CONTROL TECHNIQUES
DYNAMICS

SERVO MOTOR SERIES

UNIMOTOR FM

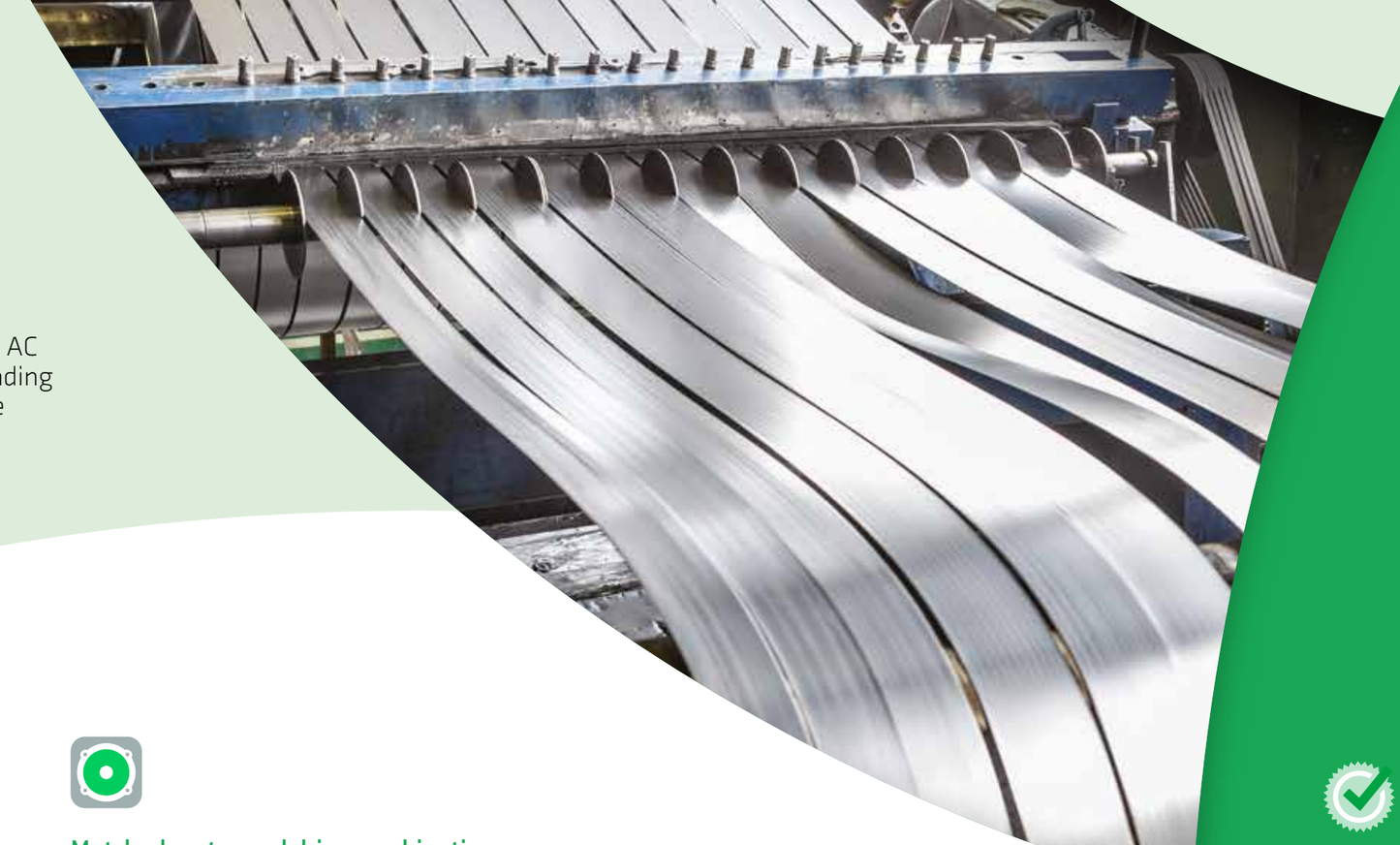
AC brushless servo motor

075 to 250 Frames
1.4 to 136 Nm
(408 Nm Peak)

Nidec
All for dreams

Unimotor fm

Unimotor fm is a high performance brushless AC servo motor range designed for use in demanding continuous duty applications. The motors are available in frame sizes from 075 to 250.



Reliability and innovation

Unimotor fm is designed using a proven development process that prioritises innovation and reliability. This process has resulted in a market leading reputation for both performance and quality.

Matched motor and drive combinations

Drives and motors from Control Techniques are designed to function as an optimized system. Unimotor fm is the perfect partner for Unidrive M.

Faster set-up, optimized performance

When a Control Techniques servo drive is connected to a Unimotor fm fitted with a SinCos or Absolute encoder, it can recognize and communicate with the motor to obtain the "electronic nameplate" data. This motor data can then be used to automatically optimize the drive settings. This feature simplifies commissioning and maintenance, ensures consistent performance and saves time.

Accuracy and resolution to suit your application requirements

Choosing the right feedback device for your application is critical in getting optimum performance. Unimotor fm has a range of feedback options that offer different levels of accuracy and resolution to suit most applications:

- Resolver: robust for extreme applications and conditions – low accuracy, medium resolution
- Incremental encoder: high accuracy, medium resolution
- Single turn and multi-turn and EnDat protocols supported

Wide range of accessories

In addition we offer a range of accessories to cover your system requirements:

- Feedback and power cables for static and dynamic applications
- Fan boxes
- Gearboxes
- Cable connectors

Features

Unimotor fm is suitable for a wide range of industrial applications, due to it's extensive range of features:

- Torque range from 1.4 Nm to 136 Nm
- High energy parking brakes
- World class performance
- Winding voltages for inverter supply of 400 V and 220 V
- Rated speeds from 1,000 to 6,000 rpm and others available
- Thermal protection by PTC thermistor or/optional KTY84.130 sensor

Unimotor fm and Unidrive M

Quick reference table

Frame size	PCD (mm)	Unimotor fm											
075	075	0.78	1.40 2.07	4.70									
095	100		1.45	2.50 6.0	9.30								
115	115			3.9 5.4	16.0 14.8								
142	165				6.2 10.2	25.0 36.9							
190	215					11.3 31.3	77.0 160.8						
250	300											92.0 275	136 400
Stall	(Nm) 0	1.0	3.0	5.0	8.0	10.0	15.0	20.0	30.0	60.0	80.0	100.0	136.0
Inertia	(kg.cm2) 0	0.8	1.5	2.5	6.5	8.0	9.0	20.0	60.0	100.0	150.0	300.0	400.0

Conformance and standards

c UL us CE RoHS Compliant DNV·GL

Ordering information

Use the information below in the illustration to create an order code for a Unimotor fm.

075	U3	B	30	0	B
Frame size	**Motor voltage**	**Stator length**	**Rated speed***	**Brake**	**Connection type****
	075 - 190 frame	**075 frame**	**075 - 190 frame**	**075 - 250 frame**	**Size 1**
075	**E3** = 220V	**A to D**	**20 =** 2000 rpm	**0** = Not fitted (Std)	**B** = Power and signal 90° rotatable
095	**U3** = 400V	**095 - 142 frame**	**30** = 3000 rpm	**075 - 142C frame**	
115	**250 frame**	**A to E**	**40 =** 4000 rpm	**6** = Parking brake	**D** = Single cable, power & signal combined, 90° rotatable
142	**U3** = 400V	**190 frame**	**60** = 6000 rpm	**142D - 250 frame**	
190		**A to H**	**250 frame**	**5** = Parking brake	**Size 1.5**
250		**250 frame**	**10** = 1000 rpm		**J** = Power and signal 90° rotatable
		D to F	**15** = 1500 rpm		
			20 = 2000 rpm		**E** = Single cable, power & signal combined, 90° rotatable
			25 = 2500 rpm		**Hybrid box**
					H = Power hybrid box

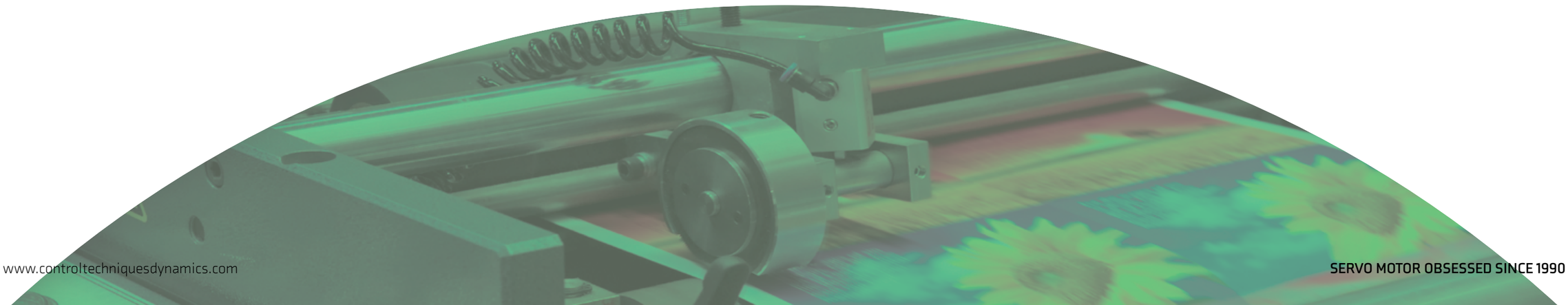
A	CA		A	075		140	
Output shaft	**Feedback device**		**Thermistor**	**PCD**		**Shaft diameter**	
075 - 250 frame	**075 - 250 frame**	**Single Cable**	**075 - 250 frame**	**075 frame**			
A = Key	**AE** = Resolver	No	**A** = PTC Thermistor (DIN44082)	**075**	Std	**11.0**	A
B = Plain Shaft	**CA** = Incremental Encoder	No	**C** = KTY Thermistor (KTY84130)			**14.0**	B-D
F = Key and half key supplied seperately	**EC** = Inductive EnDat SinCos Multi-turn	No		**095 frame**			
	FC = Inductive EnDat SinCos Single-turn	No		**100**	Std	**14.0**	A
	EF = Inductive EnDat Multi-turn FS	Yes				**19.0**	B-C
	FF = Inductive EnDat Single-turn FS	Yes		**115 frame**			
	RA = Optical Hiperface SinCos Multi-turn	No		**115**	Std	**19.0**	A-C
	SA = Optical Hiperface SinCos Single-turn	No				**24.0**	D-E
	GB = ROHS EnDat Multi-turn Size 58	Yes		**142 frame**			
	HB = ROHS EnDat Single-turn Size 58	Yes		**165**	Std	**24.0**	A-E
				190 frame			
				215	Std	**32.0**	A-H
				250 frame			
				300	Std	**48.0**	D-F

*Not all speeds are available on all motors. Please refer to performance pages 8-11.

**Single cable option must be fitted with KTY thermistor and is only available with certain feedback options. Please refer to page 22.

For recommended connector sizes please refer to performance pages 8-11.

Additonal options are available upon request but may require a longer lead time to complete, please check with the Drive Centre.



Ratings

3 Phase VPWM drives 200 - 240Vrms - Δt= 100°C winding 40°C maximum ambient.
All data subject to +/-10% tolerance

Motor Frame Size (mm)	075E3				095E3					115E3				
Frame length	A	B	C	D	A	B	C	D	E	A	B	C	D	E
Continuous stall torque (Nm)	1.4	2.7	3.7	4.7	2.5	4.5	6.3	7.9	9.3	3.9	7.4	10.8	13.7	16.0
Peak torque (Nm)	4.3	8.0	11.2	14.0	7.4	13.5	18.9	23.7	27.8	11.7	22.2	32.4	41.0	48.0
Standard inertia (kg cm²)	0.78	1.22	1.64	2.07	1.45	2.60	3.72	4.83	6.00	5.40	7.70	10.00	12.50	14.80
Winding thermal time constant (sec)	63	58	73	78	84	82	90	108	112	103	109	116	127	141
Standard motor weight (kg)	2.9	3.7	4.5	5.3	4.5	5.8	7.0	8.3	9.5	6.9	8.7	10.5	12.3	14.1
Number of poles	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Speed 2000 (rpm)	Kt(Nm/A) = 1.4 Ke(V/Krpm) = 85.5													
Rated torque (Nm)	1.3	2.5	3.5	4.5	2.4	4.3	5.9	7.3	8.5	3.7	7.3	10.1	11.9	14.1
Stall current (A)	1.0	1.9	2.7	3.3	1.8	3.2	4.5	5.6	6.6	2.8	5.3	7.7	9.8	11.4
Rated power (kW)	0.27	0.52	0.73	0.93	0.51	0.90	1.23	1.53	1.77	0.77	1.53	2.12	2.49	2.95
R (ph-ph) (Ohms)	48.24	16.32	8.96	6.22	20.69	6.78	3.79	2.42	1.92	10.65	3.43	1.82	1.81	1.34
L (ph-ph) (mH)	87.47	39.77	24.68	19.15	57.78	26.10	16.36	11.83	9.75	55.83	19.43	12.31	9.50	7.68
Recommended power conn' size	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Speed 3000 (rpm)	Kt(Nm/A) = 0.93 Ke(V/Krpm) = 57													
Rated Torque (Nm)	1.30	2.30	3.30	4.20	2.33	4.10	5.60	6.90	8.15	3.50	6.70	9.50	11.20	12.70
Stall Current (A)	1.55	2.85	4.00	5.02	2.63	4.84	6.77	8.49	9.95	4.19	7.96	11.61	14.68	17.20
Rated Power (kW)	0.41	0.72	1.04	1.31	0.73	1.29	1.76	2.17	2.56	1.10	2.10	2.98	3.52	3.99
R (ph-ph) (Ohms)	19.80	6.69	3.71	2.72	9.62	2.99	1.64	1.07	0.86	4.91	1.52	0.81	0.57	0.43
L (ph-ph) (mH)	37.20	16.80	10.69	8.27	26.29	11.47	7.15	5.16	4.35	20.26	8.63	5.47	4.35	3.41
Recommended power conn' size	1	1	1	1	1	1	1	1	1	1	1	1	1	HYBRID
Speed 4000 (rpm)	Kt(Nm/A) = 0.7 Ke(V/Krpm) = 42.75													
Rated Torque (Nm)	1.2	2.1	2.8	3.8	2.3	3.8	5.3	6.4	7.4	3.0	5.8	7.5	8.3	8.8
Stall Current (A)	2.06	3.79	5.31	6.67	3.50	6.43	9.00	11.29	13.21	5.57	10.57	15.43	19.50	22.86
Rated Power (kW)	0.50	0.86	1.17	1.59	0.94	1.59	2.20	2.68	3.10	1.26	2.43	3.12	3.46	3.69
R (ph-ph) (Ohms)	12.44	4.01	2.26	1.53	5.26	1.76	1.04	0.74	0.48	3.05	0.93	0.49	0.30	0.27
L (ph-ph) (mH)	23.35	9.62	6.32	4.63	14.94	6.67	4.52	3.53	2.44	12.44	5.13	3.34	2.25	2.18
Recommended power conn' size	1	1	1	1	1	1	1	1	1	1	1	1	HYBRID	HYBRID
Speed 6000 (rpm)	Kt(Nm/A) = 0.47 Ke(V/Krpm) = 28.5													
Rated Torque (Nm)	1.10	1.90	2.80	3.40	1.98	3.20	4.20	♦	♦	2.70	5.00	♦	♦	♦
Stall Current (A)	3.06	5.64	7.91	9.94	5.21	9.57	13.40	♦	♦	8.30	15.74	♦	♦	♦
Rated Power (kW)	0.68	1.21	1.73	2.14	1.24	2.01	2.64	♦	♦	1.70	3.14	♦	♦	♦
R (ph-ph) (Ohms)	5.37	1.81	1.02	0.68	2.33	0.73	0.46	♦	♦	1.50	0.41	♦	♦	♦
L (ph-ph) (mH)	9.80	4.42	2.88	2.06	6.57	2.77	2.07	♦	♦	6.08	2.34	♦	♦	♦
Recommended power conn' size	1	1	1	1	1	1	1	♦	♦	1	1	♦	♦	♦

♦ *not available*

142E3					190E3								Motor Frame Size (mm)
A	B	C	D	E	A	B	C	D	E	F	G	H	Frame length
6.2	11.0	15.7	20.5	25.0	11.3	22.5	33.5	44.5	54.0	63.0	71.0	77.0	Continuous stall torque (Nm)
18.6	33.0	47.1	61.5	75.0	33.8	67.5	100.5	133.5	162.0	189.0	213.0	231.0	Peak torque (Nm)
10.2	16.9	23.5	30.2	36.9	31.3	49.8	68.3	86.8	105.3	123.8	142.3	160.8	Standard inertia (kg cm²)
145	148	188	206	249	194	214	215	216	251	285	425	564	Winding thermal time constant (sec)
8.81	11.66	14.51	17.36	20.21	12.62	18.08	23.54	28.99	34.44	39.90	45.35	50.81	Standard motor weight (kg)
6	6	6	6	6	8	8	8	8	8	8	8	8	Number of poles
Kt(Nm/A) = 1.4 Ke(V/Krpm) = 85.5													Speed 2000 (rpm)
5.9	10.4	14.7	18.5	21.5	10.8	20.6	29.4	37.9	44.3	50.5	54.0	56.0	Rated torque (Nm)
4.4	7.9	11.2	14.6	17.9	8.0	16.1	23.9	31.8	38.6	45.0	50.7	55.0	Stall current (A)
1.23	2.18	3.08	3.87	4.49	2.26	4.31	6.15	7.94	9.28	10.58	11.31	11.73	Rated power (kW)
5.56	1.54	0.80	0.51	0.40	1.81	0.50	0.25	0.19	0.13	0.10	0.08	0.05	R (ph-ph) (Ohms)
35.43	14.25	8.99	6.35	5.25	17.34	7.77	4.66	3.26	3.02	2.65	2.13	1.55	L (ph-ph) (mH)
1	1	1	1	1.5	1.5	1.5	1.5	1.5	1.5	HYBRID ONLY			Recommended power conn' size
Kt(Nm/A) = 0.93 Ke(V/Krpm) = 57													Speed 3000 (rpm)
5.50	9.50	12.80	16.00	18.15	10.30	19.40	26.50	33.20	34.20	35.20	36.20	37.00	Rated Torque (Nm)
6.67	11.83	16.88	22.04	26.88	12.10	24.19	36.02	47.85	58.06	67.74	76.34	82.80	Stall Current (A)
1.73	2.98	4.02	5.03	5.70	3.24	6.09	8.33	10.43	10.74	11.06	11.37	11.62	Rated Power (kW)
2.25	0.68	0.35	0.23	0.16	0.83	0.26	0.13	0.09	0.07	0.05	0.05	0.03	R (ph-ph) (Ohms)
14.68	6.33	3.89	3.66	2.23	7.94	3.87	2.46	1.81	1.55	1.17	1.36	0.88	L (ph-ph) (mH)
1	1	1	1.5	1.5	1.5	1.5	1.5	HYBRID ONLY					Recommended power conn' size
Kt(Nm/A) = 0.7 Ke(V/Krpm) = 42.75													Speed 4000 (rpm)
4.1	8.1	10.2	12.2	♦	8.2	18.2	23.0	29.0	♦	♦	♦	♦	Rated Torque (Nm)
8.86	15.71	22.43	29.29	♦	16.07	32.14	47.86	63.57	♦	♦	♦	♦	Stall Current (A)
1.72	3.37	4.27	5.11	♦	3.43	7.62	9.63	12.15	♦	♦	♦	♦	Rated Power (kW)
1.29	0.38	0.23	0.13	♦	0.46	0.14	0.07	0.06	♦	♦	♦	♦	R (ph-ph) (Ohms)
8.39	3.44	2.49	1.99	♦	4.34	2.18	1.39	1.26	♦	♦	♦	♦	L (ph-ph) (mH)
1	1	1.5	1.5	♦	1.5	1.5	HYBRID ONLY		♦	♦	♦	♦	Recommended power conn' size
Kt(Nm/A) = 0.47 Ke(V/Krpm) = 28.5													Speed 6000 (rpm)
3.2	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	Rated Torque (Nm)
13.19	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	Stall Current (A)
2.01	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	Rated Power (kW)
0.56	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	R (ph-ph) (Ohms)
3.67	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	L (ph-ph) (mH)
1	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	Recommended power conn' size

- The information contained in this specification is for guidance only and does not form part of any contract.
- Control Techniques have an ongoing process of development and reserves the right to change the specification without notice.
- Stall torque, rated torque and power relate to maximum operation tested in a 20 °C ambient at 12 kHz drive switching frequency.
- All other figures relate to a 20 °C motor temperature. Maximum intermittent winding temperature is 140 °C.
- The recommended connector has to be selected using the connector manufacturer's de-rating values applied to a motor at full operational temperature.

Ratings

3 Phase VPWM drives 380 - 480Vrms - Δt= 100°C winding 40°C maximum ambient.
All data subject to +/-10% tolerance

Motor Frame Size (mm)	075U3				095U3					115U3				
Frame length	A	B	C	D	A	B	C	D	E	A	B	C	D	E
Continuous stall torque (Nm)	1.4	2.7	3.7	4.7	2.5	4.5	6.3	7.9	9.3	3.9	7.4	10.8	13.7	16.0
Peak torque (Nm)	4.3	8.0	11.2	14.0	7.4	13.5	18.9	23.7	27.8	11.7	22.2	32.4	41.0	48.0
Standard inertia (kg cm²)	0.78	1.22	1.64	2.07	1.45	2.60	3.72	4.83	6.00	5.40	7.70	10.00	12.50	14.80
Winding thermal time constant (sec)	63	58	73	78	84	82	90	108	112	103	109	116	127	141
Standard motor weight (kg)	2.88	3.68	4.48	5.28	4.49	5.75	7.01	8.27	9.53	6.88	8.68	10.48	12.28	14.08
Number of poles	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Speed 2000 (rpm)	Kt (Nm/A) = 2.4 Ke (V/Krpm) = 147													
Rated torque (Nm)	♦	2.5	3.5	4.5	2.4	4.3	5.9	7.3	8.5	3.7	7.3	10.1	11.9	14.1
Stall current (A)	♦	1.1	1.6	1.9	1.0	1.9	2.6	3.3	3.9	1.6	3.1	4.5	5.7	6.7
Rated power (kW)	♦	0.52	0.73	0.93	0.51	0.90	1.23	1.53	1.77	0.77	1.53	2.12	2.49	2.95
R (ph-ph) (Ohms)	♦	52.20	27.30	19.97	64.08	20.88	10.46	7.46	5.09	32.92	10.68	5.25	3.70	2.75
L (ph-ph) (mH)	♦	117.28	74.20	56.97	173.40	78.16	47.02	35.44	27.18	139.43	59.51	35.90	27.63	21.87
Recommended power conn' size	♦	1	1	1	1	1	1	1	1	1	1	1	1	1
Speed 3000 (rpm)	Kt (Nm/A) = 1.6 Ke (V/Krpm) = 98													
Rated Torque (Nm)	1.3	2.3	3.3	4.2	2.3	4.1	5.6	6.9	8.2	3.5	6.7	9.5	11.2	12.7
Stall Current (A)	0.9	1.7	2.3	2.9	1.5	2.8	3.9	4.9	5.8	2.4	4.6	6.8	8.5	10.0
Rated Power (kW)	0.41	0.72	1.04	1.31	0.73	1.29	1.76	2.17	2.56	1.10	2.10	2.98	3.52	3.99
R (ph-ph) (Ohms)	62.08	21.07	12.54	7.81	26.70	8.63	4.67	3.16	2.27	14.74	4.37	2.30	1.53	1.23
L (ph-ph) (mH)	114.59	52.65	34.18	23.89	76.65	33.71	21.09	15.95	12.06	57.29	25.19	15.57	11.60	9.89
Recommended power conn' size	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Speed 4000 (rpm)	Kt (Nm/A) = 1.2 Ke (V/Krpm) = 73.5													
Rated Torque (Nm)	1.2	2.1	2.8	3.8	2.3	3.8	5.3	6.4	7.4	3.0	5.8	7.5	8.3	8.8
Stall Current (A)	1.2	2.2	3.1	3.9	2.0	3.8	5.3	6.6	7.7	3.3	6.2	9.0	11.4	13.3
Rated Power (kW)	0.50	0.86	1.17	1.59	0.94	1.59	2.20	2.68	3.10	1.26	2.43	3.12	3.46	3.69
R (ph-ph) (Ohms)	38.01	12.71	6.49	4.94	16.14	5.22	2.61	1.81	1.40	8.49	2.61	1.31	0.84	0.66
L (ph-ph) (mH)	68.39	30.46	18.28	13.97	44.25	19.54	11.75	8.86	7.25	33.79	14.87	8.98	6.27	5.35
Recommended power conn' size	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Speed 6000 (rpm)	Kt (Nm/A) = 0.8 Ke (V/Krpm) = 49													
Rated Torque (Nm)	1.1	1.9	2.8	3.4	2.0	3.2	4.2	♦	♦	2.7	5.0	♦	♦	♦
Stall Current (A)	1.8	3.3	4.7	5.8	3.1	5.6	7.9	♦	♦	4.9	9.3	♦	♦	♦
Rated Power (kW)	0.68	1.21	1.73	2.14	1.24	2.01	2.64	♦	♦	1.70	3.14	♦	♦	♦
R (ph-ph) (Ohms)	15.48	5.19	2.86	2.12	6.59	2.13	1.22	♦	♦	3.48	1.09	♦	♦	♦
L (ph-ph) (mH)	28.66	12.77	8.01	6.33	18.62	8.24	5.44	♦	♦	14.31	6.30	♦	♦	♦
Recommended power conn' size	1	1	1	1	1	1	1	♦	♦	1	1	♦	♦	♦

♦ *not available*

142U3					190U3								250U3			Motor Frame Size (mm)
A	B	C	D	E	A	B	C	D	E	F	G	H	D	E	F	Frame length
6.2	11.0	15.7	20.5	25.0	11.3	22.5	33.5	44.5	54.0	63.0	71.0	77.0	92.0	116.0	136.0	Continuous stall torque (Nm)
18.6	33.0	47.1	61.5	75.0	33.8	67.5	100.5	133.5	162.0	189.0	213.0	231.0	276.0	348.0	408.0	Peak torque (Nm)
10.2	16.9	23.5	30.2	36.9	31.3	49.8	68.3	86.8	105.3	123.8	142.3	160.8	275.0	337.0	400.0	Standard inertia (kg cm²)
145	148	188	206	249	194	214	215	216	251	285	425	564	439	486	608	Winding thermal time constant (sec)
8.81	11.66	14.51	17.36	20.21	12.62	18.08	23.54	28.99	34.44	39.90	45.35	50.81	61.50	69.80	78.00	Standard motor weight (kg)
6	6	6	6	6	8	8	8	8	8	8	8	8	10	10	10	Number of poles
Kt (Nm/A) = 2.4 Ke (V/Krpm) = 147													Kt (Nm/A) = 5.4 Ke (V/krpm) = 323			250 frame Speed 1,000 (rpm)
5.9	10.4	14.7	18.5	21.5	10.8	20.6	29.4	37.9	44.3	50.5	54.0	56.0	75.0	92.0	106.0	Rated torque (Nm)
2.6	4.6	6.5	8.5	10.4	4.7	9.4	14.0	18.5	22.5	26.3	29.6	32.1	17.2	21.7	25.4	Stall current (A)
1.23	2.18	3.08	3.87	4.49	2.26	4.31	6.15	7.94	9.28	10.58	11.31	11.73	7.90	9.60	11.10	Rated power (kW)
14.64	4.71	2.38	1.60	1.11	6.15	1.54	0.83	0.50	0.37	0.28	0.26	0.23	0.61	0.48	0.34	R (ph-ph) (Ohms)
98.76	42.15	26.32	19.46	15.08	52.90	23.55	15.00	8.81	8.68	7.36	6.89	6.30	22.90	19.10	14.90	L (ph-ph) (mH)
1	1	1	1	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	Recommended power conn' size
Kt (Nm/A) = 1.6 Ke (V/Krpm) = 98													Kt (Nm/A) = 3.6 Ke (V/krpm) = 216			250 frame Speed 1,500 (rpm)
5.5	9.5	12.8	16.0	18.2	10.3	19.4	26.5	33.2	34.2	35.2	36.2	37.0	67.0	76.0	84.0	Rated torque (Nm)
3.9	6.9	9.8	12.8	15.6	7.0	14.1	20.9	27.8	33.8	39.4	44.4	48.1	25.8	32.5	38.1	Stall current (A)
1.73	2.98	4.02	5.03	5.70	3.24	6.09	8.33	10.43	10.74	11.06	11.37	11.62	10.50	11.90	13.20	Rated power (kW)
6.20	2.12	1.08	0.70	0.50	2.73	0.70	0.41	0.22	0.17	0.14	0.15	0.08	0.27	0.21	0.15	R (ph-ph) (Ohms)
42.97	19.11	12.06	8.91	6.70	23.50	10.47	7.35	4.89	3.86	3.60	3.06	2.42	10.00	8.60	6.60	L (ph-ph) (mH)
1	1	1	1	1	1.5	1.5	1.5	1.5	1.5	1.5	HYBRID ONLY		1.5	1.5	1.5	Recommended power conn' size
Kt (Nm/A) = 1.2 Ke (V/Krpm) = 73.5													Kt (Nm/A) = 2.7 Ke (V/krpm) = 162			250 frame Speed 2,000 (rpm)
4.1	8.1	10.2	12.2	14.0	8.2	18.2	23.0	29.0	♦	♦	♦	♦	65.0	73.0	81.0	Rated torque (Nm)
5.2	9.2	13.1	17.1	20.8	9.4	18.8	27.9	37.1	♦	♦	♦	♦	34.4	43.4	50.9	Stall current (A)
1.72	3.37	4.27	5.11	5.86	3.43	7.62	9.63	12.15	♦	♦	♦	♦	10.20	11.50	12.70	Rated power (kW)
3.64	1.18	0.61	0.41	0.29	1.35	0.38	0.21	0.14	♦	♦	♦	♦	0.15	0.10	0.08	R (ph-ph) (Ohms)
24.44	10.54	6.78	5.06	3.97	13.56	6.05	3.86	2.45	♦	♦	♦	♦	5.70	4.20	3.70	L (ph-ph) (mH)
1	1	1	1.5	1.5	1.5	1.5	1.5	1.5	♦	♦	♦	♦	1.5	HYBRID ONLY		Recommended power conn' size
Kt (Nm/A) = 0.8 Ke (V/Krpm) = 49													Kt (Nm/A) = 2.1 Ke (V/krpm) = 129			250 frame Speed 2,500 (rpm)
3.2	5.2	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	62.0	70.0	77.0	Rated torque (Nm)
7.8	13.8	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	43.0	54.2	63.6	Stall current (A)
2.01	3.27	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	9.70	11.00	12.10	Rated power (kW)
1.63	0.53	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	0.09	0.08	0.06	R (ph-ph) (Ohms)
11.08	4.78	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	3.50	3.10	2.60	L (ph-ph) (mH)
1	1	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	HYBRID ONLY			Recommended power conn' size

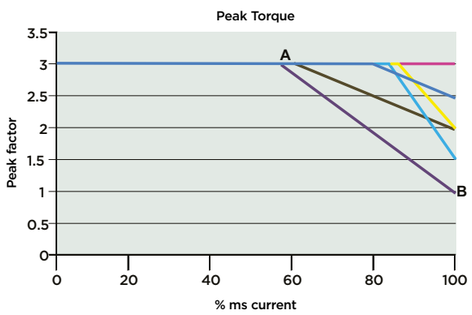
- The Unimotor fm 250 servo motor has been designed to give greatest motor efficiency up to a rated, or rms, speed of 1,500rpm. The range does include the optional speeds of 2,000rpm and 2,500rpm. These windings will allow the end user to enter the intermittent speed zone as well as the intermittent torque zone on the 250 motor.
- These higher speed windings are designed with optimum kt values that allow increased speed without demanding very high currents.
- The Unimotor fm 250 is designed for S2 to S6 duties and as such the rms values play an important part in the motor selection for torque and speed.

Peak torque information

On some of the frame sizes the full peak torque cannot be achieved at the full 100 % rms current level. As shown the 075 motor is not affected by the reduced levels and remains constant up to 100 % rms current, whereas the 250 motors all show a drop at some point along the % rms current line.

U3	Peak factor @ 0 - 100% rms	
075	3	
095	Peak Factor 0% - 88% rms	Peak Factor @ 100% rms
	3	2
115	Peak Factor 0% - 86% rms	Peak Factor @ 100% rms
	3	1.5
142	Peak Factor 0% - 57% rms	Peak Factor @ 100% rms
	3	1
190	Peak Factor 0% - 60% rms	Peak Factor @ 100% rms
	3	2
250	Peak Factor 0% - 80% rms	Peak Factor @ 100% rms
	3	2.5

Unimotor fm peak torque graph

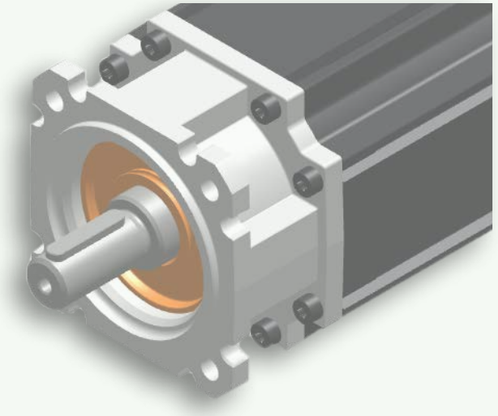


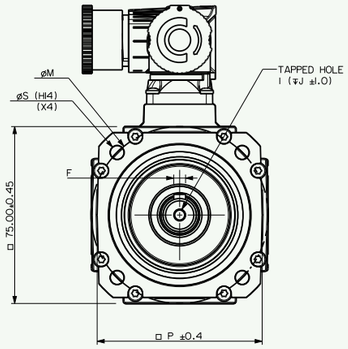
Peak factor x Stall current x kt = Peak torque
An example would be with a 142U3E300 motor, where the % rms current value is calculated to 50%, the peak factor would be 3. (Point A)
Peak factor x Stall current x kt = Peak torque
3.00 x 15.6 x 1.6 = 74.9 Nm
But if the % rms current were to be calculated at a level of 100%, the peak factor would equal 1.00. (Point B)
Peak factor x Stall current x kt = Peak torque
1.00 x 15.6 x 1.6 = 25 Nm

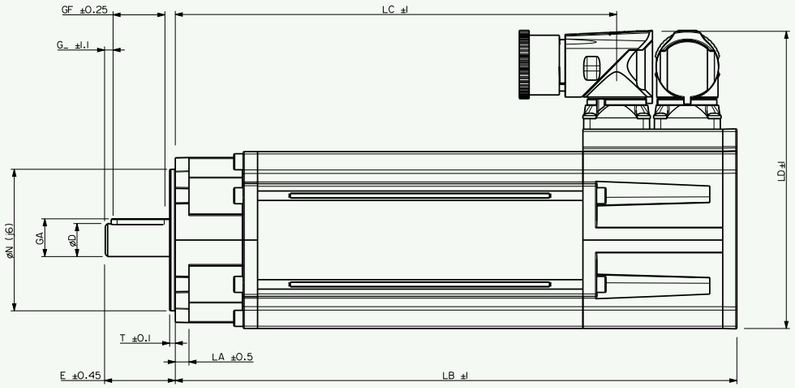
Peak torque is defined for a maximum period of 250ms, rms 3,000 rpm Δmax = 100 °C, 40 °C ambient.

To use the graph correctly, you will need to calculate the rms current and rms speed of the application. The rms current value must be converted into a percentage of the full motor current. For example, if the full current available is 10A and the rms current is 7.5A, then the percentage rms current value is 75%. Plot this value onto the graph to obtain the peak factor. -The peak factor is then used to calculate the peak torque value using the table above.

Frame size 075





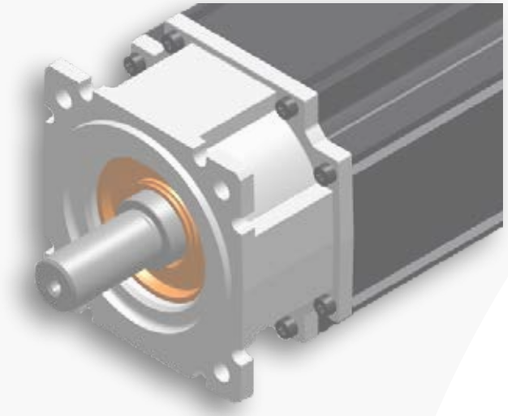


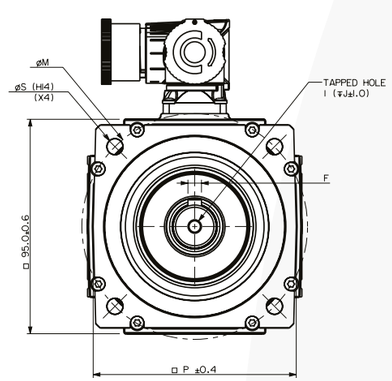
Motor dimensions (mm) Note all dimensions shown at nominal

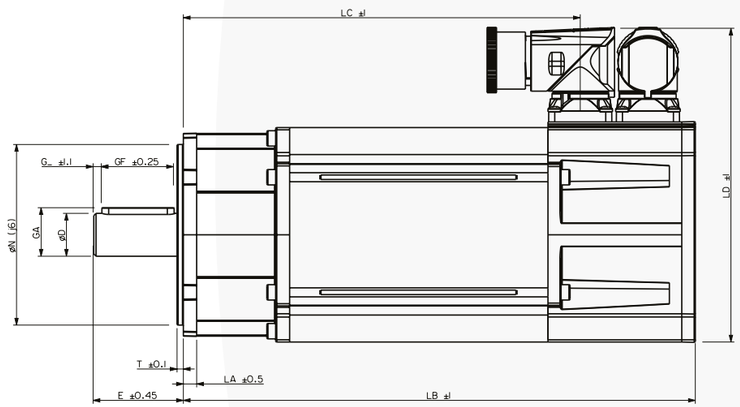
	Unbraked length		Braked length		Overall height	Flange thickness	Register length	Register diameter	Flange square	Fixing hole diameter	Fixing hole PCD	Mounting bolts
	LB (± 1)	LC (± 1)	LB (± 1)	LC (± 1)	LD (± 1.0)	LA (± 0.5)	T (± 0.1)	N (j6)	P (± 0.4)	S (H14)	M	
075A	208.2	157.2	238.2	187.2	126.0	5.8	2.4	60.0	70.0	5.8	75.0	M5
075B	238.2	187.2	268.2	217.2								
075C	268.2	217.2	298.2	247.2								
075D	298.2	247.2	328.2	277.2								

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E (±0.45)	GA	GF (±0.25)	G (±1.1)	F	I	J (±0.4)
075A	11.0	23.0	12.5	14.0	3.6	4.0	M4 x 0.7	11.0
075B-D	14.0	30.0	16.0	25.0	1.5	5.0	M5 x 0.8	13.5

Frame size 095





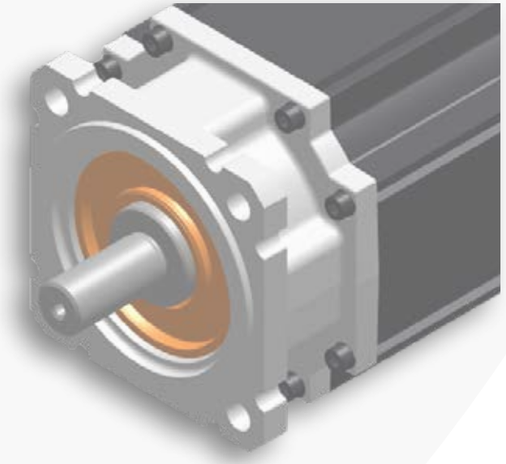


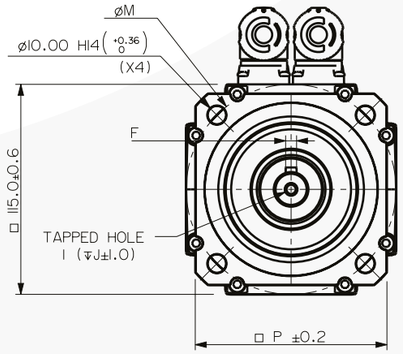
Motor dimensions (mm) Note all dimensions shown at nominal

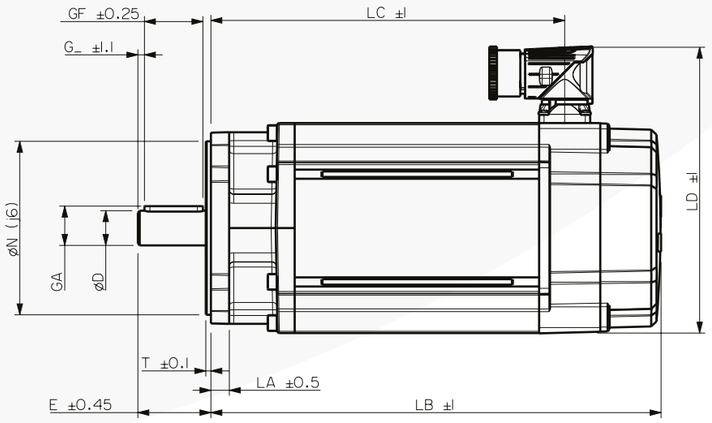
	Unbraked length		Braked length		Overall height	Flange thickness	Register length	Register diameter	Flange square	Fixing hole diameter	Fixing hole PCD	Mounting bolts
	LB (± 1)	LC (± 1)	LB (± 1)	LC (± 1)	LD (± 1.0)	LA (± 0.5)	T (± 0.1)	N (j6)	P (± 0.4)	S (H14)	M	
095A	226.9	175.9	256.9	205.9	139.0	5.9	2.8	80.0	90.0	7.0	100.0	M6
095B	256.9	205.9	286.9	235.9								
095C	286.9	235.9	316.9	265.9								
095D	316.9	265.9	346.9	295.9								
095E	346.9	295.9	376.9	325.9								

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E (±0.45)	GA	GF (±0.25)	G (±1.1)	F	I	J (±0.4)
095A	14.0	30.0	16.0	25.0	1.5	5.0	M5 x 0.8	13.5
095B-E	19.0	40.0	21.5	32.0	3.6	6.0	M6 x 1.0	17.0

Frame size 115







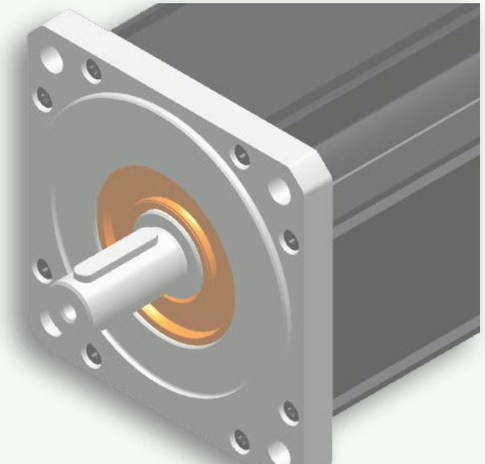
Motor dimensions (mm) Note all dimensions shown at nominal

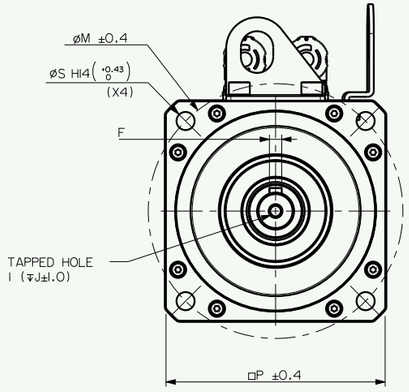
	Unbraked length		Braked length		Overall height	Flange thickness	Register length	Register diameter	Flange square	Fixing hole diameter	Fixing hole PCD	Mounting bolts
	LB (± 1)	LC (± 1)	LB (± 1)	LC (± 1)	LD (± 1.0)	LA (± 0.5)	T (± 0.1)	N (j6)	P (± 0.4)	S (H14)	M	
115A	246.6	193.8	276.6	223.8	156.5	10.1	2.8	95.0	105.0	10.0	115.0	M8
115B	276.6	223.8	306.6	253.8								
115C	306.6	253.8	336.6	283.8								
115D	336.6	283.8	366.6	313.8								
115E	366.6	313.8	396.6	343.8								

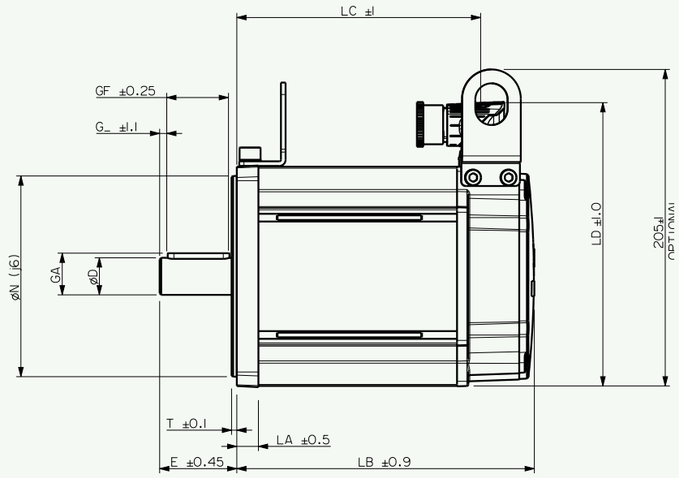
	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E (±0.45)	GA	GF (±0.25)	G (±1.1)	F	I	J (±0.4)
115A-C	19.0	40.0	21.5	32.0	3.6	6.0	M6 x 1.0	17.0
115D-E	24.0	50.0	27.0	40.0	4.6	8.0	M8 x 1.25	20.0

Note: For EC/FC encoders reduce LB length by 13mm. For AE resolvers reduce LB length by 23mm.

Frame size 142





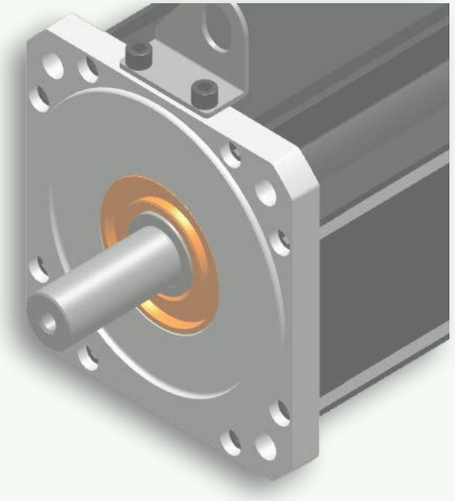


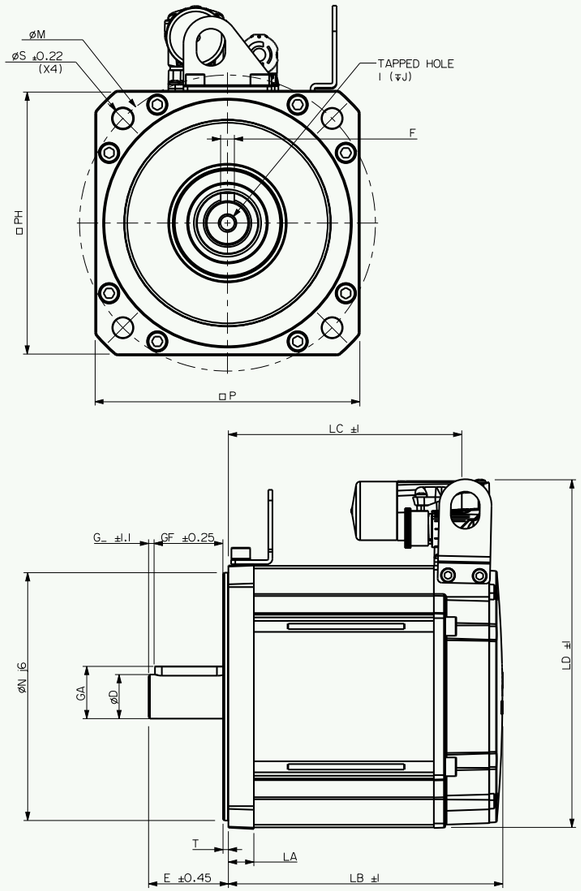
Motor dimensions (mm) Note all dimensions shown at nominal

	Unbraked length		Braked length		Overall height	Flange thickness	Register length	Register diameter	Flange square	Fixing hole diameter	Fixing hole PCD	Mounting bolts
	LB (± 1)	LC (± 1)	LB (± 1)	LC (± 1)	LD (± 1.0)	LA (± 0.5)	T (± 0.1)	N (j6)	P (± 0.4)	S (H14)	M	
142A	192.8	158.0	252.8	218.0	183.5 (Size 1) 204.5 (Size 1.5)	14.0	3.4	130.0	142.0	12.0	165.0	M10
142B	222.8	188.0	282.8	248.0								
142C	252.8	218.0	312.8	278.0								
142D	282.8	248.0	342.8	308.0								
142E	312.8	278.0	372.8	338.0								

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E (±0.45)	GA	GF (±0.25)	G (±1.1)	F	I	J (±0.4)
142	24.0	50.0	27.0	40.0	4.6	8.0	M8 x 1.25	20.0

Frame size 190



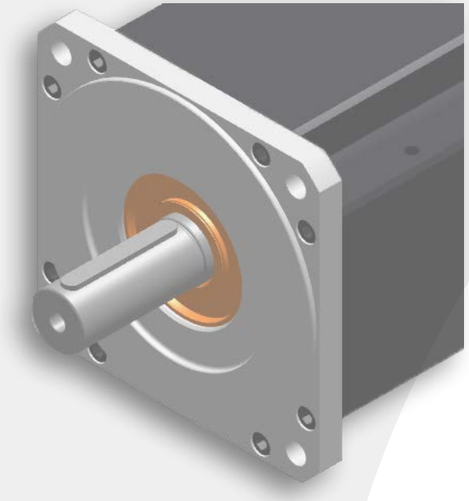


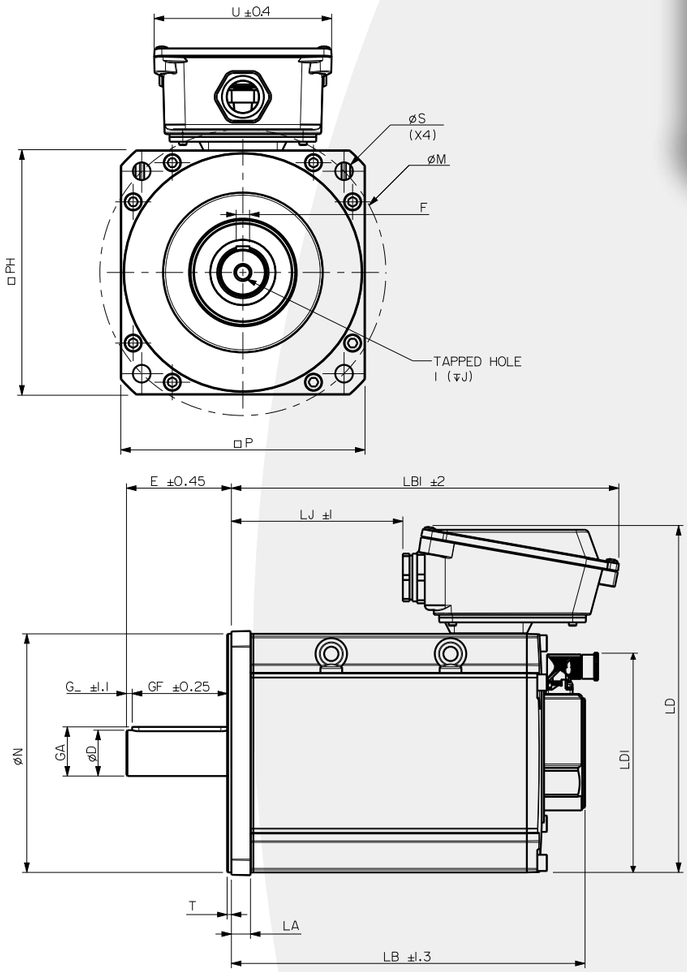
Motor dimensions (mm) Note all dimensions shown are at nominal

	Unbraked length		Braked length		Overall height	Flange thickness	Register length	Register diameter	Flange square	Fixing hole diameter	Fixing hole PCD	Mounting bolts
	LB (± 1)	LC (± 1)	LB (± 1)	LC (± 1)	LD (± 1.0)	LA (± 0.5)	T (± 0.1)	N (j6)	P (± 0.4)	S (H14)	M	
190A	199.4	169.6	289.4	259.6								
190B	229.4	199.6	319.4	289.6	252.6 (Size 1.5)							
190C	259.4	229.6	349.4	319.6								
190D	289.4	259.6	379.4	349.6	287.0 (H <40A)	18.5	3.9	180.0	190.3	14.5	215.0	M12
190E	319.4	289.6	409.4	379.6								
190F	349.4	319.6	439.4	409.6	323.0 (H <60A)							
190G	379.4	349.6	469.4	439.6								
190H	409.4	379.6	499.4	469.6								

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E (±0.45)	GA	GF (±0.25)	G (±1.1)	F	I	J (±0.4)
190	32.0	58.0	35.0	50.0	4.6	10.0	M12 x 1.75	29.0

Frame size 250





Motor dimensions (mm) Note all dimensions shown are at nominal

	Motor Length			Flange thickness	Register length	Register diameter	Overall height	Flange square	Fixing hole diameter	Fixing hole PCD	Motor housing	Hybrid box width	Signal connector height	Mounting bolts
	LB (± 1.3)	LB1 (± 2.0)	LJ (± 1.0)	LA (± 0.1)	T (± 0.1)	N (j6)	LD (± 1.0)	P (± 0.6)	S (H14)	M (± 0.4)	PH (± 1.0)	U (± 0.4)	LD1 (± 1.0)	
	Unbraked motor													
250D	375.7	406.1	179.7											
250E	405.7	436.1	209.7											
250F	435.7	466.1	239.7	20.0	4.5	250.0	363.5	256.0	18.5	300.0	250.0	186.0	228.5	M16
	Braked motor													
250D	447.5	477.9	251.5											
250E	477.5	507.9	281.5											
250F	507.5	537.9	311.5											

	Shaft diameter	Shaft length	Key height	Key length	Key to shaft end	Key width	Tapped hole thread size	Tapped hole depth
	D (j6)	E (±0.45)	GA	GF (±0.25)	G (±1.1)	F	I	J (±0.4)
250	48.0	110.0	51.5	100.0	6.0	14.0	M16 x 2.0	37.0

Motor derating

Any adverse operating conditions require that the motor performance be derated. These conditions include: ambient temperature above 40 °C, motor mounting position, drive switching frequency or the drive being oversized for the motor.

Ambient temperatures

The ambient temperature around the motor must be taken into account. For ambient temperatures above 40 °C the torque must be derated using the following formula as a guideline. (Note: Only applies to 2,000/3,000 rpm motors and assumes copper losses dominate.)

New derated torque
= Specified torque x $\sqrt{[1-((\text{Ambient temperature} - 40°C) / 100)]}$

For example with an ambient temperature of 76 °C the new derated torque will be 0.8 x specified value

Thermal test conditions

The performance data shown has been recorded under the following conditions. Ambient temperature 20 °C, with the motor mounted on a thermally isolated aluminium plate as shown below.

Mounting arrangements

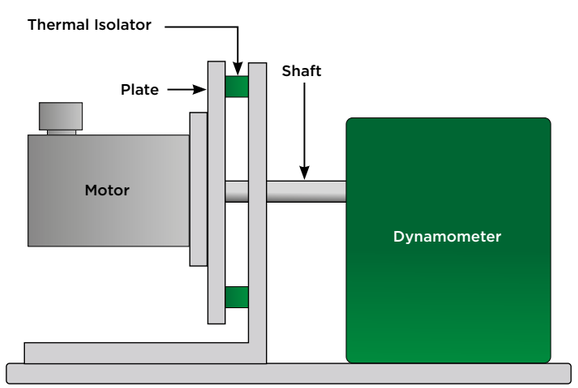
The motor torque must be derated if:

- The motor mounting surface is heated from an external source, such as a gearbox.
- The motor is connected to a poor thermal conductor.
- The motor is in a confined space with restricted air flow.

Drive switching frequency

Most Unidrive M and Digitax HD nominal current ratings are reduced for the higher switching frequencies.
See the appropriate drive manual for details.

See the table below for the motor derate factors.
These figures are for guidance only.



Motor type/frame	Aluminium heatsink plate
075-095 mm	250 x 250 x 15mm
115-142 mm	350 x 350 x 20mm
190-250 mm	500 x 500 x 20mm

UNIMOTOR FM DERATE FACTORS

Switching frequency	075	095	115		142		190		250
	A-D	A-E	A-C	D-E	A-C	D-E	A-B	C-H	D-F
3kHz	0.93	0.88	0.89	0.84	0.87	0.81	0.98	N/A	0.88
4kHz	0.94	0.91	0.91	0.84	0.91	0.86	0.99	0.55	0.90
6kHz	0.95	0.93	0.93	0.90	0.94	0.89	0.99	0.77	0.94
8kHz	0.98	0.91	0.97	0.95	0.97	0.96	1	0.90	0.98
12/16kHz	1	1	1	1	1	1	1	1	1

NOTE: Only applies to motors up to 3,000 rpm (rms) or lower. Assumes copper losses dominate on all frame sizes.
Derate factor is applied to stall torque, rated torque, stall current and rated power.

Additional motor weights

Additional motor weight information																													
Motor Frame Size	**075**				**095**					**115**					**142**					**190**								**250**		
Frame Length	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**D**	**E**	**F**
Braked '5' Brake																		+1.7kg					+3.5kg					+11.0kg	
Braked '6' Brake		+0.7kg				+1.4kg					+1.8kg				+2.3kg														
Hybrid Box Small		+0.5kg				+0.5kg					+0.5kg					+0.5kg													
Hybrid Box Medium																+0.5kg							+0.5kg						
Hybrid Box Large																							+1.5kg					+1.5kg	

Note: All motor weights approximate to ±10% Can differ depending on winding and feedback type.

Feedback selection

Feedback device order code	Feedback type	Manufacturer	Encoder supply voltage	SinCos cycle or incremental pulses per revolution	Resolution available to position loop[2&3]	Absolute multi-turn revolutions	Feedback accuracy[1]	Single cable connector available[4]	Serial communication protocol	Frame size
075-250 Motors										
AE	Resolver	Size 52	6 Vdc Excitation 6kHz	1 Transformation ratio 0.31	Medium 16384 (14 bits)	-	Low +/- 720"	-	-	-
CA	Incremental Encoder	CFS50	5 Vdc ± 10%	4096	Medium 16384 (14 bits)	-	High +/- 60"	-	-	-
EC (Multi-turn)	Inductive EnDat SinCos	EQI 1331	4.75 - 10 Vdc	32	High 5.24 x 10^5 (19 bits)	4096 (12 bits)	Medium +/- 380"	-	EnDat 2.1 / EnDat 01	Not available on 250 frames
FC (Single-turn)		ECI 1319				-				
EF (Multi-turn)	Inductive EnDat Functional Safety	EQI 1331 FS	3.60 - 14 Vdc	Serial Only	High 5.24 x 10^5 (19 bits)	4096 (12 bits)	High +/- 65"	6 wire HMC6	EnDat 2.2 / EnDat 22	-
FF (Single-turn)		ECI 1319 FS				-				-
RA (Multi-turn)	Optical Hiperface SinCos	SRM 50	7 - 12 Vdc	1024	High 1.04 x 10^6 (20 bits)	4096 (12 bits)	High +/- 52"	-	Hiperface	-
SA (Single-turn)		SRS 50				-				
GB (Multi-turn)	Optical EnDat Only	EQN 1337	3.6 - 14 Vdc	N/A	Very High 3.35 x 10^7 (25 bits)	4096 (12 bits)	Very High +/- 20"	6 wire HMC6	EnDat 2.2 / EnDat 22	-
HB (Single-turn)		ECN 1325				-				

[1] The information is supplied by the feedback device manufacturer and relates to it as a standalone device. The value may change when mounted into the motor and connected to a drive. These values have not been verified by Control Techniques.

[2] The output from the resolver is an analogue output; the resolution is determined by the analogue to digital converter used; the value shown is when the resolver is used in conjunction with the SM-Resolver

[3] The sin and cosine outputs from the SinCos optical encoders are analogue outputs; with Unidrive M and Digitax ST the resolutions quoted above are when the encoder type is set to either SC Endat or SC Hiperface depending on the encoder.

[4] To be ordered with single cable connector, see connector options. 6 wire HMC6 must be ordered with KTY 84-130 thermistor, see inertia options.

Feedback terminology

Resolver

A passive wound device consisting of a stator and rotor elements excited from an external source, such as an SM-Resolver, the resolver produces two output signals that correspond to the Sine and CoSine angle of the motor shaft. This is a robust absolute device of low accuracy, capable of withstanding high temperature and high levels of vibration. Positional information is absolute within one turn - i.e. position is not lost when the drive is powered down.

Incremental encoder

An electronic device using an optical disc. The position is determined by counting steps or pulses. Two sequences of pulses in quadrature are used so the direction sensing may be determined and 4x (pulses per rev) may be used for resolution in the drive. A marker pulse occurs once per revolution and is used to zero the position count. The encoder also provides commutation signals, which are required to determine the absolute position during the motor phasing test. This device is available in 4096, 2048 and 1024 ppr versions. Positional information is non absolute - i.e. position is lost when the drive is powered down.

SinCos / absolute encoders

Types available are: Optical or Inductive - which can be single or multi-turn.

1) Optical

An electronic device using an optical disc. An absolute encoder with high resolution that employs a combination of absolute information, transmitted via a serial link, and Sine/CoSine signals with incremental techniques.

2) Inductive

An electronic device using inductively coupled PCBs. An absolute encoder with medium resolution that employs a combination of absolute information, transmitted via a serial link, and Sine/CoSine signals with incremental techniques. This encoder can be operated with the drive using either Sine/CoSine or absolute (serial) values only. Positional information is absolute within 4096 turns - i.e. position is not lost when the drive is powered down.

Multi-turn

As previous but with extra gear wheels included so that the output is unique for each shaft position and the encoder has the additional ability to count complete turns of the motor shaft up to 4096 revolutions

Sensorless

Synchronous Rotor Flux Control. Recommended for use on the fm motor range. The motor performance will be limited when operating at low speed when using high frequency injection mode. When using closed loop vector mode the motor performance will be as stated in the ratings tables.

Environment

The environment is the external conditions that physically surround the Feedback device. The main factors that affect the feedback device are temperature and mechanical shock and vibration.

Motors are designed to allow the feedback devices to be within their operational temperature limits. Generally it is assumed that there is free air movement around the motor. If the motor is positioned where there is little or no airflow or it is connected to a heat source such as a gearbox, it can cause the air temperature around the feedback device to be operating outside its recommended operating temperature and can lead to problems.

Mechanical shock and vibration tends to be transmitted from the load through the motor shaft and into the feedback device. This should be considered when the motor and feedback device are being specified for the application.

Position

The defined position is the location in a coordinate system which is usually in two or more dimensions.

For a rotary feedback device this is defined as the location within one revolution. If it is a multi-turn device it is the location within one revolution plus the location within a number of rotations.

For a linear feedback device this is defined as the distance from a known point.

Resolution

The resolution of a feedback device is the smallest change in position or angle that it can detect in the quantity that it is measuring.

Feedback resolution of the system is a function of the type of feedback device used and drive receiving the information.

Generally, as the resolution of the feedback device increases the level of control that can be used in the servo system increases.

As with accuracy, as the resolution of the device increases the cost increases.

Accuracy

Accuracy is the measure of the difference between the expected position and actual measured value. Rotary feedback accuracy is usually given as an angle representing the maximum deviation from the expected position. Linear feedback accuracy is usually given as a distance representing the maximum deviation from the expected.

Generally, as the accuracy increases the cost of the feedback device increases.

Brake specification

Unimotor fm may be ordered with an internal rear mounted spring applied parking brake. The brake works on a failsafe principle. The brake is active when the supply voltage is switched off, and the brake is released when the supply voltage is switched on.

If a motor is fitted with a failsafe brake, take care not to subject the motor shaft to excessive torsional shocks or resonance when the brake is engaged or disengaged. Doing so can damage the brake.

Safety note

The failsafe brake is for use as a holding brake with the motor shaft stationary.

Do NOT use it as a dynamic brake. Using it in this manner will cause brake wear and eventual failure. Emergency Stop situations can contribute to brake wear and failure.

Unimotor fm

Motor frame	Supply volts	Input power	Static torque @ 120 °C	Release time	Moment of inertia	Backlash **
			Parking Brake (5)			
Size	Vdc	W	Nm	ms nom	kg.cm²*	Degrees **
142 D-E	24	23	18	126	0.21	0.75
190 A-D	24	25	38	95	1.85	0.77
190 E-H	24	25	60	120	4.95	0.77
250	24	62	122	252	14.3	0.5

Motor frame	Supply volts	Input power @ 20 °C	Static torque @ 120 °C	Release time	Moment of inertia	Backlash **
			Parking Brake (6)			
Size	Vdc	W	Nm	ms nom	kg.cm²*	Degrees **
075	24	tba	2	64	tba	tba
095	24	18	10	64	0.153	1.25°
115	24	23	16	tba	0.413	0.38°
142 A-C	24	17.5	16	tba	tba	0.38°

*Note 1 kg.cm2 = 1 x 10 - 4 kg.m2 **Backlash figure will increase with time

- The brake is intended for parking duty and is not for dynamic or safety use.
- Refer to your Automation Center or Distributor if your application requires dynamic braking in emergency conditions.
- To provide protection to the brake control circuit it is recommended that a diode is connected across the output terminals of the solid state or relay contacts devices.
- Larger torque brakes are available as on option. Contact your Automation Center or Distributor for details.
- Unless otherwise stated, all figures are representative at 20 °C brake temperature.
- The brake will engage when power is removed.
- Multiply static torque value by 1.1x for minimum holding torque at 20-100°C

It is recommended to run extensive application validation testing and confirm the motor brake life span when the motor is mounted vertically and the motor runs through high acceleration and deceleration.

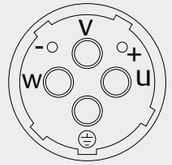
Note: Shunting the brake primary coil with an external diode to avoid switching peaks increases the release time considerably. This is usually required to protect solid state switches, or to reduce arcing at the brake relay contacts (Diode 1N4001 recommended)

"Resin" friction material application & benefits:

- The main feature change to the type 6 brake is the use of an improved Resin friction material compared to its predecessors.
- The type 6 brake has improved overall performance in operation compared to the aluminium cored friction materials containing natural rubber.
- Type 6 brakes can endure higher interface temperatures and pressures.
- Type 6 brake disk are moulded as a one-piece part providing better tensile, compressive & impact qualities compared to other friction materials.

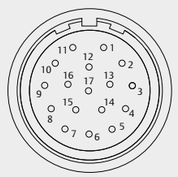
Control Techniques have continuing product improvement projects, the integration of the 'Resin' brake to all frame sizes is included in this. Please check with your drive centre for regular updates.

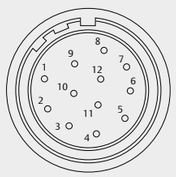
POWER PLUG - Motor end



Size 1 - Type B			Size 1.5 - Type J Connector		
	With brake	Without brake		With brake	Without brake
Pin	Function	Function	Pin	Function	Function
1	Phase U (R)	Phase U (R)	U	Phase U (R)	Phase U (R)
2	Phase V (S)	Phase V (S)	V	Phase V (S)	Phase V (S)
3	Ground	Ground	⏚	Ground	Ground
4	Phase W (T)	Phase W (T)	W	Phase W (T)	Phase W (T)
5	Brake		+	Brake	
6	Brake		-	Brake	
Shell	Screen	Screen	Shell	Screen	Screen

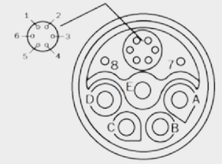
SIGNAL PLUG - Motor end

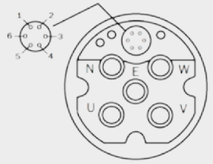




	SI		SE	SR	SS
	Incremental encoder (CA)	Heidenhain Sincos EnDat 2.1 absolute encoders (EC, FC)	Heidenhain EnDat 2.2 only absolute encoders (EF, FF, GB, HB)	Resolver (AE)	SICK SinCos Hiperface encoders (RA, SA)
Pin	Function	Function	Function	Function	Function
1	Thermistor	Thermistor	Thermistor	Excitation High	REF Cos
2	Thermistor	Thermistor	Thermistor	Excitation Low	+ Data
3		Screen (Optical only)	Screen (Optical only)	Cos High	- Data
4	S1			Cos Low	+ Cos
5	S1 Inverse			Sin High	+ Sin
6	S2			Sin Low	REF Sin
7	S2 Inverse			Thermistor	Thermistor
8	S3	+ Clock	+ Clock	Thermistor	Thermistor
9	S3 Inverse	- Clock	- Clock		Screen
10	Channel A	+ Cos			0 Volts
11	Index	+ Data	+ Data		-
12	Index Inverse	- Data	- Data		+ V
13	Channel A Inverse	- Cos			
14	Channel B	+ Sin			
15	Channel B Inverse	- Sin			
16	+ V	+ V	+ V		
17	0 Volts	0 Volts	0 Volts		
Body	Screen	Screen	Screen		Screen

POWER & SIGNAL COMBINED PLUG - Motor end





Size 1 - Type D Connector			Size 1.5 - Type E Connector		
Heidenhain EnDat 2.2 only absolute encoders (EF, FF, GB, HB)			Heidenhain EnDat 2.2 only absolute encoders (EF, FF, GB, HB)		
	With brake	Without brake		With brake	Without brake
Pin	Function	Function	Pin	Function	Function
1	+ Volts	+ Volts	1	+ Volts	+ Volts
2	0 Volts	0 Volts	2	0 Volts	0 Volts
3	+ Data	+ Data	3	+ Data	+ Data
4	- Data	- Data	4	- Data	- Data
5	+ Clock	+ Clock	5	+ Clock	+ Clock
6	- Clock	- Clock	6	- Clock	- Clock
7	- Brake		N	-	-
8	+ Brake		U	Phase U (R)	Phase U (R)
A	Phase U (R)	Phase U (R)	V	Phase V (S)	Phase V (S)
B	Phase V (S)	Phase V (S)	PE	Ground	Ground
C	Phase W (T)	Phase W (T)	W	Phase W (T)	Phase W (T)
D	-	-	+	Brake	
E	Ground	Ground	-	Brake	

15 WAY PLUG - Drive end

	SI		SE	SR	SS
	Incremental encoders (CA)	SinCos absolute encoders (EC, FC)	EnDat 2.2 only absolute encoders (EF, FF, GB, HB)	Resolvers (AE)	SinCos Hiperface encoders (RA, SA)
Pin	Function	Function	Function	Function	Function
1	Channel A	+ Cos	+ Data	+ Cos	+ Cos
2	Channel A Inverse	- Cos	- Data	- Cos	REF Cos
3	Channel B	+ SIn	+ Clock	+ Sin	+ Sin
4	Channel B Inverse	-Sin	- Clock	- Sin	REF Sin
5	Index	+ Data		+ Excitation	+ Data
6	Index Inverse	- Data		- Excitation	- Data
7	S1				
8	S1 Inverse				
9	S2				
10	S2 Inverse				
11	S3	+ Clock			
12	S3 Inverse	- Clock			
13	+ V	+ V	+ V		+ V
14	0 Volts	0 Volts	0 Volts	Thermistor	0 Volts
15	Thermistor	Thermistor	Thermistor	Thermistor	Thermistor
Body	Screen	Screen	Screen	Screen	Screen

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