

ServoTube 25^{ti} High Rigidity Unit INSTALLATION GUIDE

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WARRANTY

Copley Motion Systems guarantees its equipment against faulty components for a period of twelve months from delivery. Replacement components will be free of charge. Copley Motion Systems shall not in any event be liable for consequential damage or loss.

Copley Motion Systems operates a customer care facility and all requests for repair and replacement should be directed to the Customer Care Department. The serial number of the equipment should be quoted in any communications. The right to change specification and price is reserved by Copley Motion Systems.

DISCLAIMER

Copley Motion Systems makes no guarantees of any kind with regard to this manual. Copley Motion Systems shall not be liable for errors contained herein or for consequential or incidental damages incurred as a result of acting on information contained in the manual.


CUSTOMER CARE

For enquiries relating to the operation and use of the ServoTube 25 High Rigidity Unit described in this Manual please contact the Customer Care Helpdesk, Telephone : +44 (0)1268 287070.

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INTERNATIONAL CONTACT DETAILS

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ServoTube 25

High Rigidity Unit

INSTALLATION GUIDE

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WARNINGS

Warning symbols and meanings

In this User Manual warning symbols are used. These are intended to alert you to the potential hazards to personnel which are associated with the equipment described, in all aspects of use, including handling, installation, operation and maintenance.



Heart pacemakers. Personnel fitted with pacemakers must not handle or work on this equipment.



Strong magnets. The thrust rod contains powerful magnets and will strongly attract ferrous objects. Damage can occur to computer disks and credit cards.



Electric shock. Potentially lethal voltages may be present during the commissioning and servicing of this equipment. Isolate and disconnect all sources of electrical supply before working on the equipment. Particular care needs to be taken when working on or around motor phase connections.



Hot surface. Surface temperatures of up to 80 °C can be present during the commissioning and servicing of this equipment. Allow the forcer and thrust rod to cool before working on the equipment.



Heavy object. May need two people to lift.



Crush hazard. The forcer may move unexpectedly. Always isolate all sources of electrical supply before working on the equipment.



General hazard. Follow the advice given.

Electrical safety

This equipment must be earthed using the green/yellow conductor.

EMC precautions

This equipment is intended for use in a light industrial environment. It is recommended that the following precautions be observed during installation:

- Keep all cable lengths to a minimum.
- Provide as much physical separation as possible between power and signal cables. In particular, avoid long, parallel runs of cables.
- Maintain screen continuity throughout the cable run.
- Use 360 degree screen terminations where possible. "Pig-tail" terminations are not recommended.
- It is the responsibility of the User to ensure compliance with any local electrical and EMC regulations in force at the time of installation.

READER'S NOTES

GENERAL

This manual describes the Installation, Maintenance and Spares of the ServoTube 25 High Rigidity Unit linear motor.

ASSOCIATED PUBLICATIONS

The following publications are associated with the ServoTube 25 High Rigidity Unit Installation Guide.

Title	Reference Number
ServoTube Applications Guide	UM03012
XTR25 Data sheet	DS01096
SBR25 Data sheet	DS01092
Xenus XSL User Guide	-
Xenus XSL Data Sheet	-
Xenus XTL-S User Guide	-
Xenus XTL-S Data Sheet	-
Xenus Micro Panel XSJ-S User Guide	-
Xenus Micro Panel XSJ-S Data Sheet	-

Chapter 1

Product Overview

The ServoTube high rigidity actuator with integrated outrigger-bearings is an ideal solution for applications with high side-loading. A ball-bushing option with steel bearing rails provides maximum side-loading support. Polymer bushings use aluminum rails for reduced weight and are ideal for vertical loads.

FOUR MODELS

Iron-sleeve design produces up to 20% more force than standard ServoTube actuator. Four models deliver a continuous force range of 61~119 N (14~27 lb) with peak forces up to 860 N (193 lb). Twelve stroke lengths are available from 29~311mm.

The patented magnetic design of ServoTube generates 12 micron (0.47 mil) repeatability and 350 micron (14 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.

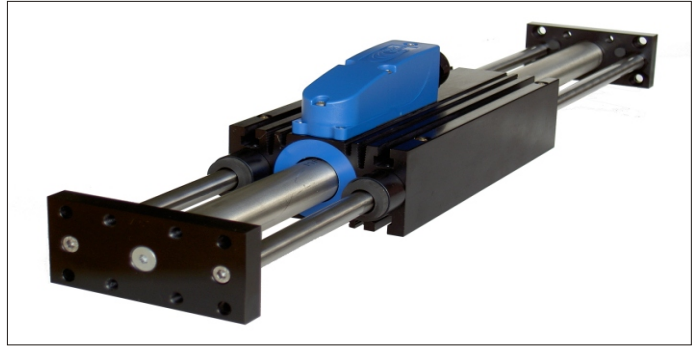


Figure 1.1 - The ServoTube 25 High Rigidity Unit

INSTALLATION

ServoTube is an ideal OEM solution for easy integration into pick-and-place gantries and general purpose material handling machines. The load is mounted directly to the industry standard mounting plate.

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

AMPLIFIERS

ServoTube is complemented by a range of matched, self-tuning servo-amplifiers and indexers complete with plug-and-play cabling. Amplifiers interface easily to PLCs and feature CANopen and DeviceNet connectivity.

Chapter 2

Installation



UNPACKING

- Check packaging for signs of damage.



- Metal surfaces may be hot or below 0°C following prolonged storage.

- Remove packaging. Do not discard. In the event of items requiring return, it is recommended that the original packaging be used.
- Ensure that the delivery note correctly reflects your order and the items delivered.
- Check equipment for signs of damage. Never use the equipment if it appears damaged in any way.
- Read the User Guide before installing and using this equipment.

INSTALLATION

Intended operating environment

This equipment is intended for use in an environment within the following conditions: -

Operating temperature	0 to +40 °C
Storage temperature	-25 to +70 °C
Humidity (relative)	0 to 95% non-condensing
Altitude (above mean sea level)	1000 m
Overvoltage category	II
Pollution degree	2
EMC	light industrial

Mechanical - XTR25

The outline drawing of the XTR25 is shown in Figure 2.1. It comprises the forcer with dual shafts and bearing bushes. The external bearing acts as a guide for the moving thrust rod. It is not intended to withstand side loading.

The XTR25 forcer can be mounted by two methods.

- Using the T-slots in the top of the forcer.
- Using M5 T-nuts 7Nm.

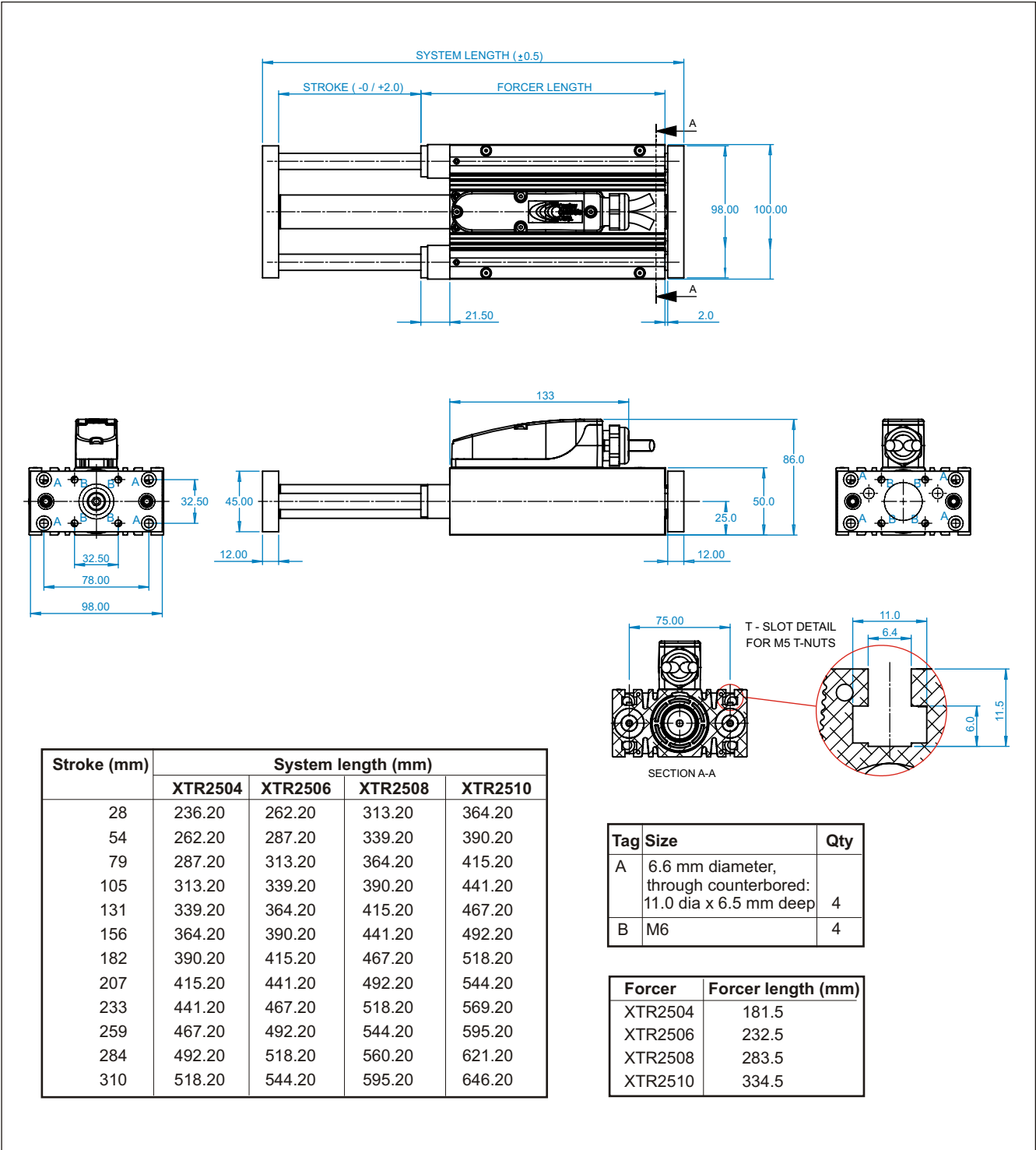


Figure 2.1 - XTR25 Outline drawings and mounting details

Electrical

All electrical connections to the XTR25 are made via two cables, see Figure 2.2a and Figure 2.2b. One cable carries power to the forcer and the other carries signals from the position sensor. These cables are supplied either pre-terminated for a specific drive or with flying leads. Where they are pre-terminated, simply plug the cables into the relevant connectors on the drive:

Forcer Power Connector reference	Position sensor connector reference	Amplifier
J2	J8	Copley Xenus XSL
J2	J8	Copley Xenus XTL-S
J2	J6	Copley Xenus Micro Panel XSJ-S
X3	X13	Parker Compax 3

For cable reference numbers refer to Chapter 4 - Service.

**WARNING**

THE THRUST ROD ON THE XTR25 MUST BE EARTHED. THIS CAN BE ACHIEVED BY EARTHING THE CONNECTED MECHANICAL PARTS ON THE USER'S MACHINE.

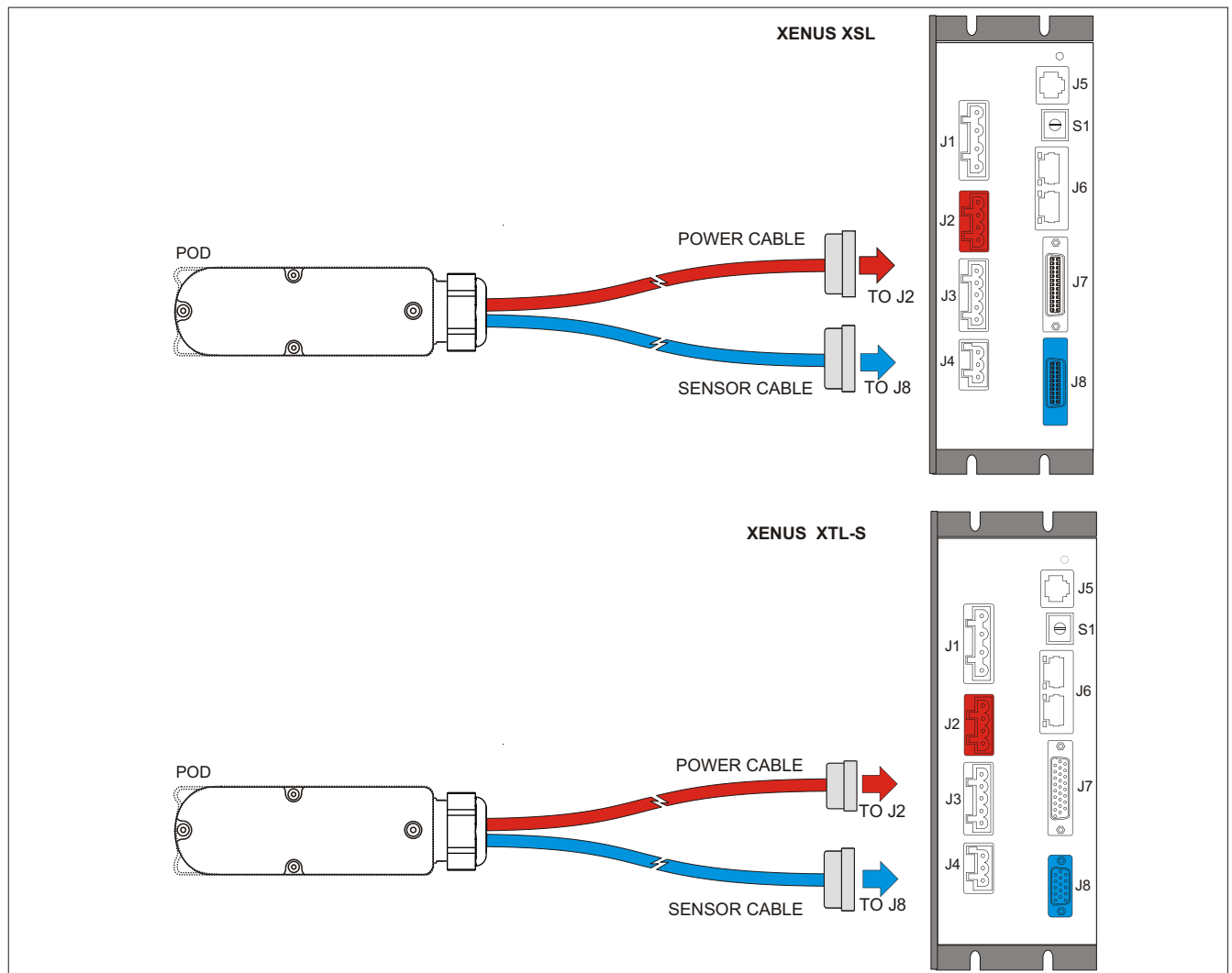


Figure 2.2a - Schematic showing connection of the XTR25 to the Xenus Amplifier XSL and Xenus Amplifier XTL-S.

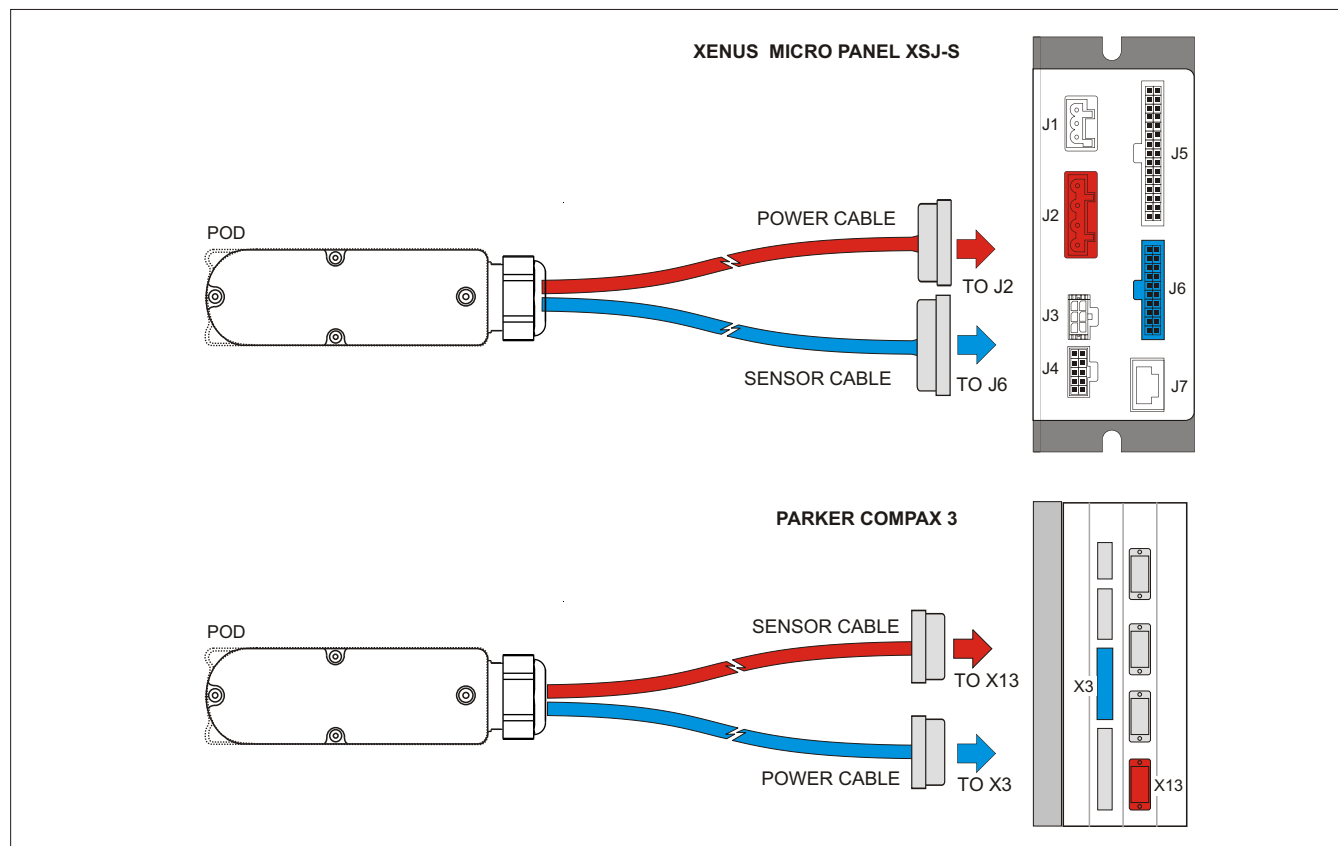


Figure 2.2b - Schematic showing connection of XTA / XTB to the Xenus Micro Panel Amplifier XSJ-S and the Parker Compax 3 Amplifier

Chapter 3 Maintenance



XTR25

The XTR25 is low maintenance and as such requires only minimal periodic inspection.

The polymerbearings are dry running, requiring no lubrication. The bush bearings should be lubricated with Rocol Sapphire 2 at intervals of 100 kilometres.

Periodically:

- Check that the thrust rod can move freely over the entire stroke.
- Clean any accumulated debris from the thrust rod surface (ferrous material, in particular, can be attracted to the thrust rod surface).
- Check all fixings are tight and secure.



WARNING

ISOLATE AND DISCONNECT ALL SOURCES OF ELECTRICAL SUPPLY BEFORE WORKING ON THE EQUIPMENT.

CABLE REPLACEMENT

If a cable needs to be replaced it will be necessary to gain access to the termination box inside the pod, see Figure 3.1.

Removal

- Unscrew the four M3 pod cover fixings.
Note that the fixings are of different lengths. Make a record from where each fixing is removed so they can be correctly replaced later.
- Remove the pod cover from the termination box.
- Unscrew the pressure nut from the cable gland.
- Disconnect the power cable from the screw terminal connector, TB1 and the earth terminal and/or unplug the sensor cable from the PCB at connector PL1.
- Loosen the two fixings on the cable clamp.
- Pull the cable out through the cable gland.

Replacement

Re-fitting is the reverse of the removal procedure.

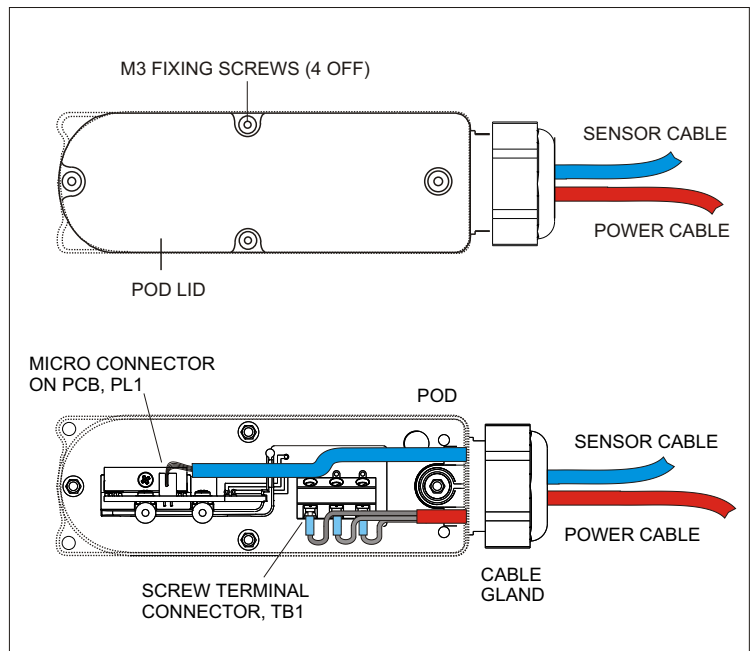


Figure 3.1 - Power and Sensor cable connection details in the pod

- Feed the new cable(s) through the cable gland.
- Connect the cable(s) including the earth lead.
- Tighten the cable retaining clamp.
- Take care not to damage the sealing gasket on the termination box when replacing the cover.
- Replace the fixings according to the record made when they were removed.
- Tighten the four M3 fixings to a torque of 0.7 Nm.

Chapter 4

Service

SERVICE

Should you need to return any items to Copley Motion Systems, before doing so, please call our Sales co-ordinator on +44 (0)1268 287070 or send a fax to +44 (0)1268 293344 in order to obtain an RMA (Returned Materials Authorisation) number. The RMA number should then be quoted on all items returned and quoted for all enquiries.

Please note that when returning items it is recommended that the original packaging be used.

SPARES

The available spares for the XTR25 are listed in Tables 4.1 and 4.2.

Table 4.1 Cables available: terminated for Xenus, Parker Compax 3 and with flying leads

Description	Xenus XTL-S	Xenus Micro Panel XSJ-S	Xenus XSL	Parker Compax 3	Flying leads
<i>Non-flexing cables</i>					
XTR25 power cable 3m	450 476 103A	450 476 103A	450 476 103A	450 476 183A	450 476 143A
XTR25 sensor cable 3m	450 476 563N	450 476 543N	450 476 423N	450 476 443N	450 476 403N
XTR25 power cable 5m	450 476 105A	450 476 105A	450 476 105A	450 476 185A	450 476 145A
XTR25 sensor cable 5m	450 476 565N	450 476 545N	450 476 425N	450 476 445N	450 476 405N
<i>Flexing cables</i>					
XTR25 power cable 3m	450 476 103	450 476 103	450 476 103	450 476 183	450 476 143
XTR25 sensor cable 3m	450 476 563A	450 476 543A	450 476 423A	450 476 443A	450 476 403A
XTR25 power cable 5m	450 476 105	450 476 105	450 476 105	450 476 185	450 476 145
XTR25 sensor cable 5m	450 476 565A	450 476 545A	450 476 425A	450 476 445A	450 476 405A

Table 4.2 Hardware

Description	Order Code
M5 T-nut	045 205 007

To place an order for spare parts please telephone or fax your order to the Sales co-ordinator:

Tel: +44 (0)1268 287070
Fax: +44 (0)1268 293344

Appendices

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APPENDIX B - TROUBLE SHOOTING

APPENDIX C - TECHNICAL SPECIFICATION

Appendix A

Glossary of Terms & Abbreviations

GLOSSARY OF TERMS

TERM	DESCRIPTION OF TERM
Peak force	<p>Peak force is the force produced when the peak current is applied to the forcer. It is the product of Force constant (N/A_{pk}) and Peak current (A_{pk}).</p> <p>The forcer is not moving, there is no forced cooling and no additional heat-sinking. The duration of the peak force is thermally limited and is therefore only allowable for a period of 1 second.</p>
Continuous stall force	<p>Continuous stall force is the force produced when the continuous current is applied to the forcer. It is the product : Force constant (N/A_{pk}) x Continuous stall current (A_{pk}) or : Force constant (N/A_{rms}) x Continuous stall current (A_{rms}).</p> <p>The forcer is not moving and there is no forced cooling.</p> <p>It is quoted with and without the addition of a 25 x 25 x 2.5 cm heatsink plate mounted with thermal grease to the mounting surface of the forcer.</p>
Peak current	<p>Peak current is the current required to heat the forcer phases to their maximum operating temperature when the ambient temperature is 25°C, the forcer is not moving, there is no forced cooling and no additional heat-sinking.</p> <p>It is the maximum allowable current before demagnetisation of the magnets occurs when the magnet temperature is 100°C.</p> <p>The duration of the peak current is thermally limited and is therefore only allowable for a period of 1 second.</p>
Continuous stall current	<p>Continuous stall current is the current required to heat the forcer phases to their maximum operating temperature when the ambient temperature is 25°C, the forcer is not moving and there is no forced cooling.</p> <p>It is quoted with and without the addition of a 25 x 25 x 2.5 cm heatsink plate mounted with thermal grease to the mounting surface of the forcer.</p>
Force constant	<p>Force constant is the peak force produced when 1 ampere (peak) flows into one phase and 0.5 ampere (peak) flows out of the remaining two phases (as in sinusoidal commutation) quoted in N/A_{pk}. Alternatively, it is the peak force produced when 0.707 ampere (rms) flows into one phase and 0.353 ampere (rms) flows out of the remaining two phases (again as in sinusoidal commutation) quoted in N/A_{rms}.</p>
Back EMF	<p>Back EMF constant is the peak phase to phase voltage generated when the forcer is travelling at a velocity of 1m/s.</p>
Fundamental forcer constant	<p>Fundamental forcer constant is the continuous stall force divided by the square root of the power dissipated in the forcer at that continuous stall force.</p>
Eddy current loss	<p>Eddy current loss is the amount of opposing force produced by the forcer when it is travelling at a velocity of 1m/s.</p>
Sleeve clogging force	<p>Sleeve clogging force is the amount of force variation produced by having an iron sleeve. The variation is independant of forcer current.</p>
Resistance	<p>Resistance is measured phase to phase at temperatures of 25°C and 100°C.</p>
Inductance	<p>Inductance is measured phase to phase at a frequency of 1 kHz. The actual value of inductance varies as the forcer position varies so it is the minimum value that is quoted.</p>
Electrical time constant	<p>Electrical time constant is the time taken for a step current input to the forcer to reach 63.2% of its value.</p>

TERM	DESCRIPTION OF TERM
Continuous working voltage	Continuous working voltage is the maximum allowable continuous voltage between any two forcer phases or between any forcer phase and the forcer safety earth.
Pole pitch	Pole pitch is the distance in millimetres for one complete electrical cycle (between like magnetic poles).
Power dissipation	Power dissipation is the maximum power that can be dissipated by the forcer when the forcer phases are at their maximum operating temperature, the ambient temperature is 25°C, the forcer is not moving and there is no forced cooling. It is quoted with and without the addition of a 25 x 25 x 2.5cm heatsink plate mounted with thermal grease to the mounting surface of the forcer.
Maximum phase temperature	Maximum phase temperature is the maximum operating temperature for the forcer phases. It is limited to provide a safe operating temperature for the magnets.
$R_{thphase-housing}$	$R_{thphase-housing}$ is the temperature rise from the forcer housing to the forcer phases for an input power of 1 watt to the forcer. The forcer is not moving, there is no forced cooling and no additional heatsinking.
$R_{thhousing-ambient}$	$R_{thhousing-ambient}$ is the temperature rise from ambient temperature to the forcer housing for an input power of 1 watt to the forcer. The forcer is not moving and there is no forced cooling. It is quoted with and without the addition of a 25 x 25 x 2.5cm heatsink plate mounted with thermal grease to the mounting surface of the forcer.
Thermal time constant	Thermal time constant is the time taken for the forcer phases to cool to 36.8% of the difference between forcer phase and ambient temperatures when there is no current flowing, the forcer is not moving there is no forced cooling and no additional heatsinking.

ABBREVIATIONS

The abbreviations used in this Guide are listed in the following table.

A_{pk}	Ampere peak	PCB	Printed circuit board
A_{rms}	Ampere root mean square	PUR	Polyurethane
AWG	American Wire Gauge	PVC	Poly Vinyl Chloride
COS	cosine	s	second
d.c.	direct current	SIN	sine
EMC	Electro-Magnetic Compatibility	TYP	Typical
EMF	Electro-Motive Force	UL	Underwriters Laboratory
kg	kilogramme	V	Volt
m	metre	V_{pk}	Volt peak
mA	milliampere	V_{pk-pk}	Volt peak to peak
mH	millihenry	V_{rms}	Volt root mean square
mm	millimetre	W	Watt
MTG	Mounting	°C	degrees Celsius
N	Newton	m	micrometre (micron)
PTC	Positive Temperature Coefficient		

Appendix B

Troubleshooting

TROUBLESHOOTING CHART

Check to see if the problem you are experiencing is listed in the chart below. If the problem cannot be solved with reference to this chart, contact the customer services department.

Fault	Possible cause	Action
Forcer/thrust rod fails to move and produces no force.	<ol style="list-style-type: none"> 1. Drive not powered. 2. Forcer phase connections not made. 3. Forcer over-temperature sensor not connected. 4. Forcer over-temperature. 	<ol style="list-style-type: none"> 1. Apply power to drive. 2. Check forcer phase connections on drive. 3. Check forcer over-temperature sensor connections on drive. 4. Allow forcer to cool.
Forcer/thrust rod fails to move but does produce force.	<ol style="list-style-type: none"> 1. One or more forcer phase connections not made or made incorrectly. 2. One or more position sensor connections not made or made incorrectly. 3. Forcer/thrust rod mechanically blocked. 	<ol style="list-style-type: none"> 1. Check forcer phase connections on drive. 2. Check position sensor connections on drive. 3. Check forcer/thrust rod is free to move.
Forcer/thrust rod moves but is jerky in motion.	Incorrect pole pitch set up or phase offset between position sensor and forcer back emf.	Check drive or controller set up.
Forcer/thrust rod moves in wrong direction.	One or more position sensor and forcer phase connections made incorrectly.	Check position sensor and forcer phase connections on drive.

Appendix C

Technical Datasheet

ELECTRICAL SPECIFICATIONS

FORCER TYPE	2504		2506		2508		2510		units
	S (1)	P (1)	S (1)	P (1)	S (1)	P (1)	S (1)	P (1)	
Peak force @ 25°C ambient for 1 sec	344	172	516	258	688	344	860	430	N
Peak current @ 25°C ambient for 1 sec	20		20		20		20		A _{pk}
With 25 x 25 x 2.5 cm heatsink plate									
Continuous stall force @ 25°C ambient (2)	60.7		81.8		101.2		119.4		N
Continuous stall current @ 25°C ambient	2.49	4.98	2.24	4.48	2.08	4.16	1.96	3.92	A _{rms}
	3.53	7.06	3.17	6.34	2.94	5.88	2.78	5.56	A _{pk}
Without heatsink plate									
Continuous stall force @ 25°C ambient (2)	52.2		72.3		90.4		108.0		N
Continuous stall current @ 25°C ambient	2.15	4.30	1.98	3.96	1.86	3.72	1.78	3.56	A _{rms}
	3.03	6.06	2.80	5.60	2.63	5.26	2.51	5.02	A _{pk}
Force constant (sine commutation)	24.3	12.1	36.5	18.2	48.6	24.3	60.8	30.4	N/A _{rms}
	17.2	8.6	25.8	12.9	34.4	17.2	43.0	21.5	N/A _{pk}
Back EMF constant (phase to phase)	19.9	9.9	29.8	14.9	39.7	19.8	49.7	24.8	V _{pk} /m/s
Fundamental forcer constant	7.53		9.22		10.65		11.90		N/ W
Eddy current loss	2.35		2.35		2.35		2.35		N/m/s
Sleeve cogging force	2.2		3.2		3.3		3.0		+/-N
Resistance @ 25°C (phase to phase)	5.40	1.35	8.11	2.03	10.81	2.70	13.51	3.38	Ohm
Resistance @ 100°C (phase to phase)	6.96	1.74	10.45	2.61	13.93	3.48	17.41	4.35	Ohm
Inductance @ 1kHz (phase to phase)	4.32	1.08	6.48	1.62	8.64	2.16	10.80	2.70	mH
Electrical time constant	0.80		0.80		0.80		0.80		ms
Continuous working voltage	380		380		380		380		V d.c.
Pole pitch (one electrical cycle)	51.2		51.2		51.2		51.2		mm
XTR25 Peak acceleration (3, 5)	225	113	288	144	334	167	369	185	m/s ²
XTR25 Maximum speed (4, 5)	5.6	4.1	5.3	5.0	4.8	5.5	4.3	5.8	m/s
XTR25 Peak acceleration (3, 6)	276	138	354	177	413	206	458	229	m/s ²
XTR25 Maximum speed (4, 6)	6.1	4.6	5.7	5.5	5.1	6.2	4.5	6.3	m/s

Notes

- (1) S = series forcer phases, P = parallel forcer phases.
- (2) Reduce continuous stall force to 89% at 40°C ambient.
- (3) Based on a moving thrust rod with 28 mm stroke and no payload.
- (4) Based on triangular move over maximum stroke and no payload.
- (5) -B bush bearing option.
- (6) -P polymer bearing option.

THERMAL SPECIFICATIONS

FORCER TYPE	2504	2506	2508	2510	units
Maximum phase temperature	100	100	100	100	°C
Thermal resistance $R_{th\text{phase-housing}}$	0.39	0.28	0.23	0.19	°C/W
With 25 x 25 x 2.5 cm heatsink plate					
Power dissipation @ 25°C ambient	65.0	78.8	90.4	100.6	Watt
Thermal resistance $R_{th\text{housing-ambient}}$	0.76	0.67	0.60	0.56	°C/W
Without heatsink plate					
Power dissipation @ 25°C ambient	48.1	61.5	72.1	82.4	Watt
Thermal resistance $R_{th\text{housing-ambient}}$	1.17	0.94	0.81	0.72	°C/W
Thermal time constant	1639	1773	1940	2080	s

MECHANICAL SPECIFICATIONS

FORCER TYPE	2504	2506	2508	2510	units
Maximum stroke	310	310	310	310	mm
Forcer mass	1.65	2.25	2.85	3.45	kg
Moving mass (-B bush bearing option)	0.25 +(overall length (m) x 5.24)				kg
Moving mass (-P polymer bearing option)	0.25 +(overall length (m) x 4.10)				kg

MECHANICAL RIGIDITY

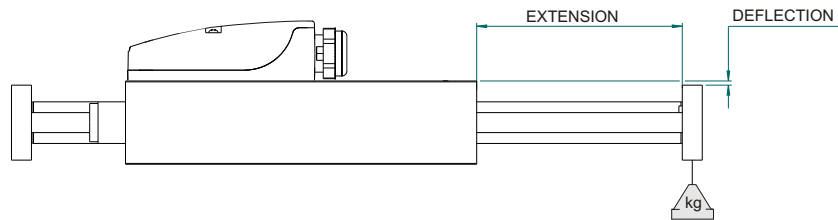
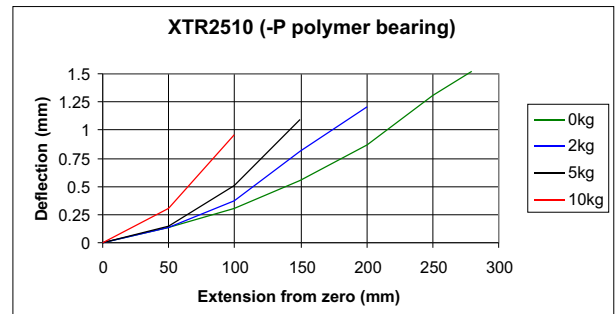
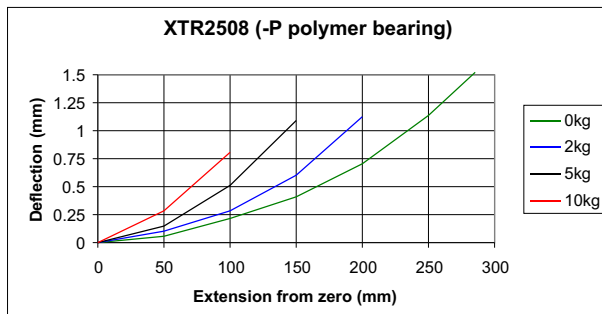
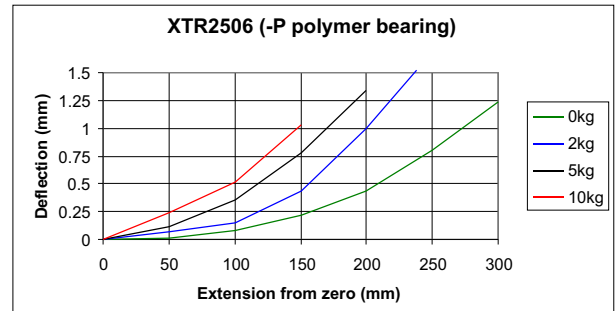
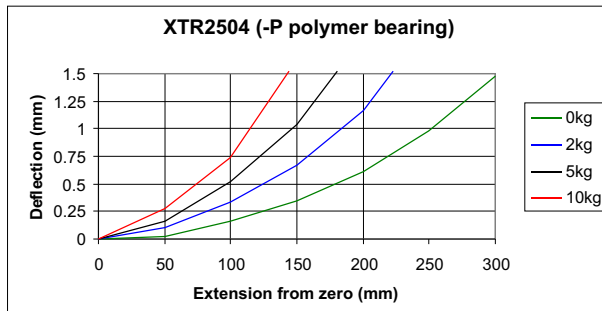
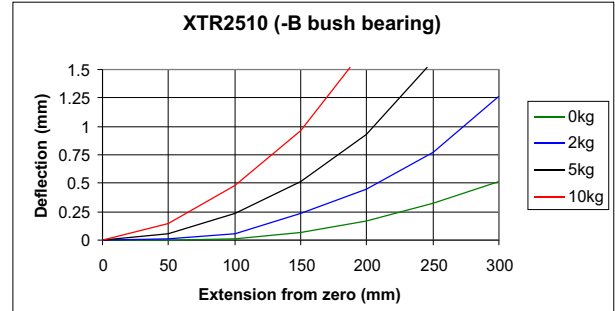
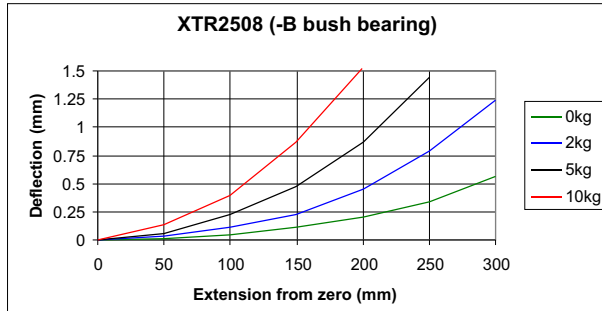
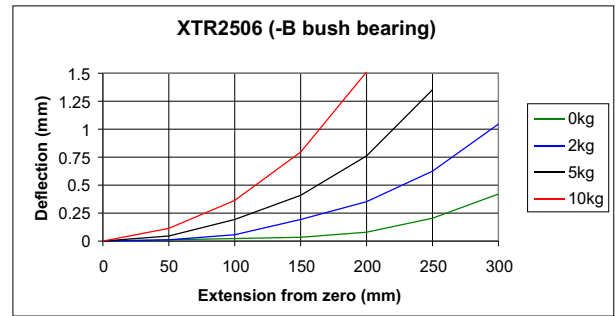
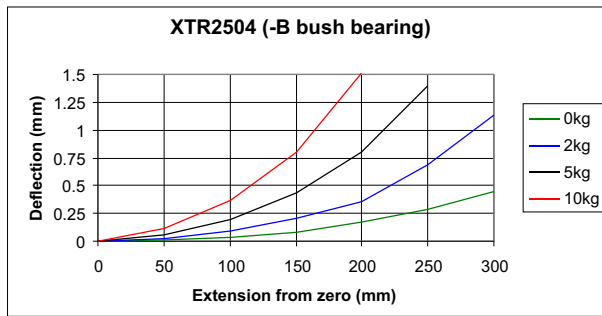
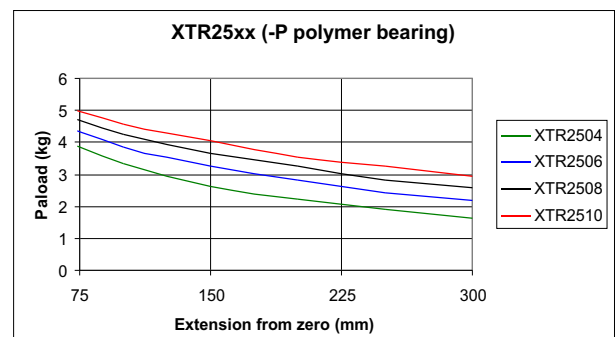
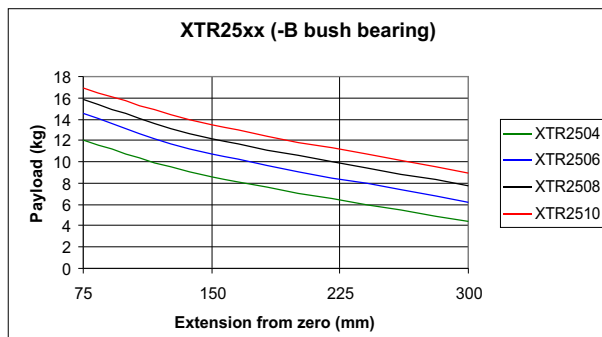


Figure C.1 - Mechanical Rigidity measurement arrangements

MECHANICAL RIGIDITY (continued)**PAYLOAD VERSUS EXTENSION FOR 10,000km LIFE**

POSITION SENSOR

The position sensor outputs analogue, differential sine and cosine signals for providing position feedback. Figure C.2 shows the relationships between forcer phase back EMF and position sensor outputs for one direction of motion (as shown by arrows in Figures C.2 and C.3). 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.

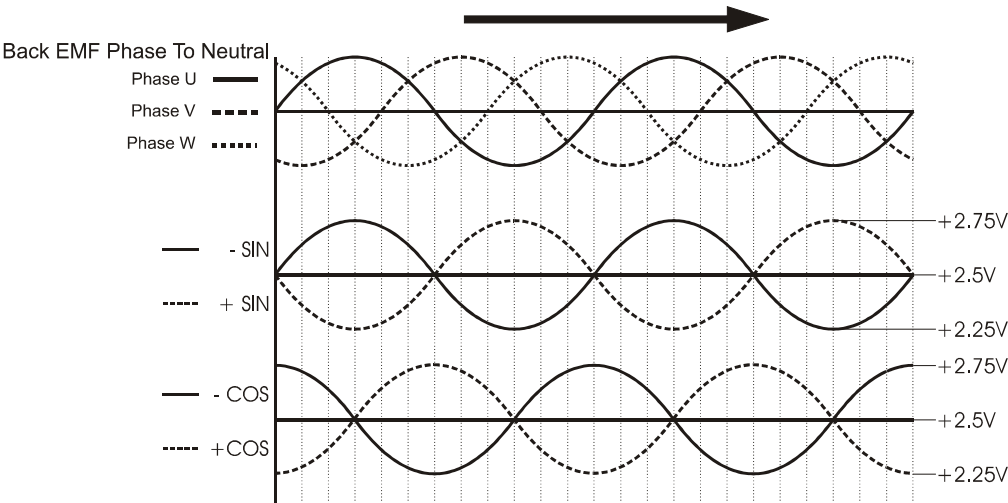


Figure C.2 - The relationships between forcer phase back EMF and position sensor outputs

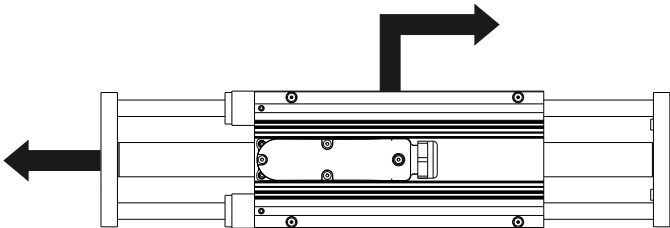


Figure C.3 - Arrows indicate direction of motion

SPECIFICATION	VALUE	UNITS
Output signal period	51.2	mm
Signal amplitude (between +/- signals)	1	V _{pk-pk}
Output current	±10	mA
Supply voltage	5 ± 0.25	V d.c.
Supply current (output current =0)	15 ± 5	mA
Resolution (1)	12	m
Position Repeatability (2)	±12	m
Absolute Accuracy (3)	±350	m/m

Notes

(1) Dependent on amplifier. (2) Dependent on amplifier. Under constant operating conditions. Self-heating of the thrust rod by 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 m. (3) Maximum error over 1metre 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 exhibit 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
Response time for a 20°C to 100°C temperature step to register a trip	3	s
Maximum continuous voltage	30	Vd.c.

CABLE

The XTR25 has two separate cables providing connections for forcer power and position sensor. The standard cables supplied are flexible but are not intended for continuous flex or drag chain applications.

SPECIFICATION	POWER	SENSOR
Overall diameter (nominal)	8.2 mm	6.5 mm
Outer jacket material	PVC	PVC
Number of conductors	4	4 x twisted pair
Size of conductors	1.5mm ² (16 AWG)	0.14mm ² (26 AWG)
Screened / Unscreened	Screened	Screened
Minimum bending radius-fixed routing	41 mm	33 mm
Operating temperature-fixed routing	-40 °C to + 90 °C	-30 °C to +70 °C

As an option, flexible cables are available that are suitable for continuous flex or drag chain applications.

SPECIFICATION	POWER	SENSOR
Overall diameter (nominal)	7.6 mm	5.8 mm
Outer jacket material	PUR	PUR
Number of conductors	4	4 x twisted pair
Size of conductors	1.5mm ² (16 AWG)	0.14mm ² (26 AWG)
Screened / Unscreened	Screened	Screened
Minimum bending radius-flexible routing	38 mm	44 mm
Operating temperature-flexible routing	-40 °C to + 80 °C	-40 °C to +90 °C

CONNECTIONS

Connections within the forcer termination box are as follows:

TB1	FUNCTION	CONDUCTOR DESIGNATION
1	Forcer phase U	Black <u>1</u>
2	Forcer phase V	Black <u>2</u>
3	Forcer phase W	Black <u>3</u>
Chassis	Protective earth + both cable screens	Green/Yellow

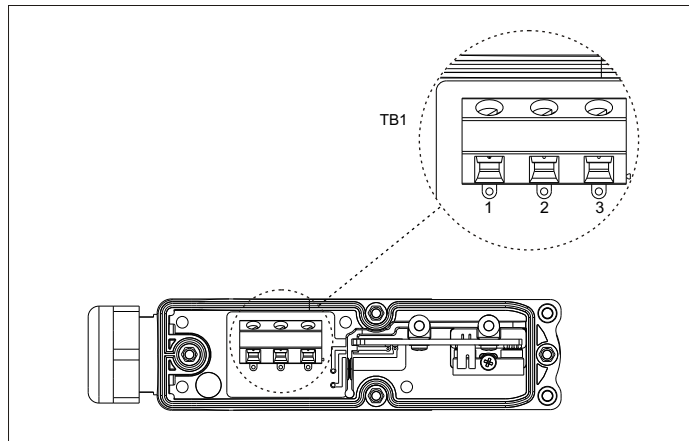


Figure C.4 - Power cable connection at TB1

PIN No.	FUNCTION	CONDUCTOR DESIGNATION
1	+SIN	Blue
2	-SIN	Red
3	+COS	White
4	-COS	Brown
5	+5Vd.c.	Yellow
6	0V	Green
7	+TH (Thermistor)	Pink
8	-TH (Thermistor)	Grey

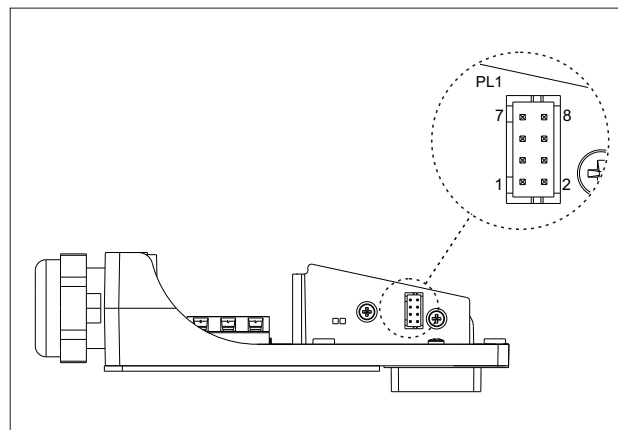


Figure C.5 - Sensor cable connection at PL1 on the Sensor PCB

XTR25 FORCE / VELOCITY PROFILES (WITH AN OPERATING VOLTAGE OF 325 V.D.C.)

S=series forcer phases P=parallel forcer phases

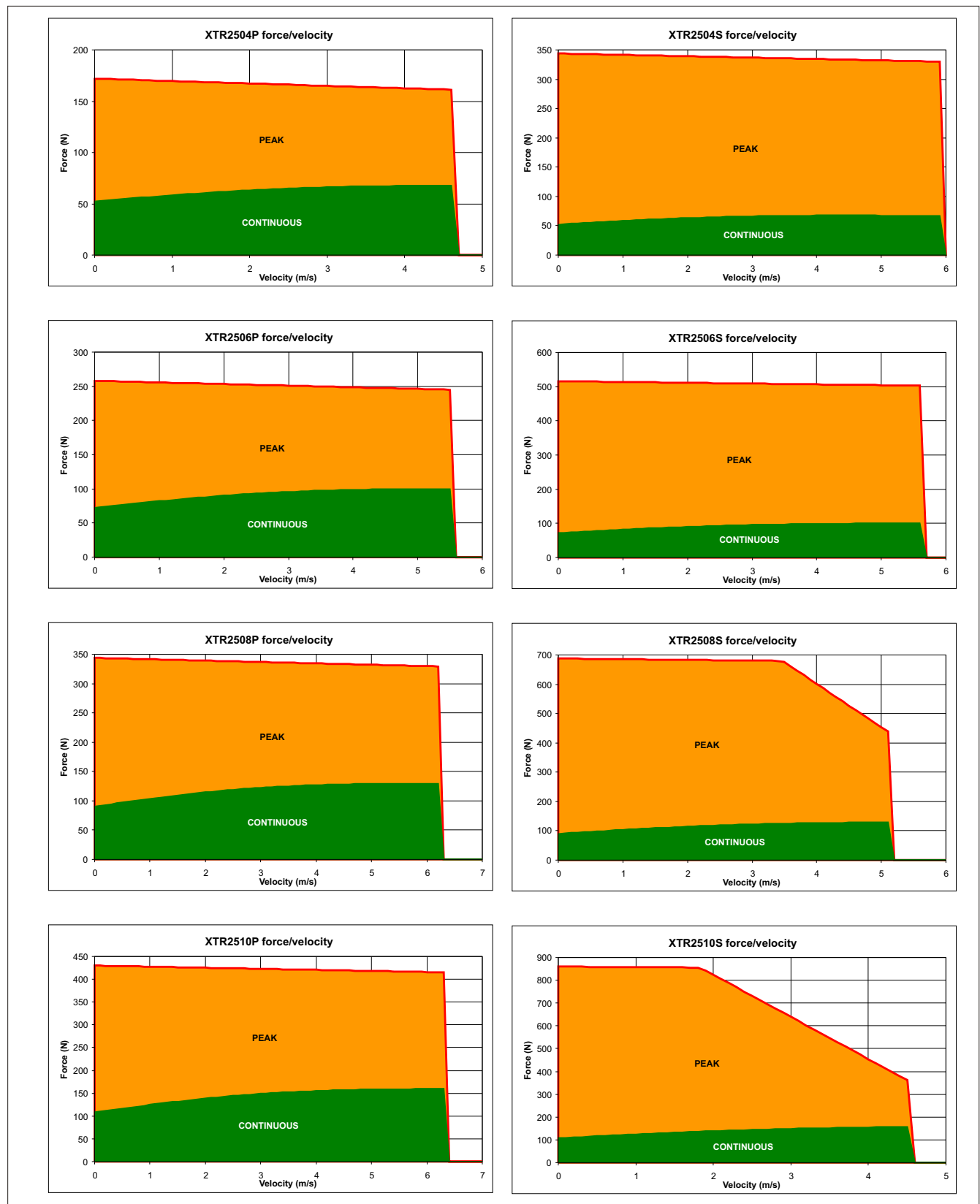


Figure C.5 - XTR25 force / velocity profiles



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