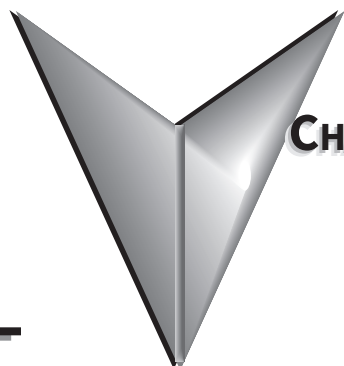


GETTING STARTED



CHAPTER

1

CONTENTS OF THIS CHAPTER

<i>Manual Overview</i>	1-2
<i>Overview of This Publication</i>	1-2
<i>Who Should Read This Manual.</i>	1-2
<i>Supplemental Publications</i>	1-2
<i>Technical Support</i>	1-2
<i>Special Symbols</i>	1-2
<i>GS1 AC Drive Introduction</i>	1-2
<i>Purpose of AC Drives</i>	1-2
<i>Selecting the Proper Drive Rating</i>	1-3
<i>Nameplate Information</i>	1-4
<i>Model Explanation.</i>	1-4
<i>Drive Package Contents.</i>	1-4
<i>External Parts and Labels</i>	1-5
<i>GS1 AC Drive Specifications</i>	1-6
<i>GS1 Model-Specific Specifications</i>	1-6
<i>GS1 General Specifications</i>	1-7

MANUAL OVERVIEW

OVERVIEW OF THIS PUBLICATION

The GS1 AC Drive User Manual describes the installation, configuration, and methods of operation of the GS1 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 GS1 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:

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

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



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



WARNING: 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).

GS1 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

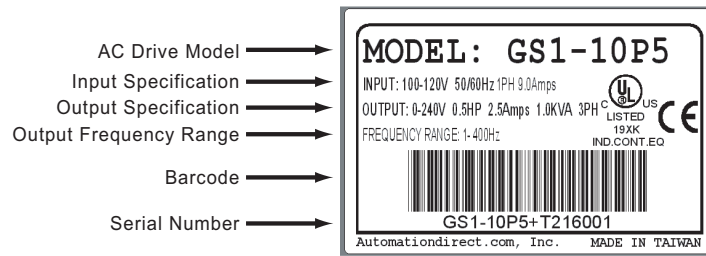
- **Example 2 (DURAPULSE GS3 drive):**

Motor FLA = 8A; Overload = 135% @ 75s; Altitude = 1100m; MEIT = 35°C

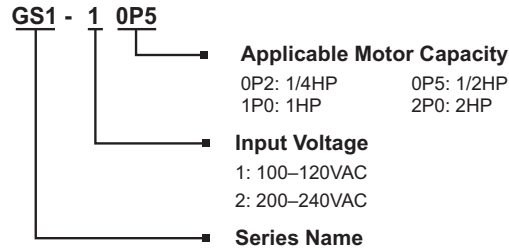
Calculating Required Drive Current				
If		Then Enter	Example 1 GS1 or GS2	Example 2 GS3 DURAPULSE
Overload Derate (overload %)				
If overload is < 150% and < 60 seconds		1	1.33	
If overload is > 150% and < 60 seconds		(overload / 150)%		
If overload is > 60 seconds		(overload / 100)%		
Overload Result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

NAMEPLATE INFORMATION

Example of 0.5 hp 115 VAC drive



MODEL EXPLANATION



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 GS1 Series 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

- ① Digital Keypad
- ② Ventilation Slots
- ③ Mounting Screw Holes
- ④ Nameplate Label
- ⑤ Input Power Terminals
- ⑥ Control Input/Output Terminals
- ⑦ Output Power Terminals



GS1 AC DRIVE SPECIFICATIONS

GS1 MODEL-SPECIFIC SPECIFICATIONS

115V Class GS1 Specifications			
Model Name		GS1-10P2	GS1-10P5
Motor Rating	HP	1/4 hp	1/2 hp
	kW	0.2 kW	0.4 kW
Rated Input Voltage		Single-phase: 100–120 VAC ±10%, 50/60 Hz, ±5%	
Maximum Output Voltage		Three-phase: 200–240 VAC (x2 of input voltage)	
Rated Input Current (A)		6	9
Rated Output Current (A)		1.6	2.5
Short Circuit Withstand (A, rms symmetrical)		5kA @ 120 VAC	
Watt Loss 100% I (W)		19.2	19.2
Weight (lb)		2.16	2.24
Dimensions (HxWxD)		132.0 mm [5.20 in] x 68.0 mm [2.68 in] x 128.1 mm [5.04 in]	

230V Class GS1 Specifications					
Model Name		GS1-20P2	GS1-20P5	GS1-21P0	GS1-22P0
Motor Rating	HP	1/4 hp	1/2 hp	1 hp	2 hp
	kW	0.2 kW	0.4 kW	0.7 kW	1.5 kW
Rated Input Voltage *		Single/three-phase: 200–240 VAC ±10%, 50/60 Hz ±5%			Three-phase*: 200–240VAC ±10%, 50/60Hz ±5%
Maximum Output Voltage		Three-phase: 200–240VAC (proportional to input voltage)			
Rated Input Current (A)		4.9/1.9	6.5/2.7	9.7/5.1	9
Rated Output Current (A)		1.6	2.5	4.2	7.0
Short Circuit Withstand (A, rms symmetrical)		5kA @ 240 VAC			
Watt Loss 100% I (W)		18.4	26.8	44.6	73
Weight (lb)		2.06	2.2	2.26	2.2
Dimensions (HxWxD)		132.0 mm [5.20 in] x 68.0 mm [2.68 in] x 128.1 mm [5.04 in]			
* All 3-phase power sources must be symmetrical. Do NOT connect GS1 drives to grounded, center-tapped, delta transformers (which are typically used for lighting circuits).					

GS1 GENERAL SPECIFICATIONS

General Specifications			
Control Characteristics			
Control System	Sinusoidal Pulse Width Modulation, carrier frequency 3–10 kHz		
Rated Output Frequency	1.0 to 400.0 Hz		
Output Frequency Resolution	0.1 Hz		
Overload Capacity	150% of rated current for 1 minute		
Torque Characteristics	Includes auto-slip compensation and starting torque 150% @ 5.0 Hz		
DC Braking	Operation frequency: 0 to 60 Hz, 0–30% rated voltage. Start time 0.0–5.0 seconds. Stop time 0.0–25.0 seconds		
Acceleration/Deceleration Time	0.1 to 600 seconds (can be set individually)		
Voltage/Frequency Pattern	V/F pattern adjustable. Settings available for Constant Torque - low and high starting torque, Variable Torque - low and high starting torque, and user configured		
Stall Prevention Level	20 to 200% or rated current		
Operation Specifications			
Inputs	Frequency Setting	Keypad	Setting by <UP> or <DOWN> buttons or potentiometer
		External Signal	Potentiometer - 3 to 5kΩ, 0.5W; 0 to 10 VDC (input impedance 10 kΩ); 0 to 20 mA / 4 to 20 mA (input impedance 250Ω); Multi-function inputs 3 and 4 (3 steps, JOG, UP/DOWN command); RS-485 communication setting
	Operation Setting	Keypad	Setting by <RUN>, <STOP> buttons
		External Signal	DI1, DI2, DI3, DI4 can be combined to offer various modes of operation, RS-485 communication port
	Input Terminals	Digital	4 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 (1and 2), Jog, External Base Block (N.O./N.C.), Second Accel/Decel Time, Speed Hold, Increase Speed, Decrease Speed, Reset Speed to Zero, Input Disable
Analog		1 user-configurable, 10 bit resolution 0 to 10 VAC, (input impedance 10 kΩ), 0 to 20 mA, (input impedance 250Ω) 4 to 20 mA, (input impedance 250Ω)	
Outputs	Output Terminals	Digital	1 user programmable: AC drive Running, AC drive Fault, At Speed, Zero Speed, Above Desired Frequency (P 3-16), Below Desired Frequency (P 3-16), At Maximum Speed, Over-torque Detected, Above Desired Current (P3-17), Below Desired Current (P 3-17)
	Operating Functions		Automatic voltage regulation, S-curve, Over-voltage stall prevention, DC braking, Fault records, Adjustable carried frequency, Starting frequency setting of DC braking, Over-current stall prevention, Momentary power loss restart, Reverse inhibition, Frequency limits, Parameter lock/reset
Protective Functions			Overcurrent, Overvoltage, Undervoltage, Electronic thermal motor overload, Overheating, Overload, Self testing
Operator Interface	Operator Devices		5-key, 4-digit, 7-segment LED, 4 status LEDs, potentiometer
	Programming		Parameter values for setup and review, fault codes
	Status Display		Master Frequency, Output Frequency, Scaled Output Frequency, Output Voltage, DC Bus Voltage, Output Direction, Trip Event Monitor, Trip History Monitor
	Key Functions		RUN/STOP, DISPLAY/RESET, PROGRAM/ENTER, <UP>, <DOWN>
Environment	Enclosure Rating		Protected chassis, IP20
	Ambient Temperature		-10° to 40°C (14°F to 104°F) w/o derating
	Ambient Humidity		0 to 90% RH (non-condensing)
	Vibration		9.8 m/s ² (1G), less than 10 Hz; 5.88 m/s ² (0.6G) 20 to 50 Hz
	Installation Location		Altitude 1000m or lower above sea level, keep from corrosive gas, liquid and dust

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