GETTING STARTED

CONTENTS OF THIS CHAPTER

MANUAL OVERVIEW

OVERVIEW OF THIS PUBLICATION

The *DURAPULSE* AC Drive User Manual describes the installation, configuration, and methods of operation of the *DURAPULSE* Series AC Drive.

WHO SHOULD READ THIS MANUAL

This manual contains important information for those who will install, maintain, and/or operate any of the *DURAPULSE* GS3 Series AC Drives.

SUPPLEMENTAL PUBLICATIONS

The National Electrical Manufacturers Association (NEMA) publishes many different documents that discuss standards for industrial control equipment. Global Engineering Documents handles the sale of NEMA documents. For more information, you can contact Global Engineering Documents at:

<div align="center">

15 Inverness Way East
Englewood, CO 80112-5776
1-800-854-7179 (within the U.S.)
303-397-7956 (international)
www.global.ihs.com

</div>

NEMA documents that might assist with your AC drive systems are:

- *Application Guide for AC Adjustable Speed Drive Systems*
- *Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems.*

TECHNICAL SUPPORT

- *By Telephone: 770-844-4200 (Mon.-Fri., 9:00 a.m.-6:00 p.m. E.T.)*
- *On the Web: www.automationdirect.com*

Our technical support group is glad to work with you in answering your questions. If you cannot find the solution to your particular application, or, if for any reason you need additional technical assistance, please call technical support at 770-844-4200. We are available weekdays from 9:00 a.m. to 6:00 p.m. Eastern Time.

We also encourage you to visit our web site where you can find technical and non-technical information about our products and our company. Visit us at www.automationdirect.com.

SPECIAL SYMBOLS

When you see the "notepad" icon in the left-hand margin, the paragraph to its immediate right will be a special note.

WHEN YOU SEE THE "EXCLAMATION MARK" ICON IN THE LEFT-HAND MARGIN, THE PARAGRAPH TO ITS IMMEDIATE RIGHT WILL BE A WARNING. THIS INFORMATION COULD PREVENT INJURY, LOSS OF PROPERTY, OR EVEN DEATH (IN EXTREME CASES).

DURAPULSE GS3 AC DRIVE INTRODUCTION

PURPOSE OF AC DRIVES

AC drives are generally known by many different names: Adjustable Frequency Drives (AFD), Variable Frequency Drives (VFD), and Inverters. Drives are used primarily to vary the speed of three phase AC induction motors, and they also provide non-emergency start and stop control, acceleration and deceleration, and overload protection. By gradually accelerating the motor, drives can reduce the amount of motor startup inrush current.
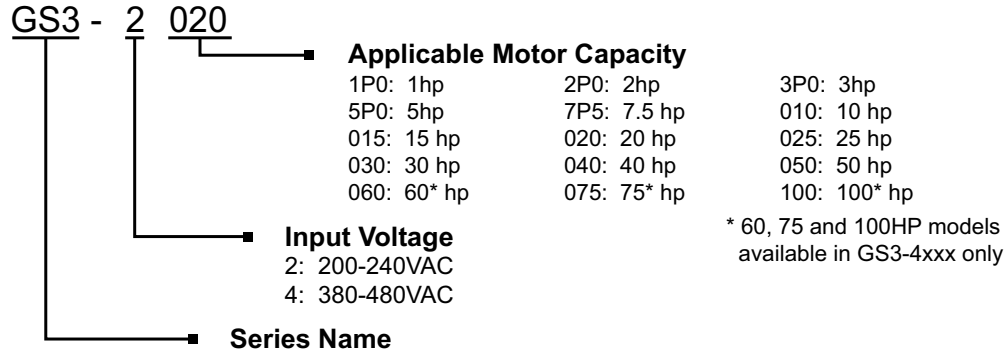
AC drives function by converting incoming AC power to DC, which is then synthesized back into three phase output power. The voltage and frequency of this synthesized output power is directly varied by the drive, where the frequency determines the speed of the three phase AC induction motor.
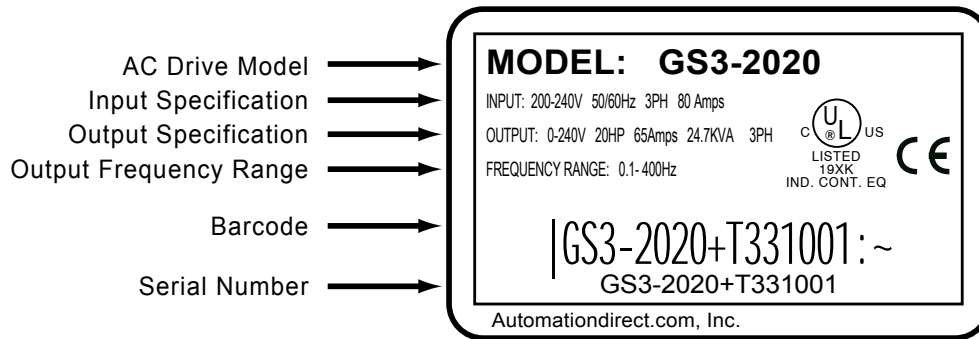
SELECTING THE PROPER DRIVE RATING

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 motor 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, and 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 meters. Above 1000m, 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, even when the ambient temperature is less than 104 °F (40 °C). Enclosure ventilation and/or cooling may be required to maintain a maximum internal temperature of 104 °F (40 °C) or less. 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, as shown by the following examples. Select the rating that equals the motor's voltage and equals or exceeds the calculated amperage.
- *Example 1 (GS1 or GS2 drive):*
  Motor FLA = 6A; Overload = 200% @ 45s; Altitude = 800m; MEIT = 45°C
- *Example 2 (DURApulse GS3 drive):*
  Motor FLA = 8A; Overload = 135% @ 75s; Altitude = 1100m; MEIT = 35°C

If	Then Enter	Example 1 GS1 or GS2	Example 2 GS3 DURAPULSE
Calculating Required Drive Current			
Overload Derate (overload %)			
If overload is < 150% and < 60 seconds	1		
If overload is > 150% and < 60 seconds	(overload / 150)%	1.33	1.35
If overload is > 60 seconds	(overload / 100)%		
Overload Result — Multiply FLA x overload entry		**8.0**	**10.8**
Altitude Derate (meters)			
Altitude is < 1,000m	1		
Altitude is > 1,000m and < 3,000m	1 + ((altitude - 1,000m) x 0.0001)	1	1.01
Altitude Result — Multiply overload result x altitude entry		**8.0**	**10.91**
Ambient Temperature (°C)			
Maximum enclosure internal temperature (MEIT) is < 40°C	1		
40°C < MEIT < 50° and GS1/2 AC drive up to 5hp	1	1	1
40°C < MEIT < 50° and GS1/2 AC drive > 5hp or *DURAPULSE* GS3 AC drive	1.2		
Required Drive FLA — Multiply altitude result x MEIT entry		**8.0**	**10.91**

MODEL NUMBER EXPLANATION

GS3 - 2 020

Applicable Motor Capacity

1P0: 1hp	2P0: 2hp	3P0: 3hp
5P0: 5hp	7P5: 7.5 hp	010: 10 hp
015: 15 hp	020: 20 hp	025: 25 hp
030: 30 hp	040: 40 hp	050: 50 hp
060: 60* hp	075: 75* hp	100: 100* hp

* 60, 75 and 100HP models
  available in GS3-4xxx only

Input Voltage
2: 200-240VAC
4: 380-480VAC

Series Name

NAMEPLATE INFORMATION

AC Drive Model ⟶

Input Specification ⟶

Output Specification ⟶

Output Frequency Range ⟶

Barcode ⟶

Serial Number ⟶

MODEL: GS3-2020

INPUT: 200-240V 50/60Hz 3PH 80 Amps

OUTPUT: 0-240V 20HP 65Amps 24.7KVA   3PH

FREQUENCY RANGE: 0.1- 400Hz

C (UL) US
LISTED
19XK
IND. CONT. EQ

CE

|GS3-2020+T331001:~

GS3-2020+T331001

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DRIVE PACKAGE CONTENTS

After receiving the AC motor drive, please check for the following:

- *Make sure that the package includes an AC drive and the DURApulse GS3 AC Drive Quick Reference.*
- *Inspect the unit to insure it was not damaged during shipment.*
- *Make sure that the part number indicated on the nameplate corresponds with the part number of your order.*

EXTERNAL PARTS AND LABELS

GS3-25P0 shown
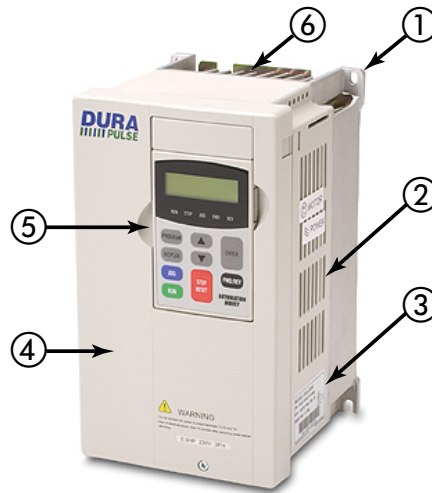
① Mounting Screw Holes
② Ventilation Slots
③ Nameplate Label
④ Cover
⑤ Digital Keypad
⑥ Heat Sink Fins
⑦ Input Power Terminals
⑧ Braking Terminals
⑨ Control Terminals
⑩ Output Power Terminals
⑪ Input Mode Switch (Sink/Source)
⑫ Serial Communication Port
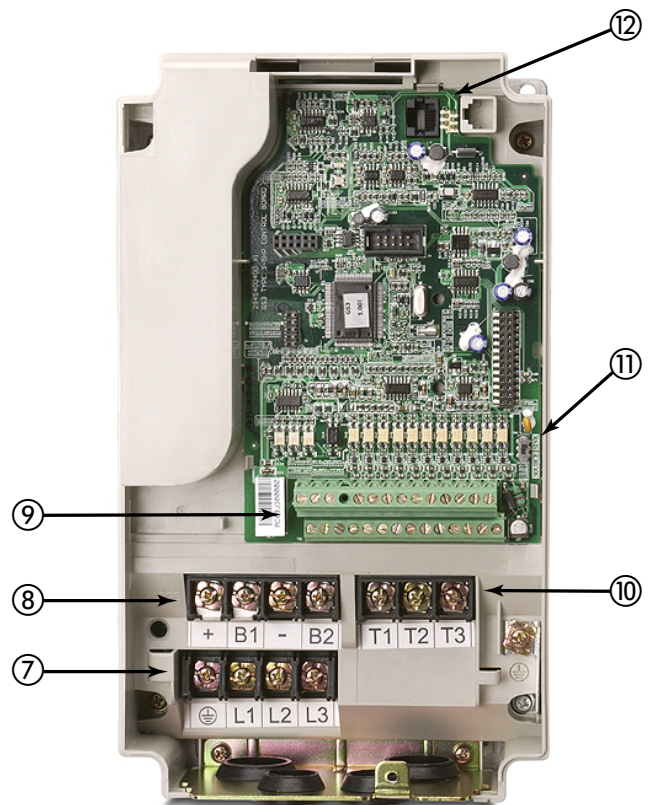
DURApulse GS3 AC Drive Specifications

230V Class Specifications

230V Class						
Model Name: GS3-xxxx			**21P0**	**22P0**	**23P0**	**25P0**	**27P5**
Output Rating	**Maximum Motor Output**	**hp**	1.0	2.0	3.0	5.0	7.5
		kW	0.75	1.5	2.2	3.7	5.5
	Rated Output Current (A)		5	7	11	17	25
	Maximum Output Voltage		Three-phase 200 to 240V (proportional to input voltage)				
	Rated frequency		0.1 to 400 Hz				
Input * Rating	**Rated Voltage/Frequency**		Single/Three-phase; 50/60 Hz; 200/208/220/230/240 VAC			Three-phase; 50/60 Hz; 200/208/220/230/240 VAC	
	Rated Input Current (A)		11.9 / 5.7	15.3 / 7.6	22 / 15.5	20.6	26
	Voltage/Frequency Tolerance		Voltage: ± 10% Frequency: ± 5%				
	Short Circuit Withstand (SCCR) (A, rms symmetrical)		5kA @ 240 VAC				
Watt Loss 100% I (W)			60	82	130	194	301
Weight (lb [kg])			4.5 [2.03]	4.5 [2.03]	9.4 [4.24]	9.4 [4.24]	13.3 [6.03]

* All 3-phase power sources must be symmetrical. Do not connect DURApulse GS3 drives to grounded, center-tapped delta transformers (which are typically used for lighting circuits).

230V Class (continued)								
Model Name: GS3-xxxx			**2010**	**2015**	**2020**	**2025**	**2030**	**2040**	**2050**
Output Rating	**Maximum Motor Output**	**hp**	10	15	20	25	30	40	50
		kW	7.5	11	15	18.5	22	30	37
	Rated Output Current (A)		33	49	65	75	90	120	145
	Maximum Output Voltage		Three-phase 200 to 240V (proportional to input voltage)						
	Rated frequency		0.1 to 400 Hz						
Input * Rating	**Rated Voltage/Frequency**		Three-phase; 200/208/220/230/240 VAC; 50/60 Hz						
	Rated Input Current (A)		34	50	60	75	90	110	142
	Voltage/Frequency Tolerance		Voltage: ± 10% Frequency: ± 5%						
	Short Circuit Withstand (SCCR) (A, rms symmetrical)		5kA @ 240 VAC						
Watt Loss 100% I (W)			380	660	750	920	1300	1340	1430
Weight (lb [kg])			13.3 [6.03]	14.3 [6.49]	26.5 [12]	26.5 [12]	26.5 [12]	77.2 [35]	77.2 [35]

* All 3-phase power sources must be symmetrical. Do not connect DURApulse GS3 drives to grounded, center-tapped delta transformers (which are typically used for lighting circuits).

460V Class Specifications

460V Class – Three Phase							
Model Name: GS3-xxxx		**41P0**	**42P0**	**43P0**	**45P0**	**47P5**	**4010**	**4015**

Output Rating	**Maximum Motor Output**	**HP**	1	2	3	5	7.5	10	15
		kW	0.75	1.5	2.2	3.7	5.5	7.5	11
	Rated Output Current (A)		2.7	4.2	5.5	8.5	13	18	24
	Maximum Output Voltage		Three-phase 380 to 480V (proportional to input voltage)						
	Rated frequency		0.1 to 400 Hz						
Input * Rating	**Rated Voltage/Frequency**		Three-phase; 380/400/415/440/460/480VAC; 50/60 Hz						
	Rated Input Current (A)		3.2	4.3	5.9	11.2	14	19	25
	Voltage/Frequency Tolerance		Voltage: ± 10% Frequency: ± 5%						
	Short Circuit Withstand (SCCR) (A, rms symmetrical)		5kA @ 480 VAC						
Watt Loss 100% I (W)			70	102	132	176	250	345	445
Weight (lb [kg])			3.9 [1.76]	4.4 [1.99]	4.1 [1.86]	9.4 [4.24]	13.2 [6.00]	13.5 [6.11]	14.4 [6.53]

* All 3-phase power sources must be symmetrical. Do not connect DURApulse GS3 drives to grounded, center-tapped delta transformers (which are typically used for lighting circuits).

460V Class – Three Phase (continued)							
Model Name: GS3-xxxx		**4020**	**4025**	**4030**	**4040**	**4050**	**4060**	**4075**	**4100**

Output Rating	**Maximum Motor Output**	**HP**	20	25	30	40	50	60	75	100
		kW	15	18.5	22	30	37	45	55	75
	Rated Output Current (A)		32	38	45	60	73	91	110	150
	Maximum Output Voltage		Three-phase 380 to 480V (proportional to input voltage)							
	Rated frequency		0.1 to 400 Hz							
Input * Rating	**Rated Voltage/Frequency**		Three-phase; 380/400/415/440/460/480; 50/60 Hz							
	Rated Input Current (A)		32	39	49	60	63	90	130	160
	Voltage/Frequency Tolerance		Voltage: ± 10% Frequency: ± 5%							
	Short Circuit Withstand (SCCR) (A, rms symmetrical)		5kA @ 480 VAC					10 kA @ 480 VAC		
Watt Loss 100% I (W)			620	788	1290	1420	1680	2020	2910	3840
Weight (lb [kg])			26.5 [12]	26.5 [12]	26.5 [12]	77.2 [35]	77.2 [35]	77.2 [35]	116.8 [53]	116.8 [53]

* All 3-phase power sources must be symmetrical. Do not connect DURApulse drives to grounded, center-tapped delta transformers (which are typically used for lighting circuits).

GENERAL SPECIFICATIONS

General Specifications			
Control Characteristics			
Control System			Pulse Width Modulation, Carrier frequency 1-15 kHz, adjustable, depending on the model. This system determines the control methods of the AC drive: 00: V/Hz open loop control, 01: V/Hz closed loop control, 02: Sensorless Vector, 03: Sensorless Vector with external feedback
Rated Output Frequency			0.1 to 400.0 Hz
Output Frequency Resolution			0.1 Hz
Overload Capacity			150% of rated current for 1 minute
Torque Characteristics			Includes auto-torque boost, auto-slip compensation, starting torque 125% @ 0.5 Hz / 150% @ 1.0 Hz
Braking Torque			20% without dynamic braking, 125% with optional braking resistor (braking circuit built-in only for units under 20 hp)
DC Braking			Operation frequency 60-0 Hz, 0–100% rated current, Start time 0.0–5.0 seconds, Stop time 0.0–5.0 seconds
Acceleration/Deceleration Time			0.1 to 600 seconds (linear or non-linear acceleration/deceleration), second acceleration/deceleration available
Voltage/Frequency Pattern			Settings available for Constant Torque - low & high starting torque, Variable Torque - low & high starting torque, and user configured
Stall Prevention Level			20 to 200% of rated current
Operation Specification			
Inputs	**Frequency Setting**	**Keypad**	Setting by <UP> or <DOWN> buttons
		External Signal	Potentiometer - 3-5 kΩ, 0 to 10 VDC (input impedance 10 kΩ), 0 to 20 mA / 4 to 20 mA (input impedance 250Ω). Multi-Speed Inputs 1 to 4, RS-232C/RS-485 communication interface
	Operation Setting	**Keypad**	Setting by <RUN>, <STOP>, <JOG> buttons
		External Signal	Forward/Stop, Reverse/Stop (run/stop, fwd/rev), 3-wire control, Serial Communication RS-232C & RS-485 (Modbus RTU)
	Input Terminals	**Digital Sink/Source Selectable**	11 user-programmable: FWD/STOP, REV/STOP, RUN/STOP, REV/FWD, RUN momentary (N.O.), STOP momentary (N.C.), External Fault (N.O./N.C.), External Reset, Multi-Speed Bit (1-4), Manual Keyboard Control, Jog, External Base Block (N.O./N.C.), Second Accel/Decel Time, Speed Hold, Increase Speed, Decrease Speed, Reset Speed to Zero, PID Disable (N.O.), PID Disable (N.C.), Input Disable
		Analog	3 user-configurable, 0 to 10 VDC (input impedance 10 kq), 0 to 20mA / 4 to 20mA (input impedance 250q), 10 bit resolution; -10V to +10V, 10 bit resolution
Outputs	**Output Terminals**	**Digital 3 transistors 1 relay**	4 user-programmable: Inverter Running, Inverter Fault, At Speed, Zero Speed, Above Desired Frequency, Below Desired Frequency, At Maximum Speed, Over Torque Detected, Above Desired Current, Below Desired Current, PID Deviation Alarm, Heatsink Overheat Warning (OH), Soft Braking Signal, Above desired Frequency 2, Below desired Frequency 2, Encoder Loss
		Analog	1 user-programmable, 0 to 10 VDC, 8 bit resolution frequency, current, process variable PV
	Operating Functions		Automatic voltage regulation, voltage/frequency characteristics selection, non-linear acceleration/deceleration, upper and lower frequency limiters, 15-stage speed operation, adjustable carrier frequency (1 to 15 kHz), PID control, 5 skip frequencies, analog gain & bias adjustment, jog, electronic thermal relay, automatic torque boost, trip history, software protection
Protective Functions			Electronic Thermal, Overload Relay, Auto Restart after Fault, Momentary Power Loss, Reverse Operation Inhibit, Auto Voltage Regulation, Over-Voltage Stall Prevention, Auto Adjustable Accel/Decel, Over-Torque Detection Mode, Over-Torque Detection Level, Over-Torque Detection Time, Over-Current Stall Prevention during Acceleration, Over-Current Stall Prevention during Operation
(table continued next page)			

General Specifications (cont.)		
Operator Interface	**Operator Devices**	9-key, 2 line x 16 character LCD display, 5 status LEDs
	Programming	Parameter values for setup and review, fault codes
	Status Display	Output Frequency, Motor Speed, Scaled Frequency, Output Current, Motor Load, Output Voltage, DC Bus Voltage, PID Setpoint, PID Feedback, Frequency Setpoint
	Key Functions	RUN, STOP/RESET, FWD/REV, PROGRAM, DISPLAY, <UP>, <DOWN>, ENTER
Environment	**Enclosure Rating**	Protected Chassis, IP20
	Ambient Temperature	-10°C to 40°C (14°F to 104°F)
	Ambient Humidity	20 to 90% RH (non-condensing)
	Vibration	9.8 m/s^2 (1G) less than 10 Hz, 5.9 m/s^2 (0.6G) 10 to 60 Hz
	Installation Location	Altitude 1000m or lower above sea level, keep from corrosive gas, liquid and dust
Options		Noise filter, input AC reactor, output AC reactor, cable for remote operator, programming software, Dynamic braking resistor, input fuses

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