

Variable Frequency Drive (VFD)

## GA800 Mechanical Specification Submittal

**For UL Type 12 Rated Configured Drives (G8C2/G8C5)**

# GENERAL

The GA800 Configured drive package provides a GA800 in a UL Type 12 enclosure, with space for several commonly used options, such as reactors, circuit breakers, network communication cards, etc. The GA800 Configured drive has been designed for flexibility in providing commonly requested features and options.

The GA800 drive is a high performance PWM (pulse-width-modulated) AC drive. Three-phase input line power is converted to a sine-coded, variable frequency output, which provides optimum speed control of any conventional squirrel cage induction motor. The use of IGBTs (Insulated Gate Bipolar Transistors), with a carrier frequency range of 1 kHz to 15 kHz, permits quiet motor operation.

This drive has one control logic board and keypad for all horsepower ratings. Printed circuit boards employ surface mount technology, providing both high reliability, and small physical size of the printed circuit assemblies.

# CONFIGURED PANEL STANDARDS

UL 508A (Industrial Control Panels)

UL, cUL listed

**CONFIGURED PANEL SERVICE CONDITIONS**

Ambient service temperature: -10°C to 40°C (14°F to 104°F)

Ambient storage temperature: -20°C to 60°C (-4°F to 158°F)

Humidity: 95% RH or less, non-condensing

Altitude: Up to 1000 meters (3300 feet), higher by derating

Service factor: 1.0

# QUALITY ASSURANCE

In circuit testing of all printed circuit boards is conducted to ensure proper manufacturing

Final printed circuit board assemblies are functionally tested via computerized test equipment

All fully assembled controls are tested with induction motor loads to assure unit specifications are met

# CONSTRUCTION

Input Section- The drive power input stage converts three-phase AC line power into a fixed DC voltage via a solid-state full wave diode rectifier with MOV (Metal Oxide Varistor) surge protection. An internal 3% DC bus reactor at ratings of greater than 40 HP reduces harmonics for cleaner power (optional at smaller ratings).

Intermediate Section- The DC bus maintains a fixed, filtered DC voltage with short circuit protection as a DC supply for the drive output section. The DC bus is monitored by drive diagnostic logic circuits to continuously protect and monitor the power components.

Output Section- Insulated Gate Bipolar Transistors (IGBTs) convert DC bus voltage to a variable frequency, variable voltage PWM sine-coded AC output to the motor. Use of IGBT devices allow motor noise at 60 Hz to measure less than 2 dB (@ 1 meter) above that resulting from across the line operation.

UL Type 12 full enclosure

Available horsepower ratings:

 240VAC: 1 thru 150 HP
 480VAC: 1 thru 600 HP

Non-volatile memory (EEPROM); all programming memory is saved when the VFD is disconnected from power.

Digital operator keypad and display provide local control and readout capability:

Local/Remote/Start/Stop commands

Speed Reference command

Reset command

Easy to remove heatsink cooling fan with programmable on/off control.

USB mini-B port for quick and easy PC connection

# PROTECTION

Output current overload rating of 110% for 60 seconds (normal duty) or 150% for 60 seconds (heavy duty)

Output short circuit protection

Current limited stall prevention (overload trip prevention) during acceleration, deceleration, and run conditions

Optically isolated operator controls

Fault display

“Hunting” prevention logic

Electronic ground fault protection

Electronic motor overload protection (UL approved)

DC bus charge indication

Heatsink overtemperature protection

Cooling fan operating hours recorded

Input/output phase loss protection

Reverse prohibit selectability

Panel SCCR up to 100 kA RMS (dependent on configuration)

# OPERATION

Output frequency and speed display can be programmed for other speed-related and control indications, including: Hz, RPM, % of maximum RPM, or custom.

Power loss ride-through (2 seconds capable)

VFD accepts either a direct acting or a reverse acting speed command signal.

Bi-directional “Speed Search” capability to start into a rotating load. Two types: current detection and residual voltage detection

DC injection braking

Remote Run/Stop command input

Two programmable 0 to 10 VDC, -10 to 10 VDC, or 4-20 ma analog outputs, proportional to drive monitor functions including output frequency, output current, output power, PI feedback, output voltage and others

8-Line, 32-character Local/Remote LCD display provides readout functions that include output frequency, output voltage, output current, output power, DC bus voltage, interface terminal status, PI feedback and fault status.

Over 100 programmable functions, resettable to factory presets

User parameter initialization to re-establish project specific parameters

Ramp-to-stop or coast-to-stop selection

Auto restart capability: 0 to 10 attempts with adjustable delay time between attempts

One custom selectable Volts/Hertz pattern and multiple preset Volts/Hertz patterns

Auto speed reference input signal, adjustable for bias and gain

While the VFD is running, operational changes in control and display functions are possible, including:

 Acceleration time (0 to 6000 seconds)

 Deceleration time (0 to 6000 seconds)

 Frequency reference command

 Monitor display

 Removable digital operator

Automatic energy saving, reduced voltage operation

# DRIVE FEATURES

Displacement power factor of .98 throughout the motor speed range

Data logging – record status for up to 10 monitors with adjustable sample time

Built-In real time clock for time and date stamping events along with timer functions for starting, stopping and speed changes without the need for external controls

Voltmeter, ammeter, kilowatt meter, elapsed run time meter, and heatsink temperature monitoring functions

24 VDC, 150 mA transmitter power supply

Input and output terminal status indication

Diagnostic fault indication

VFD efficiency: 96% at half-speed; 98% at full-speed

“S-curve” soft start / soft stop capability

Run/Fault output contacts

Serial communication loss detection and selectable response strategy

“Up/Down” floating point control capability

Output Frequency 0 to 590 Hz

Controlled speed range of 40:1 (V/f, V/f with encoder), 200:1 (open loop vector), 1500:1 (closed loop vector), 200:1 (advanced open loop vector), 20:1 (open loop vector for PM), 100:1 (advanced open loop vector for PM, EZ vector)

Maximum output frequency; 590 Hz

Safe Torque Off: SIL3, PLe

200% starting torque capability, available from 0 Hz to 60 Hz

Remote speed reference (speed command) signal:

0 to 10 VDC (20 kΩ)

4 to 20 mA DC (250 Ω)

Critical frequency rejection capability: three selectable, adjustable bandwidths

Analog/Digital Virtual I/O – internally sends an output to an input (no wiring needed)

Adjustable carrier frequency, from 2 kHz to 15 kHz

Dynamic noise control for quiet motor operation

Programmable security code

Cloud service (Yaskawa Drive Cloud) for product registration and parameter storage

Store up to four additional parameter sets in keypad

Integrated PLC (DriveWorks EZ)

Eight programmable multi-function input terminals (24 VDC) providing 60+ programmable features, including:

Fault reset

Motor operated pot (MOP)

External fault

16 preset speeds

PI control enable / disable

Three programmable multi-function output relays (Form A rated 1 A @ 250 VAC & 30 VDC), providing 50+ functions, including:

Fault status

Run status

Overtorque / undertorque detection

Serial communication status

One fixed “Fault” Form C output relay (Rated 1 A @ 250 VAC & 30 VDC)

Sixteen preset speeds

Built-in Modbus RTU protocols accessible via RS-422/485 communication, which is standard. EtherNet/IP, Modbus TCP/IP, PROFINET, EtherCAT, DeviceNet, and PROFIBUS are optionally available.

Rotational as well as Stationary motor auto-tuning

“Kinetic Energy Braking” (KEB) function stops the motor in up to half the time it would take without this function.

Control Methods Include:

 V/f Control

 V/f Control with encoder feedback

 Open loop vector

 Advanced open loop vector

 Closed loop vector

 Open loop vector for PM

 Closed loop vector for PM

 Advanced open loop vector for PM

 SynRM Motor Control

Motor Types:

 Induction

 Permanent Magnet

 Synchronous Reluctance

Temperature controlled fans

Side by side mounting

LCD keypad with Local/Remote, Start/Stop and Copy keypad functions.

Motor preheat function

Flash upgradeable firmware

Heatsink overtemperature speed fold-back feature

Fan failure detection and selectable drive action

Programming and firmware upgrade without three-phase main power DriveWizard Mobile

Programming Application

LED Status Ring

Conformal coating (IEC 60721-3-3, IP20/Protected Chassis: 3C3, 3S2)

# Model Number Configuration (G8C1)

## Step 1. Complete the Base Number for the voltage and current rating.

## Step 2. Add the Option Code letter for each required option. If an option is not wanted, no character is inserted in that position.



1. Option F is not allowed with options E,C,J, or M for the following 480 V package models because input fusing is automatically included:
G8C1B007 - G8C1B720, G8C2B065 - G8C2B720, G8C3B180 - G8C3B720
G8C4B004 - G8C4B590, G8C5B052 - G8C5B590, G8C6B156 - G8C6B590
2. Options J and L not allowed together.
3. Type 3R enclosures only.
4. Not available for Type 3R enclosures.
5. 3% Bus reactors are only available as an option on small ratings - see table; large drives have a bus reactor as standard.
6. If no option from Group 1 or Group 3 is selected, then both options from Group 2 may be selected.
If no option from Group 1 is selected, then ALL options from Group 2 and Group 3 may be selected.
Select anything from Group 4, regardless of other group selections.

### **ENCLOSURE TYPE**

**(1)** The Normal Duty drive and Configured controls are provided in a Type 1 enclosure, large enough to accommodate any or all of the Configured package options.

 **(4)** The Heavy Duty drive and Configured controls are provided in a Type 1 enclosure, large enough to accommodate any or all of the Configured package options.

 **(2)** The Normal Duty drive and Configured controls are provided in a Type 12 enclosure, large enough to accommodate any or all of the Configured package options.

 **(5)** The Heavy Duty drive and Configured controls are provided in a Type 12 enclosure, large enough to accommodate any or all of the Configured package options.

 **(3)** The Normal Duty drive and Configured controls are provided in a Type 3R enclosure, large enough to accommodate any or all of the Configured package options.

 **(6)** The Heavy Duty drive and Configured controls are provided in a Type 3R enclosure, large enough to accommodate any or all of the Configured package options.

### **VOLTAGE**

**(A)** 240 volt model for nominal, 230 or 240 VAC (+10/-15%); 60 or 50 Hz (+/-5%) systems

**(B)** 480 volt model for nominal, 380, 400, 415, 440, 460 or 480 VAC (+10/-15 %); 60 or 50 Hz (+/-5%) systems

### **[P] POWER OPTIONS**

**(E)** This option provides a circuit breaker with operating handle.

**(C)** This option provides a circuit breaker with operating handle and an Interrupting Capacity of 65 kA.

**(M)** This option provides a circuit breaker with operating handle and an Interrupting Capacity of 100 kA.

**(D)** This option provides a non-fused disconnect with operating handle.

**(F)** This option provides input fuses for drive short circuit protection.

**(R)** No form of input impedance is normally required for the GA800 Configured. A 3% line reactor is available if additional impedance is desired, usually to reduce the effects of line-side transients and input current THD.

**(X)** Large HP drives include 3% bus impedance. A 3% bus reactor is available for small HP drives (see table) if additional impedance is desired, usually to reduce the effects of line-side transients and input current THD.

**(H)** No form of output impedance is normally required for the GA800 Configured. A 3% load reactor is available if additional output impedance is desired, usually for long lead-lengths or noise reduction.

 **(N)** The standard configuration does not include a filter. The cap filter is a delta-wye capacitive network, used to help attenuate electrical noise.

**(L)** This option provides 10-15% duty cycle braking capability (DB resistors not included) to improve deceleration performance. This option does not include over temperature protection. Not available for Type 3R enclosures.

**(J)** This option provides 10-15% duty cycle braking capability (DB resistors not included) to improve deceleration performance. A shunt trip circuit breaker (equivalent to option E) and circuitry is also provided to disconnect the input power from the drive if the DB overtemperature switches activate. Not available for Type 3R enclosures.

### **[P] POWER OPTIONS (con’t)**

 **(2)** This option will offer some degree of protection from transient surges coming through the power line cables. Lightning strikes are the most common source of surges. This option is only available for the Type 3R enclosure.

**(3)** This option maintains the internal cabinet temperature to reduce condensation. This option is only available for the Type 3R enclosure.

**(4)** This option will allow the enclosure to be operated in an ambient temperature of 50 °C (122 °F). The standard basic design is rated for 40 °C ambient. This option is only available for the Type 3R enclosure.

### **[T] CONTROL & COMMUNICATION OPTIONS**

**(D)** This option allows the drive to communicate on an Ethernet/IP network.

**(G)** This option allows the drive to communicate on a DeviceNet network.

**(H)** This option allows the drive to communicate on a PROFIBUS network.

**(C)** This option allows the drive to communicate on a PROFINET network.

**(Q)** This option allows the drive to communicate on a Modbus TCP/IP network.

**(A)** This option provides 3 additional high-resolution analog inputs (13 Bit to the drive.

**(F)** This option provides 16 additional digital inputs (binary or BCD; 8, 12, to the drive.

**(N)** This option provides 2 additional isolated signal outputs (11 Bit + Sign) remote monitoring of any two of the drive’s “U1” parameters.

**(E)** This option provides 8 additional digital outputs for use in monitoring the of the drive.

**(X)** This option provides speed feedback using a line driver pulse generator

**(V)** This option converts external 120 VAC control signals to the drive’s 24 digital input terminals (S1 through S8).

**(Y)** This option provides a door-mounted Hand/Off/Auto Selector Switch determining start/stop and speed control.

**(Z)** This option provides a door-mounted Speed Pot with knob to control speed.

**(M)** All GA800 standard drive packages include a door mounted keypad enclosed in a plastic bezel with a clear door that opens for access. Option M (for Type only) provides a larger painted steel solution, including a keylock that protects keypad and other door mounted controls.

**[S] Special**

**(B)** This option equips the configured package with a BlueTooth enabled keypad.