FRAEN CORPORATION

Advanced Manufacturing Division

6405-1500 Stepper Motor

6405-1512 Stepper Motor

6405-1553 Stepper Motor

6405-1561 Stepper Motor

FRAEN 6405-15XX

Standard Stepper Motors

FRAEN 6405 SERIES STANDARD STEPPER MOTOR				
PARAMETER	**MINIMUM**	**TYPICAL**	**MAXIMUM**	**UNITS**
Pointer weight		2	3	g force
Pointer Load inertia		200	800	$g.mm^2$
Pointer imbalance at 4.7 to 5v, 20ºC to 95ºC		1	2.5	g.mm
Distance from the bottom of the pointer hub to motor housing		12		mm
Start/Stop speed @ 5v, no vibration		>150	>140	º/sec
Start/Stop speed, no vibration @ coil voltage = 4.7v		>135	>130	º/sec
Start/Stop speed, no vibration @ 4.7v, T=95ºC		>105	>100	º/sec
Start/Stop speed, 10g accel vibration, @ 4.7v, & T=95ºC		>90	>65	º/sec
Max Speed @ 5v, no vibration			>800	º/sec
Max Acceleration (up to 400º /sec) @ 5v, no vibration		>6000	>5000	$º/sec^2$
Operating Temperature	-40		105	ºC
Storage Temperature	-40		105	ºC
Coil Resistance[1]	214	227	240	Ohms
Operating Voltage	2.5	5	7.5	Volts
Operating Current @ 5v		22		mA
Magnetic Saturation Voltage		12		Volts
Coil Inductance	45	55	65	mH
Rotor magnetic pole pairs		5		pole pairs
Gear ratio		1:36		
Rotor rotation per magnetic cycle (North pole to North pole)		72		Degrees

FRAEN 6405 SERIES STANDARD STEPPER MOTOR				
Output shaft rotation per magnetic cycle		2		Degrees
Output shaft rotation in full step mode		0.5		Degrees
Output shaft rotation in half-step mode		0.25		Degrees
Output shaft rotation in microstep mode @ 12steps/degree		0.083		Degrees
Maximum Sweep Span	300			Degrees
Dynamic Torque @ 20ºC				
@ 200º/sec	1.2			mNm
@ 400º/sec	0.6			mNm
Static Torque		3.6		mNm
Detent Torque	0.3	0.4		mNm
Hysteresis		0.6	1	Degrees
Linearity Error		0.3	0.5	Degrees
Maximum Speed	600			º/sec
Equivalent motor inertia @ output		6.50E-06		Kg*m²
Noise Level				
@ 100º/sec		30	35	dB(A)
@ 200º/sec		35	40	dB(A)
@ 400º/sec		40		dB(A)
Permissible forces on output shaft[2]				
Push/Pull Force (Axial)			100	N
Push/Pull Force (Radial @ 8mm)			12	N
Front Mount motor insertion force[3] into circuit board with PWB hole size 2.2 +0.1/-0.0 mm		34		N
Rear Mount motor Insertion Force[3] into circuit board with PWB diameter interference 0.02-0.25mm		105		N
Internal Stop Break-out Torque	70			mNm
Permissible number of insertions of motor into PWB		1		
Weight		7		g

Unless otherwise specified: Tdut = 20º C
Full step 2-phase on

[1] The temperature conversion for copper wire used in the bobbins is: RT=(1+(T-20)*(0.00393))*R20

[2] Since the permissible pointer push-on/pull-off forces are 100N, the solder joints must not be damaged with these loads. The snaps are intended to carry much of the load when the pointer is pulled off, regardless of circuit board hole variations within permissible limits.

[3] The insertion force is to be measured by applying a normal force to the botor housing while the snaps are resting above the circuit board holes. Board thickness and hole locations and tolerances are to be as specified on the drawing.

[4] Other information:

Part Number	Output Shaft	Motor Orientation
6405-1500	8mm	Front Mount
6405-1512	12mm	Front Mount
6405-1553	16.5mm	Rear Mount
6405-1561	12mm	Rear Mount