Kay Industries
Rotary Phase Converters

OPERATION AND INSTALLATION MANUAL

ROTARY PHASE CONVERTERS

(Models TMA, PM, AG, BC)

240 VOLTS

WARNING: To reduce the risk of injury, the user must read and understand the operator's manual before using this product.

PHASEMASTER®

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PHASEMASTER®

Section 1: Introduction and Installation Notes

HIGH VOLTAGE – Risk of Electrical Shock. This equipment is connected to line voltage that can create a potentially hazardous situation.

Your rotary phase converter has been engineered and manufactured to our standards for dependability, ease of operation, and operator safety. When properly cared for, it will give you years of rugged, trouble-free performance.

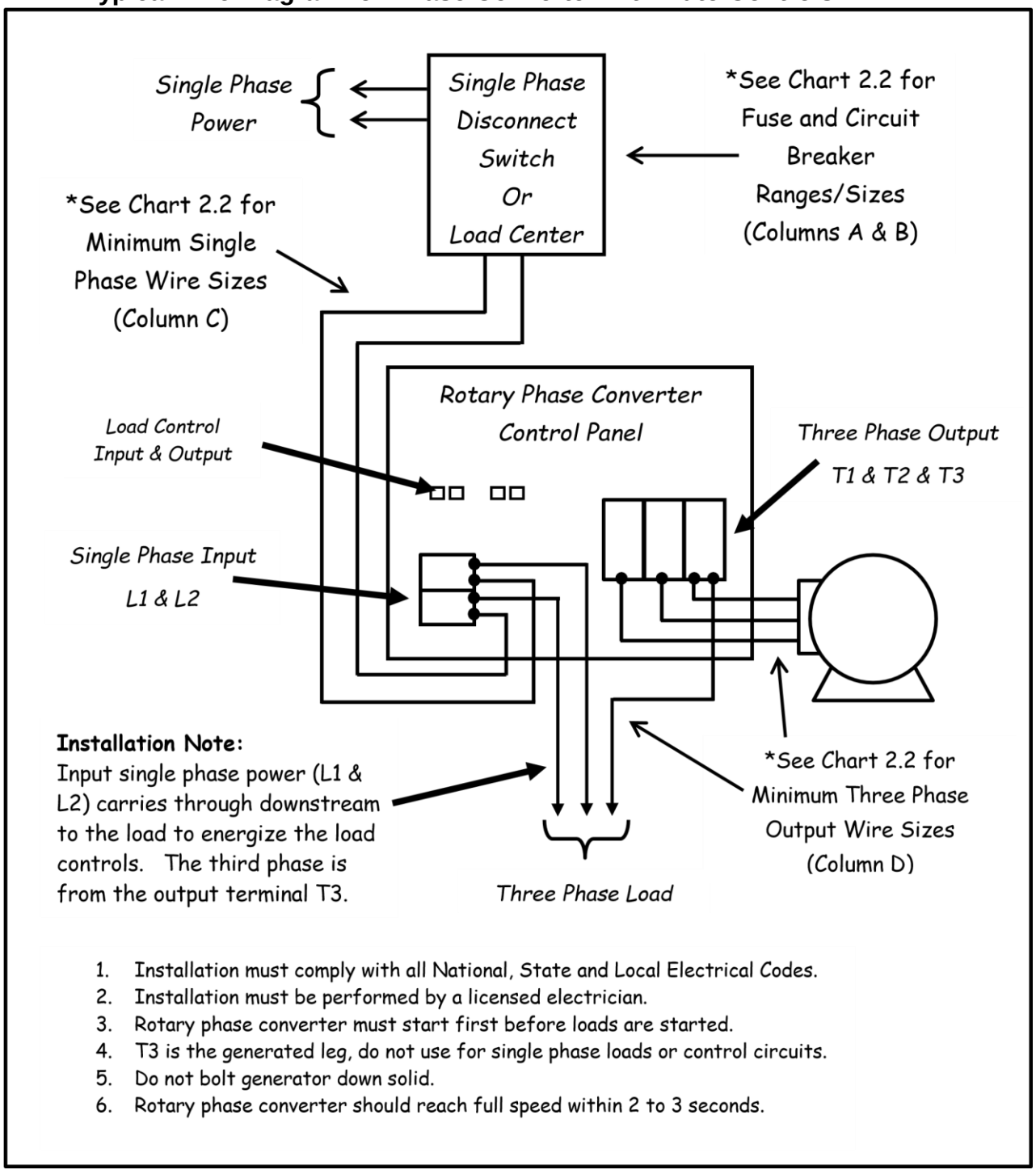
- Installation of this equipment must comply with all national, state and local electrical codes.
- Installation must be performed by qualified licensed electrician and should have experience working with this line voltage.
- Always make certain power is off before servicing this equipment.
- The input wire gauge must be sized to furnish the single-phase input current (amperage); this wire is larger than the three phase output current to the load.
- Make sure the input voltage is 208-240 before connecting.
- Do not connect control circuits to T3.
- Do not connect a ground or neutral to T3.
- All loads (including transformers) must be turned off before starting phase converter.
- Do not bolt Phasemaster® down solid. This can diminished the life of the induction generator portion of the phase converter and potentially void warranty.
- Make sure phase converter and equipment are properly grounded.

- Wire recommendations are minimums.
- Voltage drop is dependent on wire length and gauge. Increase wire one (1) additional size for every fifty (50) feet of wire run.
- Wire recommendation is based on the use of copper wire. If using aluminum wire, use the copper equivalent for current amount.
- Single phase loads must always be energized by lines L1 and L2.

SAVE THIS MANUAL FOR FUTURE REFERENCE

Section 2: Installation

2.1 Typical Line Diagram for Phase Converter with Auto Controls



1. Installation must comply with all National, State and Local Electrical Codes.
2. Installation must be performed by a licensed electrician.
3. Rotary phase converter must start first before loads are started.
4. T3 is the generated leg, do not use for single phase loads or control circuits.
5. Do not bolt generator down solid.
6. Rotary phase converter should reach full speed within 2 to 3 seconds.

2.2 Branch Circuit and Wire Sizing

Column	A	B	C	D
Phase Converter HP	***Minimum** Circuit Breaker & Fuse Size*	***Maximum** Circuit Breaker & Fuse Size*	***Minimum** Single Phase Wire Sizes*	***Minimum** Three Phase Wire Sizes*
3	*10 amps*	*20 amps*	*12 or 125% of breaker/fuse size*	*12 or based on load*
5	*20 amps*	*30 amps*	*10 or 125% of breaker/fuse size*	*12 or based on load*
7.5	*20 amps*	*40 amps*	*8 or 125% of breaker/fuse size*	*10 or based on load*
10	*30 amps*	*50 amps*	*6 or 125% of breaker/fuse size*	*10 or based on load*
15	*40 amps*	*80 amps*	*4 or 125% of breaker/fuse size*	*8 or based on load*
20	*50 amps*	*100 amps*	*2 or 125% of breaker/fuse size*	*6 or based on load*
25	*60 amps*	*125 amps*	*1/0 or 125% of breaker/fuse size*	*4 or based on load*
30	*70 amps*	*150 amps*	*2/0 or 125% of breaker/fuse size*	*2 or based on load*
40	*100 amps*	*200 amps*	*4/0 or 125% of breaker/fuse size*	*1 or based on load*
50	*125 amps*	*250 amps*	*250 MCM or 125% of breaker/fuse size*	*2/0 or based on load*
60	*150 amps*	*300 amps*	*300 MCM or 125% of breaker/fuse size*	*3/0 or based on load*
80	*175 amps*	*325 amps*	*350 MCM or 125% of breaker/fuse size*	*4/0 or based on load*
100	*200 amps*	*350 amps*	*350 MCM or 125% of breaker/fuse size*	*4/0 or based on load*

Branch Circuit (Circuit breaker and Fuse) Sizing: Your rotary phase converter has a minimum and maximum circuit range/size. Your circuit protection can be sized at the minimum, maximum or anywhere between the two amounts.

To determine your single phase branch circuit required to feed your converter and load:

- Add your total 3 phase loads together and multiply by 1.73.
  This is the amount of single phase current you will draw at full load.

This is the minimum single phase service needed to run your phase converter and loads.

However, the National Electric Code (N.E.C.) Article 455 recommends multiplying your total phase loads by 2.5.

Examples:
Total 3 phase load(s) amperage X 1.73 = Single Phase Current Draw

Total 3 phase load(s) amperage X 2.5 = **Minimum** Circuit Protection Size

Wire / Conductor Sizing: Wire sizing is extremely important in order that proper voltage may be maintained during motor start-up. The N.E.C. Article 455.6 governs the wire size of phase converters. Article 455.6 states that the input wire size shall not be less than 125% of the phase converter nameplate input full-load amperes (for variable loads) and/or not less than 250% of the sum of the full-load 3-phase current rating (for variable and fixed loads).

Minimum wire size recommendations are listed in the chart above. These wire recommendations are for wire runs of fifty (50) feet or less. Increase the wire size one (1) size for every additional fifty (50) foot run.

Note – Wire recommendations are for copper wire. If using aluminum wire, use the copper equivalent for current amount.

2.3 Wire Connection

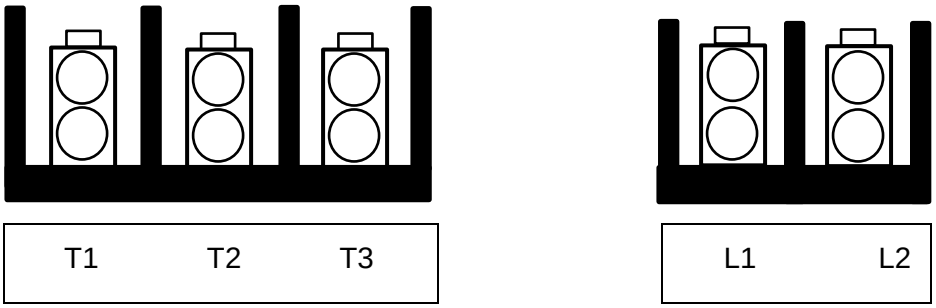
All TMA MODEL rotary phase converters are equipped with power distribution blocks for wire terminations.

Single phase **input** power connections are labeled **L1 and L2**. These terminal blocks have double lug holes to continue wiring down to your load. This assures the load always has continuous control power available.

Output *Induction generator* connections are labeled T1, T2 and T3.

T3 is the manufactured leg of power. T3 also continues down to your load

Here is an illustration of the wiring connections:



*Front view of power distribution blocks

2.4 Bolting Suggestions

*Based on 3rd party recommended of AMG Bolting Solutions.

Recommend Tightening Torque	
10 - 14 AWG	35 Lb.-in
8 AWG	**40 Lb.-in**
6 - 2/0 AWG	120 Lb.-in
1/0 - 400 MCM	**275 Lb.-in**

2.5 Switch Assembly

On the front cover of the control panel, press the “red” stop button. While doing this, look at the back side of the panel cover and note on which side the “red” tab pushes forward.

Securely push the terminal blocks into the back of switch. The “red” terminal block matches the “red” tab.

Lastly, slide the tab on top of the terminal blocks to the right (when looking at the back of the switch) to lock the switch terminal blocks into place.

2.6 Automatic Control Connections

IMPORTANT SAFETY NOTE TYPE AUTO CONTROLS CONVERTER

The L1 and L2 lines at the input terminals are always ENERGIZED regardless of whether the converter is on or off. This assures the load always has continuous control power available.

Control connections

The phase converter must be operating **before** the load can be turned on. This converter control is designed for loads that cycle automatically such as air compressors, air conditioners, pumps, etc.

To accomplish this, the converter is energized from some type of pilot switch actuator on the load machine.

Examples of this actuator are tank pressure switch on an air compressor or a float switch on a pump. These actuators simply close a contact when the load motor is called upon to run.

The Phasemaster® rotary phase converter is controlled by re-routing this actuator contact to control terminals in the converter. When the actuator contact closes it starts the converter and simultaneously energizes a timing relay that closes an output contact after a short time delay.

The output terminals from the timing relay present a dry contact to actually start the load. The time delay period is adjustable and will assure that the converter is started and 3-phase power is available at the load terminals before the load can be started.

NOTE:
Start-stop arrangements differ widely among equipment types and manufacturers. There is no single method of connecting them all. You may need to consult the control wiring diagram of your load equipment to determine the best way to inter-connect it with the converter.

There are two sets of control terminals located in the control panel.

One pair is labeled **input contact from load controller.** The other terminal pair is labeled **output contact to load controller**.

The simplest way to wire the control is to locate the two wires from the actuator switch to that are responsible for starting the load.

These leads should be extended and re-routed to the converter's input actuator and timed output contacts. #14 AWG is usually adequate size to extend the control wiring.

Two control pairs are required to make the control connections. Route the control pairs between the load and the phase converter control enclosure.

Connect one pair from the load's actuator switch to the terminals marked **INPUT CONTACT FROM LOAD CONTROLLER.**

When these terminals are jumped (auto position), the converter will start.

The actuator contacts from your pilot control (PLC, float switch, pressure switch, etc.) that turn the converter on and off must be rated for 12-240 volts.

Connect a pair of control wires from the control terminals marked **OUTPUT CONTACT TO LOAD CONTROLLER.**

This is a “dry contact” that will close when the converter is up to speed. Connect the opposite end of these wires to any point in the load controller circuit where it can act as an on-off switch.

This is usually in series with the load contactor circuit between the contactor coil and the control voltage source.

Consult the load control wiring diagram if necessary to determine the best point to break into the control circuit. The “dry contact” from the time-delay relay of the converter will now make and break the load contactor voltage as the converter is turned on and off whenever the load is called for by the load actuator switch.

After tightening all terminals and checking wiring, adjust the time-delay relay to approximately 10 seconds.

Control checkout

Start the converter and verify that the load does not become energized until after the converter has reached full speed.

If the converter does not reach full speed within five seconds, there may be problem of excessive utility line voltage drop or inadequate transformer capacity.

If the load starts before the converter reaches full speed, increase the time-delay period.

The time delay period may be adjusted to any duration as long as the converter is running prior to the load. Once the time delay relay is set up, turn off all power and replace all covers.

Section 3: Checking the Converter

3.1 Checking Single Phase Line Voltage

Measure the single phase utility input supply voltage between L1 and L2 with a voltmeter and record.

It should measure between 208 and 245 on a standard single phase system.

Note – If your input voltage is too high, you may need to install a buck-boost transformer to decrease the voltage.

Please contact Kay Industries (574) 236-6220; we carry a complete line of buck-boost transformers.

Input Voltage L1-L2 _____

3.2 Checking Three Phase Output Voltage

Start the rotary phase converter.

Press the “Green” Start push button. A light between the start and stop buttons will illuminate. The phase converter should reach full speed within 2 – 3 seconds.

Note – If the phase converter does not start in 5 seconds, turn it off.

Measure the output line-to-line voltages at the phase converter and record.

This is done by measuring between the three (3) combinations of output terminals. (T1-T2, T1-T3 and T2-T3).

Output Voltages T1-T2_____, T1-T3_____, T2-T3_____

T1-T2’s voltage should be the same or within 1-2 volts of L1-L2. T1-T3 and T2-T3 should measure 5 – 15 volts higher than T1-T2 without a load running.

Once a load is applied, these voltages will drop down closer together.

Note – If voltage is too high, capacitors can be removed. If voltage is too low, contact us. Despite being sized correctly, occasionally capacitors may be needed to increase voltage without upsizing the converter.

Note – Line–to-ground voltage are not relevant.

However, T1 and T2 should measure @120 to ground and T3 should measure between 190 and 250 when measuring to ground.

You can now start your loads.

Note – If a load motor rotates backwards, switch any two (2) connections at the load.

Section 4: Operation & Maintenance

1.1 Operation

1. A Phasemaster® rotary phase converter may operate continuously with or without a load.
2. DO NOT start the phase converter under load.
3. Wait until phase converter reaches full speed before starting loads.
4. If possible, avoid starting more than one load at the same time.
5. Turn rotary converter off if excessive noise or vibration occurs.

1.2 Maintenance

Your converter requires very little maintenance. We recommend periodic lubrication, cleaning and inspection.

Lubrication
All rotary phase converters generator bearings are pre-greased by the factory. This initial greasing generally will last the lifetime of the generator; however, a squirt of grease may be needed from time to time.

Available on our website

Cleaning and Inspection

1. Inspect the rotary converter from time to time.
2. Make sure all vents are clear and clean.
3. Clean off dust, dirt and any debris buildup on the generator. This can insulate the generator and cause overheating.
4. Open control panel and inspect power and control components.
5. Check all wires for loose connections, cuts/nicks or damage. Clean, tighten or replace if necessary.

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Since 1971, Kay Industries has been the worldwide leader in 3PH converter expertise and operational knowledge.

Thanks again for trusting Kay Industries with your application.

Should you need any assistance contact us online and https://KayInd.com, https://Phasemaster.us, or simply call us at (574) 236-6220.

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