

DC-Micromotors

2,5 mNm

Precious Metal Commutation

For combination with (overview on page 14-15)

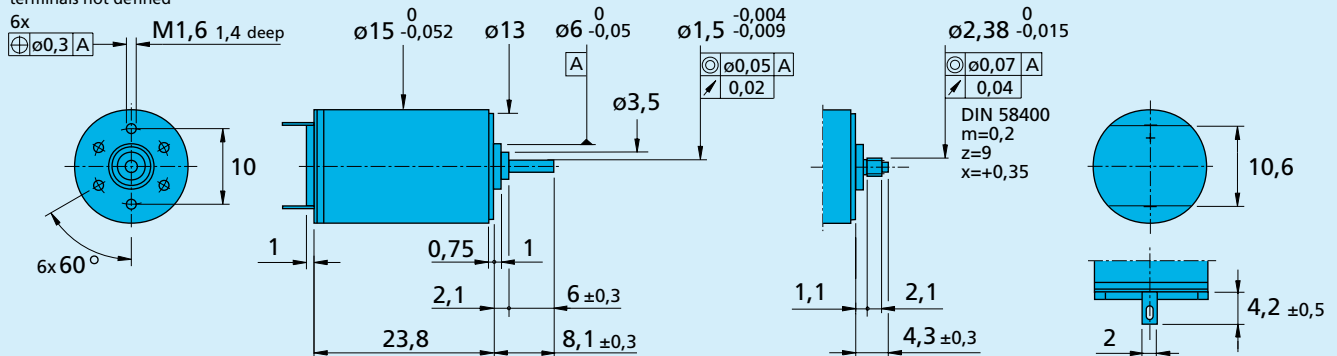
Gearheads:
15A, 15/3, 15/4, 15/5, 15/8, 16A, 16/7

Encoders:
IE2 – 16 ... 512

Series 1524 ... SR

	1524 T	003 SR	006 SR	009 SR	012 SR	018 SR	024 SR	
1 Nominal voltage	U_N	3	6	9	12	18	24	Volt
2 Terminal resistance	R	1,1	5,1	10,4	19,8	44,0	79,6	Ω
3 Output power	$P_{2 \max}$	1,92	1,70	1,88	1,75	1,78	1,75	W
4 Efficiency	η_{\max}	77	77	77	76	77	78	%
5 No-load speed	n_0	10 800	9 700	10 100	9 900	9 900	9 900	rpm
6 No-load current (with shaft \varnothing 1,5 mm)	I_0	0,047	0,021	0,014	0,011	0,007	0,005	A
7 Stall torque	M_H	6,80	6,68	7,12	6,76	6,86	6,75	mNm
8 Friction torque	M_R	0,12	0,12	0,12	0,13	0,12	0,11	mNm
9 Speed constant	k_n	3 660	1 650	1 140	840	560	419	rpm/V
10 Back-EMF constant	k_E	0,273	0,607	0,877	1,190	1,790	2,380	mV/rpm
11 Torque constant	k_M	2,61	5,80	8,37	11,40	17,10	22,80	mNm/A
12 Current constant	k_i	0,384	0,172	0,119	0,088	0,059	0,044	A/mNm
13 Slope of n-M curve	$\Delta n / \Delta M$	1 590	1 450	1 420	1 460	1 440	1 470	rpm/mNm
14 Rotor inductance	L	17	70	150	250	560	1 000	μ H
15 Mechanical time constant	τ_m	10	10	10	10	10	10	ms
16 Rotor inertia	J	0,60	0,66	0,67	0,65	0,66	0,65	gcm ²
17 Angular acceleration	α_{\max}	110	100	110	100	100	100	$\cdot 10^3 \text{rad/s}^2$
18 Thermal resistance	$R_{th 1} / R_{th 2}$	4,5 / 31						K/W
19 Thermal time constant	τ_{w1} / τ_{w2}	2,4 / 300						s
20 Operating temperature range:								
– motor		– 30 ... + 85 (optional – 55 ... + 125)						°C
– rotor, max. permissible		+ 125						°C
21 Shaft bearings		sintered bronze sleeves	ball bearings	ball bearings, preloaded				
22 Shaft load max.:		(standard)	(optional)	(optional)				
– with shaft diameter		1,5	1,5	1,5				mm
– radial at 3 000 rpm (3 mm from bearing)		1,2	5	5				N
– axial at 3 000 rpm		0,2	0,5	0,5				N
– axial at standstill		20	10	10				N
23 Shaft play:								
– radial	\leq	0,03		0,015		0,015		mm
– axial	\leq	0,2		0,2		0		mm
24 Housing material		steel, black coated						
25 Weight		21						g
26 Direction of rotation		clockwise, viewed from the front face						
Recommended values - mathematically independent of each other								
27 Speed up to	$n_{e \max}$	10 000	10 000	10 000	10 000	10 000	10 000	rpm
28 Torque up to	$M_{e \max}$	2,5	2,5	2,5	2,5	2,5	2,5	mNm
29 Current up to (thermal limits)	$I_{e \max}$	1,300	0,630	0,440	0,320	0,210	0,160	A

Orientation with respect to motor terminals not defined



1524 T ... SR

1524 E ... SR
for Gearheads 15/... (except 15A)

Spur Gearheads

0,1 Nm

For combination with (overview on page 14-15)
 DC-Micromotors:
 1319, 1331, 1516, 1524, 1624
 DC-Motor-Tacho Combinations:
 1841

Series 15/5, 16/5

	15/5 and 16/5
Housing material	metal
Geartrain material	steel ¹⁾
Recommended max. input speed for:	
– continuous operation	5 000 rpm
Backlash, at no-load	≤ 3°
Bearings on output shaft	preloaded ball bearings
Shaft load, max.:	
– radial (6,5 mm from mounting face)	≤ 25 N
– axial	≤ 5 N ²⁾
Shaft press fit force, max.	≤ 5 N ²⁾
Shaft play (on bearing output):	
– radial	≤ 0,02 mm
– axial	= 0 mm ²⁾
Operating temperature range	– 30 ... + 100 °C

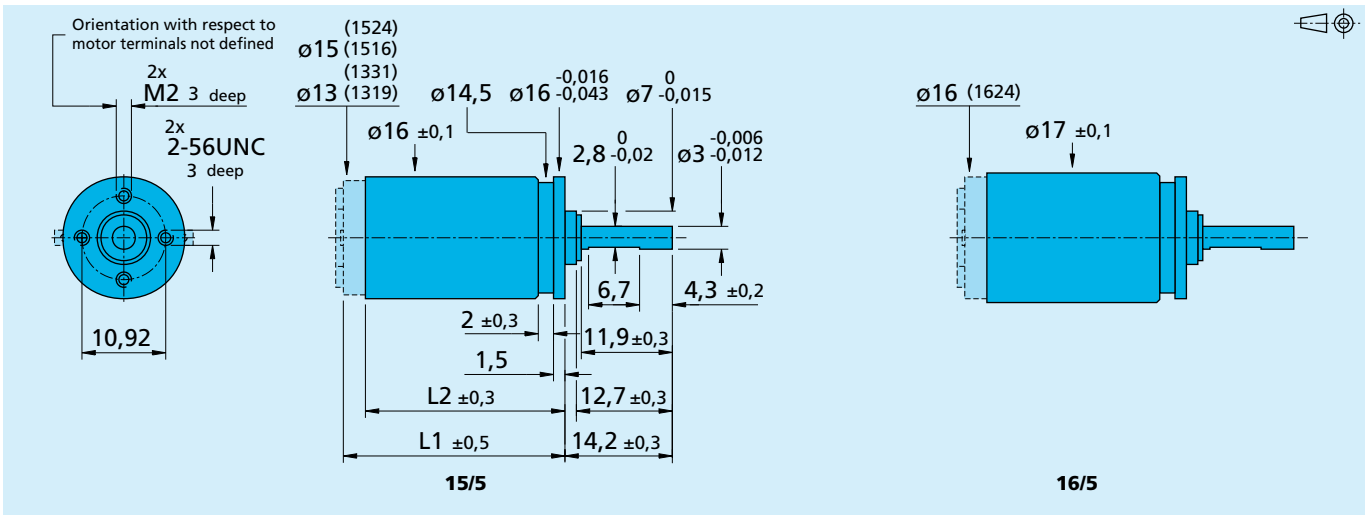
Specifications

reduction ratio (nominal)	weight without motor	length without motor L2	length with motor				output torque		direction of rotation (reversible)	efficiency
			1319 E	1331 E	1516 E	1524 E 1624 E	continuous operation	intermittent operation		
	g	mm	L1	L1	L1	L1	M max. mNm	M max. mNm		%
6,3 :1	17	26,2	32,5	44,5	29,1	37,1	60	150	=	81
11,8 :1	17	26,2	32,5	44,5	29,1	37,1	60	150	=	81
22 :1	19	29,9	36,2	48,2	32,8	40,8	60	150	≠	73
41 :1	19	29,9	36,2	48,2	32,8	40,8	60	150	≠	73
76 :1	21	32,0	38,3	50,3	34,9	42,9	100	300	=	66
141 :1	21	32,0	38,3	50,3	34,9	42,9	100	150	=	66
262 :1	22	34,1	40,4	52,4	37,0	45,0	100	300	≠	59
485 :1	22	34,1	40,4	52,4	37,0	45,0	100	150	≠	59
900 :1	24	36,2	42,5	54,5	39,1	47,1	100	300	=	53
1 670 :1	24	36,2	42,5	54,5	39,1	47,1	100	150	=	53
3 101 :1	25	38,3	44,6	56,6	41,2	49,2	100	300	≠	48
5 752 :1	25	38,3	44,6	56,6	41,2	49,2	100	150	≠	48
10 683 :1	26	40,4	46,7	58,7	43,3	51,3	100	300	=	43
19 813 :1	26	40,4	46,7	58,7	43,3	51,3	100	150	=	43
36 796 :1	28	42,5	48,8	60,8	45,4	53,4	100	300	≠	39
68 245 :1	28	42,5	48,8	60,8	45,4	53,4	100	150	≠	39
126 741 :1	30	44,6	50,9	62,9	47,5	55,5	100	300	=	35
235 067 :1	30	44,6	50,9	62,9	47,5	55,5	100	150	=	35

¹⁾ Gearheads with ratio ≥ 3101:1 have plastic gears in the input stage.
 For extended life performance, the gearheads are available with all steel gears and heavy duty lubricant: type 15/5 S and 16/5 S.

²⁾ Limited by the preloaded ball bearings.
 A higher axial load negates the preload.

Note: The reduction ratios are rounded, the exact values are available on request.



Encoders

Magnetic Encoders

- Features:**
 1,10,12,15 or 16 Lines per revolution
 2 Channels
 Digital output

HE See beginning of the Encoder Section for Ordering Information

		10 mm technology	15 mm technology	
Signal output, square wave		2	2	channels
Supply voltage	V _{CC}	4.5 ... 15.0	4.5 ... 15.0	V DC
Current consumption, typical (V _{CC} = 5 V DC)	I _{CC}	5	5	mA
Pulse width	P	180 ± 45	180 ± 45	°e
Phase shift, channel A to B	Φ	90 ± 45	90 ± 45	°e
Logic state width	S	90 ± 45	90 ± 45	°e
Cycle	C	360 ± 30	360 ± 30	°e
Signal rise/fall time, typical	tr/tf	5 / 0.2	5 / 0.2	µs
Frequency range ¹⁾	f	up to 7.2	up to 7.2	kHz
Inertia of code disc	J	1.3 · 10 ⁻⁶	2.832 · 10 ⁻⁶	oz-in-sec ²
Operating temperature range		-40 to +85 (-40 to +185)	-40 to +85 (-40 to +185)	°C (°F)

¹⁾ Velocity (rpm) = f (Hz) x 60/N

Encoder type	number of channels	counts per revolution	in combination with DC-Micromotors and DC-Motor-Tacho units
		Ø 10 technology Ø 15 technology	
HEM 0816	2	1, 10, 12	series 0816
HEM 1016, 1219, 1224	2	1, 10, 12	series 1016, 1219, 1224
HEM 1319, 1331, 1336	2		series 1319, 1331, 1336
HEM 1516, 1524, 1624, 1841	2	1, 10, 12 15, 16	series 1516, 1524, 1624, 1841
HEM 1717, 1724, 1727	2	1, 10, 12 15, 16	series 1717, 1724, 1727
HEM 2230, 2233, 2251	2	1, 10, 12 15, 16	series 2230, 2233, 2251
HEM 2338, 2342	2	1, 10, 12 15, 16	series 2338, 2342
HEM 2842, 3042	2	1, 10, 12 15, 16	series 2842, 3042
HEM 3557	2	1, 10, 12 15, 16	series 3557

Phase Relationship (with clockwise motor shaft rotation as seen from the shaft end)
 HEM1016 thru HEM12.. with 10 or 12 CPR Channel A leads channel B
 HEM1319 thru HEM35.. with 15 CPR Channel A leads channel B
 HEM1319 thru HEM35.. with 1⁽¹⁾,10,12 or 16 CPR Channel B leads channel A

⁽¹⁾ 1 pulse encoders are 180° phase shift ± 45°

Features

These incremental shaft encoders in combination with the FAULHABER® DC-Micromotors are designed for indication and control of both shaft velocity and direction of rotation as well as for positioning.

Solid state Hall sensors and a low inertia magnetic disc provide two channels with 90° phase shift.

The supply voltage for the encoder and the DC-Micromotor as well as the two channel output signals are interfaced with a ribbon cable to a 6-pin or 10-pin connector on motors ≤ 22mm in diameter. Motors ≥ 23mm in diameter the motor voltage is supplied separately.

Details for the DC-Micromotors and suitable reduction gearheads are on separate catalog pages.

Output signals / Circuit diagram / Connector information

OUTPUT SIGNALS
with clockwise rotation as seen from the shaft end

OUTPUT CIRCUIT
* Motor types 2842, 3042, 3557 have separate motor connectors

STANDARD CONNECTOR
(Panduit 050-010-455)
.050" Ribbon cable - PVC
6 conductors - 28 AWG

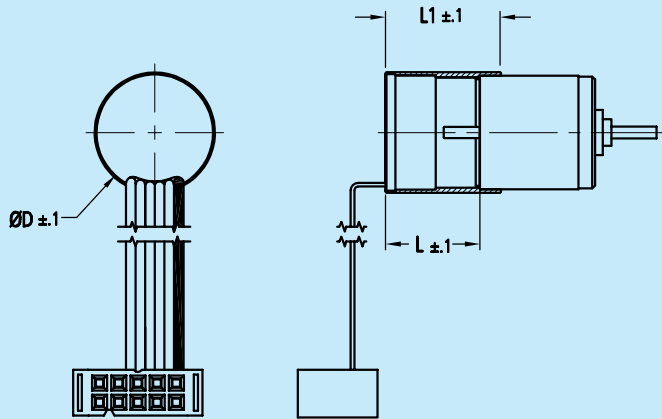
PIN FUNCTION BOTH CONNECTORS	
1	* MOTOR (+)
2	Vcc
3	CHANNEL A
4	CHANNEL B
5	GND
6	* MOTOR (-)
7	N.C.
8	N.C.
9	N.C.
10	N.C.

OPTIONAL CONNECTOR
(Panduit 050-006-455)
.050" Ribbon cable - PVC
6 conductors - 28 AWG

For notes on technical data refer to "Technical Information". Specifications subject to change without notice. MME0701

HE

Encoder HEM 15... & HEM 16... & HEM 17...

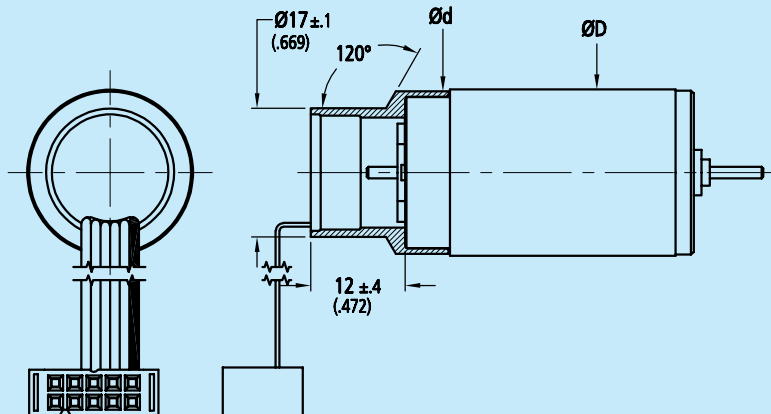


MODEL	$\varnothing D$	L1	L
HEM 1516	16 (.630)	15.3 (.602)	12.5 (.492)
HEM 1616	17 (.669)	15.3 (.602)	12.5 (.492)
HEM 1524	16 (.630)	23.0 (.906)	12.5 (.492)
HEM 1624	17 (.669)	23.0 (.906)	12.5 (.492)
HEM 1717	17 (.669)	18.4 (.724)	12.5 (.492)
HEM 1724	17 (.669)	18.4 (.724)	12.5 (.492)
HEM 1727	17 (.669)	19.1 (.752)	12.5 (.492)

Rear View

HEM 15../16../17..

Encoder HEM 22... & HEM 2338

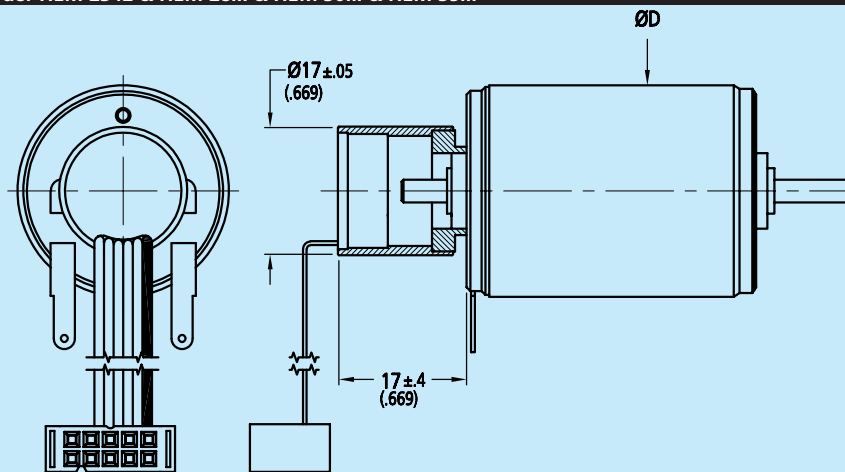


MODEL	$\varnothing d$	$\varnothing D$
HEM 22..	21.5 ± 1 (.846)	22 (.866)
HEM 2338	22 $\begin{smallmatrix} +.00 \\ -.12 \end{smallmatrix}$ (.866)	23 (.906)

Rear View

HEM 22../2338

Encoder HEM 2342 & HEM 28... & HEM 30... & HEM 35...



MODEL	$\varnothing D$
HEM 2342	23 (.906)
HEM 28..	28 (1.102)
HEM 30..	30 (1.181)
HEM 35..	35 (1.378)

Rear View

HEM 2342/28../30../35..

For notes on technical data refer to "Technical Information". Specifications subject to change without notice. MME0701