SOMAR

Single Phase Intelligent Motor Controllers.

# Powerboss PB Series

## Current Ratings 6 to 20 Amps

# Installation and Commissioning Guide

''Failure to read these instructions prior to installation and use may result in damage to the starter and or the driven equipment and may render the warranty invalid''

# Index

# INTRODUCTION

## THEORY OF OPERATION

In the single-phase induction motor the current drawn at no load is relatively high because the stator windings still supply all the magnetic field energy. See Figure 1.
This means that even during idling the motor draws the majority of its full load operating current. This excess energy is converted into heat and vibration, in addition to being wasted the heat and vibration shortens the life of the motor.
In the single-phase induction motor the current lags the voltage due to the inductive reactance in the windings. The cosine of the amount of lag in degrees is the motor power factor. Power factors are 1 for resistive loads (heaters etc) and typically vary from 0.65 for a fully loaded motor to as low as 0.1 for an idling motor. See Figure 2.

The actual power being consumed by the motor is Voltage X Current X Power Factor.

A lightly loaded motor has a low power factor, as the motor reaches its rated load the power factor moves closer to its designed maximum. Powerboss calculates the motor loading by measuring the time delay between voltage and current zero crossing points, in effect the motors power factor. When the load on the motor is low Powerboss lowers power consumption by lowering the voltage to the motor by switching a triac at the correct time in the voltage cycle. Powerboss continually adjusts the power to the motor every mains cycle to ensure the motor always has enough power to suit the driven load.

Powerboss will usually reduce the motor current and thereby improve motor power factor, system power factor will not be effected.

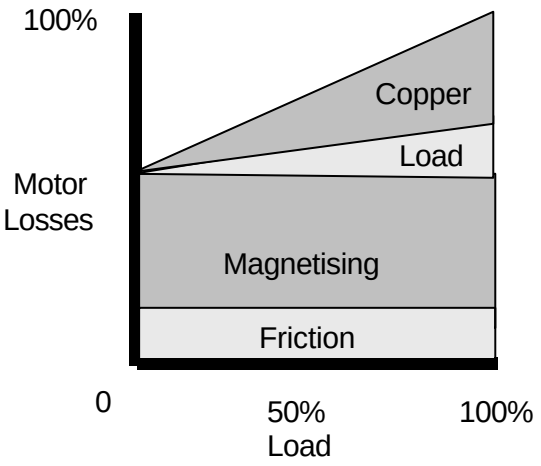



Figure 1.
Induction Motor Losses

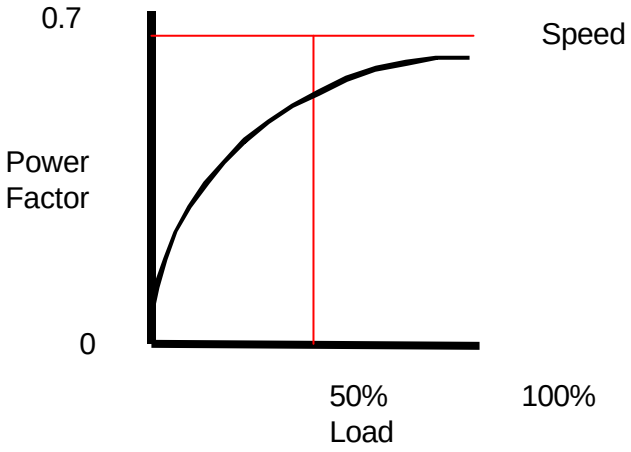



Figure 2.
Induction Motor Power Factor

## SUITABLE MOTOR TYPES FOR OPERATION WITH POWERBOSS

### SINGLE PHASE MOTORS SPLIT PHASE TYPE

This is a single-phase motor built with two windings, a start winding and a run winding. A centrifugal switch fitted on the shaft of the motor disconnects the start winding when the motor reaches about 65% of its rated speed. Then the motor operates continuously with the run winding only connected.
The split-phase motor has moderate starting torque, which varies between 130 and 170% of the nominal running torque. This type of motor is usually fitted on types of applications that require few starts with a moderate starting torque requirement.

### SINGLE PHASE MOTORS SPLIT PHASE CAPACITOR START TYPE

This is a single phase motor built with two windings, a start winding with a capacitor of a suitable value connected in series and a run winding. A centrifugal switch fitted on the shaft of the motor disconnects the start winding when the motor reaches about 80% of its rated speed. Then the motor operates continuously with the run winding only connected.
The split-phase capacitor start motor has high starting torque, which varies between 200 and 300% of the nominal running torque. This type of motor is usually fitted on types of applications with a high starting torque requirement.

### SINGLE PHASE MOTORS SPLIT PHASE CAPACITOR RUN TYPE

Powerboss will provide little or no savings to motors fitted with a capacitor to the run winding, this is due to the high power factor of the motor.

# Powerboss PB Product Specifications

| Parameter | Description |
|---|---|
| Supply Voltage | 220 - 240V +10% / -15%<br>***110V +20% / -15%* US versions only*** |
| Supply Frequency | 50 Hz<br>***60 Hz* US versions only*** |
| Ambient Temperature | -10 - +40 Deg C<br>Reduce kW Rating 2% per Deg C up to 50 Deg C |
| Storage Temperature | -40 - +60 Deg C |
| Relative Humidity | <95% No condensation allowed |
| Altitude | Maximum 1000 m. Reduce kW Rating by 1% per additional 100 M |
| Starting Duty | Size 1 - 30 Starts per hour.<br>Size 2 - 30 Starts per hour. |
| Cooling | Naturally cooled |
| LED Indications Size 1 | None |
| LED Indications Size 2 | Mains, Power on, Status |
| Enclosure | IP20 |
| EU Directives | EN50082-2, EN55011, 73/23/EEC |

## POWERBOSS PB SELECTION GUIDE

| Chassis Size HxWxD mm | | Model | Weight kg | Rating Amps | Rating kW @ 220V | Rating HP @ 220V | Rating kW @ 110v | Rating HP @ 110v | Cooling |
|---|---|---|---|---|---|---|---|---|---|
| H130<br>W75<br>D55 | SIZE 1 | PB6 | 0.2 | 6 | 1.1 | 1.5 | 0.5 | 0.75 | Natural |
| | | PB8 | 0.2 | 8 | 1.5 | 2 | 0.75 | 1 | Natural |
| H215<br>W128<br>D48 | SIZE 2 | PB13 | 0.86 | 13 | 2.2 | 3 | 1.1 | 1.5 | Natural |
| | | PB20 | 0.9 | 20 | 3 | 4 | 1.5 | 2 | Natural |

# Installation

**IMPORTANT SAFETY NOTICE**

**SAFETY AT WORK**

**The owner, installer and user of this Powerboss unit are responsible for its correct installation and use, and must ensure that:**

**a) Only qualified persons install the unit;**

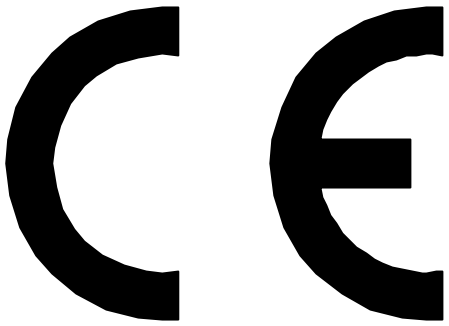
**b) No adjustments should be made with the unit live;**

**c) The installation complies with the information contained in this publication; and**

**d) The operation and maintenance of the unit complies with the relevant Codes of Practice, Regulations and Statutory Requirements.**

**Powerboss manufacturers, or their agents, do not assume any liability, expressed or implied, for any consequences resulting from inappropriate, negligent or incorrect installation, application, use or adjustment of the product or circuit design, or from the mismatch of the unit to a motor.**

**MANUFACTURERS DECLARATION OF CONFORMITY**



**This is to certify that the products described in this manual conform to the requirements of the following standards in respect of the low voltage directive, 73/23/EEC.**

**EN 60947-4-2** **AC Semiconductor motor controllers and starters.**

**This is to certify that the products described in this manual conform to the requirements of the following standards in respect of the European EMC directive, EN50082-2 CLASS A, EN55011 CLASS A.**

**SIGNED A. F. SMITH JANUARY 2000.**

## PRIOR TO INSTALLATION

1. Carefully remove the Powerboss from the packaging and check that the parts supplied identify with the delivery note and the purchase order. Check that the parts supplied identify with the kW size of the motor.

2. Check the **Voltage** and **Current** ratings of the Powerboss correspond with the motor name plate details.
3. Check that there are no loose parts or objects within the Powerboss unit.
4. Check sufficient space exists to correctly install the Powerboss.
5. Check you have sufficient tools to correctly install the Powerboss

## MECHANICAL INSTALLATION

Unless the Powerboss is fitted within a suitable enclosure the following should be avoided.

1. Exposure to explosive and/or corrosive atmospheres.

2. Atmospheres containing a high proportion of conductive dust.
3. Extremes of temperature and/or humidity beyond published limits.

Fix the Powerboss to a flat vertical surface using the mounting holes provided using adequately sized mounting bolts. Please see page 10 for details.

Care should be taken to ensure the orientation of the Powerboss is correct and a gap of 40mm is maintained above and below the Powerboss. This is to ensure a safe exit path for the heat generated by the Semiconductors within Powerboss.

## ELECTRICAL INSTALLATION

### LIGHTNING STRIKES / VERY HIGH VOLTAGE TRANSIENTS

In areas subject to frequent lightning strikes or other very high voltage transients, a suitably rated Metal Oxide Varistor (MOV) should connect each input line to earth.

### ELECTRO MAGNETIC INTERFERENCE

Where the supply voltage to the Powerboss is thought to be subject to EMI beyond the published limits a suitable line filter with transient voltage suppression should be fitted between the control supply and the Powerboss.

### COIL SUPPRESSION

It is good practice for any AC relay or contactor coil either connected to Powerboss or sharing a common supply to be fitted with a RC suppresser.

### ADDITIONAL EQUIPMENT

All necessary electrical connections for mains, earth and control wiring are provided for in the Powerboss unit. However the following additional components will need to be provided.

1. Isolator.
2. Cable protection fuses.
3. Motor overload.

**WARNING**

**POWERBOSS USES A TRIAC SWITCHING DEVICE IN ITS MAIN CIRCUIT AND IS NOT DESIGNED FOR ISOLATION. A SUITABLY RATED MECHANICAL ISOLATION METHOD MUST BE EMPLOYED IN LINE WITH THE MAIN INPUT TERMINALS TO THE POWERBOSS.**

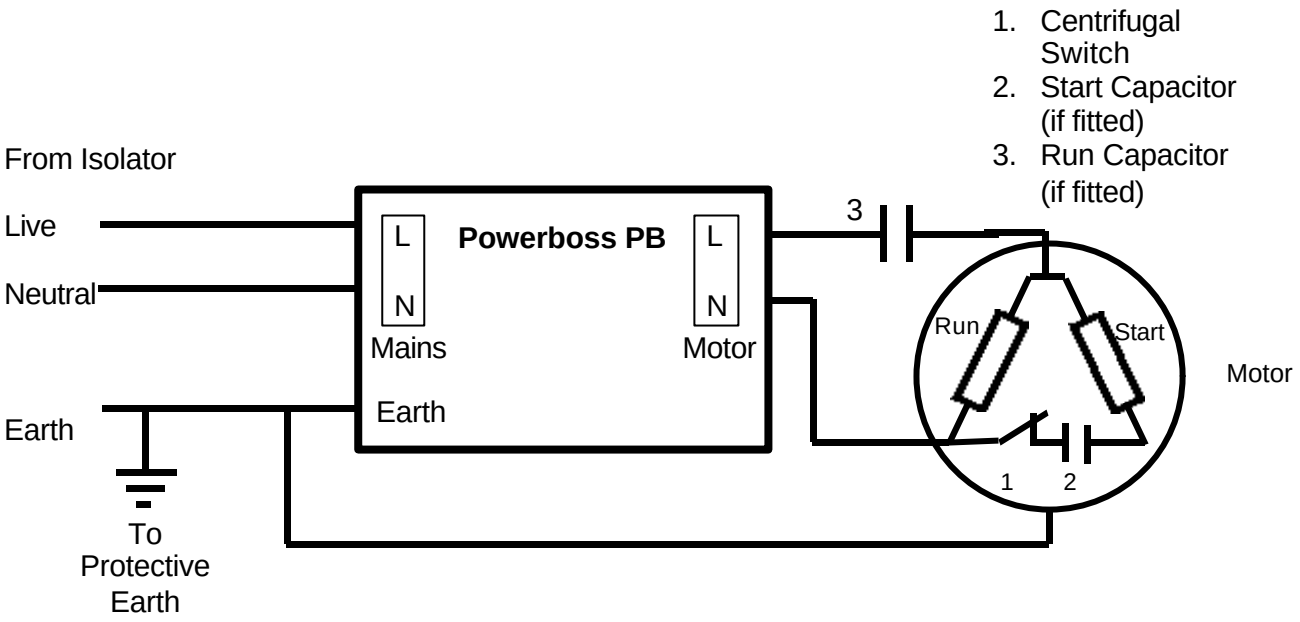
### EARTHING

**WARNING**

**POWERBOSS MUST BE EARTHED.**

**CONNECT THE EARTHING TERMINAL OF THE POWERBOSS UNIT TO A SUITABLE LOW IMPEDANCE EARTH AS IS REQUIRED BY STATUTORY REGULATIONS COVERING THE INSTALLATION OF ELECTRICAL EQUIPMENT.**

**POWERBOSS PB CONNECTION DRAWING**




Notes.

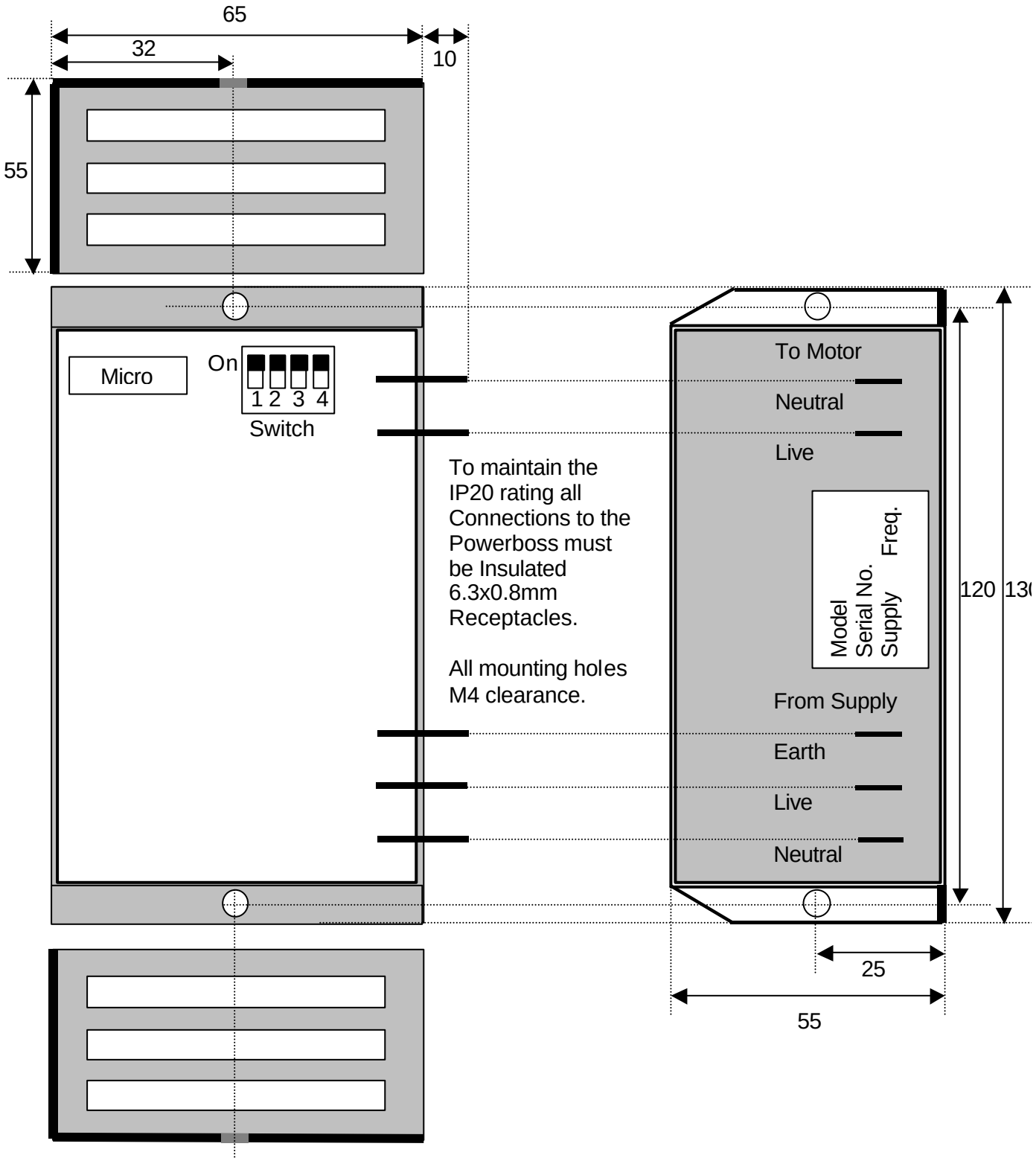
1. Powerboss will not operate to its full potential with capacitor run motors in the Automatic Mode. If Powerboss is to be fitted to capacitor run motors the Semi-Automatic Mode must be selected. Savings, if any, will be much smaller with capacitor run motors.

2. No load other than the target motor load should be connected to the output of Powerboss.

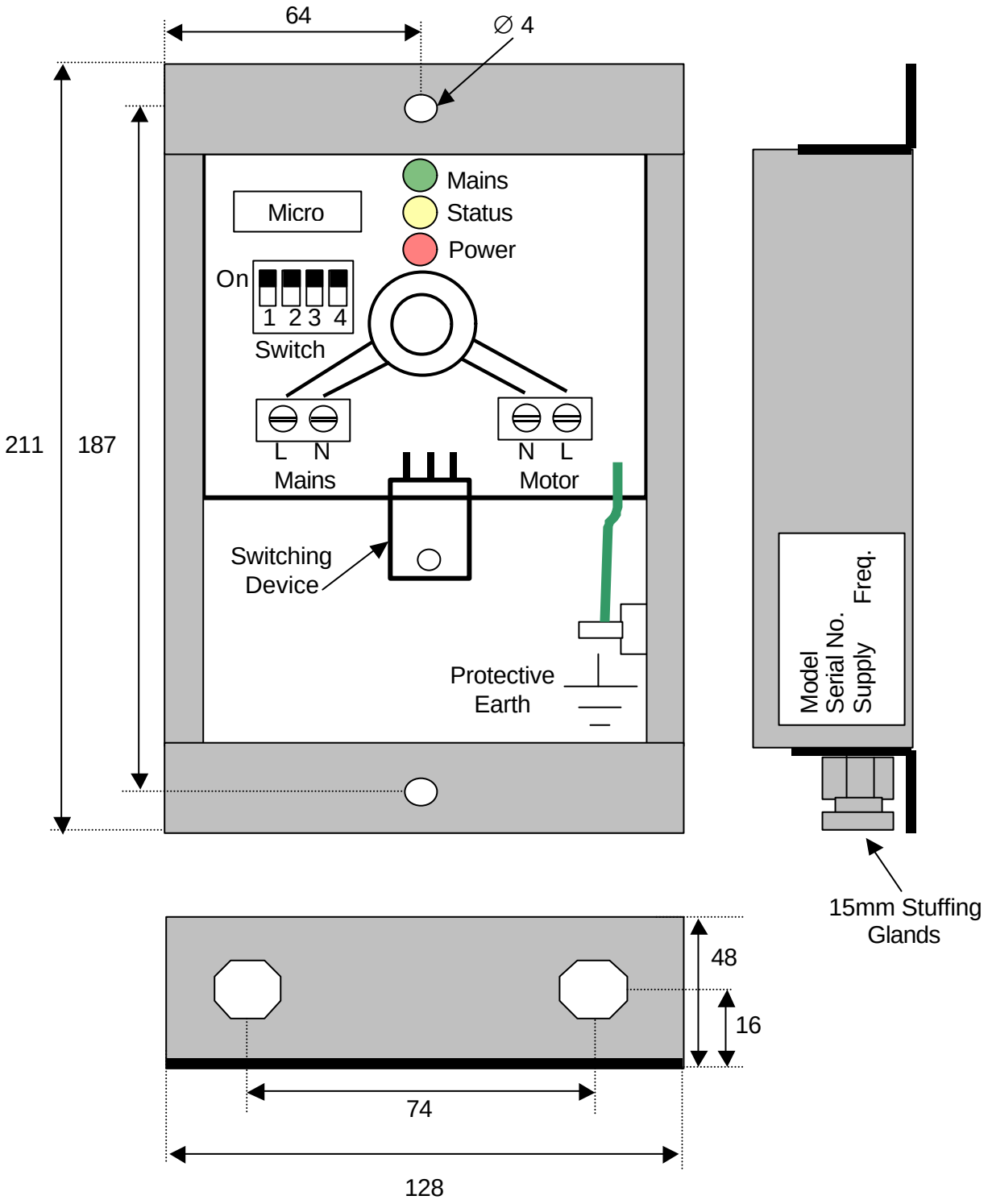
3. This diagram must be used in conjunction with the installation notes in this manual.

4. Powerboss will only control a single motor load.

# USER CONTROL SETTINGS AND DIMENSIONS SIZE 1



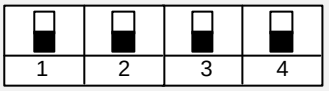
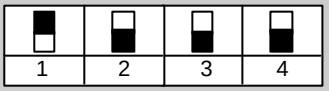
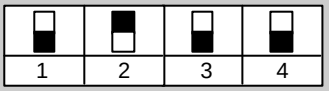
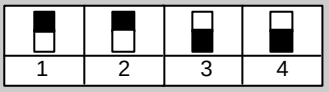
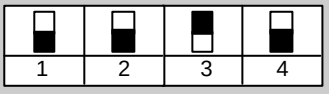
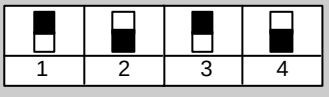
# USER CONTROL SETTINGS AND DIMENSIONS SIZE 2



**LED FUNCTIONS SIZE 2 ONLY**

| Function | Colour | Description |
|---|---|---|
| Mains | Green | Illuminates when Powerboss is connected to a mains supply |
| Status | Yellow | Illuminates when Powerboss is not connected to a motor<br>Illuminates during the learning cycle<br>Flashes when optimising<br>- Slow flashing = Partial optimisation<br>- Fast flashing = Full optimisation |
| Power | Red | Illuminates when internal power supply is healthy |

**SWITCH SETTINGS**

| Function | Switch Position | Resultant Value @220/127V Input (Approximate) |
|---|---|---|
| Automatic Learning Mode |  | Automatic |
| Backstop Voltage 1 |  | 206/119V |
| Backstop Voltage 2 |  | 202/116V |
| Backstop Voltage 3 |  | 193/111V |
| Backstop Voltage 4 |  | 179/103V |
| Backstop Voltage 5 |  | 170/98V |
| Backstop Voltage 6 |  | 156/900V |
| Backstop Voltage 7 |  | 142/82V |

# COMMISIONING

### PRE-COMMISSIONING CHECKS

1. Ensure that the unit supplied is of the correct voltage and frequency rating.
2. Ensure that the motor current does not exceed the Powerboss rating.
3. Check that the Powerboss is connected as per the preceding connection diagrams.
4. Ensure that no other load other than the target motor is connected to the output terminals of Powerboss.

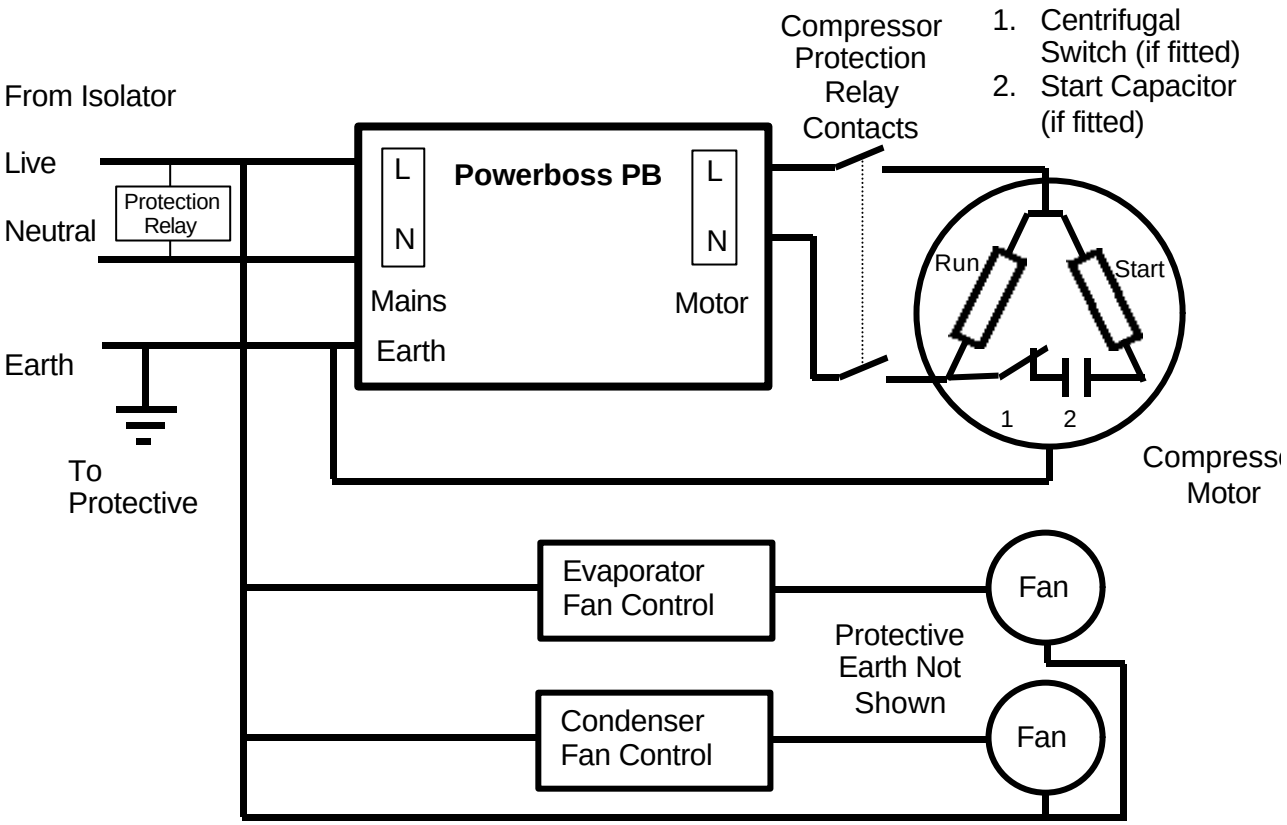
### COMMISSIONING IN AUTOMATIC MODE

1. Ensure that all the pre-commissioning checks have been followed.
2. Set switch1 to the automatic mode and replace cover.
3. Switch on.
4. Once the motor has started it should be allowed to run for a period of two minutes. This allows the motor to come to normal load conditions before testing the results.
5. During the initial 10 second period Powerboss will give full power to the motor.
6. After the initial 10 seconds the on board microcontroller will enter its learning cycle, during this time Powerboss will learn the minimum amount of power required to allow the motor to attain full speed.
7. At the end of the learning cycle Powerboss will then go into control mode and progressively reduce the motor current until it has reached the optimum level.
8. Powerboss will only perform a learning cycle if the electricity supply to the unit has been removed since its last learning cycle.
9. On the correct type of motor Powerboss will usually produce savings of around 20%, if the equipment fails to produce this margin of savings then refer to the next section of this manual for operation in semi-automatic mode.

### COMMISSIONING IN SEMI-AUTOMATIC MODE

1. Ensure that all the pre-commissioning checks have been followed.
2. Set switch1 to backstop voltage 1 and replace cover.
3. Switch on.
4. Powerboss will repeat its learning cycle as in the automatic mode but the voltage will not drop further than the set limit. Leave the motor running for a few minutes to ensure stability.
5. Repeat the above process until the motor operates on the minimum possible current without slowing down.
6. Set Powerboss on the next highest backstop setting to allow for a reduction in the supply voltage.
7. Ensure all covers are replaced and Powerboss is fitted in a suitable position.

**POWERBOSS PB REFRIGERATION COMPRESSOR CONNECTION DRAWING**




Notes.

1. No load other than the target motor load should be connected to the output of Powerboss.

2. This diagram must be used in conjunction with the installation notes in this manual.

3. Powerboss will only control a single motor load.

## NOTES ON INSTALLING POWERBOSS ON REFRIGERATION COMPRESSORS

1. Before carrying out any installation a complete inspection of all equipment to which Powerboss is to be fitted must be made. During this process establish the most suitable position to which Powerboss is to be fitted. It is most desirable to fit Powerboss directly in the line feeding the compressor motor, so during this initial inspection establish the best place to fit. If during the inspection any defects are found they should be pointed out to the customer. This will prevent any possible misunderstanding arising between you and the customer.

2. When switching off refrigeration equipment a period of one to three minutes should be given before switching back on. This will allow the pressures to drop and the thermal switch in the motor to cool down. If this delay is not given it is likely that the compressor will go into a locked rotor condition. Whilst this will not damage the equipment you will have to wait for a much longer period before the compressor will try to restart.

3. It has been found that some compressors fitted with voltage operated protection relays (referred usually to Potential Relays), de-energise when the voltage supplied to the compressor falls below say 180 volts. If this is found to be the case and the relay coil cannot be re-connected to the input Powerboss must be put into SEMI AUTOMATAIC mode and the output voltage be limited to a minimum of 200 volts. If this is not done damage to the compressor may occur