

Eckelmann

MOTION AND PROPULSION



E°SU3 synchronous compact motors

Technical catalogue

IMPORTANT!

READ CAREFULLY BEFORE USE!

KEEP FOR FUTURE REFERENCE!

Document ID: E°SU3 motors: Technical catalogue

Please indicate when placing reorder

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Version 1.5

English

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CHANGE LOG

Version	Chapter	Date	Editor	Change
1.0	all	June 2020	A. Litschel	Document created
1.1	all	July 2021	A. Litschel	Conversion to Eckelmann FCS
1.2	1.1, 1.8	October 2021	A. Litschel	New: type plate, designation key, declaration of conformity
1.3	1, 2.1	November 2021	A. Litschel	Minor corrections (ch. 1, 2.1)
1.4	1.1, 3.2	December 2021	A. Litschel	New designation code, feedback connection added
1.5	2	January 2023	A. Litschel	Length measurements added for all motors

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1 About this document

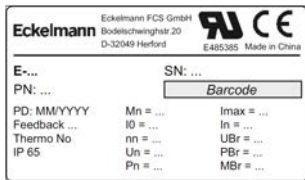
1.1 About the product

1.1.1 Manufacturer and designations

- Manufacturer: Eckelmann FCS GmbH
- Designation: E°SU3 synchronous compact motors

This catalogue applies to all E°SU3 synchronous compact motors built from 2023 onwards.

- Type plate: The type plate is always attached to the left side of the motor and contains the following data:



Position (marking)	Item/meaning
E-...	Type designation
PN: ...	Item number
SN: ...	Serial number
PD: MM/YYYY	Year/month of production
Feedback	(as entered)
Thermo	„no“/sensor as entered
(Protection class)	(as entered)
Mn = ...	Rated torque
IO = ...	Stall current
nn = ...	Rated speed
Un = ...	Rated voltage
Pn = ...	Rated power
Imax = ...	Max. current
In = ...	Rated current
UBr =	Voltage (brake)
PBr = ...	Power (brake)
MBr = ...	Holding torque (brake)

Tab. 1: Type plate

1.1.2 Performance specification

Together with the servo drives of the E°Darc product family, Eckelmann FCS's E°SU3 synchronous compact motors form very precise and highly dynamic servo drive units.

Electronic commutation

These motors are permanently excited motors with sinusoidal electronic commutation. Feedback systems used include incremental encoders or single- or multiturn encoders.

Holding brake

All motors are also available with holding brake. This enables backlash-free clamping of the drive shaft at standstill. The holding force of the brake is designed according to the standstill torque of the motors.

Very high operational reliability

The brushless design and the use of grease-lubricated bearings (for the entire service life) ensure very high operational reliability.

1.1.3 Designation code for E°Motors

Motor (example):

E°SM - 063 - 06 - 60 - 37 - B N 0 1

Type:

E°SL	Synchronous compact motor (low-pole)	400 V
E°SX	Synchronous compact motor (multi-pole)	400 V
E°SM	Synchronous motor (low-pole)	400 V
E°SY	Synchronous motor (multi-pole)	400 V
E°SU3	Synchronous compact motor (UL listed)	230 V
E°SC3	Synchronous compact motor	230 V
E°SL3	Synchronous compact motor	230 V
E°SM3	Synchronous motor	230 V
E°SCL	Low-voltage synchronous motor (low-pole)	48 V
E°SCX	Low-voltage synchronous motor (multi-pole)	48 V

Flange size:

020 = flange 40 mm	056 = flange 92 mm
028 = flange 58 mm	063 = flange 115 mm
030 = flange 60 mm	065 = flange 130 mm
036 = flange 70 mm	071 = flange 142 mm
040 = flange 80 mm	100 = flange 190 mm
055 = flange 110 mm	

Stall torque:

(if < 3 Nm, classified as follows:

- D < 1 Nm
- E < 2 Nm
- F < 3 Nm)

Examples: "06" = 6.0 Nm; "E4" = 1.4 Nm.

Rated speed:

- 30 = 3000 rpm
- 40 = 4000 rpm
- 45 = 4500 rpm
- 50 = 5000 rpm
- 60 = 6000 rpm

Feedback:

01 = Resolver	37 = EQN1337-S
04 = SKS36	38 = EQI1331-S
05 = SKM36	39 = EQI1131-S
06 = SRS50	40 = MAR ST
07 = SRM50	41 = SROA35/46
19 = SEK37	
20 = SEL37	
21 = OIH35/AR38	
23 = S35	
24 = MAR MT	
29 = ECN1123-S ⁽¹⁾	

* safety encoder (SIL 2)

(1) non-standard

Holding brake:

- N = no holding brake
- B = with holding brake
- M = added moment of inertia

Shaft:

- N = smooth shaft
- K = keyway
- S = special shaft
- G = gear system

Connection/terminal box:

- 0 = no terminal box
- 1 = with terminal box
- 3 = - E°SC3/E°SU3/E°SCL/E°SCX motors: flange-mounted power supply
- all other motors with EnDat 2.2 encoders: Shield of encoder cable on pin 9
- 4 = separate cable outlet - circular connector
- 5 = HFO connector
- 6 = encoder connection: M23, 17-pole (option for motors with feedback codes 24, 40 or 41)

Cooling fan:

- 1 = with 24 V fan
- 2 = with 230 V fan

1.1.4 Overview of the motor series

	Motor series	Designated servo drive: E°Darc	Properties	Encoders/feedback
400 V motors	E°SL	Cxxi	8- to 10-pole synchronous compact motor (low mass inertia)	Resolvers, incremental and absolute encoders (Hiperface®), safety encoders (EnDat 2.2)
		K313		Incremental and absolute encoders
	E°SM	Cxxi	4- to 6-pole synchronous motor (high mass inertia)	Resolvers, incremental and absolute encoders (Hiperface®), safety encoders (EnDat 2.2)
	E°SX	Cxxi	10-pole synchronous compact motor (low mass inertia)	Resolvers, incremental and absolute encoders (Hiperface®), safety encoders (EnDat 2.2)
		K313		Incremental and absolute encoders
	E°SY	Cxxi	10-pole synchronous compact motor (high mass inertia)	Resolvers, incremental and absolute encoders (Hiperface®), safety encoders (EnDat 2.2)
230 V motors	E°SL3	Kxx	Synchronous compact motor for wide speed range (low mass inertia)	Incremental and absolute encoders
	E°SM3	Kxx	Synchronous motor (high mass inertia)	Incremental and absolute encoders
	E°SU3	Kxx	Synchronous compact motor for the low price segment	Incremental and absolute encoders
48 V motors	E°SCL	Sxx	Low-voltage synchronous motor (6-pole)	Absolute encoders
	E°SCX	Sxx	Low-voltage synchronous motor (10-pole)	Absolute encoders

1.2 Contents of this document

This technical catalogue contains information about Eckelmann FCS E°SU3 synchronous compact motors, including dimensional drawings, technical data and connection specifications. The catalogue is intended for all persons who carry out assembly, installation, commissioning, parameterization, maintenance and service work related to E°SU3 synchronous compact motors.

In order to avoid handling mistakes, this document must be kept available for operating and maintenance personnel at all times.

Keep it for future reference when operating the machine or machining line in which E°SU3 synchronous compact motors are integrated!

1.3 Target audience

The target audience for this technical catalogue consists of technicians and skilled workers who are familiar with the functional principles of automation systems in an industrial environment.

The information given in this catalogue requires the level of knowledge of trained personnel. Make sure that your relevant personnel have read and understood this document.

1.4 Disclaimer of liability

In order to handle and operate E°SU3 synchronous compact motors safely and without failure, it is necessary to adhere strictly to the information given in this catalogue and adequately train all personnel. The manufacturer accepts no liability for any damage resulting from disregard of this information or employment of untrained personnel.

1.5 Additional documents of reference

See [Eckelmann E°EDP: Zuordnung E°Darc K <-> Motoren ...](#) for available combinations of motors and drives.

1.6 Standards compliance and conformity

1.6.1 EU declaration of conformity

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EU-Konformitätserklärung EU Declaration of Conformity

Hersteller: Manufacturer:	Eckelmann FCS GmbH
Anschrift: Address:	Bodelschwinghstr. 20, 32049 Herford
Produktbezeichnung: Product designation:	E°SC3-/E°SU3-/E°SCL-/E°SCX-Motoren E°SC3/E°SU3/E°SCL/E°SCX motors

Oben genannte Produkte entsprechen den wesentlichen Schutzanforderungen, die in der Richtlinie des Rates zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit 2014/30/EU, in der Niederspannungsrichtlinie 2014/35/EU und in der RoHS-Richtlinie 2011/65/EU festgelegt sind.
This is to confirm that the specified equipment conforms to the safety regulations determined by the Council for the Approximation of the Legislation amongst the Member Countries in the directives 2014/30/EU – EMC Directive, 2014/35/EU – LVD Directive and 2011/65/EU – RoHS Directive.

Die Übereinstimmung der bezeichneten Produkte mit den Vorschriften der Richtlinien wird begründet durch die Einhaltung folgender Normen:
The conformity of the specified equipment with the applicable regulations is established by compliance with the following standards:

Norm/Standard	Titel/Title
DIN EN 60034-1: 2010 IEC 60034-1: 2010	Drehende elektrische Maschinen – Teil 1: Bemessung und Betriebsverhalten Rotating electrical machines – Part 1: Rating and performance
DIN EN 61800-3: 2004/A1:2012 IEC 61800-3: 2004	Drehzahlveränderbare elektrische Antriebe – Teil 3: EMV-Anforderungen einschließlich spezieller Prüfverfahren Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods
DIN EN 60204-1: 2018 IEC 60204-1: 2016	Sicherheit von Maschinen – Elektrische Ausrüstungen von Maschinen – Teil 1: Allgemeine Anforderungen Safety of machinery – Electrical equipment of machines – Part 1: General requirements

Ort, Datum: Place, date:	Herford, 29.07.2022	
Rechtsverbindliche Unterschriften: Legally binding signatures:		
	Frank van Beek (Geschäftsführer/Managing Director)	Dr. Andreas Pottharst (Entwicklungsleiter/Director R&D)

1.6.2 UL listing and compliance

For E°SU3 motors, UL listing and compliance are documented under the UL file number **E485385**.

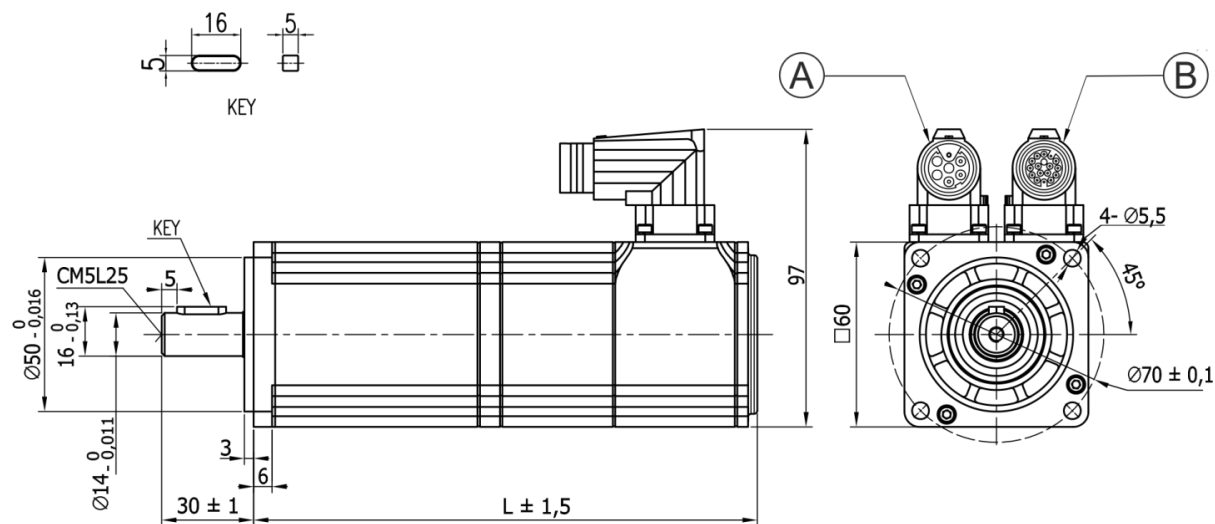
2 Technical data: E°SU3 motors

2.1 General technical data (E°SU3 motors)

E°SU3 motors	
IP code	IP65, shaft seal IP54
Holding brake	optional
Temperature sensor	PTC 140
Position feedback	see E°Motoren: Geberinformationen
Ambient conditions	
Temperature (operation)	-20 °C ... +40 °C
Temperature (storage)	-25 °C ... +55 °C
Permissible humidity	max. 90 % (non-condensing)
Site of installation/operation	protection from gases and oils required
Permissible altitude of installation/operation	at rated power: up to 1000 m a. s. l.

2.2 E°SU3-030...

2.2.1 Dimensions



A: Power connection B: Feedback connection

All dimensions indicated in mm

Motor type	Length (L)
E°SU3-030-D7-30-21-BK0	165.5
E°SU3-030-D7-30-21-NK0	121
E°SU3-030-D7-30-24-NK0	121
E°SU3-030-E4-30-21-BK0	194.5
E°SU3-030-E4-30-21-NK0	151.5
E°SU3-030-E4-30-24-BK0	194.5
E°SU3-030-E4-30-24-NK0	151.5

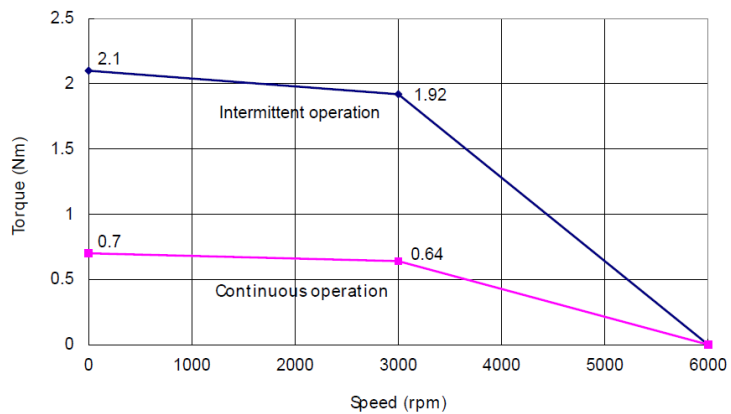
Tab. 2: Measure of length

2.2.2 Technical data

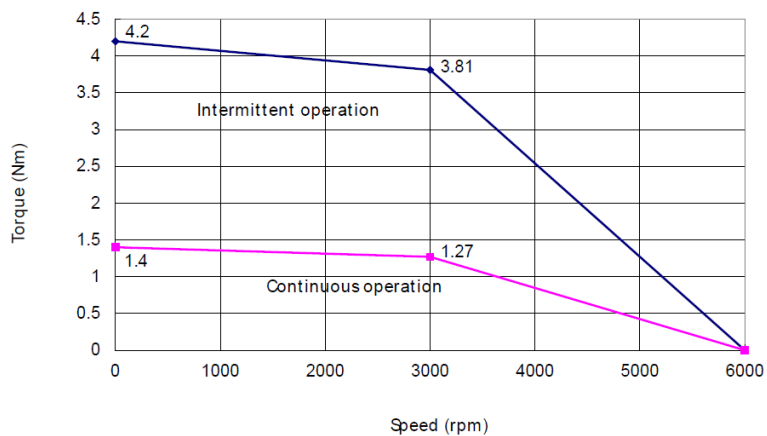
Motor type			E°SU3-030-D7-30...	E°SU3-030-E4-30
Recommended servo drive: E°Darc			K04	K04
M_0	Stall torque	Nm	0.7	1.4
M_{max}	Peak torque at rated speed	Nm	1.92	3.81
M_N	Rated torque	Nm	0.64	1.27
n_N	Rated speed	rpm	3000	3000
n_k	Cutoff speed (at operating temperature)	rpm	3000	3000
J	Rotor moment of inertia	kgcm ²	0.375	0.51
F_r	Max. radial force	N	180	180
F_a	Max. axial force	N	90	90
m	Weight (w/o brake)	kg	1.3	1.8
p	Number of pole pairs	/	3	3
k_T	Torque constant	Nm/A _{RMS}	0.48	0.48
k_E	Voltage constant	V/krpm	29	29
I_0	Stall current	A _{RMS}	1.8	3.41
I_N	Rated current	A _{RMS}	1.6	3.1
P_N	Rated power	W	200	400
RW	Phase resistance	Ohm	4.01	1.76
LW	Phase inductance	mH	8.15	3.9
U	Supply voltage	V AC	230	230
Brake				
M	Holding torque at 100 °C	Nm	1.3	1.3
J	Moment of inertia	kgcm ²	0.004	0.004
m	Weight	kg	0.5	0.5
U	Voltage DC +/- 10 %	V DC	24	24
I_B	Power consumption	A DC	0.3	0.3
R	Resistance	Ohm	80	80
Cable				
Q	Cross section (at cable length < 20 m)	mm ²	1	1

2.2.3 Torque characteristics

E°SU3-030-D7-30...



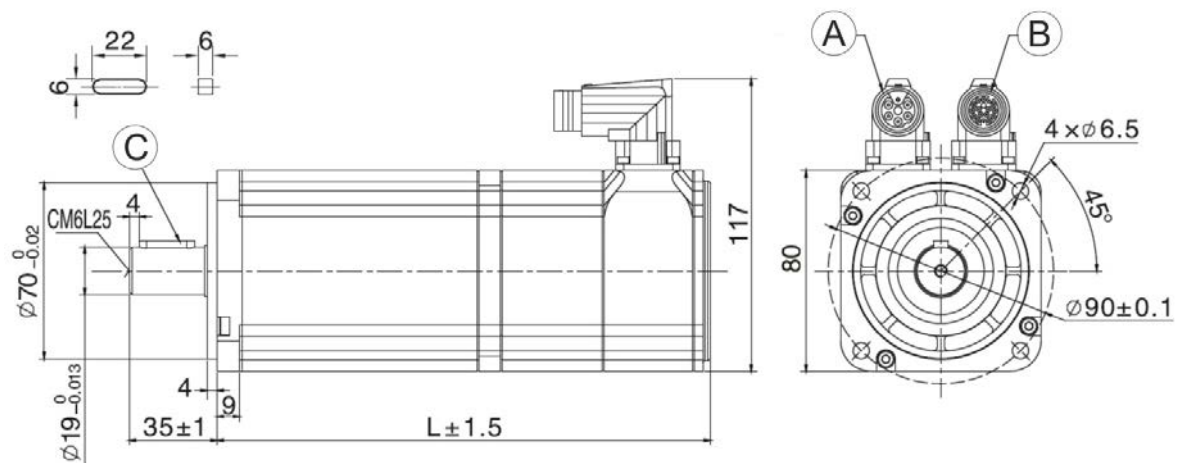
E°SU3-030-E4-30...



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2.3 E°SU3-040...

2.3.1 Dimensions



A: Power connection B: Feedback connection C: Key

All dimensions indicated in mm

Motor type	Length (L)
E°SU3-040-03-30-21-BK0	217,5
E°SU3-040-03-30-21-NK0	167
E°SU3-040-03-30-24-NK0	167
E°SU3-040-F6-30-21-BK0	197
E°SU3-040-F6-30-21-NK0	147
E°SU3-040-F6-30-24-BK0	198
E°SU3-040-F6-30-24-NK0	147

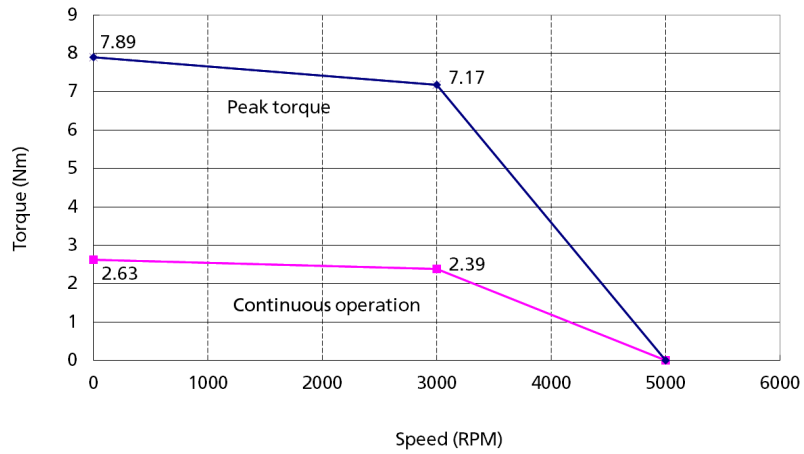
Tab. 3: Measure of length

2.3.2 Technical data

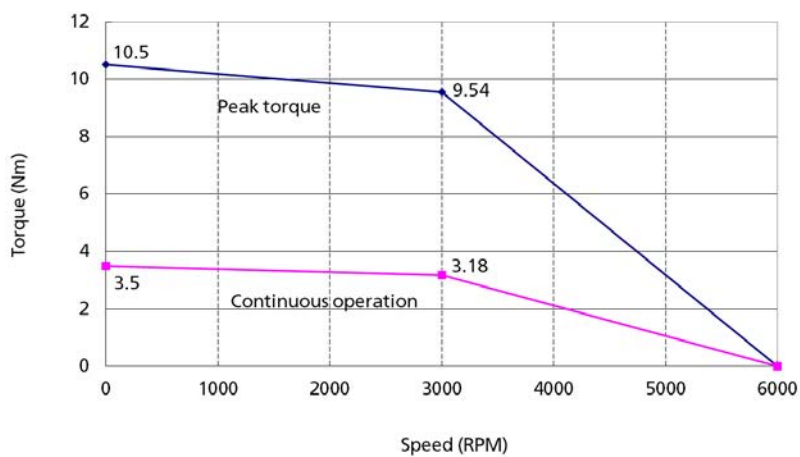
Motor type			E°SU3-040-F6-30...	E°SU3-040-03-30...
Recommended servo drive: E°Darc			K10	K10
M_0	Stall torque	Nm	2.63	3.5
M_{max}	Peak torque at rated speed	Nm	7.17	9.54
M_N	Rated torque	Nm	2.39	3.18
n_N	Rated speed	rpm	3000	3000
n_k	Cutoff speed (at operating temperature)	rpm	3000	3000
J	Rotor moment of inertia	kgcm ²	1.36	1.9
F_r	Max. radial force	N	335	335
F_a	Max. axial force	N	167.5	167.5
m	Weight (w/o brake)	kg	3.3	3.9
p	Number of pole pairs	/	3	3
k_T	Torque constant	Nm/ A_{RMS}	0.66	0.56
k_E	Voltage constant	V/krpm	40	34
I_0	Stall current	A_{RMS}	4.29	6.93
I_N	Rated current	A_{RMS}	3.9	6.3
P_N	Rated power	W	750	1000
RW	Phase resistance	Ohm	0.7	0.43
LW	Phase inductance	mH	3.75	2.25
U	Supply voltage	V AC	230	230
Brake				
M	Holding torque at 100 °C	Nm	3.2	3.2
J	Moment of inertia	kgcm ²	0.025	0.025
m	Weight	kg	0.7	0.7
U	Voltage DC +/- 10 %	V DC	24	24
I_B	Power consumption	A DC	0.48	0.48
R	Resistance	Ohm	50	50
Cable				
Q	Cross section (at cable length < 20 m)	mm ²	1	1

2.3.3 Torque characteristics

E°SU3-040-F6-30-21-...

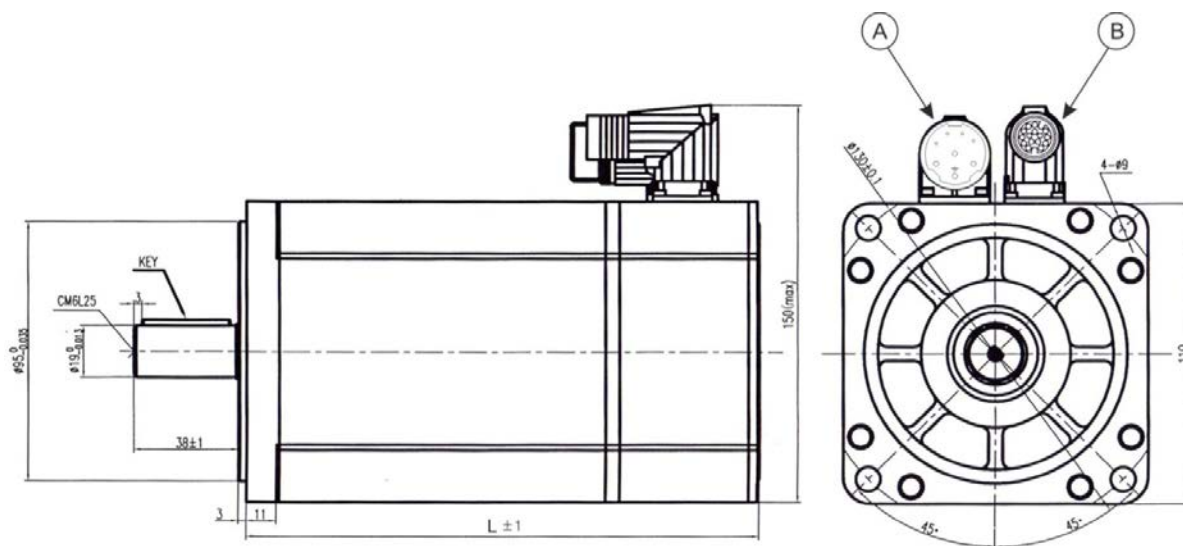


E°SU3-040-03-30-21-...



2.4 E°SU3-055...

2.4.1 Dimensions



A: Power connection B: Feedback connection

All dimensions indicated in mm

Motor type	Length (L)
E°SU3-055-04-20-21-NK0	168
E°SU3-055-04-30-24-BK0	228
E°SU3-055-06-20-21-NK0	187
E°SU3-055-06-20-24-BK0	245.5
E°SU3-055-06-20-24-NK0	185.5
E°SU3-055-07-20-21-BK0	264
E°SU3-055-07-20-24-NK0	203.5

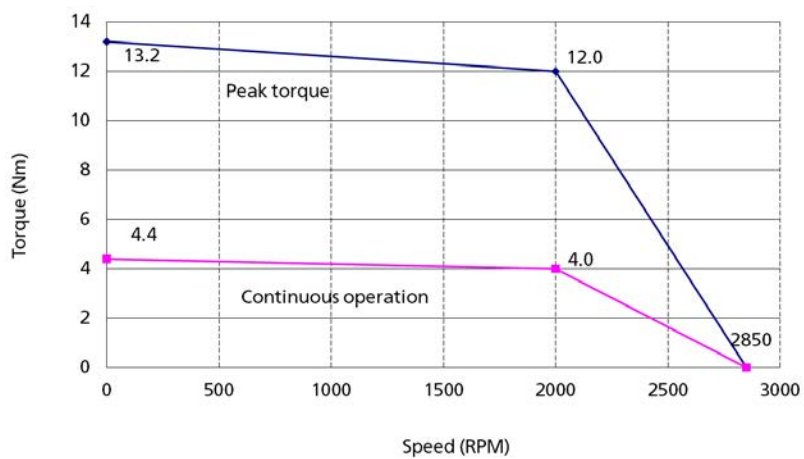
Tab. 4: Measure of length

2.4.2 Technical data

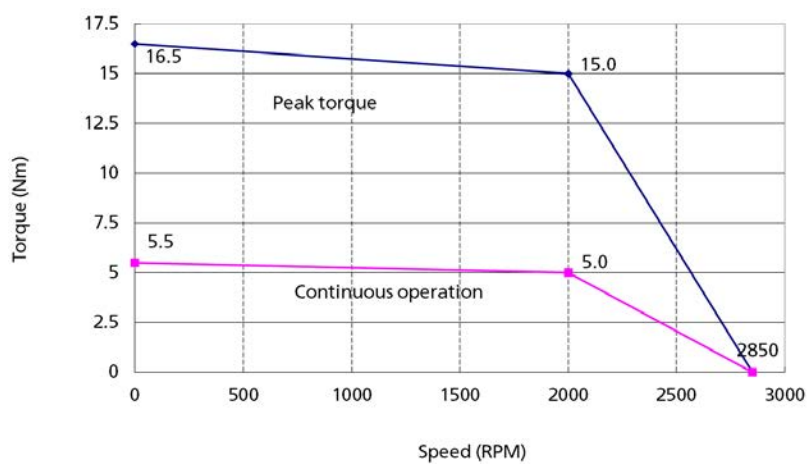
Motor type			E°SU3-055-04-20-...	E°SU3-055-06-20-...	E°SU3-055-07-20-...
Recommended servo drive: E°Darc			K10	K10	K10
M ₀	Stall torque	Nm	4.4	5.5	6.6
M _{max}	Peak torque at rated speed	Nm	12.0	15.0	18.0
M _N	Rated torque	Nm	4.0	5.0	6.0
n _N	Rated speed	rpm	2000	2000	2000
n _k	Cutoff speed (at operating temperature)	rpm	2000	2000	2000
J	Rotor moment of inertia	kgcm ²	5.8	7.2	8.5
F _r	Max. radial force	N	630	630	630
F _a	Max. axial force	N	315	315	315
m	Weight (w/o brake)	kg	6.2	7.2	8.2
p	Number of pole pairs	/	4	4	4
k _T	Torque constant	Nm/A _{RMS}	1.058	0.91	1.09
k _E	Voltage constant	V/krpm	64	55	66
I ₀	Stall current	A _{RMS}	4.73	6.49	7.04
I _N	Rated current	A _{RMS}	4.3	5.9	6.4
P _N	Rated power	W	840	1050	1260
R _W	Phase resistance	Ohm	0.92	0.52	0.56
L _W	Phase inductance	mH	6.75	3.6	4.95
U	Supply voltage	V AC	230	230	230
Brake					
M	Holding torque at 100 °C	Nm	10	10	10
J	Moment of inertia	kgcm ²	0.575	0.575	0.575
m	Weight	kg	1.3	1.3	1.3
U	Voltage DC +/- 10 %	V DC	24	24	24
I _B	Power consumption	A DC	0.94	0.94	0.94
R	Resistance	Ohm	25.6	25.6	25.6
Cable					
Q	Cross section (at cable length < 20 m)	mm ²	1	1	1

2.4.3 Torque characteristics

E°SU3-055-04-20-XX-...

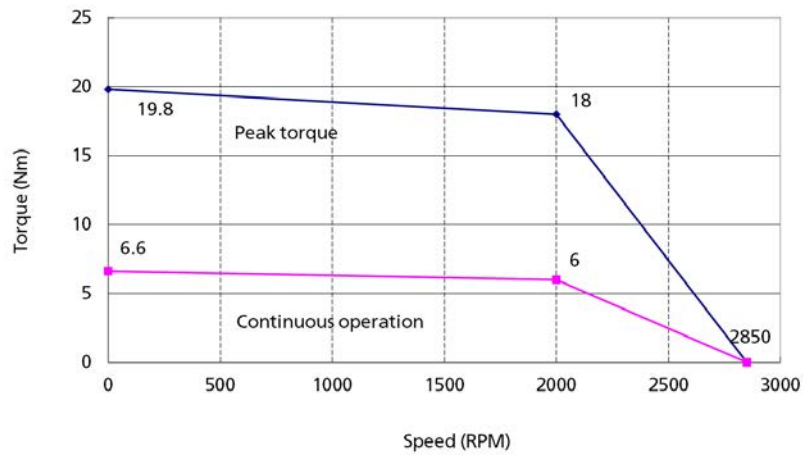


E°SU3-055-06-20-XX-...



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E°SU3-055-07-20-XX-...




3 Connections

3.1 Power connections

E°SU3-030...-040...



Thread size: M17

Pin	Assignment
1	Phase U
2	Phase V
3	Phase W
4	Brake (+)
5	Brake (-)
6	NC
	Motor PE

E°SU3-055...



Thread size: M23

Pin	Assignment
1	Phase U
2	PE
3	Phase V
4	Phase W
A	NC
B	NC
C	Brake (+)
D	Brake (-)

3.2 Feedback connections

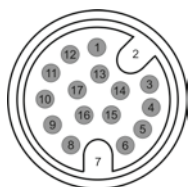


NOTE

The feedback type of a particular motor is determined by the two-digit type code at the following position of the type designation: E°Sx-0xx-xx-xx-**XX**-...

Incremental encoder

Type code: 21

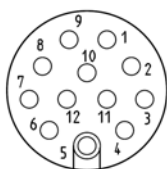


Thread size: M17

Pin	Assignment
1	DC + 5 V
2	GND
3	A
4	/A
5	B
6	/B
7	Temp. +
8	Temp. -
9	U
10	/U
11	V
12	/V
13	Shield
14	Z
15	/Z
16	W
17	/W

Absolute encoder

Type code: 24
(w/ final figures ...-xx0)

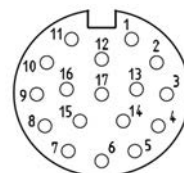


Thread size: M17

Pin	Assignment
1	DC + 5 V
2	GND_5V
3	SD
4	/SD
5	Shield
6	NC
7	Temp. +
8	Temp. -
9	V_batt
10	GND_batt
11	NC
12	NC

Absolute encoder

Type code: 24
(w/ final figures ...-xx6)



Thread size: M23

Pin	Assignment
1	DC + 5 V
2	GND_5V
3	SD
4	/SD
5	Shield
6	NC
7	Temp. +
8	Temp. -
9	V_batt
10	GND_batt
11	NC
12	NC
13	NC
14	NC
15	NC
16	NC
17	NC

4 Decommissioning and disposal

4.1 Disassembly

Only trained and authorised personnel are permitted to disassemble the device. When disassembling the device, follow the same safety instructions as during maintenance.

4.2 Disposal

Eckelmann FCS exclusively delivers components for machine equipment. We do not carry out measures for recovery or municipal waste management.



NOTE

The client is obliged in accordance with contractual agreements to carry out the disposal of waste electrical and electronic equipment in compliance with legal requirements based on EC directive 2012/19/EU.

