Operating and Maintenance Handbook
Linear Transfer Mechanism LTM Series
Motor Driven SLTM Series

REVISION	DATE	COMMENTS	INITIALS
1	Jan 1994	Original release	MJD
2	Aug 2015	Vacgen branding	AJL

sales@vacgen.com **www.vacgen.com** **+44 (0) 1424 856 333**

WARRANTY

1. Subject to fair wear and tear and the due, observance of any installation user, storage, operating or maintenance instructions the Seller undertakes to replace or, at its option repair free of charge to the purchaser, any goods which the purchaser can establish are defective by reason of defective workmanship or materials which are returned to the Seller, carriage paid, within 12 months of the date of dispatch by the Seller. In the event, however, that the Seller supplies spare parts either direct, or that are fitted or installed or replaced by the Sellers' service center such spare parts will be subject to a warranty period of six months only.
2. The Purchaser cannot return any product for warranty repair without the prior approval of VACGEN and the issue of a Goods Return Number (GRN). This shall be obtained by contacting the service center at VACGEN. All returned products must be accompanied by a completed Declaration of Contamination form. Customers must, in the first instance, contact the local selling agent.
3. We reserve the right to decline to service equipment, we consider is in any way hazardous until a clearance or safety certificate, in a form satisfactory to VACGEN, has been completed and returned by the customer.

REPAIR

The following additional terms and conditions apply in the event that the customer elects to use the services of VACGEN workshop on a chargeable basis.

1. At its own cost the customer shall dispatch the equipment to the workshop, carriage paid, suitably packaged, protected and insured, bearing, a Goods Return Number (GRN)and a completed Declaration of Contamination certificate obtained from VACGEN in advance of shipment.
2. During the period that the equipment is on VACGEN premises, VACGEN will insure the equipment against all risks.
3. Vacuum Generator will provide an acknowledgement of the receipt together with an estimate of the repair charges. Such estimates are carried out on a visual basis and are therefore intended as a guide only. Formal fixed price repair quotations are available and involve the disassembly of the equipment to determine the full extent of
the work necessary to restore the equipment to an acceptable standard. In the event that the customer chooses not to proceed with the repair VACGEN will make a charge to cover this examination effort.

Note:
The above are extracts from VACGEN Conditions of sale. Complete copies can be obtained from:
VACGEN, Maunsell Road, Castleham Industrial Estate St. Leonards on Sea, East Sussex, TN38 9NN, United Kingdom.

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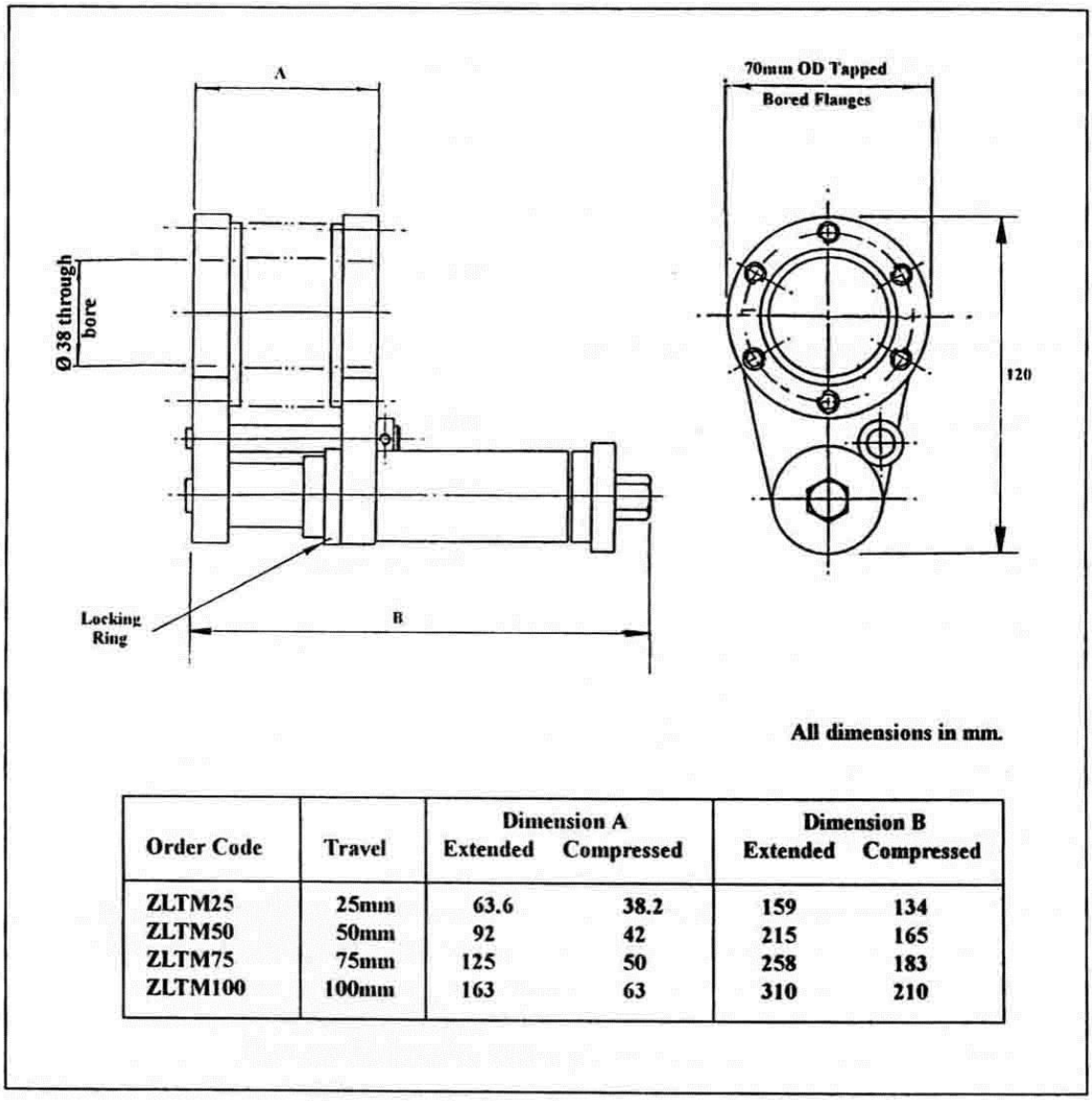
1. INTRODUCTION

This Linear Transfer mechanism has been developed to meet the need for a simple, relatively robust, device capable of controlled linear movement in a single axis.
It is available with travel lengths of 50, 75 and 100 mm and is supplied with 70mm OD tapped flanges at both ends. The LTM can either be driven manually, or with a stepper motor (see section 8.0).



Order Code	Travel	Dimension A Extended	Dimension A Compressed	Dimension B Extended	Dimension B Compressed
ZLTM25	25mm	63.6	38.2	159	134
ZLTM50	50mm	92	42	215	165
ZLTM75	75mm	125	50	258	183
ZLTM100	100mm	163	63	310	210

Figure 1- Dimensions of the LTM Series Linear Transfer Mechanism

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2.0 Specification

Travel distances:	25, 50, 75 and 100mm
Thread pitch of elevating screw:	1.5mm
Bore through bellows:	38.0mm
Over travel protection:	Stop at both ends
Parallelism of flange faces:	Within 0.04mm/cm
Concentricity of flange bores:	Within 0.5mm
Approximate maximum torque required to elevate:	120 N cm
Maximum applied axial load:	200 N - See note below
Maximum applied radial load to small pillar:	50 N - See note below
Operating temperature:	200^{o}C
Operating pressure range:	1 bar to 10^{-11} mbar
Baking temperature:	250^{o}C recommended maximum
Flange fixing:	70mm OD, 6 tapped fixing holes

Note.
Load that may be exerted by the LTM when vertically or horizontally mounted, or applied to the LTU when vertically mounted.

3.0 Construction

The construction is principally of stainless steel, all joints of the vacuum envelope being welded. An edge welded bellows is used for economy of space. Each flange has 6 tapped holes. The two flanges have radial lugs to which are attached the guide pillars and guide sleeve which provide the guidance system; all are demountable. The guide sleeve has a pair of bronze bushes at the lower end and a ball bearing at the upper end to locate the elevating screw and to carry the thrust load. The upper part of the major guide pillar has a 10mm x I.5mm pitch threaded hole to engage with the bronze elevating screw. The end of the elevating screw is pinned to a knurled thumb wheel to which is also attached a hexagon nut, 13min A/F.

4.0 Installation

The transfer mechanism may be mounted vertically or horizontally, the former is the preferred orientation. When mounted horizontally the orientation should, as far as this is possible, be such as to generate the smallest turning moment about the main guide pillar. The purpose of this is to minimise the load that is applied to the smaller rod, whose function is to prevent rotation and to act as a travel limit stop. The minimum turning moment will be generated when the axis of the bellows is in a vertical plane that passes through the axis of the main guide pillar.

Note.Ensure that the flange fixing screws used do not protrude, otherwise the bellows could damaged resulting in a leak.

5.0 Operation

There are no restrictions in operation other than:

1. Observance of the maximum recommended axial, radial and torsional loads that should be applied. See Section 2.0 above.

2. Avoiding the application of any unnecessary turning moment to the elevating screw at both extremes of travel.

6.0 Bakeout

The recommended maximum bakeout temperature is 250^{o}C.Whilst higher temperatures can be used, this will shorten the life of the elevating screw thrust bearing and possibly the screw itself. Temperatures in excess of 300^{o}C are not recommended.

7.0 Maintenance

The only Maintenance that may be required is the occasional renewal of the lubricants as follows:

1. The two guide pillars and elevating screws are sprayed with a molybdenum disulphide spray, such as Rocol DFSM anti-scuffing spray.

2 The ball thrust bearing is lubricated with silicone oil. The need to re-lubricate this bearing should seldom arise when the maximum bakeout temperature is limited to 250^{o}C.

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7.1 Lubrication: Transfer mechanism removed from the vacuum system
Lubrication should be carried out as described below. Numbers in brackets refer to items in Figure 2.

1. Loosen and remove the locking collar (1) situated on the underside of the upper platform (2). The collar has 3 axial grooves on the periphery to engage with a' C' spanner. The thread is right-hand.

2. Rotate the elevating screw anti-clockwise (when viewed from above) using the knurled thumb wheel (3) until the guide sleeve (4) can be completely removed from the guide pillar.

3. Clean away the remains of the existing lubricant from the two guide pillars (5) Using a cloth moistened with a solvent such as Ethyl Alcohol, Tri-chlorethylene, Acetone etc.

4. Drive out the pin holding the knurled thumb wheel (3) to the elevating screw sufficiently to enable the thumb wheel to be removed. Mark the underside of the thumb wheel and the top of the shaft to enable them to be re-assembled in the same orientation.

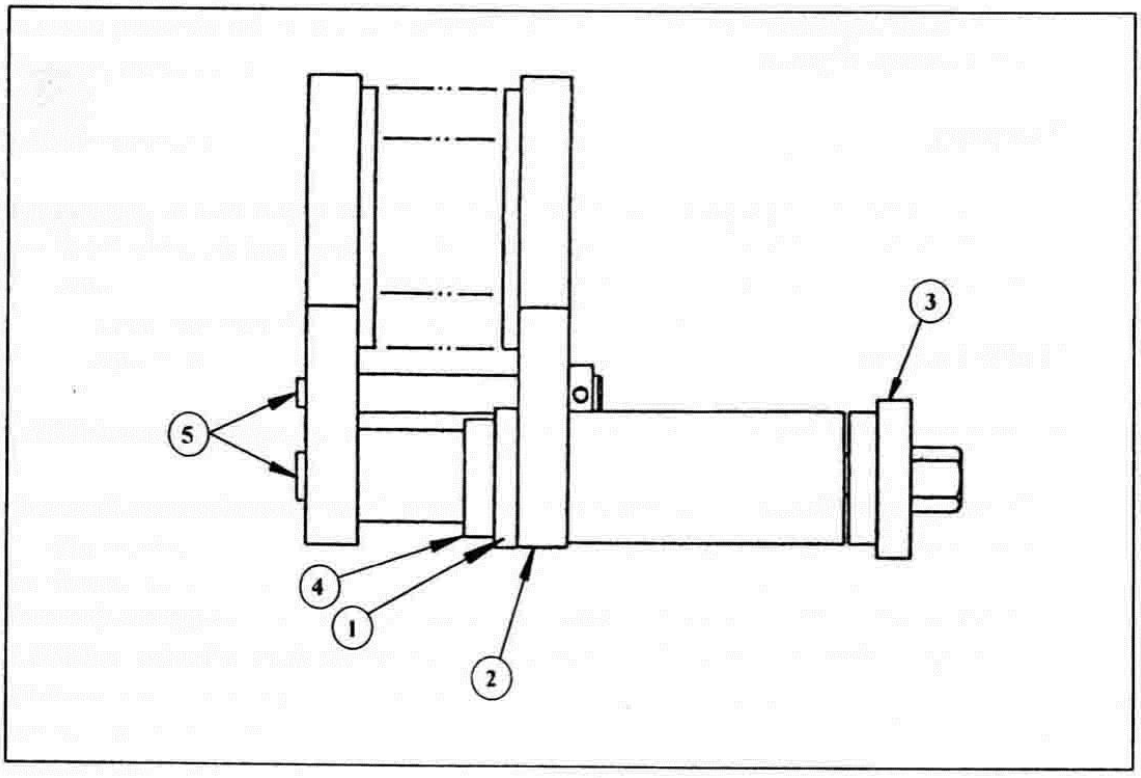


Figure 2- Diagram for lubrication procedure (section 7.1 and 7.2)

5. Remove the elevating screw leaving the ball bearing in position in the end of the guide sleeve. Remove the old lubricant from the screw thread with a fine wire brush and finally wipe clean as described in 3 above.

6. Clean away the old lubricant from the inside of the guide sleeve bearings, again as in 3 above.

7. Should the ball bearing appear to be dry, or not revolve smoothly, it is advisable to re-lubricate it, after removal of the lubricant that remains. The removal of the old lubricant requires immersion of the ball bearing in a solvent such as Tri-clorethylene. It is more convenient if the ball bearing is removed from the top of the guide sleeve. This will necessitate the removal of the circlip. Take care not to lose the shim washers positioned under the bearing. Rotate the bearing whilst it is immersed to assist in removal of the old lubricant. Removal of one of the shields from the bearing will assist in the removal of the lubricant and in re-lubrication.

Warning: Do not use an ultrasonic cleaner as this will damage the bearing.

8. Re-lubricate the guide rods (5) and the elevating screw by evenly coating with a suitable MoS Aerosol spray and allow to dry. Suitably protect the outer and especially the internal surfaces with foil, paper and/or tape from being coated by the over spray.

9. To relubricate the ball bearing, place it on a clean piece of paper. Apply 3 or 4 drops of silicone oil onto the upper face of the bearing and leave for a few minutes to allow it to soak into the bearing. If the oil and the bearing are warmed the process will be assisted.

10. Now slowly rotate the inner or outer member backwards and forwards to distribute the lubricant. If necessary add more silicone oil until it starts to appear on the underside of the bearing. Continue rotating until it is considered that the whole of the inside of the bearing is coated. Now wipe away the surplus lubricant from the outside of the bearing.

Finally re-assemble the parts in the reverse order.

7.2 Lubrication: Transfer mechanism installed on an evacuated vacuum system

In this case it is necessary to support the moving platform because of atmospheric pressure acting on the bellows. The recommended procedure is as follows:

Take a piece of tube 63.5 to 65.0 mm ID and machine the ends parallel to a length which is about 5 mm longer than the minimum distance between the two platforms. Cut into two pieces. Remove all burrs to avoid possible damage to the bellows or personnel.

2. Place the two halves of the tube around the bellows and secure in position with tape or similar means.

3. Lower the upper platform, using the elevating screw, until the split tube is taking all the atmospheric load and the elevating screw is slack.

4. Now proceed in exactly the same manner to that described in 7.1 above that is operations 1 - 10 complete.

5. Raise the upper platform and remove the split tube.

The materials recommended for lubrication are:
1. MoS_2, Spray Rocol DFSM anti-scuffing spray
2. MoS_2, Spray Rocol Grade A.S.

3. Silicon Oil Dow Corning Silicone Oil 710 or 710R

A lubrication kit containing 10 ml of Dow Corning 710 silicone oil is available (Part Code ZLTMLK).

The aerosol spray is obtainable from Rocol Ltd at Leeds, London and Birmingham, UK, or through their distributors.

8.0 The SLTM Stepper Motor Driven LTM

To enable remote or computer control, the model LTM Linear Transfer Mechanism is available with a stepper motor drive. When fitted with the stepper motor drive the model reference is prefixed by the letter S, becoming the SLTM, The travel lengths remain at 25, 50, 75 and 100mm.

8.1 Construction

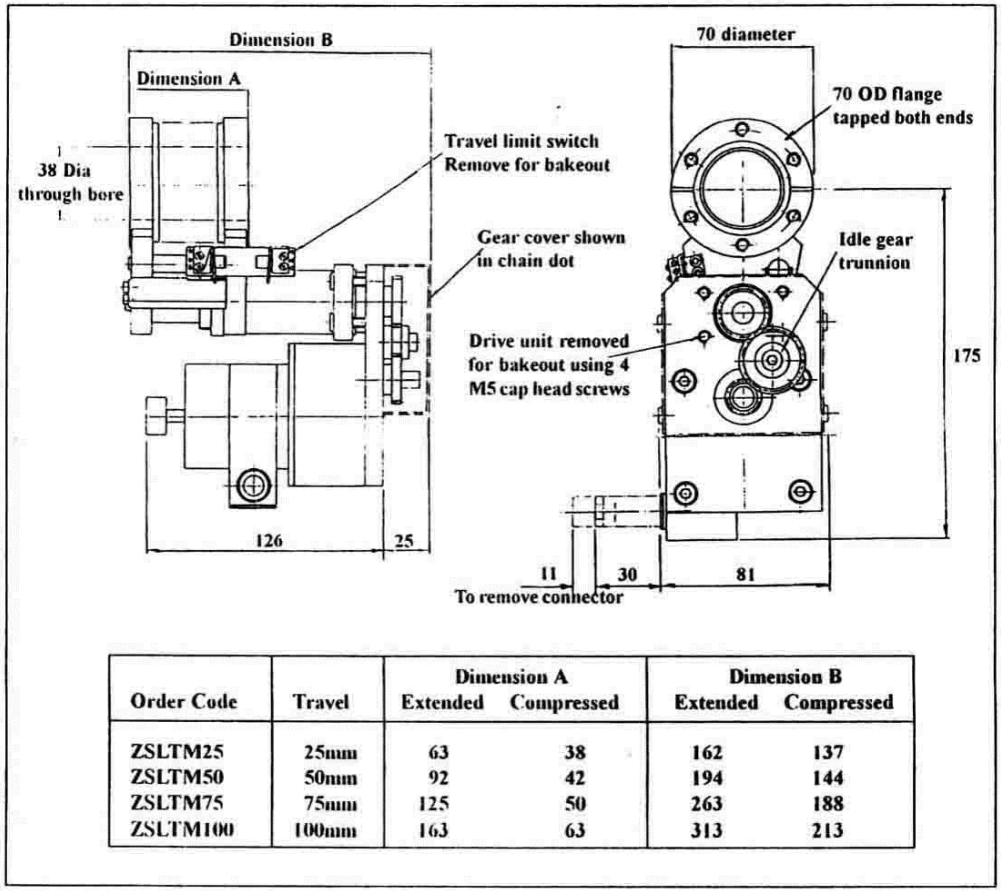
The stepper motor drive is located from, and attached to, the tubular member which carries the accessory flange and slides on the guide pillar attached to the lower flange. The 23 frame size stepper motor is attached to a 7.5 to 1 reduction gear box, the output shaft of which drives the elevating screw of the LMT via a 2:1 reduction gear train making a 15:1 reduction in total.

Adjustable travel limit switches are provided to protect the drive from over-travel, and are normally positioned to stop the motor just short of the maximum travel at each end. The switches can be repositioned to operate at any desired part of the travel. Both the travel limit switch assembly and the motor drive are easily detachable for bakeout. The motor supplied is fitted with a double ended shaft and knob to enable minor positional adjustments to be made manually, should this be required.

9.0 Specification of the SLTM

Motor type:	23 Frame Size Motor, 4 phase (8 wire)
Motor Current:	3.8 Amps per phase maximum
Movement per Half Step:	0.25 microns
Speed - Raising,*	60 mm/minute at 4000 half steps/second 90 mm/minute at 6000 half steps/second
Speed - Lowering,*	75 mm/minute at 5000 half steps/second 120 mm/minute at 8000 half steps/second

* Speed attainable will depend on applied load and motor drive unit used.



Order Code	Travel	Dimension A		Dimension B	
		Extended	Compressed	Extended	Compressed
ZSLTM25	25mm	63	38	162	137
ZSLTM50	50mm	92	42	194	144
ZSLTM75	75mm	125	50	263	188
ZSLTM100	100mm	163	63	313	213

Figure 3 - The SLTM stepper motor driven linear transfer mechanism

10. Operation of the SLTM

The mode and speed of operation will depend on the control and drive unit that is to be used, and, to some extent, by the superimposed load and the mounting attitude. The speed of operation will be governed largely by the type of motor drive unit that is used. If it is desired to operate at maximum traverse rates it will be necessary to use a Dipolar chopper drive, which, with the motor windings connected in series and operating from a 48 volt power supply should enable a step rate of at least 8000 half steps/second (and possibly more) to be achieved. Figure 4 shows the series wiring connections for the stepper motor. Reference to section 9.0 will provide more detailed information on the performance data. VACGEN supply a range of open and closed loop stepper motor controllers suitable for use with the SLTM (and other VACGEN motor drives), see section 13.0 for details.

11.0 Preparation for Bakeout

Before commencing bakeout it is necessary to remove the motor gearbox assembly and the travel limit switch assembly. Refer to figure 3 and proceed as follows.

1. Remove the screws securing the bracket, on which the two micro-switches are mounted, to the upper (moving) member of the mechanism.

2. Remove the four fixing screws retaining the cover over the gear train and remove the cover.

3. Remove the four M5 cap head screws that retain the gearbox mounting plate to the top of the tubular member, after which it will be possible to remove the motor and gearbox assembly together with the microswitch mounting bracket. The clamping plate, which is captive on the tubular pillar may be left in position during the bakeout.

For details of the recommended bakeout procedure refer to section 6.0. After bakeout it is possible that the idler gear and microswitches may need to be adjusted. The procedure for this is given in section 12.0 below.

12.0 Maintenance of the SLTM

The general maintenance requirements are as specified in section 7.0. In addition it is necessary to observe the following:-

1. The motor and gear-box require no maintenance apart from the occasional check that none of the screwed fixings have loosened.

2. After replacing the gearbox and motor assembly following bakeout, or if the drive should become noisy, it is advisable to check to check the the clearance in the gear train is not. excessive. Generally there should be no noticeable clearance, the smaller the clearance, the quieter the drive will be. The idler gear, which connects the pinion on the gearbox
shaft to the gear on the elevating screw of the SLTM, is adjustable. To adjust the position of the idler gear slacken the central cap head screw, adjust as required, and securely retighten. It should be noted flat the only lubricated parts of the gear train are the
bore of the nylon idler gear and the trunnion on which it runs. The initial factory lubrication should last for extremely long periods (years) under normal conditions. Should it be necessary to relubricate this part, the use of a fluorinated silicone grease, such as Dow, Corning FS 3451 (which is included in the VG lubrication kit. order code ZHPTLK) is recommended.

Note. Ensure that only the bearing surfaces are lubricated. The gear teeth should be run clean and dry.

3. After replacement of the gear train cover and the microswitch bracket it is recommended to check that all the fixing screws are secure and that the microswitches operate correctly.

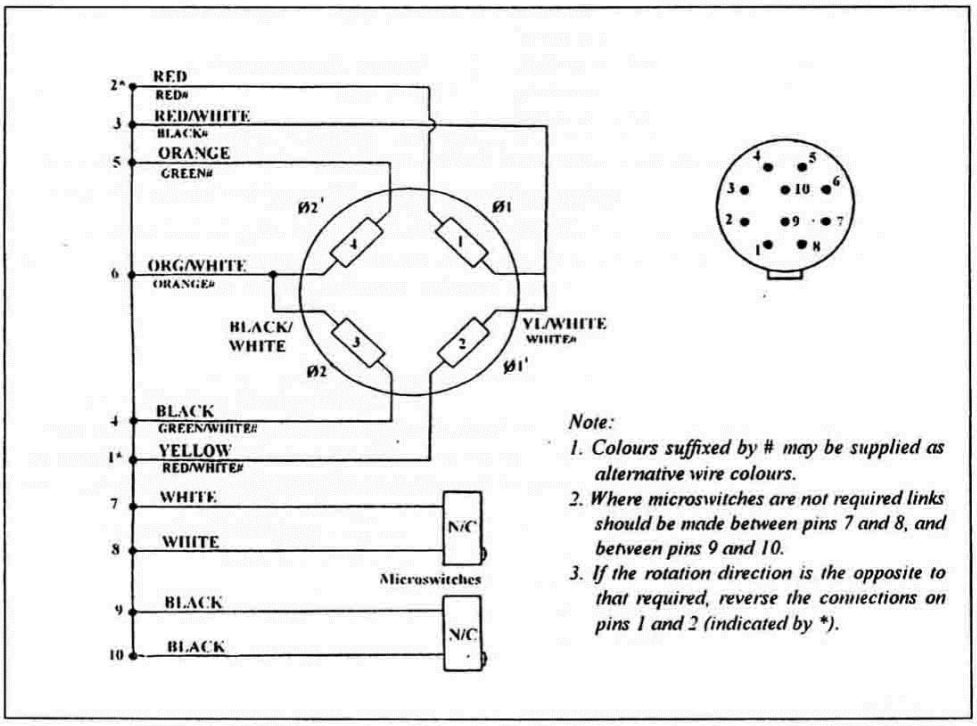


Figure 4 - Series motor connections and motor socket connections (where fitted)

13.0 Spares and Accessories

Order Code	Description
ZLTMLK	Lubrication kit for LTM and SLTM
ZSDU	Single Axis Open Loop Stepper Motor Controller
ZSMC Series	Open Loop Steeper Motor Controller, 1 to 5 axes
ZSMC..E Series	Closed Loop Stepper Motor Controller, 1 to 5 axes

Replacement parts for the LTM and SLTM drives are available to order

Service and Repair Form

Declaration of Contamination of Equipment and Components

Serving and repairs will only be carried out if the conditions for Servicing and Repair are complied with in full, according to the VACGEN Ltd. Conditions of Sale. A summary of these requirements are included on the inside front cover of the Operating Instructions. The manufacturer will refuse to accept any equipment without a signed declaration attached to the OUTSIDE of the packaging. This declaration can only be completed and signed by authorized and qualified staff.

1 Description of Equipment and Components

Equipment Type……Model Number……
Serial Number…… Your Reference Number……

2 Reasons for return……
……
……
……
……
……

3 Condition of Equipment

YES ( ) NO ( ) Toxic? YES ( ) NO ( ) Corrosive?
YES ( ) NO ( ) Explosive? YES ( ) NO ( ) Biological Hazard?
YES ( ) NO ( ) Radioactive? YES ( ) NO ( ) Other Harmful Substances?

Equipment and Components that have been contaminated, WILL NOT be accepted without written evidence of decontamination.

5 Contamination Materials

List all the substances, gases and by-products that may have come in contact with the equipment, giving trade name, manufacture, chemicals names or symbols.
Please note that any of these listed, must be completely removed, so it is safe to handle and weld, without giving off health threatening gases. Please enter details below and/or attach data sheets
……
……
……

6 Legally Binding Declaration

I hereby declare that the information supplied on this form is complete and accurate.
There by stating that the goods offer no risk to health or safety
Organisation…… Name……
Country…… Job Title……
Post/ZIP code…… Telephone……
Email……
Signature…… Date……

Return goods to: Address at top
Phone: (0) 1424 851291 Fax (0) 1424 851489 (Form VGF33)