Phase Changer Pty Ltd trading as

The Worlds Smartest
3 Phase Power Converters

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Phase–Changer Installation & User Guide

Thankyou for purchashasing a Phase-Changer, three phase power converter. These converters are manufactured to the highest standards and utilize our unique microprocessor based controller to provide quality 3 phase output from your single phase utility supply.

While your converter does provide a true 3 phase output, there are a few 'tricks' that you must understand before you connect your Phase-Changer power converter. Therefore it is most important that you read the following installation information BEFORE powering up your equipment.

1. Understanding the Phase-Changer Output

Three phase converters are designed primarily for the connection of 3 phase machines and other 3 phase loads. It is important that you understand that 2 of the 3 phases are generated by the converter. The third 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 240V OUTPUT WHEN MEASUERED TO NEUTRAL OR EARTH. THE OTHER 2 GENERATED PHASES DO NOT HAVE A 240V REFERENCE TO EARTH OR NEUTRAL. The two generated phases are L1/Red output and L2/White output.

L1/ Red output to earth or neutral will measure approx 160V.
L2 / White output to earth or neutral will be approx 360V.
L3 / Blue output to earth or neurtal will measure the original supply voltage - 240V.

For 99% of applications this is not a problem as phase to phase voltages of 415V +/- 5% between each of the 3 phases still exists.

What is important is that each machine connected to the converter is checked to the following guidelines. If not, machines may not function correctly and in some extreme cases, damage to the machine or the converter may occur.

WE HIGHLY RECOMMEND YOU ALWAYS USE A LICENCED QUALIFIED ELECTRICIAN FOR THE INSTALLATION OF YOUR PHASE-CHANGER POWER CONVERTER

2. Phase-Changer Electrical Connection

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 (even on 480V installations). In standard form, the converter is supplied with a 5mtr orange circular supply cable for direct connection to the single phase power supply.

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

Please consult Phase Change for larger sized converters (ie 18KW, 22KW, 30KW, 37KW, 45KW, 55KW, 64KW)

Output: In standard order, the converter is supplied with a 3 phase distribution board fitted with correctly sized input and output circuit breakers. You will need to provide correctly sized cable for supply to mains and to the connected load(s), just like a normal 3 phase installation. Machines or 3 phase outlets would be connected to the distribution board. Alternatively, converters can be ordered with either optional outlet(s).

3. Machine Connections

General:

Most 3 phase machinery requires a 3 wire 3 phase (plus earth) connection only. If this is the case with your machine, and a plug is fitted there will only be 4 pins on the plug. Many of these have no more than a 3 phase motor and a switch, without any 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.

3 Phase 3 Wire (plus earth), without Neutral but with internal control circuit, contactors and/or relays:

The internal control circuit will be designed to operate off two of the three phases, or 415V (Australia). This will either be via a 415V control transformer or by contactors and relays that have 415V coils fitted. In any case it is critical that the control circuit is powered from the L1 / Red and L3 / Blue phases only.

To check this one method is to simply trace out the wires. Alternatively, connect the supply to and from the converter so the control circuit of your machine is powered up, but do not attempt to start the machine itself. Using a multimeter on the ACV range, measure each of the 2 legs of the control voltage to earth. For example, across the control transformer input, one leg should read 160V (being L1) to earth and the other should read 240V (being L3) to earth. Between the 2 phases there will be 415V (or possibly up to 5% more, due to an unloaded condition).

If L2 is connected, one leg will read approx 360V to earth and some minor changes will need to be made to correct this:
Suggestion 1; swap the control circuit supply wire in the control panel to the correct phase.
Suggestion 2; rotate phases on the machines supply plug or connection box to establish the correct voltages on the control circuit. Use multimeter voltage check to confirm.

Test the machine; Once all of the above is OK, quickly pulse the motor on and off to check direction. If correct the installation is now complete. If the motor direction needs changing, swap supply phases L1 / Red and L3 / Blue ONLY. This will reverse the motor direction, while keeping the control circuit phase connections still correct. Swapping phases at the machines supply will change the direction of all motors or individual motors can be changed at their control contactor or overload.

3 Phase 4 Wire (plus earth), with Neutral:

All 3 phase machines that also require a neutral connection, have one thing in common – there is 240V load(s) associated with that machine. It may be a control circuit, lighting, heating element, smaller single phase motor, solenoid etc.

What you must do is determine that the single phase load(s) are and ensure that the active associated with that load is supplied by L3 / Blue wire from the converter. As explained previously, this is the only phase that has a 240V reference to neutral (& earth).

If the wrong phase is connected, the supply voltage to the single phase load(s) will be low (approx 170V for L1) or high (approx 360V for L2). The machine will probably not function correctly and in extreme cases damage may occur to either the machine or to the converter.

Suggested checking method;

- Apply power to the machine, but leave the main switch or circuit breaker on the machine turned off.
- Use a multimeter to identify which phase is which. As stated previously, L1 to N or earth will be approx 170V, L2 to N or earth will be approx 360V and L3 to N or earth will 240V
- Once you know the phase connections coming in, switch off the converter and trace the machines wires to ensure any 240V loads are connected between L3 / Blue phase and Neutral ONLY.

Test the Machine: Once all the above is OK, pulse the motor on and off to determine motor direction. If correct, installation is complete. If the motor direction needs changing, swap L1 / red phase and L2 / white phase ONLY. This will change the motor(s) direction, while still keeping the control circuit and other single phase loads on the correct L3 phase. Swapping L1 & L2 at the machine supply will change the direction of all motors, while individual motors can be changed at the associated motor contactor or overload.

The most common single phase 240V load on a machine is a control transformer, however it is possible (in very few cases) to have a 415V control circuit while still having other single phase 240V loads on the machine. In this situation, you will need to take extra special care, when checking out the machine connections. A competent controls electrician is highly recommended.

Welders:

Provided the correct sized converter is selected, most 3 phase welders work extremely when powered by a Phase-Changer. 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.

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. If this is happening a lot while welding, you may well be welding at high currents nearer the limit of the converters output capability. In very few cases and as an added feature in the Phase-Changer, the hard start feature may be desensitised by removing a link LK1 on the top board of the microprocessor controller. As an option we can fit a selector switch to the outside of the converter for multiple applications where the two levels of sensitivity can be selected simply.

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 determined and you must then confirm with our factory before proceeding. 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 of two wires only, in the case of a 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 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.

4. Converter Operation

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.

In standard form the Phase-Changer is not fitted with power switch. For these models simply turn power on at the supply circuit breaker or on another separate external power switch that has been installed by your electrician.

Phase-Changers from 8KW upwards are also fitted with a delayed start contactor also. This contactor is controlled by the microprocessor controller and ensures that the pilot motor has stopped rotating before allowing the converter to start or restart. During a normal start there will be a few seconds delay once power is applied before the converter actually starts. In the event of a brown out or other short term power loss, the converter will shut down completely and wait until the start conditions are safe before automatically restarting the converter. Depending on the size of the converter, the restart may take anywhere from 10 seconds to a minute.

All Phase-Changers are fitted with a delayed output contactor that connects the load to the converter several seconds after the converter has started. This prevents failed starts due to loads being connected to the machine at the same time that the converter is attempting to start. This is also for applications like compressors, with the internal load contactor replacing the need for an external timer and motor contactor which is usually required with other converter manufacturers installations.

There is no overload protection fitted inside the Phase-Changer. Simply selecting the correct size supply circuit breaker, as detailed in the previous table, at the time of installation will provide overall overload protection. We always recommend that individual machines are separately protected by the correct sized 3 phase circuit breaker or fuses, in exactly the same way as a normal utility 3 phase installation.

4. Phase-Changer Options

- Delayed Start; standard on 8KW plus converters as detailed above. Does provide addition protection to the converter from power disturbances etc. Can be fitted to smaller converters, usually with either the on/off switch or manual/off/automatic switch as detailed below.
- On/Off switch on converter; for starting and stoping the converter locally. Requires delayed start option as detailed above.
- Manual/Off/Automatic switch; 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 start the converter which in turn provides the 3 phase power back to the machine.

5. Service

Phase-Changer Converters are designed for long life operation. Other than an electric motor, there are no moving parts in your Phase-Changer Converter. Regular servicing is not required.

6. Warranty

Three year ‘back to base’ from invoice date. Includes parts and labour, but excludes transport charges.

7. Phase-Changer Controller

The controller is installed inside the power converter and does not need to be viewed for normal operation.

The electronics module within the power converter has six indicator lamps. These are labelled **POWER, TRACK, RUN1, RUN2, RUN3** and **START.**

The Yellow POWER lamp

The **POWER** lamp indicates that the mains supply is presently connected to the system. This is a safety indicator. No maintenance should be carried out on a converter unit while this lamp is ON

The Red TRACK lamp

The **TRACK** lamp performs two functions:

1. If the power converter is fitted with a START contactor, there will be a settling delay between the time that power is switched to the converter and when it actually starts up. This delay is usually 5 seconds, but it may be longer if the converter motor is still spinning from a previous operation. The red TRACK lamp will flash rapidly during this period to indicate that the start up timer is active.

2. Whenever the converter is running, the electronics manages the output voltage of the converter by switching banks of capacitors in or out as required. When the TRACK lamp comes ON it indicates that the output is presently balanced and stable.

   When the TRACK lamp is OFF, the electronics is actively trying to balance the converter output. (the green capacitor lamps are usually active at this time)

   Note that when the converter is running with no load connected, it is common for the red tracking lamp to remain OFF.

The Green CAPACITOR lamps

There are FOUR green capacitor lamps labelled CS, R1, R2, R3. These indicate when output balancing capacitors are being engaged. When the converter is first activated all four lamps will pulse briefly to assist with the motor start.

When a load is applied to the converter the three capacitor lamps (R1, R2, R3) will be operated in a binary sequence until an appropriate combination of balancing capacitors have been selected to match the present load. (whereupon the TRACK lamp is activated)

When a load is disconnected from the converter, the binary sequence is reversed until all three RUN lamps are extinguished.

Occasionally, when a very large load is first connected, the converter may briefly enter a 'boost' mode where all four green lamps will briefly pulse in order to help satisfy a peak demand of power. After the boost event has concluded, the R1,R2,R3 lamps will return to a stable combination.

The exact combination of lamps that are apparent for any given load is not important. Like a cruise control in a car, the converter will adjust itself to an optimum setting. The green lamp activity is simply an indicator that the converter is coping with the present load.