INSTRUCTION MANUAL

PC3
Phase Change Converter (240V)
3kW / 4hp
Run 415 Volt machines from 240 Volt Power

E151

PHASE CHANGE CONVERTERS

3 Phase Power Converter Operation Manual & Warranty Policy

Release 2.1 June 2007
for all models PC2 to PC37
and PCS series converters

This Operator Manual will assist users to get the most out of their Phase Changer Converter product.

*The electrical Installer must read and understand the **'Installation & Service Manual'** before proceeding with any installation of this equipment.*

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Power Converter Operation Manual

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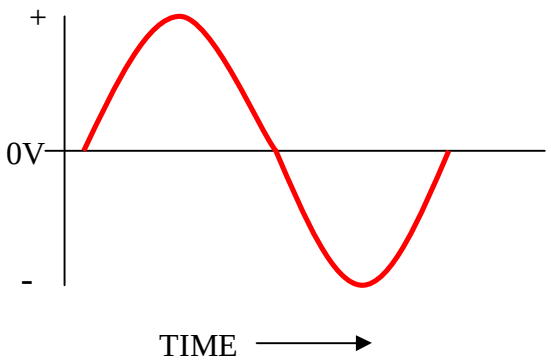
An Introduction to 3 Phase Power

The power available from a domestic power outlet is **220V** or **240V** of **AC** (depending upon conventions in different parts of the world) The electricity available from these outlets is called **Single Phase Power**. This is a single voltage that alternates in polarity between '+' and '-' at 50 times per second, hence the term '**AC**' meaning **Alternating Current**.

AC is used because AC can pass through a power transformer to efficiently increase or decrease voltage. Direct Current, or D.C. (as found in batteries) cannot do this. The picture below shows a typical AC voltage passing through the '+' and '–' stages of one cycle, which takes **one-fiftieth** of a second to complete.

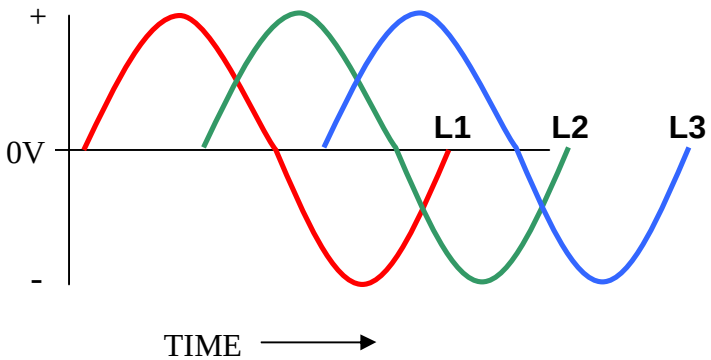
Single Phase 'Active' voltage



Most small domestic appliances use Single Phase power because it is easy to work with and requires only two wires, **Active** and **Neutral**, (plus a protective **Earth** wire) to deliver energy to a load. However, there are some limitations to single phase power. As the voltage passes through a 'zero' point *twice* for each cycle, there are instants in time when no energy is available to drive loads. This can be a problem for heavy and industrial loads which use a lot of power. Another problem is that single phase electric motors do not know which way to rotate when they start, unless special wiring methods or motor-start devices are used.

Three Phase Power is *three* simultaneous AC signals, spaced one-third of a cycle apart in a single 50 Hz cycle.

Three Phase voltages, L1, L2 and L3



Three Phase Power needs more wires to convey the power. The three phases require three wires designated **L1, L2, L3.** There is also a **Protective Earth** wire, and sometimes a '**Neutral'** or common wire.

Most commercial machinery over a few kilowatts is designed to operate on 3 phase power. That's because 3 phase motors are more reliable, much less expensive, have a much better starting capability, run more efficiently (eg. 90% compared to 70%), and last many years longer than their single phase counterparts.

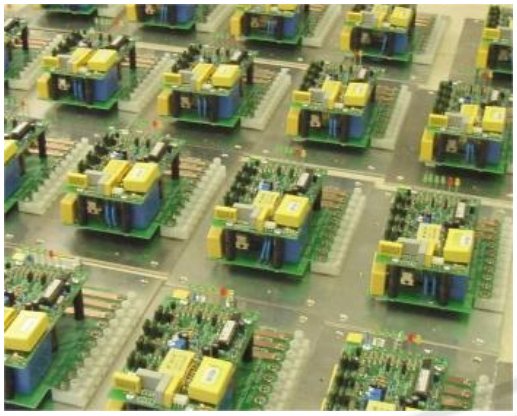
Simply put, single phase motors are expensive, inefficient and

*A **PC2** 3 Phase outlet*

less reliable when compared to a 3 phase motor.
Larger machinery requirements often means that 3 phase connection is the only option. In many cases, machine manufacturers do not offer single phase solutions. Having 3 phase power available opens up a whole new world of alternatives to the machinery shopper. A large variety of 3 phase machinery is available from both new and used machinery dealers - and it is usually cheaper and more readily available.

A general description of Phase Change Converters

Phase-Changers are based on the proven technique of a rotary conversion which has been extensively used for the last 50 years. The concept was simple, but in practice they had serious limitations. A large problem was the way that output voltages would dramatically change with the amount of load connected. If the load was light or unconnected, then generated voltages could be 25% higher than they should be. If large loads were applied, output voltages would fall really low or stall the converter entirely. However, with the Phase Changer system we've added some very important new technology improvements.



What we have done is added the "smarts". By using the best current micro-controller technology available, we have dramatically enhanced the performance of the rotary converter. By continually monitoring the output of the converter, the micro-controller controls the value of the capacitors required for "ideal tracking". Using high voltage industrial solid state switches called ‘thyristors’. Large capacitor banks are switched in and out quickly and silently as determined by the micro-controller in NINE distinct levels. All switching is done with precision ensuring there is no stress to either the capacitors or to the thyristor switching devices.

In the real world of the connected load, this means that the quality of the generated 3 phase is comparable or in some cases better than that of a utility 3 phase power supply. The ability to reconnect any capacitor bank automatically based on real world load conditions, means that a Phase-Changer can access this stored energy at anytime to *hardstart* or boost machines with high mechanical loads such as fans and refrigeration equipment.

The Phase-Changer is the least expensive way to operate 3 phase equipment wherever utility 3 phase is unavailable or is too expensive to obtain. It eliminates the extremely high costs of extending 3 phase power lines, installing new supply transformers and power metering. It also saves the cost of a new 3 phase switchboard within a building and can usually be installed very quickly

Phase-Changers can be used on Single Wire Earth Return (**SWER**) power supplies which are very common in remote areas around the world. They operate at a high line voltage and have a small transformer for each property to provide 220/240V

Standard converter model sizes range from **2.2KW** to **37KW** and suit any application. The limiting factor is the capacity of the single phase supply available.

Converters larger than **11kW** require a **Two Phase** power source to deliver the required energy A Phase-Changer is both quieter and less costly than a generator to own and operate. Phase-Changers are 'stand alone' units that the customer owns. This means that it can be sold or relocated to a new property at the owners convenience.

A 240V tap on a Single Wire Power line

Safety Precautions when using Converters

It is most important that operators read the following safety information BEFORE working with Power Converter equipment.

- Phase Changer Power Converter systems should not be used in situations where its failure will present a threat to human health and safety. Use of converter equipment in these situations is entirely at the risk and discretion of the owner or operator and is in no way approved by the Phase Changer company.
- Power converters are *heavy*. When unpacking and moving this equipment be sure to get some help and where possible use suitable mechanical aids such as forklifts and heavy duty hand trolleys.
- The power converter should be installed by an experienced electrician. It is the responsibility of the purchaser to ensure that the installing electrician has access to the complete Installation Manual.
- Dangerous voltages are present inside power converters and only experienced people should access the interior of this equipment. Charged capacitors inside may retain dangerously high voltages, even some minutes after power has been disconnected
- The converter should be mounted in a vertical position on its integral rubber mounts. The unit should be oriented so that models with an LED display can be easily viewed by the operator.
- Chose the location of the power converter with care. High voltages are present within these units, so keeping moisture and dust to a minimum is important.
- Vermin such as rats and mice are sometimes a problem with electrical equipment and have been known to chew through and short out wires. Often they are attracted by the warmth of this equipment in cool weather. If the presence of vermin, mud wasps or ants near converter equipment presents a risk, consider placing traps and poison bait nearby.
- The converter should not be connected to loads that exceeds its rated output. It is possible that several high-current loads, when powered up at the same time, may exceed the rating of the converter, but these loads may still be within working converter limits if they are operated sequentially.

Starting the Converter

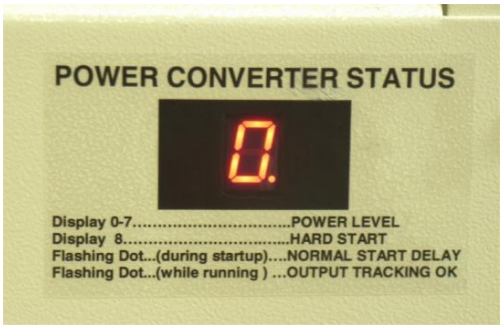
Smaller converters come with a 3-pin power plug that can be inserted into a standard power outlet. They also feature a combined **OFF/ON** switch and standard three phase power outlet. (right) These converters will start up instantly when the power switch is activated.

Larger converter models have a circuit breaker control box mounted on the side of the unit (pictured below) which are designed for hard-wired installations.

The single switch activates mains power to the converter. The Three-pole switch on the right may be used to manually disconnect the converter output from the load. Should an overload condition occur, these circuit breakers will provide over-current protection
The **Converter Model Chart** on **Page 7** should be consulted to find which features are supported by the different model converters.
A successful converter start will be evident by the sound of the rotating pilot motor and the click of the load contactor energising a few seconds later.

Larger converters have an automatic switch fitted that will delay any start by several seconds. This is part of the protection system from brief power interruptions. Larger motors do not like being re-started if they are still spinning from a recent activation because a spinning motor generates a small amount of power on its own that is usually out of synchronisation with the mains supply. The electronics in the converter will detect the motor if it is still spinning, wait for it to slow down to a near stop, add a four second delay, then go through a normal startup sequence. While the motor is waiting to start the '**decimal point**' on the LED display will flash. (Note that the single-stage 'PCS' series of converters do not come with this LED display)

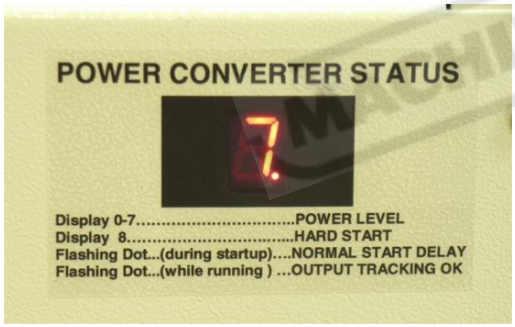
When the converter starts there is usually a brief 'shudder' as the internal motor is quickly brought up to maximum speed. The LED display will briefly flash a digit '**8**' as the internal motor is first activated, but this will quickly revert to a '**0**' or '**1**' as the converter reaches full speed.



A converter under no load

Approximately two seconds after the converter starts, a second switch will automatically operate to connect the generated 3 phase power to the customer load. This short two second delay ensures that the converter motor has achieved full speed before any load is applied.
(The 3 phase circuit breaker within the control box must be **ON** for the load to be connected)

Connecting the load



A converter under heavy load

Once the 3 phase customer load is successfully applied to the converter, the electronics will measure the load current and decide how it should be managed. As well as displaying a '**0**' for a no-load condition, the converter can display a value from '**1**' to '**7**' which indicates the present drive level of the converter. If the load is a light one, it may simply step up to a level '**2**' or '**3**'. Level '**7**' would be regarded as a heavy load. When the load has settled down, the display will remain steady on a given drive level and the **decimal point** of the display will have a steady glow. This indicates that all the output voltages are satisfactorily balanced and stable.

Display Level '**8**' is a special '**Hard Start**' level that only comes on briefly when the converter is first activated or when a very heavy, hard to start load is first applied. It engages a large bank of capacitors inside the converter to get big motors turning. Equipment such as air compressors and refrigeration systems need a lot of energy to get the motor going against built up air or coolant pressures. The converter will automatically govern the duration of this boost level so that it quickly reverts back to level 1-7 tracking as soon as the load gets going.

This special Hard Start level is a valuable feature of all Phase Changer converters. Because it can draw on the energy stored in the capacitor bank and the kinetic energy obtained from the spinning converter motor, it can deliver instantaneous current many times the maximum level available from the power line source. If sufficient start power cannot be delivered to a big load, then the load motor will stall and effectively short out the supply until a circuit breaker trips a shutdown.

Converter Model & Specification Chart

The chart below shows the entire range of the Phase Changer converter series. Refer to the section on PCS series converters for more details on this product range.

Model	Total Output kW/HP	Auto Hard Start & Boost	Nine stage Voltage Control & boost +/-5%	Single Stage Control with Boost +/- 10%	Multi Motor & Elec-tronic loads	220/240 A.C. Input	380/415 A.C. Input	Max Starting Load & Running Load kW/HP	Supply Cct. Breaker 240/480	Pilot Motor type
PCS2	**2.2 / 3**	√		√		√		**2.2 / 3**	**10A / -**	**Int.**
PC2	**2.2 / 3**	√	√		√	√		**2.2 / 3**	**10A / -**	**Int.**
PCS3	**3 / 4**	√		√		√		**3 / 4**	**16A / -**	**Int.**
PC3	**3 / 4**	√	√		√	√		**3 / 4**	**16A / -**	**Int.**
PCS4	**4 / 5.5**	√		√		√	√	**4 / 5.5**	**20/10A**	**Int.**
PC4	**4 / 5.5**	√	√		√	√	√	**4 / 5.5**	**20/10A**	**Int.**
PC6	**6 / 7.5**	√	√		√	√	√	**6 / 7.5**	**30/15A**	**Int.**
PC8	**8 / 10**	√	√		√	√	√	**8 / 10**	**40/20A**	**Int.**
PC11	**11 / 15**	√	√		√	√	√	**11 / 15**	**60/30A**	**EXT.**
PC15	**15 / 20**	√	√		√		√	**15 / 20**	**- / 40A**	**EXT.**
PC18	**18 / 25**	√	√		√		√	**18 / 24**	**- / 45A**	**EXT.**
PC22	**22 / 30**	√	√		√		√	**22 / 30**	**- / 50A**	**EXT.**
PC30	**30 / 40**	√	√		√		√	**30 / 40**	**- / 65A**	**EXT.**
PC37	**37 / 50**	√	√		√		√	**37 / 50**	**- / 80A**	**EXT.**

Phase-Changers have formally been tested and approved in 2005 to meet the stringent safety and EMC standards for the EU (European CE approval), as well as C-Tick approval for Australian and New Zealand markets.
Unlike inverters or VSD's (Variable Speed Drives), Phase-changers create no harmonics that may interfere with other electrical or electronic equipment.

Dealing with different types of load

During start-up of the 'Phase Changer' converter or any connected motor or machine, supply currents may rise to 500% of the maximum nominal input currents shown on the motor nameplate. **The converter should be installed as close to the switchboard as possible.** This will reduce voltage drop when the converter or an external motor starts. Install a motor rated fuse or delayed circuit breaker in the customers switchboard. Install an industrial single-phase three pin wall switch-socket combination, or connect directly to the Switchboard circuit breaker.
(The neutral wire must be connected to the converter unit on all installations, this includes 460-480V dual phase installations).

Motor Rated fuses or Circuit Breaker size	@ 240V supply	@480V supply	Approx max continuous Output current at 415V 3 phase	Position of pilot motor
4KW Converter	20A	10A	7.5A	Internal
6KW Converter	30A	15A	11A	Internal
8KW Converter	40A	20A	14.3A	Internal
11KW Converter	50A	25A	20A	*external*
15KW Converter	N/A	40A	28A	*external*

Consult Phase Change for larger sized converters (ie 18KW, 22KW, 30KW, 37KW)

Machine Connections

This section contains technical information to give customers some insight into the requirements of their installation. For more information, discuss details with experienced electrical installers and consult the Phase Changer Installation Manual.

Power converters are designed primarily for the connection of 3 phase machines and loads. It is important to understand that 2 of the 3 phases are generated by the converter.
The **L3 - Blue** phase is the original supply active which is used to power the converter. This phase goes straight through the converter and is the only phase that has a **220/240V** output when measured to neutral or earth. The **L1-Red** and **L2-White** generated phases do not have a **220/240V** reference to earth or neutral.

L1 - Red output to earth or neutral will measure approx **160V** (on a 240V supply)
L2 - White output to earth or neutral will measure approx **360V** (on a 240V supply)
L3 - Blue output to earth or neurtal will measure the original supply voltage of **220/240V**.

Find out if the load equipment require a 'Neutral' wire.

Nearly all 3 phase applications will be content with the normal **380/415V** phase-to-phase voltage that the converter produces, but it is very important to note that all 3 phase machines that require a neutral connection, have one thing in common – *there is a **220/240V** load associated with that machine*. It may be a control circuit, lighting, heating element, smaller single phase motor, solenoid etc.
The installer must check to determine if there are single phase load(s) present, and ensure that the 'Active' associated with that load is supplied by the L3-Blue phase from the converter. This is the *only* phase that has a **240V** reference to Neutral (& Earth).

Most three phase machinery requires a 3 wire, 3 phase, (plus earth) connection only. If a plug is fitted there will often be only 4 pins on the plug. Many of these installations have no more than a 3 phase motor and a switch and have no internal control circuit or contactor. For these type of machines no special connection is required other than checking motor direction, which can be changed by swapping two of any of the 3 phases.

Welders:

Provided the correct sized converter is selected, most 3 phase welders work extremely well when powered by a Phase Changer Converter. All Phase-Changer converters are fitted standard with a 'hard start feature' which will provide a significant power boost for short periods in high load conditions. This is ideal for most machine applications, but not necessarily desirable while welding.


A modern 3-phase Welder

As welder sizes, operating currents and welding applications vary dramatically, it is very difficult to set the correct level for the 'hard start' feature to cut in during welding applications. A 'hard start' event will be evident by a solid pulsing of the converter and a brief flash of digit '**8**' on the LED display.
If this is happening a lot while welding, the welder may be welding at high currents near the limit of the converters output capacity. Also, five consecutive 'Hard starts' in quick succession may be interpreted by the controller as a motor that is having problems starting, and may trip a level 3 shutdown. (refer to the section on Alarm Codes) In these situations, the hard start feature may be suppressed by removing an option link from the microprocessor controller. If necessary, we can fit a selector switch to the outside of the converter to enable/disable this 'hard start' for a choice between welding and other loads.

Special notes on Single phase 415V welders

There have been a couple of instances where a customer thought he had a 3 phase welder (as it was fitted with a 3 phase plug), but in actual fact it was a **single phase 415V welder**, which was connected across **two phases only**. This needs to be confirmed before connecting the welder to the converter. If it is in fact a single phase welder, the input current requirements need to be checked and our factory should be consulted before proceeding. (call direct or email support@phasechanger.com)

Welders by their nature are high current, high power devices and while the current draw on 3 phases can be quite high, it is significantly higher if the welder needs to operate from the two wire, single phase **415V** connection. While we do not recommend the connection of single phase welders to Phase-Changer converters, connection may be possible provided the input power requirements do not exceed the rated output of the internal transformer or of the internal start and load contactors. Connection MUST only be between **L1** (red phase) and **L3** (blue phase). Any connection of single phase welders to **L2** (white phase) will not work and will probably cause damage to the converter which will not be covered under warranty. Damage due to component overload caused by the connection of single phase welders to Phase-Changer converters will also not be covered under the factory warranty.

Using Converters on marginal power lines

Over Voltage problems

Often power converters are purchased to run equipment in remote locations where 3 phase power is unavailable. Unfortunately, these same locations are notorious for poor quality power due to long line lengths and heavy usage by other customers on the same circuit. This can be particularly evident on remote **SWER** (*Single Wire, Earth Return*) power lines. The long power lines have a relatively high resistance, and when big customer loads are applied there can be correspondingly large drops in line voltage. Sometimes these lines have a high line voltage when customer loads are low. This high voltage has been known to cause problems by frequently burning out household light bulbs or hot water systems heating elements. Phase Changer converters are also sensitive to these very high voltages as they contain internal step-up transformers which tend to multiply the voltage error and put internal components at risk. In consultation with an experienced electrician, there are two courses of action that could be taken to manage sites with higher than normal line voltage:

- Contact the power company and have them adjust the line voltage at a local substation transformer. (this action may help with *other* equipment at the customer location)
- Contact the Phase Changer company and discuss the possibility of getting a special transformer fitted with a lower output voltage.

Voltage drop on start-up problems

Phase Changer converters are quite robust in dealing with hard-to-start loads, however they do not create any energy, they only change its form. There will always be a point where the size of the load is just too big for the available power and will not start. Symptoms of this are motors that trip circuit breakers before they can start, motors that take a long time to start and big dips in line voltage that affect lights and other appliances. Here are some hints that can improve this situation:

- Ensure that non-critical loads (such as electric heaters and hot water services) are temporarily turned off while big loads are being started.
- Where multiple loads are being used, stagger the operation of these loads manually or with a short delay timer so not all equipment tries to start at the same time.
- Place both the converter and the load close as possible to the point where the supply enters the premises or:
- Increase the size (diameter) of the cables that feed the converter and its load to minimise the drops in line voltage.

- It is also worth discussing these difficulties with the power authority who may be able to increase the capacity of the local substation transformer

Remote Start option

An **Automatic/Manual** switch option allows manual operation of the converter or automatic operation via a 2 wire remote control cable. This is ideal for compressors, cool rooms etc, where an existing pressure or temperature switch on the machine can be used to automatically start the converter and supply the 3 phase power.

The remote start of the converter is a simple system that operates by switching on or off the Neutral conductor that feeds the controller box inside the converter enclosure. This feature would normally be fitted at the Phase Changer factory

Auto/Manual switch Option

PCS series converters

*The compact controller unit that manages **PCS** series converters*

Note that the '**PCS**' series converters use a reduced size controller system (left) that have only a singe boost stage. These units are ideal where the converter drives a single constant load, such as a pump or fan in a fixed installation.
The PCS series converters still support most of the other unique Phase Changer features, but does not include the LED status display.

For driving workshop machinery or multiple loads, the standard '**PC**' series will provide much finer stability and control spread over nine possible automatic drive levels.

Displayed Error Codes

The standard PC series of Phase Change Converters comes with a single LED display visible on the outside of the converter enclosure. During normal operation this display will indicate the present output drive level from '**0**' to '**8**' which is managed automatically by the internal controller. This controller also monitors the installation for a variety of critical fault conditions that may disrupt normal operation. These faults are rare and indicate major problems, but act as a safety net to prevent further damage from taking place.

When a fault condition has been detected the converter unit will undergo a full shutdown where the internal **START** and **RUN** contactors are released and the pilot motor is shut down. The display will rapidly flash between a '**0**' and an alarm code digit. This will continue until the operator manually intervenes and turns the converter OFF then ON again. These alarm conditions are critical and should be reported to Phase Changer or its distributors for service advice as soon as possible.

Alarm 1 – 'L1' Phase fault

If the display flashes a '**Digit 1**' it indicates that the '**L1**' phase is no longer being detected by the controller module. ('L1' phase has been measured at less than 100V for more than two seconds) It is a critical fault caused by an internal wiring problem or a failure of the logic module to accurately measure the 'L1' voltage.

Alarm 2 – 'L2' Phase fault

If the display flashes a '**Digit 2**' it indicates that the '**L2**' phase is no longer being detected by the controller module. ('L2' phase has been measured at less than 100V for more than two

seconds) It is a critical fault caused by an internal wiring problem or a failure of the logic module to accurately measure the 'L2' voltage.

Alarm 3 – Excessive 'Hard Start' events

The 'Hard Start' feature of the Phase Changer converter is a valuable one that injects a lot of energy into the customer's load to get it started properly. It rarely lasts for more than a few seconds. If necessary, the controller will wait for 3 seconds then attempt another Hard Start event. It is conceivable for a motor connected to the converter to suffer from a major problem, such as a ceased out bearing, or an obstruction jammed in the impeller of a pump. In that situation the load motor would never start and *without* Alarm 3 detection it would continue to trigger hard start events until the converter (or the motor) could burn out.
Alarm 3 detection looks for *Five* consecutive Hard Start events in quick succession. If the load has not started by then, it probably never will, so the converter is shut down as a safety precaution and a digit '**3**' flashes on the display.
There are rare circumstances where a welder or similar machine could trigger an Alarm 3 condition as a part of its normal operation. Refer to the section on welders for information on dealing with this problem or suppressing Hard Start events.

Alarm 4 – 'L2' Over Voltage

Phase Change converters employs a number high power electronic switches for balancing output voltages. Should one of these electronic switches (called Thyristors) break down it would continuously activate one or more of the storage capacitors and effectively cause a boost condition to lock on indefinitely.
The **Alarm 4** detection software looks for an untimely rise in the '**L2**' output voltage beyond normal tolerances. If this high voltage condition persists for more than 3 seconds, the converter is shut down as a safety precaution and a digit '**4**' flashes on the display. An Alarm 4 condition will require technical support. Typically this would entail the fitting of a replacement thyristor switch, or the entire controller unit would need be swapped.

Note that smaller converter units that do not come equipped with a START contactor cannot perform an automatic shutdown because the pilot motor is hard wired to the ON/OFF switch. These converters should be manually shut down as quickly as possible

Equipment Protection & Maintenance

Phase Change Converter units are not sealed due to their ventilation requirements. As a consequence they should never be located where they are exposed to direct elements of weather, particularly in costal areas. Converters require housing within a building or shed.

Converters should give many years of reliable service and require little maintenance. Generally there is no regular action to take except to prevent dust build up from causing problems. This condition is more prevalent in remote areas. High voltages exist inside the converter units and a large build up of dust across terminals could cause faults and trigger alarm conditions.
If the customer has access to an air compressor, an experienced electrical serviceman could turn off all power to the converter, remove the lid and use a burst of dry compressed air from building up any dust on critical components. (If the compressor must run from 3 phase generated by the converter, charge it up, kill all converter power and then flush the dust out with air still stored in the compressor tank.)

If the converter is located in a place where mice and vermin are abundant, an important task is the maintenance of vermin protection. This may mean regular replacement of rat poison and bait to the area around the converter and other load equipment. Converter damage caused by vermin problems are not covered under the Phase Changer warranty.

Troubleshooting

Description of problem	Recommended action
Converter Dead, no display, no signs of any activity.	• Check the main circuit breaker that feeds the converter and ensure that it is in the ON position. • Check the position of the On/Off switch on the converter. • Check the position of the Remote Start option (if fitted) and ensure that it is ON. • Contact the Phase Changer distributor for further advice.
Converter display comes on, but converter motor will not start.	• Do not persist if this happens, consult the Phase Changer distributor for advice
Converter starts, but no sign of activity on the 3 phase load.	• Ensure that all power switches on the 3 phase load are turned ON. • Ensure that the 3 phase output cct. breaker on the converter (if fitted) is in the ON position
The circuit breaker that feeds power to the converter drops out occasionally.	• Check the current rating on the circuit breaker and compare it to the chart on **page '8'** for the correct rating. • Discuss this problem with an experienced electrician • Consult the Phase Changer distributor for further advice
Converter starts, but Load will not start properly.	• There may be insufficient power available to start the load. Read the ***Voltage Drop on Start Up*** section of this guide on **page 9**
Converter shuts down & re-starts by itself.	• The automatic mains fail detection may be operating too easily. • Check the total motor load capacity against the power available
Converter emits unpleasant odours	• Have an experienced electrician remove the cover from the converter and inspect the insides for signs of electrocuted vermin.
Converter shuts down and flashes a fault code digit on the display.	• Refer to the Displayed Error Codes section of this manual on **pages 10** and **11**.
Converter runs well, but customer equipment does not correctly.	• It is possible that the equipment has internal control circuits that are wired to the wrong phase of the converter. Refer to the important section on **Customer Loads** for more details on solving this problem.

Packaging Requirements

In the event that a converter must be sent to the distributor for service, or even just being transported to a new location, it must be adequately prepared for transport. The best way to do this is to fasten the converter to a small wooden pallet and wrap the combination in a protective wrap.

Before sending the converter to any destination, contact the relevant Phase Changer distributor and ensure that they are expecting to receive the goods.
*(for address information, consult the **Service Contacts** section within this manual)*

We also suggest that a digital photograph is taken of the equipment just before collection. (with the Date & Time stamp option enabled) This way a proven image of its condition is recorded in the event of loss or damage to the delivery.

A LARGE label should be taped to the outside clearly stating where the unit is going, where the unit had come from, with telephone numbers and contact persons for each location.

If the converter is a smaller style and has the converter motor built *inside* the cabinet, then mount the converter on a pallet standing upright on its 4 rubber feet. Then securely lash the converter to the pallet with metal strapping, heavy rope or wire

If the converter is a **PC6** or **PC8** model converter where the motor is mounted *underneath* the main enclosure, then the preferred method of transport is to lay the converter on its *back* with labels facing UP so that it may be strapped down firmly.

Important! Ensure that for the **PC6**, **PC8** that the motor has a spacer-packer supporting the motor from underneath it to prevent the mounting rubbers being stretched and damaged during transit. Rolled up cardboard will work well for this task.

To minimise transport costs it is recommended that that a small size pallet be used, or if this is not possible, cut a larger one in half.

A Half-sized pallet usually attracts lower courier fees than full sized ones.

Power converters are **HEAVY!** Use mechanical aids when loading and unloading from trucks.

Phase Changer Three Year Warranty – Terms & Conditions *Oct 2006*

Phase Changer converter systems are constructed to rigid quality control standards and should provide reliable service for many years. For this reason we are proud to give a 3 year warranty on all power converter products from their date of purchase. Should a system failure occur, Phase Changer P/L and its network of distributors will work hard to restore service effectively and in reasonable time. This may entail telephone support to an electrician on-location, a visit by a technician, or it may require that the converter be shipped back to the distributor for service. Power Converters are used in situations where both the quality of the mains supply and the behaviour of customer loads are beyond our control, hence a number of limitations apply to our warranty.

- Phase Changer converter systems should be installed by experienced electricians using the installation notes provided. Installations not conforming to these standards may have their warranty voided.
- Converter equipment is designed to operate on a mains supply between 200V and 255V AC. and each converter model has a maximum load rating that should be observed. Unreliable operation and possible damage to converter equipment not covered by this warranty may occur if used outside these limits.
- Phase Changer systems are not suitable for operation on generator sets where the supply frequency may vary by more than 1% at any time. Converters are designed for utility mains supply only.
- Phase Changer converter systems are not suitable for Singe Phase, 380V/415V welders and warranty exclusions may apply if this equipment is used.
  (refer to the *Dealing with different types of load* section of the user or installation manual.)
- Warranty is void where converters have been affected by water, vermin, mechanical stress or connected to defective customer loads. Reasonable precautions must be taken by the owner to avoid these situations.

Limitations of Liability

- Power converter equipment will provide quality 3 phase power in situations where this is not usually available. Accordingly continuous operation may be regarded as critical by the owner. If power converter systems are being used in this way it is incumbent of the owner to provide their own contingency plan in the event of failure. Whether this is by way of purchasing a second converter as a backup or diesel generator is entirely up to the discretion of the owner. Our warranty is not extended to losses incurred by an equipment failure beyond the converter itself. Losses including produce, livestock, manufactured goods, lost time by staff and costs incurred by hiring or purchasing backup equipment shall not be the responsibility of Phase Changer P/L or its distributors.
- Phase Changer Power Converter systems should not be used in situations where its failure will present a direct or indirect threat to human health and safety. Use of converter equipment in these situations is entirely at the risk and discretion of the owner or operator and is in no way approved by Phase Changer P/L or its distributors.

Replacement parts

Unless prior arrangements have been made with Phase Changer or its Distributors, the following policy applies to all replacement parts provided under warranty.

- Replacement parts should be fitted by an experienced electrician.
- Should any replacement parts be sent to a customer location, they will be sent via regular freight or mail services free of charge. If use of a premium courier or postal service is requested by the customer, this may incur a separate fee.
- Replacement parts are sent on strictly on an *Exchange Basis Only*. The defective or unused parts must be returned to the supplier within 14 days of receiving the replacement part. Failure to do so will cause an invoice to the full value of the parts to be sent to the customer. Further warranty support may be suspended until this invoice is paid up, or the parts returned to the Phase Changer distributor.

Transport Policy.

- Power Converters are by their nature heavy and expensive to transport. Should the cause of the fault be positively identified as being beyond normal operating conditions as described in this document, transport and service costs may be charged to the owner of the converter system at a reasonable market rate.
- Unless special arrangements apply, the costs of transporting equipment returned to Phase Changer or its distributor, shall be borne by the customer. Serviced equipment being *returned* to the customer will be sent free of charge
- If any power converter equipment is being returned to an authorised Phase Changer service location it is incumbent on the owner of the equipment to ensure that the equipment is suitably packed for transport and that the goods are insured against any damage or loss that may occur while the equipment is in transit. (*Details of preferred packing methods are outlined in the Customer Operation Manual*)

Limitations of Third Party Servicing

- Phase Changer P/L and its distributors shall not be liable for costs of service work or travel expenses incurred by third parties except where these arrangements have been approved in advance. If service work is to be attempted by a third party, a full quotation should be obtained in advance and forwarded to Phase Changer or its distributors. This is necessary to ensure that any warranty service work that is delegated to an external agency or person, must be done at a reasonable rate by competent service staff.

Service Contacts

The Phase Changer international distribution network is rapidly growing. For service, first contact the Agent or Distributor from where the converter product was originally purchased. For additional support, contact one of the main distribution centres shown below, or consult the Phase Changer website on www.phasechanger.com/international.php for a recent listing.

Australia
Phase Change Converters

10 Mackey Street
Longwarry, Victoria 3816
email australia@phasechanger.com
Sales Phone: 1300 137 510 or
(61) 03 5629 9799 Fax:(61) 03 9445 9274

China
Phase Change Converters China
Ningbo, Zhejiang, China

Contact: Wan Lai Su
email: china@phasechanger.com

South Africa
SAPCC
(South Africa Phase Change Converters)

2 Willingdom Avenue
Kloof 3610
Contact: Jan Smit
email: sa@phasechanger.com

New Zealand
Chevpac Machinery LTD

131B Pilkington Rd
Panmure (Auckland)
Contact: Stephen Browne
Phone: (64) 09 570 1134
email: nz@phasechanger.com

Thailand
Grace Services

63 / 588 Chao-Fa Road
Muang Ap.
Phuket, Thailand 83000
Contact: Somchai Katnimit
email: thailand@phasechanger.com