
S O M A **R**

Three Phase Intelligent Motor Controllers

Powerboss[®] *Integra*

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”



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INTRODUCTION

THE PROBLEMS WITH INDUCTION MOTORS

Since its invention one hundred years ago, the standard 3-phase induction motor has become one of the most familiar items of industrial equipment ever known. Due to its simplicity of construction, low cost, reliability and relatively high efficiency, it is likely to remain the prime source of mechanical energy for the foreseeable future.

The main problems are the motor's inability to match motor torque to load torque both during starting and running and the high starting current. During starting the motor usually produces 150 - 200% torque (see Figure 1) accelerating the load to full speed in a fraction of a second, which can cause damage to the drive train. At the same time the motor can commonly draw 8 times nominal current (I_n) causing supply stability problems (see Figure 2).

When the motor is operating at light load for extended periods the motor's efficiency falls due to the over-fluxing of the windings for the particular torque required to drive the load. At a constant terminal voltage this flux, often referred to as magnetising current, is fixed and accounts for around 30-50% of the motors total losses.

Figure 1

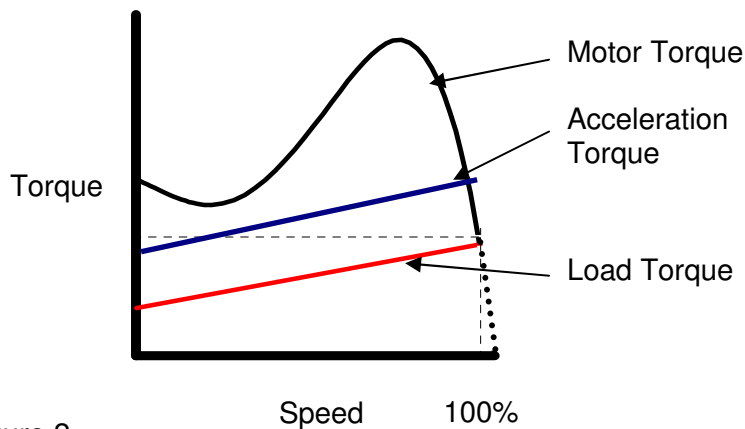
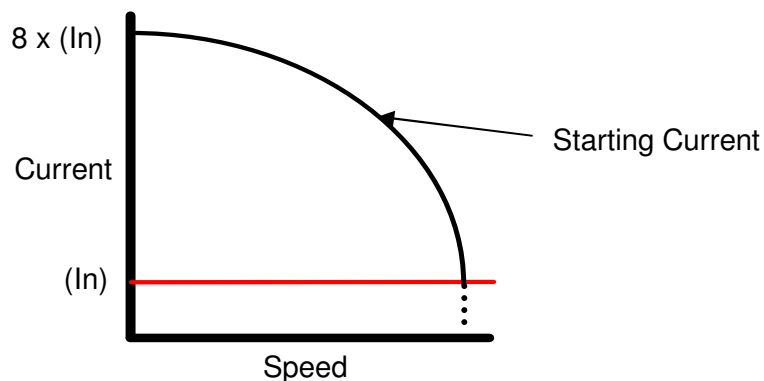


Figure 2



STARTING INDUCTION MOTORS - THE POWERBOSS SOLUTION

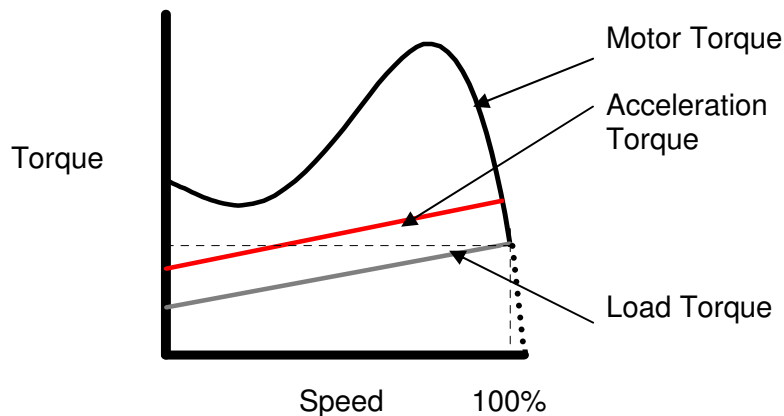
In common with all soft start devices Powerboss uses thyristor's to accurately control the voltage applied at the motor terminals.

A characteristic of the thyristor to switch rapidly from "OFF" to "ON" when pulsed, and to remain "ON" until the current through the device falls to zero at the end of each half-cycle in the AC supply, is called self commutation.

By controlling the switch-on point relative to the voltage zero crossing in each half cycle of the supply, it is possible to regulate the current flowing through the thyristor. The closer the turn-on point is to the end of the cycle the smaller the value of current that will be allowed to flow. Conversely, the closer the turn-on point is to the beginning of the cycle the higher the value of current will be. Using this principle and by connecting two thyristor's in anti-parallel to each of the phase connections to a motor Powerboss can continuously adjust the voltage to the motor terminals by precisely controlling the thyristor's turn-on points. This provides just sufficient voltage for the motor to accelerate the load. See Figure 3.

So, for instance, by starting with a large delay to the turn on point in each half cycle, and progressively reducing it over a selected time period, the voltage applied to the motor starts from a relatively low value and increases to full voltage. Due to the motor torque being proportional to the square of the applied voltage, the starting torque increases in a stepless manner ensuring a soft start for both the motor and the driven load.

Figure 3



MOTOR EFFICIENCY – THE POWERBOSS SOLUTION

When working at or near full load, the typical 3-phase induction motor is relatively efficient, achieving efficiencies of between 80% to 92%. However, as shown in Figure 4 below, motor efficiency falls dramatically when the load falls to less than 50% of rated output. In fact, very few motors actually experience consistent fully rated operation, the vast majority operate at much lower loads due to either over-sizing (a very frequent situation), or natural load variations.

In applications where motor speeds do not need to be varied, the optimisation software in the Powerboss will produce energy savings in lightly loaded motors.

Less sophisticated soft-starters remain at full conduction and the motor then behaves as if it were connected directly to the mains supply. However, at light loads at full mains voltages, induction motors always have excess magnetising current (see Figure 5). By detecting the load at any instant, and adjusting the motor terminal voltage accordingly, Powerboss is able to save some of the excitation energy and load loss, and improve motor Power Factor when the motor is running inefficiently at light loads.

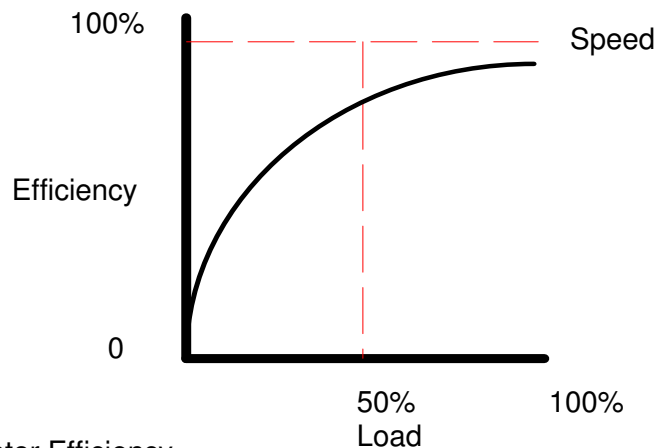


Figure 4.
Induction Motor Efficiency

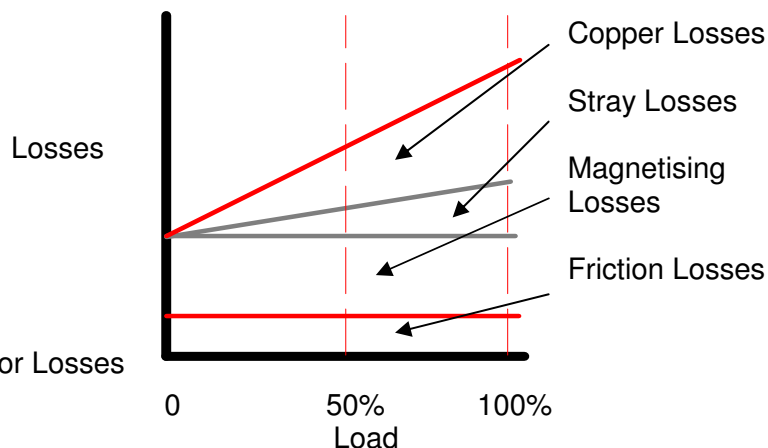


Figure 5.
Induction Motor Losses

POWERBOSS INTEGRA PRODUCT SPECIFICATIONS

Parameter	Description
Supply Voltage	220 – 480V +6% / -15%
Supply Frequency	47/63 Hz
Ambient Temperature	-10 - +40C, Reduce kW Rating 2% per Deg C up to 50 C
Storage Temperature	-40 - +60 C
Relative Humidity	<95% No condensation allowed
Application Sets	7 Application sets are provided as standard
Altitude	Maximum 1000 m. Reduce kW Rating by 1% per additional 100 M
Starting Duty	2.5 X unit rating in amperes for 60 Sec, 3 X unit rating in amperes for 30 Sec, 4 X unit rating in amperes for 10 Sec, 5.5 X unit rating in amperes for 5 Sec.
Starts per Hour	12 evenly spaced starts per hour at the 'Starting Duty' ratings
Pedestal Voltage	25 – 80% of supply voltage 1% increments *
Starting Current Limit	25 – 80% of the DOL starting current in 1% increments *
Starting Current Time	0 – 255 in 1 Sec increments *
Starting Torque	6 – 64% of the DOL starting torque in 1% increments *
Kick Start Level	9 – 100% of the DOL starting torque in 1% increments *
Kick Start Time	0.1– 25 Sec in 0.1 Sec increments *
Ramp Up Time	0.5 – 255 Sec in 1 Sec increments *
Ramp Down Time	0.5 – 120 Sec in 1 Sec increments *
Step Down Voltage	100 - 30% Line voltage in 1% increments *
Fault Detection	Shut down for loss of phase and short-circuit Thyristor
Cooling	Naturally cooled <42 amps, force cooled >53 amps
LED Indications	Power on, Run, Ramp up, Ramp down, Fault and Optimising/Top of ramp
Relays	Run and Fault. Contact Rating 1.2kVA, 250V AC Max
Fan Voltage	110 or 220V as specified
Enclosure	IP20 / Nema 1
Safety Standards	UL508C, CSA, EEC EN50082-2, EN55011, 73/23/EEC

* SEPARATE PROGRAMMER REQUIRED TO ACCESS PARAMETERS OTHERWISE ONLY STANDARD APPLICATION SETS ARE AVAILABLE. SEE PAGES 33-36.

POWERBOSS INTEGRA SELECTION GUIDE

Chassis Size HxWxD mm		Model	Weight kg	Motor Rating Amps	Motor kW @ 220V	Motor kW @ 380/480V	Protection	Cooling
H 270 W 130 D 115	SIZE 1	PBI 2.2	3.5	4	1.1	2.2	IP20	Natural
		PBI 4	3.5	9	2.2	4	IP20	Natural
		PBI 5.5	3.5	11	3	5.5	IP20	Natural
		PBI 7.5	4	15	4	7.5	IP20	Natural
		PBI 11	4	23	5.5	11	IP20	Natural
		PBI 15	4	30	7.5	15	IP20	Natural
		PBI 22	4	42	11	22	IP20	Natural
H 385 W 130 D 215	SIZE 2	PBI 30	9.9	53	15	30	IP20	Forced
		PBI 37	9.9	65	22	37	IP20	Forced
		PBI 55	9.9	97	30	55	IP20	Forced

LOAD AND DUTY CYCLE TABLE

Application	Load Type	Inertia	Starts / Hour	Start Type
Centrifugal Pump	Low	Low	12 or Less 8 or Less	Standard Heavy
Positive Displacement Pump	Medium	Low	12 or Less 6 or Less	Standard Heavy
Submersible Pump	Medium	Low	8 or Less 6 or Less	Standard Heavy
Reciprocating Compressor	Medium	Medium	10 or Less 6 or Less	Standard Heavy
Screw Compressor	Medium	Medium/High	6 or Less 4 or Less	Standard Heavy
Axial Fan - No Load Start	Low	High	4 or Less 2 or Less	Standard Heavy
Axial Fan - Full Load Start	Medium	High	3 or Less 1 or Less	Heavy Very Heavy
Blower	Low	Low	4 or Less 2 or Less	Standard Heavy
Centrifuge	Low	Very High	1	Very Heavy
Conveyor Off Load Start	Low	High	10 or Less 6 or Less	Standard Heavy
Conveyor On Load Start	High	High	6 or Less 4 or Less	Heavy Very Heavy
Steel Press	Low	High	6 or Less 4 or Less	Standard Heavy
Escalator	Low	High	6 or Less 4 or Less	Standard Heavy
Plastic Extruder Off Load Start	Low	Low	10 or Less 6 or Less	Standard Heavy
Grinders	Low	High	4 or Less 2 or Less	Standard Heavy
Circular Saw	Low	Low	10 or Less 6 or Less	Standard Heavy

POWERBOSS INTEGRA STARTING DUTY TABLE

Model	Motor Current Rating Start Type Standard	Motor Current Rating Start Type Heavy	Motor Current Rating Start Type Very Heavy
PBI 2.2	4	3	2.5
PBI 4	9	6	4
PBI 5.5	11	8	6
PBI 7.5	15	10	7.5
PBI 11	23	15	10
PBI 15	30	19	15
PBI 22	42	28	20
PBI 30	53	38	28
PBI 37	65	47	35
PBI 55	97	68	50

SIZING POWERBOSS INTEGRA FOR A PARTICULAR DUTY

Determine the load type from the Load and Duty Cycle Table paying particular attention to the starts per hour rating on page 9, and then select a unit according to the **Motor Current** from the above Table.

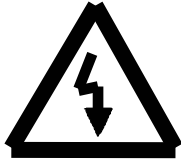
Example; Load Type - Reciprocating Compressor, 9 starts per hour
 Start Type = Heavy
 Motor Current = 15

Unit required is a PBI11.

If a particular application is not listed on page 9 refer to the Starting Duty and Starts per Hour listed in the **POWERBOSS INTEGRA PRODUCT SPECIFICATIONS** on page 7.

INSTALLATION

IMPORTANT SAFETY NOTICE



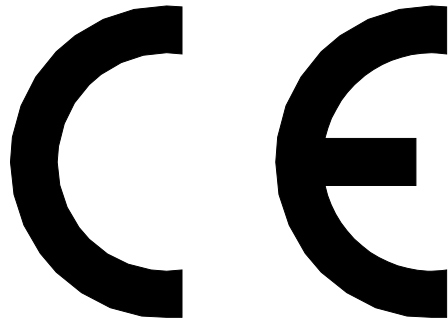
SAFETY AT WORK

The owner, installer and user of this Powerboss Integra 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.
- 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

AUGUST 2000.

PRIOR TO INSTALLATION

1. Carefully remove the unit 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 unit correspond with the motor name plate details.
3. Check the **Voltage** rating of the cooling fans if fitted.
4. Check that there are no loose parts or objects within the unit.
5. Check sufficient space exists to correctly install the unit.
6. Check you have sufficient tools to correctly install the unit.

MECHANICAL INSTALLATION

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

1. Exposure to rain, spray or wet areas.
2. Exposure to explosive and/or corrosive atmospheres.
3. Atmospheres containing a high proportion of conductive dust.
4. Extremes of temperature and/or humidity beyond published limits.

WALL MOUNTING

Fix the unit to a flat vertical surface using the mounting holes provided using adequately sized mounting bolts. Please see page 41 for details.

Care should be taken to ensure the orientation of the unit is correct and a gap of 80mm (100mm for PBI 30 and above) is maintained above and below the Powerboss. This is to ensure a safe exit path for the heat generated by the semiconductors within the unit.

MOUNTING POWERBOSS INTEGRA WITHIN AN ENCLOSURE

If the unit has been purchased purely for the soft start features and optimisation is not required, the unit can be bypassed using a contactor driven by the Top of Ramp relay provided within the unit, negating any need to consider any cooling requirements.

The software programmer is required to access this feature.

COOLING POWERBOSS INTEGRA WITHIN AN ENCLOSURE TO IP54

If the optimisation feature is required the installer must ensure that the temperature within the enclosure (T_{enc}) is kept below the maximum permitted for Powerboss, which is normally 40 C, (see page 7). Care should be taken to include any other heat producing equipment within the enclosure into the calculation.

The following formula should be used to calculate the minimum airflow through the enclosure.

$$AF = \frac{W}{T_{enc} - T_{amb}}$$

AF = Required airflow in cubic metres per hour

W = Power dissipation within the enclosure

T_{enc} = Maximum enclosure ambient temperature

T_{amb} = Temperature of external air (Deg C)

The power dissipation figure for the individual Powerboss models can be taken from the table on page 16.

Perform the minimum airflow calculation using the power dissipation information provided in the Powerboss Integra Heat Dissipation Table, the resultant figure should then be used to select a cooling fan from the Fan Selection Table on page 16.

Example;

Powerboss PBI 22

$$AF = \frac{150}{40 - 30} = 15 \text{ M}_3/\text{Hr}$$

Airflow requirement is 15 M₃/Hr

Fan required is a Papst (or any other manufacturer) 8556N which has a rating of 57 M₃/Hr.

MINIMUM ENCLOSURE SIZE FOR OPERATION IN AN IP55 ENCLOSURE

To preserve the full rating of Powerboss the internal enclosure temperature must be maintained at 40 C or below. The thermal resistance (Rth) of the enclosure must therefore be low enough to naturally disperse the heat generated by Powerboss through the walls of the enclosure.

The minimum enclosure size can be calculated as follows:

$$R_{th} = \frac{E-X}{P}$$

Where:

E = Enclosure maximum ambient temperature
X = External ambient temperature
P = Total power dissipation (Watts) +any other equipment within the enclosure.

$$A = \frac{K}{R_{th}}$$

Where:

A = Effective surface area
K = Constant of thermal resistance per square meter.
(A constant of 0.12 Deg C per Watt is common for most metal enclosures, contact the manufacturer for a more precise figure.)

The thermal resistance of the enclosure is dependant on the total surface area adjacent to free air. Therefore the back of a wall mounting enclosure cannot be taken into consideration.

Example:

Powerboss PBI 22 controller

Total power dissipated within the enclosure = 150 Watts (excluding any other equipment). See page 16.

External ambient temperature = 25 C

$$R_{th} = \frac{40-25}{150} = 0.1 \text{ Deg C per Watt}$$

Proposed enclosure dimensions = 800 x 600 x 275mm

$$A = (0.8 \times 0.6) + (0.6 \times 0.275 \times 2) + (0.8 \times 0.275 \times 2) = 1.25 \text{ Sq M}$$

$$\text{Minimum value for } A = \frac{K}{R_{th}} = \frac{0.12}{0.1} = 1.2 \text{ Sq M}$$

The effective area of the proposed enclosure is greater than the minimum required for this application therefore can be used.

POWERBOSS INTEGRA HEAT DISSIPATION TABLE

Model	Power Dissipation in Watts
PBI 2.2	15
PBI 4	32
PBI 5.5	40
PBI 7.5	54
PBI 11	82
PBI 15	108
PBI 22	150
PBI 30	190
PBI 37	235
PBI 55	350

FAN SELECTION TABLE

PAPST Model No.		Air Flow With Filter 50Hz			Air Flow With Filter 60Hz		
Fan Model 110V	Fan Model 220V	L/sec	CFM	M³Hr	L/sec	CFM	M³Hr
8506N	8556N	13	24	57	15	28	67
4600N	4650N	40	82	159	47	96	186

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. The Varistors **should not be mounted** within the Powerboss enclosure.

CONTROL VOLTAGE TRANSIENTS

Where the supply voltage to the Powerboss is thought to be subject to EMI a suitable line filter with transient voltage suppression should be fitted on the control supply.

COIL SUPPRESSION

It is good practice for any AC relay or contactor coil either connected to Powerboss or sharing a common control supply to be fitted with a RC suppresser. DC coils should be fitted with a suitable flywheel diode.

INPUT / OUTPUT CONTROL CONNECTIONS

To avoid 'pick up' it is good practice to keep all control connections as short as possible and to run them separately from the main motor cables. If this cannot be guaranteed an interposing relay fitted with suitable suppression must be used, mounted as close to the Powerboss as possible.

HARMONICS

Because motor starting currents are measured in multiples of full-load current, the harmonic effect of Powerboss is at its greatest during the starting phase. However, provided the Ramp Time is not excessive the effects can be ignored.

When a longer Ramp Time is necessary due to high inertia loads, most regulatory authorities will accept the use of Soft Starting provided the starts per hour are not excessive. With this concession almost all Powerboss installations **will not need any special considerations**.

Powerboss will introduce odd harmonics (5th and higher) while the Optimising function is active during normal running at periods of light load. Harmonic currents are related to the line current, which is significantly less during optimisation than the motor full load or part load current.

The effects, which are measured at the point of common coupling (PCC) **will be minimal** except in unusual circumstances.

Harmonic test data for optimisers is available if local regulations need to be satisfied.

POINT OF COMMON COUPLING

The point of common coupling (PCC) is the point at which a consumer is connected to other consumers on the Public Electricity Supply, generally consumers with less than a 300 kVA total load (720 amps@415V) will be connected to a transformer shared with other consumers.

Consumers with higher power demands will normally be connected to the medium voltage network by a dedicated transformer, in which case this medium voltage level will be their PCC.

The levels of harmonic current and voltage at intermediate points in a consumer's own network, are solely at the discretion of the consumer.

Example - If a factory is fed by a dedicated distribution transformer with a nominal ratio of 11kV/415V and no other consumers are fed by the 415V system, then the PCC is at 11kV.

INDIVIDUAL MOTOR POWER FACTOR CORRECTION CAPACITORS

Power factor correction capacitors, if fitted to the motor, should be connected to the live side of K1 (see mains connection drawings) and switched in or out before starting Powerboss.

Never connect Power Factor Correction Capacitors to the output terminals of the Powerboss.

THERMAL PROTECTION SWITCH

The thermal protection switch (if fitted) is the automatic reset type and should be wired into the control circuit in such a way as not to allow an automatic re-start in the event of a trip.

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 in a new installation.

1. Isolator.
2. Motor rated cable protection fuses.
3. AC3 rated contactor.
4. Motor overload.

WARNING

POWERBOSS INTEGRA USES THYRISTOR SWITCHING DEVICES 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 UNIT.

EARTHING

WARNING

THIS EQUIPMENT MUST BE EARTHED.

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

FUSE PROTECTION

The mains supply, and the control supply each require fuse protection. The installer should always fuse the mains supply with **motor rated fuses** before the input to the unit.

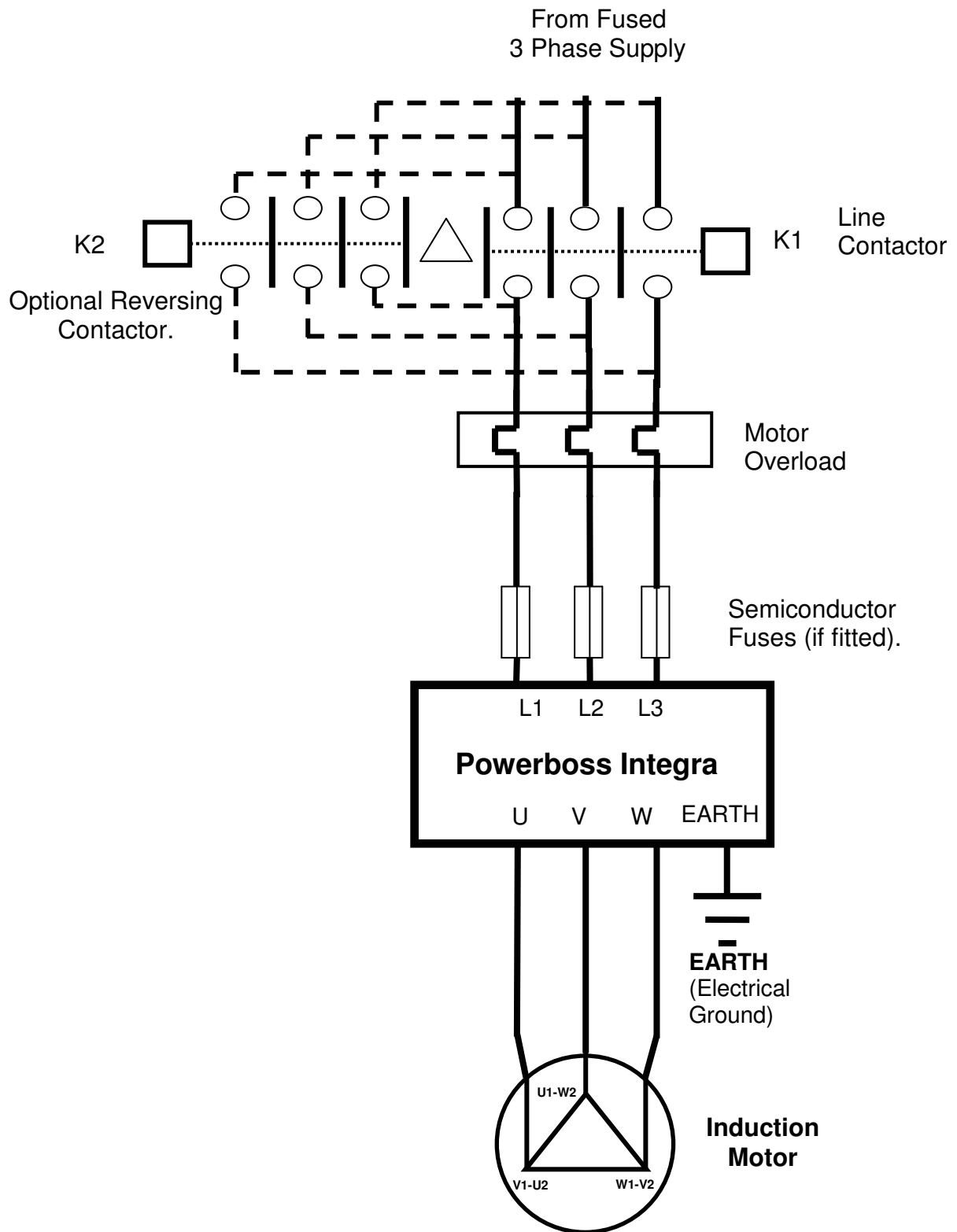
Some retrofit installations may only be fitted with standard fuses, it is advisable to replace these fuses with the motor rated type to avoid spurious failures.

Semiconductor fuses are available as an optional extra and must be mounted external to the unit.

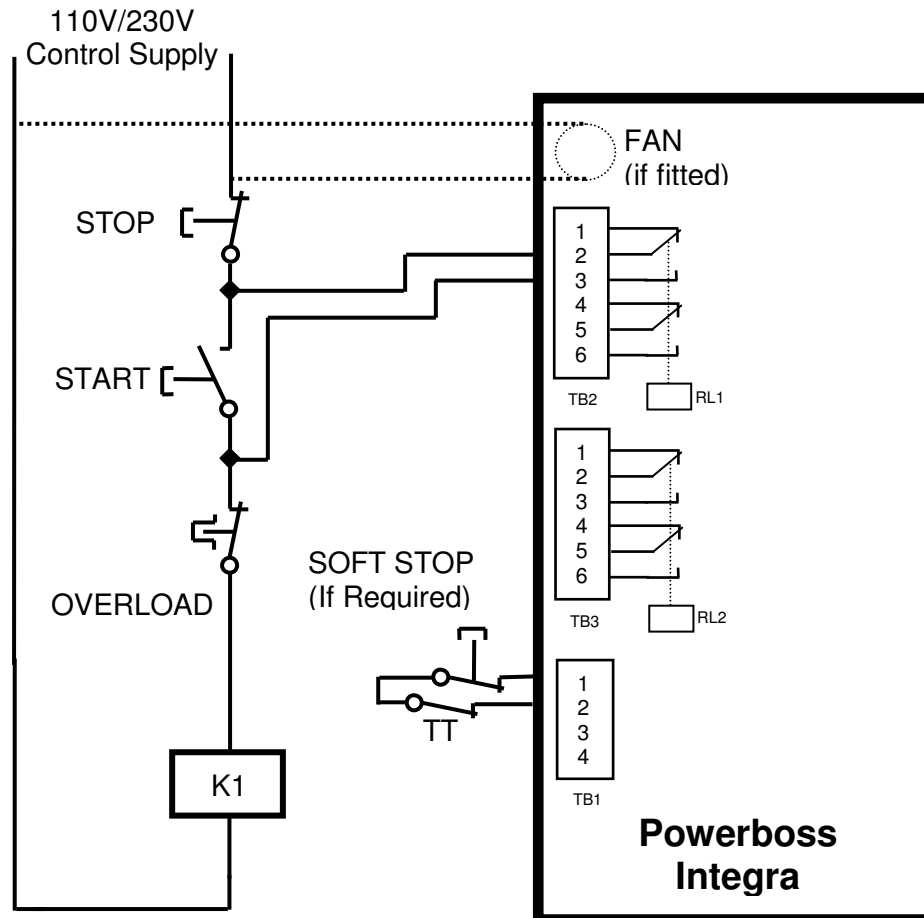
WARNING

SEMICONDUCTOR FUSES SHOULD NOT BE USED IN PLACE OF CABLE PROTECTION FUSES.

POWERBOSS INTEGRA MAINS CONNECTION DRAWING



STANDARD CONTROL CIRCUIT REQUIREMENTS



Note.

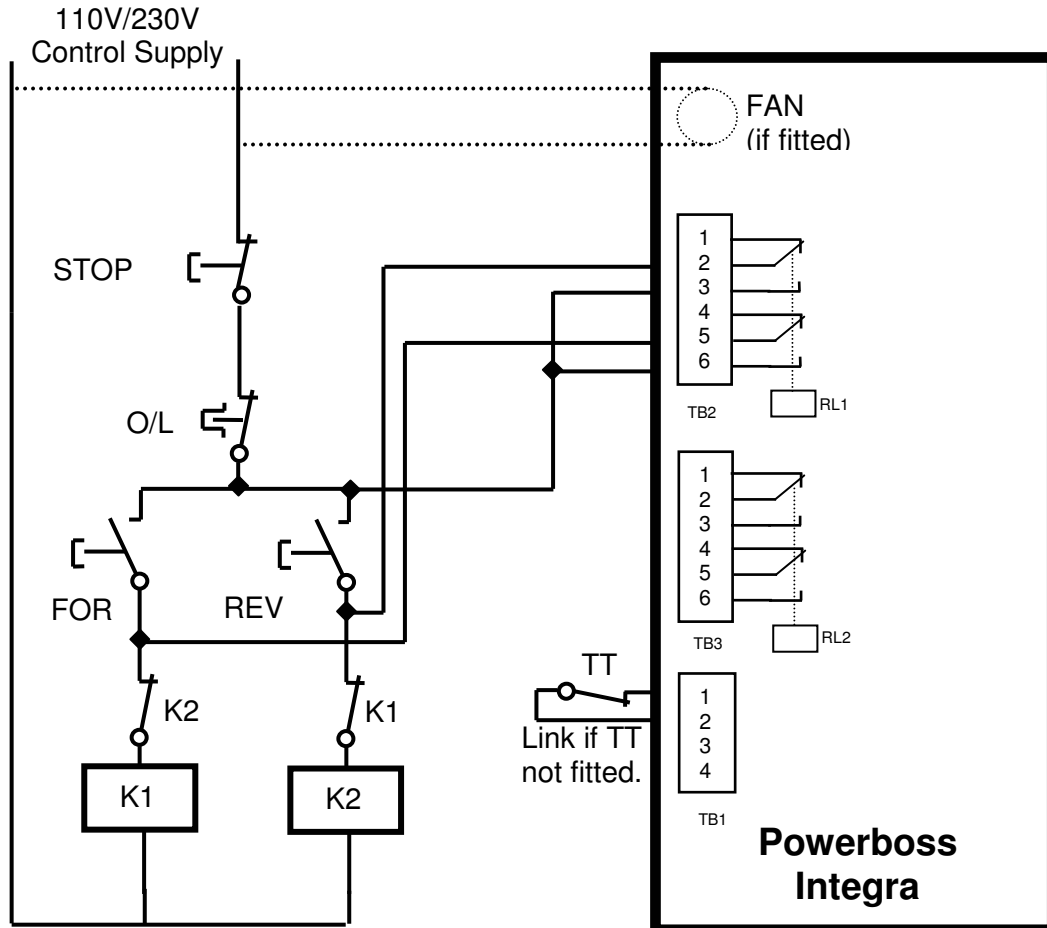
Relay RL1 closes when Powerboss is asked to start and maintains the line contactor K1 after the start button is released. In the event of a fault Relay RL1 will de-energise and drop out the line contactor.

WARNING

THE THERMAL PROTECTION SWITCH, TT (IF FITTED) IS THE AUTOMATIC RESET TYPE. IF IT IS USED ELSEWHERE IN THE CIRCUIT IT SHOULD BE WIRED TO PREVENT THE UNIT FROM AUTOMATICALLY RE-STARTING IN THE EVENT OF AN OVER TEMPERATURE TRIP.

TERMINALS 1 & 2 SHOULD BE LINKED IF TT NOT FITTED.

CONTROL CIRCUIT REQUIREMENTS FOR REVERSING



Note.

Relay RL1 closes when Powerboss is asked to start and maintains the direction contactor K1 or K2 after the forward or reverse is released. In the event of a fault Relay RL1 will de-energise and drop out the direction contactor.

WARNING

THE THERMAL PROTECTION SWITCH, TT (IF FITTED) IS THE AUTOMATIC RESET TYPE. IF IT IS USED ELSEWHERE IN THE CIRCUIT IT SHOULD BE WIRED TO PREVENT THE UNIT FROM AUTOMATICALLY RE-STARTING IN THE EVENT OF AN OVER TEMPERATURE TRIP.

TERMINALS 1 & 2 SHOULD BE LINKED IF TT NOT FITTED.

STAR DELTA INSTALLATION - DESCRIPTION OF OPERATION

MAINS CIRCUIT

The Powerboss should be connected as shown in the installation manual and operates as follows.

When the motor is started using the existing start/stop circuit, the star contactor K2 and the line contactor K1 are energised, at this stage no current should flow through the motor. The star timer must be reduced to its minimum setting.

After the star timer operation is completed the star contactor K2 will de-energise and the delta contactor K3 will energise, the motor will then start according to the Powerboss settings.

CONTROL CIRCUIT

There is no control circuit connections other than the start circuit connection to terminal block TB1.

INSTALLING ON A COMPRESSOR

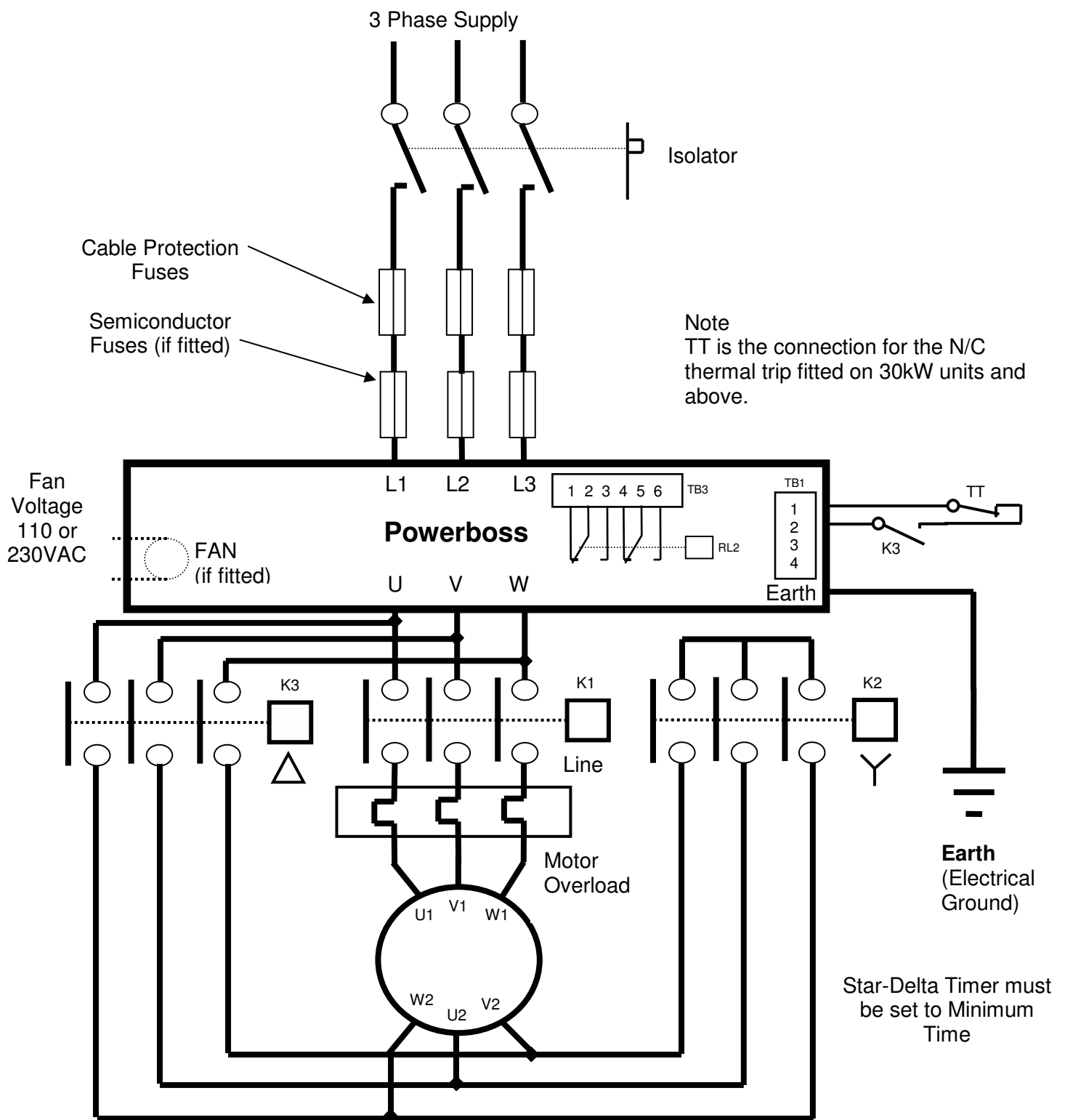
Some Compressor control circuits require that the Compressor rotate within a certain time frame dictated by the control software within the Compressor. More often than not, the lack of rotation before the delta contactor is energised will cause the Compressor safety circuit to trip due to lack of oil pressure.

If this is the case you need to configure the motor to start in delta, to do this follow the instructions below.

1. Remove the output from the 'Compressor Controller' to the star contactor coil.
2. Connect the output from the 'Compressor Controller' to the delta contactor coil and the line contactor coil together, this will ensure the Compressor begins to rotate as soon as the Powerboss is started.

The control connections to the Powerboss should not be changed.

INSTALLING POWERBOSS WITH AN EXISTING STAR DELTA STARTER



INSTALLING POWERBOSS ON TWO SPEED TWO WINDING MOTORS

GENERAL

The principle of the two speed induction motor and its torque/speed characteristics are the same as the standard squirrel cage motor except that the stator is fitted with two electrically separate windings. As the windings are electrically separate any speed combinations are possible, commonly the motors are 2 pole (2850rpm) and 4 pole (1450rpm).

Other two speed motors have tap (or Dhalander) wound single winding stators, to change the speed the windings are re-configured by contactor control gear similar to two winding motors. The number of two, even three or four speed connections are too numerous and it would be laborious to list them all.

MAIN CONNECTIONS

Powerboss must be connected after the switch fuse and motor overload but before the stator control gear. Some motors may be fitted with an overload for both windings, in this case the overloads will be fitted after the individual contactors.

In most cases the stator control gear will be mechanically as well as electrically interlocked.

CONTROL CONNECTIONS

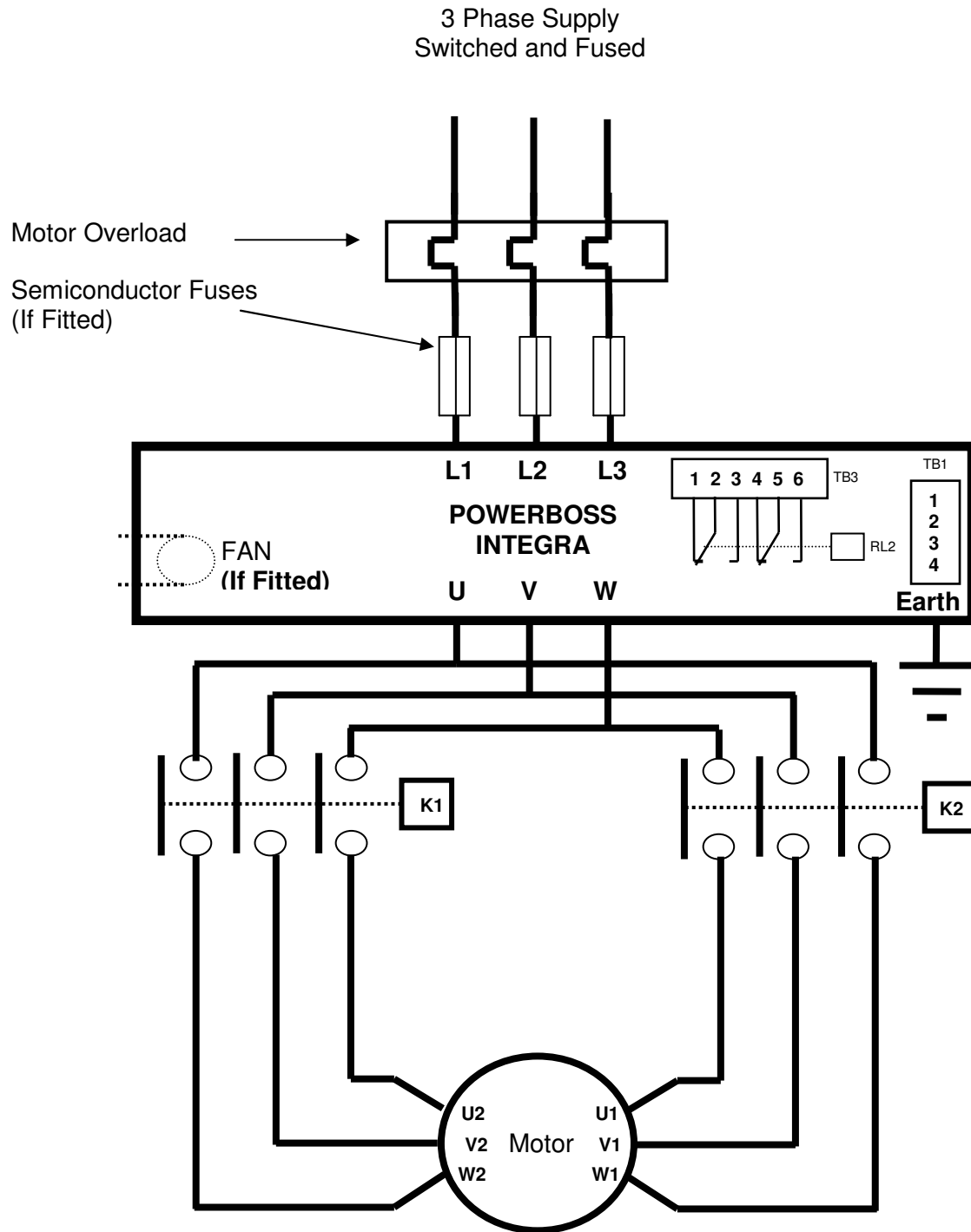
To select the **Slow Speed Winding**, close the Slow speed start contact, contactor K1 will energise and close the start circuit on TB1. Provided there is no fault with either the incoming supply or Powerboss, Relay RL2 will remain energised and maintain contactor K1 via terminal block TB3.

Powerboss will then start the motor in the normal manner.

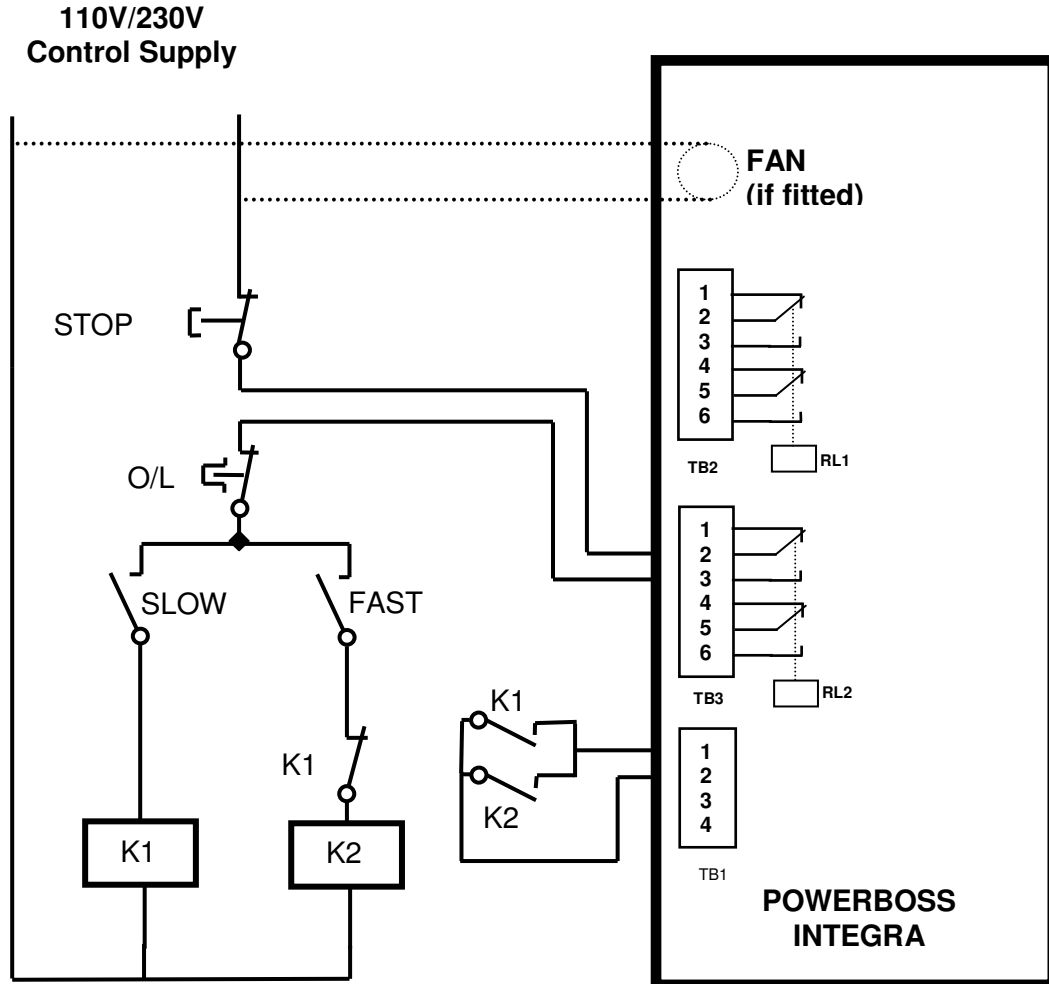
To select the **Fast Speed Winding**, close the Fast speed start contact, contactor K2 will energise and close the start circuit on TB1. Provided there is no fault with either the incoming supply or Powerboss, Relay RL2 will remain energised and maintain contactor K2, via terminal block TB3.

Powerboss will then start the motor in the normal manner.

MAINS CONNECTIONS FOR TWO SPEED TWO WINDING MOTOR



CONTROL CONNECTIONS FOR TWO SPEED TWO WINDING MOTOR



Note.

Relay RL2 is configured as a fault relay as standard. RL2 closes when power is applied and opens in the event of a fault de-energising the slow or fast speed contactors.

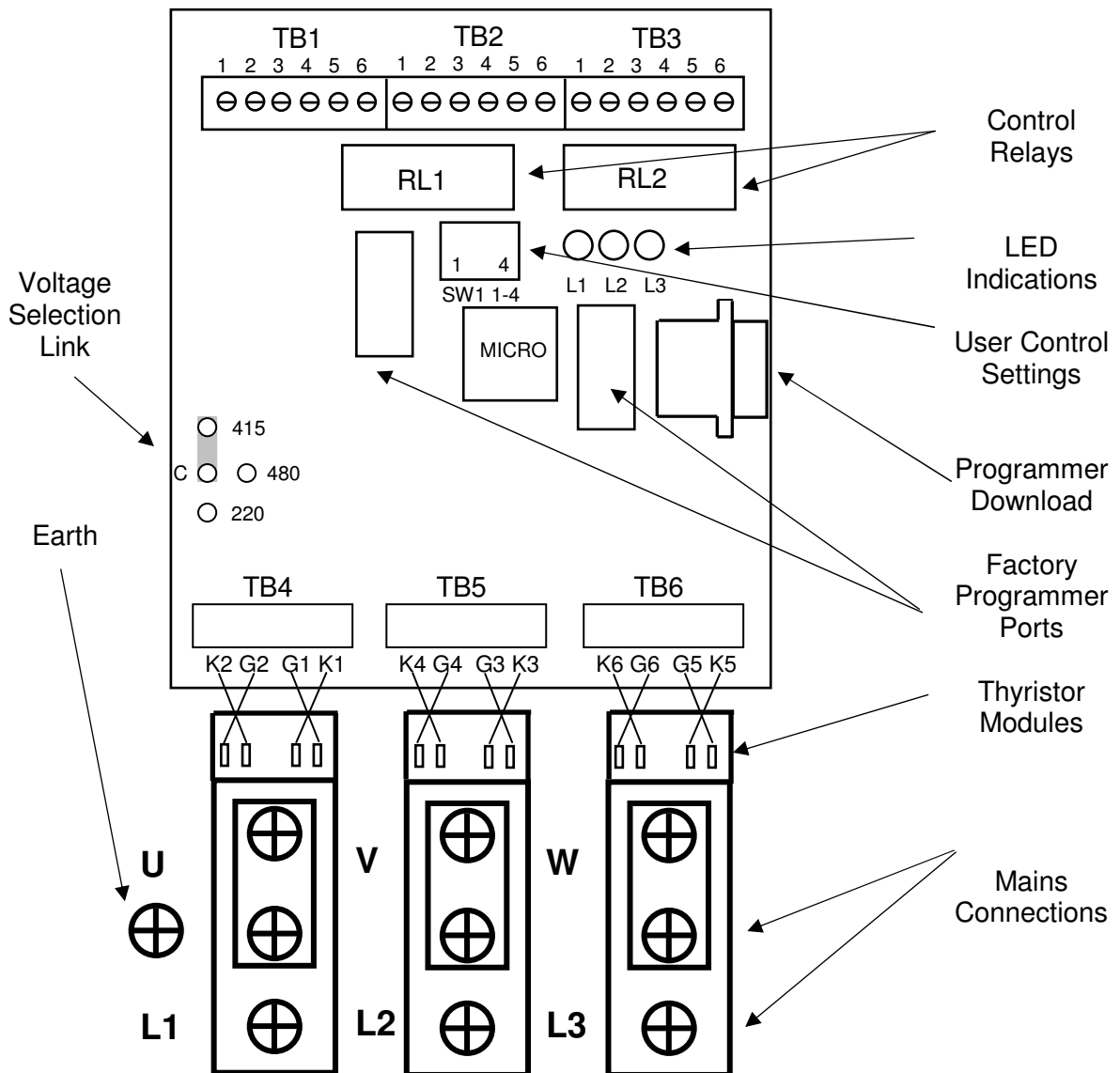
WARNING

THE THERMAL PROTECTION SWITCH, TT (IF FITTED) IS THE AUTOMATIC RESET TYPE. IF IT IS USED ELSEWHERE IN THE CIRCUIT IT SHOULD BE WIRED TO PREVENT THE UNIT FROM AUTOMATICALLY RE-STARTING IN THE EVENT OF AN OVER TEMPERATURE TRIP.

TERMINALS 1 & 2 SHOULD BE LINKED IF TT NOT FITTED.

USER CONTROL SETTINGS

POWERBOSS INTEGRA PCB USER ADJUSTMENTS MAP



DESCRIPTION OF USER CONTROL SETTINGS

SUPPLY FREQUENCY SELECTION

WARNING.

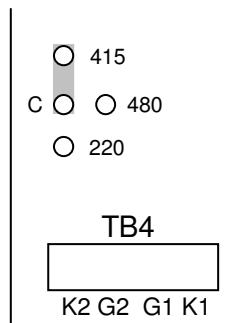
BEFORE PROCEEDING FURTHER WITH COMMISSIONING THE SUPPLY FREQUENCY AND VOLTAGE SELECTION LINK MUST BE SET. FAILURE TO DO SO MAY RESULT IN DAMAGE TO THE UNIT AND INFRINGE THE WARRANTY.

POWERBOSS STORES THE INITIAL SETTINGS AT SWITCH ON FOR WARRANTY DETERMINATION PURPOSES.

THE SUPPLY FREQUENCY CAN ALSO BE SET USING THE PROGRAMMING MODULE, IN THIS CASE THE LINK SHOWN BELOW MUST NOT BE USED AS TERMINALS 3 & 4 MAY BE ASSIGNED BY THE PROGRAMMER.



SUPPLY VOLTAGE SELECTION LINK



Before applying any voltage to the unit ensure the Supply Voltage Selection Link is set to the correct value.

1. Link C to 220 - 208 to 230V 50 or 60 Hz
2. Link C to 415 - 380 to 415V 50 or 60 Hz
3. Link C to 480 - 440 to 480V 50 or 60 Hz

PEDESTAL VOLTAGE

The Pedestal Voltage is the initial voltage supplied to the motor at the beginning of the start routine. The Pedestal Voltage within the application sets has been carefully chosen to provide the best performance within know criteria for the given application. You can change the Pedestal voltage by either selecting a more suitable application set or by connecting the software programmer, which is available separately.

RAMP UP TIME

The Ramp Up Time is the time taken from the Pedestal Voltage to reach full voltage. The Ramp Up Time controls the availability of acceleration torque available to the motor and therefore controls the acceleration time of the motor. The motor will not necessarily accelerate to full speed as per the Ramp Time, this is due to the miss match of motor torque and the load torque requirements which often prevail.

You can change the Ramp Up Time by either selecting a more suitable application set or by connecting the software programmer, which is available separately.

STARTING CURRENT LIMIT

The Starting Current Limit can only be accessed by connecting the software programmer, which is available separately. See programmer manual for details.

KICK START

The Kick Start feature can only be accessed by connecting the software programmer, which is available separately. See programmer manual for details.

RAMP DOWN TIME

The Ramp Down feature is only available within application set 7, this feature controls the torque available to the motor during the stop phase. This feature should only be used on high static friction loads such as centrifugal water pumps to reduce water hammer. See application set 7 for details of standard settings. The timings can be changed using the software programmer, which is available separately.

STEP DOWN VOLTAGE

The Step Down feature is only available within application set 7, this feature controls the initial torque available to the motor during the stop phase. This feature should only be used on high static friction loads such as centrifugal water pumps to reduce water hammer. See application set 7 for details of standard settings. The voltage levels can be changed using the software programmer, which is available separately.

RELAY RL1

Relay RL1 is designated as the 'Run Relay', as standard the relay is designed to energise when the unit is given the start command. Provided there is no fault the relay remains energised. Relay RL1 has two volt free changeover contacts accessed on terminal block TB2. Relay RL1 is often used as a maintenance contact for a momentary start button. RL1 can be programmed, using the software programmer, as either of the following in addition to RL2.

Run Relay, Top of Ramp Relay or a Fault Relay.

RELAY RL2

Relay RL2 is designated as a Fault Relay as standard. RL2 will energise when mains power is applied to Powerboss and de-energise in the event of a fault.

By connecting the software programmer RL2 can be programmed as either of the following in addition to RL1.

Run Relay, Top of Ramp Relay or a Fault Relay.

DWELL TIME

The Dwell Time is the time between the Top of Ramp and Optimisation. The Dwell Time is set for the standard application sets and can only be changed using the software programmer.

OPTIMISATION ENABLE / DISABLE

Optimisation can be enabled or disabled using Switch 4. Optimisation is enabled with the switch down and disabled with the switch up. The switch can be operated with Powerboss running.

START AND STOP INPUT

To start the unit, close terminals 1 and 2 on terminal block TB1, if no fault is present the unit will start at the programmed settings. **The mains supply and the motor must be present to allow the unit to start.**

To stop the unit open terminals 1 and 2 on TB1, the motor will then coast to a stop. If application set 7 is chosen the unit will Ramp Down at the set rate. After the Ramp Down the unit will switch off the thyristors then de-energise the line contactor.

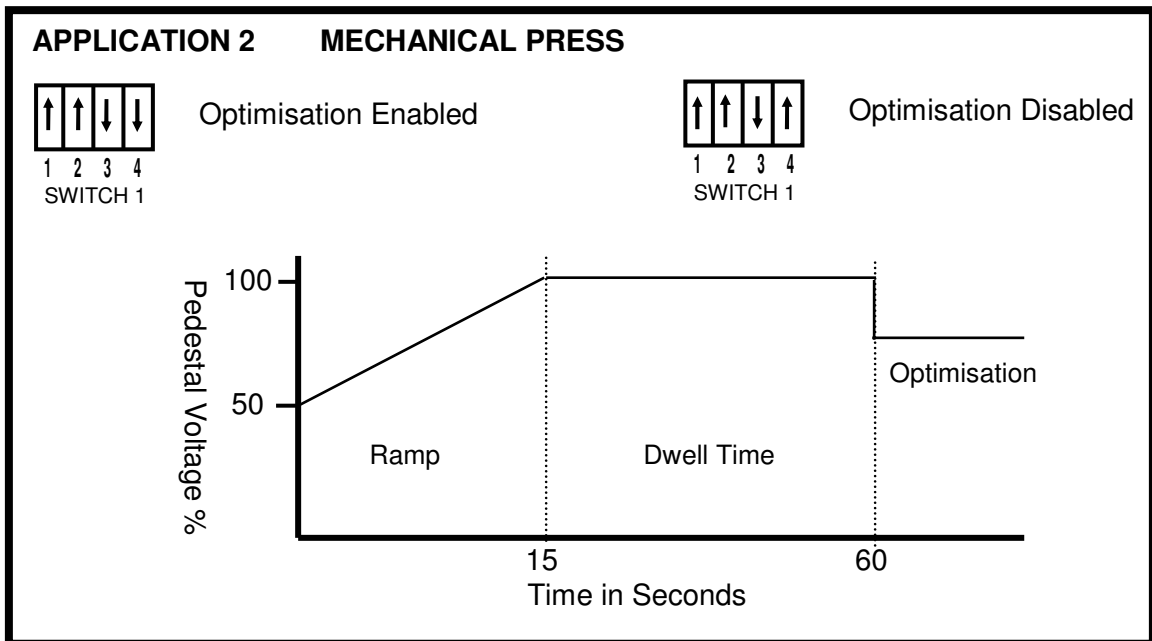
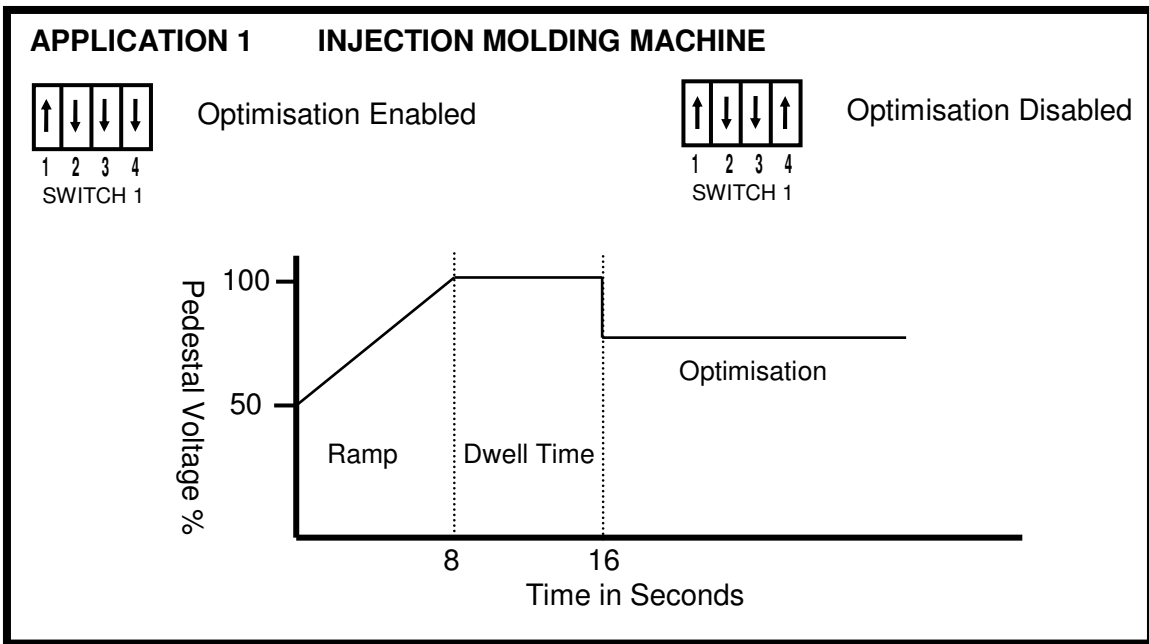
PROGRAMMABLE INPUT

An unused digital input is provided on terminals 5 and 6 on terminal block TB1. This can be configured using the software programmer to provide access to user specified features.

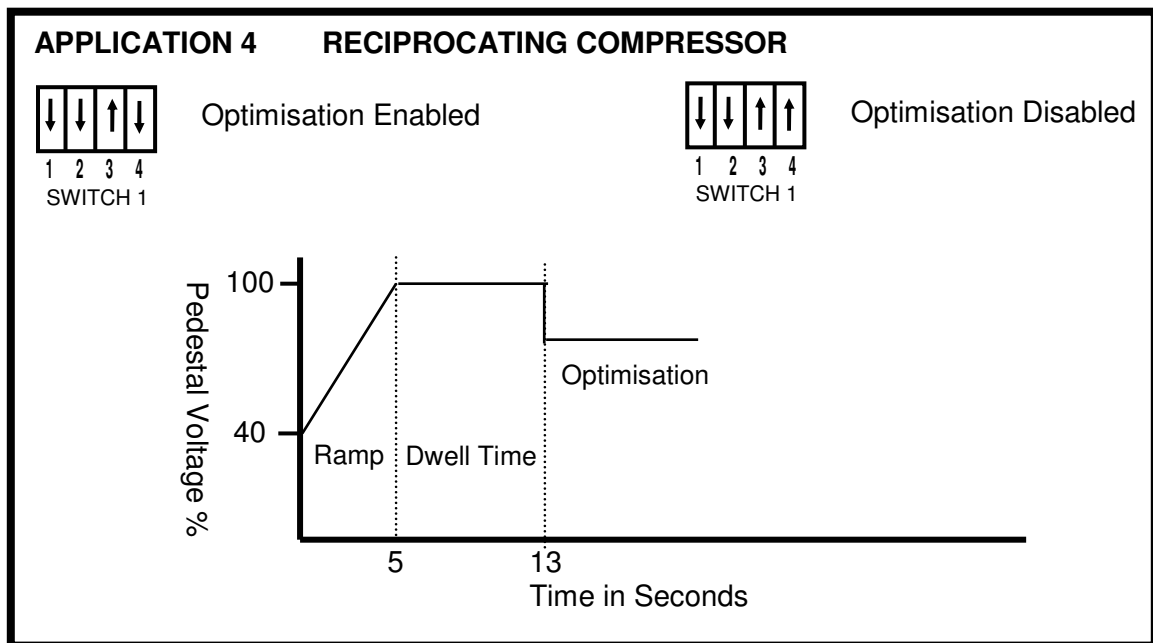
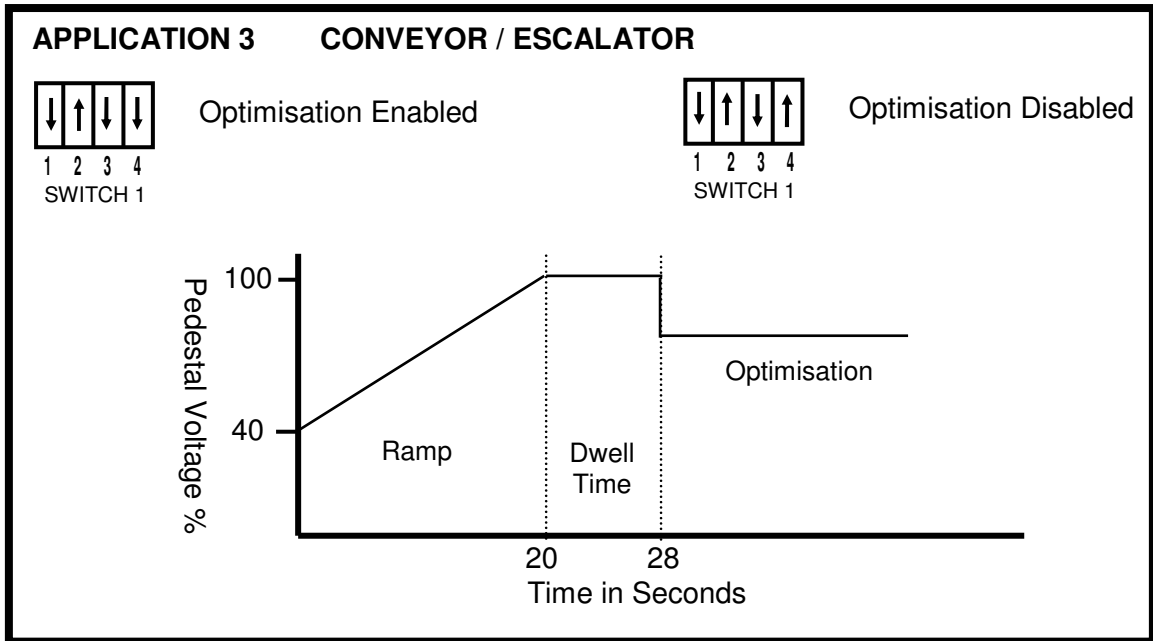
LED INDICATIONS

LED	FUNCTION	COLOUR	LED FUNCTION
L1	Power On	Green	Illuminates when mains power is applied
L2	Top of Ramp	Green	Illuminates when the unit reaches full voltage after the Ramp Time and Optimisation is disabled
L2	Optimisation	Green	Steady flash during Optimisation
L3	Starting	Yellow	Illuminates during Starting, extinguished after Top of Ramp
L3	Current Limit	Yellow	Steady flash during start when in Current Limit, extinguished after Top of Ramp
L3	Ramp Down	Yellow	Fast flash when Ramping Down, extinguished after Ramp Down
L2 + L3	Thyristor Fault	Green Yellow	Steady flash indicates a shorted Thyristor Module
L2 + L3	Line Fault	Green Yellow	Fast flash indicates a Line fault
L2 + L3	Timed Power Off	Green Yellow	L2 and L3 flash twice every 5 seconds after a programmed no load shutdown

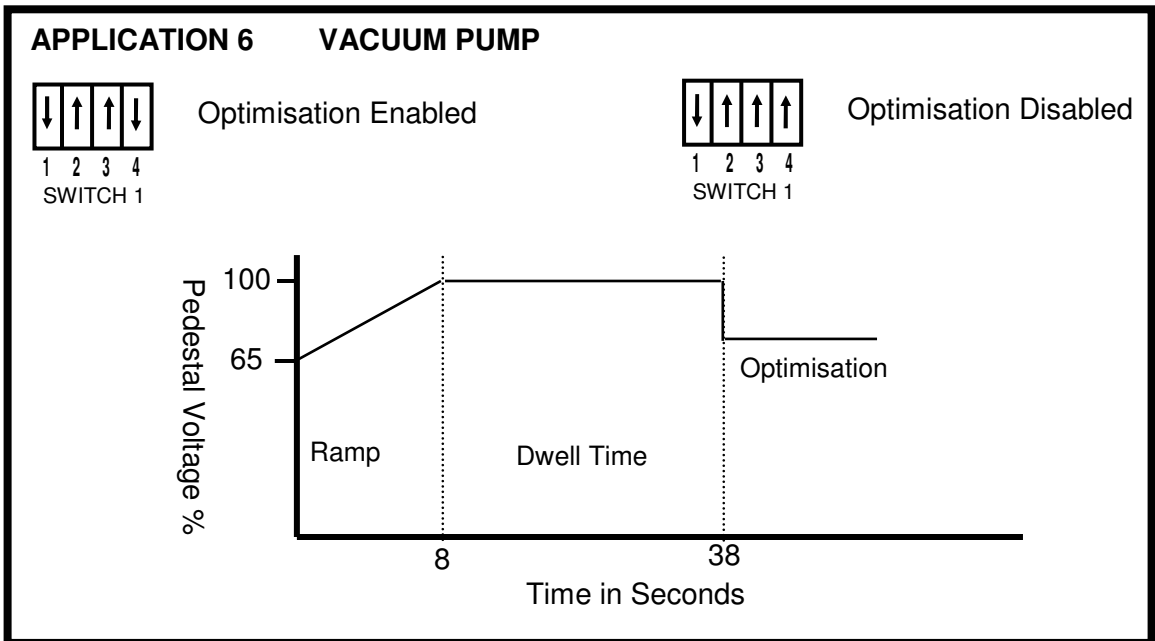
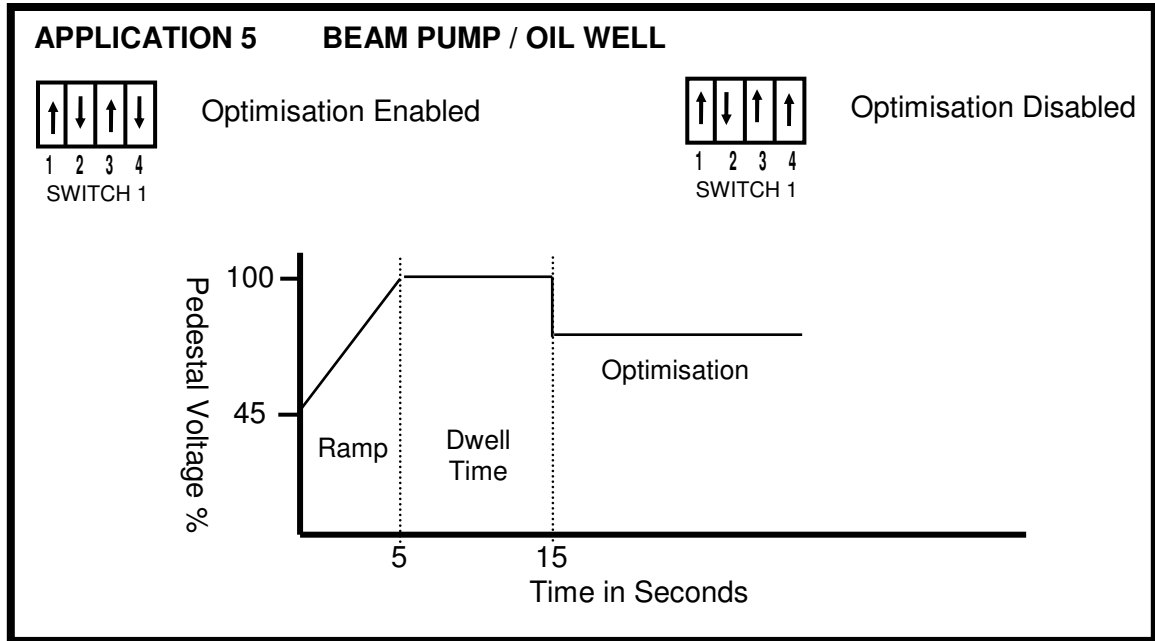
APPLICATION SETS



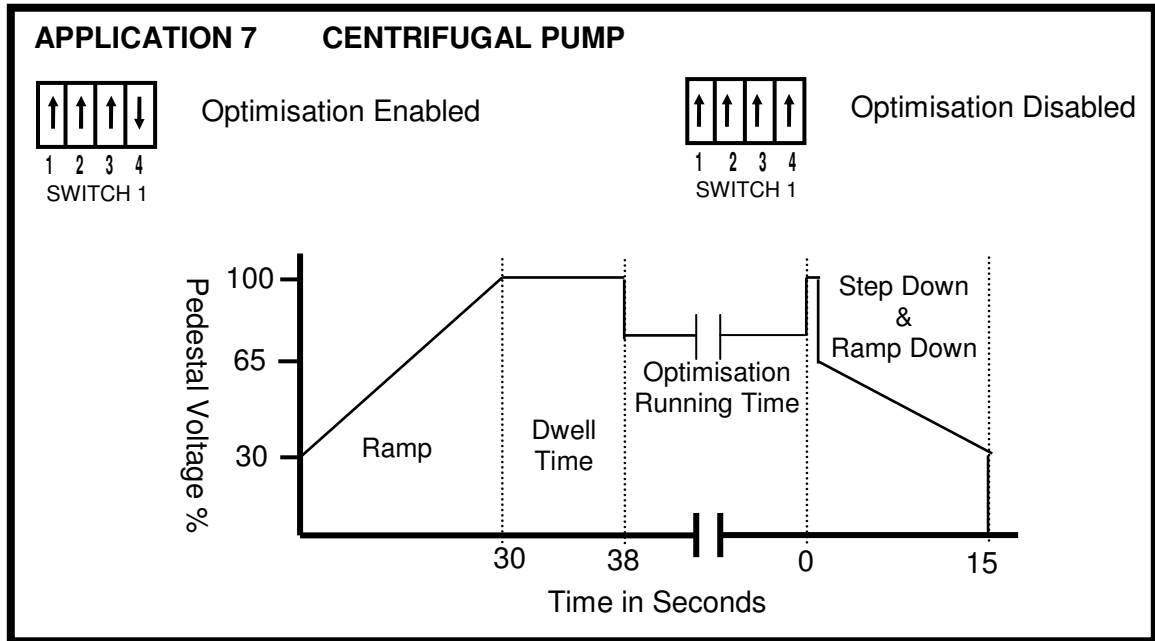
APPLICATION SETS CONTINUED



APPLICATION SETS CONTINUED



APPLICATION SETS CONTINUED



COMMISSIONING

PRE-COMMISSIONING CHECKS

1. Ensure that **Frequency and Voltage** setting is configured correctly.
 2. Ensure that Fans (if fitted) are connected to the correct voltage.
 3. Ensure that a suitable application set is selected.
 4. Check that the unit is connected correctly as per the preceding connection diagrams.
 5. Ensure any Power Factor Correction Capacitors are connected on the input side of the line contactor and are only switched in or out before or after starting.
 6. Do not exceed the recommended starts per hour while commissioning.
 7. **Start Powerboss.**
 - a) Powerboss should start the motor in a smooth controlled manner.
 - b) If the motor is running in the opposite direction reverse two of the motor phases.
 - c) You may be able to improve the start by selecting a different application set or by connecting the software Programmer Module. See Programmer Manual for operation.
-

SERVICE AND MAINTENANCE

WARNING

THIS EQUIPMENT MUST BE SERVICED BY QUALIFIED PERSONNEL ONLY. BEFORE ANY WORK ON THE UNIT IS UNDERTAKEN ALL ELECTRICAL SUPPLIES MUST BE ISOLATED AND A 5 MINUTE PERIOD OBSERVED TO ALLOW CAPACITOR FILTERS TO DISCHARGE BEFORE WORKING ON THE UNIT.

GENERAL

Powerboss Optimisers and soft starters have shown themselves to be very robust and reliable provided they are used within their design capability. The unit requires very little maintenance, however the checks listed below should be performed at half yearly intervals.

- i) Check that the environment has not changed and that no restriction has occurred to the fan or cooling apertures.
- ii) Check all connections for tightness.
- iii) Check all connections for signs of oxidation. A small amount of non-conducting grease can be smeared on the power connections to prevent oxidation.
- iv) Check mains and control wiring for signs of deterioration.
- v) Visually inspect the control PCB for signs of deterioration, the PCB can be cleaned with a dry airline if required.
- vi) Replace fan filters if required.

FAULT FINDING

Before moving to the fault finding procedure the following checks should be performed.

- i) Check that supply and motor cables are connected correctly to the terminals of the unit. Powerboss Integra will not work within the delta loop.
- ii) Check external control circuitry.
- iii) All fuses including the semiconductor type (if fitted) should be checked for continuity with a DVM.
- iv) If an electronic overload is fitted check with the manufacturer that it is suitable for use with a chopped waveform, some electronic overloads interpret a chopped waveform as a single-phase condition.

WARNING

A HIGH VOLTAGE INSULATION TESTER SUCH AS A MEGGER SHOULD ONLY BE USED TO TEST TO EARTH. TESTING BETWEEN THE PHASES ON THE POWERBOSS MAY CAUSE IRREPAIRABLE DAMAGE TO THE UNIT.

FAULT FINDING PROCEDURE TABLE

FAULT	POSSIBLE CAUSE
Power On LED not illuminated	i) Mains supply not present, check fuses
	ii) Faulty control PCB
Powerboss will not start, fault LED illuminated	i) Mains supply not present, check fuses
	ii) Motor phase not connected
	iii) Short circuit thyristor(s)
	iv) Faulty control PCB
	i) Start circuit on TB1 not closed
	ii) Faulty control PCB
Powerboss trips during start, fault LED illuminated	i) Faulty fuse
	ii) Short circuit thyristor(s)
Powerboss trips during running, fault LED not illuminated	i) Over-temperature trip (TT if fitted)
	ii) Motor overload trip
	iii) Motor thermistor trip (if fitted)
	iv) Faulty control PCB
Powerboss trips during running, fault LED illuminated	i) Faulty fuse
	ii) Short circuit thyristor(s)

NOTE.

THE CONTROL PCB IS THE LEAST LIKELY ITEM TO DEVELOP A FAULT AND SHOULD ONLY BE SUSPECTED IF ALL OTHER AVENUES OF INVESTIGATION HAVE BEEN EXHAUSTED.

FAULTY PCB's SHOULD BE RETURNED TO THE MANUFACTURER FOR REPAIR OR REPLACEMENT.

TESTING AND REPLACING THYRISTORS

THYRISTOR SHORT CIRCUIT TEST

Before performing this test remove all power connections to the unit. Using a good quality DVM measure the resistance between the input and output of each thyristor. A healthy device will give a reading in excess of 100k ohm. Short circuit thyristors should be replaced.

THYRISTOR GATE TEST

Using a good quality DVM measure between the following terminals on the control PCB.

Red phase	K1-G1 and K2-G2 on Terminal Block TB4
Yellow phase	K3-G3 and K4-G4 on Terminal Block TB5
Blue phase	K5-G5 and K6-G6 on Terminal Block TB6

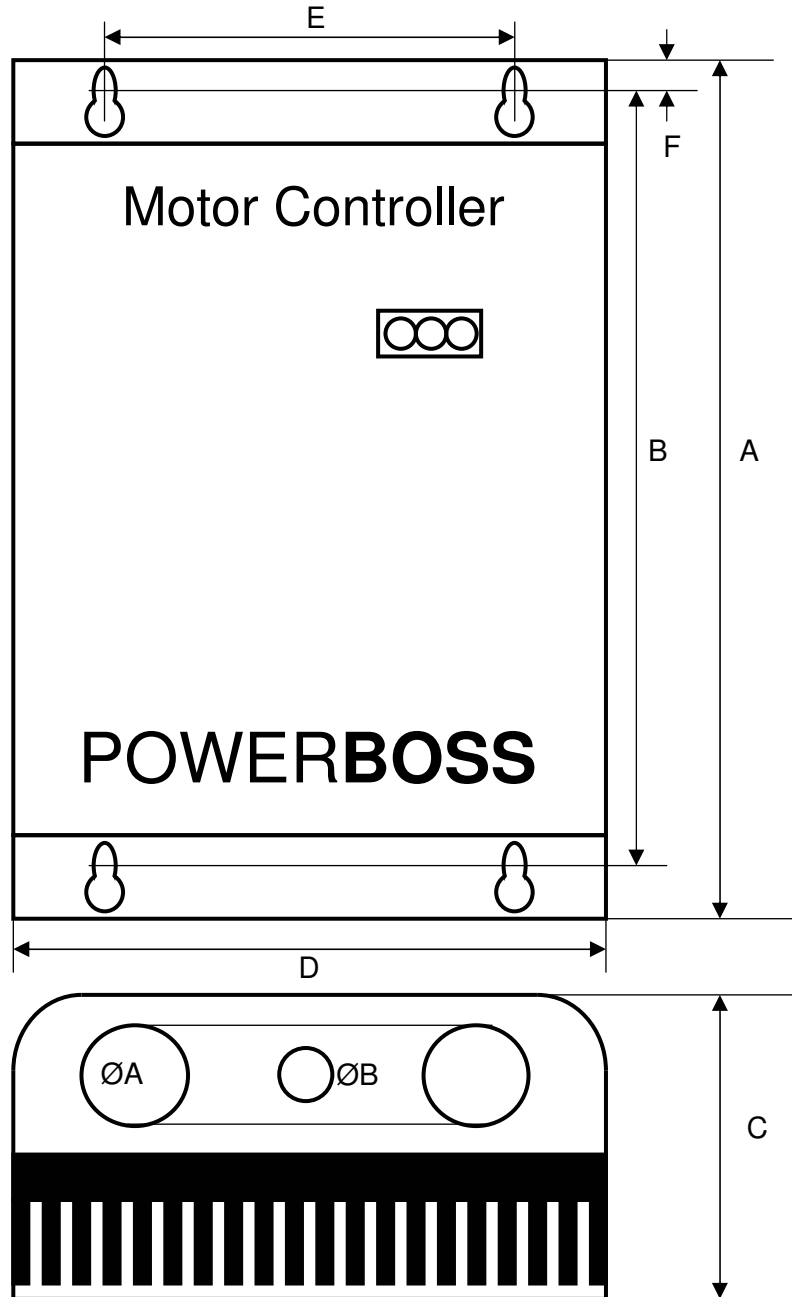
Each thyristor should give a reading between 6 and 50 ohms; any readings above or below this figure indicate a damaged thyristor.

THYRISTOR REMOVAL AND REPLACEMENT – SEMIPACK TYPES

Throughout the Powerboss Integra range all thyristor switching devices are the isolated Semipack type and configured as an anti-parallel pair. To remove the thyristor first remove the gate/cathode connections from the Thyristor taking care not to damage them, they are keyed and can only be re-connected correctly, then remove the heatsink retaining screws.

Remove the shorting copper link from the thyristor terminals and fit to the new thyristor. Smear a light film of heatsink compound on the bottom of the thyristor and fix to the heatsink, tightening the retaining screws evenly to a torque of 6 Nm. Lastly re-connect the gate/cathode connections.

DIMENSIONS PBI 2.2 – PBI 55



DIMENSIONS									
TYPE	A	B	C	D	E	F	ØA	ØB	Kg
PBI 2.2 - 22	270	250	115	130	80	10	25	12.5	4
PBI 30 - 55	385	365	215	130	80	10	30	12.5	10.2
ALL MOUNTING HOLES 4MM CLEARANCE									