DURA PULSE

AC Drive
User Manual

230V Class:
1 - 50 Hp
460V Class:
1 - 100 Hp

AUTOMATION DIRECT®

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WARNING

WARNING: Always read this manual thoroughly before using *DURAPULSE* AC Motor Drives.

WARNING: AC input power must be disconnected before performing any maintenance. Do not connect or disconnect wires or connectors while power is applied to the circuit. Maintenance must only be performed by a qualified technician.

WARNING: There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. To avoid damage to these components, do not touch these components or the circuit boards with metal objects or your bare hands.

WARNING: A charge may still remain in the DC-link capacitor with hazardous voltages even if the power has been turned off. To avoid personal injury, do not remove the cover of the AC drive until all "DISPLAY LCD" lights on the digital keypad are off. Please note that there are live components exposed within the AC drive. Do not touch these live parts.

WARNING: Ground the *DURAPULSE* AC Drive using the ground terminal. The grounding method must comply with the laws of the country where the AC drive is to be installed. Refer to "Basic Wiring Diagram" in CHAPTER 2.

WARNING: The mounting enclosure of the AC drive must comply with EN50178. Live parts shall be arranged in enclosures or located behind barriers that meet at least the requirements of the Protective Type IP20. The top surface of the enclosures or barrier that is easily accessible shall meet at least the requirements of the Protective Type IP40. Users must provide this environment for *DURAPULSE* AC Drive.

WARNING: The AC drive may be destroyed beyond repair if incorrect cables are connected to the input/output terminals. Never connect the AC drive output terminals T1, T2, and T3 directly to the AC main circuit power supply.

*DURA*PULSE AC DRIVE
USER MANUAL

Please include the Manual Number and the Manual Issue, both shown below, when communicating with Technical Support regarding this publication.

Manual Number: **GS3-M**

Issue: **First Edition, Revision A**

Issue Date: **2/26/04**

Publication History		
Issue	**Date**	**Description of Changes**
First Edition	12/08/03	Original
First Edition, Revision A	2/26/04	Corrected watt loss information in Chapter One. Minor changes and corrections throughout

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Appendix B: *DURApulse* AC Drives with *Direct*LOGIC PLCs

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CHAPTER 1

GETTING STARTED

In 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 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:

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

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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 AC Drive Introduction

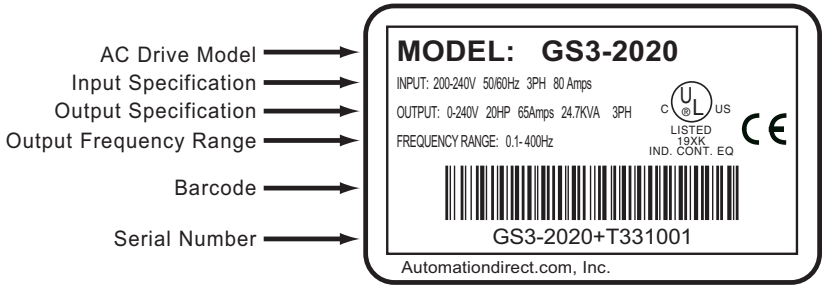
Unpacking

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

- Make sure that the package includes an AC drive, the ***DURAPULSE*** AC Drive User Manual, and the ***DURAPULSE*** 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.

Nameplate Information:

Example of 20HP 230V AC drive



Model Explanation:

GS3 - 2 020

Applicable Motor Capacity

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

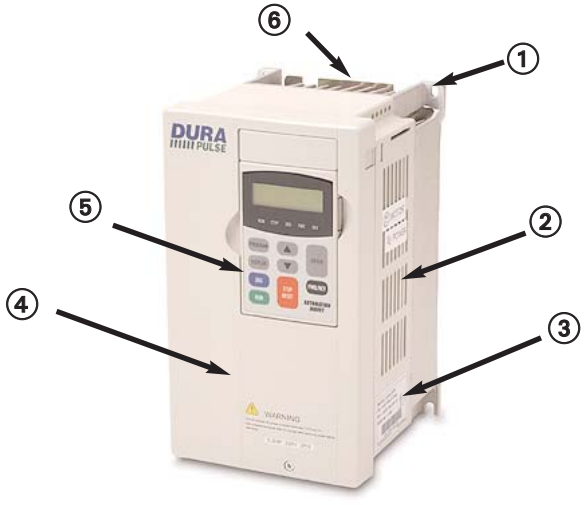
* 60, 75 and 100HP models available in GS3-4xxx only

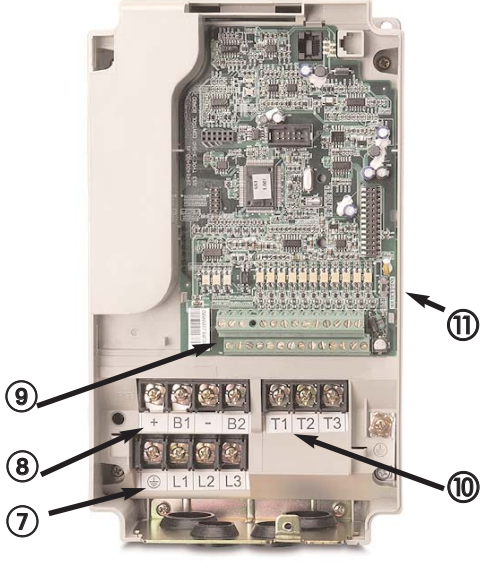
Input Voltage

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

Series Name

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)

*DURA*PULSE AC Drive Specifications

230V Class - Three Phase							
Model Name: GS3-xxx			**21P0**	**22P0**	**23P0**	**25P0**	**27P5**
Output Rating	**Maximum Motor Output**	**HP**	1.0	2.0	3.0	5.0	7.5
		kW	.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**		Three-phase, 200/208/220/230/240 VAC, 50/60Hz				
	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%				
Watt Loss 100% (I)			60	82	130	194	301
Weight, lb, (kg)			4.5 (2.034)	4.5 (2.034)	9.4 (4.24)	9.4 (4.24)	13.3 (6.031)

230V Class - Three Phase								
Model Name: GS3-xxx			**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, 50/60Hz						
	Rated Input Current (A)		34	50	60	75	90	110	142
Voltage/Frequency Tolerance			Voltage: ± 10% Frequency: ± 5%						
Watt Loss 100% (I)			380	660	750	920	1300	1340	1430
Weight, lb. (kg)			13.3 (6.031)	14.3 (6.487)	26.5 12	26.5 12	26.5 12	77.2 (35)	77.2 (35)

Note: Please review the AutomationDirect Terms and Conditions for this product. There is no 30-day money-back guarantee on any drive over 10HP.

460V Class - Three Phase								
Model Name: GS3-xxx			**41P0**	**42P0**	**43P0**	**45P0**	**47P5**	**4010**	**4015**
Output Rating	**Maximum Motor Output**	**HP**	1	2	3	5	7.5	10	15
		kW	.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, 50/60Hz						
	Rated Input Current (A)		3.2	4.3	5.9	11.2	14	19	25
Voltage/Frequency Tolerance			Voltage: ± 10% Frequency: ± 5%						
Watt Loss 100% (I)			70	102	132	176	250	345	445
Weight lb (kg)			3.9 (1.759)	4.4 (1.994)	4.1 (1.857)	9.4 (4.24)	13.2 (6.002)	13.5 (6.106)	14.4 (6.525)

460V Class - Three Phase									
Model Name: GS3-xxx			**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, 50/60Hz							
	Rated Input Current (A)		32	39	49	60	63	90	130	160
Voltage/Frequency Tolerance			Voltage: ± 10% Frequency: ± 5%							
Watt Loss 100% (I)			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)

Note: Please review the AutomationDirect Terms and Conditions for this product. There is no 30-day money-back guarantee on any drive over 10HP.

General Specifications			
Control Characteristics			
Control System			Pulse Width Modulation, Carrier frequency 1k - 15kHz, 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% @ 0.5Hz / 150% @ 1.0Hz
Braking Torque			20% without dynamic braking, 125% with optional braking resistor (braking resistor built-in only for units under 20HP)
DC Braking			Operation frequency 60-0Hz, 0 - 100% rated current, Start time 0.0 - 5.0 seconds, Stop time 0.0 - 25.0 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% or rated current
Operation Specification			
Inputs	**Frequency Setting**	**Keypad**	Setting by <UP> or <DOWN> buttons
		External Signal	Potentiometer - 3k-5kΩ, 0 to 10Vdc (input impedance 10kΩ), 4 to 20 mA (input impedance 250Ω), 0 to 20mA. Multi-Speed Inputs 1 to 4, RS232C/RS485 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 RS232C & RS485 (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 10Vdc (input impedance 10kΩ), 0 to 20mA, 4 to 20mA (input impedance 250Ω), 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 10Vdc, 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

General Specifications (cont.)		
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
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)
	Storage Temperature	-20°C to 60°C (-4°F to 140°F) – during short term transportation period
	Ambient Humidity	20 to 90% RH (non-condensing)
	Vibration	9.8 m/s^2 (1G) less than 10Hz, 5.9 m/s^2 (0.6G) 10 to 60Hz
	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

Chapter 2

Installation and Wiring

In This Chapter...

Ambient Conditions

The AC drive should be kept in the shipping carton before installation. In order to retain the warranty coverage, the AC drive should be stored properly when it is not to be used for an extended period of time. Some storage suggestions are:

- Store in a clean and dry location free from direct sunlight or corrosive fumes.
- Store within an ambient temperature range of -20°C to +60°C (-4°F to 140°F).
- Store within a relative humidity range of 0% to 90% and non-condensing environment.
- Store within an air pressure range of 86 kPA to 106kPA.

Ambient Conditions	
Ambient Temperature	-10°C to 40°C (14°F to 104°F)
Storage Temperature	-20° to 60 ° C (-4°F to 140°F)
Relative Humidity	0 to 90% (non-condensing)
Atmosphere Pressure	86 kPA to 106kPA
Vibration	9.8 m/s^2 (1G) less than 10Hz, 5.9 m/s^2 (0.6G) 10 to 60Hz
Installation Location	Altitude 1000m or lower above sea level, keep from corrosive gas, liquid and dust
Enclosure Rating	IP20: Protection against contact by fingers. Protection against medium-size foreign objects

Installation

Improper installation of the AC drive will greatly reduce its life. Be sure to observe the following precautions when selecting a mounting location:

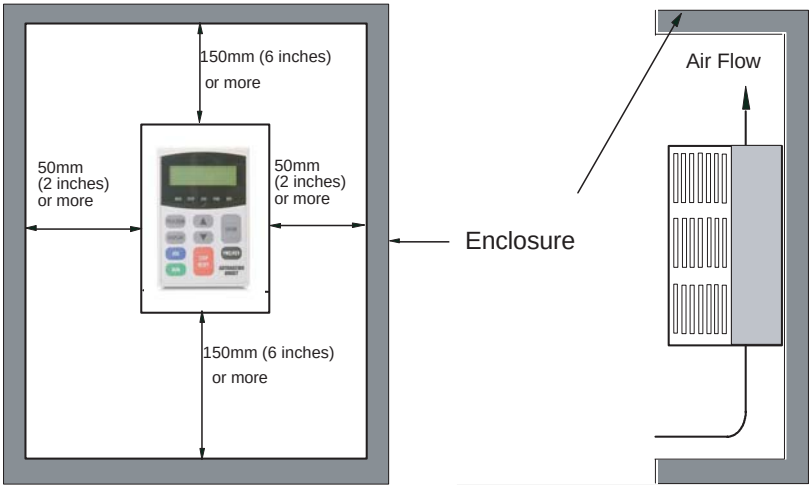
WARNING: Failure to observe these precautions may damage the drive and void the warranty!

- Do not mount the AC drive near heat-radiating elements or in direct sunlight.
- Do not install the AC drive in a place subjected to high temperature, high humidity, excessive vibration, corrosive gases or liquids, or airborne dust or metallic particles.
- Mount the AC drive vertically and do not restrict the air flow to the heat sink fins.

WARNING: AC drives generate a large amount of heat which may damage them. Auxiliary cooling methods are typically required in order not to exceed maximum ambient temperatures.

Minimum Clearances and AirFlow

MAXIMUM AMBIENT TEMPERATURES MUST NOT EXCEED 40°C (104°F)!

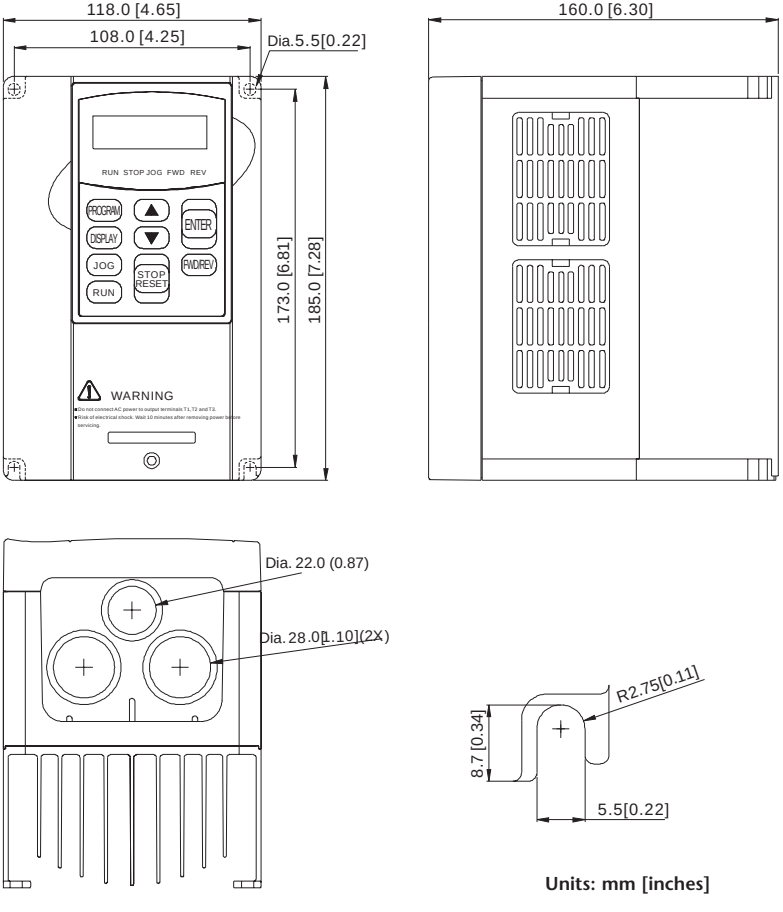


Minimum Clearances and Air Flow

Dimensions

Frame A

Part numbers: GS3-21P0, GS3-22P0, GS3-41P0, GS3-42P0

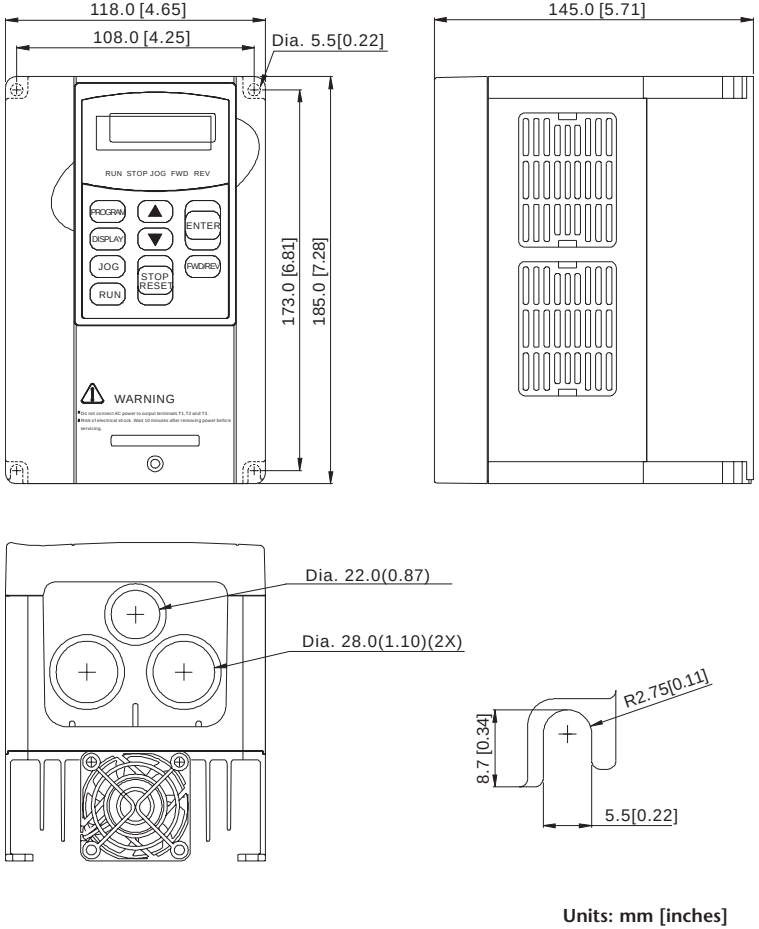


Units: mm [inches]

Dimensions, cont.

Frame A with Fan

Part Numbers: GS3-43P0

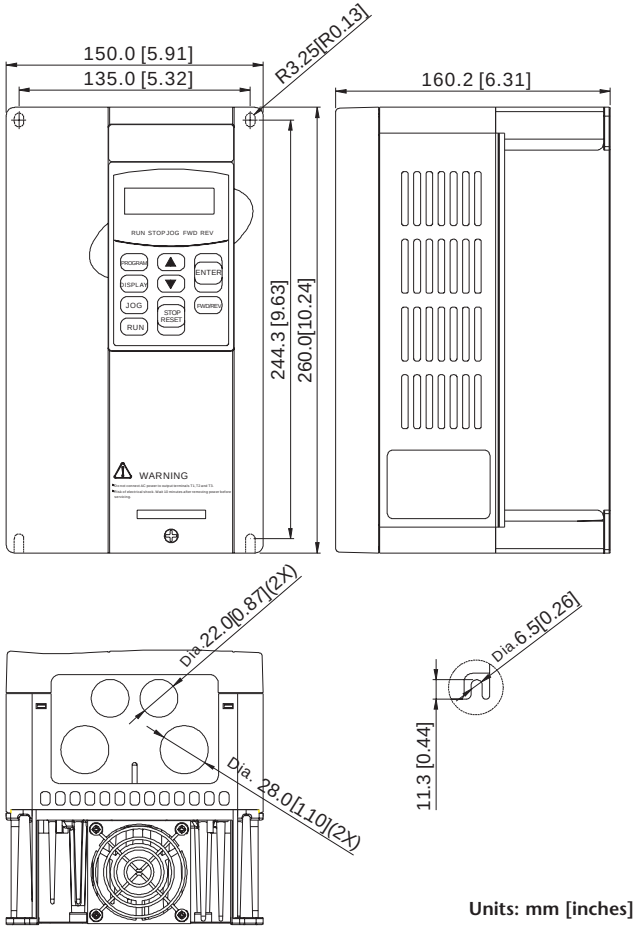


Units: mm [inches]

Dimensions, cont.

Frame B

Part numbers: GS3-23P0, GS3-25P0, GS3-45PO

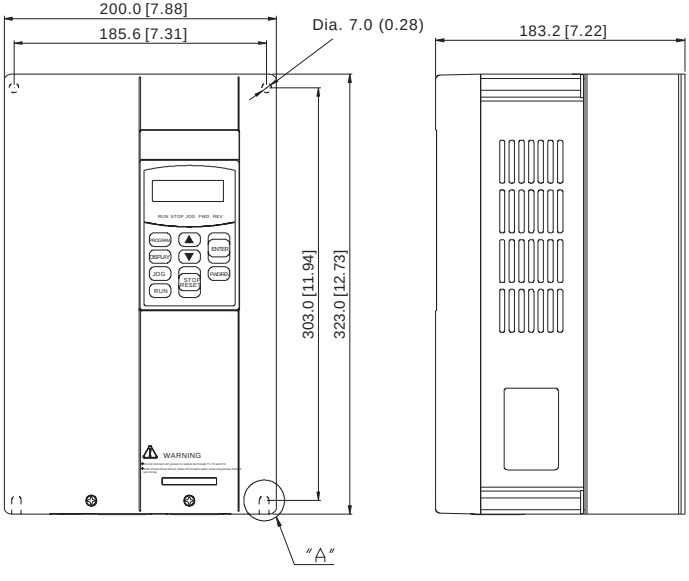


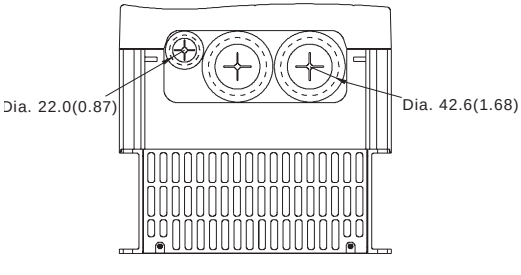
Units: mm [inches]

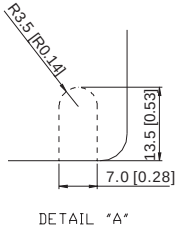
Dimensions, cont.

Frame C

Part numbers: GS3-27P5, GS3-2010, GS3-2015
GS3-47P5, GS3-4010, GS3-4015





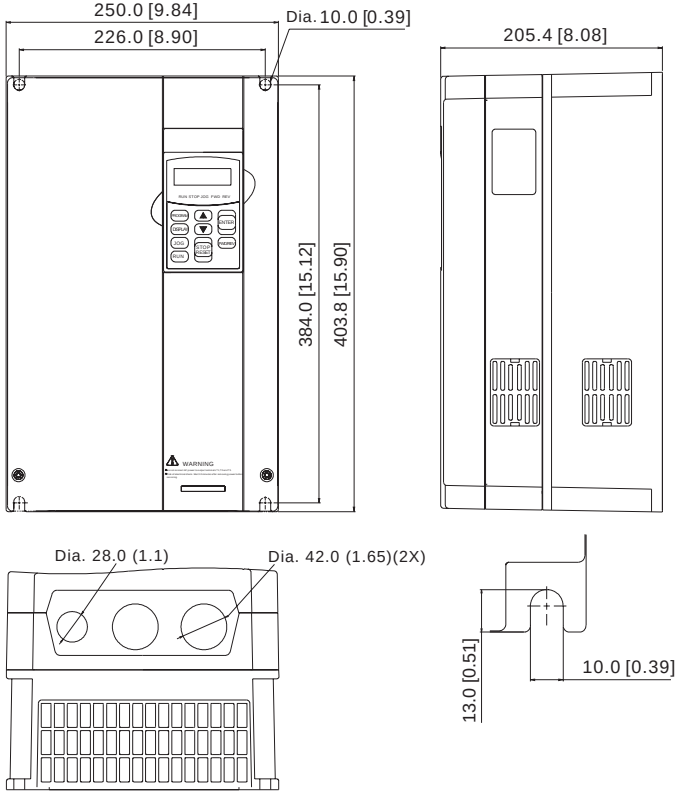


Units: mm [inches]

Dimensions, cont.

Frame D

Part numbers: GS3-2020, GS3-2025, GS3-2030
GS3-4020, GS3-4025, GS3-4030

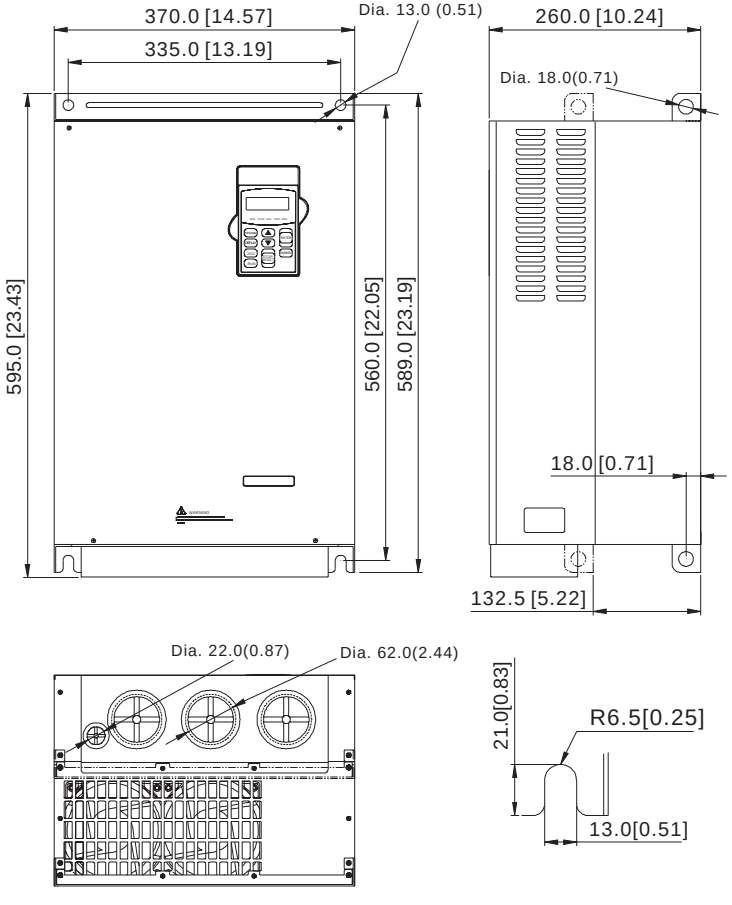


Units: mm [inches]

Dimensions, cont.

Frame E

Part Numbers: GS3-2040, GS3-2050
GS3-4040, GS3-4050, GS3-4060

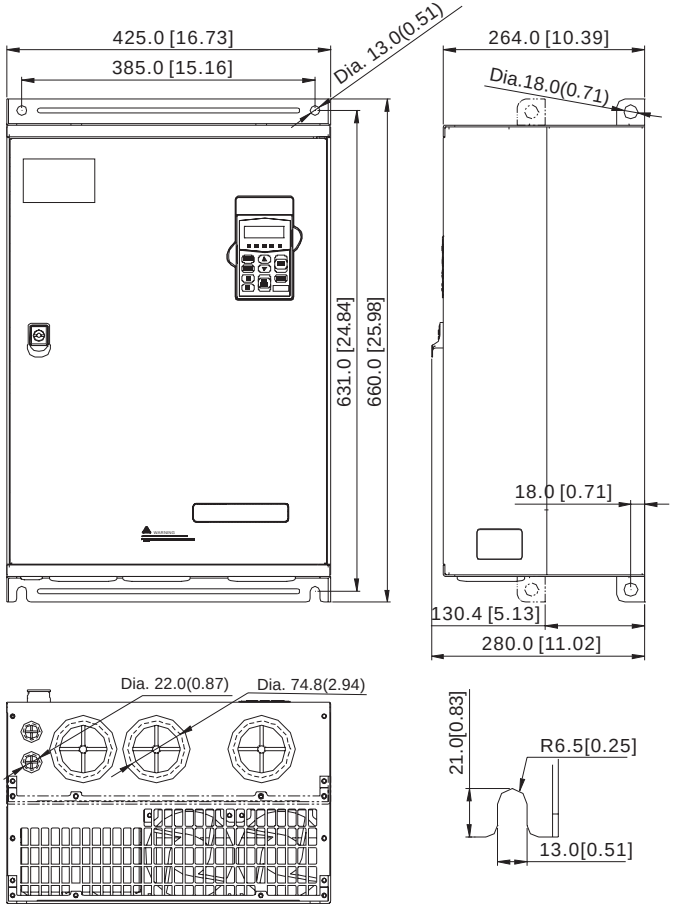


Units: mm [inches]

Dimensions, cont.

Frame F

Part Numbers: GS3-4075, GS3-4100



Units: mm [inches]

Circuit Connections

DANGER!

HAZARDOUS VOLTAGE! Before making any connection to the AC drive, disconnect all power to the AC drive, and wait five minutes for DC bus capacitors to discharge.

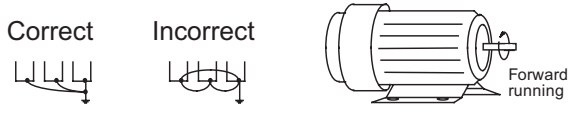
WARNING: Any electrical or mechanical modification to this equipment without prior written consent of AutomationDirect.com, Inc. will void all warranties, may result in a safety hazard, and may void the UL listing.

WARNING: Do not connect the AC input power to the T1, T2, and T3 output terminals. This will damage the AC drive

WARNING: Tighten all screws to the proper torque rating. See "Main Circuit Wiring" later in this chapter.

Wiring Notes: PLEASE READ PRIOR TO INSTALLATION.

1. During installation, follow all local electrical, construction, and safety codes for the country in which the AC drive is to be installed.
2. Make sure the appropriate protective devices (circuit breaker or fuses) are connected between the power supply and AC drive.
3. Make sure that the leads are connected correctly and the AC drive is properly grounded. (Ground resistance should not exceed 0.1Ω.)
4. Use ground leads that comply with AWG/MCM standards and keep them as short as possible.
5. Do not use a contactor or disconnect switch for run/stop control of the AC drive and motor. This will reduce the operating life cycle of the AC drive. Cycling a power circuit switching device while the AC drive is in run mode should be done only in emergency situations.
6. Multiple *DURAPULSE* units can be installed in one location. All the units should be grounded directly to a common ground terminal. The *DURAPULSE* ground terminals may also be connected in parallel, as shown in the figure below. **Make sure there are no ground loops.**



7. When the AC drive output terminals T1, T2, and T3 are connected to the motor terminals T1, T2, and T3, respectively, the motor will rotate counterclockwise (as viewed from the shaft end of the motor) when a forward operation command is received. To reverse the direction of motor rotation, switch the connections of any of the two motor leads.

8. Make sure that the power source is capable of supplying the correct voltage and required current to the AC drive.
9. Do not attach or remove wiring when power is applied to the AC drive.
10. Do not inspect components unless inside "POWER" lamp is turned off.
11. Do not monitor the signals on the circuit board while the AC drive is in operation.
12. GS3 series *DURAPULSE* drives cannot be used with single-phase motors..
13. Route the power and control wires separately, or at 90 degree angle to each other.
14. If a filter is required for reducing EMI (Electro Magnetic Interference), install it as close as possible to the AC drive. EMI can also be reduced by lowering the Carrier Frequency.
15. If the AC drive is installed in a place where a load reactor is needed, install the filter close to the T1, T2, and T3 side of AC drive. Do not use a Capacitor, L-C Filter (Inductance-Capacitance), or R-C Filter (Resistance-Capacitance), unless approved by AutomationDirect.
16. When using a GFCI (Ground Fault Circuit Interrupt), select current sensor with sensitivity of 200mA, and not less than 0.1-second detection to avoid nuisance tripping.

Motor Operation Precautions

1. When using the AC drive to operate a standard 3-phase induction motor, notice that the energy loss is greater than for an inverter duty motor.
2. Avoid running a standard induction motor at low speed, which may cause the motor temperature to exceed the motor rating due to limited airflow produced by the motor's fan.
3. When the standard motor operates at low speed, the output load must be decreased.
4. If 100% output torque is desired at low speed, it may be necessary to use a special "inverter-duty" rated motor.

Short Circuit Withstand

Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes. For all 460V models, the maximum is 480 volts. For all 230V Models, the maximum is 240 volts.

Applicable Codes

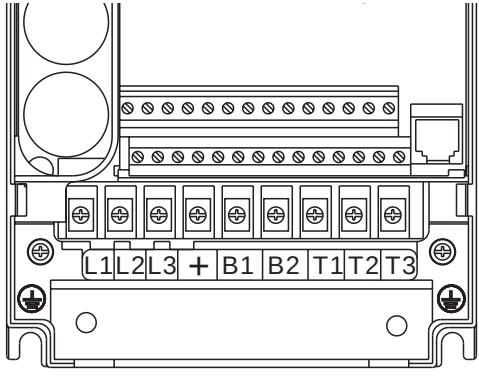
All *DURAPULSE* AC drives are Underwriters Laboratories, Inc. (UL) and Canadian Underwriters Laboratories (cUL) listed, and therefore comply with the requirements of the National Electrical Code (NEC) and the Canadian Electrical Code (CEC).

Installation intended to meet the UL and cUL requirements must follow the instructions provided in "Wiring Notes" as a minimum standard. Follow all local codes that exceed UL and cUL requirements. Refer to the technical data label affixed to the AC drive and the motor nameplate for electrical data.

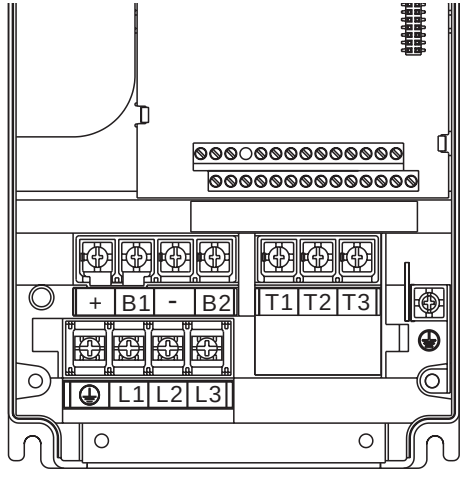
The "Circuit Protection Devices" section in APPENDIX A, lists the recommended fuse part number for each *DURAPULSE* part number. These fuses (or equivalent) must be used on all installations where compliance with U.L. standards is required.

Terminal Wiring Diagrams

GS3-21P0, GS3-22P0, GS3-41P0, GS3-42P0, GS3-43P0

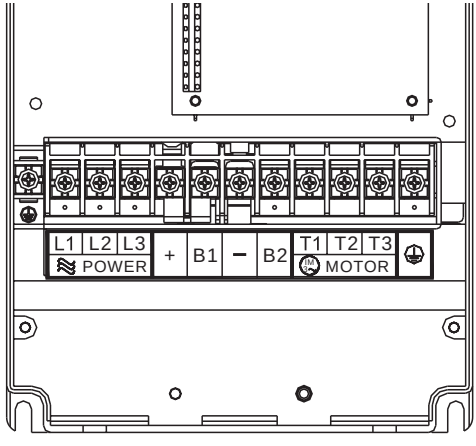


GS3-23P0, GS3-25P0, GS3-45P0

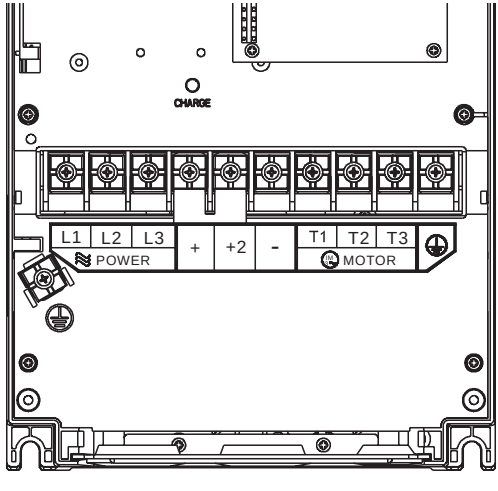


Terminal Wiring Diagrams (cont.)

GS3-27P5, GS3-47P5, GS3-2010, GS3-4010, GS3-2015, GS3-4015

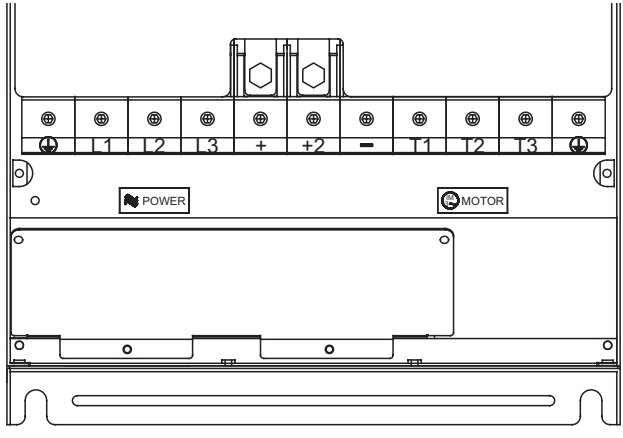


GS3-2020, GS3-4020, GS3-2025, GS3-4025, GS3-2030, GS3-4030

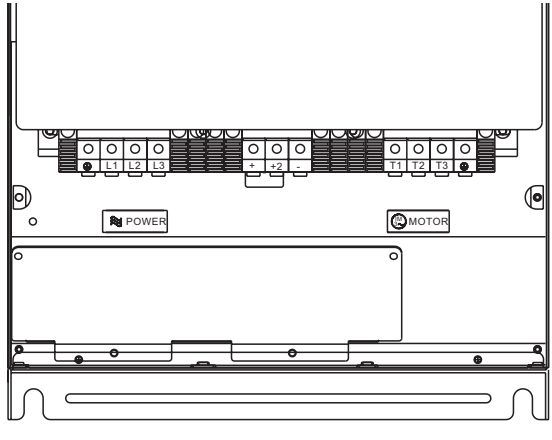


Terminal Wiring Diagrams (cont.)

GS3-2040, GS3-2050

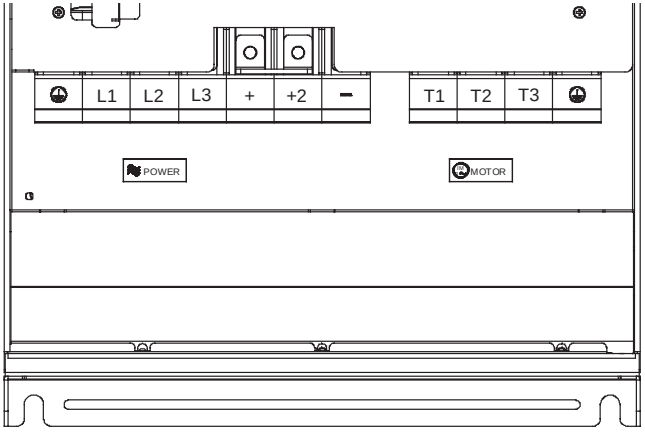


GS3-4040, GS3-4050,GS3-4060



Terminal Wiring Diagrams (cont.)

GS3-4075, GS3-4100



Main Circuit Wiring

Main Circuit Terminals	
Terminal	Description
L1, L2, L3	Input Power
T1, T2, T3	AC Drive Output
B1, B2	Braking Resistor Connection (Under 20HP)
+2, – (negative)	External Dynamic Brake Unit (20HP & Over)
⏚	Ground

GS3-4030

Main Circuit Wiring Specifications			
AC Drive Model	**Input Current (A)**	**Output Current (A)**	**Torque**
GS3-21P0	5.7	5	18kgf-cm
GS3-22P0	7.6	7	
GS3-23P0	15.5	10	
GS3-25P0	20.6	17	
GS3-27P5	26	25	30kgf-cm
GS3-2010	34	33	
GS3-2015	50	49	40kgf-cm
GS3-2020	60	65	
GS3-2025	75	75	
GS3-2030	90	90	
GS3-2040	110	120	200kgf-cm
GS3-2050	142	145	
GS3-41P0	3.2	2.7	18kgf-cm
GS3-42P0	4.3	4.2	
GS3-43P0	5.9	5.5	
GS3-45P0	11.2	8.5	
GS3-47P5	14	13	30kgf-cm
GS3-4010	19	18	
GS3-4015	25	24	40kgf-cm
GS3-4020	32	32	
GS3-4025	39	38	
GS3-4030	49	45	
GS3-4040	60	60	57kgf-cm
GS3-4050	63	73	
GS3-4060	90	91	
GS3-4075	130	110	200kgf-cm
GS3-4100	160	150	

Main Circuit Wiring (cont.)

3-phase Input Power	
200V Class	200-240V ± 10%; 50, 60Hz ± 5%
400V Class	380-480V ± 10%; 50, 60Hz ± 5%

230V Class - Three Phase						
Model Name: GS3-xxx		**21P0**	**22P0**	**23P0**	**25P0**	**27P5**
Maximum Motor Output	**HP**	1.0	2.0	3.0	5.0	7.5
	kW	.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				

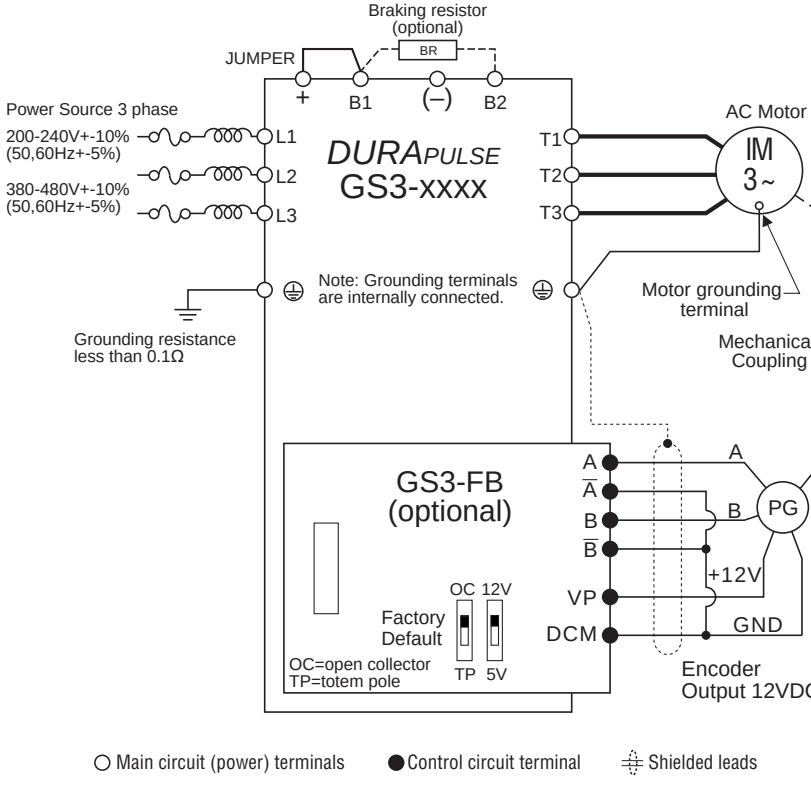
230V Class - Three Phase								
Model Name: GS3-xxx		**2010**	**2015**	**2020**	**2025**	**2030**	**2040**	**2050**
Maximum Motor Output	**HP**	10	15	20	25	30	40	50
	kW	7.5	11	15	18.5	22	30	37
Rated Output Current (A)		33	49	65	75	90	120	145
Maximum Output Voltage		Three-phase 200 to 240V (proportional to input voltage)						
Rated frequency		0.1 to 400 Hz						

460V Class - Three Phase								
Model Name: GS3-xxx		**41P0**	**42P0**	**43P0**	**45P0**	**47P5**	**4010**	**4015**
Maximum Motor Output	**HP**	1	2	3	5	7.5	10	15
	kW	.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 380V to 480V (proportional to input voltage)						
Rated frequency		0.1 to 400 Hz						

460V Class - Three Phase									
Model Name: GS3-xxx		**4020**	**4025**	**4030**	**4040**	**4050**	**4060**	**4075**	**4100**
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 380V to 480V (proportional to input voltage)							
Rated frequency		0.1 to 400 Hz							

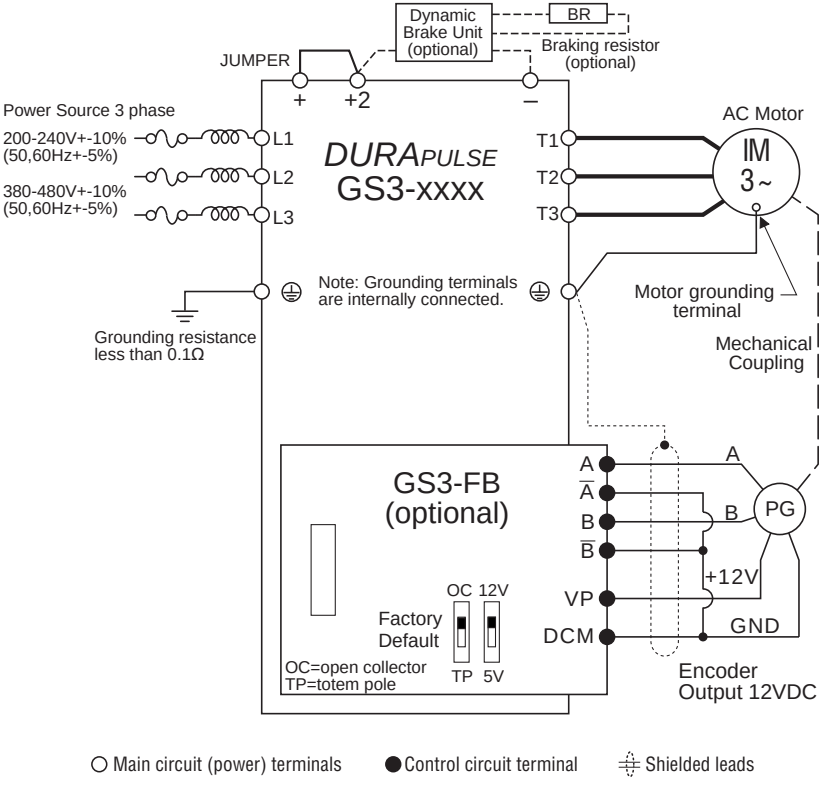
Power Wiring Diagram - drives under 20 HP

Note: Users must connect wiring according to the circuit diagram shown below.



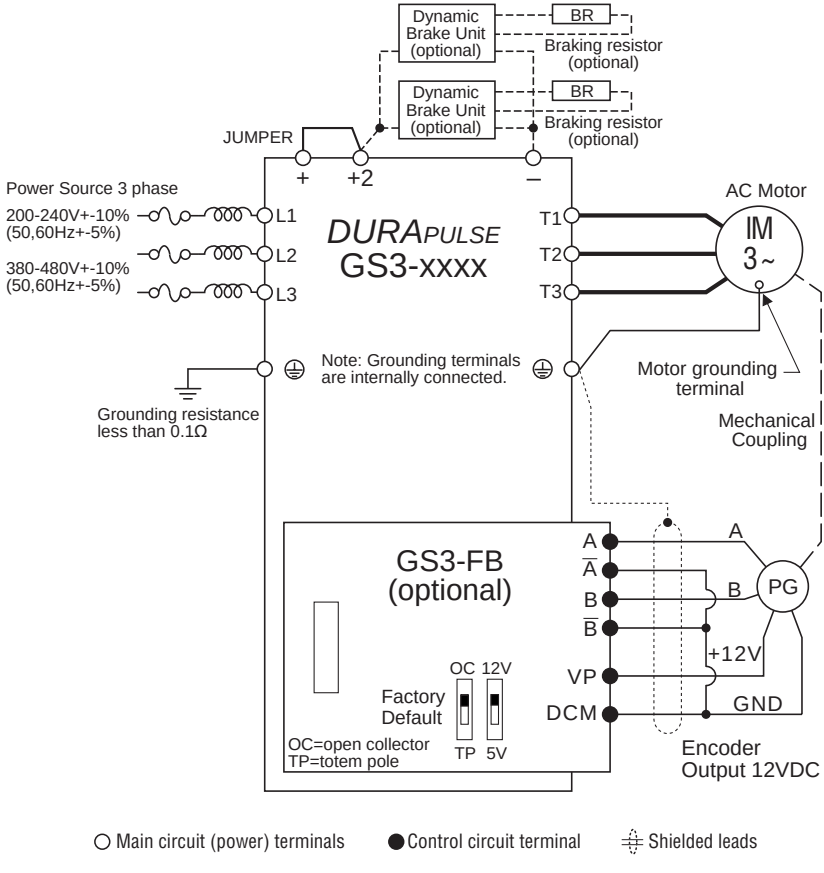
Power Wiring Diagram - drives 20–30HP (230VAC) & 20-60HP (460VAC)

Note: Users must connect wiring according to the circuit diagram shown below.



Power Wiring Diagram - drives 40–50HP (230VAC) & 75–100HP (460VAC)

Note: Users must connect wiring according to the circuit diagram shown below.



Control Terminal Designations

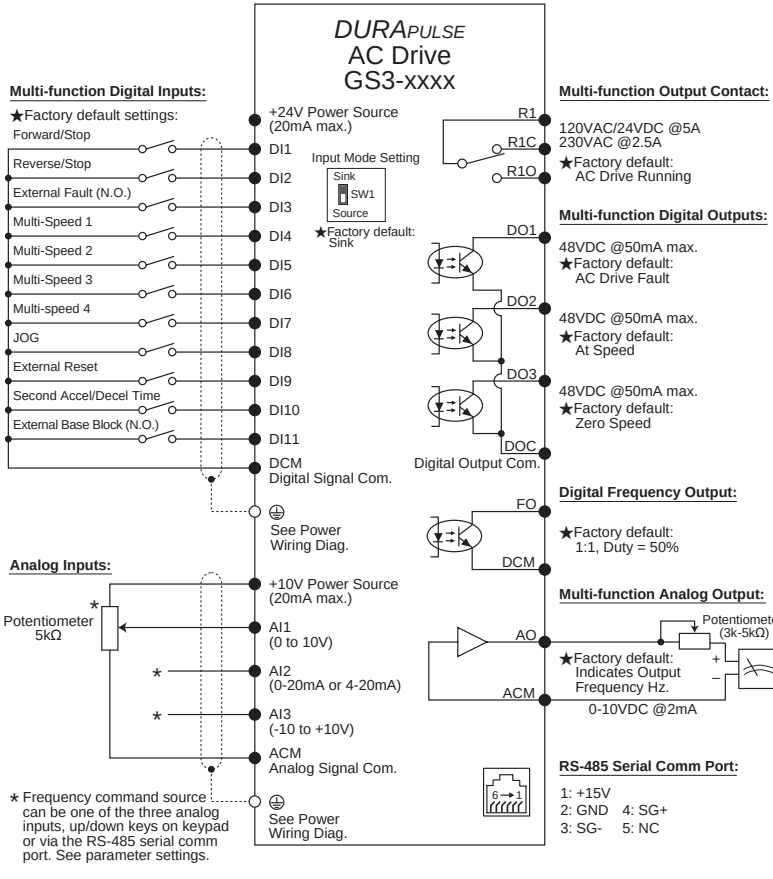
Control Circuit Terminals		
Terminal Symbol	**Description**	**Remarks**
+24V	DC Voltage Source	(+24V, 20mA), used only for AC drive digital inputs wired for source mode operation
DI1	Digital Input 1	Input Voltage: Internally Supplied *(see WARNING below)* Sink Mode: Low active, Vin_L Min = 0V, Vin_L Max = 15V, Iin Min = 2.1mA, Iin Max = 7.0mA Source Mode: High active, Vin_H Min = 8.5V, Vin_H Max = 24V, Iin Min = 2.1mA, Iin Max = 7.0mA Input response: 12 - 15 msec Also see "Basic Wiring Diagram" on the next pages.
DI2	Digital Input 2	
DI3	Digital Input 3	
DI4	Digital Input 4	
DI5	Digital Input 5	
DI6	Digital Input 6	
DI7	Digital Input 7	
DI8	Digital Input 8	
DI9	Digital Input 9	
DI10	Digital Input 10	
DI11	Digital Input 11	
DCM	Digital Common	
+10V	Internal Power Supply	+10VDC (10mA maximum load)
AI1	Analog Input	0 to +10 V input
AI2	Analog Input	0 to 20mA input only
AI3	Analog Input	-10 to +10 V input only
ACM	Analog Common	
R1O	Relay Output 1 Normally Open	Resistor Load: 240VAC - 5A (N.O) / 3A (N.C.) 24VDC - 5A (N.O.) / 3A (N.C.) Inductive Load: 240VAC - 1.5A (N.O) / 0.5A (N.C) 24VDC - 1.5A (N.O) / 0.5A (N.C) See P 3.01 to P 3.03
R1C	Relay Output 1 Normally Closed	
R1	Relay Output 1 Common	
DO1	Photocoupled digital output	Maximum 48VDC, 50mA
DO2	Photocoupled digital output	
DO3	Photocoupled digital output	
DOC	Digital Output Common	
AO	Analog Output	0 to +10 V 2mA Output
FO	Digital Pulse per second Output	+10V terminal with ratio of 1:20 to input at duty of 50%

WARNING: Do NOT connect external voltage sources to the Digital Inputs. Permanent damage may result.

Note: Use twisted-shielded, twisted-pair or shielded-lead wires for the control signal wiring. It is recommended to run all signal wiring in a separate steel conduit. The shield wire should only be connected at the AC drive. Do not connect shield wire on both ends.

Control Wiring Diagram - Sinking Inputs

Note: Users must connect wiring according to the circuit diagram shown below.



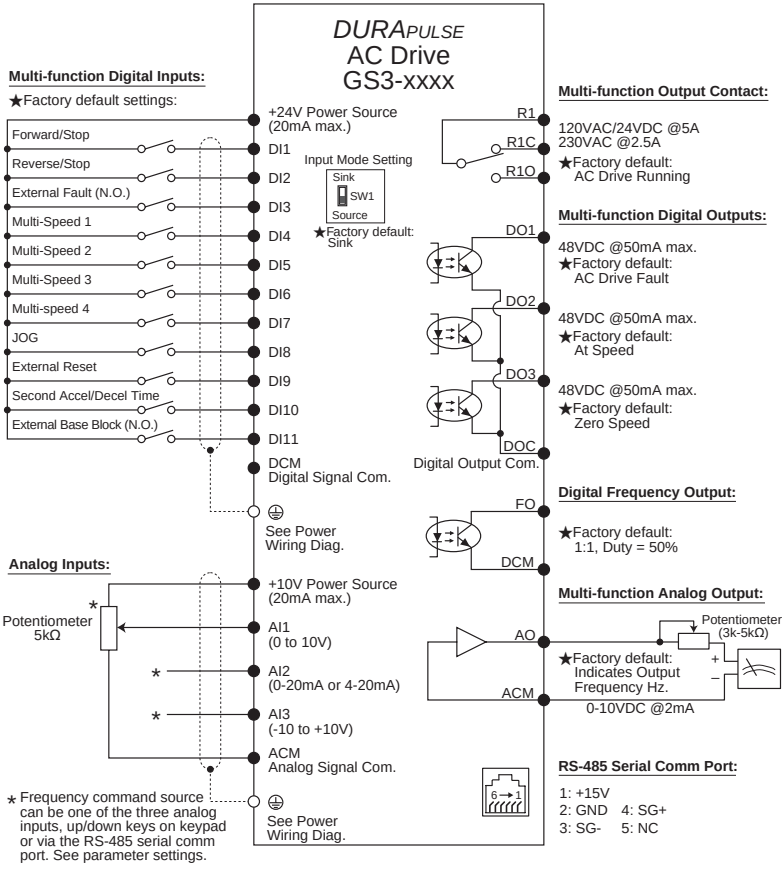
★Factory default: output frequency determined by the up/down keys on the keypad.

○ Main circuit (power) terminals ● Control circuit terminal ⏚ Shielded leads

WARNING: Do not plug a modem or telephone into the *DURAPULSE* RJ-12 Serial Comm Port, or permanent damage may result..

Control Wiring Diagram - Sourcing Inputs

Note: Users must connect wiring according to the circuit diagram shown below.

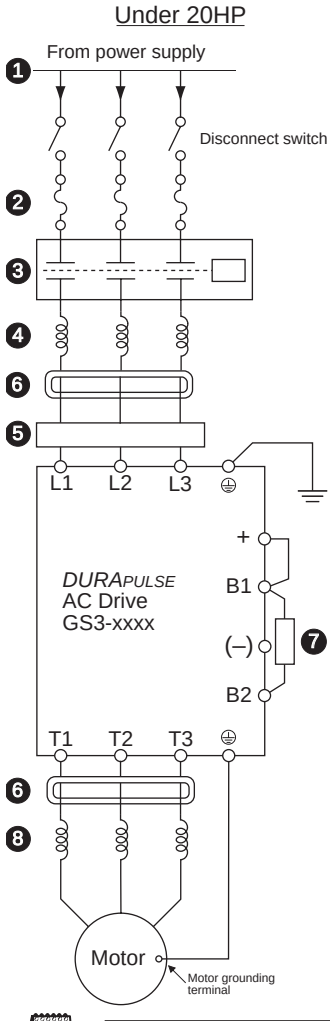


★Factory default: output frequency determined by the up/down keys on the keypad.

○ Main circuit (power) terminals ● Control circuit terminal ⏚ Shielded leads

WARNING: Do not plug a modem or telephone into the *DURAPULSE* RJ-12 Serial Comm Port, or permanent damage may result.

External Wiring



1 Power Supply
Please follow the specific power supply requirements shown in CHAPTER 1

2 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.

3 Contactor (Optional)
Do not use a contactor or disconnect switch for run/stop control of the AC drive and motor. This will reduce the operating life cycle of the AC drive. Cycling a power circuit switching device while the AC drive is in run mode should be done only in emergency situations.

4 AC Line Reactor (Optional)
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.

5 EMI filter (Optional)
Input EMI filters reduce electromagnetic interference or noise on the input side of the AC drive. They are required for CE compliance and recommended for installations prone to or sensitive to electromagnetic interference.

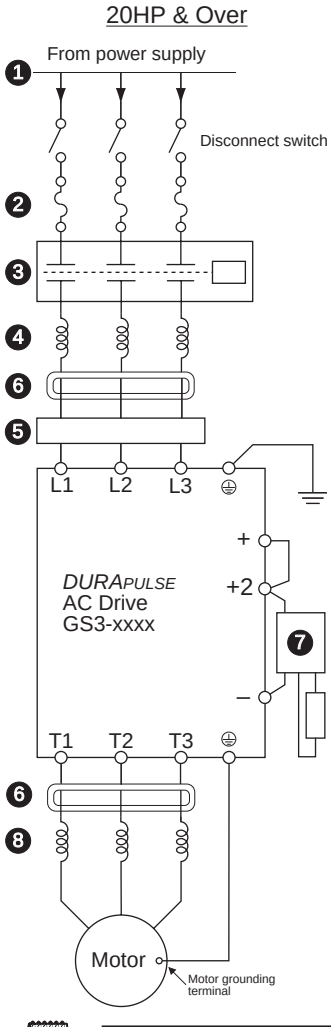
6 RF filter (Optional)
RF filters reduce the radio frequency interference or noise on the input or output side of the inverter.

7 Braking Resistor (Optional)
Dynamic braking allows the AC drive to produce additional braking (stopping) torque. AC drives can typically produce between 15% & 20% braking torque without the addition of any external components. The addition of optional braking may be required for applications that require rapid deceleration or high inertia loads.

8 AC Line Reactor (Optional)
Output line reactors protect the motor insulation against AC drive short circuits and IGBT reflective wave damage, and also "smooth" the motor current waveform, allowing the motor to run cooler. They are recommended for operating "non-inverter-duty" motors and when the length of wiring between the AC drive and motor exceeds 75 feet.

Note: Please refer to Appendix A for specifications on DURAPULSE AC Drive Accessories.

External Wiring (cont.)



1 Power Supply
Please follow the specific power supply requirements shown in CHAPTER 1

2 Fuse
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.

3 Contactor (Optional)
Do not use a contactor or disconnect switch for run/stop control of the AC drive and motor. This will reduce the operating life cycle of the AC drive. Cycling a power circuit switching device while the AC drive is in run mode should be done only in emergency situations.

4 AC Line Reactor (Optional)
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.

5 EMI filter (Optional)
Input EMI filters reduce electromagnetic interference or noise on the input side of the AC drive. They are required for CE compliance and recommended for installations prone to or sensitive to electromagnetic interference.

6 RF filter (Optional)
RF filters reduce the radio frequency interference or noise on the input or output side of the inverter.

7 Braking Unit and Braking Resistor (Optional)
Dynamic braking allows the AC drive to produce additional braking (stopping) torque. AC drives can typically produce between 15% & 20% braking torque without the addition of any external components. The addition of optional braking may be required for applications that require rapid deceleration or high inertia loads.

8 AC Line Reactor (Optional)
Output line reactors protect the motor insulation against AC drive short circuits and IGBT reflective wave damage, and also "smooth" the motor current waveform, allowing the motor to run cooler. They are recommended for operating "non-inverter-duty" motors and when the length of wiring between the AC drive and motor exceeds 75 feet.

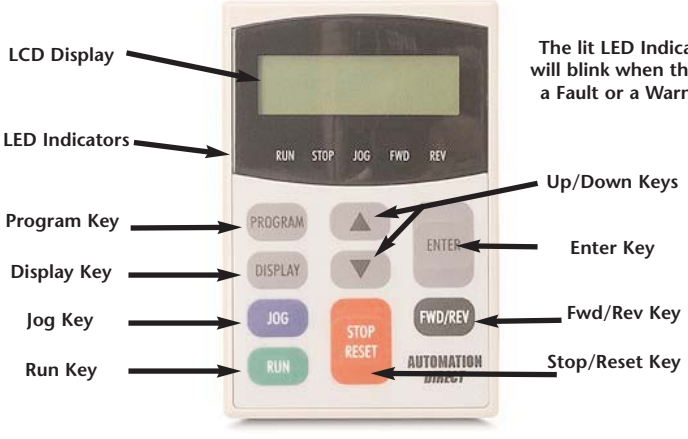
Note: Please refer to Appendix A for specifications on DURAPULSE AC Drive Accessories.

KEYPAD OPERATION AND QUICKSTART

In This Chapter...

The *DURAPULSE* Digital Keypad

The digital keypad includes a 2 line x 16 character LCD display, 5 status LED Indicators, and 9 function keys. The diagram below shows all of the features of the digital keypad and an overview of their functions.



LCD Display

The LCD Display shows the operation values and parameter settings of the AC drive.

LED Indicators

RUN The RUN LED indicates the AC drive is in Run Mode.

STOP The STOP LED indicates the AC drive is not in Run Mode.

FWD The FWD LED indicates the AC drive is running the motor in the forward direction.

REV The REV LED indicates the AC drive is running the motor in the reverse direction.

JOG The JOG LED indicates the AC drive is in the Jog Mode.

Note: If the STOP key on the keypad is active and the keypad is removed, the drive will stop.

Function Keys

Program Key

Pressing the PROGRAM key will display the parameter groups. Use the UP/DOWN or PROGRAM keys to cycle through the parameter groups. The LCD display will show which parameter group is currently selected.

Display Key

Pressing the DISPLAY key on the keypad repeatedly will cycle through the status messages on the AC drive.

Fwd/Rev Key

Pressing the FWD/REV key changes the direction in which the motor operates.

Run

Pressing the RUN key starts the AC drive operation. This key has no function if the AC drive is controlled by the external control terminals.

Up/Down Keys

The UP/DOWN keys are used to scroll through the parameter groups, the various parameters in each group and also change the parameter settings in single-unit increments. To quickly run through the range of settings, press and hold the UP or DOWN key.

Enter Key

Press the ENTER key to view parameters and store parameter settings.

Stop/Reset Key

Used to stop AC drive operation. If the AC drive has stopped due to a fault, clear the fault first, then press this key to reset the AC drive.

Jog Key

Pressing the JOG key controls the jog function.

Note: The keypad LCD display will automatically revert to the display mode and display the user defined display function selected in parameter P 8.00 after a one (1) minute key inactivity.

Adjust Frequency Setpoint

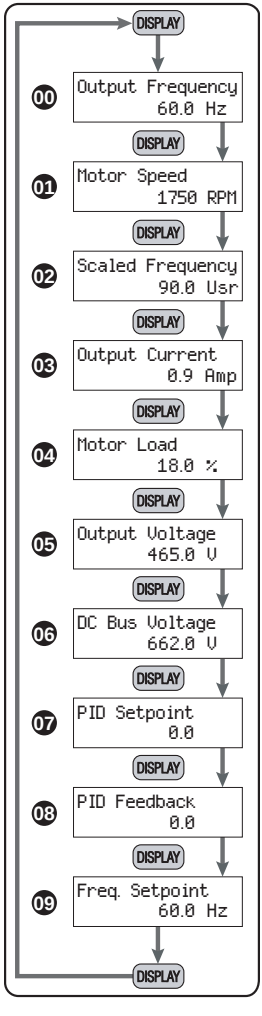
If the UP and DOWN keys are pressed when the LCD is in DISPLAY mode and the AC drive frequency is being controlled by the keypad (P 4.00=1), then the keypad will display the frequency setpoint and have the ability to adjust the frequency setpoint with the UP/DOWN keys accordingly.

Adjust PID Setpoint

The ability to adjust the PID setpoint with the UP and DOWN keys will be true if parameter P 7.00 is set to a value of 01, 02, 03, or 04, parameter P 7.02 = 00 and the LCD display shows the PID setpoint.

Displaying the Status of the *DURAPULSE* AC Drive

Press the DISPLAY key on the keypad repeatedly to cycle through the status messages on the AC drive. The diagram below shows the order of the status messages as you cycle through them and shows the definition of the status messages. The status of the AC drive can be shown in RUN or STOP mode.



00 Actual Operating Frequency

Displays the actual operating frequency present at the T1, T2, and T3 terminals. *Example: 60.0Hz*

01 RPM

Displays the present *estimated* speed of the motor. *Example: 1750 RPM*

02 Scaled Frequency

Displays the result of output frequency x parameter P 8.01. *Example: 60Hz x 1.5 = 90.0*

03 Amps

Displays the output current present at the T1, T2, and T3 terminals. *Example: 0.9A*

04 % Motor Load

Displays the amount of load on the AC drive. *Example: (Output Current ÷ Drive Rated Current) x 100*

05 Output Voltage

Displays the output voltage present at the T1, T2, and T3 terminals. *Example: 465V*

06 DC Bus Voltage

Displays the DC Bus Voltage. *Example: 662 VDC*

07 PID Setpoint

Displays the PID setpoint. *Note: It is possible to change the PID setpoint with the ▲ and ▼ keys when the PID setpoint value is displayed on the keypad. The PID function (P 7.00) must be enabled, and the PID Setpoint source (P 7.02) must be set to keypad (00).*

08 PID Feedback Signal (PV)

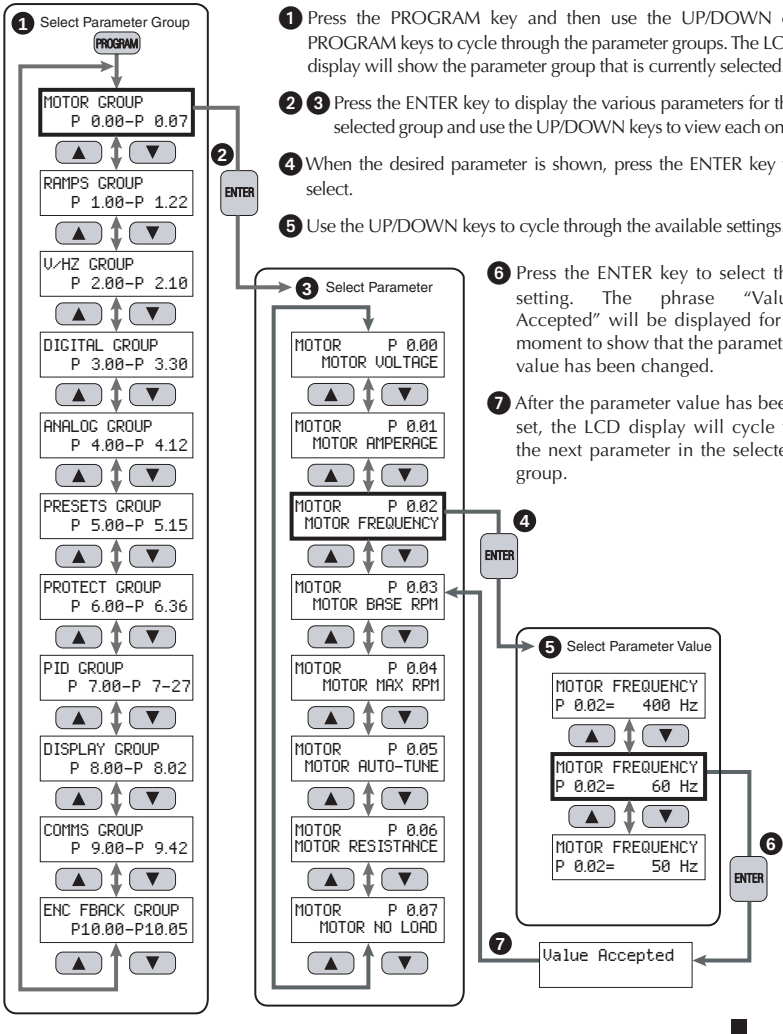
Displays the PID feed-back signal.

09 Frequency Setpoint

Displays the frequency setting of the AC drive. *Example: 60.0Hz*

Programming the *DURAPULSE* AC Drive

The ***DURAPULSE*** AC Drive parameters are organized into eleven (11) different groups according to their functions plus a special "Copy Keypad" function for storing up to four (4) different sets of program parameters into the keypad. The illustration below shows you how to navigate through the parameter groups and parameter settings. For a complete list of parameters, see CHAPTER 4.



1. Press the PROGRAM key and then use the UP/DOWN or PROGRAM keys to cycle through the parameter groups. The LCD display will show the parameter group that is currently selected.
2. 3. Press the ENTER key to display the various parameters for the selected group and use the UP/DOWN keys to view each one.
4. When the desired parameter is shown, press the ENTER key to select.
5. Use the UP/DOWN keys to cycle through the available settings.
6. Press the ENTER key to select the setting. The phrase "Value Accepted" will be displayed for a moment to show that the parameter value has been changed.
7. After the parameter value has been set, the LCD display will cycle to the next parameter in the selected group.

DURAPULSE Quickstart

The following examples will help you quickly set up your ***DURAPULSE*** AC Drive for two common applications.The first example applies to an application that requires constant torque, and the second example requires variable torque in its application.

Note: For a complete list and description of the parameters for the ***DURAPULSE*** *AC drives, see CHAPTER 4.*

Example 1: Constant torque (e.g. conveyors, compressors, etc.)

In this example, the AC drive needs to operate a motor that is connected to a conveyor. In order to decide which parameters need modifications, we will make a list of the needs for the application.

Application Needs

- The AC drive must control a 460V, 1HP motor. The AC drive model we will be using for this application is a GS3-41P0. An example of the motor nameplate is shown below.

INVERTER DUTY MOTOR							
HP	1	Volts	460	PHASE	3	TYPE	P
RPM	1725	AMPS	2.6	HZ	60	SF	1.15
DESIGN	B			AMB	40°C	INSUL CLASS	F
DUTY	CONT			ENCL	TEFC	CODE	K

- The maximum speed for the motor is 2000 RPM.
- The motor should accelerate to maximum speed in 5 seconds.
- The motor should decelerate from maximum speed in 5 seconds.
- The motor will require a high torque when starting.
- The operation of the motor (start, stop, etc.) will be controlled by remote control terminals. All keys on the ***DURAPULSE*** keypad should be disabled.
- The frequency of the AC drive will be determined by remote potentiometer that has a 0 to +10V signal.
- The display of the AC drive should default to the motor speed (RPM) when running.

Parameter Setup

In order to meet the needs of this application, the parameters should be set as follows:

P 0.00 **Motor Nameplate Voltage** **Setting: 460**

Range: 200V series: 200/208/220/230/240 Default Setting: 240
460V series: 380/400/415/440/460/480 Default Setting: 480

This parameter setting is determined by the motor nameplate.

P 0.01 **Motor Nameplate Amps** **Setting: 2.6**

Range: Drive Rated Amps x .1 to Drive Rated Amps x 1.0 Default Setting: Drive Rating (A)

This parameter setting is determined by the motor nameplate..

P 0.02 **Motor Base Frequency** **Setting: 60**

Range: 50/60/400 Default Setting 60

This parameter setting is determined by the motor nameplate.

P 0.03 **Motor Base RPM** **Setting: 1725**

Range: 375 to 24,000 RPM Default Setting: 1750

This parameter setting is determined by the motor nameplate.

P 0.04 **Motor Maximum RPM** **Setting: 2000**

Range: P 0.03 to 24,000 RPM Default Setting: P 0.03

This parameter setting is determined by the needs of the application.

WARNING: The Motor Maximum RPM parameter (P 0.04) should never exceed the maximum RPM rating for the motor you are using. If this information is not readily available, consult your motor manufacturer.

P 1.00 **Stop Methods** **Setting: 00**

Range: 00 Ramp to Stop Default Setting: 00
01 Coast to stop

The application requires that this parameter be set to Ramp to Stop because the motor needs to stop under power. If the AC drive was set for Coast to Stop, the AC drive would ignore the Deceleration Time setting.

WARNING: If the Stop Method for the *DURAPULSE* AC drive is set for Coast to Stop, the AC drive will ignore any setting you have for Deceleration Time (P 1.02).

P 1.01 **Acceleration Time** **Setting: 5.0**

Range: 0.1 to 600 sec Default Setting: 10 sec

The motor should accelerate from 0 RPM to Maximum Motor RPM (P 0.04) in 5 seconds.

P 1.02 **Deceleration Time** **Setting: 5.0**

Range: 0.1 to 600 sec Default Setting: 30 sec

The motor should decelerate from 2000 RPM; Maximum Motor RPM (P 0.04) to 0 RPM in 5 seconds.

P 2.00 **Volts/Hertz Settings** **Setting: 01**

Range: 00 - General Purpose Default Setting: 0.0
01 - High Starting Torque
02 - Fans and Pumps
03 - Custom

The *DURAPULSE* AC drive has some predefined torque settings that meet the needs of most applications. A custom setting is available if needed. In this example, the application requires a high starting torque.

P 3.00 **Source of Operation Command** **Setting: 02**

Default Setting: 00

Settings	00	Operation Determined by Digital Keypad
	01	Operation determined by external control terminals. Keypad STOP is enabled.
	02	Operation determined by external control terminals. Keypad STOP is disabled.
	03	Operation determined by RS485 interface. Keypad STOP is enabled.
	04	Operation determined by RS485 interface. Keypad STOP is disabled.

The AC drive operation will be determined by external control terminals and the keypad stop will be disabled.

Note: If parameter P 3.00 = 0, 1, or 3, enabling the keypad STOP key, the drive will stop if the keypad is removed from the drive.

P 4.00 **Source of Frequency Command** **Setting: 02**

Default: 01

Settings:

01	Frequency determined by digital keypad up/down
02	Frequency determined by 0 to +10V input on AI1 terminal.
03	Frequency determined by 4 to 20mA input on AI2 terminal.
04	Frequency determined by 0 to 20mA input on AI2 terminal.
05	Frequency determined by RS485 communication interface
06	Frequency determined by-10V~+10V input on AI3 terminal

P 8.00 **User Defined Display Function** **Setting: 01**

Default Setting: 00

Settings:

00	Output Frequency (Hz)
01	Motor Speed (RPM)
02	Scaled Frequency
03	Output Current (A)
04	Motor Load (%)
05	Output Voltage(V)
06	DC Bus Voltage (V)
07	PID Setpoint
08	PID Feedback (PV)
09	Frequency Setpoint

The AC drive display will default to motor speed (RPM) when running.

Example 2: Variable torque (e.g. fans, centrifugal pumps, etc.)

In this example, the AC drive needs to operate a motor that is connected to a centrifugal pump. As in Example 1, we will make a list of the needs for the application in order to decide which parameters need modifications.

Application Needs

- The AC drive must control a 208V, 3HP motor. The AC drive model we will be using for this application is a GS3-23P0. An example of the motor nameplate is shown below.

INVERTER DUTY MOTOR							
HP	3	Volts	208	PHASE	3	TYPE	P
RPM	3525	AMPS	9.2	HZ	60	SF	1.15
DESIGN	B	AMB	40°C			INSUL CLASS	F
DUTY	CONT	ENCL	TEFC			CODE	K

- The maximum speed for the motor is 3600 RPM.
- The motor should accelerate to maximum speed in 20 seconds.
- The motor should coast to stop when operation is terminated.
- The motor will be turning a centrifugal pump.
- The operation of the motor (start, stop, etc.) will be controlled by the *DURAPULSE* digital keypad.
- The frequency of the AC drive will be determined by the *DURAPULSE* keypad potentiometer.
- The display of the AC drive should default to output current (A) when running.

Parameter Setup

In order to meet the needs of this application, the parameters should be set as follows:

P 0.00 **Motor Nameplate Voltage** **Setting: 208**

Range: 200V series: 200/208/220/230/240 Default Setting: 240
460V series: 380/400/415/440/460/480 Default Setting: 480

This parameter setting is determined by the motor nameplate.

P 0.01 **Motor Nameplate Amps** **Setting: 9.2**

Range: Drive Rated Amps x .1 to Drive Rated Amps x 1.0 Default Setting: Drive Rating (A)

This parameter setting is determined by the motor nameplate.

P 0.02 **Motor Base Frequency** **Setting: 60**

Range: 50/60/400 Default Setting 60

This parameter setting is determined by the motor nameplate.

P 0.03 **Motor Base RPM** **Setting: 3525**

Range: 375 to 24,000 RPM Default Setting: 1750

This parameter setting is determined by the motor nameplate.

P 0.04 **Motor Maximum RPM** **Setting: 3600**

Range: P 0.03 to 24,000 RPM Default Setting: P 0.03

This parameter setting is determined by the needs of the application.

WARNING: The Motor Maximum RPM parameter (P 0.04) should never exceed the maximum RPM rating for the motor you are using. If this information is not readily available, consult your motor manufacturer.

P 1.00 **Stop Methods** **Setting: 01**

Range: 00 Ramp to Stop Default Setting: 00
01 Coast to stop

The application requires that this parameter be set to Coast to Stop.

WARNING: If the Stop Method for the *DURAPULSE* AC drive is set for Coast to Stop, the AC drive will ignore any setting you have for Deceleration Time (P 1.02).

P 1.01 **Acceleration Time** **Setting: 20.0**

Range: 0.1 to 600 sec Default Setting: 10 sec

The motor should accelerate from 0 RPM to Maximum Motor RPM (P 0.04) in 20 seconds.

P 2.00 **Volts/Hertz Settings** **Setting: 02**

Range: 00 - General Purpose
01 - High Starting Torque
02 - Fans and Pumps
03 - Custom

Default Setting: 00

The *DURAPULSE* AC drive has some predefined torque settings that meet the needs of most applications. A custom setting is available if needed. In this example, the motor will be running a pump.

Note: In some applications it is perfectly acceptable to leave this parameter set for "00" - General Purpose.

P 3.00 **Source of Operation Command** **Setting: 00**

Default Setting: 00

Settings	00	Operation Determined by Digital Keypad
	01	Operation determined by external control terminals. Keypad STOP is enabled.
	02	Operation determined by external control terminals. Keypad STOP is disabled.
	03	Operation determined by RS485 interface. Keypad STOP is enabled.
	04	Operation determined by RS485 interface. Keypad STOP is disabled.

The AC drive operation will be determined by the Digital Keypad.

Note: If parameter P 3.00 = 0, 1, or 3, enabling the keypad STOP key, the drive will stop if the keypad is removed from the drive.

P 4.00 Source of Frequency Command — Setting: 00

Default: 01

Settings:
- 01 Frequency determined by digital keypad up/down
- 02 Frequency determined by 0 to +10V input on AI1 terminal.
- 03 Frequency determined by 4 to 20mA input on AI2 terminal.
- 04 Frequency determined by 0 to 20mA input on AI2 terminal.
- 05 Frequency determined by RS485 communication interface.
- 06 Frequency determined by -10V ~ +10V input on AI3 terminal

P 6.00 Electronic Thermal Overload Relay — Setting: 01

Range: 00 - Constant Torque
01 - Variable Torque
02 - Inactive

Default Setting: 00

- This function is used to limit the output power of the AC drive when powering a "self-cooled" motor at low speed.

P 8.00 User Defined Display Function — Setting: 03

Default Setting: 00

Settings:
- 00 Output Frequency (Hz)
- 01 Motor Speed (RPM)
- 02 Scaled Frequency
- 03 Output Current (A)
- 04 Motor Load (%)
- 05 Output Voltage(V)
- 06 DC Bus Voltage (V)
- 07 PID Setpoint
- 08 PID Feedback (PV)
- 09 Frequency Setpoint

The AC drive display will default to indicate Output Current (A) when running.

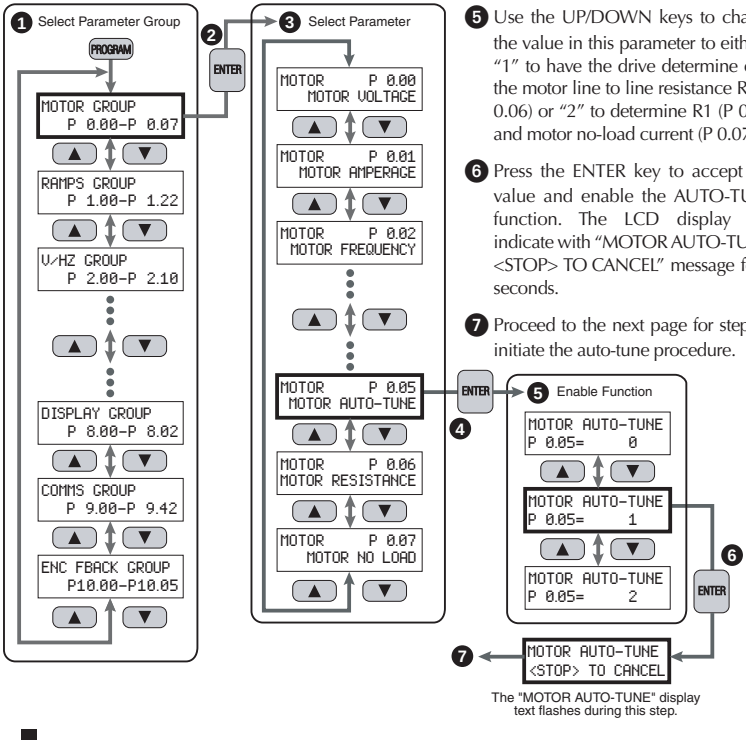
Note: For a complete list and description of the parameters for the DURAPULSE AC drives, see CHAPTER 4.

Auto-Tune Procedure

WARNING: The motor will rotate when executing the auto-tuning procedure. It is also very important that no load be connected to the motor output shaft at the time the auto-tune procedure is performed.

The *DURAPULSE* AC drive is capable of performing an auto-tune procedure when a motor is connected to the AC drive. It is also very important for safety and functional reasons that no load be physically connected to the motor output shaft during auto-tuning. The auto-tune will begin when the RUN key is pressed on the AC drive keypad. To enable the Auto-Tune procedure, do the following:

1. Press the PROGRAM key repeatedly until the MOTOR GROUP, P 0.00-P 0-07, is displayed on the keypad LCD display.
2. Press the ENTER key to display the various parameters for this group.
3. Use the UP/DOWN keys to display parameter P 0.05, the MOTOR AUTO-TUNE function.
4. Press the ENTER key to display the current value for this parameter.



5. Use the UP/DOWN keys to change the value in this parameter to either a "1" to have the drive determine only the motor line to line resistance R1 (P 0.06) or "2" to determine R1 (P 0.06) and motor no-load current (P 0.07).
6. Press the ENTER key to accept this value and enable the AUTO-TUNE function. The LCD display will indicate with "MOTOR AUTO-TUNE, <STOP> TO CANCEL" message for 3 seconds.
7. Proceed to the next page for steps to initiate the auto-tune procedure.

Note: It is not necessary to set up the encoder and control mode before performing the auto-tuning function.

Initiate Auto-Tune

1. Make sure all wiring is correctly connected to the AC drive and motor.

2. Make sure there is no load connected to the motor's output shaft, including any belts or gear boxes.

3. Program parameters P 0.00, P 0.01, P 0.02, P 0.03 and P 0.04 with the correct values for the motor being used.

4. After enabling the Auto-Tune parameter P 0.05 as shown on the previous page for either a "1" to have the AC drive determine only the motor line to line resistance R1 (P 0.06) or a "2" to determine R1 (P 0.06) and the motor's no-load current (P 0.07), the message MOTOR AUTO-TUNE (flashing), <STOP> TO CANCEL will appear on the keypad LCD display for a 3 second period. If the STOP key is pressed during this time, the Auto-Tune procedure will terminate, the value in parameter P 0.05 will reset to "0" and the LCD display will return to the display mode.

5. After the confirmation message is shown, (the AC drive is ready to perform an Auto-Tune), the keypad LCD display will display the message PRESS <RUN>, TO CONTINUE for 60 seconds. Once the RUN key is pressed, the display will show DETECTING MOTOR (flashing), <STOP> TO CANCEL. If the STOP key is pressed, the Auto-Tune procedure will terminate, the keypad LCD display will show either a "R1 Detect Error" or "No Load Error" warning message, and the value in parameter P 0.05 will reset to "0". Use the STOP/RESET key to clear the warning message and return the drive to the display mode. Then, repeat the procedure .

6. The Auto-Tune procedure will take approximately 15 seconds to execute plus the acceleration and deceleration times in parameters P 1.01 and P 1.02. (The greater the horsepower of the AC drive and motor, the more acceleration and deceleration time will be required.)

7. Upon completion of the Auto-Tune procedure, the display will show the message TUNING COMPLETE, PRESS <ENTER>. At this time, the determined values for parameters P 0.06 and P 0.07 will be filled in automatically. Please check these parameters to make sure a value was determined. If no value was determined, then repeat the procedure.

8. If the STOP/RESET key on the keypad is pressed during auto-tuning, or if the RUN key is not pressed within 60 seconds once the message PRESS <RUN>, TO CONTINUE is displayed, the Auto-Tune procedure will terminate and the value in parameter P 0.05 will reset to "0". The ***DURAPULSE*** AC drive will return to the normal display mode.

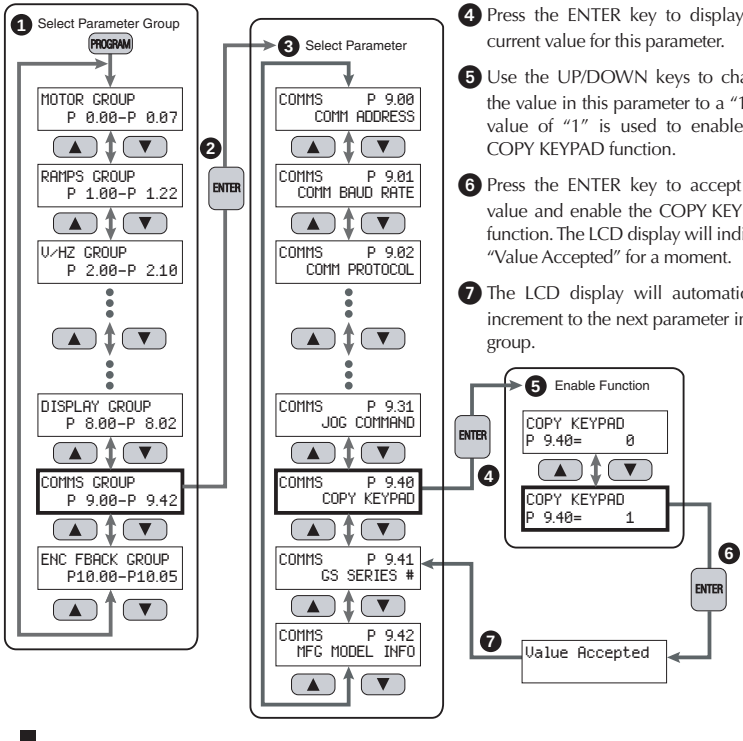
Copy Keypad Function

The COPY KEYPAD function has the ability to permanently store up to four (4) different program parameter settings within the keypad device. The stored parameter settings can be for any of the DURApulse AC Drives. This allows the parameter settings to be backed-up and readily available for either duplicating the same multiple AC drives or for maintenance use if a drive needs to be replaced.

Note: It is recommended that once the application has been programmed, the parameter settings be backed-up in the keypad for future use and maintenance.

Enable Copy Keypad Function

1. Press the PROGRAM key repeatedly until the COMMS GROUP, P 9.00-P 9.42, is displayed on the keypad LCD display.
2. Press the ENTER key to display the various parameters for this group.
3. Use the UP/DOWN keys to display parameter P 9.40, the COPY KEYPAD function.

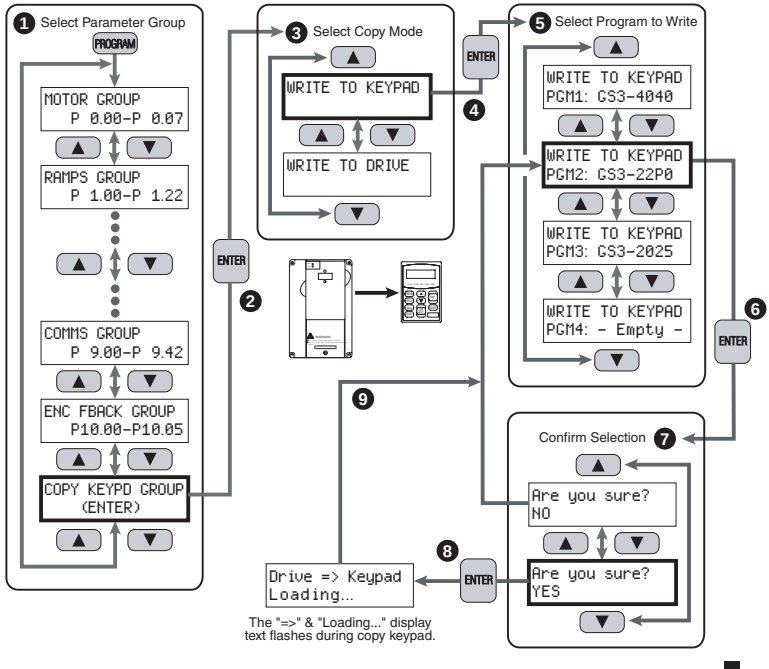


4. Press the ENTER key to display the current value for this parameter.
5. Use the UP/DOWN keys to change the value in this parameter to a "1". A value of "1" is used to enable the COPY KEYPAD function.
6. Press the ENTER key to accept this value and enable the COPY KEYPAD function. The LCD display will indicate "Value Accepted" for a moment.
7. The LCD display will automatically increment to the next parameter in the group.

Write Parameter Settings to Keypad

WARNING: Do not remove the Keypad during transfer of program parameter settings to or from the AC drive.

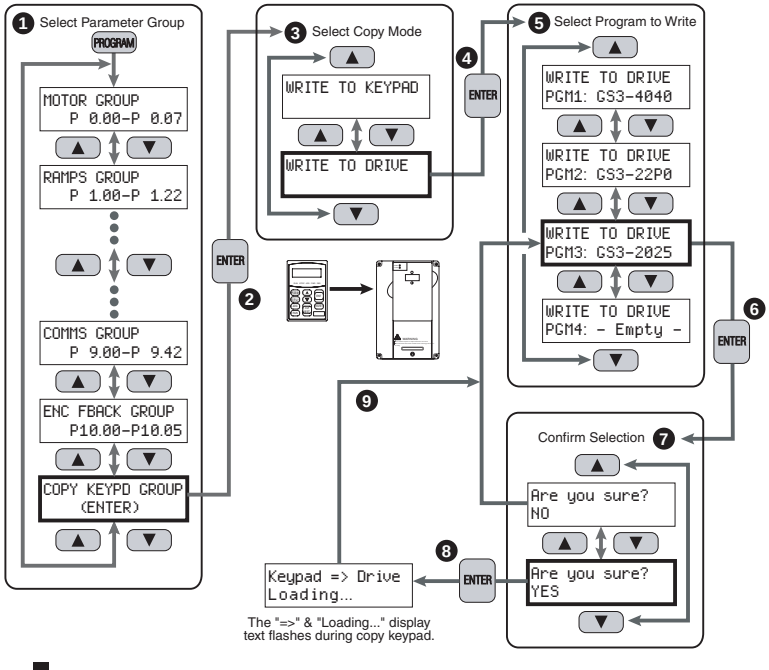
1. After the COPY KEYPAD parameter is enabled, the LCD display will show an additional group called COPY KEYPD GROUP. Press the PROGRAM key and then the UP/DOWN or PROGRAM keys until this new group is displayed.
2. Press the ENTER key to display the copy mode selections.
3. Select the WRITE TO KEYPAD mode using the UP/DOWN keys.
4. Press the ENTER key to display the four (4) available program numbers to write from the AC drive to the keypad. The program name will automatically be named the part number of the AC drive, for example: GS3-22P0.
5. 6. Use the UP/DOWN keys to select the desired program number; PGM1 thru PGM4 and press the ENTER key.
7. 8. Use the UP/DOWN keys to select "Yes" to confirm and press the ENTER key.
9. The LCD display will show the message "Drive => Keypad, Loading..." while the parameters are being copied and return to the program selection when finished.



Write Parameter Settings to Drive

WARNING: Do not remove the Keypad during transfer of program parameter settings to or from the AC drive.

1. After the COPY KEYPAD parameter is enabled, the LCD display will show an additional group called COPY KEYPD GROUP. Press the PROGRAM key and then the UP/DOWN or PROGRAM keys until this new group is displayed.
2. Press the ENTER key to display the copy mode selections.
3. Select the WRITE TO DRIVE mode using the UP/DOWN keys.
4. Press the ENTER key to display the four (4) available program numbers to write from the keypad to the AC drive. The program name must match the part number of the AC drive being programmed, for example: GS3-2025.
5. 6. Use the UP/DOWN keys to select the desired program number; PGM1 thru PGM4 and press the ENTER key.
7. 8. Use the UP/DOWN keys to select "Yes" to confirm and press the ENTER key.
9. The LCD display will show the message "Keypad => Drive, Loading..." while the parameters are being copied and return to the program selection when finished.



Note: Use the PROGRAM key to back out of the various menu selections.

Note: The warning message RATING MISMATCH will be displayed on the LCD display if trying to do a WRITE TO DRIVE copy mode and selecting an existing program that does not match the drive being used.

AC Drive Parameters

In This Chapter...

DURAPULSE Parameter Summary

Motor Parameters			
DURAPULSE Parameter	Description	Range	Default
P 0.00	Motor Nameplate Voltage	200/208/220/230/240 380/400/415/440/460/480	240 480
P 0.01	Motor Nameplate Amps	Drive Rated Amps x .10 to 100%	Drive Rated Amps x 1.0
P 0.02	Motor Base Frequency	50/60/400	60
P 0.03	Motor Base RPM	375 to 24,000 RPM	1750
P 0.04	Motor Maximum RPM (Max operation Freq., AI1 and AI2 100% value)	P 0.03 to 24,000 RPM	P 0.03
P 0.05	Motor Auto Detection	00 Disable 01 Enable P 0.06 only 02 Enable P 0.06 and P 0.07	00
P 0.06	Motor Line to line resistance R1	00 to 65535 milliohm	00
P 0.07	Motor No-Load Current	Drive Rated Amps x 0.0 to 0.9 (amps)	Drive Rated Amps x 0.4
Ramps			
P 1.00	Stop Methods	00: Ramp to Stop 01: Coast to Stop	00
◆ **P 1.01**	Acceleration Time 1	0.1 to 600.0 sec	10.0
◆ **P 1.02**	Deceleration Time 1	0.1 to 600.0 sec	30.0
P 1.03	Accel S-curve	0 to 7	00
P 1.04	Decel S-curve	0 to 7	00
◆ **P 1.05**	Acceleration Time 2	0.1 to 600.0 sec	10.0
◆ **P 1.06**	Deceleration Time 2	0.1 to 600.0 sec	30.0
P 1.07	Select method to use 2nd Accel/Decel	00: RMP2 from terminal 01: Transition Frequencies P1.08 & P 1.09	00
P 1.08	Accel 1 to Accel 2 frequency transition	0.0 to 400.0 Hz	0.0
P 1.09	Decel 2 to Decel 1 frequency transition	0.0 to 400.0 Hz	0.0
P 1.10	Skip Frequency 1	0.0 to 400.0 Hz	0.0
P 1.11	Skip Frequency 2	0.0 to 400.0 Hz	0.0
P 1.12	Skip Frequency 3	0.0 to 400.0 Hz	0.0
P 1.13	Skip Frequency 4	0.0 to 400.0 Hz	0.0
P 1.14	Skip Frequency 5	0.0 to 400.0 Hz	0.0
P 1.17	Skip Frequency Band	0.0 to 20.0 Hz	0.0
P 1.18	DC Injection Current Level	00 to 100 %	00
P 1.20	DC Injection during Start-up	0.0 to 5.0 sec	0.0
P 1.21	DC Injection during Stopping	0.0 to 25.0 sec	0.0
P 1.22	Start-point for DC Injection	0.0 to 60.0 Hz	0.0

◆ Parameter can be set during RUN Mode.

Volts/Hertz			
DURAPULSE Parameter	Description	Range	Default
P 2.00	Volts/Hertz Settings	00: General Purpose 01: High Starting Torque 02: Fans and Pumps 03: Custom	00
◆ **P 2.01**	Slip Compensation	0.0 to 10.0	0.0 (V/f mode) 1.00 (vector mode)
◆ **P 2.02**	Auto-torque Boost	00 to 10	00
◆ **P 2.03**	Torque Compensation Time Constant	00 to 10 sec	0.05
P 2.04	Mid-point Frequency	0.1 to 400 Hz	0.5
P 2.05	Mid-point Voltage	240V 0.1 to 240V 480V 0.1 to 480V	5.0 10.0
P 2.06	Min. Output Frequency	0.1 to 20.0 Hz	0.5
P 2.07	Min. Output Voltage	240V 0.1 to 50V 480V 0.1 to 100V	5.0 10.0
P 2.08	PWM Carrier Frequency	01 to 15 KHz 01 to 15 KHz 01 to 09 KHz 01 to 06 KHz	1-5HP = 15 7.5-25HP = 9 30-60HP = 6 75-100HP = 6
P 2.10	Control Mode	00: V/Hz open loop control 01: V/Hz closed loop control 02: Sensorless Vector 03: Sensorless Vector with external feedback	00
Digital			
P 3.00	Source of Operation Command	00: Operation determined by digital keypad 01: Operation determined by external control terminals, keypad STOP is enabled 02: Operation determined by external control terminals, keypad STOP is disabled 03: Operation determined by RS-485 interface, keypad STOP is enabled 04: Operation determined by RS-485 interface, keypad STOP is disabled	00
P 3.01	Multi-function Input Terminals (DI1 - DI2)	00: DI1 - FWD / STOP, DI2 - REV / STOP 01: DI1 - RUN / STOP, DI2 - REV / FWD 02: DI1 - RUN momentary (N.O.) DI2 - REV / FWD DI3 - STOP momentary (N.C.)	00

◆ Parameter can be set during RUN Mode.

Digital Parameters			
*DURA*PULSE Parameter	Description	Range	Default
P 3.02	Multi-function Input (DI3)	00: External Fault (N.O.) 01: External Fault (N.C.) 02: External Reset 03: Multi-Speed Bit 1 04: Multi-Speed Bit 2 05: Multi-Speed Bit 3 06: Multi-Speed Bit 4 07: Manual Keyboard Control 08: Reserved 09: Jog 10: External Base Block (N.O.) 11: External Base Block (N.C.) 12: Second Accel/Decel Time 13: Speed Hold 14: Increase Speed* 15: Decrease Speed* 16: Reset Speed to Zero 17: PID Disable (N.O.) 18: PID Disable (N.C.) 99: Input Disable	00
P 3.03	Multi-function Input (DI4)		03
P 3.04	Multi-function Input (DI5)		04
P 3.05	Multi-function Input (DI6)		05
P 3.06	Multi-function Input (DI7)		06
P 3.07	Multi-function Input (DI8)		09
P 3.08	Multi-function Input (DI9)		02
P 3.09	Multi-function Input (DI10)		12
P 3.10	Multi-function Input (DI11)		10
P 3.11	Multi-Function Output Terminal 1 (Relay Output)	00: AC Drive Running 01: AC Drive Fault 02: At Speed 03: Zero Speed 04: Above Desired Frequency (P 3.16) 05: Below Desired Frequency (P 3.16) 06: At Maximum Speed (P 0.04) 07: Over torque detected (P 6.08) 08: Above Desired Current (P 3.17) 09: Below Desired Current(P 3.17) 10: PID Deviation Alarm 11: Heatsink overheat warning (OH1) 12: Soft Braking Signal 13: Above Desired Frequency 2 (P 3.20) 14: Below Desired Frequency 2 (P 3.20) 15: Encoder Loss	00
P 3.12	Multi-Function Output Terminal 2 (DO1)		01
P 3.13	Multi-Function Output Terminal 3 (DO2)		02
P 3.14	Multi-Function Output Terminal 4 (DO3)		03
◆ P 3.16	Desired Frequency	0.0 to 400.0 Hz	0.0
◆ P 3.17	Desired Current	0.0 to <Drive Rated Amps>	0.0
◆ P 3.18	PID Deviation Level	1.0 to 50.0 %	10.0
◆ P 3.19	PID Deviation Time	0.1 to 300.0 sec	5.0
◆ P 3.20	Desired Frequency 2	0.0 to 400.0 Hz	0.0
◆ P 3.30	Frequency Output Multiplying Factor	1 to 20	1

**Note: Accel / Decel times must be more than one second to work efficiently.*

◆ Parameter can be set during RUN Mode.

Analog Parameters			
DURAPULSE Parameter	Description	Range	Default
P 4.00	Source of Frequency Command	01: Frequency determined by digital keypad up/down 02: Frequency determined by 0 to +10V input on AI1 terminal 03: Frequency determined by 4 to 20mA input on AI2 terminal 04: Frequency determined by 0 to 20mA input on AI2 terminal 05: Frequency determined by RS-485 communication interface 06: Frequency determined by 10V ~ +10V input on (AI3) terminal	01
P 4.01	Freqency Command Offset Polarity	00: No Offset 01: Positive Offset 02: Negative Offset	00
◆ **P 4.02**	Freqency Command Offset	0.0 to 100.0%	0.0
◆ **P 4.03**	Freqency Command Gain	0.0 to 300.0%	100.0
P 4.04	Freqency Command Reverse Motion Enable	00: Forward Motion Only 01: Reverse Motion Enable	00
P 4.05	Loss of AI2 Signal (4-20mA)	00: Decelerate to 0Hz 01: Stop immediately and display error code "External Fault" 02: Continue operation by the last frequency command	00
◆ **P 4.11**	Analog Output Signal	00: Frequency Hz 01: Current A 02: PV	00
◆ **P 4.12**	Analog Output Gain	00 to 200%	100

◆ Parameter can be set during RUN Mode.

Presets			
DURAPULSE Parameter	Description	Range	Default
◆ **P 5.00**	Jog	0.0 to 400.0 Hz	6.0
◆ **P 5.01**	Multi-Speed 1	0.0 to 400.0 Hz	0.0
◆ **P 5.02**	Multi-Speed 2	0.0 to 400.0 Hz	0.0
◆ **P 5.03**	Multi-Speed 3	0.0 to 400.0 Hz	0.0
◆ **P 5.04**	Multi-Speed 4	0.0 to 400.0 Hz	0.0
◆ **P 5.05**	Multi-Speed 5	0.0 to 400.0 Hz	0.0
◆ **P 5.06**	Multi-Speed 6	0.0 to 400.0 Hz	0.0
◆ **P 5.07**	Multi-Speed 7	0.0 to 400.0 Hz	0.0
◆ **P 5.08**	Multi-Speed 8	0.0 to 400.0 Hz	0.0
◆ **P 5.09**	Multi-Speed 9	0.0 to 400.0 Hz	0.0
◆ **P 5.10**	Multi-Speed 10	0.0 to 400.0 Hz	0.0
◆ **P 5.11**	Multi-Speed 11	0.0 to 400.0 Hz	0.0
◆ **P 5.12**	Multi-Speed 12	0.0 to 400.0 Hz	0.0
◆ **P 5.13**	Multi-Speed 13	0.0 to 400.0 Hz	0.0
◆ **P 5.14**	Multi-Speed 14	0.0 to 400.0 Hz	0.0
◆ **P 5.15**	Multi-Speed 15	0.0 to 400.0 Hz	0.0

◆ Parameter can be set during RUN Mode.

Protection			
DURAPULSE Parameter	Description	Range	Default
P 6.00	Electronic Thermal Overload Relay	00: Constant Torque 01: Variable Torque 02: Inactive	00
P 6.01	Auto Restart after Fault	00 to 10	00
P 6.02	Momentary Power Loss	00: Stop operation after momentary power loss 01: Continue operation after momentary power loss, speed search from Speed Reference 02: Continue operation after momentary power loss, speed search from Minimum Speed	00
P 6.03	Reverse Operation Inhibit	00: Enable Reverse Operation 01: Disable Reverse Operation	00
P 6.04	Auto Voltage Regulation	00: AVR enabled 01: AVR disabled 02: AVR disabled during decel 03: AVR disabled during stop	00
P 6.05	Over-Voltage Stall Protection	00: Enable Over-voltage Stall Prevention 01: Disable Over-voltage Stall Prevention	00
P 6.06	Auto Adjustable Accel/Decel	00: Linear Accel/Decel 01: Auto Accel, Linear Decel 02: Linear Accel, Auto Decel 03: Auto Accel/Decel 04: Auto Accel/Decel Stall Prevention (limited by P 1.01, P 1.02, P 1.05 and P 1.06)	00
P 6.07	Over-Torque Detection Mode	00: Disabled 01: Enabled during constant speed operation 02: Enabled during acceleration	00
P 6.08	Over-Torque Detection Level	30 to 200%	150
P 6.09	Over-Torque Detection Time	0.1 to 10.0	0.1
P 6.10	Over-Current Stall Prevention during Acceleration	20 to 200% 00: Disable	150
P 6.11	Over-Current Stall Prevention during Operation	20 to 200%	150
P 6.12	Maximum Allowable Power Loss Time	0.3 to 5.0 sec	2.0
P 6.13	Base-Block Time for Speed Search	0.3 to 5.0 sec	0.5
P 6.14	Maximum Speed Search Current Level	30 to 200%	150
P 6.15	Upper Bound of Output Frequency	0.1 to 400Hz	400
P 6.16	Lower Bound of Output Frequency	0.0 to 400Hz	0.0
P 6.17	Over-Voltage Stall Prevention Level	230V series - 330V to 450V 460V series - 600V to 900V	390 780
P 6.18	Braking Voltage Level	230V series - 370V to 450V 460V series - 740V to 900V	380 760

Protection (cont.)			
DURAPULSE Parameter	Description	Range	Default
P 6.31	Present Fault Record	00: No Fault occurred 01: Over-current (oc) 02: Over-voltage (ov) 03: Over-temperature 04: Overload (oL) 05: Thermal Overload (oL1) 06: Over-Torque (oL2) 07: External Fault (EF) 08: CPU failure 1 (CF1) 09: CPU failure 2 (CF2) 10: CPU failure 3 (CF3) 11: Hardware Protection Failure (HPF) 12: Over-current during accel (OCA) 13: Over-current during decel (OCd) 14: Over-current during steady state (OCn) 15:Ground fault or fuse failure (GFF) 17: Input power 3-phase loss 19: Auto Ramp Fault 21: PID Feedback loss (FbE) 22: Encoder Feedback Loss 23: Output Shorted 24: Momentary Power Loss	00
P 6.32	Second Most Recent Fault Record		00
P 6.33	Third Most Recent Fault Record		00
P 6.34	Fourth Most Recent Fault Record		00
P 6.35	Fifth Most Recent Fault Record		00
P 6.36	Sixth Most Recent Fault Record		00

PID			
DURAPULSE Parameter	Description	Range	Default
P 7.00	Input Terminal for PID Feedback	00: Inhibit PID operation 01: Forward-acting (heating loop) PID feedback, PV from AI1 (0 to + 10V) 02: Forward-acting (heating loop) PID feedback, PV from AI2 (4 to 20mA) 03: Reverse-acting (cooling loop) PID feedback, PV from AI1 (0 to +10V). 04: Reverse-acting (cooling loop) PID feedback, PV from AI2 (4 to 20mA).	00
P 7.01	PV 100% Value	0.0 to 999	100.0
P 7.02	PID Setpoint Source	00: Keypad 01: Serial Communications 02: AI1 (0 to +10V) 03: AI2 (4 to 20mA)	02
◆ **P 7.03**	PID Feedback Gain	00 to 300.0%	100
◆ **P 7.04**	PID Setpoint Offset Polarity	00: No Offset 01: Positive Offset 02: Negative Offset	00
◆ **P 7.05**	PID Setpoint Offset	0.0 to 100.0%	0.0
◆ **P 7.06**	PID Setpoint Gain	0.0 to 300.0%	100
◆ **P 7.10**	Keypad PID Setpoint	0.0 to 999	0.0
◆ **P 7.11**	PID Multi-setpoint 1	0.0 to 999	0.0
◆ **P 7.12**	PID Multi-setpoint 2	0.0 to 999	0.0
◆ **P 7.13**	PID Multi-setpoint 3	0.0 to 999	0.0
◆ **P 7.14**	PID Multi-setpoint 4	0.0 to 999	0.0
◆ **P 7.15**	PID Multi-setpoint 5	0.0 to 999	0.0
◆ **P 7.16**	PID Multi-setpoint 6	0.0 to 999	0.0
◆ **P 7.17**	PID Multi-setpoint 7	0.0 to 999	0.0
◆ **P 7.20**	Proportional Control	0.0 to 10.0	1.0
◆ **P 7.21**	Integral Control	0.00 to 100.0 sec	1.00
◆ **P 7.22**	Derivative Control	0.00 to 1.00 sec	0.00
P 7.23	Upper Bound for Integral Control	00 to 100%	100
P 7.24	Derivative Filter Time Constant	0.0 to 2.5 sec	0.0
P 7.25	PID Output Frequency Limit	00 to 110%	100
P 7.26	Feedback Signal Detection Time	0.0 to 3600 sec.	60
P 7.27	PID Feedback Loss	00: Warn and AC Drive Stop 01: Warn and Continue Operation	00

◆ Parameter can be set during RUN Mode.

DISPLAY			
DURAPULSE Parameter	Description	Range	Default
◆ P 8.00	User Defined Display Function	00: Output Frequency (Hz) 01: Motor Speed (RPM) 02: Scaled Frequency 03: Output Current (A) 04: Motor Load (%) 05: Output Voltage (V) 06: DC Bus Voltage (V)) 07: PID Setpoint 08: PID Feedback (PV) 09: Frequency Setpoint	00
◆ P 8.01	Frequency Scale Factor	0.01 to 160.0	1.0
◆ P 8.02	Backlight Timer	00: Timer Enable (1 min light off) 01:Timer Disable	00

Communications			
DURAPULSE Parameter	Description	Range	Default
P 9.00	Communication Address	01 to 254	01
P 9.01	Transmission Speed	00: 4800 baud 01: 9600 baud 02: 19200 baud 03: 38400 baud	01
P 9.02	Communication Protocol	00: MODBUS ASCII mode 7 data bits, no parity, 2 stop bits 01: MODBUS ASCII mode 7 data bits, even parity, 1 stop bit 02: MODBUS ASCII mode 7 data bits, odd parity, 1 stop bit 03: MODBUS RTU mode 8 data bits, no parity, 2 stop bits 04: MODBUS RTU mode 8 data bits, even parity, 1 stop bit 05: MODBUS RTU mode 8 data bits, odd parity, 1 stop bit	00
P 9.03	Transmission Fault Treatment	00: Display fault and continue operating 01: Display fault and RAMP to stop 02: Display fault and COAST to stop 03: No fault displayed and continue operating	00
P 9.04	Time Out Detection	00: Disable 01: Enable	00
P 9.05	Time Out Duration	0.1 to 60.0 seconds	0.5
◆ P 9.07	Parameter Lock	00: All parameters can be set and read 01: All parameters are read-only	00
P 9.08	Restore to Default	99: Restores all parameters to factory defaults	00

◆ Parameter can be set during RUN Mode.

Communications (cont.)			
DURAPULSE Parameter	Description	Range	Default
◆ **P 9.11**	Block Transfer Parameter 1	P 0.00 to P 8.02	P 9.99
◆ **P 9.12**	Block Transfer Parameter 2	P 0.00 to P 8.02	P 9.99
◆ **P 9.13**	Block Transfer Parameter 3	P 0.00 to P 8.02	P 9.99
◆ **P 9.14**	Block Transfer Parameter 4	P 0.00 to P 8.02	P 9.99
◆ **P 9.15**	Block Transfer Parameter 5	P 0.00 to P 8.02	P 9.99
◆ **P 9.16**	Block Transfer Parameter 6	P 0.00 to P 8.02	P 9.99
◆ **P 9.17**	Block Transfer Parameter 7	P 0.00 to P 8.02	P 9.99
◆ **P 9.18**	Block Transfer Parameter 8	P 0.00 to P 8.02	P 9.99
◆ **P 9.19**	Block Transfer Parameter 9	P 0.00 to P 8.02	P 9.99
◆ **P 9.20**	Block Transfer Parameter 10	P 0.00 to P 8.02	P 9.99
◆ **P 9.21**	Block Transfer Parameter 11	P 0.00 to P 8.02	P 9.99
◆ **P 9.22**	Block Transfer Parameter 12	P 0.00 to P 8.02	P 9.99
◆ **P 9.23**	Block Transfer Parameter 13	P 0.00 to P 8.02	P 9.99
◆ **P 9.24**	Block Transfer Parameter 14	P 0.00 to P 8.02	P 9.99
◆ **P 9.25**	Block Transfer Parameter 15	P 0.00 to P 8.02	P 9.99
◆ **P 9.26**	Serial Comm (RS485) Speed Reference	0.0 to 400.0 Hz	60.0
◆ **P 9.27**	Serial Comm RUN Command	00: Stop 01: Run	00
◆ **P 9.28**	Serial Comm Direction Command	00: Forward 01: Reverse	00
◆ **P 9.29**	Serial Comm External Fault	00: No fault 01: External fault	00
◆ **P 9.30**	Serial Comm Fault Reset	00: No action 01: Fault Reset	00
◆ **P 9.31**	Serial Comm JOG Command	00: Stop 01: Jog	00
◆ **P 9.40**	Parameter Copy	00: Disable Copy Keypad Function 01: Enable Copy Keypad Function	00
P 9.41	GS Series Number	01: GS1 02: GS2 03: GS3 04: GS4	##

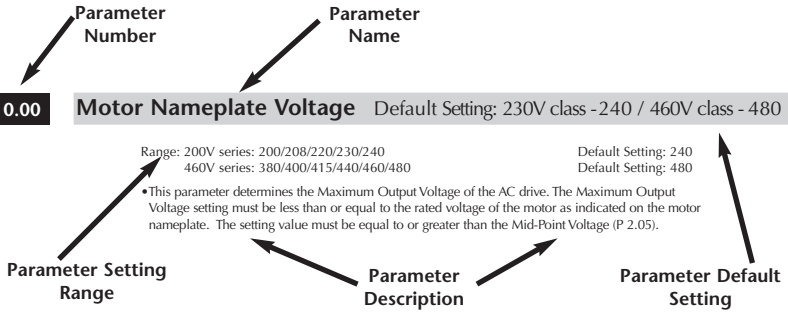
◆ Parameter can be set during RUN Mode.

DURAPULSE Parameter	Description	Range	Default
P 9.42	Manufacturer Model Information	00: GS3-21P0 (230V 3ph 1.0HP) 01: GS3-22P0 (230V 3ph 2.0HP) 02: GS3-23P0 (230V 3ph 3.0HP) 03: GS3-25P0 (230V 3ph 5.0HP) 04 :GS3-27P5 (230V 3ph 7.5HP) 05: GS3-2010 (230V 3ph 10HP) 06: GS3-2015 (230V 3ph 15HP) 07: GS3-2020 (230V 3ph 20HP) 08: GS3-2025 (230V 3ph 25HP) 09: GS3-2030 (230V 3ph 30HP) 10: GS3-2040 (230V 3ph 40HP) 11: GS3-2050 (460V 3ph 50HP) 12: GS3-41P0 (460V 3ph 1.0HP) 13: GS3-42P0 (460V 3ph 2.0HP) 14: GS3-43P0 (460V 3ph 3.0HP) 15: GS3-45P0 (460V 3ph 5.0HP) 16: GS3-47P5 (460V 3ph 7.5HP) 17: GS3-4010 (460V 3ph 10HP) 18: GS3-4015 (460V 3ph 15HP) 19: GS3-4020 (460V 3ph 20HP) 20: GS3-4025 (460V 3ph 25HP) 21: GS3-4030 (460V 3ph 30HP) 22: GS3-4040 (460V 3ph 40HP) 23: GS3-4050 (460V 3ph 50HP) 24: GS3-4060 (460V 3ph 60HP) 25: GS3-4075 (460V 3ph 75HP) 26: GS3-4100 (460V 3ph 100HP)	##

Encoder Feedback			
DURAPULSE Parameter	Description	Range	Default
P 10.00	Encoder Pulse per Revolution	01 to 20000	1024
P 10.01	Encoder type Input	00: Disable 01: Single Phase 02: Quadrature, FWD - CCW 03: Quadrature, FWD - CW	00
◆ **P 10.02**	Proportional Control	0.0 to 10.0	1.0
◆ **P 10.03**	Integral Control	0.00 to 100.00 sec	1.00
P 10.04	Speed Control Output Speed Limit	0.0 to 20.0%	7.5
P 10.05	Encoder Loss Detection	00: Warn and continue operation 01: Warn and RAMP to stop 02: Warn and COAST to stop	00

◆ Parameter can be set during RUN Mode.

Detailed Parameter Listings



Note: If the ◆ symbol is found next to the parameter name, the parameter can be edited when the AC drive is in RUN Mode.

Motor Parameters

P 0.00 **Motor Nameplate Voltage** Default Setting: 230V class - 240 / 460V class - 480

Range: 230V series: 200/208/220/230/240

460V series: 380/400/415/440/460/480

- This parameter determines the Maximum Output Voltage of the AC drive. The Maximum Output Voltage setting must be less than or equal to the rated voltage of the motor as indicated on the motor nameplate. The setting value must be equal to or greater than the Mid-Point Voltage (P 2.05).

P 0.01 **Motor Nameplate Amps** Default Setting: Drive Rating (A)

Range: Drive Rated Amps x 10 to 100%
Drive Rated Amps x 1.0

- This parameter sets the output current to the motor. The value is determined by the value found on the motor nameplate.

P 0.02 Motor Base Frequency

Default Setting 60

Range: 50/60/400

- This value should be set according to rated frequency of the motor as indicated on the motor nameplate. Motor Base Frequency determines the volts per hertz ratio.

P 0.03 Motor Base RPM

Default Setting: 1750

Range: 375 to 24,000 RPM

- This value should be set according to rated Base RPM of the motor as indicated on the motor nameplate.

P 0.04 Motor Maximum RPM

Default Setting: P 0.03

Range: P 0.03 to 24,000 RPM

- This value should be set according to the desired maximum speed of the motor. This value should not exceed the motor's maximum rated speed.

WARNING: The Motor Maximum RPM parameter (P 0.04) should never exceed the maximum RPM rating for the motor you are using. If this information is not readily available, consult your motor manufacturer.

- This value cannot be set lower than Motor Base RPM (P 0.03).

This parameter, along with P 0.02 and P 0.03, determines the Maximum Output Frequency of the AC Drive. The Maximum Output Frequency is can be calculated as follows:

$$\text{Max. Output Frequency} = \left(\frac{\text{Maximum Speed (P 0.04)}}{\text{Base Speed (P 0.03)}}\right) \times \text{Base Frequency (P 0.02)}$$

- If an output limit based on Maximum Output Frequency is desired, use the following equation to determine the corresponding value for Motor Maximum RPM:

$$\text{Motor Maximum RPM} = \left(\frac{\text{Max. Output Frequency}}{\text{Motor Base Frequency (P 0.02)}}\right) \times \text{Motor Base RPM (P 0.03)}$$

P 0.05 Motor Auto Detection

Default Setting: 00

Range: 00 Disable
01 Enable P 0.06 only (R1)
02 Enable P 0.06 and P 0.07 (R1 + No-load Test)

Unit will auto detect by pressing RUN key after this parameter is set to 01 or 02. When setting to 01, it will auto detect R1 value only (enter the motor rated current manually). When setting to 02, the AC drive should be set to No-load and the value of P 0.06 and P 0.07 will be filled in automatically. Do not set auto-tuning without a motor connected. If unit is set to auto tuning with no motor connected, the drive will be in auto-tune infinite loop without access to parameter groups. To fix this, smply power down unit, connect motor, complete auto-tune, even if incorrect, reset factory default (9.08 - 99), then start over.

The steps to AUTO-Tuning are:

1. Make sure all wiring is correctly connected to the AC drive and motor.
2. Make sure there is no load connected to the motor's output shaft, including any belts or gear boxes.
3. Fill in parameters P 0.00, P 0.01, P 0.02, P 0.03 and P 0.04 with the correct values for the motor being used.
4. After enabling the Auto-Tune parameter P 0.05 for either a "1" to have the AC drive determine only the motor line to line resistance R1 (P 0.06) or a "2" to determine R1 (P 0.06) and the motor's no-load current (P 0.07), the message MOTOR AUTO-TUNE (flashing), <STOP> TO CANCEL will appear on the keypad LCD display for a 3 second period. If the STOP key is pressed during this time, the Auto-Tune procedure will terminate, the value in parameter P 0.05 will reset to "0" and the LCD display will return to the display mode.
5. After the confirmation message is shown, (the AC drive is ready to perform an Auto-Tune), the keypad LCD display will display the message PRESS <RUN>, TO CONTINUE for 60 seconds. Once the RUN key is pressed, the display will show DETECTING MOTOR (flashing), <STOP> TO CANCEL. If the STOP key is pressed, the Auto-Tune procedure will terminate, the keypad LCD display will show either a "R1 Detect Error" or "No Load Error" warning message, and the value in parameter P 0.05 will reset to "0". Use the STOP/RESET key to clear the warning message and return the drive to the display mode. Then repeat the procedure.
6. The Auto-Tune procedure will take approximately 15 seconds to execute, plus the acceleration and deceleration times in parameters P 1.01 and P 1.02. (The greater the horsepower of the AC drive and motor, the more acceleration and deceleration time will be required.)
7. Upon completion of the Auto-Tune procedure, the display will show the message TUNING COMPLETE, PRESS <ENTER>. At this time, the determined values for parameters P 0.06 and P 0.07 will be filled in automatically. Please check these parameters to make sure a value was determined. If not, then repeat the procedure .
8. If the STOP/RESET key on the keypad is pressed during auto-tuning or if the RUN key is not pressed within 60 seconds once the message PRESS <RUN>, TO CONTINUE is displayed, the Auto-Tune procedure will terminate and the value in parameter P 0.05 will reset to "0". The ***DURA**PULSE* AC drive will return to the normal display mode.

Note: It is not necessary to set up the encoder and control mode before performing the auto tuning.

Warning: Motor will rotate when executing the auto-tuning procedure.

P 0.06 **Motor line-to-line Resistance R1** Default: 00

Range: 00 to 65535 milliohm

The motor auto detection feature will set this parameter. The user may also set this parameter without using P 0.05. Some manufacturers of motors have this value listed on the nameplate.

P 0.07 **Motor No-Load Current** Default: Drive Rated Amps x 0.4

Range: Drive Rated Amps x 0.0 to 0.9 (Amps)

The rated current of the AC drive is regarded as 100%. The setting of the motor no-load current will affect the slip compensation. The setting value must be less than the Motor Rated Current (P 0.01).

Ramp Parameters

P 1.00 Stop Methods

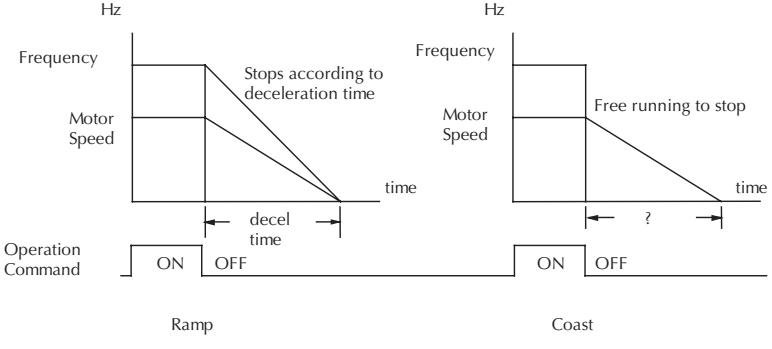
Default Setting: 00

Range: 00 Ramp to Stop
01 Coast to stop

This parameter determines how the motor is stopped when the AC drive receives a valid stop command.

- Ramp: The AC drive decelerates the motor to Minimum Output Frequency (P 2.06) and then stops according to the deceleration time set in P 1.02 or P 1.06.
- Coast:The AC drive stops output instantly upon command, and the motor free runs until it comes to a complete stop.

Note:The drive application or system requirements will determine which stop method is needed.



P 1.01 ◆ Acceleration Time 1

Default Setting: 10 sec

Range: 0.1 to 600 sec
This parameter is used to determine the time required for the AC drive to ramp from 0 to its Maximum Motor RPM (P 0.04). The rate is linear unless S-Curve is "Enabled."

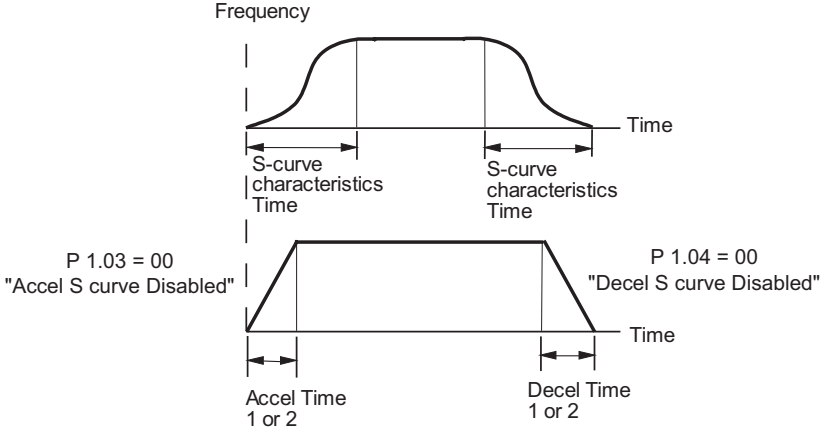
P 1.02 ◆ **Deceleration Time 1** Default Setting: 30 sec

Range: 0.1 to 600 sec
This parameter is used to determine the time required for the AC drive to decelerate from the Maximum Motor RPM (P 0.04) down to 0Hz. The rate is linear unless S-Curve is "Enabled."

P 1.03 **Accel S-Curve** Default Setting: 00

Range: 00 to 07

This parameter is used whenever the motor and load need to be accelerated more smoothly. The Accel S-Curve may be set from 0 to 7 to select the desired acceleration S Curve.



Note: S-curves can only be seen when the motor is loaded. Static testing will result in no noticeable change on tuning software (i.e.: GSoft or Directsoft.).

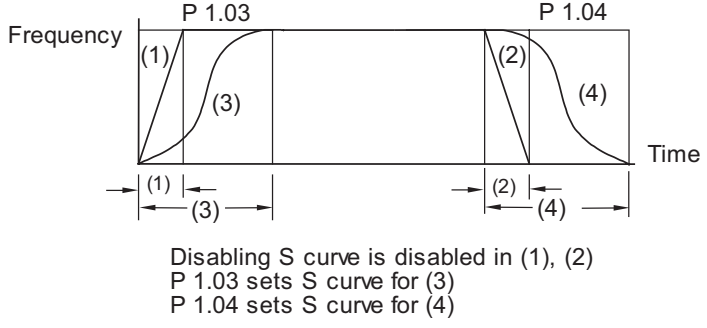
Note: Accel / Decel times 1 and 2 are applied to S-curve calculations.

P 1.04 **Decel S-Curve** Default Setting: 00

Range: 00 to 07

This parameter is used whenever the motor and load need to be decelerated more smoothly. The Decel S-Curve may be set from 00 to 07 to select the desired deceleration S-Curve.

Note: From the diagram shown below, the original setting accel/decel time will be for reference when the function of the S-curve is enabled. The actual accel/decel time will be determined based on the S-curve selected (1 to 7).



Disabling S curve is disabled in (1), (2)
P 1.03 sets S curve for (3)
P 1.04 sets S curve for (4)

P 1.05 ◆ **Acceleration Time 2** Default Setting: 10.0

Range: 0.1 to 600 sec

- The Second Acceleration Time determines the time for the AC drive to accelerate from 0 RPM to Maximum Motor RPM (P 0.04). Acceleration Time 2 (P 1.05) can be selected using a multi-function input terminal or frequency transition (P 1.07).

P 1.06 ◆ **Deceleration Time 2** Default Setting: 30 sec

Range: 0.1 to 600 sec

- The Second Deceleration Time determines the time for the AC drive to decelerate from Maximum Motor RPM (P 0.04) to 0 RPM. Deceleration Time 2 (P 1.06) can be selected using a multi-function input terminal or frequency transition (P 1.07).

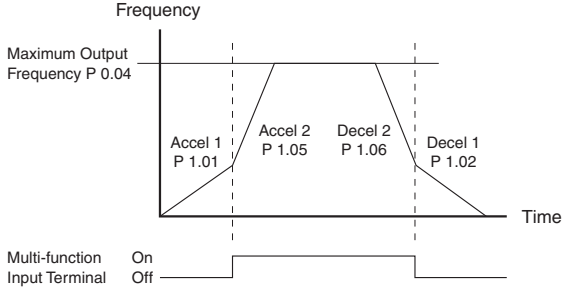
P 1.07 Select method for 2nd Accel/Decel

Default Setting: 00

Range: 00: Second Accel/Decel from terminal
01: Frequency Transition
P 1.08 & P 1.09

- The second set of acceleration and deceleration times P 1.05 and P 1.06 can be selected either with a multi-function input terminal programmed to Second Accel/Decel or by the values of the transition frequencies P 1.08 and P 1.09

Second Accel/Decel Times selected with Multi-Function Input Terminal

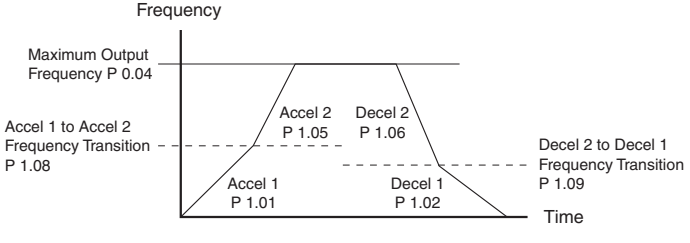


P 1.08 Accel 1 to Accel 2 Frequency Transition

Default Setting: 0.0

Range: 0.0 to 400.0 Hz

Second Accel/Decel Times selected with Frequency Transition



P 1.09 Decel 1 to Decel 2 Frequency Transition

Default Setting: 0.0

Range: 0.0 to 400.0 Hz

P 1.10 **Skip Frequency 1** Default Setting: 0.0

Range: 0.0 to 400.0Hz

P 1.11 **Skip Frequency 2** Default Setting: 0.0

Range: 0.0 to 400.0Hz

P 1.12 **Skip Frequency 3** Default Setting: 0.0

Range: 0.0 to 400.0 Hz

- P 1.10, P 1.11, and P 1.12 determine the location of the frequency bands that will be skipped during AC drive operation.

P 1.13 **Skip Frequency 4** Default Setting: 0.0

Range: 0.0 to 400.0 Hz

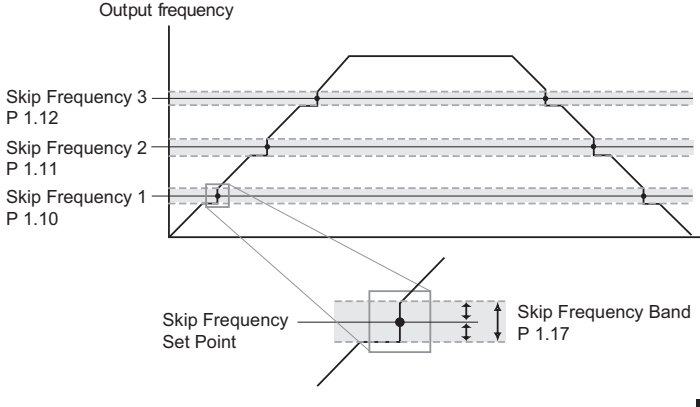
P 1.14 **Skip Frequency 5** Default Setting: 0.0

Range: 0.0 to 400.0 Hz

P 1.17 **Skip Frequency Band** Default Setting: 0.0

Range: 0.0 to 20.0 Hz

This parameter determines the frequency band for a given Skip Frequency (P 1.10, P 1.11, or P 1.12). Half of the Skip Frequency Band is above the Skip Frequency and the other half is below. Programming this parameter to 0.0 disables all skip frequencies.



P 1.18 DC Injection Current Level

Default Setting: 00

Range: 00 to 100%

This parameter determines the amount of DC Braking Current applied to the motor during start-up and stopping. When setting DC Braking Current, please note that 100% is equal to the rated current of the drive. It is recommended to start with a low DC Braking Current Level and then increase until proper holding torque has been attained.

P 1.20 DC Injection during Start-up

Default Setting: 0.0

Range: 0.0 to 5.0 sec

This parameter determines the duration of time that the DC Braking Current will be applied to the motor during the AC drive start-up. DC Braking will be applied for the time set in this parameter until the Minimum Frequency is reached during acceleration.

P 1.21 DC Injection during Stopping

Default Setting: 0.0

Range: 0.0 to 25.0 sec

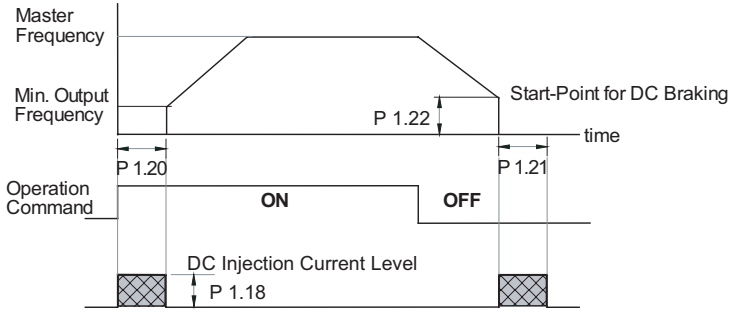
This parameter determines the duration of time that the DC braking voltage will be applied to the motor during stopping. If stopping with DC Braking is desired, then P 1.00 must be set to Ramp to Stop (00).

P 1.22 Start-point for DC Injection

Default Setting: 0.0

Range: 0.0 to 60.0 Hz

This parameter determines the frequency when DC Braking will begin during deceleration.



Volts/Hertz Parameters

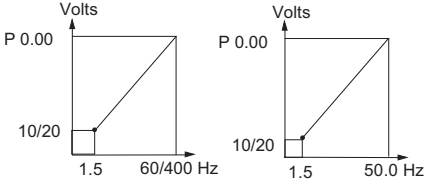
P 2.00 **Volts/Hertz Settings** Default Setting: 0.0

Range: 00 - General Purpose (constant torque)
01 - High Starting Torque
02 - Fans and Pumps (variable torque)
03 - Custom

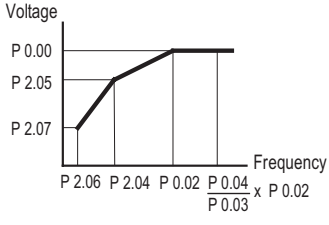
The Electronic Thermal Relay (P 6.00) should be set to correspond to this parameter.

Note: P 2.04 through P 2.07 are only used when the Volts/Hertz parameter (P 2.00) is set to 03.

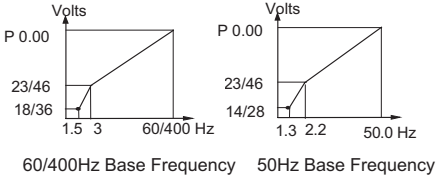
00: General Purpose



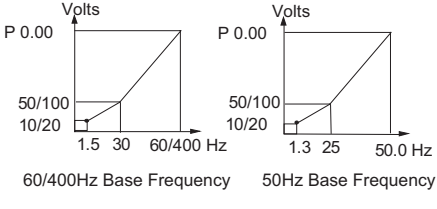
03: Custom



01: High Starting Torque



02: Fans and Pumps



P 2.01 **◆Slip Compensation** Default Setting: 0.0

Range: 0.0 to 10.0

- When controlling an asynchronous induction motor, load on the AC drive will increase causing an increase in slip. The formula for this is:

$$\text{Slip \%} = \frac{Ns - N}{Ns} \times 100$$

Ns = Synchronous Speed
N = Actual Speed

- This parameter may be used to compensate the nominal slip within a range of 0 to 10. When the output current of the AC drive is greater than the Motor Nameplate Amps (P 0.01), the AC drive will adjust its output frequency according to this parameter.

P 2.02 **◆ Auto-torque Boost** Default Setting: 00

Range: 00 to 10

- This parameter only applies in V/Hz mode.

P 2.03 **Torque Compensation Time Constant** Default Setting: 0.05

Range: 00 to 10 sec

Note: P 2.04 through P 2.07 are only used when the Volts/Hertz parameter (P 2.00) is set to 03. If trying to set when P 2.00 is not 03, "ERR" will result.

P 2.04 **Mid-point Frequency** Default Setting: 1.5

Range: 0.1 to 400 Hz

- This parameter sets the Mid-Point Frequency of V/F curve. With this setting, the V/F ratio between Minimum Frequency and Mid-Point frequency can be determined. T**his parameter must be greater than or equal to the Minimum Output Frequency (P 2.06) and less than or equal to the Maximum Voltage Frequency (P 0.02).**

P 2.05 **Mid-point Voltage** Default Setting: 240V class: 10.0 / 480V class: 20.0

Range: 240V - 0.1 to 240V
480V - 0.1 to 480V

- This parameter sets the Mid-Point Voltage of any V/F curve. With this setting, the V/F ratio between Minimum Frequency and Mid-Point Frequency can be determined. **This parameter must be greater than or equal to the Minimum Output Voltage (P 2.07) and less than or equal to the Maximum Output Voltage (P 0.00).**

P 2.06 **Minimum Output Frequency** Default Setting: 1.5

Range: 0.1 to 20.0 Hz

- This parameter sets the Minimum Output Frequency of the AC drive. **This parameter must be less than or equal to the Mid-Point Frequency (P 2.04).**

P 2.07 Minimum Output Voltage

Default Setting: 240V class: 10.0 / 480V class: 20.0

Range: 240V - 0.1 to 50V
480V - 0.1 to 100V

- This parameter sets the Minimum Output Voltage of the AC drive.
  This parameter must be equal to or less than Mid-Point Voltage (P 2.05).

P 2.08 PWM Carrier Frequency

Default Settings: 15/09/06/06

Range:		Default Setting:
	1 to 5HP, 01 to 15 KHz	15
	7.5 to 25HP, 01 to 15 KHz	09
	30 to 60HP, 01 to 09 KHz	06
	75 to 100HP, 01 to 06 KHz	06

This parameter sets the carrier frequency of PWM (Pulse-Width Modulated) output.

- In the table below, we see that the carrier frequency of PWM output has a significant influence on the electromagnetic noise, leakage current and heat dissipation of the AC drive, and the acoustic noise to the motor

Carrier Frequency	Acoustic Noise	Electromagnetic Noise, Leakage Current	Heat Dissipation
1kHz	significant	minimal	minimal
15kHz	minimal	moderate	moderate

P 2.10 Control Mode

Default: 00

Range: 00: V/Hz open loop control
01: V/Hz closed loop control
02: Sensorless Vector
03: Sensorless Vector with external feedback

This parameter determines the control methods of the AC drive

Digital Parameters

P 3.00 Source of Operation Command

Default Setting: 00

Settings	00	Operation Determined by Digital Keypad
	01	Operation determined by external control terminals. Keypad STOP is enabled.
	02	Operation determined by external control terminals. Keypad STOP is disabled.
	03	Operation determined by communication interface. Keypad STOP is enabled.
	04	Operation determined by communication interface. Keypad STOP is disabled.

- This parameter sets the input source for the AC drive operation commands.
- Refer to P 3.01 to P 3.10 for more details.

P 3.01 Multi-function Input Terminals (DI-DI2)

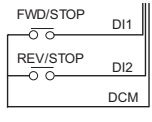
Default Setting: 00

Settings	00	DI1 - FWD/STOP DI2 - REV/STOP
	01	DI1 - RUN/STOP DI2 - REV/FWD
	02	DI1 - RUN (N.O. latching input) DI2 - REV/FWD DI3 - STOP (N.C. latching input)

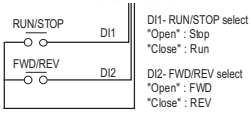
Note: Multi-function Input Terminals DI1 and DI2 do not have separate parameter designations. DI1 and DI2 must be used in conjunction with one another to operate two and three wire control.

P 3.01: Setting 00

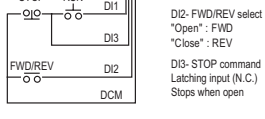
DI1	DI2	Result
OFF	OFF	STOP
ON	OFF	FWD
OFF	ON	REV
ON	ON	STOP



P 3.01: Setting 01



P 3.01: Setting 02



P 3.02	**Multi-Function Input (DI3)**	Default Setting: 00
P 3.03	**Multi-Function Input (DI4)**	Default Setting: 03
P 3.04	**Multi-function Input (DI5)**	Default Setting: 04
P 3.05	**Multi-function Input (DI6)**	Default Setting: 05
P 3.06	**Multi-function Input (DI7)**	Default Setting: 06
P 3.07	**Multi-function Input (DI8)**	Default Setting: 09
P 3.08	**Multi-function Input (DI9)**	Default Setting: 02
P 3.09	**Multi-function Input (DI10)**	Default Setting: 12
P 3.10	**Multi-function Input (DI11)**	Default Setting: 10

Settings for P 3.02 to P 3.10

00	External Fault (N.O.)	
01	External Fault (N.C.)	
02	External Reset	
03	Multi-Speed Bit 1	
04	Multi-Speed Bit 2	
05	Multi-Speed Bit 3	
06	Multi-Speed Bit 4	
07	Manual Keyboard Control	
08	Reserved	
09	Jog	
10	External Base Block (N.O.)	
11	External Base Block (N.C.)	
12	Second Accel/Decel Time	
13	Speed Hold	} P 4.00 must be set to 01.
14	Increase Speed*	
15	Decrease Speed*	
16	Reset Speed to Zero	
17	PID Disable (N.O.)	
18	PID Disable (N.C.)	
99	Input Disable	

**Note: Accel / Decel times must be more than one second to work efficiently.*

Setting Explanations for parameters P 3.02 through P 3.10

Setting 00: External Fault (N.O.)

When an External Fault input signal is received, the AC drive output will turn off, the drive will display the words “External Fault” on the LED Display, and the motor will Coast to Stop.To resume normal operation, the external fault must be cleared, and the drive must be reset.

Setting 01: External Fault (N.C.)

Setting 02: External Reset

An External Reset has the same function as the Reset key on the digital keypad. Use an External Reset to reset the drive after a fault.

Settings 03, 04, 05 and 06: Multi-Speed Bits 1, 2, 3 and 4

The four Multi-Speed Bits are used to select the multi-speed settings defined by parameters P 5.01 to P 5.15.

Multi-Speed Bits				Speed Selection
Bit 4	Bit 3	Bit 2	Bit 1	
OFF	OFF	OFF	OFF	P 4.00: Source of Frequency
OFF	OFF	OFF	ON	P 5.01: Multi-Speed 1
OFF	OFF	ON	OFF	P 5.02: Multi-Speed 2
OFF	OFF	ON	ON	P 5.03: Multi-Speed 3
OFF	ON	OFF	OFF	P 5.04: Multi-Speed 4
OFF	ON	OFF	ON	P 5.05: Multi-Speed 5
OFF	ON	ON	OFF	P 5.06: Multi-Speed 6
OFF	ON	ON	ON	P 5.07: Multi-Speed 7

Multi-Speed Bits				Speed Selection
Bit 4	Bit 3	Bit 2	Bit 1	
ON	OFF	OFF	OFF	P 5.08: Multi-Speed 8
ON	OFF	OFF	ON	P 5.09: Multi-Speed 9
ON	OFF	ON	OFF	P 5.10: Multi-Speed 10
ON	OFF	ON	ON	P 5.11: Multi-Speed 11
ON	ON	OFF	OFF	P 5.12: Multi-Speed 12
ON	ON	OFF	ON	P 5.13: Multi-Speed 13
ON	ON	ON	OFF	P 5.14: Multi-Speed 14
ON	ON	ON	ON	P 5.15: Multi-Speed 15

Setting 07

This setting is used to initiate the Manual Keyboard Control function only. It does not control the Speed Reference.

Note: In order to use the Multi-Speed settings, parameters P 5.01 - P 5.15 must be set.

Note: When all multi-speed inputs are off, the AC drive reverts back to the Command Frequency (P 4.00).

Setting 09: Jog Command

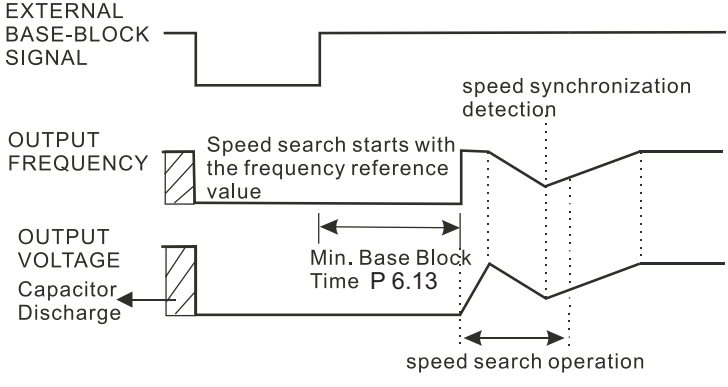
This setting configures a Multi-function Input Terminal to give the Jog Command when activated. P 5.00 sets the Jog Speed.

Note: The Jog Command cannot be used when the motor is running. The motor must be stopped to initiate this command.

Setting 10 and 11: External Base Block (N.O.) and External Base Block (N.C.)

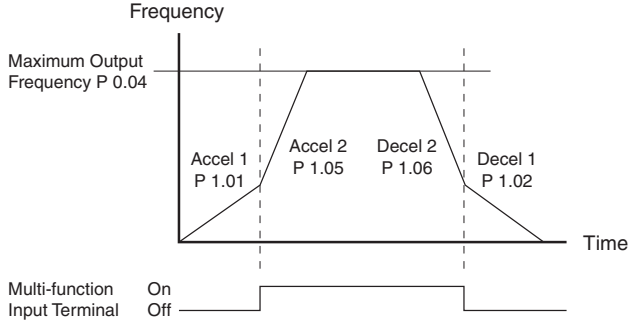
Value 10 is for a normally open (N.O) input and value 11 is for a normally closed (N.C.) input.

When an External Base Block is activated, the LCD display reads "EXT.BASE-BLOCK," the AC drive stops all output, and the motor will free run. When the External Base Block is deactivated, the AC drive will start the speed search function and synchronize with the motor speed. The AC drive will then accelerate to the Master Frequency.



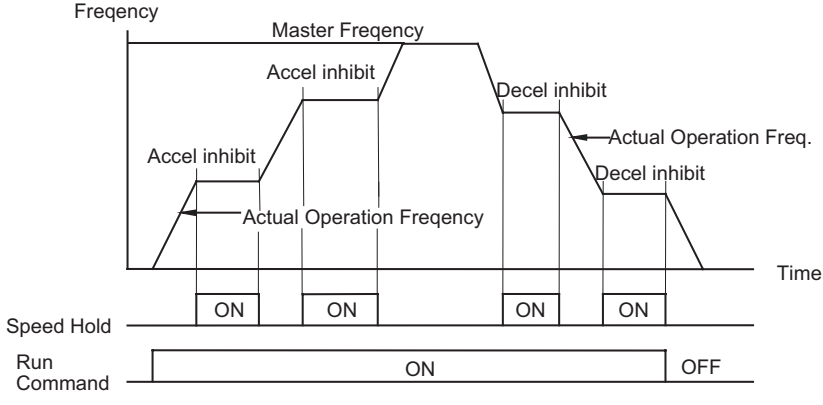
Setting 12: Second Accel/Decel Time

Multi-function Input Terminals DI3-DI6 can be set to select between Accel/Decel times 1 and 2. Parameters P 1.01 and P 1.02 set Accel 1 and Decel 1 times. Parameters P 1.05 and P 1.06 set Accel 2 and Decel 2 times.



Setting 13: Speed Hold

When the Speed Hold command is received, the drive acceleration or deceleration is stopped and the drive maintains a constant speed.



Settings 14 and 15: Increase and Decrease Speed
(Electronic Motor Operated Potentiometer)

Settings 14 and 15 allow the Multi-function terminals to be used to increase or decrease speed incrementally. Each time an increase/decrease speed input is received the Master Frequency will increase/decrease by one unit.

Note: In order to use these settings, P 4.00 must be set to 01.

Note: Accel / Decel times must be more than one second to work efficiently.

Setting 16: Reset Speed to Zero

Settings 17 and 18: PID Disable (N.O) and (N.C.)

Settings 17 and 18 set the Multi-function terminals to disable PID operation.

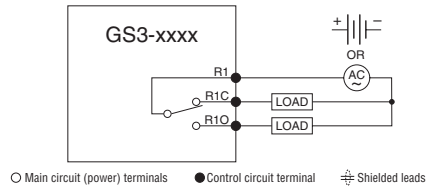
Setting 99: Multi-Function Input Disable

Setting a Multi-Function Input to 99 will disable that input. The purpose of this function is to provide isolation for unused Multi-Function Input Terminals. Any unused terminals should be programmed to 99 to make sure they have no effect on drive operation.

Note: Any unused terminals should be programmed to 99 to make sure they have no effect on drive operation.

P 3.11 Multi-function Output Terminal 1 (Relay Output) Default Setting: 00

Wiring diagram of Relay Output (Output Terminal)



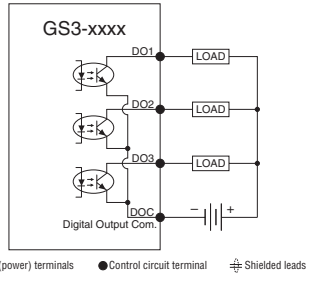
P 3.12 Multi-function Output Terminal 2 (DO1) Default Setting: 01

P 3.13 Multi-function Output Terminal 3 (DO2) Default Setting: 02

P 3.14 Multi-function Output Terminal 4 (DO3) Default Setting: 03

Settings:	00	AC Drive Running
	01	AC Drive Fault
	02	At Speed
	03	Zero Speed
	04	Above Desired Frequency (P 3.16)
	05	Below Desired Frequency (P 3.16)
	06	At Maximum Speed (P 0.02)
	07	Over Torque Detected
	08	Above Desired Current (P 3.17)
	09	Below Desired Current (P 3.17)
	10	PID Deviation Alarm (P 3.18 and P 3.19)
	11	Heatsink Overheat Warning (OH)
	12	Soft Braking Signal
	13	Above Desired Frequency 2 (P 3.20)
	14	Below Desired Frequency 2 (P 3.20)
	15	Encoder Loss

Wiring diagram of DO1, DO2, DO3 and DOC



Function Explanations:

Setting 00: AC Drive Running—The terminal will be activated when there is an output from the drive.

Setting 01: AC Drive Fault—The terminal will be activated when a fault occurs.

Setting 02: At Speed—The terminal will be activated when the AC drive attains the Command Frequency (P 4.00).

Setting 03: Zero Speed—The output will be activated when Command Frequency (P 4.00) is lower than the Minimum Output Frequency (P 2.06).

Setting 04: Above Desired Frequency—The output will be activated when the AC drive is above the Desired Frequency (P 3.16).

Setting 05: Below Desired Frequency—The output will be activated when the AC drive is below the Desired Frequency (P 3.16).

Setting 06: At Maximum Speed—The output will be activated when the AC drive reaches Motor Maximum RPM (P 0.04).

Setting 07: Over Torque Detected—The output will be activated when the AC drive reaches the Over-torque Detection Level (P 6.08) and exceeds this level for a time greater than the Over-torque Detection Time (P 6.09).

Setting 08: Above Desired Current—The output will be activated when the AC drive is above the Desired Current (P 3.17).

Setting 09: Below Desired Current—The output will be activated when the AC drive is below the Desired Current (P 3.17).

Setting 10: PID Deviation Alarm—The output will be activated when the AC drive exceeds the PID Deviation Level (P 3.18) for longer than the PID Deviation Time (P 3.19).

Setting 11: Heatsink Overheat Warning (OH) — The output will be activated when the heatsink overheats.The function will be activated as follows: Temperature range: 1 ~ 15HP, >90°C (194°F) ON; <90°C (194°F) OFF. Above 15HP: >80°C (176°F) ON; <80°C (176°F) OFF

Setting 12: Soft Braking Signal – The output will be activated when the drive needs help braking the load. A smooth deceleration is achieved using this function.

Setting 13: Above Desired Frequency 2 –The output will be activated when the AC drive is above the Desired Frequency.(P3.20)

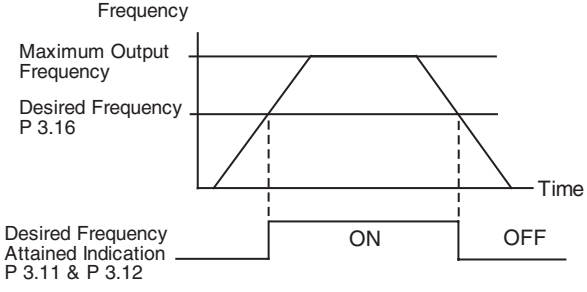
Setting 14: Below Desired Frequency—The output will be activated when the AC drive is below the Desired Frequency. (P 3.20)

Setting 15: Encoder Loss: The output will be activated when the AC drive experiences loss of the encoder signal.

P 3.16 ◆ **Desired Frequency** Default Setting: 0.0

Range: 0.0 to 400.0 Hz

- If a Multi-function output terminal is set to function as Desired Frequency Attained (P 3.11 or P 3.12 = 04 or 05), then the output will be activated when the programmed frequency is attained.



P 3.17 ◆ **Desired Current** Default Setting: 0.0

Range: 0.0 to <Drive Rated Amps>

P 3.18 ◆ **PID Deviation Level** Default Setting: 10.0

Range: 1.0 to 50.0%

P 3.19 ◆ **PID Deviation Time** Default Setting: 5.0

Range: 0.1 to 300.0 sec

P 3.20 ◆ **Desired Frequency 2** Default Setting: 0.0

Range: 0.0 to 400.0 Hz

P 3.30 ◆ **Frequency Output Multiplying Factor** Default Setting: 1

Range: 1 to 20

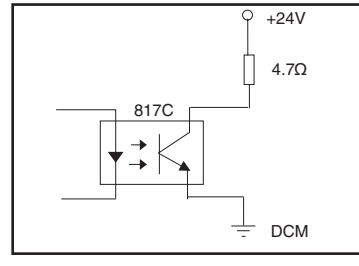
This parameter determines the multiplying factor for the AC drives' digital output frequency at the digital output terminals (FO-DCM). The number of output pulses per second is equal to the AC drive output frequency multiplied by P 3.30. (Pulse per second = actual output frequency x P3.30).

Example 1: When drive frequency is 60.0Hz, P 3.30 =10
60.0Hz x 10 = 600.0Hz
Frequency of FO's outputted square wave is 600.0Hz

Example 2: When drive output frequency = 400.0Hz, P 3.30 = 20
400.0Hz x 20 = 8kHz

F0's output frequency is 8kHz.

FO is an open collector circuit. Square wave is generated, for example, by sending +24V through a 4.7K Ω resistor as shown in the diagram to the right.



Analog Parameters

P 4.00 **Source of Frequency Command** Default Setting: 01

Settings:	01	Frequency determined by digital keypad up/down
	02	Frequency determined by 0 to +10V input on AI1 terminal.
	03	Frequency determined by 4 to 20mA input on AI2 terminal.
	04	Frequency determined by 0 to 20mA input on AI2 terminal.
	05	Frequency determined by RS485 communication interface
	06	Frequency determined by -10V ~ +10V input on AI3 terminal.

P 4.01 **Analog Input Offset Polarity** Default Setting: 00

Range: 00 Offset disabled
01 Positive Offset
02 Negative Offset

- This parameter sets the potentiometer Bias Frequency to be positive or negative.
- The Analog Input Offset calculation will also define the Offset Polarity. See the note after P 4.02.

P4.02 ◆ Analog Input Offset

Default Setting: 0.0

Range: 0.0 to 100%
This parameter can be set during the operation

- This parameter provides a frequency offset for an analog input.
- Use the equation below to determine the Analog Input Offset. For this equation,

$$\text{Analog Offset \%} = \left(\frac{\text{Min. Frequency Reference}}{\text{Maximum Output Frequency}} \right) \times 100$$

you will need to know the necessary Minimum Frequency References and and Maximum Output Frequency needed for your application.

Note: The result of the Analog Input Offset calculation will also define the Analog Input Offset Polarity (P 4.01). A positive answer means you should have a positive offset. A negative answer means you should have a negative offset.

P 4.03 ◆ Analog Input Gain

Default Setting: 100.0

Range: 0.0 to 300.0%
This parameter can be set during the operation

- This parameter sets the ratio of analog input vs frequency output.
- Use the equation below to calculate the Analog Input Gain. For this equation, you will need to know the minimum and maximum set-point frequencies needed for your application.

$$\text{Analog Gain \%} = \left(\frac{\text{Max. Frequency Reference} - \text{Min. Frequency Reference}}{\text{Maximum Output Frequency}} \right) \times 100$$

P 4.04 Analog Input Reverse Motion Enable

Default Setting: 00

Range: 00 Forward Motion Only
01 Reverse Motion Enable

- P 4.01 to P 4.04 are used when the source of frequency command is the analog signal (0 to +10V DC, 0 to 20mA DC, or 4 to 20mA DC). Refer to the following examples:

Analog Input Examples

Use the equations below when calculating the values for the Maximum Output Frequency, Analog Input Offset, Analog Input Gain, and the Mid-point Frequency.

A) **Max. Output Frequency =** $\left(\frac{\text{Maximum Speed (P 0.04)}}{\text{Base Speed (P 0.03)}}\right)$ x Base Frequency (P 0.02)

Note: The Maximum Output Frequency is not a parameter setting but is needed in order to calculate the Analog Gain. The default Maximum Output Frequency for the DURAPULSE drive is 60Hz. If parameters P 0.02, P 0.03, or P 0.04 are changed, then the Maximum Output Frequency will change.

B) **Analog Offset % =** $\left(\frac{\text{Min. Frequency Reference}}{\text{Maximum Output Frequency}}\right)$ x 100

C) **Analog Gain % =** $\left(\frac{\text{Max. Frequency Reference – Min. Frequency Reference}}{\text{Maximum Output Frequency}}\right)$ x 100

D) **Mid-point Freq. =** $\left(\frac{\text{Max. Freq. Reference – Min. Freq. Reference}}{2}\right)$ + Min. Freq. Reference

Note: The Mid-point Frequency calculation shows the frequency reference of the drive when the potentiometer or other analog device is at its mid-point.

Example 1: Standard Operation

This example illustrates the default operation of the drive. The example is given to further illustrate the use of the analog calculations. The full range of the analog input signal corresponds to the full forward frequency range of the AC drive.

- Minimum Frequency Reference = 0Hz
- Maximum Frequency Reference = 60Hz

Calculations

A) **Max. Output Frequency =** $\left(\frac{1750\ \text{RPM}}{1750\ \text{RPM}}\right)$ x 60Hz = (60Hz)

B) **Analog Offset % =** $\left(\frac{0\text{Hz}}{60\text{Hz}}\right)$ x 100 = (0%)

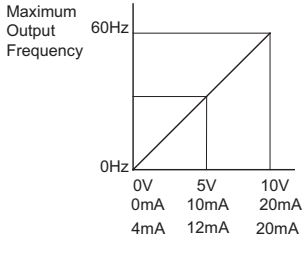
C) **Analog Gain % =** $\left(\frac{60\text{Hz} - 0\text{Hz}}{60\text{Hz}}\right)$ x 100 = (100%)

D) **Mid-point Frequency =** $\left(\frac{60\text{Hz} - 0\text{Hz}}{2}\right)$ + 0Hz = (30Hz)

Parameter Settings

P 4.01: 01 – Positive Input Offset Polarity
P 4.02: 00 – 0% Analog Input Offset
P 4.03: 100 – 100% Analog Input Gain
P 4.04: 00 – Forward Motion Only

Results



Example 2: Positive Offset

In this example, the Analog Input will have a positive offset while still using the full scale of the potentiometer. When the potentiometer is at its lowest value (0V, 0mA, or 4mA), the set-point frequency will be at 10Hz. When the potentiometer is at its maximum value (10V or 20mA), the set-point frequency will be at 60Hz.

- Minimum Frequency Reference = 10Hz
- Maximum Frequency Reference = 60Hz

Calculations

A) **Max. Output Frequency =** $\left(\frac{1750\ \text{RPM}}{1750\ \text{RPM}}\right) \times 60\text{Hz} = 60\text{Hz}$

B) **Analog Offset % =** $\left(\frac{10\text{Hz}}{60\text{Hz}}\right) \times 100 = 16.7\%$

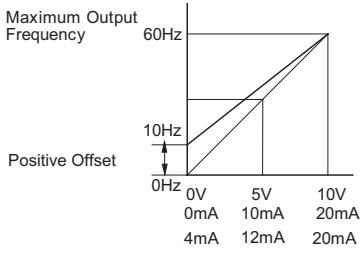
C) **Analog Gain % =** $\left(\frac{60\text{Hz} - 10\text{Hz}}{60\text{Hz}}\right) \times 100 = 83.3\%$

D) **Mid-point Frequency =** $\left(\frac{60\text{Hz} - 10\text{Hz}}{2}\right) + 10\text{Hz} = 35\text{Hz}$

Parameter Settings

P 4.01: 01 – Positive Input Offset Polarity
P 4.02: 16.7 – 16.7% Analog Input Offset
P 4.03: 83.3 – 83.3% Analog Input Gain
P 4.04: 00 – Forward Motion Only

Results



Example 3: Forward and Reverse Operation

In this example, the potentiometer is programmed to run a motor full-speed in both forward and reverse direction. The frequency reference will be 0Hz when the potentiometer is positioned at mid-point of its scale. Parameter P 4.04 must be set to enable reverse motion.

Note: When calculating the values for the Analog Input using reverse motion, the reverse frequency reference should be shown using a negative (-) number. Pay special attention to signs (+/-) for values representing reverse motion.

- Minimum Frequency Reference = -60Hz (reverse)
- Maximum Frequency Reference = 60Hz

Calculations

A) **Max. Output Frequency =** $\left(\frac{1750\ \text{RPM}}{1750\ \text{RPM}}\right)$ x 60Hz = (60Hz)

B) **Analog Offset %** = $\left(\frac{-60\text{Hz}}{60\text{Hz}}\right)$ x 100 = (-100%)

Note: The negative (-) value for the Analog Offset % shows that a negative offset is needed for P 4.01.

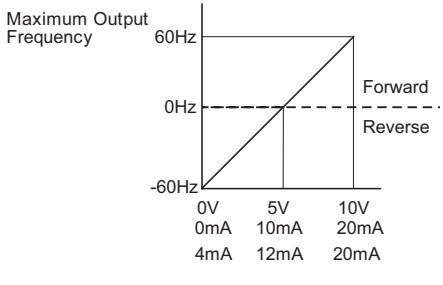
C) **Analog Gain %** = $\left(\frac{60\text{Hz} - (-60\text{Hz})}{60\text{Hz}}\right)$ x 100 = (200%)

D) **Mid-point Frequency** = $\left(\frac{60\text{Hz} - (-60\text{Hz})}{2}\right)$ + (-60Hz) = (0Hz)

Parameter Settings

P 4.01: 02 – Negative Input Offset Polarity
P 4.02: 100 – 100% Analog Input Offset
P 4.03: 200 – 200% Analog Input Gain
P 4.04: 01 – Reverse Motion Enable

Results



Example 4: Forward Run/Reverse Jog

This example shows an application in which the drive runs full-speed forward and jogs in reverse. The full scale of the potentiometer will be used.

Note: When calculating the values for the Analog Input using reverse motion, the reverse frequency reference should be shown using a negative (-) number. Pay special attention to signs (+/-) for values representing reverse motion.

- Minimum Frequency Reference = -15Hz (reverse)
- Maximum Frequency Reference = 60Hz

Calculations

A) **Max. Output Frequency =** $\left(\frac{1750\ RPM}{1750\ RPM}\right)$ x 60Hz = (60Hz)

B) **Analog Offset % =** $\left(\frac{-15Hz}{60Hz}\right)$ x 100 = (-25%)

Note: The negative (-) value for the Analog Offset % shows that a negative offset is needed for P 4.01.

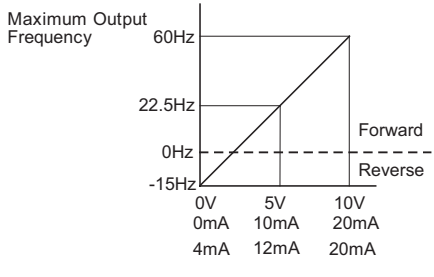
C) **Analog Gain % =** $\left(\frac{60Hz - (-15Hz)}{60Hz}\right)$ x 100 = (125%)

D) **Mid-point Frequency =** $\left(\frac{60Hz - (-15Hz)}{2}\right)$ + (-15Hz) = (22.5Hz)

Parameter Settings

P 4.01: 02 – Negative Input Offset Polarity
P 4.02: 25 – 25% Analog Input Offset
P 4.03: 125 – 125% Analog Input Gain
P 4.04: 01 – Reverse Motion Enable

Results



P 4.05 **Loss of AI2 Signal (4-20mA)** Default Setting: 00

Range: 00 - Decelerate to 0Hz
01 - Stop immediately and display "EF".
02 - Continue operation by the last frequency command

- This parameter determines the operation of the drive when the ACI frequency command is lost.

P 4.11 ◆ **Analog Output Signal** Default Setting: 00

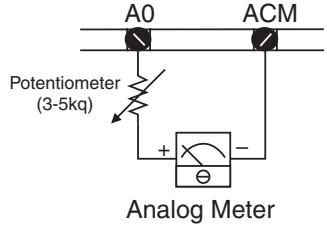
Range: 00 - Frequency Hz
01 - Current A
02 - PV

- This parameter selects either Output Frequency or current to be displayed using the 0 to10V A0 output.

P 4.12 ◆ **Analog Output Gain** Default Setting: 100

Range: 00 to 200%

- This parameter sets the voltage range of the analog output signal, on output terminal A0.



- When P 4.11 is set to 00, the analog output voltage is directly proportional to the output frequency of the AC drive. With the factory setting of 100%, the Maximum Output Frequency of the AC drive corresponds to +10VDC analog voltage output. (The actual voltage is about +10VDC, and can be adjusted by P 4.12)
- When P 4.11 is set to 01, the analog output voltage is directly proportional to the output current of the AC drive. With the factory setting of 100%, the 2.5 times rated current of the AC drive corresponds to +10 VDC analog voltage output. (The actual voltage is about +10 VDC, and can be adjusted by P 4.12).

Note: Any type of voltmeter can be used. If the meter reads full scale at a voltage less than 10 volts, then P 4.12 should be set by the following formula:

P 4.12 = (meter full scale voltage ÷ 10)×100%

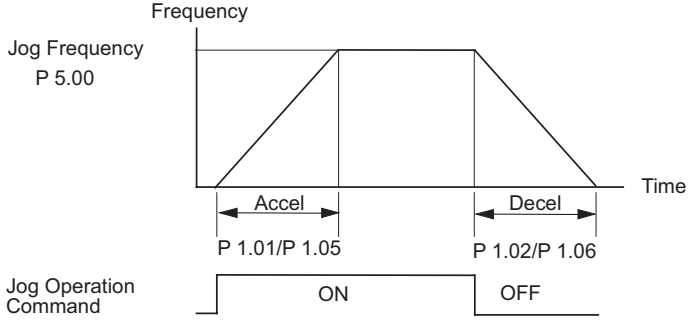
For Example: When using the meter with full scale of 5 volts, adjust P 4.12 to 50%.

Preset Parameters

P5.00 ◆ **Jog** Default Setting: 6.0

Range: 0.0 to 400.0 Hz

- The Jog Command is selected by a Multi-Function Input Terminal (P 3.02 to P 3.10) set to the Jog Function (09).



P 5.01	◆ Multi-Speed 1	Default Setting: 0.0
P 5.02	◆ Multi-Speed 2	Default Setting: 0.0
P 5.03	◆ Multi-Speed 3	Default Setting: 0.0
P 5.04	◆ Multi-Speed 4	Default Setting: 0.0
P 5.05	◆ Multi-Speed 5	Default Setting: 0.0
P 5.06	◆ Multi-Speed 6	Default Setting: 0.0
P 5.07	◆ Multi-Speed 7	Default Setting: 0.0
P 5.08	◆ Multi-Speed 8	Default Setting: 0.0
P 5.09	◆ Multi-Speed 9	Default Setting: 0.0
P 5.10	◆ Multi-Speed 10	Default Setting: 0.0
P 5.11	◆ Multi-Speed 11	Default Setting: 0.0
P 5.12	◆ Multi-Speed 12	Default Setting: 0.0
P 5.13	◆ Multi-Speed 13	Default Setting: 0.0
P 5.14	◆ Multi-Speed 14	Default Setting: 0.0
P 5.15	◆ Multi-Speed 15	Default Setting: 0.0

Range for P 5.01-P 5.15: 0.0 to 400.0 Hz

- The Multi-Function Input Terminals (refer to P 3.01 to P 3.05) are used to select one of the AC drive Multi-Step speeds. The speeds (frequencies) are determined by P 5.01 to P 5.15 shown above.

Note: When all multi-speed inputs are off, the AC drive reverts back to the Command Frequency (P 4.00).

Multi-Speed Bits				Speed Selection
Bit 4	Bit 3	Bit 2	Bit 1	
OFF	OFF	OFF	OFF	P 4.00: Source of Frequency
OFF	OFF	OFF	ON	P 5.01: Multi-Speed 1
OFF	OFF	ON	OFF	P 5.02: Multi-Speed 2
OFF	OFF	ON	ON	P 5.03: Multi-Speed 3
OFF	ON	OFF	OFF	P 5.04: Multi-Speed 4
OFF	ON	OFF	ON	P 5.05: Multi-Speed 5
OFF	ON	ON	OFF	P 5.06: Multi-Speed 6
OFF	ON	ON	ON	P 5.07: Multi-Speed 7

Multi-Speed Bits				Speed Selection
Bit 4	Bit 3	Bit 2	Bit 1	
ON	OFF	OFF	OFF	P 5.08: Multi-Speed 8
ON	OFF	OFF	ON	P 5.09: Multi-Speed 9
ON	OFF	ON	OFF	P 5.10: Multi-Speed 10
ON	OFF	ON	ON	P 5.11: Multi-Speed 11
ON	ON	OFF	OFF	P 5.12: Multi-Speed 12
ON	ON	OFF	ON	P 5.13: Multi-Speed 13
ON	ON	ON	OFF	P 5.14: Multi-Speed 14
ON	ON	ON	ON	P 5.15: Multi-Speed 15

Protection Parameters

P 6.00 Electronic Thermal Overload Relay

Default Setting: 00

Range: 00 - Constant Torque
01 - Variable Torque
02 - Inactive

- This function is used to limit the output power of the AC drive when powering a "self-cooled" motor at low speed.

Note: The Electronic Thermal Overload Relay (P 6.00) should be set to correspond with the Volts/Hertz Settings (P 2.00).

P 6.01 Auto Restart after Fault

Default Setting: 00

Range: 00 to 10

- After fault occurs (allowable faults: over-current OC, over-voltage OV), the AC drive can be reset/restarted automatically up to 10 times. Setting this parameter to 0 will disable the reset/restart operation after any fault has occurred. When enabled, the AC drive will restart with speed search, which starts at the previous Frequency. To set the fault recovery time after a fault, please see (P 6.13) base-block time for speed search.

P 6.02 Momentary Power Loss

Default Setting: 00

Settings:	00	Stop operation after momentary power loss.
	01	Continue operation after momentary power loss, speed search from Speed Reference.
	02	Continue operation after momentary power loss, speed search from Minimum Speed.

Note: This parameter will only work if the Source of Operation (P 3.00) is set to something other than 00 (Operation determined by digital keypad).

P 6.03 Reverse Operation Inhibit

Default Setting: 00

Settings:	00	Enable Reverse Operation
	01	Disable Reverse Operation

This parameter determines whether the AC Motor Drive can operate in the reverse direction.

P 6.04 Auto Voltage Regulation

Default Setting: 00

Settings:
- 00 AVR enabled
- 01 AVR disabled
- 02 AVR disabled during decel
- 03 AVR disabled during Stop

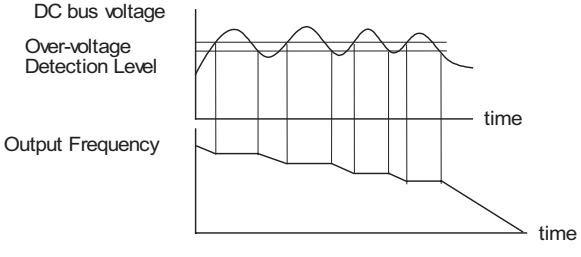
- AVR function automatically regulates the AC drive output voltage to the Maximum Output Voltage (P 0.00). For instance, if P 0.00 is set at 200 VAC and the input voltage is at 200V to 264VAC, then the Maximum Output Voltage will automatically be regulated to 200 VAC.
- Without AVR function, the Maximum Output Voltage may vary between 180V to 264VAC, due to the input voltage varying between 180V to 264 VAC.
- Selecting program value 2 enables the AVR function and also disables the AVR function during deceleration. This offers a quicker deceleration.

P 6.05 Over-Voltage Stall Prevention

Default Setting: 00

Range: 00 Enable Over-voltage Stall Prevention
01 Disable Over-voltage Stall Prevention

- During deceleration, the AC drive DC bus voltage may exceed its Maximum Allowable Value due to motor regeneration. When this function is enabled, the AC drive will stop decelerating, and maintain a constant output frequency. The drive will resume deceleration when the voltage drops below the factory-preset value.



Note: With moderate inertial loads, over-voltage during deceleration will not occur. For applications with high inertia loads, the AC drive will automatically extend the deceleration time. If deceleration time is critical for the application, a dynamic braking resistor should be used.

P 6.06 Auto Adjustable Accel/Decel

Default Setting: 00

Settings:	00	Linear Accel/Decel
	01	Auto Accel, Linear Decel
	02	Linear Accel, Auto Decel
	03	Auto Accel/Decel
	04	Auto Accel/Decel Stall Prevention

If the auto accel/decel is selected, the AC drive will accel/decel in the fastest and smoothest means possible by automatically adjusting the time of accel/decel.

This parameter provides five modes to choose:

- 00 Linear Acceleration and deceleration (operation by P 1.01, P 1.02 or P 1.05, P 1.06 acceleration/deceleration time).
- 01 Automatic acceleration, linear deceleration (Operation by automatic acceleration time, P 1.02 or P 1.06 deceleration time).
- 02 Linear acceleration and automatic deceleration (Operation by automatic acceleration time, P 1.01 or P 1.05 acceleration time).
- 03 Automatic acceleration, deceleration (Operation by AC drive auto adjustable control).
- 04 Auto acceleration, deceleration. The auto accel/decel will not be quicker than the settings for acceleration (P 1.01 or P 1.05) or deceleration (P 1.02 or P 1.06). The operation is specific to preventing a stall.

P6.07 Over-Torque Detection Mode

Default Setting: 00

Settings:	00	Disabled
	01	Enabled during constant speed operation
	02	Enabled during acceleration

P 6.08 Over-Torque Detection Level

Default Setting: 150

Range: 30 to 200%

- A setting of 100% is proportional to the Rated Output Current of the drive.
- This parameter sets the Over-Torque Detection level in 1% increments. (The AC drive rated current is equal to 100%.)

P 6.09 Over-Torque Detection Time

Default Setting: 0.1

Range: 0.1 to 10.0

This parameter sets the Over-Torque Detection Time in units of 0.1 seconds.

P 6.10 **Over-current Stall Prevention during Acceleration** Default Setting: 150

Range: 20 to 200%

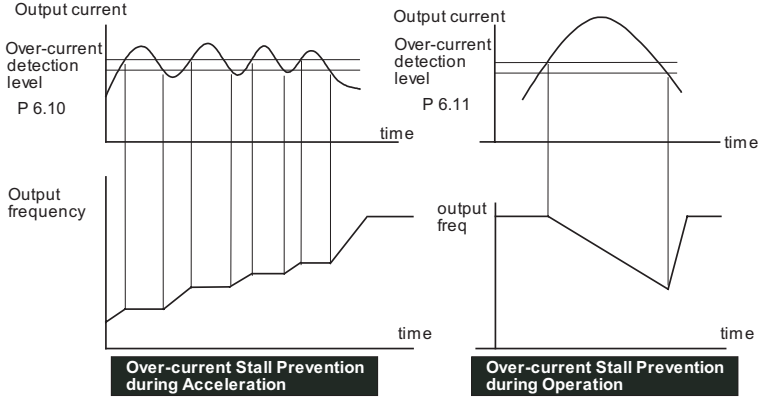
A setting of 100% is equal to the Rated Output Current of the drive.

- Under certain conditions, the AC drive output current may increase abruptly, and exceed the value specified by P 6.10 This is commonly caused by rapid acceleration or excessive load on the motor. When this function is enabled, the AC drive will stop accelerating and maintain a constant output frequency. The AC drive will only resume acceleration when the current drops below the maximum value.

P 6.11 **Over-current Stall Prevention during Operation** Default Setting: 150

Range: 20 to 200%

- During steady-state operation with motor load rapidly increasing, the AC drive output current may exceed the limit specified in P 6.11. When this occurs, the output frequency will decrease to maintain a constant motor speed. The drive will accelerate to the steady-state output frequency only when the output current drops below the level specified by P 6.11.



P 6.12 Maximum Allowable Power Loss Time

Default Setting: 2.0

Range: 0.3 to 5.0 sec

- During a power loss, if the power loss time is less than the time defined by this parameter, the AC drive will resume operation. If the Maximum Allowable Power Loss Time is exceeded, the AC drive output is turned off.

P 6.13 Base-Block Time for Speed Search

Default Setting: 0.5

Range: 0.3 to 5.0 sec

- When a momentary power loss is detected, the AC drive turns off for a specified time interval determined by P 6.13 before resuming operation. This time interval is called Base-Block. This parameter should be set to a value where the residual output voltage due to regeneration is nearly zero, before the drive resumes operation.

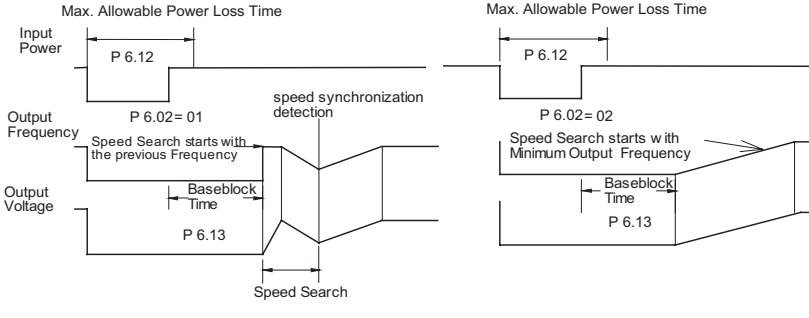
- This parameter also determines the searching time when performing external Base-Block and Fault Reset (P 6.01)

P 6.14 Maximum Speed Search Current Level

Default Setting: 150

Range: 30 to 200%

- Following a power failure, the AC drive will start its speed search operation only if the output current is greater than the value determined by P 6.14. When the output current is less than that of P 6.14, the AC drive output frequency is at a "speed synchronization point". The drive will start to accelerate or decelerate back to the operating frequency at which it was running prior to the power failure.



P 6.15 Upper Bound of Output Frequency

Default Setting: 400

Range: 0.1 to 400 Hz

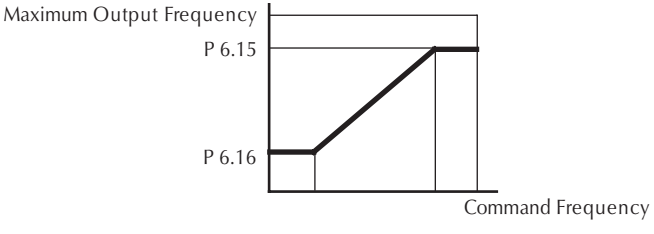
- The Upper/Lower Bound of Output Frequency is to prevent operation error and machine damage.
- This parameter must be equal to or greater than the Lower Bound of Output Frequency (P 6.16).
- If the Upper Bound of Output Frequency is 50Hz and the Maximum Output Frequency is 60 Hz, then any Command Frequency above 50 Hz will generate a 50 Hz output from the drive.
- The Output Frequency is also limited by the Motor Maximum RPM (P 0.04).

P 6.16 Lower Bound of Output Frequency

Default Setting: 0.0

Range: 0.0 to 400 Hz

- The Upper/Lower Bound of Output Frequency is to prevent operation error and machine damage.
- This parameter must be equal to or less than the Upper Bound of Output Frequency (P 6.15).
- If the Lower Bound of Output Frequency is 10 Hz, and the Minimum Output Frequency (P 2.06) is set at 1.0 Hz, then any Command Frequency between 1-10 Hz will generate a 10 Hz output from the drive.
- The Upper/Lower Bound of Output Frequency is to prevent operation error and machine damage.



P 6.17 **Over-Voltage Stall Prevention Level** Default:230 series=390V/460=780V

Range: 230V Series - 330V to 450V
460V Series - 660V to 900V

- When drive is running, if the DC bus voltage exceeds Over-Voltage Stall level (P 6.17), the AC drive will start over-voltage stall prevention.

P 6.18 **Braking Voltage Level** Default: 230V series: 380 / V460V series: 760V

Range: 230V Series - 370V to 450V
460V Series - 740V to 900V

- This parameter controls the braking voltage level; please refer to the DC voltage on the DC-BUS for reference. When the drive is running, if DC bus voltage exceeds the Braking Voltage Level, the braking signal is activated.

P 6.31	**Present Fault Record**	Default Setting: 00
P 6.32	**Second Most Recent Fault Record**	Default Setting: 00
P 6.33	**Third Most Recent Fault Record**	Default Setting: 00
P 6.34	**Fourth Most Recent Fault Record**	Default Setting: 00
P 6.35	**Fifth Most Recent Fault Record**	Default Setting: 00
P 6.36	**Sixth Most Recent Fault Record**	Default Setting: 00

Settings for P 6.31 - P 6.36:

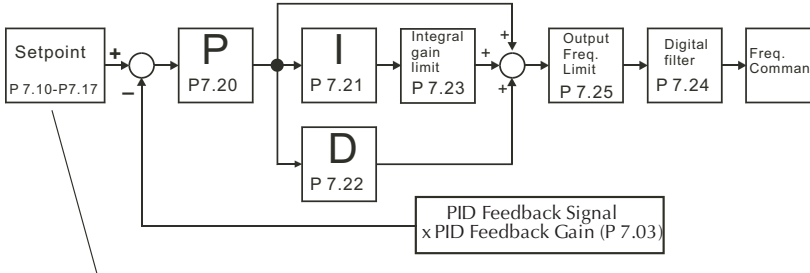
00	No Fault occurred
01	Over-current (oc)
02	Over-voltage (ov)
03	Over-temperature (oH)
04	Overload (oL)
05	Thermal Overload (oL1)
06	Over-Torque (oL2)
07	External Fault (EF)
08	CPU failure 1 (CF1)
09	CPU failure 2 (CF2)
10	CPU failure 3 (CF3)
11	Hardware Protection Failure (HPF)
12	Over-current during accel (OCA)
13	Over-current during decel (OCd)
14	Over-current during steady state (OCn)
15	Ground fault or fuse failure (GFF)
17	Input Power 3 phase loss
19	Auto Ramp Fault
21	PID Feedback Loss
22	Encoder Feedback Loss
23	Output Shorted(OCC)
24	Momentary Power Loss

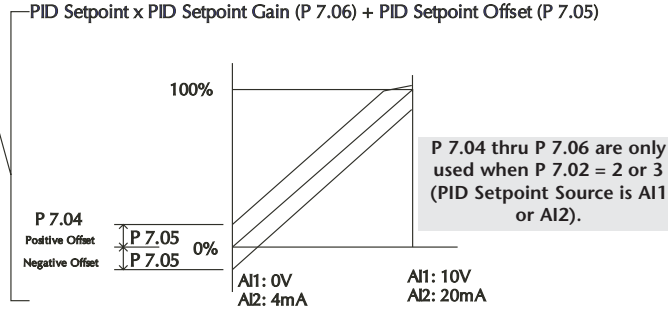
PID Parameters

P 7.00 **Input Terminal for PID Feedback** Default Setting: 00

Settings:
- 00 Inhibit PID operation.
- 01 Forward-acting (heating loop) PID feedback, PV from AI1 (0 to +10V)
- 02 Forward-acting (heating loop) PID feedback, PV from AI2 (4 to 20mA)
- *03* Reverse-acting (cooling loop) PID feedback, PV from AI1 (0 to +10V)
- 04 Reverse-acting (cooling loop) PID feedback, PV from AI2 (4 to 20mA)

Basic Loop Diagram





P 7.01 **PV 100% Value** Default Setting: 100.0

Range: 0.0 to 999

This parameter should be set to the value corresponding to the 100% value of the process variable (PV). The setting for P 7.01 cannot be less than any setting for P 7.10 to P 7.17.

Note: The setting for PV 100% value (P 7.01) cannot be set less than any value set for P 7.10 to P 7.17. If you are unable to reduce P 7.01 to the desired value, check parameters P 7.10 to P 7.17 and reduce these values accordingly.

P 7.02 **PID Setpoint Source** Default Setting: 02

Range: 00: Keypad
01: Serial Communications*
02: AI1 (0 to 10V)
03: AI2 (4 to 20mA)

The user may change the display to PID setpoint by changing 8.00 to 07 on the keypad.

**Note: Memory Address: Hexadecimal - 070A, MODBUS Decimal - 41803, Octal - V3412*

.P 7.03 **◆PID Feedback Gain** Default: 100

Range: 00 to 300.0%

P 7.04 **◆PID Setpint Offset Polarity** Default: 00

Range: 00 No Offset
01 Positive Offset
02 Negative Offset

P 7.05 **◆PID Setpoint Offset** Default: 0.0

Range: 0.0 to 100.0%

P 7.06 **◆PID Setpoint Gain** Default: 100

Range: 0.0 to 300.0%

P 7.10 **◆ Keypad PID Setpoint*** Default Setting: 0.0

Range: 0.0 to 999

• Setting cannot be greater than setting for P 7.01.

P 7.11 **◆ PID Multi-setpoint 1** Default Setting: 0.0

Range: 0.0 to 999

P 7.12 **◆ PID Multi-setpoint 2** Default Setting: 0.0

Range: 0.0 to 999

P 7.13 **◆ PID Multi-setpoint 3** Default Setting: 0.0

Range: 0.0 to 999

P 7.14 ◆ **PID Multi-setpoint 4** Default Setting: 0.0

Range: 0.0 to 999

P 7.15 ◆ **PID Multi-setpoint 5** Default Setting: 0.0

Range: 0.0 to 999

P 7.16 ◆ **PID Multi-setpoint 6** Default Setting: 0.0

Range: 0.0 to 999

P 7.17 ◆ **PID Multi-setpoint 7** Default Setting: 0.0

Range: 0.0 to 999

Note: The settings for P 7.10 to P7.17 cannot exceed the setting for P 7.01.

**Note:Memory Address: Hexadecimal - 070A, MODBUS Decimal - 41803, Octal - V3412.*

P 7.20 ◆ **Proportional Control (P)** Default Setting: 1.0

Range: 0.0 to 10.0

The first parameter of PID control is Proportional Control (P). For a given process, if the Proportional Value is set too low, the control action will be too sluggish. If the Proportional value is set too high, the control action will be unstable (erratic).

Set the Integral Control (I) and Derivative Control (D) to zero (0). Begin tuning the process with a low Proportional Value, and increase the Proportional value until the system goes unstable (erratic). When instability is reached, reduce the Proportional Value slightly until the system becomes stable (smaller values reduce system Gain). Stability can be tested by moving between two wide-spread setpoint values.

With 10% deviation and P=1, then P X 10% = Control Output. For example, if the speed of a motor is dragged down 10% due to a load increase, a corrective speed signal increase of 10% is generated. In a perfect world, this increase in speed command should bring the motor speed back to normal.

P 7.21 ◆ **Integral Control (I)** Default Setting: 1.00

Range: 0.00 to 100.0 sec (0.00 disable)

Using only the Proportional Control, the corrective action may not increase fast enough or the setpoint may never be reached because of system losses. The Integral Control is used to generate additional corrective action.

When tuning, begin with a large Integral value and reduce the value until the system goes unstable (erratic). When instability is reached, increase the Integral value slightly until the system becomes stable and the desired setpoint value is reached.

P 7.22 ◆ Derivative Control (D)

Default Setting: 0.00

Range: 0.00 to 1.00 sec

If the control output is too sluggish after the Proportional Control (P) and Integral Control (I) values are set, Derivative Control (D) may be required. Begin with a high Derivative value and reduce the value to the point of system instability. Then increase the Derivative value until the control output regains stability. Stability can be tested by moving between two wide-spread setpoint values.

P 7.23 Upper Bound for Integral Control

Default Setting: 100

Range: 00 to 100%

- This parameter defines an upper boundary or limit for the integral gain (I) and therefore limits the Master Frequency. Use the formula below to calculate the Integral upper limit.
- The formula is: Integral upper limit = (Maximum Output Frequency) x P 7.23. This parameter can limit the Maximum Output Frequency.

$$\text{Max. Output Frequency} = \left(\frac{\text{Maximum Speed (P 0.04)}}{\text{Base Speed (P 0.03)}}\right) \times \text{Base Frequency (P 0.02)}$$

P 7.24 Derivative Filter Time Constant

Default Setting: 0.0

Range: 0.0 to 2.5 sec

- To avoid amplification of measured noise in the controller output, a derivative digital filter is inserted. This filter helps smooth oscillations. Larger values for P 7.24 provide more smoothing.

P 7.25 PID Output Frequency Limit

Default Setting: 100

Range: 00 to 110%

- This parameter defines the percentage of output frequency limit during the PID control. The formula is Output Frequency Limit = (Maximum Output Frequency) x P 7.25. This parameter will limit the Maximum Output Frequency.

$$\text{Max. Output Frequency} = \left(\frac{\text{Maximum Speed (P 0.04)}}{\text{Base Speed (P 0.03)}}\right) \times \text{Base Frequency (P 0.02)}$$

P 7.26 Feedback Signal Loss Detection Time

Default Setting: 60

Range: 0.0 to 3600 sec

- This parameter defines how long the PID Feedback signal is lost before an error is generated. Setting this parameter to 0.0 disables the PID Feedback loss timer. When the feedback signal is lost, the PID Feedback loss timer starts timing. When the timer value is greater than the setting value of P. 7.26, the PID Feedback Loss parameter (P 7.27) is activated. The display shows "PID FBACK LOSS", meaning a feedback abnormality is detected. When the signal is corrected, the warning message "PID FBACK LOSS" will automatically be corrected if a PV signal is still present. If no signal is present, then the screen must be manually reset.

P 7.27 PID Feedback Loss Operation

Default Setting: 00

Range: 00 - Warn and AC Drive Stop
01 - Warn and Continue Operation

- This parameter sets the operation of the drive when there is a loss of the PID feedback signal.

Display Parameters

P 8.00 ◆ User Defined Display Function

Default Setting: 00

Settings:

00	Output Frequency (Hz)
01	Motor Speed (RPM)
02	Scaled Frequency
03	Output Current (A)
04	Motor Load (%)
05	Output Voltage(V)
06	DC Bus Voltage (V)
07	PID Setpoint
08	PID Feedback (PV)
09	Frequency Setpoint

P 8.01 ◆ Frequency Scale Factor

Default Setting: 1.0

Range: 0.01 to 160.0

- The coefficient K determines the multiplying factor for the user-defined unit.
- The display value is calculated as follows:

Display value = output frequency x K

- The display window is only capable of showing four digits, but P 8.01 can be used to create larger numbers. The display window uses decimal points to signify numbers up to three digits.

P 8.02 ◆Backlight Timer

Default Setting: 00

Range: 00 to 01

- This parameter is used to enable or disable the backlight timer.

Settings: 00 Timer Enable (1 min light off)
01 Timer Disable

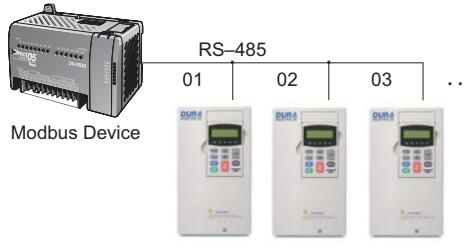
Communication Parameters

P 9.00 Communication Address

Default Setting: 01

Range: 01 to 254

- If the AC drive is controlled by serial communication, the communication address must be set via this parameter.



P 9.01 Transmission Speed

Default Setting: 01

Range: 00 to 03

Setting
00: 4800 baud data transmission speed
01: 9600 baud data transmission speed
02: 19200 baud data transmission speed
03: 38400 baud data transmission speed

This parameter is used to set the transmission speed between the computer and AC drive. Users can set parameters and control the operation of the AC drive via the RS-485 serial interface of a personal computer.

P 9.02 Communication Protocol

Default Setting: 00

Settings:		
	00	MODBUS ASCII mode. <7 data bits, no parity, 2 stop bits>
	01	MODBUS ASCII mode <7 data bits, even parity, 1 stop bit>
	02	MODBUS ASCII mode <7 data bits, odd parity, 1 stop bit>
	03	MODBUS RTU mode <8 data bits, no parity, 2 stop bits>
	04	MODBUS RTU mode <8 data bits, even parity, 1 stop bit>
	05	MODBUS RTU mode <8 data bits, odd parity, 1 stop bit>

Each *DURAPULSE* AC drive has a pre-assigned communication address specified by P 9.00. The computer then controls each AC drive according to its communication address. *DURAPULSE* drives can be set up to communicated on Modbus networks using one of the following modes: ASCII (American Standard Code for Information Interchange) or RTU (Remote Terminal Unit). Users can select the desired mode along with the serial port communications protocol using the settings above.

P 9.03 **Communication Fault Operation** Default Setting: 00

Setting: 00 - Display fault and continue operating
01 - Display fault and RAMP to stop
02 - Display fault and COAST to stop
03 - No fault displayed and continue operating

This parameter is used to detect an error and take appropriate action.

P 9.04 **Time Out Detection** Default Setting: 00

Range: 00 - Disable
01 - Enable

This parameter is used for ASCII mode. When this parameter is set to 01, it indicates that the over-time detection is enabled and the time slot between each character cannot exceed 500 ms.

P 9.05 **Time Out Duration** Default Setting: 0.5

Range: 0.1 to 60.0 seconds

P 9.07 ◆ **Parameter Lock** Default Setting: 00

Range: 00 - All parameters can be set and read
01 - All parameters are read-only

P 9.08 **Restore to Default** Default Setting: 00

Range: 0 to 99

- Setting 99 restores all parameters to factory defaults.

P 9.11 ◆ **Block Transfer Parameter 1** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.12 ◆ **Block Transfer Parameter 2** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.13 ◆ **Block Transfer Parameter 3** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.14 ◆ **Block Transfer Parameter 4** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.15 ◆ **Block Transfer Parameter 5** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.16 ◆ **Block Transfer Parameter 6** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.17 ◆ **Block Transfer Parameter 7** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.18 ◆ **Block Transfer Parameter 8** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.19 ◆ **Block Transfer Parameter 9** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.20 ◆ **Block Transfer Parameter 10** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.21 ◆ **Block Transfer Parameter 11** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.22 ◆ **Block Transfer Parameter 12** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.23 ◆ **Block Transfer Parameter 13** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.24 ◆ **Block Transfer Parameter 14** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.25 ◆ **Block Transfer Parameter 15** Default Setting: P 9.99

Range: P 0.00 to P 8.02

P 9.26 ◆ **Serial Comm Speed Reference** Default Setting: 60.0

Range: 0.0 to 400.0 Hz

- This parameter is used to set the Frequency Command when the AC drive is controlled by communication interface.

Note: In order for this parameter to function, the Source of Frequency Command (P 4.00) must be set to 05.

P 9.27 ◆**Serial Comm RUN Command** Default Setting: 00

Range: 00 - Stop
01 - Run

Note: In order for this parameter to function, the Source of Operation Command (P 3.00) must be set to 03.

P 9.28 ◆ **Serial Comm Direction Command** Default Setting: 00

Range: 00 - Forward
01 - Reverse

P 9.29 ◆ **Serial Comm External Fault** Default Setting: 00

Range: 00 - No action
01 - External fault

P 9.30 ◆**Serial Comm Fault Reset** Default Setting: 00

Range: 00 - No action
01 - Fault Reset

P 9.31 ◆**Serial Comm JOG Command** Default Setting: 00

Range: 00 - Stop
01 - Jog

P 9.40 ◆**Parameter Copy** Default Setting: 00

Range: 00 - DISABLE Copy Keypad Function
01 - ENABLE Copy Keypad Function
This parameter is used to upload or download information to the drive.

P 9.41 GS Series Number

Default Setting: ##

Settings:
01 GS1
02 GS3
03 GS3
04 GS4

P 9.42 Manufacturer Model Information

Default Setting: ##

Settings:
00: GS3-21P0 (230V 3ph 1.0HP)
01: GS3-22P0 (230V 3ph 2.0HP)
02: GS3-23P0 (230V 3ph 3.0HP)
03: GS3-25P0 (230V 3ph 5.0HP)
04: GS3-27P5 (230V 3ph 7.5HP)
05: GS3-2010 (230V 3ph 10HP)
06: GS3-2015 (230V 3ph 15HP)
07: GS3-2020 (230V 3ph 20HP)
08: GS3-2025 (230V 3ph 25HP)
09: GS3-2030 (230V 3ph 30HP)
10: GS3-2040 (230V 3ph 40HP)
11: GS3-2050 (230V 3ph 50HP)
12: GS3-41P0 (460V 3ph 1.0HP)
13: GS3-42P0 (460V 3ph 2.0HP)
14: GS3-43P0 (460V 3ph 3.0HP)
15: GS3-45P0 (460V 3ph 5.0HP)
16: GS3-47P5 (460V 3ph 7.5HP)
17: GS3-4010 (460V 3ph 10HP)
18: GS3-4015 (460V 3ph 15HP)
19: GS3-4020 (460V 3ph 20HP)
20: GS3-4025 (460V 3ph 25HP)
21: GS3-4030 (460V 3ph 30HP)
22: GS3-4040 (460V 3ph 40HP)
23: GS3-4050 (460V 3ph 50HP)
24: GS3-4060 (460V 3ph 60HP)
25: GS3-4075 (460V 3ph 75HP)
26: GS3-4100 (460V 3ph 100HP)

PID and Feedback Control

P 10.00 Encoder Pulse Per Revolution Default 1024

Range: 01 to 20000

An encoder is used as a transducer to feed back the motor speed, and this parameter defines the number of pulses for each cycle of the PI control.

P 10.01 Encoder Type Input Default: 00

Range: 00: Disable
01: Single Phase
02: Quadrature, FWD - CCW
03: Quadrature, FWD - CW

This parameter is used to specify encoder signal type. Settings 02 and 03 are used to distinguish motor rotation in relation to the quadrature type encoder signal. Error message "ENC SIGNAL ERROR" will come up if motor rotation does not match quadrature settings.

P 10.02 ◆Proportional Control Default: 1.00

Range: 0.0 to 10.0

This parameter specifies Proportional control and associated gain (I), used for vector control with encoder feedback.

Note: The diagram on the following page shows the output control relationship of P 10.02, P 10.03 and P 10.04.

P 10.03 ◆Integral Control Default: 1.00

Range: 0.0 to 100.0 sec

This parameter specifies integral control and associated gain (I).

P 10.04 Speed Control Output Speed Limit Default: 7.5

Range: 0.0 to 20.0%

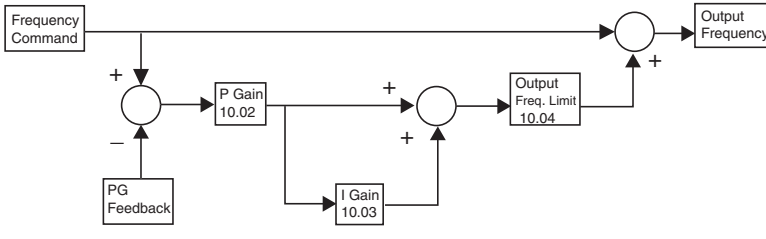
This parameter limits the amount of correction by the PI control on the output frequency when controlling speed. It can limit the maximum output frequency.

P 10.05 **Encoder Loss Detection** Default: 00

Range: 00: Warn and continue operation
01: Warn and RAMP to stop
02: Warn and COAST to stop

This parameter governs the response of the drive to the feedback signals, such as the analog or encoder pulse signals, when they are performing abnormally.

Closed Loop Tuning Diagram



DURAPULSE MODBUS COMMUNICATIONS

In This Chapter...

Communication Parameters Summary

A summary of the *DURAPULSE* Communications Parameters is listed below. For a complete listing of the *DURAPULSE* Parameters, refer to CHAPTER 4.

Communications			
Parameter	**Description**	**Range**	**Default**
P 9.00	Communication Address	01 to 254	01
P 9.01	Transmission Speed	00: 4800 baud 01: 9600 baud 02: 19200 baud 03: 38400 baud	01
P 9.02	Communication Protocol	00: MODBUS ASCII mode 7 data bits,no parity,2 stop bits 01: MODBUS ASCII mode 7 data bits,even parity,1 stop bit 02: MODBUS ASCII mode 7 data bits,odd parity,1 stop bit 03: MODBUS RTU mode 8 data bits,no parity,2 stop bits 04: MODBUS RTU mode 8 data bits,even parity,1 stop bit 05: MODBUS RTU mode 8 data bits,odd parity,1 stop bit	00
P 9.03	Transmission Fault Treatment	00: Display fault and continue operating 01: Display fault and RAMP to stop 02: Display fault and COAST to stop 03: No fault displayed and continue operating	00
P 9.04	Time Out Detection	00: Disable 01: Enable	00
P 9.05	Time Out Duration	0.1 to 60.0 seconds	0.5
◆ **P 9.07**	Parameter Lock	00: All parameters can be set and read 01: All parameters are read-only	00
P 9.08	Restore to Default	99: Restores all parameters to factory defaults	00
◆ **P 9.11**	Block Transfer Parameter 1	P 0.00 to P 8.02	P 9.99
◆ **P 9.12**	Block Transfer Parameter 2	P 0.00 to P 8.02	P 9.99
◆ **P 9.13**	Block Transfer Parameter 3	P 0.00 to P 8.02	P 9.99
◆ **P 9.14**	Block Transfer Parameter 4	P 0.00 to P 8.02	P 9.99
◆ **P 9.15**	Block Transfer Parameter 5	P 0.00 to P 8.02	P 9.99
◆ **P 9.16**	Block Transfer Parameter 6	P 0.00 to P 8.02	P 9.99
◆ **P 9.17**	Block Transfer Parameter 7	P 0.00 to P 8.02	P 9.99
◆ **P 9.18**	Block Transfer Parameter 8	P 0.00 to P 8.02	P 9.99
◆ **P 9.19**	Block Transfer Parameter 9	P 0.00 to P 8.02	P 9.99

◆ Parameter can be set during RUN Mode.

Communications (cont.)			
Parameter	**Description**	**Range**	**Default**
◆ **P 9.20**	Block Transfer Parameter 10	P 0.00 to P 8.02	P 9.99
◆ **P 9.21**	Block Transfer Parameter 11	P 0.00 to P 8.02	P 9.99
◆ **P 9.22**	Block Transfer Parameter 12	P 0.00 to P 8.02	P 9.99
◆ **P 9.23**	Block Transfer Parameter 13	P 0.00 to P 8.02	P 9.99
◆ **P 9.24**	Block Transfer Parameter 14	P 0.00 to P 8.02	P 9.99
◆ **P 9.25**	Block Transfer Parameter 15	P 0.00 to P 8.02	P 9.99
◆ **P 9.26**	Serial Comm Speed Reference	0.0 to 400.0 Hz	60.0
◆ **P 9.27**	Serial Comm RUN Command	00: Stop 01: Run	00
◆ **P 9.28**	Serial Comm Direction Command	00: Forward 01: Reverse	00
◆ **P 9.29**	Serial Comm External Fault	00: No fault 01: External fault	00
◆ **P 9.30**	Serial Comm Fault Reset	00: No action 01: Fault Reset	00
◆ **P 9.31**	Serial Comm JOG Command	00: Stop 01: Jog	00
◆ **P 9.40**	Parameter Copy	00: Disable Copy Keypad function 01: Enable Copy Keypad function	00
P 9.41	GS Series Number	01: GS1 02: GS2 03: GS3 04: GS4	##

◆ Parameter can be set during RUN Mode.

Communications (cont.)			
Parameter	**Description**	**Range**	**Default**
P 9.42	Manufacturer Model Information	00: GS3-21P0 (230V 3ph 1.0HP) 01: GS3-22P0 (230V 3ph 2.0HP) 02: GS3-23P0 (230V 3ph 3.0HP) 03: GS3-25P0 (230V 3ph 5.0HP) 04: GS3-27P5 (230V 3ph 7.5HP) 05: GS3-2010 (230V 3ph 10HP) 06: GS3-2015 (230V 3ph 15HP) 07: GS3-2020 (230V 3ph 20HP) 08: GS3-2025 (230V 3ph 25HP) 09: GS3-2030 (230V 3ph 30HP) 10: GS3-2040 (230V 3ph 40HP) 11: GS3-2050 (230V 3ph 50HP) 12: GS3-41P0 (460V 3ph 1.0HP) 13: GS3-42P0 (460V 3ph 2.0HP) 14: GS3-43P0 (460V 3ph 3.0HP) 15: GS3-45P0 (460V 3ph 5.0HP) 16: GS3-47P5 (460V 3ph 7.5HP) 17: GS3-4010 (460V 3ph 10HP) 18: GS3-4015 (460V 3ph 15HP) 19: GS3-4020 (460V 3ph 20HP) 20: GS3-4025 (460V 3ph 25HP) 21: GS3-4030 (460V 3ph 30HP) 22: GS3-4040 (460V 3ph 40HP) 23: GS3-4050 (460V 3ph 50HP) 24: GS3-4060 (460V 3ph 60HP) 25: GS3-4075 (460V 3ph 75HP) 26: GS3-4100 (460V 3ph 100HP)	##

◆ Parameter can be set during RUN Mode.

*DURA*PULSE Parameter Memory Addresses

Motor Parameters				
Parameter	**Description**	**Hexadecimal**	**MODBUS Decimal**	**Octal**
P 0.00	Motor Nameplate Voltage	0000	40001	0
P 0.01	Motor Nameplate Amps	0001	40002	1
P 0.02	Motor Base Frequency	0002	40003	2
P 0.03	Motor Base RPM	0003	40004	3
P 0.04	Motor Maximum RPM	0004	40005	4
P 0.05	Motor Auto Detection	0005	40006	5
P 0.06	Motor Line to line resistance R1	0006	40007	6
P 0.07	Motor No-Load Current	0007	40008	7
Ramps				
P 1.00	Stop Methods	0100	40257	400
◆ **P 1.01**	Acceleration Time 1	0101	40258	401
◆ **P 1.02**	Deceleration Time 1	0102	40259	402
P 1.03	Accel S-curve	0103	40260	403
P 1.04	Decel S-curve	0104	40261	404
◆ **P 1.05**	Acceleration Time 2	0105	40262	405
◆ **P 1.06**	Deceleration Time 2	0106	40263	406
P 1.07	Select method to use 2nd Accel/Decel	0107	40264	407
P 1.08	Accel 1 to Accel 2 frequency transition	0108	40265	410
P 1.09	Decel 2 to Decel 1frequency transition	0109	40266	411
P 1.10	Skip Frequency 1	010A	40267	412
P 1.11	Skip Frequency 2	010B	40268	413
P 1.12	Skip Frequency 3	010C	40269	414
P 1.13	Skip Frequency 4	010D	40270	415
P 1.14	Skip Frequency 5	010E	40271	416
P 1.17	Skip Frequency Band	0111	40274	421
P 1.18	DC Injection Current Level	0112	40275	422
P 1.20	DC Injection during Start-up	0114	40277	424
P 1.21	DC Injection during Stopping	0115	40278	425
P 1.22	Start-point for DC Injection	0116	40279	426

◆ Parameter can be set during RUN Mode.

Note: The octal address also can be used in the WX / RX instruction of the DL-250-1, DL-450 and DL05.

Parameter	Description	Hexadecimal	MODBUS Decimal	Octal
Volts/Hertz				
P 2.00	Volts/Hertz Settings	0200	40513	1000
◆ **P 2.01**	Slip Compensation	0201	40514	1001
◆ **P 2.02**	Auto-torque Boost	0202	40515	1002
◆ **P 2.03**	Torque Compensation Time Constant	0203	40516	1003
P 2.04	Mid-point Frequency	0204	40517	1004
P 2.05	Mid-point Voltage	0205	40518	1005
P 2.06	Min. Output Frequency	0206	40519	1006
P 2.07	Min. Output Voltage	0207	40520	1007
P 2.08	PWM Carrier Frequency	0208	40521	1010
P 2.10	Control Mode	020A	40522	1012
Digital				
P 3.00	Source of Operation Command	0300	40769	1400
P 3.01	Multi-function Input Terminals (DI1 - DI2)	0301	40770	1401
P 3.02	Multi-function Input (DI3)	0302	40771	1402
P 3.03	Multi-function Input (DI4)	0303	40772	1403
P 3.04	Multi-function Input (DI5)	0304	40773	1404
P 3.05	Multi-function Input (DI6)	0305	40774	1405
P 3.06	Multi-function Input (DI7)	0306	40775	1406
P 3.07	Multi-function Input (DI8)	0307	40776	1407
P 3.08	Multi-function Input (DI9)	0308	40777	1410
P 3.09	Multi-function Input (DI10)	0309	40778	1411
P 3.10	Multi-function Input (DI11)	030A	40779	1412
P 3.11	Multi-Function Output Terminal 1 (Relay)	030B	40780	1413
P 3.12	Multi-Function Output Terminal 2 (DO1)	030C	40781	1414
P 3.13	Multi-Function Output Terminal 3 (DO2)	030D	40782	1415
P 3.14	Multi-Function Output Terminal 3 (DO3)	030E	40783	1416
◆ **P 3.16**	Desired Frequency	0310	40785	1420
◆ **P 3.17**	Desired Current	0311	40786	1421
◆ **P 3.18**	PID Deviation Level	0312	40787	1422
◆ **P 3.19**	PID Deviation Time	0313	40788	1423
◆ **P 3.20**	Desired Frequency 2	0314	40789	1424
◆ **P 3.30**	Frequency Output Multiplying Factor	031E	40799	1436
Analog Parameters				
P 4.00	Source of Frequency Command	0400	41025	2000
P 4.01	Frequency Command Offset Polarity	0401	41026	2001
◆ **P 4.02**	Frequency Command Offset	0402	41027	2002
◆ **P 4.03**	Frequency Command Gain	0403	41028	2003
P 4.04	Frequency Command Reverse Motion Enable	0404	41029	2004
P 4.05	Loss of AI2 Signal (4-20mA)	0405	41030	2005
◆ **P 4.11**	Analog Output Signal	040B	41036	2013
◆ **P 4.12**	Analog Output Gain	040C	41037	2014

◆ Parameter can be set during RUN Mode.

Presets				
Parameter	**Description**	**Hexadecimal**	**MODBUS**	**Octal**
◆ **P 5.00**	Jog	0500	41281	2400
◆ **P 5.01**	Multi-Speed 1	0501	41282	2401
◆ **P 5.02**	Multi-Speed 2	0502	41283	2402
◆ **P 5.03**	Multi-Speed 3	0503	41284	2403
◆ **P 5.04**	Multi-Speed 4	0504	41285	2404
◆ **P 5.05**	Multi-Speed 5	0505	41286	2405
◆ **P 5.06**	Multi-Speed 6	0506	41287	2406
◆ **P 5.07**	Multi-Speed 7	0507	41288	2407
◆ **P 5.08**	Multi-Speed 8	0508	41289	2410
◆ **P 5.09**	Multi-Speed 9	0509	41290	2411
◆ **P 5.10**	Multi-Speed 10	050A	41291	2412
◆ **P 5.11**	Multi-Speed 11	050B	41292	2413
◆ **P 5.12**	Multi-Speed 12	050C	41293	2414
◆ **P 5.13**	Multi-Speed 13	050D	41294	2415
◆ **P 5.14**	Multi-Speed 14	050E	41295	2416
◆ **P 5.15**	Multi-Speed 15	050F	41296	2417
Protection				
P 6.00	Electronic Thermal Overload Relay	0600	41537	3000
P 6.01	Auto Restart after Fault	0601	41538	3001
P 6.02	Momentary Power Loss	0602	41539	3002
P 6.03	Reverse Operation Inhibit	0603	41540	3003
P 6.04	Auto Voltage Regulation	0604	41541	3004
P 6.05	Over-Voltage Stall Protection	0605	41542	3005
P 6.06	Auto Adjustable Accel/Decel	0606	41543	3006
P 6.07	Over-Torque Detection Mode	0607	41544	3007
P 6.08	Over-Torque Detection Level	0608	41545	3010
P 6.09	Over-Torque Detection Time	0609	41546	3011
P 6.10	Over-Current Stall Prevention during Accel	060A	41547	3012
P 6.11	Over-Current Stall Prevention during Operation	060B	41548	3013
P 6.12	Maximum Allowable Power Loss Time	060C	41549	3014
P 6.13	Base-Block Time for Speed Search	060D	41550	3015
P 6.14	Maximum Speed Search Current Level	060E	41551	3016
P 6.15	Upper Bound of Output Frequency	060F	41552	3017
P 6.16	Lower Bound of Output Frequency	0610	41553	3020
P 6.17	Over-Voltage Stall Prevention Level	0611	41554	3021
P 6.18	Braking Voltage level	0612	41555	3022
P 6.31	Present Fault Record	061F	41568	3037
P 6.32	Second Most Recent Fault Record	0620	41569	3040
P 6.33	Third Most Recent Fault Record	0621	41570	3041
P 6.34	Fourth Most Recent Fault Record	0622	41571	3042
P 6.35	Fifth Most Recent Fault Record	0623	41572	3043
P 6.36	Sixth Most Recent Fault Record	0624	41573	3044

PID				
Parameter	**Description**	**Hexadecimal**	**MODBUS Decimal**	**Octal**
P 7.00	Input Terminal for PID Feedback	0700	41793	3400
P 7.01	PV 100% Value	0701	41794	3401
P 7.02	PID Setpoint Source	0702	41795	3402
◆ **P 7.03**	PID Feedback Gain	0703	41796	3403
◆ **P 7.04**	PID Setpoint Offset Polarity	0704	41797	3404
◆ **P 7.05**	PID Setpoint Offset	0705	41798	3405
◆ **P 7.06**	PID Setpoint Gain	0706	41799	3406
◆ **P 7.10**	*PID Setpoint	070A	41803	3412
◆ **P 7.11**	PID Multi-setpoint 1	070B	41804	3413
◆ **P 7.12**	PID Multi-setpoint 2	070C	41805	3414
◆ **P 7.13**	PID Multi-setpoint 3	070D	41806	3415
◆ **P 7.14**	PID Multi-setpoint 4	070E	41807	3416
◆ **P 7.15**	PID Multi-setpoint 5	070F	41808	3417
◆ **P 7.16**	PID Multi-setpoint 6	0710	41809	3420
◆ **P 7.17**	PID Multi-setpoint 7	0711	41810	3421
◆ **P 7.20**	Proportional Control	0714	41813	3424
◆ **P 7.21**	Integral Control	0715	41814	3425
◆ **P 7.22**	Derivative Control	0716	41815	3426
P 7.23	Upper Bound for Integral Control	0717	41816	3427
P 7.24	Derivative Filter Time Constant	0718	41817	3430
P 7.25	PID Output Frequency Limit	0719	41818	3431
P 7.26	Feedback Signal Detection Time	071A	41819	3432
P 7.27	PID Feedback Loss	071B	41820	3433
DISPLAY				
◆ **P 8.00**	User Defined Display Function	0800	42049	4000
◆ **P 8.01**	Frequency Scale Factor	0801	42050	4001
◆ **P 8.02**	Backlight Timer	0802	42051	4002

◆ Parameter can be set during RUN Mode.

**Note: This address is used for Serial PID setpoint input.*

Communication				
Parameter	**Description**	**Hexadecimal**	**MODBUS Decimal**	**Octal**
P 9.00	Communication Address	0900	42305	4400
P 9.01	Transmission Speed	0901	42306	4401
P 9.02	Communication Protocol	0902	42307	4402
P 9.03	Transmission Fault Treatment	0903	42308	4403
P 9.04	Time Out Detection	0904	42309	4404
P 9.05	Time Out Duration	0905	42310	4405
◆ **P 9.07**	Parameter Lock	0907	42312	4407
P 9.08	Restore to Default	0908	42313	4410
◆ **P 9.11**	Block Transfer Parameter 1	090B	42316	4413
◆ **P 9.12**	Block Transfer Parameter 2	090C	42317	4414
◆ **P 9.13**	Block Transfer Parameter 3	090D	42318	4415
◆ **P 9.14**	Block Transfer Parameter 4	090E	42319	4416
◆ **P 9.15**	Block Transfer Parameter 5	090F	42320	4417
◆ **P 9.16**	Block Transfer Parameter 6	0910	42321	4420
◆ **P 9.17**	Block Transfer Parameter 7	0911	42322	4421
◆ **P 9.18**	Block Transfer Parameter 8	0912	42323	4422
◆ **P 9.19**	Block Transfer Parameter 9	0913	42324	4423
◆ **P 9.20**	Block Transfer Parameter 10	0914	42325	4424
◆ **P 9.21**	Block Transfer Parameter 11	0915	42326	4425
◆ **P 9.22**	Block Transfer Parameter 12	0916	42327	4426
◆ **P 9.23**	Block Transfer Parameter 13	0917	42328	4427
◆ **P 9.24**	Block Transfer Parameter 14	0918	42329	4430
◆ **P 9.25**	Block Transfer Parameter 15	0919	42330	4431
◆ **P 9.26**	Serial Comm Speed Reference	091A	42331	**4432**
◆ **P 9.27**	Serial Comm RUN Command	091B	42332	**4433**
◆ **P 9.28**	Serial Comm Direction Command	091C	42333	**4434**
◆ **P 9.29**	Serial Comm External Fault	091D	42334	**4435**
◆ **P 9.30**	Serial Comm Fault Reset	091E	42335	**4436**
◆ **P 9.31**	Serial Comm JOG Command	091F	42336	**4437**
◆ **P 9.40**	Parameter Copy	0928	42345	4450
P 9.41	GS Series Number	0929	42346	4451
P 9.42	Manufacturer Model Information	092A	42347	4452

◆ Parameter can be set during RUN Mode.

Encoder Feedback				
Parameter	**Description**	**Hexadecimal**	**MODBUS Decimal**	**Octal**
P 10.00	Encoder Pulse per Revolution	0A00	42561	5000
P 10.01	Encoder Type Input	0A01	42562	5001
◆**P 10.02**	Proportional Gain	0A02	42563	5002
◆**P 10.03**	Integral Gain	0A03	42564	5003
P 10.04	Speed Control Ouput Speed Limit	0A04	42565	5004
P 10.05	Encolder Loss Detection	0A05	42566	5005

◆ Parameter can be set during RUN Mode.

DURApulse Status Addresses

The *DURAPULSE* AC drive has status memory addresses that are used to monitor the AC drive. The status addresses and value definitions are listed below.

Status Addresses (Read Only)

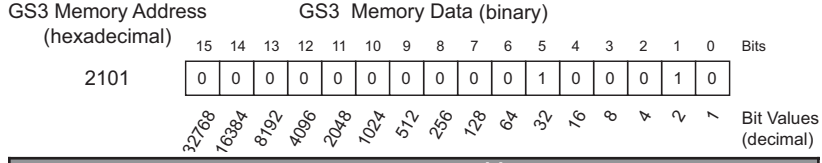
Status Monitor 1

Error Codes

00: No fault occurred
01: Over-current (oc)
02: Over-voltage (ov)
03: Overheat (oH)
04: Overload (oL)
05: Thermal Overload (oL1)
06: Over-Torque (oL2)
07: External Fault (EF)
08: CPU failure 1 (CF1)
09: CPU failure 2 (CF2)
10: CPU failure 3 (CF3)
11: Hardware Protection Failure (HPF)
12: Over-current during accel (OCA)
13: Over-current during decel (Ocd)
14: Over-current during steady state (Ocn)
15: Ground fault or fuse failure (GFF)
17: Input power 3-phase loss
18: External Base-Block (bb
19: Auto adjust accel/decel failure (cFA)
21: PID Feedback Loss (FbE)
22: Encoder Feedback Loss
23: Output Shorted (OCC)
24: Momentary Power Loss

Note: Some error codes will not display under status address if only a warning message. The drive must have a hard trip. To manually check this, set "External Fault" to Terminal Control, and trip. This will simulate the result of a hard trip.

Status Monitor 2



DURAPULSE Memory Addresses		
Address Bit(s)	**Bit(s) Value** Binary (Decimal)	**AC Drive Status**
0 and 1	00 (0)	Drive operation stopped (STOP)
	01 (1)	Run to Stop transition
	10 (2)	Standby
	11 (3)	Drive operation running (RUN)
2	1 (4)	JOG active
3 and 4	00 (0)	Rotational direction forward (FWD)
	01 (8)	REV to FWD transition
	10 (16)	FWD to REV transition
	11 (24)	Rotational direction reverse (REV)
5 to 7	N/A	Reserved
8	1 (32)	Source of frequency determined by communication interface (P 4.00 = 5)
9	1 (64)	Source of frequency determined by AI terminal (P 4.00 = 2, 3, 4, or 6)
10	1 (128)	Source of operation determined by communication interface (P 3.00 = 3 or 4)
11	1 (256)	Parameters have been locked (P 9.07 = 1)
12		Copy Command enable

DURAPULSE Status Addresses			
Description	**Hexadecimal**	**MODBUS Decimal**	**Octal**
Status Monitor 1	2100	48449	20400
Status Monitor 2	2101	48450	20401
Frequency Command F	2102	48451	20402
Output Frequency H	2103	48452	20403
Output Current A	2104	48453	20404
DC-BUS Voltage d	2105	48454	20405
Output Voltage U	2106	48455	20406
Motor RPM	2107	48456	20407
Scale Frequency (Low word)	2108	48457	20410
Scale Frequency (High word)	2109	48458	20411
Power Factor Angle	210A	48459	20412
% Load	210B	48460	20413
PID Setpoint	210C	48461	20414
PID feedback signal (pv)	210D	48462	20415
Firmware Version	2110	48465	20420

Communicating with *Direct*LOGIC PLCs

The following steps explain how to connect and communicate with the *DURAPULSE* AC drives using ***Direct***LOGIC PLCs.

Step 1: Choose the Appropriate CPU.

The *DURAPULSE* AC drives will communicate with the following ***Direct***LOGIC CPUs using MODBUS communications.

Choose Your CPU	
Primary	D2-260 and DL06 with MRX / MWX instruction
Secondary	DL05, DL250, DL450 with RX / WX instruction

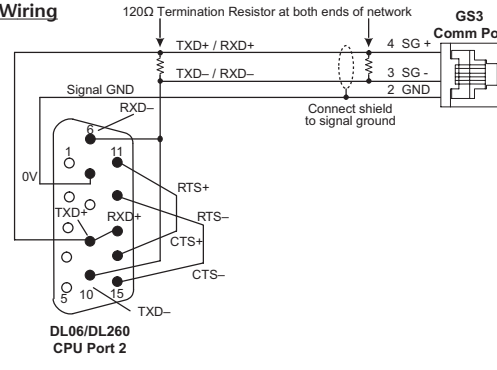
Step 2: Make the Connections

The *DURAPULSE* Comm Port requires an RS-485 input. There are two means of communicating serially from a ***Direct***logic PLC.

CPU Connection	
1	D2-260 and DL06 directly out of port 2 via RS-485
2	DL05, DL250-1, D4-450 via the RS232 to RS-485 FA-ISOCON Serial converter

If using multiple drives, the RS-485 communication boards (GS-RS485-4 or GS-RS485-8) provide an easy means to break out the RS-485 signal to several drives at one location. This creates a star configuration. However, the transmission errors are negligible, so this configuration is acceptable for proper operation of the VFDs.

DL06/DL260: RS-485 Connection Wiring



Note: Termination Resistors are required at both ends of RS-485 networks. It is necessary to select resistors that match the impedance rating of the cable (between 100 and 500 ohms.)

Note: DURAPULSE drives have a provision for shutting down control or power to the inverter in the event of a communications timeout. This can be set up through the drive parameters 9.03, 9.04 and 9.05.

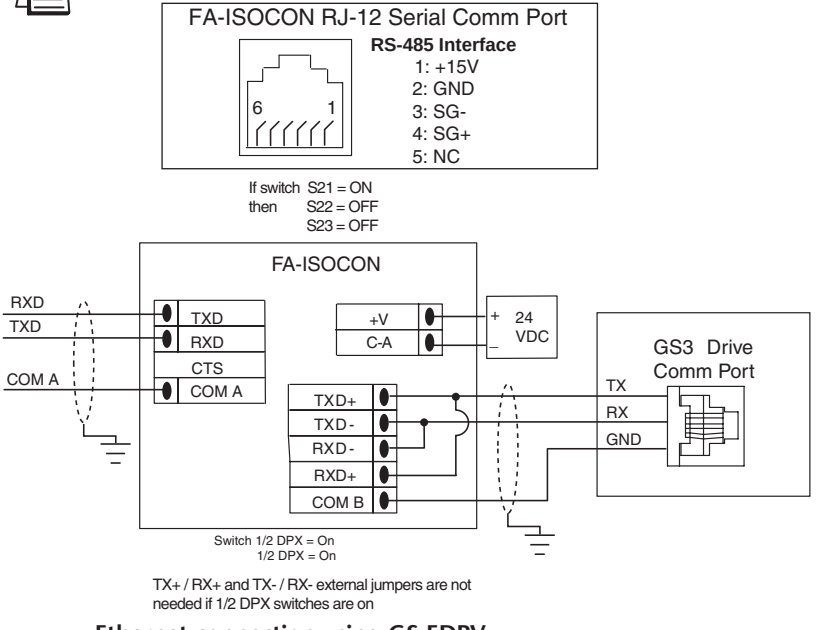
RS-485 to RS-232C Connection

An RS-485 network cable can span up to 1000 meters (4000 feet). However, most DirectLOGIC PLCs require an FA-ISOCON (RS-232C to RS422/485 network adapter) in order to make this type of connection.

Use the following wiring diagram to connect your ***Direct***LOGIC PLC to a *DURAPULSE* AC drive with an RS-485 interface.

Note: If an FA-ISOCON module is used in your connection, make sure the dip switches are set for RS-485 communications.

Note: A cable (D0-DSCBL) is available that will connect a DL05 to an FA-ISOCON.



Ethernet connection using GS-EDRV

The GS-EDRV provides a high-performance Ethernet link between a control system and a *DURAPULSE AC* DRIVE. It mounts on DIN rail and connects a drive to an Ethernet hub or PC. The GS-EDRV processes signals to and from the drive. It formats the signals to conform with the Ethernet standard to the H2-ERM or H4-ERM, KEPdirect EBC I/O server, or independent controller with a MODBUS TCP/IP driver. This Ethernet interface allows for great connectivity to many control system architectures. An additional feature is the built-in web browser which allows users to configure and control the drive from any web browser via the IP address of the GS-EDRV card.

Step 3: Set AC Drive Parameters

The following parameters need to be set as shown in order to communicate properly.

P 3.00: 03 or 04 – Operation Determined by RS-485 interface. Keypad STOP is enabled (03) or disabled (04).

P 4.00: 05 – Frequency determined by RS-485 communication interface

P 9.00: xx – Communication address 1-254 (unique for each device, see P 9.00)

P 9.01: 01 – 9600 baud data transmission speed

P 9.02: 05 – MODBUS RTU mode <8 data bits, odd parity, 1 stop bit>

*Note: The previous list of parameter settings is the minimum required to communicate with a **Direct**LOGIC PLC. There may be other parameters that need to be set to meet the needs of your application.*

Step 4: Configure the *Direct*LOGIC CPUs

The ***Direct***LOGIC CPUs must be configured to communicate with the *DURAPULSE* AC drives. This setup includes setting up the communication port and adding instructions to your logic program.

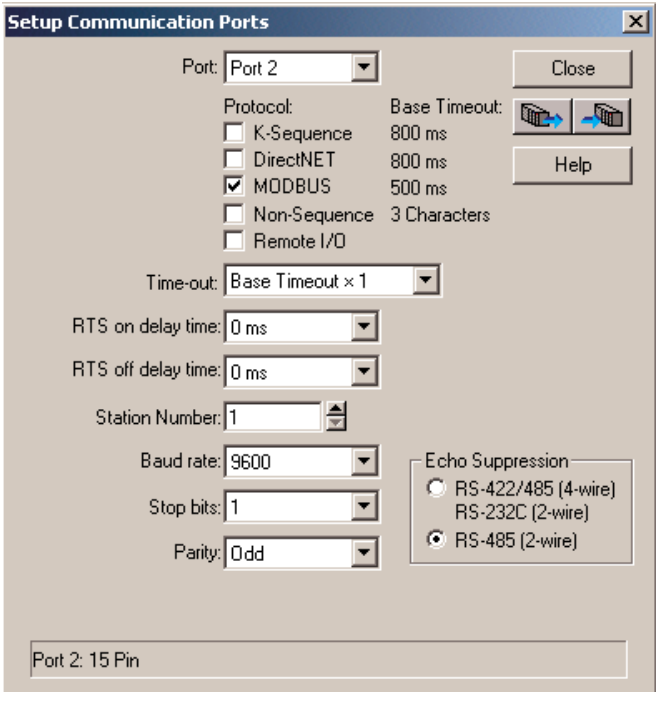
The set up for all of the ***Direct***LOGIC CPUs is very similar. However, there may be some subtle differences between CPUs. Refer to the appropriate CPU User Manual for the specifics on your ***Direct***LOGIC CPU.

Note: For instructions on MODBUS Configuration for your specific CPU, refer to the appropriate CPU User Manual.

*Direct*LOGIC MODBUS Port Configuration for D2-260 and DL06

The following configuration example is specific to the D2-260 and DL06. Refer to the appropriate CPU User Manual for the specifics on your ***Direct***LOGIC CPU.

- In DirectSOFT32, choose the PLC menu, then Setup, then "Secondary Comm Port"
- From the port number list box at the top, choose "**Port 2**".
- For the Protocol, select "**MODBUS**"
- Response Delay Time should be "**0 mS**" Both CTS and RTS time must be set to **0 mS** when using D2-260 or DL06.
- The Station Number should be set to **1** to make the D2-260 or DL06 CPU a MODBUS master.
- The Baud Rate should be set at **9600.**
- In the Stop Bits list box Choose **1.**
- In the Parity list box choose **Odd**.

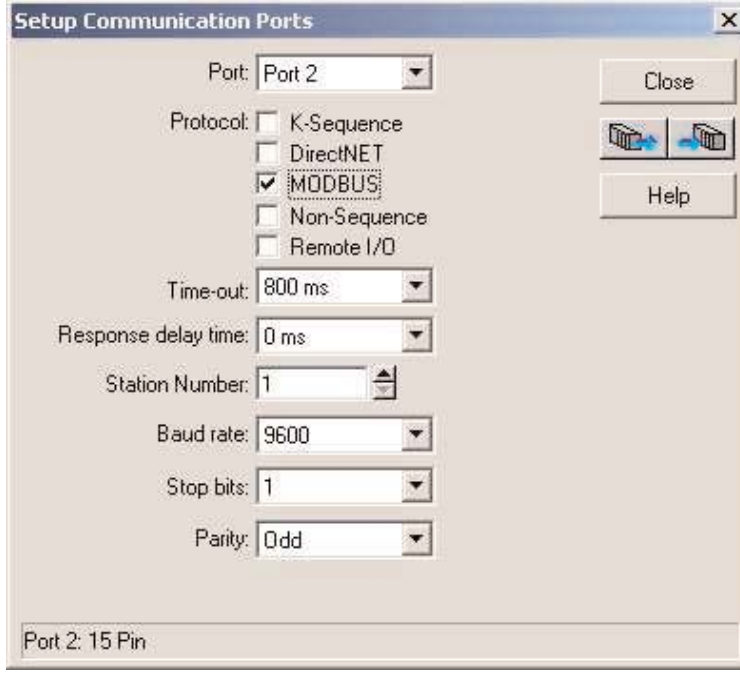


***Direct*LOGIC MODBUS Port Configuration for D2-250-1, D4-450 or DL05**

The following configuration example is specific to the DL250-1 or DL05 CPU. Refer to the appropriate CPU User Manual for the specifics on your ***Direct***LOGIC CPU.

- In DirectSOFT32, choose the PLC menu, then Setup, then "Secondary Comm Port"
- From the Port list box, choose **"Port 2"**.
- For the Protocol, select **"MODBUS"**.
- In the Timeout list box, select **"800 mS"**.
- Response Delay Time should be **"0 mS"**.
- The Station Number should be set to **"1"** to make the DL250 CPU a MODBUS Master.
- The Baud Rate should be set at **"9600"**.
- In the Stop Bits list box, choose **"1"**
- In the Parity list box, choose **"Odd"**.

Note: The DL250 network instructions used in Master mode will access only slaves 1 to 90. Each slave must have a unique number.



DirectLOGIC MODBUS Ladder Programming

The set up for all of the ***Direct***LOGIC CPUs is very similar. However, there may be some subtle differences between CPUs. Refer to the appropriate CPU User Manual for the specifics on your ***Direct***LOGIC CPU.

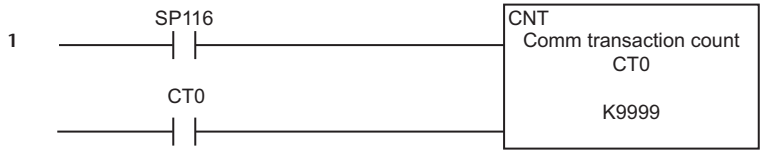
The following ladder program shows some examples of how to control the *DURA*PULSE AC drive through MODBUS RTU. The drive should be set up and tested for communications before it is connected to a load.

WARNING: A drive should never be connected to a load until any applicable communication programs have been proven.

Note:This program is for illustration purposes only and not intended for a true application.

In many drive applications, electromagnetic interference can at times cause frequent, short duration, communication errors. Unless the application environment is perfect, an occasional communication error will occur. In order to distinguish between these non-fatal transients and a genuine communication failure, you may want to use the instructions as shown in Rungs 1 and 2.

Rung 1 monitors the number of times that the PLC attempts to communicate with the AC drive. When the PLC's communication attempts are successful, SP116 will count up and SP117 will not count. Once the count reaches 9999, the counter will reset and resume counting.



Note: Alternative resets can be added for application-specific needs.

Note: SP116 and SP117 are special relays in the DirectLOGIC CPUs that monitor the PLC's communications. SP116 is on when Port 2 is communicating with another device. SP117 is on when Port 2 has encountered a communication error.

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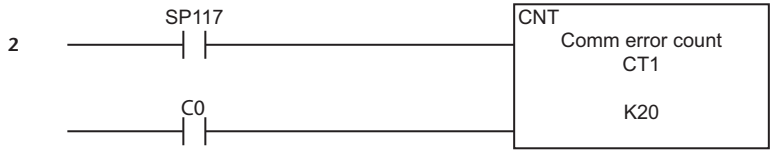
DirectLOGIC MODBUS Ladder Programming (cont.)

Rung 2 monitors the number of times the PLC fails in communicating with the AC drive.



Note: Alternative resets can be used.

Block Transfer

There is a group of block transfer parameters available in the DURApulse AC drive (P 9.11 to P 9.25). This contiguous block of parameters can be used to "group" miscellaneous parameters throughout the drive. This will allow you to update these miscellaneous parameters in one block instead of having to use multiple MWX or MRX commands.

For example: If you need to change the PID setpoint (P 7.10), accel time (P 1.01), decel time (P 1.02), and multi-speed 1 (P 5.01), this would typically take three different MWX commands because the parameters are non-contiguous. If you set P 9.11 to P 7.11, P 9.12 to P 1.01, P 9.13 to P 1.02, and P 9.14 to P 5.01, then all of these MRX parameters could be controlled using one MWX command..

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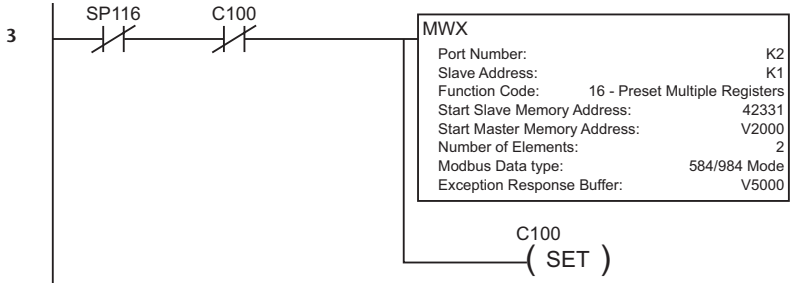
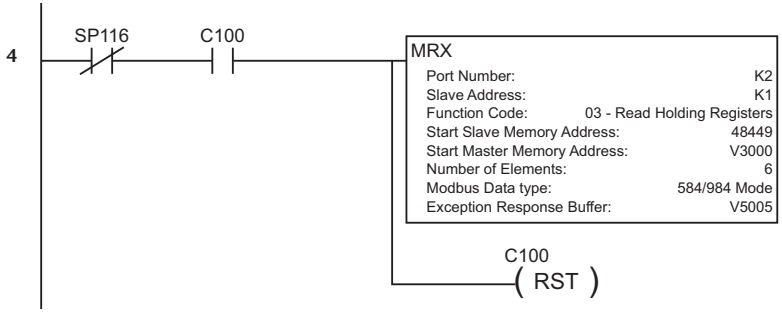
DirectLOGIC MODBUS Ladder Programming (cont.)

The Read and Write commands for the DL260 and DL06 CPUs are different from other ***Direct***LOGIC CPUs. Rungs 3 and 4 are shown below as they relate to DL260 and DL06 CPUs.

Rung 3 shows only the start/stop and speed reference control. The rung will write from V2000 and V2001 to Modbus address 42331 and 42332 for run command and speed reference.



Rung 4 is used to read the 6 words starting at Modbus address 48449 into V3000 through V3005



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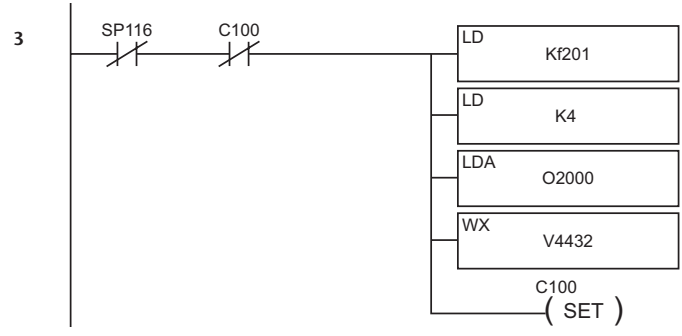
Alternate Rungs 3 and 4 for use with DL05, D2-250-1 and D4-450

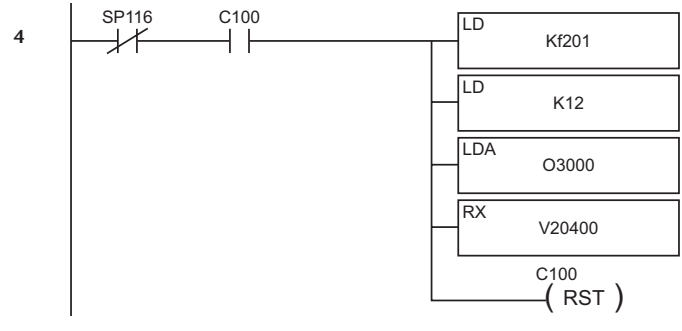
Rung 3 shows only the start//stop and speed reference control. The rung will write from WX command to V4432. Then V2000 would be the speed reference location and V2001 would be the start/stop location.



Rung 4 is used to read six of the status addresses of the *DURA*PULSE AC drive. These instructions read the values from the *DURA*PULSE status addresses 2100 to 2105, and place the values into the PLC memory addresses, V3000 to V3005.

Notice the number in the RX box - V20400. 20400 is an **octal** number as are all address references in the *Direct*LOGIC PLCs. 20400 **octal** converted to hex gives you 2100 - the first status address for the *DURA*PULSE drive.

Note: Refer to your PLC User Manual for more specifics on MODBUS addressing and address conversions.



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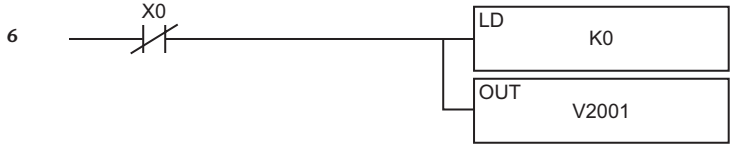
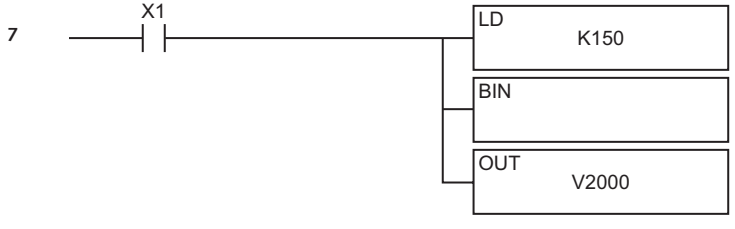
DirectLOGIC MODBUS Ladder Programming (cont.)

Rung 5 loads a value of 1 into drive parameter P 9.27. This is the signal to run.

Rung 6 loads a value of 0 into drive parameter P 9.27. This is the signal to stop.



Rung 7 loads a decimal value of 150 into drive parameter P 9.26. The BIN instruction converts BCD/HEX to decimal. This tells the drive to run at 15.0Hz.



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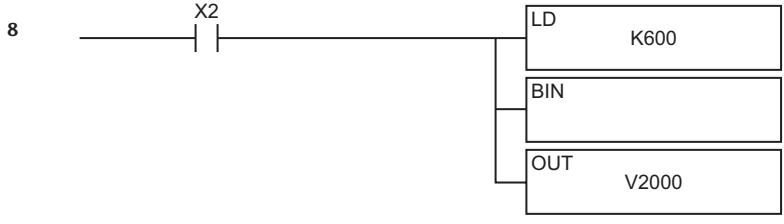
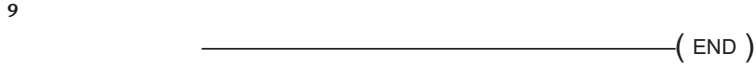
DirectLOGIC MODBUS Ladder Programming (cont.)

Rung 8 loads a decimal value of 600 into P 9.26. The BIN istruction converts BCD/HEX to decimal. This tells the drive to run at 60.0Hz.





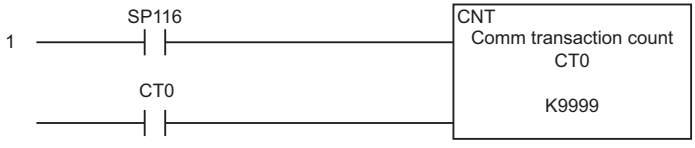
DirectLOGIC MODBUS Ladder Programming - Multiple Drives

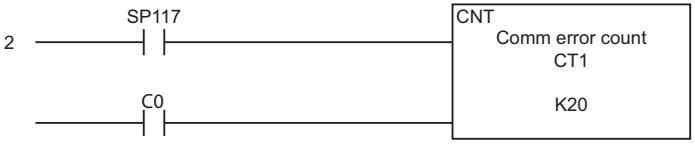
The set up for all of the ***Direct***LOGIC CPUs is very similar. However, there may be some subtle differences between CPUs. Refer to the appropriate CPU User Manual for the specifics on your ***Direct***LOGIC CPU.

The following ladder program shows an examples of a D2-260 CPU controlling two drives directly out of port 2 to a GS-RS485-4. The drive should be set up and tested for communications before it is connected to a load.

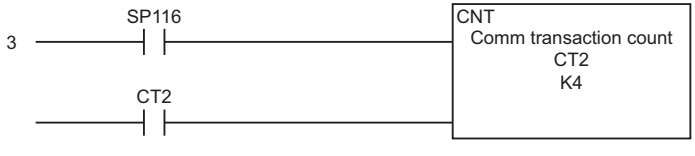
WARNING: A drive should never be connected to a load until any applicable communication programs have been proven.

Note:This program is for illustration purposes only and not intended for a true application.





Rung 3 contains a counter which is used to determine which MRX or MWX instruction to execute. Its purpose is to prevent multiple MRX/MWX rungs being active at the same time. Since the counter may only have one value at any particular time, only a single rung may be active.



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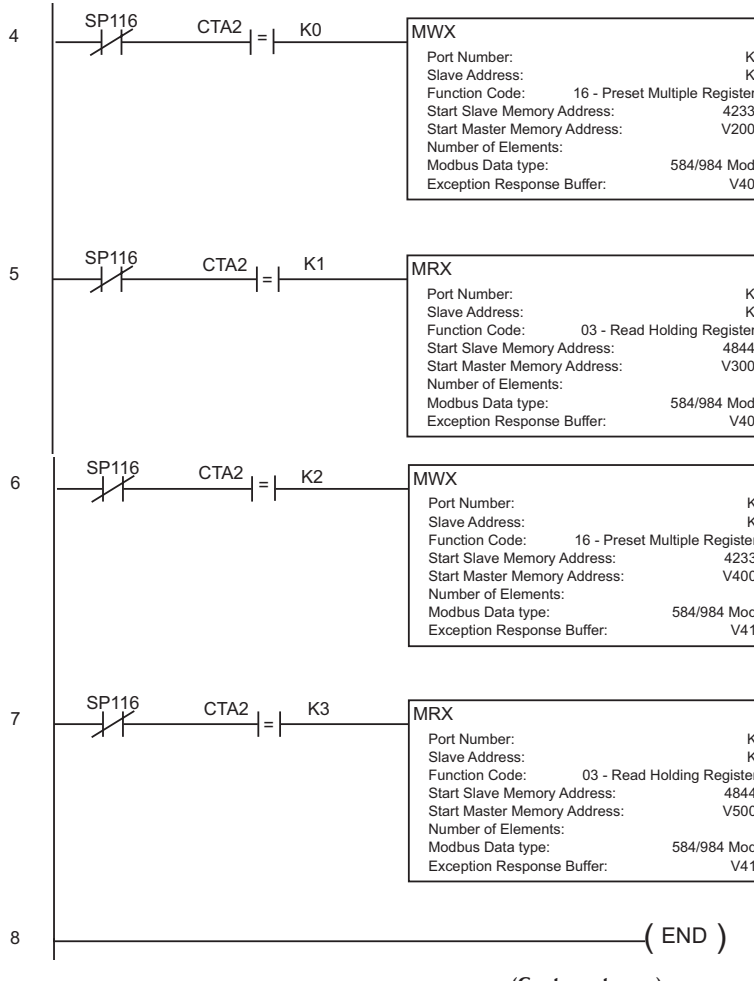
DirectLOGIC MODBUS Ladder Programming -Multiple Drives, cont.

Please also note that adding additional MRX/MWX rungs would be accomplished simply by increasing the K4 value to the new total number of MRX and MWX instructions needed. SP116 is used to increment the counter so that each time an MRX or MWX is executed, the counter then enables the next MRX or MWX once the current MRX or MWX is complete.



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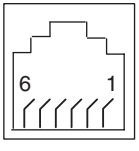
Communicating with Third-party Devices

The ***DURAPULSE*** RJ-12 Serial Comm Port will accommodate an RS-485 connection.

An RS-485 network cable can span up to 1000 meters (4000 feet).
The ***DURAPULSE*** AC drive communication address is specified by P 9.00. The third party device then controls each AC drive according to its communication address.

The ***DURAPULSE*** AC drive can be set up to communicate on standard MODBUS networks using the following transmission modes: ASCII or RTU. Using the Communication Protocol parameter (P 9.02), you can select the desired mode, data bits, parity, and stop bits. The mode and serial parameters must be the same for all devices on a MODBUS network.

RJ-12 Serial Comm Port



RS-485 Interface

1: +15V
2: GND
3: SG-
4: SG+
5: NC

Note: DURAPULSE drives have a provision for shutting down control or power to the inverter in the event of a communications timeout. This can be set up through the drive parameters P 9.03, P 9.04 and P 9.05.

Common MODBUS RTU Masters

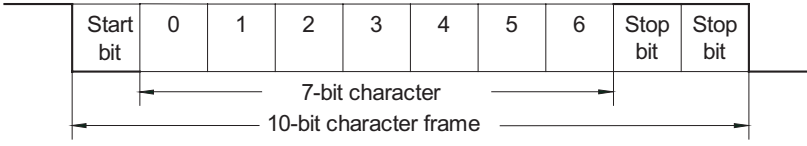
- MODSCAN from www.wintech.com
- KEPSERVER EX 4.0 from www.kepware.com
- Entivity Studio 7.2
- Think & Do Live 5.5.1

For additional technical assistance, go to our Technical support home page at:
http://support.automationdirect.com/technotes.html

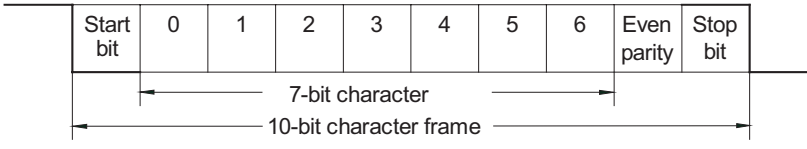
Data Format

ASCII Mode: 10-bit character frame (For 7-bit character):

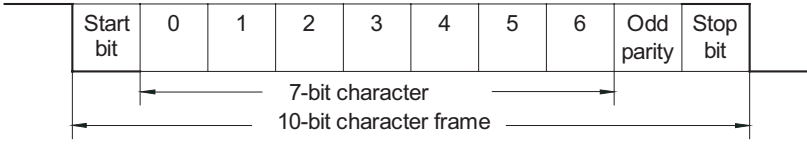
P 9.02 = 00 (7 data bits, no parity, 2 stop bits)



P 9.02 = 01 (7 data bits, even parity, 1 stop bit)

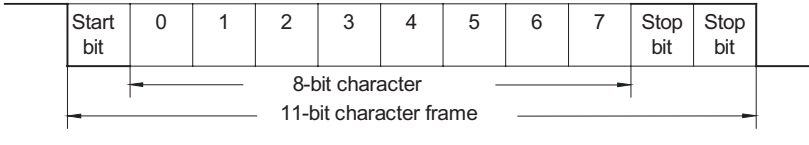


P 9.02 = 02 (7 data bits, odd parity, 1 stop bit)

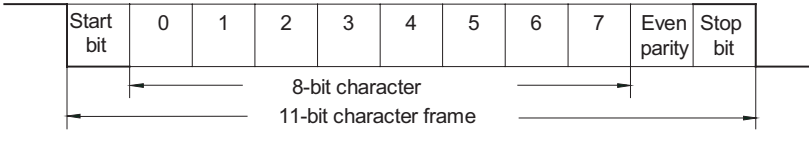


RTU Mode: 11-bit character frame (For 8-bit character):

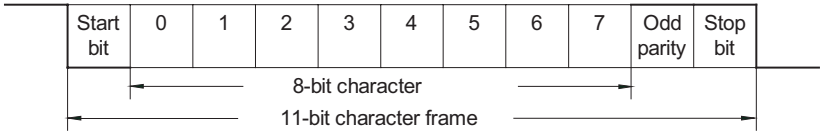
P 9.02 = 03 (8 data bits, no parity, 2 stop bit)



P 9.02 = 04 (8 data bits, even parity, 1 stop bit)



P 9.02 = 05 (8 data bits, odd parity, 1 stop bit)



Communication Protocol

ASCII Mode:

STX	Start Character: (3AH)
ADR 1	Communication Address: 8-bit address consists of 2 ASCII codes
ADR 0	
CMD 1	
CMD 0	
DATA (n-1)	Contents of data: n x 8-bit data consists of 2n ASCII codes. n[]25 maximum of 50 ASCII codes
.....	
DATA 0	
LRC CHK 1	LRC check sum: 8-bit check sum consists of 2 ASCII codes
LRC CHK 0	
END 1	END characters: END 1=CR (0DH), END 0 =LF (0AH)
END-0	

RTU Mode:

START	A silent interval of more than 10 ms
ADR	Communication Address: 8-bit address
CMD	
DATA (n-1)	Contents of data: n x 8-bit data,n<=25
.....	
DATA 0	
CRC CHK Low	CRC check sum: 16-bit check sum consists of 2 8-bit characters
CRC CHK High	
END	A silent interval of more than 10 ms

ADR (Communication Address)

Valid communication addresses are in the range of 0 to 254. A communication address equal to 0 means broadcast to all AC drives (AMD). In this case, the AMD will not reply any message to the master device.

For example, communication to AMD with address 16 decimal:

ASCII mode: (ADR 1, ADR 0)='1','0' => '1'=31H, '0'=30H
RTU mode: (ADR)=10H

CMD (Command code) and DATA (data characters)

The format of data characters depends on the command code. The available command codes are described as follows: Command code: 03H, read N words. The maximum value of N is 12. For example, reading continuous 2 words from starting address 2102H of AMD with address 01H.

ASCII mode:

Command Message	
STX	':'
ADR 1 ADR 0	'0' '1'
CMD 1 CMD 0	'0' '3'
Starting data address	'2' '1' '0' '2'
Number of data (Count by word)	'0' '0' '0' '2'
LRC CHK 1 LRC CHK 0	'D' '7'
END 1 END 0	CR LF

Response Message	
STX ':'	':'
ADR 1 ADR 0	'0' '1'
CMD 1 CMD 0	'0' '3'
Number of data (Count by byte)	'0' '4'
Content of starting data address 2102H	'1' '7' '7' '0'
Content data address 2103H	'0' '0' '0' '0'
LRC CHK 1 LRC CHK 0	'7' '1'
END 1 END 0	CR LF

RTU mode:

Command Message	
ADR	01H
CMD	03H
Starting data address	21H 02H
Number of data (Count by word)	00H 02H
CRC CHK Low CRC CHK High	6FH F7H

Response Message	
ADR	01H
CMD	03H
Number of data (Count by byte)	04H '0'
Content of data address 2102H	17H 70H
Content of data address 2103H	00H 02H
CRC CHK Low CRC CHK High	FEH 5CH

Command code: 06H, write 1 word

For example, writing 6000(1770H) to address 0100H of AMD with address 01H.

ASCII mode:

Command Message	
STX	':'
ADR 1 ADR 0	'0' '1'
CMD 1 CMD 0	'0' '6'
Data Address	'0' '1' '0' '0' '1' '7' '7' '0'
LRC CHK 1 LRC CHK 0	'7' '1'
END 1 END 0	CR LF

Response Message	
STX ':'	':'
ADR 1 ADR 0	'0' '1'
CMD 1 CMD 0	'0' '6'
Data Address	'0' '1' '0' '0'
Data Content	'1' '7' '7' '0'
LRC CHK 1 LRC CHK 0	'7' '1'
END 1 END 0	CR LF

RTU mode:

This is an example of using function code 16 for writing to multiple registers.

Command Message	
ADR	01H
CMD	10H
Starting data address	20H 00H
Number of data (Count by byte)	04H
Content of data address 2000H	00H 02H
Content of data address 2001H	02H 58H
CRC CHK Low CRC CHK High	CBH 34H

Response Message	
ADR	01H
CMD	10H
Starting data address	20H 00H
Number of data (Count by word)	00H 02H
CRC CHK Low CRC CHK High	4AH 08H

CHK (check sum)

ASCII Mode:

LRC (Longitudinal Redundancy Check) is calculated by summing up module 256, the values of the bytes from ADR1 to last data character, then calculating the hexadecimal representation of the 2's-complement negation of the sum.

For example, reading 1 word from address 0401H of the AC drive with address 01H.

Command Message	
STX	':'
ADR 1 ADR 0	'0' '1'
CMD 1 CMD 0	'0' '3'
Starting data address	'0' '4' '0' '1'
Number of data (Count by word)	'0' '0' '0' '1'
LRC CHK 1 LRC CHK 0	'F' '6'
END 1 END 0	CR LF

01H+03H+04H+01H+00H+01H=0AH,
the 2's complement negation of 0AH is F6H.

RTU Mode:

Response Message	
ADR	01H
CMD	03H
Starting data address	21H 02H
Number of data (Count by word)	00H 02H
CRC CHK Low CRC CHK High	6FH F7H

CRC (Cyclical Redundancy Check) is calculated by the following steps:

Step 1: Load a 16-bit register (called CRC register) with FFFFH.

Step 2: Exclusive OR the first 8-bit byte of the command message with the low order byte of the 16-bit CRC register, putting the result in the CRC register.

Step 3: Shift the CRC register one bit to the right with MSB zero filling. Extract and examine the LSB.

Step 4: If the LSB of CRC register is 0, repeat step 3, else Exclusive or the CRC register with the polynomial value A001H.

Step 5: Repeat step 3 and 4 until eight shifts have been performed. When this is done, a complete 8-bit byte will have been processed

.Step 6: Repeat steps 2 to 5 for the next 8-bit byte of the command message.

Continue doing thisuntil all bytes have been processed. The final contents of the CRC register equal the CRC value.

Note: When transmitting the CRC value in the message, the upper and lower bytes of the CRC value must be swapped, i.e. the lower order byte will be transmitted first.

The following is an example of CRC generation using C language. The function takes two arguments:

Unsigned char* data ← a pointer to the message buffer
Unsigned char length ← the quantity of bytes in the message buffer

The function returns the CRC value as a type of unsigned integer.

```
Unsigned int crc_chk(unsigned char* data, unsigned char length){
  int j;
  unsigned int reg_crc=0xFFFF;
  while(length--){
     reg_crc ^= *data++;
     for(j=0;j<8;j++){
        if(reg_crc & 0x01){  /* LSB(b0)=1 */
           reg_crc=(reg_crc>>1) ^ 0xA001;
      }else{
           reg_crc=reg_crc >>1;
      }
    }
  }
 return reg_crc;
}
```

Note: RTU mode is preferred. Limited support is available to ASCII users.

Chapter 6

Maintenance and Troubleshooting

In This Chapter...

Maintenance and Inspection

Modern AC drives are based on solid state electronics technology. Preventive maintenance is required to operate the AC drive in its optimal condition, and to ensure a long life. It is recommended that a qualified technician perform a regular inspection of the AC drive. Some items should be checked once a month, and some items should be checked annually. Before the inspection, always turn off the AC Input Power to the unit. Wait at least 10 minutes after all display lamps have turned off, and then confirm that the capacitors have fully discharged by measuring the voltage between B1 and Frame Ground using a multimeter set to measure DC voltage.

WARNING! Disconnect AC power and ensure that the internal capacitors have fully discharged before inspecting the AC drive!

Monthly Inspection:

Check the following items at least once a month.

1. Make sure the motors are operating as expected.
2. Make sure the installation environment is normal.
3. Make sure the cooling system is operating as expected.
4. Check for irregular vibrations or sounds during operation.
5. Make sure the motors are not overheating during operation.
6. Check the input voltage of the AC drive and make sure the voltage is within the operating range. Check the voltage with a voltmeter.

Annual Inspection

Check the following items once a year.

1. Tighten and reinforce the screws of the AC drive if necessary. They may loosen due to vibration or changing temperatures.
2. Make sure the conductors and insulators are not corroded and/or damaged.
3. Check the resistance of the insulation with Megaohmeter.
4. Check the capacitors and relays, and replace if necessary.
5. Clean off any dust and dirt with a vacuum cleaner. Pay special attention to cleaning the ventilation ports and PCBs. Always keep these areas clean. Accumulation of dust and dirt in these areas can cause unforeseen failures.

If the AC drive is not used for a long period of time, turn the power on at least once every two years and confirm that it still functions properly. To confirm functionality, disconnect the motor and energize the AC drive for 5 hours or more before attempting to run a motor with it.

Troubleshooting

Fault Messages

The AC drive has a comprehensive fault diagnostic system that includes several different alarms and fault messages. Once a fault is detected, the corresponding protective functions will be activated. The fault messages are then displayed on the digital keypad LCD display. The six most recent faults can be read on the digital keypad display by viewing parameters P06.31 to P06.36.

NOTE: Faults can be cleared by a reset from the keypad or input terminal.

Fault Messages	
Fault Name/Description	**Corrective Actions**
OVER-CURRENT The AC drive detects an abnormal increase in current.	1. Check whether the motor's horsepower is equal to or less than the AC drive output power. 2. Check the wiring connections between the AC drive and motor for possible short circuits. 3. Increase the Acceleration time (P 1.01 or P 1.05). 4. Check for possible excessive loading conditions at the motor. 5. If there are any abnormal conditions when operating the AC drive after short-circuit is removed, or fault does not clear, call ADC Support for assistance.
OVER-VOLTAGE The AC drive detects that the DC bus voltage has exceeded its maximum allowable value.	1. Check whether the input voltage falls within the rated AC drive input voltage. 2. Check for possible voltage transients. 3. Bus over-voltage may also be caused by motor regeneration. Either increase the decel time or add an optional braking resistor. 4. Check whether the required braking power is within the specified limits. 5. Check braking resistor on drives under 20HP and dynamic brake unit & braking resistor on drives 20HP and above.
OVER-TEMPERATURE The AC drive temperature sensor detects excessive heat.	1. Ensure that the ambient temperature falls within the specified temperature range. 2. Make sure that the ventilation holes are not obstructed. 3. Remove any foreign objects on the heat sinks and check for possible dirty heat sink fins. 4. Provide enough spacing for adequate ventilation.
UNDER-VOLTAGE The AC drive detects that the DC bus voltage has fallen below its minimum allowable value.	Check whether the input voltage falls within the rated AC drive input voltage.
OVERLOAD The AC drive detects excessive drive output current.	1. Check whether the motor is overloaded. 2. Reduce torque compensation setting as set in P 2.03. 3. Increase the AC drive's output capacity. **Note: The AC drive can withstand up to 150% of the rated current for a maximum of 60 seconds.**

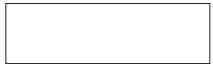
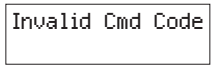
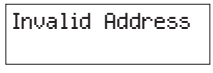
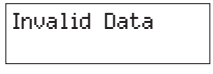
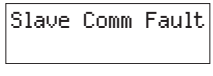
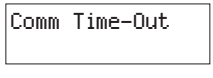
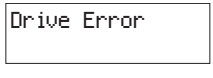
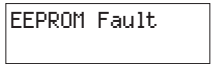
Fault Messages	
Fault Name/Description	**Corrective Actions**
THERMAL OVERLOAD Parameter settings (P 6.07 to P 6.09) An external condition has occured to cause an internal electronic or motor thermal overload fault	If P 6.07 is set to '1' to enable during steady state: 1. Check for possible motor overload. 2. Check electronic thermal overload relay setting (P 6.00).. 3. Increase motor capacity. 4. Reduce the current level so that the AC drive output current does not exceed the value set by the Motor Rated Current P 0.01.
OVER-TORQUE Parameter settings (P 6.07 to P 6.09) An external condition has occured to cause an over-torque fault.	If P 6.07 is set to '2' to enable detection during accel/decel: 1. Reduce the motor overload. 2. Adjust the over-torque detection setting to an appropriate level.
OVER-CURRENT ACC Over-current during acceleration: 1. Short-circuit at motor output. 2. Torque boost too high. 3. Acceleration time too short. 4. AC drive output capacity is too small.	1. Check for possible poor insulation at the output line. 2. Decrease the torque boost setting in P 2.02. 3. Increase the acceleration time P 1.01 and P 1.05. 4. Replace the AC drive with one that has a higher output capacity.
OVER-CURRENT DEC Over-current during deceleration: 1. Short-circuit at motor output. 2. Deceleration time too short. 3. AC drive output capacity is too small.	1. Check for possible poor insulation at the output line. 2. Increase the deceleration time P 1.02 and P 1.06. 3. Replace the AC drive with one that has a higher output capacity.
OVER-CURRENT STD Over-current during steady state operation 1. Short-circuit at motor output. 2. Sudden increase in motor loading. 3. AC drive output capacity is too small.	1. Check for possible poor insulation at the output line. 2. Check for possible motor stall. 3. Replace the AC drive with one that has a higher output capacity.
CPU FAILURE 1 Internal memory IC cannot be programmed	1. Switch off power supply. 2. Check whether the input voltage falls within the AC drive's rated input voltage. 3. Switch the AC drive back on. If fault does not clear, contact ADC Support for assistance.
CPU FAILURE 2 Internal memory IC cannot be read.	1. Reset drive to factory defaults P 9.08 to 99. 2. Switch off power supply 3. Switch the AC drive back on. If fault does not clear, contact ADC Support for assistance.
CPU FAILURE 3 Internal memory IC failed to receive output status	1. Check all connections at L1, L2 and L3. 2. Verify correct voltage at L1, L2,L3. 3. Contact ADC Support for assistance.

Fault Messages	
Fault Name/Description	**Corrective Actions**
HARDWARE FAILURE Hardware protection failure	1. Check all connections at L1, L2 and L3. 2. Verify correct voltage at L1, L2,L3. 3. Contact ADC Support for assistance.
MOM POWER LOSS Input power has been lost	Check line power to drive
EXTERNAL FAULT The external terminal EF-CM goes from OFF to ON	When external terminal EF-CM is closed, the output will be turned off (under Normally Open. External Fault.).
AUTO RAMP FAULT Auto accel/decel failure	Refer to Over-current or Over-voltage error
GROUND FAULT 1. Possible unbalanced load 2. Possible current leakage	1. Check the motor for possible insulation damage. 2. Check for possible poor insulation at the output line.
EXT. BASE-BLOCK AC drive output is turned off.	1. When the external input terminal (base-block) is active, the AC drive output will be turned off. 2. Disable this connection and the AC drive will begin to work again.
INPUT POWER LOSS One phase of the input power is lost	1. Check for possible poor connection on the input power line. 2. Check for possible loss of phase on input power line.
OUTPUT SHORTED .IGBT Short Circuit	Contact ADC Support for assistance.
PID FBACK LOSS 1. If P 7.27 = 0, (*warn and AC drive stop)*, PID feedback loss recorded. 2. If P 7.27 = 1, (*warn and continue operation)*, PID feedback loss not recorded.	PID Warning: PID Feedback Loss - The 4-20mA PID signal has been lost. The corrective action can be set with the PID Feedback Loss parameter (P 7.27). The available settings are: 00 - Warn and AC Drive Stop 01 - Warn and Continue The default setting is 00.

Fault Messages	
Fault Name/Description	**Corrective Actions**
ENCODER LOSS 1. If P 10.05 = 1 or 2 (*warn and AC drive stop*), Encoder feedback loss would be recorded. 2. If P 10.05 = 0 (*warn and continue operation*), Encoder feedback loss would not be recorded.	1. Verify that the encoder board has power 2. Check to be sure it is not mis-wired 3. Check for incorrect voltage or encoder set-up 4. Check both the mechanical and electrical integrity of the encoder.
ENC SIGNAL ERROR Encoder A/B phase signal is in error when the control mode is from the encoder	1.Verify power to the encoder feedback card 2. Verify encoder and feedback card wiring 3. Check encoder feedback card dip switch settings and encoder voltage requirements

Warning Messages: Serial Communication and Keypad Errors

There are several Warning Messages that a DURApulse AC Drive may give. The DURApulse AC Drive allows you to decide its response to these messages. The descriptions of the Warning Messages are listed below.

Warning Messages	
Error Name	**Description**
 No display shown on the keypad	1. The Keypad LCD display has failed. 2. Check input power 3. Make sure the keypad is tightly connected to the drive.
	Invalid Command Code when communicating
	Invalid Address when communicating
	Invalid Data when communicating
	Slave Comm Fault device failure
	Communication Time Out
	Drive model doesn't match keypad
	When the copy function is enabled (P 9.40), there is a Read/Write EEPROM Fault

Warning Messages	
Error Name	**Description**
Rating Mismatch	Data range doesn't match
Group# Overflow	When the copy function is enabled (P 9.40), keypad's group number data is more than the drive's.
No Space	When the copy function is enabled (P 9.40),EEPROM data block in the keypad is full.
Delete Failure	When the copy function is enabled (P 9.40), delete EEPROM block fails.
No Data	When the copy function is enabled (P 9.40), EEPROM data block is null.
R1 Detect Error Failure to detect motor resistance during Auto-tune procedure	1. Check to make sure the motor is connected to the drive correctly. 2. Check line power to drive 3. STOP key was pressed during Auto-Tune procedure
No Load Error Failure to detect any motor load during Auto-tune procedure	1. Check to make sure the motor is connected to the drive correctly. 2. Check line power to drive 3. STOP key was pressed during Auto-Tune procedure
Copy Error-COMMS Communications error during Copy Keypad function	1.Check connection between the keypad and drive and make sure it is not loose 2. Check communications protocol for correct settings
Copy Error-Data Data error during Copy Keypad function	1. Check connection between the keypad and drive and make sure it is not loose 2. Check communications protocol for correct settings

Warning Messages	
Error Name	**Description**
Overheat Warning The AC drive temperature has exceeded 85% of the Over-temperature condition.	1. Ensure that the ambient temperature falls within the specified temperature range. 2. Make sure that the ventilation holes are not obstructed. 3. Remove any foreign objects on the heat sinks and check for possible dirty heat sink fins. 4. Provide enough spacing for adequate ventilation.
Write Failure	When the copy function is enabled (P 9.40),Write to EEPROM fails.
Parameter Locked	Parameters have been locked: read only - cannot be set/cannot write.
--- ERR ---	Error: The configuration is not accepted, or the parameter is locked.
Value Accepted	Value Accepted.

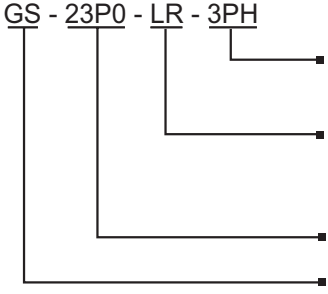
Appendix A

Accessories

In This Appendix...

Accessories Part Numbering

With the exception of the EMI filters and RF filters, each accessory part number begins with **GS**, followed by the AC Drive rating, and then the relevant accessory code. Following the accessory code, you will find a description code when applicable. The diagram below shows the accessory part numbering scheme.



Description Code
1PH: Single phase 3PH: Three phase
GS-xxxx-LR: Three phase

Accessory Code
LR: Line reactor BR: Braking Resistor
FKIT: Fuse Kit FUSE: Replacement fuses for FKIT

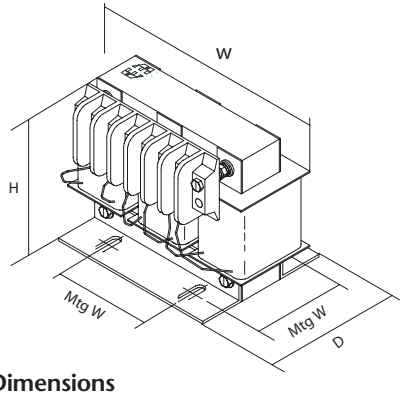
Drive Rating **(See Drive P/N description)**

Drive Series
GS1: GS1 Series GS2: GS2 Series GS3: GS3 Series
GS: All GS Series Drives

Line Reactors

Line Reactor Specifications					
230 VOLT Class Three Phase					
Part Number	**Rated HP**	**Rated Amps**	**Impedance**	**Inductance**	**Watts Loss**
GS-21P0-LR-3PH	1	5	3%	3.00mH	7
GS-22P0-LR-3PH	2	7	3%	1.50mH	11
GS-23P0-LR-3PH	3	11	3%	1.30mH	23
GS-25P0-LR	5	17	3%	0.80mH	19
GS-27P5-LR	7.5	25	3%	0.50mH	23
GS-2010-LR	10	33	3%	0.40mH	36
GS-2015-LR	15	49	3%	0.30mH	33
GS-2020-LR	20	65	3%	0.25mH	39
GS-2025-LR	25	75	3%	0.20mH	88
GS-2030-LR	30	90	3%	0.20mH	88
GS-2040-LR	40	120	3%	0.10mH	95
GS-2050-LR	50	145	3%	0.10mH	95

Line Reactors Specifications					
460 VOLT Class Three Phase					
Part Number	**Rated HP**	**Rated Amps**	**Impedance**	**Inductance**	**Watts Loss**
GS-41P0-LR	1	2	3%	12.0mH	7
GS-42P0-LR	2	4	3%	6.50mH	13
GS-43P0-LR	3	8	3%	5.00mH	31
GS-45P0-LR	5	8	3%	3.00mH	25
GS-47P5-LR	7.5	12	3%	2.50mH	26
GS-4010-LR	10	18	3%	1.50mH	29
GS-4015-LR	15	24	3%	1.20mH	44
GS-4020-LR	22	32	3%	.80mH	51
GS-4025-LR	25	38	3%	.80mH	51
GS-4030-LR	30	45	3%	.70mH	64
GS-4040-LR	40	60	3%	.50mH	75
GS-4050-LR	50	73	3%	.40mH	138
GS-4060-LR	60	91	3%	.40mH	138
GS-4075-LR	75	105	3%	.30mH	123
GS-4100-LR	100	145	3%	.20mH	115



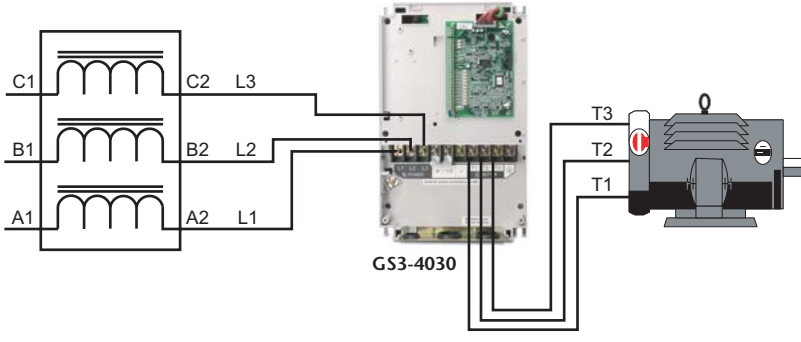
Line Reactor Dimensions

AC Line Reactor Dimensions (inches)							
Part Number	**H**	**W**	**D**	**Mtg.D**	**Mtg. W**	**Mtg Slot Hole Size**	**Weight (lbs)**
GS-21P0-LR-3PH	3.40	4.40	2.83	1.77	1.44	.28 X .63	2.30
GS-22P0-LR-3PH	3.40	4.40	2.83	1.77	2.00	.28 X .63	2.80
GS-23P0-LR-3PH	3.40	4.40	2.83	1.77	2.00	.28 X .63	2.90
GS-25P0-LR	4.80	6.00	3.30	2.09	2.00	.28 X .63	7.10
GS-27P5-LR	5.70	6.00	3.09	2.09	3.00	.28 X .63	7.00
GS-2010-LR	5.70	6.00	3.34	2.34	3.00	.28 X .63	9.00
GS-2015-LR	5.70	6.00	3.84	2.84	3.00	.28 X .63	13..0
GS-2020-LR	5.70	6.00	3.84	2.84	3.00	.28 X .63	12.0
GS-2025-LR	6.88	8.50	4.37	3.12	3.60	.44 X 1.00	26.0
GS-2030-LR	6.88	8.50	4.37	3.12	3.60	.44 X 1.00	26.0
GS-2040-LR	6.88	8.50	4.37	3.12	3.00	.44 X 1.00	27.0
GS-2050-LR	6.88	8.50	4.37	3.12	3.00	.44 X 1.00	27.0
GS-41P0-LR	3.40	4.40	2.83	1.77	1.44	.28 X .63	2.30
GS-42P0-LR	3.40	4.40	2.83	1.77	1.44	.28 X .63	2.80
GS-43P0-LR	3.40	4.40	3.39	2.39	2.00	.28 X .63	4.30
GS-45P0-LR	3.40	4.40	2.83	1.77	2.00	.28 X .63	3.10
GS-47P5-LR	4.80	6.00	3.30	2.09	2.00	.28 X .63	7.50
GS-4010-LR	4.80	6.30	3.55	2.34	2.00	.28 X .63	9.10
GS-4015-LR	5.70	6.00	3.34	2.34	3.00	.28 X .63	10.0
GS-4020-LR	5.61	6.90	3.95	2.75	3.00	.38 X .63	17.0
GS-4025-LR	5.61	6.90	3.95	2.75	3.00	.38 X .63	17.0
GS-4030-LR	5.61	6.90	4.45	3.25	3.00	.38 X .63	22.0
GS-4040-LR	6.88	8.50	4.37	3.12	3.00	.44 X 1.00	26.0
GS-4050-LR	6.88	8.50	4.87	3.62	3.60	.44 X 1.00	36.0
GS-4060-LR	6.88	8.50	4.87	3.62	3.60	.44 X 1.00	36.0
GS-4075-LR	8.29	10.50	5.35	3.73	3.60	.44 X 1.25	52.0
GS-4100-LR	8.29	10.50	5.35	3.73	3.60	.44 X 1.25	41.0

Line Reactor Applications and Connections

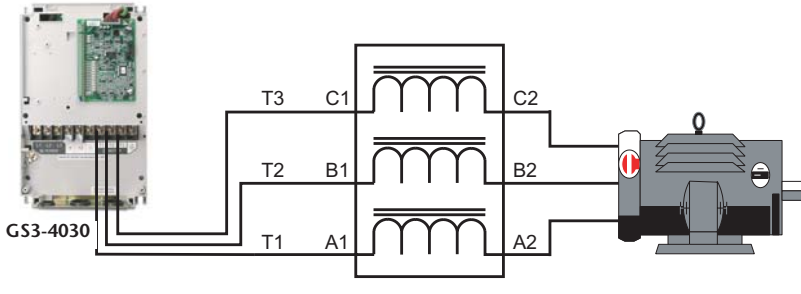
Input Side of AC Drive

When installed on the input side of the AC Drive, line reactors will reduce line notching, limit current and voltage spikes and surges from the incoming line. The line reactors will also reduce harmonic distortion from the AC Drive onto the line. Units are installed in front of the AC Drive as shown.



Output Side of AC Drive

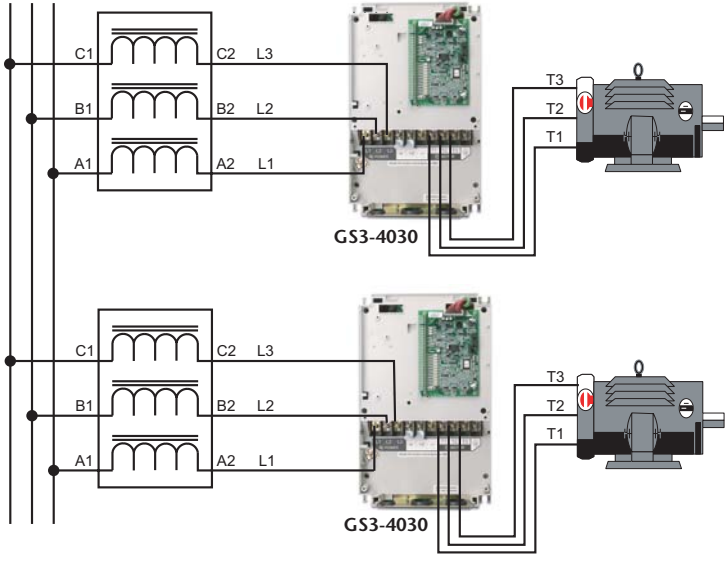
When installed on the output side of the AC Drive, line reactors protect the AC Drive from short circuits at the load. Voltage and current waveforms from the AC Drive are enhanced, reducing motor overheating and noise emissions.



Note: Single phase line reactors should not be installed on the output of the AC Drive. Use three-phase only.

Multiple AC Drives

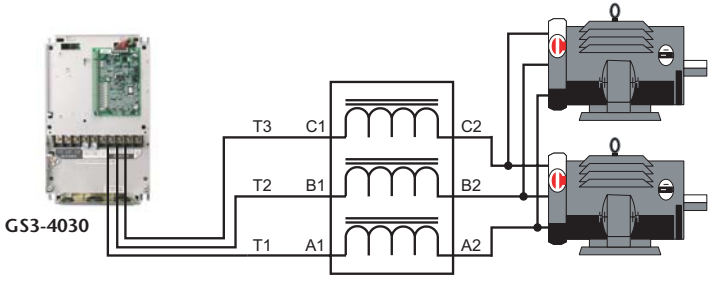
Individual line reactors are recommended when installing multiple AC Drives on the same power line. Individual line reactors eliminate cross-talk between multiple AC Drives and provide isolated protection for each AC Drive for its own specific load.



Multiple Motors

A single reactor can be used when the application calls for multiple motors on the same AC Drive. The reactor is sized based on the total horsepower of all the motors.

Note: A single reactor should only be used with multiple motors when the motors will operate simultaneously.



Braking Units

Braking units are used to absorb the motor regeneration energy when the motor stops by deceleration. With the braking unit, the regeneration energy is dissipated by braking resistors. Our braking units are suitable for 230V and 460V *DURAPULSE* drives, and must be used in conjunction with GS series braking resistors to provide the best braking results.

To avoid injury, please refer to the dynamic braking manual, GS3-DB-M before wiring.

Braking Units and Braking Resistors for *DURAPULSE* Drives

AC Drive		Brake Unit		Braking Resistor				
Voltage Class	AC Drive Part No.	QTY	Brake Unit Part No.	QTY	Resistor Part No.	Resistor Specification for Each Braking Unit	Braking Torque 10% Duty Cycle	Typical Thermal Overload Relay Value
230V	GS3-2020	1	GS-2DBU	1	GS-2020-BR-ENC	3000W 10Ω	125%	30A
	GS3-2025	1		1	GS-2025-BR-ENC	4800W 8Ω	125%	35A
	GS3-2030	1		1	GS-2030-BR-ENC	4800W 6.8Ω	125%	40A
	GS3-2040	2		2	GS-2040-BR-ENC	3000W 10Ω	125%	30A
	GS3-2050	2		2	GS-2050-BR-ENC	3000W 10Ω	100%	30A
460V	GS3-4020	1	GS-4DBU	1	GS-4020-BR-ENC	1500W 40Ω	125%	15A
	GS3-4025	1		1	GS-4025-BR-ENC	4800W 32Ω	125%	15A
	GS3-4030	1		1	GS-4030-BR-ENC	4800W 27.2Ω	125%	20A
	GS3-4040	1		1	GS-4040-BR-ENC	6000W 20Ω	125%	30A
	GS3-4050	1		1	GS-4050-BR-ENC	9600W 16Ω	125%	40A
	GS3-4060	1		1	GS-4060-BR-ENC	9600W 13.6Ω	125%	50A
	GS3-4075	2		2	GS-4075-BR-ENC	6000W 20Ω	125%	30A
	GS3-4100	2		2	GS-410 0-BR-ENC	9600W 13.6Ω	125%	50A

Dynamic Brake Unit General Specifications

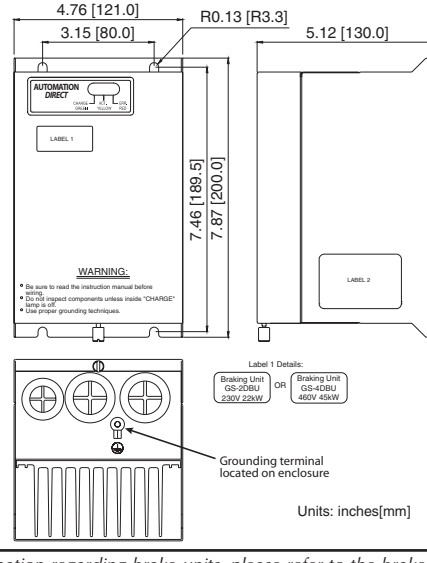
Dynamic Brake Unit Specifications			
Model		230V Class	460V Class
Part Number		GS-2DBU	GS-4DBU
Max. Motor Capacity HP(KW)		30(22)	60(45)
Output Rating	Max. Peak Discharge Current (A) 10% ED (Duty Cycle)	60	60
	Continuous Discharge Current (A)	20	18
	Braking Start-up Voltage (DC)	330/345/360/380/400/415 ±3V	660/690/720/760/800/830 ±6V
	Maximum On-Time	60 Seconds	60 Seconds
Input Rating	DC Voltage	200~400 VDC	400~800 VDC
Protection	Heat Sink Overheat	Temperature over +95 °C (203 °F)	
	Alarm Output	Relay contact 5A @ 120VAC/28VDC (RA, RB, RC)	
	Power CHARGE LED (Green)	ON until the bus (P-N) voltage is below 50VDC	
	Braking ACT LED (Yellow)	ON during braking	
	Fault ERR LED (Red)	ON if a fault has occurred	
Usage Environment	Installation Location	Indoor (no corrosive gases, metallic dust)	
	Operating Temperature	-10 °C to +50 °C (14 °F to 122 °F)	
	Storage Temperature	-20 °C to +60 °C (-4 °F to 140 °F)	
	Humidity	90% Non-condensing	
	Vibration	9.8m/s² (1G) under 20 2m/s² (0.2G) @ 20~50Hz	
Mechanical Configuration		Wall-mounted enclosed type IP50	

Brake Unit Terminal Specifications

Circuit	Terminal Mark	Wire Gauge AWG/mm^2	Terminal	Torque
Power Input Circuit	+ (P), – (N)	10 ~12AWG/3.5~5.5mm^2	M4 Screw	18 KG-CM
Braking Resistor	B1, B2			
Slave and Fault Circuit	M1, M2	20~18AWG/0.25~0.75mm^2 M1, M2, S1, S2 with shielded wires	M2 Screw	4 KG-CM
	S1, S2			
	RA, RB, RC			

Part Numbers: GS-2DBU, GS-4DBU

Dimensions



Note: For more information regarding brake units, please refer to the brake unit user manual GS3-DB-M

Braking Resistors

Braking resistors are used to increase the control torque of the AC Drive, for frequently repeated ON-OFF cycles of the AC Drive, or for decelerating a load with large inertia.

Braking Resistor Specifications								
Voltage Class	AC Drive Model	QTY	Braking Resistor Part Number	Motor HP	Braking Torque ED 10%	Type (Ohms)	Power (W)	Duty Cycle
230V	GS3-21P0	1	GS-21P0-BR-ENC	1	125%	200Ω	80	10%
	GS3-22P0	1	GS-22P0-BR-ENC	2	125%	100Ω	300	10%
	GS3-23P0	1	GS-23P0-BR-ENC	3	125%	70Ω	300	10%
	GS3-25P0	1	GS-25P0-BR-ENC	5	125%	40Ω	400	10%
	GS3-27P5	1	GS-27P5-BR-ENC	7.5	125%	30Ω	500	10%
	GS3-2010	1	GS-2010-BR-ENC	10	125%	20Ω	1000	10%
	GS3-2015	1	GS-2015-BR-ENC	15	125%	13.6Ω	2400	10%
	GS3-2020	1	GS-2020-BR-ENC	20	125%	10Ω	3000	10%
	GS3-2025	1	GS-2025-BR-ENC	25	125%	8Ω	4800	10%
	GS3-2030	1	GS-2030-BR-ENC	30	125%	6.8Ω	4800	10%
	GS3-2040	2	GS-2040-BR-ENC	40	125%	10Ω	3000	10%
	GS3-2050	2	GS-2050-BR-ENC	50	125%	8Ω	4800	10%
460V	GS3-41P0	1	GS-41P0-BR-ENC	1	125%	750Ω	80	10%
	GS3-42P0	1	GS-42P0-BR-ENC	2	125%	400Ω	300	10%
	GS3-43P0	1	GS-43P0-BR-ENC	3	125%	250Ω	300	10%
	GS3-45P0	1	GS-45P0-BR-ENC	5	125%	150Ω	400	10%
	GS3-47P5	1	GS-47P5-BR-ENC	7.5	125%	100Ω	500	10%
	GS3-4010	1	GS-4010-BR-ENC	10	125%	75Ω	1000	10%
	GS3-4015	1	GS-4015-BR-ENC	15	125%	50Ω	1000	10%
	GS3-4020	1	GS-4020-BR-ENC	20	125%	40Ω	1500	10%
	GS3-4025	1	GS-4025-BR-ENC	25	125%	32Ω	4800	10%
	GS3-4030	1	GS-4030-BR-ENC	30	125%	27.2Ω	4800	10%
	GS3-4040	1	GS-4040-BR-ENC	40	125%	20Ω	6000	10%
	GS3-4050	1	GS-4050-BR-ENC	50	125%	16Ω	9600	10%
	GS3-4060	1	GS-4060-BR-ENC	60	125%	13.6Ω	9600	10%
	GS3-4075	2	GS-4075-BR-ENC	75	125%	20Ω	6000	10%
	GS3-4100	2	GS-4100-BR-ENC	100	125%	13.6Ω	9600	10%

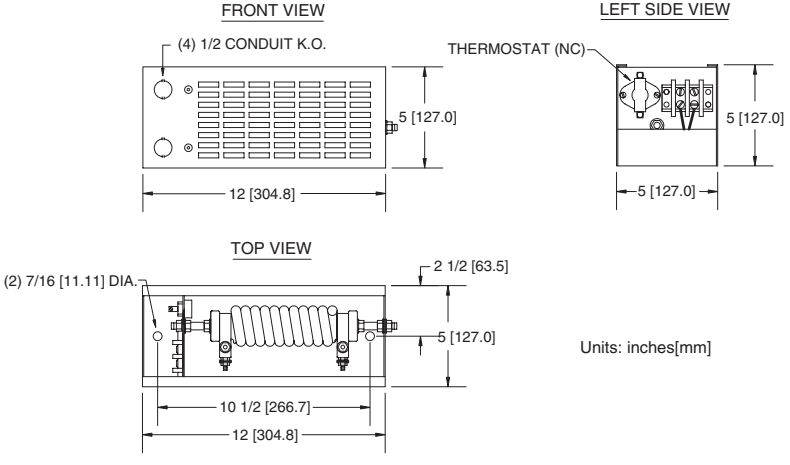
Note:For DURAPULSE drive models 20HP and above, a dynamic braking unit must be used in conjunction with the braking resistor, as shown in the Braking Units and Braking Resistors table earlier in this chapter. For additional information, please refer to the dynamic braking manual, GS3-DB-M

Braking Resistor Dimensions				
Voltage Class	AC Drive Model	Braking Resistor Part Number	Enclosure Type	Dimensions
230V	GS3-21P0	GS-21P0-BR-ENC	GCE1	Figure 1
	GS3-22P0	GS-22P0-BR-ENC	GCE1	
	GS3-23P0	GS-23P0-BR-ENC	GCE1	
	GS3-25P0	GS-25P0-BR-ENC	GCE1	
	GS3-27P5	GS-27P5-BR-ENC	GCE2	Figure 2
	GS3-2010	GS-2010-BR-ENC	GCE3	Figure 3
	GS3-2015	GS-2015-BR-ENC	GCE6	Figure 4
	GS3-2020	GS-2020-BR-ENC	GCE6	
	GS3-2025	GS-2025-BR-ENC	GCE9	Figure 5
	GS3-2030	GS-2030-BR-ENC	GCE9	
	GS3-2040	GS-2040-BR-ENC	(2) x GCE6	(2) x Figure 4
	GS3-2050	GS-2050-BR-ENC	(2) x GCE9	(2) x Figure 5
460V	GS3-41P0	GS-41P0-BR-ENC	GCE1	Figure 6
	GS3-42P0	GS-42P0-BR-ENC	GCE1	
	GS3-43P0	GS-43P0-BR-ENC	GCE1	
	GS3-45P0	GS-45P0-BR-ENC	GCE1	
	GS3-47P5	GS-47P5-BR-ENC	GCE2	Figure 7
	GS3-4010	GS-4010-BR-ENC	GCE3	Figure 8
	GS3-4015	GS-4015-BR-ENC	GCE3	
	GS3-4020	GS-4020-BR-ENC	GCE4	Figure 9
	GS3-4025	GS-4025-BR-ENC	GCE12	Figure 10
	GS3-4030	GS-4030-BR-ENC	GCE12	
	GS3-4040	GS-4040-BR-ENC	GCE12	
	GS3-4050	GS-4050-BR-ENC	GCE15	Figure 11
	GS3-4060	GS-4060-BR-ENC	GCE15	
	GS3-4075	GS-4075-BR-ENC	(2) x GCE12	(2) x Figure 10
	GS3-4100	GS-4100-BR-ENC	(2) x GCE15	(2) x Figure 11

Braking Resistor Dimensions

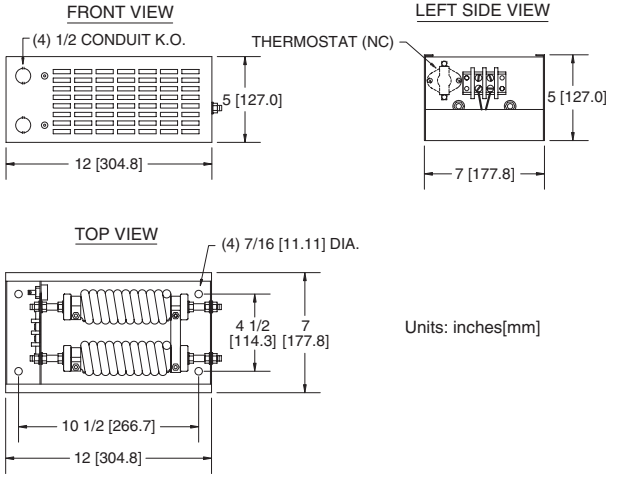
GS-21P0-BR-ENC, GS-22P0-BR-ENC, GS-23P0-BR-ENC, GS-25P0-BR-ENC

Figure 1



GS-27P5-BR-ENC

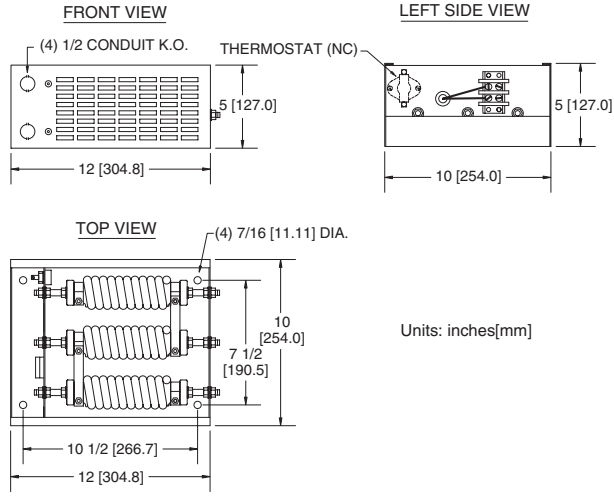
Figure 2



Dimensions, continued

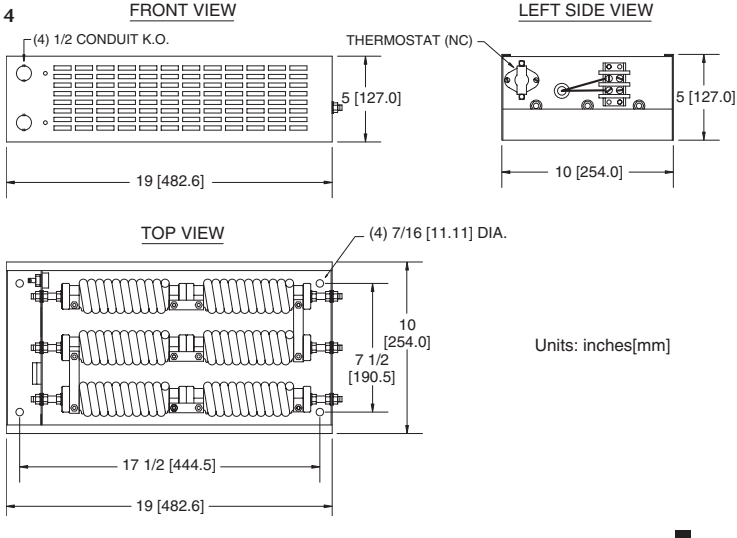
GS-2010-BR-ENC

Figure 3



GS-2015-BR-ENC, GS-2020-BR-ENC, GS-2040-BR-ENC = 2 units

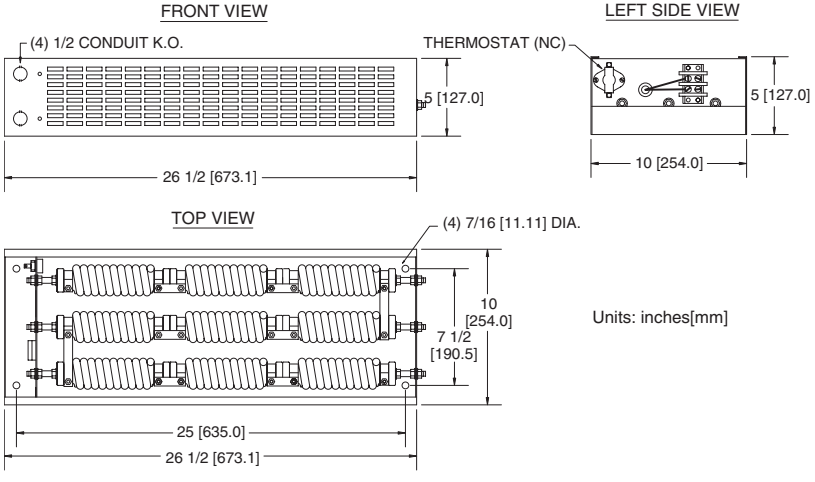
Figure 4



Dimensions (continued)

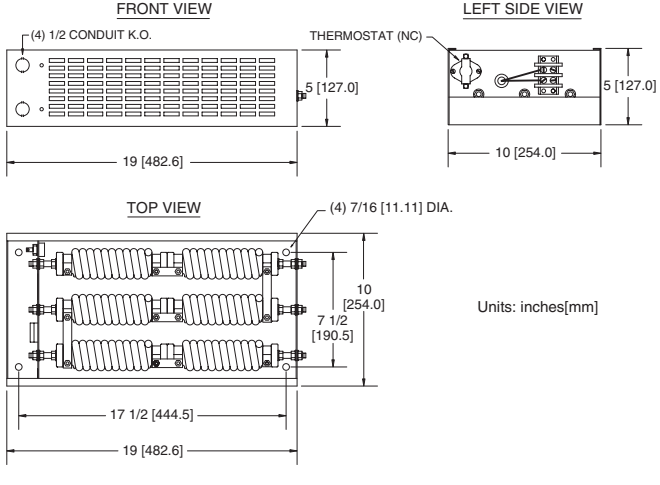
GS-2025-BR-ENC, GS-2030-BR-ENC, GS-2050-BR-ENC = 2 units

Figure 5



GS-41P0-BR-ENC, GS-42P0-BR-ENC, GS-43P0-BR-ENC, GS-45P0-BR-ENC

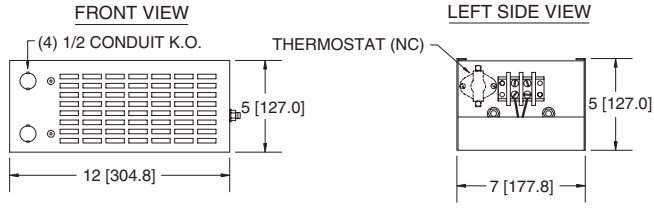
Figure 6

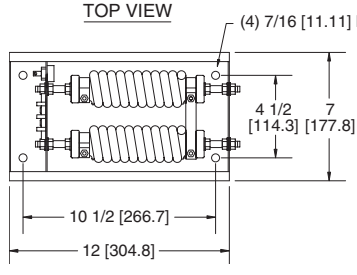


Dimensions (continued)

GS-47P5-BR-ENC

Figure 7

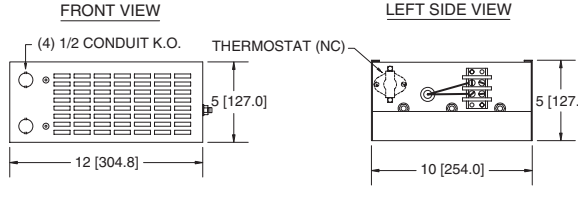


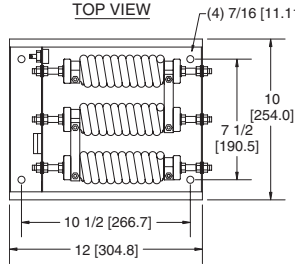


Units: inches[mm]

GS-4010-BR-ENC, GS-4015-BR-ENC

Figure 8



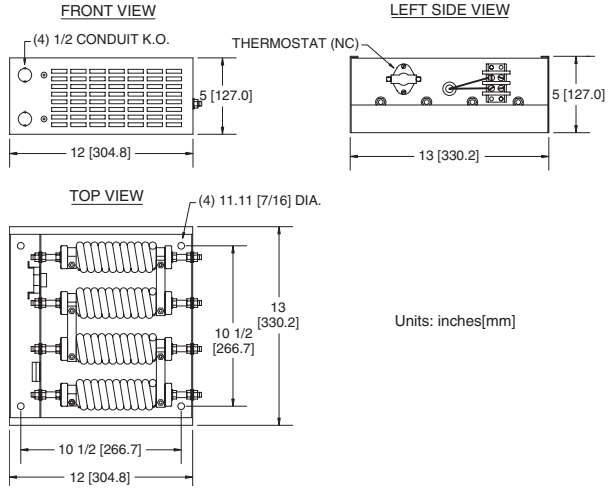


Units: inches[mm]

Dimensions (continued)

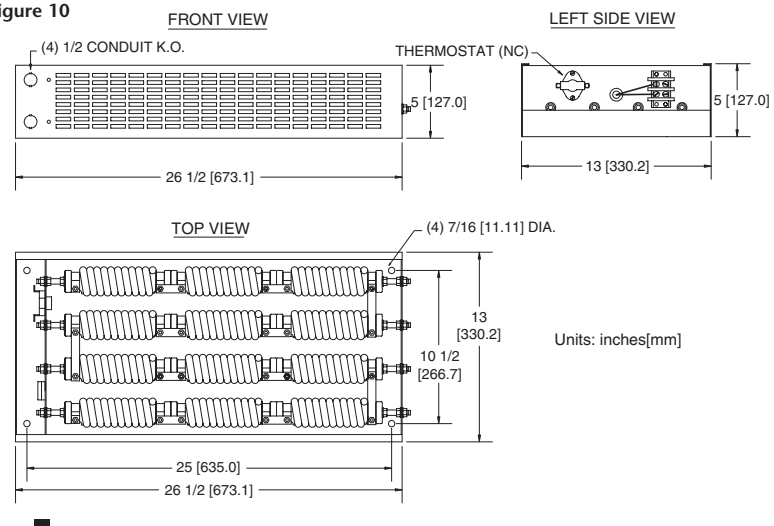
GS-4020-BR-ENC

Figure 9



GS-4025-BR-ENC, GS-4030-BR-ENC, GS-4040-BR-ENC, GS-4075-BR-ENC = 2 Units

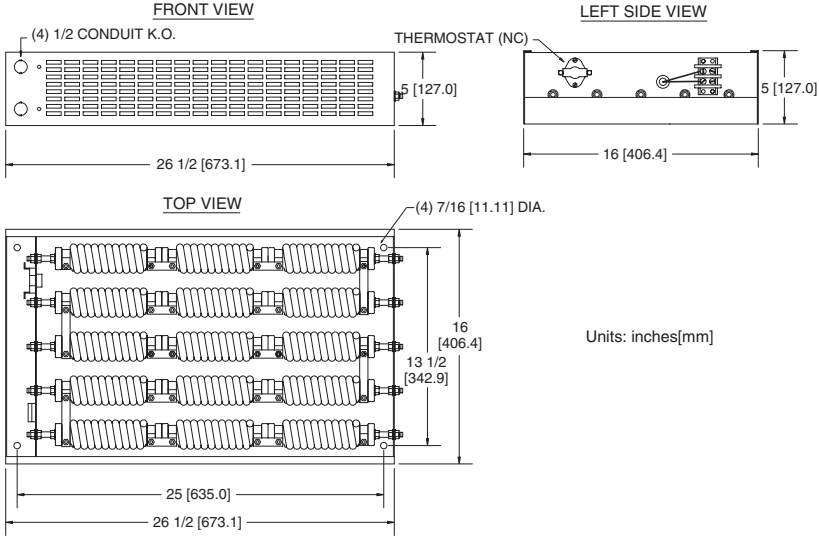
Figure 10



Dimensions (continued)

GS-4050-BR-ENC, GS-4060-BR-ENC, GS-4100-BR-ENC = 2 Units

Figure 11



EMI Input Filters

The EC Declaration of Conformity for the *DURAPULSE* AC Drives was completed in conjunction with EMI Filters listed below. Use the following table to specify the corresponding EMI Filter for each AC Drive model.

Note: CE compliance requires the use of EMI filters.

Specifications

EMI Input Filter Specifications			
AC Drive Model	**EMI Filter Model**	**Input Power Max Rating**	**Dimensions**
GS3-21P0	**10TDT1W4C**	250V, 3-phase, 10A	Figure 1
GS3-22P0			
GS3-23P0	**26TDT1W4C**	250V, 3-phase, 26A	Figure 2
GS3-25P0			
GS3-27P5	**50TDS4W4C**	250V, 3-phase, 50A	Figure 3
GS3-2010			
GS3-2015	**100TDS84C**	250V, 3-phase, 100A	Figure 4
GS3-2020			
GS3-2025	**150TDS84C**	250V, 3-phase, 150A	Figure 5
GS3-2030			
GS3-2040			
GS3-2050	**180TDS84C**	250V, 3-phase, 180A	Figure 6
GS3-41P0	**RF022B43AA**	480V, 3-phase, 5.9A	Figure 7
GS3-42P0			
GS3-43P0			
GS3-45P0	**RF037B43BA**	480V, 3-phase, 11.2A	Figure 8
GS3-47P5	**RF110B43CA**	480V, 3-phase, 25A	Figure 9
GS3-4010			
GS3-4015			
GS3-4020	**50TDS4W4C**	480V, 3-phase, 50A	Figure 10
GS3-4025			
GS3-4030	**100TDS84C**	480V, 3-phase, 100A	Figure 11
GS3-4040			
GS3-4050			
GS3-4060	**150TDS84C**	480V, 3-phase, 150A	Figure 12
GS3-4075	**200TDDS84C**	480V, 3-phase, 200A	Figure 13
GS3-4100			

EMI Input Filters Dimensions

Figure 1

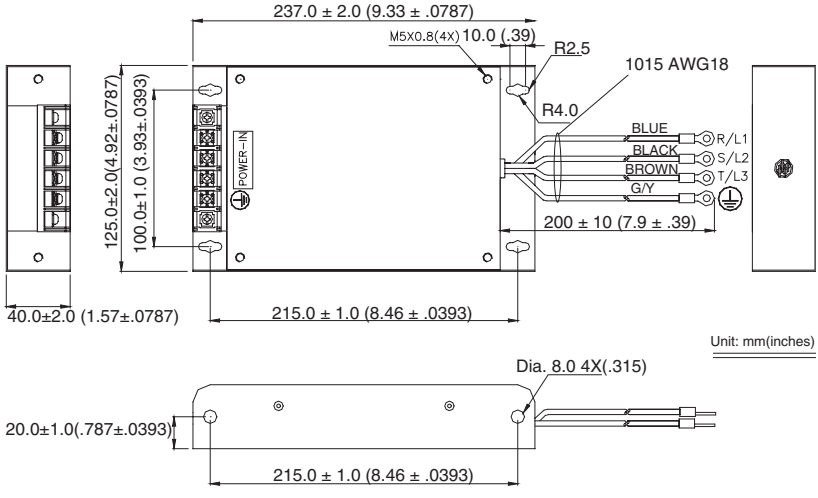


Figure 2

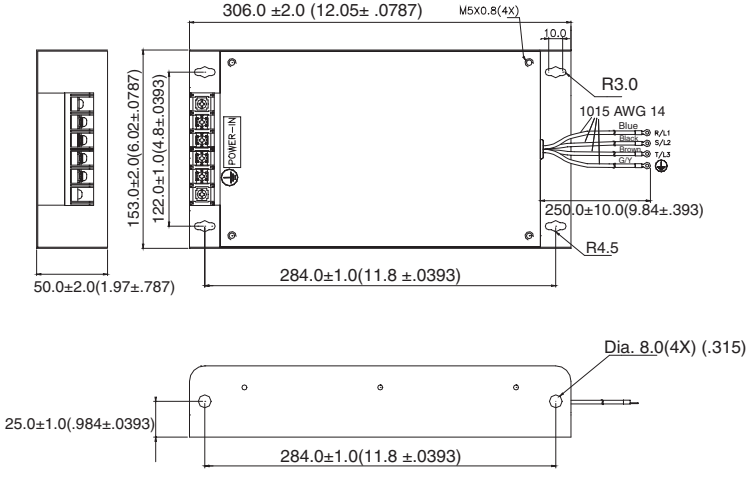


Figure 3

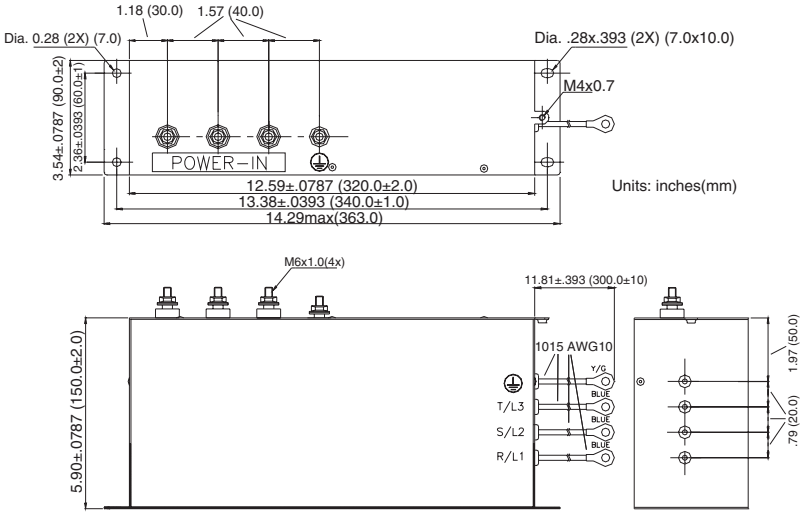


Figure 4

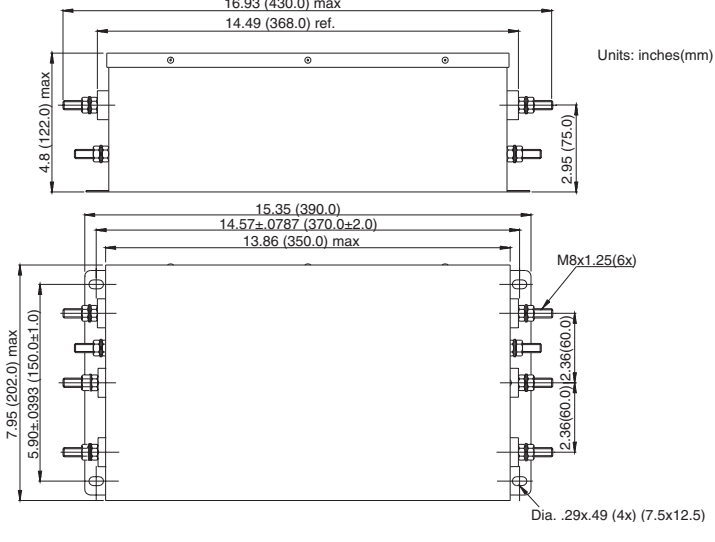


Figure 5

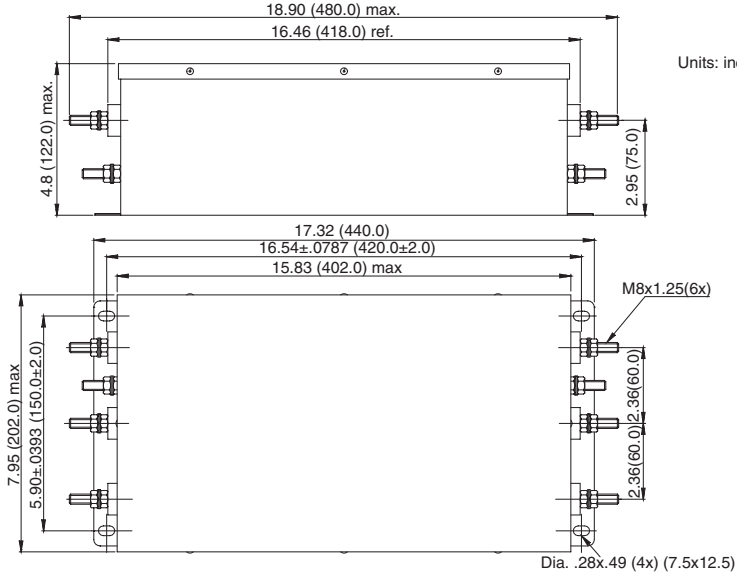
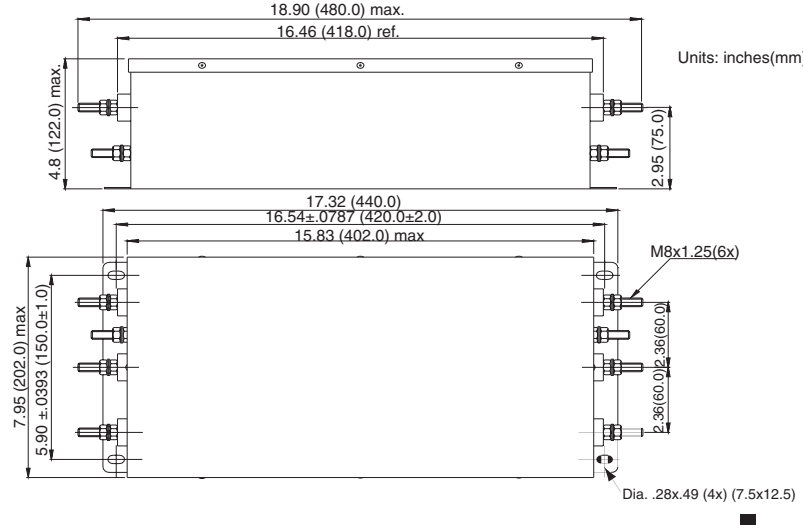


Figure 6



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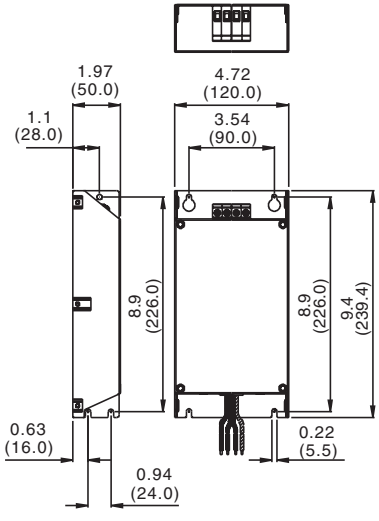
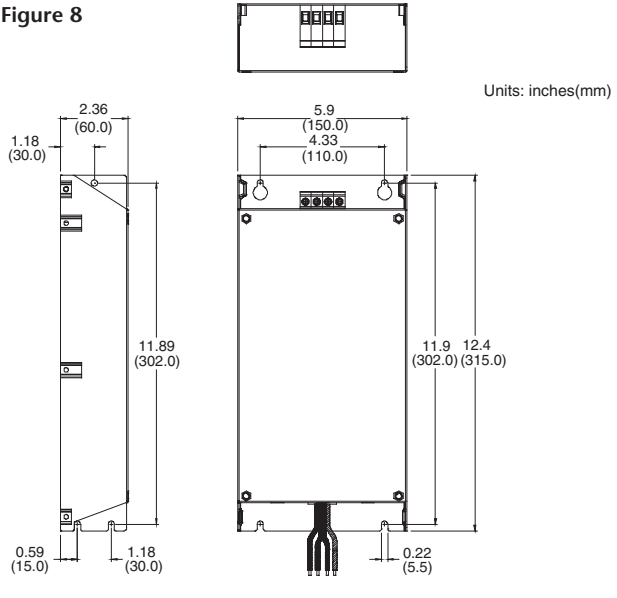


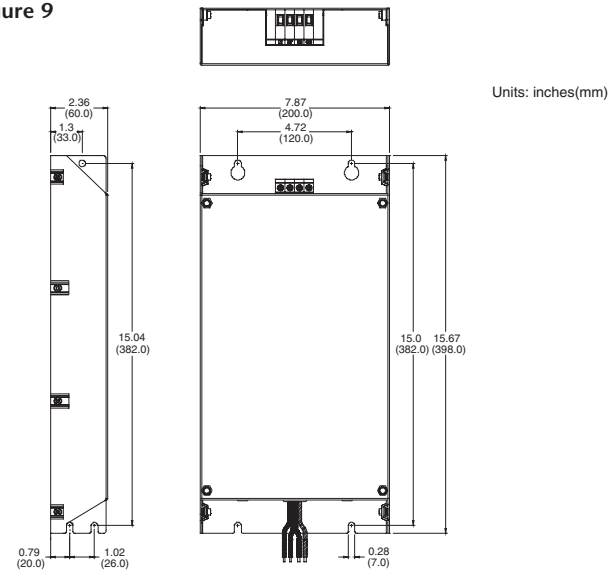
Units: inches(mm)

Figure 8



Units: inches(mm)

Figure 9



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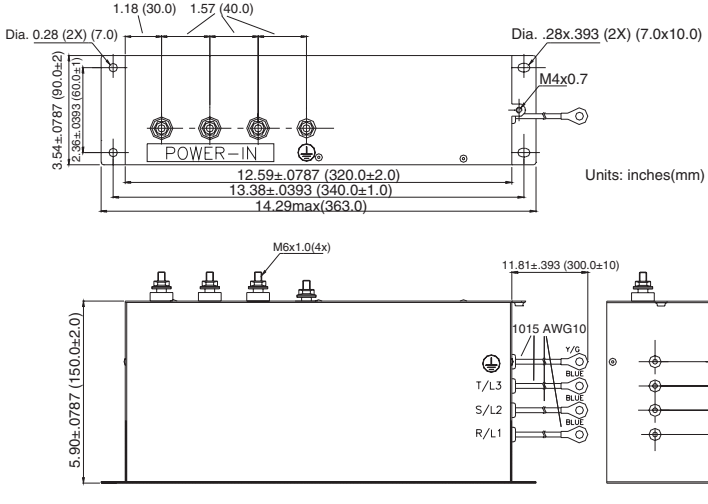


Figure 11

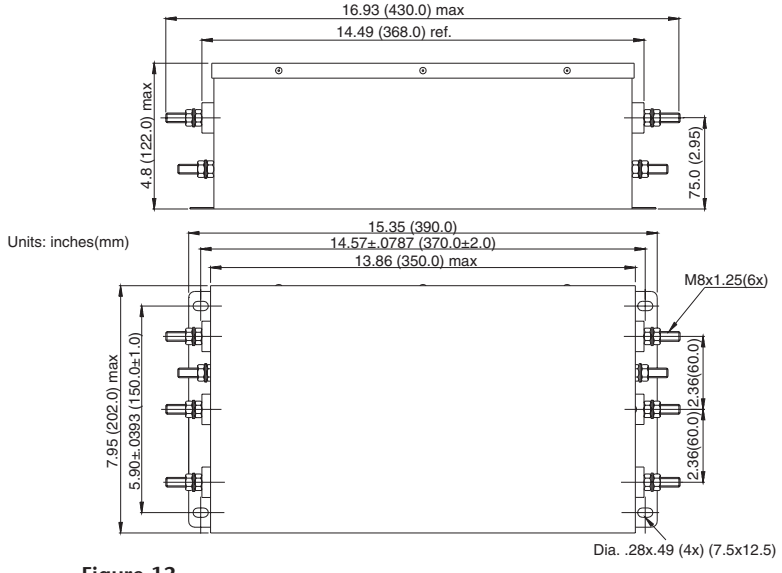


Figure 12

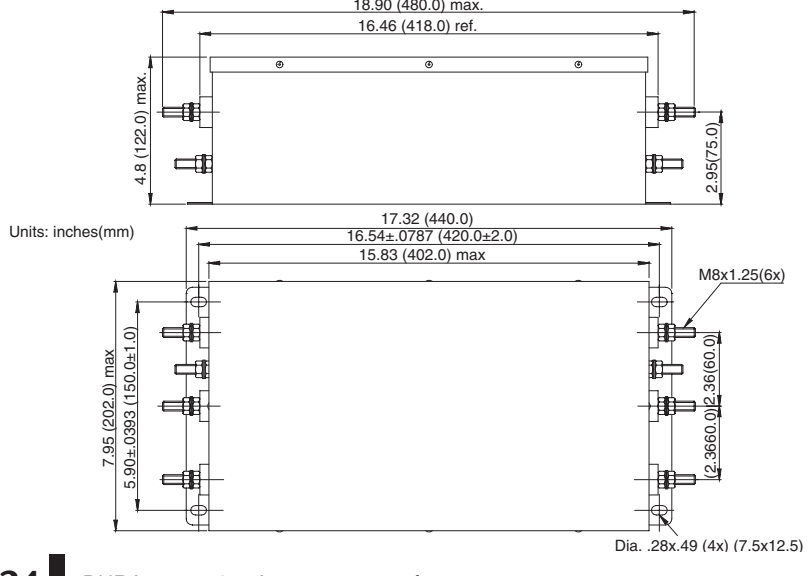
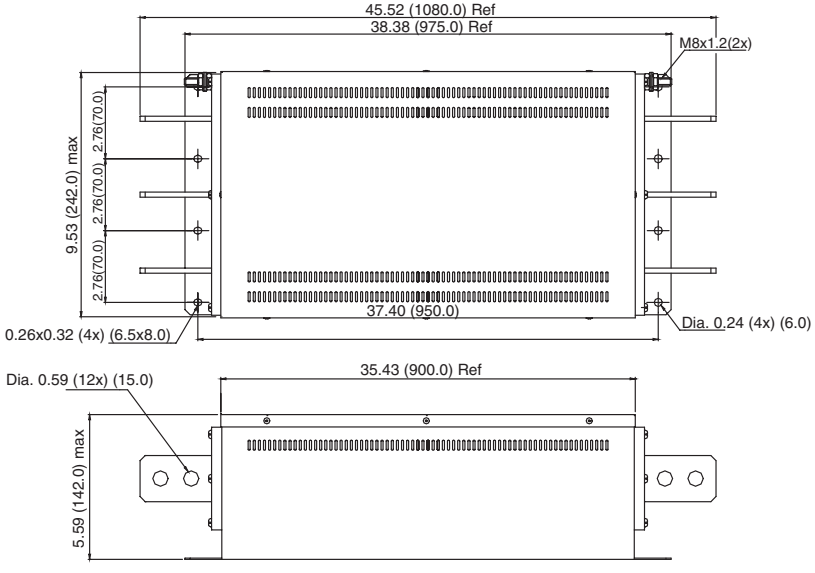
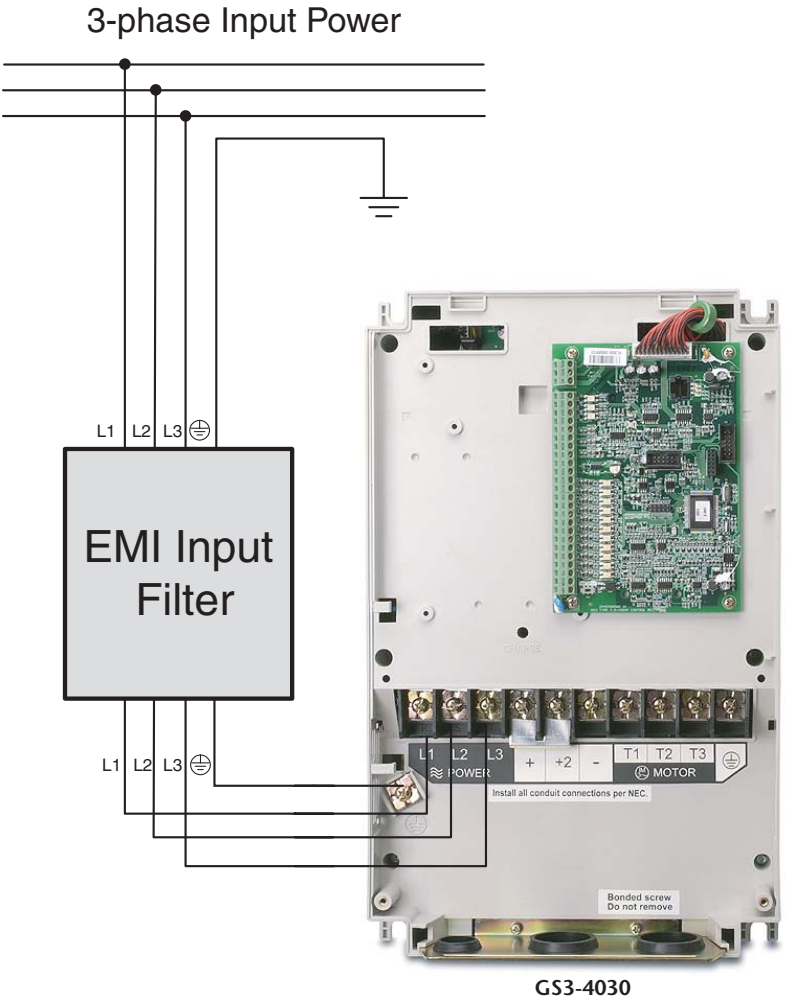


Figure 13


45.52 (1080.0) Ref
38.38 (975.0) Ref
M8x1.2(2x)
9.53 (242.0) max
2.76(70.0)
2.76(70.0)
2.76(70.0)
37.40 (950.0)
Dia. 0.24 (4x) (6.0)
0.26x0.32 (4x) (6.5x8.0)
Dia. 0.59 (12x) (15.0)
35.43 (900.0) Ref
5.59 (142.0) max

EMI Filter Connections



GS3-4030

Note: Distance of wires from filter to drive should be as short as possible.

Fuse Kits

Short-circuit and ground fault protection devices are essential to prevent costly damage to your AC Drive application equipment. Fuse kits are available from AutomationDirect for the *DURAPULSE* AC Drives, and their specifications are found below.

Warning: The fuse kits only provide protection for the semiconductor components inside the AC drive. Motor branch circuit overcurrent protection should be separately provided using applicable local codes.

The following fuse kits consist of one fuse block and fuses sized to match each *DURAPULSE* AC Drive. Replacement fuses are also available, and their part numbers are listed in the table below.

Fuse Kit Specifications						
Part Number	**Fuse Block**	**Wire Range**	**Fuse Type**	**Dimensions**	**Fuse Rating**	**Replacement Fuses**
GS-21P0-FKIT-3PH	Three-pole	Al/Cu #2-14	A3T	Figure 1	300V@20A	**GS-21P0-FUSE-3PH**
GS-22P0-FKIT-3PH	Three-pole				300V@25A	**GS-22P0-FUSE-3PH**
GS-23P0-FKIT-3PH	Three-pole				300V@40A	**GS-23P0-FUSE-3PH**
GS-25P0-FKIT	Three-pole				300V@60A	**GS-25P0-FUSE**
GS-27P5-FKIT	Three-pole	Al/Cu 2/0-#6		Figure 2	300V@100A	**GS-27P5-FUSE**
GS-2010-FKIT	Three-pole			Figure 3	300V@125A	**GS-2010-FUSE**
GS-2015-FKIT	Three-pole				300V@175A	**GS-2015-FUSE**
GS-2020-FKIT	Three-pole			Figure 4	300V@250A	**GS-2020-FUSE**
GS-2025-FKIT	Three-pole				300V@300A	**GS-2025-FUSE**
GS-2030-FKIT	Three-pole				300V@350A	**GS-2030-FUSE**
GS-2040-FKIT	Three-pole			Figure 5	300V@450A	**GS-2040-FUSE***
GS-2050-FKIT	Three-pole				300V@500A	**GS-2050-FUSE***
GS-41P0-FKIT	Three-pole	Al/Cu #2-14	A6T	Figure 6	600V@10A	**GS-41P0-FUSE**
GS-42P0-FKIT	Three-pole				600V@15A	**GS-42P0-FUSE**
GS-43P0-FKIT	Three-pole				600V@20A	**GS-43P0-FUSE**
GS-45P0-FKIT	Three-pole				600V@30A	**GS-45P0-FUSE**
GS-47P5-FKIT	Three-pole			Figure 7	600V@50A	**GS-47P5-FUSE**
GS-4010-FKIT	Three-pole	Al/Cu 2/0-#6		Figure 8	600V@70A	**GS-4010-FUSE**
GS-4015-FKIT	Three-pole				600V@90A	**GS-4015-FUSE**
GS-4020-FKIT	Three-pole			Figure 9	600V@125A	**GS-4020-FUSE**
GS-4025-FKIT	Three-pole				600V@150A	**GS-4025FUSE**
GS-4030-FKIT	Three-pole				600V@175A	**GS-4030-FUSE**
GS-4040-FKIT	Three-pole			Figure 10	600V@225A	**GS-4040-FUSE***
GS-4050-FKIT	Three-pole				600V@250A	**GS-4050-FUSE***
GS-4060-FKIT	Three-pole				600V@350A	**GS-4060-FUSE***
GS-4075-FKIT	Three-pole				600V@400A	**GS-4075-FUSE***
GS-4100-FKIT	Three-pole			Figure 11	600V@600A	**GS-4100-FUSE***

*** Three units required**

Fuse Kit Dimensions

Figure 1

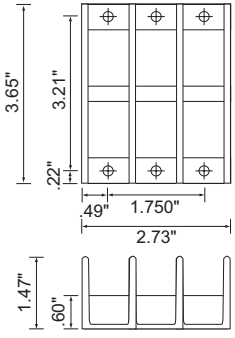


Figure 2

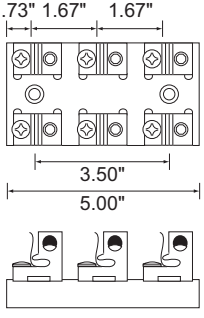


Figure 3

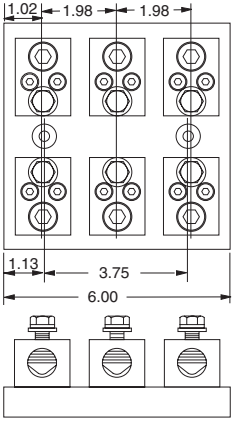


Figure 4

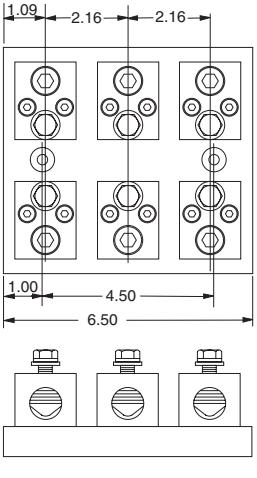


Figure 5

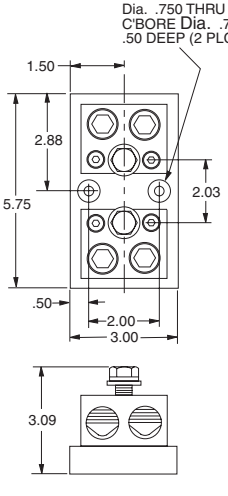
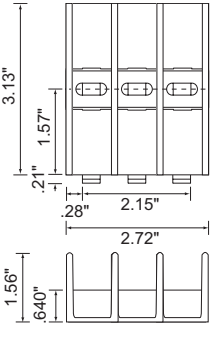


Figure 6



***Units = inches**

Fuse Kit Dimensions, continued

Figure 7

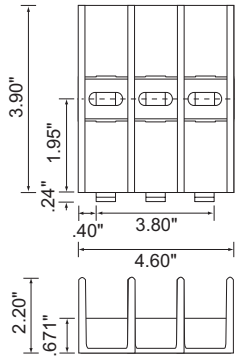


Figure 8

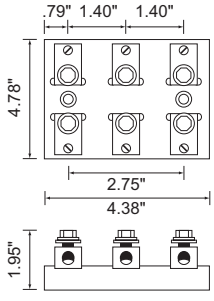


Figure 9

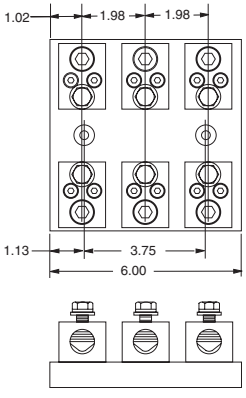


Figure 10

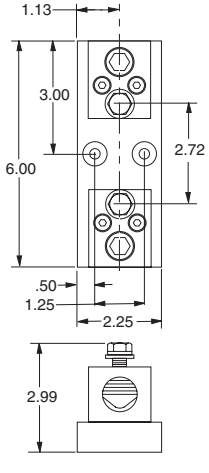
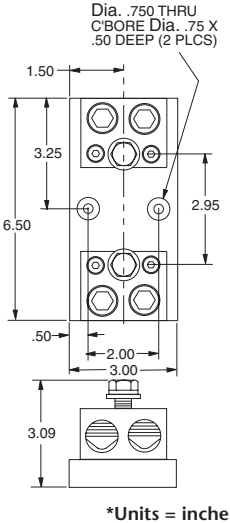


Figure 11

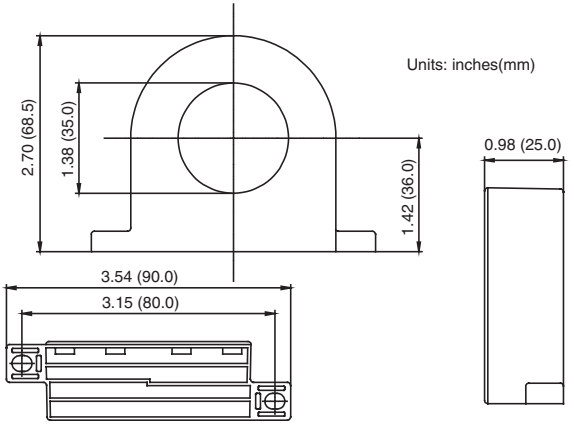


***Units = inches**

RF Filter, RF220X00A

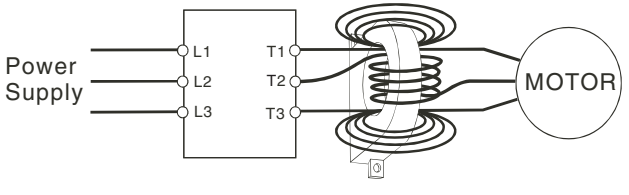
RF Filters are used to reduce the radio frequency interference or noise on the input or output side of the inverter. RF220X00A can be used with all GS model drives.

Dimensions

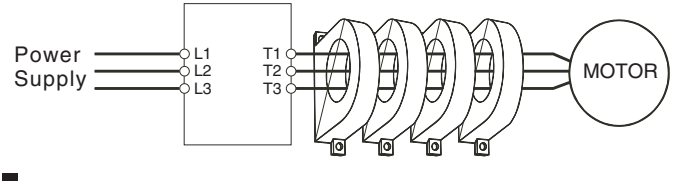


Wiring Method:

Wind each wire four times around the core. The RF filter must be located as close as possible to the output side of the inverter.



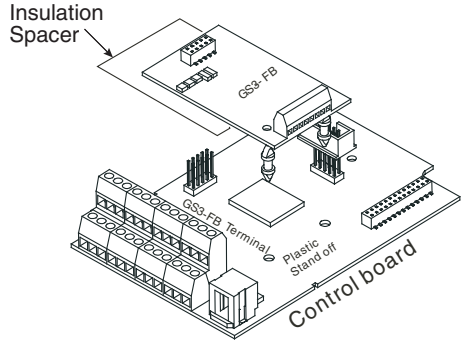
If you are unable to wire as shown above due to wire size, or another aspect of your application, put all wires through four cores in series without winding, as in the following diagram.



GS3-FB Feedback Card

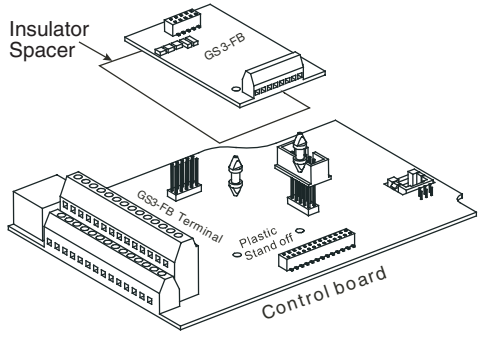
INSTALLATION

For 1 to 2HP
0.75kW to 1.5kW)
drives.



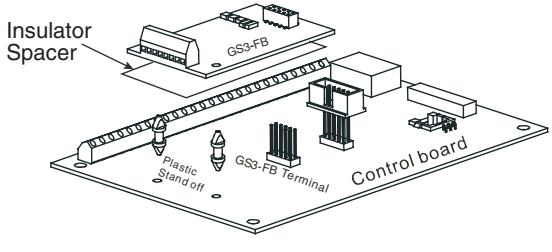
INSTALLATION

For 3 to 5HP
(2.2kW to 3.7kW)
drives



INSTALLATION

For drives 7.5HP
(5.5kW)
and above.



Note: Make sure GS3-FB card snaps firmly into board. If it is not properly installed, LEDs will not light upon power-up.

GS3-FB Terminal Descriptions Wiring Notes

Terminal Symbols	Descriptions
VP	Power source of GS3-FB (SW1 can be switched to 12V or 5V) Output Voltage: (+12VDC ±5% 200mA) or (+5VDC ±2% 400mA)
DCM	Power source (VP) and input signal (A, B) common
A, NOT A, B, NOT B	Input signal from Encoder. Input type is selected by SW2. Maximum 500KP/Sec
A/O, B/O	GS3-FB output signal for use with RPM Meter. (Open Collector) Maximum DC24V 100mA
COM	GS3-FB output signal (A/O, B/O) common.
PG	Pulse generator or Encoder.
IM 3~	3-Phase motor

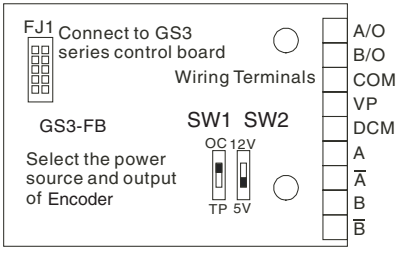
The control, power supply and motor leads must be laid separately. They must not be fed through the same cable conduit / trunking.

1. Please use a shield cable to prevent interference. Do not run control wire parallel to any high voltage AC power line (220 V and up).
2. Connect shielded wire to Ground only.
3. Recommended wire size for shielded cable: AWG24 to AWG18 (0.21 to 0.81mm^2)
4. Wire length:

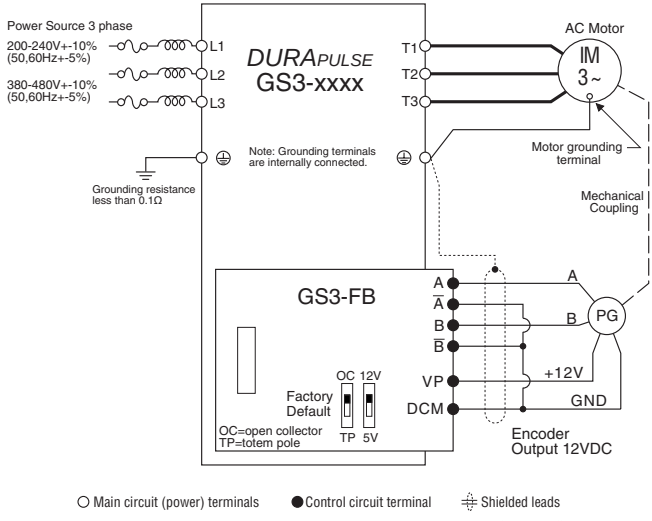
Types of Encoders	Maximum Wire Length	Wire Gauge at Maximum Wire Length
Output Voltage	165 Ft. (50m)	AWG16 (1.25mm^2) or larger
Open Collector	165 Ft. (50m)	
Line Driver	1000 Ft. (300m)	
Complimentary	230 Ft. (70m)	

Note: For additional installation information, please refer to instructions supplied with product.

Control Terminals Block Designations

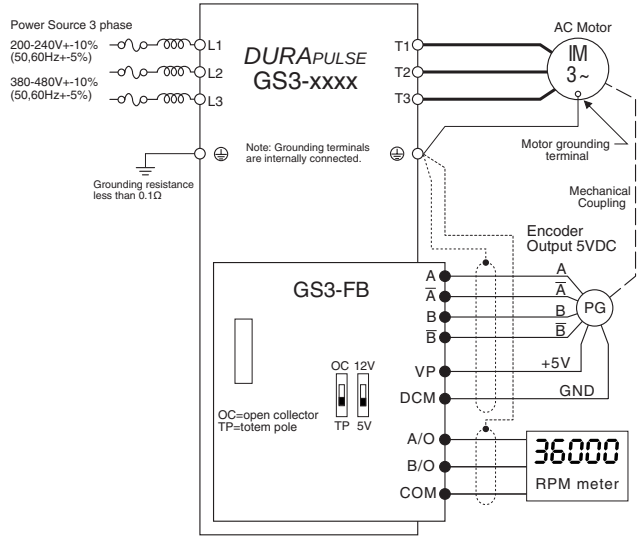


GS3-FB - Basic Wiring Diagram -Open Collector type Encoder



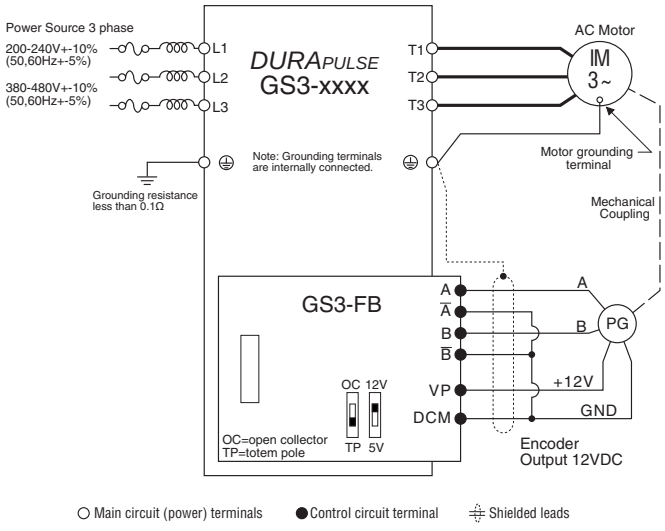
○ Main circuit (power) terminals ● Control circuit terminal ⏚ Shielded leads

GS3-FB Basic Wiring Diagram - Line Driver type Encoder with RPM Meter

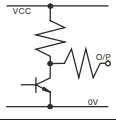
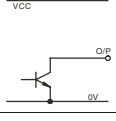
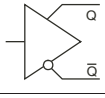
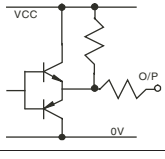


○ Main circuit (power) terminals ● Control circuit terminal ⏚ Shielded leads

GS3-FB Basic Wiring Diagram - Output Voltage or Complimentary type Encoder



Types of Encoders and Dip Switch Settings

Types of Encoders		SW1 and SW2 switches	
		5V	12V
Output Voltage			
Open collector			
Line driver			
Complimentary			

GS-EDRV Ethernet Interface

The GS-EDRV provides a high-performance Ethernet link between a control system and a *DuraPULSE* drive. It mounts on DIN rail and connects a drive to an Ethernet hub or PC. The GS-EDRV processes signals to and from the drive. It formats the signals to conform with the Ethernet standard to the H2-ERM or H4-ERM, KEPdirect EBC I/O server, or Independent controller with a MODBUS TCP/IP driver. This allows for great connectivity to many control system architectures.

The function of the interface is to:

- process input signals from the AC drive
- format the signals to conform to the Ethernet standard
- transmit the signals to the PC-based controller
- receive and translate output signals from the PLC/PC-based Control software
- distribute the output signals to the appropriate drive

The control function is not performed by the interface. The control function is performed by PC–based Control software (which is purchased separately) running on a PC.

GS-EDRV

GS Drive Configuration Software

GSoft is the configuration software for the Automation Direct GS family of drives. It is designed to allow you to connect a personal computer to drives in the GS family, and perform a variety of functions:

- Upload/download drive configurations
- Create new drive configurations using Quick Start, Detailed, or Schematic Views
- Edit drive configurations
- Archive/store multiple drive configurations on your PC
- Trend drive operation parameters
- Tune the drive PID loop
- View drive faults
- Print a schematic representation of the drive configuration

System Requirements

GSoft will run on PCs that meet the following requirements:

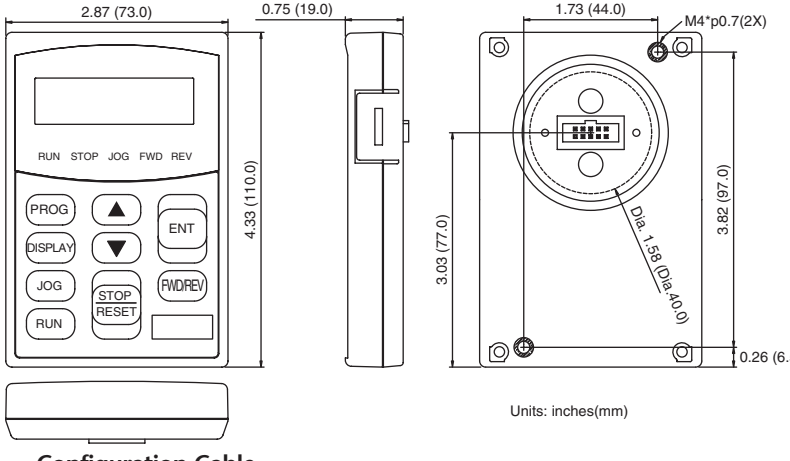
- Windows 95, 98, Me, NT, 2000, and XP
- Internet Explorer 4.0 or higher (for HTML help support)
- 24Mb of available memory
- 8 Mb hard drive space
- Available RS-232 serial port

Miscellaneous Accessories

Spare Keypad

GS3-KPD

Spare or replacement keypad for *DURAPULSE* AC drives



Units: inches(mm)

Configuration Cable

GS-232CBL

Required programming cable for GSOFT software

Keypad Cables

GS-CBL2-1L

1 meter keypad cable

GS-CBL2-3L

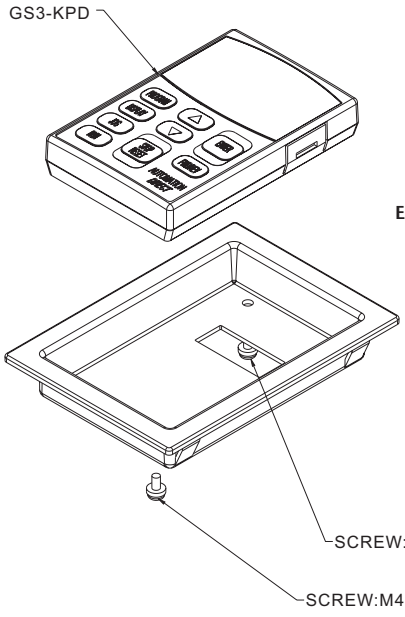
3 meter keypad cable

GS-CBL2-5L

5 meter keypad cable

Remote Panel Adapter, GS3-BZL

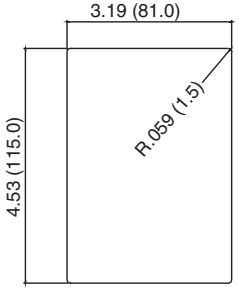
Mounting Instructions



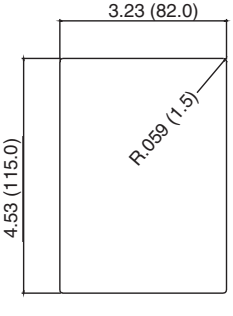
Enclosure rating: IP20

The thickness of the panel will determine required screw hole dimensions:

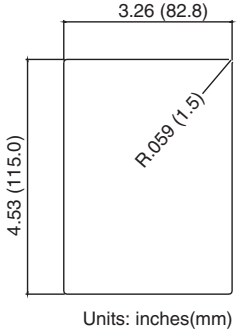
t = .0393 (1.0) - .0551 (1.4)



t = .629 (1.6) - .0787 (2.0)



t = .0866 (2.2) - .1181 (3.0)



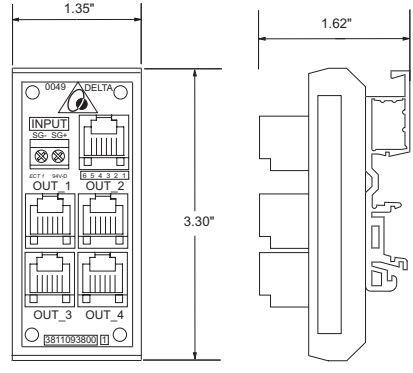
Units: inches(mm)

Communication Distribution Blocks

Using the RS-485 communication board (GS-RS485-4 or GS-RS485-8) provides an easy means to break out the RS-485 signal to several drives at one location. This is a star configuration, but the transmission errors are negligible, so this configuration is acceptable for proper operation of the VFDs.

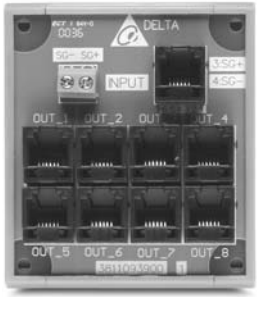
GS-RS485-4

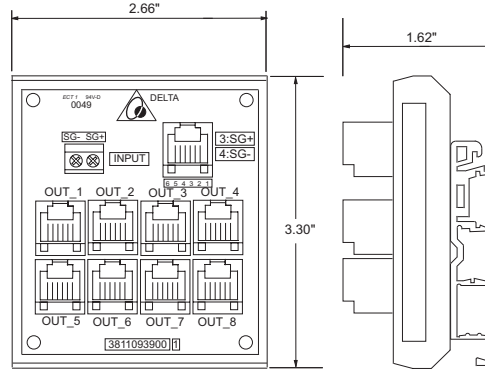
4 port RS485 Communication Distribution Block



GS-RS485-8

8 port RS485 Communication Distribution Block





Using *DURApulse* AC Drives with *Direct*LOGIC PLCs

Appendix B

In This Appendix

Compatible *Direct*LOGIC PLCs and Modules

The following tables show which *Direct*LOGIC PLCs and modules can be used with the *DURAPULSE* AC Drive.

DirectLOGIC PLC Modules for Use with *DURAPULSE* AC Drives	
DL05 PLCs	
D0-05AR	DL05 CPU, 8 AC in / 6 Relay out, 110/220VAC Power Supply. Inputs: 8 AC inputs, 90-120 VAC, 2 isolated commons. Outputs: 6 Relay outputs, 6-27 VDC, 6-240 VAC, 2A/pt. max., 2 isolated commons
D0-05DR	DL05 CPU, 8 DC in / 6 Relay out, 110/220VAC Power Supply. Inputs: 8 DC inputs, 12-24 VDC current sinking/sourcing, 2 isolated commons. Outputs: 6 Relay outputs, 6-27 VDC, 6-240 VAC, 2A/pt. max., 2 isolated commons
D0-05DD	DL05 CPU, 8 DC in / 6 DC out, 110/220VAC Power Supply. Inputs: 8 DC inputs, 12-24 VDC current sinking/sourcing, 2 isolated commons. Outputs: 6 DC outputs, 6-27 VDC current sinking, 1.0A/pt. max.
D0-05DD-D	DL05 CPU, 8 DC in / 6 DC out, 12/24VDC Power Supply. Inputs: 8 DC inputs, 12-24 VDC current sinking/sourcing, 2 isolated commons. Outputs: 6 DC outputs, 6-27 VDC current sinking, 1.0A/pt. max.
D0-05DR-D	DL05 CPU, 8 DC in / 6 Relay out, 12/24VDC Power Supply. Inputs: 8 DC inputs, 12-24 VDC current sinking/sourcing, 2 isolated commons. Outputs: 6 Relay outputs, 6-27 VDC, 6-240 VAC, 2A/pt. max., 2 isolated commons
DL06 PLCs	
D0-06DD1	DL06 CPU, 20 DC in / 16 DC out, 110/220VAC Power Supply, with 0.3A 24VDC Auxiliary Device Power Supply. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). Outputs: 16 DC outputs, 12-24 VDC current sinking, 1.0A/pt. max., 4 commons non-isolated (4 points per common)
D0-06DD2	DL06 CPU, 20 DC in / 16 DC out, 110/220VAC power supply, with 0.3A 24VDC auxiliary device power supply. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). Outputs: 16 DC outputs, 12-24 VDC current sourcing 1.0A/pt. max., 4 commons non-isolated (4 points per common).
D0-06DR	DL06 CPU, 20 DC in / 16 Relay out, 110/220VAC Power Supply, with 0.3A 24VDC Auxiliary Device Power Supply. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). Outputs: 16 Relay outputs, 6-27 VDC, 6-240 VAC, 2A/pt. max., 4 isolated commons (4 points per common)
D0-06AR	DL06 CPU, 16 AC in / 20 Relay out, 110/220VAC power supply, with 0.3A 24VDC auxiliary device power supply. Inputs: 20 AC inputs, 90-120 VAC, 5 isolated commons (4 inputs per common). Outputs: 16 Relay outputs, 6-27 VDC, 6-240 VAC, 2A/pt. max., 4 isolated commons (4 points per common)
D0-06DD1-D	DL06 CPU, 20 DC in / 16 DC out, 12/24VDC Power Supply. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). Outputs: 16 DC outputs, 12-24 VDC current sinking, 1.0A/pt. max., 4 commons non-isolated (4 points per common).
D0-06DD2-D	DL06 CPU, 20 DC in / 16 DC out, 12/24VDC power supply. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). Outputs: 16 DC outputs, 12-24 VDC current sourcing, 1.0A/pt. max., 4 commons non-isolated (4 points per common).
D0-06DR-D	DL06 CPU, 20 DC in / 16 Relay out, 110/220VAC Power Supply. Inputs: 20 DC inputs, 12-24 VDC current sinking/sourcing, 5 isolated commons (4 inputs per common). Outputs: 16 Relay outputs, 6-27 VDC, 6-240 VAC, 2A/pt. max., 4 isolated commons (4 points per common)
DL05/DL06 DC Input/Output Module	
D0-08CDD1	4 pt. 12-24VDC current sinking/sourcing input, 1 common, 4 pt. 12-24VDC sinking output, 0.3A/point, 1.2A/module, removable terminal, no fuse

*Direct*LOGIC PLC Modules for Use with *DURAPULSE* AC Drives (cont.)	
DL05/DL06 DC Output Module	
D0-10TD1	10 pt. 12-24 VDC current sinking output module, 2 commons non-isolated (5 pts. per common), 0.3A/point, 1.5A/common, removable terminal, no fuse
D0-10TD2	10 pt. 12-24 VDC current sourcing output module, 2 commons non-isolated (5 pts. per common), 0.3A/point, 1.5A/common, removable terminal, no fuse
D0-16TD1	16 pt. 12-24 VDC current sinking output module, 2 commons non-isolated (5 pts. per common), 0.3A/point, 1.5A/common, removable terminal, no fuse
D0-16TD2	16 pt. 12-24 VDC current sourcing output module, 2 commons non-isolated (5 pts. per common), 0.3A/point, 1.5A/common, removable terminal, no fuse. One pre-wired Ziplink cable (0.5 meter) and terminal block connector module required for this I/O module.
DL05/DL06 Analog Module	
F0-2AD2DA-2	2 channel in, 2 channel out voltage analog option card; 0-5V, 0-10V
F0-4AD2DA-2	4 channel in, 2 channel out voltage analog option card; 0-5V, 0-10V
F0-4AD2DA-1	4 channel in, 2 channel sourcing out current analog option card; 4-20mA
DL105 PLCs	
F1-130DR	DL130 CPU, 10 DC in / 8 Relay out, 110/220VAC Power Supply. Inputs: 10 DC inputs, 12-24 VDC current sinking/sourcing, 3 isolated commons. Outputs: 8 relay outputs, 12-30 VDC, 12-250VAC, 7A/pt. max., 4 isolated commons
F1-130DD	DL130 CPU, 10 DC in / 8 DC out, 110/220VAC Power Supply. Inputs: 10 DC inputs, 12-24 VDC current sinking/sourcing, 3 isolated commons. Outputs: 8 DC outputs, 5-30VDC current sinking, 0.5A/pt. max, 3 internally connected commons
F1-130DR-D	DL130 CPU, 10 DC in / 8 Relay out, 12/24VDC Power Supply. Inputs: 10 DC inputs, 12-24 VDC current sinking/sourcing, 3 isolated commons. Outputs: 8 relay outputs, 12-30 VDC, 12-250VAC, 7A/pt. max., 4 isolated commons
F1-130DD-D	DL130 CPU, 10 DC in / 8 DC out, 12/24VDC Power Supply. Inputs: 10 DC inputs, 12-24 VDC current sinking/sourcing, 3 isolated commons. Outputs: 8 DC outputs, 5-30VDC current sinking, 0.5A/pt. max, 3 internally connected commons
DL205 DC Output Module	
D2-08TD1	8 pt. 12-24 VDC current sinking output module, 1 common (2 common terminals), 0.3A/point, 2.4A/module, fused per common (non-replaceable), removable terminal
D2-08TD2	8 pt. 12-24 VDC current sourcing output module, 1 common (2 common terminals), 0.3A/point, 2.4A/module, fused per common (non-replaceable), removable terminal
D2-16TD1-2	16 pt. 12-24 VDC current sinking output module, 1 common (2 common terminals), 0.1A/point, 1.6A/module, no fuse, European type removable terminal
D2-16TD2-2	16 pt. 12-24 VDC current sourcing output module, 1 common (2 common terminals), 0.1A/point, 1.6A/module, no fuse, European type removable terminal
D2-32TD1	32 pt. 12-24 VDC current sinking output module. 1 common (4 common terminals), 0.1A/point, 3.2A/module, no fuse
D2-32TD2	32 pt. 12-24 VDC current sourcing output module, 4 commons (isolated), 0.1A/point, 3.2A/module, no fuse. Requires one connector, sold separately. NOTE: Recommended pre-wired Ziplink connector cable for this I/O Module is part number ZL-4CBL4#; where # designates either 0.5, 1, or 2 meter cable lengths. Accessory cable connector module for ZL-4CBL4# cable is part number ZL-CM40. (Or build a custom cable with D4-IO3264R, D4-IO3264S or D4-IOCBL-1.)

*Direct*LOGIC PLC Modules for Use with *DURAPULSE* AC Drives (cont.)	
DL205 Relay Output Modules	
D2-04TRS	4-pt. 5-30 VDC or 5-240 VAC isolated relay output module, 4 Form A (SPST) relays, 4 commons, 4A/point, 8.0A/module, replaceable fuse, removable terminal
D2-08TR	8-pt. 5-30 VDC or 5-240 VAC output module, 8 Form A (SPST) relays, 1 common (2 common terminals), 1A/point, 4.0A/module, replaceable fuse, removable terminal
F2-08TR	8-pt relay output, 10A/common, 5-30VDC or 5-240VAC
F2-08TRS	8-pt. 12-28 VDC or 12-240 VAC output module, 5 Form A (SPST) relays, 3 Form C (SPDT) relays, 8 isolated commons, 7A/point max., no fuses, removable terminal
D2-12TR	12 pt. 5-30 VDC or 5-240 VAC relay output module, 12 Form A (SPST) relays, 2 commons, 1.5A/point max., 3.0A/common, 2 replaceable fuses, removable terminal
DL205 DC Input/Output Modules	
D2-08CDR	4 pt. 24VDC sinking/sourcing input, 1 common, 4 pt. relay output, 1A/pt., 4A/module, 1 common, replaceable fuse
DL205 Analog Output Module	
F2-02DAS-1	2 channel, 16-bit resolution, Isolated 4-20mA sourcing (2 isolated commons). Designed to operate with 24 VDC user-supplied power supply
F2-02DAS-2	2 channel analog output, 16 bit resolution, isolated, range: 0-5V, 0-10V (2 isolated commons). Designed to operate with 24 VDC user-supplied power supply
F2-08DA-1	8 channel analog output module, 12 bit resolution, range: 4-20mA, sink or source output configurable. Designed to operate with 24 VDC user-supplied power supply.
F2-02DA-2	2 channel analog output module, 12 bit resolution, ranges: 0-5V, 0-10V, -5 to +5V, -10 to +10V. Designed to operate with 24 VDC user-supplied power supply.
F2-08DA-2	8 channel analog output module, 12 bit resolution, ranges: 0-5V, 0-10V. " Designed to operate with 24 VDC user-supplied power supply.
DL205 Analog Input Modules	
F2-04AD-2	4 channel, 12-bit, 0-5V, 0-10V, -5 to +5V, -10 to +10V.. Designed to operate with a 24VDC user supplied power supply
F2-08AD-2	8 channel, 12-bit, 0-5V, 0-10V, -5 to +5V, -10 to +10V.. Designed to operate with a 24VDC user supplied power supply

*Direct*LOGIC PLC Modules for Use with *DURAPULSE* AC Drives (cont.)	
DL305 Relay Output Modules	
D3-08TR	8 pt. 5-30 VDC or 5-220 VAC output module, 5A/point DC or 4A/point AC, 8 Form A relays (SPST), 2 commons (isolated), non-removable terminal, 2 user replaceable fuses
D3-16TR	16 pt. 5-30 VDC or 5-220 VAC output module, 2A/point,16 Form A relays (SPST), 2 commons (isolated), removable terminal, no internal fuses
DL305 Analog Output Modules	
F3-04DAS	4 channel isolated analog output module, 12 bit resolution, ranges: 0 to 5V, 0 to 10V, -5 to +5V, -10 to +10V, 4 to 20mA, 0 to 20mA. -750 to +750 VDC channel to channel isolation
F3-16AD	16 channel analog input module, 12 bit resolution, ranges: -5 to +5V, -10 to +10V, 0 to 10V, 0 to 20mA. Each point can be either a voltage or current input
DL305 Analog Output Modules	
F3-04DAS	4 channel isolated analog output module, 12 bit resolution, ranges: 0 to 5V, 0 to 10V, -5 to +5V, -10 to +10V, 4 to 20mA, 0 to 20mA. -750 to +750 VDC channel to channel isolation
DL405 DC Output Modules	
D4-08TD1	8 pt. 12-24 VDC current sinking output module, 2 commons (internally connected), 2A/point, 5A/common, removable terminal
D4-16TD1	16 pt. 5-24 VDC current sinking output module, 2 commons (internally connected), 0.5A/point, 3A/common, removable terminal
D4-16TD2	16 pt. 12-24 VDC current sourcing output module, 2 commons (isolated), 0.5A/point, 3A/common, removable terminal
D4-32TD1	32 pt. 5-24 VDC current sinking output module, 4 commons (isolated), 0.2A/point, 1.6A/common. Requires one connector, sold separately
D4-32TD2	32 pt. 12-24 VDC current sourcing output module, 4 commons (isolated), 0.2A/point, 1A/common. Requires one connector, sold separately.
DL405 Relay Output Modules	
D4-08TR	8 pt. 5-30 VDC or 5-250 VAC output module, 8 Form A (SPST) relays, 2 commons (isolated), 2A/point, 5A/common, removable terminal
F4-08TRS-1	8 pt. 12-30 VDC or 12-250 VAC isolated output module, 4 Form A (SPST) and 4 Form C (SPDT) relays, 8 commons (isolated), 10A/point, 40A/module, removable terminal
F4-08TRS-2	8 pt. 12-30 VDC or 12-250 VAC isolated output module, 4 Form A (SPST) relays and 4 Form C (SPDT) relays, 8 commons (isolated), 5A/point, 40A/module, replaceable fuses, removable terminals
D4-16TR	16 pt. 5-30 VDC or 5-250 VAC output module, 8 Form A (SPST) relays, 2 commons (isolated), 1A/point, 5A/common, removable terminals
DL405 Analog Input Modules	
F4-04ADS	4 channel isolated analog input module, 12 bit resolution, ranges: 0 - 5V, 0 - 10V, 1 - 5V, -5V to +5V, -10V to +10V, 0 - 20mA, 4 - 20mA
F4-08AD	8 channel analog input module, 12 bit resolution, ranges: 4 to 20mA, 1 to 5V, 0 to 20mA, 0 to 5V, 0 to 10V, -5V to +5V, -10V to +10V
F4-16AD-2	16 channel analog input module, 12 bit resolution, ranges: 0-5V, 0-10V
DL405 Analog Output Modules	
F4-04DAS-1	4 channel analog output module, 16 bit resolution, isolated, range: 4 to 20mA current sourcing
F4-04DAS-2	4 channel analog output module, 16 bit resolution, isolated, range: 0-5V, 0-10V
F4-08DA-2	8 channel analog output module, 12 bit resolution, range: 0-5V or 0-10V
F4-16DA-2	16 channel analog output module, 12 bit resolution, range: 0-5V or 0-10V

*Direct*LOGIC PLC Modules for Use with *DURAPULSE* AC Drives (cont.)	
Terminator I/O DC Output Modules	
T1K-08TD1	8 pt. 12-24 VDC current sinking output module, 4 points per common, 1.0A/point, 2 replaceable fuses (T1K-FUSE-1). (use with T1K-08B or T1K-08B-1 terminal base)
T1K-08TD2-1	8 pt. 12-24 VDC current sourcing output module, 4pts/common, 1.0A/point, 2 replaceable fuses (Use with T1K-08B or T1K-08B1 terminal base.)
T1K-16TD1	16 pt. 12-24 VDC current sinking output module, 4 points per common, 1.0A/point, 4 replaceable fuses (T1K-FUSE-1). (use with T1K-16B or T1K-16B-1 terminal base)
T1K-16TD2-1	16 pt. 12-24 VDC current sourcing output module, 4pts/common, 1.0A/point, 4 replaceable fuses. (Use with T1K-16B or T1K-16B-1 terminal base.) Note: Replaces T1K-16TD2 with improved derating. Not a direct replacement; simple device wiring change if used as replacement part for T1K-16TD2.
Terminator I/O Relay Output Modules	
T1K-08TR	8 pt. 5-30 VDC or 5-240 VAC output module, 8 Form A (SPST) relays, 4 points per common, 2.0A/point max., 2 replaceable fuses (T1K-FUSE-2). (use with T1K-08B or T1K-08B-1 terminal base)
T1K-16TR	16 pt. 5-30 VDC or 5-240 VAC output module, 16 Form A (SPST) relays, 4 points per common, 2.0A/point max., 4 replaceable fuses (T1K-FUSE-2). (use with T1K-16B or T1K-16B-1 terminal base)
T1K-08TRS	8 pt. 5-30 VDC or 5-240 VAC isolated relay output module, 8 Form A (SPST) relays, 1 point per common, 7.0A/point max., 8 replaceable fuses (T1K-FUSE-3). (isolation requires use of T1K-16B or T1K-16B-1 terminal base)
Terminator I/O Analog Input Modules	
T1F-08AD-2	8 channel analog input module, 14 bit resolution (13 bit plus sign bit), range: 0-5VDC, 0-10VDC, +/-5VDC, +/-10VDC (Use with T1K-08B or T1K-08B-1 terminal base.)
T1F-16AD-2	16 channel analog input module, 14 bit resolution (13 bit plus sign bit), range: 0-5VDC, 0-10VDC, +/-5VDC, +/-10VDC (use with T1K-16B or T1K-16B-1 terminal base.)
Terminator I/O Analog Output Modules	
T1F-08DA-1	8 channel analog output, 12 bit resolution, range: 0-20mA, 4-20mA (Use with T1K-08B or T1K-08B-1 terminal base.)
T1F-08DA-2	8 channel analog output, 12 bit resolution, range: 0-5VDC, 0-10VDC, +/-5VDC, +/-10VDC. (use with T1K-08B or T1K-08B-1 terminal base)
T1F-16DA-1	16 channel analog output, 12 bit resolution, range: 0-20mA, 4-20mA. (use with T1K-16B or T1K-16B-1 terminal base).
T1F-16DA-2	16 channel analog output, 12 bit resolution, range: 1-5VDC, 1-10VDC, +/-5VDC, +/-10VDC. (use with T1K-16B or T1K-16B-1 terminal base)
Terminator I/O Analog Input/Output Modules	
T1F-8AD4DA-1	8 channel analog input module and 4 channel analog output module. Inputs: 14 bit resolution (13 bit plus sign bit), range: -20 to 20mA, 0-20mA, 4-20mA. Outputs: 12 bit resolution, range:4-20mA, sinking or sourcing compatible. (use with T1K-08B or T1K-08B-1 terminal base)
T1F-8AD4DA-2	8 channel analog input module and 4 channel analog output module. Inputs: 14 bit resolution (13 bit plus sign bit), range: 0-5VDC, 0-10VDC, +/-5VDC, +/-10VDC. Outputs: 12 bit resolution, range: 0-5VDC, 0-10VDC, +/-5VDC, +/-10VDC. (use with T1K-08B or T1K-08B-1 terminal base)

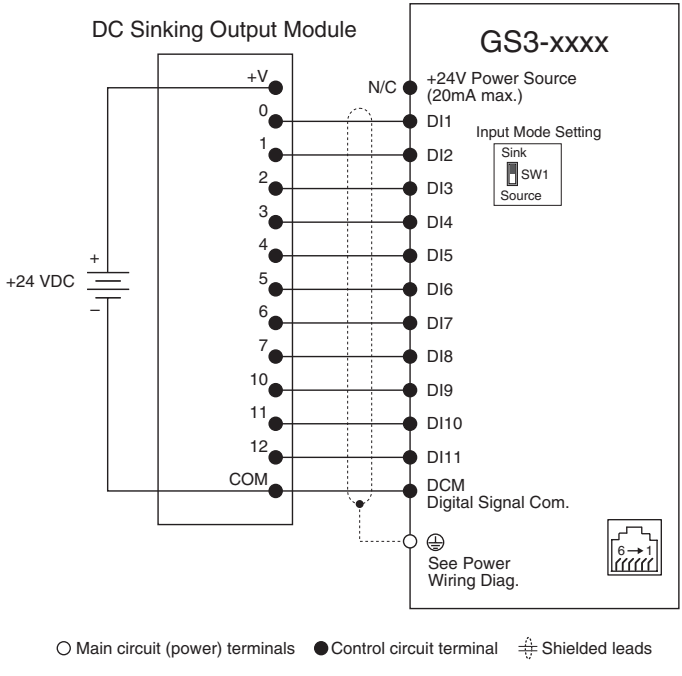
Typical Connections to the *DURAPULSE* AC Drive

The following drawings show some typical connections between the ***DURAPULSE*** AC Drive and ***Direct*LOGIC** PLCs and modules.

DC Sinking Output Modules

- D0-05DD
- D0-05DD-D
- D0-06DD1
- D0-06DD1-D
- D0-08CDD1
- D0-10TD1
- D0-16TD1
- F1-130DD
- F1-130DD-D
- D2-08TD1
- D2-16TD1-2
- D2-32TD1
- D4-08TD1
- D4-16TD1
- D4-32TD1
- T1K-08TD1
- T1K-16TD1

DC Voltage Supplied from PLC or external source:

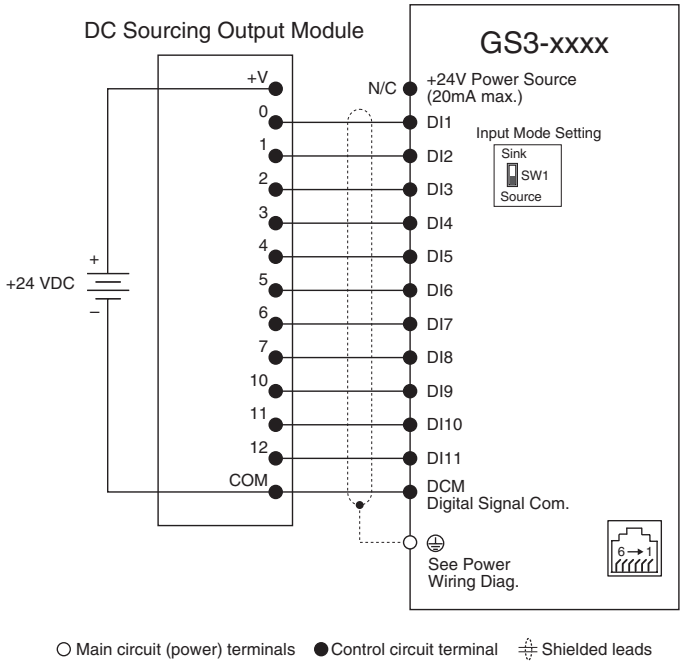


Note: Mode switch SW1 needs to be set to the "Sink" position.

DC Sourcing Output Modules

- D0-06DD2
- D0-06DD2-D
- D0-10TD2
- D0-16TD2
- D2-08TD2
- D2-16TD2
- D2-32TD2
- D4-08TD2
- D4-16TD2
- D4-32TD2
- T1K-08TD2-1
- T1K-16TD2-1

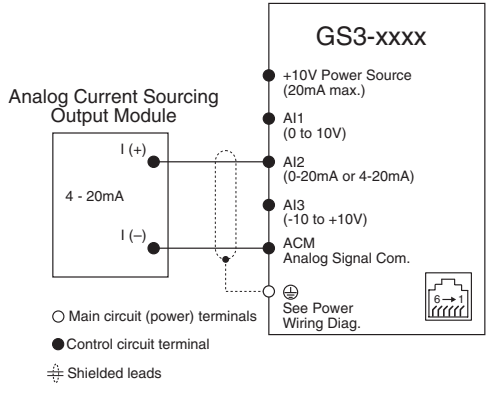
DC Voltage Supplied from PLC or external source:

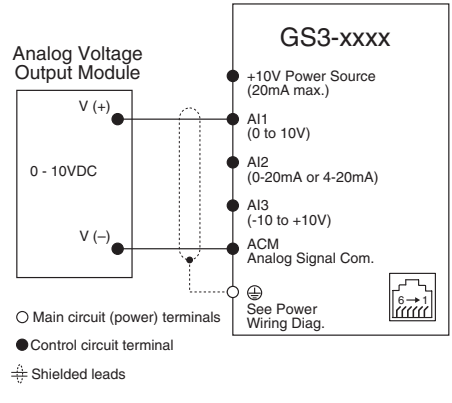


Note: Mode switch SW1 needs to be set to the "Source" position.

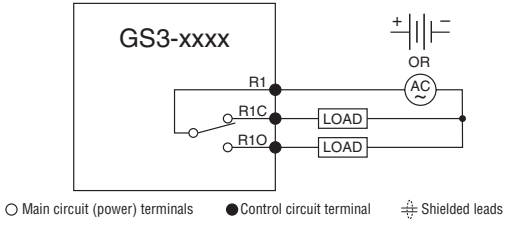
Voltage or Sourcing Current Analog Ouput Modules

- F0-2AD2DA-2
- F0-4AD2DA-1
- F0-4AD2DA-2
- F2-02DAS-1
- F2-02DAS-2
- F2-08DA-1
- F2-02DA-2
- F2-08DA-2
- F4-08DA-2
- F4-16DA-2
- F4-04DAS-1
- F4-04DAS-2
- T1F-08DA-2
- T1F-16DA-2
- T1F-8AD4DA-1
- T1F-8AD4DA-2

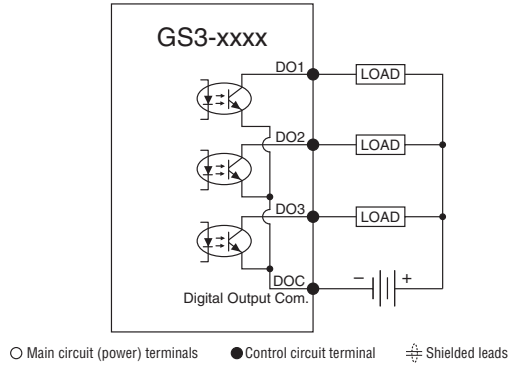




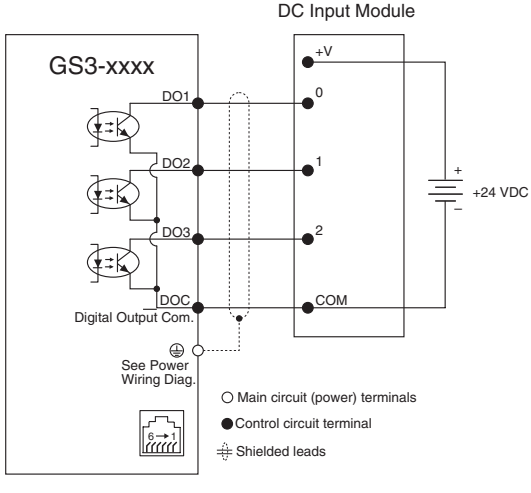
Relay Contact Output Terminal Wiring:



Digital Output Terminal Wiring:



PLC Input Module Wiring:



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