

TURBODISC MOTOR BASICS

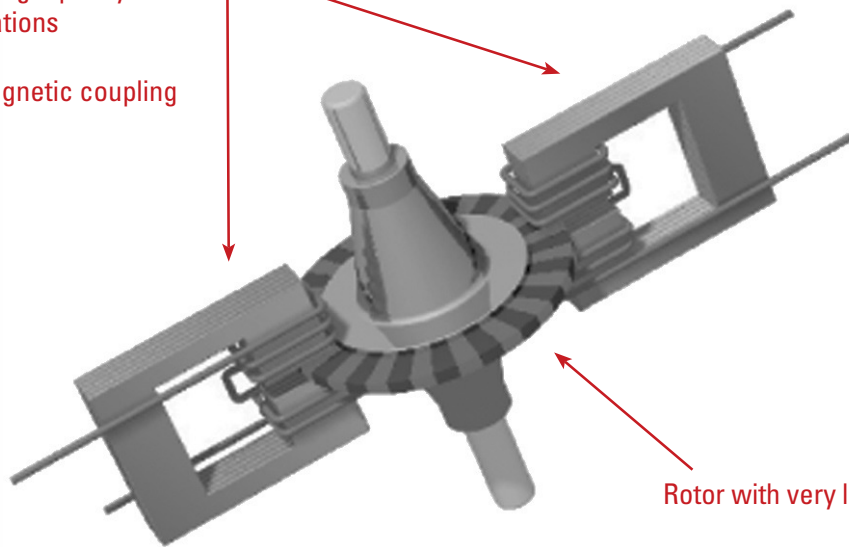
THE HIGH PERFORMANCE DISC MAGNET TECHNOLOGY

The exceptional possibilities offered by the Turbo Disc line of disc magnet stepper motors are unequalled by any other kind of stepper motor. The advanced technology, developed and patented by Portescap, allows for truly exceptional dynamic performance. The rotor of these motors consists of a rare earth magnet having the shape of a thin disc which is axially magnetized. A particular magnetization method allows for a high number of magnetic poles, giving much smaller step angles than conventional two-phase permanent magnet stepper motors.

Such a rotor design has a very low moment of inertia, resulting in outstanding acceleration and dynamic behavior. These features, together with high peak speeds, mean that any incremental movement is carried out in the shortest possible time. Low inertia also means high start/stop frequencies allowing to save time during the first step and to solve certain motion problems without applying a ramp. Those motors, specially designed for microstepping, feature a sinusoidal torque function with very low harmonic distortion and low detent torque. Excellent static and dynamic accuracy is obtained for any position and under any load or speed conditions.

Short magnetic circuit
using high quality
laminations

No magnetic coupling



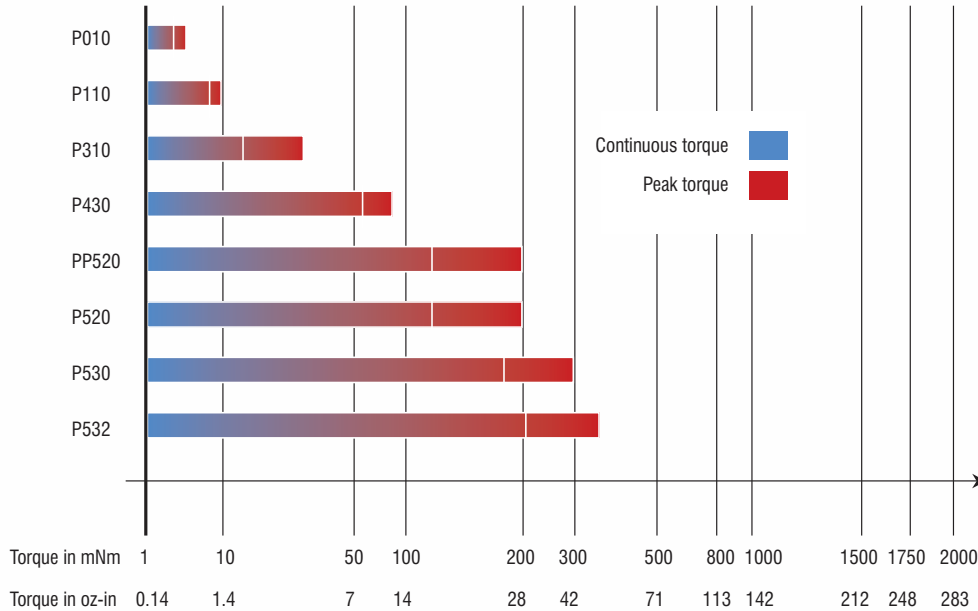
Rotor with very low inertia

Concept Detail	Motor Characteristics	Advantages for the application
Thin multipolar rare earth disc magnet	Very low motor inertia	Very high acceleration, high start/stop frequencies
Very short iron circuit made of SiFe / NdFeB laminations, Coils placed near to the airgap	No coupling between phases Sinusoidal torque function Low detent torque	Superior angular resolution in microstep mode
Optimally dimensioned iron circuit	Torque constant is linear up to 2 to 3 times nominal current	High peak torques
High energy magnet	High power to weight ratio	For motors in mobile applications For size limitations

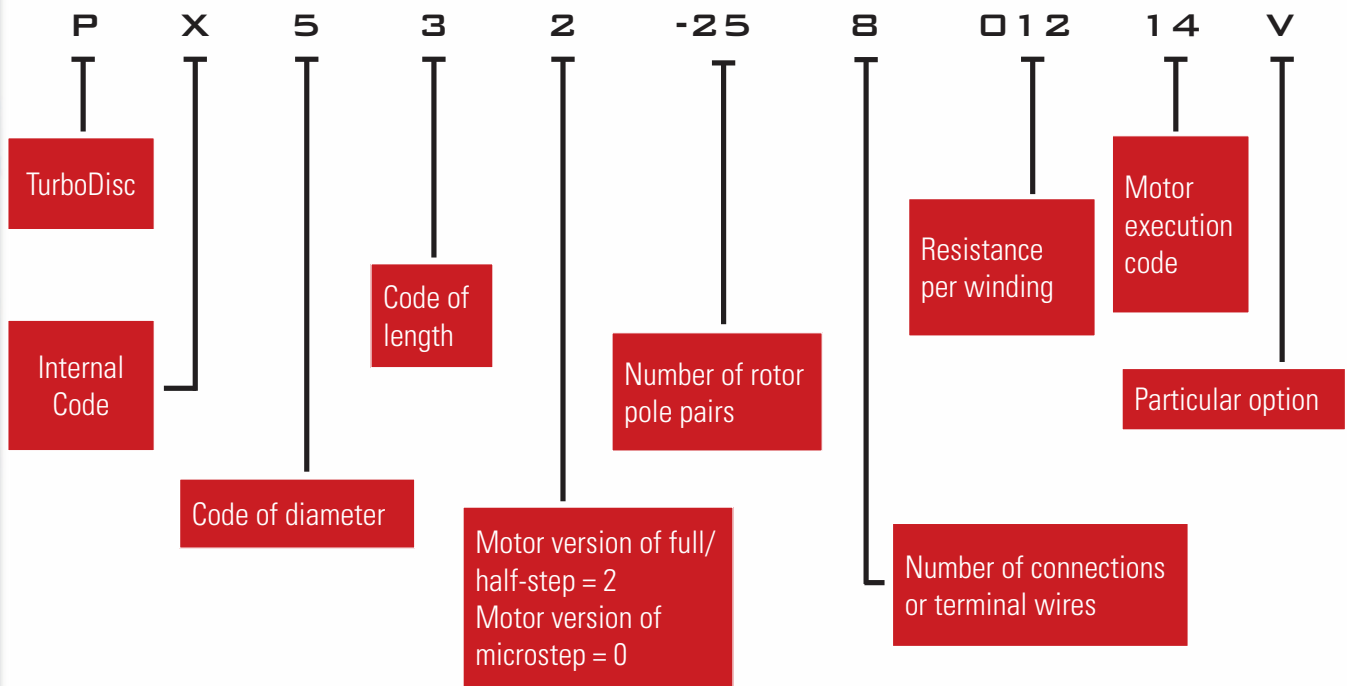


HOW TO SELECT YOUR TURBODISC STEPPER

TURBODISC MOTOR TORQUE RANGE



TURBODISC MOTOR DESIGNATION



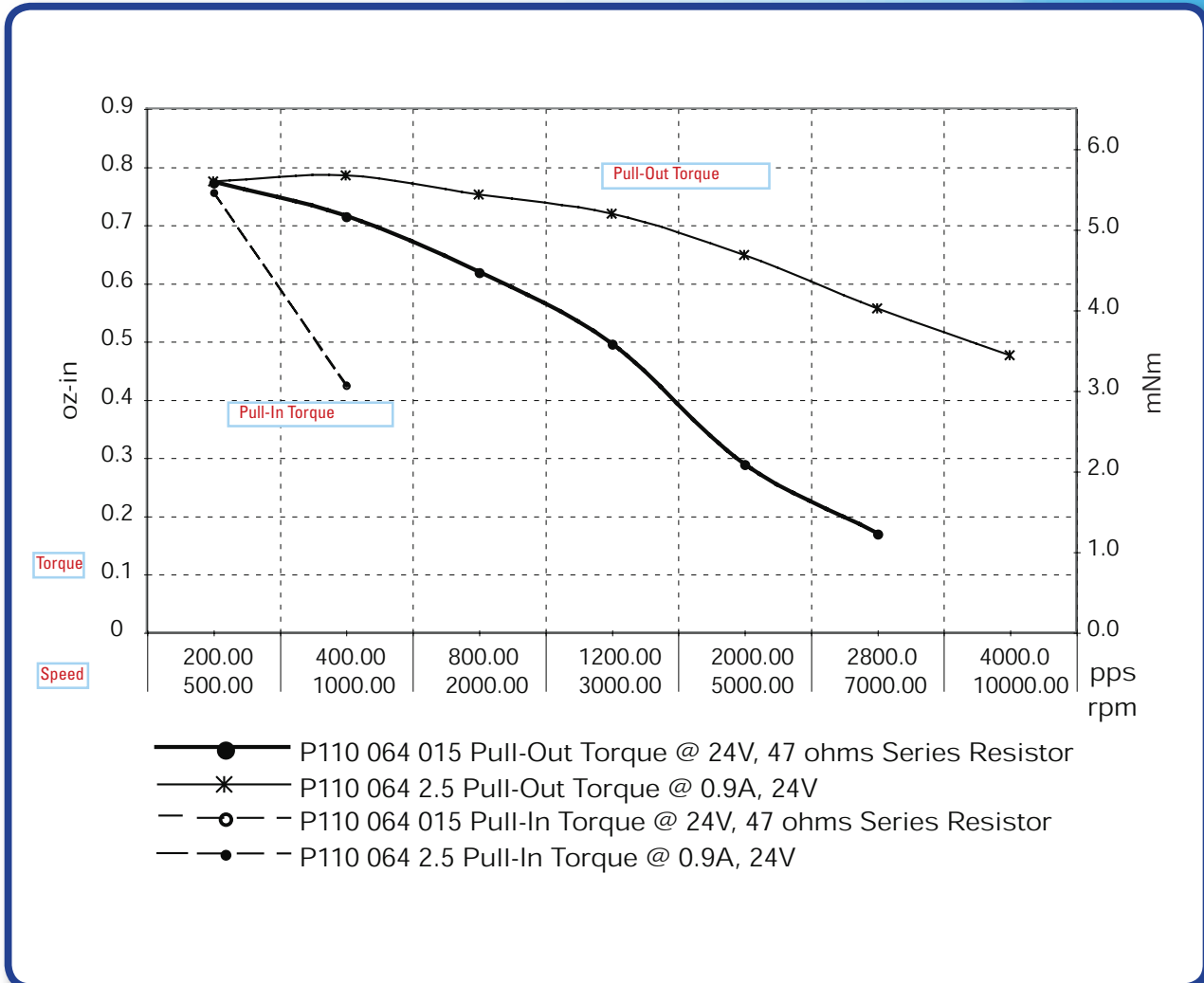
EXPLANATION OF SPECIFICATIONS

MOTOR PART NUMBER		P110 064 068 08/12		EXPLANATION
RATED VOLTAGE		vdc	12.00	Voltage rating of motor - motor can be run continuously at this voltage
RESISTANCE PER PHASE, ± 10%		ohms	62.00	Winding resistance dictated by magnet wire diameter and # of turns
INDUCTANCE PER PHASE, TYP		mH	46.00	Winding inductance dictated by magnet wire diameter and # of turns
RATED CURRENT PER PHASE *		amps	0.12	Current rating of motor - motor can be run continuously at this current
BACK-EMP AMPLITUDE		V/kst/s	10.80	The torque constant of the motor - the back EMF generated by the motor when externally spun at 1000 steps per second
HOLDING TORQUE, TYPICAL *		oz-in / mNm	1.0 / 7	When energized, the amount of torque to move from one mechanical step to the next
DETENT TORQUE, TYPICAL		oz-in / mNm	0.1 / 1	When un-energized, the amount of torque to move from one mechanical step to the next
STEP ANGLE, ± 10% *		degrees	15.00	360 deg / number of mechanical steps of the motor
STEPS PER REVOLUTION *		-	24.00	Number of mechanical steps of the motor
NATURAL RESONANCE FREQUENCY (NOMINAL CURRENT)		Hz	160.00	The frequency at which the motor vibrates at maximum amplitude
ELECTRICAL TIME CONSTANT		ms	0.80	Represents the time it takes for the input current to the motor coil to reach approximately 63% of its final value
ANGULAR ACCELERATION (NOMINAL CURRENT)		rad/s ²	167000.00	The rotational acceleration of the motor when supplied with nominal current
THERMAL RESISTANCE		°C/watt	45.00	
ROTOR MOMENT OF INERTIA		oz-in-s ² / g-cm ²	0.057 x 10E-4 / 0.4	Inertia of the rotor
AMBIENT TEMPERATURE RANGE	OPERATING	°C	-20 ~ +50	Temperature range which the motor will operate
	STORAGE	°C	-40 ~ +85	Storage temperature where the motor will operate
BEARING TYPE		-	SINTERED BRONZE SLEEVE (Optional Ball Bearing on request)	Bearings on front and rear of the motor
INSULATION RESISTANCE AT 500VDC		Mohms	100 MEGOHMS	
DIELECTRIC WITHSTANDING VOLTAGE		vac	300 FOR 5 SECONDS	
WEIGHT		lbs / g	0.05 / 23	Weight of the motor
SHAFT LOAD RATINGS, MAX AT 1500 RPM	RADIAL	lbs / N	0.12 / 0.5 (AT SHAFT CENTER)	Maximum load that can be applied against the shaft
	AXIAL	lbs / N	0.12 / 0.5 (BOTH DIRECTIONS)	Maximum load that can be applied directly down the shaft
LEADWIRES		-	Insulated Cable, AWG 26	Rating of the lead wires
TEMPERATURE CLASS, MAX		-	B (130°C)	Maximum temperature of the winding insulation
RoHS		-	COMPLIANT	



P010 064 015 / P110 064 003

PULL-OUT TORQUE VS SPEED • FULL STEP, BIPOLAR VOLTAGE



DEFINITIONS

Pull-Out Torque The amount of torque that the motor can produce at speed without stalling

Pull-In Torque The amount of torque that the motor can produce from zero speed without stalling

Speed # of pulses per second provided to the motor, also stated in revolutions per minute

Voltage Voltage applied to the drive

Current Current applied to the drive

Drive Chopper type drive - current controlled to the motor winding

WHERE TO APPLY YOUR TURBODISC STEPPER

THE TURBODISC STEPPER PROVIDES THE HIGHEST TORQUE TO INERTIA RATIO AND IS IDEAL FOR APPLICATIONS REQUIRING, FAST AND PRECISE POSITIONING.



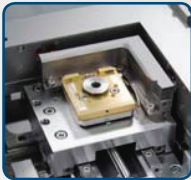
FOCUS ON: MEDICAL ANALYZER

Portescap's challenge for the application was to provide maximum torque in a small diameter package. The higher speed capability of the TurboDisc allowed a higher gear ratio to be utilized, yielding an increase in output torque at the desired speed. The disc magnet design creates quick response time for the motor, increasing the throughput of the machine.



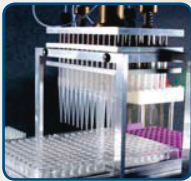
TEXTILE

- Yarn monitoring system
- Electronic wire winding



FACTORY AUTOMATION

- Pick & place machines
- Head positioning
- Die bonding
- Wafer handling
- Feeders



MEDICAL & LAB AUTOMATION

- Analyzers
- Syringe pumps
- Pipettes
- Milling machines
- Prosthetics



OTHER INDUSTRIES & APPLICATIONS

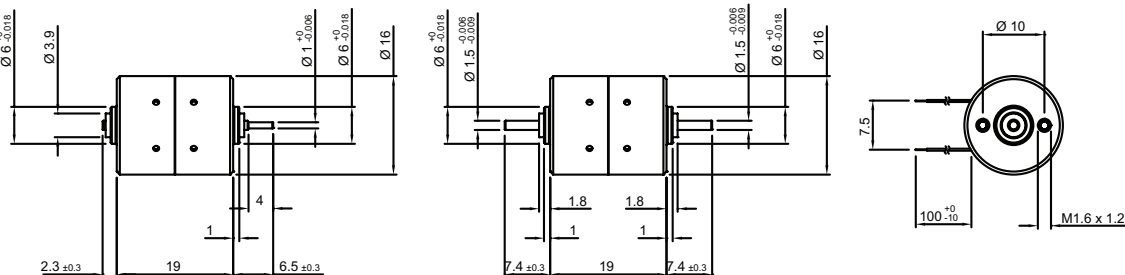
- Engraving
- Laser cutting
- Bar code scanning
- Aircraft instrumentation
- Fiber optic splicers
- Mail sorting

MOTION SOLUTIONS THAT MOVE LIFE FORWARD.™



Turbo Disc™ P110

24 steps/revolution
15° step angle



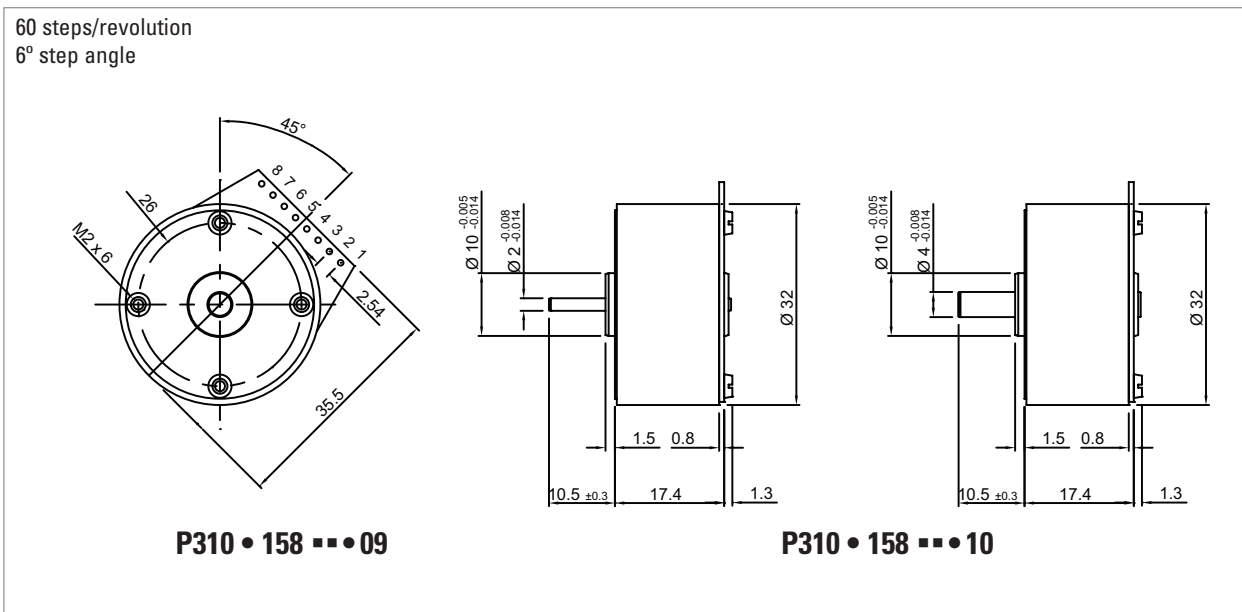
P110 • 064 ••• 08

P110 • 064 ••• 12

Motor Part Number	P110 064 068 08/12	P110 064 015 08/12	P110 064 2.5 08/12	
Rated voltage	vdc	12.00	6.00	3.00
Resistance per phase, ± 10%	ohms	62.00	15.00	2.50
Inductance per phase, typ	mH	46.00	12.00	2.20
Rated current per phase *	amps	0.12	0.25	0.65
Back-emf amplitude	V/kst/s	10.80	5.20	2.00
Holding torque, typical *	oz-in / mNm		1.0 / 7	
Detent torque, typical	oz-in / mNm		0.1 / 1	
Step angle, ± 10% *	degrees		15.0	
Steps per revolution *			24.0	
Natural resonance frequency (nominal current)	Hz		160.00	
Electrical time constant	ms		0.8	
Angular acceleration (nominal current)	rad/s ²		167,000	
Thermal resistance	°C/watt		45.0	
Rotor moment of inertia	oz-in-s ² / g-cm ²		0.057 x 10E-4 / 0.4	
Ambient temperature range				
Operating	°C		-20 ~ +50	
Storage	°C		-40 ~ +85	
Bearing type	Sintered bronze sleeve (optional ball bearing on request)			
Insulation resistance at 500vdc	Mohms		100 megohms	
Dielectric withstanding voltage	vac		300 for 5 seconds	
Weight	lbs / g		0.05 / 23	
Shaft load ratings, max at 1500 rpm				
Radial	lbs / N		0.11 / 0.5 (at shaft center)	
Axial	lbs / N		0.11 / 0.5 (both directions)	
Leadwires	Insulated Cable, AWG 26			
Temperature class, max	B (130°C)			
RoHS	COMPLIANT			

ALL MOTOR DATA VALUES AT 25°C UNLESS OTHERWISE SPECIFIED
* ENERGISE AT RATED CURRENT, 2 PHASE ON

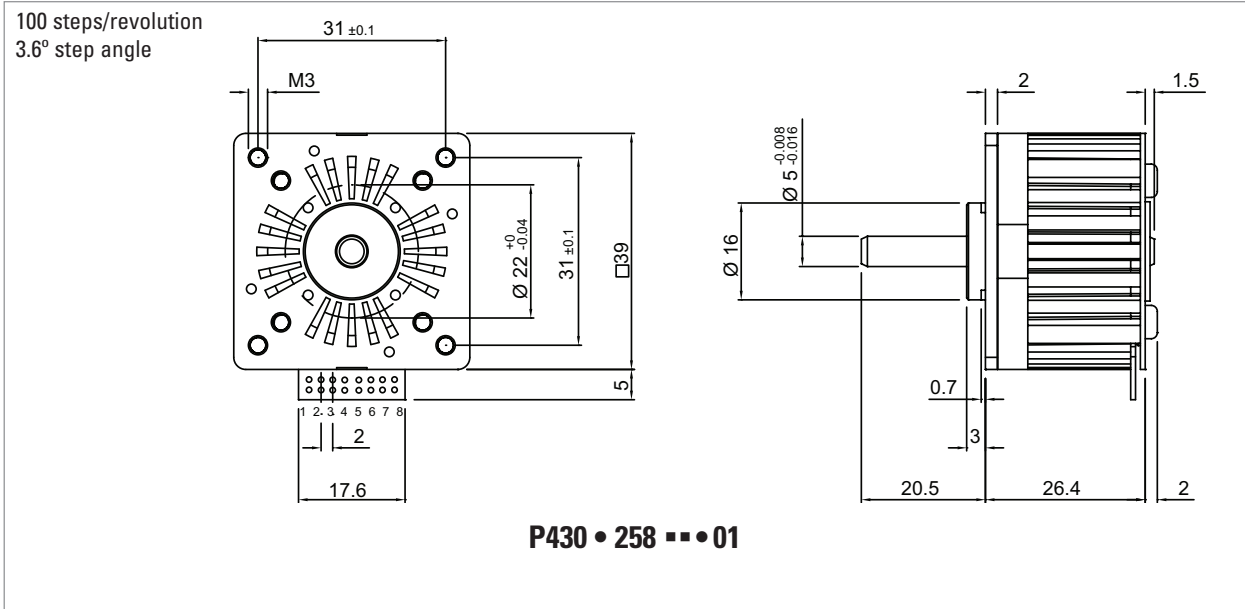
Turbo Disc™ P310



Motor Part Number	P310 158 170 09		P310 158 005 09		
	Series	Parallel	Series	Parallel	
Rated voltage	vdc	20.00	10.00	6.00	6.00
Resistance per phase, ± 10%	ohms	332.00	83.00	10.50	2.60
Inductance per phase, typ	mH	184.00	46.00	6.40	1.60
Rated current per phase *	amps	0.06	0.12	0.36	0.72
Back-emf amplitude	V/kst/s	18.00	9.00	3.20	1.60
Holding torque, typical *	oz-in / mNm	2.0 / 14			
Detent torque, typical	oz-in / mNm	0.3 / 2.5			
Step angle, ± 10% *	degrees	6.0			
Steps per revolution *		60			
Natural resonance frequency (nominal current)	Hz	230.00			
Electrical time constant	ms	0.60			
Angular acceleration (nominal current)	rad/s ²	140,000			
Thermal resistance	°C/watt	25.00			
Rotor moment of inertia	oz-in-s ² / g-cm ²	0.122 X 10 ⁻⁴ / 0.86			
Ambient temperature range					
Operating	°C	-20 ~ +50			
Storage	°C	-40 ~ +85			
Bearing type		Sintered bronze sleeve or ball bearings			
Insulation resistance at 500vdc	Mohms	100 megohms			
Dielectric withstanding voltage	vac	500 for 2 seconds			
Weight	lbs / g	0.09 / 40			
Shaft load ratings, max at 1500 rpm					
Radial	lbs / N	0.22 / 1.0, 2.2 [^] / 10 [^] (at shaft center)			
Axial	lbs / N	0.11 / 0.5, 4.5 [^] / 20 [^] (both directions)			
Leadwires		NA (PCB connection)			
Temperature class, max		B (130°C)			
RoHS		COMPLIANT			

ALL MOTOR DATA VALUES AT 25°C UNLESS OTHERWISE SPECIFIED
 * ENERGISE AT RATED CURRENT, 2 PHASE ON
 ^ Ball bearings

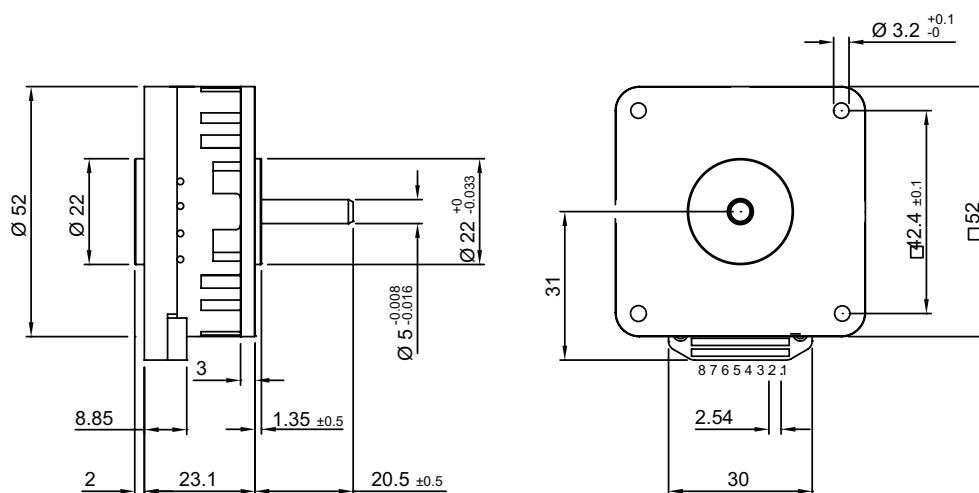
Turbo Disc™ P430



Motor Part Number	P430 258 013 01		P430 258 005 01	
	Series	Parallel	Series	Parallel
Rated voltage	vdc	12.00	12.00	12.00
Resistance per phase, ± 10%	ohms	26.00	6.50	2.50
Inductance per phase, typ	mH	40.00	10.00	3.50
Rated current per phase *	amps	0.34	0.68	1.12
Back-emf amplitude	V/kst/s	7.50	3.80	4.70
Holding torque, typical *	oz-in / mNm			8.5 / 60
Detent torque, typical	oz-in / mNm			0.5 / 3.5
Step angle, ± 10% *	degrees			3.60
Steps per revolution *				100
Natural resonance frequency (nominal current)	Hz			360.00
Electrical time constant	ms			1.50
Angular acceleration (nominal current)	rad/s ²			200,000
Thermal resistance	°C/watt			11.00
Rotor moment of inertia	oz-in-s ² / g-cm ²			0.425 x 10E-4 / 3.0
Ambient temperature range				
Operating	°C			-20 ~ +50
Storage	°C			-40 ~ +85
Bearing type				Radial ball bearings
Insulation resistance at 500vdc	Mohms			100 megohms
Dielectric withstanding voltage	vac			500 for 5 seconds
Weight	lbs / g			0.22 / 100
Shaft load ratings, max at 1500 rpm				
Radial	lbs / N			4.5 / 20 (at shaft center)
Axial	lbs / N			6.7 / 30 (both directions)
Leadwires				NA (PCB connection)
Temperature class, max				B (130°C)
RoHS				COMPLIANT

ALL MOTOR DATA VALUES AT 25°C UNLESS OTHERWISE SPECIFIED
* ENERGISE AT RATED CURRENT, 2 PHASE ON

Turbo Disc™ P520

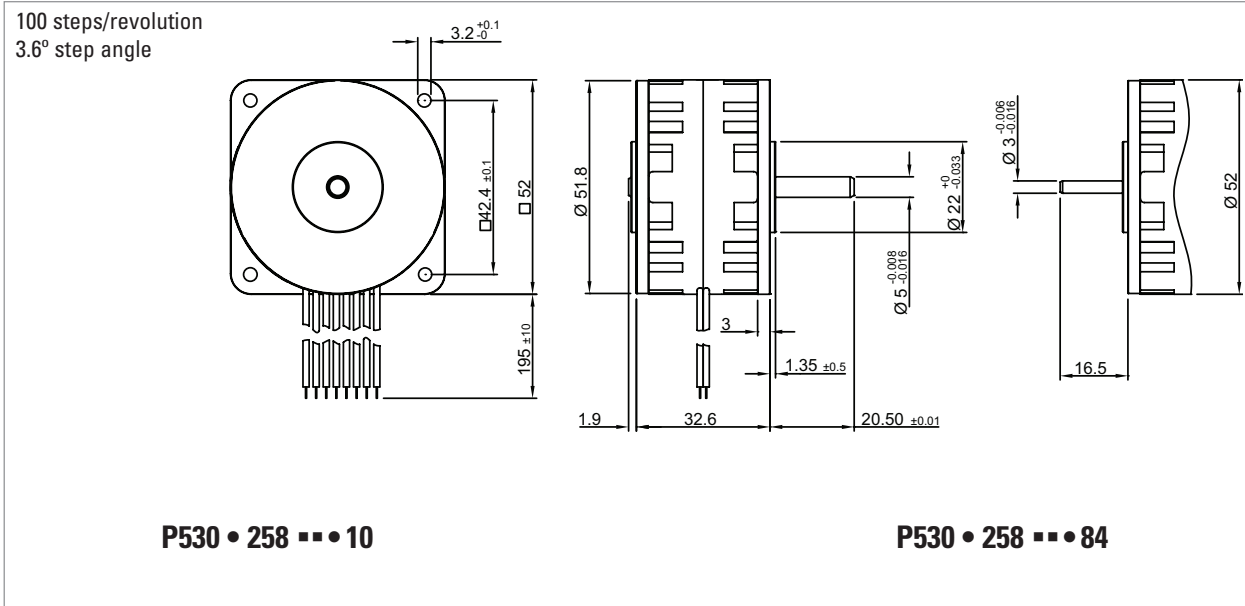
 100 steps/revolution
 3.6° step angle


PP520 • 258 ■■■ 01

Motor Part Number		P520 254 013 60 PP520 258 013 01	P520 254 004 60 PP520 258 004 01	P520 254 0.7 60 PP520 258 0.7 01
Rated voltage	vdc	12.00	12.00	12.00
Resistance per phase, ± 10%	ohms	13.50	4.40	0.70
Inductance per phase, typ	mH	27.00	8.00	1.30
Rated current per phase *	amps	0.50	0.90	2.30
Back-emf amplitude	V/kst/s	9.80	5.50	2.10
Holding torque, typical *	oz-in / mNm		17 / 120	
Detent torque, typical	oz-in / mNm		1.4 / 10	
Step angle, ± 10% *	degrees		3.60	
Steps per revolution *			100.00	
Natural resonance frequency (nominal current)	Hz		250.00	
Electrical time constant	ms		1.80	
Angular acceleration (nominal current)	rad/s ²		100,000	
Thermal resistance	°C/watt		9.50	
Rotor moment of inertia	oz-in-s ² / g-cm ²		1.7 x 10 ⁻⁴ / 12	
Ambient temperature range				
Operating	°C		-20 ~ +50	
Storage	°C		-40 ~ +85	
Bearing type			Radial Ball Bearings	
Insulation resistance at 500vdc	Mohms		100 megohms	
Dielectric withstanding voltage	vac		500 for 5 seconds	
Weight	lbs / g		0.40 / 180	
Shaft load ratings, max at 1500 rpm				
Radial	lbs / N		4.5 / 20 (at shaft center)	
Axial	lbs / N		6.7 / 30 (both directions)	
Leadwires			Insulated Cable, AWG 24	
Temperature class, max			B (130°C)	
RoHS			COMPLIANT	

 ALL MOTOR DATA VALUES AT 25°C UNLESS OTHERWISE SPECIFIED
 * ENERGISE AT RATED CURRENT, 2 PHASE ON

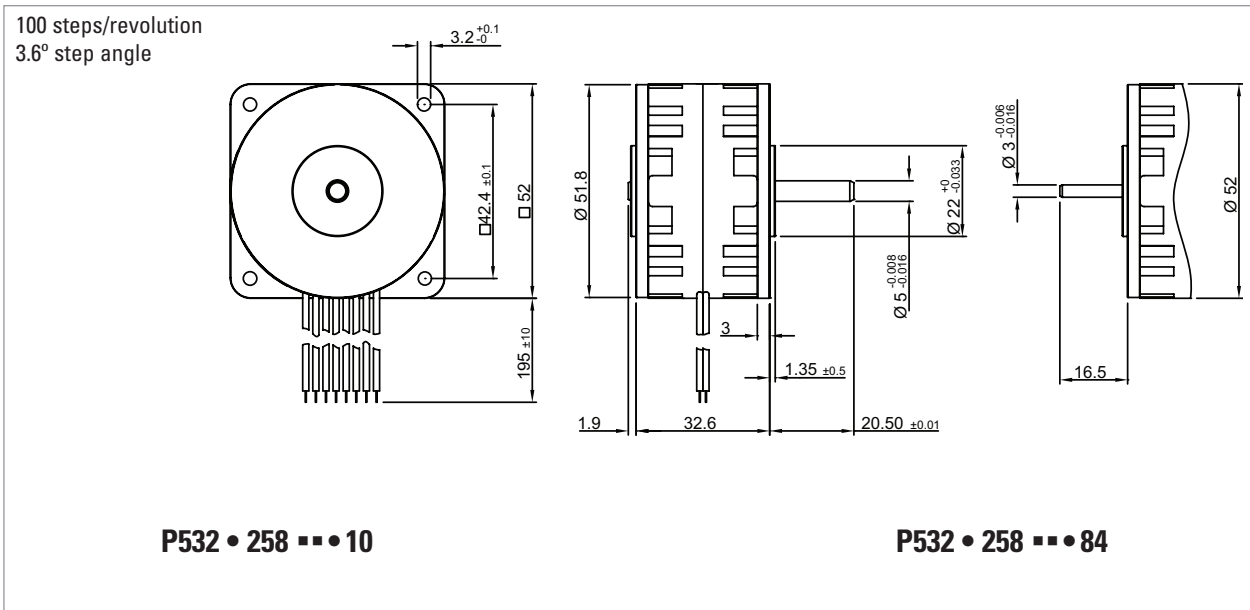
Turbo Disc™ P530



Motor Part Number	P530 258 012 10/84		P530 258 004 10/84		P530 258 0.7 10/84	
		Series	Parallel	Series	Parallel	
Rated voltage	vdc	15.00	12.00	6.00	3.00	
Resistance per phase, ± 10%	ohms	27.00	8.80	2.20	0.35	
Inductance per phase, typ	mH	64.00	20.00	5.00	0.70	
Rated current per phase *	amps	0.40	0.70	1.40	3.70	
Back-emf amplitude	V/kst/s	20.00	11.00	5.50	2.10	
Holding torque, typical *	oz-in / mNm			25 / 175		
Detent torque, typical	oz-in / mNm			1.4 / 10		
Step angle, ± 10% *	degrees			3.60		
Steps per revolution *				100		
Natural resonance frequency (nominal current)	Hz			300.00		
Electrical time constant	ms			2.30		
Angular acceleration (nominal current)	rad/s ²			141,000		
Thermal resistance	°C/watt			7.30		
Rotor moment of inertia	oz-in-s ² / g-cm ²			1.7 X 10E-4 / 12		
Ambient temperature range						
Operating	°C			-20 ~ +50		
Storage	°C			-40 ~ +85		
Bearing type				Ball bearings		
Insulation resistance at 500vdc	Mohms			100 megohms		
Dielectric withstanding voltage	vac			500 for 5 seconds		
Weight	lbs / g			0.55 / 250		
Shaft load ratings, max at 1500 rpm						
Radial	lbs / N			4.5 / 20.0 (at shaft center)		
Axial	lbs / N			6.75 / 30.0 (both directions)		
Leadwires				INSULATED CABLE, 0.25 mm ² (AWG 24)		
Temperature class, max				B (130°C)		
RoHS				COMPLIANT		

ALL MOTOR DATA VALUES AT 25°C UNLESS OTHERWISE SPECIFIED
* ENERGISE AT RATED CURRENT, 2 PHASE ON

Turbo Disc™ P532



Motor Part Number	P532 258 012 10/84		P532 258 004 10/84		P532 258 0.7 10/84	
	Series	Parallel	Series	Parallel	Series	Parallel
Rated voltage	vdc		15.00	12.00	6.00	3.00
Resistance per phase, ± 10%	ohms		27.00	8.80	2.20	0.35
Inductance per phase, typ	mH		64.00	20.00	5.00	0.70
Rated current per phase *	amps		0.40	0.70	1.40	3.70
Back-emf amplitude	V/kst/s		21.00	12.00	6.00	2.30
Holding torque, typical *	oz-in / mNm		29 / 205			
Detent torque, typical	oz-in / mNm		4.0 / 28			
Step angle, ± 10% *	degrees		3.60			
Steps per revolution *			100			
Natural resonance frequency (nominal current)	Hz		330.00			
Electrical time constant	ms		2.30			
Angular acceleration (nominal current)	rad/s ²		171,000			
Thermal resistance	°C/watt		7.30			
Rotor moment of inertia	oz-in-s ² / g-cm ²		1.7 X 10E-4 / 12			
Ambient temperature range						
Operating	°C		-20 ~ +50			
Storage	°C		-40 ~ +85			
Bearing type			Ball bearings			
Insulation resistance at 500vdc	Mohms		100 megohms			
Dielectric withstanding voltage	vac		500 for 5 seconds			
Weight	lbs / g		0.55 / 250			
Shaft load ratings, max at 1500 rpm						
Radial	lbs / N		4.5 / 20.0 (at shaft center)			
Axial	lbs / N		6.7 / 30.0 (both directions)			
Leadwires			INSULATED CABLE, 0.25 mm ² (AWG 24)			
Temperature class, max			B (130°C)			
RoHS			COMPLIANT			

ALL MOTOR DATA VALUES AT 25°C UNLESS OTHERWISE SPECIFIED
* ENERGISE AT RATED CURRENT, 2 PHASE ON