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## AC & DC Drives

### GS Series & DURAPULSE AC Drives

High-quality, feature-rich drives that are affordable and provide a higher return on your investment.



DURA  
IIIIIPULSE

IRONHORSE

WEG

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AC and DC Drives

mGSX-1



# AC Drives offer the following advantages:

- **Reduce start up current** - controlling the inrush current at motor start-up allows the use of smaller fuses, and reduces electrical peak load.
- **Reduce mechanical stress** - controlled/smooth starting and stopping minimize mechanical shock and wear and tear on the system.
- **Power Factor** - Motors have very poor power factors (especially at light loading). Drives significantly increase power factor (even at light loading) and can eliminate the need for power factor correction capacitors and/or utility power factor charges.
- **Variable Speed and integrated functionality** - AC drives can vary motor speed and direction by operator input (keypad buttons/speed control knob) or by digital and analog inputs (from pushbuttons/switches/pots or PLC outputs) or by communication from a PLC or master controller. Basic machine control can sometimes be performed in the drive (limit switches/sensors can be wired to the drive's inputs to control motor speed or direction).



## CFW100 AC micro drive

WEG CFW100 drives are the smallest variable frequency drives in the world. Although small in size, it is big on features such as a built-in PLC and sensorless vector control. When space is at a premium, the WEG CFW100 series drives are available in ratings from ¼ to 1hp.

- Smallest AC drive in the world
- Single-phase input power (110/230 VAC)
- Scalar Volts/Hertz (V/Hz) and sensorless vector (also called Voltage Vector (VVW)) control modes
- Built-in operator interface (HMI)
- PID control function
- Fire mode function



## DURAPULSE GS20(X) AC sensorless vector drive

The GS20 and GS20X drives have taken what has worked well in the GS2 series drives, added sensorless vector and field oriented control as well as expanded on the built-in I/O, added a built-in PLC and offers the option for Ethernet communications. The GS20X versions offer a NEMA 4X enclosure so you can install it in a washdown or harsh location. You are going to have a hard time believing that a drive this feature-rich costs as little as it does. DURApulse GS20 drives are available in ratings from ¼ to 30 hp; GSX20 versions are available from ½ to 10 hp. Both series offer 575VAC rated models.

- V/Hz, sensorless vector control and field oriented control modes
- Torque Control Mode
- STO – Safe Torque Off
- Built-in PLC (up to 2,000 steps)
- USB programming
- Optional Ethernet communications for Modbus TCP and EtherNet/IP
- GS2 mode to ease with migration from GS2 VFDs (not supported on GS20X)
- GS20X models offer NEMA 4X enclosure and optional NEMA 4X disconnect



## DURAPULSE GS3 AC sensorless vector drives

The DURApulse GS3 series offers sensorless vector control with autotune and many other advanced features such as Modbus communications, PID control, motor autotune and DC injection braking. A detachable keypad with Forward/Reverse control can store/transfer up to four separate drive parameter configurations. DURApulse GS3 drives are available in ratings from 1 to 100 hp.

- V/Hz and sensorless vector control modes
- 150% starting torque
- Removable keypad
- Optional encoder feedback card
- 11 programmable digital inputs, four programmable outputs and three analog inputs
- Optional Ethernet communications



## DURAPULSE GS4 AC sensorless vector drives

The DURApulse GS4 series is our most advanced sensorless vector AC Drive with all the features of the GS3, plus enhancements such as 100kA SCCR Rating, 50°C rating, circulatory control mode and field upgradeable firmware. The DURApulse GS4 can operate off of single-phase power up to the 100 hp size, and is available in ratings from 1 hp to 300 hp.

- Single-phase models up to 100 hp
- V/Hz control or sensorless vector
- STO -Safe Torque Off (TUV certified)
- Flange-Mount Capability for frame sizes A to F (1 to 215 hp)
- Built-in PLC (up to 10k rungs)
- Expanded I/O capability – 110V Inputs, Relay Outputs, and DC I/O
- Analog I/O: 3 Inputs and 2 Outputs
- Fire mode
- High-speed communication interfaces with MODBUS RTU and BACnet protocols built-in, plus optional communication cards: MODBUS TCP, EtherNet/IP



## GS1 AC mini drive

If all you need is basic scalar control and you want simplicity, the GS1 series can get the job done. All models offer an integrated keypad with speed control knob and built-in Modbus communications. GS1 series drives are available in ratings from ¼ to 2 hp

- Simple Volts/Hertz (V/Hz) control
- 130% starting torque at 5 Hz
- External analog input (0-10V, 0-20 mA or 4-20 mA)
- Four programmable digital inputs, One programmable relay output
- One programmable relay output
- DIN-rail mountable



## CFW300 AC micro drive

WEG CFW300 variable frequency drives are high-performance VFDs for three-phase induction motors. The CFW300 series features a compact size with contactor-style electrical connections (top in / bottom out). The CFW300's performance can be scaled to match the application by selecting sensorless vector or scalar control. CFW300 series drives are available in ratings from ¼ to 5 hp.

- Scalar Volts/Hertz (V/Hz) and sensorless vector (also called Voltage Vector (VVW)) control modes
- Remote Keypad (optional)
- Side-by-side zero-stack mounting
- 5 digital I/O built-in with 4 digital & analog I/O option modules
- PID control (built-in)
- PLC (built-in)



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# DURAPULSE® GS20(X) AC Drives

## New GS2 Replacement



### DURAPULSE GS20(X) AC Sensorless Vector Drives

The DURAPULSE GS20/GS20X series line of sensorless vector AC drives bridge the gap between the GS2 and GS3 series VFDs. The GS20/GS20X series AC drives have all of the features of the GS2, as well as many of the features offered on the GS3 and some new features not found on the other series all at a great price.



Removable Keypad can be remotely mounted.  
5-digit, 7 segment LED display;  
Speed control potentiometer



Safe Torque Off (STO)  
provides an additional  
level of safety  
EN 61508 SIL2  
EN 62061 SIL CL2  
ISO 13849-1:2015 Cat3

Removable RFI  
jumper (depends on  
application needs)

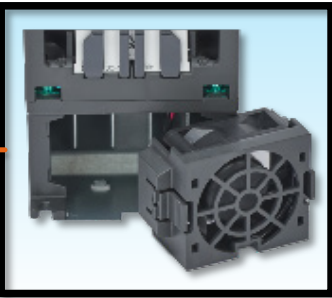


Built-in USB port for fast  
& easy programming



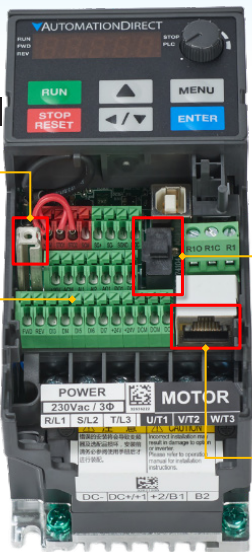
QR Code for remote  
access to product  
details (online)

Removable fan, fast &  
easy to replace



### Zero-Stack Installation

Zero-stack installation saves time, money and panel space by allowing the GS20 drives to be mounted right up next to each other.



Option card connector

Option card mount

Spring clamp  
terminal blocks

Built-in RS-485  
w/ Modbus RTU

### Option Cards

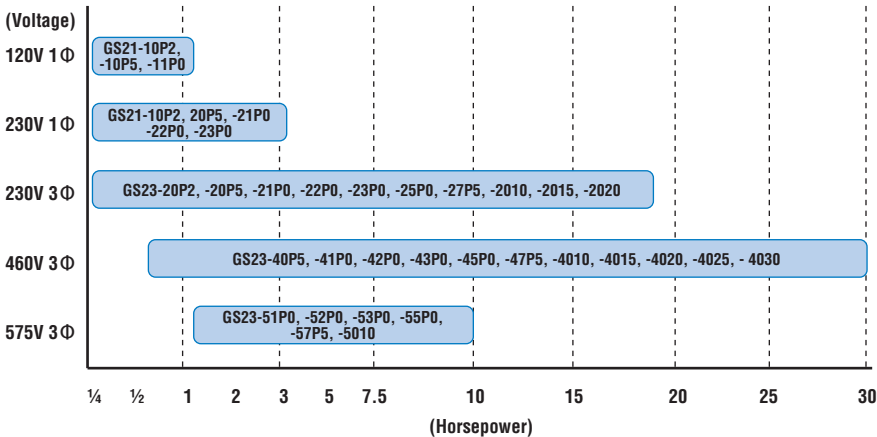
Option cards are available for the GS20 to add features like Ethernet communications over Ethernet/IP and Modbus TCP or add a backup to the built-in 24VDC power supply.



	120V 1-ph	230V 1-ph	230V 3-ph	460V 3-ph	575V 3-ph
Frame A - HP	1/4 , 1/2	1/4 , 1/2	1/4 , 1/2 , 1	1/2 , 1	1
Frame B - HP		1	2	2	2
Frame C - HP	1	2 , 3	3 , 5	3 , 5	3 , 5
Frame D - HP			7.5	7.5 , 10	7.5 , 10
Frame E - HP			10 , 15	15 , 20	
Frame F - HP			20	25 , 30	
Part #s	GS21-1xxx	GS21-2xxx	GS23-2xxx	GS23-4xxx	GS23-5xxx

### GS23(X)-47P5

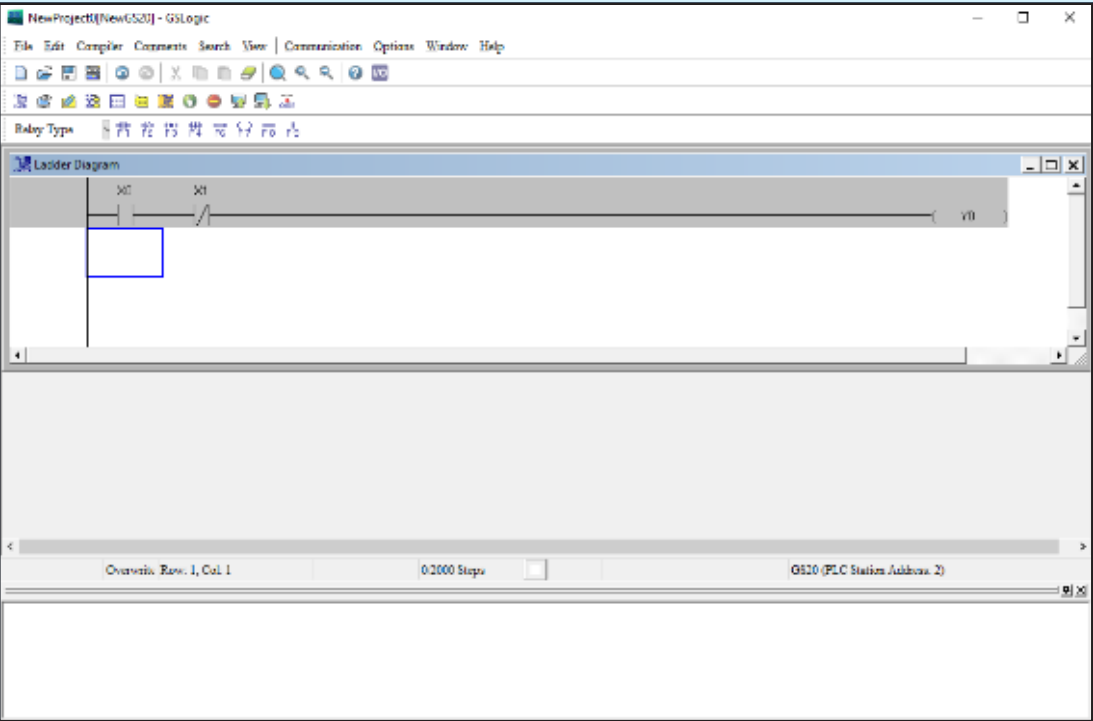
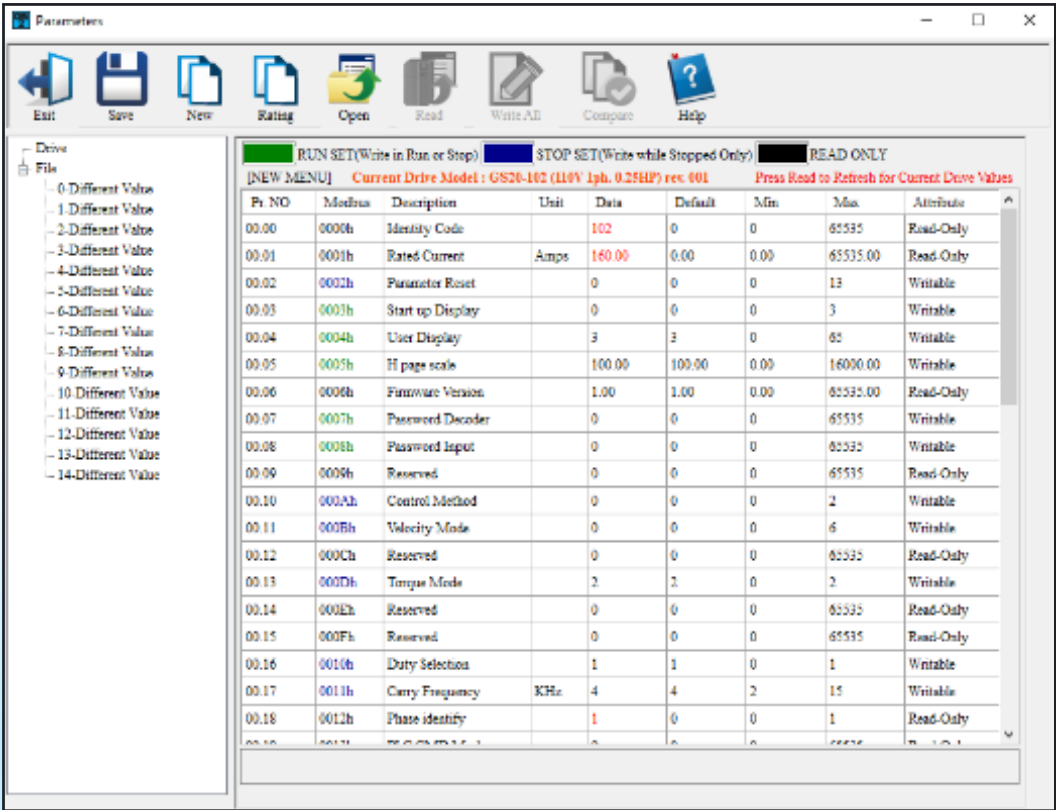
- Motor HP: OP2: 0.25hp, OP5: 0.5hp, 1P0: 1.0hp, 2P0: 2.0hp, 3P0: 3.0hp, 5P0: 5.0hp, 7P5: 7.5hp, 010: 10hp, 015: 15hp, 020: 20hp, 025: 25hp, 030: 30hp
- Input Volts: 1: 120VAC, 2: 230VAC, 4: 460VAC, 5: 575VAC
- Model Line: blank: Std GS20, X: NEMA 4X, A: Accessory
- Input Phase: 1: single phase, 3: three phase
- Series Name: GS2\_ = GS20



GS20(X) Programming

The GS20 and GS20X VFDs support parameter configuration, setup and troubleshooting via the GSOF2 software. In addition to this, the GS20 has a built-in PLC that is programmed with GSLOGIC software. To make migration from the older generation GS2 drives, the GS20 has a GS2 mode that allows the drive to be programmed using the same parameter set as the GS2.

GSOF2 – for parameter configuration, setup, troubleshooting & FW upgrade



GSLOGIC – for the built-in PLC ladder program

GS20(X) Control Modes

The GS20 supports three different control modes offering various levels of torque output control at different speed ranges. Also available is torque control mode that allows the drive to control the level of torque as opposed to speed. Torque control mode is a feature usually only found on higher cost drives.

		V/F Mode (+encoder)	SVC Mode	FOC Mode
Induction Motor (IM)	Torque	150% @ 3Hz	150% @ 3Hz	200% @ 0.5Hz
	Accuracy	1:50 speed control	1:50 speed control	1:100 speed control
Permanent Magnet (PM)	Torque	NA	100% @ 1/20 rated Hz	NA
	Accuracy		1:20 speed control	

GS20(X) Additional Features

These are just some of the features that the GS20 has. You will be hard-pressed to find a drive for the same price with all of the features it supports. In addition to what was mentioned the GS20 also supports.

- V/Hz Control, Sensorless Vector Control, Field Oriented Control
  - Torque Control Mode
  - Maximum frequency 0-599Hz
  - Multiple motor support, supports up to 4 induction motor switching control from a single VFD
  - Built-in braking chopper
  - DEB, deceleration energy backup, controls motor deceleration during power loss
  - 100kA short circuit current rating
  - STO – Safe Torque Off
  - 100% Conformal coating (IEC 60721-3-3 class 3C2) on PCBs provides moisture, corrosion & dustproof in critical environments
  - Built-in PLC (up to 2,000 steps)
- USB programming
  - Built-in RS485 communications (Modbus RTU)
  - Optional Ethernet communications Modbus TCP and Ethernet/IP
  - Generous built-in I/O
  - Analog inputs +/- 10VDC, 0-10VDC, 0-20mA/4-20mA
  - 7 Digital inputs, 2 relay outputs
  - Pulse in/out 33KHz pulse input & output
  - Mounting, NEMA1 conduit box; DIN rail adapter; EMC shield plate; Top-wire mounting plate (all optional)
  - Compact size
  - GS2 mode to ease with migration from GS2 VFDs
  - One-year warranty
  - UL, CE listed

GS Drive Accessories

- VTF output filters
- Drive fuses and fuse kits
  - Class T fuse kits
  - High speed Class J fuses and fuse holders
- Dynamic braking resistors and DBUs
- EMI and RFI filters
- Replacement cooling fans





GS20X NEMA 4X AC Drives

The GS20X delivers all of the features and performance of the GS20 drive\* including PID, sensorless vector and field oriented control modes but adds a washdown rating up to 10hp. The GS20X comes in a NEMA 4X/IP66 enclosure to withstand the rigors of extreme environments. The GS20X also offers an optional NEMA 4X disconnect to make installation simple.



\*GS2 mode not supported on GS20X models

GS1 series AC drives



GS1 AC mini drives

- ¼ and ½ hp, 115 VAC (single-phase input)
- ¼, ½ and 1 hp, 230 VAC (single/three-phase input)
- 2 hp, 230 VAC (three-phase input)

Features

- Simple Volts/Hertz control
- Pulse Width Modulation(PWM)
- 3 - 10 kHz carrier frequency
- IGBT technology
- 130% starting torque at 5 Hz
- 130% rated current for 1 minute
- Electronic overload protection and stall prevention
- Adjustable accel and decel ramps
- S-curve settings for acceleration and deceleration
- Automatic torque and slip compensation
- DC braking
- Three skip frequencies
- Trip history
- Integral keypad and speed potentiometer
- Programmable jog speed
- Three programmable preset speeds
- Four programmable digital inputs, one programmable relay output
- Programmable analog input
- RS-485 Modbus communications up to 19.2K
- Optional Ethernet communications
- UL/CUL listed; CE

GS1 Drives vs. the competition

AutomationDirect GS1

VS.

Allen-Bradley Powerflex 4M™

0.25 hp

\$117.00  
GS1-10P2



\$356.00  
22F-V1P6N103



2 hp

\$170.00  
GS1-22P0



\$455.00  
22F-B8P0N103



All prices are U.S. published prices. AutomationDirect prices as of 8/23/2021. Allen-Bradley prices taken from [www.wemerelectric.com](http://www.wemerelectric.com) 11/5/2020. Prices subject to change without notice.



DURAPULSE® GS3 AC drives

DURAPULSE GS3 builds on the GS series

The *DURAPULSE* series builds on the simplicity and flexibility of the GS1 and GS2 series, incorporating feedback from our customers and extensive research and testing in our own drives lab. While the GS1 offers simple Volts per Hertz control, and the GS2 adds PID functionality and dynamic braking, *DURAPULSE* offers sensorless vector control and autotuning, as well as optional encoder feedback for enhanced speed control. *DURAPULSE* configuration settings are a superset of the GS series, so programming for the same parameters is identical across all series.

- 1 to 3 hp, 230VAC (single/three-phase input)
- 5 to 50 hp, 230VAC (three-phase input)
- 1 to 100 hp, 460 VAC (three-phase input)



GS3 features

- Simple Volts/Hertz control
- Sensorless vector control with autotune
- Sensorless vector control with optional encoder feedback card, for tighter speed control
- Variable carrier frequency, depending on model
- IGBT technology
- 150% starting torque
- 150% rated current for one minute
- Internal dynamic braking circuit for models under 20 hp
- Automatic torque and slip compensation
- Programmable jog speed
- Removable smart keypad with parameter upload/download
- Easy-to-understand parameter text labels
- HIM keypad with memory to store up to four programs of any DURApulse drive
- Three analog inputs and one analog output
- Eleven digital inputs
- Four programmable outputs: Three digital and one relay
- One digital frequency pulse output
- RS-485 Modbus communications
- Ethernet communication optional
- UL/CE listed
- Optional software package with full programmability, trending and application setup

Durability guaranteed

*DURAPULSE* drives are backed by the same 2-year warranty as the GS series!

Little programming required

Default values were carefully selected so the drives run “out of the box” for most applications, with default values set for the U.S. industrial market. Keypad can store up to 4 configuration programs for any *DURAPULSE* GS3 drive. This is great for maintenance backup as well as OEM programming ease.

Remote mounting of keypad

Standard keypad mounted on unit's face can also be remote mounted for easy access to data and parameters. Requires remote cable.

U.S. operating parameters

*DURAPULSE* GS3 drives are programmed with easy-to-understand parameters and functionality. Instead of only parameters numbers or codes, GS3 uses terms like “Max Motor RPM” for parameter settings.

Encoder feedback

Optional encoder feedback module allows additional control routine for tighter speed control.



Sensorless vector technology up to 100 hp

The *DURAPULSE* GS3 digital keypad

The digital keypad includes a 2 line 16 character LCD display, 5 status LED Indicators, and 9 function keys. The diagram above shows all of the features of the digital keypad.

The standard smart keypad (aka HIM or Human Interface Module) is designed with defaults for the North American customer and allows you to configure the drive, set the speed, start and stop the drive, and monitor critical parameters for your application. In addition, this keypad has internal memory that allows four complete programs to be stored and transferred to any *DURAPULSE* drive.

GS3 accessories

- AC line reactors
- EMI filters
- Braking resistors
- Fuse kits and replacement fuses
- RF filter
- GS3-FB feedback card
- Ethernet interface
- GSoft drive configuration software
- Replacement keypads
- Remote panel adapter
- Keypad cables in 1, 3 and 5 meter lengths
- Four and eight-port communication boards

Drives	AutomationDirect DURAPULSE GS3	VS. Allen-Bradley Powerflex 40	Our Price vs A-B
10 hp, 240V	\$752.00 GS3-2010	\$3,010.00 22B-B033N104	73% Savings
5 hp, 460V	\$481.00 GS3-45P0	\$1,850.00 22B-D010N104	73% Savings
10 hp, 460V	\$835.00 GS3-4010	\$2,790.00 22B-D017N104	69% Savings

All prices are U.S. published prices. AutomationDirect prices as of 8/23/2021. Allen-Bradley prices taken from [www.wernerelectric.com](http://www.wernerelectric.com) 11/5/2020. Prices subject to change without notice.

GSoft configuration software

GSoft configuration software is a Windows-based package that allows connection from a PC to any GS1, GS2 or *DURAPULSE* GS3 drive for easy configuration and tuning (see later in section for GS4 software). You can create new drive configurations, upload and download archived configurations, and tune the drive's PID loop with intuitive screens. GSoft is available as a free download from our Web site.

GSoft configuration software available for free download (CD available for \$9.75).  
[www.automationdirect.com/pn/gsoft](http://www.automationdirect.com/pn/gsoft)



# The next generation of *DURAPULSE* AC drives available up to 300hp!

**DURA  
III PULSE  
GS4**

Starting at **\$463.00**

1-7.5HP, 10-20HP, 25-40HP, 50-60HP, 75-100HP, 125-150HP, 175-200HP, 250-300HP

Starting at only \$463.00, GS4 AC inverters are loaded with features!

- V/Hz control or sensorless vector in all 8 frames sizes
- All 230V drives have single-phase input capability
- Dual rating design – CT/VT ratings (light & heavy duty)
- Flexible carrier frequency to 15kHz and output frequency to 600Hz
- STO – Safe Torque Off (TUV Certified)
- Built-in PLC to support up to 10k steps
- 100kA short circuit current rating
- Free downloadable software for configuration and programming (\$9 for hard copy)
- Field-upgradable firmware via USB port
- Hot-pluggable LCD text-based keypad can be remotely mounted
- Embedded quick-start menus
- Control mode selection from keypad, communication input, or digital I/O
- Display units of measure of your choice (GPM, FPM, etc.)
- Momentary power loss restarts
- Built-In DC choke (some models)
- Flange-mount capability for frame sizes A to F (1 to 215hp)
- Conduit boxes for NEMA 1 installations
- Expanded I/O capability – 110V inputs, relay outputs, combo DC I/O card
- Analog I/O – configurable 3 inputs and 2 outputs
- Auto speed search capability
- Multi-motor control
- Dynamic braking
- PID controller – including sleep and wake
- Password protection
- RTD and/or PTC Input Motor Protection
- Parameter organization similar to GS3 (for easy upgrades)
- Calendar function allows chronological program control (daylight savings time, etc.)
- MODBUS RTU and BACnet communication protocols built-in
- Optional communication cards for MODBUS TCP and EtherNet/IP
- Modularized design eases maintenance and expansion
- Conformal coating on PCBs for improved environmental tolerance
- Excellent heat-sink design; operate at 50°C without derating
- Fire Mode – emergency smoke removal and HVAC system pressure
- Multi-motor control: control up to 8 pumps at the same time
- Two-year warranty
- CE, TUV, UL, cUL



## DURAPULSE GS4 AC sensorless vector drives

- 1 to 100 hp, 230VAC (single/three-phase input)
- 1 to 300 hp, 460VAC



Watch the GS4 overview video

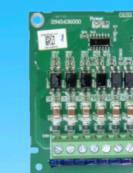


## A built-in PLC and expanded I/O capabilities

### Upgrade to Modbus/TCP or Ethernet/IP with optional comm cards



Ethernet/IP



6 Digital Inputs



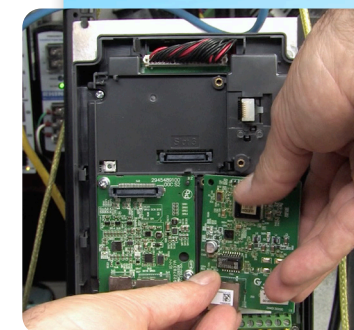
Modbus TCP



4 Digital Inputs  
2 Digital Outputs



6 Relay Outputs



### PLC inside

A fully functional PLC is built in to the GS4 drive. Capable of up to 10k steps, it's perfect for drive-related logic requirements. Control the drive and I/O with standard ladder logic (and our FREE downloadable PLC software, GS Logic). Advanced PLC features include 32-bit math, Gray Code, drive frequency control, read/write drive parameters, real-time clock/calendar with support for daylight savings time and full drive PID control. And it's all on-board!

### You have I/O choices

Perfect for drive related and PLC operations, the built-in I/O includes eight DC digital inputs, two DC digital outputs (up to 48V), 2 form-C relay outputs, as well as five analog channels (3 inputs and 2 outputs) configurable for either voltage, current or potentiometer (input). The expansion I/O slot will accept any one of three I/O option cards: the combo DC discrete card with four 24VDC input (sinking or sourcing) and two 24VDC outputs, the six-point 110VAC input card, or the six-relay output (250VAC/30VDC) card.

### High-speed communication interfaces

GS4 drives support both Modbus RTU/ASCII and BACnet (serial) protocols out-of-the-box. Modbus RTU is ubiquitous on the factory floor – all PLCs and most other equipment are compatible. Similarly, BACnet is the de facto standard for the HVAC and building automation worlds. The GS4 drives also accept an optional Ethernet card; choose from the Modbus TCP option or the EtherNet/IP version. These economically priced option cards put your GS4 drive on a fast network at a low cost. You'll be amazed at how easily you can set up the drive to communicate with any of our PLCs (especially the newer Do-more and Productivity Series models).





## Be safe with DURAPULSE GS4



### Safe Torque Off

The Safe Torque Off (STO) function is a basic drive-integrated safety feature. Use this input signal to ensure that no torque-generating energy can flow to the motor. This function is often used in emergency stop situations and/or to prevent unintentional motor starting.



### 100kA SCCR rating

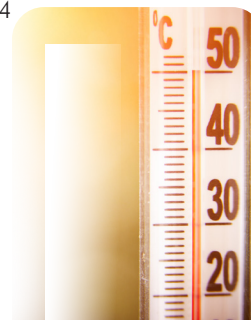
A 100kA Short Circuit Current Rating (SCCR) is required for personnel safety in many factory environments and to meet a host of regulatory requirements including:

- NEC Article 409
- UL508A
- NFPA70E

SCCR is defined as the maximum short circuit current a component or assembly can safely withstand when protected by a specific overcurrent protective device, or for a specified time interval. The use of high-speed class J or class T fuses on the incoming power is required for these installations.

### 50°C rating

The excellent heatsink design of the GS4 series provides a 50°C rating, allowing the GS4 drives to operate in harsh ambient conditions (that's 122°F!). GS1, GS2 and GS3 models are rated for 40°C, but can require additional cooling for the enclosure. Furthermore, all the GS4 drives up to 215 hp can be "flange mounted", a through-mounting method that puts the drive's heatsinks on the outside of the enclosure. This allows the use of a smaller enclosure, or reduces the need to cool the enclosure, or both!



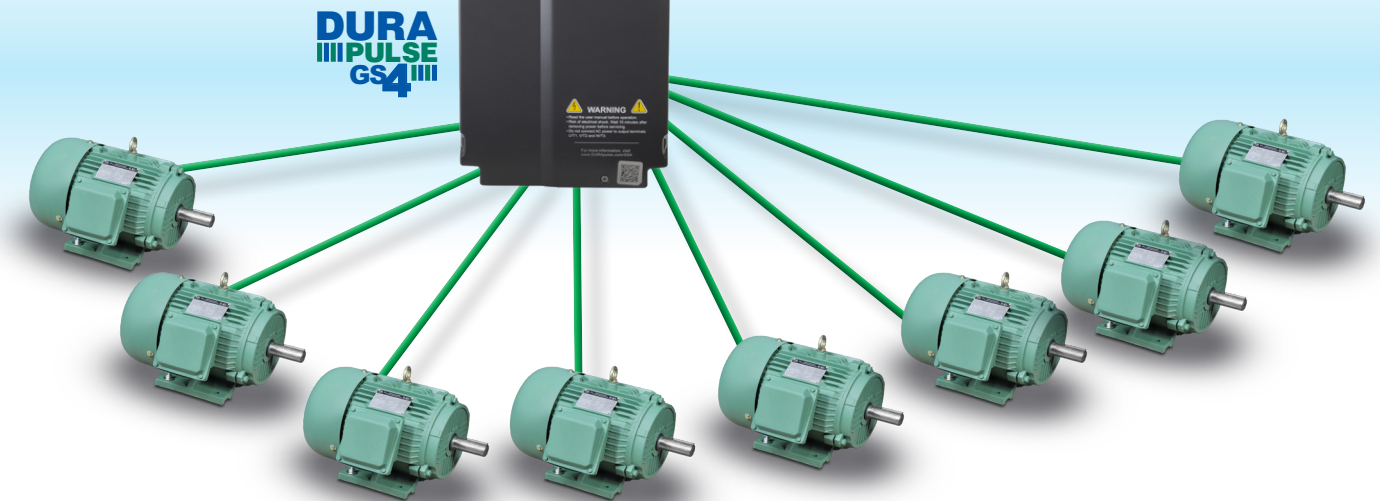
### Fire mode

Run Fire mode during emergencies for uninterrupted smoke removal and system pressure. Sometimes called "run until destruction" mode, this feature should be used as a measure of last resort; it can be useful, even life-saving in certain situations (keeping a stairwell clear of smoke, for instance). The drive will ignore all alarm inputs, and reset immediately on any trips. Use with caution, especially during any testing that is required.

## DURAPULSE GS4 AC drives are in control

### Circulative control mode (multi-motor control)

The GS4 drives offer five different control modes for circulation pump control. The drive can control up to 8 motors in a cyclic or cascading fashion by using a combination of VFD control and across-the-line control. Relay outputs on the drive operate contactors that allow the VFD to control one or more motors, while additional relay outputs provide across-the-line control of other motors via separate contactors. These modes can be used to balance usage of multiple pump motors, or to provide scalability and efficiency (with vastly differing pumping volumes) with an array of smaller motors.



### PID control (including sleep and wake)

The GS4 series drives support full PID control to automatically apply accurate and responsive corrections to a control function with external influences. Proportional, Integral, Derivative (PID) control is a mainstay in industrial control, bringing complex processes up to speed with little or no overshoot, or controlling pressure, force, feed rate, flow rate, position, etc. The Sleep Mode function is actuated when the frequency of the output command or the feedback signal falls below the Sleep Reference point for a specified period of time. When asleep, the drive output is off and it simply monitors Wake-up Reference point. A separate Wake-up Delay Time can be used to delay the Wake-Up routine.



### WARNING

- Read the user manual before operation.
- Risk of electrical shock. Wait 10 minutes after removing power before servicing.
- Do not connect AC power to output terminals UT1, V/T2 and W/T3.

For more information, visit  
[www.DURApulse.com/GS4](http://www.DURApulse.com/GS4)





# Designed for the future (and backward compatible)

**DURA  
IIIIPULSE  
GS4**



## Field upgradeable firmware

Now you can take advantage of new features and functional enhancements long after you've purchased your VFD. All GS4 drives have the built-in "3-in-1 Firmware Upgrade Module" that allows you to upgrade not only the drive, but also the firmware in the intelligent keypad, and even the optional Ethernet/IP or Modbus TCP cards (if present in your system). Just connect your USB cable to the upgrade module and download the latest firmware; we've got detailed "Tech Tip" videos that walk you through the entire process!

# Quality features at AutomationDirect prices

## Intelligent keypad (can mount remotely)

The LCD keypad on GS4 drives is text-based with full English parameter names and descriptions (no mnemonic codes to puzzle over). Configure and store up to 4 complete sets of drive parameters for backup and recovery operations. It can be remotely mounted with a simple bezel kit and a standard Ethernet patch cable, so you can mount the keypad on the outside of the drive enclosure, near the motor, or the driven machinery. Beyond initial drive setup, the keypad can be used for run/stop control of the motor, or as a scalable speed or frequency display. The keypad has a NEMA 1 rating, and provides ingress protection to IP20.

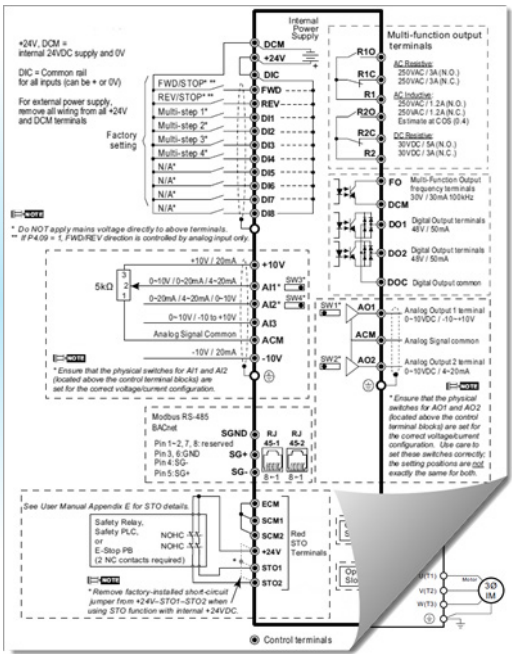
## Display units of measure of your choice (GPM, FPM, etc.)

Configure the keypad to scale and display relevant units for your application. Configure Gallons Per Minute (GPM) of flow for a pumping application, or Feet Per Minute (FPM) for conveyor or material speed, or any other units you desire. Just configure the scaling factor and the units you wish to be displayed.



## Rugged dependable design

GS4 drives are designed for long life and maintainability, with self diagnosis for key components. Their modular design makes expansion a breeze and helps ease maintenance (quick replacement of fans, for example). The internal circuit boards all have conformal coating to protect against moisture, dust, chemicals, and temperature extremes.



## Already familiar with our GS3 drive?

The GS4 parameter organization is very similar to GS3. If you have worked with a GS3 drive in the past, you will find most of the parameter settings in the same locations in the GS4. Better yet, if you currently have a PLC connected to a GS3, switching to a GS4 will be very easy, with minimal changes required to your PLC program. Of course you may wish to make some changes to take advantage of all the great new features!

## Embedded Quick-Start menus

The Quick Start menu has the most common motor parameters listed together, so you can get your motor running quickly. Just reference your motor nameplate for a few critical values, and enter them into the drive, and get started FAST! See Chapter 3 of the manual for an overview of keypad operation and our comprehensive quick-start guide (that ships with each drive), or check out our quick-start video to see just how easy it can be.







**DURA  
III PULSE  
GS4**

**Smartly  
designed  
to be rugged,  
efficient and tough**

### Flange mounting

All GS4 drives up to 215hp can be “flange mounted”, a through-mounting technique that puts the drive’s heatsinks on the outside of the enclosure. This allows the use of a smaller enclosure, or reduces the need to cool the enclosure, or both! The smaller A through C frame drives have optional flange mount kits, while the D through F frame models come with the flanges already attached. The largest G frame drive isn’t normally mounted in an enclosure, so it doesn’t have provisions for flange mounting.



### Conduit boxes

Conduit boxes allow larger GS4 drives to be mounted without an enclosure in many applications, saving considerable cost and installation time. The three smallest frame sizes (A-C) have conduit boxes built in, with conduit holes in the bottom of the drive. GS4 drives with conduit boxes are rated for IP20, UL Type 1, and NEMA 1, which generally means that they protect against intrusion by objects and personnel. They aren’t protected against dust, water, oil, etc. without an enclosure, so take necessary precautions if a higher degree of protection is required.

See our video for all the details.



**All the features you need . . . for less.**

### Built-in dynamic braking (models below 40 hp)

When a variable frequency drive decelerates an AC motor, especially one with a large inertial load attached, the process is known as dynamic braking. While all GS4 Drives are capable of dynamic braking, the smaller sized drives (those below 40 hp) have this capability built in, while the larger drives (above 40 hp) require an optional dynamic braking unit. A thermal overload and external braking resistors are required to dissipate the energy safely. A comprehensive line of braking units, thermal overloads, and braking resistors is available; check out our video on Dynamic Braking for all the details.

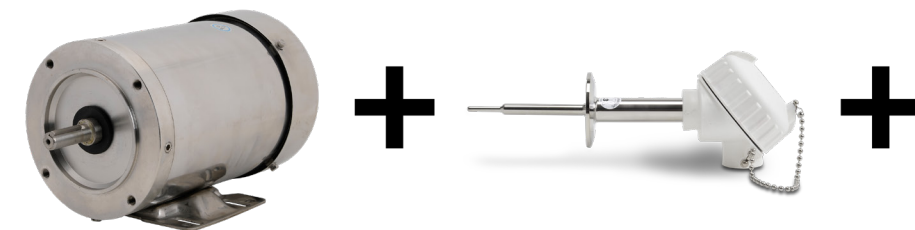


### Built-in DC choke (models above 40 hp)

A DC choke is used to mitigate the impact of harmonics in VFD applications. Harmonics on the power line can cause additional heating of the transformer and cabling to the VFD, as well as disrupting other connected equipment. Performing a similar function as an AC line reactor (on the line input to a drive), a DC choke is connected after the input diode in the VFD circuit. The larger GS4 drives (above 40 hp) have the DC choke built in, while the smaller drives will accept an optional DC choke if you find that one is needed for your application.

### Auto speed search

Also known as “catch on the fly”, this control technique allows the GS4 drive to take control of a motor that is already spinning. In some applications, such as fan control where the fan blade is located in a moving air stream, it isn’t always practical or desired to stop the motor prior to bringing it under VFD control. The GS4 drives can send small current signals to the motor to detect the motor’s speed, and then engage the motor in full V/Hz or sensorless vector mode within a few seconds. Very advantageous in certain circumstances!



### Protect your motor from overheating

Wire a standard temperature sensor (such as an RTD) from your motor into the GS4 drive and protect that motor from overheating. It’s a UL requirement in some applications, and a darn good idea ALL of the time. PTC or Positive Temperature Coefficient sensors rely on the electrical properties of certain metals whose resistance increases with temperature. The most common are RTDs (Resistance Temperature Detectors), but thermistors may also be used.



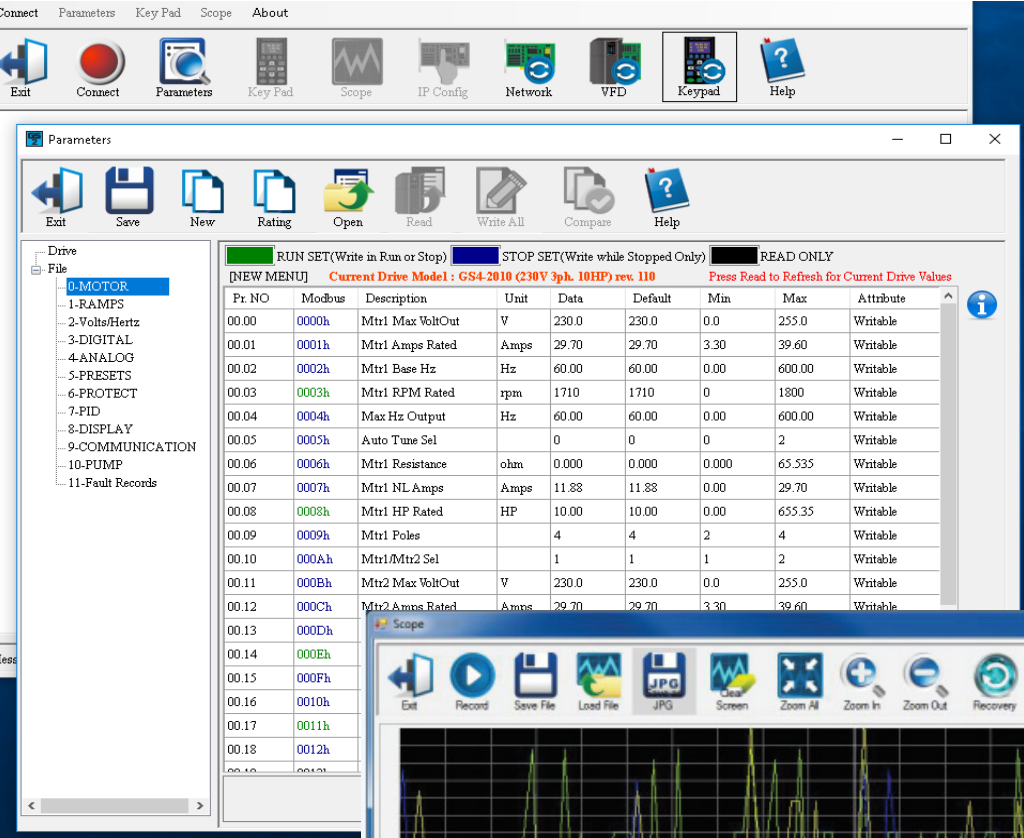


# Free downloadable configuration software

GSOFT2 is the configuration software for the GS4 and GS20 family of drives. It allows you to connect a personal computer to a GS4 and GS20 drive, and perform a variety of functions:

- Create new drive configurations
- Upload/download drive configurations
- Edit drive configurations
- Archive/store multiple drive configurations on your PC
- Trend drive operation parameters
- Tune the PID loop in the drive
- View key operating parameters in real-time
- View drive faults
- Start/Stop drive and switch directions, provided drive is set up for remote operation
- Upgrade firmware in the drive, keypad, or Ethernet comm cards.

GSoft2 includes an integral help file with software instructions. GSoft2 can be downloaded for free or purchased on CD from AutomationDirect.com. Your PC must have an RS-485 connection (see our USB-485M USB-to-serial converter).



Download  
GSOFT2  
NOW!



Download  
GSLOGIC  
NOW!



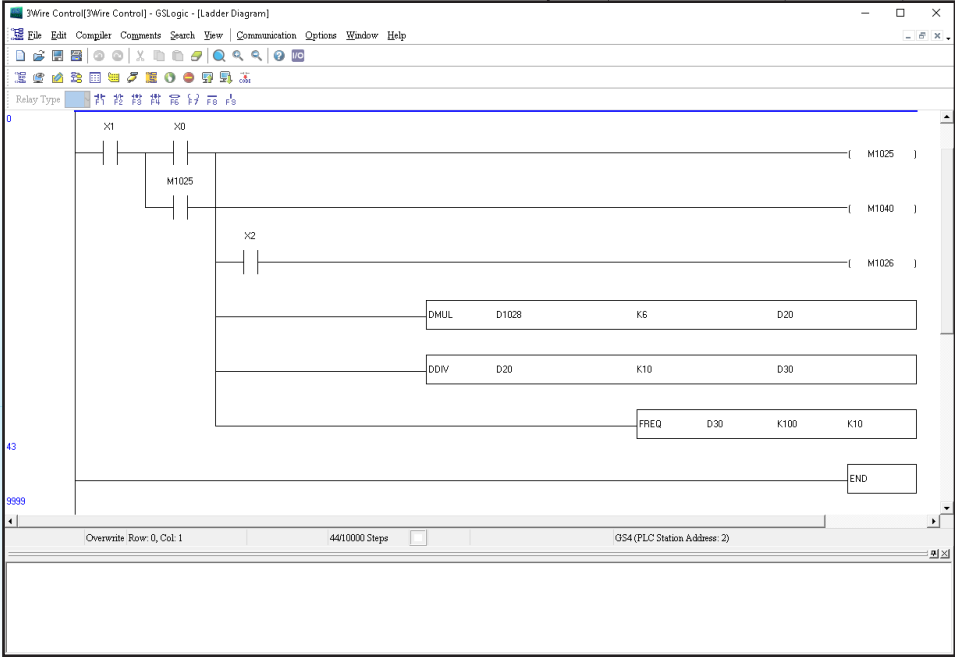
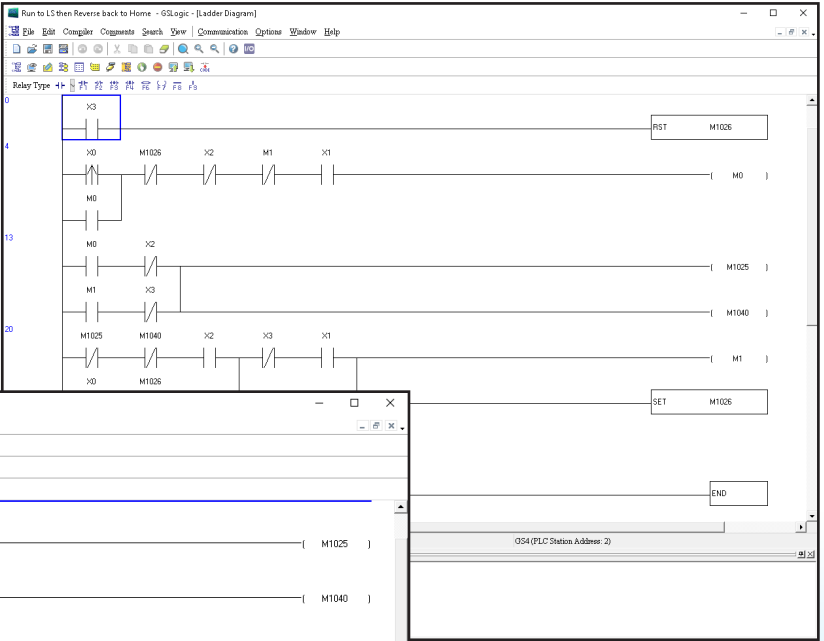
# Free downloadable ladder logic software

Use the built-in PLC and our free downloadable ladder logic software (GSLogic) to take your VFD applications to new heights. Program up to 10,000 steps (2,000 for the GS20) of ladder logic to control your drive and the related machine or process. The PLC can read from or write to any parameter in the drive, and control the ample on-board and optional I/O in your GS4 or GS20/GS20X. Access the real-time clock calendar to program date-specific, or daily, weekly, or monthly routines, with full support for daylight savings time built in. Use the serial interfaces to communicate with other GS4/GS20/GS20X drives, or other equipment in your factory. There's even a special instruction that allows the PLC to monitor and adjust the drive PID loop.

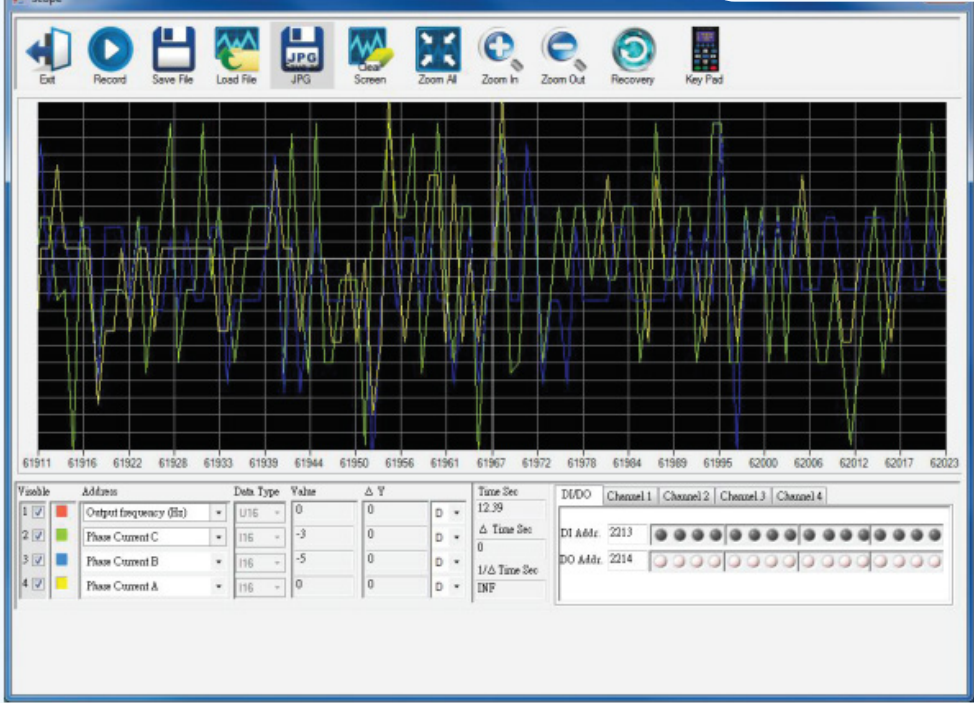
The software supports all the standard Windows editing functions like cut, copy, paste, multiple windows, etc. GSLogic also allows register editing, online monitoring, and other convenience functions, such as:

- Create and edit GS4/GS20/GS20X drive-specific PLC programs
- Upload/download PLC program files to the onboard PLC
- Archive/store multiple PLC programs on your PC in the GS4/GS20/GS20X keypad
- Control the GS4/GS20/GS20X drive PID loop (FPID instruction)
- View all GS4/GS20/GS20X PLC registers in real time
- Print GS4/GS20/GS20X drive PLC program files

GSLogic includes an integral help file with explanations of all software instructions, a how-to-use GSLogic section, and a how-to-use the GS4 PLC section.



Check out the  
three part  
Quick-Start Video





# DURA PULSE GS4

## Packed with thoughtful features that you'd never expect at this price point!

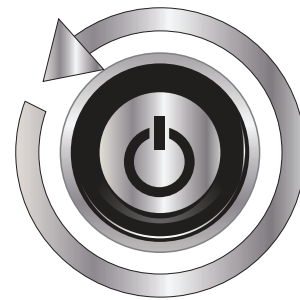


### Clock/calendar with support for daylight savings time

The GS4 drives have a real-time clock/calendar that allows the user to program the PLC (and by extension, to control the drive) with ON/OFF control in chronological order, for certain times of day, days of the week, seasonal changes, etc. And it includes full support for daylight savings time.

### Momentary power loss restart

After many power loss or brown out situations, the entire machine or process may need to go through a prescribed start-up process, but there are times when having a VFD come back online automatically and ASAP is advantageous. Enable this function and the GS4 drive will automatically restart and use "speed search" to catch the motor on the fly and continue running. The GS4 drive can also be set to automatically restart after a fault (with a limit on the number of fault restarts allowed within a given time frame).



### Dual rating design – CT/VT ratings (light & heavy duty)

All the GS4 drives are rated for both Variable Torque (VT) and Constant Torque (CT) applications, making the selection process easier. VT (light duty) ratings allow up to 120% of current, and CT (heavy duty) allow up to 150% of current for brief periods. Be sure to set these limits carefully to avoid motor damage. There are certain situations in which the GS4 drives may need to be de-rated, at altitude or when using single phase line input, to name a few. See the pages on drive selection for all the derating details.

### Flexible carrier frequency to 15kHz

The GS4 drives have an adjustable carrier frequency, the rate at which output transistors are gated on and off, from 2 to 15 kHz. Higher carrier frequencies provide better efficiency (lower harmonic losses) in the motor and lower audible noise from the motor. Lower carrier frequencies offer better efficiency in the drive, lower EMI (electrical noise), and reduced reflective wave peak voltage (reflected wave peak voltages can damage motor insulation).

As a general rule, the carrier frequency should be set as low as possible without creating unacceptable audible noise in the motor. Smaller systems can have higher carrier frequencies, but larger drives (>20 or 30 hp) should not have carrier frequencies set higher than 6kHz. Heavy duty applications typically run around 2 to 4kHz.

GS4 drives even have the optional ability to automatically change the carrier frequency based on the load (if the drive experiences a more demanding load, it will reduce the carrier frequency until the overload is gone).





# Networking AC drives with built-in Modbus communications

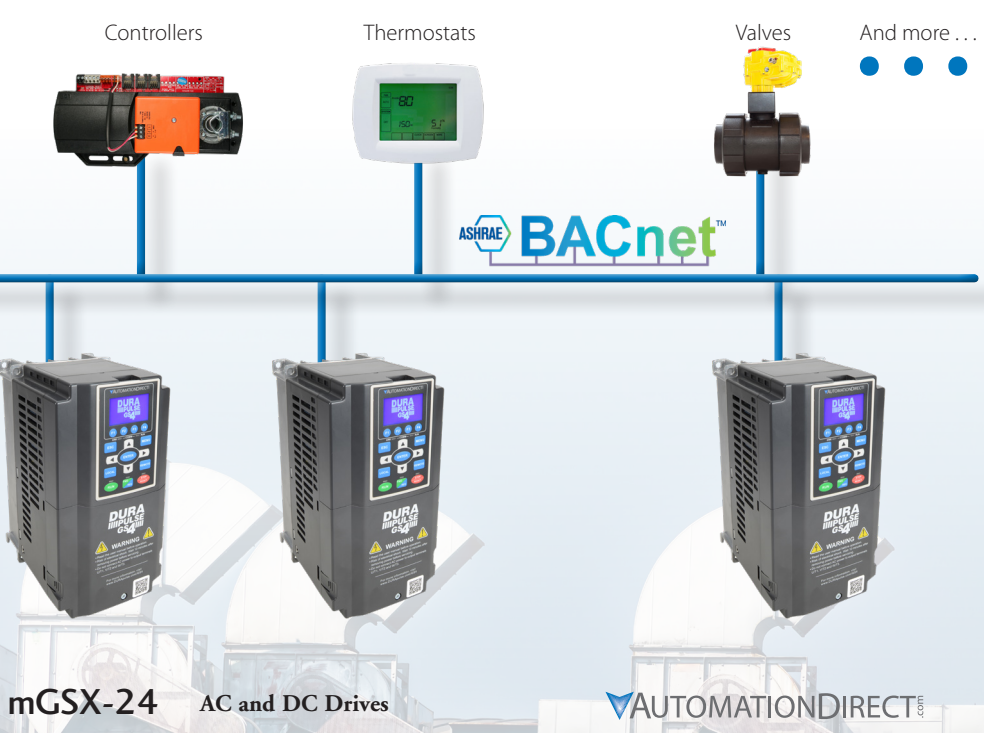
AUTOMATIONDIRECT's AC drives offer "out-of-the-box" serial connectivity. Modbus RTU is the onboard standard protocol used for control and monitoring. This can be used to connect several Modbus masters like AUTOMATIONDIRECT's family of **DirectLOGIC**, **CLICK**, **Do-more**, and **Productivity** series PLCs and any OPC server that has a Modbus driver such as Kepware or Software Toolbox.

Imagine getting all the parameter settings and control functionality on one cable, even when the information is not readily available by any other means. This flexibility offers cost savings, standardization, smaller PLC usage, and less development time.

See the Motor Controller Communications table later in this section for creating plug-and-play serial networks with drives and PLCs.



RS-485 Modbus Network



## GS4 drives support BACnet

BACnet is an open protocol for data communication in building automation and control networks. The protocol is developed, supported and maintained by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers). BACnet is an American national standard, and international standard used in more than 30 countries.

The BACnet serial protocol is built in to every GS4 drive. On BACnet, your GS4 drive can communicate with building automation devices such as controllers, thermostats, valves, and I/O devices. Often used for HVAC fan and pump applications, the GS4 drives even have a "fire mode" in which they will "run until destruction" in an attempt to keep stairwells and emergency exit pathways clear of smoke in emergency situations.

# Add Ethernet connectivity for advanced functionality

Add Ethernet connectivity and enable high-speed communications to PLCs, HMIs, SCADA systems and many other factory devices. For the GS4 drives, select the optional Modbus TCP card or the EtherNet/IP card to mount internally in the drive. The GS1 and GS3 drives require the externally mounted GS-EDRV100 module, which also provides a high-performance Ethernet link to Modbus TCP networks.

## Modbus TCP

Connect your GS drives to any of our PLC platforms (and many others) with Modbus TCP. Modbus was originally developed by Modicon (now Schneider Electric) in 1979 for use with its programmable logic controllers (PLCs). It has been managed by the Modbus Organization since April 2004, when Schneider Electric transferred all rights. Simple and robust, it has become a de facto standard communication protocol and is now a commonly available means of connecting industrial electronic devices. Modbus TCP is a Modbus variant used for communications over TCP/IP networks.

## EtherNet/IP

Connect your GS4 drives to EtherNet/IP devices, including our Productivity series PLCs, our Do-more series PLCs, and our C-more HMIs. EtherNet/IP is one of the leading industrial protocols in the United States and is widely used in a range of

industries including factory, hybrid and process. The EtherNet/IP standard is managed by ODVA, Inc., a global trade and standards development organization founded in 1995 with over 300 corporate members.

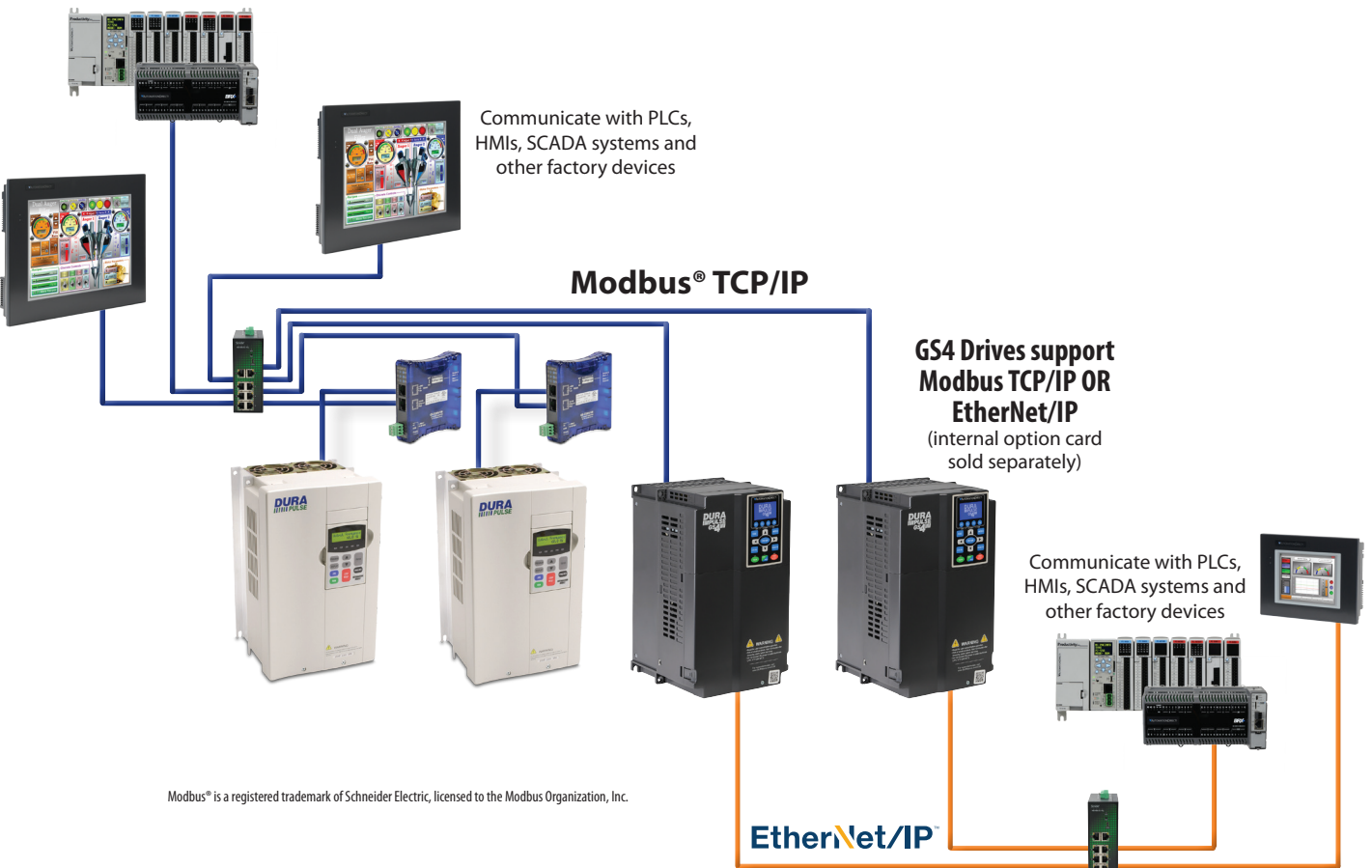
## Auto-shutdown

The DURApulse and GS series drives have a provision for shutting down control or power to the inverter in the event of a communications timeout. This function can be set up through the drive's parameter group 9 on all the drive platforms.

## SCADA

KEPDirect Server software and many other SCADA software packages provide a way to connect your favorite Windows client software to the GS drives. SCADA software allows the user a direct line into the drive parameter group just like an Ethernet field I/O drop. The user can also control or monitor from any OPC/DDE compliant third party software.

For a complete description of the KEPDirect software features, see the Software tech specs document. Several application notes specific to the versatility of this software can be found on our web site at [www.automationdirect.com](http://www.automationdirect.com).



Modbus is a registered trademark of Schneider Electric, licensed to the Modbus Organization, Inc.



# 3 Steps to Selecting the Right AC Drive

STEP 1

## STEP 1 - Select The Right Model

### A. Determine motor voltage, horsepower and full-load amperage

	AC Drive Models					
	CFW100	GS1	CFW300	GS20/GS20X	GS3	GS4
Horsepower	1/4 - 1*	1/4 - 2	1/4 - 5*	1/4 - 30*	1-100*	1-300*
Input voltage	115/230 VAC	115/230 VAC	115/230 VAC	115/230/460/575 VAC	230/460 VAC	230/460 VAC
Motor voltage	230 VAC	230 VAC	230 VAC	230/460/575 VAC	230/460 VAC	230/460 VAC
	* 115V up to 1.5 hp 230V up to 1 hp		* 115V up to 1.5 hp 230V up to 5 hp	*115V up to 1 hp 230V up to 20 hp (7.5hp for GS20X) 460V up to 30 hp (10 hp for GSX20) 575V up to 10 hp	* 230V up to 50 hp 460V up to 100 hp	*230V up to 100 hp 460V up to 300 hp

#### Check the nameplate on the motor for specs needed:

Motor horsepower	Inverter Duty Motor							
	hp	1	Volts	460	PHASE	3	TYPE	P
Motor voltage	RPM	1725	AMPS	2.6	HZ	60	SF	1.15
Motor amperage	DESIGN	B	AMB	40°C	INSUL CLASS	F		
	DUTY	CONT	ENCL	TEFC	CODE	K		

Motor voltage, horsepower, and amperage can be found on the motor's nameplate.

Note: Most motors can be connected for multiple voltages and will have multiple amperages listed.

In the example to the left the motor can be connected for 460V only. The 460V amperage is 2.6.

### B. Select your application and/or control mode

	CFW100	GS1	CFW300	GS20/GS20X	GS3	GS4
Volts/Hertz Control	✓	✓	✓	✓	✓	✓
Sensorless Vector Control	✓	✓	✓	✓	✓	✓
Encoder Feedback			Optional	✓	Optional	✓
Integral PID Control	✓		✓	✓	✓	✓
Built-in PLC	✓		✓	✓		✓
Integral Dynamic Braking Unit			✓	✓		✓
	Pump Fan / Blower Blender / Mixer Centrifuges Compressors Material handling Granulators Rotary Fillers Shop tools	Conveyor Pump Fan Shop tools	3 to 5 hp Pump Fan / Blower Blender / Mixer Centrifuges Compressors Material handling Granulators Rotary Fillers Shop tools	Up to 30 hp* Conveyor Pump Fan Material handling HVAC Mixing Compressor Shop tools	Up to 15 hp* Conveyor Pump Fan Material handling HVAC Mixing Compressor Shop tools	Up to 30 hp* Conveyor Pump Fan Material handling HVAC Mixing Compressor Shop tools

Either choose your application from those listed or select the control mode that meets your application's requirements. For applications not listed, either select the control mode that offers the same or higher level of performance as the existing control, or call us and ask for assistance.

	Control Mode		
	Volts/Hertz	Sensorless Vector	Encoder Feedback
Complexity	Low	Moderate	Complex
Performance	Good	Good	High
Starting Torque	175%	200%	200%
Speed Regulation	+/- 2%	+/- 1%	+/- 0.2%

\*Larger systems require external braking units

### C. Determine the I/O requirements of the AC drive

	CFW100	GS1	CFW300	GS20/GS20X	GS3	GS4
Digital Inputs	4/4*	4	4/8*	7	11	8/12*
Digital Inputs (110VAC)						0/6*
Digital Outputs - Transistor				2	3	2/4*
Digital Outputs - Relay	0/1*	1	3/4*	1	1	0/8*
Digital Output - Frequency pulse				1	1	1
Analog Input	0/1*	1	1/1*	2	3	3
Analog Output	0/1*		0/2*	1	1	2
Thermister Input			0/1*			
Encoder Input			0/1*		0/1*	

\* built-in / optional I/O capacity

Digital inputs are used to interface the AC drive with devices such as pushbuttons, selector switches and PLC digital output modules, either DC or relay. These signals are typically used for functions such as Start/Stop, Forward/Reverse, External Fault, Preset Speed selection, Fault Reset, etc.

Digital outputs are typically used to connect the AC drive to devices such as pilot lights, alarms, auxiliary relays, solenoids,

and PLC digital input modules. Relay outputs are rated for both AC and DC voltages. Transistor outputs are rated for only DC voltages.

The analog input is used to interface the AC drive with an external 0-10 VDC or 4-20 mA signal. This signal can represent either a speed setpoint or if available, PID feedback.

### D. Determine location of AC drive's keypad

	CFW100	GS1	CFW300	GS20/GS20X	GS3	GS4
Removable Keypad						
Remotely Mountable Keypad	✓		✓	✓	✓	✓

If the AC drive is installed in a location that the operator cannot easily access, its keypad could be relocated to a more suitable location.

Remote mounting may require the purchase of the appropriate cable or other accessories. Also available for the DURApulse drives is a remote, panel-mount bezel.

### E. Determine communications requirements

	CFW100	GS1	CFW300	GS20/GS20X	GS3	GS4
MODBUS Serial RTU	Optional	✓	✓	✓	✓	✓
BACnet Serial						✓
MODBUS Ethernet TCP		Optional		Optional	Optional	Optional
Ethernet I/P				Optional		Optional
USB	Optional		Optional	✓		✓

A serial communication interface can be used to connect the AC drive to other devices. The device can control the AC drive with this interface instead of using the digital and analog I/O. The device can also use this interface to monitor the status of various AC drive parameters, speed, current, fault status, etc.

The WEG CFW300, GS1 and DURApulse AC drives have a standard Modbus RS-485 interface.

The GS1 and DURApulse drives also have the optional capability to communicate through a remote Ethernet interface (GS-EDRV100). The DURApulse GS4 drive also has the BACnet protocol built-in. The GS20, GS20X and GS4 have the ability to add Ethernet communications (either MODBUS TCP or EtherNet/IP via internal option card). Please refer to the technical section of each GS or DURApulse model to determine the required Ethernet interface adapter and compatible Ethernet devices.

The WEG CFW100 and CFW300 offer optional RS-232 or 485 Modbus communications modules for connecting to peripheral devices or for programming and monitoring. An optional USB v2.0 port is also available for programming and monitoring only.

### F. Select the proper series

After you have selected the AC drive series that meets your requirements, you need to determine the correct rating. Turn the page and proceed to Step two.



STEP 2

STEP 2 - Select the Proper Rating

STEP 1

STEP 2 HERE

STEP 3

A. Determine motor full load amperage (FLA)

Motor FLA is located on the nameplate of the motor.  
Note: FLA of motors that have been rewound may be higher than stated.

B. Determine overload requirements

Many applications experience temporary overload conditions due to starting requirements or impact loading. Most AC drives are designed to operate at 150% overload for 60 seconds. If the application requires an overload greater than 150% or longer than 60 seconds, the AC drive must be oversized. NOTE: Applications that require replacement of existing motor starters with AC drives may require up to 600% overload.

C. Installation altitude

AC drives rely upon the cooling properties of air for cooling. As the altitude increases, the air becomes less dense. This decrease in air density decreases the cooling properties of the air. Therefore, the AC drive must be oversized to

compensate for the decrease in cooling. Most AC drives are designed to operate at 100% capacity up to altitudes of 1000 m. Above 1000 m, the AC drive must be derated.

D. Determine max enclosure internal temp

AC drives generate a significant amount of heat and will cause the internal temperature of an enclosure to exceed the rating of the AC drive. Enclosure ventilation and/or cooling may be required. Ambient temperature measurements/calculations should be made for the maximum expected temperature.

E. Calculate required output amperage

Use the chart below to calculate the required FLA of the AC drive. Select the rating that equals the motor's voltage and equals or exceeds the calculated amperage.

		Ex. 1	Ex. 2	Ex. 3	Ex. 4
		GS1	CFW300/100	GS20 zero-stack/ GS20X/GS3	GS20 open style/ GS4
Example 1: Motor FLA=4, Overload=200%@45 secs, Altitude=800m, MEIT=45° C, GS1					
Example 2: Motor FLA=6, Overload=120%@80 secs, Altitude=326m, MEIT=45° C, CFW300					
Example 3: Motor FLA=8, Overload=135%@75 secs, Altitude=1100m, MEIT=35° C, GS3					
Example 4: Motor FLA=12, Overload=145%@45 secs, Altitude=800m, MEIT=55° C, GS4 Open Type*					
ENTER Motor FLA		4	6	8	12
Overload Derate (overload %)	If Overload is less than 150% and less than 60 seconds,	Then ENTER 1			
	If Overload is greater than 150% and less than 60 seconds,	Then ENTER (overload/150%)1.33			
	If Overload is greater than 60 seconds,	Then ENTER (overload/100%) Multiply FLA x overload entry (This entry is the overload result)			
Altitude Derate (meters)	If Altitude is less than 1000m	Then ENTER 1			
	If Altitude is more than 1000m and less than 3000m	Then ENTER 1 + ((altitude -1000) x 0.0001) Multiply overload result x altitude entry (This entry is the altitude result)			
	If Max enclosure internal temperature (MEIT) is less than 40° C	Then ENTER 1			
Ambient Temperature (°Celsius)	If 40° C < MEIT < 50° C and CFW300 or GS4 Open Type*	Then ENTER 1			
	If 40° C < MEIT < 50° C and GS1 up to 2 hp	Then ENTER 1			
	If 40° C < MEIT < 50° C and GS20 zero-stack, GS20X or GS3	Then ENTER 1.2			
	If 40° C < MEIT < 50° C and GS4 Type 1	Then ENTER 1 + ((MEIT - 40) x 0.2)			
	If 50° C < MEIT < 60° C and GS20 opebn style or GS4 Open Type*	Then ENTER 1 + ((MEIT - 50) x 0.2)			
	Multiply altitude result x MEIT entry (This result is the required drive FLA)	5.32	7	10.91	12.96

\*Open Type temperature ratings apply to GS4 frame sizes A–C with top covers removed, and frame sizes D–G without conduit boxes.

STEP 1

STEP 2

STEP 3 HERE

STEP 3

STEP 3 - Options, Options, and more Options

A. Input fuses

Input fuses protect the AC drive from excessive input current due to line surges, short circuits, and ground faults. They are recommended for all installations and may be required for UL-listed installations. Input fuse kits and replacement fuses are available for GS series and **DURAPULSE** AC drives.

B. Input line reactor

Input line reactors protect the AC drive from transient overvoltage conditions, typically caused by utility capacitor switching. The input line reactor also reduces the harmonics associated with AC drives. Input line reactors are recommended for all installations.

C. Input EMI filter

Input EMI filters reduce electromagnetic interference or noise on the input side of the inverter. They are required for CE compliance and recommended for installations prone to or sensitive to electromagnetic interference.

D. Output line reactor

Output line reactors protect the motor insulation against drive short circuits and IGBT reflective wave damage. Output line reactors also “smooth” the motor current waveform, allowing the motor to run cooler. The line reactor can be used for either input or output applications.

Output line reactors are recommended for operating “noninverter-duty” motors and when the length of wiring between the AC drive and motor is longer than the recommended max length of a given motor model. Inverter-duty rated motors support longer lead length than do non-inverter duty motors.

E. Dynamic braking

Dynamic braking allows the AC drive to produce additional braking (stopping) torque. AC drives can typically produce between 15% and 20% braking torque without the addition of any external components. The GS3 AC drives have built-in braking circuits on all units below 15 hp, the GS20, GS20X and GS4 drives have built-in braking on units up to 30 hp (up to 40 hp for 480VAC models). These drives usually require the addition of a braking resistor to increase their braking torque capability. Larger drives require separate braking units in addition to the braking resistors to increase their braking torque capability. Dynamic braking may be required for applications requiring rapid deceleration or high inertia loads.

