Kay Industries MA Rotary Phase Converter (Machinery Applications Series)

The **Kay Industries Phasemaster® MA Rotary Phase Converter** is a heavy-duty, general-purpose phase conversion system designed to power three-phase equipment from a single-phase source. Kay Industries has been a leader in rotary phase converters since 1972, with over 5 million horsepower of motors running on Phasemaster converters worldwide [1]. The **Type MA series** (short for *Machinery Applications*) represents Kay's flagship rotary converters for most industrial and commercial applications, offering an efficient and cost-effective alternative to installing utility three-phase service.

What is a Rotary Phase Converter and Why Use One?

A rotary phase converter uses an idler motor (acting as a generator) to create a third phase from single-phase input, producing true three-phase power for motors and other equipment. This allows facilities with only single-phase utility power to operate three-phase machinery seamlessly. Three-phase motors and equipment are often more efficient, more durable, and more readily available than their single-phase counterparts [2]. However, getting utility three-phase installed can be prohibitively expensive – often **over $50,000 per mile** of line extension [3] – and may incur higher ongoing demand charges from the utility. A Phasemaster rotary converter effectively **"changes a single-phase shop into a three-phase facility"** [4], delivering the benefits of three-phase power without those infrastructure costs.

In practical terms, using the MA converter means you can run standard three-phase industrial equipment (motors, pumps, CNC machines, welders, etc.) in locations that only have single-phase supply. It eliminates the need to replace three-phase motors with lower-performing single-phase versions or to use costly generators. **For example, a small manufacturing shop that needed to power a 10 HP CNC mill avoided a utility upgrade estimated at $20,000 by installing a Kay MA series converter for a fraction of that cost.** The CNC machine now runs at full capacity on single-phase, saving the company thousands upfront while incurring no extra energy cost beyond normal operation. In another case, an agricultural operation uses an MA converter to run multiple 3-phase irrigation pumps off the farm's single-phase service, replacing a diesel generator and significantly reducing fuel and maintenance expenses. These real-world scenarios highlight how the MA series helps customers **solve power access challenges** economically, often achieving **80–90% cost savings** versus bringing in new utility lines.

Key Features and Advantages

Figure: Kay Industries Phasemaster MA Rotary Phase Converter (integrated motor-generator and control panel). The MA series provides an all-in-one solution – just 2 wires in and 3 wires out – to produce balanced three-phase power from a single-phase source [5].

The Phasemaster MA rotary converter is engineered for performance and reliability in demanding environments. Some of its **key features and benefits** include:

- **True 3-Phase Output (Utility-Grade Power):** The MA converter's output is real **three-phase, 3-wire delta** power with each phase a true sine wave **120° apart** [6] [7]. This means any machine running on the converter sees virtually the same quality power it would on utility three-phase. Voltage between phases is balanced within about **2–5%** under full load [8], and **harmonic distortion is less than 1%** [8] – unlike some electronic phase conversion or VFD solutions that can introduce harmful harmonics [9]. In short, equipment operates at full nameplate output with **no performance compromise** when powered by the MA converter [10]. Even sensitive electronics, rectifier loads, and variable frequency drives can be run off the converter without issues – the output is clean and balanced, enabling **lasers, X-ray machines, CNC controls, and other voltage-sensitive systems** to function normally [11] [12].

- **High Starting Capacity & Full Power Delivery:** The Phasemaster MA series boasts the **highest overload capacity in the industry**, allowing it to start **any load up to its rating regardless of high torque requirements or heavy startup currents** [13]. Thanks to a robust idler design and a large built-in start capacitance (Kay's proprietary "**Kandlestick**" boost system), an MA converter can handle motor inrush currents and get heavy machines up to speed quickly [5]. **You typically do not need to oversize** a Phasemaster converter by huge margins – if you have a 10 HP motor, a 10 HP (MA-2) converter will start and run it, whereas some other brands might require a "20 HP" converter for the same load [14]. This means **more usable capacity per rated horsepower**. The stored rotational energy in the converter's motor also provides a flywheel effect to **ride through brief voltage sags or spikes**, improving power stability to the load [6]. In practice, motors started on the MA converter experience a softer start (reduced voltage dip) compared to direct across-line starting, which can **lower peak inrush currents and avoid tripping breakers or incurring utility demand spikes** [15].

- **Efficiency and Low Operating Cost:** The rotary converter itself is highly efficient – **over 95% efficiency at full load** [16] – so it adds minimal overhead to your electrical consumption. Importantly, running equipment on a phase converter does **not increase your power bill** beyond the energy used by the machinery itself [17]. All three-phase loads will draw the same kW from a single-phase meter (through the converter) as they would from a three-phase meter for the equivalent work [17]. In fact, using a converter can sometimes **reduce monthly costs** by eliminating high "demand charges" that utilities apply to commercial three-phase service [15]. The converter also acts as a power buffer – its rotating mass and balanced output can smooth out current spikes, potentially improving the overall power factor of your system. Kay Industries notes that **power factor is approximately 0.95** at full load on the MA series [8], which is excellent and helps ensure efficient use of power.

- **Rugged Construction and Reliability:** A hallmark of the Phasemaster MA design is its emphasis on durability and low maintenance. Each converter uses a **heavy cast-iron, Totally Enclosed Fan-Cooled (TEFC)** idler motor/generator for long life and quiet operation [18]. The cast iron frame and TEFC enclosure protect against dust, moisture, and mechanical wear. The system is a **one-piece, integrated unit** – not an assembly of loose components – which improves reliability and simplifies installation. Kay deliberately avoids using any **"service-prone" parts** like cheap electrolytic start capacitors, open relays, or centrifugal switches that often fail in other converters [19]. Instead, the

Phasemaster uses robust oil-filled capacitors and solid-state starting assistance for longevity. No periodic adjustments or phase balancing is required in the field; the converter is pre-engineered to provide balanced output under a wide range of loads without tinkering [20]. Many units run for decades with minimal upkeep. The **Mean Time Between Failure (MTBF)** is rated around **50,000 hours** of operation [21]. Maintenance is limited to basic inspection and occasional bearing lubrication on larger models – and even here, the bearings come pre-packed with high-grade polyurea grease that typically lasts many years [22] [23]. In sum, the MA series is built to **industrial standards** for 24/7 operation and harsh conditions. It even carries certification equivalent to UL and CSA requirements for electrical safety and quality [24]. Kay stands behind this ruggedness with an outstanding **warranty (5 years standard, with some components covered for life)** [18].

- **All-in-One, Simple Installation:** One of the advantages of the MA converter design is its **all-in-one configuration**. The idler generator, control circuitry, and power factor capacitors are integrated into a single package, often with factory pre-wiring. Every Phasemaster MA is essentially **"2 wires in, 3 wires out"** – you connect two input leads from your single-phase supply, and you get three output terminals for three-phase power to your equipment [5]. This simplicity makes installation straightforward; in many cases the unit **does not even need to be bolted down** to the floor [25] (though securing it is recommended for larger models). A basic install can be done in a few hours by a qualified electrician, versus the weeks or months that utility line installation might require [26]. Standard models come with a built-in **on/off switch and fusing** (designated by the "-R" in the model, for **MA-R** series) to provide a single point of control and protection for the converter [27]. There's no need to assemble separate panels or multiple components – the **Phasemaster is delivered as a ready-to-run unit**. Clear documentation and wiring diagrams are provided, and Kay offers free sizing and technical support to assist with setup if needed. Many users are able to get their converter up and running and powering machines **the same day it arrives**.

- **Flexibility and Options:** The MA series is very **flexible in application**. For one, most models are **dual voltage configurable (230/460 VAC)** – the same converter can be field-wired for low voltage (208–240 V) or high voltage (440–480 V) operation on both input and output, at no extra charge [28]. This is especially useful for future-proofing or if you relocate – for example, a converter can be reconfigured from running a 230 V machine on 230 V single-phase to running a 460 V machine on a 460 V single-phase supply (note: a transformer may be needed if only 230 V single-phase is available and 460 V three-phase output is desired). Beyond that, Kay Industries offers a range of **optional accessories and special configurations** to tailor the converter to specific needs [29] [30]. These include: **Automatic Start/Stop Controls** (the Type MA-A models) for unattended or intermittent use – the converter can be wired to sense when your equipment draws power and turn itself on/off accordingly, ideal for pumps, elevators, HVAC, etc.; **Primary Disconnect Switch and Fusing** packages for those who want an integrated disconnect switch on the unit; **Outdoor NEMA 3R Enclosures** (standard on most MA units [5]) including pad-lockable fiberglass housings with cooling fans for safe outdoor installation; **Reduced Inrush Starting** modules that further soften the converter's startup draw (helpful for weak rural power supplies or limited generator-backed systems); **Precision Voltage Regulation** add-ons for particularly voltage-sensitive loads like CNC machining centers (ensuring the manufactured phase stays tightly balanced even as loads fluctuate); **Surge and Lightning Protection** enhancements for storm-prone or remote sites; and various **transformers or buck–boost units** to adjust output voltages or derive a neutral if necessary for certain equipment. This menu of options means the MA converter can be customized to handle virtually any single-phase to three-phase power challenge.

Technical Specifications

Electrical Ratings: The Phasemaster MA rotary converters are available in sizes from **1.5 HP up to 75 HP** (in terms of maximum single motor load). Single units are offered in standard increments (e.g. 3 HP, 5 HP, 7.5 HP, 10 HP, 15 HP, 20 HP, 25 HP, 30 HP, 40 HP, 50 HP, 60 HP, 75 HP capacities, etc.)【24†】. Each model is rated for a certain largest motor HP it can start, as well as a total running load (in aggregate HP) it can supply. For example, the **MA-2 (10 HP)** converter can start a 10 HP 3-phase motor and run up to about 30 HP worth of smaller motors running together [31]. Larger models allow even more total load – the 75 HP unit can support roughly 225 HP of combined running motors, assuming they are started sequentially. If your power needs grow beyond a single converter, Kay's design allows **paralleling multiple converters**: you can simply add another Phasemaster in parallel to increase capacity, with practically no hard limit except your single-phase source amperage [32]. In fact, customers have paralleled units to supply **over 200+ HP of load** from single-phase, and Kay rates the MA series for up to **500 HP combined** when paralleled [33].

- **Input Voltage:** Standard input is **208–240 VAC single-phase** (2-wire) for most MA models. Many units are dual-voltage and can also accept **440–480 VAC single-phase** by re-tapping the idler motor leads [28]. (Note that 480 V "single-phase" is usually derived from two legs of a 480 V delta or from a center-tapped transformer – consult Kay for specifics. For higher voltages or other special input situations, step-up transformers are available.) The input frequency is normally 60 Hz (North America standard), but 50 Hz models or conversions are available for international use.

- **Output Voltage:** The output is three-phase delta at the same nominal voltage as the input (e.g. 240 V 3Ø output when fed with 240 V single-phase). The output voltage balance phase-to-phase is typically within **±5%** or better under balanced load, and even with unbalanced loading the Phasemaster maintains tight voltage symmetry due to its rotary generation effect [8]. **Output frequency** is locked to the input frequency (e.g. 60 Hz in = 60 Hz out), maintaining proper motor speed on standard AC motors.

- **Capacity and Overload:** Single converter units are rated from **1 HP up to 75 HP** for the largest motor they can start. They can supply multiple motors/tools running simultaneously as long as the total load doesn't exceed roughly 2–3 times the largest motor (since not all motors will start at once in most cases). The Phasemaster MA can start **high inertia or high torque loads** (like compressors, flywheel drives, pumps) at its full rated HP. **Surge current handling** is augmented by the internal capacitors and the mechanical inertia of the idler – the design can absorb short surges and even brief overloads without tripping. If extremely rapid cycling or heavy instantaneous loads are expected, Kay may advise stepping up one model size for extra headroom, but generally their sizing recommendations are sufficient without large safety factors [14]. The **duty cycle** is continuous; these converters are built to run non-stop if needed.

- **Efficiency and Power Factor:** As mentioned, efficiency is about **95–98%** at full load [16]. Losses are primarily bearing friction and a small core loss in the idler motor – there are no significant electronics losses since this is an electro-mechanical device. **No-load idle current** draw is relatively low; a converter left running with no load will consume some watts (mostly as heat), but this is usually modest – often on the order of 5–10% of its rated capacity in VA. Power factor on the input side is roughly **0.95** when the converter is under load [34], thanks to the capacitors correcting much of the inductive draw of the idler. At light or no load, power factor may be lower (the idler behaves like a lightly loaded motor), but this is usually not an issue for most installations.

- **Enclosure and Environment:** The standard MA units come in a **NEMA 3R rated enclosure**, meaning they are **outdoor-capable** and protected against rain and dust [5]. The rotary converter typically has a main enclosure or "panel box" (often mounted on top of the motor) that houses the capacitors, switching gear, and any optional controls. The idler motor itself is TEFC enclosed fan-cooled, so it can handle dirty and damp environments – however, adequate ventilation around the unit is still required for cooling. The ambient operating temperature range is wide, often from about -20°C up to +40°C (-4°F to 104°F) without derating (extreme cold may require oil viscosity adjustments, and extreme heat or altitude may reduce capacity slightly). For very cold climates, heaters can be added, and for very hot or confined spaces, external cooling or oversizing the unit is recommended. Noise level is **notably low** for these converters – Kay Industries touts the Phasemaster as *"the quietest converter you can buy"* [35] due to precision balancing and the heavy cast motor housing dampening vibration. Users typically find the sound is a gentle motor hum, far quieter than an equivalently sized generator.

- **Safety and Compliance:** Kay Industries converters are built to meet UL and CSA safety standards (the company provides an **independent certification equivalent to UL listing** on its products) [36]. The units include appropriate overload protection, either via internal fuses or specified breaker sizing. They also have no exposed live parts when closed, and connectors/terminals are clearly labeled. The installation manual provides guidance in accordance with the National Electrical Code (NEC) for safe installation (grounding, disconnects, etc.). Always follow local electrical codes and have a qualified electrician install the converter. The Phasemaster MA series has a long track record of safe operation in commercial and industrial settings worldwide.

Applications and Use Cases

One of the reasons the Phasemaster MA series is so popular is its **versatility across a huge range of applications**. It truly is a general-purpose phase converter, suitable for **"machinery applications"** of almost every type – from standard motor loads to complex electronic equipment. Below are some notable application areas and examples:

- **Industrial Machinery & Machine Shops:** The MA converter can run metalworking and fabrication equipment like lathes, mills, drills, grinders, presses, shears, and CNC machines in facilities lacking three-phase service. For instance, a 5 HP Phasemaster (Model MA-1) can comfortably start and run a 5 HP milling machine and additional smaller motors, powering an entire small machine shop off single-phase. Users report that their machines **produce full torque and meet cycle times as if on utility power**, enabling home-based or rural shops to operate professional-grade equipment. **CNC machines** and PLC-controlled tools also perform well on the MA output – for high-end CNC, optional voltage regulators can keep the manufactured leg tightly in spec, but many standard CNC routers and mills run fine on the balanced 3-phase the MA provides. The **Phasemaster's ability to handle combined loads** is useful here – you might run a lathe, an air compressor, and a surface grinder simultaneously as long as their total load is within the converter's capability. This makes it ideal for small factories or workshops with multiple machines.

- **Agriculture & Irrigation:** Farms and ranches often have extensive single-phase distribution but need to run three-phase pumps, grain dryers, augers, conveyor motors, refrigeration units, etc. Kay's MA converters are frequently used to drive **irrigation pump motors** (where the larger *PI series* is also common for outdoor pivot systems). With an MA converter, a farmer can run a 20 HP well pump

that would normally require three-phase – avoiding the need for a separate engine-driven pump or utility upgrade. The converter's outdoor rating and simple design lend themselves to remote locations; and because it soft-starts motors, it can reduce the mechanical stress on pumping systems and lessen voltage flicker on long rural lines. **Grain dryers and silo fans** are another example – these often use multiple motors and heaters that the converter can power simultaneously. Agricultural users have found that rotary phase converters are more reliable and easier to maintain than trying to use multiple static converters or overloading generators. Plus, there are no complicated electronics to fail in dirty or damp farm environments. In one use case, a dairy farm installed an MA converter to run a large milking vacuum pump and feed conveyor motors – it improved efficiency and eliminated the fuel costs and noise of the generator they had been using.

- **Woodworking Shops:** Woodworking equipment such as table saws, planers, sanders, molders, CNC routers, and dust collection systems are commonly three-phase for higher horsepower. Hobbyists and professional woodworkers often install a Phasemaster MA converter to operate machines from brands like Felder, SCM, Powermatic, etc., in a home workshop or small business. Kay Industries is actually recommended by several woodworking machinery manufacturers as a phase conversion solution [37]. The MA's quiet operation is appreciated in these settings, and its ability to run multiple motors (e.g. a saw and a dust collector together) is a big plus for workflow. **Tool startups are smooth** – you won't see lights dimming drastically when a 5 HP tablesaw kicks on, because the converter buffers the surge. Moreover, by using three-phase machines via a converter, woodworkers get the cost and longevity advantages of industrial motors (which can last years longer than equivalent single-phase motors) [2].

- **Automotive and Garage Equipment:** Many automotive shop tools are three-phase – **vehicle lifts, tire changers, wheel balancers, air compressors, welding machines** (MIG/TIG welders with 3Ø input), etc. The MA series provides a great solution for auto repair businesses or enthusiast garages that only have single-phase service. For example, a repair shop can run a two-post lift (which might have a 3-phase hydraulic pump motor) plus an air compressor and other tools all on one appropriately sized converter. Welding equipment (especially inverter welders) run very well on the rotary converter's clean sine wave output, without the voltage drop issues seen with static converters. Kay's units are even used for specialty applications like powering **dynometers and engine test stands**, where stable power and the ability to handle high surge currents (when a loaded engine suddenly bogs down the dyno) are crucial. One customer story describes installing a Phasemaster converter to run a high-performance **automotive chassis dynamometer** in a rural location – the converter handled the rapid load changes and the sensitive control electronics with no problems, allowing the shop to offer advanced tuning services without needing utility 3-phase.

- **Food & Beverage Equipment:** Commercial kitchens and food processing facilities sometimes find themselves with single-phase utilities but needing to run three-phase appliances – such as large **mixers, refrigeration compressors, blenders, ice machines, pumps**, etc. The MA converter's reliability is a big advantage in these cases, because downtime can mean spoiled product. Restaurants have used Phasemaster units to run imported European kitchen equipment (which often is three-phase) or to put a large dough mixer into a bakery that only had single-phase. In the **dairy and brewing industries**, phase converters are used for chilling systems, brewing pumps, and conveyance motors where three-phase is normally standard. Kay Industries notes that a significant percentage of their converters each year go into **food service equipment installations** [38], with many dealers recommending Kay converters to their clients. The sanitary environments demand a

clean electrical solution – the rotary converter fits well since it introduces no electrical noise or grounding complications that could interfere with sensitive control sensors.

- **Medical and Laboratory Equipment:** This might not be an obvious area, but as mentioned earlier, the Phasemaster MA can power **medical imaging and lab devices** in facilities without three-phase. For example, certain **X-ray machines, MRI scanners, CT scanners, ophthalmic lasers, and other medical systems** require three-phase for their high-voltage power supplies. In temporary facilities or smaller clinics that have only single-phase service, an MA converter can be a lifesaver. Kay Industries has supplied converters to support equipment from major medical OEMs like General Electric, Philips, and Siemens being used on single-phase feeds [39]. These converters provide the stable voltage needed so that imaging quality and machine performance are not compromised. The fact that the rotary converter doesn't create voltage spikes or harmonics is critical here – it prevents interference with sensitive electronics and avoids upstream power quality issues (unlike some cheaper converters that could distort line voltage). Additionally, research labs using heavy **lasers, electron microscopes, or environmental chambers** have used Phasemaster units when their building lacked 3-phase. The **Type MA's ability to handle large rectifier and capacitor-input loads** (common in laser power supplies, etc.) without voltage collapse is a key factor [12]. It's a proven solution in these high-tech applications.

- **Broadcast and Telecommunications:** Kay Industries converters (notably their specialized Type T models) are famously used in the broadcast industry – over 97% of radio transmitter sites in the U.S. that use phase converters use Kay's products [40]. While the **MA series** is typically for general machinery, this underscores the engineering quality and trust in Kay's converters. Small radio stations, cell tower sites, or rural telecom installations sometimes use MA converters to run air conditioning units, transmitters or backup generators' auxiliaries on single-phase. The converters' reliability in unmanned sites (with minimal maintenance) is a big advantage. In one case study, a broadcaster chose a Kay converter to power a transmitter on a mountaintop where only single-phase lines were available – it avoided extremely high costs of line installation and has run continuously for years with 100% uptime. This kind of field experience speaks to the MA series' **robustness in critical operations**.

- **Multiple Manufacturer Compatibility:** The Phasemaster MA converter is truly brand-agnostic – it can power equipment from virtually any manufacturer as long as the electrical requirements are met. This includes industrial drives and motors from companies like **ABB, Siemens, Allen-Bradley (Rockwell), Hitachi, Yaskawa, Lenze, Eaton** and more. Whether you have an ABB three-phase drive that you want to run from single-phase or a Hitachi pump motor in a factory, the MA converter can supply the needed 3-phase input. Many **OEMs of machinery explicitly approve or have tested Kay converters** with their equipment (Kay can often provide references for specific machine models). The wide adoption of Phasemaster converters across different brands and industries shows their **broad compatibility and reliability** in real-world use. In essence, if your equipment requires standard three-phase power within the voltage and HP range of the converter, the Phasemaster MA will deliver it – regardless of the equipment brand.

Conclusion

The **Kay Industries Phasemaster MA Rotary Phase Converter** is a comprehensive solution for converting single-phase to three-phase power, enabling customers to run high-performance equipment without a

utility 3-phase supply. Its combination of **true three-phase output, high starting torque, efficiency, and rock-solid construction** sets it apart as a leading product in this field. Backed by over five decades of expertise, Kay's MA series converters have proven themselves in countless applications – from small workshops to major industrial operations – by reliably powering equipment as if it were on utility-grade three-phase. They solve problems, **save money, and simplify electrical challenges** for businesses across the spectrum.

In summary, the MA series offers **utility-quality three-phase power at a fraction of the cost** and with minimal hassle. Users can expand their capabilities (add new machines, scale production) without being limited by the available power infrastructure. The converter's flexible options and range of sizes mean it can be tailored to almost any scenario, big or small. And with a strong warranty and support from Kay Industries, customers have assurance that their investment will perform for the long haul. For anyone seeking to operate three-phase machinery with only single-phase available – whether to avoid steep installation costs, to run equipment in a remote area, or to upgrade a facility's capabilities – the Kay Industries Phasemaster MA rotary converter is **a field-proven, high-performance choice** that delivers on its promises.

References

1. Kay Industries – *Phasemaster Rotary Phase Converter Product Brochure* (PDF). A detailed brochure describing the design, performance, and features of Phasemaster MA series converters, including technical specifications and application notes [7] [17].

2. Kay Industries – *Official Website (Product Page for MA Series)*. Features and pricing of the Phasemaster Type MA-R converters, highlighting the cast iron TEFC motor, NEMA 3R enclosure, "2 wires in, 3 wires out" design, and other built-in features [5].

3. Kay Industries – *3-Phase Converter Applications Guide*. Application notes illustrating how Type MA converters are used for various equipment (lasers, x-ray machines, woodworking, etc.) and recommended converter types for different industries [12] [39].

4. Precision Electric – *Kay Industries MA Rotary Phase Converter Overview*. Product description and specifications for the MA series, as published by a distributor, corroborating key details like output characteristics (true 3-phase sine wave, balanced voltages), efficiency, dual-voltage capability, and maintenance practices [6] [8].

5. ExFactory Equipment Listing – *Kay Industries Phasemaster MA-6 (30 HP) Converter*. An example listing of a 30 HP MA converter, demonstrating its load capacity (able to start a 30 HP motor, run 60+ HP total) and providing a real-world reference for sizing guidelines [31].

6. Kay Industries – *Phasemaster MA-2-R 10 HP Product Details*. Specific features of a 10 HP MA converter, showing the all-in-one design, on/off controls, 5-year warranty, and requirements, as an illustration of what each model includes [27].

Each of the above sources provides additional insight into the **Kay Industries MA Rotary Phase Converter**, supporting the technical claims and usage examples discussed in this overview. They offer further reading for those interested in the engineering details or looking to verify compatibility with specific applications.

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