

Manual: U132196A

Version: 1.1

## Operating and Maintenance Handbook

### PR Series Rotating Platform RP100C, RP100H and RP100M



| Revision | Date       | Comments             | Initials |
|----------|------------|----------------------|----------|
| 1        | April 2004 | Original Release     | MJD      |
| 2        | June 2015  | Rebranding to VACGEN | AW       |

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## 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.

## 1. Warnings

Warning: Keep clear of moving parts

Warning: It is the responsibility of the user to fit emergency stops to automated equipment.

Warning: This equipment must be installed by qualified personnel.

Warning: Refer to the Operating Instructions for the proper use and maintenance of this equipment. Failure to observe these instructions may result in safety hazards.

Warning: Equipment must be fully earthed to prevent dangerous electrostatic charge build-up.

Warning: It is the responsibility of the user to consider the safety requirements of hazardous materials used with this equipment and the consequence of any leakage, however caused. Consider possible reactions with materials of construction. Any equipment returned to VACGEN must have the correct Declaration of Contamination securely fastened to the outside of the packaging.

Warning: Lubricants used in this assembly may cause irritation to sensitive skin. Wear protective clothing. Do not swallow.

## Important Notes

Attention is drawn to the following points of which all users must be aware.

Mounting bolts or studs must not be allowed to enter the tapped holes by more than 10mm. Permanent damage may be caused by tightening bolts against the bottom of the threads. Use anti-seize lubricant to protect the tapped holes.

When installing the device, provision should be made for earthing both the static and rotating parts of the device, as continuity cannot be assured across the bearing surfaces. It is the responsibility of the user to ensure that the equipment is properly and permanently earthed.

VACGEN requires a Declaration of Contamination to be included with any equipment returned for repair or service. Full details of this requirement are detailed in the Warranty section.

Do not exceed the specified bakeout temperature. A reduction of UHV sealing performance may result. If subject to extreme high temperatures, toxic gases may be evolved.

The lubricants used in this device have low toxicity, but are tenacious and may cause irritation to sensitive skin. Avoid contact with skin. Wash affected skin and clothing in warm water and soap. Do not swallow. Full Health & Safety literature on this, or any other compound sold through VACGEN is available on request.

Do not allow contaminants, such as pump oil, to enter the pumping ports. Do not allow these ports to remain unprotected at any time. The bearing unit is an integral ball race that is carefully set and must not be tampered with in any way. Any attempt to dismantle the bearing unit will invalidate the warranty. If you are experiencing problems, seek advice from any VACGEN service center.

When disposing of the equipment or materials associated with it, ensure that the applicable regulations and safety measures are followed to reduce any environmental hazard.

## 1.0 Introduction

The RP rotating platform is constructed for ultra-high vacuum conditions and is provided with standard Conflat details on all connecting flanges. Equipment mounted to the rotating flange can be turned through 360° continuously. The bearing unit is a twin integral ball race giving high load capacity.

Vacuum sealing is by two stage differential pumping, in which three spring energised seals create two interspaces. These interspaces are vacuum pumped so that a negligible pressure gradient exists across the UHV seal. Gas transfer across this seal is virtually eliminated, allowing ultra-high vacuum to be achieved within the system. With this method there is an inherent residual leak and gas bursts will occur during rotation, so correct pumping is important.

Three versions are available - simple manual operation, worm and wheel drive, and motorized worm and wheel drive; diagrams showing these three options are given in figures 1a, 1b and 1c respectively. Each version uses the common bearing unit, and upgrading is possible from one to the other.

## 2.0 Specification

| Specifications                                     |   |
|--|---|
| Connecting Flanges:                                | 150mm (6") OD Conflat, DN100CF, ZFC100<br>Note, flanges connecting to the platform must have clearance holes as this equipment has tapped flanges |
| Bore Size:   | 102.5mm (4.03")   |
| Flange face distance:                              | 42.6mm (1.68")  |
| Pressure Range:                                    | Atmosphere to 1 x 10 <sup>-10</sup> mbar  |
| Pump stages  | 2   |
| Interspace pump requirements<br>Stage1:<br>Stage2: | Pump flanges are 34mm (1.33") OD Conflat<br>< 10 <sup>-2</sup> mbar<br>< 10 <sup>-5</sup> mbar  |
| Seal Type:   | PTFE/MoS2 sprung seals  |
| Bearing type:                                      | Twin integral races   |
| Bakeout Temperature:                               | 1500C   |
| Payload Limits:                                    |   |
| Vertical:  | 80kg @ 20mm polar offset  |
| Horizontal:  | 20kg @ 100mm flange offset and 20mm polar offset  |
| Inverted:  | 60kg @ 20mm polar offset  |
| Vernier resolution:                                | 0.05o   |
| Worm and wormwheel gearing:                        | 1 turn = 2o   |
| Torque to rotate (unloaded):                       | 18Nm maximum (0.30NM approximately at worm shaft input)   |
| Motorised platform:                                |   |
| Resolution:  | 0.005o in half step mode  |
| Maximum speed:                                     | >30sec-l unloaded   |

\* Gas bursts will increase with higher rotational speed and may reduce the achievable vacuum. Higher interspace pumping speed will be required for high rotational speeds.

## 2.1 Specifications for the CR, CRD and CSD Series

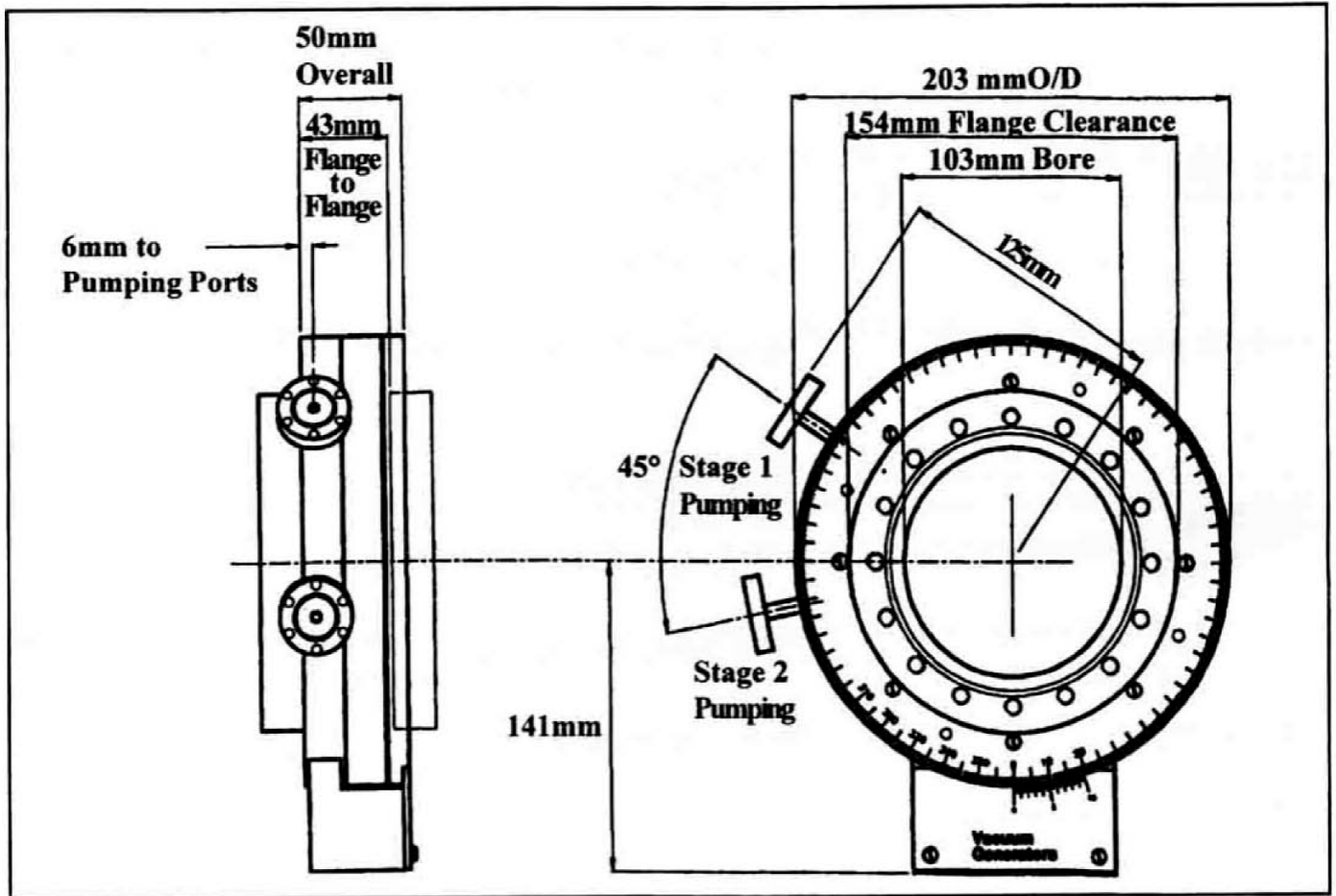


Figure 1a - The RP100 manual operation rotating platform

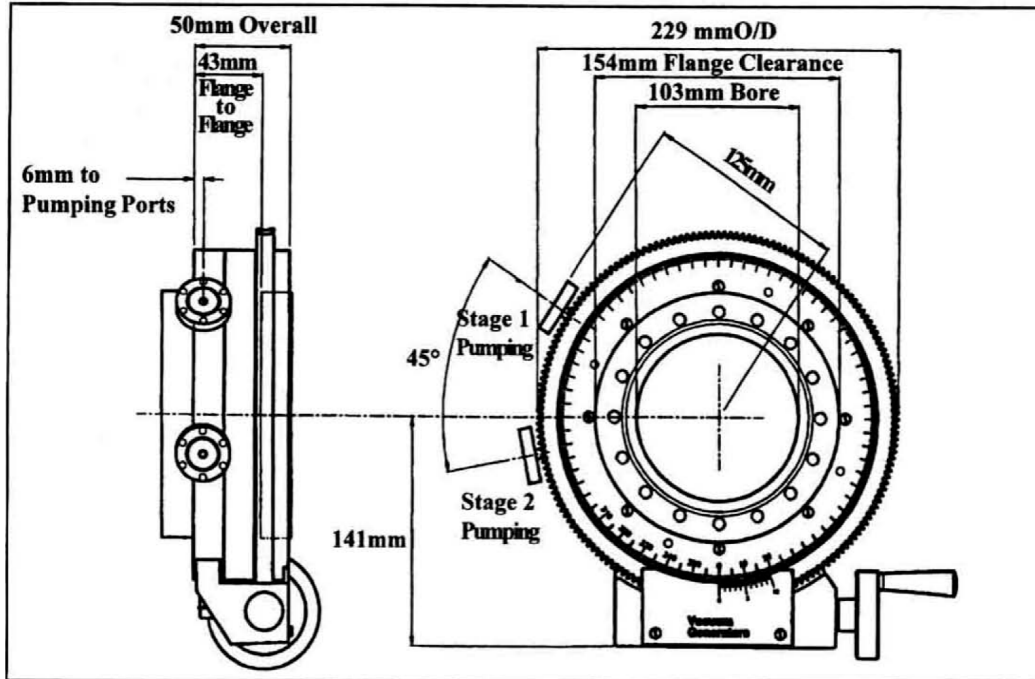


Figure 1b - The RP100H Handwheel operated rotating platform

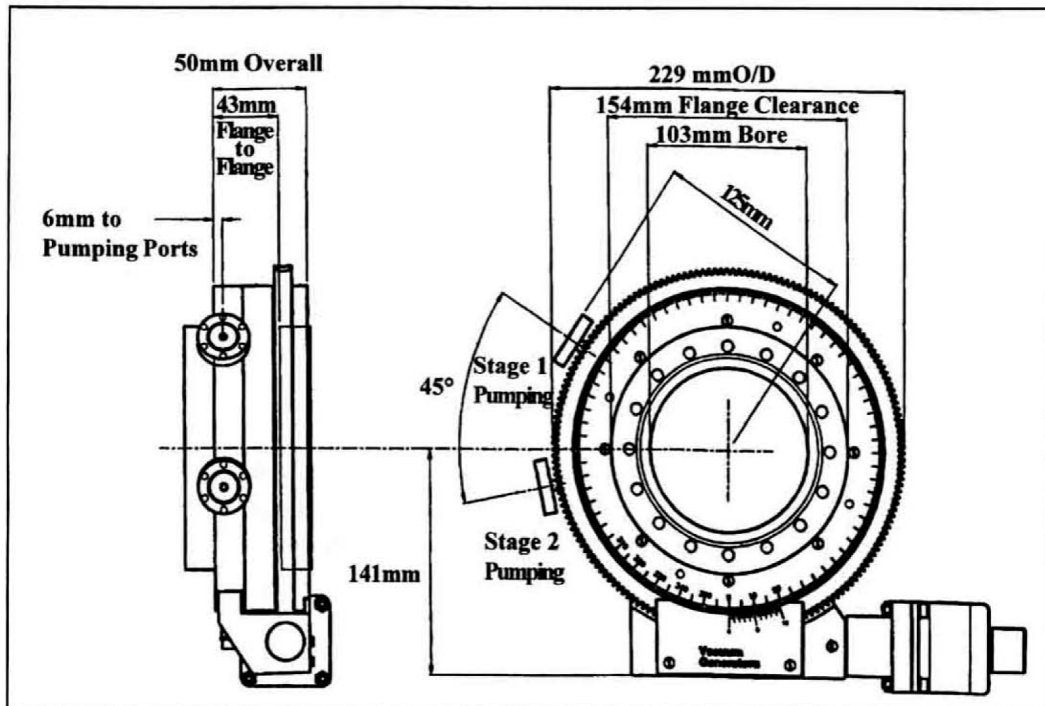


Figure 1c - The RP100M stepper Motor driven rotating platform

### 3.0 Installation

Remove the unit carefully from its transit packaging, which should be retained if possible. Inspect for signs of transit damage and check that all visible bolts and screws are secure.

Do not remove the flange protection until the last moment. The device is supplied in a UHV clean condition, and can be fitted to the vacuum system without further cleaning. Do not use the pumping ports as lifting points.

Mounting requires M8 bolts or studs. These must not be allowed to enter the tapped holes by more than 10mm. Permanent damage may be caused by tightening bolts against the bottom of the threads. Use anti-seize lubricant to protect the tapped holes. Gasket requirements are the standard Conflat style. Refer to figure 2 and to the information in section 2.0 for details of the limitations on the payload capability of the device when mounted in different orientations.

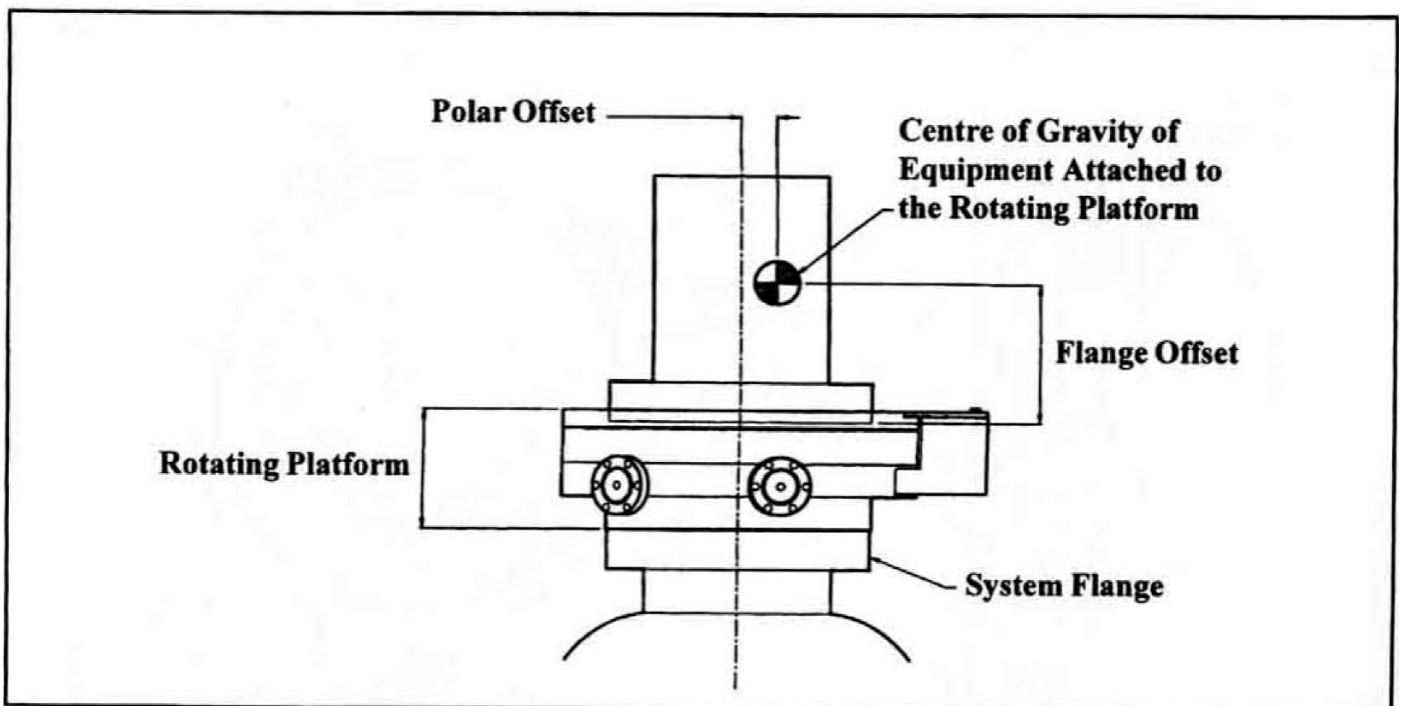
The pumping port flanges are 34mm (1.33") OD and have clearance holes. These are standard Conflat style and use standard hardware.

Note:

RP100C only - Beware of unintentional rotation when tightening bolts on flanges mounted to it. Beware that, if the unit is horizontally mounted, there is a possibility of slippage against the seal friction if the applied load is offset from the polar axis.

Note:

That the rotating platform must be earthed to both the static flange and the rotating flange, as the polymer based seals and lubricant cannot be considered to make adequate continuity through the device.





## 4.0 Pumping Requirements

Avoid removing the flange protectors until ready to connect to the pumps. Do not allow these ports to remain unprotected at any time and do not allow contaminants, such as pump oil, to enter the ports.

Stage 1 can be identified by having a single identification hole drilled on the circumference of the base flange. Connect pumping to achieve rough vacuum or better. Do not allow contaminants, such as pump oil, to enter the port.

Stage 2 can be identified by having two identification holes drilled on the circumference of the base flange. Connect pump(s) to achieve the specified vacuum, or better, at the pumping port. Pump speed should be greater than 50 l.s-1 to allow for start-up and bakeout gas desorption, although the normal gas load will be much lighter and pump speeds of 2 l.s-1 should be adequate for most applications. If the device is to be continuously or rapidly rotated, higher pump speed will be required to reduce the effect of gas bursts.

It is possible to use the rotating platform with only one pump, attached to the stage 2 port, with the stage 1 port blanked off. Alternatively, stage 1 and stage 2 can be connected together and pumped by a single pump. Ultimate pressure will be impaired only slightly, but the gas load on the interspace pump will be increased and recovery from gas bursts will be extended. It is possible to use the rotating platform with no interspace pumping. This will reduce the vacuum performance, but may be a useful option during pump maintenance or changeover.

## 5.0 Operation

RP100C - use the pin spanner provided to turn the device. Locate the pins into two of the four holes in the top of the graduated indicator dial. Take care to locate securely to reduce the risk of slip and wear of the holes. Apply sufficient torque to rotate the unit. Since more rapid rotation will result in larger gas bursts, it is recommended that rotation is done at a gentle, even speed.

The use of equipment attached to the device, to provide the turning force may increase loading on the rotating platform or the vacuum system to an unacceptable level. Attention is drawn to the payload limitations and maximum rotating torque (section 2.0).

Beware of unintentional rotation of the coarse platform when tightening bolts on flanges mounted to it, or when offset loads are fitted to horizontally mounted devices, as these ungeared devices are free to rotate against the sealing friction. Note the maximum polar offset limitation of horizontally mounted devices.

**RP100H** - Simply turn the handwheel! Periodic lubrication of the wormgear is necessary; apply Carbaflo grease after approximately 1000 rotations, or when the movement sounds dry. Avoid touching the gears which have a coating of grease.

**RP100M** - The motor is a 4-phase, 23 frame stepper motor with 8 flying leads for connection to a stepper motor drive. VACGEN SDU or SMC bi-polar drive and controller units are fully compatible. Periodic lubrication of the wormgear is necessary; apply Carbaflo grease after approximately 1000 rotations, or when the movement sounds dry. Avoid touching the gears which have a coating of grease.

## 6.0 Upgrading

Upgrading is possible. Refer to the Spares and Accessories section (section 9.0) for the available options and contact your VACGEN representative for advice. Remember to quote your model and serial numbers in any correspondence.

## 7.0 Bakeout

A reduction of UHV sealing performance may occur if the maximum bakeout temperature is exceeded. At temperatures above 300oC toxic gases may be evolved by degradation of the seals and lubricant. Wear gloves if the unit is to be operated above 55oC.

## 8.0 Maintenance and Service

Warning: Disconnect the motor from the mains supply during maintenance.

On manual rotating platforms, check periodically that the holes used for locating the pin spanner have not worn to the extent that the pin spanner might slip during use. Re-lubricate the wormwheel gear periodically. Frequency depends of usage but after approximately 1000 full revolutions of normal use, remove the worm gear cover and wipe clean both gears using a lint free cloth, moistened in solvent. Do not allow solvent to enter the worm shaft bearings. Apply Carbaflo lubricant sparingly and wipe off any excess. The use of gloves is recommended when handling any lubricant; wash off hands with warm water and soap.

| Specifications  |   |
|---|---|
| ZTL   | Thread lubricant, (260g)                        |
| ZLUB07A   | Carbaflo lubricant, (100g)                      |
| ZCU100  | Copper gaskets for 150 OD flange, (pack of 10)  |
| ZCUI9   | Copper gaskets for 34mm OD flange, (pack of 10) |
| Other gasket options include annealed, silver plated, blank, Viton and aluminium. Refer to the VACGEN catalogue for details |   |
| TSPN1160  | Pin spanner,                                    |
| M8 Stud and bolt kits   |   |
| Upgrade kits are also available:  | Upgrade kit from RP100C to RP100H               |
|   | Upgrade kit from RP100C to RP100M               |
|   | Upgrade kit from RP100H to RP100M               |

## Appendix A. Stepper Motor Connections

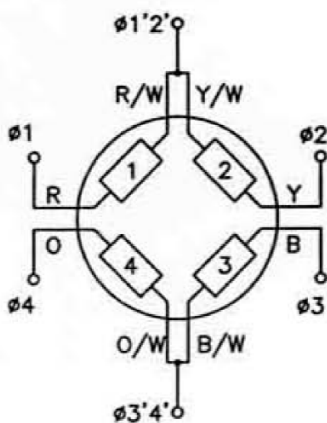
### A1. Overview

Motors and encoders used in VACGEN equipment achieve their intended performance with VACGEN controllers (SDU, SMC or SMC-E) and no responsibility can be accepted should performance be inadequate when other controllers are used.

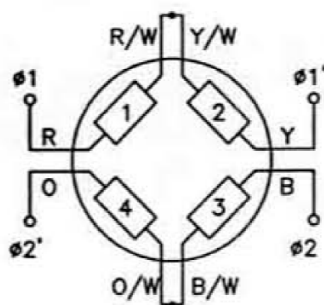
For attachment to VACGEN controllers, the motors (and encoders if applicable) can be supplied wired with suitable connectors. Otherwise, motors are supplied without connectors to allow connection to alternative drive and controller systems.

All motor variants are 4 phase, 8-lead hybrid stepper motors that can be wired up in most normal configurations as shown below. Some motor kits may include microswitches.

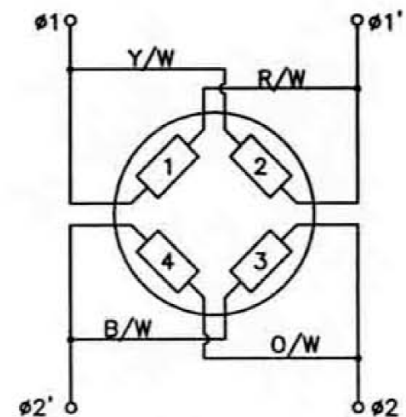
For motors fitted with incremental encoders, the VACGEN SMC-E range of controllers is required to provide passive feedback. If the motor has no encoder fitted, the controller cannot be used in the "Loop Active" mode. Note that encoders cannot be retrofitted to motors.



Uni-Polar  
Use only where low torque  
at low speed is sufficient



Bi-Polar in Series  
Provides high torque  
at low speed.



Bi-Polar in Parallel  
Provides moderate torque  
at low and high speeds.

### Key to Colour Coding:

Wire colours as follows.

R - Red, W - White, Y - Yellow, B - Black, O - Orange, G - Green

Alternative motors may be used, with alternative colours. Refer to the following sections.

#### 4.1 Specification of the MD Series of All Metal Leak Valves

| Motor Type | Step Angle | Step Angle Tolerance | Rotor inertia            | Resistance per phase | Current per phase | Inductance per phase |
|------------|------------|----------------------|--------------------------|----------------------|-------------------|----------------------|
| 23HS-108E  | 1.8o(1)    | 5%                   | 0.12 kg cm <sup>2</sup>  | 0.33                 | 3.9A(2)           | 0.38mH               |
| 23HS-309E  | 1.8o(1)    | 5%                   | 0.23 kg cm <sup>2</sup>  | 0.40                 | 4.7A(2)           | 0.84mH               |
| 23HS-409E  | 1.8o(1)    | 5%                   | 0.33 kg cm <sup>2</sup>  | 0.48                 | 4.6A(2)           | 1.00mH               |
| 34HS-109E  | 1.8o(1)    | 5%                   | 0.67 kg.cm <sup>2</sup>  | 0.45                 | 4.7A(2)           | 1.30mH               |
| 34HS-209E  | 1.8o(1)    | 5%                   | 11.30 kg cm <sup>2</sup> | 0.55                 | 4.6A(2)           | 2.50mH               |

#### Notes:

(1) Step angle quoted for full step drive. VACGEN controllers use half step drives with step angle being 0.9°.

(2) Limit the maximum current to the following values, determined by the drive used. (Note that running at maximum current can cause motor to run hot and can give rise to resonance.)

- \* Maximum current/phase for unipolar drive = rated current.
- \* Maximum current/phase for bi-polar in series = 0.70 x rated current.
- \* Maximum current/phase for bi-polar in parallel = 1.4 x rated current.

#### A3: Colour Coding of motor wires

##### Key to Colour Coding:

R - Red, W - White, Y - Yellow, B - Black, O - Orange, G - Green

**Alternative Motors may be used. Wire colours as follows.**

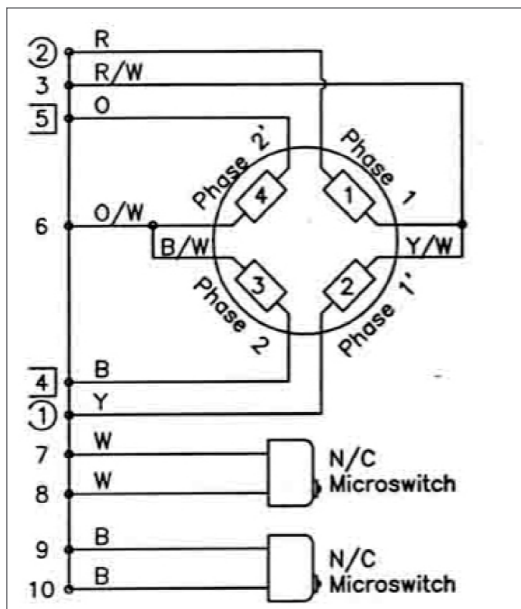
|          | As drawn | Alternative 1 | Alternative 2 |
|----------|----------|---------------|---------------|
| Phase 1  | R        | R             | R             |
|          | R/W      | B             | Purple        |
| Phase 1' | Y        | R/W           | Y             |
|          | Y/W      | W             | Blue          |
| Phase 2  | B        | G/W           | Pink          |
|          | B/W      | B/W           | Grey          |
| Phase 2' | O        | G             | B             |
|          | O/W      | O             | W             |

## A4. Motor Wiring Diagrams

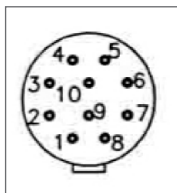
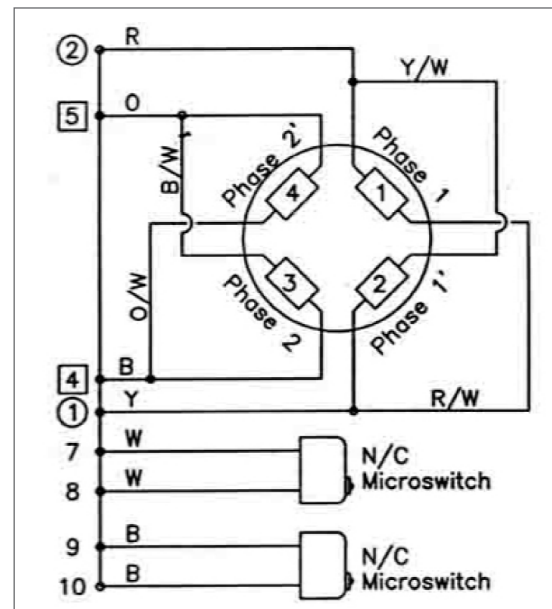
Caution: When wiring motors, care must be taken to make all connections secure. Failure to do so may result in disconnection during use and this can permanently damage the motor drive. For the same reason, never disconnect a motor from its drive unless the power has first been switched off.

Refer to previous section for colour coding of wires.

Series Motor Wiring



Parallel Motor Wiring



These diagrams show connections for compatibility with VACGEN motor controllers.

Socket used is ref. XSOC24 (Series and parallel connection).

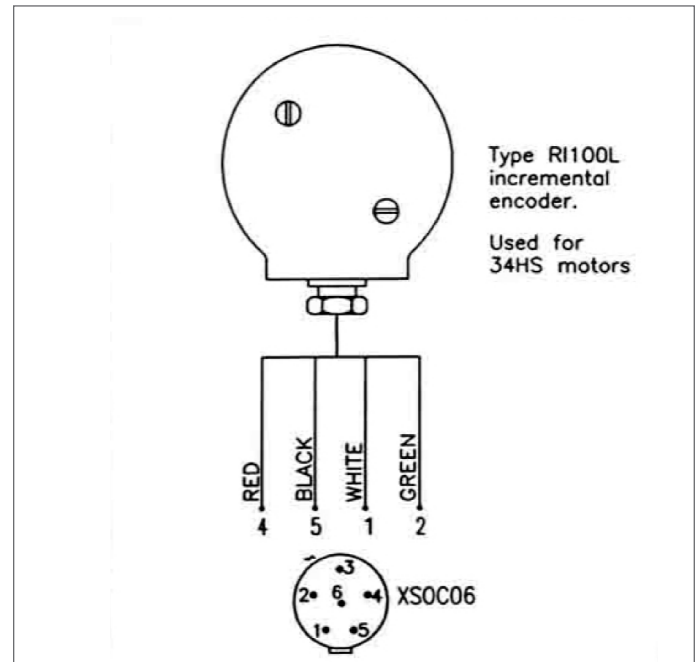
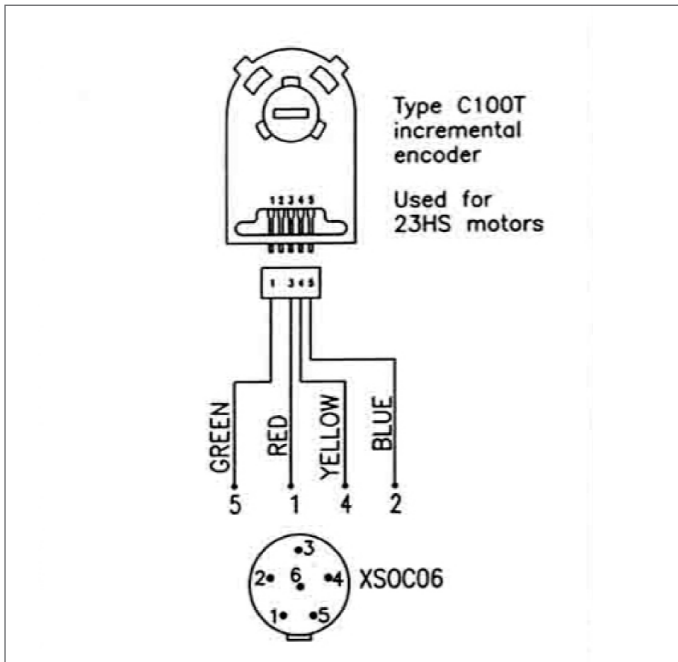
Series connection is preferred for high torque at low speed. Parallel connection is used for higher speed applications.

Where microswitches are not used, links must be made between outputs 7 and 8, and between pins 9 and 10.

If the rotation direction is opposite to that required, reverse the connections on pins 1 and 2

Twist together phase pairs to reduce electro-magnetic emission, i.e. 1 and 2, and 4 and 5

## Encoder Wiring Diagrams



| Socket Pin | Colour | Function | Encoder Pin |
|------------|--------|----------|-------------|
| 1          | RED    | Ch.A     | 3           |
| 2          | BLUES  | Ch.B     | 5           |
| 4          | YELLOW | VCC      | 4           |
| 5          | GREEN  | GND      | 1           |

| Socket Pin | Wire Colours |             | Function  |
|------------|--------------|-------------|-----------|
|            | Normal       | Alternative |           |
| 1          | WHITE        | Thin Brown  | Channel A |
| 2          | GREEN        | Thin Grey   | Channel B |
| 4          | RED          | Thick Brown | VCC       |
| 5          | BLACK        | Thick Whire | GND       |

### Wiring diagrams for incremental motor encoders

#### A6. Motor Spares

| Order code | Description  |
|------------|--|
| ZSMPC3LH   | ZSMPC3LH Cable: Motor to SMC, SME-E or SDU controller.                       |
| DB08073    | Cable: Encoder to SMC-E controller.  |
| XSOC24     | Connector socket. Fitted to motor lad or connection to VACGEN controllers.   |
| XPLU11     | Connector plug. Fitted to controllers for connection to XSOC24 motor socket. |