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Yaskawa GA800 Variable Frequency Drives (VFDs)

The **Yaskawa GA800** series is a family of high-performance, general-purpose AC variable frequency drives designed to deliver exceptional motor control and operational flexibility. These drives cover a broad power range from approximately **3/4 HP up to 1000 HP** across multiple voltage classes (200–240 V, 380–480 V, and 500–600 V) [1] [2]. With its wide range of capacities and advanced features, the GA800 is engineered to handle everything from simple fan or pump applications to complex industrial machinery requiring precise speed and torque control. In addition to raw power, the GA800 emphasizes **ease of use, network connectivity, and safety**, making it a comprehensive solution for modern motor control needs [3] [4].

Power Range and Performance

One of the standout attributes of the GA800 series is its **broad power and voltage coverage**. Models are available for low-voltage 240 V systems up to 150 HP, standard 480 V systems up to 1000 HP, and even 600 V-class systems (commonly 575 V) up to around 500 HP in Normal Duty rating [2]. Each drive is dual-rated for **Normal Duty (ND)** and **Heavy Duty (HD)** operation, allowing users to apply the drive in variable torque applications (fans, pumps, etc.) at higher HP, or in constant torque applications (conveyors, mixers) at a somewhat lower HP for extra overload capacity. For example, a given GA800 model might be rated **200 HP ND / 150 HP HD**, meaning it can deliver 150% overload for 60 seconds when sized for heavy-duty loads [5] [6]. All GA800 drives provide a **150% overload capability for 60 seconds in HD mode (110% in ND mode)**, ensuring robust performance during peak load conditions [7].

In terms of frequency and speed control, the GA800 is extremely versatile. It can output frequencies from **0 up to 590 Hz**, suitable for high-speed motor applications [5]. The drive supports a **speed control range of 1500:1 in closed-loop vector mode** (with encoder feedback) and up to 200:1 in open-loop mode, allowing precise regulation even at very low speeds [8] [9]. **Speed accuracy** is rated at **±0.02% in closed-loop** and **±0.2% in open-loop** control, which means the GA800 can hold a very steady motor RPM under varying loads [10]. Rapid response is also a key performance metric – Yaskawa specifies a **speed response bandwidth up to 50 Hz for induction motors in closed-loop, and even 250 Hz for permanent-magnet motors**, enabling the drive to react to command changes or disturbances almost instantly [11]. This level of performance makes the GA800 suitable for high dynamic applications such as test stands and stamping presses where quick torque adjustments are critical.

The GA800's **motor control algorithms** include both **open-loop and closed-loop vector control**, as well as traditional V/f (volts-per-hertz) control [6]. In open-loop (sensorless) vector mode, the drive can provide excellent torque and speed regulation without an encoder, while closed-loop mode with encoder feedback enables precision positioning and maximum torque at zero speed. Notably, the GA800 can control not only standard AC induction motors but also **advanced motor types**: it supports **surface permanent magnet (SPM) motors, interior permanent magnet (IPM) motors, and even synchronous reluctance motors** [12]. This flexibility means users can employ high-efficiency motor technologies (like IPM or reluctance motors) for energy savings without needing a different drive. The GA800 even includes specialized control features (such as high-frequency injection algorithms) to optimize startup and control of IPM motors, ensuring smooth operation across all supported motor types.

Ease of Use and Programming Tools

Despite its industrial capabilities, the GA800 is designed to be **user-friendly and easy to commission**. Every unit comes with a **high-resolution multi-language graphical display** and intuitive keypad interface [13]. The keypad features navigation and parameter selection buttons, status LEDs (for run, alarm, etc.), and a built-in **copy function** that allows cloning settings from one drive to another for quick setup of multiple units. The display can present setup wizards that guide the user through initial programming, drastically flattening the learning curve for new users. Common tasks like setting motor data, configuring I/O, or enabling network control are simplified through the step-by-step wizard menus. The keypad also includes a **real-time clock** and a **microSD card slot** for data logging and backup – the drive can log operational data and fault history to an inserted microSD card, which is invaluable for troubleshooting and preventive maintenance [14] [15].

For even greater convenience, Yaskawa provides **DriveWizard** software tools for the GA800. Using the **DriveWizard Desktop** application, users can connect a PC to the drive (via USB or network) for comprehensive configuration, monitoring, and tuning of parameters [16] [17]. The GA800 features an **embedded USB port that allows programming without main power applied** – you can power the control circuit from a USB connection alone, which means you can configure the drive safely at your desk or in a panel without energizing the high-power section [16]. This "no power programming" capability is a huge time saver during system integration.

In addition, the GA800 supports **Bluetooth connectivity** (with an optional module), enabling the use of **DriveWizard Mobile** on a smartphone or tablet [3] [18]. Through a Bluetooth interface, users can commission or monitor the drive wirelessly – for example, viewing real-time data or adjusting settings from a convenient location on the factory floor. This mobile connectivity and the associated **DriveWizard Mobile app** make it easier to manage drives installed in hard-to-reach places or to quickly diagnose issues without physically accessing the panel. Yaskawa's focus on easy interaction is further evidenced by features like **on-board data logging and diagnostics**, QR codes for quick access to documentation, and an **integrated help function** in the keypad that describes parameters and faults in plain language.

Another powerful tool built into GA800 is **DriveWorks EZ**, a graphical function block programming environment [17]. DriveWorks EZ allows users to create custom logic inside the drive by arranging function blocks (logic gates, timers, math operations, etc.) – essentially a simple PLC-like capability embedded in the VFD. The GA800 can handle up to 200 connections in a DriveWorks program with a fast 500 µs scan time [19]. This means you can implement application-specific control schemes (like interlocking multiple drives, sensor monitoring, or simple sequencing) *inside* the drive, often eliminating the need for an external PLC for certain tasks. For example, you could program the GA800 to monitor an analog sensor and adjust speed accordingly, or to perform cascading control of multiple pumps, all through parameter logic rather than separate controllers.

Connectivity and I/O

The GA800 is equipped with a rich set of **built-in I/O** and supports modern industrial communication networks, ensuring it can integrate into virtually any control system. On the standard hardware, each drive includes **8 digital inputs**, **3 analog inputs** (configurable for voltage 0–10 V or current 4–20 mA signals), **1 pulse input** (for frequency or pulse train references), and **2 dedicated Safe Torque Off (STO) inputs** for

safety circuits [20]. Outputs provided include **3 programmable relay outputs** (Form A contacts), **1 dedicated fault relay** (Form C), **2 analog outputs** (0–10 V or 4–20 mA), and **1 pulse/train output** for frequency output or speed feedback [20]. This generous assortment of I/O allows the GA800 to directly interface with sensors, actuators, and indicator devices in many applications without extra hardware. For instance, you can hook up push buttons and potentiometers to the inputs for local control, use the analog outputs to feed speed feedback to external instruments, and have the relays drive external fans or valves based on drive status – all configurable via parameters.

For applications requiring even more I/O, Yaskawa offers optional **expansion cards**. By installing an expansion module, the GA800 can gain up to an additional **16 digital inputs, 8 digital outputs, 3 analog inputs, and 2 analog outputs** beyond the standard complement [21] [22]. This level of expandability means a single GA800 drive can serve as a mini control hub for a small system, handling multiple sensors and control signals directly. Such capability is useful in distributed control scenarios or retrofits where adding a full PLC might not be practical.

On the **networking side**, the GA800 supports a variety of fieldbus protocols to communicate with PLCs and plant automation systems. **Modbus RTU** over RS-485 at 115 kbps is included as a **standard** interface on every drive [23], allowing basic serial communications and integration into SCADA or building management systems. Additionally, the drive is designed to accommodate optional network communication cards for all the major industrial networks: **EtherNet/IP**, **Modbus TCP/IP**, **PROFINET**, **PROFIBUS-DP**, **DeviceNet**, and more are available [23]. With these options, a GA800 can seamlessly join an Ethernet-based control network or a legacy fieldbus, enabling remote control, monitoring, and integration into IIoT (Industrial Internet of Things) platforms. For example, using an EtherNet/IP option card, the drive can be a node on a Rockwell/Allen-Bradley PLC system, exchanging data such as speed reference, status words, and diagnostic alarms with the PLC in real time. This flexibility in network connectivity ensures that **no matter the PLC or control architecture (Allen-Bradley, Siemens, Schneider, etc.), the GA800 can communicate reliably**.

It's also worth noting that the GA800 includes an **embedded 24 Vdc control power input** on the drive [18]. This auxiliary power input (if supplied by an external 24 V source) can keep the drive's control circuit and network communication active even if main AC power is removed. In practical terms, this means you can maintain network communications and diagnostics during an E-Stop or power outage – the PLC can still read the drive status or program it while the motors are off. This feature helps maximize uptime by allowing faster recovery; for instance, with 24 V backup power, the drive doesn't have to reboot on every power loss, and any fieldbus connection remains live [24] [25].

Safety and Standards Compliance

Safety is a paramount concern in modern industrial systems, and the Yaskawa GA800 addresses this through integrated features and compliance with global standards. Every GA800 comes with **embedded** Safe Torque Off **(STO) functionality**, which is a hardware-based safety feature that can quickly disable the drive's output to prevent the motor from delivering torque. The STO inputs meet **SIL 3 (Safety Integrity Level 3) per IEC 62061 and PLe (Performance Level "e") per ISO 13849-1** [26]. In practical terms, this means the GA800's safety circuit is designed such that if used properly, it can achieve Category 3 PL e safety stop functions – sufficient for most machinery emergency stop circuits. By wiring the emergency stop or safety gate interlocks to the GA800's dual STO terminals, users can achieve a safe stop without external contactors, simplifying the system design and reducing hardware costs. The integrated STO is **TÜV-**

certified and allows the drive to be part of a safety system that complies with international standards for machinery safety.

Beyond functional safety, the GA800 carries a full array of **global certifications and compliance marks**. It is UL Listed and CSA certified for use in North America, CE marked for Europe (meeting the Low Voltage Directive EN 61800-5-1 and EMC requirements), RCM compliant for Australia/New Zealand, and RoHS compliant for environmental safety [27] [28]. (It also meets standards like TÜV, EAC, and KCC as applicable, covering Europe/Eurasia and Korean markets.) This broad certification portfolio means the GA800 can be deployed in facilities worldwide and meet the necessary electrical codes and standards out of the box.

The drive's **design for harsh environments** also contributes to safety and longevity. All GA800 units come with **conformal-coated circuit boards**, providing resistance to dust, moisture, and chemical contaminants. Yaskawa specifies that the GA800 meets at least **IEC 60721-3-3 Class 3C2 (chemical gas) and 3S2 (solid particle)** environmental standards for resistance to corrosion and pollution. In other words, the electronics are protected from moderate levels of hydrogen sulfide, sulfur dioxide, dust, and other industrial pollutants that could otherwise cause failures [29]. This robust construction helps ensure reliable operation in settings like wastewater plants, steel mills, or woodworking shops where airborne contaminants exist. The drive's operating temperature range is **-10 to +50 °C** for the standard IP20 models (up to +60 °C with derating) [30], and it can handle up to 95% non-condensing humidity. With optional enclosure kits or configured panel solutions, GA800 drives can achieve **NEMA Type 1, 12, or even 3R/4 ratings**, suitable for dust-tight or outdoor installations. For instance, a **"flange mount" option** allows mounting the drive with its heatsink extended out the back of a panel – this yields an effective **IP55/Type 12 rating on the heatsink side** (for protection and heat removal) while the front side remains accessible inside a Type 1 enclosure [31]. These options provide flexibility to install the drive in various environmental conditions safely.

Energy Efficiency and Power Quality

Employing VFDs like the GA800 is fundamentally an energy-efficiency strategy – by varying motor speed to match demand, significant energy savings can be achieved in fan, pump, and compressor applications. The GA800's advanced motor control ensures that motors run at optimal speeds and torque, avoiding the wasteful throttling or bypass methods of control. Yaskawa's vector control also improves efficiency by maintaining a proper V/Hz ratio and power factor across the operating range. Moreover, the GA800 is designed to minimize losses: it uses modern IGBT power devices with high switching frequencies (adjustable up to 15 kHz) to reduce motor noise and core losses, and it features a **controlled cooling fan** that adjusts its speed based on temperature, which lowers the drive's own energy consumption and acoustic noise during lighter loads.

To help maintain **power quality**, medium and larger GA800 models come with **integrated DC reactors** (also known as DC link chokes) built in [32]. Starting at drives roughly 40 HP and above, the DC reactor is included inside the unit. This reactor smooths the DC bus current drawn from the AC supply, thereby reducing input current harmonics (THDi) and improving the power factor. By mitigating harmonics, the GA800 helps facilities comply more easily with standards like **IEEE 519** for harmonic distortion limits on the power system. In scenarios that demand even lower harmonics, Yaskawa offers **12-pulse versions** of the GA800 or pairing with passive filters. The **12-pulse GA800** models use a phase-shifting transformer and a dual-diode bridge input to significantly cancel out harmonics – these models can achieve much lower total harmonic distortion on the line side, providing a cost-effective solution for sensitive power environments [33]. Notably, some of the highest capacity GA800 units (Frame 12 models) are **field configurable for 6-**

pulse or 12-pulse operation without changing hardware, giving users flexibility to upgrade to a low-harmonic solution if needed [34].

For applications with frequent or heavy braking (such as downhill conveyors or decelerating high-inertia loads), the GA800 includes an **integrated brake chopper (transistor)** on models up to 125 HP (ND) [35]. This means for small to mid-sized drives, you can connect a dynamic braking resistor directly to the drive to dissipate regenerative energy, without needing an external braking unit. It provides a built-in way to handle regen energy and avoid overvoltage trips when stopping loads quickly. For larger drives or continuous regeneration scenarios, Yaskawa can provide separate regen units (like the D1000 or R1000 modules), but having the brake transistor built-in on many GA800s simplifies installation for moderate braking needs.

Finally, Yaskawa's **engineering of the GA800 for longevity** plays an indirect role in efficiency and uptime: the conformal coating and robust design were mentioned, and additionally the drive uses **long-life components** (such as bus capacitors and cooling fans with expected life over 10 years in normal operation). By ensuring high reliability and reducing unplanned downtime, the GA800 maximizes the *effective* energy efficiency of a system – a drive that doesn't fail or cause stoppages allows processes to run optimally without interruption.

Robust Design and Reliability

The GA800 is built with a **rugged, industrial design** aimed at high reliability in demanding conditions. Its compact size belies the careful thermal and electrical design inside. In fact, Yaskawa has managed to make the newest GA800 models significantly more compact and lighter than prior generations. The largest frame size (Frame 12) of GA800, which handles the 700–1000 HP range, is noted to be **39% smaller in width and 34% lighter than the previous generation drive** it replaces [36] [37]. This reduction in size helps customers save valuable panel or floor space and simplifies handling during installation. Even in the mid-range sizes, users will find the GA800 drives often have a smaller footprint than many competitors, thanks to Yaskawa's optimized heat dissipation and component layout. The **modular design** of GA800, especially in configured packages, also allows fast access for maintenance – for example, replacement of the cooling fan or surge suppressors can be done from the front with minimal disassembly.

From a reliability standpoint, Yaskawa is known for conservative component ratings and extensive testing. The GA800 is no exception: it's rated for **up to 10,000 hours of operation at full load and temperature without failure** and has protective features to guard both itself and the motor. The drive includes **overcurrent, overvoltage and undervoltage protection, output short-circuit and ground-fault detection, motor overtemperature (via thermal modeling or PT100 inputs with an option card), and phase-loss protection** [38] [39]. If any abnormal condition occurs (like an input phase drop or motor overload), the GA800 will trip in a controlled manner to protect the equipment. At the same time, it has **fast-acting current and voltage limit functions** that attempt to avoid tripping during transient events. Yaskawa describes this as "near trip-less operation" – the drive will automatically modulate to ride through events such as sudden load spikes or line voltage fluctuations, rather than simply faulting out [40]. This capability can dramatically **minimize unplanned downtime**, as the drive keeps running through momentary challenges that might shut other drives down.

Another contributor to reliability is the **24/7 technical support and global service network** behind the product. Yaskawa offers free technical support and has a reputation for responsive service. In fact, the GA800 has been highlighted in field cases for how quickly Yaskawa could deliver and commission a

replacement drive in a downtime situation. For example, one automotive parts manufacturer experienced a failure with a non-Yaskawa drive on an extrusion line, and they turned to the GA800 as a solution. **Yaskawa was able to ship and install a GA800 drive within 24 hours, getting the line back up and running with minimal production loss** [41] [42]. The GA800 smoothly took over the application (even though the system had previously used DC drives and then a different VFD), thanks to its advanced motor control and easy integration with the existing PLC [43]. This real-world example illustrates not only the reliability of the GA800 itself but also the manufacturer support that comes with it – a critical factor for customers who need maximum uptime.

Applications and Case Studies

As a **general-purpose drive**, the Yaskawa GA800 finds use in virtually every industrial sector. Its combination of high horsepower capacity and fine control makes it suitable for **heavy industries** (like mining, metals, or oil & gas) just as much as its user-friendly features appeal to **commercial HVAC and pump systems**. Some common application areas include:

- **Pumps and Fans:** The GA800 excels in variable torque applications such as centrifugal pumps, blowers, and cooling towers. The drive's **PID control functionality** is built-in, allowing it to maintain pressure, flow, or temperature setpoints by modulating motor speed. Multi-pump coordination and sleep mode features help optimize energy use in municipal water systems or HVAC installations. In one field case, GA800 drives used in an oil & gas pipeline pump station significantly **improved pumping efficiency** and reliability of pressure control, contributing to energy savings and smoother operation [44].

- **Material Handling and Conveyors:** With its high overload capability and torque control, the GA800 is well-suited for conveyors, elevators, and cranes. It can handle high starting torque demands (especially in closed-loop mode) and manage **high-inertia loads** without tripping. A success story from a lumber processing line showed that replacing older drives with GA800 units **improved line efficiency and reduced downtime** in a HewSaw timber cutting operation [45]. Similarly, the drive's ability to **catch a spinning motor (fly-start)** and perform **automatic restart after power loss** is valuable in keeping conveyors running through power dips or brief stoppages [46].

- **Manufacturing Machines:** The GA800 is used in extruders, mixers, presses, and mills – applications that often demand precise speed regulation and consistent torque. The drive's **low-speed torque production** and slip compensation allow it to hold constant speed under varying load (useful in extrusion or dosing applications to maintain product quality). In stamping press and metal forming applications, the GA800's fast response and large power range enable it to **efficiently drive presses with high inertia**, as noted in a case where it successfully managed a stamping press that was previously prone to trip on deceleration [47] [48].

- **Replacement of Obsolete Drives:** Thanks to its flexibility, the GA800 is often chosen to retrofit older drive systems, including DC motor drives or early-generation VFDs. Its ability to run different motor types and mimic various control interfaces (analog, serial, network) makes changeovers easier. In one example, a GA800 effectively **replaced an old DC drive in an MDF fiberboard plant**, improving reliability and simplifying the system by eliminating the DC motor maintenance issues [49] [50]. The GA800's compact size also helped it fit into the existing space, and its advanced control improved the conveyor's throughput consistency.

These examples highlight a key benefit of the GA800: it helps customers **solve problems and optimize operations**. Whether the goal is to reduce energy consumption, minimize downtime, increase process precision, or upgrade to newer motor technology, the GA800 provides a feature set to address it. The drive's robust performance and safety features can reduce nuisance trips and maintenance interventions (as in the stamping press case), its efficient control algorithms can extend equipment life (for instance, by soft-starting a pump to avoid water hammer, thereby **improving pump longevity** [51]), and its network connectivity enables detailed monitoring for predictive maintenance.

Conclusion

In summary, the Yaskawa GA800 VFD stands out as a **comprehensive and versatile motor control solution**. It combines high-power capability with precise control techniques, adapting readily to a wide range of AC motor types and load conditions. The GA800's thoughtful design — from the user-friendly keypad with wizards, to the mobile app connectivity and the built-in safety interlocks — demonstrates Yaskawa's emphasis on **making advanced drive technology accessible and reliable**. Backed by extensive certifications and Yaskawa's global support network, the GA800 series can be confidently deployed in industries around the world, providing **improved efficiency, enhanced safety, and reduced downtime** for end users. Whether you need to regulate the speed of a simple pump or coordinate the drives of a complex production line, the GA800 offers the performance and features to **exceed expectations and deliver a tangible return on investment** [2].

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