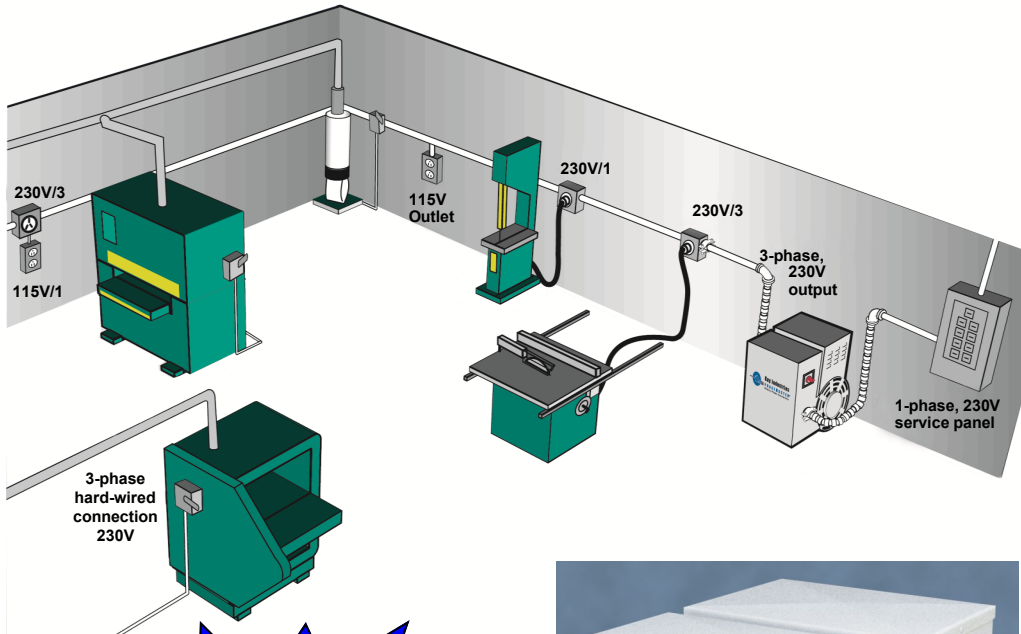


No Three-Phase Power? No Problem!



Operate any 3-phase machine or an entire shop from a 1-phase power supply with a **Phasemaster® Rotary Phase**

visit us at www.kayind.com



The LEAST expensive Alternative to utility 3-phase service

Recommended by the leading manufacturers in the woodworking industry including:

- Quiet running
- True 3-phase output
- Ideal for CNC machines
- Expert application assistance
- Will not affect your power bill
- Run all motors at full horsepower
- Highly reliable, low maintenance
- Installs in a few hours
- 5-yr warranty plus lifetime on bearings

- | | |
|----------|--------------|
| Felder | Laguna Tools |
| Multicam | Altendorf |
| Holz-Her | Sunhill |
| Mini-Max | Timesavers |
| Martin | Powermatic |
| SCM | Colonial Saw |
| Ritter | Omega |
- And many others!

Kay Industries
PHASEMASTER®
Rotary Phase Converters

WORLD LEADERS IN SINGLE TO 3-PHASE POWER CONVERSION

PROTECT YOUR MACHINERY INVESTMENT - INSIST ON PHASEMASTER

Phasemaster® rotary converters have become the standard of the woodworking industry because of their high capacity, superior engineering, and unmatched reliability. A **Phasemaster**® converter will handle any combination of woodworking machines including, edgebanders, wide belt sanders, table saws, jointers, planers, band saws, moulders, panel saws, CNC routers, dust collectors, boring machines, combination machines, lathes and many more. Visit www.kayind.com for further details.

TECHNICAL PERFORMANCE SPECIFICATIONS

Voltage Input: 208V, 230V, 460V field changeable on most non-automatic models
Voltage Output: Equals 3-phase equivalent of 1-phase input voltage
Ratings: 1-100HP single units, may be paralleled up to 500HP
% Regulation: 2-5% at full load output
Harmonic Content: <1%
Power Factor: .95 or greater at full load
Operating Efficiency: >95% at full load
Operating Reliability: MTBF 50,000 hours

Available in our low cost manual configuration or with built-in controls for faster installation and the convenience to fit your operating needs.

Type MA



Requires a field supplied disconnect switch to turn converter on and off.



The lowest cost Phasemaster® configuration. Ideal for small shops running one or two machines.

Type MA-R



Converter contains a built-in switch, power fuses, input and output terminals. Simplifies and reduces installation time.



"Two wires in, three wires out" design makes the Phasemaster Type MA-R a snap to install. Also ideal for small facilities especially when the converter is located next to the machine being operated. Just switch it on and run.

Type MA-A



Converter includes a magnetic contactor, power fuses, input and output terminals. The magnetic start feature allows the converter to be located anywhere in the facility and turned on by a remote wired pilot switch (Type MA-AW).

Type MA-VS



Converter is equipped with our specially designed Load Range Controller for CNC applications and for variable frequency drives (VDF). This enables the converter top maintain balanced output voltages over a wide load range

Made in U S A



Corporate Office
P.O. Box 1323
South Bend, IN 46624
800-348-5257 · 574-289-5932(fax)
www.kayind.com

Western Region Office
Fremont, CA
510-656-8766
info@kayind.com

PHASEMASTER® ROTARY PHASE CONVERTERS

Affordable 3-Phase Power From a Single-Phase Supply



NO 3-PHASE? NO PROBLEM!

The **Phasemaster**® rotary phase converter changes a 230 or 460 volt, 1-phase service to an equivalent 3-phase output. It will efficiently operate any 3-phase equipment from an existing 1-phase supply and will provide years of trouble-free service. The output of a **Phasemaster**® converter is just like utility 3-phase. It can power any combination of motors, heaters, rectifiers, and variable speed drives. Any machine operating on a **Phasemaster**® converter will deliver its full rated nameplate output and will perform identically as if connected to utility 3-phase, except at a fraction of the cost of a new service.



The World Leader in Single to Three-Phase Power Conversion

THE LEAST COST ALTERNATIVE TO UTILITY 3-PHASE

Kay Industries has applied the **Phasemaster**[®] converter in thousands of applications for nearly 40 years. Over 5 million horsepower of motors are now operating on **Phasemaster**[®] converters as well as 1000 radio and television stations worldwide. The reason for such broad acceptance is that a **Phasemaster**[®] converter is simply the *least expensive* way to operate 3-phase equipment wherever utility 3-phase is unavailable or too expensive to obtain. It eliminates utility charges to extend 3-phase lines. Such charges often exceed \$50,000 per mile. A converter is also much less costly than a generator or changing to 1-phase motors. Replacing motors may be a viable option up to about 3HP but above that they are very expensive and difficult to locate. It is also necessary to convert all machine controls to 1-phase: not a cheap proposition. The converter also saves the cost of a new 3-phase service panel and can be installed in a few hours compared to several weeks or even months for a new utility line extension.

THE BENEFITS OF 3-PHASE WITHOUT THE COST Most commercial machinery over a few horsepower is designed to operate on 3-phase power. That's because 3-phase motors are much less expensive, more readily available, run more efficiently, and last an average of 6-8 years longer than 1-phase motors. Similarly, 3-phase power supplies operate more efficiently and require less output filtering than their 1-phase counterparts. But these cost and performance advantages are only available to those with 3-phase service. The **Phasemaster**[®] converter effectively changes a 1-phase shop to a 3-phase location thus allowing a much wider selection of equipment for almost any application.

TRUE 3-PHASE OUTPUT WITHOUT HARMONICS The output of the **Phasemaster**[®] converter is real 3-phase 3-wire delta. Each of the phase voltages is a true sine wave separated by 120° and will deliver closely balanced currents to the load equipment. The stored energy of the unique patented construction enables it to ride through short-term line voltage transients including over-voltage spikes and the more common under-voltage sags. Further, the converter will not generate the unwanted or harmful harmonics that are characteristic of solid-state variable frequency drives or solid state converters.

NO EFFECT ON YOUR POWER BILL

The **Phasemaster**[®] converter is more than 95% efficient and **will not increase** your utility bill. All loads connected to the converter develop their full nameplate output and will consume the *same* number of kilowatt-hours of energy regardless if measured on a single or 3-phase service meter. In addition to the initial savings, a phase converter may actually reduce your utility bills by eliminating the demand charges that often apply to 3-phase services. As a further bonus, the Phasemaster converter actually buffers and soft starts all motor loads thus reducing the in-rush demand on your utility service.

THE MOST CAPACITY PER RATED HORSEPOWER

The **Phasemaster**[®] rotary phase converter family is available in ratings from 1-100 HP. Most sizes are available from stock or within a few days. It will start *any* load regardless of torque requirements or duty cycle and enables the load to develop full rated horsepower or KW output just as if running on utility 3-phase.

Phasemaster[®] converters are designed with the highest capacity and the most overload capability in the industry. All converters are conservatively rated to insure that you get the most output for your money. That means you don't have to buy a "20HP" converter to start a 10HP load as some brands require.

FEATURES UNMATCHED IN THE FIELD

- The quietest converter you can buy, thanks to our advanced construction design and workmanship
- All converters are available with a wide range of optional built-in controls
- Dual voltage 230/460 on most ratings, at no charge.
- Clearly written and easy to understand instructions assure fast installation
- CSA certification, equivalent to UL
- Contains no service prone parts such as electrolytic capacitors, relays, or centrifugal switches
- No adjustments or phase balancing are required
- And it's backed by the most comprehensive warranty and the best technical support in the industry, 24-7

Every **Phasemaster**[®] converter is operated extensively and subjected to a rigorous series of production tests and quality inspections to verify that it meets our strict performance and workmanship requirements before it is shipped to our customers. An original signed copy of that test report is packed with every unit.

YOU NEVER OUTGROW YOUR PHASEMASTER!

All **Phasemaster**[®] converters are designed to grow with your needs. That means you can order the converter you need for today's requirements without concern that it will be too small in the future. As your power needs increase, simply add another converter in parallel with the original. You are limited only by the size of your 1-phase service.



DESIGNED FOR HIGH RELIABILITY AND LOW MAINTENANCE

The **Phasemaster**[®] converter is engineered for years of worry-free performance. It is a one-piece, self-contained unit, not an “erector set” of separate capacitor panels, idler motors or other external components. Capacitors are safely isolated in a top-mounted enclosure that reduces floor space requirements and vibration. No special adjustment, tap changing or phase balancing is required. The rotor does not carry thrust loads, thus assuring maximum bearing life. **Phasemaster**[®] converters do not use electrolytic capacitors, potential relays, brushes, slip rings or other high-maintenance parts. Inspection and annual lubrication are the only maintenance procedures required. The fine workmanship is accented with a distinctive white paint finish that tells you it’s an authentic **Phasemaster**[®] converter.

INSTALLATION

A **Phasemaster**[®] converter is designed for easy installation. It does not have to be bolted down and can be quickly connected to produce 3-phase in just a few hours. Clearly written instructions explain how to size branch circuits and supply wires to assure both user safety and compliance with the National Electric Code. Converters with built-in controls also contain terminal blocks for simple “2-wires in, 3-wires out” installation convenience.

APPLICATIONS

Kay Industries has unmatched application experience. The following abbreviated list demonstrates the extraordinary versatility of **Phasemaster**[®].

Agricultural Equipment:

Dryers, augers, balers, grain drying fans, irrigation pumps

Air Conditioning & Refrigeration:

Ice makers, ice cream machines

Automotive equipment:

Hydraulic lifts, compressors, tire balancers, spray booths

Battery Chargers

Broadcast Transmitters:

AM, FM, analog and digital TV

Compressors of all types

Dryers & Kilns

Dry Cleaning & Laundry Machines

Embroidery Machines

Environmental & Soil Remediation:

Blowers, vacuums, balers, compactors, shredders

Elevators, Cranes & Hoists

Food Processing Equipment:

Ovens, mixers, grinders, graters

Heaters

Injection Molders

Machine tools:

Lathes, mills, CNC machines, EDM machines, shears, presses punches, saws & grinders

Medical & Electronic Equipment:

X-ray machines, lasers

Printing Equipment:

Presses, cutters, binders

Pumping and Irrigation:

Pivot systems, lift stations, submersible pumps

Saw Mills

Stone Saws

Welders (all types)

Woodworking Equipment:

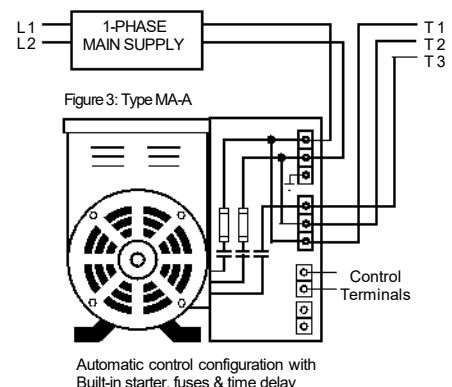
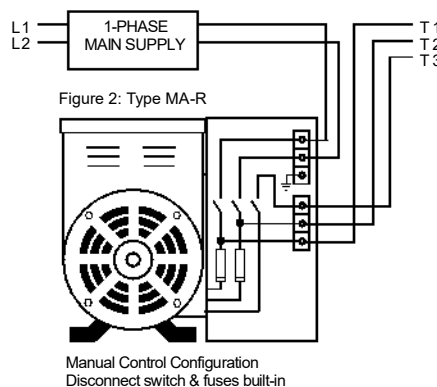
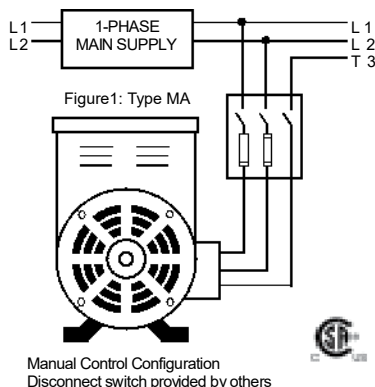
Saws, planers, shapers, dust collectors, edgebanders, lathes, routers including CNC, molders, wide belt sanders

HOW DOES A ROTARY PHASE CONVERTER WORK?

A rotary phase converter is actually a *rotating* transformer. It consists of a *stator* with three stationary primary windings and one secondary in the form of a *rotor* mounted on bearings. When the converter runs, 1-phase power is applied to one of the stationary windings. An exact copy of that applied voltage sine wave is induced in the spinning rotor. As the rotor’s magnetic field spins, it cuts across those stationary windings that were not energized from the utility line and re-induces a copy of the supply voltage. This voltage is taken out of the converter as the “manufactured” third leg. Since the rotor spins at an exact multiple of 60Hz and the three stationary windings are evenly spaced around the stator, the resulting voltages created at the converter output are shifted exactly 120°, *i.e.*, *true* 3-phase.

In a 3-phase system, the load current is distributed equally in each phase. This is the reason that motors connected to the **Phasemaster**[®] can develop full rated nameplate horsepower. However, any motor running at *less* than its full rated horsepower actually contributes its unused capacity back into the system as additional conversion capability. The in-rush and no-load idling currents of a converter are substantially lower than that of an electric motor of comparable size.

Connection Arrangements



- MA** General Purpose Converters for most motor load and heater applications
- MA-A** Same capacity as Type MA but with automatic controls for unattended or cyclical applications
- MA-R** Same capacity as Type MA but with built-in switch, fuses and terminals for fast installation and single point control
- PI** Totally enclosed converters for pivot irrigation or other severe outdoor duty applications
- T** Expressly designed for analog and digital Radio and TV Broadcast Transmitters. Refer to Kay Industries.

The table below shows typical sizing for the **TYPE MA** General Purpose **Phasemaster**. Refer to Kay Industries publication **How To Select A Phasemaster Rotary Converter** for further details on proper sizing procedures

Model No.	Largest HP	Max HP	Approx Dimensions			
			L	W	H	Wt.
SD-60	1.5	3	10	11	12	64
MA-00	2	6	10	12	14	89
MA-0	3	9	11	12	14	108
MA-1	5	15	14	14	17	204
MA-1B	7.5	22	16	17	20	261
MA-2	10	30	18	17	22	307
MA-3	15	45	20	18	26	358
MA-4	20	60	21	21	28	423
MA-5	25	75	22	21	28	487
MA-6	30	90	23	23	30	622
MA-7	40	120	24	23	30	768
MA-8	50	150	25	27	34	885
MA-9	60	180	27	27	37	923

PHASE CONVERTER ACCESSORIES

Tailor your **Phasemaster**® converter for special requirements:

Automatic Controls

Adds built-in fuses, magnetic starter, terminal blocks, and time delay relay to allow converter to be energized on demand by the load controller in unattended applications.

Primary Disconnect Switch And Fuses

Adds built-in switch, fuses and terminal blocks to speed installation and provide a single point of on-off converter control.

Outdoor Weatherproof Enclosures

Padmounted fiberglass enclosure for outdoor service. Pre-wired ventilating fans and provision for padlocking.

Reduced In-rush Current Starting

Special magnetic controls that reduce the converter starting current by 70% are "friendly" to weak utility services and limit power demand and voltage drop on the incoming service.



Type MA



Type MA-R



Type MA-A



Type PI

TECHNICAL PERFORMANCE SPECIFICATIONS

- Voltage Input: 208V, 230V, 460V field changeable on most non-automatic models
- Voltage Output: Equals 3-phase equivalent of 1-phase input voltage
- Ratings: 1-100HP single units, may be paralleled up to 500HP
- % Regulation: 2-5% at full load output
- Harmonic Content: <1%
- Power Factor: .95 or greater at full load
- Operating Efficiency: >95% at full load
- Operating Reliability: MTBF 50,000 hours

Voltage Regulation for CNC Machines

Especially designed for CNC applications and for variable frequency drives. Enables the converter to maintain balanced output voltages over a wide load range.

Lightning & Surge Protection

Built-in arrestors protect against severe line transients. Recommended for remote areas or high elevations subject to frequent electrical storms or line disturbances.

Transformers for Special Output Voltages

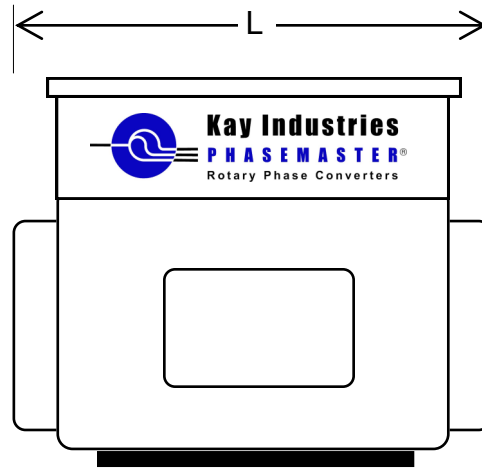
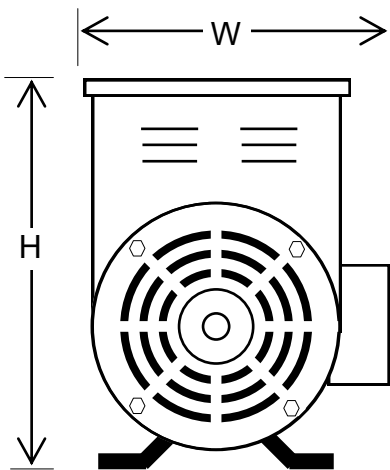
Step-Up - Used where supply voltage is 240V, 1-phase but 480V, 3-phase output is required.

Delta-Wye - To change the converter output from 3-wire delta output to 4-wire wye.

Buck-Boost - To reduce or increase input voltage by 10-15%. Change 240V supply to 208V or vice versa.

PHASEMASTER® ROTARY PHASE CONVERTER

TYPE MA



Model No.	Largest HP	Max HP	Dimensions (inches)			
			L	W	H	Wt.
SD-60	1.5	3	10	11	12	64
MA-00	2	6	10	12	14	89
MA-0	3	9	11	12	14	108
MA-1	5	15	14	14	17	204
MA-1B	7.5	22	16	17	20	261
MA-2	10	30	18	17	22	307
MA-3	15	45	20	18	26	358
MA-4	20	60	21	21	28	423
MA-5	25	75	22	21	28	487
MA-6	30	90	23	23	30	622
MA-7	40	120	24	23	30	768
MA-8	50	150	25	27	34	885
MA-9	60	180	27	27	34	923

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NOTES:

Converter requires separately mounted disconnect switch and fuses for proper installation and short circuit protection.

See Drawing 0302-MA for complete connection details including switch, fuse and feeder sizes.

Actual dimensions will not exceed those shown.



Kay Industries
PHASEMASTER®
Rotary Phase Converters

Corporate Office

PO Box 1323

South Bend, IN 46624

800-348-5257 219-289-5932 fax

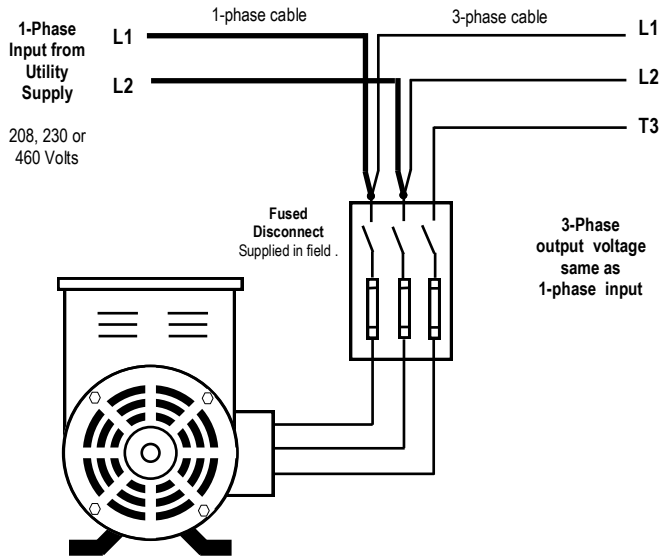
Western Region Office

Fremont, CA

510-656-8766

TYPE MA General Purpose Phasemaster Converter with Field Mounted Controls

Connection Configuration #1

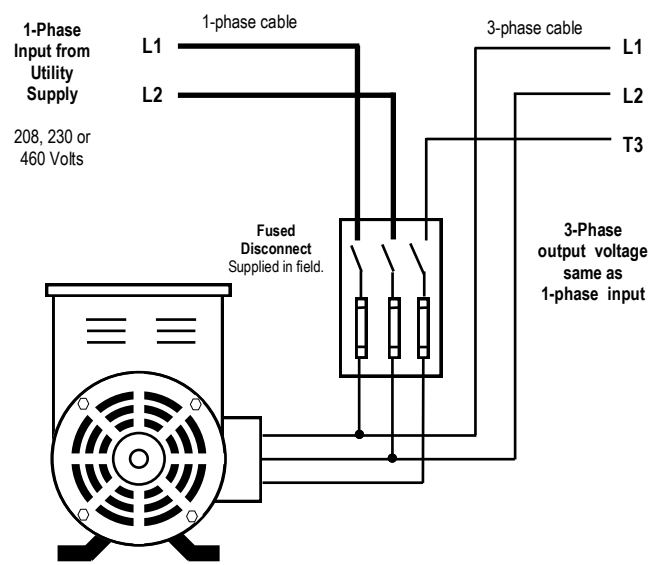


This connection arrangement allows the L1 & L2 line to remain energized regardless of whether the converter is operating. It is used where any downstream load equipment requires continuous single-phase service. The converter must be started and running to operate any 3-phase load.

Advantages: Allows continuous 1-phase service to loads that require continuous control power even when 3-phase is not required. Converter is fused separately from load thus offering better overload protection

Disadvantages: The load equipment could try to start on 1-phase if the converter is not started prior to energizing the 3-phase portion of the load.

Connection Configuration #2



The disconnect switch controls the L1-L2 input supply line to the converter and isolates those lines from the load. All three output lines are de-energized as long as the switch remains off. This control arrangement requires the disconnect switch to be sized large enough to withstand the entire 1-phase input current to the load.

Advantages: Safety. All lines de-energized when switch is open. No possibility of single-phasing load

Disadvantages: Converter must be running to power any 1-phase power or control loads. Requires larger disconnect switch and fuses than Config #1. The converter and load are group-fused and not separately

DISCONNECT SWITCH AND WIRE SIZE SELECTION CHART *

		Configuration 1							
Model No.	Start HP	230 Volts				460 Volts			
		Switch	Fuse	1-Ph Cable	3-Ph Cable	Switch	Fuse	1-Ph Cable	3-Ph Cable
SD-60	1.5	30	10	#12	#12	30	10	#12	#12
MA-00	2	30	15	10	12	30	10	12	12
MA-0	3	30	20	8	10	30	10	10	12
MA-1	5	30	30	8	10	30	15	10	12
MA-1B	7.5	60	35	6	8	30	15	8	12
MA-2	10	60	40	4	8	30	20	8	10
MA-3	15	60	60	1	6	30	30	6	10
MA-4	20	100	80	1/0	4	60	40	4	8
MA-5	25	100	100	3/0	4	60	50	2	6
MA-6	30	200	125	4/0	2	60	60	1/0	6
MA-7	40	200	150	2-1/0	1/0	100	80	2/0	4
MA-8	50	200	175	2-2/0	2/0	100	80	2/0	4
MA-9	60	200	200	2-2/0	3/0	100	100	3/0	2

DISCONNECT SWITCH AND WIRE SIZE SELECTION CHART *

		Configuration 2							
Model No.	Start HP	230 Volts				460 Volts			
		Switch	Fuse	1-Ph Cable	3-Ph Cable	Switch	Fuse	1-Ph Cable	3-Ph Cable
SD-60	1.5	30	20	#12	#12	30	10	#12	#12
MA-00	2	30	20	10	12	30	15	12	12
MA-0	3	60	30	8	10	30	20	10	12
MA-1	5	60	60	8	10	30	30	10	12
MA-1B	7.5	100	80	6	8	60	35	8	12
MA-2	10	100	80	4	8	60	40	8	10
MA-3	15	200	100	1	6	100	80	6	10
MA-4	20	200	150	1/0	4	100	80	4	8
MA-5	25	200	200	3/0	4	100	100	2	6
MA-6	30	400	250	4/0	2	200	125	1/0	6
MA-7	40	400	300	2-1/0	1/0	200	150	2/0	4
MA-8	50	400	350	2-2/0	2/0	200	175	2/0	4
MA-9	60	400	400	2-2/0	3/0	200	200	3/0	2

This table is based on utilizing the converter at approximately 150% of start rating, it is conservative and applies in 95% of all installations. For total loads exceeding 150% of start rating, contact Kay Industries.

INSTALLATION AND WIRING NOTES

1. This diagram does not replace or supersede any requirements of local, state or national electric codes.
2. Conductor sizes are based on type THHN, 90° C, copper conductors in 30° C max. ambient.
 1. Use only dual element time delay fuses to protect the phase converter.
 2. Do not bolt converter to floor. Use vibration pads supplied with unit.
 3. Do not connect control circuits to manufactured phase, T3.
 4. Increase wire size for Aluminum conductors or runs in excess of 50 feet.
 5. No-load output voltage L2-T3 will exceed L1-L2 by 12-15%. Voltages will balance when load is connected.

0302-MA

PHASEMASTER® ROTARY PHASE CONVERTER WITH BUILT-IN DISCONNECT SWITCH

TYPE MA-R

The World Leader in Single to Three-Phase Electric Power Conversion

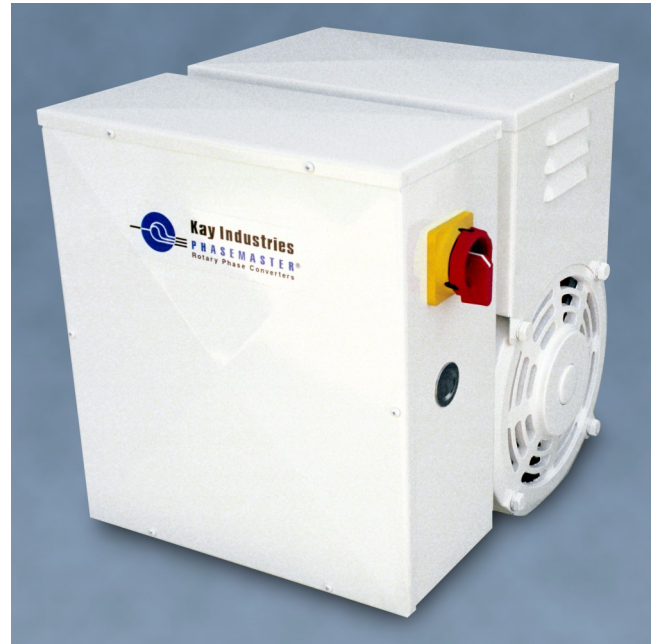
DESCRIPTION:

The PHASEMASTER Type MA-R rotary phase converter is a highly reliable source of 3-phase power from any 1-phase supply. It features a completely self-contained disconnect switch along with fuses and terminal blocks to minimize installation time and provide a safe method of electrical isolation.

When connected to a 230 volt 1-phase line, it produces a near replica of utility 3-phase at its output terminals with each phase shifted 120 degrees. The converter is ideal for applications where utility 3-phase is not available or is too expensive to obtain. It will operate ANY 3-phase load including pumps, woodworking equipment, machine tools, heaters, elevators, mixers, hoists, air conditioners, and many more. Converter system efficiency exceeds 95%.

CONSTRUCTION:

The TYPE MA-R converter is a *rotary* design which produces *true* 3-phase power at its output terminals. It is capable of starting and providing a closely balanced current into one or more motors simultaneously. In addition it features a side-mounted control panel which contains the input-output terminals, disconnect switch and fuses to protect the converter.



Model MA-1-R, 5HP converter, compact and ready to install

INSTALLATION & MAINTENANCE:

The converter can be connected to any existing 1-phase service. It is as simple as "2 wires in and 3 wires out." The converter can be installed most anywhere and does not have to be bolted down. Occasional lubrication and overall inspection are the only maintenance procedures required.

SIZING AND ORDERING INFORMATION:

The sizing tables are useful for most applications. However, motor designs and operational characteristics vary widely among manufacturers, so some motors require a larger converter. It is advisable to consult a factory representative before making a final selection. The following information is required for proper sizing:

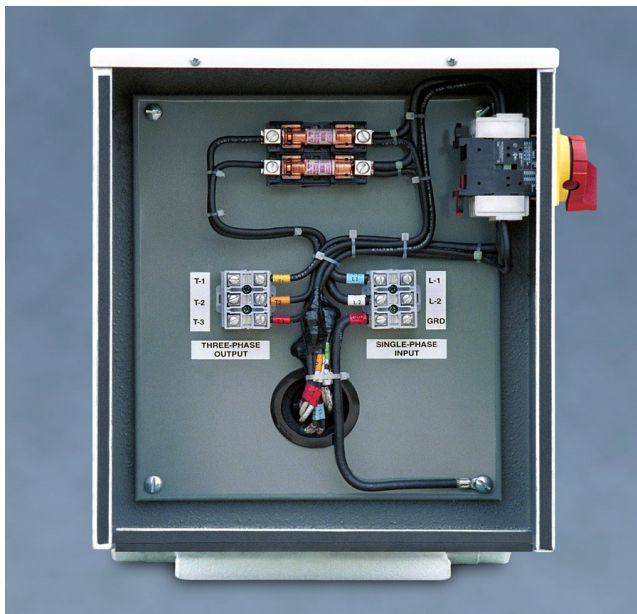
- ◆ Load equipment description and manufacturer
- ◆ HP/KW, voltage rating and motor nameplate data
- ◆ Starting load HP/KW and running load HP/KW

OUTPUT:

All units are factory wired for 230 Volts. 460 Volt units are available on request. Consult factory for 208 volt applications or for 208 volt 4-wire output.

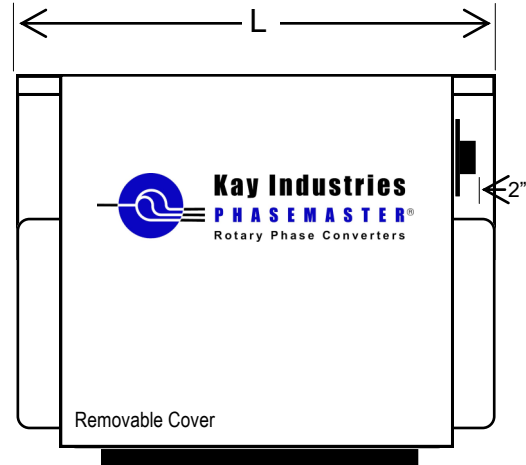
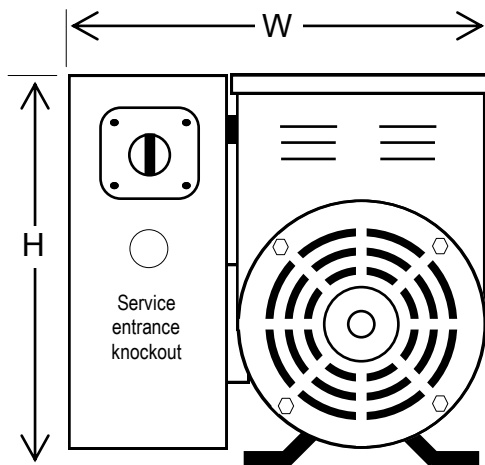
OPTIONAL EQUIPMENT:

- ◆ Enclosures for weather protection
- ◆ Step up transformers for 230-380-460 Volts

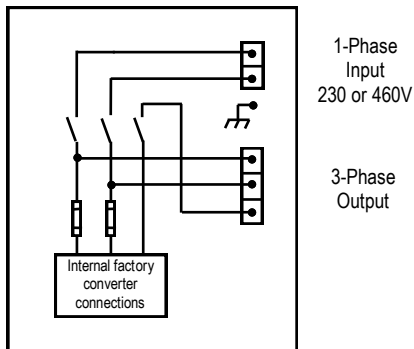


PHASEMASTER® ROTARY PHASE CONVERTER WITH BUILT-IN DISCONNECT SWITCH

TYPE MA-R



Type MA-R Connection Arrangement



No voltage is present at output terminals unless converter is operating. Output voltage is 3-phase equivalent of input

Model No.	Largest HP	Max HP	Dimensions (inches)			
			L	W	H	Wt.
SD-60-R	1.5	3	12	12	14	75
MA-00-R	2	4	12	12	15	100
MA-0-R	3	6	12	12	15	120
MA-1-R	5	15	14	17	18	225
MA-1B-R	7.5	22	17	20	22	277
MA-2-R	10	30	19	20	22	327
MA-3-R	15	45	20	22	26	444
MA-4-R	20	60	22	24	27	450
MA-5-R	25	75	25	24	27	515
MA-6-R	30	90	25	27	33	660
MA-7-R	40	120	26	27	33	805
MA-8-R	50	150	27	29	35	925
MA-9-R	60	180	30	29	35	970

GENERAL OPERATING SPECIFICATIONS:

Input Voltage: 230 or 460V single-phase, 50 or 60 Hz
 Output Voltage: 230 or 460V single-phase, 3-wire delta
 Output Regulation: 2-5% at rated output
 Harmonic Content: <1%
 Power Factor: .95 or greater at full load
 Operating Efficiency: >95% at full load
 Operating Reliability: MTBF >50,000 hours

NOTES:

- Models MA-7-R through MA-9-R available in 480V only
- Specify input voltage when ordering
- See Drawings 0302-MAR for switch, fuse and feeder sizes
- Actual dimensions will not exceed those shown.
- Input/output terminal are right side entry unless otherwise specified
- Max HP rating may vary depending type of load equipment operated

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**Single-Phase
Input from
Main Utility
Supply Panel**

208, 230 or
460 Volts

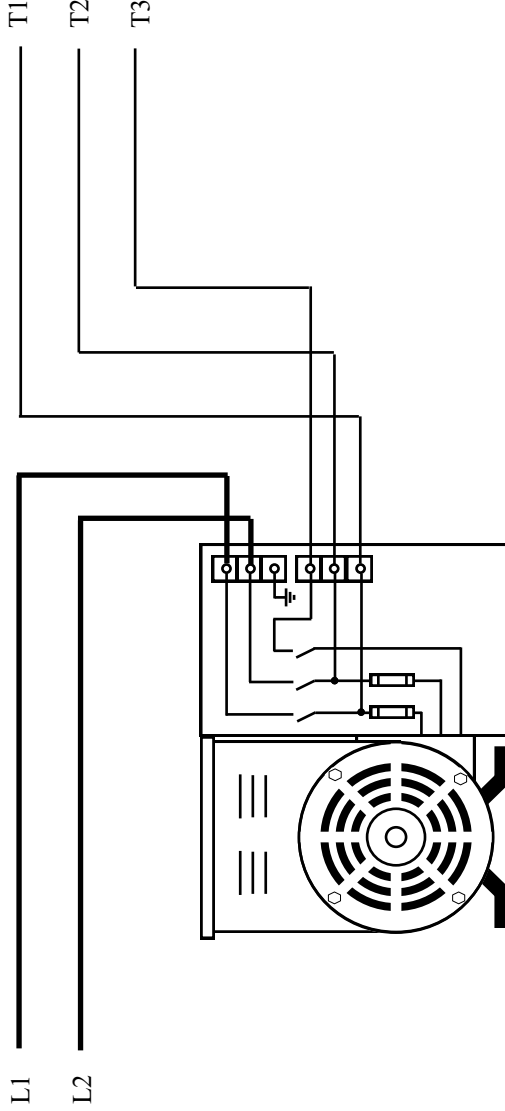
See Section III Pg 4
For Branch Circuit Sizing

Phasemaster® Type MA-R
Rotary Phase Converter
with built-in disconnect switch
and fuses

**Three-Phase
Output to
Load**

Output voltage
equals
3-phase
equivalent of
input voltage

See Note 4



WIRE SIZE SELECTION CHART

Model No.	Start HP	230 Volts			460 Volts		
		Switch* Fuse* 1-Ph Cable	3-Ph Cable	Switch* Fuse* 1-Ph Cable	3-Ph Cable	3-Ph Cable	
SD-60-R	1.5	30	#12	#12	30	10	#12
MA-00-R	2	30	10	12	30	10	12
MA-0-R	3	30	20	10	30	10	12
MA-1-R	5	30	30	8	30	15	12
MA-1B-R	7.5	60	35	6	30	15	8
MA-2-R	10	60	40	4	30	20	8
MA-3-R	15	60	60	1	30	30	6
MA-4-R	20	100	80	1/0	60	40	4
MA-5-R	25	100	100	3/0	60	50	2
MA-6-R	30	200	125	4/0	60	60	1/0

* Supplied with converter

Wiring Notes: This table is based on utilizing the converter at approximately 150% of start rating, it is conservative and applies in 95% of all installations. For total loads exceeding 150% of start rating, contact Key Industries.

- Conductor sizes based on type THHN, 90° C, copper in 30° C max. ambient. Adjust conductor size accordingly for different wire types.
- Increase wire size for Aluminum conductors or runs in excess of 50 feet.
- Consult National Electric Code for runs in excess of 50 feet or for aluminum conductors.

INSTALLATION NOTES

1. This diagram does not replace or supersede any requirements of local, state or national electric codes.
2. Fuses are supplied with converter. Use only dual element time delay fuses as replacements.
3. Do not bolt converter to floor. Use vibration pads supplied with unit.
4. Do not connect control circuits to manufactured phase, T3.
5. No-load output voltage L2-T3 will exceed L1-L2 by 12-15%. Voltages will balance when load is connected.
6. If input voltage exceeds 240V, refer to Section II page 3.

**Connection Diagram for Phasemaster MA-R Rotary
Phase Converter with built-in
Switch and Fuses**

0302-MAR

PHASEMASTER® AUTOMATIC ROTARY PHASE CONVERTER FOR UNATTENDED APPLICATIONS

TYPE MA-A

The World Leader in Single to Three-Phase Electric Power Conversion

DESCRIPTION:

The PHASEMASTER Type MA-A rotary phase converter is a highly reliable source of 3-phase power for all types of *unattended* cyclical applications such as air conditioners, compressors, elevators, etc. or where the operator desires to control the converter from a remote location.

The TYPE MA-A converter is identical in operation and performance to a manually switched unit except that it is *remotely* controllable. It is designed to be turned on and off from a remote pilot control as required by the load, thus saving energy when the load is not operating. The control panel is housed in a side-mounted box which includes starter, fuses, and terminal blocks. The converter is designed to be interlocked with the load to start on demand *or* from a remote mounted pushbutton station at the operators station.

When connected to a 1-phase supply line, it produces a near replica of utility 3-phase at its output terminals with each phase shifted 120 degrees. The converter will maintain a voltage between phases within 2-5% with efficiency in excess of 95%.

CONSTRUCTION:

The MA-A converter is a *rotary* type which uses a spinning armature to create a phase shifted third voltage leg. *Unlike a static* converter, it produces *true* 3-phase power at its output terminals. Thus it is capable of starting and providing a near balanced current into one or more motors simultaneously. The converter does not use electrolytic capacitors, potential relays, brushes, slip rings, or other high maintenance, failure prone components. It is built for extra quiet performance.

INSTALLATION & MAINTENANCE:

The MA-A converter can be fed from any 1-phase service large enough to supply the total demand of the *connected* load. The converter can be installed indoors or out (with an enclosure) and does not have to be bolted down. Inspection of control contacts and bearing lubrication are the only maintenance requirements.

SIZING AND ORDERING INFORMATION:

Sizing tables are provided for information and estimating purposes only. Motor designs and operational characteristics vary widely. Some loads require a converter rated larger than the motor nameplate HP. It is advisable to consult a factory representative before making a final selection. The following information is required for proper sizing:

- ◆ Type of load (compressor, elevator, etc.)
- ◆ HP or KW, Voltage and motor nameplate data
- ◆ Starting load HP load and running load HP

Refer to the Sizing and Selection Worksheet for further discussion of essential information required.

OUTPUT:

All units are factory wired for 230 Volts. 460 Volt units are available on request. Consult factory for 208 volt applications or for 208 volt 4-wire output.

OPTIONAL ACCESSORIES:

- ◆ Enclosures for weather protection
- ◆ Voltage regulated output for variable loads
- ◆ Surge protection
- ◆ Step up transformer 230-460 Volts



**5 HP Model MA-1-A Automatic Rotary Phase Converter
With optional start-stop buttons and plug-in receptacle**



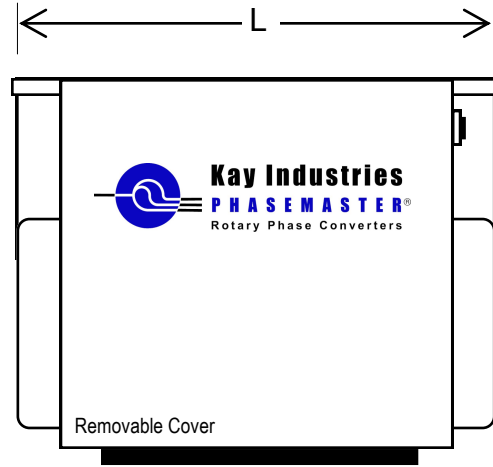
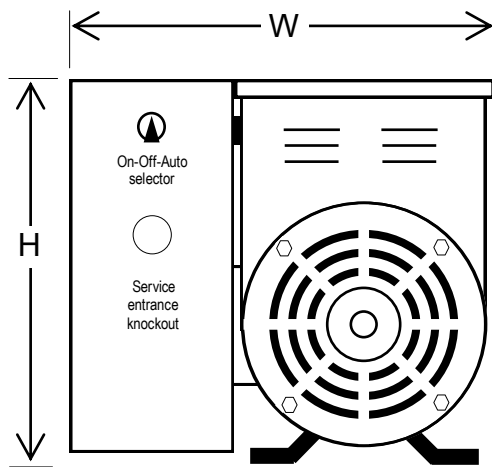
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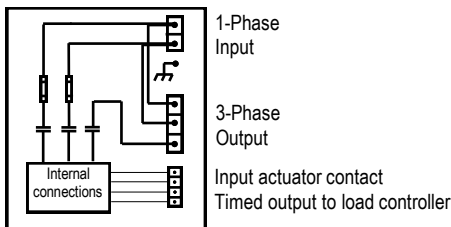
PHASEMASTER® ROTARY PHASE CONVERTER WITH AUTOMATIC CONTROLS

TYPE MA-A MA-AW



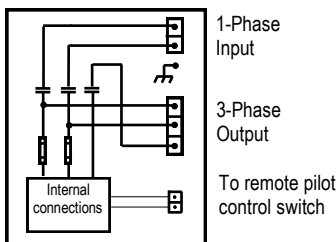
Front Access View

Type MA-A



L1-L2 voltage is continuously present at output terminals whether converter is on or off. This configuration is designed for unattended, cyclical loads, a/c compressors etc.

Type MA-AW



No voltage is present at output terminals unless converter is operating. Designed for remote on-off control. Prevents starting a load on 1-phase. Can accept multiple switches in parallel

Model No.	Largest HP	Max HP	Dimensions (inches)			Wt.
			L	W	H	
SD-60-A(W)	1.5	3	12	12	14	100
MA-00-A(W)	2	4	12	12	15	130
MA-0-A(W)	3	6	12	12	15	150
MA-1-A(W)	5	10	16	17	17	235
MA-1B-A(W)	7.5	15	17	20	22	327
MA-2-A(W)	10	20	19	20	22	360
MA-3-A(W)	15	30	20	22	26	490
MA-4-A(W)	20	40	22	24	24	540
MA-5-A(W)	25	50	25	24	24	600
MA-6-A(W)	30	60	27	27	27	780
MA-7-A(W)	40	80	29	27	27	840
MA-8-A(W)	50	100	30	29	32	1000
MA-9-A(W)	60	120	33	29	32	1060

NOTES:

- See Drawings 0302-A and 0302-AW for connection details
- Actual dimensions will not exceed those shown.
- Input/output terminals are right side entry unless otherwise specified

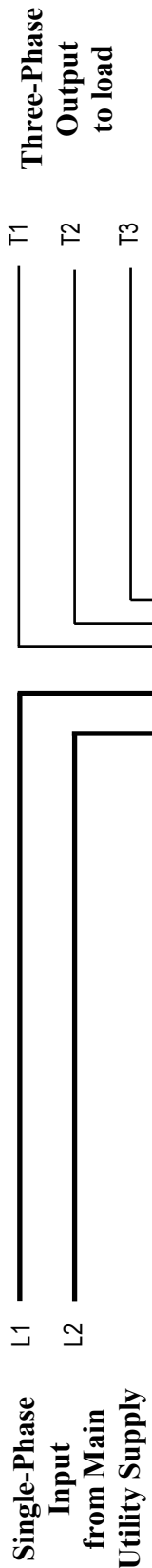
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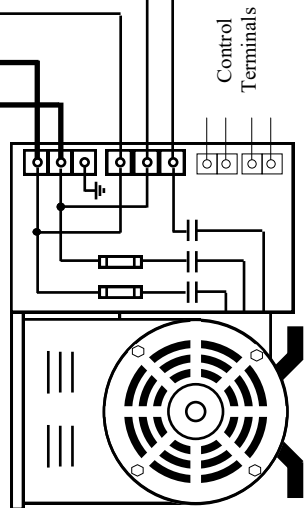
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Single-Phase Service Sizing

To insure adequate utility supply to the converter and load, it is necessary to size the 240V, 2-pole branch circuit to provide a **minimum** of 5-6 amps of 1-phase service for every simultaneously operating horsepower of connected 3-phase load. For example, a 10HP and 20HP load operating simultaneously will require at least 150-180 amps of 1-phase service



Phasemaster® Type MA-A Rotary Phase Converter with built-in fuses and automatic magnetic controls for remote actuation.

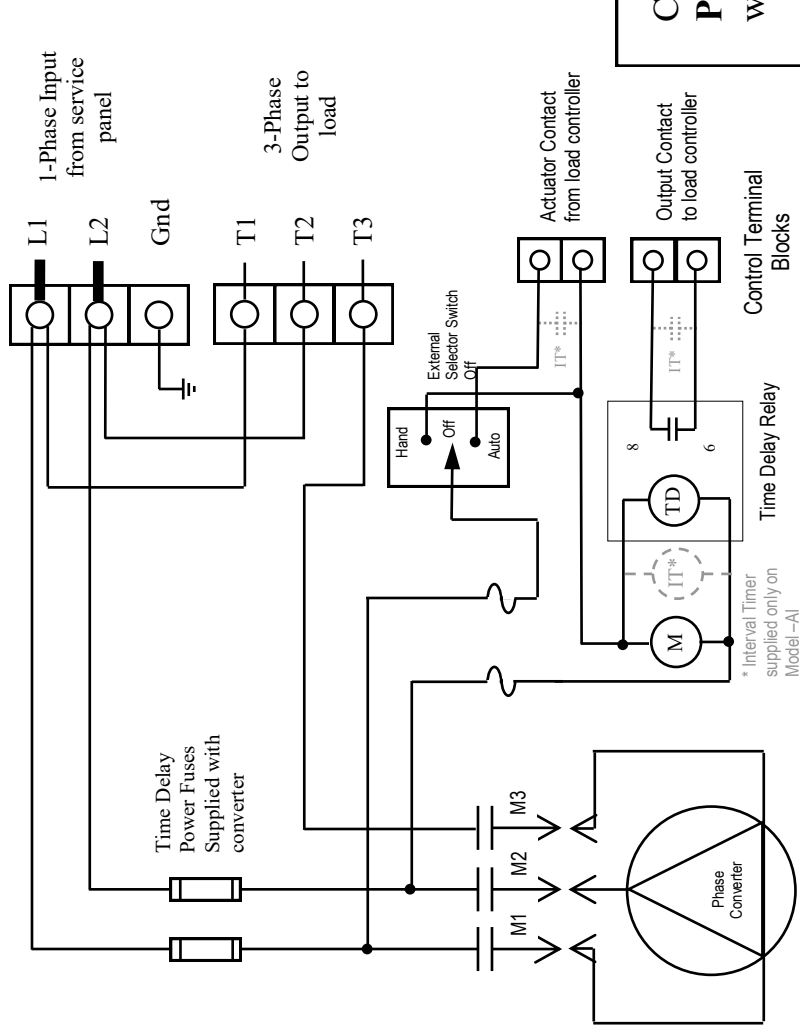
See L-Phase Service Sizing note above wire selection table

Model No.	240 Volts			480 Volts		
	Fuse	1-Ph Cable	3-Ph Cable	Fuse*	1-Ph Cable	3-Ph Cable
SD-60-A	10	#12	#12	10	#12	#12
MA-00-A	15	10	12	10	12	12
MA-0-A	20	8	10	10	10	12
MA-1-A	30	8	10	15	10	12
MA-1B-A	35	6	8	15	8	12
MA-2-A	40	4	8	20	8	10
MA-3-A	15	1	6	30	6	10
MA-4-A	20	1/0	4	40	4	8
MA-5-A	25	3/0	4	50	2	6
MA-6-A	30	4/0	2	60	1/0	6
MA-7-A	40	2-1/0	1/0	80	2/0	4
MA-8-A	50	2-2/0	2/0	80	2/0	4
MA-9-A	60	2-2/0	3/0	100	3/0	2

Sequence of Operation in Auto-Operating Mode

1. Input actuator contact from load controller closes magnetic starter M and energizes timing relay TD. Interval timer IT is also energized on "AI" Models.
2. Converter starts and the adjustable timing relay waits for the time delay period, typically 2-5 seconds until converter reaches full speed.
3. Output contacts 1-3 then close, signaling or allowing the load to start.
4. Interval timer contacts IT remain closed for duration set on timer. This keeps the converter running and allows the load to operate for that period of time after the last load operation. This reduces unnecessary starting operations.

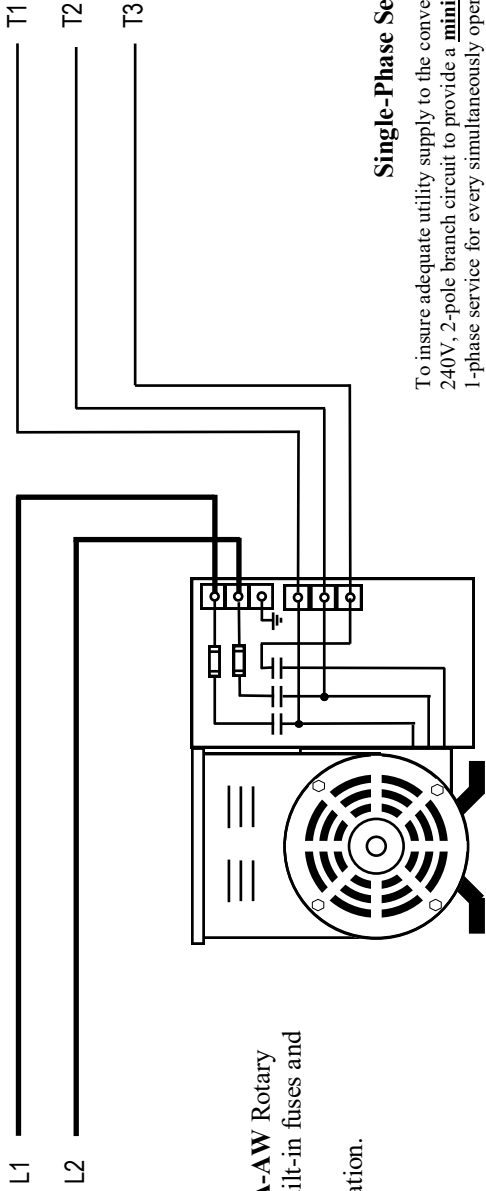
Control Panel Connection Detail



Connection Diagram for Type MA-A & MA-AI Phasemaster Rotary Phase Converter with automatic controls

0302-A

Single-Phase Input from Main Utility Panel



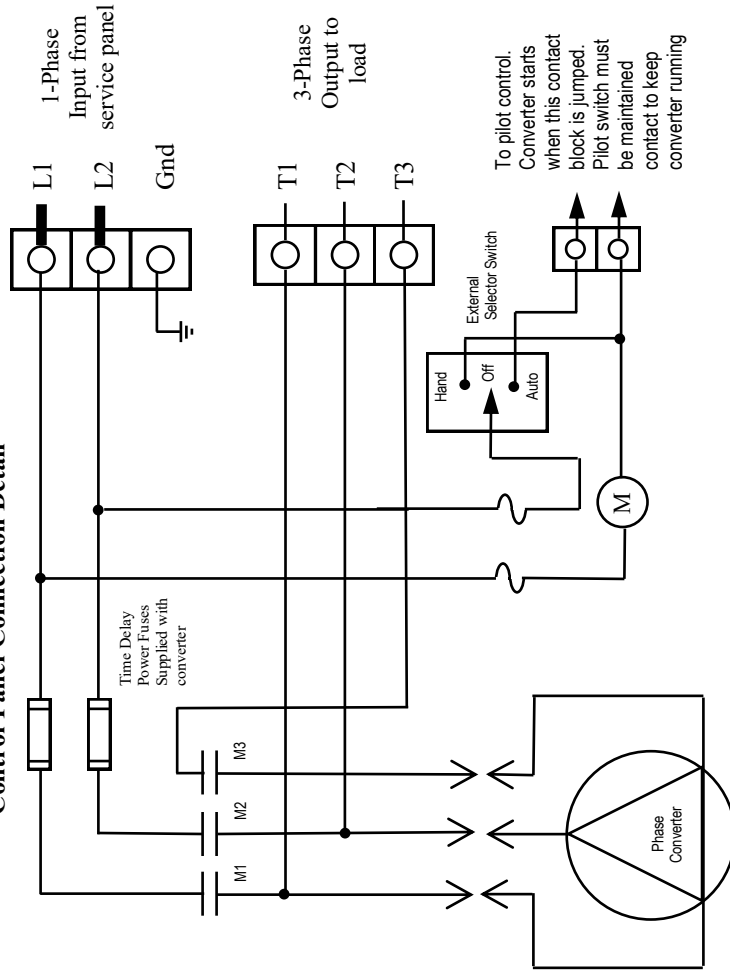
Phasemaster® Type MA-AW Rotary Phase Converter with built-in fuses and automatic magnetic controls for remote actuation.

All converter output lines are de-energized until converter is started.

Single-Phase Service Sizing

To insure adequate utility supply to the converter and load, it is necessary to size the 240V, 2-pole branch circuit to provide a **minimum** of 5-6 amps of 1-phase service for every simultaneously operating horsepower of connected 3-phase load. For example, a 10HP and 20HP load operating simultaneously will require at least 150-180 amps of 1-phase service

Control Panel Connection Detail



WIRE SIZE SELECTION CHART

Model No.	Start HP**	230 Volts			460 Volts		
		Fuse*	1-Ph Cable	3-Ph Cable	Fuse*	1-Ph Cable	3-Ph Cable
SD-60-AW	1.5	10	#12	#12	10	#12	#12
MA-00-AW	2	15	10	12	10	12	12
MA-0-AW	3	20	8	10	10	10	12
MA-1-AW	5	30	8	10	15	10	12
MA-1B-AW	7.5	35	6	8	15	8	12
MA-2-AW	10	40	4	8	20	8	10
MA-3-AW	15	60	1	6	30	6	10
MA-4-AW	20	80	1/0	4	40	4	8
MA-5-AW	25	100	3/0	4	50	2	6
MA-6-AW	30	125	4/0	2	60	1/0	6
MA-7-AW	40	150	2-1/0	1/0	80	2/0	4
MA-8-AW	50	175	2-2/0	2/0	80	2/0	4
MA-9-AW	60	200	2-2/0	3/0	100	3/0	2

* Fuses supplied with converter

** Total HP operating capacity is two times the start rating

Connection Diagram for Type MA-AW
Phasemaster Rotary Phase Converter with
 automatic controls for remote
 actuation

0302-AW

KAY INDUSTRIES ANSWERS THE MOST FREQUENTLY ASKED QUESTIONS ABOUT PHASE CONVERTERS

FAQs

The World Leader in Single to Three-Phase Electric Power Conversion

Is there any type of 3-phase equipment that cannot be operated on a phase converter?

In a word, NO! Any machine can be operated at its full capacity and specified performance on a rotary phase converter. A properly sized converter can run motors, heaters, and rectifiers, separately or simultaneously.

What is the efficiency of the phase converter?

Phase converter installations are extremely efficient. At full load, over 95% of all the power consumed is turned into useful work by the load equipment. The actual losses are insignificant. But the true difference between efficiency and the capability of running a load at full power is widely misunderstood. See the next question for a further explanation.

Do I “lose” power when running on a phase converter?

With a rotary converter, the answer is a resounding NO! You do not “lose” anything. The motor or any other load develops its full rated nameplate capacity. The same cannot be said for a static converter, which is essentially an “electric rope starter.” A static converter simply starts a motor and then switches off. It is not able to balance the motor currents, which means that one phase carries all the load. As soon as that winding reaches its full capacity, the motor can’t be loaded further without stalling, tripping an overload, or burning up. This occurs at 60-75% of the rated motor horsepower and is commonly, though incorrectly, referred to as a “power loss.” It’s not a true loss because you got all the power that that you could possibly consume without causing a motor failure. But it is a loss of running load capability that occurs with a static converter. If this distinction were understood, this question would never be asked.

How much power does the converter draw?

A more meaningful question is how much does the load draw. Since the converter is actually a transformer, it merely passes through whatever current is called for by the load. If the load calls for 25 amps, that's what gets pulled through the converter. As long as the converter is large enough, anything the load wants, it gets. A small amount of current on the order of a few amps is consumed by the converter, but it's a fraction of the power delivered to the load.

How will the converter affect my power bill?

In most cases, it will have little or no effect on your bill. The load consumes exactly the same number of kilowatt-hours of electricity regardless of whether it is being registered on a 3-phase or 1-phase meter. Any change in your power bill will be caused by the difference between the utility rate structure for single vs. 3-phase. Most 3-phase rates include a demand charge. 1-phase rates rarely include a demand charge. The result is that quite often it actually costs significantly less to operate from a 1-phase supply with a phase converter rather than to install utility 3-phase.

How reliable is a phase converter? What can go wrong?

There is very little to go wrong with a rotary phase converter. It has no external shaft and only two moving parts. Radio stations run them on transmitters around the clock for years without shutdown. All rotary converters are extraordinarily reliable, particularly when compared to generators, pumps and other mechanical equipment.

What maintenance is required on a phase converter?

Converters need minimal ongoing maintenance. Small converters use pre-greased sealed bearings which do not require regular greasing. Large converters require only annual lubrication. We also recommend routine periodic inspection for signs of unusual wear, corrosion or obstructed ventilation.

If my two utility wires are 1-phase, how can one extra wire from the converter give me 3-phase?

Your two utility lines A and B have one voltage between them, Va-Vb. When line C from the converter is introduced, it creates two new voltage relationships, Va-Vc and Vb-Vc. These three voltages are not in-step with each other. Each voltage follows its own AC sine wave corresponding to a complete revolution of the converter. Each voltage reaches its peak value at a different time, 120 degrees apart to be specific, much like the piston position in a 3-cylinder engine.

Can I operate a motor with a variable speed (variable frequency) drive?

Absolutely. And don't believe anyone who says otherwise. Just be sure to make it clear that you will be powering a VFD because it may change the size recommendation.



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What size service do I need to supply the converter?

We must first know the total connected load. To size the service, add together the full load amps of all loads that operate simultaneously. The National Electric Code requires the service to be at least 250% of that total. A 10 HP and 5 HP motor pulling 26 and 14 amps respectively require a minimum 1-phase service of 40A times 2.5 or 100 amps.

Can I run the converter continuously even when there is no load connected?

Absolutely. The Phasemaster converter is designed to operate continuously without overheating regardless of whether load is connected. The converter operates at a somewhat higher temperature without load but will cool down as soon as load is applied. Converter brands which use extra capacitor panels tend to run particularly hot.

How much noise does the converter make?

Phasemaster converters have been carefully designed for quiet operation at their running speed of 1800 RPM. The normal sound level will be 72 db or less at no-load, quieter when loaded. Many converter are designed for 3600 RPM to reduce cost and, as such, are much louder. Noise conscious buyers should insist on 1800 RPM converter speed.

Where is the converter normally installed? Can it be installed outdoors?

The most common location is next to the incoming single-phase service panel. It may also be placed near the load equipment. The converter may be installed outdoors in a sheltered area. Kay Industries offers an outdoor fiberglass enclosure or a totally enclosed converter for the most severe environments.

How does a converter compare to the cost of replacing the 3-phase motors with 1-phase motors?

It may be economical to replace motors under 3HP, but you must also figure in the cost to rewire the machines for 1-phase controls. However at 5HP and above, 1-phase motors are difficult to find and VERY expensive. Since one converter can operate many motors, it is almost always less costly to use a converter than to change motors. Aside from higher cost, 1-phase motors are far more maintenance-prone and less efficient than 3-phase motors.

What type of controls are necessary ahead of the converter?

A two or three-pole safety switch is all that is required to provide on-off control for the converter. For most attended loads, that's all that is necessary. Some loads such as elevators or pumps are often unattended. For maximum economy of operation, these applications require the converter to be equipped with magnetic controls that turn the converter on and off as required by the load.

Can I put in 240V single-phase and get 480V three-phase output?

The phase converter will produce a three-phase version of any input voltage. Put in 240 volts, 1-phase and you will get 240 volts, 3-phase out. In order to get 480 volts, it will require a 240 to 480 volt single-phase step-up transformer ahead of the converter. Operating the converter at 480V will then produce the necessary 480V, 3-phase output.

Does the converter require any adjustments when operating?

If the converter is properly sized, the voltages and currents will usually balance without further adjustment.

Is a phase converter like an Motor-Generator set?

No, a phase converter is nothing like an M-G set. After all if you think about it, in the absence of 3-phase power an M-G set requires a single-phase drive motor...expensive and not easy to find. Instead, the converter is a single rotating machine with three windings that starts from a single-phase line. The spinning rotor replicates the applied 1-phase voltage by induction into the other two windings thus producing a true 3-phase output that looks almost exactly like utility 3-phase with each line shifted by 120°.

This single frame construction is much more efficient than an M-G set.

How do you size a converter? How many motors can operate on a single converter?

It is generally adequate to size a converter for the largest horsepower motor which will start alone or the sum of all motors that start simultaneously. A rotary converter can operate many motors at the same time provided they do not all start together. This capability makes the converter an ideal way to run a shop with many different machines. A rotary phase converter carries two ratings, the maximum starting horsepower and the maximum running horsepower. Any combination of motors that fits within these ratings will normally operate successfully.

Are converters approved by the utility company?

Most utilities will not object to using a phase converter. In fact many even recommend them. It is generally not necessary to consult the utility prior to installing a converter unless you are planning are going to need a larger service.

Can the converter output be wired into a three-phase panel?

Yes. Just keep track of the phasing so that the manufactured phase from the converter is not used in the control circuit of the loads connected to the panel.

About Kay Industries

Kay Industries, Inc., is the worldwide industry leader in designing, manufacturing, and marketing single-phase to three-phase electrical power converters. A privately held corporation, Kay Industries sells phase converters nationwide in the U.S. and exports to Central and South America and the Pacific Rim. Kay Industries, Inc., markets under the registered trademark Phasemaster® and is headquartered in South Bend, Indiana, with offices in Fremont, California.

Kay Industries, Inc., was the first phase converter company to offer:

- Rotary converters (1960)
- Automatic controls (1972)
- Money-back performance guarantee (1975)
- Independent agency approval (CSA/NRTL) (1979)
- National toll-free lines (1980)
- Extended warranties (1986)

Phasemaster units are manufactured under U.S. Patent Nos. 3349316, 3387202, 3609430 and Canadian Patent No. 786933



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