

#### Force

- » Peak: 744 - 1860 N
- » Continuous: 120 - 276N

#### Maximum Velocity

- » Up to 9.4 m/s

#### Feedback

- » Built-in position sensor
- » 1V pk-pk sin/cos
- » 20 micron repeatability

#### Range of motion

- » Travel lengths up to 1750 mm

#### Dimensions

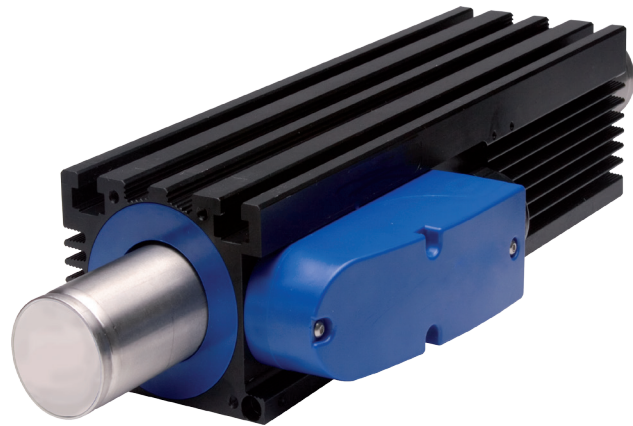
- » W x H: 70 x 122mm
- » Rod diameter: 38mm

#### Applications

- » Packaging
- » Material Handling
- » Automated Assembly
- » Bio-medical

#### The OEM advantage

- » Reliable and cost-effective
- » Flexible position control
- » High speed and acceleration
- » Clean, quiet operation
- » No maintenance or adjustment



ServoTube delivers the speed of a belt-drive system with the clean reliability of a linear forcer at a price unprecedented in the industry. Familiar form factor, integral position feedback and large air gap make installation simple.

The ServoTube forcer components consist of an IP67 rated forcer and a sealed stainless steel thrust rod enclosing rare-earth magnets. Four models deliver a continuous force range of 120~276 N (31~62 lb) with peak forces up to 1860 N (418 lb). A range of Thrust Rods are available for travel lengths up to 1362mm.

The patented magnetic design of ServoTube generates 20 micron (0.79 mil) repeatability and 400 micron (16 mil) accuracy from a non-contact, integral position sensor. No external encoder is required. Position output is industry standard 1V pk-pk sin/cos signals.

ServoTube is an ideal OEM solution for easy integration into pick-and-place gantries and general purpose handling machines. The load is mounted directly to the forcer typically supported by a single bearing rail. The Thrust Rod is mounted at both ends, similar to a ballscrew. A large air gap reduces alignment constraints.

The tubular forcer has superior thermal efficiency, radiating heat uniformly. High duty cycles are possible without the need for forced-air or water cooling.

## ELECTRICAL SPECIFICATIONS

FORCER TYPE	3804		3806		3808		3810		units
	S <sup>(1)</sup>	P <sup>(1)</sup>	S <sup>(1)</sup>	P <sup>(1)</sup>	S <sup>(1)</sup>	P <sup>(1)</sup>	S <sup>(1)</sup>	P <sup>(1)</sup>	
Peak force @ 25°C ambient for 1 sec	744	372	1116	558	1488	744	1860	930	N
Peak current @ 25°C ambient for 1 sec	20		20		20		20		Apk
<b>With 25 x 25 x2.5cm heatsink plate</b>									
Continuous stall force @ 25°C ambient <sup>(2)</sup>	137.3		186.9		232.1		276.2		N
Continuous stall current @ 25°C ambient	2.61	5.23	2.37	4.74	2.20	4.41	2.10	4.20	Arms
	3.69	7.39	3.35	6.71	3.12	6.23	2.97	5.94	Apk
<b>Without heatsink plate</b>									
Continuous stall force @ 25°C ambient <sup>(2)</sup>	120.1		168.2		212.7		255.0		N
Continuous stall current @ 25°C ambient	2.28	4.57	2.13	4.27	2.02	4.04	1.94	3.88	Arms
	3.23	6.46	3.01	6.03	2.86	5.72	2.74	5.49	Apk
Force constant (sine commutation)	52.6	26.3	78.9	39.4	105.2	52.6	131.5	65.7	N/Arms
	37.2	18.6	55.8	27.9	74.4	37.2	93.0	46.5	N/Apk
Back EMF constant (phase to phase)	43.0	21.5	64.4	32.2	85.9	42.9	107.4	53.7	Vpk/m/s
Fundamental forcer constant	14.54		17.80		20.56		22.99		N/√W
Eddy current loss	3.7		3.7		3.7		3.7		N/m/s
Sleeve cogging force	7.3		4.2		8.3		5.6		+/-N
Resistance @ 25°C (phase to phase)	6.77	1.69	10.16	2.54	13.54	3.38	16.93	4.23	Ohm
Resistance @ 100°C (phase to phase)	8.73	2.18	13.10	3.27	17.45	4.36	21.82	5.45	Ohm
Inductance @ 1kHz (phase to phase)	8.52	2.13	12.78	3.19	17.04	4.26	21.30	5.32	mH
Electrical time constant	1.26		1.26		1.26		1.26		ms
Maximum working voltage	380		380		380		380		V d.c.
Pole pitch (one electrical cycle)	71.2		71.2		71.2		71.2		mm
Peak acceleration <sup>(3)</sup>	244	122	276	138	295	147	307	154	m/s <sup>2</sup>
Maximum speed <sup>(4)</sup>	6.2	9.4	4.5	7.6	3.5	6.2	2.8	5.2	m/s

### Notes:

- <sup>(1)</sup> S=series forcer phases, P=parallel forcer phases  
<sup>(2)</sup> Reduce continuous stall force to 89% at 40°C ambient  
<sup>(3)</sup> Based on a moving forcer with typical bearings and no payload  
<sup>(4)</sup> Based on a moving forcer with triangular move over maximum stroke and no payload

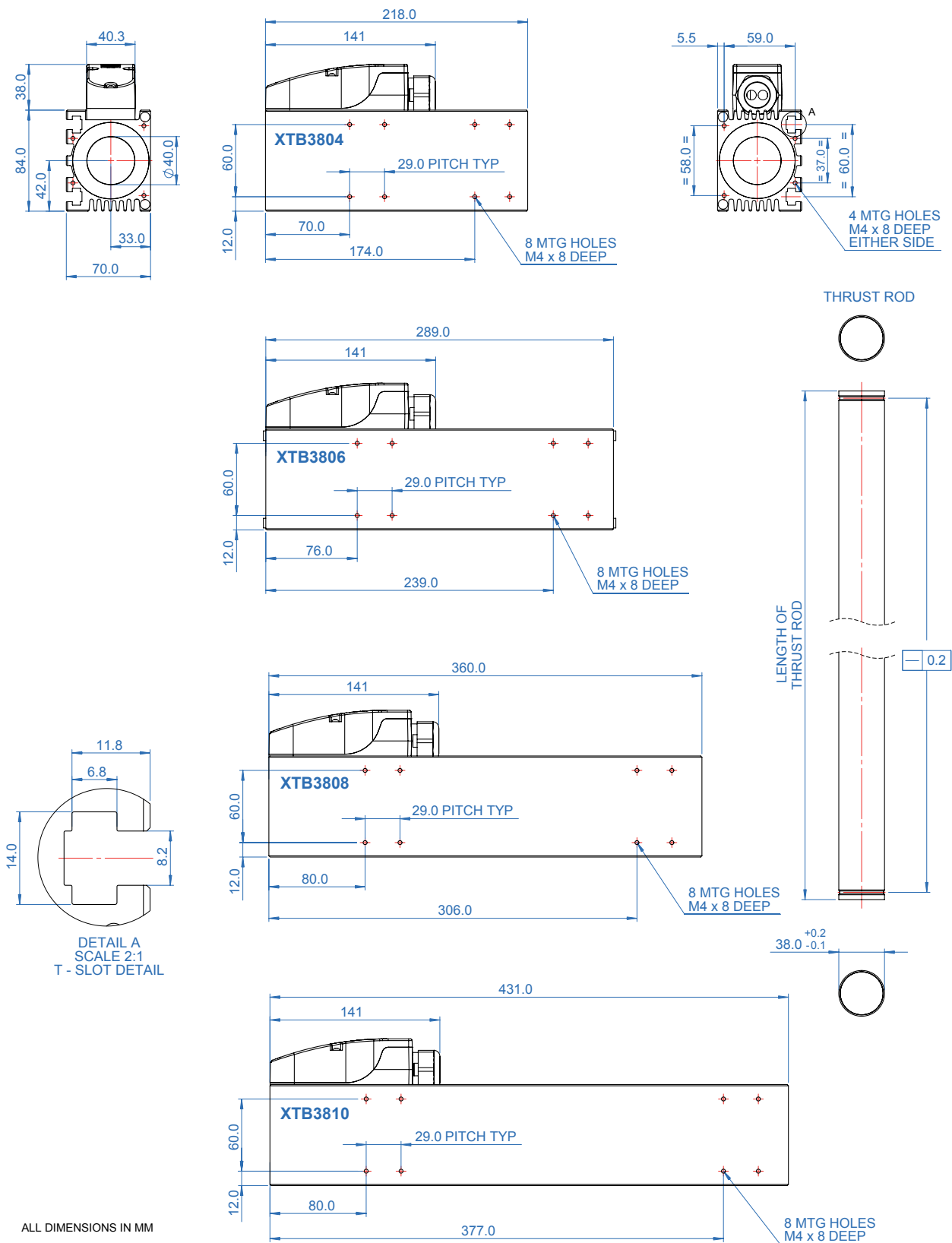
## THERMAL SPECIFICATIONS

FORCER TYPE	3804	3806	3808	3810	units
Maximum phase temperature	100	100	100	100	°C
Thermal resistance Rth <sub>phase-housing</sub>	0.23	0.16	0.13	0.11	°C/Watt
<b>With 25 x 25 x2.5cm heatsink plate</b>					
Power dissipation @ 25°C ambient	89.3	110.3	127.1	144.2	Watt
Thermal resistance Rth <sub>housing-ambient</sub>	0.61	0.52	0.46	0.41	°C/Watt
<b>Without heatsink plate</b>					
Power dissipation @ 25°C ambient	68.2	89.3	107.0	123.0	Watt
Thermal resistance Rth <sub>housing-ambient</sub>	0.87	0.68	0.57	0.50	°C/Watt
Thermal time constant	1677	1798	1924	2056	s

## MECHANICAL SPECIFICATIONS

FORCER TYPE	3804	3806	3808	3810	units
Maximum stroke	1362	1291	1219	1148	mm
Forcer mass (including bearings)	3.05	4.05	5.05	6.05	kg
Forcer mass (excluding bearings)	2.55	3.55	4.55	5.55	kg
Thrust rod mass/metre	8.3	8.3	8.3	8.3	kg/m

OUTLINE DRAWINGS



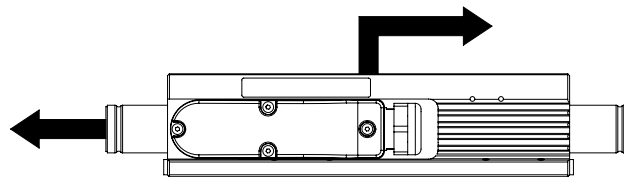
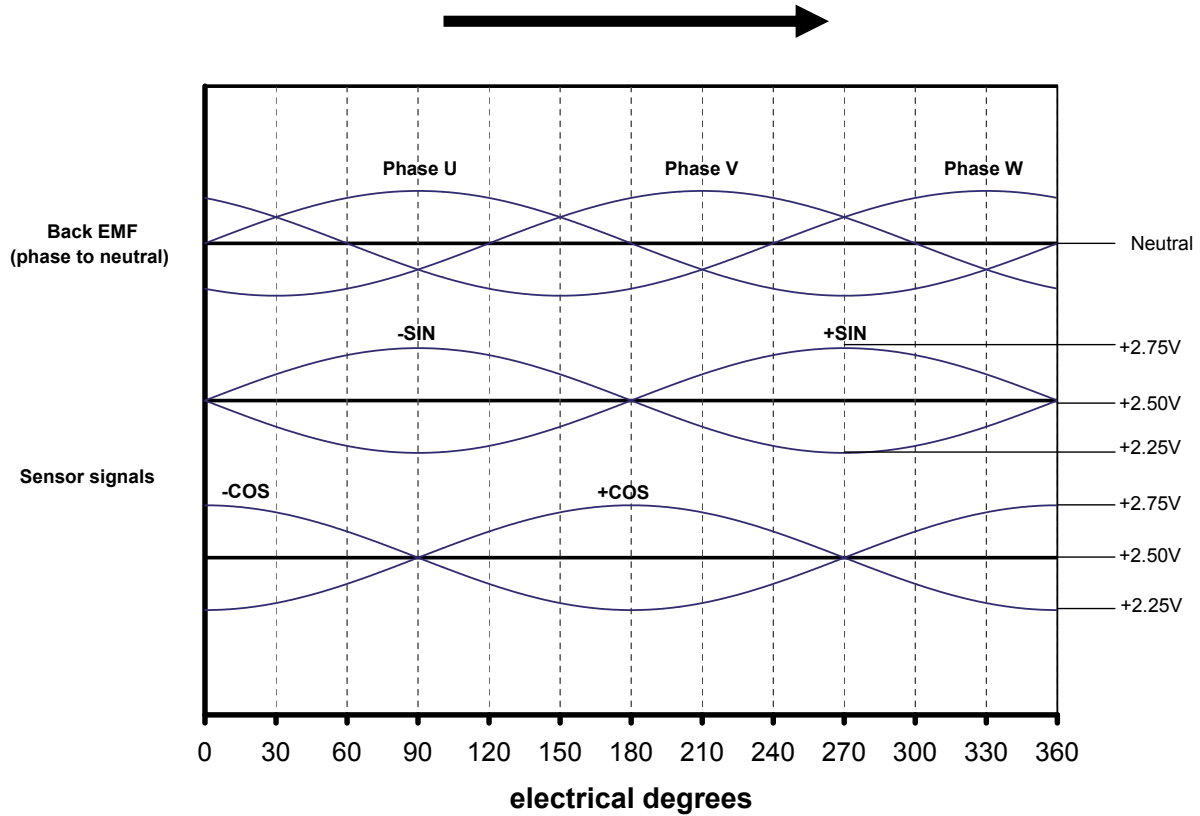
ALL DIMENSIONS IN MM

Available thrust rod lengths (dimensions in mm)

265	301	337	372	408	444	479	515	550	586	622	657	693	729	764	800	836
871	907	943	978	1014	1050	1085	1121	1157	1192	1228	1263	1299	1335	1370	1406	1442
1477	1513	1549	1584	1620	1656	1691	1727	1763	1798	1834	1870	1905	1941	1976	2012	2048

### POSITION SENSOR

The position sensor outputs analogue, differential sine and cosine signals for providing position feedback. Shown below are the relationships between forcer phase back EMF and position sensor outputs for one direction of motion (as shown by arrows). It should be noted that +SIN or -SIN is always in phase with forcer phase U. For the motion shown, -SIN is in phase with forcer phase U. For motion in the opposing direction +SIN is in phase with forcer phase U.



SPECIFICATION	VALUE	units
Output signal period	71.2	mm
Signal amplitude (between +/- signals)	1	Vpk-pk
Output current	± 10	mA
Supply voltage	5 ± 0.25	Vd.c.
Supply current (output current=0)	15 ± 5	mA
Resolution <sup>(1)</sup>	20	micron
Position repeatability <sup>(2)</sup>	± 25	micron
Absolute accuracy <sup>(3)</sup>	± 400	micron

**Notes: -**

- <sup>(1)</sup> Dependent on amplifier (indication with 12 bit resolution)
- <sup>(2)</sup> Dependent on amplifier. Under constant operating conditions. Self-heating of the forcer will cause expansion in the thrust rod during the initial warm up period. In high duty applications (corresponding to an internal forcer temperature of 80°C) a 1 metre thrust rod will expand typically by 250 microns.
- <sup>(3)</sup> Maximum error over 1 metre under constant operating conditions.

### FORCER OVER TEMPERATURE SENSOR



It is strongly recommended that the forcer over-temperature sensor is connected to the drive amplifier or servo controller **at all times** in order to reduce the risk of damage to the forcer due to excessive temperatures.

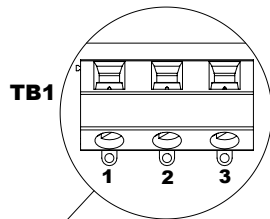
Protection is provided by three positive temperature coefficient (PTC) thermistors embedded in the forcer phases. As the forcer phase temperature approaches 100°C, the PTC thermistors exhibits a sharp increase in electrical resistance. This change in resistance can be detected by circuitry within the drive amplifier or servo controller and used to reduce or disable the output of the drive amplifier in order to protect the forcer.

SPECIFICATION	VALUE	units
Resistance in the temperature range -20°C to + 70°C	60 to 750	Ohms
Resistance at 85°C	≤1650	Ohms
Resistance at 95°C	≥3990	Ohms
Resistance at 105°C	≥12000	Ohms
Maximum continuous voltage	30	Vd.c.

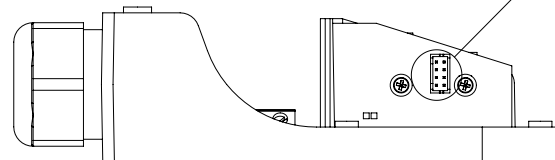
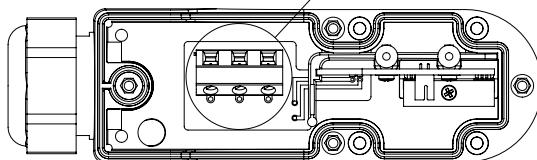
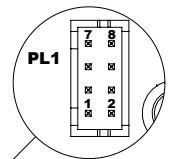
### FORCER ELECTRICAL CONNECTIONS

Connections are made within the termination box.

PIN NUMBER	FUNCTION
1	Phase U
2	Phase V
3	Phase W
Chassis	Earth/Screen



PIN NUMBER	FUNCTION
1	+SIN
2	-SIN
3	+COS
4	-COS
5	+5Vd.c.
6	0V
7	+TH (Thermistor)
8	-TH (Thermistor)



### CABLE TYPE

The XTB has two separate cables providing connections for forcer power and position sensor. Cable types are available in 3 metre, 5 metre and 10 metre lengths.

Cables are suitable for continuous flex or drag chain applications.

	POWER	SENSOR
Overall diameter (nominal)	8.0mm	5.8mm
Outer jacket material	PUR	PUR
Number of conductors	4	4 x twisted pair
Size of conductors	1.5mm <sup>2</sup> (16 AWG)	0.14mm <sup>2</sup> (26AWG)
Screened / Unscreened	Screened	Screened
Minimum bending radius - flexible routing	42mm	42mm
Operating temperature - flexible routing	-15°C to +80°C	-15°C to +80°C
Operating temperature - fixed routing	-30°C to +80°C	-30°C to +80°C

## CABLE TERMINATION

The XTB cable is available with three termination options. **Option F** has the wire ends stripped and solder tinned ready for termination. All other options are terminated with connectors that plug directly into the desired amplifier. The connections for all options are shown below:

SENSOR FUNCTION	D - (XTL-S)	N - (ESR Pollmeier)	F - (Flying leads)
+SIN	14	6	Blue
-SIN	13	7	Red
+COS	12	11	White
-COS	11	12	Brown
+5Vd.c.	4	10	Yellow
0V	5	15	Green
+TH (Thermistor)	10	5	Pink
-TH (Thermistor)	15	15	Grey
SCREEN	1+ shell	Shell	SCREEN
Connector type	15-way high density D	15-way high density D	-
Amplifier connection	J8	X6.2	-
<b>POWER FUNCTION</b>			
Forcer phase U	4	U	Black <u>1</u>
Forcer phase V	3	V	Black <u>2</u>
Forcer phase W	2	W	Black <u>3</u>
Earth (forcer body)	1	PE	Green/Yellow
SCREEN	1	Shell	SCREEN
Connector type	4-way 5mm pluggable terminal	4-way pluggable terminal	-
Amplifier connection	J2	X3	-

## ENVIRONMENT

The XTB is intended for use in an environment within the following conditions:

SPECIFICATION	VALUE
Operating temperature	0°C to +40°C
Storage temperature	-25°C to +70°C
Ingress protection	IP67
Altitude (above mean sea level)	1000m
Overvoltage category	II
Pollution degree	2
EMC	light industrial

In addition, the XTB is available with two environmental coating options. **Option S** has the forcer body coated with a 25 micron layer of black anodise that is suitable for general use. **Option H** has the forcer body coated with a 90 micron layer of hard natural anodise that is suitable for harsher environments. This option is available at a minimum quantity of 25 pieces per year.

**ORDER CODES**

**Forcer**

**XTB38**    -  -

**Forcer**  
04, 06, 08, 10

**Winding**  
S - Series  
P - Parallel

**Environment**  
S - Standard  
H - Harsh (on request)

**Cable Termination**  
D - Xenus (XTL-S)  
F - Flying leads  
N - ESR Pollmeier

**Cable Length**  
03 - 3 m  
05 - 5 m  
10 - 10 m

**Cable Type**  
R - Robotic

**Thrust Rod**

**TRB38** -

**Thrust rod length**

0265	0444	0622	0800	0978	1157	1335	1513	1691	1870	2048
0301	0479	0657	0836	1014	1192	1370	1549	1727	1905	
0337	0515	0693	0871	1050	1228	1406	1584	1763	1941	
0372	0550	0729	0907	1085	1263	1442	1620	1798	1976	
0408	0586	0764	0943	1121	1299	1477	1656	1834	2012	

Length in mm