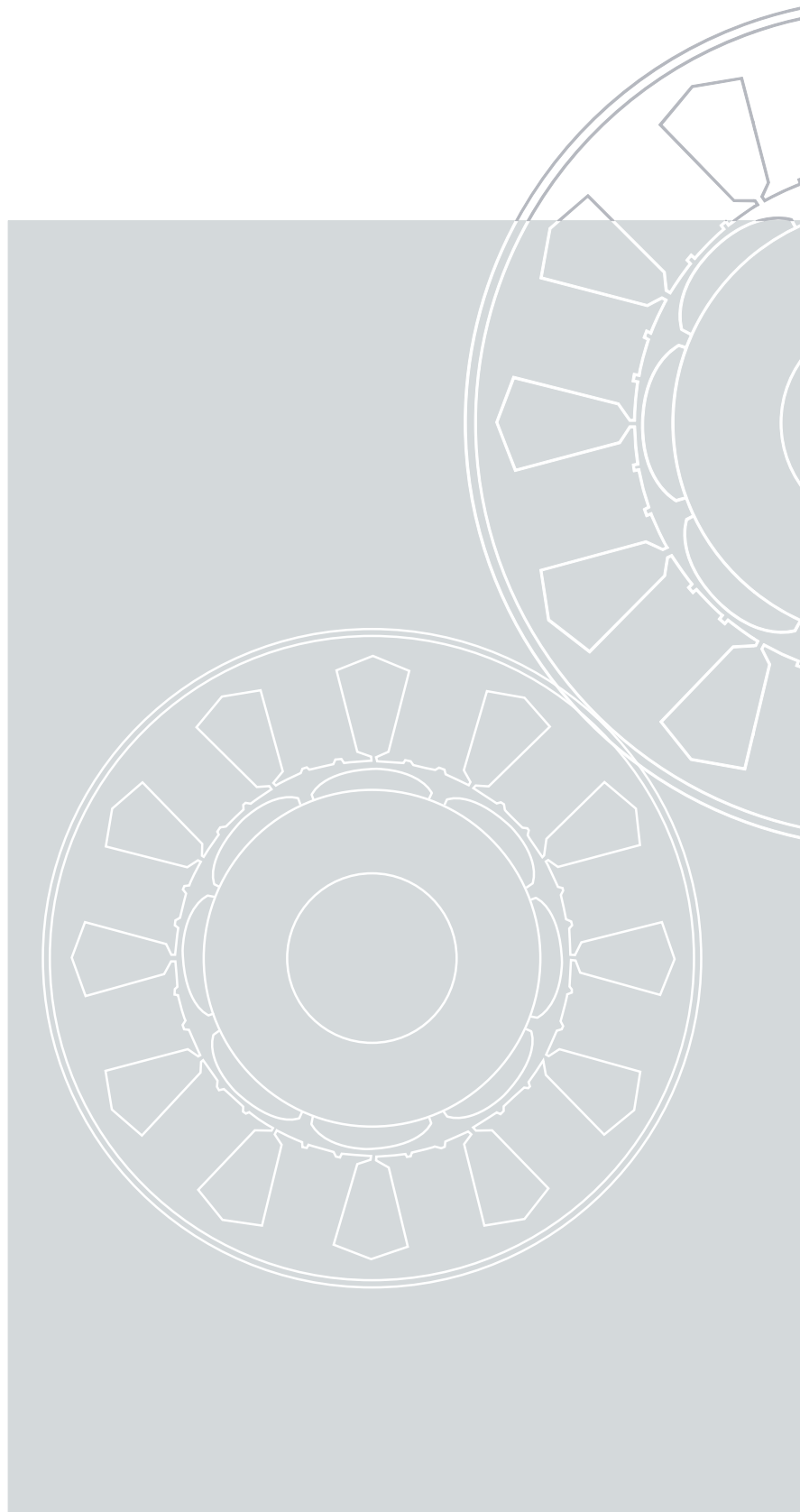


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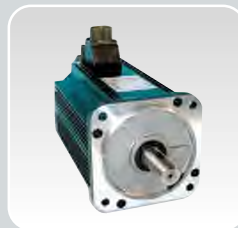
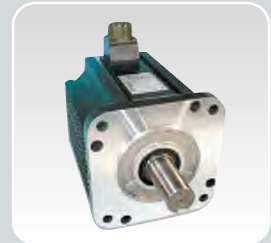
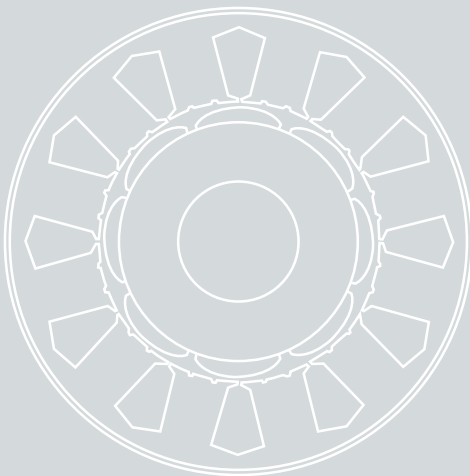
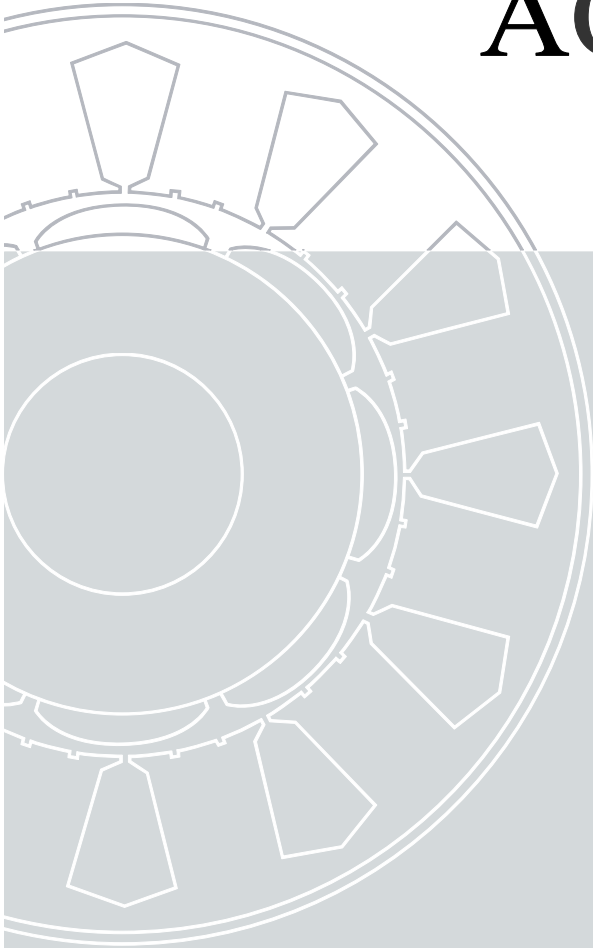
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*Ottlinghaus*

# AC Servo Motor

Quality, Reliability and Flexibility

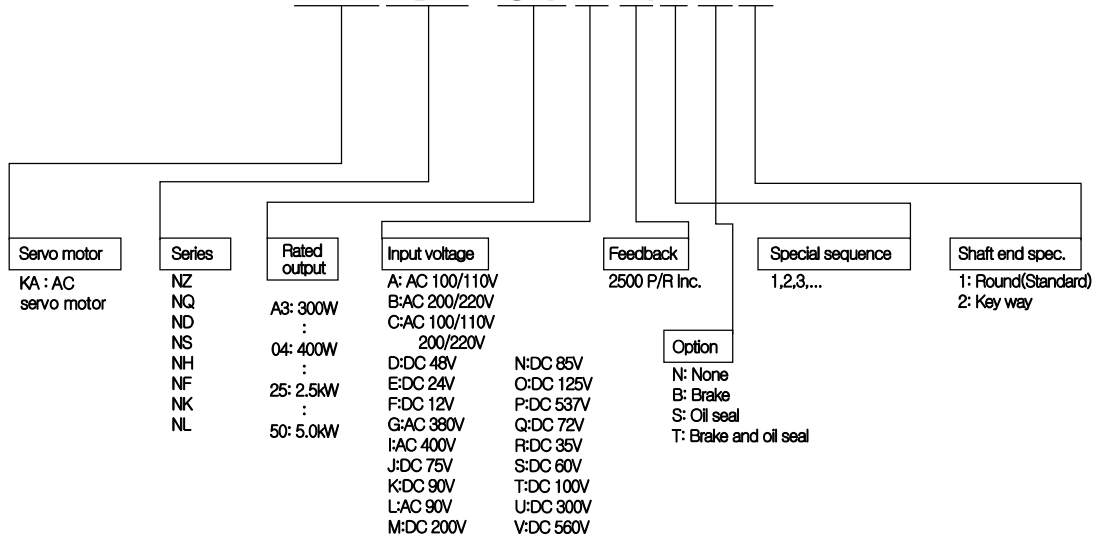


# AC Servo Motor...



## Model configurations

# KAND-25BE1B2



## Feedback specifications

Symbol	Spec.	KANZ/Q	KAND	KANS	KANH	KANF	KANK	KANL
A	2000 P/R INC.(9wires)							
B	2000 P/R INC.(15wires)							
C	2048 P/R INC.(9wires)	standard	standard	standard	standard	standard	standard	standard
D	2048 P/R INC.(15wires)							
E	2500 P/R INC.(9wires)	standard	standard	standard	standard	standard	standard	standard
F	2500 P/R INC.(15wires)							
G	17bit ABS.	standard	standard	standard	standard	standard	standard	standard
H	11bit ABS.							
K	5000 P/R INC.(15wires)							
L	6000 P/R INC.(15wires)							
Z	1000 P/R INC.(15wires)							
M	10000 P/R INC.(15wires)							
N	3000 P/R INC.(15wires)							
R	Resolver							

Regarding specially developed products, please inquire about items individually.

# Motor Classifications

Motor series	Rated output	Rated/ Maximum speed (r/min)	Input voltage	Type	Protection level	Features	Application examples
KANZ	 30W~600W	3000/5000	100/110V 200/220V	Cylinder	IP65	Ultra low inertia	Belt drives, Robots, Mounters, Inserters, XY tables
	750W	3000/4500	200/220V				
	950W	3000/3500	200/220V				
KANQ	 100W~400W	3000/5000	100/110V 200/220V	Pan cake	IP65	Low inertia	Robots, XY tables, Mounters, Sewing machines, Food processing machines
KAND	 0.75kW~5kW	2000/3000	200/220V	Cylinder	IP65	Middle inertia	Conveyor machines, Robots, XY tables
	1.0kW~9.0kW	2000/2000 2000/3000	380V				
KANS	 1.0kW~3.5kW	3000/5000	200/220V	Cylinder	IP65	Low inertia	High frequency positioning equipments
	4.0kW~5.0kW	3000/4500	200/220V				
KANH	 0.5kW~5kW	2000/3000	200/220V	Cylinder	IP65	Ultra high inertia	Machine tools, Winding machines, Press feeders, Woodworking machines
KANF	 0.4kW~5.5kW	2000/3000	200/220V	Pan cake	IP65	Middle inertia	Robots, Food processing machines
	2.5kW~15kW	2000/2000 2000/3000	380V				
KANK	 0.3kW~6.0kW	1000/2000	200/220V	Cylinder	IP65	Middle inertia	Machine tools, Transfer machines, Woodworking machines
KANL	 0.3kW~6.0kW	1000/2000	200/220V	Cylinder	IP65	High inertia	Machine tools, Transfer machines, Woodworking machines, Spring forming machines

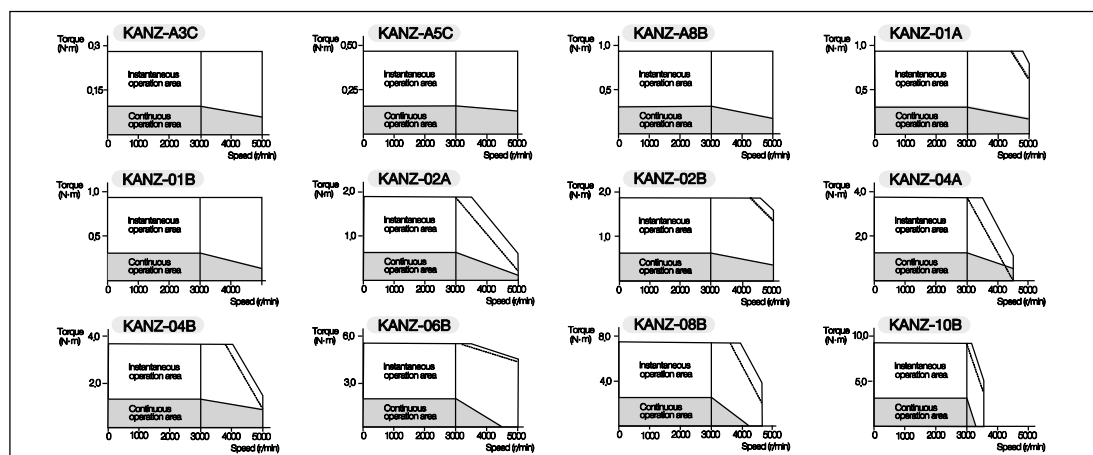
# Specifications and Classifications

## KANZ series servo motor specifications

Servo motor series		KANZ														
Flange size (mm)		40			60			40		60		80				
Model		A3	A5	01	02	04	A8	01	02	04	06	08	10			
Specifications		100/110V,200/220V			100/110V			200/220V								
Continuous running duty	Rated output (W)	30	50	100	200	400	80	100	200	400	600	750	950			
	Rated torque (N·m)	0.095	0.16	0.32	0.64	1.3	0.26	0.32	0.64	1.3	1.9	2.4	3.0			
Maximum torque (N·m)		0.28	0.48	0.95	1.91	3.8	0.76	0.95	1.91	3.8	5.73	7.1	9.1			
Rated rotation speed (r/min)		3000														
Maximum rotation speed (r/min)		5000			4500			5000			4500			3500		
Rated power rate (kW/s)		6.2	10.9	17.2	21.8	48.7	17.0	17.7	21.8	50.2	39.7	48.3	62.2			
Rated current (Arms)		1.0	1.0	1.6	2.5	4.4	1.0	1.0	1.6	2.5	4.1	4.3	4.3			
Momentary maximum current (Arms)		3.04	3.04	4.87	7.42	13.15	3.04	3.04	4.87	7.42	12.3	12.9	12.9			
Rotor inertia ( $\times 10^{-4}$ kg·m <sup>2</sup> )	Standard	0.015	0.024	0.06	0.19	0.34	0.039	0.059	0.19	0.33	0.93	1.20	1.47			
	With brake	0.019	0.029	0.063	0.21	0.36	0.049	0.061	0.21	0.35	1.05	1.32	1.49			
Recommended load/motor inertia ratio		Less than 30-times the servo motor's inertia														
Structure		Totally enclosed non ventilated (protection level:IP65)														
Environment	Ambient Temperature	0 to 40°C(32 to 104 F)(non freezing), storage: -15 to 70°C(5 to 158 F) (non freezing)														
	Ambient humidity	85% RH max. (non condensing), storage: 90% RH max.(non condensing)														
	Atmosphere	Indoors (no direct sunlight): no corrosive gas, inflammable gas, oil mist, or dust														
	Elevation/Vibration	1000meters or less above sea level, 49m/s <sup>2</sup> below														
Insulation Class	Type	B														
	Permission Temperature(°C)	130°C Blow														
Weight (kg)	Standard	0.32	0.39	0.66	1.0	1.7	0.50	0.66	1.0	1.7	2.9	3.5	4.1			
	With brake	0.54	0.63	0.93	1.5	2.3	0.77	0.93	1.5	2.3	3.5	4.3	4.9			

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- 2.This specification is guaranteed after combining and adjusting with the driver.
3. All ratings typical and at 20°C unless otherwise noted.
4. Contact Ortlinghaus if the load/motor of inertia moment ratio exceeds the figure in the table.

## KANZ series servo motor torque characteristics



1. Dotted lines show torque characteristics for 10% derated voltage operation.

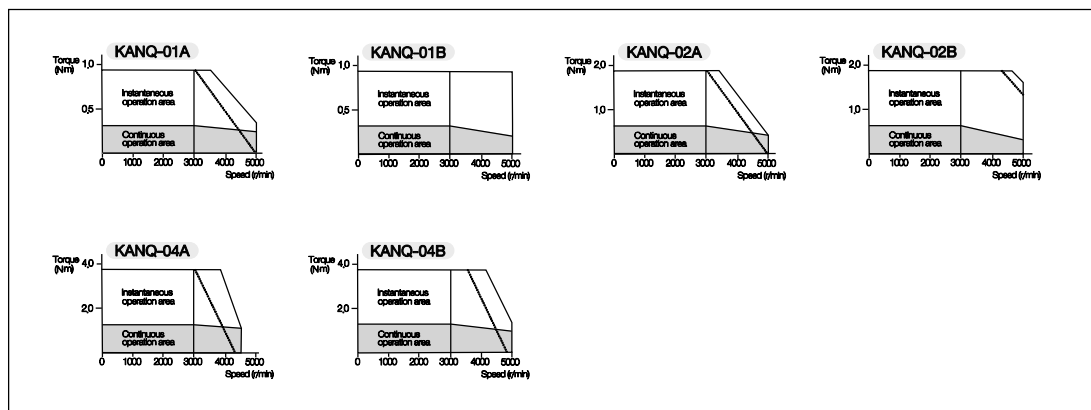
# Specifications and Characteristics

## KANQ series servo motor specifications

Servo motor series		KANQ					
Flange size (mm)		40	60		60	80	
Model		01	02	04	01	02	04
Specifications							
Supply voltage (V <sub>c</sub> )		100/110V			200/220V		
Continuous running duty	Rated output (W)	100	200	400	100	200	400
	Rated torque (N·m)	0.32	0.64	1.3	0.32	0.64	1.3
Maximum torque (N·m)		0.95	1.91	3.82	0.95	1.91	3.82
Rated rotation speed (r/min)		3000					
Maximum rotation speed (r/min)		5000		4500	5000		
Rated power rate (kW/s)		9.4	11.5	26.7	9.4	11.5	26.7
Rated current (Arms)		1.6	2.5	4.4	1.0	1.6	2.5
Momentary maximum current (Arms)		4.87	7.42	13.15	3.04	4.88	7.42
Rotor inertia (×10 <sup>-4</sup> kg·m <sup>2</sup> )	Standard	0.11	0.36	0.62	0.11	0.36	0.62
	With brake	0.14	0.49	0.74	0.14	0.49	0.74
Recommended load/motor inertia ratio		Less than 20-times the servo motor's inertia					
Structure		Totally enclosed non ventilated (protection level:IP65)					
Environment	Ambient Temperature	0 to 40°C (32 to 104 F)(non freezing), storage: -15 to 70°C (5 to 158 F) (non freezing)					
	Ambient humidity	85% RH max. (non condensing), storage: 90% RH max.(non condensing)					
	Atmosphere	Indoors (no direct sunlight): no corrosive gas, inflammable gas, oil mist, or dust					
	Elevation/Vibration	1000meters or less above sea level, 49m/s <sup>2</sup> below					
Insulation Class	Type	B					
	Permisson Temperature(°C)	130°C Blow					
Weight (kg)	Standard	0.78	1.5	2.1	0.78	1.5	2.1
	With brake	1.2	2.3	3.0	1.2	2.3	3.0

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2. This specification is guaranted after combining and adjusting with the driver.
3. All ratings typical and at 20°C unless otherwise noted.
4. Contact Ortlinghaus if the load/motor of inertia moment ratio exceeds the figure in the table.

## KANQ series servo motor torque characteristics



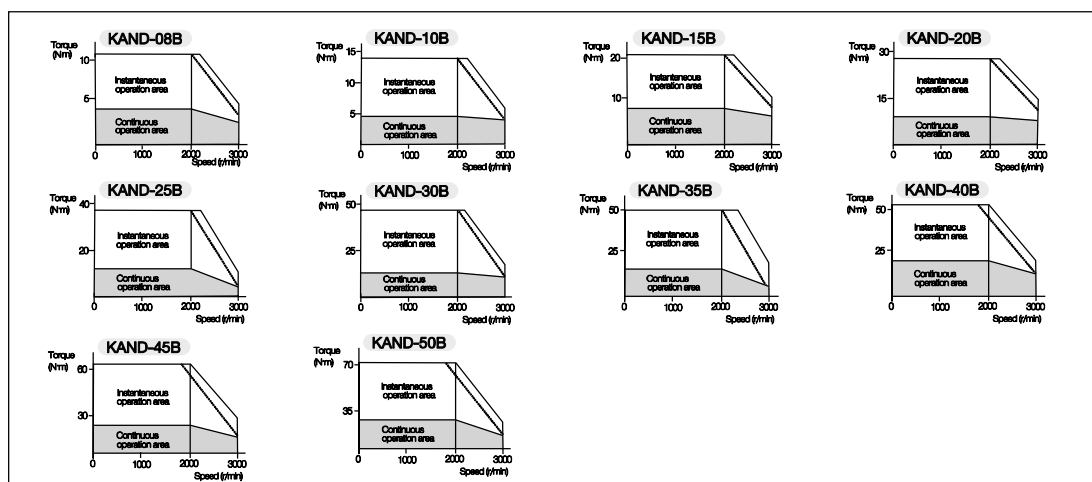
# Specifications and Classifications

## KAND series servo motor specifications [1]

Servo motor series		KAND									
Flange size (mm)		120	130					180			
Model		08	10	15	20	25	30	35	40	45	50
Specifications											
Supply voltage (V <sub>c</sub> )		200/220V									
Continuous running duty	Rated output (kW)	0.75	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	Rated torque (N·m)	3.58	4.77	7.15	9.55	11.9	14.3	16.7	19.1	21.5	23.9
Maximum torque (N·m)		10.85	14.4	21.5	28.5	35.5	42.9	50.0	56.4	64.3	71.4
Rated rotation speed (r/min)		2000									
Maximum rotation speed (r/min)		3000									
Rated power rate (kW/s)		49.1	48.8	74.6	100.0	124.9	151.2	90.7	111.0	124.8	128.3
Rated current (Amps)		5.0	5.6	9.4	12.3	14.0	17.8	19.6	23.4	26.2	28.0
Momentary maximum current (Amps)		15.0	16.9	28.3	36.8	42.4	53.7	56.1	70.7	78.5	84.9
Rotor inertia (×10 <sup>-4</sup> kg·m <sup>2</sup> )	Standard	2.67	4.82	7.0	9.3	11.5	13.8	31.5	33.5	37.7	45.5
	With brake	3.12	6.10	8.3	10.5	12.8	15.0	36.2	38.7	42.9	50.7
Recommended load/motor inertia ratio		Less than 10-times the servo motor's inertia									
Structure		Totally enclosed non ventilated (protection level:IP65)									
Environment	Ambient Temperature	0 to 40°C(32 to 104 F)(non freezing), storage: -15 to 70°C(5 to 158 F) (non freezing)									
	Ambient humidity	85% RH max. (non condensing), storage: 90% RH max.(non condensing)									
	Atmosphere	Indoors (no direct sunlight): no corrosive gas, inflammable gas, oil mist, or dust									
	Elevation/Vibration	1000meters or less above sea level, 49m/s <sup>2</sup> below									
Insulation Class	Type	F									
	Permission Temperature(°C)	155°C Blow									
Weight (kg)	Standard	4.8	6.8	8.5	10.6	12.8	14.6	16.2	19.8	21.5	25.0
	With brake	6.1	8.7	10.1	12.5	14.7	16.5	18.7	23.3	25.0	28.5

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## KAND series servo motor torque characteristics





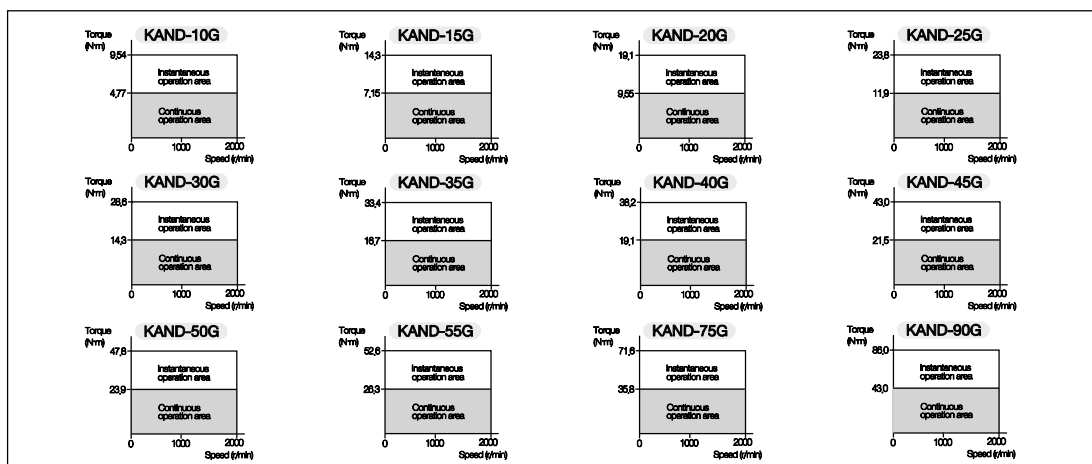
# Specifications and Characteristics

## KAND series servo motor specifications [2]

Servo motor series		KAND											
Flange size (mm)		130						180					
Model		10	15	20	25	30	35	40	45	50	55	75	90
Specifications													
Supply voltage (V <sub>c</sub> )		380V											
Continuous running duty	Rated output (kW)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	7.5	9.0
	Rated torque (N·m)	4.77	7.15	9.55	11.90	14.3	16.7	19.1	21.5	23.9	26.3	35.8	43.0
Maximum torque (N·m)		9.54	14.3	19.1	23.8	28.6	33.4	38.2	43.0	47.8	52.6	71.6	86.0
Rated rotation speed (r/min)		2000											
Maximum rotation speed (r/min)		2000											
Rated power rate (kW/s)		48.2	74.6	100.1	125.7	151.3	90.4	111.2	125.2	128.2	144.9	190.4	214.5
Rated current (Arms)		2.45	4.00	4.90	6.20	7.30	8.60	9.00	10.30	11.30	12.1	16.4	18.8
Momentary maximum current (Arms)		4.88	8.00	13.90	17.50	20.70	24.30	25.50	29.10	32.00	34.2	46.4	53.2
Rotor inertia (*10 <sup>-4</sup> kg·m <sup>2</sup> )	Standard	4.82	7.0	9.3	11.5	13.8	31.5	33.5	37.7	45.5	48.8	68.8	88.0
	With brake	6.1	8.30	10.5	12.8	15.0	36.2	38.7	42.9	50.7	-	-	-
Recommended load/motor inertia ratio		Less than 30-times the servo motor's inertia											
Structure		Totally enclosed non ventilated (protection level:IP65)											
Environment	Ambient temperature	0 to 40°C(32 to 104 F)(non freezing), storage: -15 to 70°C(5 to 158 F) (non freezing)											
	Ambient humidity	85% RH max. (non condensing), storage: 90% RH max.(non condensing)											
	Atmosphere	Indoors (no direct sunlight): no corrosive gas, inflammable gas, oil mist, or dust											
	Elevation/Vibration	1000meters or less above sea level, 49m/s <sup>2</sup> below											
Insulation Class	Type	F											
	Permission Temperature(°C)	155°C Blow											
Weight (kg)	Standard	6.8	8.5	10.6	12.8	14.6	16.2	19.8	25.0	25.0	28.6	43.0	53.8
	With brake	8.7	10.1	12.5	14.7	16.5	18.7	23.3	28.5	28.5	-	-	-

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## KAND series servo motor torque characteristics



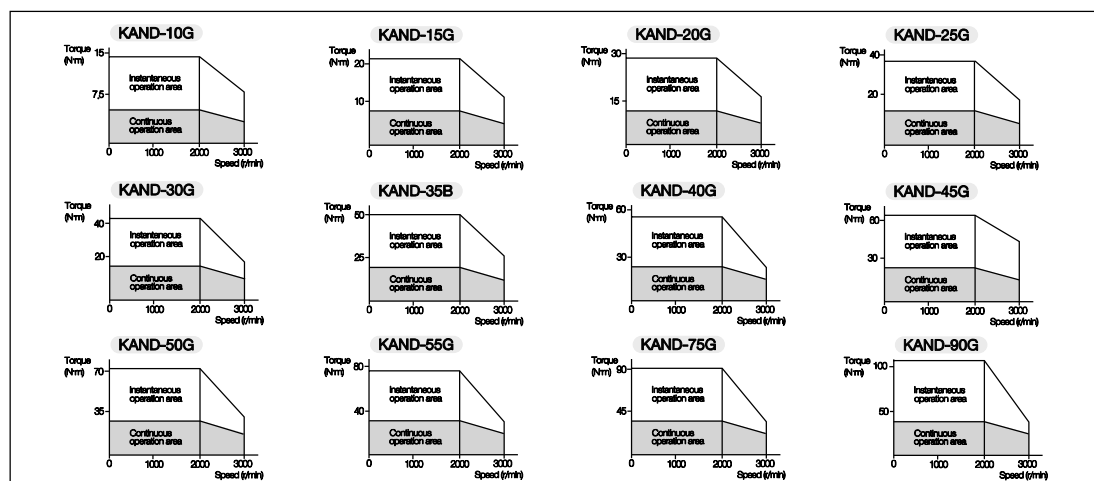
# Specifications and Classifications

## KAND series servo motor specifications [3]

Servo motor series		KAND											
Flange size (mm)		130					180						
Model		10	15	20	25	30	35	40	45	50	55	75	90
Specifications													
Supply voltage (V <sub>ac</sub> )		380V											
Continuous running duty	Rated output (kW)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	7.5	9.5
	Rated torque (N·m)	4.77	7.15	9.55	11.90	14.3	16.7	19.1	21.5	23.9	26.3	35.8	43.0
Maximum torque (N·m)		14.4	21.5	28.5	35.5	42.9	50	56.4	64.3	71.4	77.7	89.5	107.4
Rated rotation speed (r/min)		2000											
Maximum rotation speed (r/min)		3000											
Rated power rate (kW/s)		48.2	74.6	100.1	125.7	151.3	90.4	111.2	125.2	128.2	144.9	190.4	214.2
Rated current (Arms)		3.50	5.65	7.10	7.95	9.90	12.00	12.90	15.00	16.30	18.0	23.1	28.6
Momentary maximum current (Arms)		15	24.20	31.00	34.60	44.00	50.60	52.60	62.40	68.20	73.5	79.2	97.0
Rotor inertia (×10 <sup>-4</sup> kg·m <sup>2</sup> )	Standard	4.82	7.0	9.3	11.5	13.8	31.5	33.5	37.7	45.5	48.8	68.8	88.0
	With brake	6.1	8.30	10.5	12.8	15.0	36.2	38.7	42.9	50.7	-	-	-
Recommended load/motor inertia ratio		Less than 10-times the servo motor's inertia											
Structure		Totally enclosed non ventilated (protection level:IP65)											
Environment	Ambient temperature	0 to 40°C(32 to 104 F)(non freezing), storage: -15 to 70°C(5 to 158 F) (non freezing)											
	Ambient humidity	85% RH max. (non condensing), storage: 90% RH max.(non condensing)											
	Atmosphere	Indoors (no direct sunlight): no corrosive gas, inflammable gas, oil mist, or dust											
	Elevation/Vibration	1000meters or less above sea level, 49m/s <sup>2</sup> below											
Insulation Class	Type	F											
	Permission Temperature(°C)	155°C Blow											
Weight (kg)	Standard	6.8	8.5	10.6	12.8	14.6	16.2	19.8	25.0	25.0	28.6	43.0	53.8
	With brake	8.7	10.1	12.5	14.7	16.5	18.7	23.3	28.5	28.5	-	-	-

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2. This specification is guaranted after combining and adjusting with the driver.
3. All ratings typical and at 20°C unless otherwise noted.
4. Contact Ortinghaus if the load/motor of inertia moment ratio exceeds the figure in the table.

## KAND series servo motor torque characteristics



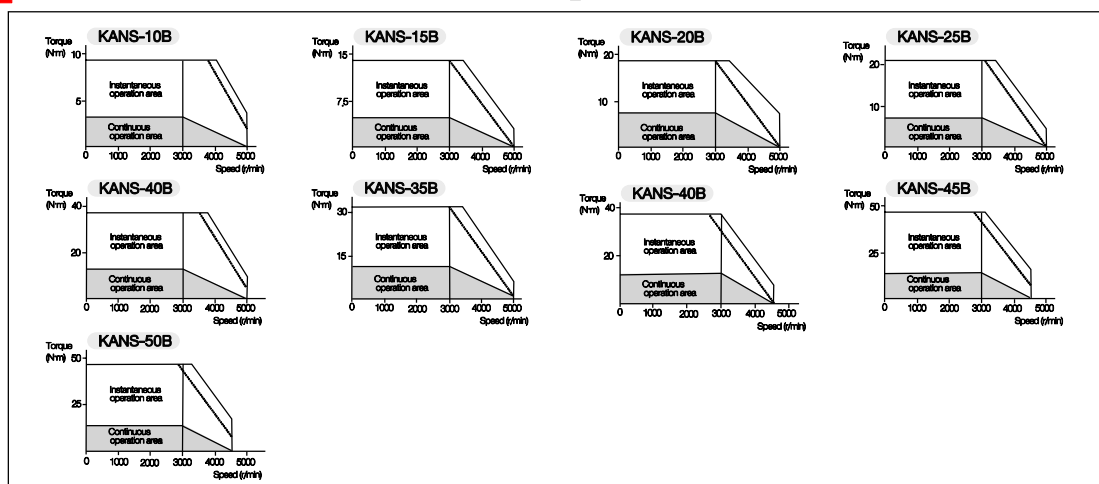
# Specifications and Characteristics

## KANS series servo motor specifications

Servo motor series		KANS								
Flange size (mm)		100			120		130			
Model		10	15	20	25	30	35	40	45	50
Specifications										
Supply voltage (V <sub>ac</sub> )		200/220V								
Continuous running duty	Rated output (kW)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
	Rated torque (N·m)	3.18	4.77	6.37	7.96	9.54	11.14	12.7	14.3	15.9
Maximum torque (N·m)		9.5	14.5	19.24	23.8	28.59	33.3	37.9	42.9	47.6
Rated rotation speed (r/min)		3000								
Maximum rotation speed (r/min)		5000					4500			
Rated power rate (kW/s)		50.08	97.21	136.29	171.16	155.1	183.0	134	154	161
Rated current (Arms)		7.2	9.4	13.0	15.9	20.0	21.6	24.7	28.0	28.5
Momentary maximum current (Arms)		21.0	28.3	39.6	48.1	56.3	61.0	74.2	83.4	84.9
Rotor inertia (×10 <sup>-4</sup> kg·m <sup>2</sup> )	Standard	2.06	2.39	3.04	3.78	5.99	6.93	12.4	13.6	16.0
	With brake	2.5	2.84	3.49	4.23	6.44	7.38	13.7	14.9	17.3
Recommended load/motor inertia ratio		Less than 15-times the servo motor's inertia								
Structure		Totally enclosed non ventilated (protection level:IP65)								
Environment	Ambient temperature	0 to 40°C (32 to 104 F)(non freezing), storage: -15 to 70°C (5 to 158 F) (non freezing)								
	Ambient humidity	85% RH max. (non condensing), storage: 90% RH max.(non condensing)								
	Atmosphere	Indoors (no direct sunlight): no corrosive gas, inflammable gas, oil mist, or dust								
	Elevation/Vibration	1000meters or less above sea level, 49m/s <sup>2</sup> below								
Insulation Class	Type	F								
	Permission Temperature(°C)	155°C Blow								
Weight (kg)	Standard	4.5	5.1	6.5	7.5	9.3	10.9	12.9	15.1	17.3
	With brake	5.1	6.4	7.8	8.8	10.6	12.2	14.8	17.0	19.2

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2. This specification is guaranted after combining and adjusting whith the driver.
3. All ratings typical and at 20°C unless otherwise noted.
4. Contact Ortinghaus if the load/motor of inertia moment ratio exceeds the figure in the table.

## KANS series servo motor torque characteristics



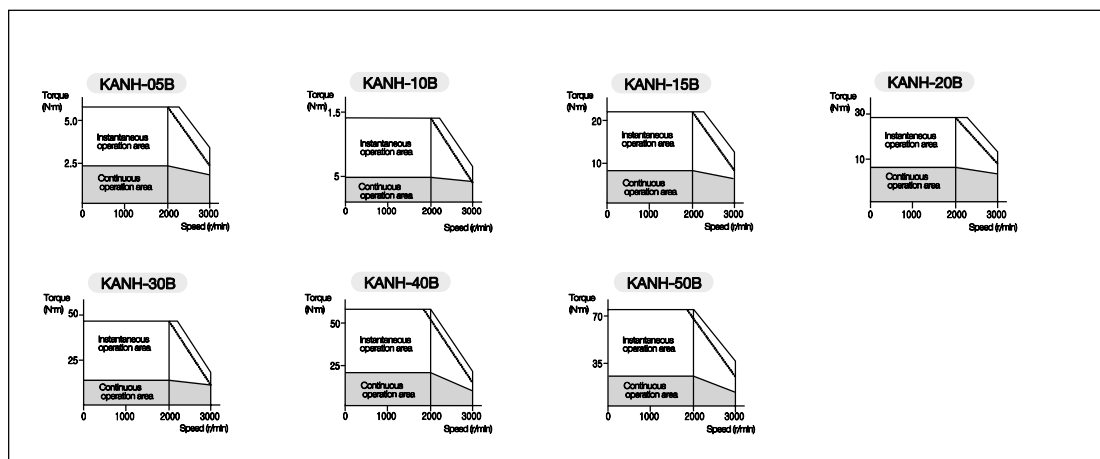
# Specifications and Classifications

## KANH series servo motor specifications

Servo motor series		KANH						
Flange size (mm)		130			180			
Model		05	10	15	20	30	40	50
Specifications								
Supply voltage (V <sub>ic</sub> )		200/220V						
Continuous running duty	Rated output (kW)	0.5	1.0	1.5	2.0	3.0	4.0	5.0
	Rated torque (N·m)	2.39	4.77	7.15	9.55	14.32	19.1	23.87
Maximum torque (N·m)		6.0	14.4	21.5	28.5	42.9	56.4	71.4
Rated rotation speed (r/min)		2000						
Maximum rotation speed (r/min)		3000						
Rated power rate (kW/s)		4.1	8.9	12.2	15.0	22.2	31.1	34.1
Rated current (Arms)		3.2	5.6	9.4	12.3	17.8	23.4	28.0
Momentary maximum current (Arms)		8.1	16.8	28.3	36.7	53.6	70.7	84.9
Rotor inertia (*10 <sup>-4</sup> kg·m <sup>2</sup> )	Standard	14.0	26.0	42.9	62.0	94.1	120.0	170.0
	With brake	15.2	27.2	44.1	67.9	100.0	126.0	176.0
Recommended load/motor inertia ratio		Less than 15-times the servo motor's inertia						
Structure		Totally enclosed non ventilated (protection level:IP65)						
Environment	Ambient temperature	0 to 40°C(32 to 104 F)(non freezing), storage: -15 to 70°C(5 to 158 F) (non freezing)						
	Ambient humidity	85% RH max. (non condensing), storage: 90% RH max.(non condensing)						
	Atmosphere	Indoors (no direct sunlight): no corrosive gas, inflammable gas, oil mist, or dust						
	Elevation/Vibration	1000meters or less above sea level, 49m/s <sup>2</sup> below						
Insulation Class	Type	F						
	Permisson Temperature(°C)	155°C Blow						
Weight (kg)	Standard	5.3	8.5	10.0	16.0	18.2	22.0	26.7
	With brake	6.9	9.5	11.6	19.5	21.7	25.5	30.2

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2. This specification is guaranted after combining and adjusting with the driver.
3. All ratings typical and at 20°C unless otherwise noted.
4. Contact Ortlinghaus if the load/motor of inertia moment ratio exceeds the figure in the table.

## KANH series servo motor torque characteristics



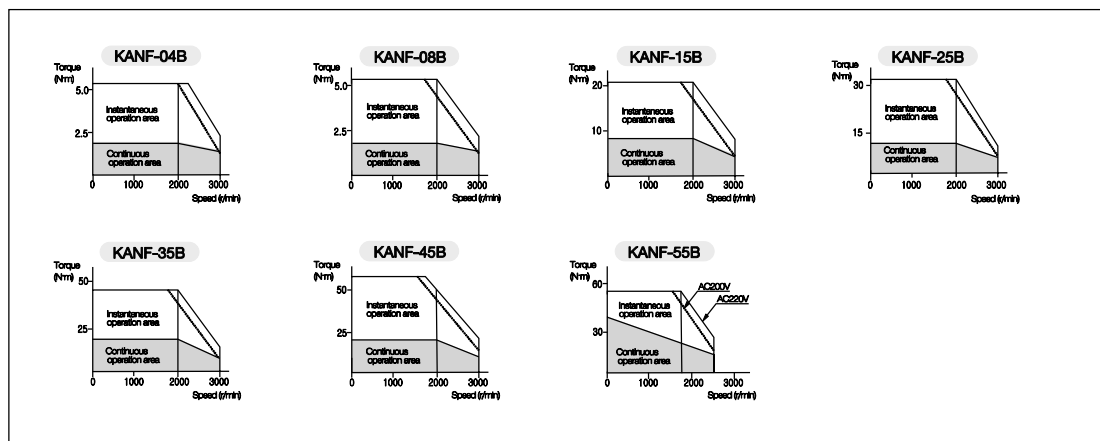
# Specifications and Characteristics

## KANF series servo motor specifications[1]

Servo motor series		KANF						
Flange size (mm)		130	180			220		
Model		04	08	15	25	35	45	55
Specifications								
Supply voltage (V <sub>ac</sub> )		200/220V						
Continuous running duty	Rated output (kW)	0.4	0.75	1.5	2.5	3.5	4.5	5.5
	Rated torque (N·m)	1.91	3.58	7.16	11.9	16.7	21.5	26.3
Maximum torque (N·m)		5.3	10.7	21.5	30.4	44.1	54.9	52.9
Rated rotation speed (r/min)		2000						
Maximum rotation speed (r/min)		3000						2500
Rated power rate (kW/s)		17.5	13.6	29.0	42.6	66.5	80.1	106.1
Rated current (Arms)		2.8	5.0	9.5	13.4	20.0	23.5	26.4
Momentary maximum current (Arms)		8.4	15.0	28.5	40.2	59.4	70.5	72.5
Rotor inertia (×10 <sup>-4</sup> kg·m <sup>2</sup> )	Standard	2.13	9.6	18.0	33.7	42.6	58.7	66.6
	With brake	3.42	14.8	23.2	45.3	54.3	70.3	77.6
Recommended load/motor inertia ratio		Less than 15-times the servo motor's inertia						
Structure		Totally enclosed non ventilated (protection level:IP65)						
Environment	Ambient temperature	0 to 40°C(32 to 104 F)(non freezing), storage: -15 to 70°C(5 to 158 F) (non freezing)						
	Ambient humidity	85% RH max. (non condensing), storage: 90% RH max.(non condensing)						
	Atmosphere	Indoors (no direct sunlight): no corrosive gas, inflammable gas, oil mist, or dust						
	Elevation/vibration	1000meters or less above sea level, 49m/s <sup>2</sup> below						
Insulation Class	Type	F						
	Permisson Temperature(°C)	155°C Blow						
Weight (kg)	Standard	4.7	8.6	11.0	14.8	15.5	19.9	22.5
	With brake	6.7	10.6	14.0	17.5	19.2	24.3	26

1. If used in location such as a actual site of machinery where oil or water may influence the product, contacts Ortinghaus for apply special specifications.
2. This specification is guaranted after combining and adjusting with the driver.
3. All ratings typical and at 20°C unless otherwise noted.
4. Contact Ortinghaus if the load/motor of inertia moment ratio exceeds the figure in the table.

## KANF series servo motor torque characteristics



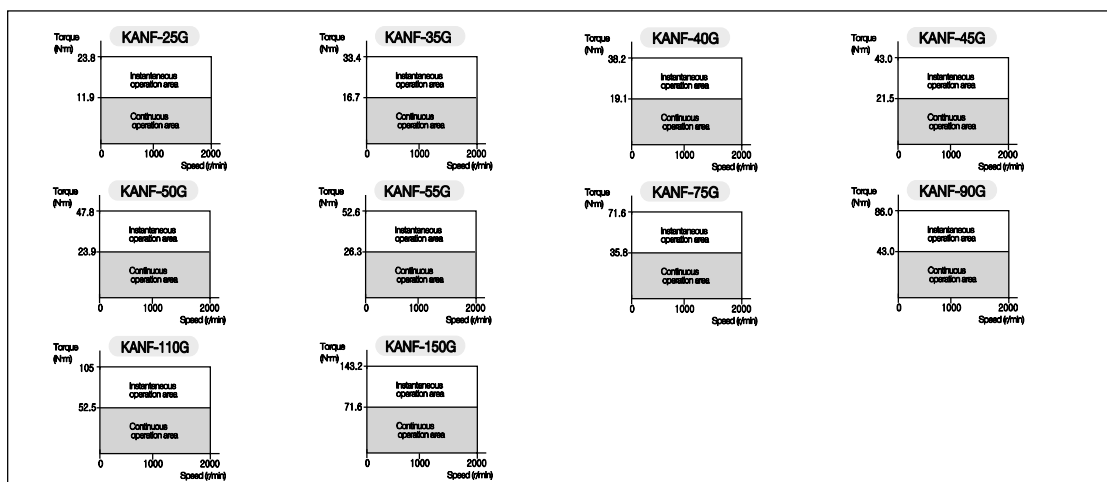
# Specifications and Classifications

## ■ KANF series servo motor specifications [2]

Servo motor series		KANF									
Flange size (mm)		220									
Model		25	35	40	45	50	55	75	90	110	150
Specifications											
Supply voltage (V <sub>ic</sub> )		380V									
Continuous running duty	Rated output (kW)	2.5	3.5	4.0	4.5	5.0	5.5	7.5	9.0	11.0	15.0
	Rated torque (N·m)	11.9	16.7	19.1	21.5	23.9	26.3	35.8	43.0	52.5	71.6
Maximum torque (N·m)		23.8	33.4	38.2	43.0	47.8	52.6	71.6	86.0	105.0	143.2
Rated rotation speed (r/min)		2000									
Maximum rotation speed (r/min)		2000									
Rated power rate (kW/s)		42.9	66.8	80.8	80.4	97.3	106.0	169.5	188.7	243.6	269.5
Rated current (Arms)		6.00	8.60	9.20	10.00	10.90	12.30	17.50	19.90	24.70	32.5
Momentary maximum current (Arms)		17.0	24.3	26.0	28.3	30.8	34.8	49.5	56.3	69.9	91.9
Rotor inertia (*10 <sup>-4</sup> kg·m <sup>2</sup> )	Standard	33.7	42.6	46.1	58.7	60.0	66.6	77.2	100.1	115.5	194.2
	With brake	45.3	54.3	47.2	70.3	71.1	77.6	88.3	-	-	-
Recommended load/motor inertia ratio		Less than 10-times the servo motor's inertia									
Structure		Totally enclosed non ventilated (protection level:IP65)									
Environment	Ambient temperature	0 to 40°C(32 to 104 F)(non freezing), storage: -15 to 70°C(5 to 158 F) (non freezing)									
	Ambient humidity	85% RH max. (non condensing), storage: 90% RH max.(non condensing)									
	Atmosphere	Indoors (no direct sunlight): no corrosive gas, inflammable gas, oil mist, or dust									
	Elevation/Vibration	1000meters or less above sea level, 49m/s <sup>2</sup> below									
Insulation Class	Type	F									
	Permisson Temperature(°C)	155°C Blow									
Weight (kg)	Standard	14.8	15.5	17.7	19.9	26.0	26.0	33.0	42.0	49.0	71.0
	With brake	17.5	19.2	22.1	24.3	30.4	30.4	37.4	-	-	-

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2. This specification is guaranted after combining and adjusting with the driver.
3. All ratings typical and at 20°C unless otherwise noted.
4. Contact Ortlinghaus if the load/motor of inertia moment ratio exceeds the figure in the table.

## ■ KANF series servo motor torque characteristics



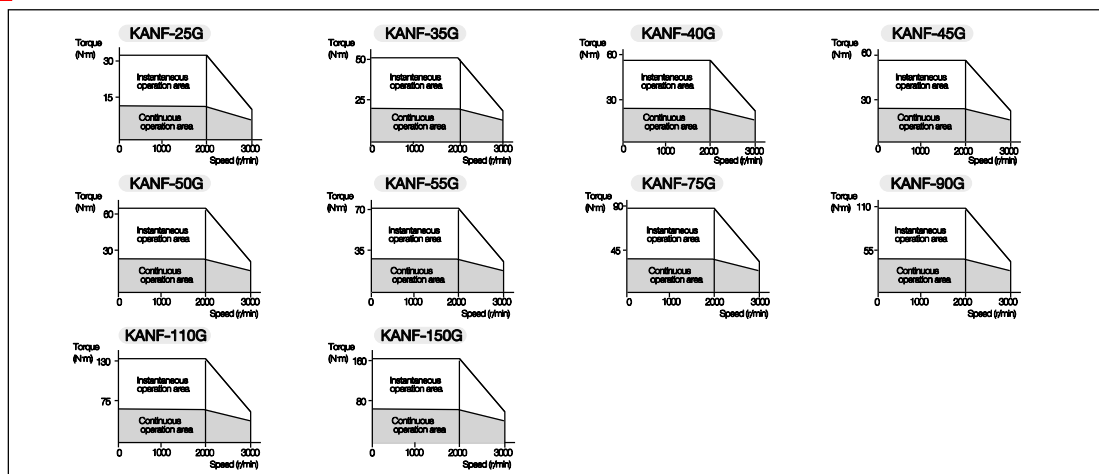
# Specifications and Characteristics

## KANF series servo motor specifications [3]

Servo motor series		KANF									
Flange size (mm)		220									
Model		25	35	40	45	50	55	75	90	110	150
Specifications											
Supply voltage (V <sub>ac</sub> )		380V									
Continuous running duty	Rated output (kW)	2.5	3.5	4.0	4.5	5.0	5.5	7.5	9.0	11.0	15.0
	Rated torque (N·m)	11.9	16.7	19.1	21.5	23.9	26.3	35.8	43.0	52.5	71.6
Maximum torque (N·m)		32.2	50.1	55.4	58.0	63.5	70.1	89.5	107.4	131.0	164.7
Rated rotation speed (r/min)		2000									
Maximum rotation speed (r/min)		3000									
Rated power rate (kW/s)		42.9	66.8	80.8	80.4	97.2	85.4	169.5	188.6	243.7	269.6
Rated current (Arms)		8.10	12.80	14.40	16.00	17.50	19.00	25.90	30.10	36.40	42.0
Momentary maximum current (Arms)		27.3	57.0	61.3	62.3	61.0	67.2	88.0	101.0	125.0	128.0
Rotor inertia (×10 <sup>-4</sup> kg·m <sup>2</sup> )	Standard	33.7	42.6	46.1	58.7	60.0	66.6	77.2	100.1	115.5	194.2
	With brake	45.3	54.3	47.2	70.3	71.1	77.6	88.3	-	-	-
Recommended load/motor inertia ratio		Less than 10-times the servo motor's inertia									
Structure		Totally enclosed non ventilated (protection level:IP65)									
Environment	Ambient temperature	0 to 40°C(32 to 104°F)(non freezing), storage: -15 to 70°C(5 to 158°F) (non freezing)									
	Ambient humidity	85% RH max. (non condensing), storage: 90% RH max.(non condensing)									
	Atmosphere	Indoors (no direct sunlight): no corrosive gas, inflammable gas, oil mist, or dust									
	Elevation/Vibration	1000meters or less above sea level, 49m/s <sup>2</sup> below									
Insulation Class	Type	F									
	Permisson Temperature(°C)	155°C Blow									
Weight (kg)	Standard	14.8	15.5	17.7	19.9	26.0	26.0	33.0	42.0	49.0	71.0
	With brake	17.5	19.2	22.1	24.3	30.4	30.4	37.4	-	-	-

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2. This specification is guaranted after combining and adjusting with the driver.
3. All ratings typical and at 20°C unless otherwise noted.
4. Contact Ortlinghaus if the load/motor of inertia moment ratio exceeds the figure in the table.

## KANF series servo motor torque characteristics



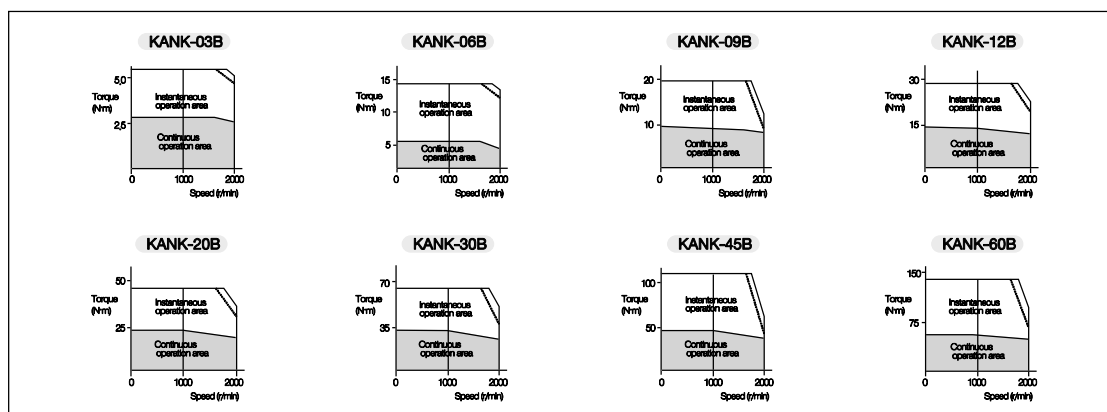
# Specifications and Classifications

## KANK series servo motor specifications

Servo motor series		KANK							
Flange size (mm)		130			180				
Model		03	06	09	12	20	30	45	60
Specifications									
Supply voltage (V <sub>ic</sub> )		200/220V							
Continuous running duty	Rated output (kW)	0.3	0.6	0.9	1.2	2.0	3.0	4.5	6.0
	Rated torque (N·m)	2.84	5.70	8.62	11.5	19.1	28.4	42.9	57.2
Maximum torque (N·m)		6.3	14.4	19.3	28.0	44.0	63.7	107.0	129.0
Rated rotation speed (r/min)		1000							
Maximum rotation speed (r/min)		2000							
Rated power rate (kW/s)		31.2	67.0	108.0	44.0	104.0	148.0	232.0	337.0
Rated current (Arms)		3.5	6.2	7.6	11.6	18.5	24.0	33.0	47.0
Momentary maximum current (Arms)		7.8	15.6	17.0	28.3	42.4	56.6	83.4	109.6
Rotor inertia (*10 <sup>-4</sup> kg·m <sup>2</sup> )	Standard	2.64	4.9	7.0	30.4	35.5	55.7	80.9	99.0
	With brake	3.84	6.20	8.3	36.2	41.4	61.7	86.9	108.0
Recommended load/motor inertia ratio		Less than 15-times the servo motor's inertia							
Structure		Totally enclosed non ventilated (protection level:IP65)							
Environment	Ambient temperature	0 to 40°C(32 to 104 F)(non freezing), storage: -15 to 70°C(5 to 158 F) (non freezing)							
	Ambient humidity	85% RH max. (non condensing), storage: 90% RH max.(non condensing)							
	Atmosphere	Indoors (no direct sunlight): no corrosive gas, inflammable gas, oil mist, or dust							
	Elevation/Vibration	1000meters or less above sea level, 49m/s <sup>2</sup> below							
Insulation Class	Type	F							
	Permisson Temperature(°C)	155°C Blow							
Weight (kg)	Standard	4.8	6.2	8.6	15.5	17.5	25.0	34.0	41.0
	With brake	6.3	8.0	10.1	19.0	21.0	29.0	39.5	47.0

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3. All ratings typical and at 20°C unless otherwise noted.
4. Contact Ortlinghaus if the load/motor of inertia moment ratio exceeds the figure in the table.

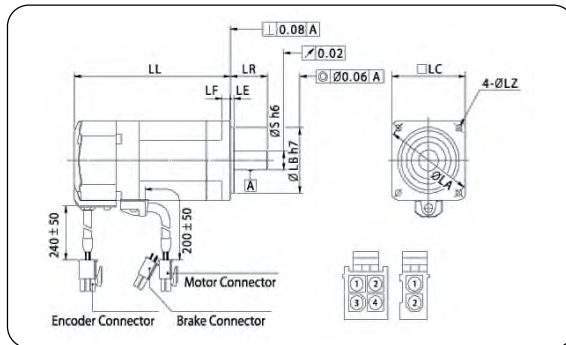
## KANK series servo motor torque characteristics





# Motor Dimensions

## KANZ/Q series



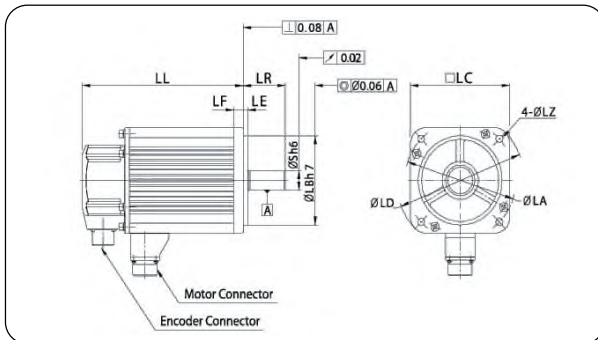
Specifications of motor/brake connector

Brake	Standard		with Brake	
Part no.	AMP/ 172167-1		AMP/ 172167-1 AMP/ 172165-1	
Pin spec.	Pin no.	Signal	Pin no.	Signal
	1	U	1	U
	2	V	2	V
	3	W	3	W
	4	FG	4	FG
			1	BR
		2	BR	

Series		KANZ									KANQ		
Model		A3	A5	A8	01	02	04	06	08	10	01	02	04
LL	Standard	74	82	102	112	98.5	128	129	147	165	86	97	112
	With brake	106	114	134	144	131	160.5	164	182	200	118.5	132	147
LR		25	25	25	25	30	30	35	35	35	25	30	30
S		7	8	8	8	11	14	16	19	19	8	11	14
LA		45	45	45	45	70	70	90	90	90	70	90	90
LB		30	30	30	30	50	50	70	70	70	50	70	70
LC		40	40	40	40	60	60	80	80	80	60	80	80
LE		3	3	3	3	3	3	3	3	3	3	3	3
LF		6	6	6	6	7	7	8	8	8	7	8	8
LZ		3.6	3.6	3.6	3.6	5.5	5.5	6.6	6.6	6.6	5.5	6.6	6.6

# Motor Dimensions

## KAND/S/H/F series



Motor connector (MS 3102A)

Series	KAND			KANS			KANH			KANF		
Model	08~25	30~75	90	10~25	30~50	05~15	20~50	04~15	25~75	90~150		
Standard	20-4P	22-22P	32-17P	20-4P	22-22P	20-4P	22-22P	20-18P	24-11P	32-17P		
With brake	20-18P	24-11P	-	20-18P	24-11P	20-18P	24-11P	20-18P	24-11P	32-17P 14S-10P		

Specifications of motor/brake connector

Brake	Standard			With brake		
	MS 3102A 20-4P MS 3102A 22-22P	MS 3102A 20-18P	MS 3102A 24-11P	MS 3102A 20-18P	MS 3102A 24-11P	
Pin spec.	Pin No.			Signal		
		G	A		G	A
		H	B		H	B
		A	C		A	C
	A	F	D	U	F	D
	B	I	E	V	I	E
	C	B	F	W	B	F
	D	G	FG	E	G	
	D	H	FG	D	H	
	C	I		C	I	
Outlines						

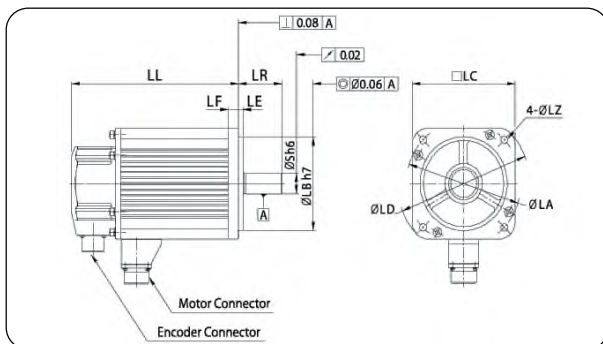
Series	KAND(220V)															KAND(380V)														
	Model	08	10	15	20	25	30	35	40	45	50	10	15	20	25	30	35	40	45	50	55	75	90							
LL	Standard	144.5	158	183	208	233	258	198	203	213	233	150	175	200	225	250	190	195	205	225	245	315	370							
	With brake	169.5	183	208	233	258	283	223	228	238	258	175	200	225	250	275	215	220	230	250	270.5	-	-							
LR		55	55	55	55	65	65	65	65	70	70	55	55	55	65	65	65	65	70	70	70	79	113							
S		19	22	22	22	24	24	28	28	35	35	22	22	22	24	24	28	28	35	35	35	35	42							
LA		130/145	145	145	145	145	145	200	200	200	200	145	145	145	145	145	200	200	200	200	200	200	200							
LB		110	110	110	110	110	110	114.3	114.3	114.3	114.3	110	110	110	110	110	114.3	114.3	114.3	114.3	114.3	114.3	114.3							
LC		120	130	130	130	130	130	180	180	180	180	130	130	130	130	130	180	180	180	180	180	180	180							
LD		162	165	165	165	165	165	230	230	230	230	165	165	165	165	165	230	230	230	230	230	230	230							
LE		3	6	6	6	6	6	3.2	3.2	3.2	3.2	6	6	6	6	6	3.2	3.2	3.2	3.2	3.2	3.2	3.2							
LF		12	12	12	12	12	12	18	18	18	18	12	12	12	12	12	18	18	18	18	18	18	18							
LZ		9	9	9	9	9	9	13.5	13.5	13.5	13.5	9	9	9	9	9	13.5	13.5	13.5	13.5	13.5	13.5	13.5							

Series	KANS										KANH									
	Model	10	15	20	25	30	35	40	45	50	05	10	15	20	30	40	50			
LL	Standard	162.5	187.5	210.5	235.5	214.5	234.5	248	268	288	158	183	208	200	215	230	260			
	With brake	182.5	207.5	230.5	255.5	239.5	259.5	273	293	313	183	208	233	225	240	255	285			
LR		55	55	55	55	55	55	65	65	65	70	70	70	80	80	80	80			
S		19	19	19	19	22	22	24	24	24	22	22	22	35	35	35	35			
LA		115	115	115	115	130/145	130/145	145	145	145	145	145	145	200	200	200	200			
LB		95	95	95	95	110	110	110	110	110	110	110	110	114.3	114.3	114.3	114.3			
LC		100	100	100	100	120	120	130	130	130	130	130	130	180	180	180	180			
LD		135	135	135	135	162	162	162	162	162	165	165	165	230	230	230	230			
LE		3	3	3	3	3	3	6	6	6	6	6	6	3.2	3.2	3.2	3.2			
LF		10	10	10	10	12	12	12	12	12	12	12	12	18	18	18	18			
LZ		9	9	9	9	9	9	9	9	9	9	9	9	13.5	13.5	13.5	13.5			

Series	KANF(220V)										KANF(380V)									
	Model	04	08	15	25	35	45	55	25	35	40	45	50	55	75	90	110	150		
LL	Standard	128	135	155	146	155	171	181.5	138	147	154	163	173.5	173.5	193.5	293.5	314	379		
	With brake	153	160	180	182.5	191.5	207.5	212.5	239.5	183.5	190.5	199.5	204.5	204.5	223.5	348.5	366	431		
LR		55	55	65	65	65	70	70	65	65	65	70	70	70	116	124.5	124.5			
S		19	22	35	35	35	35	35	35	35	35	35	35	35	55	55	55			
LA		145	200	200	235	235	235	235	235	235	235	235	235	235	235	235	235			
LB		110	114.3	114.3	200	200	200	200	200	200	200	200	200	200	200	200	20			
LC		130	180	180	220	220	220	220	220	220	220	220	220	220	220	220	220			
LD		165	230	230	268	268	268	268	268	268	268	268	268	268	268	268	268			
LE		6	3.2	3.2	4	4	4	4	4	4.0	4	4	4	4	4	10	10			
LF		12	18	18	16	16	16	16	16	16.0	16	16	16	16	16	38	38			
LZ		9	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5			

# Motor Dimensions

## KANK/L series



Motor connector (MS 3102A)

Series	KANK			KANL		
Model	03~09	12~45	60	03~09	12~45	60
Standard	20-4P	20-22P	32-17P	20-4P	22-22P	32-17P
With brake	20-18P	24-11P	32-17P +14S-2P	20-18P	24-11P	32-17P +14S-2P

Specifications of motor/brake connector

Brake	Standard		with Brake				
Part No.	MS 3102A 20-4P MS 3102A 22-22P MS 3102A 32-17P		MS 3102A 20-18P	MS 3102A 24-11P	MS 3102A 14S-2P		
Pin spec.	Pin No.	Signal	Pin No.	Signal	Pin No.	Signal	
	A	U	G	A	BR	A	BR
	B	V	H	B	BR	B	BR
	C	W	A	C			
	D	FG	F	D			
			I	E	U		
			B	F	V		
			E	G	W		
Outlines			MS 3102A 20-18P	MS 3102A 24-11P	MS 3102A 14S-2P		

Series		KANK							
LL	Model	03	06	09	12	20	30	45	60
	Standard	133	158	183	183	203	243	309.2	364.2
	With brake	158	183	208	208	228	268	334.2	389.2
LR		70	70	70	80	80	80	113	113
S		22	22	22	35	35	35	42	42
LA		145	145	145	200	200	200	200	200
LB		110	110	110	114.3	114.3	114.3	114.3	114.3
LC		130	130	130	180	180	180	180	180
LD		165	165	165	230	230	230	230	230
LE		6	6	6	3.2	3.2	3.2	3.2	3.2
LF		12	12	12	18	18	18	20	20
LZ		9	9	9	13.5	13.5	13.5	13.5	13.5

Series		KANL							
LL	Model	03	06	09	12	20	30	45	60
	Standard	158	183	208	207	227	267	334.6	389.6
	With brake	183	208	233	232	252	292	359.6	414.6
LR		55	55	55	80	80	80	113	113
S		22	22	22	35	35	35	42	42
LA		145	145	145	200	200	200	200	200
LB		110	110	110	114.3	114.3	114.3	114.3	114.3
LC		130	130	130	180	180	180	180	180
LD		165	165	165	230	230	230	230	230
LE		6	6	6	3.2	3.2	3.2	3.2	3.2
LF		12	12	12	18	18	18	20	20
LZ		9	9	9	13.5	13.5	13.5	13.5	13.5

# Special Specifications

## Electromagnetic brake specifications

KANZ/Q series													
Series		KANZ									KANQ		
Model		A3	A5	A8	01	02	04	06	80	10	01	02	40
Static friction torque	Nm	0.29	0.29	0.29	0.29	1.27	1.27	2.45	2.45	2.45	1.27	2.45	2.45
Response time	ms	25	25	25	25	50	50	60	60	60	50	60	60
Release time	ms	20	20	20	20	15	15	15	15	15	15	15	15
Rated voltage	V <sub>DC</sub>	24	24	24	24	24	24	24	24	24	24	24	24
Rated current	A(at20°C)	0.26	0.26	0.26	0.26	0.36	0.36	0.43	0.43	0.43	0.36	0.43	0.43

KAND/S series																				
Series		KAND										KANS								
Model		08	10	15	20	25	30	35	40	45	50	10	15	20	25	30	35	40	45	50
Static friction torque	Nm	12	16.5	16.5	16.5	16.5	16.5	25	25	25	25	12	12	12	12	12	12	16.5	16.5	16.5
Response time	ms	100	110	110	110	110	110	160	160	160	160	100	100	100	100	100	100	110	110	110
Release time	ms	20	50	50	50	50	50	75	75	75	75	20	20	20	20	20	20	50	50	50
Rated voltage	V <sub>DC</sub>	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
Rated current	A(at20°C)	0.81	0.9	0.9	0.9	0.9	0.9	1.3	1.3	1.3	1.3	0.81	0.81	0.81	0.81	0.81	0.81	0.9	0.9	0.9

KANH series								
Series		KANH						
Model		05	10	15	20	30	40	50
Static friction torque	Nm	16.5	16.5	16.5	25	25	25	25
Response time	ms	110	110	110	160	160	160	160
Release time	ms	50	50	50	75	75	75	75
Rated voltage	V <sub>DC</sub>	24	24	24	24	24	24	24
Rated current	A(at20°C)	0.9	0.9	0.9	1.3	1.3	1.3	1.3

KANF series														
Series		KANF												
Model		04	08	15	25	35	40	45	50	55	75	90	110	150
Static friction torque	Nm	16.5	25	25	45	45	45	45	45	45	45	120	120	120
Response time	ms	110	160	160	220	220	220	220	220	220	220	350	350	350
Release time	ms	50	75	75	100	100	100	100	100	100	100	150	150	150
Rated voltage	V <sub>DC</sub>	24	24	24	24	24	24	24	24	24	24	24	24	24
Rated current	A(at20°C)	0.9	1.3	1.3	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.3	1.3	1.3

KANK series									
Series		KANK							
Model		03	10	09	12	20	30	45	60
Static friction torque	Nm	16.5	16.5	16.5	25	25	25	25	25
Response time	ms	110	110	110	160	160	160	160	160
Release time	ms	50	50	50	75	75	75	75	75
Rated voltage	V <sub>DC</sub>	24	24	24	24	24	24	24	24
Rated current	A(at20°C)	0.9	0.9	0.9	1.3	1.3	1.3	1.3	1.3

KANL series									
Series		KANL							
Model		03	10	09	12	20	30	45	60
Static friction torque	Nm	16.5	16.5	16.5	25	25	25	25	25
Response time	ms	110	110	110	160	160	160	160	160
Release time	ms	50	50	50	75	75	75	75	75
Rated voltage	V <sub>DC</sub>	24	24	24	24	24	24	24	24
Rated current	A(at20°C)	0.9	0.9	0.9	1.3	1.3	1.3	1.3	1.3

The electromagnetic brake is for holding. It cannot be used for braking applications.

# Special Specifications

## Special shaft end specifications

KANZ, KANQ series(With key & D-cut)

Series	KANZ									KANQ		
Model	A3	A5	A8	01	02	04	06	08	10	01	02	04
LW/LN(D-cut)	13/20	14/20	14/20	14/20	20/22	25/22	25/25	25/25	25/25	14/20	20/22	25/22
LK	12	12.5	12.5	12.5	18	22.5	22	22	22	12.5	18	22.5
KW	2h9	3h9	3h9	3h9	4h9	5h9	6h9	6h9	6h9	3h9	4h9	5h9
KH	2	3	3	3	4	5	6	6	6	3	4	5
PH/LP(D-cut)	5.8/6.5	6.2/7.5	6.2/7.5	6.2/7.5	8.5/10	11/12.5	12.5/14.5	15.5/17.5	15.5/17.5	6.2/7.5	8.5/10	11/12.5

Key

D-cut

KAND, KANS, KANH, KANF, KANK, KANL series(With key)

Series	KAND					KANS			KANH		KANF			KANK			KANL		
Model	08	10-20	25-35	40	45-75	10-25	30-35	40-50	05-15	20-50	04	08	15-75	03-09	12-30	45-60	03-09	12-30	45-60
LW	45	45	55	55	55	45	45	55	45	55	45	45	55	45	55	96	45	55	96
LK	42	41	51	51	50	42	41	51	41	50	42	41	50	41	50	90	41	50	90
KW	6h9	8h9	8h9	8h9	10h9	6h9	8h9	8h9	8h9	10h9	6h9	8h9	10h9	8h9	10h9	12h9	8h9	10h9	12h9
KH	6	7	7	7	8	6	7	7	7	8	6	7	8	7	8	8	7	8	8
PH	15.5	18	20	24	30	15.5	18	20	18	30	15.5	18	30	18	30	37	18	30	37

Key

# Connector pin Arrangement

## Encoder connectors

KANZ, KANQ series				Pin Specification										Outlines
Model	Encoder Type	Wires	Part No.	Pin	1	2	3	4	5	6	7	8	9	
KANZ-A3~10 KANQ-01~04	Inc.	15	AMP/ 172171-1	Pin	1	2	3	4	5	6	7	8	9	
				Signal	A	$\bar{A}$	B	$\bar{B}$	Z	$\bar{Z}$	U	$\bar{U}$	V	
				Pin	10	11	12	13	14	15				
				Signal	$\bar{V}$	W	$\bar{W}$	+5V	0V	FG				
	9	AMP/ 172169-1	Pin	1	2	3	4	5	6	7	8	9		
			Signal	A	$\bar{A}$	B	$\bar{B}$	Z	$\bar{Z}$	+5V	0V	FG		
9	Abs. (17bit)	9	AMP/ 172169-1	Pin	1	2	3	4	5	6	7	8	9	
				Signal	BAT+	BAT-	FG	SD	$\bar{SD}$		+5V	0V		

KAND, KANS, KANH, KANF, KANK, KANL series				Pin Specification										Outlines
Model	Encoder Type	Wires	Part No.	Pin	A	B	C	D	E	F	G	H	J	
KAND-08~90 KANS-10~50 KANH-05~50 KANF-04~150 KANK-03~60 KANL-03~60	Inc.	9	MS 3102A 20-29P	Pin	A	B	C	D	E	F	G	H	J	
				Signal	A	$\bar{A}$	B	$\bar{B}$	Z	$\bar{Z}$	OV	+5V	FG	
				Pin	A	B	C	D	E	F	G	H	J	
				Signal	A	$\bar{A}$	B	$\bar{B}$	Z	$\bar{Z}$	OV	+5V	FG	
	Pin	K		L	M	N	P	R	S	T				
	Signal	U		$\bar{U}$	V	$\bar{V}$	W	$\bar{W}$						
9	Abs. (17bit)	9		Pin	A	B	C	D	E	F	G	H	J	
				Signal							OV	+5V	FG	
				Pin	K	L	M	N	P	R	S	T		
				Signal	SD	$\bar{SD}$					BAT-	BAT+		

# Glossary

Power	<p>1. The rate at which work is done. In motion control, power is equal to torque multiplied by speed.</p> <p>2. The rate of doing work or expending energy. It may be written as:  <math>\text{Power (watts)} = \text{force} \times \text{distance} / \text{time}</math>. Expressed in electrical terms it is <math>\text{voltage} \times \text{current} = \text{power (watts)}</math></p>
Speed	Describes the linear or rotational velocity of a motor or other object in motion.
Torque	A measure of angular force which produces rotational motion. This force is defined by a linear force multiplied by a radius e.g.N-m. Torque is an important parameter of motion control system.
Cogging Torque	A term used to describe non-uniform angular velocity. Cogging appears as a jerkiness especially at low speeds.
Inductance	The electrical equivalent to mechanical inertia: that is, the property of a circuit, which when no current flows has a tendency to resist current flow, and when current is flowing has a tendency to maintain that current flow. Ortlinghaus measures inductance(line to line) with a bridge at 1000Hz and with an average value of several points where the rotor appears as a jerkiness.
Inertia	The property of an object to resist change in velocity unless acted upon by an outside force. Higher inertia objects require larger torques to accelerate and decelerate. Inertia is dependent upon the mass and shape of the object.
Back EMF	The voltage generated when a permanent magnet motor is rotated. This voltage is proportional to motor speed and is present regardless of whether the motor windings are energized or unenergized.
Torque-to-Inertia ratio	Defined as the motor's holding torque divided by the inertia of its rotor. The higher the ratio, the higher a motor's maximum acceleration capability will be.
Back EMF constant	When a motor is operated, it generates a voltage proportional to speed but opposing the applied voltage. It describes the ratio of generated voltage to rotation speed at no load. The shape of the voltage waveform depends upon the specific motor design. For example, in a brushless motor the waveshape may be trapezoidal, or sinusoidal in nature. All Ortlinghaus brushless motor designs have a sinusoidal voltage.
Torque constant	An expression of the relationship between input current and output torque. For each ampere of current, a fixed amount of torque is produced.
Brushless servo motor	A class of servo motors which operates using electronic commutation of phase currents rather than electromechanical(brushes) commutation. Commutation is a function of rotor position. These motors typically have a permanent magnet rotor and wound stator.
Class B insulation	A NEMA insulation specification. Class B insulation is rated to an operating(internal) temperature of 130°C
Class F insulation	A NEMA insulation specification. Class F insulation is rated to an operating(internal) temperature of 155°C