

# ***REDFERN Radio***

## ***POWER CONVERSION***



## **Phase Converter**

**230 V AC Single Phase to 390/440 V 3 Phase**

**for 3 phase motors from .5 to 4 HP (in three switched ranges)**

- .. Low cost alternative allowing three phase motor operation without the expense of installing three phase power in small light industrial and rural situations.
- .. These units can provide three phase power from a single phase supply for portable machines.
- .. Three phase motors are more efficient than single phase motors and a wider range in size/power is available.
- .. With the close down of much industry over 12 years a wide range of 3 phase motors are available at low cost.

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## DESCRIPTION

Phase converters are a proven "old technology", in fact the first patent was taken out in 1898. They are widely used in urban and rural America where three phase power is very expensive. They are used in Europe and Australia.

In the USA phase converters have been built up to 100HP rating. In New Zealand, single phase 230 V supplies are generally limited to a maximum of 70 Amps, i.e. about 16kVA or approx. 20 HP. At that point three phase mains supply is installed.

The REDFERN PHASE CONVERTER is built entirely from passive components. There are NO ELECTRONICS in the units and this simplicity means a long service-free life. Servicing is infrequent and usually consists of replacing worn contactors about every ten years. This can be carried out by electricians without specialised electronic knowledge.

The REDFERN PHASE CONVERTER is very energy efficient, about 90 %, so little internal heat is generated.

There are electronic variable speed inverter drives available which produce a three phase output from a single phase supply, these are limited in power, complex, need specialist servicing, and expensive. Unless the variable speed facility is important the REDFERN CONVERTER is the preferred option. The REDFERN CONVERTER is for fixed speed motors.

## APPLICATION

The phase converter can not produce three phase power on its own. A motor must be connected. The converter is basically a device which produces an artificial third phase allowing the motor to start. Once the motor starts, its 120 Deg spaced windings act as a three phase generator and motor by magnetic induction effectively producing its own three phase. But to maintain operation the artificial third phase circuit must be sustained.

The three phase output is a three wire system, i.e. there is no neutral. This is important. The single phase NEUTRAL IS NOT A NEUTRAL for the three phase motor.

Motor connections. Most three phase motors are delta connected which suits the phase converter. A star connection with NO NEUTRAL can be used.

Phase Voltage balance is not as good as true mains supplied three phase but is adequate for motor operation. The balance between phase voltages varies with motor loading. The unbalance at worst is about 15%. If the motor is stalled the artificial phase will collapse.

## WIRING & TESTING FOR SINGLE MOTOR

Read general instructions. Fit HPM socket if used, wire this to the top 400 V terminal group. Make L1 the blue phase. Wire the motor into an HPM matching plug. If an HPM socket is not used, wire the motor directly to the 400 V terminal group.

If remote starting is used, wire twin cable through the remote start grommet into the R1 R2 terminals at the right hand side of cabinet - Wire in 230V mains cable, mains end requires 15/20Amp three pin plug. Check wiring earthing of motor etc.

**TESTING** Make sure power on switch is off and remote switch (if used) is off. Set the MOTOR POWER RANGE switch to the power band setting for the motor name plate rating. Set the start switch to low (normal). Turn on circuit breaker. Live mains, press the reset switch. Turn on the power switch. The motor should start, if using remote then turn this switch on to start the motor. If rotation is wrong, turn off and reverse red and yellow motor phase wires. The motor can now be loaded and start tested on load. If heavy load starting is sluggish try putting the set start switch to high. This completes testing.

**WIRING AND TESTING FOR MULTI MOTOR.** Follow the motor selection described in general instructions (2). The main motor is started directly from the converter. Use a remote switch for this. The other motors can have DOL starting switches fitted or even ordinary three phase switches. Set the MOTOR POWER RANGE Switch to the power band setting for the group.

**TESTING.** The main (largest) motor must be started first before the other motors are started even if the machine this motor runs is not being used. Each individual motor can be load tested etc. The main motor can be switched off provided one of the other motors is running. If this is done the main motor may not be able to restart if switched on again and the whole system will fail ("crash") - Turn off the phase converter and restart the system again. Anyone using the multi motor set up will soon adapt to its peculiarities. A crash may trip the circuit breaker.

**WIRING AND TEST FOR ROTARY PHASE CONVERTER.** Read general instructions (2) covering rotary phase converter mode. Select suitable rotary or spinner motor, protect shaft of this motor. The wiring instructions are the same as for multi motor operation but wire the spinner to the bottom three phase terminal group.

With the rotary system the MOTOR POWER RANGE switch can be set to a lower power band which should be selected when testing. The B setting may be adequate but load and starting tests on the other motors should be tried on site. When starting the system the spinner must be started first.

**WARNING TO USERS.** DO NOT ALTER THE MOTOR POWER RANGE SWITCH WHEN THE MOTOR IS RUNNING. THIS COULD DAMAGE THE MOTOR WINDINGS.



Under normal loaded operation the phase balance is better than 7.5%. Voltage regulation of the three phase motor voltage is higher at no load, and drops as load is increased to full load.

**SINGLE MOTOR OPERATION** The phase converter can be used to run a single motor. With single motor operation a normal three phase DOL starting switch cannot be used. Instead the starting switch on the converter must be used. (This switch can be remote at the motor location) see installation instructions.

**MAINS FAIL LOCK OUT** If mains fails, the motor can only be restarted by the Power Fail Reset Button.

**MULTIPLE MOTOR OPERATION** Several motors can be operated together, in fact this improves performance. The largest motor should not exceed 50% of the power setting of the converter. Note the largest motor which CANNOT USE A DOL STARTER should be started first with the phase converter starting switch and left idling on no load. The other motors can use normal DOL starters.

**ROTARY PHASE CONVERTER OPERATION** For fixed workshop installation this is the preferred system, and in fact all large installations use this method. It gives better voltage balance, better starting of multiple motors, better on load starting etc. Also it is possible for some non-motor three phase loads such as rectifiers to be used.

The REDFERN PHASE CONVERTER is configured for rotary operation. The rotary system has a permanent idler motor connected to the three phase output. In the USA special idler motors are manufactured. This is not necessary. The idler should be a three phase motor of the full hp rating of the converter. A second hand motor with good quality ball bearings should be used. A two pole 2800 RPM is preferred, but a 1400 RPM is satisfactory. For safety the idler motor shaft should be cut off or protected. The idler is started by the phase converter and left permanently operating. This motor acts as spinning reserve to start other motors via DOL starters, its flywheel action transfers power to start other heavily loaded motors. The spinner power consumption is very low. With a spinner the maximum power rating of the overall system is increased.

**MOTOR LOAD** with a spinner the total power rating of the active motors should not exceed that of the spinner.