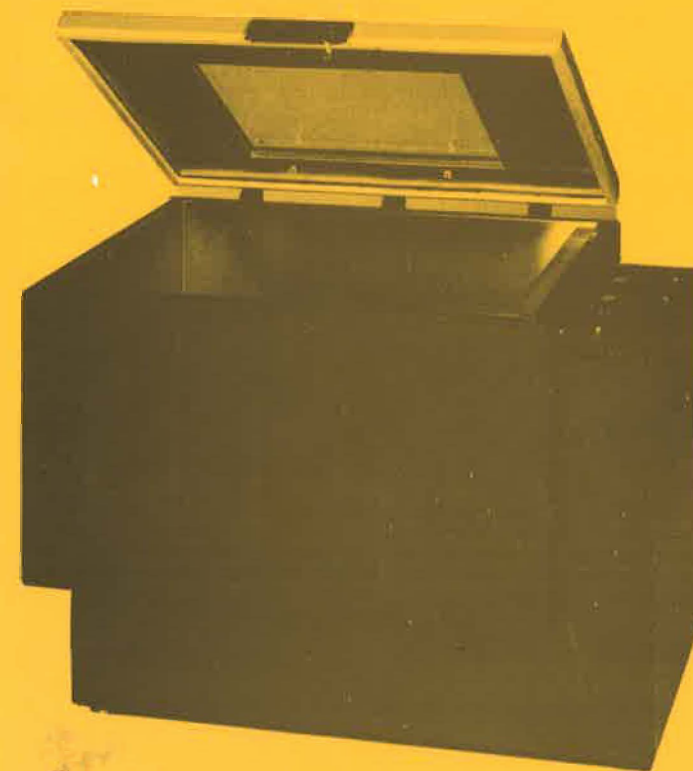


GALLENKAMP



**ORBITAL INCUBATOR**  
INR-200 and INR-250



# SANYO GALLENKAMP PLC

## Health and Safety at Work.

Sanyo Gallenkamp is required under the Health and Safety at Work, etc. Act, 1974, and other UK Legislation as designers, manufacturers, suppliers and importers of articles for use at work to ensure that, as far as reasonably practicable, the articles which we design, produce, supply or import are safe and without risk to health.

We are required to provide information on the safety and handling precautions to be observed when installing, operating, maintaining and servicing our products. Such advice is contained in this manual.

We are also obliged to update this information should circumstances change and to operate a system to this end.

We should also like to point out, however that you as users have an important responsibility in the provision and maintenance of safe working practices and conditions.

Accordingly we draw the following matters to your attention:

- 1 This apparatus should only be used as intended and within its design parameters by suitably qualified and trained personnel who have read and understood the relevant sections of this manual.
- 2 This manual should be readily available to such personnel at all times.
- 3 In addition to that which is written in the manual, normal commonsense safety precautions must be taken at all times to avoid the possibility of accidents. Particular care is required when working with apparatus at high temperature or pressure.
- 4 Installation, maintenance, servicing and connection to electrical supplies, should only be carried out by suitably trained personnel.

### TECHNICAL SUPPORT AND WARRANTY

If you are in any doubt whatsoever regarding the correct use of this apparatus, or if you require any technical data or assistance, please contact the Sanyo Gallenkamp Customer Technical Support Department at:

**Park House  
Meridian East  
Meridian Business Park  
Leicester LE3 2UZ**

**Telephone (0533) 630530  
Telex 347269 MSE G  
Fax (0533) 630353**

### NON-WARRANTY, SERVICE AND MAINTENANCE

**Fisons Instruments  
Sussex Manor Park  
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**Telephone (0293) 561222  
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*OVERSEAS CUSTOMERS: Should contact their local Sanyo Gallenkamp Distributor*

*ELECTRICITY SUPPLIES: voltage and frequency*

Sanyo Gallenkamp electrical apparatus is offered and labelled for one, or for a choice of two or more voltage ranges and, where necessary, different frequencies of mains supply. Sanyo Gallenkamp does not accept any responsibility for the operation of any such apparatus should it be connected to electricity supplies which are normally outside, or vary outside, the stated voltage and frequency values for which it is designed, nor for any consequential loss, damage or injury howsoever caused.

**Read this before use**



## ELECTRICITY SUPPLY

Before connecting this apparatus to the electricity supply, check the information given on the apparatus rating plate and ensure that:

- A) Your supply is single phase a.c. (alternating current) of the stated frequency with neutral nominally at earth potential.
- B) Your supply voltage is within the stated range.
- C) The current rating is within the capacity of your supply outlet.
- D) Your plug or electricity supply circuit is fitted with a suitable fuse.

**WARNING:** This apparatus must be earthed.

The wires in the mains lead are coloured in accordance with the following code:

Green & Yellow	Earth
Blue	Neutral
Brown	Live

Connect the wires to a non-reversible 3 pin plug as follows:

Green & Yellow wire to terminal marked E (Earth), G (Ground) coloured Green or Green & Yellow or marked with the Earth symbol.

BLUE wire to terminal marked N (Neutral) or common or coloured Blue.

Brown wire to terminal marked L (Live) or phase or coloured Brown.

**IMPORTANT** Consult an electrician if in any doubt or if your supply system has any of the following:

- No earth.
- A colour code different from the above.
- Reversible plugs.
- supply and return leads that are both above earth potential.



GALLENKAMP  
ORBITAL INCUBATORS  
INR-200 and INR-250 Series

**IMPORTANT NOTE:** SECTIONS 1 to 7 APPLY TO INCUBATORS INR-200-010V AND INR-200-030P, THESE SECTIONS APPLY ALSO TO INCUBATORS INR-250-010J AND INR-250-030D UNLESS STATED OTHERWISE IN SECTION 8.

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- Fig 1      Circuit and Wiring diagrams INR-200 Series.  
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Fig 3      Speed controller circuit and wiring diagrams.  
Fig 4      Compenstat layout and circuit diagrams.





GALLENKAMP

ORBITAL INCUBATORS

INR-200 and INR-250 Series

1. OPERATION SUMMARY

Connect the incubator to a suitable electricity power supply point, see Section 2.1.

Select and fit the required counterweights and flask platform, Section 4.

Turn on the Mains and Shaker switches, Section 3.1 and 3.2.

Set the Compenstat control knob to indicate the required temperature and set the Safety Thermostat about 5°C above the Compenstat setting.

If the Water cooling coil INR-270-502U is fitted and the desired operating temperature is near or below ambient, turn on the water supply, see Section 2.2.1.5.

Set the shaker speed control knob to the required speed.

Adjust the ventilation controls, or the supply of gas for the controlled atmosphere, Section 5, to give the required atmosphere inside the working space.

When the temperature has stabilised, as indicated by the Compenstat lamp lighting, make final adjustments to the Compenstat to bring the temperature to the exact value required.

Reset the Safety Thermostat so that it operates just above the incubator temperature.

If the incubator is to be used for static work turn off the Shaker switch.

When loading or unloading, it is preferable to stop the platform by turning off the Shaker switch than by disturbing the speed control setting.

2. INSTALLATION

2.1 Electricity supply

Before connecting this apparatus to the electricity supply check the information given on the apparatus rating plate and ensure that:

- A) Your supply is single phase a.c. (alternating current) of the stated frequency with Neutral nominally at Earth potential.
- B) Your supply voltage is within the stated range.
- C) The current rating is within the capacity of your supply outlet.
- D) Your plug or electricity supply circuit is suitably fused.

Suggested fuse ratings are:

INR-200-010V and INR-250-010J - 10 amp


INR-200-030P and INR-250-030D - 15 amp

**WARNING:** THIS APPARATUS MUST BE EARTHED.

The wires in the mains lead are coloured in accordance with the following code:

Green and Yellow	Earth
Blue	Neutral
Brown	Live

Connect the wires to a non-reversible 3-pin plug as follows:-

Green and Yellow wire to terminal marked E (Earth), G (Ground) or  or coloured green or green and yellow.

Blue wire to terminal marked N (Neutral) or common or coloured blue.

Brown wire to terminal marked L (Live) or Phase or coloured brown.

**IMPORTANT** Consult a qualified electrician if in any doubt or if your supply system has any of the following:-

No Earth

A colour code different from the above

Reversible plugs

Supply and return leads that are both above earth potential.

**IMPORTANT**

**ELECTRICAL SAFETY NOTE - INSULATION RESISTANCE**

This apparatus is fitted with a mineral insulated sheathed heater. Such heaters are liable to absorb water vapour from the air, especially under the high humidity conditions sometimes met in transit or in storage. If absorption occurs the insulation resistance of the heater can fall below the generally accepted minimum of 1 Mohm. The insulation resistance can be restored to a satisfactory level by operating the apparatus in the normal way for an hour or two. If your electricity supply system is fitted with sensitive earth leakage trips it might be necessary to run the apparatus on an unprotected circuit for this period. In normal regular use and/or laboratory storage the insulation resistance should subsequently remain at a high level.

## 2.2 Cooling Water Coil

### 2.2.1 Fitting the cooling system

2.2.1.1 Coil. Remove the cover from the side of the control box and lift out the cover over the fan, heater, etc., inside the incubator. Place the coil around the fan inside the incubator and pass its ends through the tubes below the fan. Screw the bracket at the top of the coil to the end wall of the incubator above the fan. Pass the clips over the ends of the coil to fix it in place.

2.2.1.2 Inlet and outlet connections. Fit the nozzles in the holes in the bottom rear wall of the control box.

2.2.1.3 Connecting tubes. Cut-to-length vinyl tube size N6.5 is supplied. Fit one tube on each end of the cooling coil and secure by the tubing clamps size 10-14mm supplied. Push the other ends of the tubes over the nozzles in the rear wall of the control box and fix them in place by the clamping nuts.

2.2.1.4 Water supply and waste tubes. These should have an internal diameter of 6mm and a wall thickness of 1.5mm so that they can be fixed securely in position by the clamping nuts. The tubing recommended is listed in Section 13.

2.2.1.5 Cooling water supply. The cooling coil can be supplied from the water mains or from a chilled water circulator, see Section 13. If mains water is used it should, preferably, come direct from the supply because this will be at a much more constant temperature than water from a local storage tank, such as one on the roof. When estimating the capability of the cooling water supply it is necessary to consider the maximum ambient and water temperatures and any adverse factors such as laboratory space heaters, direct sunlight, etc. which could affect performance.

## 2.3 Temperature measurement

Clips are fitted beneath the rear edge of the window to hold the thermometers listed in Section 13.

## 2.4 Drainage

A working space drainage tube is fitted in the front left-hand corner of the case to help with the removal of split sample from the incubator. The bottom of the incubator and the baseplate on it are sealed so that, if necessary, the incubator can be rinsed out after spillage has occurred.

## 2.5 Ventilation control

The plastics capped ventilation control which is packed with this Instructions Manual fits the tubulure at the top right rear corner of the incubator.

For full details of ventilation control see Section 5.

## 3. CONTROLS

All controls are grouped on the panel at the right of the incubator.

### 3.1 Mains switch

The Mains switch controls the supply of electrical power to the incubator. When it is 'on' a neon lamp in the switch lever lights.

### 3.2 Shaker switch

The Shaker switch controls the supply of power to the shaker motor circuit only. When it is 'on' neon lamps in the switch lever and beside the speed control knob light.

### 3.3 Shaker speed control

The Shaker speed control knob is used to set the speed of the shaker motor. It is calibrated to show the approximate platform speed that will be obtained for any setting. (For speed calibration see Section 7.9). Because speed control is by a solid state circuit with tachometer feedback, the speed remains constant once set and is unaffected by platform load.

### 3.4 Temperature control

The Shaker speed control knob is used to set the temperature of the incubator working space. It has a scale calibrated to show the approximate temperature that will be obtained for any setting. (For calibration procedure see Section 7.7). Incubator temperature is sensed by a thermistor in front of the fan and is controlled by the solid state Compenstat. The lamp beside the control knob lights when the incubator reaches or exceeds the set temperature.

### 3.5 Safety Thermostat

The Safety Thermostat knob is used to set an independent temperature controller a few degrees above the Compenstat set temperature. In the event of an incorrect setting or failure of the Compenstat the safety thermostat takes over and protects both the incubator and its load. The lamp beside the control knob lights when the temperature inside the incubator exceeds the setting of the safety thermostat.

### IMPORTANT

As with all protective devices, it is desirable that the safety thermostat be checked for correct functioning both when the apparatus is first put into service and at regular intervals thereafter.

#### 4. LOADING

##### 4.1 Universal Platform

A universal platform INR-270-510V is available. This platform will accept any combination of flask clips from the BKS-356 series. See section 13 for details.

##### 4.2 Fixing the platform

Each platform has three "quickfix" fasteners which engage in locating holes in the platform baseplate. Set the platform in position and secure the fasteners by a quarter turn clockwise with the specially shaped blade screwdriver supplied. (To release again, turn one quarter turn anticlockwise).

##### 4.3 Flasks

The clips on the platform are spaced to hold conical flasks of ISO standard form.

##### 4.4 Flask contents

Flasks can be used with any volume of sample up to their nominal capacity. The only precaution necessary with full flasks is to ensure that the (loose) springs are fitted around the clips of the flasks at higher speeds. The 2 litre flask clips have fixed springs.

For the efficient aeration of samples the flasks should only be filled to about 20% or 25% of their nominal capacity. Aeration can be increased by fitting each flask with a stainless steel helix of a diameter which will just pass through its neck and of a length such that it will just form one complete turn around the maximum diameter of the flask.

##### 4.5 Loading of platform

The platform and shaking system will accept out-of-balance loads but it is good practice to spread the load as symmetrically as practicable over the platform.

##### 4.6 Counterbalancing

The platform baseplate is fitted with three adjustable counterweights which are easily accessible after the flask platform has been removed. Adjustment of counterbalancing effect is by the addition or removal of weights, two of which screw into each counterweight.

NOTE: Always screw weights into position otherwise there is a danger of their rising and fouling the platform baseplate.

Each removable weight will counterbalance a sample load of about 1.0kg. In combination with the fixed counterweights, these adjustments give good counterbalancing for useful loads, (i.e. flasks plus contents) reference to the table section 4.8 will help determine the correct counter balancing either by flask size and percentage of fill or by the loading (in kgs) added to the platform. At heavier loads, a useful counterbalancing effect is still obtained but maximum speed must be reduced to keep apparatus vibration to acceptable limits.

4.7 Recommended maximum speeds

Maximum speed is determined by the vibration and tendency for the incubator to move bodily under the specific load and counterbalancing being used. The following table shows the suggested maximum operating speeds for full loads of flasks filled with water to various percentages of the nominal flask capacity. It is based on the use of glass conical flasks and extra counterbalance weights as indicated.

4.8 The information given is only approximate. Many factors such as a highly polished floor, dust on the incubator feet, or samples containing considerable solid matter can cause a reduction in the maximum useable speed attainable with a given load. Conversely, higher speeds can be attained by the use of fewer flasks as these, in the larger sizes, can be more accurately counterbalanced.

4.9 Counterbalancing Guide

TABLE. for use with ALUMINIUM UNIVERSAL PLATFORM - INR-270-51CV

FLASK SIZE (max N°)	25 ml (124)	50 ml (77)	100 ml (46)	250 ml (38)	500 ml (28)	1000 ml (18)	2000 ml (11)
(0-4 kg)	USE 0 COUNTERBALANCE WEIGHTS (0-4 kg)						
% OF FULL FLASK	20%	USE 3 C/B WEIGHTS (4-6 kg)		(6-10 kg)			
	50%	(6-10 kg)		(10-15 kg)		(15-30 kg)	
	100%	USE 6 COUNTERBALANCE WEIGHTS					
MAX SPEED	400 RPM			300 RPM		200 RPM	
Platform loading in kilogrammes shown in brackets.							

5. VENTILATION AND ATMOSPHERE CONTROL

5.1 Rough control of ventilation

An air inlet below the motor in the control box and an air outlet with adjustable plug at the top right rear corner of the case provide rough control of ventilation.

5.2 Fine control of ventilation

If metered control of ventilation and/or ventilation with humidified air is required, the following procedure is suggested:-

5.2.1 Make sure that the air inlet and cooling coil holes in the control box below the fan motor are closed with the stoppers one No. 11 and two No. 9 provided.

5.2.2 Make sure that the drainage hole, left front corner, is closed with either a stopper or a water trap. One No. 13 stopper is provided.

### 5.3 Control of atmosphere

5.3.1 Close openings as in Section 5.2. In addition, check fit of cover gasket and check that holes for heater, thermistor, etc., through end wall are substantially closed. Flexible, i.e. non-drying or non-hardening sealant can be used to seal these holes and so economise on gas. The sealant listed in Section 13 is recommended.

5.3.2 Inject gas, carbon dioxide, nitrogen etc., through a tube in the stopper. Pure gas or gas/air mixture from the Blender listed in Section 13 can be used. The use of a mixture has the advantage that there is less risk of the gas concentration drifting too far from the required value.

**NOTE 1:** The incubator can only be used with inert gases such as nitrogen, or carbon dioxide and their mixtures with air.

**WARNING:** Hydrogen, methane or other inflammable gases must not be used.

**NOTE 2:** For comments on gas transfer to flask contents see Section 4.5.

## 6. ROUTINE MAINTENANCE

### 6.1 Cleaning

Both the exterior and the interior of the incubator can be cleaned easily. The bottom of the working space is sealed so that it can be rinsed down with water to facilitate cleaning.

To gain access to the heater duct simply lift out the guard panel. The fan blade, heater, etc, are then readily accessible for cleaning.

Clean the mesh in the guard panel regularly to remove accumulations of cotton wool, etc., which could impede the air circulation.

Clean the mesh in the side panel of the control box so that the flow of cooling air to the fan motor will not be reduced.

### 6.2 Fan motor

The bearings are lubricated for life and do not require oiling. The motor cooling fan and the motor will require occasional cleaning to remove accumulation of dust. To obtain access remove the side panel of the control box.

### 6.3 Platform drive motor

The motor is fitted with bearings which are grease packed for life. If a bearing becomes noisy it should be replaced as re-greasing will not obviate this fault.

The reduction gear-box is charged with grease and sealed for life.

#### 6.4 Platform support and drive bearings

The bearings require lubrication at intervals of about 1000 hours running time.

All grease points are accessible from inside the incubator once the flask platform has been removed. The grease nipples for the platform support bearings are on the top surface of the counterweight between the holes for the adjusting weights and bearing. The grease nipples for the drive bearings is in the top of the drive shaft which projects through the plate on which the flask platform is mounted.

Shell Alvania No. 3 grease or a directly equivalent grease should be used, see Section 13.

### 7. FAULT FINDING

Possible faults are considered from the symptoms which would be observed by the operator.

To check for faults, access to the control circuits will be necessary.

ALWAYS DISCONNECT THE INCUBATOR FROM THE MAINS ELECTRICITY SUPPLY BEFORE REMOVING THE CONTROL BOX COVER.

THE WORK DESCRIBED IN THIS SECTION SHOULD BE DONE ONLY BY A SUITABLY QUALIFIED SERVICE ENGINEER.

#### 7.1 Access to control circuits

7.1.1 Main systems. Remove the cover from right-hand side of control box.

7.1.2 Platform drive motor. This is readily accessible when the incubator is turned onto its back.

WARNING: The cover is held closed by gravity acting against springs. It will fly open as the incubator is turned over unless securely held.

#### 7.2 Incubator will not heat

7.2.1 Check that the Safety Thermostat lamp is not lit. If it is, increase the setting of the Safety Thermostat knob.

7.2.2 If the fan motor and the load lamp are inoperative, check the mains switch setting and operation and the mains supply to the incubator.

7.2.3 If the fan motor and the Compenstat lamp operate correctly, check the power supply to the heater and check for heater continuity. This can most conveniently be done at the heater terminals which are located in the control box.



7.3 Compenstat lamp stays off continuously while the Safety Thermostat lamp switches on and off.

This only indicates that the safety thermostat has taken over control, it does not necessarily mean that the Compenstat has developed a fault.

Check that the safety thermostat is set a few degrees above the Compenstat setting as the incubator will always be operated by the thermostat with the lower setting. In case there is a calibration error, increase the safety thermostat setting by a few degrees. If the lamp extinguishes and remains off, leave the Safety Thermostat at the new setting. If the temperature increases and the Safety Thermostat lamp starts to switch on and off again the Compenstat is faulty.

7.4 The incubator controls but at a temperature different from the set value.

7.4.1 Check that the set temperature is not too close to ambient temperature. The incubator has a minimum working temperature of about ambient plus 5°C. For lower temperature cooling must be used or the incubator must be located in a cooled room.

7.4.2 If the error is small or if the incubator is normally operated at a fixed temperature, the position of the Compenstat knob can be adjusted on the spindle until it indicates the true temperature.

7.4.3 If the incubator is operated at widely different temperatures the following procedure is recommended: Set the Compenstat to 70°C and the safety thermostat to the top of its scale.

When the incubator temperature has stabilised insert a screwdriver into the lower trimming potentiometer on the Compenstat printed circuit board and turn the trimmer step by step until the incubator temperature stabilises at 70°C. Turn the trimmer clockwise to increase the incubator temperature and vice versa. Turn the Compenstat knob to 30°C. Allow the incubator temperature to stabilise and then adjust the upper trimmer to bring the incubator to 30°C.

If either end of scale was originally in error by more than about 5°C it is advisable to recheck the temperature obtained when the control is set to 70°C and make a further adjustment of the lower trimmer as necessary.

7.4.4 If the error is due to the ageing, damage or replacement of a thermistor or other components, proceed as in Section 7.4.3.

7.5 Incubator heats but does not control or goes out of control after a period of satisfactory operation.

7.5.1 Check whether there is an open circuit in the thermistor circuit. This could be in the wiring or in the thermistor itself. The thermistor resistance is nominally 5 kohm at 20°C.

7.5.2 If the thermistor circuit is satisfactory, the fault lies in the controller printed circuit. Replace the complete printed circuit board.

7.6 Safety thermostat will not override the Compenstat


Replace the safety thermostat.

7.7 Safety thermostat operating temperature is insufficiently accurate

Safety thermostats are adjusted during production so that the control knob and scale indicate correctly at an incubator temperature of 40°C. If the incubator is commonly operated at one end of the range and the indication of a Safety Thermostat knob is insufficiently accurate, first heat the incubator to the intended temperature using the Compenstat and allow it to stabilise. Turn the Safety Thermostat knob to indicate the incubator temperature.

For INR-200 Series Incubators. Remove the knob carefully without rotating the spindle. With a screwdriver adjust the range screw which is located just in front of the control spindle. Turn the screw clockwise if the incubator temperature is higher than the indicated temperature (or anti-clockwise if it is lower) until the load lamp just lights (or extinguishes).

A 90° angular turn of the adjusting screw corresponds approximately to a 10°C change in incubator temperature. Replace the control knob, turn the knob clockwise and allow the temperature to stabilise again. Reduce the setting of the control knob and check the load lamp lights when it indicates the incubator temperature. Increase the setting 5°C and proceed with test work.

For INR-250 Series Incubators. At the middle of one side of the safety thermostat body there is a small diameter hole marked -  +, Insert a narrow screwdriver in the hole and rotate the screw in the appropriate direction until the thermostat just operates. Reset the knob to its operating temperature.

7.8 Platform will not orbit

Check that the shaker switch is on.

Check that the platform is free to move. If not, examine the motor and the drive for obstructions.

Check the wiring and switch to the speed controller to the motor and its capacitor.

Check that the switch operates correctly and the continuity of the speed control resistor and the motor windings. If all appear satisfactory, replace the controller printed circuit board.

#### 7.9 Speed range is incorrect

The controller incorporates a preset control for the maximum obtainable speed. This is set during manufacture and should not require adjustment unless either it has been accidentally moved or there has been a component failure. A fault could show as the platform failing to reach 400 rev/min or reaching 400 rev/min at a lower control setting. Setting procedure is:-

Turn on the mains switch and turn the shaker speed control knob to give a speed of 50 rev/min. Set the knob to read 50 on the scale and then turn it to the 400 rev/min position. Use a stroboscope to measure the platform speed and adjust the preset control until the speed is 400 rev/min. It may be more convenient to set the control by using the stroboscope on the motor fan which is visible through the grille in the back of the plinth. Because the fan runs at motor speed it should be set to run at 2450 rev/min.

Check the speed at the 50 rev/min setting. If necessary readjust the knob position on its shaft and reset at 400 rev/min. using the preset control.

##### 7.9.1 Recommended procedure if a stroboscope is not available

Using the wiring diagram at the end of the Instructions Manual, locate the two terminals on the printed circuit board (MC) to which the tachometer generator (G) leads are connected.

Without disconnecting these leads, connect across them a high input resistance a.c. voltmeter, range 0 to 20V or more.

Switch on the apparatus and turn the speed control knob on the main control panel until the platform speed reaches 50 orbits per minute (as measured by counting orbits using a watch or clock with a seconds hand). Check that the knob pointer reads 50 on the scale; if it does not, slacken off the grub screw and rotate the knob on its spindle to read 50. Retighten the grub screw.

Now rotate the knob to indicate the speed setting shown on the tachometer output label which is situated near the printed circuit board MC.

Check the reading on the a.c. voltmeter and, if necessary, adjust the Maximum Speed Trimmer on MC (see wiring diagram) until the voltmeter reads the voltage stated on the label.

Re-check and, if necessary, readjust the knob setting at 50 orbits per minute. Re-check and, if necessary, readjust the Maximum Speed Trimmer as described above.

7.10 Platform will only operate at high speed

There is probably a fault in the control circuit. Replace the printed circuit board.

7.11 Cover action unsatisfactory

The spring loaded hinges of the cover are normally adjusted so that the weight of the cover is almost counterbalanced. The cover is then easy to open and stable in the open position. The spring tension and thus the cover action is controlled by the nuts inside the bottom of each hinge. Tighten the nut, i.e. screw clockwise, to make the cover easier to lift.

8. SPECIAL INSTRUCTIONS FOR REFRIGERATED MODELS INR-250-SERIES

8.1 General

This Series provides cooling when required by a built-in refrigeration system. The compressor and fan-cooled condenser are mounted behind the grille in the base of the incubator. The evaporator (cooling coil) is around the air circulation fan at the right hand end of the working space. The following instructions are in addition to Sections 1 to 9, which also apply to this model unless stated otherwise in one or more of the following sections.

8.2 Controls

8.2.1 Cooler switch. This is mounted on the main control panel. When it is turned on the compressor operates and a lamp in the switch lever lights.

8.2.2 Upper Limit and Lower Limit safety thermostats

These are fitted to protect the sample load from excessive heating (upper limit) or cooling (lower limit) in the event of a failure or incorrect setting of one of the temperature control systems. Both thermostats have scales showing the approximate operating temperature. If the scales are insufficiently accurate the thermostats can be adjusted by means of preset controls, details see Section 7.7. In normal operation the thermostats are set respectively to operate a few degrees above and below the set temperature although, when the Cooler is switched off, the lower limit thermostat is inoperative.

The lamp below the relevant control knob lights when the temperature inside the incubator is below the setting (Lower Limit lamp). For this reason it is possible for a safety thermostat lamp to light during a temperature change period, especially when the incubator is first switched on, even though all systems are working perfectly.

### 8.3 Operation

The incubator is operated exactly as described in the Instructions for the basic model with the following exceptions:-

8.3.1 When temperatures below about ambient temperature plus 5°C are required, switch on the cooler. The refrigeration system runs continuously. When the incubator has cooled to the required temperature the Compenstat turns on the heater sufficiently to balance the cooling effect and thus to maintain constant temperature.

8.3.2 Set the safety thermostats to operate a few degrees below (lower limit thermostat) and a few degrees above (upper limit thermostat) set temperature.

It must be understood that the thermostats are only safety devices, they cannot prevent natural heating or cooling if a control fails. For example, if the incubator is being used at 10°C and the compressor is accidentally switched off or fails, the incubator will slowly warm up due to natural heat conduction through its walls. On the other hand if the heater failed, the lower limit safety thermostat would take over control and switch the refrigerator on and off and thus prevent the temperature from falling more than the few degrees to the safety thermostat operating point.

### 8.4 Ventilation

When the incubator is being used with refrigeration, close all the ventilators, tubes, etc., leading into the working space as described in section 5.2. If ventilation is essential, adopt the procedure described in Section 5.3. These precautions are necessary to reduce the rate at which frosting of the cooling coil occurs and thus to increase the intervals between defrosting, see Section 8.5 and 8.6.

### 8.5 Defrosting

When the refrigeration system is being used, the incubator will require regular defrosting to prevent the excessive build-up of ice on the evaporator coil. It is not possible to specify a time interval because this is dependent on so many factors relating to the use of the apparatus and ambient conditions. When excessive ice builds up on the cooling coil turn off the Cooler switch only until the ice has melted and then turn it on again. With this procedure the temperature will not rise significantly above the set value.

A drain tube is fitted in the floor below the cooling coil to lead condensate to the outlet nozzle behind and below the control box. A barrier across the floor of the work space prevents the condensate from spreading across the floor.

### 8.6 Reduction of frosting

The only way to reduce the rate of formation of ice on the cooling coil is to reduce the amount of water vapour entering the work space.

Sources of water vapour are:

- 8.6.1 Ventilation. If possible close all vents and tubes entering the working space.
- 8.6.2. Cover opening. Reduce the number and lengths of the periods for which the cover is opened for the purpose of adding or removing flasks.
- 8.6.3 Samples. Close the sample containers as securely as possible for the work to be done.
- 8.6.4 Spillage and condensate. Remove as much as practicable of any sample spillage or melted condensate which does not run down the drains.

#### 8.7 Routine maintenance

- 8.7.1 See Sections 6.1 to 6.4.
- 8.7.3 Keep the grille in front of the condenser free from fluff, etc, which could restrict the amount of air passing through the condenser.

#### 8.8 Faults and servicing

- 8.8.1 See Section 7 for general procedures.
- 8.8.2 In the event of a fault in the compressor or a slow reduction of cooling efficiency due to loss of refrigerant gas consult a refrigeration engineer. The refrigerant gas used is Type R12.

United Kingdom users, see Page B for Service Organisation address.  
Overseas users contact local distributor.

### 9. CORRESPONDENCE

In the event of any correspondence concerning this apparatus, please quote the Catalogue Number and Serial Number given on the apparatus nameplate and the voltage and frequency of the local mains power supply. This will avoid unnecessary delays.

### 10 PARTS LIST

In this Section are listed the main electrical components and those mechanical components liable to need replacement.

These components and any other part which needs to be replaced are available from Gallenkamp Service Organisation, see Page B. When requesting spare parts please quote in full the details given in the Cat No. and Description columns, making sure that you specify the correct voltage range where alternatives are shown.

See page B for address of Service Organisation.

If the required part is not listed here, please give the fullest possible

description and quote the apparatus Cat No. and Serial No.

The Code column details refer to the circuit diagram at the end of this Manual.

10.1 Parts list for 220-240V 50 Hz Incubator INR-200-010V

<u>Cat No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Code</u>
-	Switch/lamp unit, mains	36040.016	S1/LP1
-	Switch/lamp unit, shaker	36040.017	S2/LP2
-	Potentiometer 50kohm, speed control	44060.750	VR1
-	Potentiometer 1.5kohm, temperature control	44050.012	VR2
-	Thermistor assembly	62400.001	TH
-	Tachometer generator	37040.001	G
-	Safety thermostat	72020.065	
-	Fan motor	37080.006	TS1
-	Shaker motor	34400.016	M1
-	Speed controller printed circuit	34400.040	M2
-	Lamp, neon, safety thermostat	61020.005	MC
-	Lamp, neon, shaker	34020.042	LP3
-	Lamp, neon, Compenstat	34020.046	LP5
-	Heater 1000W	34020.046	LPH
-	Solid state Compenstat	33100.053	H
-	Stopper, solid, No. 9	61010.005	TS2
SYH-450-091K	Stopper, solid, No. 9	-	-
SYH-450-111H	Stopper, solid, No. 11	-	-
SYH-530-191G	Stopper, 1-hole, No. 27	-	-

10.2 Parts list for 110-120V 60 Hz incubator INR-200-030P

<u>Cat No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Code</u>
-	Switch/lamp unit, mains	36040.015	S1/LP1
-	Switch/lamp unit, shaker	36040.018	S2/LP2
-	Potentiometer 50kohm, speed control	44060.750	VR1
-	Potentiometer 1.5kohm, temperature control	44050.012	VR2
-	Thermistor assembly	62400.001	TH
-	Tachometer generator	37040.001	G
-	Safety thermostat	72020.065	
-	Fan motor	37080.006	TS1
-	Shaker motor	34400.017	M1
-	Speed controller printed circuit	34400.041	M2
-	Lamp, neon, safety thermostat	61020.006	MC
-	Lamp, neon, shaker	34020.043	LP3
-	Lamp, neon, Compenstat	34020.047	LP5
-	Heater 1000W	34020.047	LP4
-	Solid state Compenstat	33100.054	H
-	Stopper, solid, No. 9	61010.006	TS2
SYH-450-091K	Stopper, solid, No. 9	-	-
SYH-450-111H	Stopper, solid, No. 11	-	-
SYH-530-191G	Stopper, 1-hole, No. 27	-	-

10.3 Parts List for 220-240V 50 Hz refrigerated incubator INR-250-010J

<u>Cat No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Code</u>
-	Switch/lamp unit, mains	36040.003	S1/LP1
-	Switch/lamp unit, shaker	36040.003	S2/LP2
-	Switch/lamp unit, cooler	36040.003	S3/LP3
-	Lamp, neon, shaker	62040.001	LP4
-	Lamp, neon, lower limit safety thermostat	62040.001	LP5
-	Lamp, neon, upper limit safety thermostat	62040.001	LP6
-	Lamp, neon, Compenstat	62040.001	LP7
-	Fan motor	34400.016	M1
-	Shaker motor	34400.040	M2
-	Refrigeration unit	35900.002	M3/M4
-	Tachometer generator	37040.001	G
-	Potentiometer 50kohm, speed	72020.065	VR1
-	Potentiometer 1.5kohm, temperature control	44050.012	VR2
-	Thermistor assembly	62400.001	TH
-	Heater 1000W	33100.053	H
-	Lower limit safety thermostat	37080.004	TS1
-	Upper limit safety thermostat	37080.004	TS2
-	Solid state compenstat	61010.005	TS3
SYH-450-091K	Stopper, solid, No.9	-	-
SYH-450-111H	Stopper, solid, No. 11	-	-
SYH-530-191G	Stopper, 1-hole, No. 27	-	-

10.4 Parts List for 110-120V 50 Hz refrigerated incubator INR-250-030D

<u>Cat No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Code</u>
-	Switch/lamp unit, mains	36040.018	S1/LP1
-	Switch/lamp unit, shaker	36040.018	S2/LP2
-	Switch/lamp unit, cooler	36040.018	S3/LP3
-	Lamp, neon, shaker	62040.002	LP4
-	Lamp, neon, lower limit safety thermostat	62040.002	LP5
-	Lamp, neon, upper limit safety thermostat	62040.002	LP6
-	Lamp, neon, Compenstat	62040.002	LP7
-	Fan motor	34400.017	M1
-	Shaker motor	34400.041	M2
-	Refrigeration unit	35900.001	M3/M4
-	Tachometer generator	37040.001	G
-	Potentiometer, 50kohm, speed control	72020.065	VR1
-	Potentiometer, 1.5kohm, temperature control	44050.012	VR2
-	Thermistor assembly	62400.001	TH
-	Heater 100W	33100.054	H
-	Lower limit safety thermostat	37080.004	TS1
-	Upper limit safety thermostat	37080.004	TS2



10.4 Continued

<u>Cat No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Code</u>
-	Solid state Compenstat	61010.006	TS3
SYH-450-091K	Stopper, solid, No. 9	-	-
SYH-450-111H	Stopper, solid, No. 11	-	-
SYH-530-191G	Stopper, 1-hole, No. 27	-	-

11. GALLENKAMP COMPENSTAT PARTS LIST

For users who wish to repair a faulty Compenstat, the parts and their descriptions are listed below. The circuit diagram and printed board layout are at the end of this Manual.

All parts can be obtained from Fisons Instrumentation Services, see Page B, although many may be obtainable more quickly from a local electronic component supplier. Parts described by a Gallenkamp Part No. can only be obtained from Gallenkamp. All replacement parts must have the specified characteristics and manufacturer if one is named.

See Page B for address of Service Organisation.

11.1 Parts list for 220-240V 50 Hz Compenstat Part No. 61010.005

<u>Drg Code</u>	<u>Description</u>
R1	Resistor, not fitted
R2	Resistor, wirewound 10 kohm $\pm 10\%$ 16W
R3	Resistor, carbon 470 ohm $\pm 5\%$ 1/8W
R4	Resistor carbon 100 ohm $\pm 5\%$ 1/8W
R5	Resistor, metal oxide 1.2 kohm $\pm 2\%$ 1/8W
R6	Resistor, metal oxide 1.2 kohm $\pm 2\%$ 1/8W
R7	Resistor, carbon 2.2 kohm $\pm 5\%$ 1/8W
R8	Resistor, carbon 2.2 kohm $\pm 5\%$ 1/8W
R10	Resistor, metal oxide 330 ohm $\pm 2\%$ 1/8W
R11	Resistor, carbon 1 k ohm $\pm 5\%$ 1/8W
C1	Capacitor 0.1 mfd 250V a.c.
C2	Capacitor 0.1 mfd 60V d.c.
C3	Capacitor 0.001 mfd 60V d.c.
D1	Diode bridge 20V RMS 100mA
D2	Diode Zener 12V $\pm 5\%$ 400mW
TR1	Unijunction GE2N2646
TR2	Transistor Ferranti ZTX 500
TR3	Transistor Ferranti ZTX 500
VR1	Variable resistor moulded carbon 2.2k ohm $\pm 20\%$ $\frac{1}{4}$ W
VR2	Variable resistor moulded carbon 2.2k ohm $\pm 20\%$ $\frac{1}{4}$ W
VR3	Control potentiometer see Section 10
T/1	Transformer
T/2	Transformer Gallenkamp Part No. 46050.001
CH	Choke Gallenkamp Part No. 41900.003
TC	Triac RCA 40576
TH	Thermistor
LP	Neon lamp See Section 10
D3	Suppressor

11.2 Parts list for 110-120V 60 Hz Compenstat Part No. 61010.006

As for 220-240V Compenstat, except for the following changes:

R2	Resistor wirewound 4.7 kohm $\pm 10\%$ 10W
Triac	Mullard BTX9-200
R9	Resistor metal oxide 1.8K ohm $\pm 2\%$ 1/8W
CH	Choke part no 41900-002

12. GALLENKAMP SOLID STATE SPEED CONTROLLER PARTS LIST

For users who wish to repair a faulty speed controller, the parts and their descriptions are listed below. The circuit diagram and printed board layout are at the end of this Manual. All parts can be obtained from Fisons Instrumentation Services, see Page B, although many may be obtainable more quickly from a local electronic component supplier.

See Page B for address of Service Organisation.

Parts described by a Gallenkamp Part No. can only be obtained from Gallenkamp. All replacement parts must have the specified characteristics and manufacturer is one is named.

12.1 Parts list for 220 - 240V 50 Hz Speed Controller Part No.61020.005

<u>Drg Code</u>	<u>Description</u>
R1	Resistor 15 kohm $\pm 10\%$ 16W wirewound
R2	Resistor 1 kohm $\pm 5\%$ 1/8W carbon
R3	Resistor 2.7 kohm $\pm 5\%$ 1/8W carbon
R4	Resistor 18 kohm $\pm 5\%$ 1/8W carbon
R5	Resistor 1 kohm $\pm 5\%$ 1/8W carbon
R6	Resistor 10 kohm $\pm 5\%$ 1/8W carbon
R7	Resistor 33 ohm $\pm 5\%$ 1/8W carbon
VR1	Not fitted to board
VR2	Variable resistor 33 kohm
C1	Capacitor 0.1 mfd 1000V
C2	Capacitor 8 mfd (2 x 16 mfd in series)
C3	Capacitor 47 mfd 40V
C4	Capacitor 0.1 mfd 1000V
C5	Not fitted
C6	Capacitor 0.1 mfd 600V
DB1	Diode LT164
D2	Zener diode BZY88/C22
D3	Zener diode BZY88C/3V3
DB2	Diode LT164
TC	Triac RCA 40430
T1/T2	Transformer Gallenkamp part No. CH.3274
L1	Choke Gallenkamp part No. CH.3284
TR1	Transistor 2N2646
TR2	Transistor ZTX-500

12.2 Parts list for 110-120V 60 Hz Speed Controller Part No. 61020.006

As for 220-240V speed controller except for:-

R1	Resistor 5.6 kohm $\pm 10\%$ 16W wirewound.
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### 13. ACCESSORIES

The following accessories are either specifically designed for or recommended for use with, these orbital incubators. They are available from your usual Gallenkamp Branch or Distributor.

<u>List No.</u>	<u>Description</u>
INR-270-502U	Cooling coil
THL-630-110E	Thermometer -5 to 105°C
TWR-670-150P	Tubing PVC size N6.5
	Culture flasks, conical with side indents, capacities 250-2000ml
FHC-280-050V	Flask, culture 250ml
FHC-280-070P	Flask, culture 500ml
FHC-280-090J	Flask, culture 1000ml
FHC-280-110G	Flask, culture 2000ml
-	Grease for bearings CH-1181
INR-270-510V	Platform, anodised aluminium, with perforations on a 10mm matrix to accept conical flask clips in the BKS-356 series. Will accept all one size or a combination of sizes.
	Flask clips, stainless steel, for conical flasks. Supplied singly.
BKS-356-509X	For 25ml flask (124 can be fitted)
BKS-356-511E	For 50ml flask (77 can be fitted)
BKS-356-513A	For 100ml flask (46 can be fitted)
BKS-356-515T	For 250ml flask (38 can be fitted)
BKS-356-517P	For 500ml flask (28 can be fitted)
BKS-356-519L	For 1 litre flask (18 can be fitted)
BKS-356-521B	For 2 litre flask (11 can be fitted)

### 14. SPARES KITS

A set of the components most subject to stress or wear and which, in consequence, should be available on site to assure continuity of operation.

All components are available separately, see Parts List Section.

Content of Kits for INR-200 series

<u>Description</u>	<u>Qty</u>
Thermistor assembly	1
Compenstat P.C. board complete	1
Safety thermostat	1
Indicator/Switch	1
Indicator lamp	2
Fan motor	1
D-piece	1
L.H. Screw	1
Cup washer	1

Content of Kits for INR-250 series

As above plus an additional Indicator/Switch.

Ordering information

<u>For use with:</u>	<u>Order Spares Kit No.</u>
INR-200-010V	INR-260-010C
INR-200-030P	INR-260-030T
INR-250-010J	INR-265-010S
INR-250-030D	INR-265-030M

15. SPECIFICATION

15.1 For INR-200

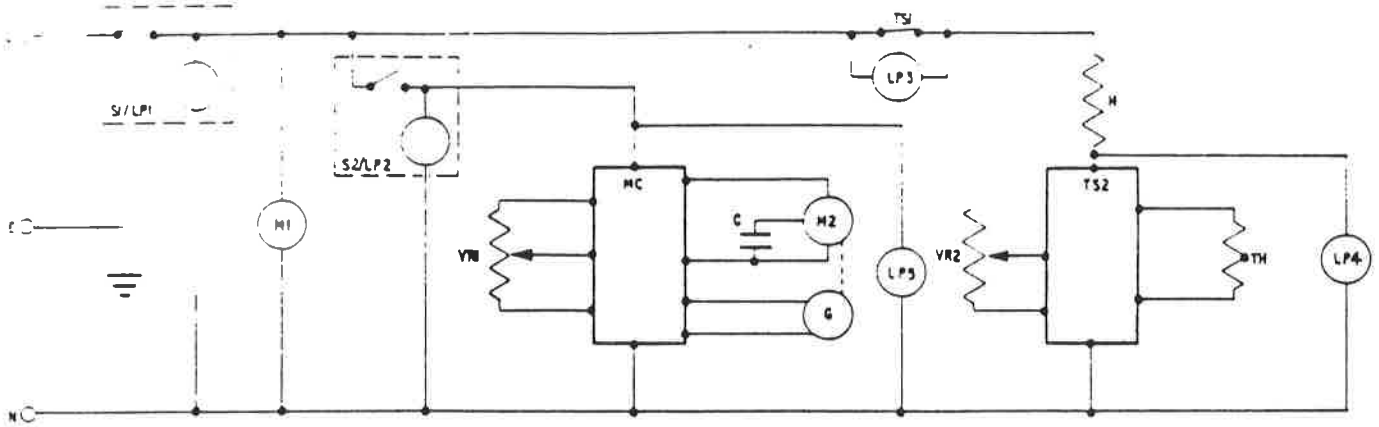
Temperature range	Ambient +5°C to 70°C (With cooling coil range extended to ambient or just below).
Temperature fluctuation	0.1°C
Temperature variation, max	±0.5°C
Diameter of orbit	32mm
Orbiting speed range	40 to 400/min continuously variable.
Platform capacity (using platform INR-270-510V and clips BKS-356)	124 x 25ml conical flasks 77 x 50ml conical flasks 46 x 100ml conical flasks 38 x 250ml conical flasks 28 x 500ml conical flasks 18 x 1litre conical flasks 12 x 2 litre conical flasks
Platform size	680 x 480mm
Window size	480 x 380mm
Internal dimensions HxWxD	340 x 755 x 540mm
Overall dimensions HxWxD (cover closed)	735 x 1020 x 680mm
Power rating, max	1.2 kW
Mass, nett	106 kg

15.2 For INR-250

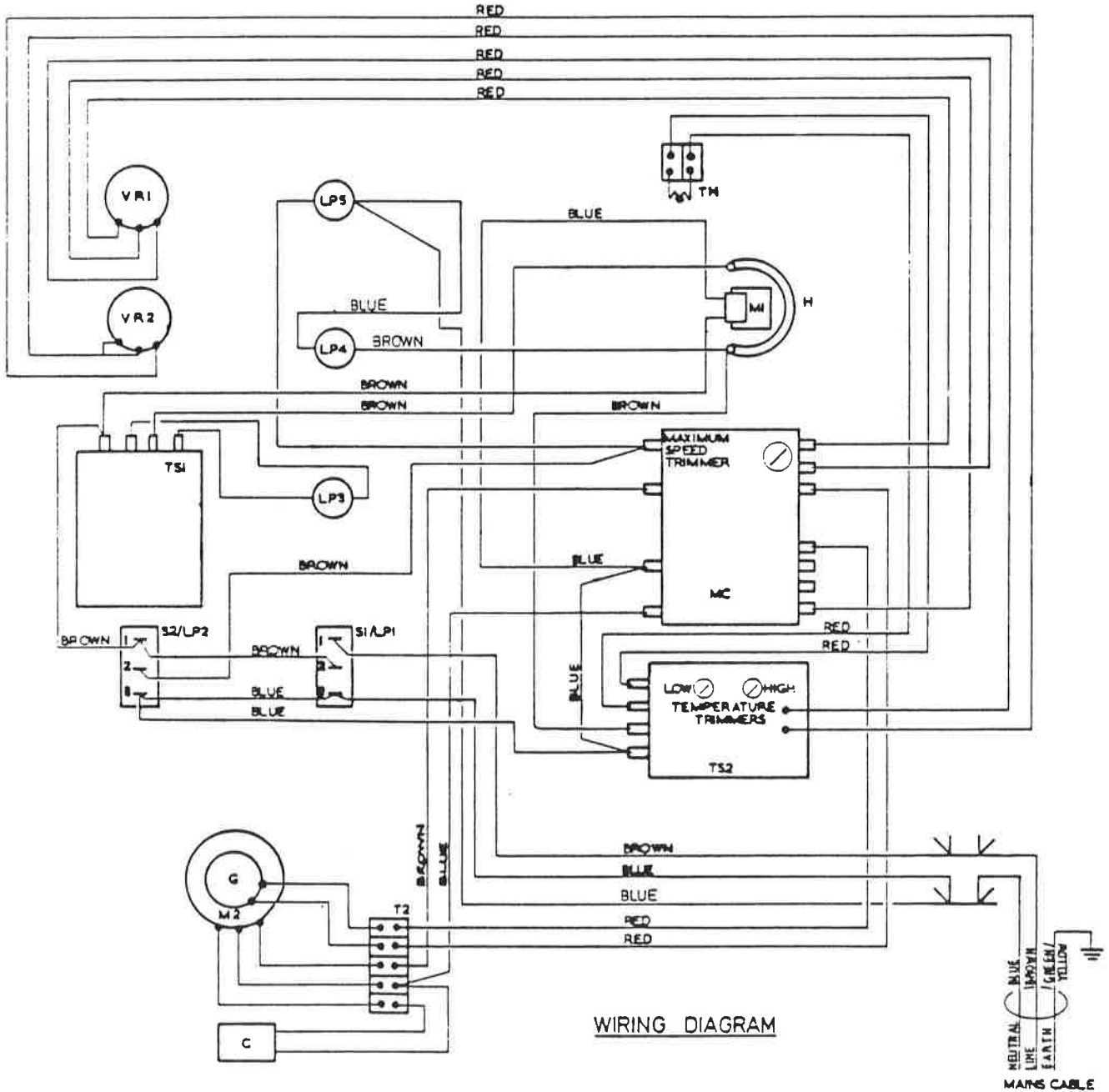
As for INR-200 except:

Temperature range	Ambient -20°C to 70°C
Power rating, max	1.5 kW
Mass, nett	125 kg





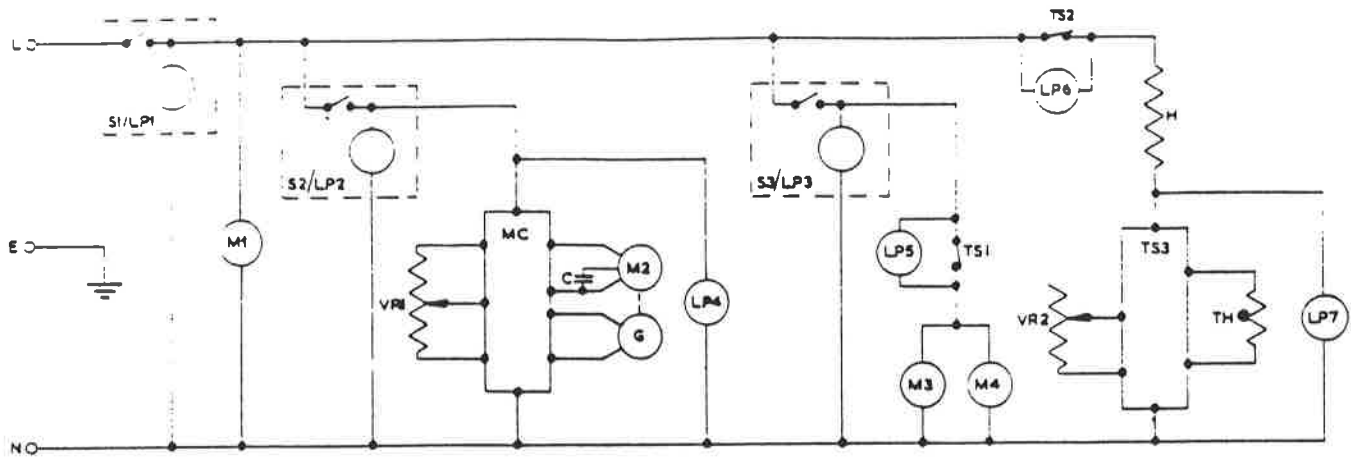
CIRCUIT DIAGRAM



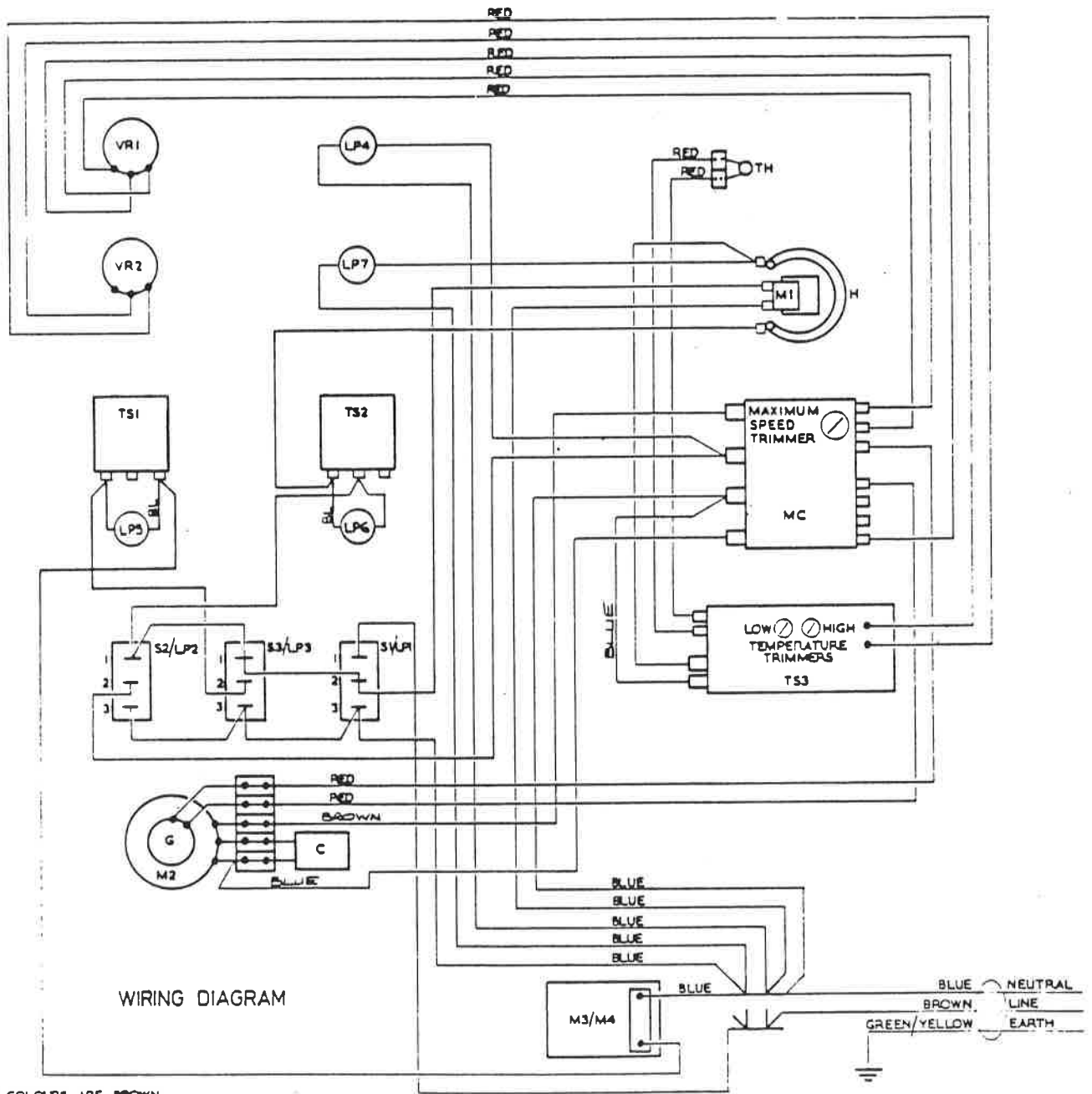
WIRING DIAGRAM







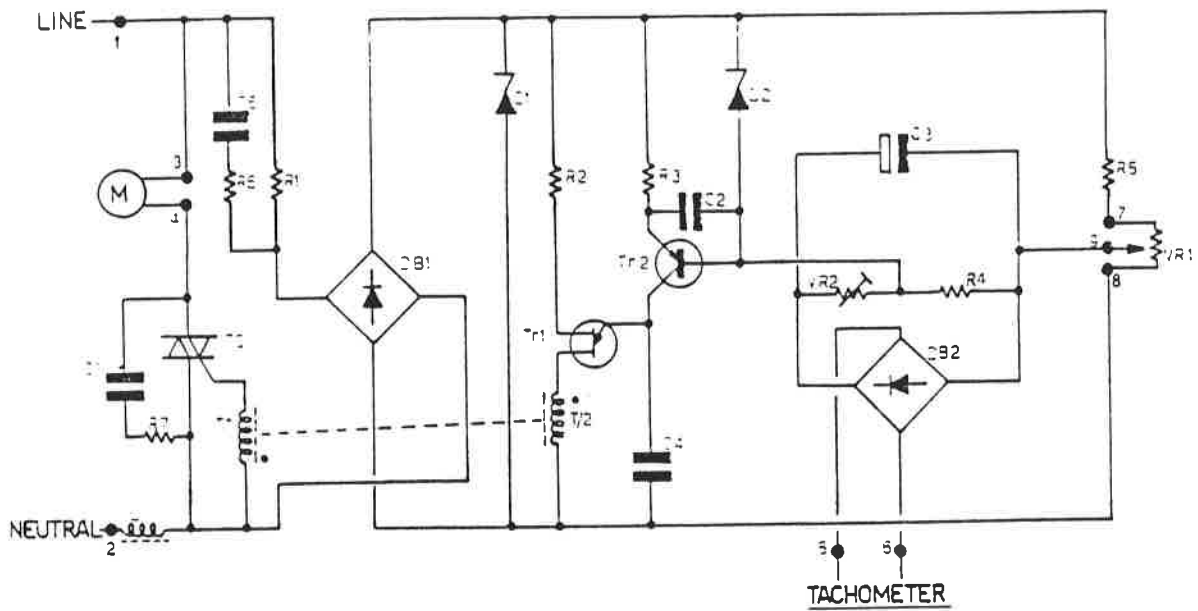
CIRCUIT DIAGRAM



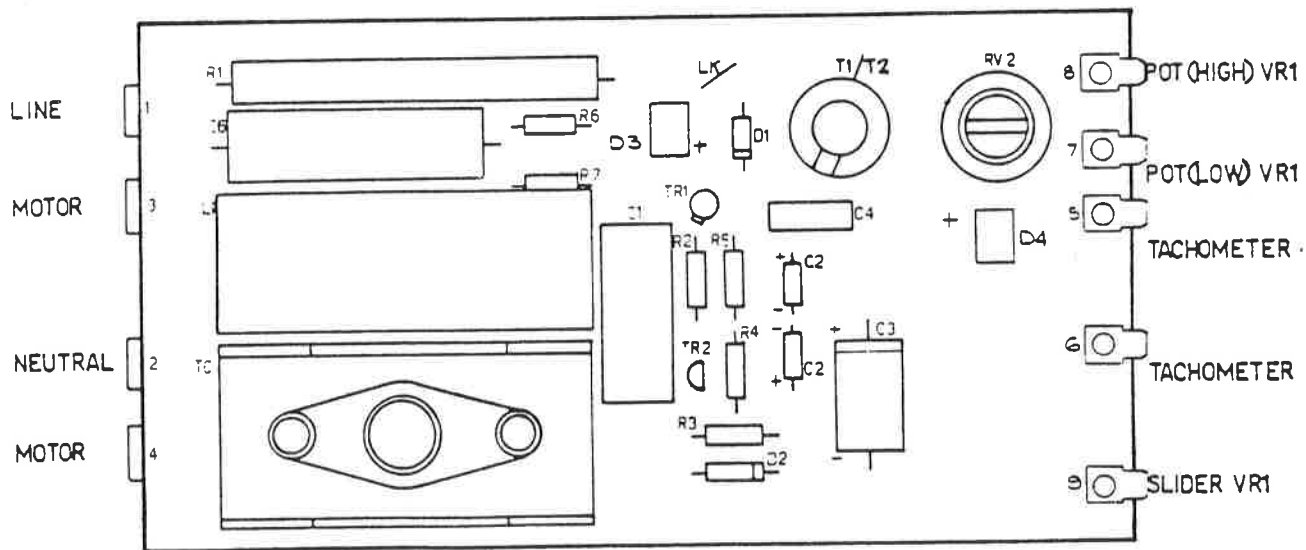
WIRING DIAGRAM

ALL WIRE COLOURS ARE BROWN  
UNLESS OTHERWISE STATED





CIRCUIT DIAGRAM

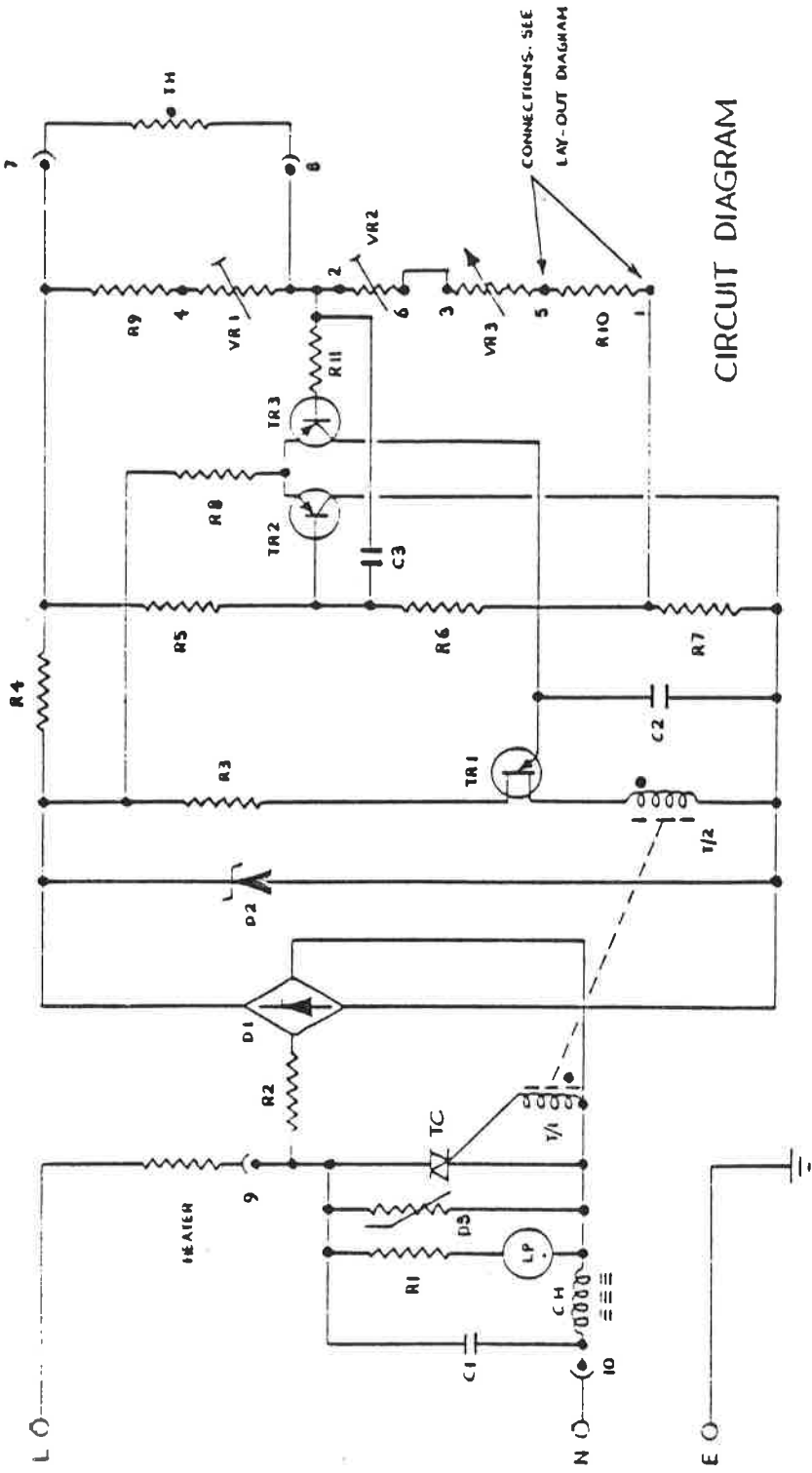


PCB COMPONENT LAYOUT

SOLID STATE SPEED CONTROLLER

FIG. 3.



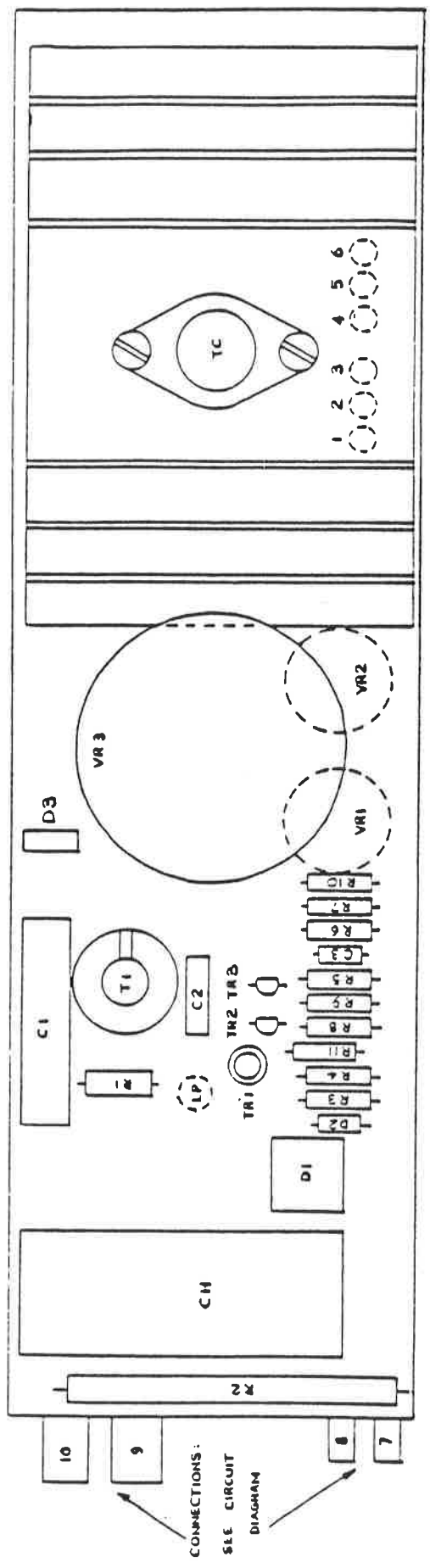


CIRCUIT DIAGRAM

CONNECTIONS. SEE LAY-OUT DIAGRAM

CAT NUMBER	APPARATUS	VOLTAGE
	SOLID STATE COMPENSTAT	220/240V
		110/20V
		FREQUENCY
		50 HZ
		60 HZ

FIG. 4.



NOTE - VR3, R1 AND LP MAY BE REMOTE FROM BOARD.

