoder. A gearing factor can also be defined using software parameters. Two motors can be very easily synchronized using this method.

Step/Direction
In “Step/Direction Mode” the motor axis follows a digital signal step-by-step. This mode can replace stepper motors. It can also be used to control the EPOS2 by a PLC without CAN interface.

Analog Commands
In the position, speed and current mode it is possible to give commands via an external analog set value. This function offers further possibilities to operate the EPOS2 without serial on-line commanding.

Capture inputs (Position Marker)
Digital inputs can be configured so that the actual position value is saved when a positive and/or negative edge of an input appears.

Trigger output (Position Compare)
Digital outputs can be configured so that a digital signal is emitted at a set position value.

Dual Loop Position and Speed Control
With an additional sensor the load can be controlled directly and with high precision; the motor control is subordinated. The mechanical backlash and the elasticity can be compensated. Wide range of sensors can be handled: digital incremental encoder, SSI absolute encoder, analog incremental encoder (sin/cos). (Only in use with EPOS2 50/5 and EPOS2 70/10.)

Control of Holding Brakes
The control of the holding brake can be implemented in the device state management. There the delay times can be individually configured for switching on and off.

Additional information for technical data of page 386/387

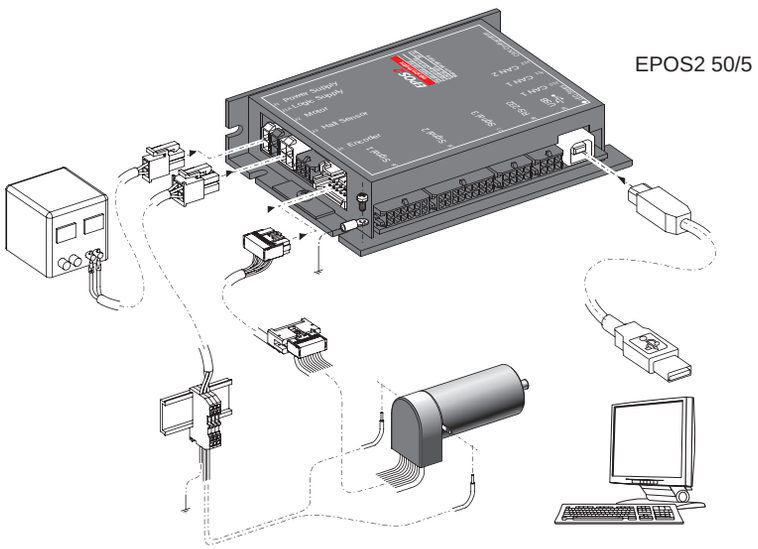
Standardized, extendable
CANopen standard CiA 301, 402 and 305. Can easily be integrated into existing CANopen systems. Networks with other CANopen modules. Alternatively controllable by serial interface (USB and RS232).

Flexible, modular
The same technology for DC and EC motors. Configurable inputs and outputs for limit switches, reference switches, brakes and for other sensors and indicators near the drive.

Easy start-up procedure
Graphic user interface with many functions and wizards for start-up procedure, automatic control settings, I/O configuration, tests.

Easy programming
IEC 61131-3 libraries for CAN master units from industry leading manufacturers (Beckhoff, Siemens/Helmholz, VIPA) as well as 32/64-bit Windows DLLs for PC master units (IXXAT, Vector, National Instruments and Kvaser) are available. Programming examples for MS Visual C#, MS Visual C++, MS Visual Basic, Borland C++, Borland Delphi, National Instruments LabVIEW and National Instruments LabWindows/CVI are available at no charge.
Also available: The 32/64-bit Linux Shared Object Library with programming examples for Eclipse C++/QT as well as ARMv6/v7 support for a wide variety of platforms (Raspberry Pi, BeagleBone). In addition, the maxon library for NI SoftMotion makes integration of EPOS2 in the National Instruments Compact Rio system easy.

State-of-the-art
Digital position, speed and current/torque control. Sinusoidal commutation for smooth operation of EC motors.



EPOS2 50/5

Operating modes
CANopen Profile Position-, Profile Velocity- and Homing Mode
Position, Velocity and Current Mode
Alternative set value setting via Step/Direction, Master Encoder or external analog commanding
Path generating with trapezoidal or sinusoidal profiles
Feed forward for velocity and acceleration
Interpolated Position Mode (PVT)
Sinusoidal or block commutation for EC motors
Dual loop position and speed controller

Communication
Communication via CANopen and/or USB 2.0/3.0 and/or RS232
Gateway function USB-to-CAN and RS232-to-CAN

Inputs/Outputs
Free configurable digital inputs e.g. for limit switches and reference switches
Free configurable digital outputs e.g. for holding brakes
Free analog inputs

Available software
EPOS Studio
Windows DLL/Linux Shared Object Library
IEC 61131-3 Libraries
Firmware

Available documentation
Feature Chart
Getting Started
Cable Starting Set
Hardware Reference
Firmware Specification
Communication Guide
Application Notes

Cable
A comprehensive range of cables is available as an option. Details can be found on page 398.

EPOS2 24/5
Matched with DC brush motors with encoder or brushless EC motors with Hall sensors and encoder, from 5 to 120 watts.

EPOS2 50/5
Matched with DC brush motors with encoder or brushless EC motors with Hall sensors and encoder, from 5 to 250 watts.

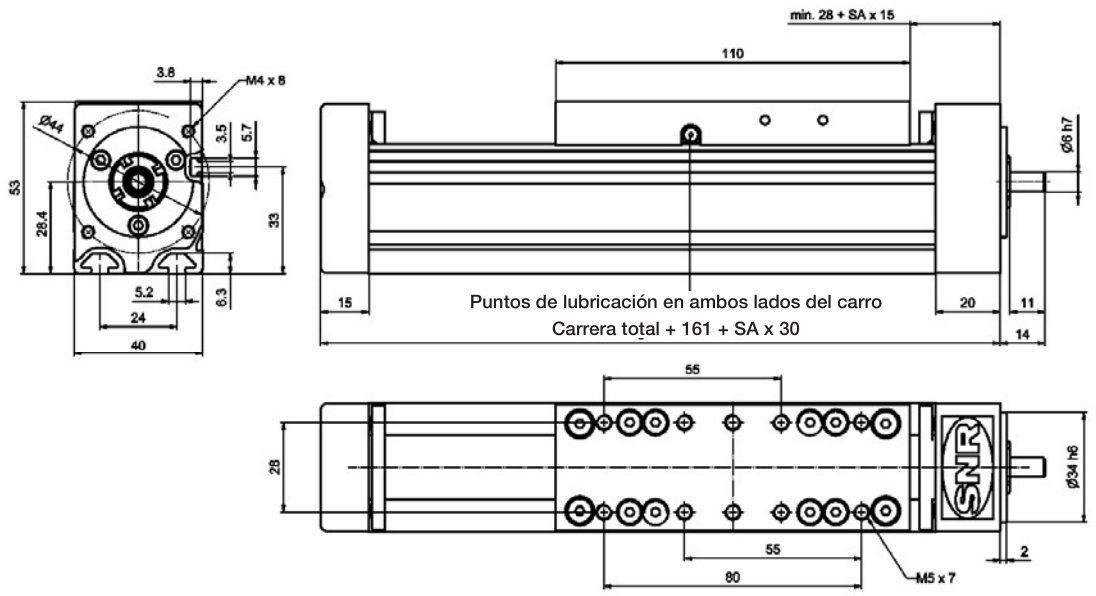
EPOS2 70/10
Matched with DC brush motors with encoder or brushless EC motors with Hall sensors or encoder, from 80 to 700 watts.

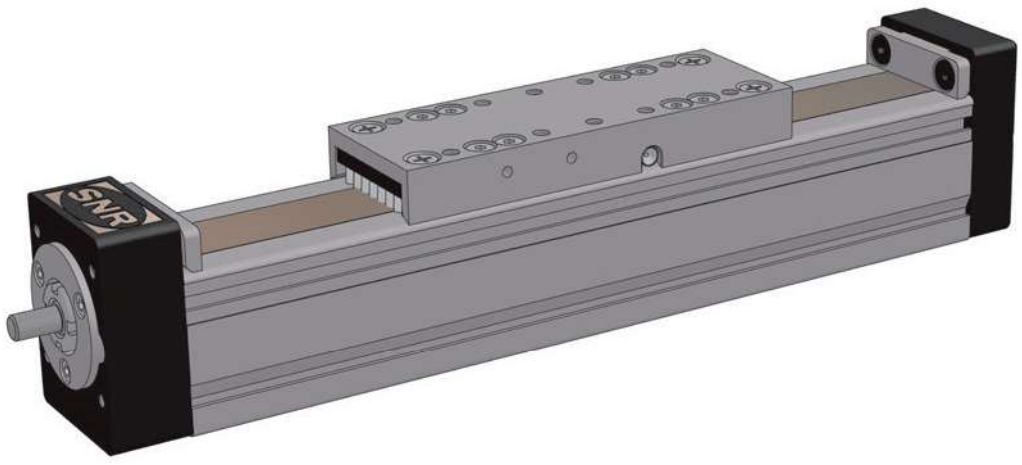
Controller versions		
CANopen Slave	**CANopen Slave**	**CANopen Slave**
Electrical Data		
11 - 24 VDC	11 - 50 VDC	11 - 70 VDC
11 - 24 VDC	11 - 50 VDC	11 - 70 VDC
0.9 x V_{CC}	0.9 x V_{CC}	0.9 x V_{CC}
10 A	10 A	25 A
5 A	5 A	10 A
50 kHz	50 kHz	50 kHz
10 kHz	10 kHz	10 kHz
1 kHz	1 kHz	1 kHz
1 kHz	1 kHz	1 kHz
25 000 rpm (sinusoidal); 100 000 rpm (block)	25 000 rpm (sinusoidal); 100 000 rpm (block)	25 000 rpm (sinusoidal); 100 000 rpm (block)
15 µH / 5 A	22 µH / 5 A	25 µH / 10 A
Input		
H1, H2, H3	H1, H2, H3	H1, H2, H3
A, A\, B, B\, I, I\ (max. 5 MHz)	A, A\, B, B\, I, I\ (max. 5 MHz)	A, A\, B, B\, I, I\ (max. 5 MHz)
6 (TTL and PLC level)	11 (7 optically isolated, 4 differential)	10 (7 optically isolated, 3 differential)
2 12-bit resolution, 0…+5 V	2 (differential) 12-bit resolution, ±10 V	2 (differential) 12-bit resolution, 0…+5 V
configurable with DIP switch 1…7	configurable with DIP switch 1…7	configurable with DIP switch 1…7
Output		
4	5 (4 optically isolated, 1 differential)	5 (4 optically isolated, 1 differential)
	1 (12-bit, 0…10 V)	
+5 VDC, max 100 mA	+5 VDC, max. 100 mA	+5 VDC, max. 100 mA
+5 VDC, max. 30 mA	+5 VDC, max. 30 mA	+5 VDC, max. 30 mA
V_{CC}, max. 1300 mA	+5 VDC, max. 150 mA	+5 VDC, max. 150 mA; +5 VDC (R_i = 1 kΩ)
Interface		
RxD; TxD (max. 115 200 bit/s)	RxD; TxD (max. 115 200 bit/s)	RxD; TxD (max. 115 200 bit/s)
high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)	high; low (max. 1 Mbit/s)
Data+; Data- (max. 12 Mbit/s)	Data+; Data- (max. 12 Mbit/s)	Data+; Data- (max.12 Mbit/s)
Indicator		
green LED, red LED	green LED, red LED	green LED, red LED
Ambient temperature and humidity range		
-10…+45°C	-10…+45°C	-10…+45°C
-40…+85°C	-40…+85°C	-40…+85°C
20…80%	20…80%	20…80%
Mechanical data		
Approx. 170 g	Approx. 240 g	Approx. 330 g
105 x 83 x 24 mm	120 x 93.5 x 27 mm	150 x 93 x 27 mm
Flange for M3-screws	Flange for M3-screws	Flange for M3-screws
Part Numbers		
367676 EPOS2 24/5	**347717** EPOS2 50/5	**375711** EPOS2 70/10

Accessories		
309687 DSR 50/5 Shunt regulator	**309687** DSR 50/5 Shunt regulator	**235811** DSR 70/30 Shunt regulator
Order accessories separately, see page 398	Order accessories separately, see page 398	Order accessories separately, see page 398

Módulo compacto AXC40S

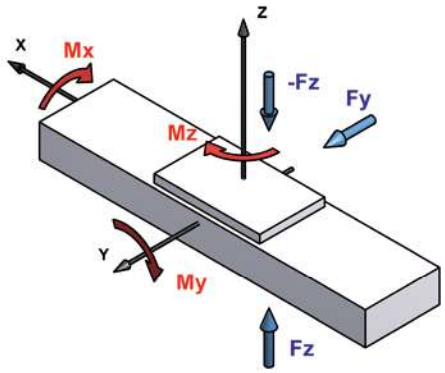
con accionamiento por husillo y guiado por patines o por rodillos





Cargas y momentos

	Guía raíl-patín	
Tipo	B	
Longitud del carro [mm]	110	
Cargas [N]	din.	estát.
Fy	660	910
Fz	660	910
-Fz	660	910
Momentos [Nm]	din.	estát.
Mx	4,5	6
My	18	25
Mz	18	25



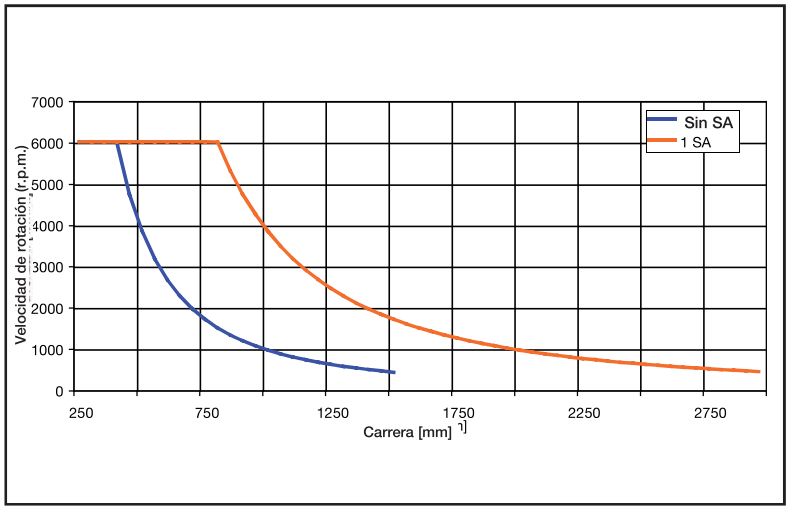
Las capacidades de carga dinámica de los sistemas de guiado se indican para una duración nominal de 27.000 km.

Características técnicas

Elemento de accionamiento	S1205	S1210	T1203
Paso del husillo	5RH	10RH	3RH
Velocidad máxima [m/min]	30	60	5,5
Precisión del paso del husillo [µ/300mm]	52		200
Capacidad dinámica de arrastre del husillo [N]	3.600	2.500	-
Momento de inercia de la transmisión [kgcm²/m]	0,11	0,11	0,10
Par de arrastre en vacío [Nm]	0,3		
Momento de inercia geométrico Iy (perfil) [cm⁴]	9,251		
Momento de inercia geométrico Iz (perfil) [cm⁴]	12,14		
Longitud total máx. [m]	2,5		3,0
Superficie portadora de la tuerca [mm²]	-		400
Rendimiento	0,98	0,98	0,46

	Guía raíl-patín
Tipo	B
Peso de base (carro incluido) [kg]	1,0
Peso para 100 mm de carrera [kg]	0,3
Peso del carro solo [kg]	0,4

Velocidad crítica de los husillos de bolas



SA = Par de soportes adicionales de husillos

Con reserva de cambios técnicos.

Características técnicas de los interruptores

• Interruptores mecánicos de fin de carrera

	Duración de vida	Material de la caja	Tipo de montaje	Clase de protección
Interruptores M1 / M4 / M5 AXC60A AXC80/120 AXDL160/240 AXS	30x10⁶ Contactos	Plástico	M20x1,5 Sección del cable: 0,5...2,5mm²	IP67
Interruptor M2 AXC60Z/S AXDL110	30x10⁶ Contactos	Plástico	Conexión atornillada: 4xM3,5 Sección del cable: 0,5...1,5mm²	IP30
Interruptor M3 AXC60Z/S AXLT155 - AXLT455	10x10⁶ Contacts	Metal	Conexión atornillada: Sección del cable: máx. 1,5mm²	IP67
Interruptor M3.1 (conexión soldada) AXLT325	10x10⁶ Contacts	Metal	Connexion soudée Section du câble : max. 1,5mm²	IP67

Tipos de contacto: 1 contacto NF y 1 contacto NO con acción brusca

• Sensores inductivos de proximidad

	Tensión de uso	Intensidad máx.	Precisión de conmutación	Longitud del cable	Clase de protección
Sensor I1 PNP-NO (cierre) NPN/PNP-NC (apertura) AXC40 AXDL AXLT AXS	10...30 V DC	100 mA	≤ 10% de la distancia de conmutación	5 m	IP67
AXC- Initiator PNP-NC (apertura)/NO (cierre) NPN-NC AXC60 - AXC120	10...30 V DC	100 mA	≤ 2% dde la distancia de conmutación	10 m	IP67
Sensor I2 AXC60 - AXC120		100 mA	≤ 5% de la distancia de conmutación	2 m	IP67

• Combinaciones posibles para los interruptores

Número de interruptores									Montaje en el eje															
Código	Interruptores mecánicos		Sensores inductivos de proximidad						AXC40Z AXC40S	AXC60Z AXC60S	AXC60A		AXC80Z AXC80S	AXC80A		AXC120Z AXC120S	AXC120A		AXDL	AXLT	AXS	
			AXC-Initiator			I1 -- I2					Carro móvil	Perfil móvil		Carro móvil	Perfil móvil		Carro móvil	Perfil móvil			Módulos horizontales	Módulos verticales
	M1, M2, M4, M5	M3, M3.1	PNP-NC 10m cable	PNP-NO 10m cable	NPN-NC 3m cable	PNP-NC	PNP-NO	NPN-NO														
0									X	X	X	X	X	X	X	X	X	X	X	X	X	X
1	1								O	X	X	X	X	X	X	X	X	X	X	O	X	X
2	2								O	X	X	X [1)]	X	X	X	X	X	X	X	O	X	X
3	2							1	O	X	X	O	X	X	O	X	X	O	X[2)]	O	X	O
4	2							1	O	X	X	O	X	X	O	X	X	O	X[2)]	O	X	O
5		1							O	X	O	O	O	O	O	O	O	O	O	X	O	O
6		2							O	X	O	O	O	O	O	O	O	O	O	X	O	O
7		2					1		O	X	O	O	O	O	O	O	O	O	O	X[3)]	O	O
8		2						1	O	X	O	O	O	O	O	O	O	O	O	X[3)]	O	O
12			1						O	X	X	O	X	X	O	X	O	O	O	O	O	O
13			2						O	X	X	O	X	X	O	X	O	O	O	O	O	O
14			3						O	O	O	O	X	X	O	X	O	O	O	O	O	O
18				1					O	X	X	O	X	X	O	X	O	O	O	O	O	O
19				2					O	X	X	O	X	X	O	X	O	O	O	O	O	O
20				3					O	O	O	O	X	X	O	X	O	O	O	O	O	O
21					1				O	X	X	O	X	X	O	X	O	O	O	O	O	O
22					2				O	X	X	O	X	X	O	X	O	O	O	O	O	O
23					3				O	O	O	O	X	X	O	X	O	O	O	O	O	O
24									O	O	O	O	X	X	O	X	O	O	O	O	O	O
25			2	1					O	O	O	O	X	X	O	X	O	O	O	O	O	O
26						1			X	X	X	X	X	X	X	X	X	X	X[2)]	X[3)]	X	X
27						2			X	X	X	X	X	X	X	X	X	X	X[2)]	X[3)]	X	X
28						3			X	X	X	O	X	X	O	X	X	O	X[2)]	X[3)]	X	O
29							1		X	X	X	X	X	X	X	X	X	X	X[2)]	X[3)]	X	X
30							2		X	X	X	X	X	X	X	X	X	X	X[2)]	X[3)]	X	X
31							3		X	X	X	O	X	X	O	X	X	O	X[2)]	X[3)]	X	O
32								1	X	X	X	X	X	X	X	X	X	X	X[2)]	X[3)]	X	X
33								2	X	X	X	X	X	X	X	X	X	X	X[2)]	X[3)]	X	X
34								3	X	X	X	O	X	X	O	X	X	O	X[2)]	X[3)]	X	O
35						2	1		X	X	X	O	X	X	O	X	X	O	X[2)]	X[3)]	X	O

* X Variantes posibles

O No posible

1) Imposible con una conexión estándar. Elegir 01 de los dos lados (combinaciones 01 + 26 / 29 / 32 también posibles).

2) Interruptor instalado a la derecha, en la cara superior, siempre sobre el 9 «Interruptores instalados en el lado izquierdo» en la codificación.

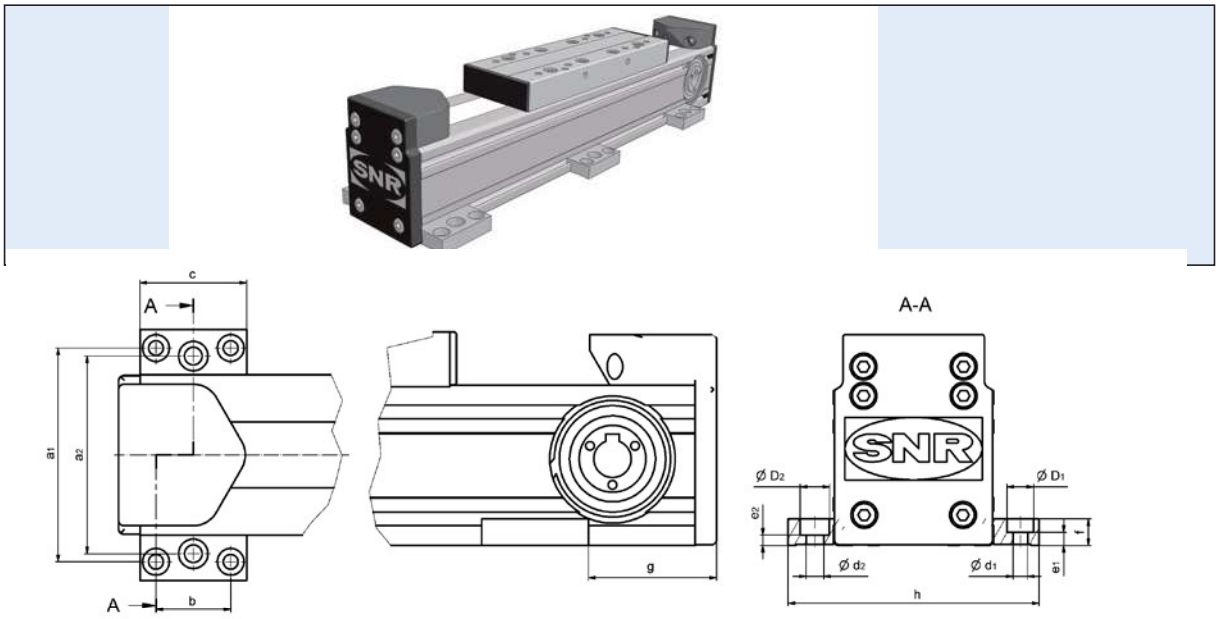
3) Interruptor instalado a la izquierda en el interior, siempre sobre el 9 «Interruptores instalados en el lado izquierdo» en la codificación.

Otras combinaciones de interruptores son posibles. En dicho caso, estarán codificadas como XX y descritas mediante comentarios adicionales.

Accesorios de fijación y de conexión

Varios accesorios estándar se encuentran disponibles para garantizar la fijación y la implantación de las unidades lineales.
Tuercas deslizantes, placas de fijación y varios modelos de adaptadores permiten la fijación de los módulos y mesas en sus instalaciones o asociarlos entre sí para crear sistemas complejos de varios ejes. También están disponibles pilares para soportar los conjuntos de tipo pórticos.

Placas de fijación para los módulos AXC / AXDL

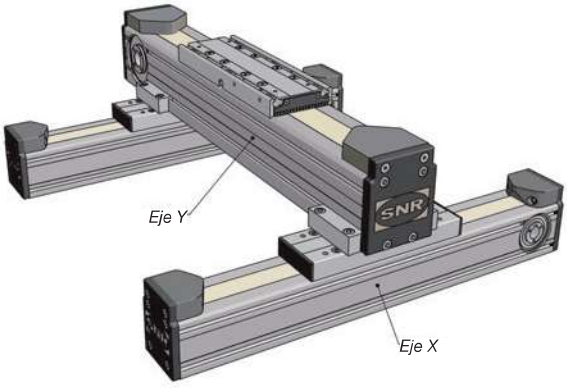


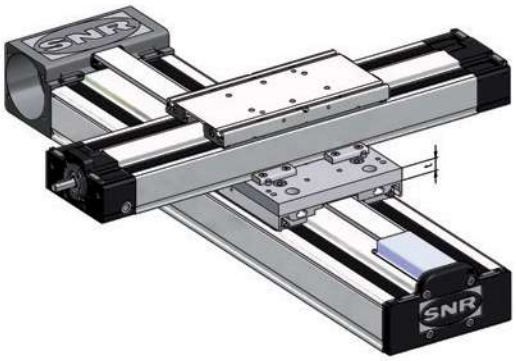
Módulo lineal	Designación	a1	a2	b	c	d1	D1	e1	d2	D2	e2	f	g [1]	h
AXC40	Placa de fijación - AXC 40	55	-	28	40	5,5	10	7	-	-	-	13	38 [2]	66
AXC60 [3]	Placa de fijación - AXC 60	80	74	28	40	5,5	10	5	6,6	11	4	10	48	94
AXC80	Placa de fijación - AXC 80	94	-	50	70	6,6	11	14	-	-	-	20	76	108
AXC120 [4]	Placa de fijación - AXC 120	136	-	60	78	9	15	11,5	-	-	-	22	105	160
	Placa de fijación 2	140	-	40	80	9	15	13	-	-	-	22	105	160
	Placa de fijación 3	140	140	80	120	9	15	13	9	15	13	22	105	160
AXDL110	Placa de fijación - AXDL 110	126	-	30	47	5,5	9	3,5	-	-	-	7	69	140
AXDL160	Placa de fijación - AXDL 160	174	-	50	68	6,6	11	3,5	-	-	-	9	88	188
AXDL240 [4]	Placa de fijación - AXC 120	256	-	60	78	9	15	11,5	-	-	-	22	108	280
	Placa de fijación 2	260	-	40	80	9	15	13	-	-	-	22	108	280
	Placa de fijación 3	260	260	80	120	9	15	13	9	15	13	22	108	280

[1] *Atención: respete la cota k2 de las adaptaciones de motores (véase la p. 84) y de los reductores o el ancho a de mecanizado de la cara de apoyo (véase la p. 90)*
[2] *Con acoplamiento montado*
[3] *Combinable con los perfiles MB de tamaño 20*
[4] *Combinable con los perfiles MB de tamaño 40*

Conexión directa

Los Kits de conexión permiten combinar los módulos y mesas lineales para formar conjuntos multi-ejes. Diferentes kits de conexión se encuentran disponibles para crear diferentes combinaciones. Todos los kits de conexión incluyen los componentes necesarios (placas de adaptación, tornillos, tuercas,...)





Eje X	Eje Y						
	AXC40	AXC60	AXC80	AXC120	AXDL110	AXDL160	AXDL240
AXC40	Kit conexión directa AXC 40-40	Kit conexión directa AXC 40-60					
AXC60		Kit conexión directa AXC 60-60	Kit conexión directa AXC 60-80	Kit conexión directa AXC 60-120	Kit conexión directa AX-60-110 4)		
AXC80				Kit conexión directa AXC 80-120		Kit conexión directa AX-80-160	Kit conexión directa AX80-240 (carro de 280 mm)
AXC120				Kit conexión directa AXC 120-120			Kit conexión directa AX120-240
Perfil Alum. MB 40		Kit conexión directa AXC 60-60 + 2 x Tuercas 8STM6		2 x placas de fijación de tipo 2 (3) + 4 (6) x M8x25 DIN 912 + 4 (6) x Tuercas 8STM8			4 placas de fijación de tipo 2 (3)
Perfil Alum. MB 50			Kit conexión directa AXC 60-80 + 4 x Tuercas 8STM6			4 placas de fijación AXDL160	
AXDL110	Kit conexión directa AX 110-40 1)	Kit conexión directa AX 110-60 1)			Kit conexión directa AXDL 110-110		
AXDL160 2)		Kit conexión directa AX 160-60	Kit conexión directa AX 160-80		Kit conexión directa AXDL 160-110	Kit conexión directa AXDL 160-160	
AXDL240 3)				Kit conexión directa AXDL 240-120		Kit conexión directa AXDL 240-160	Kit conexión directa AXDL 240-240

1) Placa intermedia t = 12 mm
2) Placa intermedia t = 15 mm
3) Placa intermedia t = 20 mm
4) Es necesario crear orificios adicionales en el carro del eje X.

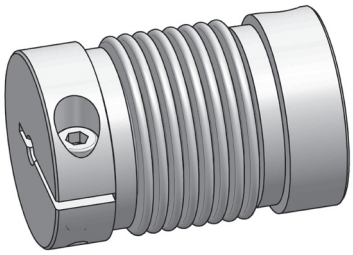
Miniature Metal Bellows Coupling I Series MKM

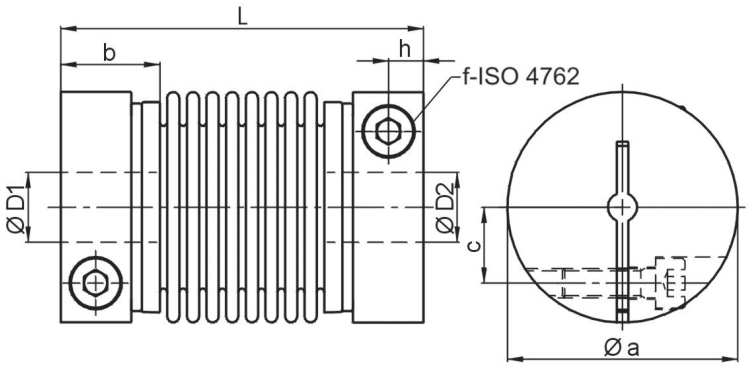
standard series with radial clamping hub

technical data:

MKM size	T_N [Nm]	max. speed [min^{-1}]	moment of inertia [10^{-6}kgm^2]	torsional stiffness [10^{-3}Nm/arcmin]	max. shaft misalignment (mm) axial ±	lateral	spring rate [N/mm] axial	lateral	mass approx. [g]	tightening torque of screws [Nm]
0,4	0,4	20.000	0,3	50	0,35	0,2	10	15	10	1
0,9	0,9	20.000	0,4	90	0,3	0,2	21	26	12	1
2	2	12.000	3,0	230	0,5	0,2	15	15	30	2
4	4	12.000	3,0	460	0,4	0,2	35	65	40	2
7	7	12.000	14	1100	0,6	0,25	45	60	80	4
8	8	12.000	26	1350	0,8	0,30	16	24	130	8
12	12	12.000	30	2050	0,7	0,25	40	70	140	8

temperature range: -40°C up to +300°C





material: *bellows: stainless steel*
hubs: high-tensile strength aluminum
screws: ISO 4762 / 12.9

Dimensions [mm]: length dimensions according to DIN ISO 2768 cH

MKM	Øa	b	c	f	h	L ±0,5	ØD1/2min	ØD1/2max
0,4	16,5	9	4,6	M 2,5	3,3	30	3	6,35
0,9	16,5	9	4,6	M 2,5	3,3	31,5	3	6,35
2	24,5 (27,5)	13	7,5 (9,6)	M 3	4,4	42	3	10 (14)
4	24,5 (27,5)	13	7,5 (9,6)	M 3	4,4	43,5	5	10 (14)
7	34	14	11	M 4	5	57	6	17
8	40 (44,5)	16,5	13 (15,5)	M 5	6	60	6	19 (24)
12	40 (44,5)	16,5	13 (15,5)	M 5	6	62	6	19 (24)

on request, couplings from size 2-12 are avaiable with EASY-clamp (see page 7)

stock bores D1/D2 (G7)

MKM	Ø3	Ø4	Ø5	Ø6	Ø6,35	Ø8	Ø9,53	Ø10	Ø12	Ø15	Ø16	Ø19
0,4/0,9	•	•	•	•	•							
2/4		•	•	•	•	•	•	•				
7				•	•	•	•	•	•	•	•	
8/12				•	•	•	•	•	•	•	•	•

note: further bore sizes possible on request

order example: MKM 0,9 - D1 = 4 ^{H7} D2 = 5 ^{G7}

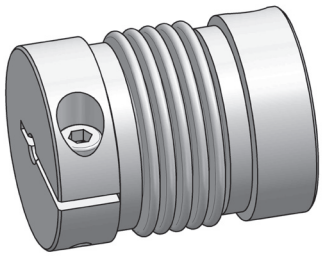
Miniature Metal Bellows Coupling I Series MKP

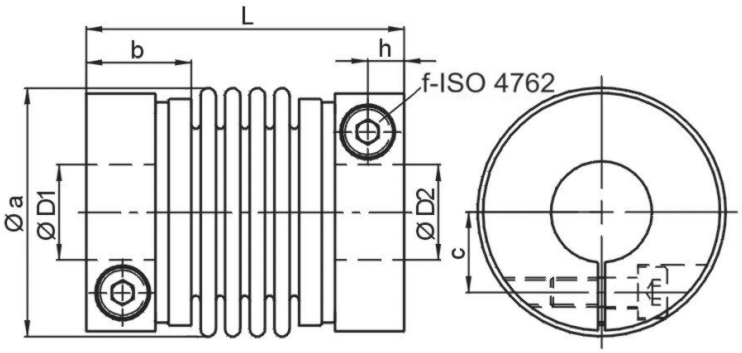
short design with radial clamping hub

technical data:

MKP size	T_N [Nm]	max. speed [min^{-1}]	moment of inertia [10^{-6}kgm^2]	torsional stiffness [10^{-3}Nm/arcmin]	max. shaft misalignment (mm) axial ±	lateral	spring rate [N/mm] axial	lateral	mass approx. [g]	tightening torque of screws [Nm]
2	2	12.000	2,5	400	0,3	0,1	32	100	30	2
5	5	12.000	2,8	800	0,3	0,1	70	400	40	2
7	7	12.000	12	1700	0,4	0,15	70	220	80	4
8	8	12.000	25	2100	0,5	0,15	20	90	125	8
12	12	12.000	28	2600	0,4	0,15	45	190	130	8
25	25	12.000	64	4000	0,5	0,15	36	180	180	8

temperature range: -40°C up to +300°C





material: *bellows: stainless steel*
hubs: high-tensile strength aluminum
screws: ISO 4762 / 12.9

Dimensions [mm]: length dimensions according to DIN ISO 2768 cH

MKP	Øa	b	c	f	h	L ±0,5	ØD1/2min	ØD1/2max
2	24,5 (27,5)	13	7,5 (9,6)	M 3	4,4	35	3	10 (14)
5	24,5 (27,5)	13	7,5 (9,6)	M 3	4,4	36	6	10 (14)
7	34	14	11	M 4	5	47	6	17
8	40 (44,5)	16,5	13 (15,5)	M 5	6	51	6	19 (24)
12	40 (44,5)	16,5	13 (15,5)	M 5	6	51	6	19 (24)
25	50	17	17	M 5	6	58	10	28

on request, all couplings are avaiable with EASY-clamp (see page 7)

stock bores D1/D2 (G7)

MKP	Ø4	Ø5	Ø6	Ø6,35	Ø8	Ø9,53	Ø10	Ø12	Ø15	Ø16	Ø19	Ø24
2/5	•	•	•	•	•	•	•					
7			•	•	•	•	•	•	•	•		
8/12			•	•	•	•	•	•	•	•	•	
25							•			•	•	•

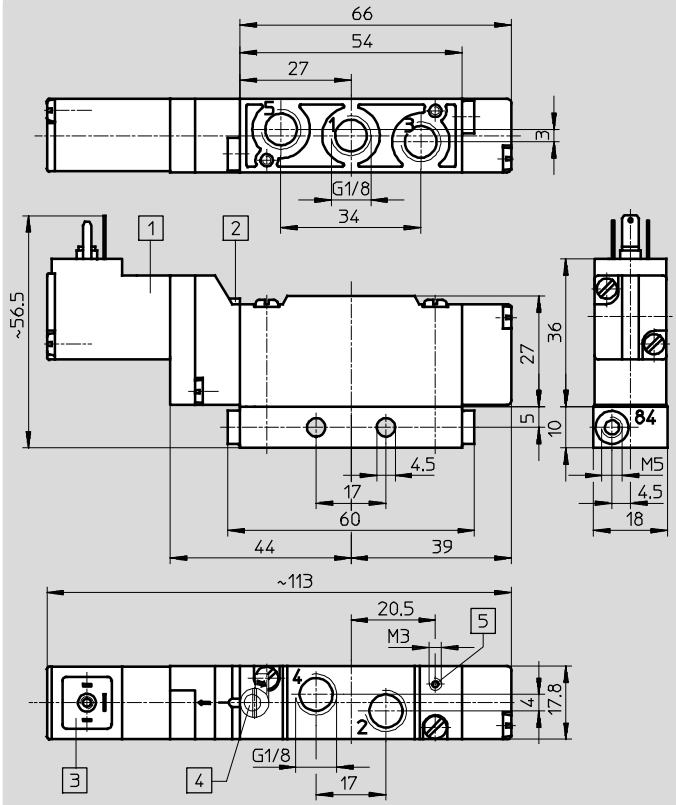
note: further bore sizes possible on request

order example: MKP 5 - D1 = 4 ^{G7} D2 = 12 ^{G7}

Dimensiones

Datos CAD disponibles en ➔ **www.festo.com**

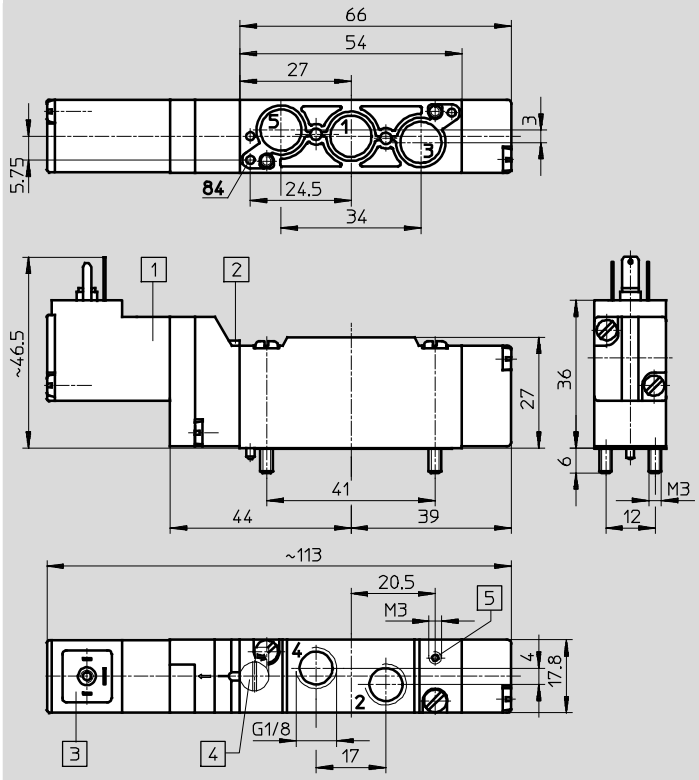
Válvula con conexiones de utilización roscadas G1⁄8



1 Bobina girable en 180° 1)
2 Accionamiento manual auxiliar
3 Apropiada para conectores NE 175301-803 forma C: MSSD-EB o KMEB-...
4 Cabezal para accionamiento manual auxiliar (accesorio) AHB-ME-1⁄8
5 Conexión para aire de pilotaje externo en tipos S

1) ¡No girar la junta!

Válvula con conexiones de utilización roscadas para placa de alimentación PRS-ME

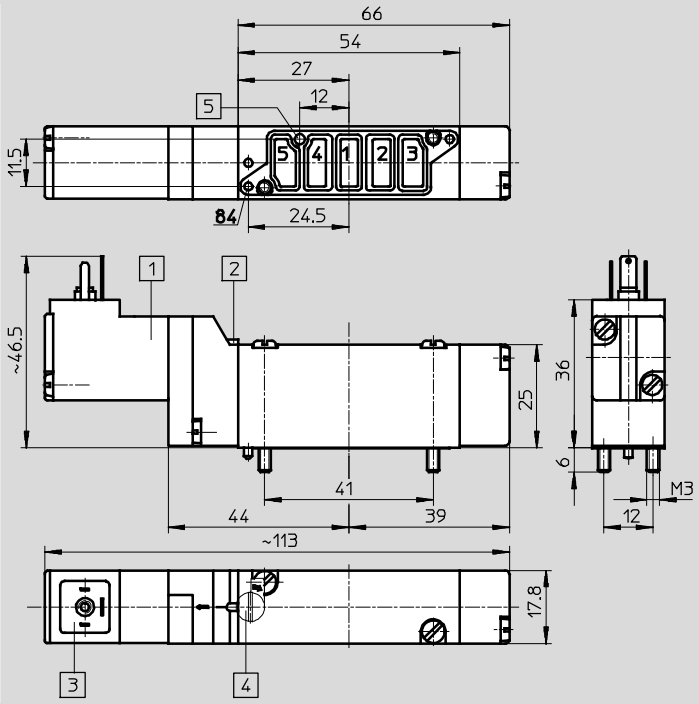


1 Bobina girable en 180° 1)
2 Accionamiento manual auxiliar
3 Apropiada para conectores NE 175301-803 forma C: MSSD-EB o KMEB-...
4 Cabezal para accionamiento manual auxiliar (accesorio) AHB-ME-1⁄8
5 Conexión para aire de pilotaje externo en tipos S

1) ¡No girar la junta!

Dimensiones Datos CAD disponibles en ➔ **www.festo.com**

Válvula para placa base



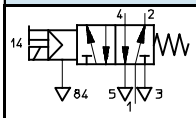
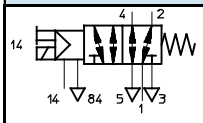
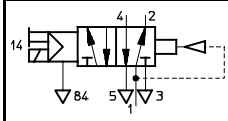
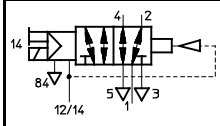
1 Bobina girable en 180° 1)
2 Accionamiento manual auxiliar
3 Apropiada para conectores NE 175301-803 forma C: MSSD-EB o KMEB-...
4 Cabezal para accionamiento manual auxiliar (accesorio) AHB-ME-1/8
5 Conexión para aire de pilotaje externo en tipos S

1) ¡No girar la junta!

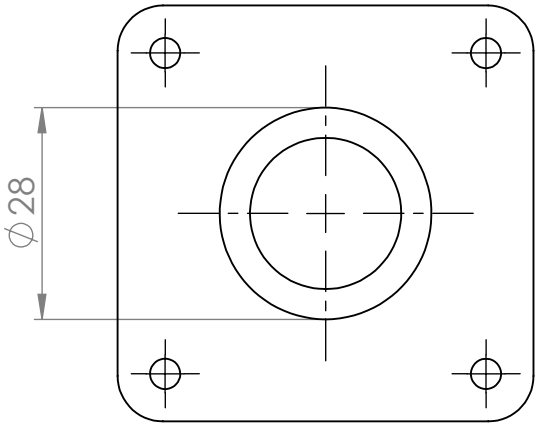
Electroválvulas MEBH, midineumática

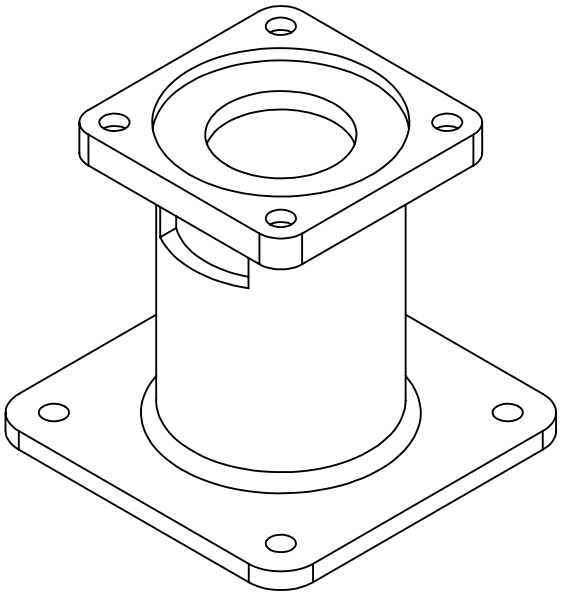
Hoja de datos: válvulas de 5/2 vías

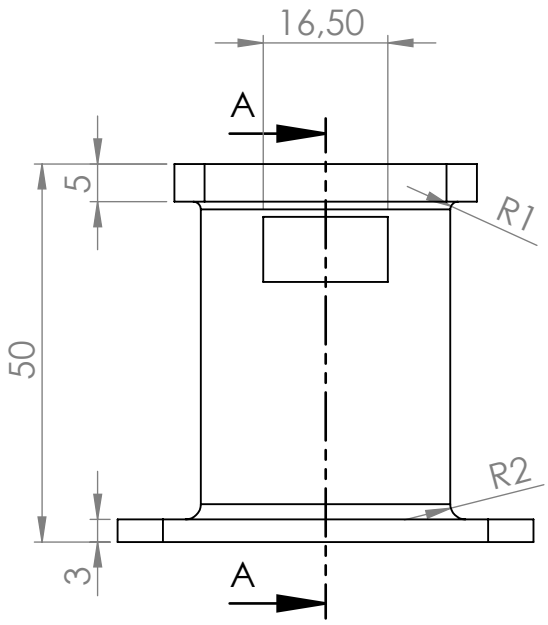
Referencias

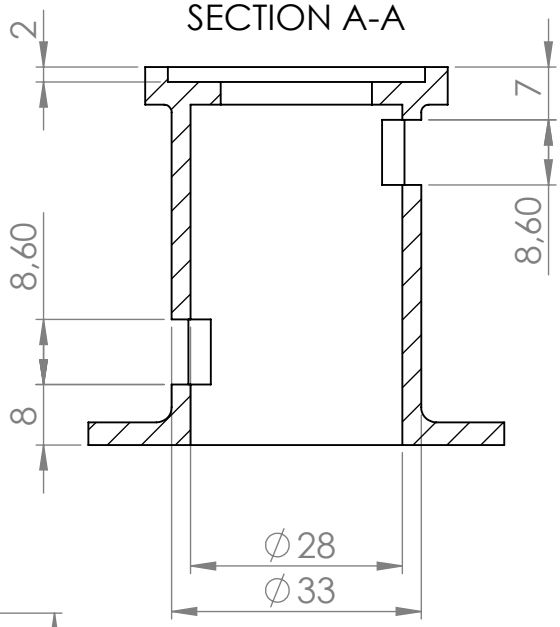
Símbolo	Descripción	Tensión	Nº de artículo	Tipo
Recuperación mecánica del muelle, alimentación interna del aire de pilotaje				
	Válvula con conexiones de utilización roscadas Con rosca G1/8	24 V DC	**173004**	**MEBH-5/2-1/8-B**
		110 V AC	**173043**	**MEBH-5/2-1/8-B-110AC**
		230 V AC	**173085**	**MEBH-5/2-1/8-B-230AC**
	Válvula con conexiones de utilización roscadas para placa de alimentación PRS-ME	24 V DC	**173006**	**MEBH-5/2-1/8-P-B**
		110 V AC	**173057**	**MEBH-5/2-1/8-P-B-110AC**
		230 V AC	**173099**	**MEBH-5/2-1/8-P-B-230AC**
	Válvula para placa base	24 V DC	**173005**	**MEBH-5/2-5,0-B**
		110 V AC	**173071**	**MEBH-5/2-5,0-B-110AC**
		230 V AC	**173113**	**MEBH-5/2-5,0-B-230AC**
Recuperación mecánica del muelle, alimentación externa del aire de pilotaje				
	Válvula con conexiones de utilización roscadas Con rosca G1/8	24 V DC	**173007**	**MEBH-5/2-1/8-S-B**
		110 V AC	**173046**	**MEBH-5/2-1/8-S-B-110AC**
		230 V AC	**173088**	**MEBH-5/2-1/8-S-B-230AC**
	Válvula con conexiones de utilización roscadas para placa de alimentación PRS-ME	24 V DC	**173009**	**MEBH-5/2-1/8-P-S-B**
		110 V AC	**173060**	**MEBH-5/2-1/8-P-S-B-110AC**
		230 V AC	**173102**	**MEBH-5/2-1/8-P-S-B-230AC**
	Válvula para placa base	24 V DC	**173008**	**MEBH-5/2-5,0-S-B**
		110 V AC	**173074**	**MEBH-5/2-5,0-S-B-110AC**
		230 V AC	**173116**	**MEBH-5/2-5,0-S-B-230AC**
Recuperación neumática del muelle, alimentación interna del aire de pilotaje				
	Válvula con conexiones de utilización roscadas Con rosca G1/8	24 V DC	**173010**	**MEBH-5/2-1/8-L-B**
		110 V AC	**173044**	**MEBH-5/2-1/8-L-B-110AC**
		230 V AC	**173086**	**MEBH-5/2-1/8-L-B-230AC**
	Válvula con conexiones de utilización roscadas para placa de alimentación PRS-ME	24 V DC	**173012**	**MEBH-5/2-1/8-P-L-B**
		110 V AC	**173058**	**MEBH-5/2-1/8-P-L-B-110AC**
		230 V AC	**173100**	**MEBH-5/2-1/8-P-L-B-230AC**
	Válvula para placa base	24 V DC	**173011**	**MEBH-5/2-5,0-L-B**
		110 V AC	**173072**	**MEBH-5/2-5,0-L-B-110AC**
		230 V AC	**173114**	**MEBH-5/2-5,0-L-B-230AC**
Recuperación neumática del muelle, alimentación externa del aire de pilotaje				
	Válvula con conexiones de utilización roscadas Con rosca G1/8	24 V DC	**173013**	**MEBH-5/2-1/8-L-S-B**
		110 V AC	**173045**	**MEBH-5/2-1/8-L-S-B-110AC**
		230 V AC	**173087**	**MEBH-5/2-1/8-L-S-B-230AC**
	Válvula con conexiones de utilización roscadas para placa de alimentación PRS-ME	24 V DC	**173015**	**MEBH-5/2-1/8-P-L-S-B**
		110 V AC	**173059**	**MEBH-5/2-1/8-P-L-S-B-110AC**
		230 V AC	**173101**	**MEBH-5/2-1/8-P-L-S-B-230AC**
	Válvula para placa base	24 V DC	**173014**	**MEBH-5/2-5,0-L-S-B**
		110 V AC	**173073**	**MEBH-5/2-5,0-L-S-B-110AC**
		230 V AC	**173115**	**MEBH-5/2-5,0-L-S-B-230AC**

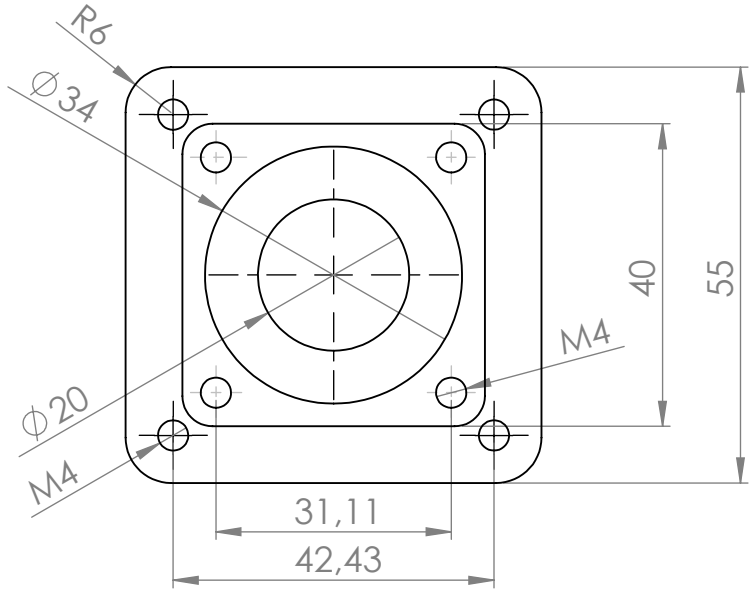
ANNEX C: Plànols



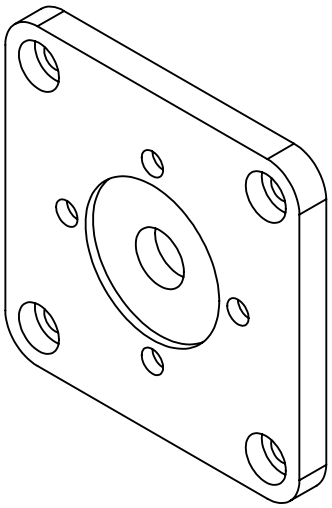


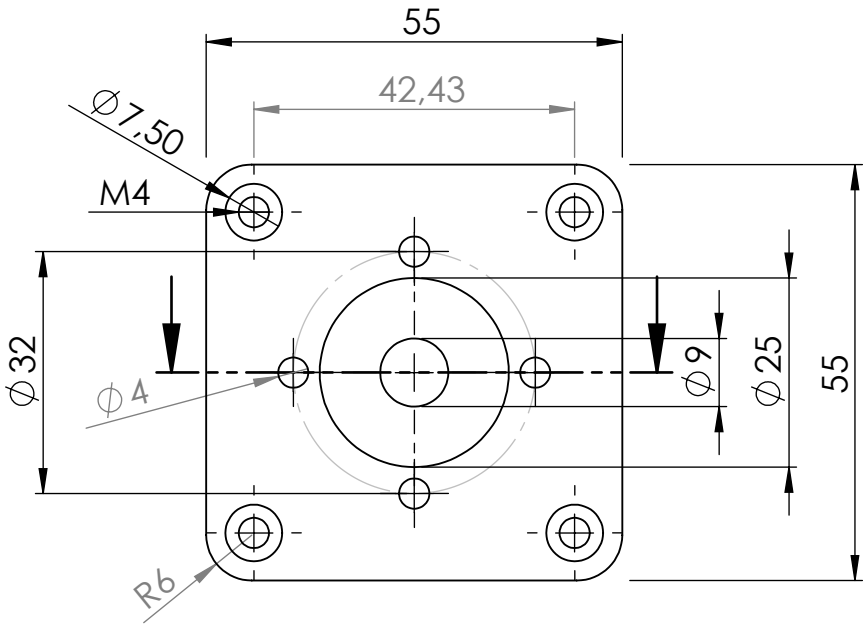


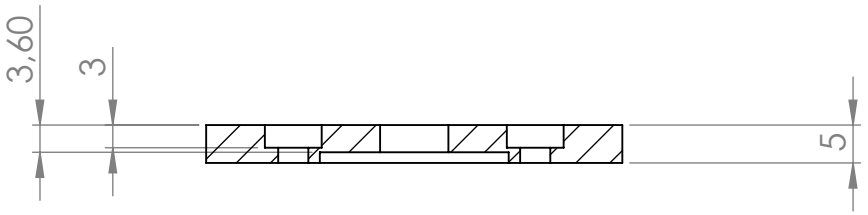




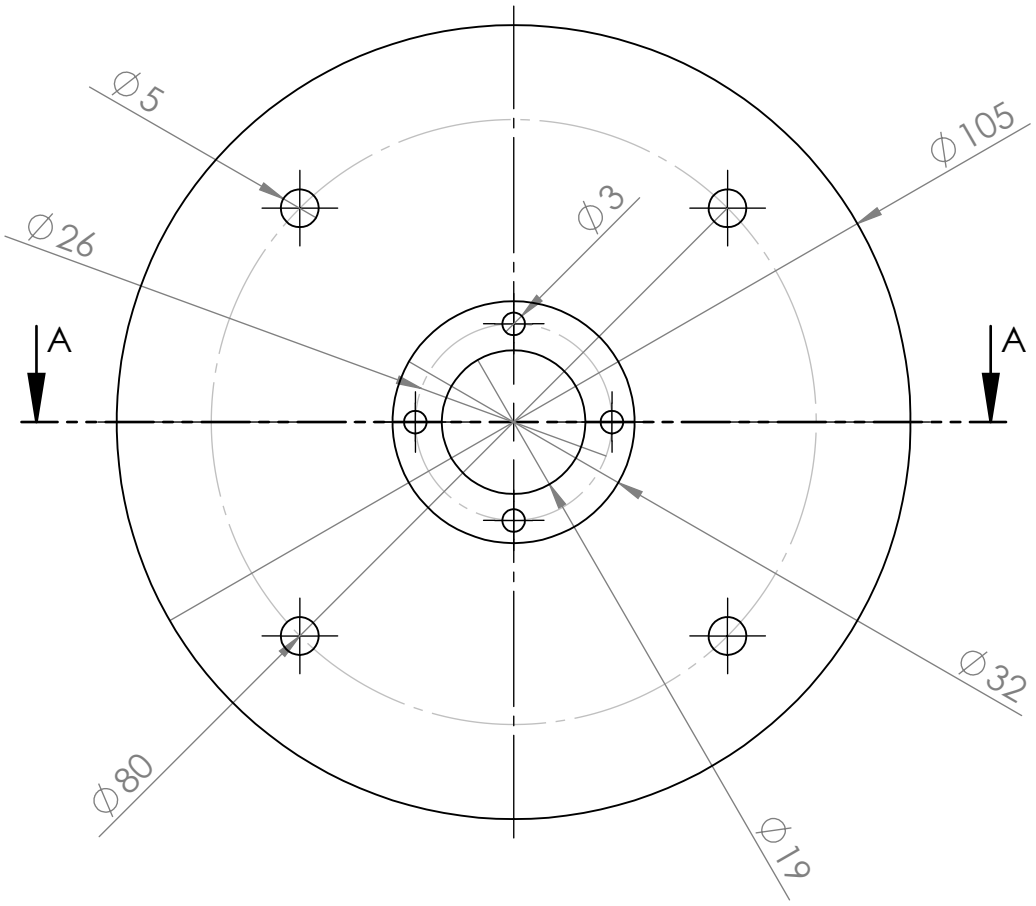
Autor: Martí Salcedo	MATERIAL: Alumini	TÍTOL: Acoblament_modul	A4
Data: 20/12/2015	MASSA: 0,06 Kg	ESCALA: 1:1	

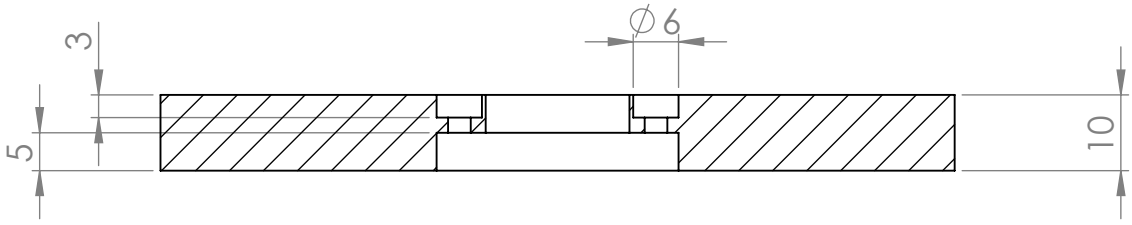






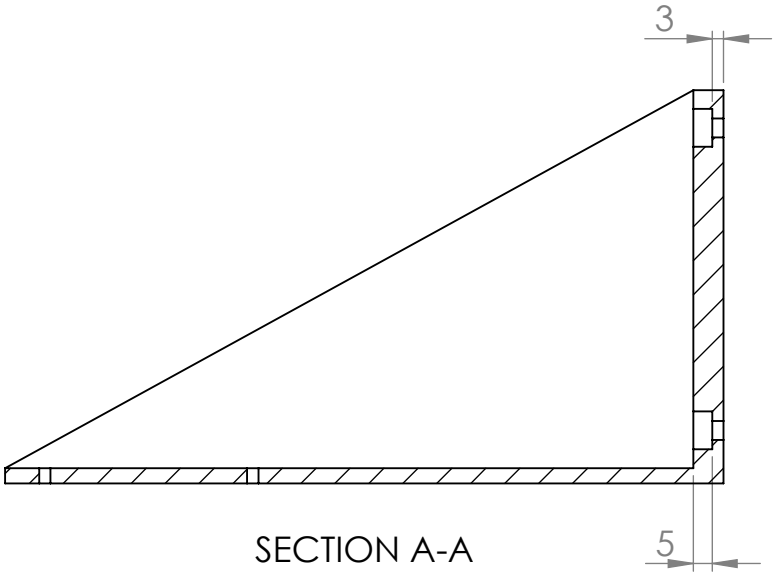
Autor: Martí Salcedo	MATERIAL: Alumini	TÍTOL: Acoblament_motor	A4
Data: 20/12/2015	MASSA: 0,03 Kg	ESCALA: 1:1	



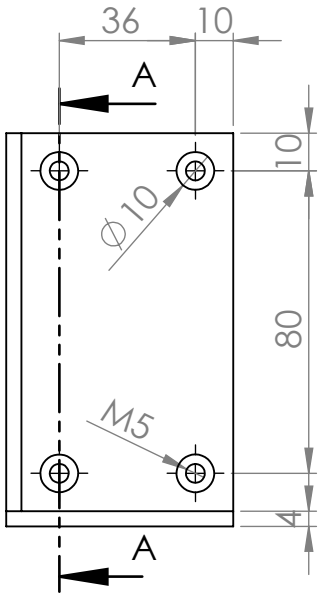


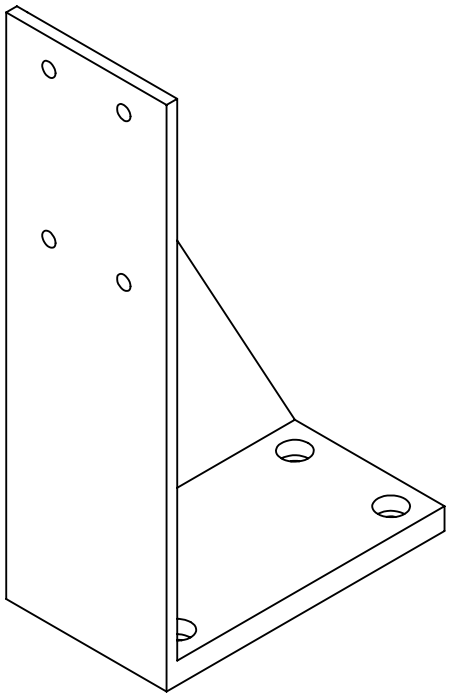
SECTION A-A
SCALE 1 : 1

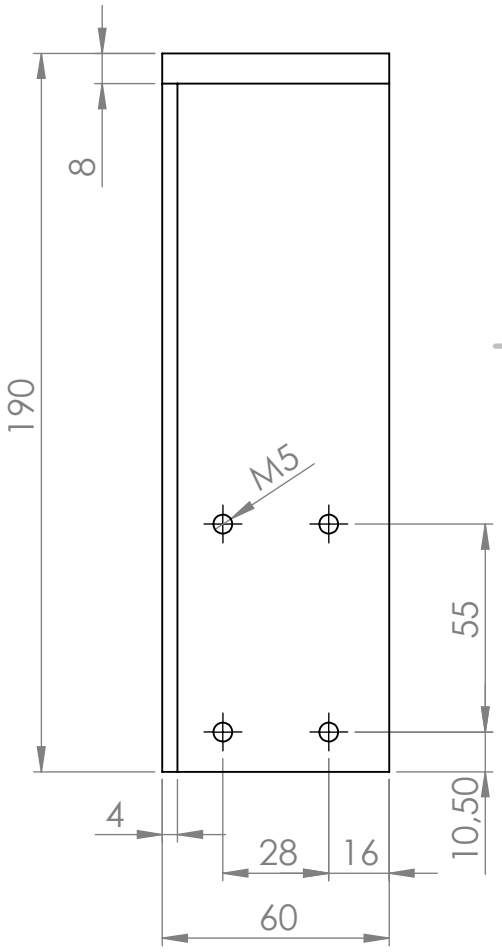
Autor: Martí Salcedo	MATERIAL: F112	TÍTOL: Disc suport	A4
Data: 20/12/2015	MASSA: 1,2 Kg	ESCALA: 1:1	



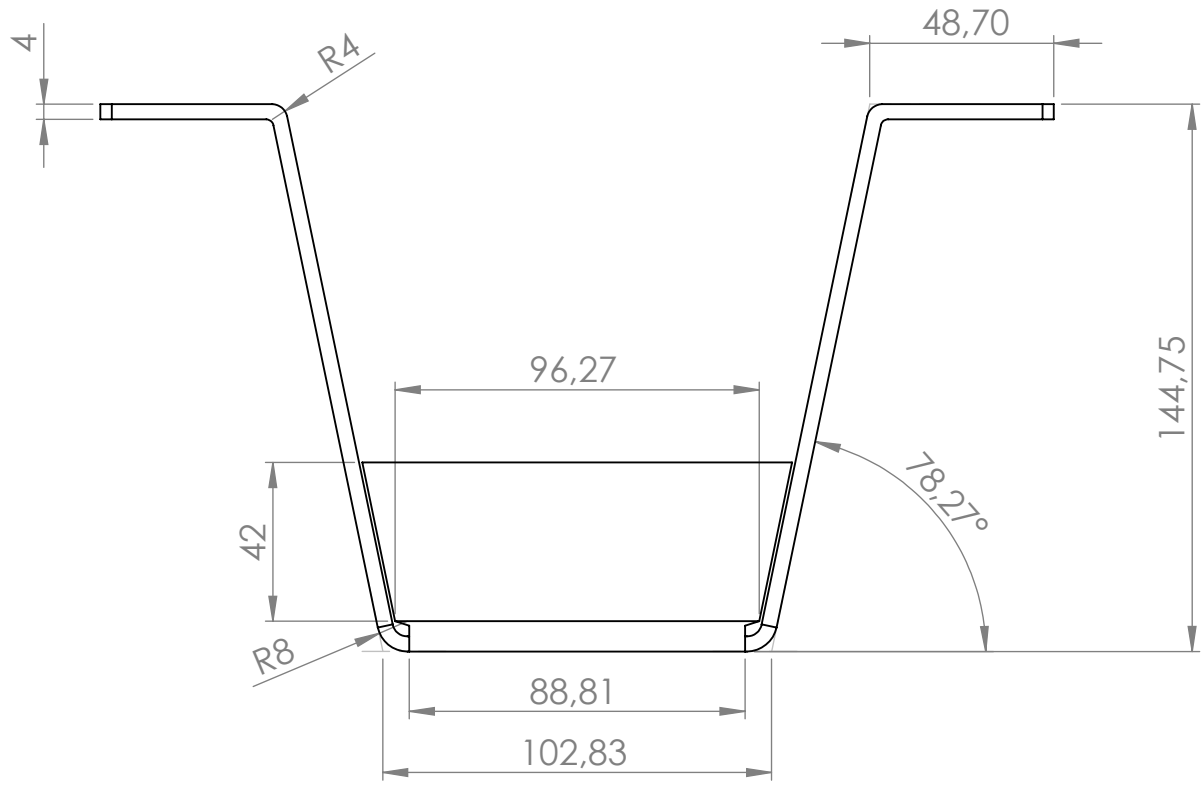
SECTION A-A

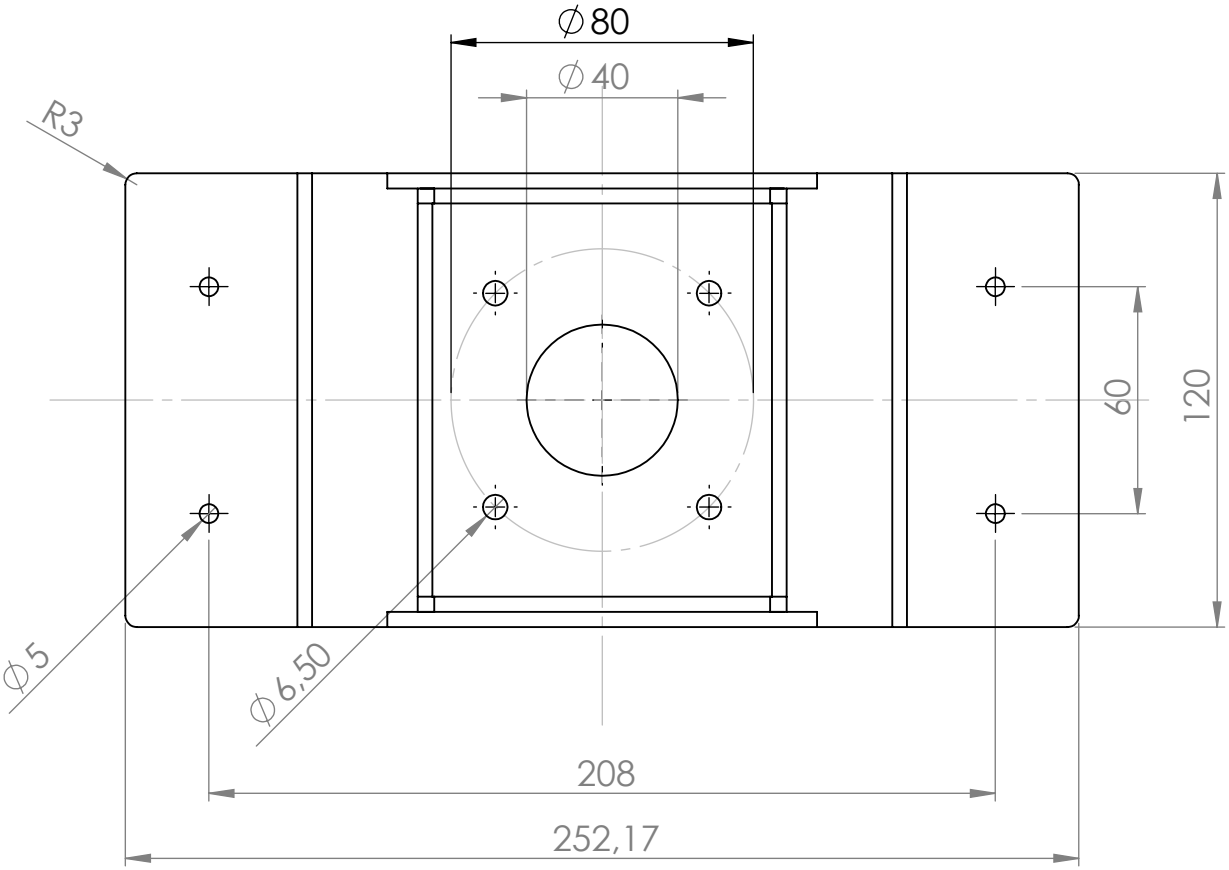




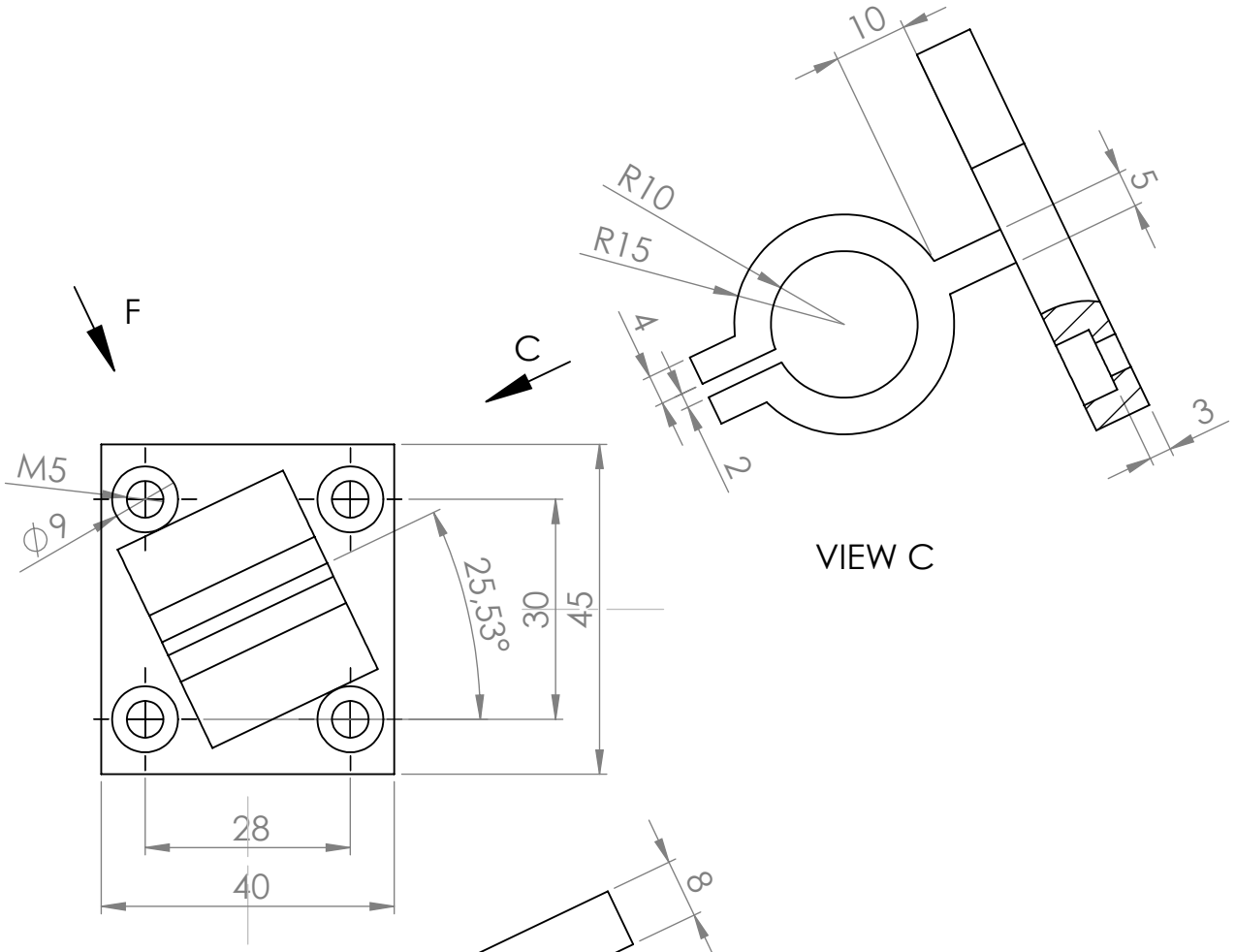


Autor: Martí Salcedo	MATERIAL: Acer	TÍTOL: Peus	A4
Data: 20/12/2015	MASSA: 1 Kg	ESCALA: 1:2	

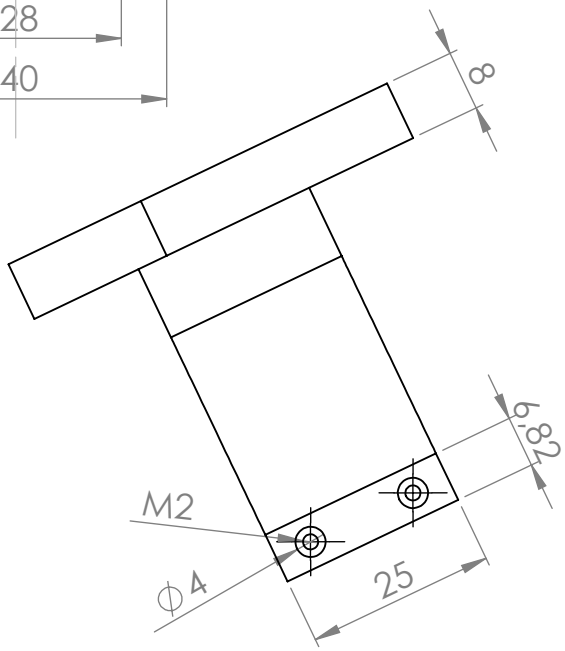




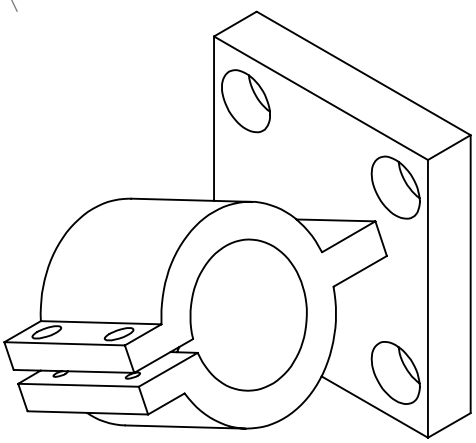
Autor: Martí Salcedo	MATERIAL: X.DEC. S/EN 10111 DD12	TÍTOL: Suport motor	A4
Data: 20/12/2015	MASSA: 2,03 Kg	ESCALA: 1:2	



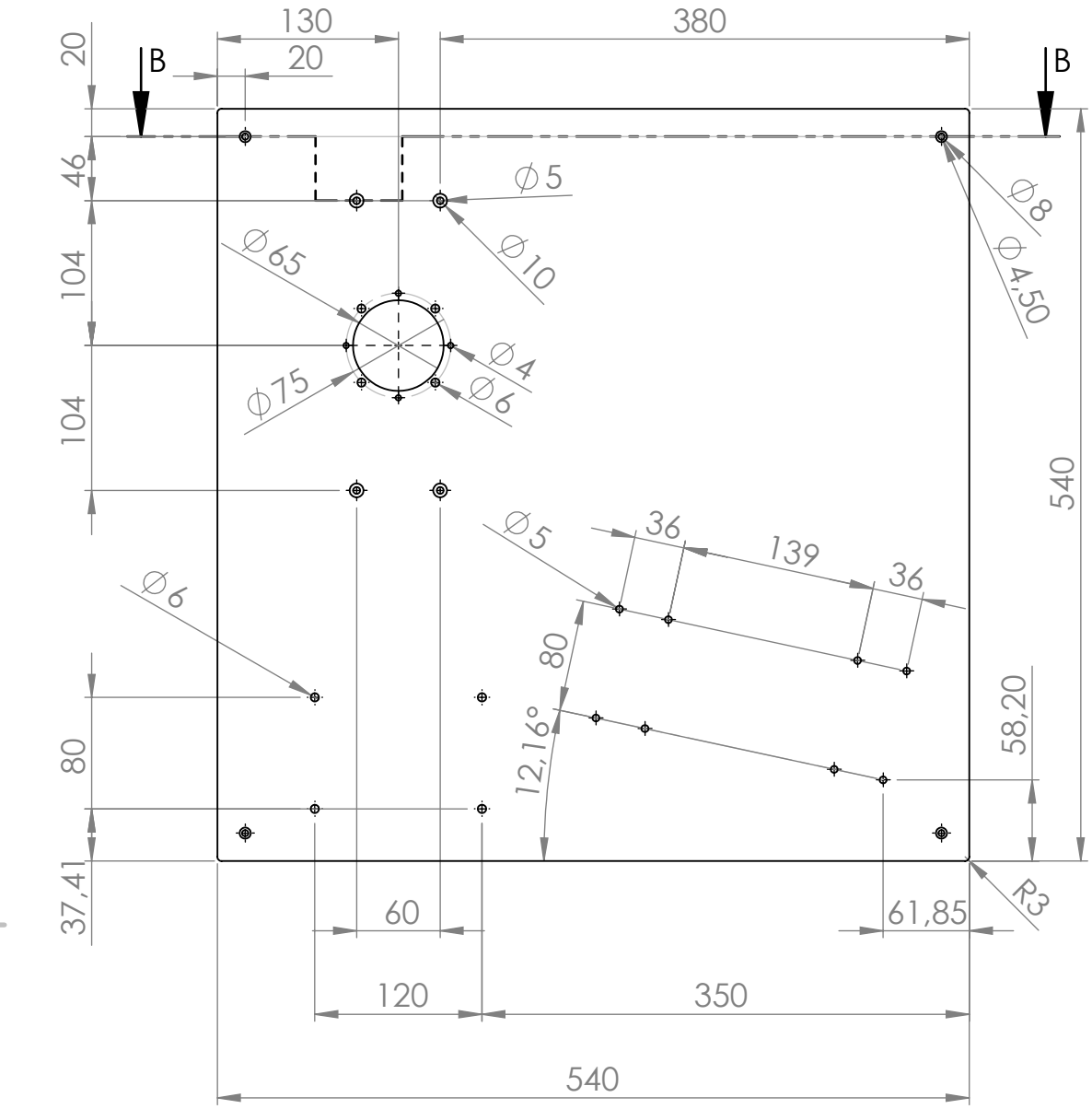
VIEW C

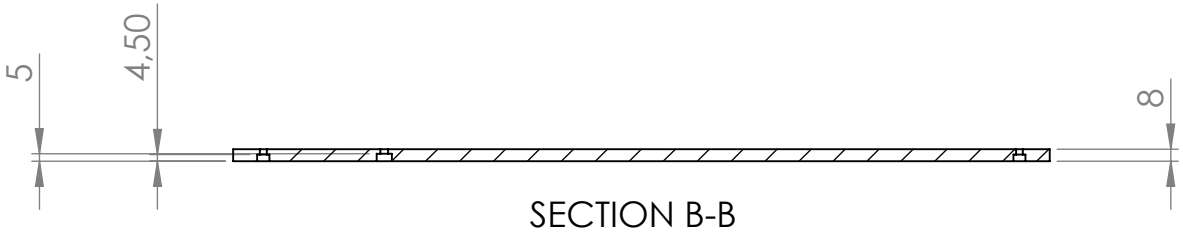


VIEW F



Autor: Martí Salcedo	MATERIAL: Alumini	TÍTOL: Suport_pistola	A4
Data: 20/12/2015	MASSA: 0,07 Kg	ESCALA: 1:1	





SECTION B-B

Autor: Martí Salcedo	MATERIAL: X.DEC. (SOLLASER SM-260)	TÍTOL: Taula-bancada		A4
Data: 20/12/2015	MASSA: 18,062 Kg	ESCALA: 1:5		