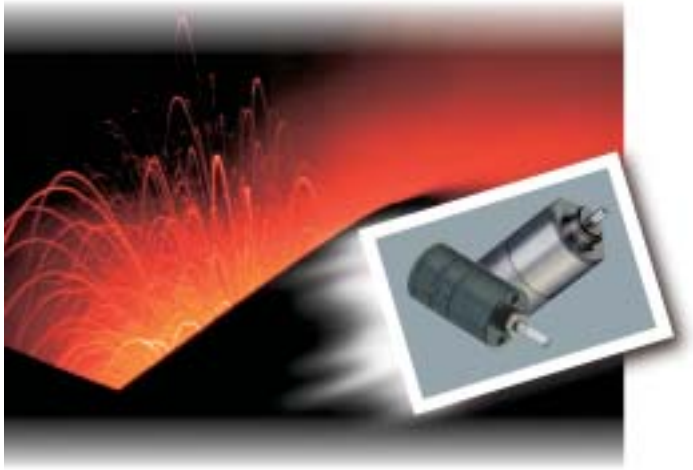
SPEEDY LINE



Portescap

MOVEMENT. SIGN OF LIFE

A Danaher Motion company

Portescap,
Putting your ideas into motion

Movement symbolises life.
Mastering motion generated by small electric actuators is our vocation, our job.
You are the specialist in your own domain and, naturally, you want the best possible solutions for your specific needs.
We are here to help you turn your ideas into reality, by actively listening to what you have to say and offering you years of experience acquired in the field of motorization.
Like you, we place value on innovation, technical excellence and providing quality service.
Our objective is not only to satisfy your present needs, but to help you prepare for the future by orienting ourselves to your long-term needs, and finding tailored solutions in terms of performance and cost. We are here, when you need a partner you can count on.
Tuning into your needs - around the world, yet close to home - the Portescap team thanks you for your confidence.

Portescap,
Partenaire de vos idées

Le mouvement symbolise la vie.
Maîtriser le mouvement généré par les actuateurs électriques de dimensions réduites est notre vocation et notre métier.
Vous êtes les spécialistes dans vos domaines d'activité et, de toute évidence, à la recherche de solutions les mieux adaptées.
Notre vocation est de vous aider à concrétiser vos idées en vous écoutant et en mettant à votre service notre expérience acquise depuis de nombreuses années dans les domaines de la motorisation.
Comme vous, nous misons sur l'innovation, les compétences, le service.
Notre objectif n'est pas seulement de satisfaire vos besoins présents, mais de préparer ensemble l'avenir, en nous orientant vers vos besoins futurs, et en trouvant conjointement des solutions optimales en terme de performances et de coûts pour devenir plus qu'un fournisseur, un partenaire.
A votre écoute, partout dans le monde et près de chez vous, toute l'équipe Portescap vous remercie de votre confiance.

Portescap,
Partner für Ihre Ideen

Bewegung ist Leben.
Diese von Ihnen benötigte Bewegung durch kleinformatige elektrische Antriebe umzusetzen, ist unser Beruf, ja unsere Berufung.
Als Fachmann auf Ihrem Tätigkeitsgebiet sind Sie auf der Suche nach den besten Lösungen!
Unsere Fachkompetenz auf dem Gebiet der Motorisierung stellen wir Ihnen bei der Verwirklichung Ihrer Wünsche stets gerne zur Verfügung.
Wie Sie, setzen auch wir auf Innovation, Fachkenntnis und Dienstleistung. Unser Ziel ist, die Zukunft mit Ihnen zusammen vorzubereiten und gemeinsam für Ihre Bedürfnisse die besten Lösungen zu finden. Vom Lieferanten werden wir für Sie zum reellen Partner.
Dies überall auf der Welt und auch in Ihrer nächsten Nähe. Ein auf Ihre Wünsche eingestelltes Team Portescap dankt Ihnen für Ihr Vertrauen.

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Portescap
A Danaher Motion company

When it comes to leading edge motion control applications, Danaher Motion has a wealth of experience and innovative products to meet your most demanding requirements.
We offer extensive prototype manufacturing facilities staffed by experienced engineers to assist you with your application-specific requirements.
Together, the companies that form Danaher Motion are the best solution for your application.

Portescap
Une société de Danaher Motion

Dans les applications haut de gamme pour le contrôle de mouvement, Danaher Motion dispose d'une grande expérience et de produits novateurs pour satisfaire vos besoins les plus exigeants.
Nous offrons des moyens étendus de fabrication de prototypes et des ingénieurs qualifiés, pour vous assister dans les problèmes particuliers de vos applications.
L'ensemble des sociétés du groupe Danaher Motion assure la solution la meilleure pour votre application.

Portescap
Ein Mitglied der Firmengruppe Danaher Motion

Für Spitzenanwendungen in kontrollierter Bewegung verfügt Danaher Motion über reichhaltige Erfahrung und innovative Produkte für die Erfüllung Ihrer höchsten Anforderungen.
Wir bieten umfangreiche Möglichkeiten für die Fertigung von Prototypen mit erfahrenen Ingenieuren als Hilfe für Ihre speziellen Anwendungsprobleme.
Zusammen stellen die zu Danaher Motion gehörenden Firmen die bestmögliche Lösung für Ihre Anwendung sicher.

Portescap provides the micromotor technology and know-how to meet your application requirements

The company was founded in 1931 in La Chaux-de-Fonds in Switzerland. Over the decades it has been recognised worldwide as a specialist in the field of high performance electromechanical drive systems. With 7 subsidiaries and 15 agencies in the major industrialised countries, Portescap offers an extended sales and service network.
The personal contact and the technical competence of the employees ensure that customer service remains today, as in the future, of prime importance.
Mechatronic specialist in the Research, Development and Engineering departments, combined with the traditional «Swiss made» quality standard, ensure satisfaction of the most demanding requirements.

Today, the Portescap team employs 600 people around the world. Extensive training and personal involvement along with a genuine team spirit guarantee the customer the optimum motion solution.
The majority of the escap®products are designed, engineered and manufactured at the parent company in La Chaux-de-Fonds, in the canton of Neuchâtel. The Marly/ Fribourg production centre is mainly devoted to manufacturing motors derived from the disc magnet technology and brushless motor.
The Portescap company is approved to ISO 9001.

Portescap fournit les technologies et les savoir-faire des micromoteurs pour satisfaire les besoins de vos applications

Fondée en 1931 à La Chaux-de-Fonds, Suisse, la société est devenue au cours des dernières décennies, un des spécialistes mondiaux dans le marché des systèmes électromécaniques de hautes performances. Avec ses 7 filiales et 15 représentations dans les pays industrialisés les plus importants, Portescap offre un réseau de vente et de service étendu.
C'est grâce au contact direct avec le client et à la compétence technique de ses collaborateurs que Portescap est à même de garantir un service supérieur à ses clients, aujourd'hui comme dans le futur.
Un département de recherche innovateur, un bureau d'ingénierie efficace, un personnel spécialisé dans la «mécatronique» ainsi que la tradition de qualité des produits suisses permettent de satisfaire les besoins les plus exigeants.

Aujourd'hui, Portescap emploie sur le plan mondial environ 600 collaborateurs. L'esprit d'équipe, l'engagement ainsi que la formation de pointe du personnel garantissent au client la solution optimale à son problème.
La majeure partie des produits escap® est développée, industrialisée et fabriquée par la maison mère, située à La Chaux-de-Fonds, dans le canton de Neuchâtel, en Suisse.
Le centre de production de Marly, dans le canton de Fribourg, en Suisse, est principalement chargé de la fabrication de la gamme des moteurs issus de la technologie aimant disque escap® et de moteurs sans balai.
La Société Portescap est certifiée selon la norme internationale ISO 9001.

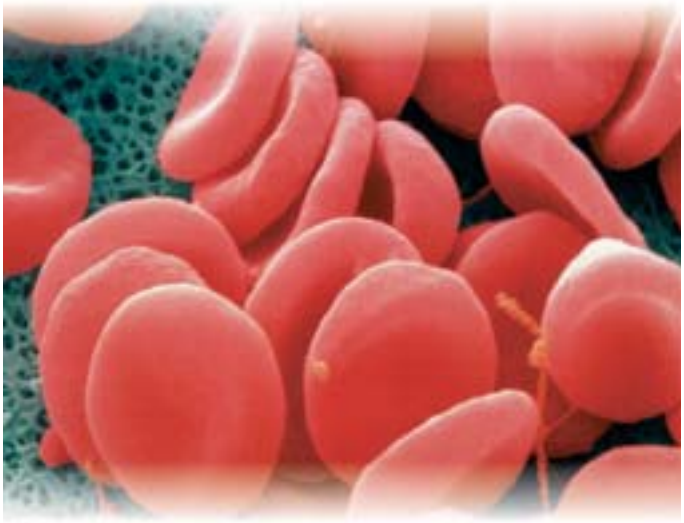
Portescap verfügt über die Technologien und das Know-how der Kleinstmotoren zur Erfüllung aller Ansprüche Ihrer Anwendung

Das Unternehmen wurde 1931 in La Chaux-de-Fonds in der Schweiz gegründet. Über die letzten Jahrzehnte wurde es zu einem weltweit führenden Hersteller im Bereich der elektromechanischen Antriebstechnik. Mit 7 Filialen und 15 Vertretungen in den wichtigsten Industrieländern verfügt Portescap über ein weitgespanntes Verkaufs- und Servicenetz.
Die Nähe zum Kunden und die technische Kompetenz der Mitarbeiter sind Basis und Garantie für die optimale Kundenbetreuung - jetzt und für Zukunft.
Mechatronik Spezialisten in Entwicklung und Engineering, zusammen mit dem durch «Swiss made» verkörperten traditionellen Qualitätsstandard, garantieren die Erfüllung höchster Ansprüche.

Weltweit hat das Unternehmen heute etwa 600 Mitarbeiter. Teamgeist, persönlicher Einsatz und qualifizierte Ausbildung garantieren dem Kunden eine optimale Lösung seines Problems.
Der überwiegende Teil der escap® Produkte wird im Stammhaus in La Chaux-de-Fonds im Kanton Neuchâtel entwickelt und gefertigt.
Das Fertigungszentrum in Marly/ Freiburg ist überwiegend auf Motoren in Scheibenmagnet-Technologie und bürstenlose Motoren spezialisiert.
Das Unternehmen Portescap is ISO 9001 zertifiziert.

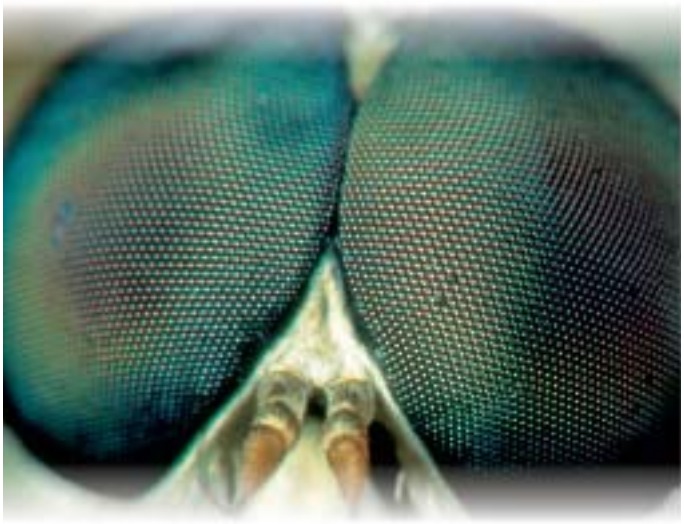
A World of Applications…
Un monde d'applications…
Die Welt der Anwendungen…

- Scientific & Measuring Instruments
- Handheld Tools and Surgical Tools
- Medical Equipment
- Security & Access Control
- Robotics & Factory Automation
- Textile Industry
- Civil Aviation and Aerospace
- Document Handling
- Semiconductor Equipment
- Model Railways
- Audio, video, shows



- Instruments scientifiques et de mesure
- Outils à main, outils de chirurgie
- Equipement médical
- Sécurité et contrôle d'accès
- Robotique et automatisation
- Industrie textile
- Aviation civile et aérospatiale
- Manutention de documents
- Industrie des semi-conducteurs
- Modèles réduits
- Audio, vidéo, spectacles

- Wissenschaftliche und Messinstrumente
- Hand-Werkzeuge und chirurgische Instrumente
- Medizinische Ausrüstungen
- Sicherheitssysteme
- Roboter und Automatisierung
- Textilindustrie
- Luft- und Raumfahrt (ziviler Bereich)
- Dokumentenhandling
- Halbleiterindustrie
- Modelleisenbahnen
- Audio, Video, Vorführungen



Technologies overview…
Vue d'ensemble des technologies…
Technologien Übersicht…

escap® D.C. Servomotors
The ironless rotor motor technology
Servomoteurs à courant continu escap®
La technologie des moteurs à rotor sans fer
escap® DC Servomotoren
Die Technologie der Motoren mit eisenlosem Rotor

escap® D.C. motors are based on a particular concept using a rotor with no iron core.
The active part of the rotor simply consists of a self-supporting cylindrical copper winding without an iron core. This results in characteristics such as a low rotor inertia, low friction, low starting voltage, absence of iron losses, very high efficiency, good heat dissipation, a linear speed-torque curve. These are substantial advantages in drive and servo systems.

Les moteurs C.C. escap® sont le résultat d'un concept original comportant notamment un rotor sans fer.
La partie active du rotor, constituée uniquement d'une bobine de cuivre autoporteuse de forme cylindrique alloue à ces moteurs c.c. des caractéristiques exceptionnelles. En effet, le faible moment d'inertie, les frottements minimes, la faible tension de démarrage, l'absence de pertes fer, le rendement élevé, la bonne dissipation thermique et la fonction couple-vitesse linéaire de cette technologie présentent des avantages déterminants pour tous les systèmes d'entraînement et d'asservissement.

Escap® DC Motoren beruhen auf einem besonderen Konzept mit einem Rotor ohne Eisenanker.
Der aktive Teil des Rotors besteht lediglich aus einer selbsttragenden zylindrischen Kupferwicklung ohne Eisenkern. Daraus ergeben sich Eigenschaften wie niedriges Trägheitsmoment, niedriges Reibmoment, kleine Anlaufspannung, Abwesenheit von Eisenverlusten, sehr hoher Wirkungsgrad, gute Wärmeabführung, lineare Drehzahl-Drehmoment Kennlinie; all das sind wesentliche Vorteile in Antriebs- und Servosystemen.

Small Brushless DC Motor Technology
Construction and Advantages
Les technologies des Petits Moteurs C.C. sans Balai
Construction & avantages
Bürstenlose DC Motoren
Konstruktion & Vorteile

escap® D.C. motors with electronic commutation: an innovative motor concept.
The rotor is a cylindrical permanent magnet, whereas the windings are part of the stator. Portescap ingenuity and experience with the ironless windings has led to the development of electronically commutated motors having very low detent torque and negligible iron losses. Therefore, they are capable of very smooth rotation and of high speed operation.

Moteurs C.C. escap® à commutation électronique, un concept innovateur.
Contrairement aux moteurs C.C. conventionnels, ici c'est l'aimant qui tourne alors que la bobine est fixe. Le savoir-faire et l'expérience de Portescap dans la technologie du bobinage sans fer ont permis la conception des moteurs à commutation électronique présentant d'une part, un couple résiduel très faible et d'autre part, des pertes fer négligeables. Ces moteurs permettent une rotation très régulière et des vitesses très élevées.

escap® DC Motoren mit elektronischer Kommutierung: Ein innovatives Motorkonzept.
Hier besteht der Rotor aus einem zylindrischen Dauermagnet, während die Wicklungen Teil des Stators sind. Portescap Know-how und Erfahrung mit eisenlosen Wicklungen führten zur Entwicklung bürstenloser, elektronisch kommutierter Motoren mit sehr niedrigen Rastmoment und vernachlässigbaren Eisenverlusten. Solche Motoren ergeben eine gleichmässige Bewegung sowie sehr hohe Drehzahlen.

Turbo Disc™ magnet stepper motors
The high performance technology
Moteurs pas à pas à aimant disque Turbo Disc™
La technologie à aimant disque: une technologie à performances uniques
Scheibenmagnet-Schrittmotoren Turbo Disc™
Die Scheibenmagnet-Technologie: eine Hochleistungstechnologie

Turbo Disc™ Magnet Stepper Motors
A technology providing unique results.
At its heart there is the rotor, a thin disc of rare earth magnet material. The Portescap know-how allowed for the axial magnetising, with a high number of magnetic poles, and for optimising the magnetic circuit with the corresponding reduction of losses. The quantum leap of this state-of-the-art technology developed and patented by Portescap is the extremely high dynamic performance, comparable with that of a servo motor but obtained from a simple stepper drive.

Moteurs pas à pas Turbo Disc™
Une technologie à performances uniques.
Le rotor de ces moteurs, cœur de la technologie, est constitué d'un aimant en terres rares en forme de disque mince. Le savoir-faire de Portescap est d'avoir d'une part optimisé le circuit magnétique et d'être d'autre part capable d'aimanter axialement un grand nombre de pôles sur l'aimant. Cette technologie de pointe, développée et brevetée par Portescap, atteint des performances dynamiques exceptionnelles. Grâce à cette nouvelle technologie, la performance du servomoteur devient accessible avec la simplicité du moteur pas à pas.

Turbo Disc™ Magnet-Schrittmotoren
Eine Technologie mit einzigartigen Ergebnissen.
Ihr Herz ist der Rotor in Form einer dünnen Scheibe aus Seltenerden-Magnetmaterial. Das Portescap Know-how erlaubt die axiale Aufmagnetisierung einer grösseren Anzahl von Magnetpolen und die Optimierung des Magnetkreises mit einer entsprechenden Verringerung der Verluste. Der Quantensprung dieser von Portescap entwickelten und patentierten Spitzentechnologie liegt in der aussergewöhnlich hohen Dynamik, vergleichbar mit jener von Servomotoren, aber erzielt mit der einfachen Steuerung des Schrittmotors.

Reduction gearboxes escap® using spur and planetary gears
Construction & Advantages
Réducteurs à dentures droites et planétaires escap®
Construction & Avantages
Stirnrad- und Planetengetriebe escap®
Konstruktion & Vorteile

The Spur gearbox technology
This gear technology offers advantages in current-limited applications where lowest input friction and high efficiency are essential.
The broad range of escap® spur gearboxes is well adapted to our motor lines, and includes integrated gearmotors.

La technologie des réducteurs à denture droite
Cette technologie de réducteur apporte un avantage certain à toute application requérant un couple de frottement réduit et un rendement élevé. Une large gamme de réducteurs escap® est proposée en combinaison avec les moteurs. Plusieurs unités motoréducteurs intégrées sont aussi disponibles.

Die Technologie der Stirnradgetriebe
Bestens geeignet für Anwendungen mit begrenzter Stromversorgung, wo ein niedriges Reibmoment und ein hoher Wirkungsgrad verlangt werden. Das breite Angebot an escap® Getrieben ist den Motorbaureihen nahtlos angepasst und teilweise integriert.

The Planetary gearbox technology
The main advantages of escap® planetary gearboxes are their high rated torque and a high reduction ratio per gear train. Both types use high quality composite materials. The all-metal have a very compact design with excellent performance and lifetime.

La technologie des réducteurs planétaires
Le mérite de ce genre de réducteurs est d'offrir une capacité de couple très importante et un grand rapport de réduction par train d'engrenage. En plastique de haute qualité ou entièrement métalliques, les réducteurs planétaires escap® sont très compacts pour une performance et une durée de vie excellentes.

Die Technologie der Planetengetriebe
Der Vorteil der escap® Planetengetriebe liegt in ihrem hohen Drehmoment und ihrem grossen Übersetzungsverhältnis pro Getriebestufe.
Die Modelle aus hochwertigen Kunststoffen ebenso wie die Ganzmetall-Getriebe vereinigen kompakte Bauweise mit hoher Leistung und Lebensdauer.

Encoder
Konstruktion & Vorteile
Capteurs
Construction & Avantages
Sensors
Construction & Advantages

The escap® Encoder technologies
Controlled movement, high performance drive and servo systems should not be limited by the precision and reliability of their sensors.
Whether exact speed control or precise positioning is required, the escap® product line provides the right solution to the particular challenges of your application. It offers precision tachogenerators as well as optimal combination of motor-tacho units, optical and magnetic encoders integrated into or adapted onto the motor, and complete motor-tacho-encoder units.

Les technologies des Codeurs escap®
Le contrôle du mouvement, les systèmes d'entraînement et d'asservissement dans les domaines de pointe ont besoin de dispositifs fiables pour contrôler le mouvement.
Que ce soit pour la régulation de vitesse ou le positionnement de précision, la gamme des produits escap® offre de multiples combinaisons répondant aux besoins spécifiques d'applications particulières, en associant de façon optimale les différentes unités proposées, telles que génératrices tachymétriques, unités moteurs-tacho, codeurs optiques et magnétiques intégrés ou adaptables aux moteurs et unités moteur-tacho-codeur.

Die Technologien der escap® Encoder
Kontrollierte Bewegung Antriebs- und Positioniersysteme der Spitzenklasse benötigen für die Bewegungsüberwachung zuverlässige und genaue Sensoren.
Für exakte Drehzahlregelung sowie für präzises Positionieren bietet das escap® Programm die richtige Lösung für die speziellen Probleme Ihrer Anwendung. Präzisionstachos, Motor-Tacho-Einheiten, integrierte oder angeflanschte Winkelschrittgeber sowie komplette Baugruppen mit Motor, Tacho und Winkelschrittgeber werden angeboten.

Main characteristics and possible combinations
Caractéristiques déterminantes et combinaisons possibles
Wichtigste Daten und Kombinationsmöglichkeiten

Motor	Type	08GS	08G	16C	16N	17N	22N28	22V28	22V48	23LT	23DT	26N	28L	28DT	35NT2R	P010	P110	P310	P430	P520	PP520	P530/2	P632	P850/2	18BT	22BT	13BC	22BM	22BL	26BC	26BC
Max. continuous torque	[mNm]	0.64	0.7	1.1	2.9	5.7	8.4	8.5	8.5	10.3	19.5	20	21	41	115	1.9	7	14	60	120	120	205	320	1060	1.2	3.0	1.9	13.5	22.8	7	4.4
	(oz-in)	0.09	0.09	0.16	0.4	0.81	1.19	1.2	1.2	1.46	2.8	2.8	2.97	5.8	16.3	0.26	1.0	2.0	8.5	17	17	29	45.3	150	0.17	0.43	0.3	1.91	3.22	0.99	0.62
	Page	10	11	12	13	14	15	16	17	18	19	20	21	22	23	25	26	27	28	29	30	31	32	33	35	36	37	38	39	40	41

Gearboxes @20rpm Type	[Nm]	(oz-in)	page
M707L	0.012	(1.7)	43
M/MU915L	0.03	(4.25)	44
R10	0.1	(14.1)	45
B16	0.12	(17)	46
R16	0.3	(42.5)	47
R22	0.6	(85)	48
M22	1.5	(212)	49
K24	0.17	(24)	50
K27	0.4	(56.6)	51
K38	1	(142)	52
RG1/9	1.2	(170)	53
R32	4.5	(638)	54
R40	10	(1416)	55
L10	–	–	56

Electronics type	Technology	Current	page
BL5010	BLDC	10A	56
EBS-484 SI	BLDC	5A	57
ELD-3503 V4	DC	2.5A	57
ESD-1200/1300	Stepper	3A	58
EDB-909	Stepper	9A	58
EDM-453	Stepper	3A	59
EDM-907	Stepper	9A	59

Encoders Type	Technology	Nr.line	page
F encoder	Magnetic	16	60
E9 encoder	Optical	500	61

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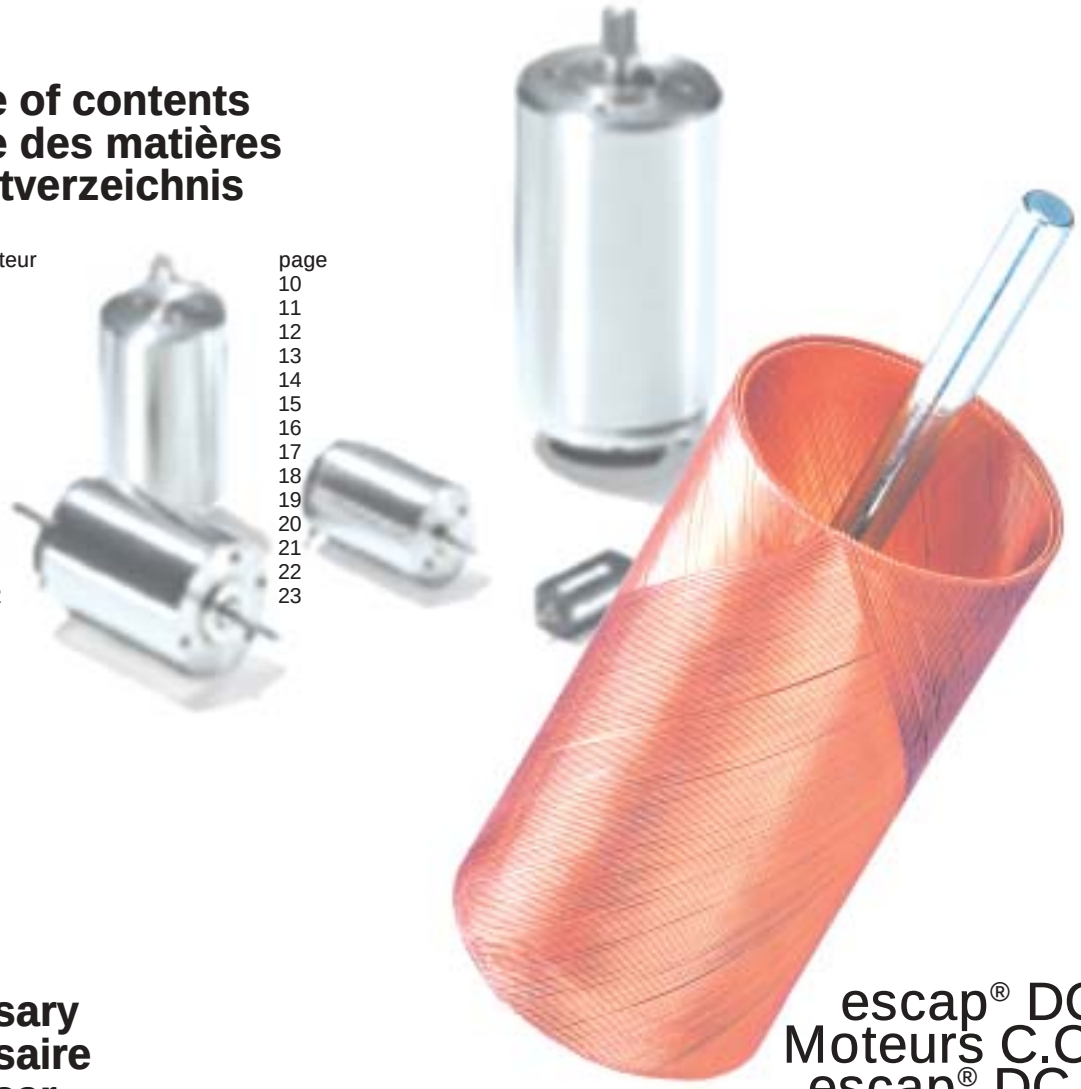


Glossary
Glossaire
Glossar

escap® DC motors
Moteurs C.C. escap®
escap® DC Motoren

Winding type

	Measured values	
1	Measuring voltage	V
2	No-load speed	rpm
3	Stall torque	mNm (oz-in)
4	Average no-load current	mA
5	Typical starting voltage	V
	Max. recommended values	
6	Max. continuous current	A
7	Max. continuous torque	mNm (oz-in)
8	Max. angular acceleration	10^3 rad/s^2
	Intrinsic parameters	
9	Back-EMF constant	V/1000 rpm
10	Torque constant	mNm/A (oz-in/A)
11	Terminal resistance	ohm
12	Motor regulation R/k^2	10^3/Nms
13	Rotor inductance	mH
14	Rotor inertia	kgm^2·10^{-7}
15	Mechanical time constant	ms

- Thermal resistance:
  rotor-body: 5°C/W
  body-ambient: 12°C/W
- Thermal time constant - rotor/stator: 10 s/580 s
- Max. rated coil temperature: 100°C
- Recom. ambient temperature range: -30°C to +65°C
- Viscous damping constant: 0.45 x 10^{-6} Nms
- Max. axial static force for press-fit: 250 N
- End play: ≤ 150 µm
  Radial play: ≤ 30 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 5 mm from mounting face:
  - sleeve bearing: 6 N
  - ball bearings: 8 N
- Motor fitted with sleeve bearings (ball bearings optional)
- With rear output shaft, the no-load current is 50% higher

Types de bobines

	Valeurs mesurées	
1	Tension de mesure	V
2	Vitesse à vide	t/min
3	Couple de démarrage	mNm (oz-in)
4	Courant à vide moyen	mA
5	Tension moyenne de démarrage	V
	Valeurs max. recommandées	
6	Courant max. en continu	A
7	Couple max. en continu	mNm (oz-in)
8	Accélération angulaire max.	10^3 rad/s^2
	Paramètres intrinsèques	
9	FEM	V/1000 t/min
10	Constante de couple	mNm/A (oz-in/A)
11	Résistance aux bornes	ohm
12	Facteur de régulation R/k^2	10^3/Nms
13	Inductance aux bornes	mH
14	Inertie du rotor	kgm^2·10^{-7}
15	Constante de temps mécanique	ms

- Résistance thermique:
  rotor-tube: 5°C/W
  tube-air ambiant: 12°C/W
- Constante de temps thermique rotor/stator:
  10 s/580 s
- Température max. tolérée par l'induit: 100°C
- Plage de température ambiante recom.:
  -30°C à +65°C
- Constante de couple visqueux: 0.45 x 10^{-6} Nms
- Pression axiale statique max.: 250 N
- Jeu axial: ≤ 150 µm
  Jeu radial: ≤ 30 µm
  Battement radial: ≤ 10 µm
- Charge radiale max. à 5 mm de la face:
  - paliers lisses: 6 N
  - roulements à billes: 8 N
- Moteur monté avec paliers lisses (roulements à billes en option)
- Avec double arbre de sortie, le courant à vide augmente de 50%

Wicklungstypen

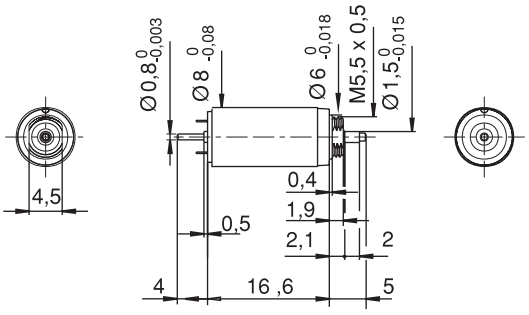
	Gemessene Werte	
1	Nennspannung	V
2	Leerlaufdrehzahl	Upm
3	Anlaufmoment	mNm (oz-in)
4	Mittlerer Leerlaufstrom	mA
5	Mittlere Anlaufspannung	V
	Max. empfohlene Werte	
6	Max. Dauerstrom	A
7	Max. Dauerdrehmoment	mNm (oz-in)
8	Max. Winkelbeschleunigung	10^3 rad/s^2
	Motorspezifische Parameter	
9	Gegen-EMK	V/1000 Upm
10	Drehmomentkonstante	mNm/A (oz-in/A)
11	Anschlußwiderstand	Ohm
12	Motorregulierung R/k^2	10^3/Nms
13	Anschlußinduktivität	mH
14	Rotorträgheitsmoment	kgm^2·10^{-7}
15	Mechanische Zeitkonstante	ms

- Wärmewiderstand:
  Rotor-Gehäuse: 5°C/W
  Gehäuse-Umgebung: 12°C/W
- Thermische Zeitkonstante Rotor /Stator: 10 s/580 s
- Max. zul. Wicklungstemperatur: 100°C
- Empfohlener Temperaturbereich: -30°C bis +65°C
- Viskoses Dämpfungsmoment: 0.45 x 10^{-6} Nms
- Max. zulässiger Aufpreßdruck: 250 N
- Axialspiel: ≤ 150 µm
  Radialspiel: ≤ 30 µm
  Wellenschlag: ≤ 10 µm
- Max. Radiallast 5 mm von der Frontplatte:
  - Sinterlager: 6 N
  - Kugellager: 8 N
- Motor mit Sinterlagern (Kugellager als Option)
- Mit hinterer Wellenverlängerung ist der Leerlaufstrom 50% höher

escap 08GS61

Precious metal commutation system - 5 segments

D.C. Motor
0.5 Watt

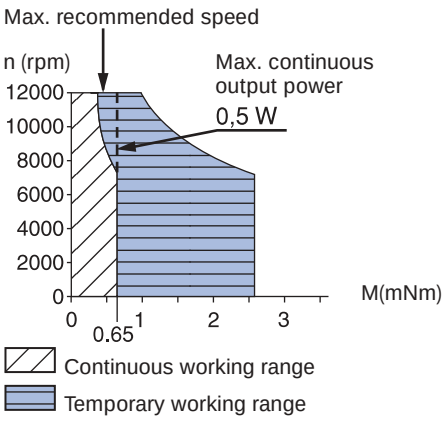


scale: 1:1
dimensions in mm
mass: 3.8 g

08GS61 [••••] • 1

Winding types	[••••]	-107
Measured values		
1 Measuring voltage	V	2
2 No-load speed	rpm	7000
3 Stall torque	mNm (oz-in)	0.3 (0.042)
4 Average no-load current	mA	8
5 Typical starting voltage	V	0.2
Max. recommended values		
6 Max. continuous current	A	0.25
7 Max. continuous torque	mNm (oz-in)	0.64 (0.09)
8 Max. angular acceleration	10^3 rad/s^2	889
Intrinsic parameters		
9 Back-EMF constant	V/1000 rpm	0.275
10 Torque constant	mNm/A (oz-in/A)	2.63 (0.37)
11 Terminal resistance	ohm	12.6
12 Motor regulation R/k^2	10^3/Nms	1800
13 Rotor inductance	mH	0.05
14 Rotor inertia	kgm^2·10^{-7}	0.03
15 Mechanical time constant	ms	5.5

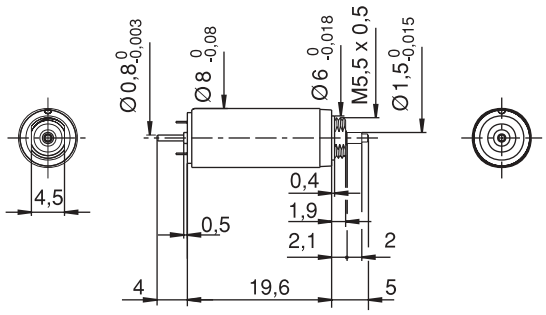
- Thermal resistance:
  rotor-body: 20°C/W
  body-ambient: 100°C/W
- Thermal time constant rotor/stator: 5 s/100s
- Max. rated coil temperature: 100°C
- Recom. ambient temperature range:
  -30°C to +85°C (-22°F to +185°F)
- Max. axial static force: 30 N
- End play: ≤ 100 µm
  Radial play: ≤ 15 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 2 mm from mounting face:
  - sleeve bearings: 0.5 N
- Motor fitted with sleeve bearings



escap 08G61

Precious metal commutation system - 5 segments

D.C. Motor 0.7 Watt

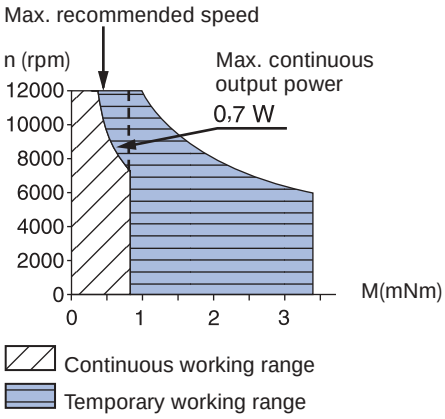


scale: 1:1
dimensions in mm
mass: 4.5 g

08G61 ▪▪▪▪ • 1

Winding types	▪▪▪▪	-107
Measured values		
1 Measuring voltage	V	3
2 No-load speed	rpm	9800
3 Stall torque	mNm (oz-in)	0.73 (0.103)
4 Average no-load current	mA	6
5 Typical starting voltage	V	0.2
Max. recommended values		
6 Max. continuous current	A	0.25
7 Max. continuous torque	mNm (oz-in)	0.7 (0.09)
8 Max. angular acceleration	10^3 rad/s²	924
Intrinsic parameters		
9 Back-EMF constant	V/1000 rpm	0.3
10 Torque constant	mNm/A (oz-in/A)	2.86 (0.406)
11 Terminal resistance	ohm	11.8
12 Motor regulation R/k²	10^3/Nms	1400
13 Rotor inductance	mH	0.03
14 Rotor inertia	kgm²·10^{-7}	0.035
15 Mechanical time constant	ms	5

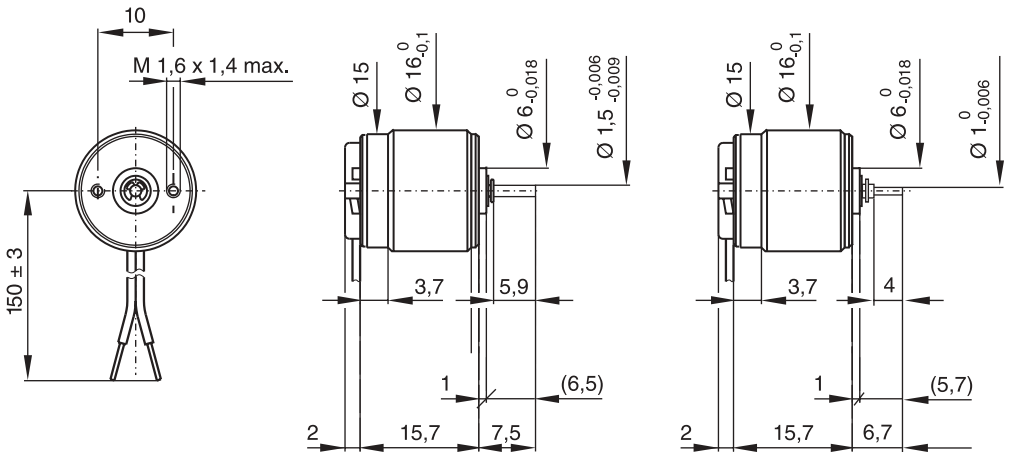
- Thermal resistance:
  rotor-body: 18°C/W
  body-ambient: 85°C/W
- Thermal time constant rotor/stator: 5 s/100s
- Max. rated coil temperature: 100°C
- Recom. ambient temperature range:
  -30°C to +85°C (-22°F to +185°F)
- Max. axial static force: 30 N
- End play: ≤ 100 µm
  Radial play: ≤ 15 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 2 mm from mounting face:
  - sleeve bearings: 0.5 N
- Motor fitted with sleeve bearings



escap 16C18

Precious metal commutation system - 5 segments

D.C. Motor
0.85 Watt

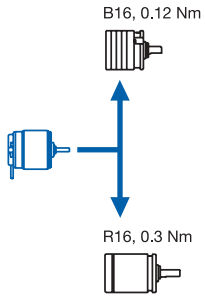


scale: 1:1
dimensions in mm
mass: 13 g

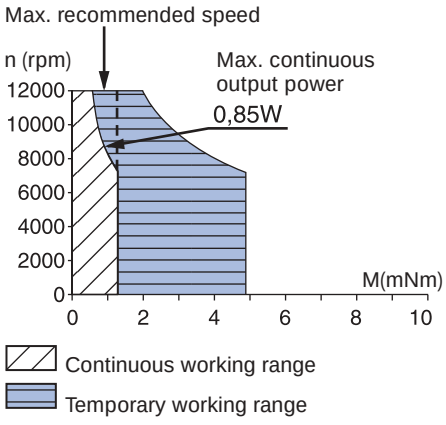
16C18 •••• • 30

16C18 •••• • 67

Winding types	••••	-210	-205
Measured values			
1 Measuring voltage	V	4.0	12.0
2 No-load speed	rpm	14700	16200
3 Stall torque	mNm (oz-in)	1.3 (0.19)	1.2 (0.17)
4 Average no-load current	mA	23.0	10.4
5 Typical starting voltage	V	0.05	0.15
Max. recommended values			
6 Max. continuous current	A	0.48	0.16
7 Max. continuous torque	mNm (oz-in)	1.12 (0.16)	1.0 (0.14)
8 Max. angular acceleration	10^3 rad/s^2	69	62
Intrinsic parameters			
9 Back-EMF constant	V/1000 rpm	0.26	0.70
10 Torque constant	mNm/A (oz-in/A)	2.48 (0.35)	6.68 (0.95)
11 Terminal resistance	ohm	7.5	65.0
12 Motor regulation R/k^2	10^3/Nms	1217	1455
13 Rotor inductance	mH	0.15	1.00
14 Rotor inertia	kgm^2·10^{-7}	0.41	0.41
15 Mechanical time constant	ms	50	60



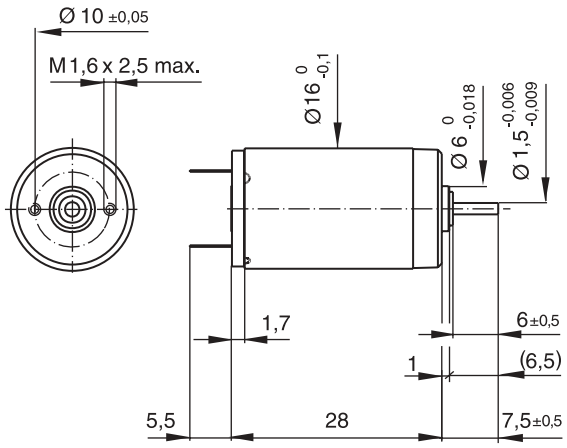
- Thermal resistance:
  rotor-body: 15°C/W
  body-ambient: 40°C/W
- Thermal time constant - rotor / stator:
  4 s / 230 s
- Max. rated coil temperature: 100°C (210°F)
- Recom. ambient temperature range:
  -30°C to +85°C (-22°F to +185°F)
- Viscous damping constant: 0.04 x 10^{-6} Nms
- Max. axial static force for press-fit: 150 N
- End play: ≤ 150 µm
  Radial play: ≤ 30 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 5 mm from mounting face:
  - sleeve bearings: 0.5 N
- Motor fitted with sleeve bearings



escap 16N28

Precious metal commutation system - 9 segments

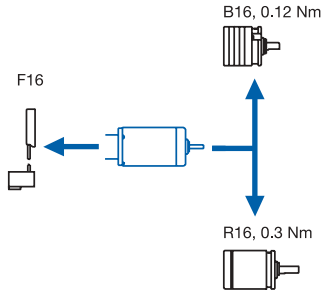
D.C. Motor 1.7 Watt



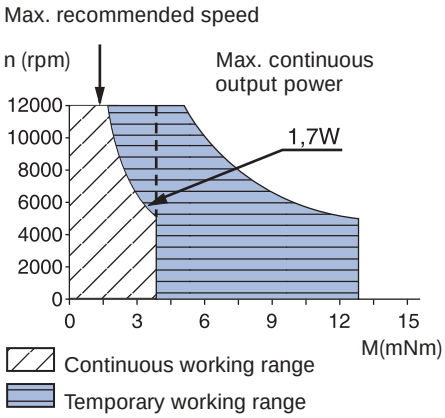
scale: 1:1
dimensions in mm
mass: 24 g

16N28 ▪▪▪▪ • 201

Winding types	▪▪▪▪	-210E	-207E	-205E
Measured values				
1 Measuring voltage	V	7.5	12.0	18.0
2 No-load speed	rpm	9700	10800	9600
3 Stall torque	mNm (oz-in)	3.9 (0.55)	3.1 (0.45)	2.9 (0.4)
4 Average no-load current	mA	13.3	7.7	4.9
5 Typical starting voltage	V	0.15	0.3	0.45
Max. recommended values				
6 Max. continuous current	A	0.42	0.24	0.15
7 Max. continuous torque	mNm (oz-in)	2.9 (0.4)	2.4 (0.35)	2.5 (0.35)
8 Max. angular acceleration	10^3 rad/s²	94	120	113
Intrinsic parameters				
9 Back-EMF constant	V/1000 rpm	0.75	1.1	1.8
10 Torque constant	mNm/A (oz-in/A)	7.2 (1.0)	10.3 (1.45)	17.3 (2.45)
11 Terminal resistance	ohm	14	40.5	109
12 Motor regulation R/k²	10^3/Nms	270	380	360
13 Rotor inductance	mH	0.5	0.9	3
14 Rotor inertia	kgm²·10^{-7}	0.77	0.51	0.55
15 Mechanical time constant	ms	21	19	20



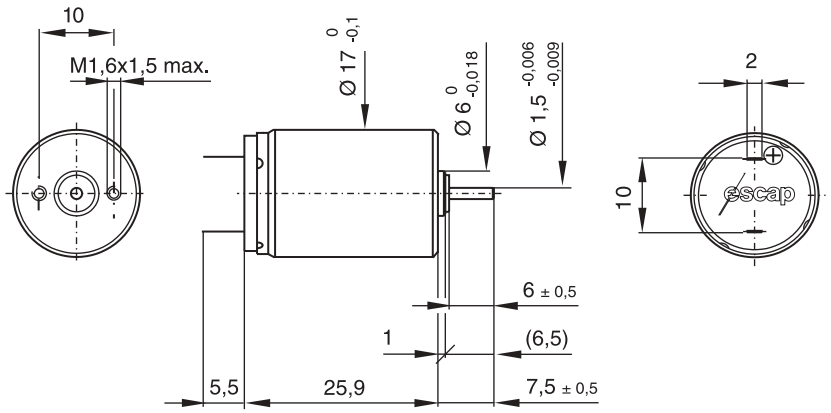
- Thermal resistance:
  rotor-body: 7°C/W
  body-ambient: 28°C/W
- Thermal time constant - rotor / stator:
  7 s / 390 s
- Max. rated coil temperature: 100°C (210°F)
- Recom. ambient temperature range:
  -30°C to +85°C (-22°F to +185°F)
- Viscous damping constant:
  0.04 x 10^{-6} Nms
- Max. axial static force for press-fit: 100 N
- End play: ≤ 150 µm
  Radial play: ≤ 30 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 5 mm from mounting face:
  - sleeve bearings: 1.5 N
- Motor fitted with sleeve bearings
- With rear output shaft, the no-load current is 50% higher
- M1.6: screw fixing torque max. 40 mNm



escap 17N78

Precious metal commutation system - 9 segments

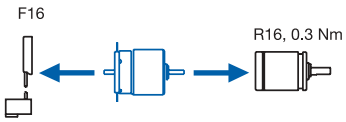
D.C. Motor 3.2 Watt



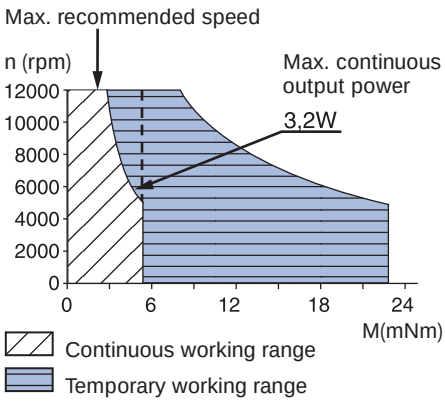
scale: 1:1
dimensions in mm
mass: 27 g

17N78 [••••] • 1

Winding types	[••••]	-216E	-210E
Measured values			
1 Measuring voltage	V	6.0	12.0
2 No-load speed	rpm	8500	8500
3 Stall torque	mNm (oz-in)	12.5 (1.77)	9.3 (1.31)
4 Average no-load current	mA	10.5	7.7
5 Typical starting voltage	V	0.04	0.08
Max. recommended values			
6 Max. continuous current	A	0.86	0.37
7 Max. continuous torque	mNm (oz-in)	5.69 (0.81)	4.85 (0.69)
8 Max. angular acceleration	10^3 rad/s^2	129	152
Intrinsic parameters			
9 Back-EMF constant	V/1000 rpm	0.70	1.40
10 Torque constant	mNm/A (oz-in/A)	6.7 (0.95)	13.4 (1.89)
11 Terminal resistance	ohm	3.20	17.3
12 Motor regulation R/k^2	10^3/Nms	72	97
13 Rotor inductance	mH	0.11	0.40
14 Rotor inertia	kgm^2·10^{-7}	1.10	0.80
15 Mechanical time constant	ms	8	8



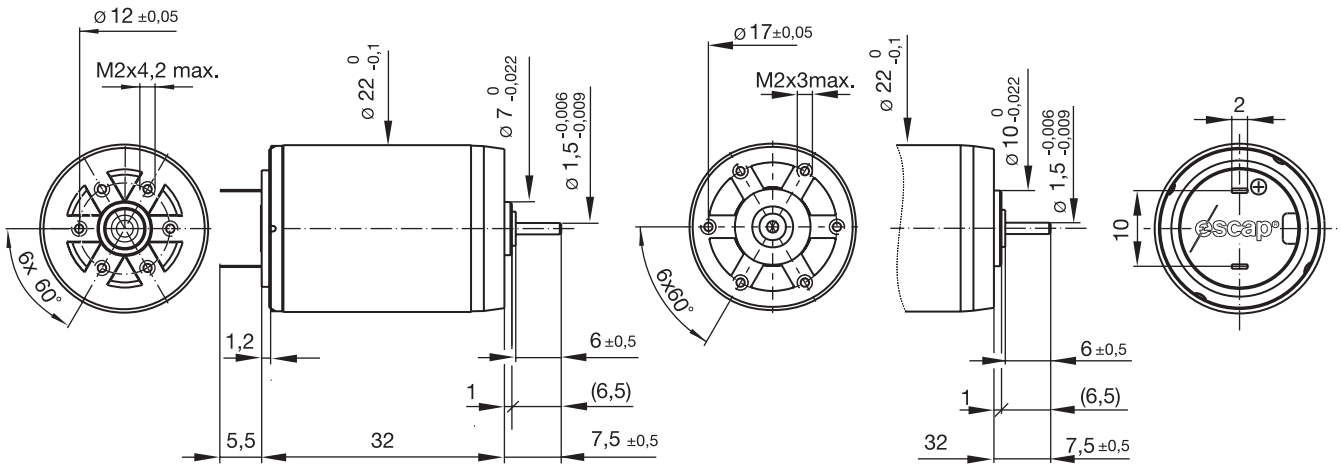
- Thermal resistance:
  rotor-body: 10°C/W
  body-ambient: 30°C/W
- Thermal time constant - rotor / stator:
  7 s / 400 s
- Max. rated coil temperature: 100°C (210°F)
- Recom. ambient temperature range:
  -30°C to +85°C (-22°F to +185°F)
- Viscous damping constant:
  0.04 x 10^{-6} Nms
- Max. axial static force for press-fit: 100 N
- End play: ≤ 150 µm
  Radial play: ≤ 30 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 5 mm from mounting face:
  - sleeve bearings: 1.5 N
- Motor fitted with sleeve bearings



escap 22N28

Precious metal commutation system - 9 segments

D.C. Motor
3.8 Watt

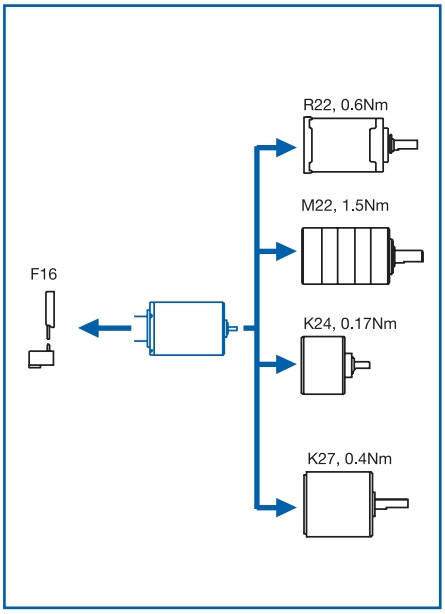


scale: 1:1
dimensions in mm
mass: 64 g

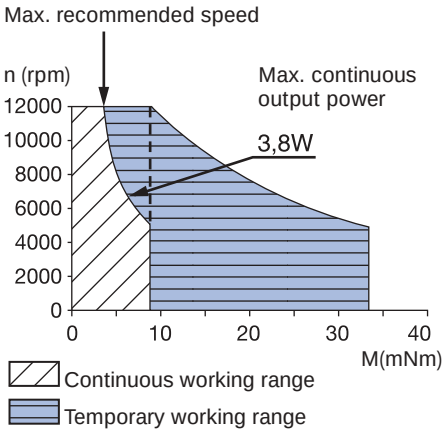
22N28 [••••] • 201

22N28 [••••] • 286

Winding types [••••]		-216E	-210E	-208E
Measured values				
1 Measuring voltage	V	6.0	12.0	18.0
2 No-load speed	rpm	5600	5900	6300
3 Stall torque	mNm (oz-in)	10.6 (1.50)	8.6 (1.21)	8.2 (1.17)
4 Average no-load current	mA	7.0	3.5	2.5
5 Typical starting voltage	V	0.3	0.6	
Max. recommended values				
6 Max. continuous current	A	0.83	0.38	0.26
7 Max. continuous torque	mNm (oz-in)	8.4 (1.19)	7.3 (1.04)	7.0 (0.98)
8 Max. angular acceleration	10^3 rad/s^2	60	61	60
Intrinsic parameters				
9 Back-EMF constant	V/1000 rpm	1.07	2.02	2.83
10 Torque constant	mNm/A (oz-in/A)	10.2 (1.45)	19.3 (2.73)	27.0 (3.83)
11 Terminal resistance	ohm	5.80	27.0	59.0
12 Motor regulation R/k^2	10^3/Nms	56	73	81
13 Rotor inductance	mH	0.35	1.20	2.30
14 Rotor inertia	kgm^2·10^{-7}	3.50	3.00	2.90
15 Mechanical time constant	ms	19	22	23



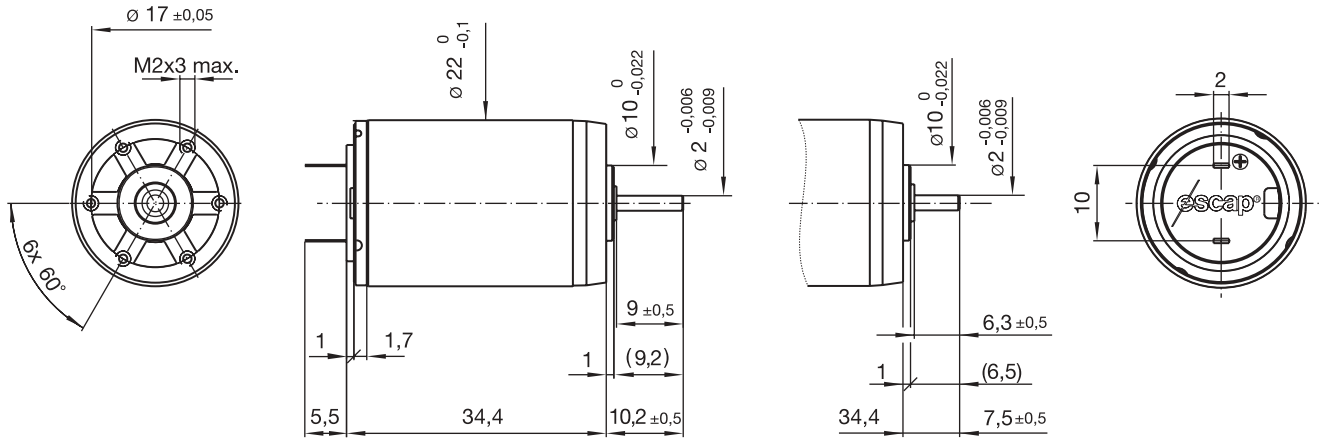
- Thermal resistance:
  rotor-body: 6°C/W
  body-ambient: 22°C/W
- Thermal time constant - rotor / stator:
  9 s / 550 s
- Max. rated coil temperature: 100°C (210°F)
- Recom. ambient temperature range:
  -30°C to +85°C (-22°F to +185°F)
- Viscous damping constant:
  0.1 x 10^{-6} Nms
- Max. axial static force for press-fit: 150 N
- End play: ≤ 150 µm
  Radial play: ≤ 30 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 2 mm from mounting face:
  - sleeve bearings: 1.5 N
- Motor fitted with sleeve bearings
- M2: screw fixing torque max.130 mNm



escap 22V28

Precious metal commutation system - 9 segments

D.C. Motor 4.2 Watt

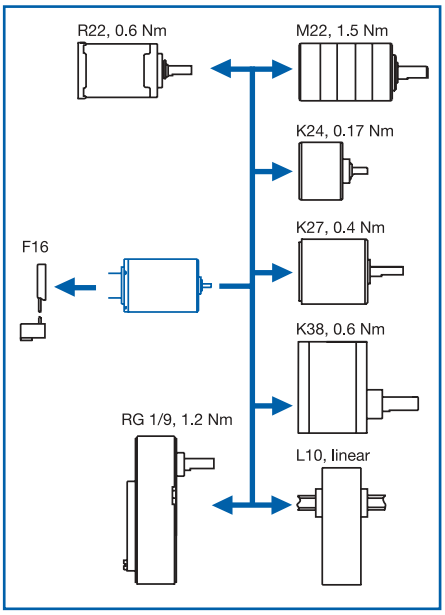


scale: 1:1
dimensions in mm
mass: 68 g

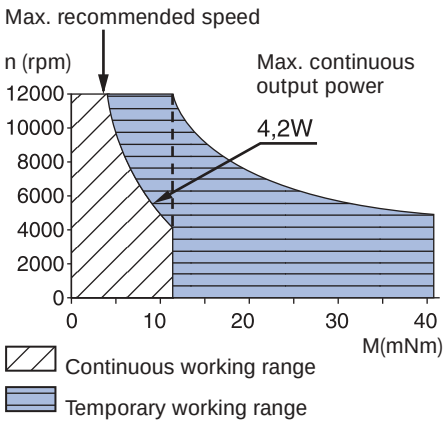
22V28 [••••] • 201

22V28 [••••] • 202

Winding types	[••••]	-213E	-208E
Measured values			
1 Measuring voltage	V	12.0	24.0
2 No-load speed	rpm	7600	6300
3 Stall torque	mNm (oz-in)	15.0 (2.13)	11.5 (1.62)
4 Average no-load current	mA	7.6	3.2
5 Typical starting voltage	V	0.15	0.20
Max. recommended values			
6 Max. continuous current	A	0.58	0.23
7 Max. continuous torque	mNm (oz-in)	8.48 (1.20)	8.13 (1.15)
8 Max. angular acceleration	10^3 rad/s^2	66	85
Intrinsic parameters			
9 Back-EMF constant	V/1000 rpm	1.56	3.75
10 Torque constant	mNm/A (oz-in/A)	14.9 (2.11)	35.8 (5.07)
11 Terminal resistance	ohm	11.9	75.0
12 Motor regulation R/k^2	10^3/Nms	54	58
13 Rotor inductance	mH	0.55	3.30
14 Rotor inertia	kgm^2·10^{-7}	3.20	2.40
15 Mechanical time constant	ms	17	14



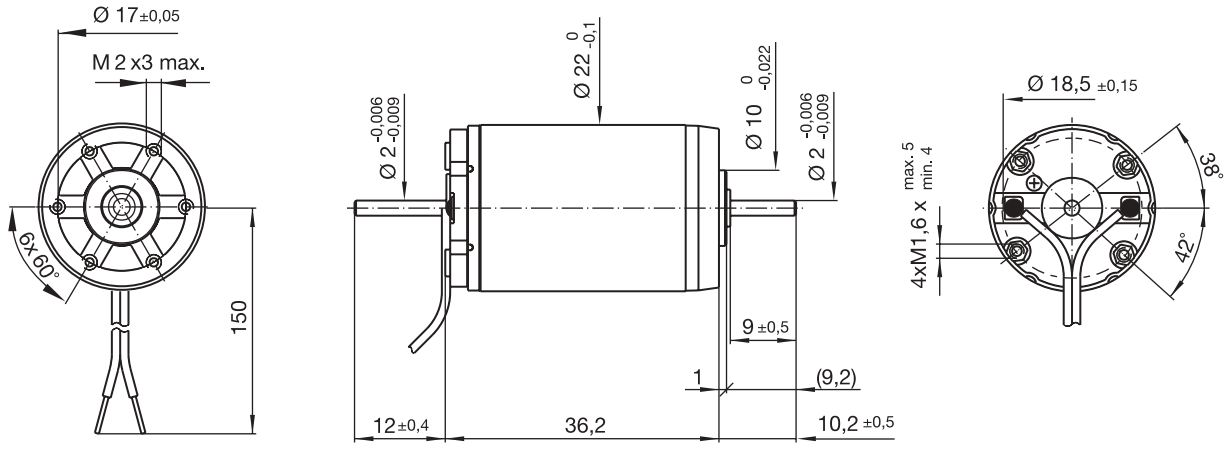
- Thermal resistance:
  rotor-body: 6°C/W
  body-ambient: 20°C/W
- Thermal time constant - rotor / stator:
  10 s / 460 s
- Max. rated coil temperature: 100°C (210°F)
- Recom. ambient temperature range:
  -30°C to +85°C (-22°F to +185°F)
- Viscous damping constant:
  0.05 x 10^{-6} Nms
- Max. axial static force for press-fit: 150 N
- End play: ≤ 150 µm
  Radial play: ≤ 30 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 5 mm from mounting face:
  - sleeve bearings: 3 N
- Motor fitted with sleeve bearings
- M2: screw fixing torque max.130 mNm



escap 22V48

Precious metal commutation system - 9 segments

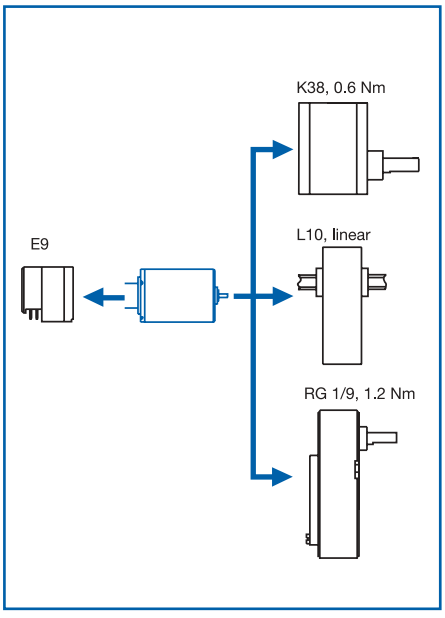
D.C. Motor
4.2 Watt



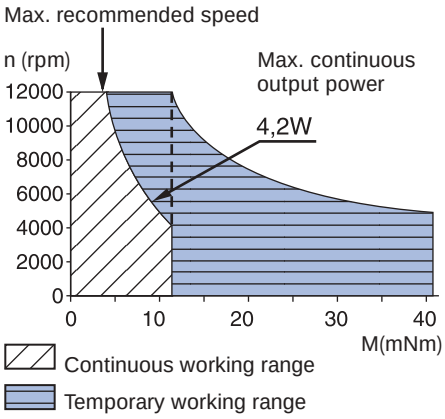
scale: 1:1
dimensions in mm
mass: 68 g

22V48 ▪▪▪▪ • 204

Winding types	▪▪▪▪	-213E	-208E
Measured values			
1 Measuring voltage	V	12.0	24.0
2 No-load speed	rpm	7600	6300
3 Stall torque	mNm (oz-in)	15.0 (2.13)	11.5 (1.62)
4 Average no-load current	mA	11	4.8
5 Typical starting voltage	V	0.15	0.20
Max. recommended values			
6 Max. continuous current	A	0.58	0.23
7 Max. continuous torque	mNm (oz-in)	8.5 (1.20)	8.1 (1.15)
8 Max. angular acceleration	10^3 rad/s^2	66	85
Intrinsic parameters			
9 Back-EMF constant	V/1000 rpm	1.56	3.75
10 Torque constant	mNm/A (oz-in/A)	14.9 (2.11)	35.8 (5.07)
11 Terminal resistance	ohm	11.9	75.0
12 Motor regulation R/k^2	10^3/Nms	54	58
13 Rotor inductance	mH	0.55	3.30
14 Rotor inertia	kgm^2·10^{-7}	3.20	2.40
15 Mechanical time constant	ms	17	14



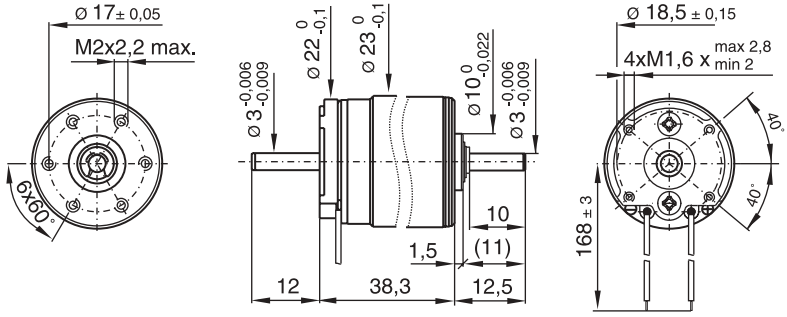
- Thermal resistance:
  rotor-body: 6°C/W
  body-ambient: 20°C/W
- Thermal time constant - rotor / stator:
  10 s / 460 s
- Max. rated coil temperature: 100°C (210°F)
- Recom. ambient temperature range:
  -30°C to +85°C (-22°F to +185°F)
- Viscous damping constant:
  0.05 x 10^{-6} Nms
- Max. axial static force for press-fit: 150 N
- End play: ≤ 150 mm
  Radial play: ≤ 30 mm
  Shaft runout: ≤ 10 mm
- Max. side load at 5 mm from mounting face:
  - sleeve bearings: 3 N
- Motor fitted with sleeve bearings
- M2: screw fixing torque max.130 mNm



escap 23LT12

Graphite/copper commutation system - 9 segments

D.C. Motor 8.5 Watt

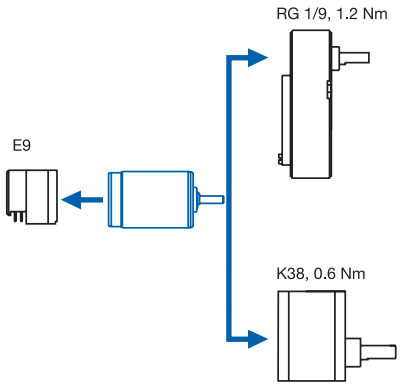


scale: 3:4
dimensions in mm
mass: 80 g

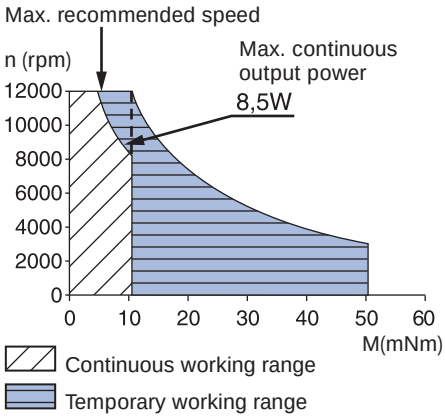
23LT2R12 ⊡ • 120

Winding types ⊡ -216E

Measured values			
1	Measuring voltage	V	12
2	No-load speed	rpm	8800
3	Stall torque	mNm (oz-in)	21.7 (3.08)
4	Average no-load current	mA	90
5	Typical starting voltage	V	-
Max. recommended values			
6	Max. continuous current	A	0.92
7	Max. continuous torque	mNm (oz-in)	10.3 (1.46)
8	Max. angular acceleration	10^3 rad/s²	88
Intrinsic parameters			
9	Back-EMF constant	V/1000 rpm	1.30
10	Torque constant	mNm/A (oz-in/A)	12.4 (1.76)
11	Terminal resistance	ohm	6.9
12	Motor regulation R/k²	10^3/Nms	45
13	Rotor inductance	mH	0.4
14	Rotor inertia	kgm²·10^{-7}	4.7
15	Mechanical time constant	ms	21



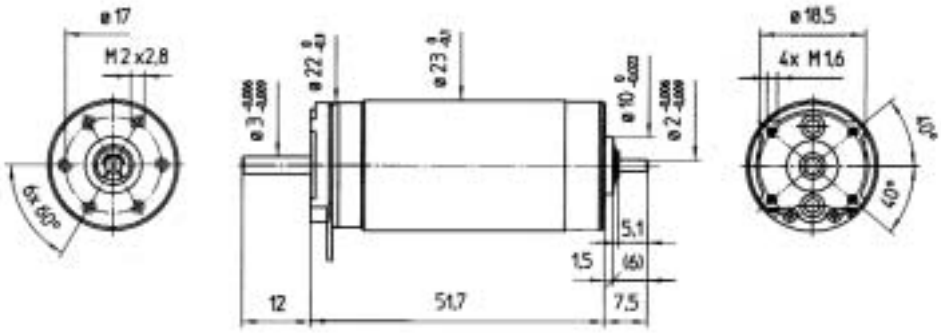
- Thermal resistance:
  rotor-body: 7°C/W
  body-ambient: 16°C/W
- Thermal time constant - rotor / stator:
  12 s / 460 s
- Max. rated coil temperature: 155°C
- Recom. ambient temperature range:
  -30°C to +125°C (-22°F to 257°F)
- Max. axial static force for press-fit: 250 N
- End play: ≤ 150 µm
  Radial play: ≤ 30 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 5 mm from mounting face:
  - ball bearings: 8 N
- Motor fitted with ball bearings



escap 23DT12

Graphite/copper commutation system - 9 segments

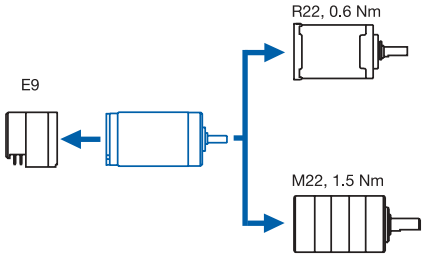
D.C. Motor
15 Watt



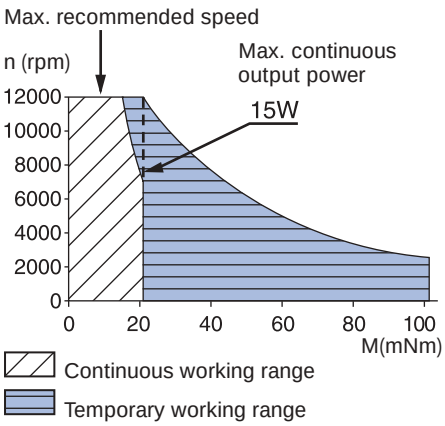
scale: 3:4
dimensions in mm
mass: 110 g

23DT2R12 ▪▪▪▪ • 93

Winding types	▪▪▪▪	-216E
Measured values		
1 Measuring voltage	V	18.0
2 No-load speed	rpm	7300
3 Stall torque	mNm (oz-in)	42 (5.9)
4 Average no-load current	mA	50
5 Typical starting voltage	V	-
Max. recommended values		
6 Max. continuous current	A	0.90
7 Max. continuous torque	mNm (oz-in)	19.5 (2.8)
8 Max. angular acceleration	10^3 rad/s^2	128
Intrinsic parameters		
9 Back-EMF constant	V/1000 rpm	2.40
10 Torque constant	mNm/A (oz-in/A)	22.9 (3.25)
11 Terminal resistance	ohm	9.8
12 Motor regulation R/k^2	10^3/Nms	19
13 Rotor inductance	mH	0.80
14 Rotor inertia	kgm^2·10^{-7}	6.10
15 Mechanical time constant	ms	12



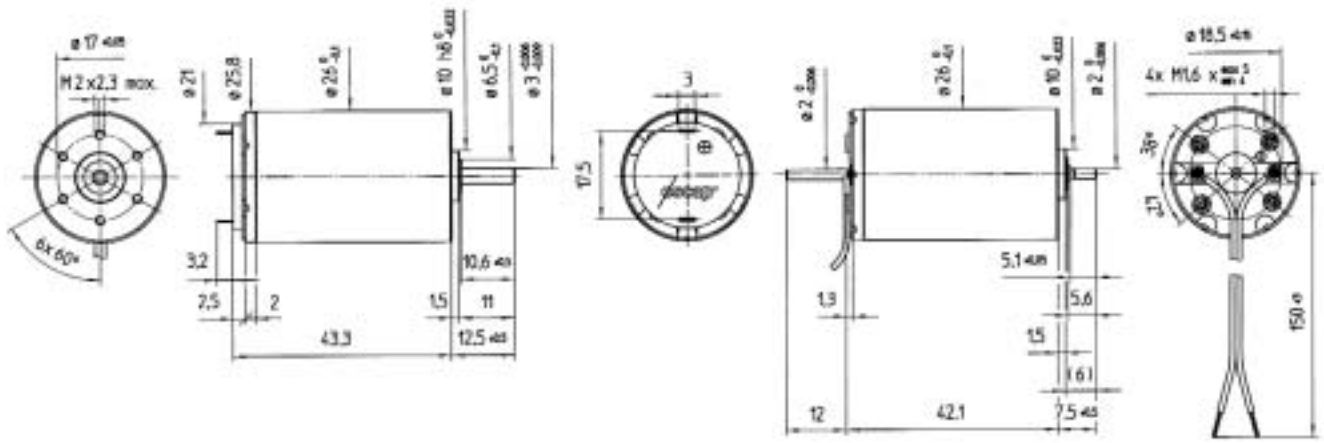
- Thermal resistance:
  rotor-body: 5°C/W
  body-ambient: 12°C/W
- Thermal time constant - rotor / stator:
  13 s / 580 s
- Max. rated coil temperature: 155°C
- Recom. ambient temperature range:
  -30°C to +125°C (-22°F to 257°F)
- Max. axial static force for press-fit: 250 N
- End play: ≤ 150 µm
  Radial play: ≤ 30 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 5 mm from mounting face:
  - ball bearings 8 N
- Motor fitted with two preloaded ball bearings



escap 26N58 & 26N48

Precious metal commutation system - 9 segments

D.C. Motor
5.7 Watt

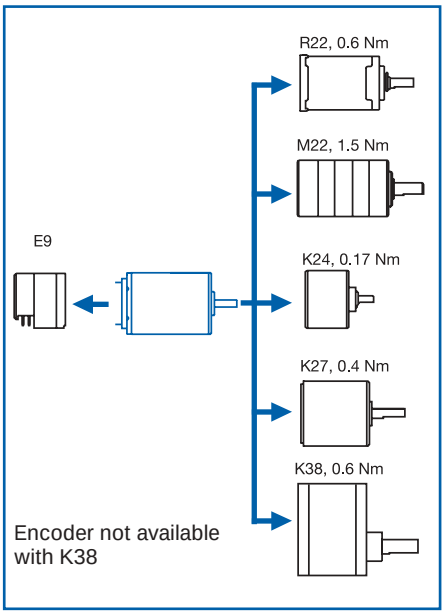


scale: 2:3
dimensions in mm
mass: 114 g

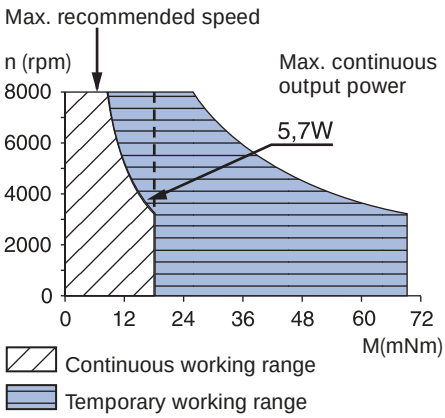
26N58 [••••] • 1

26N48 [••••] • 9

Winding types	[••••]	-216E	-110
Measured values			
1 Measuring voltage	V	12	24
2 No-load speed	rpm	4700	6700
3 Stall torque	mNm (oz-in)	28.6 (4.06)	25 (3.54)
4 Average no-load current	mA	16	12
5 Typical starting voltage	V	0.15	0.28
Max. recommended values			
6 Max. continuous current	A	0.86	0.34
7 Max. continuous torque	mNm (oz-in)	20 (2.8)	11 (1.56)
8 Max. angular acceleration	10^3 rad/s^2	84	46
Intrinsic parameters			
9 Back-EMF constant	V/1000 rpm	2.5	3.5
10 Torque constant	mNm/A (oz-in/A)	23.9 (3.38)	33.5 (4.74)
11 Terminal resistance	ohm	10	32
12 Motor regulation R/k^2	10^3/Nms	17	29
13 Rotor inductance	mH	0.8	1.7
14 Rotor inertia	kgm^2·10^{-7}	8.5	5.3
15 Mechanical time constant	ms	15	19



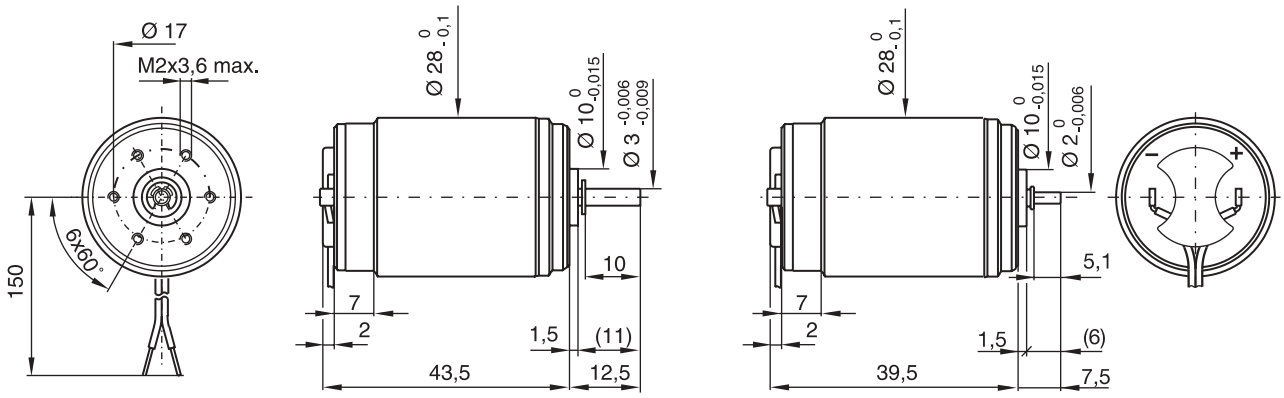
- Thermal resistance:
  rotor-body: 5°C/W
  body-ambient: 12°C/W
- Thermal time constant - rotor / stator:
  10 s / 640 s
- Max. rated coil temperature: 100°C (210°F)
- Recom. ambient temperature range:
  -30°C to +85°C (-22°F to +185°F)
- Viscous damping constant:
  0.45 x 10^{-6} Nms
- Max. axial static force for press-fit: 250 N
- End play: ≤ 150 µm
  Radial play: ≤ 30 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 5 mm from mounting face:
  - sleeve bearings: 6 N
- Motor fitted with sleeve bearings



escap 28L28

Precious metal commutation system - 9 segments

D.C. Motor 11 Watt

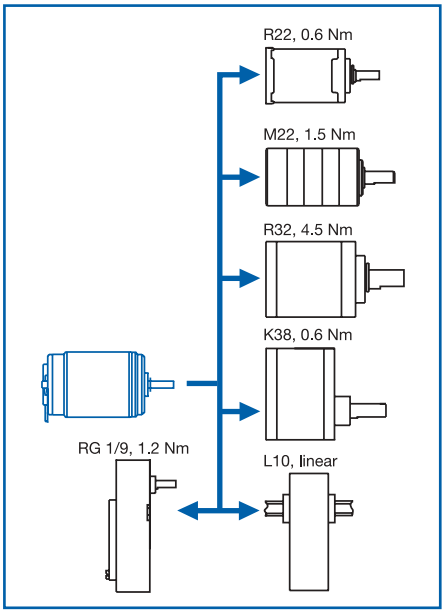


scale: 3:4
dimensions in mm
mass: 125 g

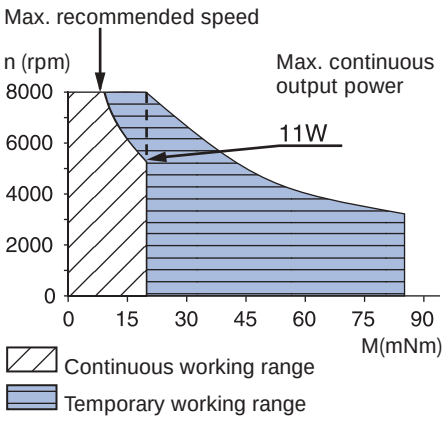
28L28 ▪▪▪▪ • 49

28L28 ▪▪▪▪ • 164

Winding types	▪▪▪▪	-219	-416E
Measured values			
1 Measuring voltage	V	12.0	24.0
2 No-load speed	rpm	5300	5600
3 Stall torque	mNm (oz-in)	43 (6.11)	50 (7.08)
4 Average no-load current	mA	22.0	11.0
5 Typical starting voltage	V	0.10	0.15
Max. recommended values			
6 Max. continuous current	A	0.95	0.53
7 Max. continuous torque	mNm (oz-in)	19.9 (2.82)	21.0 (2.97)
8 Max. angular acceleration	10^3 rad/s^2	48	30
Intrinsic parameters			
9 Back-EMF constant	V/1000 rpm	2.24	4.26
10 Torque constant	mNm/A (oz-in/A)	21.4 (3.03)	40.7 (5.76)
11 Terminal resistance	ohm	5.95	19.5
12 Motor regulation R/k^2	10^3/Nms	13	12
13 Rotor inductance	mH	0.50	2.40
14 Rotor inertia	kgm^2·10^{-7}	10.40	17.50
15 Mechanical time constant	ms	14	21



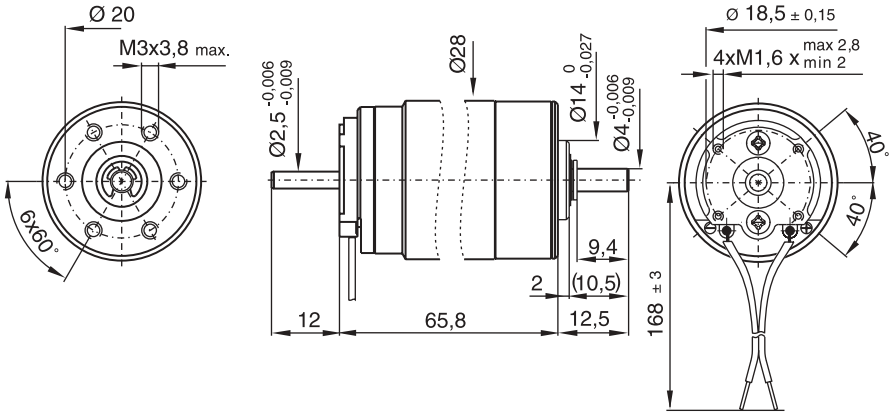
- Thermal resistance:
  rotor-body: 5 °C/W
  body-ambient: 12 °C/W
- Thermal time constant - rotor / stator:
  20 s / 760 s
- Max. rated coil temperature: 100°C (210°F)
- Recom. ambient temperature range:
  -30°C to +85°C (-22°F to +185°F)
- Viscous damping constant: 0.5 x 10-6 Nms
- Max. axial static force for press-fit: 150 N
- End play: ≤ 150 µma
  Radial play: ≤ 18 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 5 mm from mounting face
  - sleeve bearings: 6 N
- Motor fitted with sleeve bearings



escap 28DT12

Graphite/copper commutation system - 13 segments

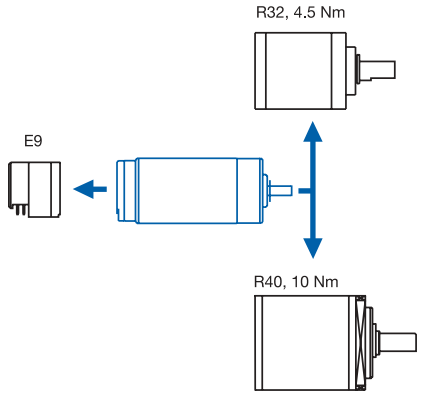
D.C. Motor
27 Watt



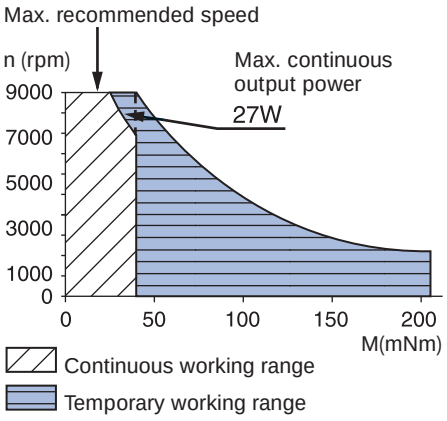
scale: 3:4
dimensions in mm
mass: 200 g

28DT2R12 ⊡ • 98

Winding types	⊡	-222E
Measured values		
1 Measuring voltage	V	24
2 No-load speed	rpm	6900
3 Stall torque	mNm (oz-in)	126 (17.8)
4 Average no-load current	mA	110
5 Typical starting voltage	V	-
Max. recommended values		
6 Max. continuous current	A	1.4
7 Max. continuous torque	mNm (oz-in)	41 (5.8)
8 Max. angular acceleration	10^3 rad/s²	82
Intrinsic parameters		
9 Back-EMF constant	V/1000 rpm	3.40
10 Torque constant	mNm/A (oz-in/A)	32.5 (4.60)
11 Terminal resistance	ohm	6.2
12 Motor regulation R/k²	10^3/Nms	5.9
13 Rotor inductance	mH	0.75
14 Rotor inertia	kgm²·10^{-7}	20
15 Mechanical time constant	ms	12



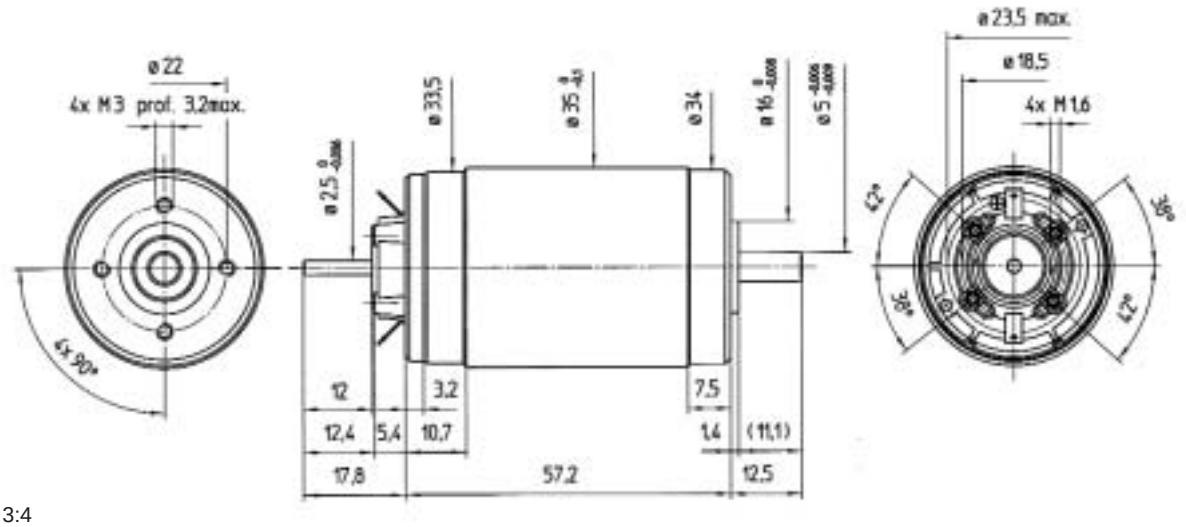
- Thermal resistance:
  rotor-body: 4°C/W
  body-ambient: 8°C/W
- Thermal time constant - rotor / stator:
  18 s / 630 s
- Max. rated coil temperature: 155°C
- Recom. ambient temperature range:
  -30°C to +125°C (-22°F to 176°F)
- Max. axial static force for press-fit: 500 N
- End play: ≤ 150 µm
  Radial play: ≤ 25 µm
  Shaft runout: ≤ 10 µm
- Max. side load at 5 mm from mounting face:
  - ball bearings: 10 N
- Motor fitted with ball bearings



escap 35NT2R82

Graphite/copper commutation system - 13 segments

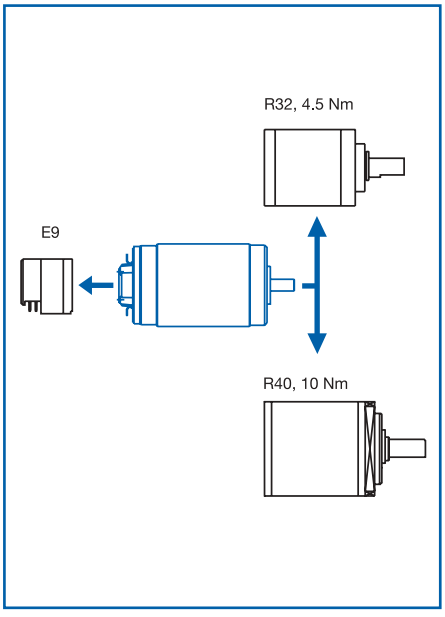
D.C. Motor
90 Watt



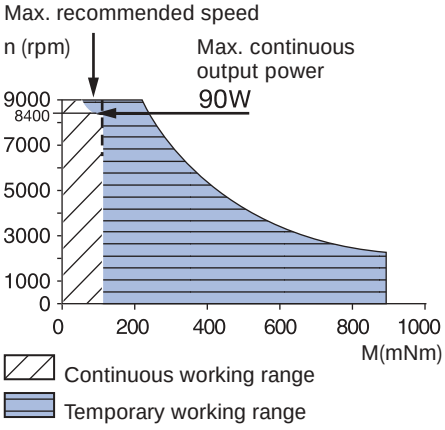
scale: 3:4
dimensions in mm
mass: 310 g

35NT2R82 [••••] • 50

Winding types	[••••]	-426SP
Measured values		
1 Measuring voltage	V	32
2 No-load speed	rpm	5900
3 Stall torque	mNm (oz-in)	756 (107)
4 Average no-load current	mA	802
5 Typical starting voltage	V	-
Max. recommended values		
6 Max. continuous current	A	2.3
7 Max. continuous torque	mNm (oz-in)	115 (16.3)
8 Max. angular acceleration	10^3 rad/s^2	64
Intrinsic parameters		
9 Back-EMF constant	V/1000 rpm	5.40
10 Torque constant	mNm/A (oz-in/A)	52 (7.3)
11 Terminal resistance	ohm	2.20
12 Motor regulation R/k^2	10^3/Nms	0.83
13 Rotor inductance	mH	0.4
14 Rotor inertia	kgm^2·10^{-7}	71.4
15 Mechanical time constant	ms	6



- Thermal resistance:
  rotor-body: 4°C/W
  body-ambient: 8°C/W
- Thermal time constant - rotor / stator:
  40 s / 920 s
- Max. rated coil temperature: 155°C
- Recom. ambient temperature range:
  -55°C to +125°C (-131°F to +257°F)
- Max. axial static force for press-fit: 100 N
  - shaft supported: 1000 N
- End play: negligible
  Radial play: negligible
  Shaft runout: ≤ 10 µm
- Max. side load at 10 mm from mounting face:
  - ball bearings: 35 N
- Motor fitted with ball bearings



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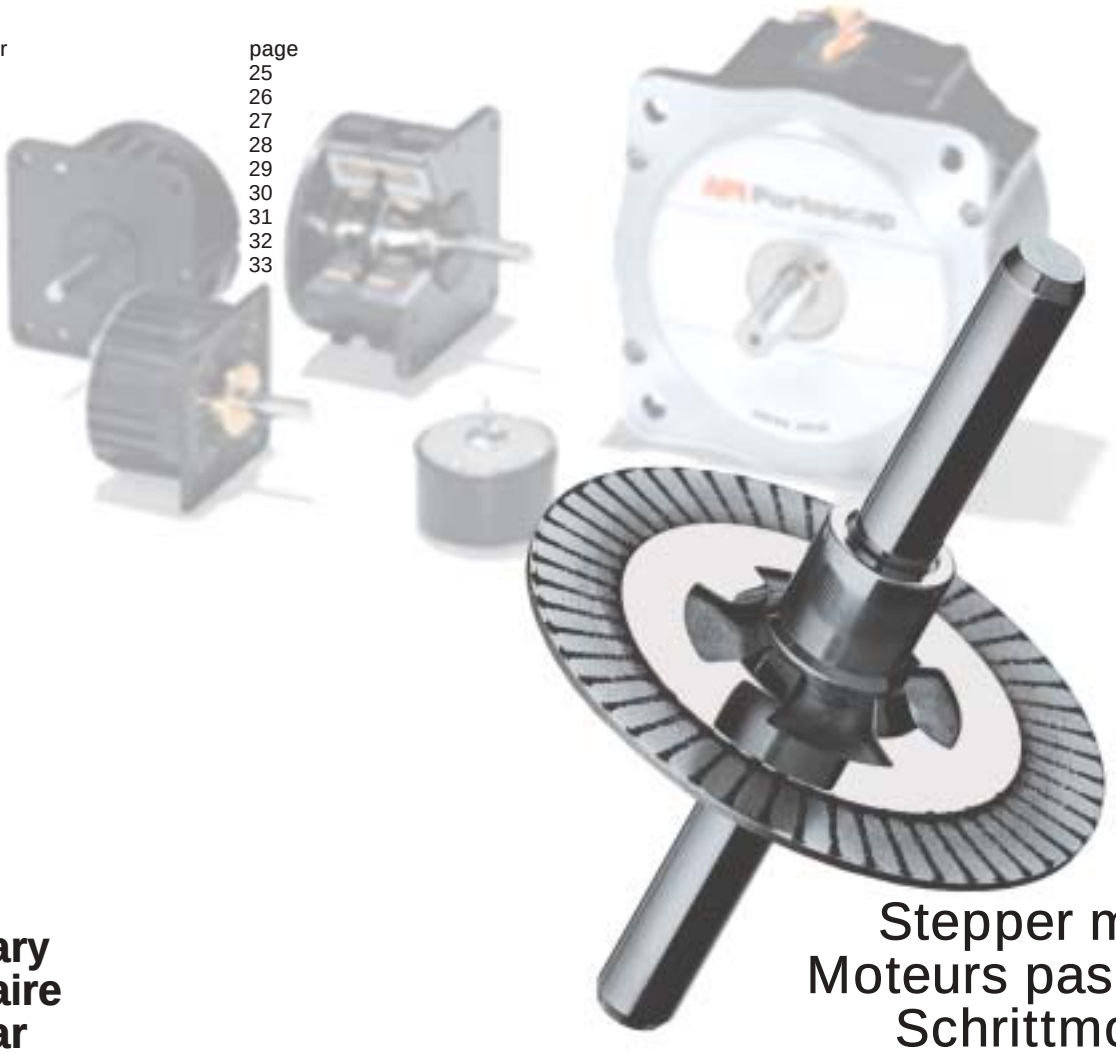


Stepper motors
Moteurs pas à pas
Schrittmotoren

Glossary
Glossaire
Glossar

Windings available

Coil dependent parameters		
1	Phase resistance	ohm
2	Phase inductance (1 kHz)	mH
3	Nominal phase current (2 ph. on)	A
4	Nominal phase current (1 ph. on)	A
5	Back-EMF amplitude	V/kst/s
Coil independent parameters		
Torque parameters		
6	Holding torque (nominal current)	mNm (oz-in)
7	Holding torque (1.5 x nominal current)	mNm (oz-in)
8	Detent torque amplitude and friction	mNm (oz-in)
Thermal parameters		
9	Thermal resistance coil-ambient	°C/W
Angular accuracy		
10	Absolute accuracy (2 ph. on full-step mode)	% ful-step
Mechanical parameters		
11	Rotor inertia	$kgm^2 \cdot 10^{-7}$
Other parameters		
12	Natural resonance frequency (nom. current)	Hz
13	Electrical time constant	ms
14	Angular acceleration (nominal current)	rad/s^2

- Bipolar driver
- The maximum coil temperature must be respected
- Motor unmounted
- Load applied at 12 mm from mounting face
- Shaft must be supported for press-fitting a pulley or pinion

Types de bobines

Paramètres dépendants des bobines		
1	Résistance de phase	ohm
2	Inductance de phase à 1 kHz	mH
3	Courant nom. de phase (2 ph. alim.)	A
4	Courant nom. de phase (1 ph. alim.)	A
5	Amplitude de f.e.m.	V/kpas/s
Paramètres indépendants des bobines		
Paramètres de couple		
6	Couple de maintien (courant nominal)	mNm (oz-in)
7	Couple de maintien (1.5 x courant nom.)	mNm (oz-in)
8	Couple sans courant	mNm (oz-in)
Paramètres thermiques		
9	Résistance thermique bobine-air	°C/W
Précision angulaire		
10	Absolue (2 ph. alim., mode pas entier)	% pas entier
Paramètres mécaniques		
11	Inertie du rotor	$kgm^2 \cdot 10^{-7}$
Paramètres divers		
12	Fréquence propre (courant nominal)	Hz
13	Constante de temps électrique	ms
14	Accélération (courant nominal)	rad/s^2

- Commande bipolaire
- La température maximale des bobines doit être respectée
- Moteur non fixé
- Charge appliquée à 12 mm de la face
- L'arbre doit être supporté pour chasser une poulie ou un pignon

Wicklungstypen

Wicklungsabhängige Parameter		
1	Phasenwiderstand	Ohm
2	Phaseninduktivität (1 kHz)	mH
3	Phasen-Nennstrom (2 Ph. bestr.)	A
4	Phasen-Nennstrom (1 Ph. bestr.)	A
5	Amplitude der Gegen-EMK	V/kSchr./s
Wicklungsunabhängige Parameter		
Drehmomente		
6	Haltemoment (Nennstrom)	mNm (oz-in)
7	Haltemoment (1.5 x Nennstrom)	mNm (oz-in)
8	Stromloses Haltemoment	mNm (oz-in)
Thermische Parameter		
9	Wärmewiderstand Wicklung-Luft	°C/W
Winkelgenauigkeit		
10	Absolute Genauig. (2 Ph. Vollschr.-Position)	% Vollschritt
Mechanische Parameter		
11	Rotorträgheitsmoment	$kgm^2 \cdot 10^{-7}$
Andere Merkmale		
12	Prüfspannung (1 Min.)	VRMS
13	Resonanzfrequenz (Nennstrom)	Hz
14	Beschleunigung (Nennstrom)	rad/s^2

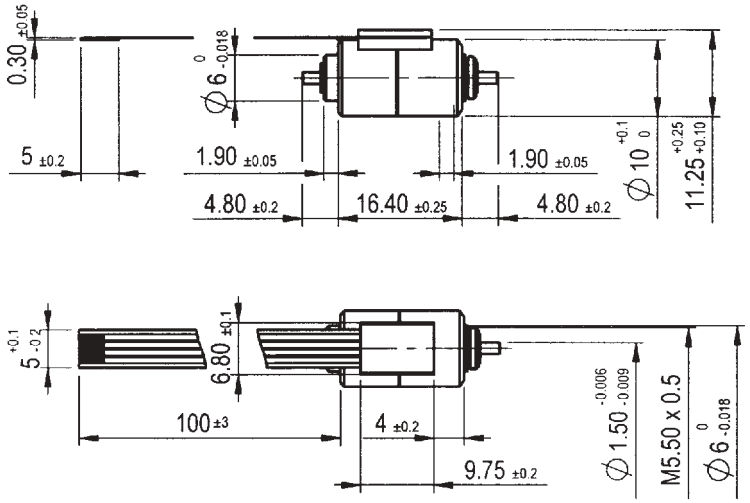
- Bipolarer Treiber
- Die max. zul. Wicklungstemperatur ist einzuhalten
- Motor nicht montiert
- Die Last ist 12 mm von der Frontplatte aufgebracht
- Beim Aufpressen von Ritzeln usw. Welle abstützen

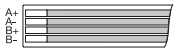
Turbo Disc™ P010

Suitable for microstep operation

Stepper motor

24 steps/revolution
15° step angle





Kapton Circuit
Reinforcement for connector
ZIF ZMP step 1 mm

Motor connections

scale: 1:1
dimensions in mm
mass: 9 g

P010-064 ▪▪▪▪ • 02

Windings available	▪▪▪▪	020	003
Coil dependent parameters		typ	typ
1 Phase resistance	ohm	20	3
2 Phase inductance (1 kHz)	mH	13.7	1.8
3 Nominal phase current (2 ph. on)	A	0.15	0.43
4 Nominal phase current (1 ph. on)	A	0.21	0.6
5 Back-EMF amplitude	V/kst/s	2.30	0.81
Coil independent parameters			
Torque parameters		typ	
6 Holding torque (nominal current)	mNm (oz-in)	1.85 (0.26)	
7 Holding torque (1.5 x nominal current) [1]	mNm (oz-in)	2.6 (0.37)	
8 Detent torque amplitude and friction	mNm (oz-in)	0.4 (0.06)	
Thermal parameters		min typ	max
9 Thermal resistance coil-ambient [2]	°C/W	100	
10 Coil temperature	°C		130
11 Operating ambient temperature	°C	-20	+50
Angular accuracy			
12 Absolute accuracy (2 ph. on full-step mode)	% full-step		±10
Mechanical parameters			
13 Rotor inertia	$kgm^2 \cdot 10^{-7}$	0.07	
14 Radial load	N	2.5	
15 Axial load [3]	N	2.5	
16 Radial shaft play (2N)	µm	30	
17 Axial shaft play (2N)	µm	40	

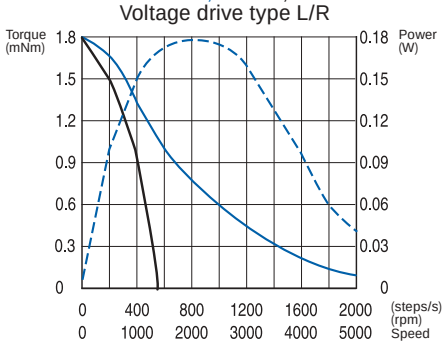
[1] Measurement with 1 phase on. The max. coil temperature must be respected

[2] Motor unmounted

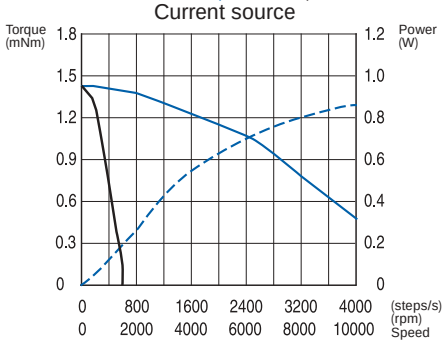
[3] Shaft must be supported when press-fitting a pulley or a pinion

With ball bearing

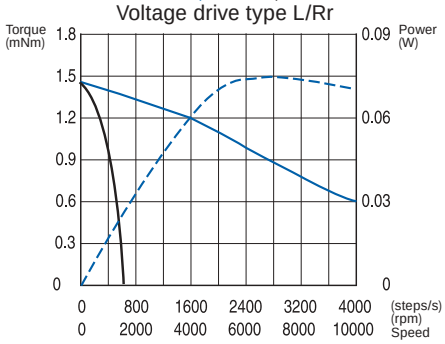
P010-064-020, U = 4V, Rs = 0 ohm
Voltage drive type L/R



P010-064-003, I = 0.6A, U = 12V
Current source



P010-064-003, U = 6V, Rs = 2.5 ohm
Voltage drive type L/Rr



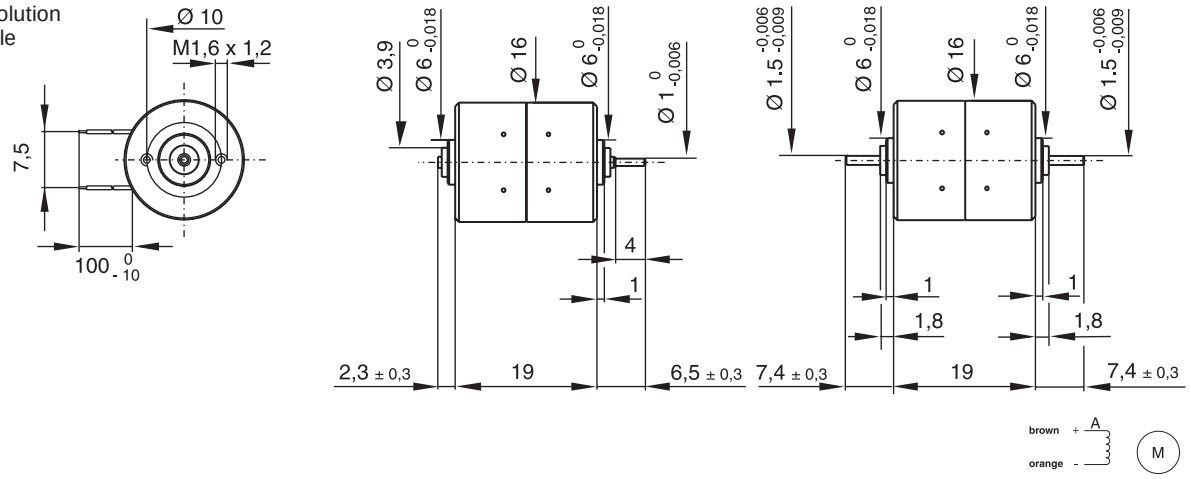
Pull-in range
Pull-out range
Power output
Pull-in is measured with a load inertia equal to the rotor inertia.

Turbo Disc™ P110

Suitable for microstep operation

Stepper motor

24 steps/revolution
15° step angle



scale: 1:1
dimensions in mm
mass: 23 g
lead wires: 100 0/-10 mm

P110-064 ▭ • 08

P110-064 ▭ • 12

Windings available ▭

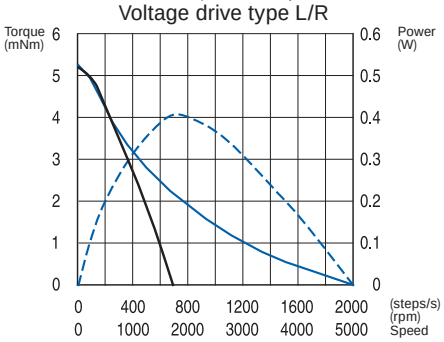
			068	015	2.5
Coil dependent parameters			typ	typ	typ
1	Phase resistance	ohm	62	15	2.5
2	Phase inductance (1 kHz)	mH	46	12	2.2
3	Nominal phase current (2 ph. on)	A	0.12	0.25	0.65
4	Nominal phase current (1 ph. on)	A	0.17	0.35	0.9
5	Back-EMF amplitude	V/kst/s	10.8	5.2	2
Coil independent parameters					
Torque parameters				typ	
6	Holding torque (nominal current)	mNm (oz-in)		7 (1.0)	
7	Holding torque (1.5 x nominal current) [1]	mNm (oz-in)		10 (1.4)	
8	Detent torque amplitude and friction	mNm (oz-in)		1 (0.1)	
Thermal parameters			min	typ	max
9	Thermal resistance coil-ambient [2]	°C/W		45	
10	Coil temperature	°C			130
11	Operating ambient temperature	°C	-20		+50
Angular accuracy					
12	Absolute accuracy (2 ph. on full-step mode)	% full-step		±3	±5
Mechanical parameters					
13	Rotor inertia	$kgm^2 \cdot 10^{-7}$		0.40	
14	Radial load	N		0.5	
15	Axial load [3]	N		0.5	
16	Radial shaft play (2N)	µm		30	
17	Axial shaft play (2N)	µm		40	

[1] Measurement with 1 phase on. The max. coil temperature must be respected

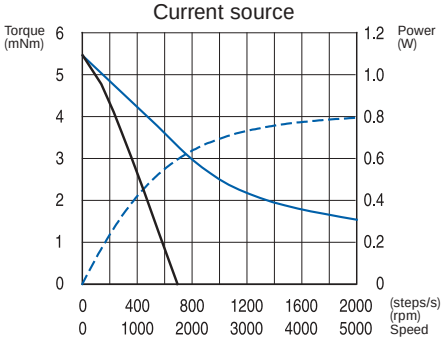
[2] Motor unmounted

[3] Shaft must be supported when press-fitting a pulley or a pinion

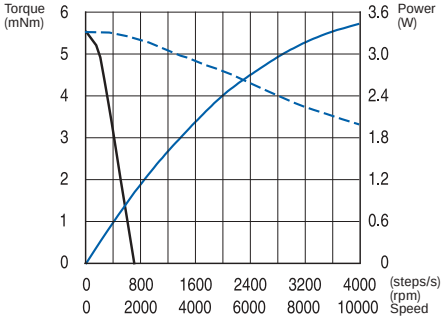
P110-064-015, U = 6V, Rs = 0 ohm
P110-064-068, U = 12V, Rs = 0 ohm
Voltage drive type L/R



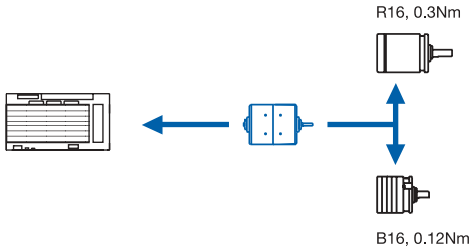
P110-064-015, U = 12V, Rs = 15 ohm
P110-064-068, U = 24V, Rs = 68 ohm
Current source



P110-064-2.5
Current chopper driver I = 0.9A, U = 24V



Pull-in range
Pull-out range
Power output
Pull-in is measured with a load inertia equal to the rotor inertia.

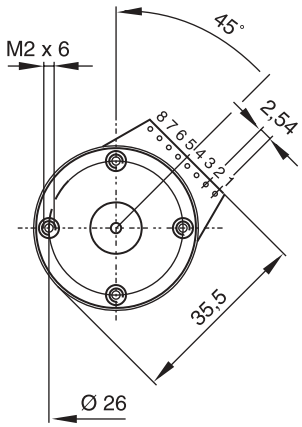


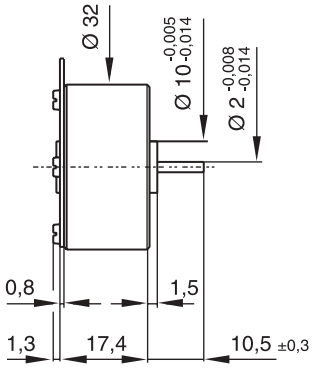
Turbo Disc™ P310

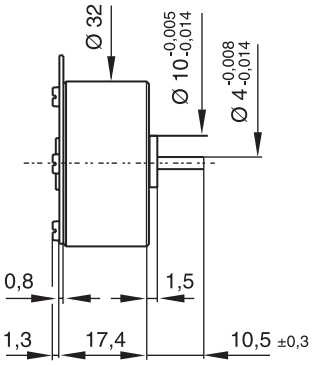
Suitable for microstep operation

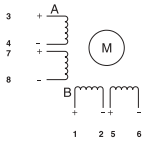
Stepper motor

60 steps/revolution
6° step angle









scale: 2:3
dimensions in mm
mass: 40 g

P310-158 [••••] • 09

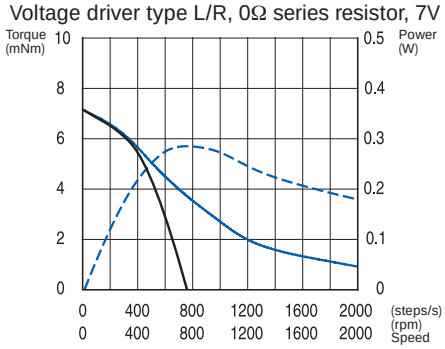
P310-158 [••••] • 10

Windings available [••••]

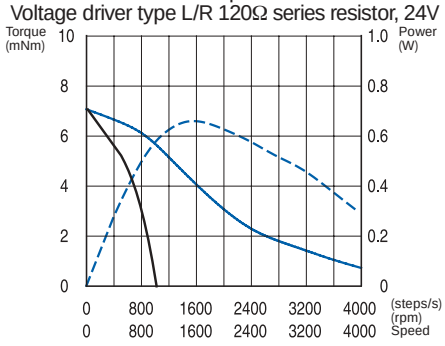
		170	170	005	005
		coils in series	coils in parallel	coils in series	coils in parallel
Coil dependent parameters		typ	typ	typ	typ
1 Phase resistance	ohm	332	83	10.5	2.6
2 Phase inductance (1 kHz)	mH	184	46	6.4	1.6
3 Nominal phase current (2 ph. on)	A	0.06	0.12	0.36	0.72
4 Nominal phase current (1 ph. on)	A	0.09	0.17	0.51	1
5 Back-EMF amplitude	V/kst/s	18	9	3.2	1.6
Coil independent parameters					
Torque parameters			typ		
6 Holding torque (nominal current)	mNm (oz-in)		14 (2)		
7 Holding torque (2 x nominal current) [1]	mNm (oz-in)		28 (4)		
8 Detent torque amplitude and friction	mNm (oz-in)		2.5 (0.3)		
Thermal parameters		min	typ	max	
9 Thermal resistance coil-ambient [2]	°C/W		25		
10 Coil temperature	°C			130	
11 Operating ambient temperature	°C	-20		+50	
Angular accuracy					
12 Absolute accuracy (2 ph. on full-step mode)	% full-step		±3.5	±5	
Mechanical parameters					
13 Rotor inertia	$kgm^2 \cdot 10^{-7}$		0.86		
14 Radial load	N		1 (10)*		
15 Axial load [3]	N		0.5 (20)*		
16 Radial shaft play (5N)	µm		35		
17 Axial shaft play (5N)	µm		100		

1) The maximum coil temperature must be respected
2) Motor unmounted
3) Load applied at 8 mm from mounting face
* Fitted with ball bearings

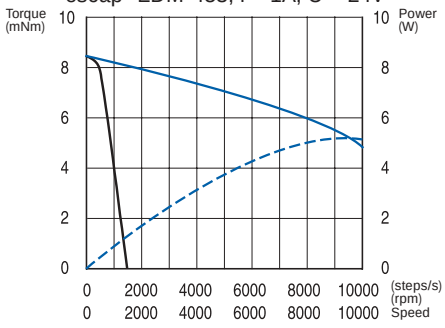
P310-158-005
Coils in serie
Voltage driver type L/R, 0Ω series resistor, 7V



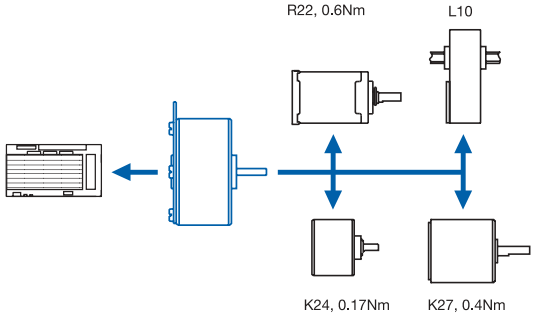
P310-158-170
Coils in parallel
Voltage driver type L/R 120Ω series resistor, 24V



P310-158-005
Coils in parallel
escap® EDM-453, I = 1A, U = 24V



Pull-in range
Pull-out range
Power output
Pull-in is measured with a load inertia equal to the rotor inertia.

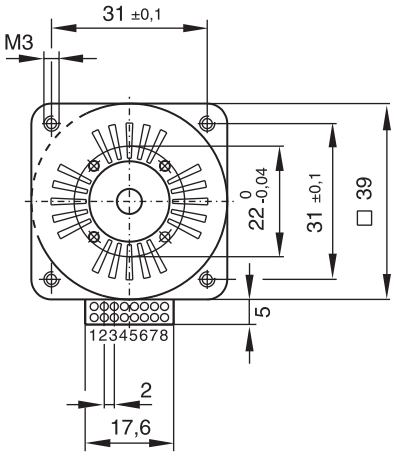


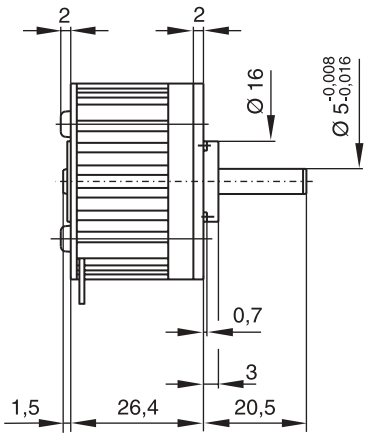
Turbo Disc™ P430

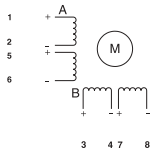
Suitable for microstep operation

Stepper motor

100 steps/revolution
3.6° step angle







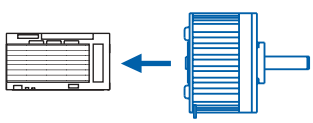
scale: 2:3
dimensions in mm
mass: 100 g

P430-258 [••••] • 01

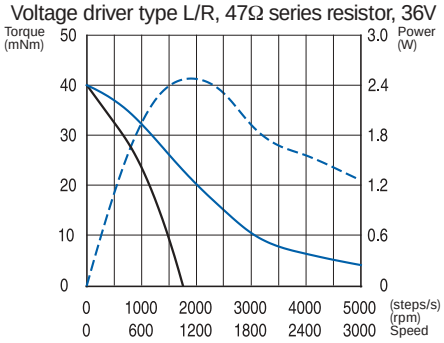
Windings available [••••]

			013	013	005	005
			coils in series	coils in parallel	coils in series	coils in parallel
Coil dependent parameters			typ	typ	typ	typ
1	Phase resistance	ohm	26	6.5	10	2.5
2	Phase inductance (1 kHz)	mH	40	10	14	3.5
3	Nominal phase current (2 ph. on)	A	0.34	0.68	0.56	1.12
4	Nominal phase current (1 ph. on)	A	0.5	1	0.8	1.6
5	Back-EMF amplitude	V/kst/s	7.5	3.8	4.7	2.3
Coil independent parameters						
Torque parameters				typ		
6	Holding torque (nominal current)	mNm (oz-in)		60 (8.5)		
7	Holding torque (2 x nominal current) [1]	mNm (oz-in)		90 (12.7)		
8	Detent torque amplitude and friction	mNm (oz-in)		3.5 (0.5)		
Thermal parameters			min	typ	max	
9	Thermal resistance coil-ambient [2]	°C/W		11		
10	Coil temperature	°C			130	
11	Operating ambient temperature	°C	-20		+50	
Angular accuracy						
12	Absolute accuracy (2 ph. on full-step mode)	% full-step		±3		
Mechanical parameters						
13	Rotor inertia	$kgm^2 \cdot 10^{-7}$		3		
14	Radial load	N		20		
15	Axial load [3]	N		30		
16	Radial shaft play (5N)	µm		15		
17	Axial shaft play (5N)	µm		10		

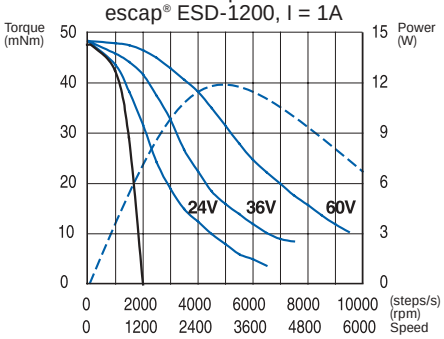
[1] The maximum coil temperature must be respected
[2] Motor unmounted
[3] Load applied at 12 mm from mounting face



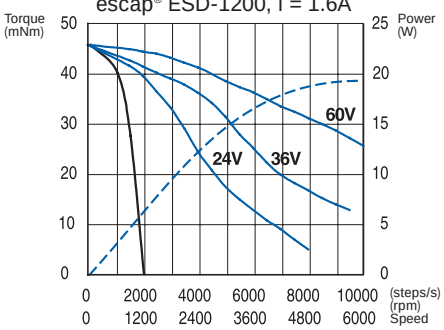
P430-258-013
Coils in serie
Voltage driver type L/R, 47Ω series resistor, 36V



P430-258-013
Coils in parallel
escap® ESD-1200, I = 1A



P430-258-005
Coils in parallel
escap® ESD-1200, I = 1.6A

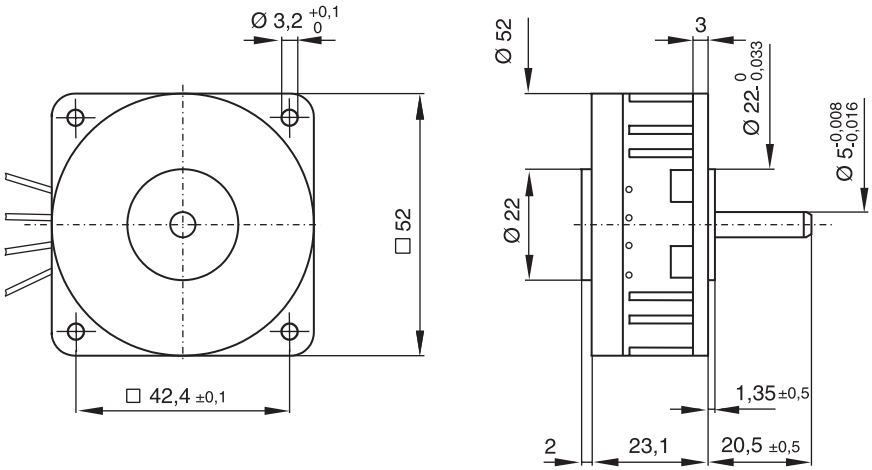


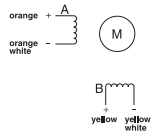
Pull-in range
Pull-out range
Power output
Pull-in is measured with a load inertia equal to the rotor inertia.

Turbo Disc™ P520

Suitable for microstep operation

100 steps/revolution
3.6° step angle





scale: 2:3
dimensions in mm
mass: 180 g
lead wires: 195 ±10 mm
0.25 mm² (AWG 24)

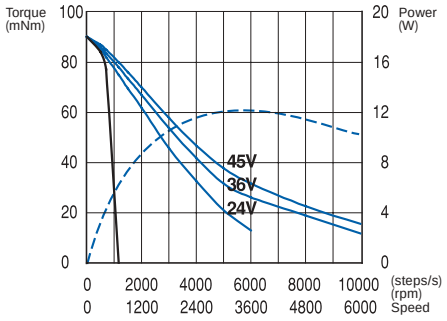
P520-254 ▪▪▪▪ • 60

Windings available ▪▪▪▪

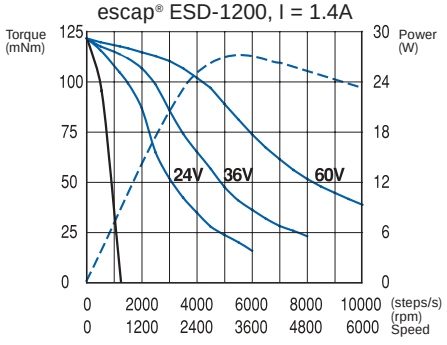
			013	004	0.7
Coil dependent parameters			typ	typ	typ
1	Phase resistance	ohm	13.5	4.4	0.7
2	Phase inductance (1 kHz)	mH	27	8	1.3
3	Nominal phase current (2 ph. on)	A	0.5	0.9	2.3
4	Nominal phase current (1 ph. on)	A	0.75	1.3	3.3
5	Back-EMF amplitude	V/kst/s	9.8	5.5	2.1
Coil independent parameters					
Torque parameters				typ	
6	Holding torque (nominal current)	mNm (oz-in)		120 (17)	
7	Holding torque (2 x nominal current) [1]	mNm (oz-in)		205 (29)	
8	Detent torque amplitude and friction	mNm (oz-in)		10 (1.4)	
Thermal parameters			min	typ	max
9	Thermal resistance coil-ambient [2]	°C/W		9.5	
10	Coil temperature	°C			130
11	Operating ambient temperature	°C	-20		+50
Angular accuracy					
12	Absolute accuracy (2 ph. on full-step mode)	% full-step		±3	±5
Mechanical parameters					
13	Rotor inertia	$kgm^2 \cdot 10^{-7}$		12	
14	Radial load	N		20	
15	Axial load [3]	N		30	
16	Radial shaft play (5N)	µm		15	
17	Axial shaft play (5N)	µm		10	

[1] The maximum coil temperature must be respected
[2] Motor unmounted
[3] Load applied at 12 mm from mounting face

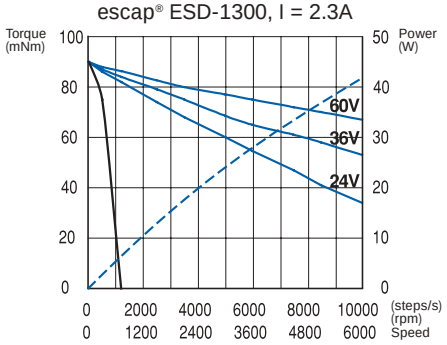
P520-254-004
escap® ESD-453, I = 1.3A



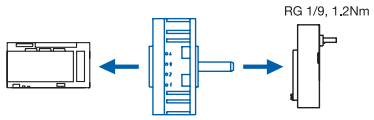
P520-254-004
escap® ESD-1200, I = 1.4A



P520-254-0.7
escap® ESD-1300, I = 2.3A



Pull-in range
Pull-out range
Power output
Pull-in is measured with a load inertia equal to the rotor inertia.

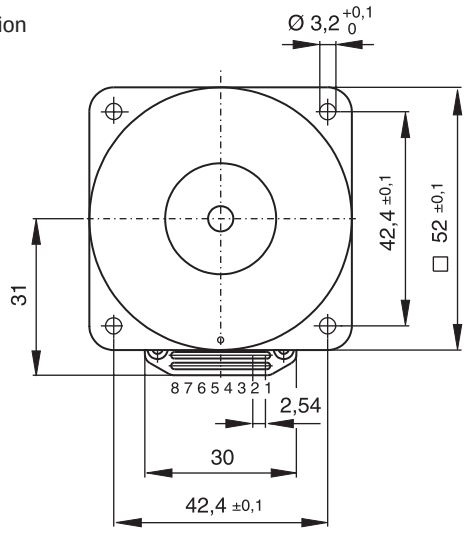


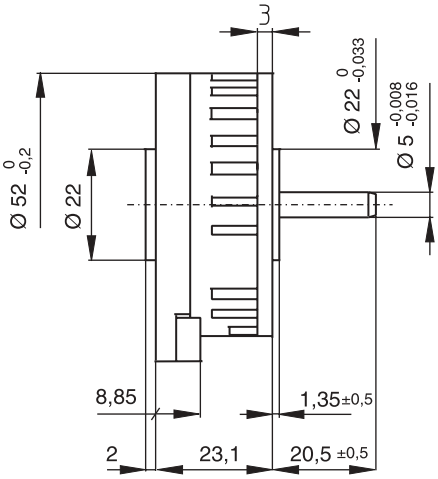
Turbo Disc™ PP520

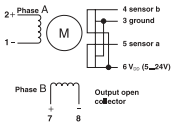
With integrated position sensors

Stepper motor

100 steps/revolution
3.6° step angle





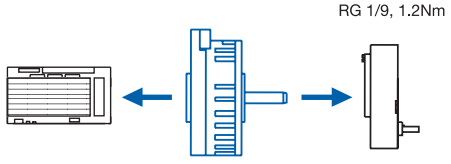


scale: 2:3
dimensions in mm
mass: 170 g

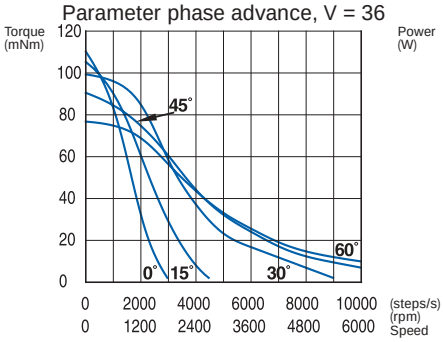
PP520-258 [••••] • 01

Windings available	[••••]	013	004	0.7
Coil dependent parameters		typ	typ	typ
1 Phase resistance	ohm	13.5	4.4	0.7
2 Phase inductance (1 kHz)	mH	27	8	1.3
3 Nominal phase current (2 ph. on)	A	0.5	0.9	2.3
4 Nominal phase current (1 ph. on)	A	0.75	1.3	3.3
5 Back-EMF amplitude	V/kst/s	9.8	5.5	2.1
Coil independent parameters				
Torque parameters			typ	
6 Holding torque (nominal current)	mNm (oz-in)		120 (17)	
7 Holding torque (2 x nominal current) [1]	mNm (oz-in)		205 (29)	
8 Detent torque amplitude and friction	mNm (oz-in)		10 (1.4)	
Thermal parameters		min	typ	max
9 Thermal resistance coil-ambient [2]	°C/W		9.5	
10 Coil temperature	°C			130
11 Operating ambient temperature	°C	-20		+50
Angular accuracy				
12 Absolute accuracy (2 ph. on full-step mode)	% full-step		±3	±5
Mechanical parameters				
13 Rotor inertia	$kgm^2 \cdot 10^{-7}$		12	
14 Radial load	N		20	
15 Axial load [3]	N		30	
16 Radial shaft play (5N)	µm		15	
17 Axial shaft play (5N)	µm		10	
Hall sensor				
18 Supply voltage	V	5		24
19 Operating temperature	°C	-40		125
20 Signal periods per revolution	-		25	
21 Elec. angle between motor ph./hall signal	degrees	35	45	55

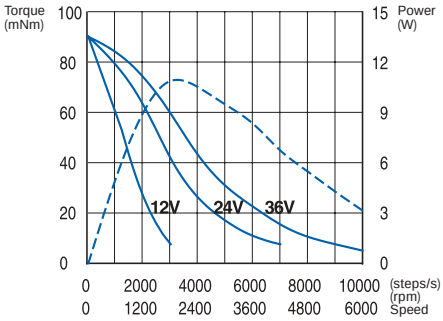
[1] The maximum coil temperature must be respected
[2] Motor unmounted
[3] Load applied at 12 mm from mounting face



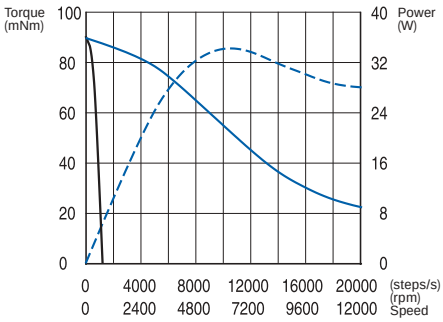
PP520-258-004
Autocommutation mode.
Parameter phase advance, V = 36



PP520-258-004
Autocommutation mode, Phase advance 45°



PP520-258-0.7
escap® ESD-1300, U = 36V



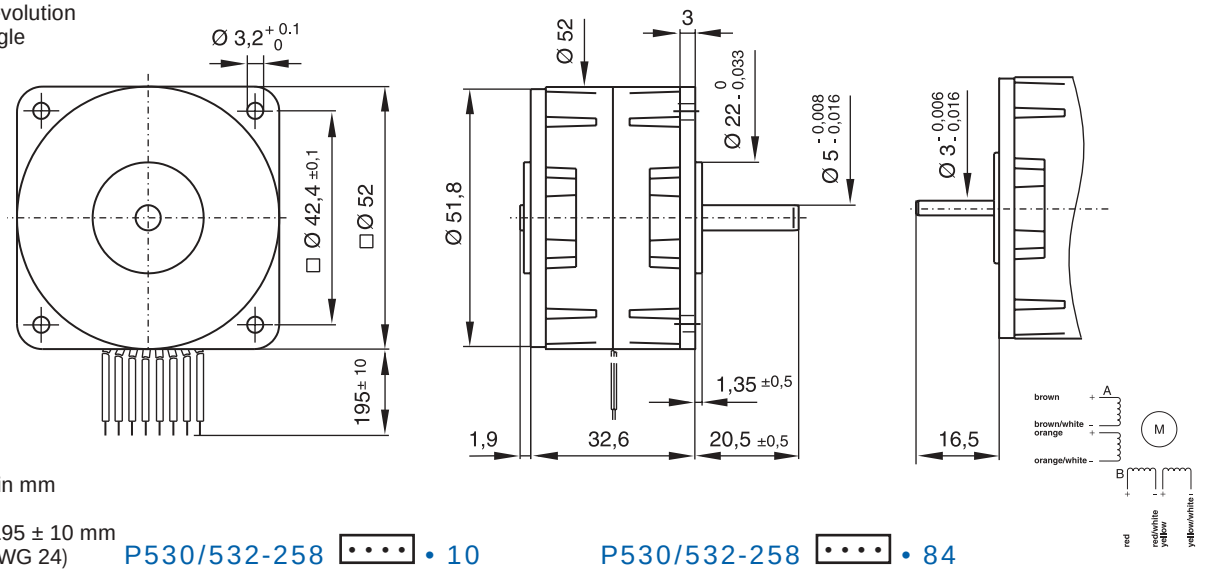
Pull-in range
Pull-out range
Power output
Pull-in is measured with a load inertia equal to the rotor inertia.

Turbo Disc™ P530/P 532

Stepper motor

P530 Suitable for microstep operation/P532 recommended for hall-/full step mode

100 steps/revolution
3.6° step angle



scale: 2:3
dimensions in mm
mass: 250 g
lead wires: 195 ± 10 mm
0.25 mm² (AWG 24)

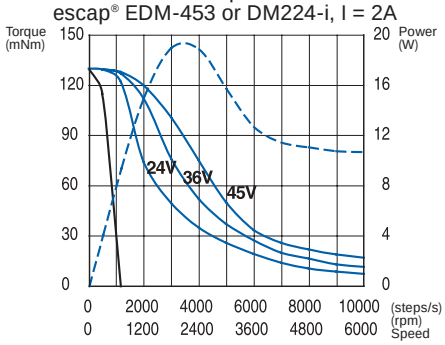
P530/532-258 [••••] • 10

P530/532-258 [••••] • 84

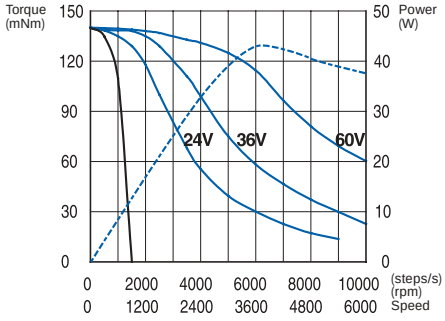
Windings available [••••]		P530/P532 012	004	004	0.7
		coils in series	coils in series	coils in parallel	coils in parallel
Coil dependent parameters		typ	typ	typ	typ
1 Phase resistance	ohm	27	8.8	2.2	0.35
2 Phase inductance (1 kHz)	mH	64	20	5	0.7
3 Nominal phase current (2 ph. on)	A	0.4	0.7	1.4	3.7
4 Nominal phase current (1 ph. on)	A	0.56	1	2	5.2
5 Back-EMF amplitude	V/kst/s	20	11	5.5	2.1
Coil independent parameters					
Torque parameters			typ		
6 Holding torque (nominal current)	mNm (oz-in)		1175 (25)/ 205 (29)		
7 Holding torque (2 x nominal current) [1]	mNm (oz-in)		300 (42.5)/ 360 (51)		
8 Detent torque amplitude and friction	mNm (oz-in)		10 (1.4)/ 28 (4)		
Thermal parameters			min	typ	max
9 Thermal resistance coil-ambient [2]	°C/W			7.3	
10 Coil temperature	°C				130
11 Operating ambient temperature	°C		-20		+50
Angular accuracy					
12 Absolute accuracy (2 ph. on full-step mode)	% full-step			±3	±5
Mechanical parameters					
13 Rotor inertia	kgm²·10⁻⁷			12	
14 Radial load	N			20	
15 Axial load [3]	N			30	
16 Radial shaft play (5N)	µm			25	
17 Axial shaft play (5N)	µm			25	

[1] The maximum coil temperature must be respected
[2] Motor unmounted
[3] Load applied at 12 mm from mounting face

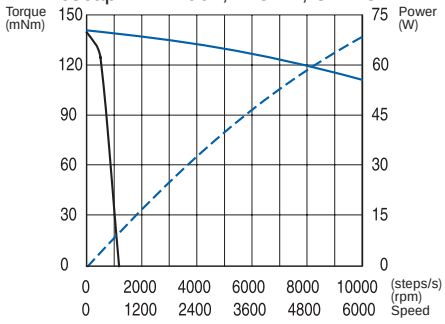
P530-258-004
Coils in parallel
escap® EDM-453 or DM224-i, I = 2A



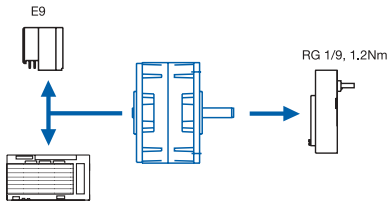
P530-258-004
Coils in parallel
escap® EDM-1200 or DM224-i, I = 2A



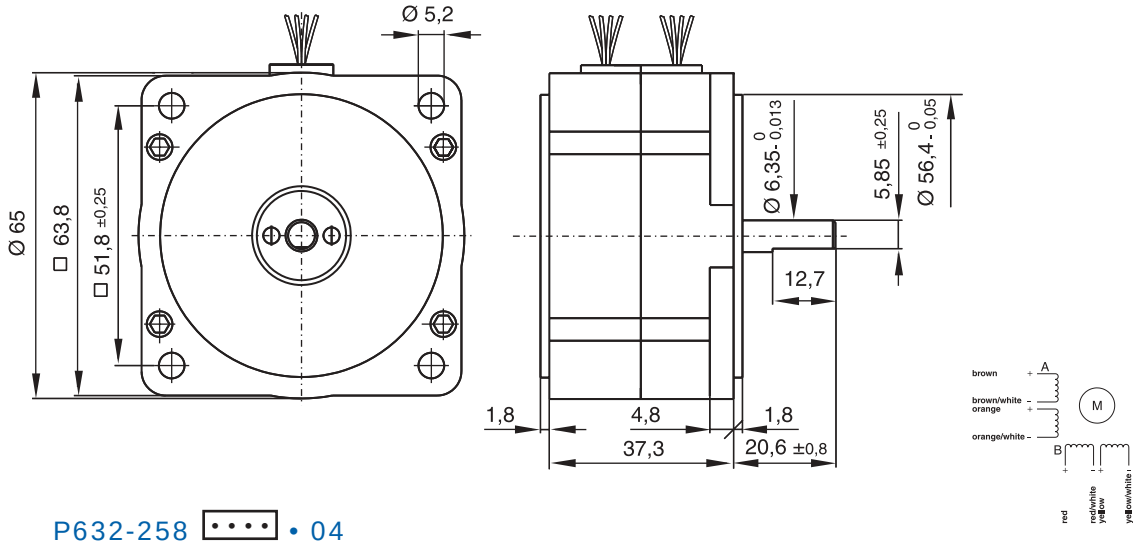
P530-258-0.7
Coils in parallel
escap® EDM-907, I =5.2A, U = 75V



Pull-in range
Pull-out range
Power output
Pull-in is measured with a load inertia equal to the rotor inertia.



100 steps/revolution
3.6° step angle



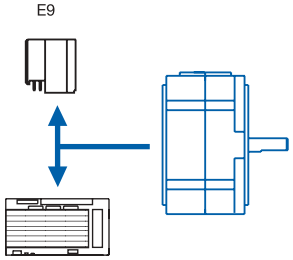
scale: 2:3
dimensions in mm
mass: 430 g

P632-258 [••••] • 04

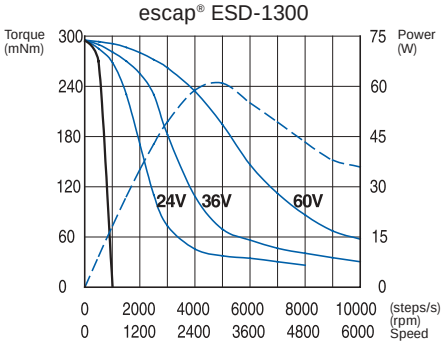
Windings available [••••]

		C	C	B	B
		coils in series	coils in parallel	coils in series	coils in parallel
Coil dependent parameters		typ	typ	typ	typ
1 Phase resistance	ohm	2.5	0.63	1.55	0.39
2 Phase inductance (1 kHz)	mH	4.8	1.2	2.7	0.68
3 Nominal phase current (2 ph. on)	A	1.4	2.8	1.8	3.6
4 Nominal phase current (1 ph. on)	A	1.9	3.8	2.5	5
5 Back-EMF amplitude	V/kst/s	10.6	5.3	8	4
Coil independent parameters					
Torque parameters			typ		
6 Holding torque (nominal current)	mNm (oz-in)		320 (45.3)		
7 Holding torque (2 x nominal current) [1]	mNm (oz-in)		600 (84.9)		
8 Detent torque amplitude and friction	mNm (oz-in)		35 (4.9)		
Thermal parameters		min	typ	max	
9 Thermal resistance coil-ambient [2]	°C/W		3.8		
10 Coil temperature	°C			155	
11 Operating ambient temperature	°C	-20		+50	
Angular accuracy					
12 Absolute accuracy (2 ph. on full-step mode)	% full-step		±3	±5	
Mechanical parameters					
13 Rotor inertia	$kgm^2 \cdot 10^{-7}$		39		
14 Radial load	N		20		
15 Axial load [3]	N		30		
16 Radial shaft play (20N)	µm		25		
17 Axial shaft play (30N)	µm		25		

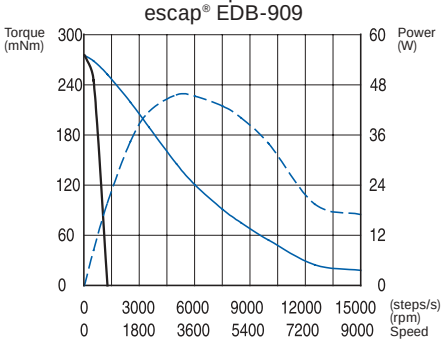
[1] The maximum coil temperature must be respected
[2] Motor mounted to an aluminium plate 10 x 20 x 1.3 cm
[43] Load applied at 12 mm from mounting face



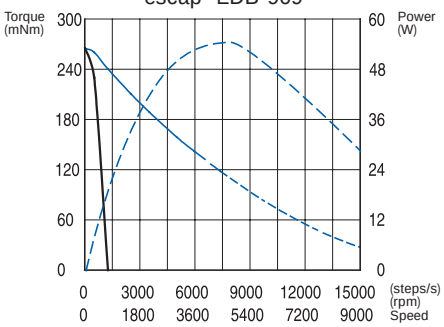
P632-258
Coils in series
escap® ESD-1300



P632-258-C
Coils in parallel
escap® EDB-909



P632-258-B
Coils in parallel
escap® EDB-909



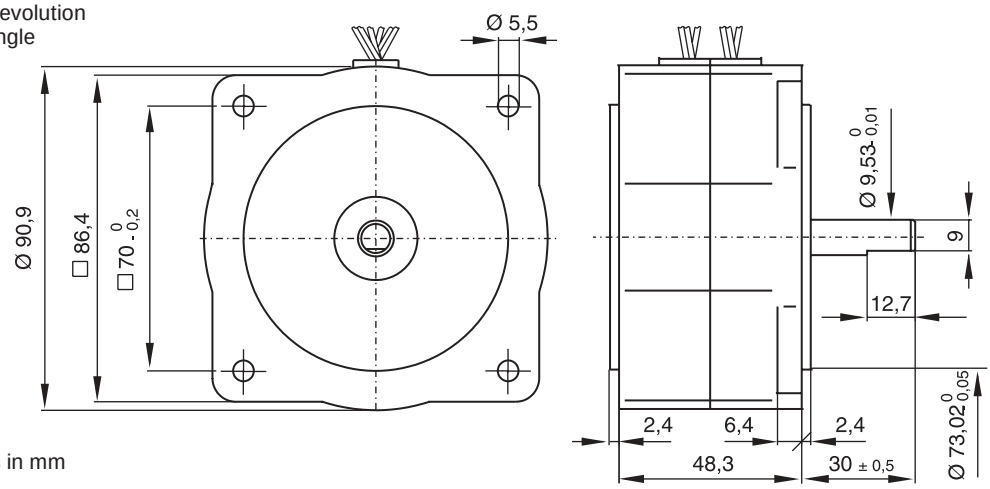
Pull-in range
Pull-out range
Power output
Pull-in is measured with a load inertia equal to the rotor inertia.

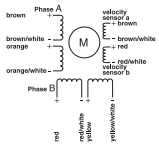
Turbo Disc™ P850/P 852

Stepper motor

P850 Suitable for microstep operation/P852 recommended for hall-/full step mode

200 steps/revolution
1.8° step angle





scale: 1:2
dimensions in mm
mass: 1 kg
lead wires: 380 ± 15 mm
0.35 mm² (AWG 22)
protection class IP 54

P850/852- •••• • 11

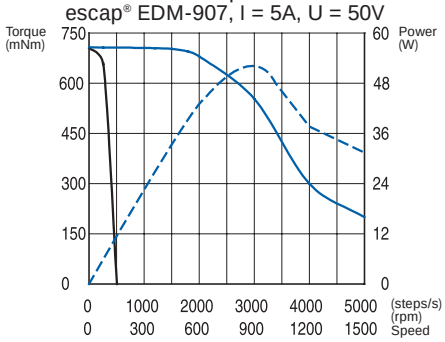
Windings available

		P850	P850	P852	P852
	••••	C	C	B	B
		coils in series	coils in parallel	coils in series	coils in paralle
Coil dependent parameters		typ	typ	typ	typ
1 Phase resistance	ohm	2.6	0.65	0.97	0.24
2 Phase inductance (1 kHz)	mH	6.4	1.6	3.2	0.8
3 Nominal phase current (2 ph. on)	A	1.8	3.6	2.3	4.6
4 Nominal phase current (1 ph. on)	A	2.5	5	3.2	6.4
5 Back-EMF amplitude	V/kst/s	9.6	4.8	10.4	5.1

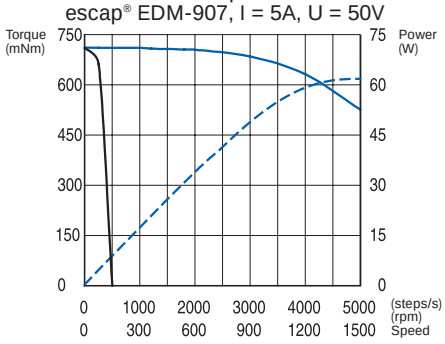
Coil independent parameters				
Torque parameters		typ		
6 Holding torque (nominal current)	mNm (oz-in)	780 (1110) / 1060 (150)		
7 Holding torque (2 x nominal current) [1]	mNm (oz-in)	1340 (190) / 1880 (266)		
8 Detent torque amplitude and friction	mNm (oz-in)	28 (3.9) / 110 (15.6)		
Thermal parameters		min	typ	max
9 Thermal resistance coil-ambient [2]	°C/W		2.6	
10 Coil temperature	°C		155	
11 Operating ambient temperature	°C	-20		+50
Angular accuracy				
12 Absolute accuracy (2 ph. on full-step mode)	% full-step		±3	±6
Mechanical parameters				
13 Rotor inertia	$kgm^2 \cdot 10^{-7}$		150	
14 Radial load	N		44	
15 Axial load [3]	N		66	
16 Radial shaft play (20N)	µm		25	
17 Axial shaft play (30N)	µm		25	

[1] The maximum coil temperature must be respected
[2] Motor unmounted
[3] Load applied at 12 mm from mounting face

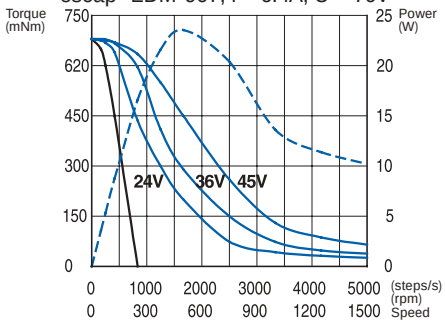
P850/P852-508-C
Coils in parallel
escap® EDM-907, I = 5A, U = 50V



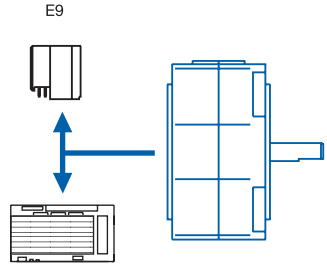
P850/P852-508-C
Coils in parallel
escap® EDM-907, I = 5A, U = 50V



P850/P852-508-B
Coils in parallel
escap® EDM-907, I = 6.4A, U = 70V



Pull-in range
Pull-out range
Power output
Pull-in is measured with a load inertia equal to the rotor inertia.



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Small Brushless DC Motors
Petits Moteurs C.C. sans balai
Kleine bürstenlose DC Motoren

Glossary
Glossaire
Glossar

Winding type

	Coil dependent parameters	
1	Phase / phase resistance	Ohm
2	Phase / phase inductance	mH
3	Back-EMF constant	V/1000 rpm
3	Torque constant	mNm/A (oz-in/A)
	Dynamic parameters	
3	Rated voltage	V
6	No-load current	A
7	No-load speed	rpm
8	Max. continuous stall torque	mNm (oz-in)
9	Max. continuous stall current	A
10	Max. continuous torque at 10 krpm	mNm (oz-in)
11	Max. continuous current at 10 krpm	A
12	Max. continuous power at 10 krpm	W
	Intrinsic parameters	
13	Motor constant	mNm/$W^{1/2}$ (oz-in/$W^{1/2}$)
14	Rotor inertia	$kgm^2 \cdot 10^{-7}$
15	Mechanical time constant	ms
16	Electrical time constant	ms
17	Thermal resistance	°C/W

Types de bobines

	Paramètres dépendants de la bobine	
1	Résistance de phase	Ohm
2	Inductance de phase	mH
3	FEM d'une bobine	V/1000 rpm
4	Constante de couple	mNm/A (oz-in/A)
	Paramètres dynamiques	
5	Tension nominale	V
6	Courant à vide	A
7	Vitesse à vide	rpm
8	Couple bloqué continu max.	mNm (oz-in)
9	Courant bloqué continu max.	A
10	Couple continu max. à 10'000 t/min	mNm (oz-in)
11	Courant continu max. à 10'000 t/min	A
12	Puissance continue max. à 10'000 t/min	W
	Paramètres intrinsèques	
13	Constante du moteur	mNm/$W^{1/2}$ (oz-in/$W^{1/2}$)
14	Inertie du rotor	$kgm^2 \cdot 10^{-7}$
15	Constante de temps mécanique	ms
16	Constante de temps électrique	ms
17	Résistance thermique	°C/W

Wicklungstyp

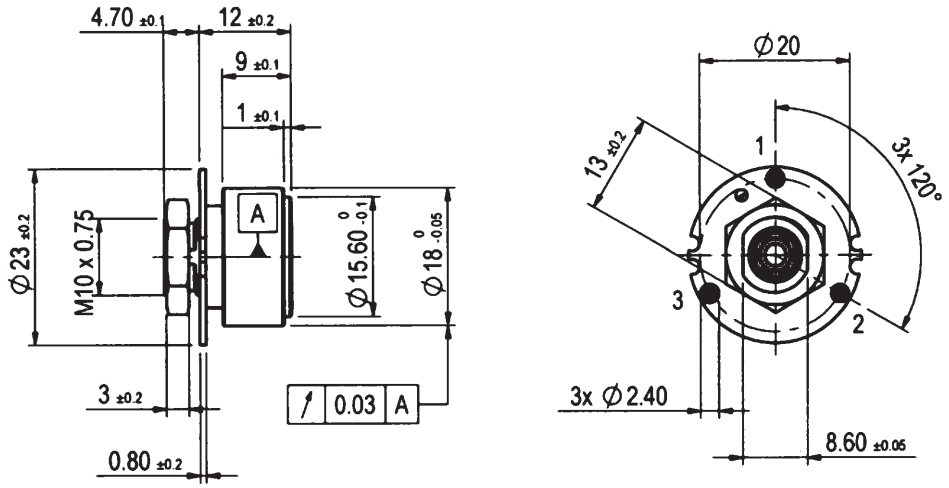
	Wicklungsabhängige Parameter	
1	Anschlußwiderstand Phase/Phase	ohm
2	Anschlußinduktivität Phase/Phase	mH
3	Gegen-EMK Konstante	V/1000 rpm
4	Drehmomentkonstante	mNm/A (oz-in/A)
	Wicklungsunbhängige Parameter	
5	Nennspannung	V
6	Leerlaufstrom	A
7	Leerlaufdrehzahl	rpm
8	Max. Daueranhaltemoment	mNm (oz-in)
9	Max. Daueranhaltestrom	A
10	Max. Dauerdrehmoment. bei 10'000 Upm	mNm (oz-in)
11	Max. Dauerbelastungsstrom bei 10'000 Upm	A
12	Max. Dauerleistung bei 10'000 Upm	W
	Spezifische Parameter	
13	Motorkonstante	mNm/$W^{1/2}$ (oz-in/$W^{1/2}$)
14	Rotorträgheitsmoment	$kgm^2 \cdot 10^{-7}$
15	Mechanische Zeitkonstante	ms
16	Elektrische Zeitkonstante	ms
17	Thermischer Widerstand	°C/W

Thermal time constant	Constante de temps thermique	Thermische Zeitkonstante
Thermal resistance	Résistance thermique	Wärmewiderstand
Axial play	Jeu axial	Axialspiel
Radial play (2.5N rad.load)	Jeu radial (2.5N rad.load)	Radialspiel
Axial load (static)	Charge axiale (statique)	Axiallast (statisch)
Radial load (static)	Charge radiale (statique)	Radiallast (statisch)
mn	mn	mn
°C/W	°C/W	°C/W
µm	µm	µm
µm	µm	µm
N	N	N
N	N	N

escap 18BT

BLDC Motor

Moteur pour commutation électronique sans capteur
Tube extérieur tournant



scale: 1:1
dimensions in mm
mass: 16 g

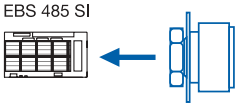
18BT-3C ⊡ • 02

Connections

Pin	Designation
1	phase 1
2	phase 2
3	phase 3

Winding type	⊡	-L
Coil dependent parameters		
1 Phase / phase resistance	ohm	58.0
2 Phase / phase inductance	mH	2.3
3 Back-EMF constant	V/1000 rpm	0.70
4 Torque constant	mNm/A (oz-in/A)	6.68 (0.95)
Dynamic parameters		
5 Rated voltage	V	15.0
6 No-load current	A	0.015
7 No-load speed	rpm	5900
8 Max. continuous stall torque	mNm (oz-in)	1.2 (0.17)
9 Max. continuous stall current	A	0.20
10 Max. continuous torque at 10 krpm	mNm (oz-in)	1.2 (0.17)
11 Max. continuous current at 10 krpm	A	0.20
12 Max. continuous power at 10 krpm	W	4.6
Intrinsic parameters		
13 Motor constant	$mNm/W^{1/2}$ ($oz\text{-}in/W^{1/2}$)	0.9 (0.12)
14 Rotor inertia	$kgm^2 \cdot 10^{-7}$	5.3
15 Mechanical time constant	ms	688
16 Electrical time constant	ms	0.04
17 Thermal resistance	°C/W	30

EBS 485 SI

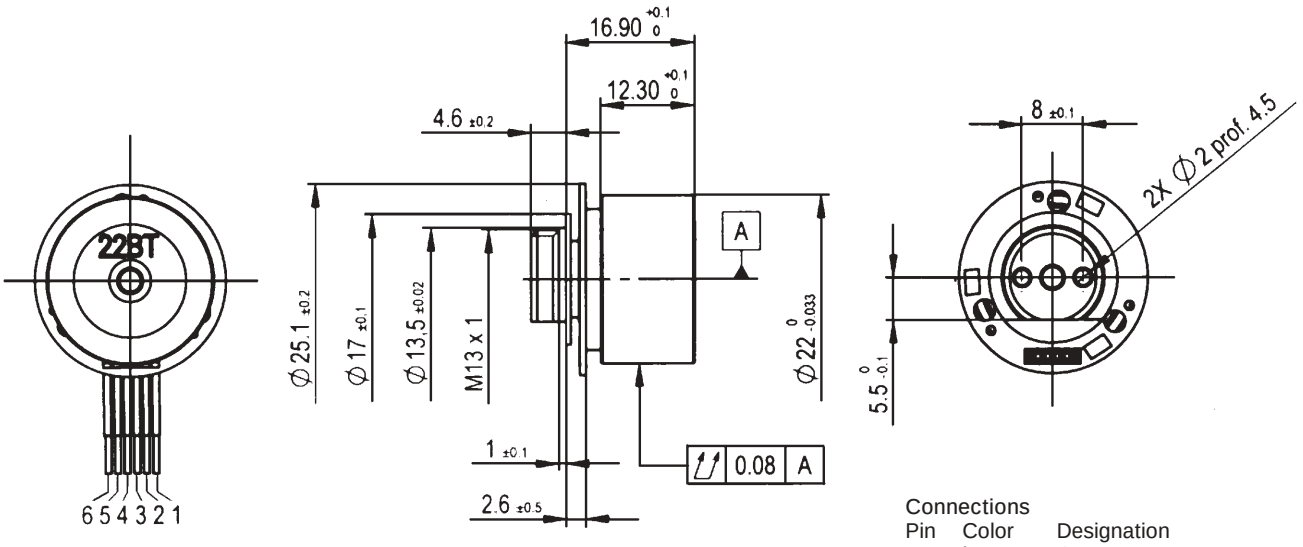


- Motor with preloaded ball bearings
- Typical preload = 3.0 N
- Maximum external load:
  - axial static: 40 N
  - axial dynamic: 3 N
  - radial dynamic: 7 N
- Operating temperature range: -40°C to +100°C
- Max. rated coil temperature: 125°C
- The rotor is not balanced

The 18BT-3C is a sensorless motor with a delta-connected winding. It is intended to use with a sensorless driver such as the EBS 485 SI or a driver using, for instance, a chip of the Philips TDA family. If the winding center-point is needed, it can be generated by using three external resistors attached to the motor phases and Y-connected together.

escap 22BT

D.C. Motor with integrated electronic commutation and rotating external tube



Connections

Pin	Color	Designation
1	brown	GND
2	red	power supply voltage [1]
3	orange	direction CCW/CW [4]
4	yellow	enable start/stop [4]
5	green	logic supply voltage [2]
6	blue	speed signal [3]

scale: 1:1
dimensions in mm
mass: 32 g

22BT-6A ⊡ • 05

Winding type	⊡	-P
Coil dependent parameters		
1 Phase / phase resistance	ohm	8.2
2 Phase / phase inductance	mH	0.33
3 Back-EMF constant	V/1000 rpm	0.59
4 Torque constant	mNm/A (oz-in/A)	5.63 (0.80)
Dynamic parameters		
5 Rated voltage	V	5.0
6 No-load current	A	0.071
7 No-load speed	rpm	7500
8 Max. continuous stall torque	mNm (oz-in)	3.0 (0.43)
9 Max. continuous stall current	A	0.60
10 Max. continuous torque at 10 krpm	mNm (oz-in)	2.8 (0.40)
11 Max. continuous current at 10 krpm	A	0.57
12 Max. continuous power at 10 krpm	W	7.2
Intrinsic parameters		
13 Motor constant	$mNm/W^{1/2}$ ($oz\text{-}in/W^{1/2}$)	2.0 (0.28)
14 Rotor inertia	$kgm^2 \cdot 10^{-7}$	17.7
15 Mechanical time constant	ms	457
16 Electrical time constant	ms	0.04
17 Thermal resistance	°C/W	24

- Motor with preloaded ball bearings
- Typical preload = 3.5 N
- Maximum external load:
  - axial static: 50 N
  - axial dynamic: 5 N
  - radial dynamic: 10 N
- Operating temperature range: -0°C to +70°C
- Max. rated coil temperature: 125°C
- Rotor not balanced
- Integrated electronic commutation
- Warning: an incorrect supply voltage polarity may damage the electronic circuitry!

[1] The motor supply voltage may vary between 2.5 V and 10 V. The use of Mosfets in the power stage provides a very low voltage drop.

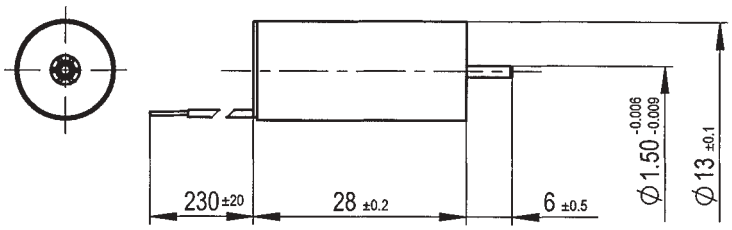
[2] The logic supply voltage may vary between 5 V and 10 V. By connecting pin 2 and pin 5 together, the motor becomes a two-wire version identical to a DC motor. In this case, the supply voltage may only vary between 5 V and 10 V.

[3] A square wave voltage with one pulse per revolution is available on pin 6 low level = OV/high level = same as on pin 5.

[4] Pins 3 and 4 have pull up resistor of 120 kohm.

escap 13BC

Electronically commutated sensorless motor



scale: 1:1
dimensions in mm
mass: 19 g

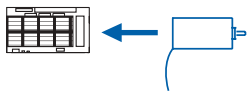
13BC-3C ⊡ • 05

Connections

Color	Designation
white	phase 1
grey	phase 2
violet	phase 3

Winding type	⊡	-H	-P
Coil dependent parameters			
1 Phase / phase resistance	ohm	14.8	5.6
2 Phase / phase inductance	mH	0.44	0.17
3 Back-EMF constant	V/1000 rpm	0.69	0.46
4 Torque constant	mNm/A (oz-in/A)	6.59 (0.93)	4.39 (0.62)
Dynamic parameters			
5 Rated voltage	V	10	10
6 No-load current	A	0.068	0.114
7 No-load speed	rpm	11600	18200
8 Max. continuous stall torque	mNm (oz-in)	1.8 (0.3)	1.9 (0.3)
9 Max. continuous stall current	A	0.34	0.55
10 Max. continuous torque at 10 krpm	mNm (oz-in)	1.6 (0.2)	1.7 (0.2)
11 Max. continuous current at 10 krpm	A	0.31	0.49
12 Max. continuous power at 10 krpm	W	4.1	4.1
Intrinsic parameters			
13 Motor constant	$mNm/W^{1/2}$ ($oz\text{-}in/W^{1/2}$)	1.7 (0.2)	1.9 (0.3)
14 Rotor inertia	$kgm^2 \cdot 10^{-7}$	0.22	0.22
15 Mechanical time constant	ms	7	6
16 Electrical time constant	ms	0.03	0.03
17 Thermal resistance	°C/W	42	42

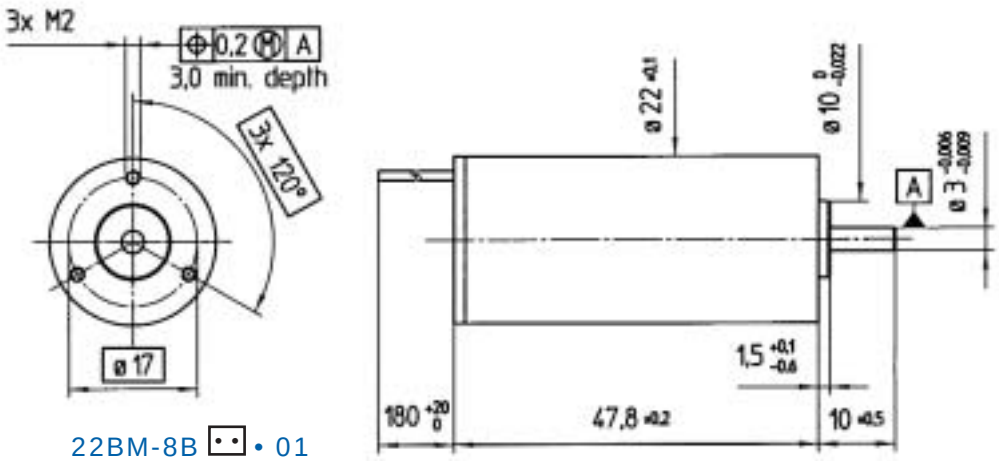
EBS 485 SI



The 13BC-3C is a sensorless motor with a delta-connected winding. It is intended to use with a sensorless driver such as the EBS 485 SI or a driver using, for instance, a chip of the Philips TDA family. If the winding center-point is needed, it can be generated by using three external resistors attached to the motor phases and Y-connected together.

escap 22BM

Electronically commutated motor



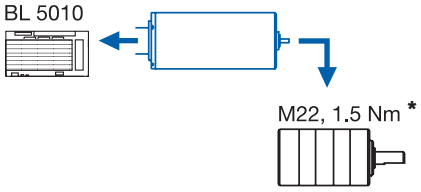
22BM-8B ⊡ • 01

With Hall effect sensors

Color	Designation
grey	phase 1
violet	phase 2
blue	phase 3
green	4.5 to 24 VDC
yellow	GND
orange	sensor 1
red	sensor 2
brown	sensor 3

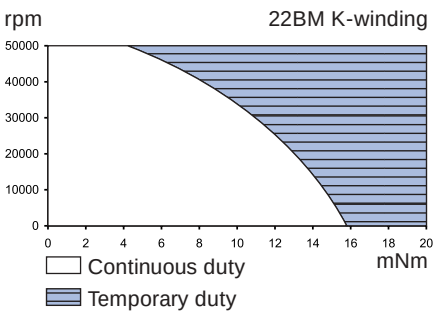
scale: 1:1
dimensions in mm
mass: 100 g

Winding type	⊡	-C	-K	-P
Coil dependent parameters				
1 Phase / phase resistance	ohm	14.36	0.63	0.34
2 Phase / phase inductance	mH	0.57	0.03	0.01
3 Back-EMF constant	V/1000 rpm	2.68	0.65	0.45
4 Torque constant	mNm/A (oz-in/A)	25.59 (3.62)	6.21 (0.87)	4.30 (0.60)
Dynamic parameters				
5 Rated voltage	V	30	24	24
6 No-load current	A	0.03	0.16	0.30
7 No-load speed	rpm	11000	36800	53100
8 Max. continuous stall torque	mNm (oz-in)	13.5 (1.91)	15.6 (2.20)	14.3 (2.02)
9 Max. continuous stall current	A	0.6	2.7	3.6
10 Max. continuous torque at 10 krpm	mNm (oz-in)	12.5 (1.77)	14.1 (1.99)	12.5 (1.77)
11 Max. continuous current at 10 krpm	A	0.5	2.4	3.2
12 Max. continuous power at 10 krpm	W	19.4	21.0	19.4
Intrinsic parameters				
13 Motor constant	$mNm/W^{1/2}$ ($oz\text{-}in/W^{1/2}$)	6.8 (0.96)	7.8 (1.10)	7.4 (1.04)
14 Rotor inertia	$kgm^2 \cdot 10^{-7}$	3.0	3.0	3.0
15 Mechanical time constant	ms	6.6	4.9	5.5
16 Electrical time constant	ms	0.04	0.04	0.04
17 Thermal resistance	°C/W	16	16	16



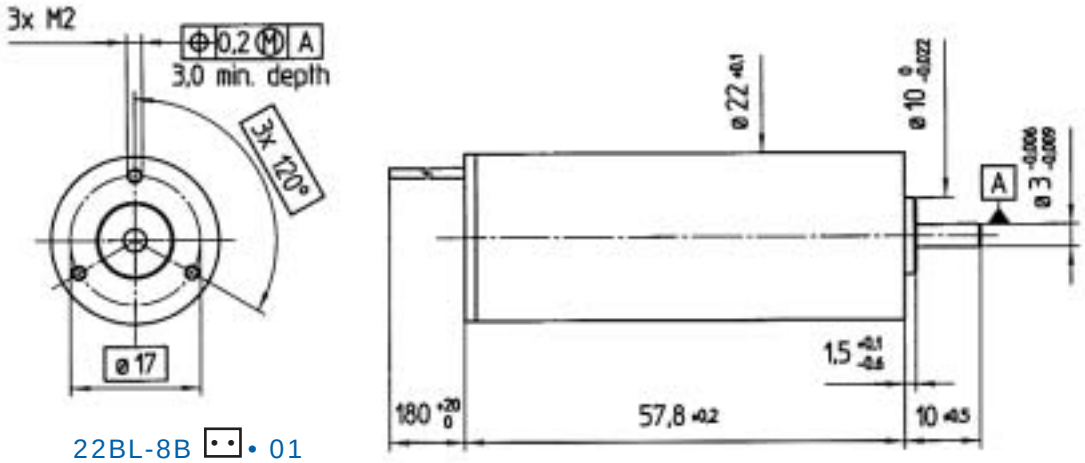
- Motor with preloaded ball bearings
- Typical preload = 6 N
- Maximum external load:
  - axial static: 50 N
  - axial dynamic: 5 N
  - radial dynamic: 10 N
- Operating temperature range: -40°C to +100°C
- Max. rated coil temperature: 125°C

* Except ratios with multiples of 5



escap 22BL

Electronically commutated motor



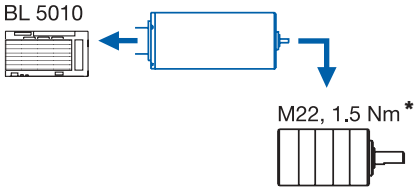
22BL-8B ⊡• 01

With Hall effect sensors

Color	Designation
grey	phase 1
violet	phase 2
blue	phase 3
green	4.5 to 24 VDC
yellow	GND
orange	sensor 1
red	sensor 2
brown	sensor 3

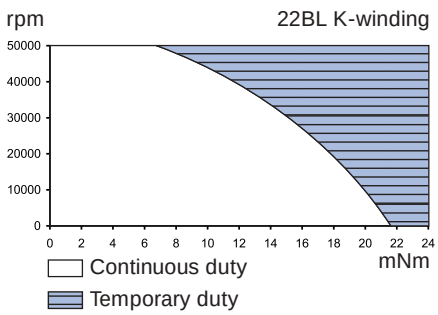
scale: 1:1
dimensions in mm
mass: 125 g

Winding type		-K	-P
Coil dependent parameters			
1 Phase / phase resistance	ohm	0.77	0.41
2 Phase / phase inductance	mH	0.03	0.02
3 Back-EMF constant	V/1000 rpm	0.94	0.65
4 Torque constant	mNm/A (oz-in/A)	8.98 (1.27)	6.21 (0.88)
Dynamic parameters			
5 Rated voltage	V	24	24
6 No-load current	A	0.13	0.19
7 No-load speed	rpm	25400	36800
8 Max. continuous stall torque	mNm (oz-in)	22.8 (3.22)	21.6 (3.06)
9 Max. continuous stall current	A	2.7	3.7
10 Max. continuous torque at 10 krpm	mNm (oz-in)	20.8 (2.94)	19.6 (2.77)
11 Max. continuous current at 10 krpm	A	2.5	3.4
12 Max. continuous power at 10 krpm	W	29.5	28.2
Intrinsic parameters			
13 Motor constant	$mNm/W^{1/2}$ ($oz\text{-}in/W^{1/2}$)	10.2 (1.45)	9.7 (1.37)
14 Rotor inertia	$kgm^2 \cdot 10^{-7}$	3.9	3.9
15 Mechanical time constant	ms	3.7	4.2
16 Electrical time constant	ms	0.04	0.04
17 Thermal resistance	°C/W	13	13



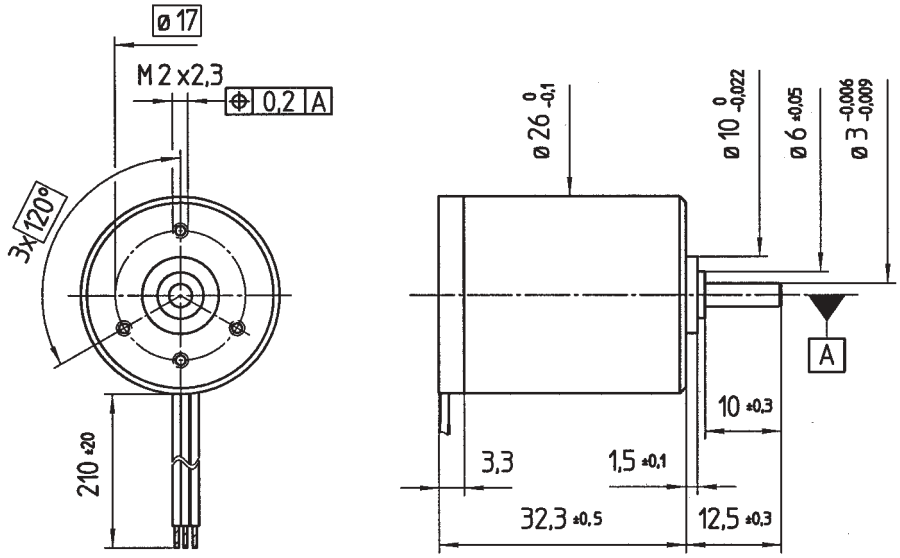
- Motor with preloaded ball bearings
- Typical preload = 6 N
- Maximum external load:
  - axial static: 50 N
  - axial dynamic: 5 N
  - radial dynamic: 10 N
- Operating temperature range: -40°C to +100°C
- Max. rated coil temperature: 125°C

* Except ratios with multiples of 5



escap 26BC

Electronically commutated sensorless motor



scale: 1:1
dimensions in mm
mass: 72 g

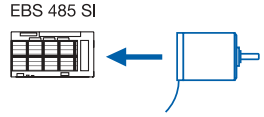
26BC-3C ▫▫ • 101

Connections

Color	Designation
white	phase 1
grey	phase 2
violet	phase 3

Winding type	▫▫	-109P
Coil dependent parameters		
1 Phase resistance	ohm	5
2 Phase inductance	mH	3.8
3 Back-EMF constant	V/1000 rpm	0.73
4 Torque constant	mNm/A	7
5 Max. continuous current	mA	1000
Coil independent parameters		
6 Friction torque	mNm	0.3
7 Viscous torque (losses)	mNm/1000 rpm	0.047
8 Max. cont. torque (up to 10000 rpm)	mNm	7
9 Max. recommended speed	rpm	20000
Mechanical parameters		
10 Rotor inertia	$kgm^2 \cdot 10^{-7}$	9.4
11 Mechanical time constant	ms	95
Dynamic performances with EBS 485 SI		
12 Rated voltage	V	12
13 No load current	mA	180
14 No load speed	rpm	14800
15 Peak torque	mNm	7

The 26BC-3C is a sensorless motor with a delta-connected winding. It is intended to use with a sensorless driver such as the EBS 485 SI or a driver using, for instance, a chip of the Philips TDA family. If the winding center-point is needed, it can be generated by using three external resistors attached to the motor phases and Y-connected together.

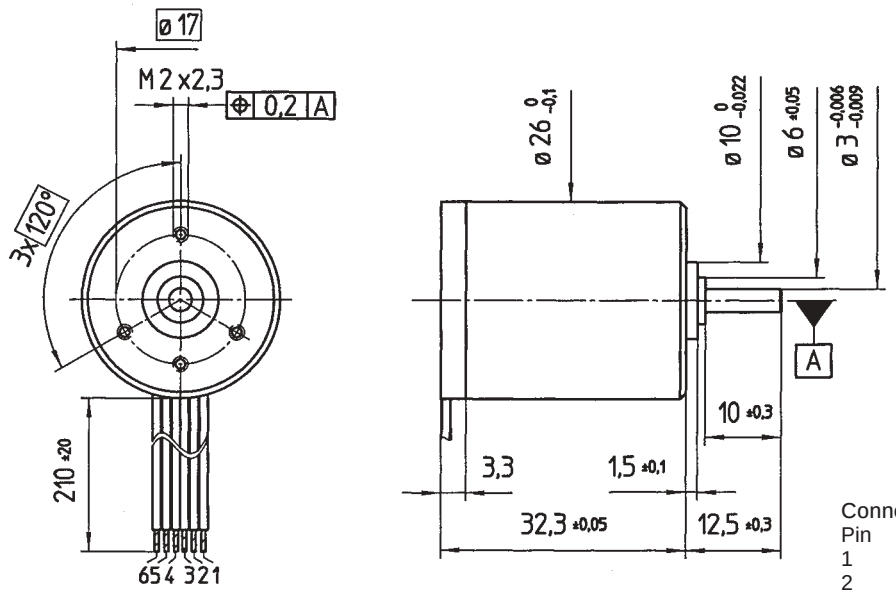


Thermal time constant	mn	11
Thermal resistance	°C/W	14
Axial play*	µm	10
Radial play (2.5N rad.load)	µm	10
Axial load (static)	N	50
Radial load (static)	N	50

*with axial load > 2.5N, max. axial play is 130µm

escap 26BC

D.C. Motor with integrated electronic commutation



scale: 1:1
dimensions in mm
mass: 72 g

26BC-6A ⊡• 101

Connections

Pin	Color	Designation
1	brown	GND
2	red	power supply voltage [1]
3	orange	direction CCW/CW [5]
4	yellow	enable start/stop [3] [5]
5	green	logic supply voltage [2]
6	blue	speed signal [4]

Winding type	⊡•	-110	-107
Coil dependent parameters			
1 Phase resistance	ohm	17.6	69
2 Phase inductance	mH	1.65	5.8
3 Back-EMF constant	V/1000 rpm	1.4	2.66
4 Torque constant	mNm/A	13.4 (1.9)	25.4 3.6)
5 Max. continuous current	mA	0.4	0.2
Coil independent parameters			
6 Friction torque	mNm	0.25	0.25
7 Viscous torque (losses)	mNm/1000 rpm	0.4	0.4
8 Max. cont. torque (up to 10000 rpm)	mNm	4.4 (0.62)	4 (0.56)
9 Max. recommended speed	rpm	11000	4800
Mechanical parameters			
10 Rotor inertia	$kgm^2 \cdot 10^{-7}$	9.4	9.4
11 Mechanical time constant	ms	92	100
Dynamic performances			
12 Rated voltage	V	15	15
13 No load current	mA	120	50
14 No load speed	rpm	9300	4700
15 Peak speed	rpm	11000	5600
16 Peak torque	mNm (oz-in)	4.4 (0.62)	4 (0.56)

Thermal time constant	mn	11
Thermal resistance	°C/W	14
Axial play*	µm	10
Radial play (2.5N rad. load)	µm	10
Axial load (static)	N	50
Radial load (static)	N	50

*with axial load > 2.5N, max. axial play is 130µm

- Integrated electronic commutation
- Warning: an incorrect supply voltage polarity may damage the electronic circuitry!
- Standard version with preloaded ball bearings
- Max. permissible coil temp. 130°C (266°F)
- Recommended ambient temperature range 0 to 70°C (32 to 158°F)
- The current consumption of the electronics is 18 mA

[1] The motor supply voltage may vary between 2.5V and 18V except for the -119 and -113 coils where the voltage should be limited to 7.5 V.

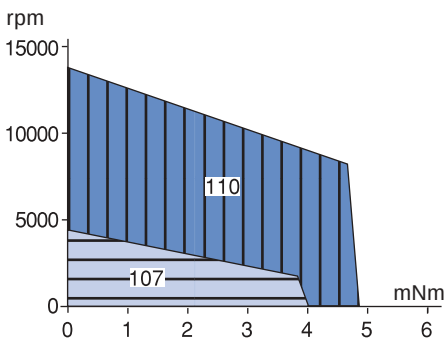
[2] The logic supply voltage may vary between 5 and 18 V. By connecting 2 and 5 together, the motor becomes a simple two wires version exactly like a DC motor. In this case, the supply voltage may vary between 5 V and 18 V except for the -119 and -113 coils where the voltage should be limited to 7.5 V.

[3] start/stop: when grounded, the motor is no more powered.

[4] Available on output 6 is a square wave voltage: low level = GND, high level = + V logic.

[5] Inputs 3-4 have pull up resistors of 120 kohm.

Speed/torque range of the various windings



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Glossaire
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Gearboxes, Electronic Drives, Compact Optical Encoder
Réducteurs, Circuits de commande, Codeur optique compact
Getriebe, Motorsteuerungen, Kompakte Optischer Encoder

Max. dyn. output torque at 20 rpm	Nm
Max. static torque	Nm
Max. recom. input speed	rpm
Reduction ratios	-
Efficiency	-
Length L1	mm
Dir. of rotation	# or =
Mass	g
Available with motor series	length (L2*)

*L2 = length (motor + gearbox)
- Gearbox with sleeve bearings
- Average backlash 2° at no-load

Couple dynamique max. à 20 t/min	Nm
Couple statique max.	Nm
Vitesse entrée max.	t/min
Rapports de réduction	-
Rendement	-
Longueur L1	mm
Sens de rotation	# ou =
Masse	g
Disponible avec moteurs	longueur (L2*)

*L2 = longueur (moteur + réducteur)
- Réducteur monté avec paliers lisses
- Jeu angulaire moyen à vide 2°

Max. dyn. Abtriebsmoment bei 20 Upm	Nm
Max. stat. Abtriebsmoment	Nm
Max. empf. Drehzahl	Upm
Untersetzungen	-
Wirkungsgrad	-
Länge L1	mm
Drehrichtung	# oder =
Masse	g
Lieferbar mit dem Motoren	Länge (L2*)

*L2 = länge (Motor + Getriebe)
- Getriebe mit Gleitlager
- Mittl. Getriebespiel unbelastet 2°

Electronic Drives
- Compact DC motor driver
- Driver for BLDC sensorless
- Bipolar chopper driver 2-3, 60V
- Small size bipolar chopper driver 9A, 70V
- Microstep bipolar chopper drivers 3-9A, 12-70-70V

Circuits de commande
- Commande compacte pour moteurs C.C.
- Carte pour moteurs BLDC sans capteurs
- Commandes bipolaires à découpage 2-3A, 60V
- Module compact bipolaire à découpage 9A, 70V
- Commandes pour mode micropas 3-9A, 12 à 70V

Motorsteuerungen
- Kompakte Steuerung DC Motoren
- Steuerung für BLDC sensorlose Motoren
- Getaktete 2-Phasen-Endstufe 2-3A, 60V
- Getaktete 2-Phasen Kompakte-Modul 9A, 70V
- Getaktete 2-Phasen für Mikroschrittbetrieb 3-9A, 12-70V

Compact Optical Encoder
Features
- 2 channel quadrature output & index pulse
- integrated direction of rotation detection
- stand-by function with latched state of channels
- complementary outputs
- up/down pulse signals
- CMOS comptabile
- single $5V_{DC}$ supply

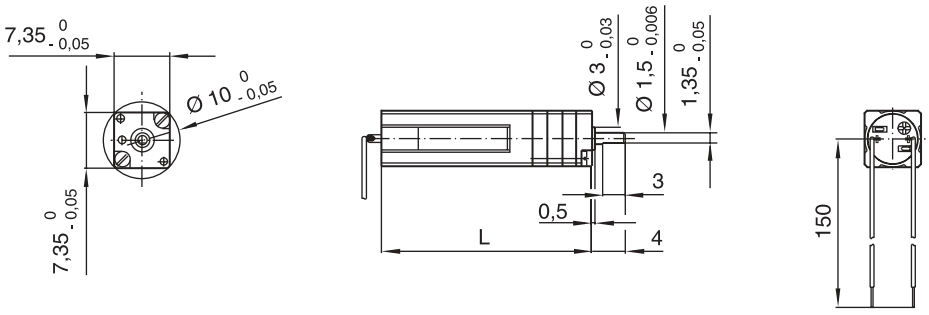
Codeur optique compact
Caractéristiques
- 2 canaux déphasés de 90° et index
- détection du sens de rotation intégré
- Stand-by avec mémorisation des états des canaux
- sorties complémentaires impulsions de comptage/décompte
- compatible CMOS
- alimentation $5V_{DC}$

Kompakte Optischer Encoder
Eingenschaften
- 2 Kanäle mit 90° Phasenverschiebung und Indexkanal
- Anzeige der Drehrichtung
- Stand-by mit Speicherung der Zustände
- Komplementärausgänge
- Auf-/Ab-Zählimpulse
- CMOS kompatibel
- Versorgungsspannung $5V_{DC}$

escap M707 L61

Reduction gearbox with spur gears

Gearbox
0.10 Nm



scale: 1:1
dimensions in mm

M707 L61 - [••••] - [••••] •0

Gearbox specifications

Ratio	[••••]	10.7	82.7	230
No. of gear stages		2	4	5
Direction of rotation		=	=	≠
1 Efficiency		0.8	0.65	0.6
2 Length = L (mm)		23.8	27.8	29.8
3 Mass (g)		4.3	4.6	4.7
4 Max. recom. dynamic output torque		mNm (oz-in)		12 (1.7) at 20 rpm
		mNm (oz-in)		8 (1.1) at 150 rpm
5 Bearing type				sleeve bearings
6 Max. static torque		mNm (oz-in)		50 (7.08)
7 Max. side load at 3 mm from mount. face		N (lb)		1 (0.225)
8 Max. axial load		N (lb)		1 (0.225)
9 Max. force for press-fit		N (lb)		5 (1.12)
10 Average backlash at no-load				2°
11 Average backlash at 12 mNm				3°
12 Radial play		µm		≤ 30
13 Axial play		µm		≤ 100
14 Max. recom. input speed.		rpm		7500
15 Temperature range		°C (°F)		30...+65 (-22...+150)

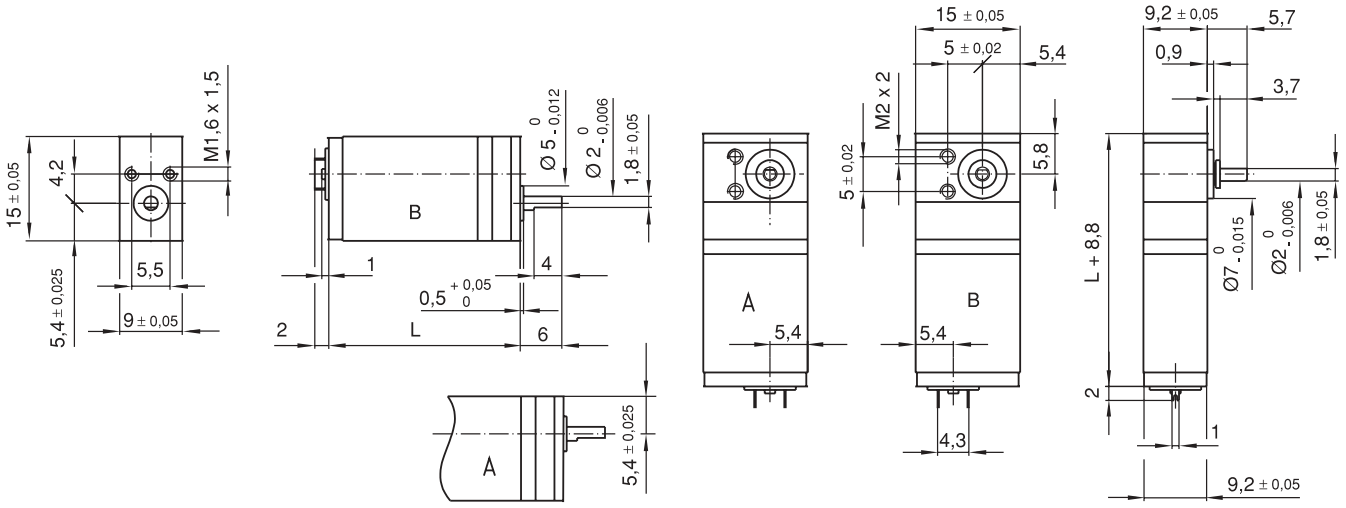
Motor specifications

Winding types	[••••]	-205
Measured values		
1 Measuring voltage	V	3.5
2 No-load speed	rpm	11400
3 Stall torque	mNm (oz-in)	0.37 (0.05)
4 Average no-load current	mA	8
5 Typical starting voltage	V	0.3
Max. recommended values		
6 Max. continuous current	A	0.18
7 Max. continuous torque	mNm (oz-in)	0.48 (0.07)
Intrinsic parameters		
8 Torque constant	mNm/A (oz-in/A)	2.8 (0.39)
9 Terminal resistance	ohm	26
10 Motor regulation R/k^2	10^3/Nms	3400
11 Terminal inductance	mH	0.10
12 Rotor inertia	$kgm^2 \cdot 10^{-7}$	0.030
Thermal parameters		
13 Mechanical time constant	ms	10
14 Thermal time constant rotor	s	3
15 Thermal resistance body-ambient	°C/W	70

escap M915 L 61 & MU915 L 61

Reduction gearbox with spur gears

Gearbox
0.03 Nm



scale: 1:1
dimensions in mm

M915 L61 - [••••] - [••••] •40

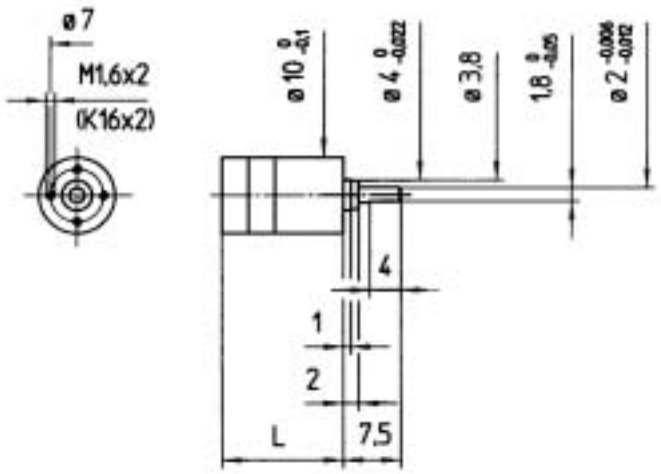
MU915 L61 - [••••] - [••••] •40

Gearbox specifications

Ratio [••••]	49.3	181	663
No. of gear stages	3	4	5
Direction of rotation	≠	=	≠
1 Efficiency	0.7	0.65	0.6
2 Length = L (mm)	26	28.7	31.4
3 Mass (g) view	11/B	12/A	13/B
4 Max. recom. dynamic output torque	mNm (oz-in)		30 (4.25) at 20 rpm
	mNm (oz-in)		20 (2.83) at 150 rpm
5 Bearing type			sleeve bearings
6 Max. static torque	mNm (oz-in)		70 (9.87)
7 Max. side load at 3 mm from mount. face	N (lb)		1.5 (0.34)
8 Max. axial load	N (lb)		1 (0.225)
9 Max. force for press-fit	N (lb)		5 (1.12)
10 Average backlash at no-load			2°
11 Average backlash at 12 mNm			3°
12 Radial play	µm		≤ 30
13 Axial play	µm		≤ 150
14 Max. recom. input speed	rpm		7500
15 Temperature range	°C (°F)		-20...+65 (-4...+150)

Motor specifications

Winding types [••••]		-205
Measured values		
1 Measuring voltage	V	3
2 No-load speed	rpm	8000
3 Stall torque	mNm (oz-in)	0.35 (0.05)
4 Average no-load current	mA	6
Max. recommended values		
6 Max. continuous current	A	0.16
7 Max. continuous torque	mNm (oz-in)	0.50 (0.07)
Intrinsic parameters		
8 Torque constant	mNm/A (oz-in/A)	3.2 (0.46)
9 Terminal resistance	ohm	26
10 Motor regulation R/k^2	10^3/Nms	2540
11 Terminal inductance	mH	0.10
12 Rotor inertia	$kgm^2 \cdot 10^{-7}$	0.03
Thermal parameters		
13 Mechanical time constant	ms	7
14 Thermal time constant rotor	s	3
15 Thermal resistance body-ambient	°C/W	60

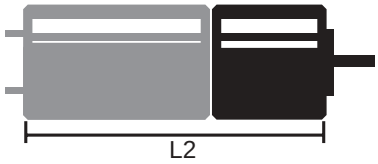


scale: 1:1
dimensions in mm

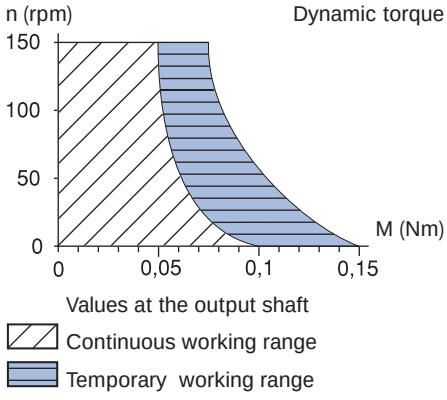
R10 • 0 ••••

Ratio ••••	4	16	64	256	1024	4096
1 No. of gear stages	1	2	3	4	5	6
2 Dir. of rotation	=	=	=	=	=	=
3 Efficiency	0.9	0.8	0.7	0.65	0.6	0.5
4 L1 (mm)	9	12.5	16	19.5	23	26.5
5 Mass (g)	3	4	5	6	7	8
6 Available with motor	L2- length with motor (mm)					
08 G61 • 1	28.6	32.1	35.6	39.1	42.6	46.1
08 GS61 • 1	25.6	29.1	32.6	36.1	39.6	43.1
P010 • 02	25.4	28.9	32.4	35.9	39.9	42.9

Motor + gearbox = L2



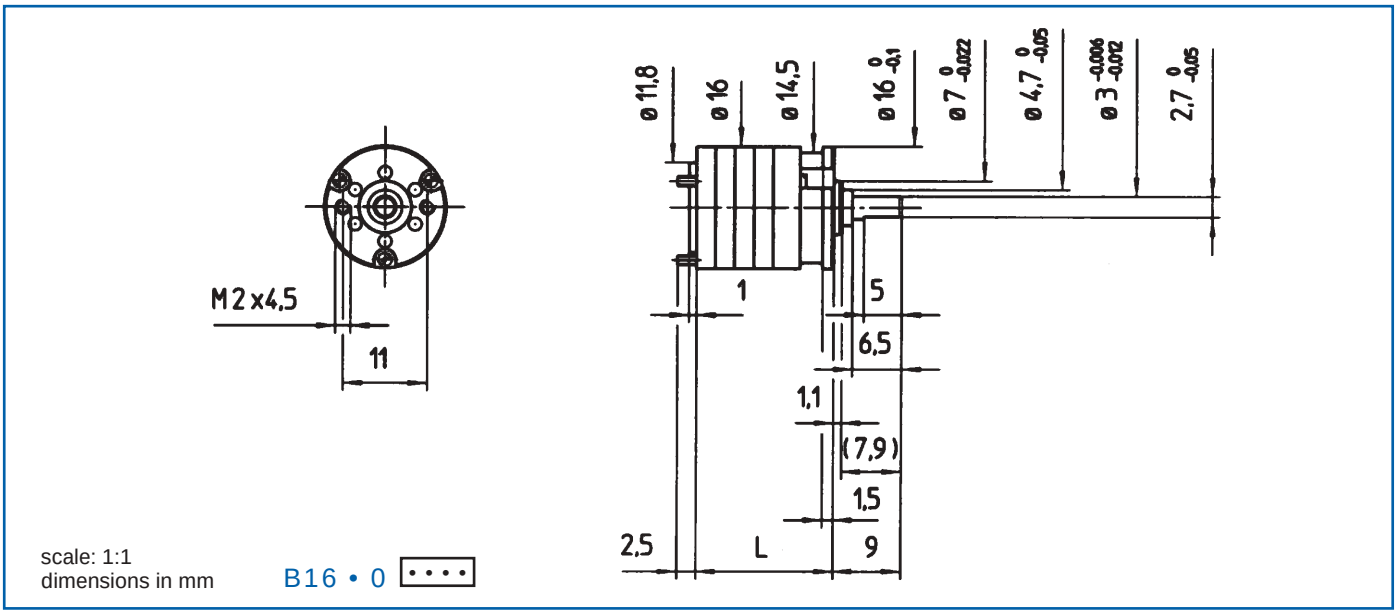
Characteristics		R10 • 0
7 Bearing type		sleeve bearings
8 Max. static torque	Nm (oz-in)	0.15 (21.4)
9 Max. radial force at 8 mm from mounting face	N (lb)	2 (0.45)
10 Max. axial force	N (lb)	5 (1.125)
11 Force for press-fit	N (lb)	10 (2.25)
12 Average backlash at no-load		1°
13 Average backlash at 0.1 Nm		3°
14 Radial play	µm	≤ 50
15 Axial play	µm	50 -150
16 Max. recom. input speed	rpm	10000
17 Operating temperature range	°C (°F)	-30...+65 (-22...+150)



escap B16

Reduction gearbox with spur gears

Gearbox 0.12 Nm

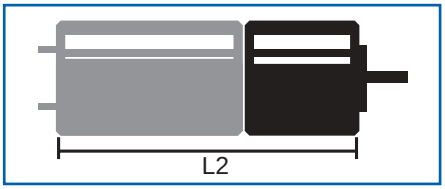


scale: 1:1
dimensions in mm

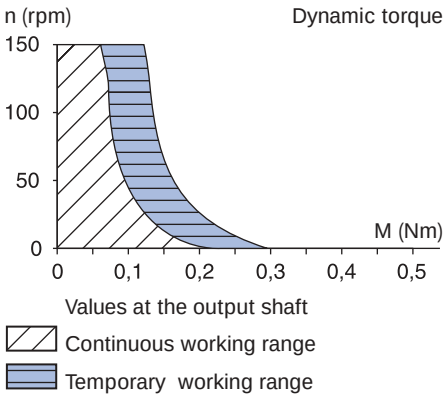
B16 • 0 ••••

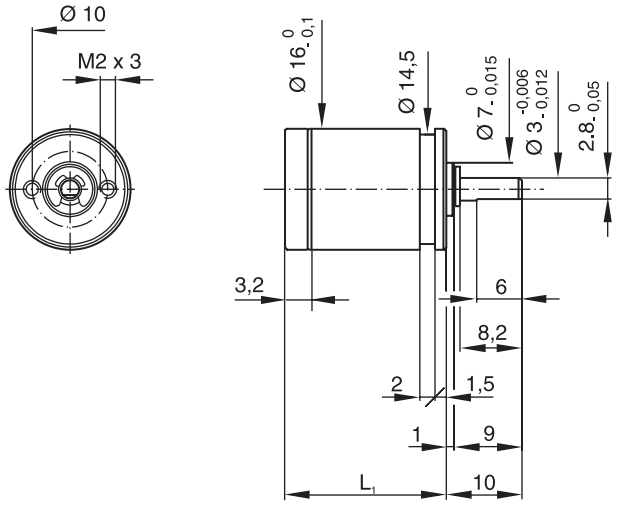
Ratio ••••	5	9	27	81	141	243	729	2187
1 No. of gear stages	2	2	3	4	5	5	6	7
2 Dir. of rotation	=	=	≠	=	≠	≠	=	≠
3 Efficiency	0.81	0.81	0.73	0.65	0.59	0.59	0.53	0.48
4 L1 (mm)	13.5	13.5	16	18.5	21	21	23.5	26
5 Mass (g)	7	7	8	9	10	10	11	12
6 Available with motor	L2- length with motor (mm)							
16C18 • 67	31.2	31.2	33.7	36.2	38.7	38.7	41.2	43.7
16N28 • 235	37.7	37.7	40.2	42.7	45.2	45.2	47.7	50.2
P110 • 8	32.5	32.5	35	37.5	40	40	42.5	45

Motor + gearbox = L2



Characteristics		B16 • 0
7 Bearing type		sleeve bearings
8 Max. static torque	Nm (oz-in)	0.4 (56)
9 Max. radial force at 8 mm from mounting face	N (lb)	5 (1.1)
10 Max. axial force	N (lb)	5 (1.1)
11 Force for press-fit	N (lb)	100 (23)
12 Average backlash at no-load		1.5°
13 Average backlash at 0.1 Nm		3°
14 Radial play	µm	≤ 20
15 Axial play	µm	50 ... 150
16 Max. recom. input speed	rpm	8000
17 Operating temperature range	°C (°F)	-30...+65 (-22...+150)



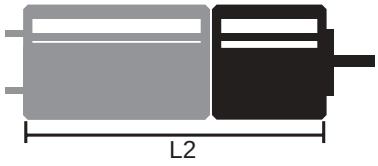


scale: 1:1
dimensions in mm

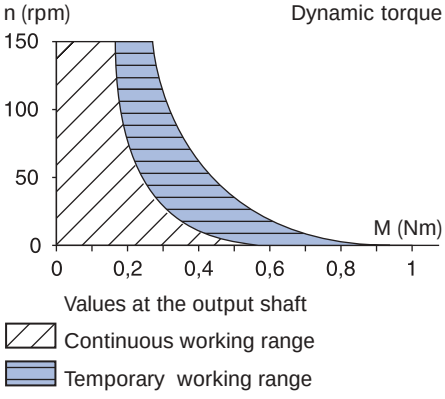
R16 • 0 • • • •

Ratio • • • •	5.5	22	88	166	484	915
1 No. of gear stages	1	2	3	3	4	4
2 Dir. of rotation	=	=	=	=	=	=
3 Efficiency	0.85	0.75	0.65	0.65	0.55	0.55
4 L1 (mm)	16	20.1	24.2	24.2	28.3	28.3
5 Mass (g)	10	13	16	16	19	19
6 Available with motor	L2- length with motor (mm)					
16N28 • 201	44	48.1	52.2	52.2	56.3	56.3
16C18 • 30	33.7	37.8	41.9	41.9	46	46
17N78 • 1	41.9	46	50.1	50.1	54.2	54.2
P110 • 12	35	39.1	43.2	43.2	47.3	47.3

Motor + gearbox = L2

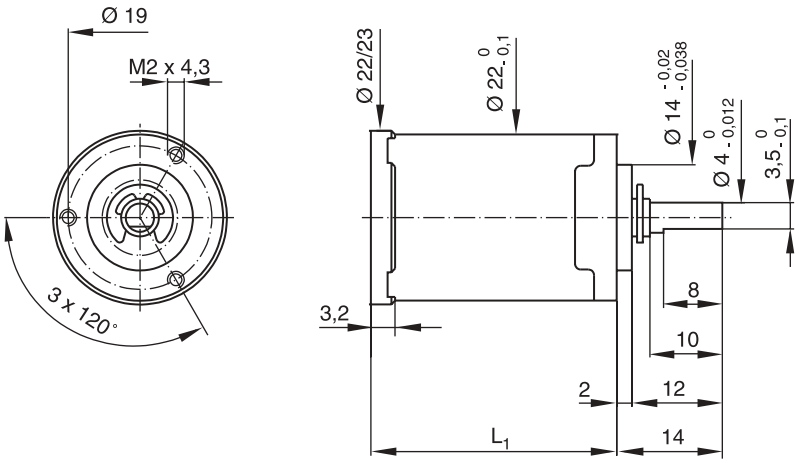


Characteristics		R16 • 0
7 Bearing type		sleeve bearings
8 Max. static torque	Nm (oz-in)	1 (141)
9 Max. radial force at 8 mm from mounting face	N (lb)	5 (1.12)
10 Max. axial force	N (lb)	8 (1.8)
11 Force for press-fit	N (lb)	100 (23)
12 Average backlash at no-load		1.25°
13 Average backlash at 0.3 Nm		2°
14 Radial play	µm	≤ 20
15 Axial play	µm	50 -150
16 Max. recom. input speed	rpm	7500
17 Operating temperature range	°C (°F)	-30...+85 (-22...+185)



escap R22
Planetary gearbox

Gearbox 0.6 Nm

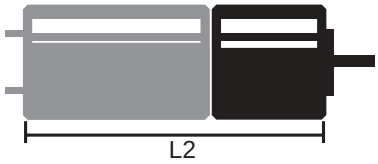


scale: 1:1
dimensions in mm

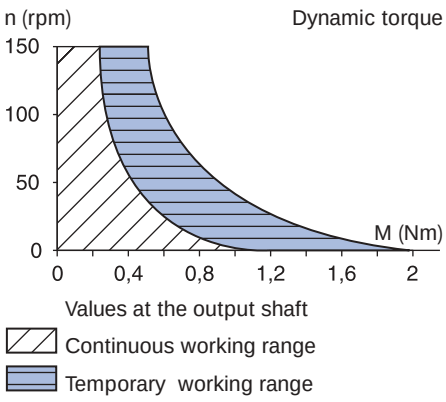
R22 • 0 ••••

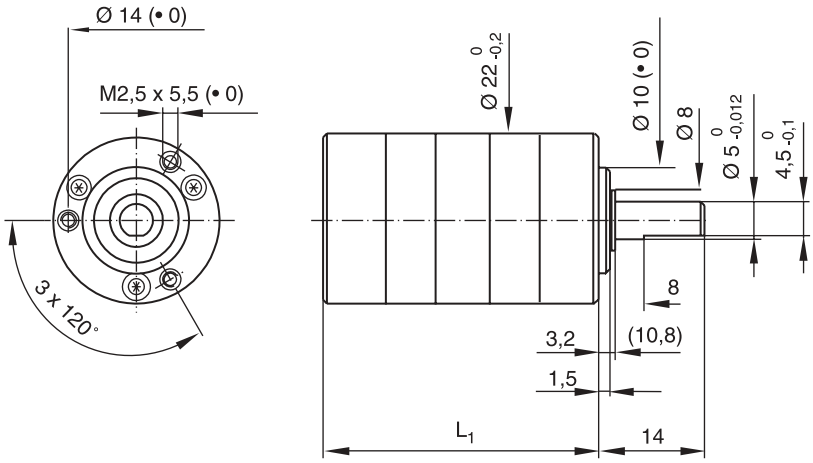
Ratio ••••	16.2	33.1	65.5	111	190	641
1 No. of gear stages	2	2	3	3	3	4
2 Dir. of rotation	=	=	=	=	=	=
3 Efficiency	0.7	0.7	0.6	0.6	0.6	0.5
4 L1 (mm)	32.5	32.5	40	40	40	40
5 Mass (g)	25	25	30	30	30	33
6 Available with motor	L2- length with motor (mm)					
22N28 • 201	62.3	62.3	69.8	69.8	69.8	69.8
22V28 • 202	66.9	66.9	74.4	74.4	74.4	74.4
23DT2R12 • 93	84.2	84.2	91.7	91.7	91.7	91.7
26N48 • 9	75.8	75.8	83.3	83.3	83.3	83.3
28L28 • 164	76	76	83.5	83.5	83.5	83.5
P310 • 09	54.2	54.2	61.7	61.7	61.7	61.7

Motor + gearbox = L2



Characteristics		R22 • 0
7 Bearing type		sleeve bearings
8 Max. static torque	Nm (oz-in)	2 (283)
9 Max. radial force at 8 mm from mounting face	N (lb)	10 (2.2)
10 Max. axial force	N (lb)	10 (2.2)
11 Force for press-fit	N (lb)	300 (67.4)
12 Average backlash at no-load		1.5°
13 Average backlash at 0.1 Nm		3°
14 Radial play	µm	≤ 25
15 Axial play	µm	50 -150
16 Max. recom. input speed	rpm	5000
17 Operating temperature range	°C (°F)	-30...+65 (-22...+150)





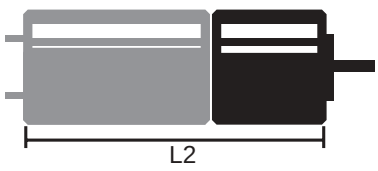
scale: 1:1
dimensions in mm

M22 • 0 ••••

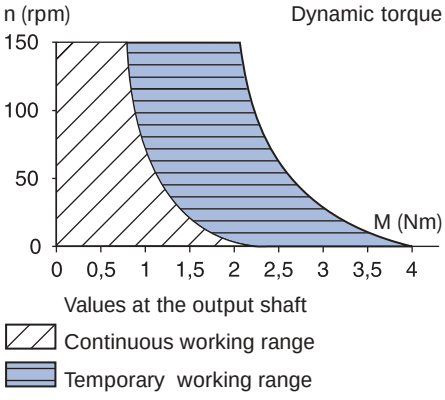
Ratio ••••	5	25	67.2	125	180.8	458.3	625
1 No. of gear stages	1	2	3	3	4	4	4
2 Dir. of rotation	=	=	=	=	=	=	=
3 Efficiency	0.8	0.7	0.6	0.6	0.55	0.55	0.55
4 L1 (mm)	22.6	29.5	36.4	36.4	43.3	43.3	43.3
5 Mass (g)	26	33	40	40	47	47	47
6 Available with motor	L2- length with motor (mm)						
22N28 • 286	54.6	61.5	68.4	68.4	75.3	75.3	75.3
22V28 • 201	57	63.9	70.8	70.8	77.7	77.7	77.7
23DT2R12 • 93	74.3	81.2	88.1	88.1	95	95	-
26N48 • 9	65.9	72.8	79.7	79.7	86.6	86.6	-
28L28 • 164	66.1	73	79.9	79.9	86.8	86.8	-
22BM* • 01	-	-	-	-	91.1	91.1	-
22BL* • 01	-	-	-	-	101.1	101.1	-

* except 5 or multiple of 5 ratios

Motor + gearbox = L2



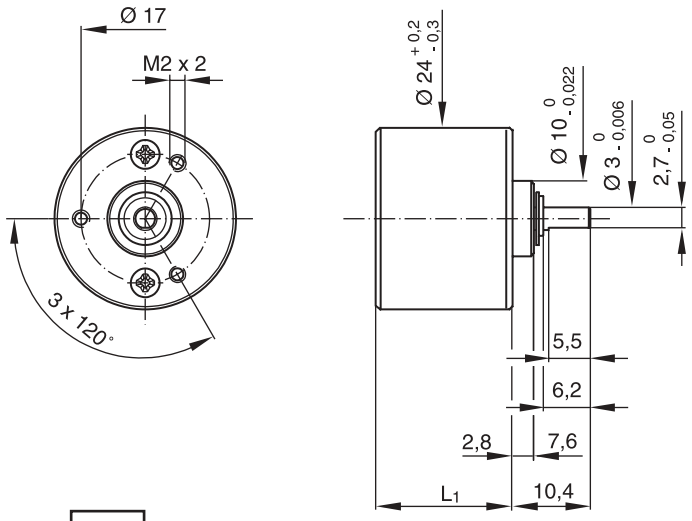
Characteristics		M22 • 0
7 Bearing type		sleeve bearings
8 Max. static torque	Nm (oz-in)	4 (556)
9 Max. radial force at 8 mm from mounting face	N (lb)	50 (11)
10 Max. axial force	N (lb)	70 (16)
11 Force for press-fit	N (lb)	100 (22)
12 Average backlash at no-load		2°
13 Average backlash at 1 Nm		3°
14 Radial play	µm	< 200
15 Axial play	µm	50 -150
16 Max. recom. input speed	rpm	7500
17 Operating temperature range	°C (°F)	-30...+65 (-22...+150)



escap K24

Reduction gearbox with spur gears

Gearbox 0.17 Nm

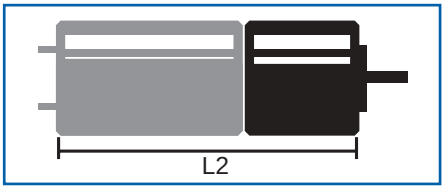


scale: 1:1
dimensions in mm

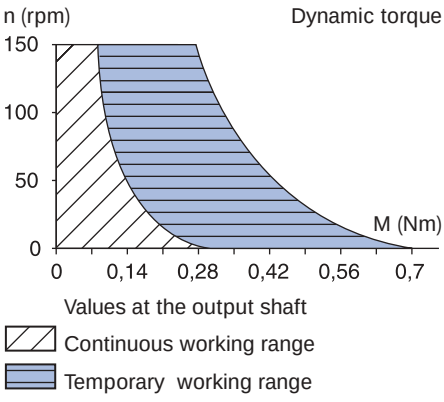
K24 • 0 ••••

Ratio ••••	5	8	32	64	128	320
1 No. of gear stages	2	2	4	4	4	6
2 Dir. of rotation	=	=	=	=	=	=
3 Efficiency	0.85	0.85	0.75	0.75	0.75	0.65
4 L1 (mm)	15	15	18	18	18	21
5 Mass (g)	15	15	18	18	18	20
6 Available with motor	L2- length with motor (mm)					
22N28 • 286	47	47	50	50	50	53
22V28 • 202	49.4	49.4	52.4	52.4	52.4	55.4
26N48 • 9	58.3	58.3	61.3	61.3	61.3	64.3
P310 • 09	36.7	36.7	39.7	39.7	39.7	42.7

Motor + gearbox = L2



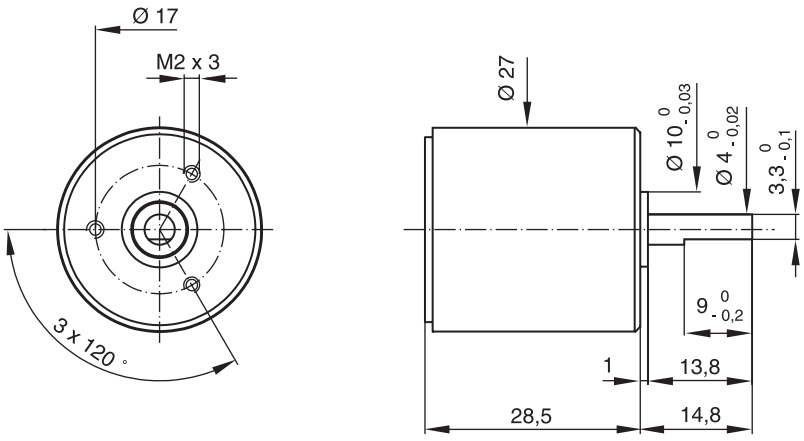
Characteristics		K24 • 0
7 Bearing type		sleeve bearings
8 Max. static torque	Nm (oz-in)	0.7 (100)
9 Max. radial force at 8 mm from mounting face	N (lb)	5 (1.1)
10 Max. axial force	N (lb)	8 (1.8)
11 Force for press-fit	N (lb)	30 (6.7)
12 Average backlash at no-load		1.5°
13 Average backlash at 0.12 Nm		2.5°
14 Radial play	µm	≤ 40
15 Axial play	µm	50 -150
16 Max. recom. input speed	rpm	5000
17 Operating temperature range	°C (°F)	-30...+65 (-22...+150)



escap K27

Reduction gearbox with spur gears

Gearbox 0.4 Nm

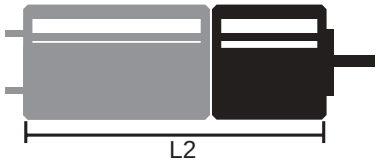


scale: 1:1
dimensions in mm

K27 • 0 ••••

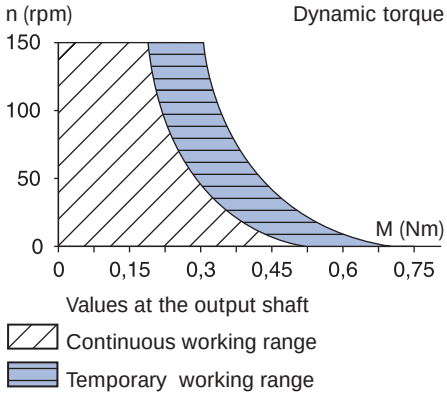
Ratio ••••	6.2	55.7	501
1 No. of gear stages	4	4	6
2 Dir. of rotation	=	=	=
3 Efficiency	0.65	0.65	0.55
4 L1 (mm)	28.5	28.5	28.5
5 Mass (g)	40	40	42
6 Available with motor	L2- length with motor (mm)		
22N28 • 286	60.5	60.5	60.5
22V28 • 202	62.9	62.9	62.9
26N48 • 9	72	72	72
P310 • 09	50.2	50.2	50.2

Motor + gearbox = L2



Characteristics

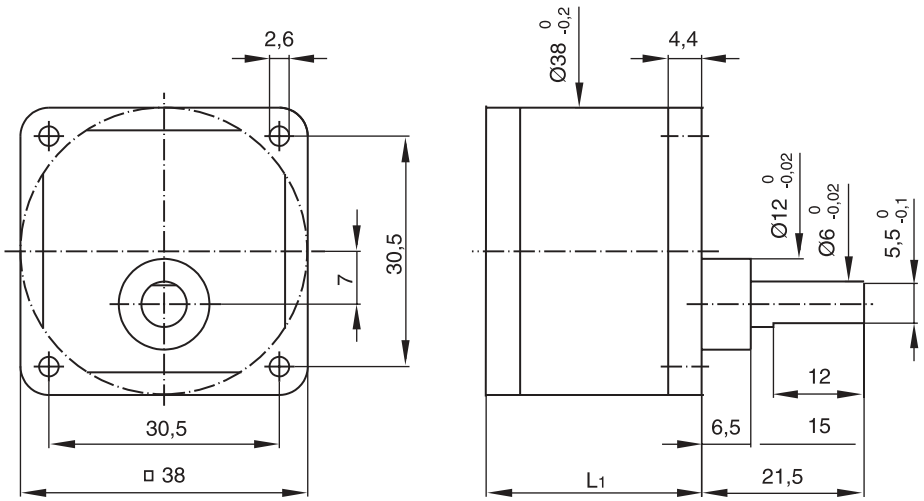
			K27 • 0
7	Bearing type		sleeve bearings
8	Max. static torque	Nm (oz-in)	0.7 (100)
9	Max. radial force at 8 mm from mounting face	N (lb)	20 (4.5)
10	Max. axial force	N (lb)	8 (1.8)
11	Force for press-fit	N (lb)	300 (67.5)
12	Average backlash at no-load		2°
13	Average backlash at 0.2 Nm		3°
14	Radial play	µm	≤ 60
15	Axial play	µm	50 -150
16	Max. recom. input speed	rpm	4000
17	Operating temperature range	°C (°F)	-30...+65 (-22...+150)



escap K38

Reduction gearbox with spur gears

Gearbox 1 Nm

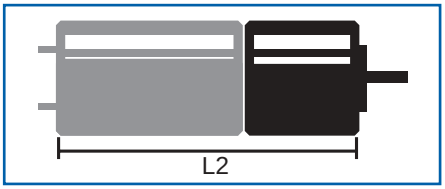


scale: 1:1
dimensions in mm

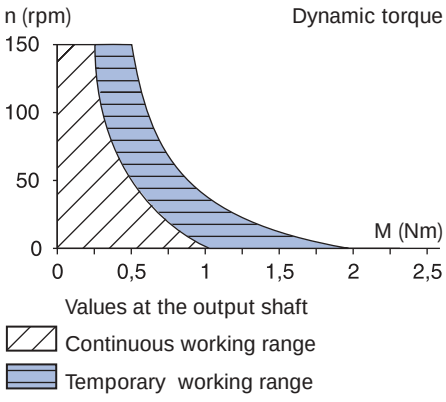
K38 • 0 ••••

Ratio ••••	6	18	60	100	200
1 No. of gear stages	2	3	4	4	5
2 Dir. of rotation	=	≠	=	=	≠
3 Efficiency	0.81	0.73	0.65	0.65	0.6
4 L1 (mm)	23.6	26.1	28.6	28.6	31.1
5 Mass (g)	55	60	65	65	70
6 Available with motor	L2- length with motor (mm)				
22V28 • 201	58	60.5	63	63	65.5
26N58 • 1	67.1	69.6	72.1	72.1	74.6
28L28 • 49	67.1	69.6	72.1	72.1	74.6
22V48 • 204	59.8	62.3	64.8	64.8	67.3
23LT2R12 • 120	61.9	64.4	66.9	66.5	69.40

Motor + gearbox = L2



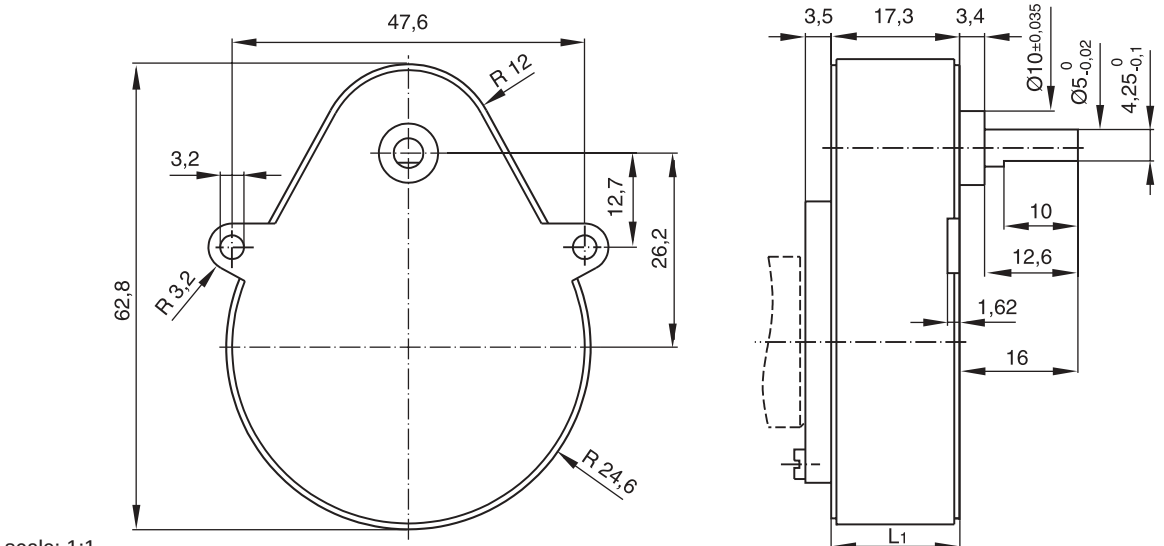
Characteristics		K38 • 0
7 Bearing type		sleeve bearings
8 Max. static torque	Nm (oz-in)	2 (282)
9 Max. radial force at 8 mm from mounting face	N (lb)	50 (11.25)
10 Max. axial force	N (lb)	30 (6.75)
11 Force for press-fit	N (lb)	500 (112.5)
12 Average backlash at no-load		1.7°
13 Average backlash at 1 Nm		2.7°
14 Radial play	µm	≤ 100
15 Axial play	µm	50 -250
16 Max. recom. input speed	rpm	5000
17 Operating temperature range	°C (°F)	-30...+65 (-22...+150)



escap RG1/9

Reduction gearbox with spur gears

Gearbox
1.2 Nm

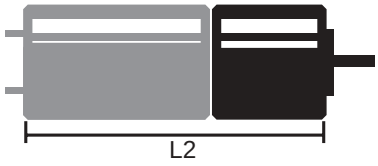


scale: 1:1
dimensions in mm

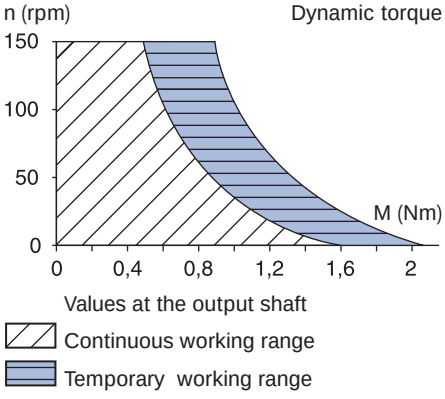
RG1/9 • 1 ••••

Ratio ••••	12	48	180	810
1 No. of gear stages	3	5	6	7
2 Dir. of rotation	≠	≠	=	≠
3 Efficiency	0.7	0.6	0.55	0.5
4 L1 (mm)	17.3	17.3	17.3	17.3
5 Mass (g)	88	92	95	98
6 Available with motor	L2- length with motor (mm)			
22V28 • 201	55.2	55.2	55.2	55.2
22V48 • 204	57	57	57	57
23LT2R12 • 120	59.1	59.1	59.1	59.1
28L28 • 49	64.3	64.3	64.3	64.3
P520 • 60	47.1	47.1	47.1	47.1
PP520 • 01	47.1	47.1	47.1	47.1
P532 • 10	56.6	56.6	56.6	56.6

Motor + gearbox = L2

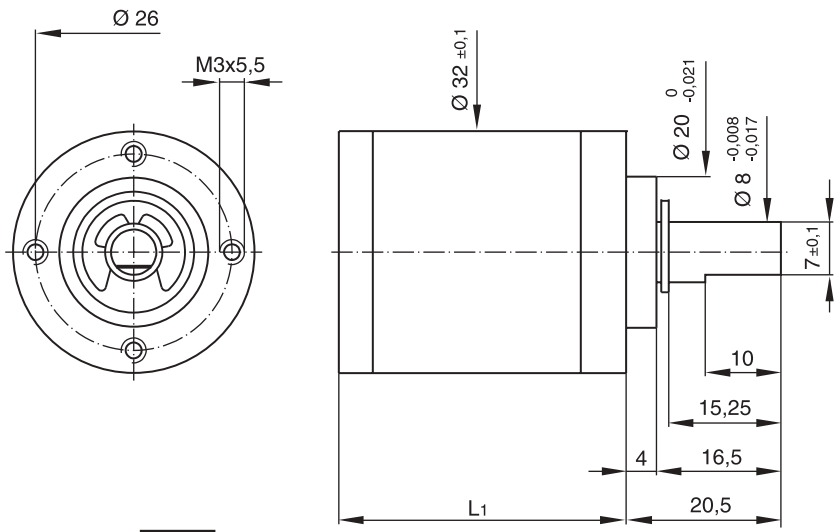


Characteristics		RG1/9 • 1
7 Bearing type		sleeve bearings
8 Max. static torque	Nm (oz-in)	2 (280)
9 Max. radial force at 8 mm from mounting face	N (lb)	60 (13.5)
10 Max. axial force	N (lb)	50 (11.25)
11 Force for press-fit	N (lb)	250 (56.25)
12 Average backlash at no-load		2.5°
13 Average backlash at 1 Nm		3°
14 Radial play	µm	≤ 60
15 Axial play	µm	50 -300
16 Max. recom. input speed	rpm	5000
17 Operating temperature range	°C (°F)	-30...+65 (-22...+150)



escap R32
Planetary gearbox

Gearbox 4.5 Nm

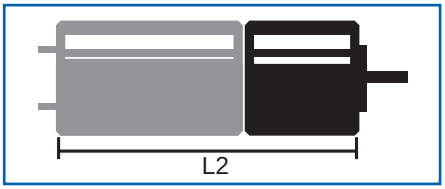


scale: 1:1
dimensions in mm

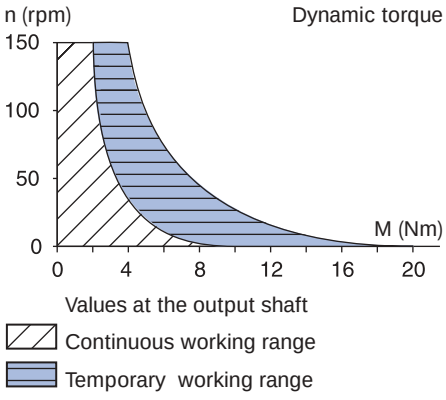
R32 • 0 ••••

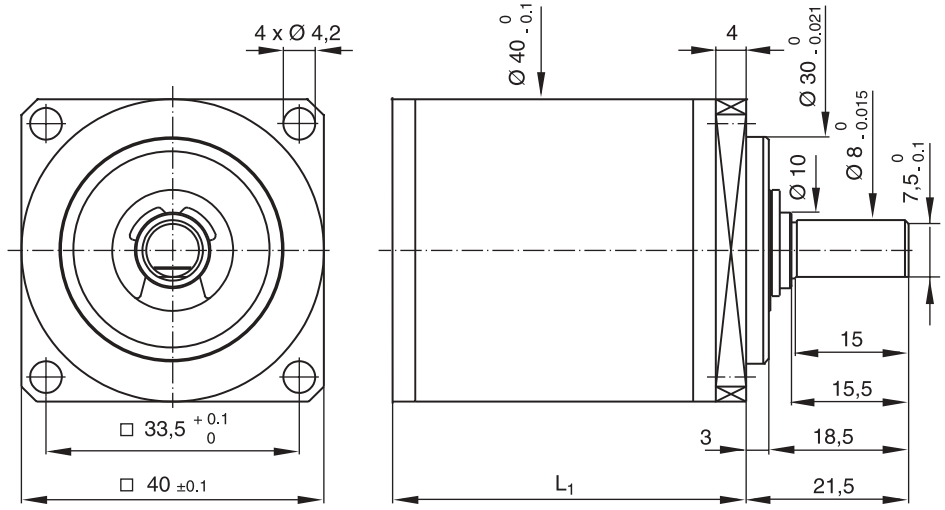
Ratio ••••	17.4	24	99.8	416
Note for motor execution	2)	2)	2)	2)
1 No. of gear stages	2	2	3	4
2 Dir. of rotation	=	=	=	=
3 Efficiency	0.75	0.75	0.65	0.55
4 L1 (mm)	38	38	44	50
5 Mass (g)	145	145	175	205
6 Available with motor	L2- length with motor (mm)			
28L28 • 49	81.5	81.5	87.5	93.5
28DT2R12 • 98 2)	102.6	102.6	108.6	114.6
35NT2R82 • 50 2)	100.9	100.9	106.9	112.9

Motor + gearbox = L2



Characteristics		R32 • 0
7 Bearing type		ball bearings
8 Max. static torque	Nm (oz-in)	20 (2832)
9 Max. radial force at 8 mm from mounting face	N (lb)	180 (40.5)
10 Max. axial force	N (lb)	150 (33.75)
11 Force for press-fit	N (lb)	500 (112.5)
12 Average backlash at no-load		1°
13 Average backlash at 3 Nm		2°
14 Radial play	µm	≤ 10
15 Axial play	µm	≤ 10
16 Max. recom. input speed	rpm	6000
17 Operating temperature range	°C (°F)	-30...+85 (-22...+185)



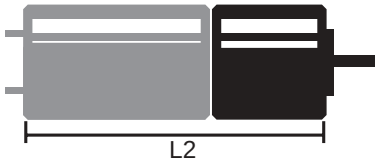


scale: 1:1
dimensions in mm

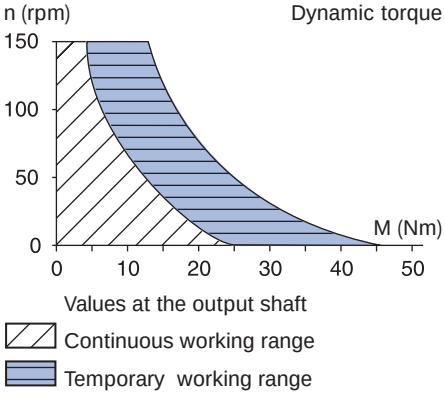
R40 • 0 ••••

Ratio ••••	24	54.2	134	478
1 No. of gear stages	2	3	3	4
2 Dir. of rotation	=	=	=	=
3 Efficiency	0.7	0.6	0.6	0.5
4 L1 (mm)	46.8	55.3	55.3	63.8
5 Mass (g)	285	340	340	400
6 Available with motor	L2- length with motor (mm)			
28DT2R12 • 98	111.4	119.9	119.9	128.4
35NT2R82 • 50	109.7	118.2	118.2	126.7

Motor + gearbox = L2

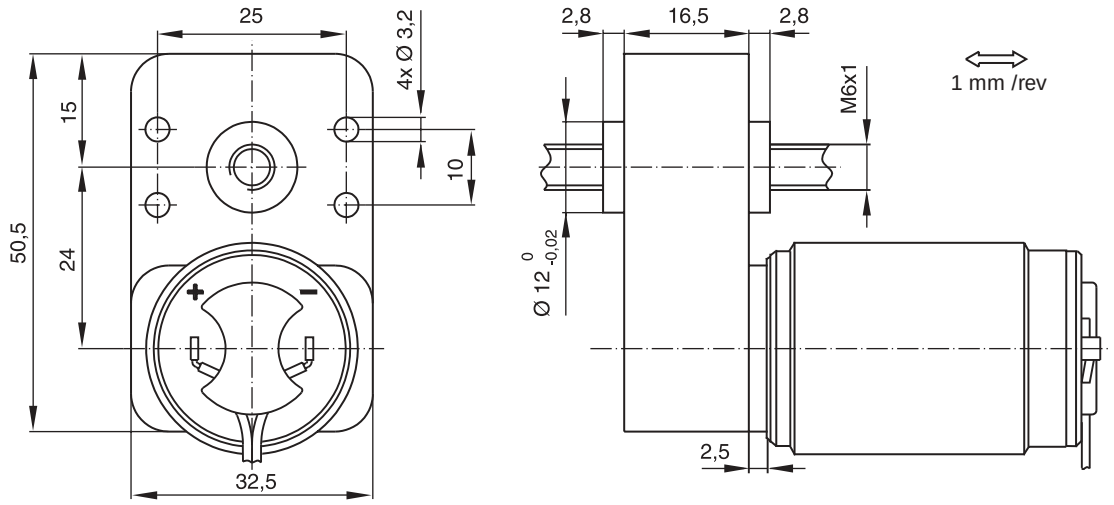


Characteristics		R40 • 0
7 Bearing type		ball bearings
8 Max. static torque	Nm (oz-in)	40 (5700)
9 Max. radial force at 8 mm from mounting face	N (lb)	600 (135)
10 Max. axial force	N (lb)	400 (90)
11 Force for press-fit	N (lb)	600 (135)
12 Average backlash at no-load		1°
13 Average backlash at 0.3 Nm		1.3°
14 Radial play	µm	≤ 10
15 Axial play	µm	≤ 10
16 Max. recom. input speed	rpm	6000
17 Operating temperature range	°C (°F)	-30...+85 (-22...+185)



escap L10

Linear actuator



scale: 1:1
dimensions in mm

L10 ▭ • 01

Ratio	▭	5	100
Characteristics			L10
1 Max. recom. holding force		N (lb)	200 (45)
2 Max. recom. linear force		N (lb)	50 at 10 mm/s (9 at 2 ft/min)
		N (lb)	100 at 2 mm/s (22 at 0.4 ft/min)
3 Average axial play		mm	0.4
4 Recom. linear speed range		mm/s	0.5 to 20
5 Temperature range		°C (°F)	-15...+55 (+5...+131)
6 Available with motor			22V28•201
			22V48•204
			28L28•49
			P310•09

The leadscrew should be prevented from rotating by the user.

Modifications to obtain higher linear speeds are available on request.

Accessories are also available on request, these include: fixing bolts, forked connector and threaded rod.

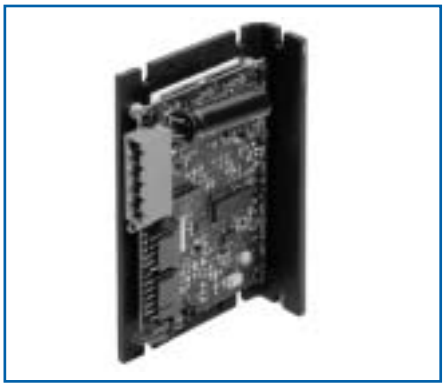
Brass output stage.

BL5010

Driver for brushless motor with Hall sensors

BLDC drive circuit

- 2 quadrant amplifier operating in open loop or closed velocity loop
- Single DC supply voltage, 12 V to 50 V
- Maximum continuous current 10 A
- Hall sensor spacing select. 60°/120°
- Compact size



Specifications

1 Power supply voltage		12 V to 50 VDC
2 Continuous current		10 A max. with heatsink
3 Auxiliary output voltage		6.25 V-30 mA / 15 V-50 mA
4 Chopper frequency		15 kHz
5 Inputs (pull-up +6.25 V)		Stop, Enable, Direction
6 Speed reference		0 V to 6.25 V
7 Selection mode		open loop or velocity loop by jumper
8 Protection		overcurrent / -temperature
9 Max. heatsink temperature		80°C

Connector	Motor lead	PIN	Name
J1	Red	1	Hall S. PWR lead
	Black	2	Hall S. GND lead
	Yellow	3	Hall S1
	Orange	4	Hall S2
	White	5	Hall S3
J2	Red	1	Power +
	Black	2	Ground -
	Blue	3	Phase A
	Brown	4	Phase B
	Violet	5	Phase C
J3	POT-GND	1	Signal GND
	Stop=low	2	Enable
	CW=Low	3	Direction
	POT wiper	4	Analog IN
P	OT +6 V	5	+6.25 V
	No connect.	6	+ 15 V
60°/120°		-	Open
	Default	-	Closed
CV	Default	-	Open
		-	Closed

EBS-485 SI

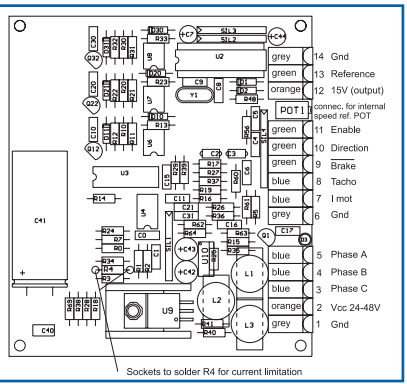
Driver for brushless, sensorless DC motors

BLDC drive circuit

- Commutation control through back-EMF detection
- Phase current 5 A continuous, adjustable current limitation
- Digital PID speed regulation 2000 to 40000 rpm
- Compact size 100 x 90 x 25 mm
- Single DC supply voltage 24V up to 48V
- Analogue motor current output Imot,1V/A
- Colour-coded clamp type connector
- Digital tacho output, 6 pulses per revolution

Specifications

1	Power supply voltage Vcc	24...48V DC
2	Max. continuous current	5A adjustable by resistor R4
3	Control inputs:	pull-up to 5V on board
	Enable	to supply the motor
	Direction	direction selection
	Brake	fast motor brake
4	Analogue input:	
	Speed reference	range 0.5V...10V*
5	Digital output:	0...5V with internal pull-up
	Tacho	digital speed information
		6 pulses per turn $n_{rpm} = 10 \times f_{Tacho(Hz)}$
6	Analogue output:	
	I_{mot}	indication of motor phase current, transconductance gain 1V/A
	Current limitation	by inserting a resistor R4**
7	Speed loop:	
	Range	2,000...40,000 rpm, 0.5V<speed ref.<10V
	Speed loop optimisation	load inertia, $J_{mot} < J_{load} < 5 \times J_{mot}$
	Ramping time	1s full scale 0...10V with no load
	Speed accuracy	≤ 5%
8	Connector	colour-coded cage clamp (clamping tool is supplied)



ELD-3503 V 4

Compact DC motor drive circuit

DC motor drive

- Linear amplifier 2.5 A, 35 V
- Speed control with a DC tacho or by RxI compensation
- Torque control with transconductance amplifier 0.5 A/V
- Suitable for low inductance motors
- Single voltage supply 12... 35 V_{DC}
- Overtemperature, overcurrent and short-circuit protection
- Software assisted implementation

Specifications

1	Single DC supply	12 to 35 V
2	Maximum permanent output current	2.5 A
3	Maximum peak current	3.5 A (factory set) 7 A max.
4	Differential input	± 10 V (± 5 V also possible)
5	Transconductance amplifier	0.5 A/V[1)]
6	Precision of the current regulation	± 5%
7	Linearity of the output	± 2% from 0 to 2 A
8	Cut-off frequency	2 kHz
9	Speed regulation using a tacho	1000 rpm/V[1)]
10	Variation due to the load in tacho mode	± 0.5%
11	Speed regulation using RxI compensation	1000 rpm/V[1)]
12	Variation due to the load in RxI mode	± 5% for n > 500 rpm
13	Precision of the speed regulation	± 5%
14	Cut-off frequency	20 Hz
15	Adjustable permanent current limitation	0 to 3.5 A
16	Slow fuse	2 A
17	Thermal circuit breaker	80°C
18	Overcurrent indication	LED I_{RMS}
19	Overtemperature indication	LED T_{max}
20	Operating temperature range	0 to 65°C
21	Dimensions	100 x 80 x 30 mm (° Europe), 250 g
22	Connections	Screw terminals

[1)] These factors should be multiplied by 2 when the input voltage of the card is changed to ± 5 V

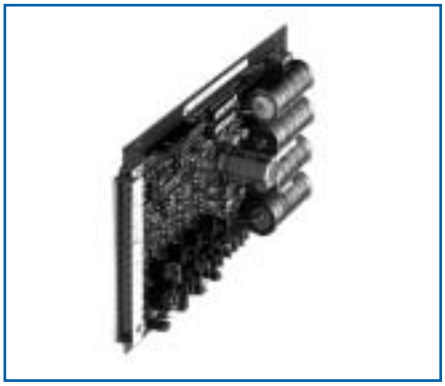
The card is delivered with an application software on a floppy disk. After entering speed, torque, power supply voltage and thermal conditions, this convenient tool calculates the minimum voltage needed for the specified motor and indicates all limitations imposed by the motor, the card or the power supply. Changes resulting from a different motor winding are displayed immediatley.
The application requires Windows 3.1 or higher.

ESD-1200/1300

Stepper motor drive circuit

Bipolar chopper driver 2 A or 3 A, 60 V

- 8 operating current levels adjustable using links or external resistor
- Built-in clock oscillator with ramp
- 30 kHz chopping frequency suitable for TurboDisc motors with short electrical time constant
- AC or DC power supply
- Automatic stand by current mode when motor is stationary if required
- Protected against overload & short-circuit (phase to phase and across phase)
- Recommended for the following TurboDisc motors: P310, P430, P520, PP520, P532, PH632, P632, P852



Specifications

1	Power motor supply volt.	AC 18 to 44 V - DC 22 to 60 V
2	Power logic supply volt.	AC 18 V - DC 24 V
3	Auxiliary DC output volt.	U = 24 V, I = 300 mA
4	Max phase current	ESD1200: 2 A · ESD1300: 3 A
5	Logic input	low level: 0...2 V or short circuit · high level: 10...12 V or open circuit
6	Logic output (Fault, Zero)	open collector NPN, 30 $V_{max,}$ I_{max} = 15 mA
7	Max. clock frequency	40 kHz in half-step mode, minimum pulse width 10 ms
8	Int. oscillator	- slow range: 100 Hz to 4 kHz not ramped
		- fast range: 2 kHz to 40 kHz ramped (ramp accel. 60 ms - decel. 30 ms)
9	Current level adjustment	with jumper, 8 current levels or with external resist. (pin 32a)
10	Current reduction	stand by function 50% reduction by jumper
11	Temperature	operating 0°C to 50°C · storage -40°C to 85°C
12	Protection	overload · short circuit phase to phase and across phase
13	Fuses	FS1 logic supply 1 A
		FS2 motor supply 3.15 A (ESD1200), 4 A (ESD1300)
14	Size / Connector	160 x 100 x 35 mm / DIN 41612 D32

Connector:

Pin	Row a	Row c
2	Motor Phase B-	Motor Phase B-
4	Motor Phase B+	Motor Phase B+
6	Motor Phase A-	Motor Phase A-
8	Motor Phase A+	Motor Phase A+
10	+24 Vdc	+24 Vdc
12	Logic Supply 1	Motor Supply 1
14	Logic Supply 2	Motor Supply 2
16	0 V	0 V
18	0 V	0 V
20	Fast	Fault
22	Slow	Zero Phase
24	Rate Adjust Com.	Slow Rate Adjust
26	Fast Rate Adj.	Direction
28	Internal Clock Out	Clock In
30	Not Connected	Energize
32	External Ref.	Signal 0 V

EDB-909

Stepper motor drive circuit

Small size bipolar chopper driver 9 A, 70 V

- Phase current from 2 A to 9 A adjusted by external resistor
- Chopping frequency 40 kHz
- Single voltage power supply from 22 V to 70 V_{DC}
- Opto-isolated inputs for Direction, Clock, Stand-by, Enable
- Choice of half-step or full-step mode via logic input or by strap
- Stand-by current activated by logic input
- Short-circuit and overtemperature protections
- Recommended for the following TurboDisc motors: P532, PH632, P632, P852

Specifications

1	Power motor supply voltage	22 V to 70 V_{DC}
2	Supply voltage output	5 V / 20 mA
3	Max phase current	2 A to 9 A
4	Optocoupler inputs:	Clock. Direction. Enable. Stand-by.
	Input current	4 mA to 10 mA
	Input voltage (with no series resistor)	5 V to 8 V
	Input voltage (with series resistor of 1 KΩ)	8 V to 15 V
	Input voltage (with series resistor of 2.2 KΩ)	15 V to 24 V
5	Open drain output:	Fault, V_{max} = 35 V, I_{max} = 25 mA
6	LED indicator	Green LED (power) - Red LED (fault)
7	Max. clock frequency	20 kHz
8	Protection	Short-circuit between phases, Overvoltage, Thermal
9	Operating temperature	0 to 40°C
10	Connector	SUB-D15 for logic inputs
	(delivered with the driver)	6 poles plug for motor and power supply
11	Size	Module 128 x 70 x 36 mm

Logic connector:

Pin	
1	+5 V out
2	+ Stand by
3	+ Enable
4	+ Clock
5	+CW/CCW
6	Fault
7	H/F
8	GND log
9	- Stand by
10	- Enable
11	- Clock
12	- CW/CCW
13	RS
14	RI
15	RI' RS'

Power connector:

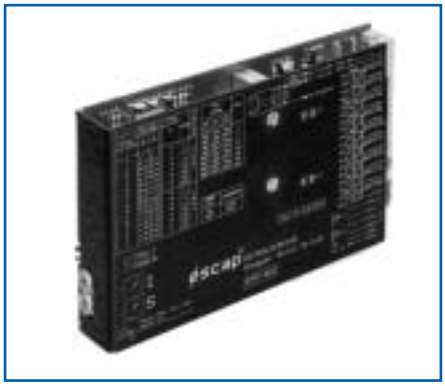
Pin	
1	Phase A-
2	Phase A+
3	Phase B-
4	Phase B+
5	GND
6	VMot

EDM-453

Stepper motor drive circuit

Microstep bipolar chopper driver 3 A, 45 V

- Single DC supply voltage 12 to 45 V
- Two different current ranges 0-3 A / 0-1,5 A user selectable; 16 levels per range, programmable with front panel commutator
- Choice of 8 various resolutions via front panel commutator or by logic inputs, from full-step to 64 microsteps
- All inputs opto-isolated
- Chopper control mode selectable between regenerative and freewheeling
- Recommended for the following TurboDisc motors: P110, P310, P430, P520, PP520, P530, P630, P850.



Specifications

1	Power supply voltage	DC 12 V to 45 V
2	Max phase current	1,5 A / 3 A, fuse max 2 A slow blow
3	Optocoupler inputs:	
	input 0	0 V or GND
	input 1 (int. series resistor 470 Ω)	+3,5 V...+6 V
	input 2 (int. series resistor 2200 Ω)	+10 V...+30 V
	current	15 mA typ, 20 mA max
4	Boost/stand by current values	nominal ± 33 % (3 A max)
5	Chopper frequency	40 kHz
6	Max. clock frequency	150 kHz
7	LED indicator	Power (green) - Fault (red)
8	Protection	short-circuit between phases, phase and +VDC
9	Temperature	0°C to 50°C
10	Size / Connector	160 x 100 x 26 mm / DIN 41612 D64

Connector:

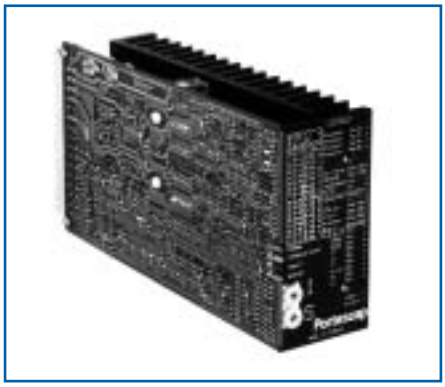
Pin	Row A	Row C
1	NC	Home H
2	NC	Home L
3	NC	Enable 0
4	Enable 1	Enable 2
5	Dir. 1	Dir. 2
6	Dir. 0	Clock 0
7	Clock 1	Clock 2
8	St-by 1	St-By
9	St-By 0	Boost 0
10	Boost 1	Boost 2
11	D2 1	D2 2
12	D2 0	D1 0
13	D1 1	D1 2
14	D0 1	D0 2
15	D0 0	Mode 0
16	Mode 1	Mode 2
18	Phase A+	Phase A+
22	Phase A-	Phase A-
24	Phase B+	Phase B+
28	Phase B-	Phase B-
30	0 VDC	0 VDC
32	+ VDC	+ VDC

EDM-907

Stepper motor drive circuit

Microstep bipolar chopper driver 9 A, 70 V

- Single DC supply voltage 22 to 70 V
- Choice of 8 peak phase current levels from 1,3 A to 9,9 A via front panel commutator or by logic inputs
- Choice of 11 resolutions from full step to 64 microsteps through front panel commutator
- Perfect current regulation especially around zero crossing
- Electronic damping available for motors having velocity sensors
- Opto-isolated inputs for Direction, Clock, Boost and Stand by
- Short-circuit and over temperature protections
- Recommended for the following TurboDisc motors: P530, P630, P850.



Specifications

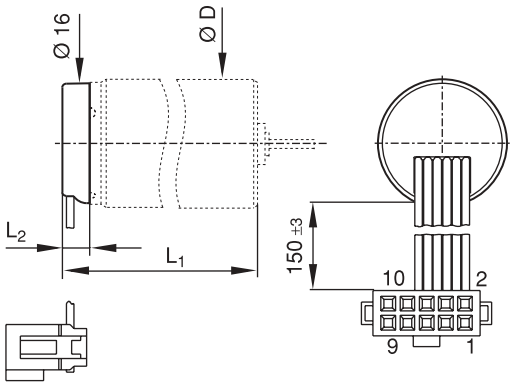
1	Power supply voltage	DC 22 V to 70 V (protected with fuse 4 A)
2	Supply voltage output	5 V / 20 mA
3	Phase current (peak value)	1.3 A to 9.9 A
4	Optocoupler inputs:	Clock. Direction. Enable. Stand by.
	input voltage (without series resistor)	5 V to 7 V
	input current	4 mA to 10 mA
5	Logic inputs	I_0, I_1, I_2 (current selection)
	input voltage	5 V to 24 V (TTL compatible)
6	TTL inputs	Energise, Damp
	input voltage	5 V
7	Open drain output	Home, Fault, (V_{max} = 50 V, I_{max} = 25 mA)
8	Max. clock frequency	500 kHz
9	Speed sensor input signal:	
	voltage range	-200 V to + 200 V
	damping gain (factory set)	1.25 A/V
10	LED indicator	Power Home (green), Fault (red), Torque loss (orange)
11	Protection	Short-circuit, Overvoltage, Thermal
12	Operating temperature	0 to 40°C
13	Size/Connector	160 x 100 x 54 mm/DIN 41612D32

Connector:

Pin	Row A	Row C
2	Phase B+	Phase B+
4	Phase B-	Phase B-
6	Phase A+	Phase A+
8	Phase A-	Phase A-
10	Vmot	Vmot
12	GND	GND
14	Output +5 V/25 mA	Fault
16	+CW/CCW	-CW/CCW
18	+CLK	-CLK
20	+Stand by	-Stand by
22	+Boost	-Boost
24	Energize	NC
26	Home	Damp
28	I_2	a+ velocity sensor a
30	I_1	a-b- velocity sensor a/b
32	I_0	b+ velocity sensor b

escap Type F

Integrated magnetic encoders



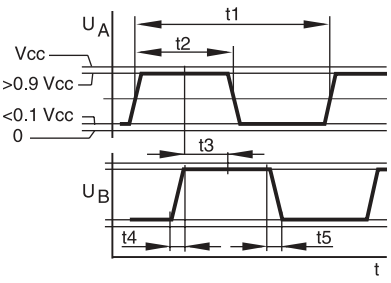
scale: 1:1
dimensions in mm

Encoder type F connections[1)]

1	Motor +	6	Motor -
2	Vcc	7	NC
3	Channel A	8	NC
4	Channel B	9	NC
5	GND	10	NC

Characteristics at 22°C				F
1	Number of pulses per rev.			16
2	Supply voltage	Vcc	V	3.5…15
3	Supply current	typical at 5 V	mA	6
4	Rise time	t4	µs	5
5	Fall time	t5	µs	0.2
6	Output signal[2)]		-	Two channels / square wave in quadrature
7	Electrical phase shift between U1 and U2	t3/t1 x 360	degree	90 ± 40
8	Signal ratio[3)]	t2/t1	%	50 ± 25
9	Max. count frequency		kHz	15
10	Operating temperature range		°C	-20…+85
11	Inertia		10^{-7} x kgm²	0.1
12	Measuring conditions	Temperature	°C	22
		Supply voltage	V	5
		Load resistance	MΩ	1
		Load capacitance	pF	25

Encoder F available on motor types	16N	17N	22N	22V
13 L_1 = length (mm)	30	28.9	34	36.3
14 L_2 = length (mm)	3.6	3.6	3.1	3.1
15 D = motor diameter (mm)	16	17	22	22
16 see page	13	14	15	16

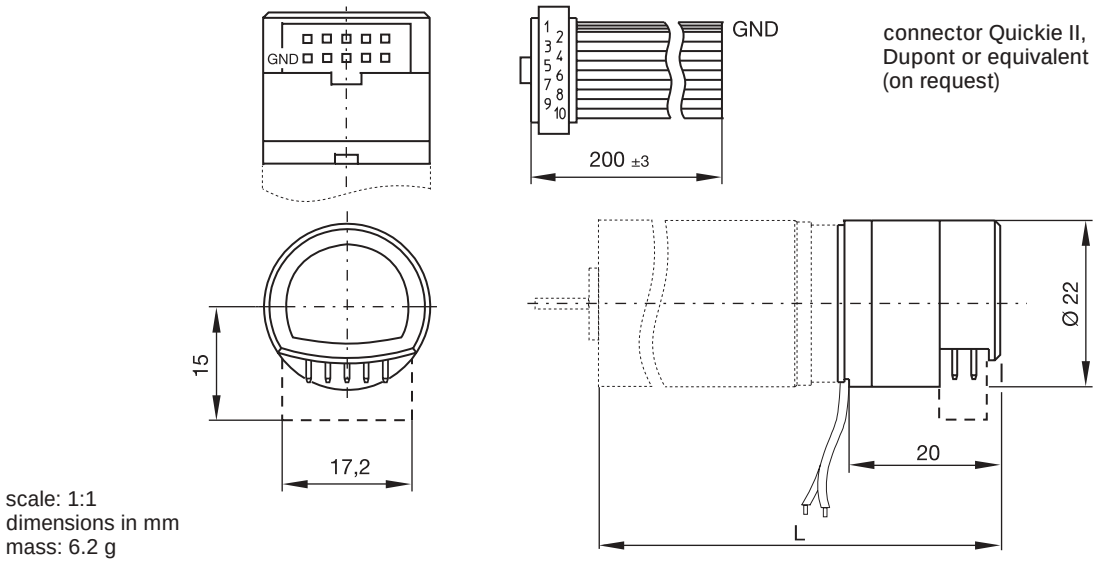


t1: Period
t2/t1: Signal ratio
t3: Phase shift
t4: Rise time
t5: Fall time

1) Connector Dupont type Quikie II or equivalent
2) Internal pull-up resistor: 10 kΩ
3) Over the entire frequency and temperature range

E9

3 channel optical encoder



scale: 1:1
dimensions in mm
mass: 6.2 g

Characteristics at 22°C

1	Number of lines available			100, 144, 200, 256, 360[1], 500[1]
2	Supply current	typical	mA	10
		max.	mA	20
		stand-by	µA	50
3	Output signal		CMOS	compatible
4	Electrical phase shift between A and B		degree	90 ± 20
5	Duty cycle		%	50 ± 10
6	Max. count frequency		kHz	200
7	Operating temperature range	at 90% humidity	°C	-40 to + 85
8	Code wheel moment of inertia		10^{-7} x kgm²	0.12
9	Supply voltage	Vcc	V	5 ± 10%

Pin out		1	2	3	4	5	6	7	8	9	10
10	Version 1	GND	Vcc	dir.	stand-by	$\overline{A}$	A	$\overline{B}$	B	$\overline{Z}$	Z

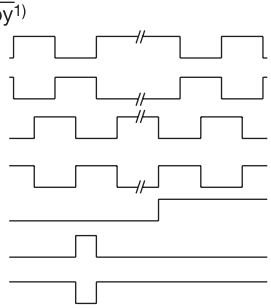
Available on motor types		22V48	23LT12	23DT12	26N48	28DT12	35NT	P530/2.84	P632.04	P850/2.11
11	L = length (mm)	56.2	57.6	71	62.1	85.1	84	57.6	62.3	75.7
12	see page	17	18	19	20	22	23	31	32	33

[1] ask for a 2R motor type for use with the E9 in 360 and 500 line versions.

Typical encoder output signal

Version 1

PIN Output
1 GND
2 Vcc
4 Standby[1]
6 CH A
5 $\overline{\text{CH A}}$
8 CH B
7 $\overline{\text{CH B}}$
3 DIR
10 CH Z
9 $\overline{\text{CH Z}}$



Features

- 2 channel quadrature output and index pulse
- small size
- integrated direction of rotation detection
- stand-by function with latched state of channels (to desactivate the stand-by mode, connect the pin 4 to the +5 V)
- complementary outputs
- up/down pulse signals (on request)
- CMOS compatible.
  [1] The input Standby has to be connected to 0 V_{DC} or +5 V_{DC}
- single 5 V_{DC} supply

The Portescap offer
L'offre Portescap
Das Portescap Produktangebot

To satisfy the variety of changing requirements of today's industries, Portescap offers a broad range of standard, non-standard and custom made solution.
The characteristics and standard tests of our products are outlined in the pages describing the technologies.
To satisfy particular requirements Portescap is prepared to offer solutions tailored to various fields of applications.

CE Regulations
According to the electromagnetic Compatibility directives in force today, the CE marking is obligatory for apparatus containing electric components intended to final user. The motors manufactured by Portescap are not subjected to the electromagnetic compatibility directives since they are considered as components. The final product only in which this component is mounted is subject to the applicable norms. The CE marking is therefore not mandatory.
Concerned about giving some guarantees to our customers, our motors have still been through an EMC conformity test (made by an official laboratory) in order to define their electromagnetic disturbances level. All tested motors have been declared as conform to the standard 89/336/CEE in force. A certificate of conformity can be delivered upon request.

Pour satisfaire aux nombreuses et diverses exigences d'un monde industriel moderne en constante évolution, Portescap offre à sa clientèle une large gamme de produits standard, non standard ou spécifiques.
Les caractéristiques et contrôles standard de nos produits sont décrits dans les chapitres des technologies concernées.
Pour répondre à des besoins différents, Portescap est à même de proposer des solutions adaptées aux divers domaines d'application de ses produits.

Marquage CE
Les moteurs fabriqués par Portescap ne sont pas soumis aux directives de compatibilité électromagnétique car ils sont considérés comme étant des composants. Seul le produit final dans lequel entre ce composant devra être testé et être conforme aux normes en vigueur. Le marquage CE n'est donc pas obligatoire.
Soucieux de pouvoir donner certaines garanties à notre clientèle, nous faisons tout de même tester nos moteurs par un laboratoire agréé afin de définir leur niveau de perturbations électromagnétiques. Tous les moteurs ont été déclarés conformes à la norme 89/336/CEE en vigueur. Un certificat de conformité électromagnétique peut être fourni sur demande.

Zur Erfüllung der vielen sich ständig ändernden Wünsche der modernen Industrie bietet API Portescap seinen Kunden eine breite Palette von Standard-, nicht-Standard- und speziell gefertigten Produkten.
Die technische Beschreibung der verschiedenen Technologien sowie die Liste der vorgenommenen Qualitätskontrollen sind am Anfang der Kapitelseiten der jeweiligen Technologien zu finden.
Für spezielle Wünsche bietet Portescap Lösungen, die den verschiedenen Anwendungen dieser Produkte angepaßt sind.

CE Vorschriften
Die von Portescap gefertigten Motoren unterliegen nicht den Vorschriften der EU für elektromagnetische Verträglichkeit, da sie nur als Bauteile betrachtet werden. Nur das solche Bauteile enthaltende Endprodukt muß entsprechend diesen Vorschriften geprüft werden. Daher tragen die Motoren kein CE-Etikett. Im Interesse unserer Kunden werden aber unsere Motoren von einem unabhängigen Labor entsprechend der Norm 89/336CEE geprüft. Bei Bedarf ist ein Konformitätszertifikat erhältlich.

Portescap, the complete service
Portescap, un service complet
Portescap, der komplette Service

Do you want further information about technologies and products of Portescap Company? Please contact the address closest to you (see next) and ask for the information you need.

Pour en savoir plus sur les technologies et les produits de Portescap, n'hésitez pas une seconde et contactez-nous à l'adresse la plus proche (voir dernière page du catalogue) afin d'obtenir les informations dont vous avez besoin.

Möchten Sie noch mehr wissen über die Technologien und Produkte von Portescap Unternehmen? Rufen Sie ohne Zögern die nächstliegende Adresse an (siehe letzte Seite unseres Kataloges) und nutzen Sie unsere Erfahrung und Fachkompetenz.

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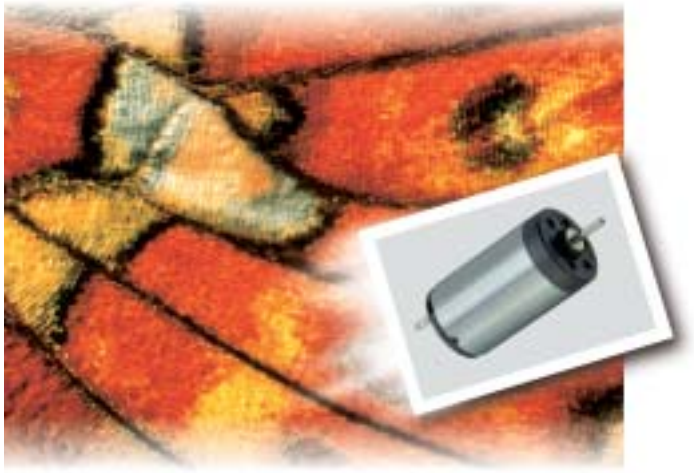

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