PHASEMAKER

PHASEMAKER ROTARY CONVERTERS

General Manual

Contents

FORWARD

Thank you for purchasing the PhaseMaker Rotary Converter. It is suitable for general purpose machines.

Please keep this user's manual in good condition, for it will be helpful for repair, maintenance, and applications in the future.

WHAT IS THE PHASEMAKER ROTARY CONVERTER?

Three-phase motors are common for industrial grade tools, as they are more efficient than their single-phase counterparts. Sometimes you may find yourself in need of using a three-phase tool, but you only have a single phase (240 volts) power supply available. To operate a three-phase motor on a single-phase power supply, an artificial three phase system is needed. An approach could be the use of a rotary phase converter.

The phase converter will artificially generate the third leg of a three-phase system from the two lines of a single-phase supply. As a result, the generated three-phase supply depends on the level of the available single phase. For example, if the supply is 240 volts, it generates three-phase close to 240 volts, if it is 415 volts, it generates three-phase close to 415 volts. In some of our products, we use step-up transformers to shift the output voltage from 240 volts to 415 volts.

Table below illustrates some of these converters.

Application / Suitable Unit	VSD, VFD, Inverter (Single Phase 240V to Three Phase 240V)	Boosted Voltage VSD (240V Input to 415V Three Phase Output)	Integrated VSD, VFD (240V Input to 415V Three Phase Output)	Static Converter	Rotary Converter	Sinusoidal Three Phase AC Supply	Sinusoidal Three Phase AC Supply with Soft Starter Facility
Contol Speed Possibility for Motor	YES	YES	YES	NO	NO	YES (Optional)	YES (Optional)
Motor (Directly coupled/hardwired motor) with 240V STAR / 415V DELTA Configuration	YES	YES	YES	Yes, ONLY 240V unit (For start and run systems only. No frequent start/stop or reversing possible)	YES	YES	YES
Motor (Directly coupled/hardwired motor) with fixed configuration. No STAR/DELTA connection possible	NO	YES	YES	Yes, ONLY 415V unit (For start and run systems only. No frequent start/stop or reversing possible)	YES	YES	YES
Double Speed Motors	Yes (ONLY if one speed is selected)	Yes (ONLY if one speed is selected)	Yes (ONLY if one speed is selected)	NO	YES	YES	YES
Systems with Start/Stop Contactor	NO	NO	NO	NO	YES	YES	YES
Systems with Multiple Motors	NO	NO	NO	NO	YES	YES	YES
Systems with Electronics control (Not Voltage Sensitive)	NO	NO	NO	NO	YES	YES	YES
Systems with Electronics control (Voltage level variation Sensitive)	NO	NO	NO	NO	NO	YES	YES
Systems with Soft Starters	NO	NO	NO	NO	NO/YES (Depends on type of Soft Starter)	YES	YES
Systems with Speed Control	NO	NO	NO	NO	NO	YES	YES
Good Efficiency	YES	YES	YES	NO	NO	YES	YES
Low Running Power Consumption	YES	YES	YES	NO	NO	YES	YES
Advanced Technology	YES	YES	YES	NO	NO	YES	YES

Figure 1: Suitability of our range of products for different applications.

The two converters which will be discussed in more details are Static phase converter and Rotary phase converter.

PhaseMaker Rotary Converters Single Phase 240V to Three Phase 415V ±10%

Static Phase Converter

To generate a three-phase waveform, one may consider a Static converter for running a three-phase motor. Phase converters are the economical option. However, power quality is often compromised with poor voltage balancing. Therefore, for most equipment loads, an oversize converter must be specified to enable the motor start up. In other words, this type of converter is the cheapest solution (if suitable) but with the least efficiency. These inefficiencies lead to an increased energy consumption and eventually may cause damage to the three-phase equipment, especially digital or electronic machinery.

We should also remember that this type of converter has a problem of providing an unbalanced three-phase output. Balance of the three-phase generated output is very much load dependent. It is extremely difficult to tune a static phase converter for a wide range of applications.

Rotary Phase Converter

These types of converters are a combination of static phase converters, idler motors, transformers, controlling circuits as well as other accessory systems. The rotary converter is an additional motor in the circuit which is acting as a three-phase generator. With the rotary converter, the idler motor is under no physical load, but it cleans up the generated signal.

As compared to the static phase converter, the output of the rotary phase converter is closer to being a true three-phase source. This product provides more power to the tool motor, and it also brings the motor speed much faster to the required speed.

The rotary phase converter is best served when you need the full power of the motor with frequent Start/ Stop functionality. Furthermore, a single rotary converter can drive several different three-phase motors, smaller than the idler motor. This means a decision must be made with the required power which commands the size of the idler motor, as the idler motor needs to be larger than the largest motor which will be operated at a time.

Important points to note:

The run capacitor of a converter has a fixed value, and as a result the power quality is very much load dependent and only acceptable at one specific load condition. As a result, in any other load conditions, the output symmetry of the three phases will become less perfect.

Manufacturers usually compensate for this mismatch by using a larger frame size in a rotary phase converter. For example, if the internal motor used is 10-20 times bigger than the largest external motor, the output symmetry would not be affected much, whether a load is connected or not, but this will cost a compromise on other disadvantages such as the larger size, greater weight, less efficiency, higher starting currents, and higher overall running cost.

Following figure illustrates different sizes of our rotary converters, their technical specifications and highest matched motor (HP).

Phase Maker Rotary Converter	Rated Output (HP)	Rated Output (kW)	Max Actual 3 Phase Motor Current (Per Phase) (A)	Supply Input Current (240V) (A)	Main Circuit Breaker On Single Phase
RC1	1.0	0.75	1.70	4	Suitable Main Circuit Breaker (MCC) should be chosen based on the Supply Input Current Rating of the system.
RC2	2.0	1.50	3.20	8	
RC3	3.0	2.20	4.50	12	
RC4	4.0	3.00	6.00	16	
RC5	5.0	3.80	7.20	20	
RC6	6.0	4.50	8.30	24	
RC7	7.0	5.30	9.50	28	
RC8	8.0	6.00	11.00	32	
RC9	9.0	6.80	12.50	36	
RC10	10.0	7.50	14.00	40	
RC11	11.0	8.30	15.00	44	
RC12	12.0	9.00	16.20	47	
RC13	13.0	9.70	17.30	51	
RC14	14.0	10.50	18.50	55	
RC15	15.0	11.20	20.00	59	
RC16	16.0	12.00	21.50	63	
RC17	17.0	12.70	23.00	67	
RC18	18.0	13.50	24.50	71	
RC19	19.0	14.20	26.00	74	
RC20	20.0	15.00	27.50	79	

Figure 2: Technical Specifications of PhaseMaker Rotary Converters

Note 1: We also have Rotary Converters for Two Lines (Line to Line) 415 V as well as 480 V which can be custom designed

Note 2: If your Motor is overloaded above the mentioned current rating (in the table) you may need the next bigger size RC

Note 3: Your selection of suitable RC may be based on the maximum current requirement of your system (including in-rush current)

Note 4: For systems with more than one motor please contact us for suitable selection

INSPECTION AND SAFETY PRECAUTIONS

Converters have been tested and inspected before leaving the manufacturer. Before unpacking the product, please check if its package is damaged due to careless transportation, and if the specifications and type of the product complies with the order. Inspection After Unpacking

- Inspect that the contents are complete: one unit of converter, an idler motor and one operation manual.

Safety Precautions

- Never connect the A.C. power supply to the output terminals of the converter.
- Fix and lock the panel before supplying power to avoid the danger caused by the poor capacity or other components inside the converter.
- After the power supply is switched on, do not perform wiring or check, etc.
- Do not touch the circuit boards or its parts or components in the converter when it is power, to avoid danger of electric shock.
- If the power supply is switched off, do not touch the PCB or other parts inside the converter within 15 minutes after the keyboard indicator lamp goes off, and you may check by using the instrument that the converter has completely discharged all its capacity before you start to work inside the converter. Otherwise, there will be the danger of electric shock.
- Fix the earthing of the supply to the metal box of the converter controller box as well as to the earth terminal of the motor. Please ensure that the earthing connections have been grounded correctly and securely according to the national electrical safety specifications and other applicable standards.

Note:

Only well-trained personnel should shouse this unit, and such personnel must read through the parts of this manual relating to the safety, installation, operation, and maintenance before using the unit. The safe operation of this unit depends on correct transport, installation, operation, and maintenance!

Condition of Use

1. Ambient temperature -10° C ~ 40° C.
2. Avoid electromagnetic interference and keep the unit away from the interference source.
3. Prevent dropping water, steam, dust, powder, cotton fiber, or fine metal powder from entering the unit.
4. Prevent oil, salt, or corrosive gas from entering the unit.
5. Avoid vibration.
6. Avoid high temperature and moisture and avoid being wetted due to raining, with the humidity below 90% RH (not dewing).
7. Prohibit the use in the dangerous environment where inflammable or combustible or explosive gas, liquid or solid exists.

INSTALLATION

Connection Precautions

- To disassemble or replace the motor, the input power supply must be turned off for the converter.
- Do not drop metal scrap, foam, or lint into the converter, otherwise the machine will be faulted.
- The motor or power supply can be switched ON/OFF only after the converter stops its output.
- Do not connect A.C. input power to the output terminals U, V, W of the converter.
- To prevent unexpected accidents, earthing terminal E or must be grounded to the earth securely (the grounding resistance should be below 100 Ω). The cable size should be greater than half of below – mentioned corresponding cable size; otherwise, current leakage will happen possibly.
- For wiring of the main circuit, please refer to the national rules.
- Capacity of the motor should be equal to or smaller than that of the converter.
- Specification of MCCP electric cable and contractor should follow the safe operation of the system on the load.

Connection Diagram

Below you may find the circuit diagram of the rotary converter.

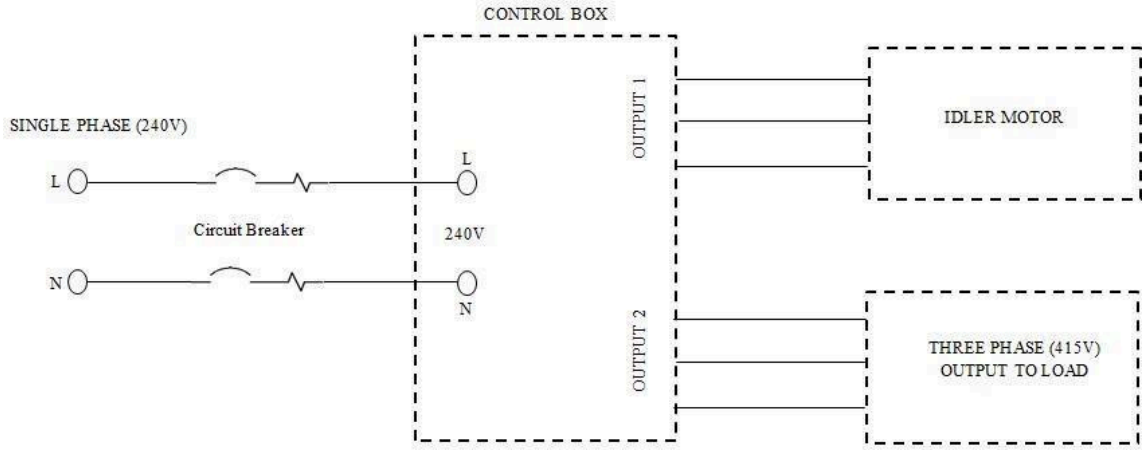

Figure 4: Rotary phase converter connection diagram

Figure 5 illustrates the connection of load, idler motor, and power supply to the controller of the rotary phase converter.

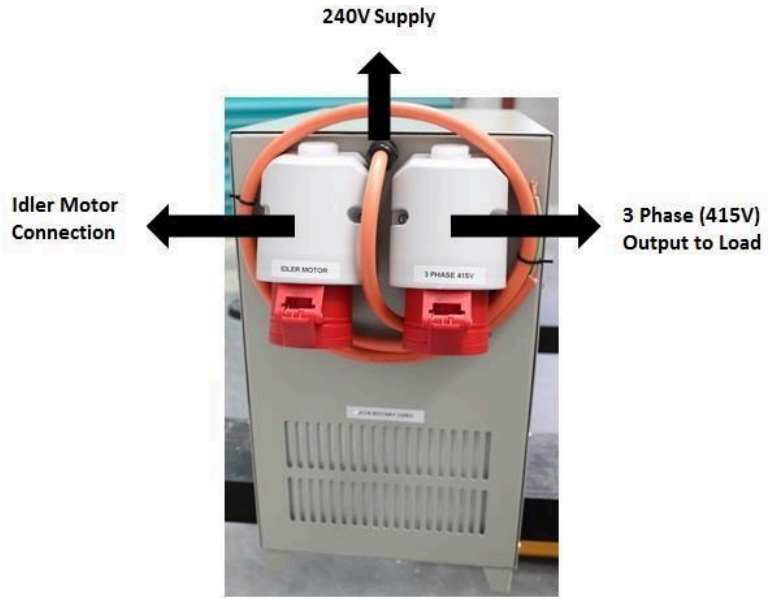

Figure 5: Power supply connection, idler motor connection and output to load connection of the rotary phase converter.

STARTING CIRCUIT

The simplest method for engaging the starting circuit is to press the starting push button (GREEN) and releasing it after the motor is up to speed. With this, the start circuit is only engaged for as long as you hold the push button down. If the push button is released too soon, before the motor gets up to the speed, it may result in high currents flowing through the motor unless it is again pressed. And if the push button were not released on time, currents would again be high after the motor gets up to speed. The purpose of the starting circuit is just to get the motor up to speed as fast as possible. The longer it takes to get the motor up to speed, the longer high currents will be present in the motor's windings. In case the push button fails or there is a fault in the starting system that causes the failure of the motor to start within a few seconds, the motor will experience excessively high currents in its winding and/or abnormal motor operation. In such cases, immediately stop the power supply and contact the manufacturer.

How to turn "ON" the Rotary Converter (RC1 to RC10)

1) Plug in the IDLER MOTOR to the corresponding socket.
   Note: Please ensure that the idler motor is connected to the controller via the supplied plug. To avoid loose contact ensure that the plugs are inserted completely in the sockets. If the idler motor is not connected to the controller at the starting time, the controller may be damaged.
2) Turn "ON" the 240V input POWER SUPPLY. You will see the input and/or output displays on the Rotary Converter (RC) Controller are turned ON. This shows that the system is now ready to run.
3) Push and hold the "START" or "ON" push button for a few seconds on the RC controller, till the idler motor runs smoothly at full speed. This may only take up to 3 seconds.
   Note: If the Idler motor does not run normally after 4-5 seconds, please turn OFF the unit.
4) Once the idler motor runs smoothly, you should have 3-phase power at the output/load socket.
5) Please ensure that your LOAD is switched OFF.
6) Plug in the LOAD to the corresponding socket.

7) Turn ON the LOAD and observe the normal operation.
8) If your machine does not turn on or you hear chattering Noise:
   - STOP
   - Turn LOAD OFF
   - Rotate the wiring connection of the LOAD plug for one full sequence:
     - Wire in L1 should go to L2
     - Wire in L2 should go to L3
     - Wire in L3 should go to L1
   - Start your Rotary Converter as instructed above. If the problem still exists please contact us.

NOTE:

For load motors bigger than 3.5 kW, in some cases a soft starter may be required.

How to Turn "ON" the Rotary Converter (RC10 and larger)

1) Please ensure that your LOAD is switched OFF.
2) Plug in the IDLER MOTOR and LOAD to the corresponding sockets.
   Note: Please ensure that the idler motor is connected to the controller via the supplied plug. To avoid loose contact ensure that the plugs are inserted completely in the sockets. If the idler motor is not connected to the controller at the starting time, the controller may be damaged.

3) Check to ensure that the LOAD SWITCH, located at the back of the controller, is "OFF".
4) Turn "ON" the 240V input POWER SUPPLY. You will see the input and/or output displays on the Rotary Converter (RC) Controller are turned ON. This shows that the system is now ready to run.

5) Push and hold the “START” or “ON” push button for a few seconds on the RC controller, till the idler motor runs smoothly at full speed. This may only take up to 3 seconds.
   Note: If the Idler motor does not run normally after 4-5 seconds, please turn OFF the unit
6) Once the idler motor runs smoothly, you can turn “ON” the LOAD SWITCH.
7) At this stage, you should have 3-phase power at the output/load socket. You can turn “ON” the LOAD and run your machine.
   NOTE: If your machine does not turn on or you hear chattering Noise:
   - STOP
   - Turn LOAD SWITCH “OFF”
   - Rotate the wiring connection of the LOAD plug for one full sequence:
     - Wire in L1 should go to L2
     - Wire in L2 should go to L3
     - Wire in L3 should go to L1
   - Start your Rotary Converter as instructed above. If the problem still exists please contact us.
8) Turn ON the load switch and observe the normal running load.

NOTE:

For load motors bigger than 3.5 kW, in some cases a soft starter may be required.

How to Turn “OFF” the Rotary Converter

1) Turn “OFF” your machine/LOAD.
2) Turn “OFF” the LOAD SWITCH, located at the back of the RC Controller.
3) If the IDLER MOTOR is still running, push the “STOP” button in front of the RC Controller.
4) Turn “OFF” the input POWER SUPPLY.

ADDITIONAL SYSTEMS (OPTIONAL FOR INDIVIDUAL APPLICATIONS)

Once the rotary converter has started based on the steps in the above instructions, the additional optional systems can be added as follow:

SOFT STARTER

The recommended soft starter should be connected directly to the terminal of the biggest motor on the load.

How to Connect the Soft Starter

1) Open the lid of the largest load motor and unscrew the power cables connected to the U1, V1, W1 of the motor.
2) Using the above cable, connect the corresponding cables to R, S, T of the soft starter, respectively.
3) Using another cable of a suitable rating, connect the output of the soft starter, U, V, W to their corresponding U1, V1, W1 of the load motor.
4) Recheck the steps 1-3 ensuring all connections are correctly tightened and secured.

NOTE:

Please note the “Earth” and “Neutral” cables (if it is used) are properly connected to the motor and **remain** the same.

- The “Earth” and “Neutral” cables are not used in the soft starter unit/ system.
- Please do not disturb the original setting of the soft starter.

How to Run the Soft Starter

1) Once the supply power has turned “ON” the VFD will start and after a few seconds the main motor should start automatically. The delay in the starting has been programmed.
   Please note the VFD at the start should display “50.00”. In case it is different please turn the knob to maximum for display to be “50.00”.
2) Once the supply to the soft starter turns off, it displays LOW VOLTAGE, and it goes off to turn the motor off.
3) For the motors which are running in both directions (Forward (FWD) and Reverse (REV)), the jumper on the control terminals between COM and DI1, should be removed and replaced by a three-way switch. Further instructions can be provided in this case.

POWER SAVER – POWER FACTOR CORRECTION (PFC)

Power Saver, provides a better power factor correction (PFC) and hence saving on the power consumption. Power saving system is of three types, Automatic, Manual, or dedicated to the design. Designs Rotary converters and corresponding dedicated power factor correction systems.

Inbuilt Power Saver

To use the inbuilt Rotary Converter Power System:

1) Connect the idler motor to the controller
2) Turn ON the rotary converter controller, by pressing the ON button for a few seconds, till the idler motor runs smoothly.
3) Plug in the Load to the rotary converter
4) Turn ON the load
5) Switch ON the Power Saver button on the controller.
6) Run your machine as usual
7) Once you are finished, Turn OFF your machine
8) Turn OFF the power Saver
9) Turn OFF the rotary Converter.

NOTE: Please always ensure that you are turning ON the Power Saver only after you have Turned on your Machine (Load).

External Power Saver Box

For a dedicated Power Saver there is a box with 3 lead cables. This box needs to be connected to the U, V, W of the load motor.

NOTE:

- Please note that this box needs to be OFF while starting the rotary converter and the load. It needs to be turned ON only after the motor (load) is running normally.

Automatic / Manual Power Saver

Power factor correction system can be a digital (automatic) or manual (switched) system.

How to Run the Power Saver

For Power Saver and manual PFC, the following instructions should be considered:

1) Turn OFF the input Power Saver (Supply side Power Saver) and output Power Saver (Load side Power Saver)
2) Turn on the rotary converter.
3) If need be, the input power factor correction (PFCI) can be adjusted.
4) Turn ON the load. Wait till it runs normally.
5) Turn ON the output power factor correction (PFCO) and adjust according to the load.

DATA SHEET

Specifications may vary slightly from the information provided.

Product Line: PhaseMaker Rotary Converter
Model No.: RC
MCC Required: Please refer to Table 2 for more information.
Input Supply: Single Phase, 240 Volts
Output: Three Phase, 415±%10 Volts
Frequency (Hz): 50/60 Hz
Acceptable Load Types: Any light loads up to the maximum three phase as specified in Figure 2.