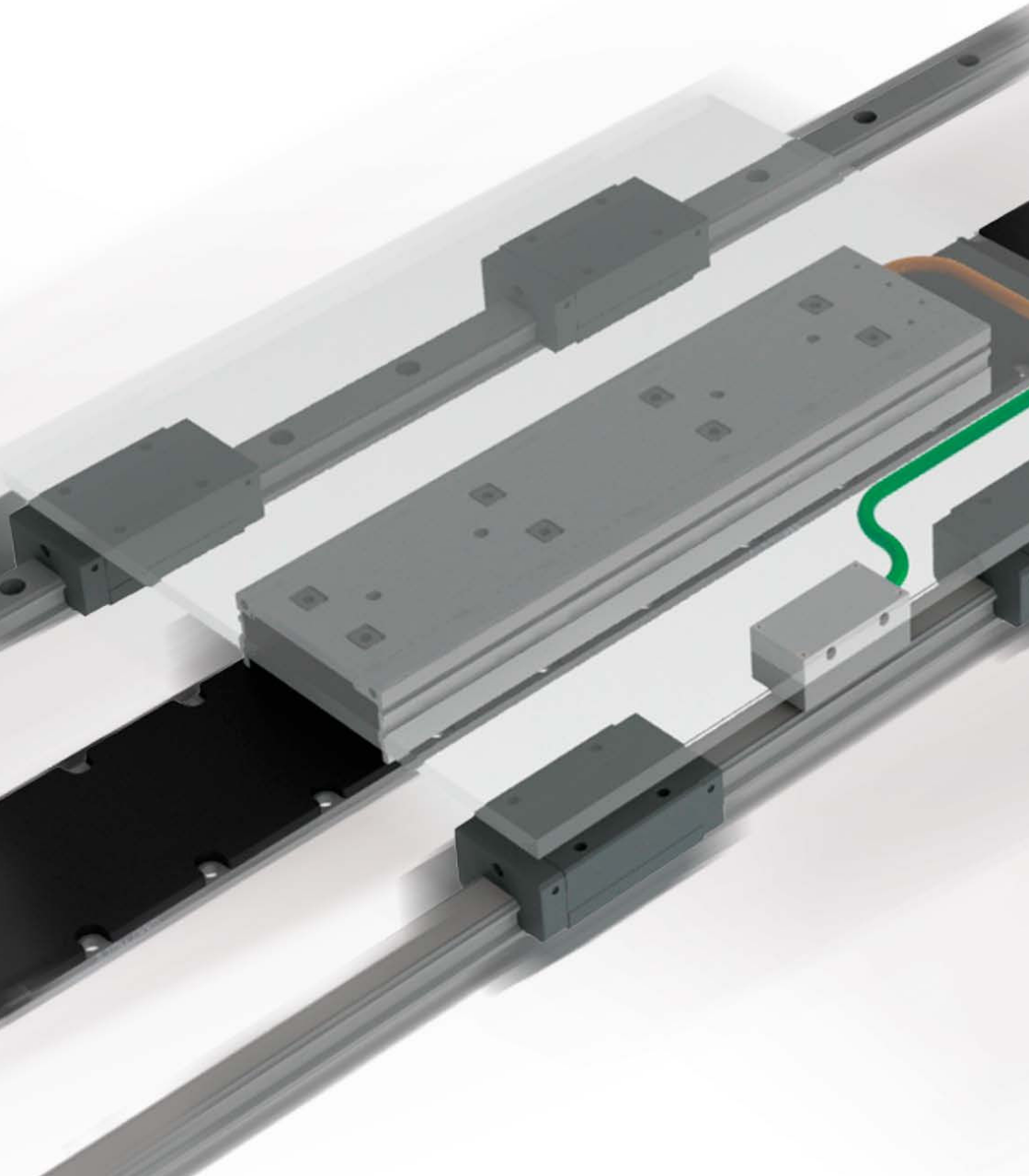
COMMISSIONING & MAINTENANCE MANUAL
LINEAR MOTOR KIT

V.03.01.2025



Imprint

Dear customer, many thanks for deciding on a SINADRIVES product. You have decided on the highest quality, excellent service and the highest precision.

You will therefore increase process reliability in your production processes and achieve the best processing results to the satisfaction of your customers.

Any questions?
We are also available at any time after you have purchased your product.
Best regards

Innovation & Excellence

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1. Before you start

Please read the following instructions very carefully. They are a requirement for the safe installation and correct commissioning of the linear motor axis.

For other information and support, please contact:

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ATTENTION
DISREGARDING THE SAFETY INSTRUCTIONS DURING INSTALLATION AND COMMISSIONING CAN CAUSE DAMAGE TO THE MACHINE AND DANGER TO THE LIFE OF OPERATING PERSONNEL.

ATTENTION
STRONG PERMANENT MAGNETS CAN CAUSE DAMAGE TO THE MAGNETIC DEVICES AND DANGER TO THE LIFE OF OPERATING PERSONNEL WITH HEART PACE MAKERS.

ATTENTION
DANGER FROM ELECTRICAL VOLTAGE!
IMPROPER CONDUCT MAY ENDANGER HUMAN LIFE.

ATTENTION
DANGER FROM MOVING PARTS.
THE AXES CAN START AUTOMATICALLY.

1.1 Basic safety information

Before installing and commissioning the linear motor axis, carefully read this instruction manual.

The manufacturer accepts no responsibility or liability for non-observance of the intended purpose of the linear motor axis or operating manual and damage or accidents due to negligence.

Transport the linear motor axis with care and caution even when it is still packed or during installation.

The magnets used are very sensitive to impact. Never expose the axis to a temperature above 70°C.

Unpack the linear motor axis and visually inspect it. If you notice damage such as marks that could have been caused by a fall, please contact the manufacturer. Please always quote the serial number of the axis.

You can find the number on both of the side plates.

1.2 Safety regulations

The linear motor axis is intended for installation in a machine or system.
The requirements of the applicable guidelines must be observed and complied with. The linear motor axis may only be used and applied within the scope of its defined application parameters. Any deviating use is deemed as incorrect use and the manufacturer accepts no liability for damage that may arise from this.

Note that the magnets installed in the aluminium profile have a high force of attraction on all ferrous materials and this can have dangerous, life-threatening consequences for persons with pacemakers. Data carriers such as credit cards are also affected by this.

Before installing the linear motor axis, make sure that the machine and system are grounded.
- The correct operating voltage is applied.
- The surrounding area is clean and dry as well as free of vapour and dust.
- The outside temperature is not ≥ 70°.

This does not apply to axes that were manufactured for special ambient conditions.

1.3 Certifications and Norms

SINADRIVES S.L. hereby declares that the linear motors and linear motor magnets comply with the applicable basic requirements of Machine Directive 2006/42/CE. The products also meet the standards and guidelines of CE, UL, CSA, ISO, RoHS, ISO 9001, and IEC 60034-25 certifications.

Linear motors and linear motor magnets
2006/42/CE

The linear motors and linear motor magnets may only be put into operation when it has been determined that the machine/system in which it should be installed complies with the regulations of Machine Directive 2006/42/CE and the additional requirements of:

- CE
- UL
- CSA
- ISO
- RoHS
- ISO 9001
- IEC 60034-25
- EN ISO 12100

For more information and certificates, please contact the Sales Manager for your area.

1.4 Taric codes

Product	Taric Code	Country of Origin
Linear motors	8503 009 999	PRC
Linear motor magnets	8503 009 999	PRC
Cables	8544 42 90	Spain
Linear guides	8482 1090 90	under request
Linear encoders	9031 80 20	under request

1.5 Magnetic field range

The recomended security distance to avoid damages produced by a magnetic field is especified at 1 meter, to assure no interference with electronic devices and heart pace makers.
However, the real magnetic force is around 1 Gauss at 15 cm above the magnets, and 0,5 Gauss at 15 cm on the side.

2. Introduction and design of the linear motor components

Thank you for purchasing SINADRIVES Direct Drive components. The Direct Drive components are designed to meet demanding automation requirements.
It is the user's responsibility to ensure that the Direct Drive components is installed in an assembly that has the legally required safety features.

The Direct Drive components is a part of a machine, system, or plant. It was developed in compliance with technical regulations concerning safety and is safe to operate.
If the linear motor components cannot be installed or used as described in the instruction manual or by trained persons, this can cause damage for which the manufacturer accepts no liability.

These instructions contain information about commissioning and maintenance for linear motors KMC and KMM, encoders KEC and KER, linear guides KGG, KGF and KGP.

Before starting installation, please check the number of delivered parts.
If you have any queries, we are available for you at any time.

3. Linear motor installation

The installation order must be followed as described in this instruction manual.
Non-compliance could cause dangerous situations and subsequent damage.
Correct order:

3.1 Mechanical installation

Before staring, please check that all surfaces to be used are clean and dry. We recommend using surfaces with an evenness of +/- 0.2 mm/metre. A larger tolerance could reduce the position accuracy.

For correct alignment, please use a side area as the alignment reference.

3.2 Electrical connections

Before staring work on the cables, make sure that the power supply is disconnected. Work carefully according to the instructions for your servo amplifier. Make sure your machine/system as a whole meets the requirements of all applicable standards, such as the EN 60204 standard.

There are two cables on the motor. One is used for the operating voltage supply and the second one is for the temperature sensors. Both cables must be shielded with a braided metal cable sheath for electromagnetic immunity.

Besides this manual you should carefully follow the installation instructions of your servo amplifier supplier. Make sure that the linear motor axis as a whole complies with the applicable electrical values. You can find all technical parameters of the linear motor from chapter 3.12 of this manual.

3.3 Grounding

Check that all grounding cables are firmly connected. The linear motor are driven according to the principle of pulse width modulation. This gives rise to large electrical impulses and causes an increased risk for electromagnetic interference. The grounding cable (PE) must be connected to the PE connection of your servo amplifier. Attach the galvanised sheathing as close as possible to the servo amplifier.

3.4 Temperature sensor

The coil unit is equipped with two temperature sensors, one PTC-1k type and one KTY:

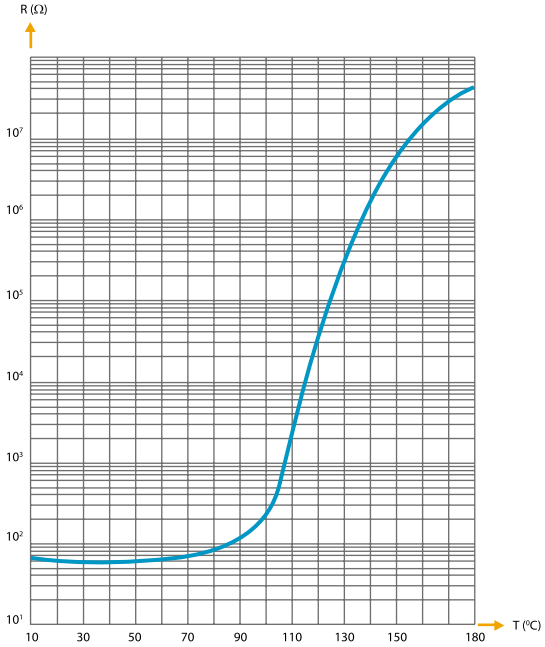
- KTY83-122 for KMC7 and KMC8
- NTC for KMC9

The temperature sensors are used for overheating protection of the coil units. The KTY sensor gives a proportional value to the driver while the PTC/NTC sensors act as a contact that is activated at 100ºC.

For more information, contact the SINADRIVES Service Team.

3.4.1 Mode of action

The PTC sensor: operates according to the principle of a PTC resistor that has a lower conductivity at high temperatures than at low temperatures. They have positive temperature coefficients. This means that their electrical resistance also increases with increasing temperature.



The NTC sensor: operates according to the principle of a thermistor that acts responds with a drop in resistance when the coils reach a critical temperature.

NTC

T°, C	20	30	40	50	60	70	80	90	100	110	120	130
R, Ohm	12490	8057	5327	3603	2488	1752	1258	918	680	511	389	301

The KTY Sensor: operates according to the principle of a Z-diode that changes its breakdown voltage proportional to the temperature. The proportional temperature can be seen at any time.

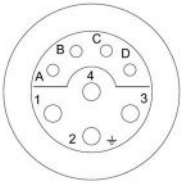
KTY83-122

T°, C	20	30	40	50	60	70	80	90	100	110	120	130
R, Ohm	972	1049	1130	1214	1301	1392	1487	1585	1687	1792	1900	2012

KTY84-130

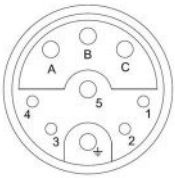
T°, C	20	30	40	50	60	70	80	90	100	110	120	130
R, Ohm	581	626	672	722	773	826	882	940	1000	1062	1127	1194

3.5 Connection of power connector M23



Pin	Signal description
1	U
2	PE
3	W
4	V
A	KTY
B	KTY
C	PTC+
D	PTC-

3.6 Connection of power connector YTEC

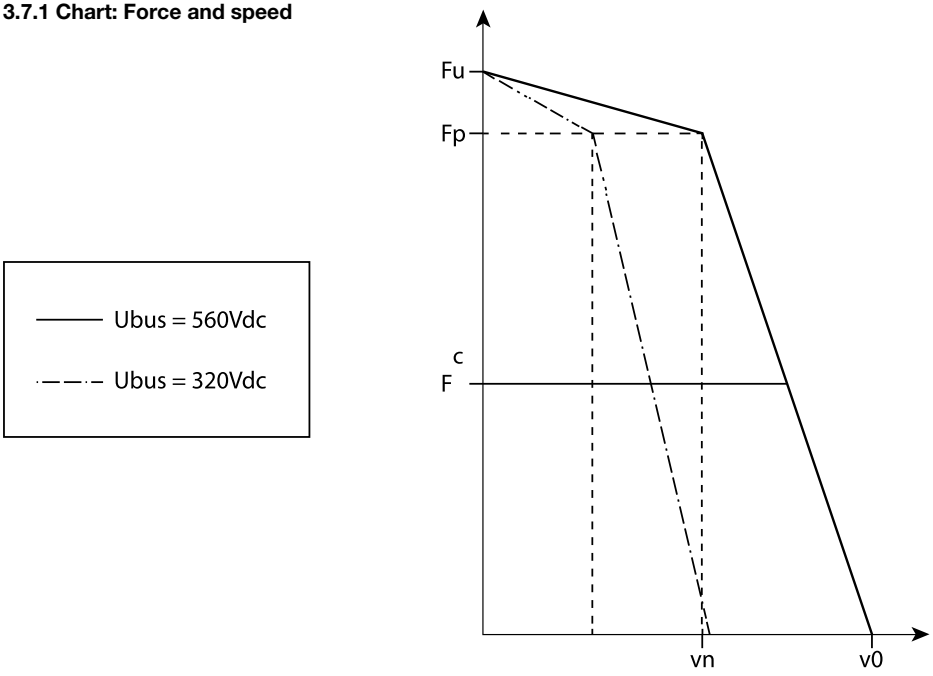


Pin	Signal description
A	U
B	V
C	W
PE	PE
1	KTY
2	KTY
3	PTC+
4	PTC-

3.7 Information about the linear motors

On the following pages, technical data for linear motors are presented. The graph “Figure 3.7.1” illustrates the maximum and nominal force in relation to the motor speed and supply voltage (S1 and S3 duty cycles).

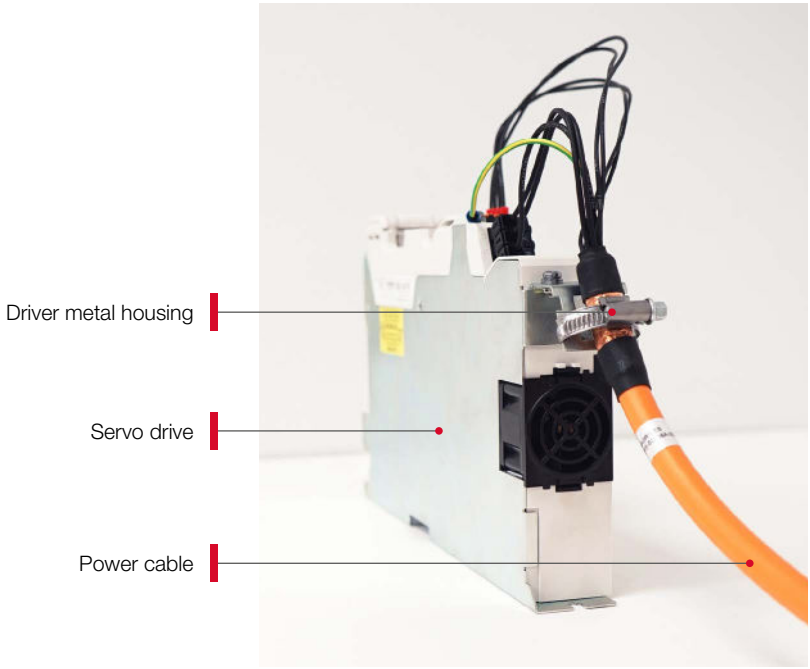
3.7.1 Chart: Force and speed



3.8 Connexion of the linear motor and encoder to the driver

When connecting a torque motor and encoder to a servodrive, it is crucial to follow these guidelines:

1. The power cable must be shielded. The shield of the cable must be securely connected to both the housing of the connectors and the housing of the driver.



2. The encoder cable must also be shielded, with its shield securely connected to the housing of the connector and the housing of the driver (or to the driver connector).

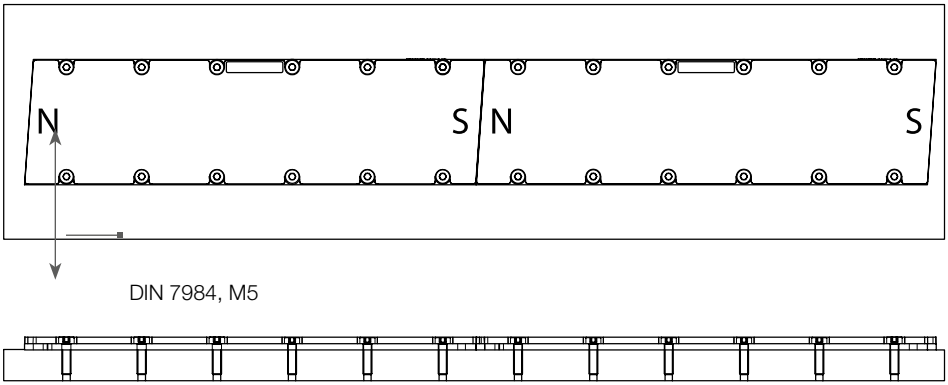
3. It is crucial to verify the maximum allowable length of the encoder and power cables. Ensuring there are no voltage drops or signal quality degradation is essential.

4. Avoid any interruptions in the shielding along the cables. If any occur, additional shielding should be applied.

3.9 Mounting of the linear motor

3.9.1 Mounting of the magnet plates

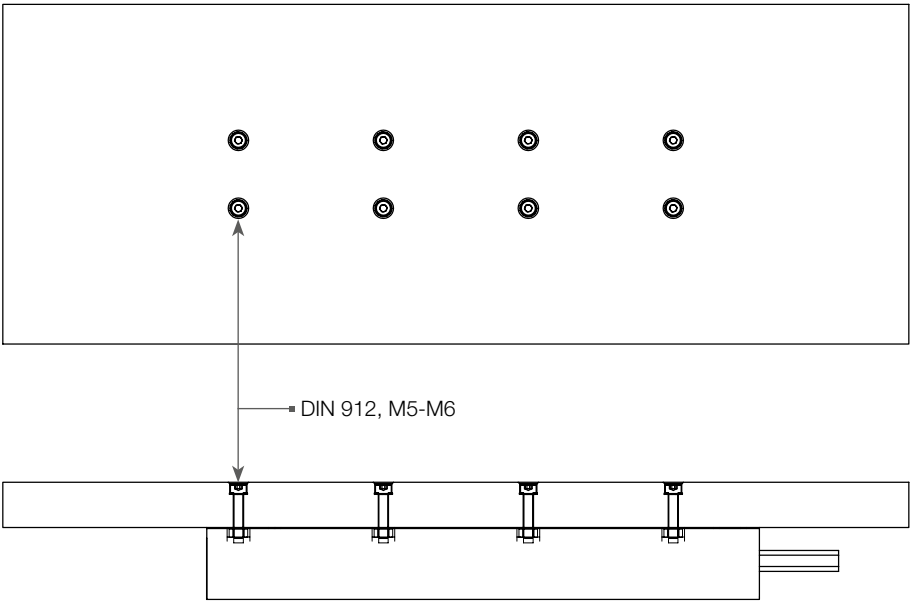
Assembly:
- Use the holes provided in the plate
- For the tightening torque, please refer to the table below
- The polarity must always be north / south (S/N)



Screw tightening torque (Nm)			
Strength grade 12.9 Alloy steel screws DIN 7984 galvanized	steel	cast iron	Non-ferrous metals
M5	8.8	5.9	4.4

3.9.2 Mounting of the linear motor

Assembly:
- Use the threaded holes provided in the linear motor
- For the tightening torque, please refer to the table below



Screw tightening torque (Nm)	
Strength grade 12.9	
Alloy steel screws	
DIN 912 galvanized	
M5	8.8
M6	13.7

KMC71S SERIES - IRON CORE LINEAR MOTOR

	Parameter	Unit	KMC71S			
Performance	Winding type		II01H	II01I	II02H	II02I
	Motortype, max voltage ph-ph		3-phase synchronous Iron core, 230V $_{ac\ rms}$ (320V$_{dc}$)			
	Ultimate force @ 10°C/s increase	N	110		220	
	Peak force @ 6°C/s increase	N	95		190	
	Continuous force	N	45		90	
	Motor force constant	N/A$_{rms}$	30	9	30	9
	Motor constant	N²/W	40	40	80	80
	Max, speed (v0) at 320Vdc	m/s	13	50	13	50
	Nominal speed (vn) at 320Vdc	m/s	5	15	5	15
Electrical	Ultimate current	A$_{rms}$	5	14.2	9.9	28.4
	Peak current	A$_{rms}$	3.7	12.3	7.3	24.6
	Maximum continuous current	A$_{rms}$	1.5	5	3	10
	Back EMF Phase-Phase$_{peak}$	V/m/s	24	7.7	24	7.7
	Resistance per phase	Ω	5	0.63	2.5	0.31
	Induction per phase	mH	30	2.92	15	1.46
	Electrical time constant	ms	6			
Thermal	Max. continuous power loss	W	66		132	
	Thermal resistance	°C/W	1.85		0.94	
	Temperature cut-off / sensor		PTC 1kΩ / KTY 83-122			
Mechanical	Coil unit weight	kg	0.4		0.7	
	Coil unit length	mm	96		160	
	Motor attraction force	N	220		500	
	Magnet pitch NN	mm	32			
	Cable Type (power FLEX)	mm (AWG)	6.6 (21)			
	Cable Type (sensor)	mm (AWG)	4.9 (26)			
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles			
	Bending Radius Static	mm	4x cable diameter			
	Bending Radius Dynamic	mm	7.5x cable diameter			

KMC73S SERIES - IRON CORE LINEAR MOTOR

	Parameter	Unit	KMC73S									
Performance	Winding type		II01H	II01I	II02H	II02I	II05H	II05I	II07N	II07H	II07I	II09N
	Motortype, max voltage ph-ph		3-phase synchronous Iron core, 400 $V_{ac\ rms}$ (max. 600 V_{dc})									
	Ultimate force @ 10°C/s increase	N	135		270		540		810			960
	Peak force @ 6°C/s increase	N	116		232		464		696			840
	Continuous force	N	60		120		240		360			480
	Motor force constant	N/A_{rms}	39	12.9	39	12.9	39	12.9	79	39	12.9	103
	Motor constant	N^2/W	95		190		380		570			760
	Max, speed (v0) at 560Vdc	m/s	13.8	51	13.9	33	13.8	51	7.5	14	51	6.3
	Nominal speed (vn) at 560Vdc	m/s	9	9	9	9	9	9	4.2	9	9	3.6
	Max, speed (v0) at 320Vdc	m/s	8.4	29	8.2	21.5	8.4	29	4.3	8.4	29	3.6
	Nominal speed (vn) at 320Vdc	m/s	5	50	5	9	5	50	2.1	5.2	50	2
Electrical	Ultimate current	A_{rms}	4.1	12.6	8.2	25.1	16.4	56.1	12.3	25.1	42.1	12.6
	Peak current	A_{rms}	3.1	9.5	6.2	18.9	12.4	41.5	9.2	18.9	31.1	9.5
	Maximum continuous current	A_{rms}	1.5	4.7	3	9.3	6	20.3	4.5	9.3	15.2	4.7
	Back EMF Phase-Phase$_{peak}$	V/m/s	32	11	32	11	32	11	65	32	11	84
	Resistance per phase	Ω	5.4	0.56	2.7	0.28	1.35	0.14	3.6	0.85	0.4	4.5
	Induction per phase	mH	35	3.75	17	1.83	9	0.9	23	5.5	2.6	29
	Electrical time constant	ms	6.5									
Thermal	Max. continuous power loss	W	49		99		197		296			394
	Thermal resistance	°C/W	1.5		0.75		0.38		0.25			0.19
	Thermal time constant	s	75									
	Temperature cut-off / sensor		PTC 1kΩ / KTY 83-122									
Mechanical	Coil unit weight	kg	0,6		0,9		1,6		2,3			3.0
	Coil unit length	mm	93		143	93	241		336			425
	Motor attraction force	N	300		500		900		1300			1700
	Magnet pitch NN	mm	24									
	Cable mass	kg/m	0.18									
	Cable Type (power FLEX)	mm (AWG)	8,3 (18)									
	Cable Type (sensor)	mm (AWG)	4,3 (26)									
	Cable Life Time (power FLEX)	Cycles	5,000,000 cycles									
	Bending Radius Static	mm	4x cable diameter									
	Bending Radius Dynamic	mm	10x cable diameter									

KMC75S SERIES - IRON CORE LINEAR MOTOR

	Parameter	Unit	KMC75S					
Performance	Winding type		II04N	II04H	II06N	II06H	II09N	II09H
	Motortype, max voltage ph-ph		3-phase synchronous Iron core, 380V $_{ac\ rms}$ (600V$_{dc}$)					
	Ultimate force @ 10°C/s increase	N	496		744		992	
	Peak force @ 6°C/s increase	N	440		660		890	
	Continuous force	N	200		300		400	
	Motor force constant	N/A$_{rms}$	93	46.5	140	46.5	93	46.5
	Motor constant	N²/W	380		570		760	
	Max, speed (v0) at 560Vdc	m/s	7	15	5	15	7	15
	Nominal speed (vn) at 560Vdc	m/s	2	5	2	5	2	5
	Max, speed (v0) at 320Vdc	m/s	4	8	3	8	4	8
	Nominal speed (vn) at 320Vdc	m/s	1	3	1	3	1	3
Electrical	Ultimate current	A$_{rms}$	6.5	13.1	6.5	19.6	13.1	26.2
	Peak current	A$_{rms}$	5	10	5	15	10	20
	Maximum continuous current	A$_{rms}$	2.26	4.5	2.26	6.8	4.5	9
	Back EMF Phase-Phase$_{peak}$	V/m/s	76	38	114	38	76	38
	Resistance per phase	Ω	7.2	1.80	10.8	1.21	3.6	0.90
	Induction per phase	mH	54	14	81	9	27	7
	Electrical time constant	ms	7.5					
Thermal	Max. continuous power loss	W	150		225		300	
	Thermal resistance	°C/W	0.48		0.32		0.24	
	Thermal time constant	s	77					
	Watercooling flow	l/min	0.7		1.1		1.4	
	Watercooling pressure-drop	bar	1		1		2	
	Temperature cut-off / sensor		PTC 1kΩ / KTY 83-122					
Mechanical	Coil unit weight	kg	1.5		2		2.6	
	Coil unit length	mm	146		194		244	
	Motor attraction force	N	950		1325		1700	
	Magnet pitch NN	mm	24					
	Cable mass	kg/m	0.18					
	Cable type (power FLEX)	mm (AWG)	9.6 (18)					
	Cable type (sensor FLEX)	mm (AWG)	4.3 (26)					
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles					
	Bending Radius Static	mm	4x cable diameter					
	Bending Radius Dynamic	mm	7.5x cable diameter					

KMC75S SERIES - IRON CORE LINEAR MOTOR

	Parameter	Unit	KMC75S								
Performance	Winding type		II11N	II11H	II13N	II13H	II18N	II18H	II25N	II25H	II36Q
	Motortype, max voltage ph-ph		3-phase synchronous Iron core, 400 $V_{ac\ rms}$ (max. 600 V_{dc})								
	Ultimate force @ 10°C/s increase	N	1240		1488		1984		2480		3600
	Peak force @ 6°C/s increase	N	1100		1320		1760		2200		3200
	Continuous force	N	500		600		800		1100		1680
	Motor force constant	N/A_{rms}	112	46.5	93	44.9	93	46.5	112.5	46.5	180
	Motor constant	N^2/W	950		1140		1520		1900		3040
	Max, speed (v0) at 560Vdc	m/s	6	15	7	15	7	15	7	15	3.5
	Nominal speed (vn) at 560Vdc	m/s	2	5	2	5	2	5	2	5	1.3
	Max, speed (v0) at 320Vdc	m/s	3	8	4	8	4	8	4	8	1.9
	Nominal speed (vn) at 320Vdc	m/s	1	3	1	3	1	3	1	3	0.3
Electrical	Ultimate current	A_{rms}	13.5	32.7	19.6	41	26.2	52	29.8	72.1	27.1
	Peak current	A_{rms}	10.4	25.0	15.0	31.0	20.0	40.0	22.7	55.0	20.7
	Maximum continuous current	A_{rms}	4.7	11.3	6.8	14.0	9.0	18.1	9.8	23.7	9.4
	Back EMF Phase-Phase$_{peak}$	V/m/s	92	38	76	38	76	38	92	38	147
	Resistance per phase	Ω	4.3	0.72	2.41	0.59	1.81	0.46	2.17	0.37	3.45
	Induction per phase	mH	32.0	5.4	18.0	4.4	14	3.4	16.3	2.8	25.9
	Electrical time constant	ms	7.5								
Thermal	Max. continuous power loss	W	375		450		600		853		1200
	Thermal resistance	°C/W	0.19		0.16		0.12		0.1		0.06
	Thermal time constant	s	77								
	Watercooling flow	l/min	1.8		2.2		2.9		3.2		5.7
	Watercooling pressure-drop	bar	2		2		3		3		7
	Temperature cut-off / sensor		PTC 1kΩ / KTY 83-122								
Mechanical	Coil unit weight	kg	3.2		3.8		5.2		6		9.75
	Coil unit length	mm	290		336		468		562		855
	Motor attraction force	N	2075		2450		3400		4150		6400
	Magnet pitch NN	mm	24								
	Cable mass	kg/m	0.18								
	Cable Type (power FLEX)	mm (AWG)	7.4 (18)					11.9 (14)			
	Cable Type (sensor)	mm (AWG)	4.3 (26)								
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles								
	Bending Radius Static	mm	4x cable diameter								
	Bending Radius Dynamic	mm	7.5x cable diameter								

KMC77S SERIES - IRON CORE LINEAR MOTOR

	Parameter	Unit	KMC77S					
Performance	Winding type		II18N	II18H	II22N	II22H	II28N	II28H
	Motortype, max voltage ph-ph		3-phase synchronous Iron core, 400 $V_{ac\ rms}$ (max. 600 V_{dc})					
	Ultimate force @ 10°C/s increase	N	1900		2375		2850	
	Peak force @ 6°C/s increase	N	1680		2100		2520	
	Continuous force	N	760		950		1200	
	Motor force constant	N/A_{rms}	186	93	225	93	186	89.9
	Motor constant	N^2/W	1750		2150		2640	
	Max, speed (v0) at 560Vdc	m/s	3.7	7.4	3.1	7.4	3.1	7.4
	Nominal speed (vn) at 560Vdc	m/s	1.1	2.7	0.9	2.8	0.9	2.8
	Max, speed (v0) at 320Vdc	m/s	2.1	4.2	1.7	4.2	1.7	4.2
	Nominal speed (vn) at 320Vdc	m/s	0.4	1.4	0.2	1.4	0.2	1.4
Electrical	Ultimate current	A_{rms}	13	26	13.5	33	21	43
	Peak current	A_{rms}	10	20	10	25	16	33
	Maximum continuous current	A_{rms}	4.1	8.2	4.2	10.2	6	13
	Back EMF Phase-Phase$_{peak}$	V/m/s	152	76	183	76	152	73
	Resistance per phase	Ω	6.3	1.6	7.6	1.3	4.24	1.02
	Induction per phase	mH	51	13	60	10	34	8
	Electrical time constant	ms	8					
Thermal	Max. continuous power loss	W	430		530		731	
	Thermal resistance	°C/W	0.15		0.12		0.11	
	Thermal time constant	s	90					
	Temperature cut-off / sensor		PTC 1kΩ / KTY 83-122					
Mechanical	Coil unit weight	kg	4.9		5.9		6.5	
	Coil unit length	mm	244		290		338	
	Motor attraction force	N	3400		4150		4900	
	Magnet pitch NN	mm	24					
	Cable Type (power FLEX)	mm (AWG)	8.4 (16)					
	Cable Type (sensor)	mm (AWG)	4.3 (26)					
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles					
	Bending Radius Static	mm	4x cable diameter					
	Bending Radius Dynamic	mm	7.5x cable diameter					

KMC77S SERIES - IRON CORE LINEAR MOTOR

	Parameter	Unit	KMC77S					
Performance	Winding type		II38N	II38H	II45N	II45H	II71N	II71H
	Motortype, max voltage ph-ph		3-phase synchronous Iron core, 400 $V_{ac\ rms}$ (max. 600 V_{dc})					
	Ultimate force @ 10°C/s increase	N	3800		4750		7125	
	Peak force @ 6°C/s increase	N	3360		4200		6300	
	Continuous force		1600		1900		3000	
	Motor force constant	N/A_{rms}	186	93	225	93	224.5	93
	Motor constant	N^2/W	3520		4300		6600	
	Max, speed (v0) at 560Vdc	m/s	3.1	7.4	3.1	7.4	3.1	7.4
	Nominal speed (vn) at 560Vdc	m/s	0.9	2.8	0.9	2.7	0.9	3
	Max, speed (v0) at 320Vdc	m/s	1.7	4.2	1.8	4.2	1.8	4.2
	Nominal speed (vn) at 320Vdc	m/s	0.2	1.4	0.2	1.4	0.2	1.5
Electrical	Ultimate current	A_{rms}	28	56	27	66	43	104
	Peak current	A_{rms}	21	42	20	50	33	79
	Maximum continuous current	A_{rms}	9	18	8.5	20.5	13	32
	Back EMF Phase-Phase$_{peak}$	V/m/s	152	76	183	76	183	76
	Resistance per phase	Ω	3.2	0.8	3.8	0.65	253	0.43
	Induction per phase	mH	25.4	6.4	30	5	20	3
	Electrical time constant	ms	8					
Thermal	Max. continuous power loss	W	853		1060		1827	
	Thermal resistance	°C/W	0.08		0.06		0.04	
	Thermal time constant	s	90					
	Temperature cut-off / sensor		PTC 1kΩ / KTY 83-122					
Mechanical	Coil unit weight	kg	9		11.6		16.5	
	Coil unit length	mm	468		562		847	
	Motor attraction force	N	6800		8300		12450	
	Magnet pitch NN	mm	24					
	Cable Type (power FLEX)	mm (AWG)	10.1 (14)				12.1 (6)	
	Cable Type (sensor)	mm (AWG)	4.3 (26)					
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles					3-5m
	Bending Radius Static	mm	4x cable diameter					4x
	Bending Radius Dynamic	mm	7.5x cable diameter					10x

KMC78S SERIES - IRON CORE LINEAR MOTOR

	Parameter	Unit	KMC78S					
Performance	Winding type		II19N	II19H	II23N	II23H	II28N	II28H
	Motortype, max voltage ph-ph		3-phase synchronous Iron core, 380 $V_{ac\ rms}$ (600V_{dc})					
	Ultimate force @ 10°C/s increase	N	1900		2375		2850	
	Peak force @ 6°C/s increase	N	1680		2100		2520	
	Continuous force watercooled**	N	1040		1300		1560	
	Continuous force aircooled*		800		1000		1200	
	Motor force constant	N/A_{rms}	186	93	224.5	93	186	90
	Motor constant	N^2/W	1760		2200		2640	
	Max, speed (v0) at 560Vdc	m/s	3.1	7.4	3.1	7.4	3.1	7.4
	Nominal speed (vn) at 560Vdc	m/s	0.9	2.8	0.9	2.8	0.9	2.8
	Max, speed (v0) at 320Vdc	m/s	1.7	4.2	1.8	4.2	1.7	4.2
	Nominal speed (vn) at 320Vdc	m/s	0.2	1.4	0.2	1.4	0.2	1.4
Electrical	Ultimate current	A_{rms}	14	28	14	35	21	43
	Peak current	A_{rms}	11	21	11	26	16	33
	Maximum continuous current	A_{rms}	6	11	6	14	8	17
	Back EMF Phase-$Phase_{peak}$	V/m/s	152	76	183	76	152	73
	Resistance per phase	Ω	6.35	1.59	7.55	1.27	4.24	1.02
	Induction per phase	mH	51	13	60	10	34	8
	Electrical time constant	ms	8					
Thermal	Max. continuous power loss	W	487		609		731	
	Thermal resistance	°C/W	0.17		0.13		0.11	
	Thermal time constant	s	87					
	Watercooling flow		2.7		3.4		4.1	
	Watercooling pressure-drop		0.8		1		1.2	
	Temperature cut-off / sensor		PTC 1kΩ / KTY 83-122					
Mechanical	Coil unit weight	kg	4.8		6		7.2	
	Coil unit length	mm	224		290		338	
	Motor attraction force	N	3400		4150		4900	
	Magnet pitch NN	mm	24					
	Cable Type (power FLEX)	mm (AWG)	8.4 (16)					
	Cable Type (sensor)	mm (AWG)	4.9 (26)					
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles					
	Bending Radius Static	mm	4x cable diameter					
	Bending Radius Dynamic	mm	7.5x cable diameter					

KMC78S SERIES - IRON CORE LINEAR MOTOR

	Parameter	Unit	KMC78S			
Performance	Winding type		II47N	II47H	II71N	II71H
	Motortype, max voltage ph-ph		3-phase synchronous Iron core, 380 $V_{ac\ rms}$ (600V_{dc})			
	Ultimate force @ 10°C/s increase	N	4750		7125	
	Peak force @ 6°C/s increase	N	4200		6300	
	Continuous force watercooled**	N	2600		3900	
	Continuous force aircooled*		1900		2850	
	Motor force constant	N/A_{rms}	225	93	225	93
	Motor constant	N^2/W	4400		6600	
	Max, speed (v0) at 560Vdc	m/s	3.1	7.4	3.1	7.4
	Nominal speed (vn) at 560Vdc	m/s	0.9	2.7	0.9	2.9
	Max, speed (v0) at 320Vdc	m/s	1.7	4.2	1.7	4.2
	Nominal speed (vn) at 320Vdc	m/s	0.2	1.4	0.2	1.5
Electrical	Ultimate current	A_{rms}	29	69	43	104
	Peak current	A_{rms}	22	53	33	79
	Maximum continuous current	A_{rms}	12	28	17	42
	Back EMF Phase-$Phase_{peak}$	V/m/s	183	76	183	76
	Resistance per phase	Ω	3.78	0.64	2.53	0.43
	Induction per phase	mH	30	5	20	3
	Electrical time constant	ms	8			
Thermal	Max. continuous power loss	W	1218		1827	
	Thermal resistance	°C/W	0.07		0.04	
	Thermal time constant	s	87			
	Watercooling flow		5.6		8.4	
	Watercooling pressure-drop		1.5		2.5	
	Temperature cut-off / sensor		PTC 1kΩ / KTY 83-122			
Mechanical	Coil unit weight	kg	12		18	
	Coil unit length	mm	568		847	
	Motor attraction force	N	8300		12450	
	Magnet pitch NN	mm	24			
	Cable Type (power FLEX)	mm (AWG)	10.1 (14)		12.1 (11)	
	Cable Type (sensor)	mm (AWG)	4.9 (26)			
	Cable Life Time (power FLEX)	Cycles	5m cycles	3-5 millions cycles		
	Bending Radius Static	mm	4x cable	5x cable diameter		
	Bending Radius Dynamic	mm	7.5x cable	10x cable diameter		

KMC79S SERIES - IRON CORE LINEAR MOTOR

	Parameter	Unit	KMC79S					
Performance	Winding type		II27N	II27H	II34N	II34H	II41N	II41H
	Motortype, max voltage ph-ph		3-phase synchronous Iron core, 380 $V_{ac\ rms}$ (600V_{dc})					
	Ultimate force @ 10°C/s increase	N	2700		3375		4050	
	Peak force @ 6°C/s increase	N	2400		3000		3600	
	Continuous force watercooled**	N	1500		1950		2340	
	Continuous force aircooled*		1200		1500		1800	
	Motor force constant	N/A_{rms}	279	139.5	336	139.5	279	135
	Motor constant	N^2/W	2864		3580		4296	
	Max, speed (v0) at 560Vdc	m/s	2.5	4.9	2	4.9	2.5	5.1
	Nominal speed (vn) at 560Vdc	m/s	0.7	1.8	0.4	1.8	0.9	1.8
	Max, speed (v0) at 320Vdc	m/s	1.4	2.8	1.2	2.8	1.4	2.9
	Nominal speed (vn) at 320Vdc	m/s	0.1	0.9	-	0.9	0.1	0.9
Electrical	Ultimate current	A_{rms}	13.1	26	13.5	33	20	41
	Peak current	A_{rms}	10	20	11	25	15	31
	Continuous current water cooled	A_{rms}	5.5	11	6	14	8	17
	Continuous current air cooled	A_{rms}	4.3	9	4.3	11	6.5	13.4
	Back EMF Phase-$Phase_{peak}$	V/m/s	228	114	274	114	228	110
	Resistance per phase	Ω	9.1	2.27	10.8	1.82	6.06	1.45
	Induction per phase	mH	77.35	19	92	15	52	12
	Electrical time constant	ms	8.5					
Thermal	Max. continuous power loss	W	713		891		1011	
	Thermal resistance	°C/W	0.13		0.12		0.11	
	Watercooling flow		3.1		4		4.8	
	Temperature cut-off / sensor		PTC 1kΩ / KTY 83-122					
Mechanical	Coil unit weight	kg	7		9		12	
	Coil unit length	mm	248		296		336	
	Motor attraction force	N	5100		6225		7350	
	Magnet pitch NN	mm	24					
	Cable Type (power FLEX)	mm (AWG)	10.1 (14)					
	Cable Type (sensor)	mm (AWG)	4.9 (26)					
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles					
	Bending Radius Static	mm	4x cable diameter					
	Bending Radius Dynamic	mm	7.5x cable diameter					

KMC79S SERIES - IRON CORE LINEAR MOTOR

	Parameter	Unit	KMC79S					
Performance	Winding type		II54N	II54H	II68N	II68H	II10N	II10H
	Motortype, max voltage ph-ph		3-phase synchronous Iron core, 380 $V_{ac\ rms}$ (600V_{dc})					
	Ultimate force @ 10°C/s increase	N	5400		6750		10125	
	Peak force @ 6°C/s increase	N	4800		6000		9000	
	Continuous force watercooled**	N	3000		3900		5850	
	Continuous force aircooled*		2400		3000		4500	
	Motor force constant	N/A_{rms}	279	139.5	336	139.5	336	139.5
	Motor constant	N^2/W	5728		7160		10740	
	Max, speed (v0) at 560Vdc	m/s	2.5	4.9	2	4.9	2.1	4.9
	Nominal speed (vn) at 560Vdc	m/s	0.9	1.7	0.5	1.7	0.9	1.8
	Max, speed (v0) at 320Vdc	m/s	1.4	2.8	1.2	2.8	1.2	2.8
	Nominal speed (vn) at 320Vdc	m/s	0.2	0.8	-	0.8	-	0.9
Electrical	Ultimate current	A_{rms}	27	52	28	66	41	98
	Peak current	A_{rms}	20	40	21	50	31	75
	Continuous current water cooled	A_{rms}	11	22	12	29	18	42
	Continuous current air cooled	A_{rms}	9	18	9	22	13.4	32
	Back EMF Phase-$Phase_{peak}$	V/m/s	228	114	274	114	274	114
	Resistance per phase	Ω	4.54	1.14	5.4	0.91	3.61	0.61
	Induction per phase	mH	39	10	46	8	31	5
	Electrical time constant	ms	8.5					
Thermal	Max. continuous power loss	W	1347		1684		2527	
	Thermal resistance	°C/W	0.09		0.07		0.03	
	Watercooling flow		6.2		8		12	
	Temperature cut-off / sensor		PTC 1kΩ / KTY 83-122					
Mechanical	Coil unit weight	kg	16		18		27	
	Coil unit length	mm	440		568		840	
	Motor attraction force	N	6800		12450		18675	
	Magnet pitch NN	mm	24					
	Cable Type (power FLEX)	mm (AWG)	10.1 (14)			12.1 (11)		14.7 (9)
	Cable Type (sensor)	mm (AWG)	4.9 (26)					
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles			3-5 millions cycles		
	Bending Radius Static	mm	4x cable diameter			5x cable diameter		
	Bending Radius Dynamic	mm	7.5x cable diameter			10x cable diameter		

KMC80S SERIES - IRON CORE LINEAR MOTOR

	Parameter	Unit	KMC80S					
Performance	Winding type		II34H	II42H	II50H	II67N	II84H	II12H
	Motortype, max voltage ph-ph		3-phase synchronous Iron core, 380 $V_{ac\ rms}$ (600V_{dc})					
	Ultimate force @ 10°C/s increase	N	3360	4200	5040	6720	8400	12600
	Peak force @ 6°C/s increase	N	3200	4000	4800	6400	8000	12000
	Continuous force watercooled**	N	2080	2600	3120	4160	5200	7800
	Continuous force aircooled*		1600	2000	2400	3200	4000	6000
	Motor force constant	N/A_{rms}	174					
	Motor constant	N^2/W	1802	2243	2883	3604	4485	12615
	Max, speed (v0) at 560Vdc	m/s	3.9					
	Nominal speed (vn) at 560Vdc	m/s	1.2	1.1	1.2	1.1	1.1	1.1
	Max, speed (v0) at 320Vdc	m/s	2.3					
	Nominal speed (vn) at 320Vdc	m/s	0.5					0.4
Electrical	Ultimate current	A_{rms}	26	34	40	52	65	98
	Peak current	A_{rms}	21	27	32	43	53	80
	Continuous current water cooled	A_{rms}	12	15	18	24	30	45
	Continuous current air cooled	A_{rms}	9.2	12	14	18.5	23	35
	Back EMF Phase-$Phase_{peak}$	V/m/s	142					
	Resistance per phase	Ω	2.8	2.25	1.75	1.4	1.125	0.8
	Induction per phase	mH	28	22.5	17.5	14	11.3	8
	Electrical time constant	ms	10					
Thermal	Max. continuous power loss	W	1847	2319	2597	3693	4638	6957
	Thermal resistance	ºC/W	0.08	0.06	0.05	0.04	0.03	0.01
	Watercooling flow		4.1	5.2	6.2	8.2	10.4	15.5
	Temperature cut-off / sensor		PTC 1kΩ / NTC					
Mechanical	Coil unit weight	kg	9	12	15	20	25	38
	Coil unit length	mm	273	321	336	465	593	865
	Motor attraction force	N	7200	9000	10800	14400	18000	27000
	Magnet pitch NN	mm	24					
	Cable Type (power FLEX)	mm (AWG)	10.1 (14)		12.1 (11)			14.7 (9)
	Cable Type (sensor)	mm (AWG)	4.9 (26)					
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles		3-5 milliones cycles			
	Bending Radius Static	mm	4x cable diameter		5x cable diameter			
	Bending Radius Dynamic	mm	7.5x cable diameter		10x cable diameter			

KMC89S SERIES - IRONLESS LINEAR MOTOR

	Parameter	Unit	KMC89S		
Performance	Winding type		UI02H	UI04H	UI06H
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 45$V_{ac\ rms}$ (60V_{dc})		
	Peak force @ 6°C/s increase	N	20	40	60
	Continuous force	N	6	12	15
	Motor force constant	N/A_{rms}	6		
	Motor constant	N^2/W	3	6	9
	Max, speed (v0) at 60Vdc	m/s	6		
	Nominal speed (vn) at 60Vdc	m/s	1.1		
Electrical	Peak current	A_{rms}	3.3	6.7	10
	Continuous current air cooled	A_{rms}	0.8	1.7	2.5
	Back EMF Phase-$Phase_{peak}$	V/m/s	5		
	Resistance per phase	Ω	4.75	2.38	1.58
	Induction per phase	mH	0.8	0.4	0.3
	Electrical time constant	ms	0.16		
Thermal	Max. continuous power loss	W	11.2	22.4	33.6
	Thermal resistance	°C/W	1.6	0.8	0.53
	Temperature cut-off / sensor		None		
Mechanical	Coil unit weight	kg	0.03	0.05	0.08
	Coil unit length	mm	45	78	111
	Motor attraction force	N	0		
	Magnet pitch NN	mm	16.5		
	Cable Type (power FLEX)	d	Leadwires 3*0.3mm^2		
	Cable Type (sensor)	d	NA		
	Cable Life Time (power FLEX)	Cycles	12.000.000		
	Bending Radius Static	mm	4x cable diameter		
	Bending Radius Dynamic	mm	7.5x cable diameter		

KMC90S SERIES - IRONLESS LINEAR MOTOR

	Parameter	Unit	KMC90S	
Performance	Winding type		UI04H	UI09H
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 45V $_{ac\ rms}$ (60V$_{dc}$)	
	Peak force @ 6°C/s increase	N	46	92
	Continuous force	N	11.5	23
	Motor force constant	N/A$_{rms}$	7.3	
	Motor constant	N²/W	7.5	15
	Max, speed (v0) at 60Vdc	m/s	5.3	
	Nominal speed (vn) at 60Vdc	m/s	1.7	
Electrical	Peak current	A$_{rms}$	6.3	12.6
	Continuous current air cooled	A$_{rms}$	1.6	3.2
	Back EMF Phase-Phase$_{peak}$	V/m/s	6	
	Resistance per phase	Ω	2.4	1.175
	Induction per phase	mH	0.8	0.4
	Electrical time constant	ms	0.355	
Thermal	Max. continuous power loss	W	24	47
	Thermal resistance	°C/W	3.2	1.6
	Temperature cut-off / sensor		PTC 1kΩ / NTC	
Mechanical	Coil unit weight	kg	0.038	0.075
	Coil unit length	mm	49	97
	Motor attraction force	N	0	
	Magnet pitch NN	mm	24	
	Cable mass	kg/m	0.065	
	Cable Type (power FLEX)	mm (AWG)	4.5 (24)	
	Cable Type (power FLEX)	mm (AWG)	4.5 (22)	
	Cable Type (sensor)	mm (AWG)	4.9 (26)	
	Cable Life Time (power FLEX)	Cycles	12.000.000 cycles	
	Bending Radius Static	mm	4x cable diameter	
	Bending Radius Dynamic	mm	7.5x cable diameter	

KMC91S SERIES - IRONLESS LINEAR MOTOR

	Parameter	Unit	KMC91S	
Performance	Winding type		UI03H	UI07H
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 45V $_{ac\ rms}$ (60V$_{dc}$)	
	Peak force @ 20°C/s increase	N	37	75
	Continuous force	N	10	20
	Motor force constant	N/A$_{rms}$	11.5	
	Motor constant	N^2/W	9	19
	Max, speed (v0) at 60Vdc	m/s	6	
	Nominal speed (vn) at 60Vdc	m/s	1.1	
Electrical	Peak current	A$_{rms}$	3.2	6.5
	Maximum continuous current	A$_{rms}$	0.88	1.76
	Back EMF Phase-Phase$_{peak}$	V/m/s	9.3	
	Resistance per phase*	Ω	4.75	2.37
	Induction per phase	mH	0.8	0.4
	Electrical time constant*	ms	0.16	
Thermal	Max. continuous power loss	W	14.8	29.6
	Thermal resistance	ºC/W	3.58	1.79
	Thermal time constant	s	25	
	Temperature sensor		none	
Mechanical	Coil unit weight	kg	0.03	0.06
	Coil unit length	mm	34	67
	Motor attraction force	N	0	
	Magnet pitch NN	mm	16.5	
	Cable mass	kg/m	0.07	
	Cable Type (power FLEX)	mm (AWG)	4.5 (22)	
	Cable Type (sensor)	mm (AWG)	Customizable	
	Cable Life Time (power FLEX)	Cycles	12.000.000 cycles	
	Bending Radius Static	mm	4x cable diameter	
	Bending Radius Dynamic	mm	7.5 cable diameter	

KMC92S SERIES - IRONLESS LINEAR MOTOR

	Parameter	Unit	KMC92S		
Performance	Winding type		UI04H	UI08H	UI01H
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 45$V_{ac\ rms}$ (60V_{dc})		
	Peak force @ 20°C/s increase	N	45	90	135
	Continuous force	N	20	40	60
	Motor force constant	N/A_{rms}	12.4		
	Motor constant	N^2/W	15	29	44
	Max, speed (v0) at 60Vdc	m/s	5.3		
	Nominal speed (vn) at 60Vdc	m/s	1.7		
Electrical	Peak current	A_{rms}	3.6	7.3	11
	Maximum continuous current	A_{rms}	1.6	3.2	4.8
	Back EMF Phase-$Phase_{peak}$	V/m/s	10		
	Resistance per phase	Ω	3.5	1.75	1.17
	Induction per phase	mH	1.2	0.6	0.4
	Electrical time constant	ms	0.35		
Thermal	Max. continuous power loss	W	37	74	74
	Thermal resistance	°C/W	2.35	1.17	0.58
	Thermal time constant	s	34		
	Temperature sensor		NTC		
Mechanical	Coil unit weight	kg	0.05	0.1	0.15
	Coil unit length	mm	49	97	145
	Motor attraction force	N	0		
	Magnet pitch NN	mm	24		
	Cable mass	kg/m	0.07		
	Cable Type (power FLEX)	mm (AWG)	4.5 (22)		
	Cable Type (sensor)	mm (AWG)	Customizable		
	Cable Life Time (power FLEX)	Cycles	12.000.000 cycles		
	Bending Radius Static	mm	4x cable diameter		
	Bending Radius Dynamic	mm	7.5x cable diameter		

KMC93S SERIES - IRONLESS LINEAR MOTOR

	Parameter	Unit	KMC93S							
Performance	Winding type		UI01N	UI01H	UI02N	UI02H	UI03N	UI03H	UI04N	UI04H
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 230 $V_{ac\ rms}$ ($320V_{dc}$)							
	Ultimate force @ 20°C/s increase	N	105		210		315		420	
	Continuous force	N	30		60		90		120	
	Motor force constant	N/A_{rms}	36.3	20	36.3	20	36.3	20	36.3	20
	Motor constant	N^2/W	24		47		71		95	
	Max, speed (v0) at 320Vdc	m/s	9.7	17.7	9.7	17.7	9.7	17.7	9.7	17.7
	Nominal speed (vn) at 320Vdc	m/s	4.5	12.3	4.5	12.3	4.5	12.3	4.5	12.3
Electrical	Peak current	A_{rms}	2.9	5.3	5.8	10.5	8.7	15.8	11.6	21
	Maximum continuous current	A_{rms}	0.8	1.5	1.7	3	2.5	4.5	3.3	6
	Back EMF Phase-$Phase_{peak}$	V/m/s	30	16	30	16	30	16	30	16
	Resistance per phase	Ω	18.5	5.5	9.3	2.8	6.2	1.8	4.6	1.4
	Induction per phase	mH	6.5	1.9	3.3	1	2.2	0.6	1.6	0.5
	Electrical time constant	ms	0.35							
Thermal	Max. continuous power loss	W	51		102		153		240	
	Thermal resistance	°C/W	1.79		0.9		0.59		0.44	
	Thermal time constant	s	36							
	Temperature cut-off / sensor		PTC 1kΩ / NTC							
Mechanical	Coil unit weight	kg	0.082		0.16		0.24		0.32	
	Coil unit length	mm	78		138		198		258	
	Motor attraction force	N	0							
	Magnet pitch NN	mm	30							
	Cable mass	kg/m	0.08							
	Cable Type (power FLEX)	mm (AWG)	6.6 (21)							
	Cable Type (sensor)	mm (AWG)	3.2 (26)							
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles							
	Bending Radius Static	mm	4x cable diameter							
	Bending Radius Dynamic	mm	7.5x cable diameter							

KMC95S SERIES - IRONLESS LINEAR MOTOR

	Parameter	Unit	KMC95S					
Performance	Winding type		UI02N	UI02H	UI05N	UI05H	UI07N	UI07H
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 230V $_{ac\ rms}$ (325V$_{dc}$)					
	Peak force @ 20°C/s increase	N	250		480		720	
	Continuous force	N	73		140		210	
	Motor force constant	N/A$_{rms}$	67.5	27.1	68	27,5	68	27,5
	Motor constant	N^2/W	93		195		290	
	Max, speed (v0) at 560Vdc	m/s	10.2	25.3	10.2	25.3	10.2	25.3
	Nominal speed (vn) at 560Vdc	m/s	6.6	21	6.6	20.8	6.5	20.9
	Max, speed (v0) at 320Vdc	m/s	5.9	14.5	5.9	14.5	5.9	14.5
	Nominal speed (vn) at 320Vdc	m/s	2.4	10.6	2.4	10.5	2.2	10.6
Electrical	Peak current	A$_{rms}$	3.7	9.2	7	17.5	10.5	26.2
	Maximum continuous current	A$_{rms}$	1.1	2.7	2.1	5.1	3.1	7.6
	Back EMF Phase-Phase$_{peak}$	V/m/s	54.7	22.1	55.5	22.5	55.5	22.5
	Resistance per phase	Ω	15.9	2.64	8.0	1.28	5.3	0.85
	Induction per phase	mH	12.7	2.1	6.5	1.0	4.2	0.7
	Electrical time constant*	ms	0.8					
Thermal	Max. continuous power loss	W	77		134		200	
	Thermal resistance	°C/W	1.2		0.6		0.43	
	Thermal time constant	s	72					
	Temperature cut-off / sensor		PTC 1kΩ / NTC					
Mechanical	Coil unit weight	kg	0.25		0.47		0.69	
	Coil unit length	mm	106		190		274	
	Motor attraction force	N	0					
	Magnet pitch NN	mm	42					
	Cables mass	kg/m	0.09		0.09		0.09	
	Cable Type (power FLEX)	mm (AWG)	7.2 (19)					
	Cable Type (sensor)	mm (AWG)	4.9 (26)					
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles					
	Bending Radius Static	mm	4x cable diameter					
	Bending Radius Dynamic	mm	7.5x cable diameter					

KMC95S SERIES - IRONLESS LINEAR MOTOR

	Parameter	Unit	KMC95S			
Performance	Winding type		UI10N	UI10H	UI12N	UI12H
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 230V $_{ac\ rms}$ (325V$_{dc}$)			
	Peak force @ 20°C/s increase	N	960		1200	
	Continuous force	N	280		350	
	Motor force constant	N/A$_{rms}$	68	27.5	68	27.5
	Motor constant	N²/W	390		485	
	Max, speed (v0) at 560Vdc	m/s	10.2	25.3	10.3	25.3
	Nominal speed (vn) at 560Vdc	m/s	6.6	21	6.6	20.8
	Max, speed (v0) at 320Vdc	m/s	5.8	14.5	5.9	14.5
	Nominal speed (vn) at 320Vdc	m/s	2.4	10.6	2.4	10.5
Electrical	Peak current	A$_{rms}$	14.1	35	17.8	44
	Maximum continuous current	A$_{rms}$	4.2	10.2	5.2	12.9
	Back EMF Phase-Phase$_{peak}$	V/m/s	55.5	22.5	55.5	22.5
	Resistance per phase	Ω	4.0	0.64	3.3	0.53
	Induction per phase	mH	3.2	0.5	3	0.4
	Electrical time constant*	ms	0.8			
Thermal	Max. continuous power loss	W	270		335	
	Thermal resistance	°C/W	0.32		0.26	
	Thermal time constant	s	72			
	Temperature cut-off / sensor		PTC 1kΩ / NTC			
Mechanical	Coil unit weight	kg	0.91		1.13	
	Coil unit length	mm	358		442	
	Motor attraction force	N	0			
	Magnet pitch NN	mm	42			
	Cables mass	kg/m	0.105		0.105	
	Cable Type (power FLEX)	mm (AWG)	7.2 (19)			
	Cable Type (sensor)	mm (AWG)	4.9 (26)			
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles			
	Bending Radius Static	mm	4x cable diameter			
	Bending Radius Dynamic	mm	7.5x cable diameter			

KMC97S SERIES - IRONLESS LINEAR MOTOR

	Parameter	Unit	KMC97S					
Performance	Winding type		UI06N	UI06H	UI13N	UI13H	UI19N	UI19H
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 230V $_{ac\ rms}$ (320V$_{dc}$)					
	Peak force @ 20°C/s increase	N	645		1290		1935	
	Continuous force	N	125		250		375	
	Motor force constant	N/A$_{rms}$	107	43.4	107	43.4	107	43.4
	Motor constant	N^2/W	242		483		725	
	Max, speed (v0) at 560Vdc	m/s	6.4	16	6.4	16	6.5	16
	Nominal speed (vn) at 560Vdc	m/s	2.8	11.3	2.8	11.3	2.8	11.4
	Max, speed (v0) at 320Vdc	m/s	3.7	9.1	3.7	9.1	3.7	9.1
	Nominal speed (vn) at 320Vdc	m/s	0.2	5.2	0.2	5.2	0.2	5.2
Electrical	Peak current	A$_{rms}$	6.0	14.9	12.1	29.7	18.1	44.6
	Maximum continuous current	A$_{rms}$	1.2	2.9	2.3	5.8	3.5	8.6
	Back EMF Phase-Phase$_{peak}$	V/m/s	87	35	87	35	87	35
	Resistance per phase	Ω	15.8	2.6	7.9	1.29	5.3	0.86
	Induction per phase	mH	28.4	4.7	14.2	2.3	9.5	1.5
	Electrical time constant*	ms	1.8					
Thermal	Max. continuous power loss	W	88		176		264	
	Thermal resistance	°C/W	1.03		0.52		0.34	
	Temperature cut-off / sensor		PTC 1kΩ / NTC					
Mechanical	Coil unit weight	kg	0.54		0.94		1.34	
	Coil unit length	mm	134		248		362	
	Motor attraction force	N	0					
	Magnet pitch NN	mm	57					
	Cable Type (power FLEX)	mm (AWG)	7.4 (18)					
	Cable Type (sensor)	mm (AWG)	4.9 (26)					
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles					
	Bending Radius Static	mm	4x cable diameter					
	Bending Radius Dynamic	mm	7.5x cable diameter					

KMC97S SERIES - IRONLESS LINEAR MOTOR

	Parameter	Unit	KMC97S			
Performance	Winding type		UI26N	UI26H	UI39N	UI39H
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 230V $_{ac\ rms}$ (320V$_{dc}$)			
	Peak force @ 20°C/s increase	N	2580		3870	
	Continuous force	N	500		750	
	Motor force constant	N/A$_{rms}$	107	43.4	107	43.4
	Motor constant	N^2/W	966		1449	
	Max, speed (v0) at 560Vdc	m/s	6.4	16	6.4	16
	Nominal speed (vn) at 560Vdc	m/s	2.8	11.3	2.8	11.3
	Max, speed (v0) at 320Vdc	m/s	3.7	9.1	3.7	9.1
	Nominal speed (vn) at 320Vdc	m/s	0.2	5.2	0.2	5.2
Electrical	Peak current	A$_{rms}$	24.1	59.4	36.2	89.2
	Maximum continuous current	A$_{rms}$	4.7	11.5	7.0	17.3
	Back EMF Phase-Phase$_{peak}$	V/m/s	87	35	87	35
	Resistance per phase	Ω	3.95	0.65	2.6	0.43
	Induction per phase	mH	7.1	1.2	4.7	0.8
	Electrical time constant*	ms	1.8			
Thermal	Max. continuous power loss	W	352		528	
	Thermal resistance	°C/W	0.25		0.18	
	Temperature cut-off / sensor		PTC 1kΩ / NTC			
Mechanical	Coil unit weight	kg	1.74		2.54	
	Coil unit length	mm	476		704	
	Motor attraction force	N	0			
	Magnet pitch NN	mm	57			
	Cable Type (power FLEX)	mm (AWG)	7.4 (18)			
	Cable Type (sensor)	mm (AWG)	4.9 (26)			
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles			
	Bending Radius Static	mm	4x cable diameter			
	Bending Radius Dynamic	mm	7.5x cable diameter			

KMC98S SERIES - IRONLESS LINEAR MOTOR

	Parameter	Unit	KMC98S			
Performance	Winding type		UI10N	UI10H	UI20N	UI20H
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 230V $_{ac\ rms}$ (320V$_{dc}$)			
	Peak force @ 20°C/s increase	N	1000		2000	
	Continuous force	N	250		500	
	Motor force constant	N/A$_{rms}$	177	84	177	84
	Motor constant	N^2/W	913		1826	
	Max, speed (v0) at 560Vdc	m/s	3.9	8.1	3.9	3.8
	Nominal speed (vn) at 560Vdc	m/s	2.4	6.3	2.4	2.4
	Max, speed (v0) at 320Vdc	m/s	2.2	4.7	2.2	2.2
	Nominal speed (vn) at 320Vdc	m/s	0.8	3	0.8	0.8
Electrical	Peak current	A$_{rms}$	5.6	11.9	11.3	23.8
	Maximum continuous current	A$_{rms}$	1.5	3.0	3.0	6.0
	Back EMF Phase-Phase$_{peak}$	V/m/s	145	69	126	60
	Resistance per phase	Ω	11.5	2.84	5.75	1.45
	Induction per phase	mH	34.5	8.50	17.3	4.40
	Electrical time constant*	ms	3			
Thermal	Max. continuous power loss	W	92		183	
	Thermal resistance	°C/W	0.8		0.4	
	Temperature cut-off / sensor		PTC 1kΩ / NTC			
Mechanical	Coil unit weight	kg	0.9		1.8	
	Coil unit length	mm	163		302.5	
	Motor attraction force	N	0			
	Magnet pitch NN	mm	70			
	Cable Type (power FLEX)	mm (AWG)	7.4 (18)			
	Cable Type (sensor)	mm (AWG)	4.9 (26)			
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles			
	Bending Radius Static	mm	4x cable diameter			
	Bending Radius Dynamics	mm	7.5x cable diameter			

KMC98S SERIES - IRONLESS LINEAR MOTOR

	Parameter	Unit	KMC98S				
Performance	Winding type		UI30N	UI30H	UI40N	UI40H	UI50N
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 230V $_{ac\ rms}$ (320V$_{dc}$)				
	Peak force @ 20°C/s increase	N	3000		4000		5000
	Continuous force	N	750		1000		1250
	Motor force constant	N/A$_{rms}$	177	84	177	84	177
	Motor constant	N^2/W	2739		3652		4565
	Max, speed (v0) at 560Vdc	m/s	3.9	8.1	3.9	8.1	3.8
	Nominal speed (vn) at 560Vdc	m/s	2.4	6.3	2.4	6.2	2.4
	Max, speed (v0) at 320Vdc	m/s	2.2	4.7	2.2	4.7	2.2
	Nominal speed (vn) at 320Vdc	m/s	0.8	3	0.8	2.9	0.8
Electrical	Peak current	A$_{rms}$	16.9	35.7	22.6	47.6	28.2
	Maximum continuous current	A$_{rms}$	4.5	6.0	12.0	7.0	-
	Back EMF Phase-Phase$_{peak}$	V/m/s	145	69	126	60	145
	Resistance per phase	Ω	3.80	0.95	2.90	0.75	2.30
	Induction per phase	mH	11.4	2.90	8.70	2.30	6.90
	Electrical time constant*	ms	3				
Thermal	Max. continuous power loss	W	275		367		459
	Thermal resistance	°C/W	0.3		0.2		0.15
	Temperature cut-off / sensor		PTC 1kΩ / NTC				
Mechanical	Coil unit weight	kg	2.7		3.6		4.5
	Coil unit length	mm	442		581.5		721
	Motor attraction force	N	0				
	Magnet pitch NN	mm	70				
	Cable Type (power FLEX)	mm (AWG)	7.4 (18)				
	Cable Type (sensor)	mm (AWG)	4.9 (26)				
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles				
	Bending Radius Static	mm	4x cable diameter				
	Bending Radius Dynamics	mm	7.5x cable diameter				

KMC99S SERIES - IRONLESS LINEAR MOTOR

	Parameter	Unit	KMC99S					
Performance	Winding type		UI07N	UI07H	UI15N	UI15H	UI22N	UI22H
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 230V $_{ac\ rms}$ (320V$_{dc}$)					
	Peak force @ 20°C/s increase	N	730		1460		2190	
	Continuous force	N	145		290		435	
	Motor force constant	N/A$_{rms}$	127	49	127	49	127	49
	Motor constant	N^2/W	340		680		1020	
	Max, speed (v0) at 560Vdc	m/s	5.6	13.6	5.5	13.6	5.6	13.6
	Nominal speed (vn) at 560Vdc	m/s	2.5	10	2.5	10	2.5	10
	Max, speed (v0) at 320Vdc	m/s	3.2	7.8	3.2	7.8	3.2	7.8
	Nominal speed (vn) at 320Vdc	m/s	0.2	4.6	0.2	4.6	0.2	4.6
Electrical	Peak current	A$_{rms}$	5.7	14.9	11.5	29.8	17.2	44.7
	Maximum continuous current	A$_{rms}$	1.1	3	2.3	5.9	3.4	8.9
	Back EMF Phase-Phase$_{peak}$	V/m/s	104	40	104	40	104	40
	Resistance per phase	Ω	15.82	2.6	7.9	1.29	5.3	0.86
	Induction per phase	mH	28.5	4.7	14.2	2.3	9.5	1.5
	Electrical time constant	ms	1.8					
Thermal	Max. continuous power loss	W	119		238		357	
	Thermal resistance	°C/W	1.03		0.52		0.34	
	Temperature cut-off / sensor		PTC 1kΩ / NTC					
Mechanical	Coil unit weight	kg	0.54		0.94		1.34	
	Coil unit length	mm	134		248		362	
	Motor attraction force	N	-					
	Magnet pitch NN	mm	57					
	Cable Type (power FLEX)	mm (AWG)	7.4 (18)					
	Cable Type (sensor)	mm (AWG)	4.9 (26)					
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles					
	Bending Radius Static	mm	4x cable diameter					
	Bending Radius Dynamics	mm	7.5x cable diameter					

KMC99S SERIES - IRONLESS LINEAR MOTOR

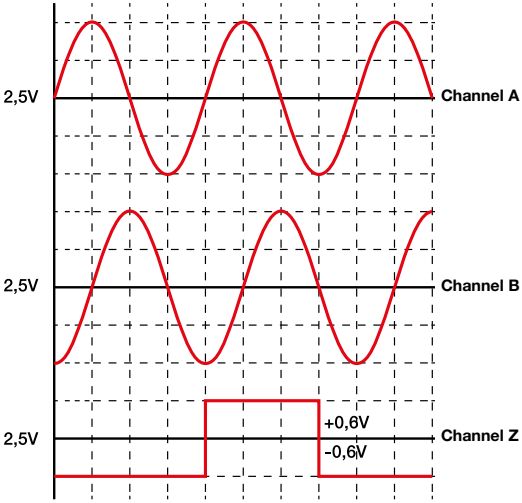
	Parameter	Unit	KMC99S			
Performance	Winding type		UI29N	UI29H	UI44N	UI44H
	Motortype, max voltage ph-ph		3-phase synchronous Ironless, 230V $_{ac\ rms}$ (320V$_{dc}$)			
	Peak force @ 20°C/s increase	N	2920		4380	
	Continuous force	N	580		870	
	Motor force constant	N/A$_{rms}$	127	49	127	49
	Motor constant	N^2/W	1359		2039	
	Max, speed (v0) at 560Vdc	m/s	5.6	13.6	6.5	13.6
	Nominal speed (vn) at 560Vdc	m/s	2.5	10	2.6	10
	Max, speed (v0) at 320Vdc	m/s	3.1	7.8	3.2	7.2
	Nominal speed (vn) at 320Vdc	m/s	0.2	4.6	0.3	4.6
Electrical	Peak current	A$_{rms}$	23.0	59.6	34.5	89.4
	Maximum continuous current	A$_{rms}$	4.6	11.8	6.9	17.8
	Back EMF Phase-Phase$_{peak}$	V/m/s	104	40	104	40
	Resistance per phase	Ω	3.95	0.65	2.6	0.43
	Induction per phase	mH	7.1	1.2	4.7	0.8
	Electrical time constant	ms	1.8			
Thermal	Max. continuous power loss	W	476		713	
	Thermal resistance	°C/W	0.25		0.18	
	Temperature cut-off / sensor		PTC 1kΩ / NTC			
Mechanical	Coil unit weight	kg	1.74		2.54	
	Coil unit length	mm	476		704	
	Motor attraction force	N	0			
	Magnet pitch NN	mm	57			
	Cable Type (power FLEX)	mm (AWG)	7.4 (18)			8.4 (16)
	Cable Type (sensor)	mm (AWG)	4.9 (26)			
	Cable Life Time (power FLEX)	Cycles	5.000.000 cycles			
	Bending Radius Static	mm	4x cable diameter			
	Bending Radius Dynamics	mm	7.5x cable diameter			

4. Encoder installation

4.1 Information about the incremental measuring system

4.1.1 1Vpp inductive encoder

The measurement system has a standard 1Vpp signal output (sin/cos).

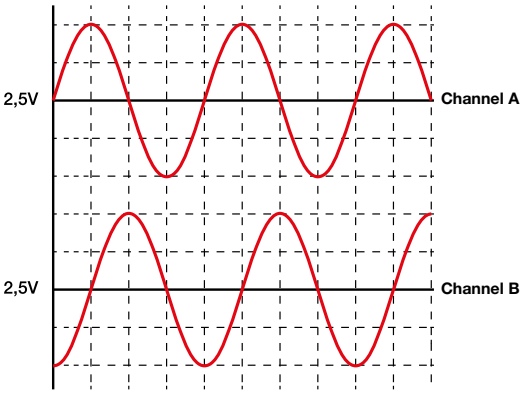


Technical data:

Order code	-0A04C-
Technology	Inductive
Operating voltage	5V ± 5%
Current consumption	240mA
Output signal	1Vpp
Period	40µm
Absolute accuracy	± 10µm/m
Repeat accuracy	± 2µm

4.1.2 1Vpp analogue Hall sensor

The measurement system has a standard 1Vpp signal output (sin/cos).

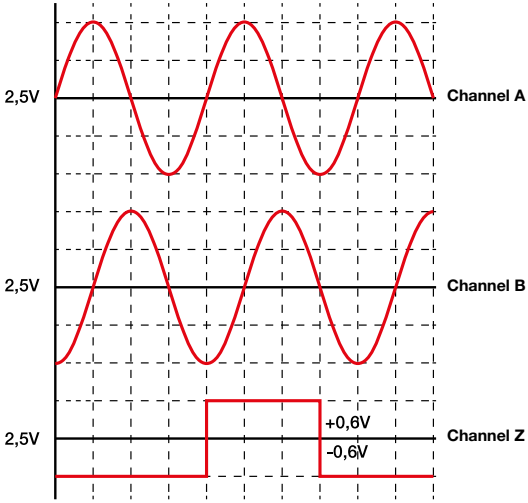


Technical data:

Order code	Not available
Technology	Inductive
Operating voltage	5V ± 5%
Current consumption	100mA
Output signal	1Vpp
Period	24000µm
Absolute accuracy	± 100µm/m
Repeat accuracy	± 50µm

4.1.3 1Vpp magnetic encoder

The measurement system has a standard 1Vpp signal output (sin/cos).

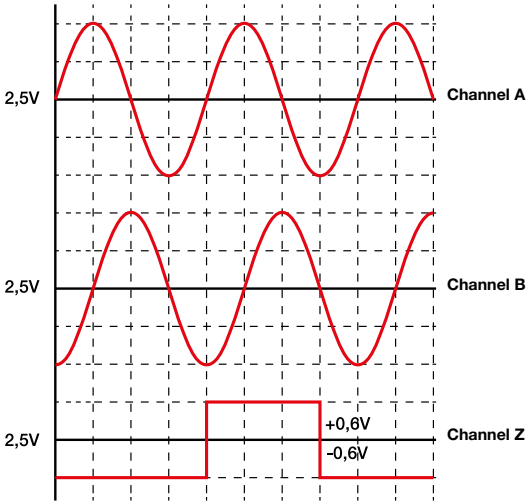


Technical data:

Order code	-2R02M-
Technology	Magnetic
Operating voltage	5V ± 5%
Current consumption	50mA
Output signal	1Vpp
Period	2000µm
Absolute accuracy	± 20µm/m
Repeat accuracy	± 10µm

4.1.4 1Vpp optical encoder

The measurement system has a standard 1Vpp signal output (sin/cos).

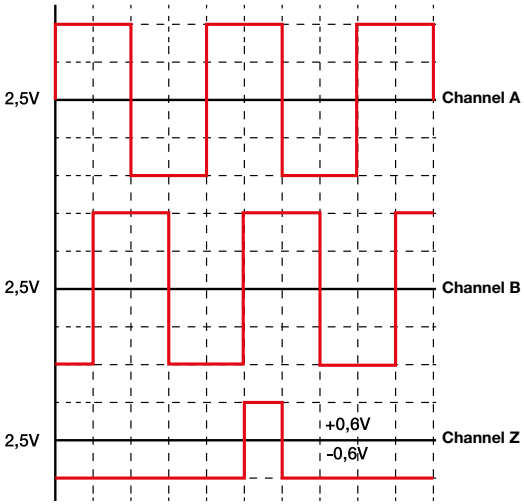


Technical data:

Order code	-1R04C-
Technology	Optic
Operating voltage	5V ± 5%
Current consumption	150mA
Output signal	1Vpp
Period	40µm
Absolute accuracy	± 15µm/m
Repeat accuracy	± 0.12µm

4.1.5 TTL inductive encoder

The measurement system has a standard RS422 signal output (TTL 5V).

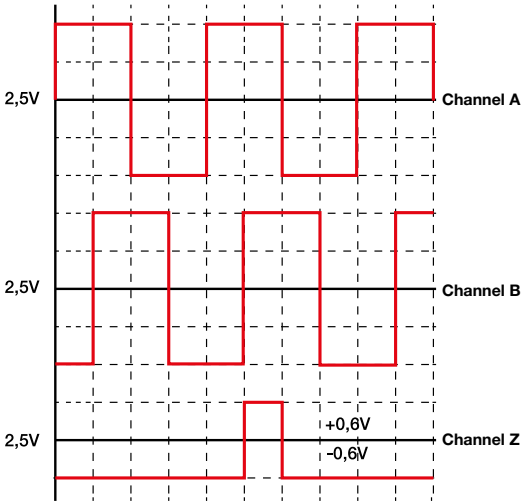


Technical data:

Order code	-0A41U-
Technology	Inductive
Operating voltage	5V ± 5%
Current consumption	240mA
Output signal	TTL
Period	4µm
Resolution	1µm
Absolute accuracy	± 10µm/m
Repeat accuracy	± 2µm

4.1.6 TTL magnetic encoder

The measurement system has a standard RS422 signal output (TTL 5V).

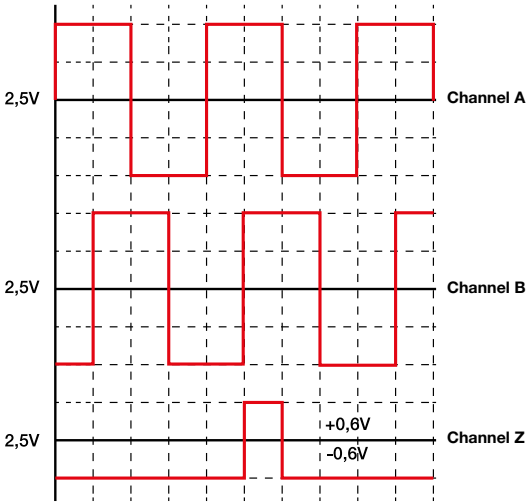


Technical data:

Order code	-2R41U-
Technology	Magnetic
Operating voltage	5V ± 5%
Current consumption	35mA
Output signal	TTL (RS422)
Period	4µm
Resolution	1µm
Absolute accuracy	± 20µm/m
Repeat accuracy	± 10µm

4.1.7 TTL optical encoder

The measurement system has a standard RS422 signal output (TTL 5V).



Technical data:

Order code	-1R41H-
Technology	Optic
Operating voltage	5V ± 5%
Current consumption	200mA
Output signal	TTL (RS422)
Period	400nm
Resolution	100nm
Absolute accuracy	± 15µm/m
Repeat accuracy	± 0.08µm

4.2 Information about the absolute measuring system

The use of the absolute measuring system (current position immediately after switching on available) guarantees a high level of security. Commutation angle finding sequence and homing are no longer necessary.

Several protocols are available to assure the compatibility with servodrive. In the next chapters the technical data of each of them are detailed.

4.2.1 SSI protocol absolute inductive encoder (is no longer available)

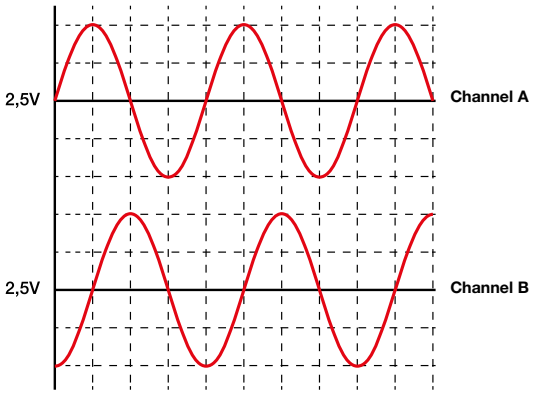
The absolute measuring system uses the SSI protocol (Synchronous Serial Interface) + 1Vpp signal output (sin/cos).

SSI Interface is a unidirectional interface which can output position values. And additionally, three special bits (Error, Warning and Parity) will be transferred.

In parallel with absolute data the measurement system has a standard 1Vpp signal output (sin/cos).

Technical data:

Order code	-3AS1U-
Technology	Inductive
Operating voltage	3.6V - 14V ± 5%
Current consumption	300mA
Absolute protocol	SSI
Max. clock frequency	1MHz
Number of bits	28+3
Resolution	1µm
Incremental output signal	1Vpp
Incremental period	40µm
Absolute accuracy	± 10µm/m
Repeat accuracy	± 1µm

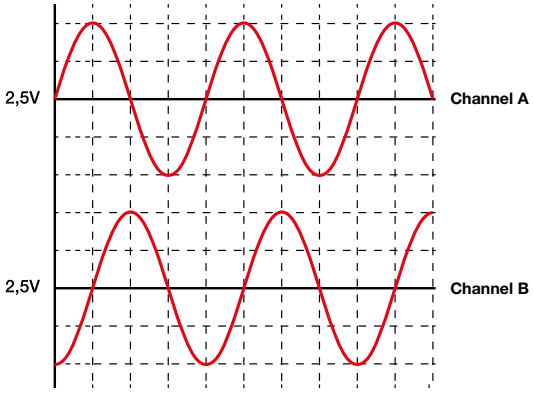


4.2.2 BISS/C protocol absolute inductive encoder (is no longer available)

BiSS is an open system - digital interface for sensors and actuators. With real-time data transfer in both directions to have fast and secure communication. (Serial Synchronous Interface compatible). In parallel with absolute data the measurement system has a standard 1Vpp signal output (sin/cos).

Technical data:

Order code:	-3AB1U-
Technology:	Inductive
Operating voltage:	3.6V - 14V ± 5%
Current consumption:	300mA
Absolute protocol:	BiSS/C
Max. clock frequency:	2.5MHz
Number of bits:	32+2
Resolution:	1µm
Incremental output signal:	1Vpp
Incremental period:	40µm
Absolute accuracy:	± 10µm/m
Repeat accuracy:	± 1µm



4.2.3 Drive-Cliq protocol absolute inductive encoder

Drive-Cliq is an open communication protocol from Siemens AG, based on 100Mbit Ethernet.

Technical data:

Order code	-3AD1S-
Technology	Inductive
Operating voltage	24V ± 5%
Current consumption	300mA
Absolute protocol	Drive-Cliq
Resolution	0.1µm
Absolute accuracy	± 10µm/m
Repeat accuracy	± 0.1µm
Safety protocol	Integrated by default

4.2.4 EnDat 2.2 protocol absolute inductive encoder

The EnDat 2.2 interface is a fully digital, bi-directional interface for measuring systems. With this interface you can read out position values and additional parameter and diagnostic information. Due to the serial data transfer four signal wires are enough.

Technical data:

Order code	-3AE2H-
Technology	Inductive
Operating voltage	3.6V - 14V ± 5%
Current consumption	300mA
Absolute protocol	EnDat 2.2
Max. clock frequency	16MHz
Resolution	0.25µm
Absolute accuracy	± 10µm/m
Repeat accuracy	± 0.25µm

Technical data – Safety option:

Order code	-3AE1S-
Technology	Inductive
Operating voltage	3.6V - 14V ± 5%
Current consumption	300mA
Absolute protocol	EnDat 2.2
Max. clock frequency	16MHz
Resolution	0.1µm
Absolute accuracy	± 10µm/m
Repeat accuracy	± 0.1µm
Safety protocol	Integrated by default

The functions of the safety-related position measuring system can be used for the following safety tasks in the complete system (also see EN 61 800-5-2):

SS1 Safe Stop 1
SS2 Safe Stop 2
SOS Safe Operating Stop
SLA Safely Limited Acceleration
SAR Safe Acceleration Range
SLS Safely Limited Speed
SSR Safe Speed Range
SLP Safely Limited Position
SLI Safely Limited Increment
SDI Safe Direction
SSM Safe Speed Monitor

4.2.5 EnDat 2.2 protocol absolute optical encoder

The EnDat 2.2 interface is a fully digital, bi-directional interface for measuring systems. With this interface you can read out position values and additional parameter and diagnostic information.
Due to the serial data transfer four signal wires are enough.

Technical data:

Order code	-4HE1H-
Technology	Optic
Operating voltage	3.6V - 14V ± 5%
Current consumption	75mA
Absolute protocol	EnDat 2.2
Max. clock frequency	16MHz
Resolution	0.1µm
Absolute accuracy	± 15µm/m
Repeat accuracy	± 0.1µm

4.2.6 Fanuc protocol absolute inductive encoder (is no longer available)

Normal and high speed, two-pair transmission interface, for Fanuc devices.

Technical data:

Order code	-3AF2H-
Technology	Inductive
Operating voltage	3.6V - 14V ± 5%
Current consumption	300mA
Absolute protocol	Fanuc α
Resolution	0.25µm
Absolute accuracy	± 10µm/m
Repeat accuracy	± 0.25µm

4.2.7 Fanuc protocol absolute optical encoder

Normal and high speed, two-pair transmission interface, for Fanuc devices.

Technical data:

Order code	-4HF1H-
Technology	Optic
Operating voltage	3.6V - 14V ± 5%
Current consumption	95mA
Absolute protocol	Fanuc α
Resolution	0.1µm
Absolute accuracy	± 15µm/m
Repeat accuracy	± 0.1µm

4.2.8 Mitsubishi protocol absolute inductive encoder (is no longer available)

For Mitsubishi devices.

Technical data:

Order code	-3AM2H-
Technology	Inductive
Operating voltage	3.6V - 14V ± 5%
Current consumption	300mA
Absolute protocol	Mitsubishi
Resolution	0.25µm
Absolute accuracy	± 10µm/m
Repeat accuracy	± 0.25µm

4.2.9 Mitsubishi protocol absolute optical encoder

For Mitsubishi devices.

Technical data:

Order code	-3HM1H-
Technology	Optic
Operating voltage	3.6V - 14V ± 5%
Current consumption	95mA
Absolute protocol	Mitsubishi
Resolution	0.1µm
Absolute accuracy	± 15µm/m
Repeat accuracy	± 0.1µm

4.2.10 Panasonic protocol absolute optical encoder

For Panasonic devices.

Technical data:

Order code	-3HP1H-
Technology	Optic
Operating voltage	3.6V - 14V ± 5%
Current consumption	95mA
Absolute protocol	Panasonic
Resolution	0.1µm
Absolute accuracy	± 15µm/m
Repeat accuracy	± 0.1µm

4.2.11 Panasonic protocol absolute magnetic encoder

For Panasonic devices.

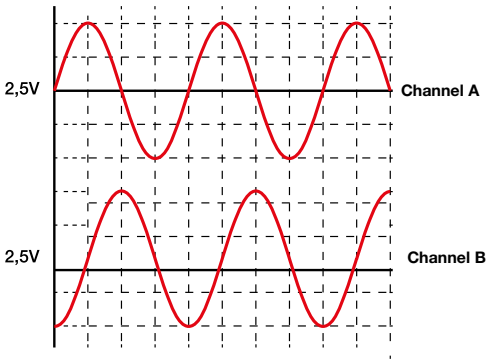
Technical data:

Order code	-5LP1U-
Technology	Magnetic
Operating voltage	3.6V - 14V ± 5%
Current consumption	200mA
Absolute protocol	Panasonic
Resolution	1µm
Absolute accuracy	± 15µm/m
Repeat accuracy	± 1µm

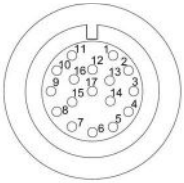
4.2.12 Hiperface protocol absolute magnetic encoder

Technical data:

Order code	-5SH1U-
Technology	Magnetic
Operating voltage	7V - 12V ± 5%
Current consumption	200mA
Absolute protocol	Hiperface
Resolution	1µm
Absolute accuracy	± 10µm/m
Repeat accuracy	± 1µm

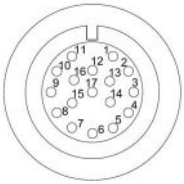


4.3 Connection for incremental measuring systems, signal connector M23



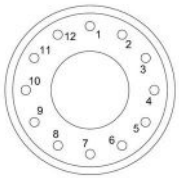
Pin	Signal description sin/cos	Signal description TTL
1	A+	A+
2	A-	A-
3	B+	B+
4	B-	B-
7	GND	GND
8	5Vdc	5Vdc
10	Z+	Z+
11	Z-	Z-
16	Vdc Sensor	Vdc Sensor
17	GND Sensor	GND Sensor

4.4 Connection for absolute measuring systems, signal connector M23



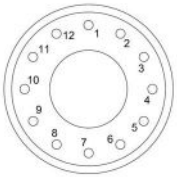
Pin	Signal description SSI	Signal description BISS/C	Signal description EnDAT	Signal description Drive-Cliq	Signal description Panasonic
1	A+	A+	-	-	-
2	A-	A-	-	-	-
3	B+	B+	-	-	-
4	B-	B-	-	-	-
7	GND	GND	GND	GND	GND
8	5Vdc	5Vdc	5Vdc	24Vdc	5Vdc
10	Data+	Data+	Data+	RXP	-
11	Data-	Data-	Data-	RXN	-
12	CLK+	CLK+	CLK+	TXP	RD - EXPS
13	CLK-	CLK-	CLK-	TXN	/RD - /EXPS
16	Vdc sensor	Vdc sensor	Vdc sensor	-	Vdc sensor
17	GND sensor	GND sensor	GND sensor	-	GND sensor

4.5 Connection for incremental measuring systems, signal connector YTEC



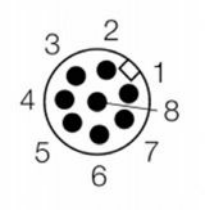
Pin	Signal description HALL	Signal description sin/cos	Signal description TTL
1	A+	A+	A+
2	A-	A-	A-
3	B+	B+	B+
4	B-	B-	B-
5	-	Z+	Z+
6	-	Z-	Z-
7	5Vdc	5Vdc	5Vdc
8	GND	GND	GND
9	PTC+	PTC+	PTC+
10	PTC-	PTC-	PTC-

4.6 Connection for absolute measuring systems, signal connector YTEC



Pin	Signal description SSI	Signal description BISS/C	Signal description EnDAT	Signal description Drive-Cliq	Signal description Panasonic
1	A+	A+	-	-	-
2	A-	A-	-	-	-
3	B+	B+	-	-	-
4	B-	B-	-	-	-
5	Data+	Data+	Data+	RXP	-
6	Data-	Data-	Data-	RXN	-
7	5Vdc	5Vdc	5Vdc	24Vdc	5Vdc
8	GND	GND	GND	GND	GND
9	PTC+	PTC+	PTC+	PTC+	PTC+
10	PTC-	PTC-	PTC-	PTC-	PTC-
11	CLK+	CLK+	CLK+	TXP	RD - EXPS
12	CLK-	CLK-	CLK-	TXN	/RD - /EXPS

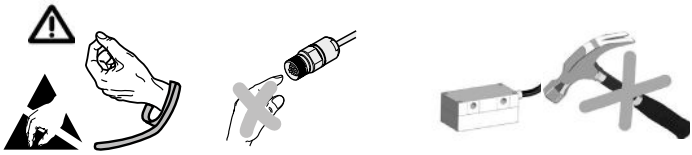
4.7 Connection for absolute measuring systems, signal connector M12



Pin	Signal description Drive-Cliq	Signal description Hiperface
1	24V	REFSIN
2	-	SIN+
3	RXP	REFCOS
4	RXN	COS+
5	GND	DATA+
6	TXN	DATA-
7	TXP	GND
8	-	12V

4.8 Mounting of the encoder

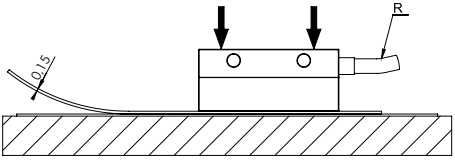
4.8.1 Warnings



Note:
- Mounting and commissioning is to be conducted by a qualified specialist under compliance with local safety regulations.
- Do not engage or disengage any connections while under power.
- Mounting surfaces must be clean and free of burrs.
- Avoid direct contact of aggressive media with the encoder and connector.
- The drive must not be put into operation during mounting.

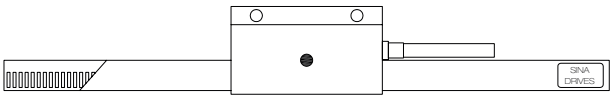
4.8.2 Mounting of the encoder (inductive)

Mounting film:
M4 with 2,00NM Torque
Md = 2,00 ± 0,05Nm



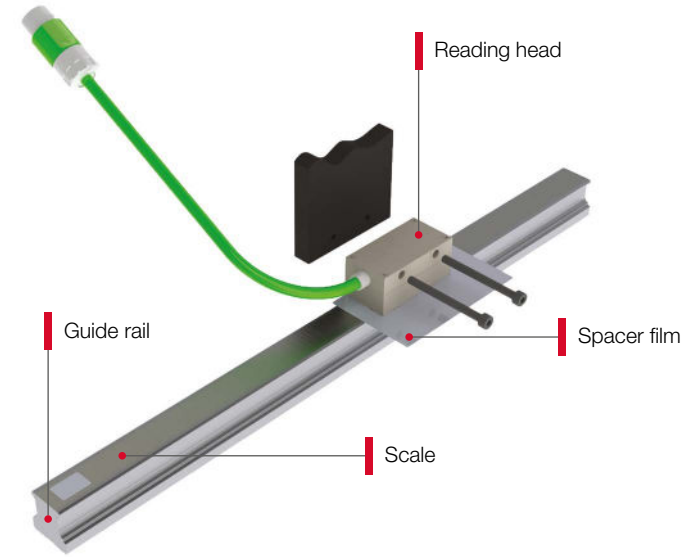
Place the supplied spacer film (thickness 0.15mm) between the scanning head and measuring flange. Press the scanning head slightly and evenly against the measuring flange and fix it with supplied screws. (M4 with 2,00Nm torque) Check with the spacer film that the airgap is uniform over the whole scanning surface and that the airgap is within the tolerance on the complete measuring length. The „dot“-marking on the read head, must be aligned on the same side as the dot marking on the measuring tape!

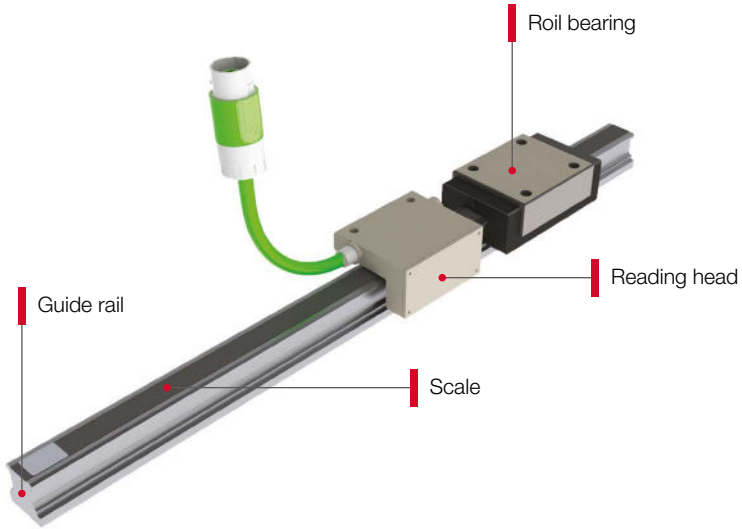
Scale absolute



Scale incremental

4.8.3 Mounting of the reading head (encoder)





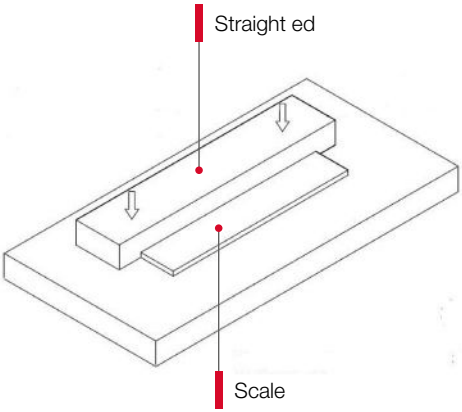
4.8.4 Mounting of scale

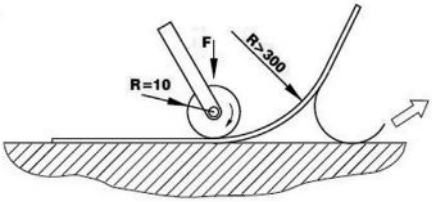
The scale must be not bended with a radius < 300 mm. Take particular care that no bends or kinks occur during the entire mounting procedure. Check the mounting surface and prepare with the utmost care.

Unpack the measuring tape and lie flat over the entire length. The base must be free of grease (clean with alcohol, acetone etc… and lintfree paper or cloth).

Pull off cover film from back of measuring tape by max. 300 mm.
Fit the measuring tape against the straight edge and press onto the mounting surface. Carefully continue this procedure until the entire type is mounted.
Using a roller, press down the measuring tape by applying a force of ~250 N/cm².

CAUTION! The adhesive strength is achieved by applying pressure. The final adhesive strength is achieved after 48 h at ~20 C°.

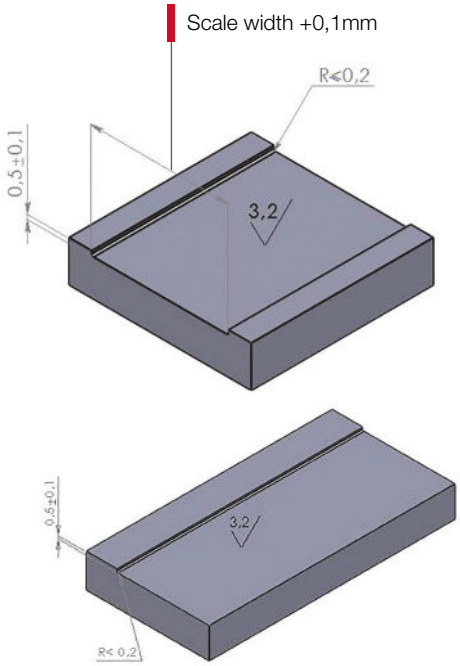




4.8.5 Mounting of the scale into the linear guide's groove

Integrated in the guide rail, Sinadrives standard

Mounted on the base plate



5.Linear guide installation

5.1 Mounting of the linear guide

5.1.1 Mounting of rails

If longer rails are required, SINADRIVES can provide a joint rail solution for which the joint number will be marked on the rail.

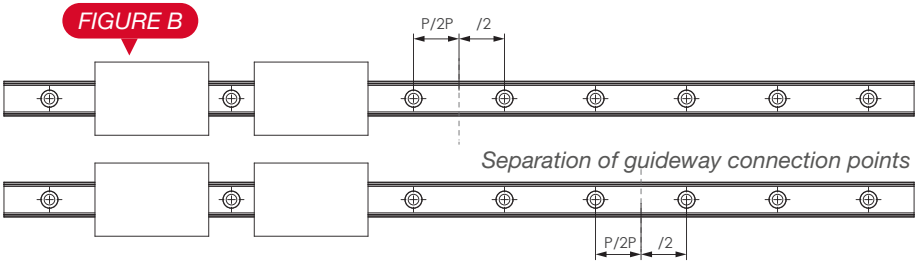
1. As shown in figure A, please follow the joint number to assemble.

2. For more than two units in each axis, to avoid accuracy effects from multiple blocks passing through the same connection point, we advise to use the connection points separately as shown on figure B.

3. Please use the slide as a connection point to tighten the slide before tightening the torques (point 1.2) to fasten the screws from inside to outside.

FIGURE A

FIGURE B



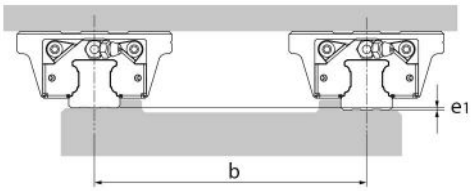
5.1.2 Technical information / Screw tightening torque (Nm)

Strength grade 12.9 Alloy steel screws	Steel	Cast iron	Non-ferrous metals
M3	2.0	1.3	1.0
M4	4.1	2.7	2.1
M5	8.8	5.9	4.4
M6	13.7	9.2	6.9
M8	30	20	15
M10	68	45	33
M12	118	78	59
M14	157	105	78

5.1.3 Installation surface geometry position accuracy

The rough finishing or milling on installation site will impact the working accuracy of linear guide, and reduce the service life of linear guide.
The accuracy of installation site and linear guides are critical factors to determine the accuracy of work bench.
When the error of installation site is larger than the value calculated by following formula, the working resistance and service life will be impacted.

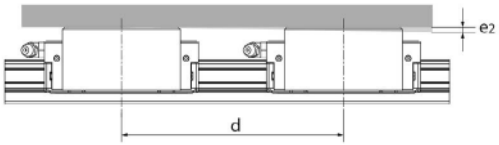
$e1(mm)=b(mm) \times f1 \times 10^{-4}$



Applicable to 15-35

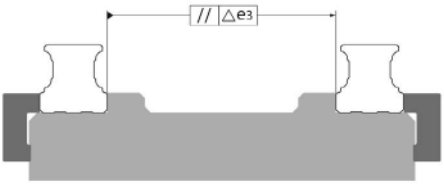
KG	
Block length	**f1**
KG	1.8

$e2\ (mm)=d(mm) \times f2 \times 10^{-5}$



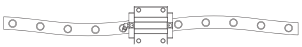
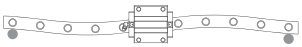
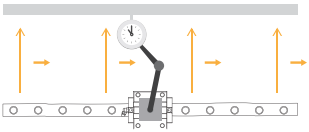
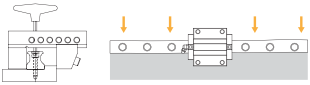
KG	
Block length	**f2**
K6	10.5

$e3\ (mm)=f3 \times 10^{-3}$



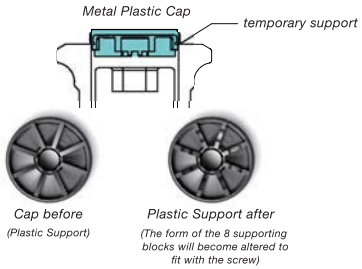
KG	
Block length	**f3**
KG 15	8
KG 20	10
KG 25	13
KG 30	15
KG 35	17

5.1.4 Description / Result

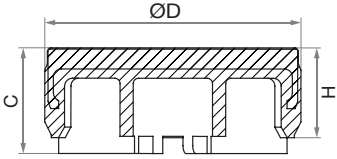
No Straightening Not allowed	No precision Low lateral bearing capacity	
Straightening by pin Not suggested	Low precision Low lateral bearing capacity	
Straightening based on straight edge, calibrated by meter	Low to mid precision Low lateral bearing capacity by meter	
Place the rail on a supporting edge	High precision One side with high lateral bearing capacity	
With support edge and lateral mounting screw	Very high precision High lateral bearing capacity	

5.1.5 Cap can be smoothly installed on Bolt-Hole

Bolt-hole cap of conventional linear guides, due to the difficulty of controlling hammering strength, often result in caps being hammered too deep or surface unevenness which leads to the accumulation of dirt or scrap iron. Our cap is especially designed with a supporting block to prop up the cap and to fix the screw stably, thus preventing such unnecessary sinking.



Dimensions

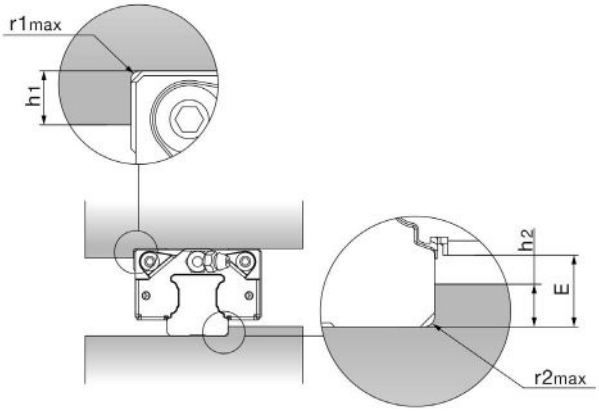


Size	Screw	Externel Ø D	H	C	Guide
A4	M4	7.7	3.6	1.7	KG 15
A5	M5	9.7	3.4	4	KG 20
A6	M6	11.3	2.9	3.5	KG 25
A8	M8	14.3	3.9	4.5	KG 30/35

5.1.6 Dimension of reference edge

To ensure that the linear guide is precisely assembled with the machine table, SINADRIVES devices have a recess installed in the reference edge corner. The corner of the machine table must be smaller than the chamfer of the linear guide to avoid interference. To consult on chamfer sizes and shoulder heights, please refer to the table below.

KG					
Typ/ Type	r1max	r2max	h1	h2	E
KG 15	0.5	0.5	4.0	2.5	3.3
KG 20	0.5	0.5	5.0	4.0	5.0
KG 25	1.0	1.0	5.0	5.0	6.0
KG 30	1.0	1.0	6.0	5.5	6.6
KG 35	1.0	1.0	6.0	6.5	7.6



5.2 Lubrication SHS and HSV

Bearing grease that complies with the standards DIN 51825 is to be used. The standard grease used on SINADRIVES products is a NLGI class 00 grease according to DIN 51818.

For the cleanroom applications standard grease is Klübersynth BEM 34-32.

Description	Reference
Standard grease	NLGI class 00 grease according to DIN 51818
Cleanroom grease	Klübersynth BEM 34-32
Food grade grease	Klüberfood 4 NH1-68
Low temperature grease	KL 15403

5.3 Lubrication procedure

1. Grease the nipples 1-4 with a grease gun.
2. Slowly move the carriage by hand, so that the grease can be spreaded.
3. Repeat steps 1 and 2.
4. Remove all excess residues from the rails using a clean cloth.

5.4 Lubrication for miniature guides

The miniature guides do not have a grease nipple. Here the lubrication is done by introducing oil into the hole of the carriage using a syringe.

Bearing grease that complies with the ISO VG 35 - SAE 10W norm is to be used.

5.5 Grease volume for standard linear block

Type	Volume mm^3
Size 15	425
Size 20	425
Size 25	450
Size 12 mini	250

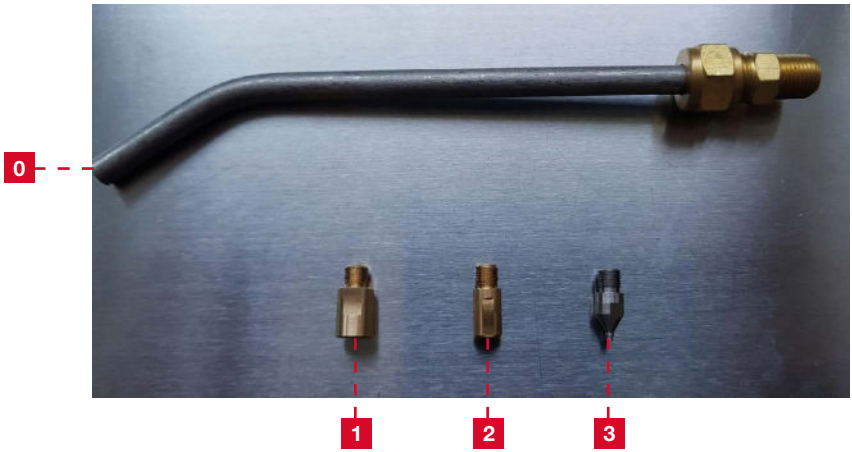
5.6 Grease frequency*

All Types	Cycle between 70% – 100% each 3 months or after 300 km Cycle between 20% – 70% each 6 months or after 600 km

* depending on application, ambient temperature and dirtiness

5.7 Lubrication kit

SINADRIVES offers you the following lubrication kit:



This kit contains a connection pipe (0) and three different adapters (1, 2, 3) for the respective grease nipples. Code: S-SOIL010

6. Troubleshooting

6.1 General troubleshooting

In case of incorrect functioning of the application, please check the individual components as listed below In case of improper operation of the application, please check the individual components as listed below: electrical connections

- check the pin assignment
- Cable condition / damage

Measuring system:

- Installation direction of the measuring head in relation to the measuring tape
- Alignment of the measuring head to the measuring tape
- Distance of the measuring head to the measuring tape
- Test the tape measure for damage
- Check installation direction

Guide rails:

- The sled is stiff
- Check guide rails for parallelism during assembly
- Carriage is not correctly mounted
- Screw the carriage from the inside to the outside while moving carriage in both directions

Magnet plates:

- Check if the magnets are mounted with the opposite poles

6.2 Troubleshooting by commissioning

Please refer to chapter 3.15 of our Commissioning and Maintenance Manual LINEAR MOTOR STAGES for more details.

7. Accessories

Please refer to chapter 5 of our Commissioning and Maintenance Manual LINEAR MOTOR STAGES for more details.

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Commissioning & maintenance manual. LINEAR MOTOR KIT

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