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GSD Series DC Drives Accessory

GSDA-DP-D PROGRAMMABLE DIGITAL CLOSED / OPEN LOOP MOTOR SPEED CONTROL SYSTEM FOR AC AND DC DRIVES User Manual

User Manual Number: GSDA-DP-D-User-M

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GSDA-DP-D Programmable Digital Motor Speed Control Manual Overview

Overview of this Publication

The IronHorse GSDA-DP-D manual describes the installation, configuration, and operation of the GSDA-DP-D programmable digital closed/open loop motor speed control system for AC and DC drives.

All information contained in this manual is intended to be correct. However, information and data in this manual are subject to change without notice. AutomationDirect (ADC) makes no warranty of any kind with regard to this information or data. Further, ADC is not responsible for any omissions or errors or consequential damage caused by the user of the product. ADC reserves the right to make manufacturing changes which may not be included in this manual.

Who Should Read This Data Sheet

This manual contains important information for those who will install, maintain, and/or operate the GSDA-DP-D motor speed control unit.

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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).*

IronHorse GSDA-DP-D Motor Speed Control General Information

The GSDA-DP-D motor speed control is a compact, microprocessor-based unit capable of being either field or factory configured for a number of motion control needs. The control is designed around a velocity form PID algorithm, and provides a DC speedpot signal to an external drive. A flexible open-loop mode is also available for applications where using a speed pickup is not practical or desired. The GSDA-DP-D is easily configured to operate as a digital speed controller, time-based process controller, or as a ratiometric follower controller in master-slave systems. Featuring a modular bus expansion slot architecture, it is ideal for volume OEM adjustable speed control applications requiring specialized inputs and outputs. The unique modular expandability makes the GSDA-DP-D ideal for applications such as:

- Water and Waste Treatment Systems
- Conveyor Oven Controllers
- Synchronized Conveyor Lines

The GSDA-DP-D durable 1/8 DIN NEMA 4/4X aluminum housing can be easily mounted in a panel or control cabinet.

Carefully check the unit for shipping damage. Report any damage to the carrier immediately. Do not attempt to operate the speed control unit if visible damage is evident to either the housing or to the electronic components.

Standard Features

- Microprocessor-based design allows for incredible flexibility to suit your process control needs.
- Modular-bus expansion makes it possible to accomodate a wide variety of I/O.
- Digital closed-loop algorithm ensures accuracy of plus or minus 1/2 RPM of set speed or equivalent.
- Digital open-loop operation available, where a speed pickup is impractical or undesired.
- Non-volatile memory stores settings without batteries, even when power has been removed.
- Factory or field programmable via front-panel keypad.
- Many adjustable settings include min, max, accel, decel, display options, alarm options, and more.
- Internal program-enable jumper selectively prevents tampering with unit's configuration.
- Universal power supply accepts line voltages inputs from 85-265VAC @ 50-60Hz without switches or jumpers. The unit automatically adjusts as needed.
- Input power transient voltage protection prolongs the unit's life in harsh industrial environments.
- Flexible user inputs support Inhibit, Emergency-Stop, and Jog functionality.
- Speed pickup input compatible with a variety of signal input types including: Hall-effect pickups, photoelectric, TTL, etc. Note: Open collector devices must be capable of sinking at least 3mA.
- Self-contained power supply for external speed pickups, limited to 5V @ 50mA.
- One programmable alarm output with Form C contacts. A second alarm output available on the GSDA-AI-A8 if installed.
- 1/8 DIN durable aluminum housing for panel mounting.
- Large 4-digit, 1/2" LED display, with user-settable decimal point (colon displayed in Time mode).
- Polycarbonate membrane and gasket (included) meet NEMA 4X standards when used with NEMA 4X enclosures.
- Wide operating ambient temperature range of -10 °C to 45 °C (14 °F to 113 °F).
- Multiple operating modes are available in closed-loop operation, including:
  - Master, Rate Mode – Controls in time unit such as HH:MM, MM:SS, SS:TT, or other unit.
  - Time Mode – Displays in time units such as HH:MM, MM:SS, SS:TT, or other units.
  - Follower Mode – Controls in percentage of master rate. This mode allows the control to precisely follow the actions of a master process.

Specifications

GSDA-DP-D – Specifications		
Electrical	***Line Input Voltage***	85–265 VAC
	Line Input Frequency	48–62 Hz
	Signal Input Voltage Range	5VDC to 24VDC (square wave, referenced to P1-6 COMMON)
	Speed Pickup Input Frequency Range (S1 and S2 Inputs)	0 – 600,000 pulses per minute @ 5V square wave
	Display Range	0.001 – 9,999
	Units of Operation	User programmable, any unit
	Sensor / Pickup Power Supply	5V @ 50mA
	Isolated Alarm Relay Output Rating	250VAC @ 5A
	Input Voltage Span Minimum / Maximum	2VDC / 24VDC
	Potentiometer "Wiper" Output Voltage Span*	Input Voltage Span minus 100mVDC
Mechanical	***Display Type***	LED, Red, 4-Digit, 1/2 inch Height
	Housing Type (with supplied gasket in NEMA 4X panel)	1/8 DIN NEMA 4X
	Connector Style	12-position 5mm European Style
	Terminal Block Torque Setting	4.4 lb·in max [0.5 N·m]
	Faceplate Material	Polycarbonate with polycarbonate overlay
	Housing Material	Aluminum
	Weight	15.30 oz [433.86g]
Environmental	***Operating Temperature Range***	-10 °C to 45 °C [14 °F to 113 °F]
	Operating Humidity Range	95% non-condensing
* Example: Input Voltage Span = 12VDC (0 to 12 VDC Range), Pot Wiper Output Voltage Span = 11.9VDC, (0VDC +50mVDC offset = 0.05VDC) to (12VDC – 50mVDC = 11.95VDC) = (11.95VDC – 0.05VDC = 11.90VDC)		

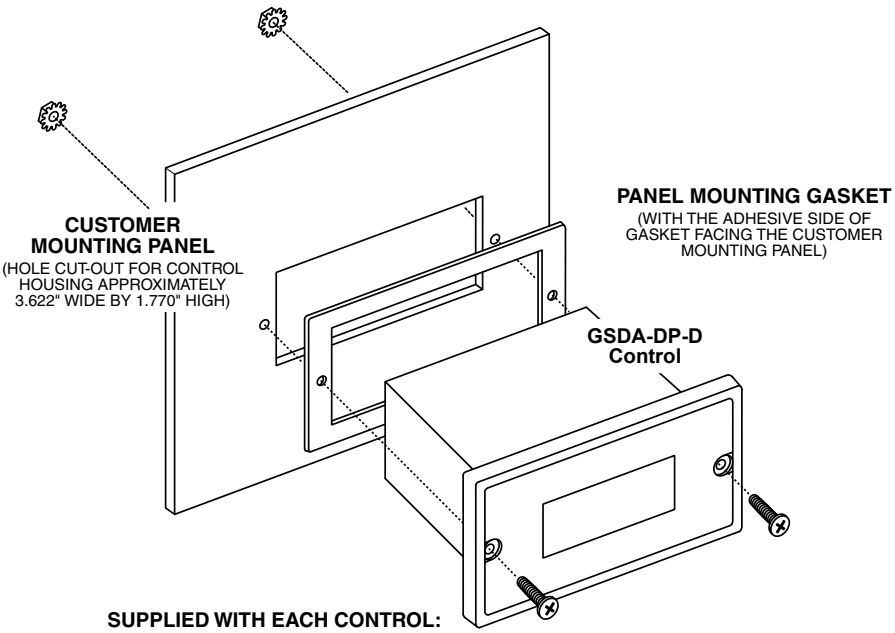
Available Accessories

Recommended Accessory	***Description***	***Pulses per Revolution***
GSDA-PU2E/PU2R	Hall-Effect Pickup, Single Channel	1 / 10 / 20
GSDA-AI-A8	Input/Output option card	-
GSDA-CM-8	Serial communications/Analog Input option card	-

Mechanical Installation

Do not mount GSDA-DP-D digital potentiometer where ambient temperature is outside the range of -10 to 45 °C (14 to 113 °F).

Panel Mounting

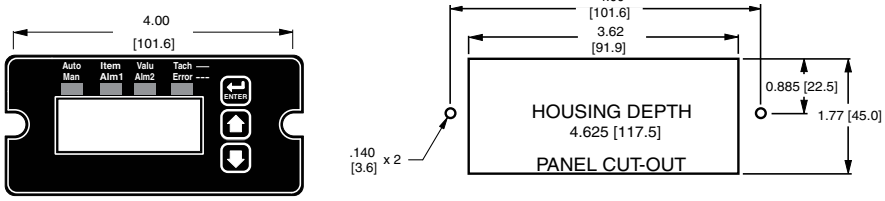


SUPPLIED WITH EACH CONTROL:

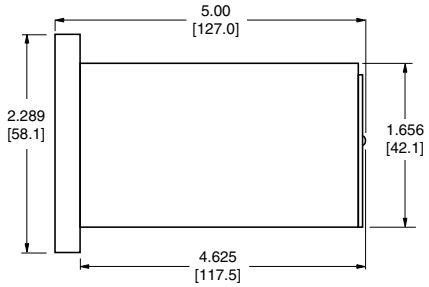
1) GASKET
2) (2) 6-32 X 3/4 PANHEAD BLACK OXIDE STAINLESS SCREWS
3) (2) #6 NUT WITH LOCKWASHER

Cut-out and Mounting Dimensions

Dimensions (in [mm])



GSDA-DP-D Dimensions



GSDA-PU2E and GSDA-PU2R Pickup Installation (Required for Closed-Loop Only)

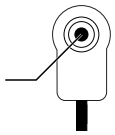
The GSDA-PU2E and GSDA-PU2R pickups are an economical way to monitor motor speed. The GSDA-PU2E is designed for indoor use and the GSDA-PU2R for wash down or outdoor use. Both provide one, ten or twenty pulses per revolution.

Their design provides for ease of installation in otherwise difficult to reach areas. They operate from a +5V power supply, producing a 5 volt square wave whose frequency is proportional to speed. This signal is fed into the GSDA-DP-D speed control as a speed or position reference for the microprocessor.

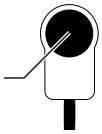
Caution: The GSDA-PU2E/GSDA-PU2R cable should not be grouped with other wires or cables. For applications with GSDA-PU2E/GSDA-PU2R wire over 6 feet long, or noisy environments, a shielded cable is recommended. Connect the shield to the common terminal on the GSDA-DP-D. Leave the shield on the GSDA-PU2E/GSDA-PU2R end floating.

Step 1 Tap motor shaft end for 10-32 screw, 1/2" deep

Step 2 Remove cap from screw



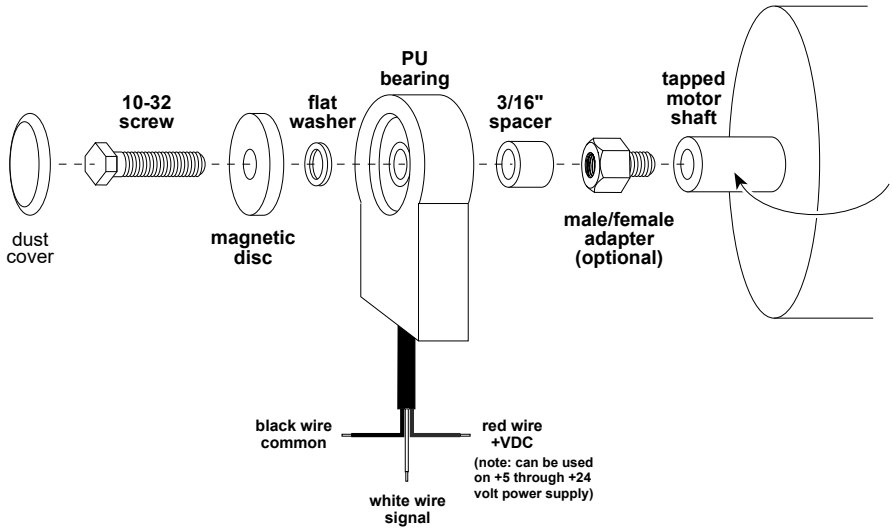
Step 3 Remove black dust cover



Step 4 Install and tighten PU assembly

Step 5 Secure black cover onto housing

- No other screws are necessary, as the cord will keep the unit from rotating.
- The PU gives a high signal when the North Pole in the magnet crosses the hall-effect transistor. The signal is switched off when the South Pole crosses the hall-effect transistor. The result is a square wave whose frequency is proportional to the speed of the shaft on which the PU is mounted. The number of North/South Pole pairs directly affects the output.



The following Ironhorse, MTPM motors are drilled and tapped 10-32 for use with these encoders: MTPM-P75-1L18 & 1M18, MTPM-001-1L18 & 1M18, MTPM-1P5-1L18 & 1M18, MTPM-002-1M18

Note: All other Ironhorse, MTPM, TENV motors are NOT drilled and tapped for use with encoders.

GSDA-PU2x Parts List

(1) PU sensor body with 6' cord and dust cap

(1) Magnetic disc[1] (#2, 1PPR)

(1) Magnetic disc[1] (#20, 10PPR)

(1) Magnetic disc[1] (#40, 20PPR) (installed)

(1) 3/16" spacer

(1) male/female adapter[2]

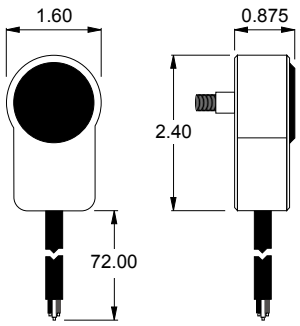
(1) Flat washer

(1) 10-32 screw[3,4]

NOTES:

1. Magnetic discs are included with the kit and are NOT available separately.
2. Use of the threaded adapter is optional, depending on the distance between the end of the motor shaft and the fan shroud. If the supplied 10-32 screw and 3/16" spacer are insufficient in length to bridge that gap, the threaded adapter should be used in addition to the screw and spacer.
3. Torque 10-32 screw to 10-12 in-lbs.
4. Use thread locker on 10-32 threaded connection

DIMENSIONS



WIRING

Refer to the following wiring diagrams for proper connection of DC Voltage, Armature, and Electrical Wiring

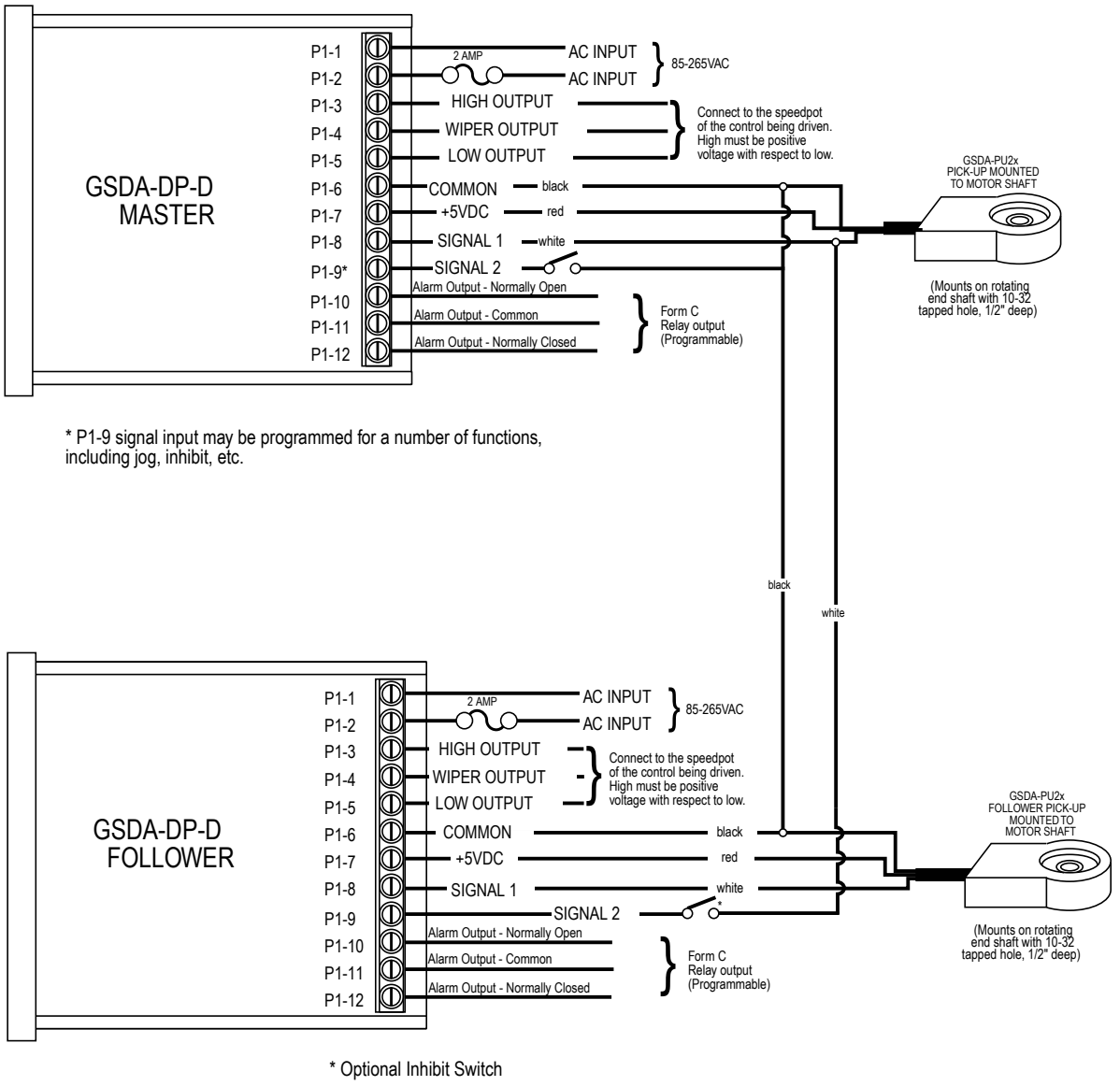
SIZE ALL WIRES THAT CARRY LINE CURRENTS AS SPECIFIED BY APPLICABLE NATIONAL, STATE, AND/OR LOCAL CODES.

SEPARATE CONTROL WIRES FROM AC LINES WHEN ROUTED IN CONDUIT OR WIRE TRAYS.

***CAUTION!!** TURN POWER **OFF** WHILE MAKING WIRING CONNECTIONS.*

IMPROPER INSTALLATION OR OPERATION OF THIS DIGITAL POTENTIOMETER MAY CAUSE INJURY TO PERSONNEL OR EQUIPMENT FAILURE. THE DEVICE MUST BE INSTALLED IN ACCORDANCE WITH LOCAL, STATE, AND NATIONAL SAFETY CODES. MAKE CERTAIN THAT THE POWER SUPPLY IS DISCONNECTED BEFORE ATTEMPTING TO SERVICE OR REMOVE ANY COMPONENTS!!! IF THE POWER DISCONNECT POINT IS OUT OF SIGHT, LOCK IT IN DISCONNECTED POSITION AND TAG IT TO PREVENT UNEXPECTED APPLICATION OF POWER. ONLY A QUALIFIED ELECTRICIAN OR SERVICE PERSONNEL SHOULD PERFORM ANY ELECTRICAL TROUBLESHOOTING OR MAINTENANCE. AT NO TIME SHOULD CIRCUIT CONTINUITY BE CHECKED BY SHORTING TERMINALS WITH A SCREWDRIVER OR OTHER METAL DEVICE.

P1 Terminal Block Wiring Diagrams



NOTE: Speed pickups shown above are not required for open-loop operation.

Wiring Terminal Functions

- P1-1 (AC / N) – For single-phase AC systems with a grounded neutral, connect the neutral AC line to this terminal. For systems with two hot AC lines, connect either of the hot AC lines to this terminal.
- P1-2 (AC / L) – For single-phase AC systems, connect the hot AC line to this terminal. For systems with two hot AC lines, connect either of the hot AC lines to this terminal.
- P1-3 (HI) – This is the POT HI reference terminal. This terminal must be connected to the most positive speed pot input terminal (minimum 2.5VDC) of the partner control device. This terminal will generally be referred to as Pot HI or +V for positive supplies, and Com for negative supplies.
- P1-4 (WP) – This is the Wiper output terminal. This terminal will output an analog voltage signal proportional to the referenced voltage signals connected to P1-3 (HI) and P1-5 (LO). This terminal should be connected to the wiper or signal input of the partner control device.
- P1-5 (LO) – This is the POT LO reference terminal. This terminal must be connected to the most negative speed pot input terminal of the partner drive. This terminal will generally be referred to as Pot LO or Com for positive supplies and –V for negative supplies.
- P1-6 (COM) – This is the common point for the control logic. The speed sensor common lead as well as any other equipment or source needing to reference the control common will be connected to this terminal.
- P1-7 (+5V) – This is a self-contained +5VDC power supply capable of up to 50 mA. The speed sensor

supply lead can be connected to this terminal for its power source.

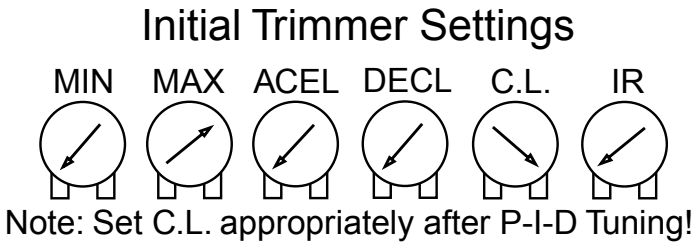
- P1-8 (S1) – This is the signal input terminal for the motor's digital pickup or encoder (closed-loop only). This signal is internally pulled-up to +5VDC via a 2.2K ohm resistor.
- P1-9 (S2) – This input can be programmed to perform a number of advanced functions. In follower mode, this input is the signal input terminal for the master's digital pickup or encoder. In master modes (rate and time), this input can be configured to function as an emergency stop, inhibit, or jog command. This signal is internally pulled-up to +5VDC via a 2.2K ohm resistor.
- P1-10 (1NO) – This is the normally-open contact of the user assignable relay output.
- P1-11 (1C) – This is the common contact of the user assignable relay.
- P1-12 (1NC) – This is the normally-closed contact of the user assignable relay output.

Basic Operating Information

Initial Drive Adjustments

Regardless of whether the GSDA-DP-D is being used in a closed-loop or open-loop operation, it is helpful to know how to set the typical initial adjustments on the drive being controlled.

IMPORTANT: If the drive that the GSDA-DP-D is controlling has a Max Speed or Gain setting, that will interact with the setup. Therefore, it is best to start with the drive's Max Speed or Gain control set to about a 2/3 of its highest setting, as shown on the drawing below. If the Max Speed/Gain on the drive is set too low, the GSDA-DP-D may not ever be able to attain the desired speed setting, and if it is set too high, it may be difficult or impossible to achieve stability. In the worst case, the system may hunt or oscillate. Also, if the drive has Current Limit settings, during P-I-D tuning (only), the Current Limit should, if at all possible, be set such that the drive is not in Current Limit. Further, when in in closed-loop operation, the drive should never require I.R. Comp, so set that control to minimum (and leave it there). Similarly, the GSDA-DP-D has both Accel and Decel, so those drive settings should be set to minimum (and left there).



Closed-Loop Control Algorithm Discussion and P-I-D Tuning

If the unit is configured for closed-loop operation, a true P-I-D speed control algorithm is employed, which allows precise and quick response to set speed or load changes. The three parameters, 26, 27 and 28 (Proportional, Integral, Derivative, respectively) are adjustable as shown in the software parameters table. P-I-D can be tuned to get precise speed response and regulation.

When adjusting P-I-D, begin by using the factory defaults the control is preset to: P (Parameter 26) to 150, I (Parameter 27) to 20, D (Parameter 28) to 10. If further adjustment of P-I-D is needed, follow these steps:

To adjust P: (Parameter 26): Run the motor from zero speed to the set speed. If the start up response of the motor is too slow, increase P in increments of 20 until the desired start up response time is obtained. If the start up response time is too fast, decrease P in increments of 10 until the desired response is reached. P is used to adjust the start up response time only. The start up response time is approximately 0 to 60% of the set speed. I can be used if adjustment of the upper response time (60 to 100% of the set speed) is needed.

To adjust I: (Parameter 27): Run the motor from zero speed to the set speed. If the upper response time (60 to 100% of the set speed) has any hesitation or has too slow of a response, then increase I in increments of 5 until the hesitation is eliminated and/or the desired upper response time is obtained. If the upper response time is too fast or has too much overshoot, decrease I in increments of 3 until the

overshoot is eliminated and/or the desired upper response time is reached.

To adjust D: (Parameter 28): D can be used to dampen the effect of P. By making D too large, the response time of the control can be reduced, so keep D as small as possible on non-regenerative controls.

Generally speaking, the proportion of P-I-D seems to be more critical than the individual values, i.e.. values of 50-50-50 will achieve virtually the same results as 999-999-999.

Closed-Loop Master (Rate & Time) and Follower (Ratio) Modes

GSDA-DP-D speed controls have two basic modes of operation, master and follower. In the master modes, the controls are capable of operating independently; whereas, in the follower mode, the control requires a signal from a master to operate. The follower mode is used in applications which require the controller to closely follow a master process. For example, if a factory has ten conveyors which must be synchronized over long periods of time, an industrial engineer could use one speed control unit as a master control for the first conveyor and nine speed control units as slaves or followers which would receive their speed commands from the first conveyor's master control or pickup.

In Master Rate Mode, the speed control unit controls the rate of the motor by tracking the motor's pickup pulses which are applied to signal input 1 (S1). In this mode, the display indicates in rate units such as gallons-per-minute, feet-per-second, or RPM.

In Master Time Mode, the speed control unit controls the process time by tracking the motor's pickup pulses which are applied to signal input 1 (S1). In this mode, the display indicates in time units such as HH:MM or MM:SS, where HH is hours, MM is minutes, and SS is seconds. This mode is most commonly used in time-sensitive processes such as conveyor ovens and plating applications.

In Follower Mode, the speed control unit tracks the rate of the pulses which are applied to the master signal input (S2). From these pulses, it calculates the speed of the master process in RPMs. This rate is then multiplied by the percentage which is displayed on the user interface. The display is in 0.1% of master units. For example, 675 = 67.5 percent of master speed. A master running at 1350 RPM, would cause the follower to run its motor at 67.5% * 1350 RPM or 911.25 RPM. Typical follower applications include synchronized rotation, synchronized conveyors, and some web-material processes.

Open-Loop Control Algorithm Discussion and Setup

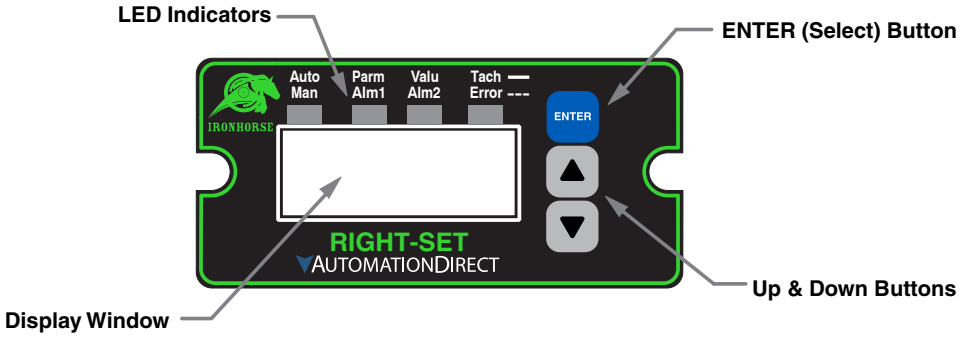
If the GSDA-DP-D is configured for open-loop operation, the P-I-D control method described above is not used, nor is a speed pickup required. Instead, a control method is employed which is not based on speed, but rather a percentage of maximum output voltage that will be developed across the LO and WP terminals (P1-5 and P1-4, respectively), which in turn is used to control the attached drive. In open-loop operation, the speed control unit operates as a Master Rate (in this case, % of max output) control only. Setting the Operation Mode (Parameter 10) to Master Time or Follower modes will result in unpredictable operation.

Setup consists of setting the Motor Control Method (Parameter 22) to a value of 32, plus the 4 Parameters that define the scaling of the output voltage. Two of the Parameters, Display Min (Parameter 20) and Display Max (Parameter 21) perform the same function as in closed-loop operation; that is, defining the range of valid engineering units to which the speed control units can be set. The other two Parameters Output Percent Min (Parameter 26) and Output Percent Max (Parameter 27) are used to define the minimum and maximum output voltage percentages that will be scaled across the engineering units range set by Display Min and Display Max, above. Parameters 26 and 27 represent values that define the Output percentages to "tenths of a percent" accuracy. In other words, a setting of 1000 actually means 100.0 (percent). Care should be taken that value in Parameter 21 is greater than the value in Parameter 20, and the value in Parameter 27 is greater than the value in Parameter 26.

Once the desired setup of the speed control unit is achieved, IR Comp and Current Limit settings on the drive that is being controlled by the speed control unit should be adjusted according to the manufacturer's setup procedure and the requirements of the particular application.

Although not used to control the output of the speed control unit, A speed pickup (if available) can still be connected to display Actual (Tach) Speed, and for Actual Speed Alarm Limits. Otherwise, those two functions should not be used in open-loop operation.

Front Panel Reference



How to Change an Item's Value

1) Hold down the Enter button until Item-Selection Mode is entered. The Item Annunciator will light.
2) Using the Up and Down buttons, select the desired Item number to view or edit.
3) Press the Enter button to change the value of the Item. The "Valu" Annunciator will light.
4) Using the Up and Down buttons, change the Item's value as desired.
5) Press the Enter button to permanently save the changes (Returns to Parameter-Selection Mode).
6) Select Item Zero ("o") and press the Enter button to return to Running Mode.

Operating the User Interface

Although the GSDA-DP-D speed control unit user interface is very versatile, it is also simple to setup and operate. With just a few button presses, it allows the user to configure a number of adjustable Parameters. The LED display has three basic operating modes: Running Mode, Parameter-Selection Mode, and Value Mode. Parameter and Value modes also have specific visual indicators (LED Annunciators) that allow the user to immediately determine the current state or mode of the user interface. Note: Parameter-Selection Mode (and Value Mode) can only be entered if the Program Enable jumper is in the On position.

Running Mode is the default display of the unit when power is applied. The speed control unit will spend the majority of its time in this mode. In Running Mode, the display shows the Target or Actual (Tach) speed value in the user-defined engineering units format for rate, time, or (in Follower mode) percentage of Master. The control will continuously attempt to drive the motor to the requested Target. In this display mode, the Up and Down buttons increase or decrease the displayed target value until either the display minimum or display maximum limit is reached. Depending on the alarm configuration, these buttons may also serve as an alarm-silence or alarm-reset button. For example, displays for rate, time, and follower operating modes could be 13.60, 45:30, and 1000, respectively.

Additionally, the speed control unit has an Auto/Manual Annunciator which displays a solid light if the source of the Target Setting comes from the 4-20mA input (Auto), or a blinking light if the Target Setting comes from the front panel Target setting (Manual).

Parameter-Selection Mode can be entered by simply pressing and holding the Enter button down for about three seconds. Once in Parameter-Selection Mode, the Item Annunciator will illuminate. The display will indicate the currently selected Item number for editing purposes. Pressing the Up or Down button will increase or decrease the selected Item number on the display. Although the Parameter numbers are in numerical order, some numbers are skipped. These numbers represent reserved Parameters that are not yet implemented and are not displayed.

In addition, Parameter numbers above 999 are actually located on the ModularBus card(s) that are installed in the host drive. The numbering scheme is the ModularBus slot number (100, 200 or 500) times 10, plus the Parameter number. Once the desired Parameter number is displayed, pressing the Enter button will change the display to the Value Mode. So, for example, to view/edit Parameter 20 on a ModularBus card in Slot 200, browse to Parameter number 2020 (200 X 10 + 20). When in Parameter-Selection Mode, pressing the Enter button with Parameter 0 selected will cause the unit to return to Running Mode. See the Software Parameters for a list of available Parameters.

Value Mode is used to modify the value of the selected Parameter. When in Value Mode, the Valu

Annunciator will illuminate. Pressing the Up or Down button increases or decreases the selected Parameter's value. With only one exception, value changes take effect immediately. For example, when adjusting P-I-D settings, the change in response can be observed live, which greatly facilitates the P-I-D tuning process. Once the desired value is showing in the display window, pressing the Enter button again will return to Parameter-Selection Mode and the new value will be saved in permanent memory. Removing power from the unit while in Value Mode will result in the specified new value being lost, and the previous (old) value being used. This can be used as an undo, for example, during editing a value that is being edited in the wrong Item. Note: Changes to Parameter 10, Operating Mode, do not take effect until power is removed and re-applied to the speed control unit.

Detailed Configuration Instructions

Default Configuration

When shipped from the factory, the following basic settings are in place:

- Closed-Loop Rate Mode Operation in RPM
- Decimal Point Display: None
- Display Range: 0 - 2400
- Speed Range: 0 - 2400 RPM
- Accel and Decel: 9999 RPM per second
- Signal Input 2 (S2) Mode: Jog (JOG1) @ 1000 RPM when Low
- Alarm 1 and Alarm 2 Outputs: Disabled

Resetting to Factory Defaults

The factory-default settings can be easily restored using either of two methods. Both methods require the Program Enable jumper to be in the On position. The first is to apply power to the unit with both the Enter and Down buttons pressed for 3 seconds. The second is to change the value of Parameter 95 to 5.

JP1 (Program Enable Jumper)

The JP1 jumper is located under the dust cover on the back end of the upper board. When the jumper is set to the Off position, all programming features are locked out from the front panel user. When the jumper is in the On position, the programming Parameters are open to change. JP1 is shipped from the factory set in the On position.

Setting and Reading SoftSwitches

Like many other devices, the motor speed control has the ability to select between a number of yes/no or on/off options, depending upon the application. Traditionally, this sort of option-selecting was done with some sort of physical switch or switches (such as a DIP switch), or by other means, such as the jumper block used to enable/disable programming on this unit. There are two problems with this approach to option-selection:

- Both DIP switches and jumper blocks are physically large, and most require that the device be at least partially disassembled to gain access to them.
- On a device with more than just a very few options, the number and combinations of switches quickly becomes overwhelming.

Because of these drawbacks, this motor controller takes a different approach (where appropriate): SoftSwitches.

It is easiest to think of a Parameter containing SoftSwitches as a DIP switch containing from one to thirty-two switches. But instead of actually flipping a switch on or off, you can set and read these switches as decimal numbers, each of which represents a binary switch number. Each switch, from #1 through #32, has been assigned a decimal number that represents its position in the virtual DIP switch assembly. When that number is used, it means that the switch is on. For example, the decimal number that

represents switch #4 is 8, the number that represents switch #6 is 32, and so on. See the table below for a full explanation of these values.

Note: Due to display limitations, switches 15 through 32 are currently unused.

Switch #	Decimal Number Representing Binary Value For Switch		Switch #	Decimal Number Representing Binary Value For Switch
1	1		8	128
2	2		9	256
3	4		10	512
4	8		11	1024
5	16		12	2048
6	32		13	4096
7	64		-	-

So, the decimal number contained in a SoftSwitch Parameter is nothing more than the sum of the numbers representing the on switches. For example, if you wanted to set switches #1, #4, and #7 to the on position, you would place the number 73 (1 + 8 + 64) into the Parameter containing those SoftSwitches; if you wanted to set switches #5 and #6 on, you would place the number 48 (16 + 32) into the Parameter, and so forth. Simply add-up the decimal values of the switches you wish to turn on, and place the total, or sum, into the Parameter containing the SoftSwitches.

The settings of the SoftSwitches can also be read the same way: For example, if a Parameter containing the SoftSwitches has been set to the number 11, you can tell that switches #1, #2 and #4 are on. You can tell this by subtracting the decimal values, from highest to lowest, starting at the highest value that is less than or equal to the total. Keep subtracting, but if you get a negative number as a result, then don't subtract that decimal value (add it back in before proceeding). Work your way downward in this manner toward Switch #1, but when your total reaches zero, you are finished.

Try a few examples of your own, and very soon you will be easily setting and reading SoftSwitches.

Setting and Reading Alarm Conditions

Taking advantage of the SoftSwitches feature described above, the motor speed control is equipped with two alarm outputs, which can be independently set to activate on any of 16,384 possible combinations of conditions or events that could be occuring at any one time. See the following table for a list of these condition flags.

The conditions are logically OR-ed together to form the particular alarm output. If the SoftSwitches for the Tach Outside Limits and the Pickup Stalled conditions for Alarm1 are set to On, then Alarm1 will be true when either one or both of those conditions are true. However, for even more flexibility, each condition can be combined in a logical AND fashion to override the alarm output.

Additionally, each condition can be inverted before being sent to the AND function, for even greater flexibility. Please note that if a particular condition is inverted, the corresponding switch in the appropriate AND Item (52/72) is inverted as well.

Also, setting any of the Softswitch Parameters in the OR/Invert/AND Alarm Conditions (Parameters 50-52 and 70-72) to a value of zero effectively removes the effect of their logic from the circuit. Therefore, even though the Alarm logic conditions are cascaded OR -> Invert -> AND, if, for example, the application does not need any AND conditions, simply set the value of the AND Item (52 and/or 72) to zero, and the AND function will be jumped around. In that case, however, it would also be best to set the Inverter Parameter (51 and/or 71) to zero as well.

Table 1: BCD Values for Drive Condition Flags

BCD Value	Description
0	No flags are currently active
1	Accel/Decel ramp in progress
2	S1 (Main) Actual Speed (Tach) is outside alarm limits
4	Target Speed is outside alarm limits
8	Target Speed = 0
16	S1 (Main) Pickup is stalled
32	S2 (Leader) Pickup is stopped (valid only in Follower Mode)
64	Jog function is activated
128	Inhibit function is activated
256	E-Stop function is activated
512	Drive is at maximum output
1024	Run condition
2048	Reserved
4096	Reserved

Table 2: BCD Values for Drive Condition Flags

BCD Value	Description
0	No flags are currently active
1	Slot 100 Alarm1 activated (valid only if ModularBus card installed in this slot)
2	Slot 200 Alarm1 activated (valid only if ModularBus card installed in this slot)
4	Slot 500 Alarm1 activated (valid only if ModularBus card installed in this slot)
8	Maintenance timer
16	Reserved
32	Reserved
64	Reserved
128	Reserved
256	Reserved
512	Reserved
1024	Reserved
2048	Reserved
4096	Reserved

Alarm Output Routing

The output of Alarm1 is permanently routed to control the Form-C Relay output on the motor speed control itself (see Hook-up Diagram, P1-9 through P1-11). The output of Alarm2, however, can be routed (through the use of Parameter 81) to control a relay located in any one of the three ModularBus slots 100, 200 or 500.

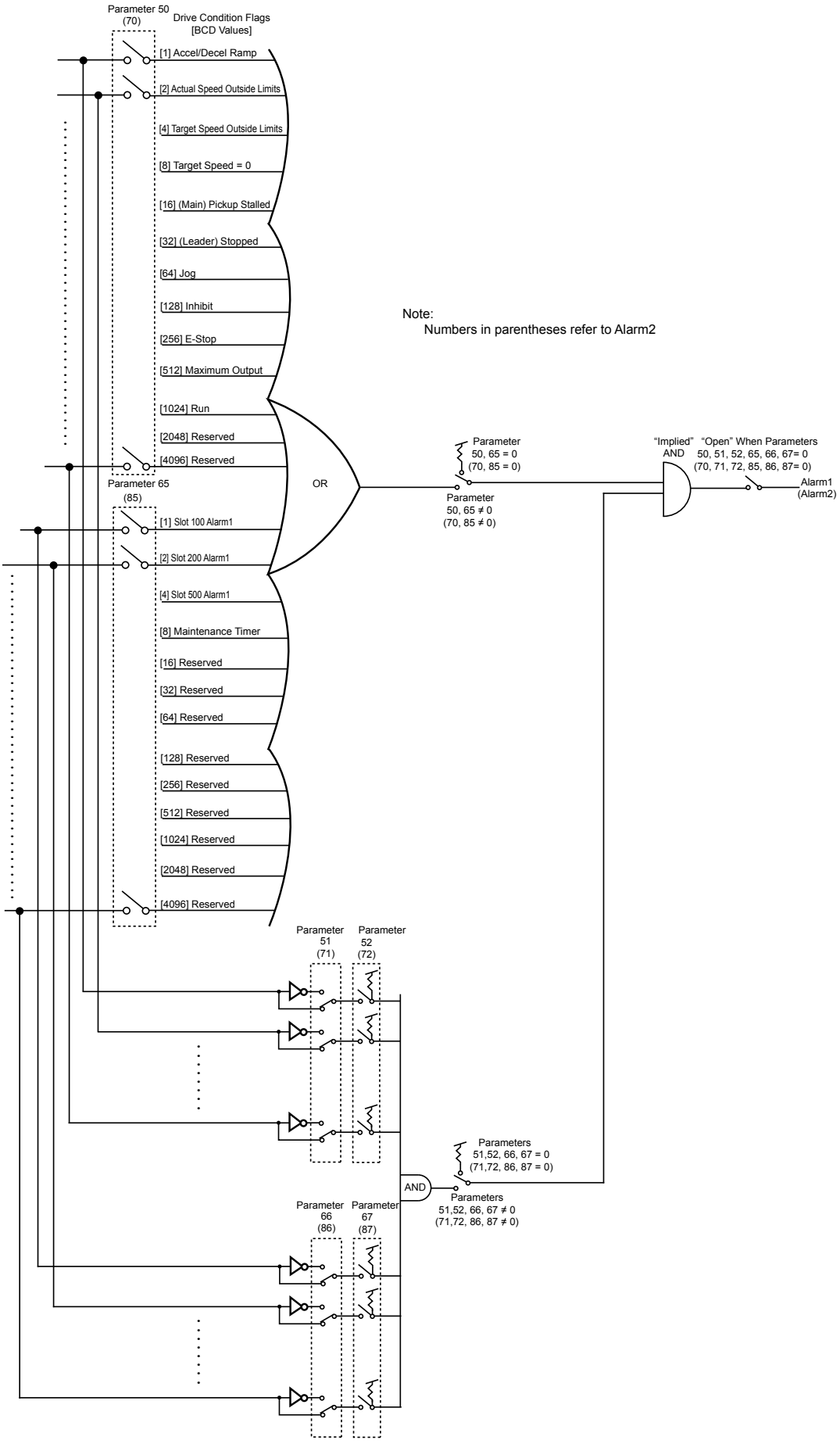
ALARM LOGIC

Note: The circuitry shown in the following logic drawing is actually implemented in software, not hardware, and although it makes little difference to the final output produced, that fact should be kept in mind.

Also note that the switches on the outputs of the OR gate, the AND gate, and the implied AND gate are only under indirect user control. That is, they are set automatically by the action of other settings that are under user control. For example, the switch on the output of the OR gate is automatically set to the uppermost position (as shown on the following logic drawing) when Parameter 50 (or 70 for Alarm2) is set to zero.

Often there is more than one way to connect the signals and logic to achieve the desired result. But determining the proper signal polarity to use is often a tricky problem in logic circuits. Sometimes it takes a bit of careful planning to arrange inverted and non-inverted signals properly. Also, keep in mind that standard logic tricks, such as the use of negative logic techniques, can be used to further expand your options. See the Application Example later in this manual for further details.

ALARM LOGIC APPLICATION EXAMPLE



GSDA-DP-D Software Parameters

Parameter	Description	Value Range	Units	Default
0	Select parameter 0 to return to Run mode	n/a	–	n/a
Read-Only Parameters				
1	Model Number	46 = GSDA-DP-D		46
2	Software Build	1-9999		n/a
3	Hardware Version	1-9999		n/a
4	Network Version (Reserved)	1-9999		n/a
5	Serial Number - Major (Reserved)	0-9999		n/a
6	Serial Number - Minor (Reserved)	0-9999		n/a
8	Drive Condition Flags	(See "Flags" - Table #1 Below)	BCD	n/a
9	Drive Condition Flags	(See "Flags" - Table #2 Below)	BCD	n/a
General Setup Parameters				
10	Operating Mode	1 = Rate Mode 2 = Time Mode 3 = Follower Mode		1
11	Display Brightness"	0-31 - (Dim-Bright)		26
12	Display Mode	1 = Target Speed 2 = S1 Actual Speed 3 = S2 (Leader) Speed		1
13	Decimal Point Position	0 = Disabled - (XXXX) 1 = X.XXX 2 = XX.XX 3 = XXX.X 4 = XXXX		0
14	Keypad Mode	1 = Linear - Constant Rate 2 = Non-Linear - Accelerating Rate		2
15	Keypad Scroll Delay	0-30 - (Fast-Slow)		10
16	Power-Up Target Speed	1 = Force Zero Speed 2 = Force Power-up Value 3 = Use Previous Target Speed		3
17	Power-Up Value	0-9999	(Eng. units)	0
18	Front-Panel Double-Click Destination	0 = Double-Click Ignored 1 = Inhibit 2 = Estop 3 = Jog1 4 = Jog2 5 = Auto/Man 4-20 mA Card		0
19	Reserved	n/a		0
Display and Control/PID Setup Parameters				
20	Display Minimum	0-9998	(Eng. units)	0
21	Display Maximum	1-9999	(Eng. units)	2400
22	Motor Control Method	0 = Gain Tracking Off, Low Spd Mode Off 1 = Gain Tracking On, Low Spd Mode Off 2 = Gain Tracking Off, Low Spd Mode On 3 = Gain Tracking On, Low Spd Mode On 4 through 31 - DO NOT USE! 32 = “Open Loop” Operation		1
23	Accel Setting	1-9999	(Eng. units)	9999
24	Decel Setting	1-9999	(Eng. units)	9999
26	Proportional Gain	0-9999		150
27	Proportional Gain	0-9999		20
28	Derivative Gain	0-9999		10
29	Startup Lag Compensation	0-5000		0
Signal Input #1 (S1) Setup Parameters				
30	S1 Display Reference	1-9999	(Eng. Units)	2400
31	S1 Reference RPM	1-9999	RPM	2400

Parameter	Description	Value Range	Units	Default
32	S1 Pulses Per Revolution	1-9999	PPR	20
33	S1 Initial Stall Timeout	0, 5-9999 - (0 = Defeat)	Sec.	0
34	Signal Input (S1) Running Stall Timeout	0-9999 - (0 = Defeat)	0.10 Sec.	0
	Signal Input #2 (S2) Setup Parameters			
35	S2 Input Configuration	1 = Disabled - (Follower Mode) 2 = E-Stop - S2 High 3 = E-Stop - S2 Low 4 = Inhibit - S2 High 5 = Inhibit - S2 Low 6 = Jog - S2 High 7 = Jog - S2 Low		7
36	S2 Setpoint Setpoint for Jog1 Function	1-9999	(Eng. Units)	1000
37	S2 Pulses Per Revolution - (Follower Only)	1-9999	PPR	20
38	S2 Stopped Timeout - (Follower Mode Only)	0-9999 - (0 = Defeat)	0.10 Sec.	0
39	Disable S2 In Manual Mode	0 = Disabled 1 = Enabled		0
	User Input #1 (UIN1) Setup Parameters			
40	UIN1 Input Configuration	1 = Disabled		1
41	Setpoint for Jog2 Function	1-9999	(Eng. Units)	1000
42	Inhibit Configuration	0 = No Accel/Decel 1 = Decel Only, No Accel 2 = Accel Only, No Decel 3 = Accel & Decel		0
	Alarm Output #1 Setup Parameters			
50	Alarm1 Logical "OR" Activation Conditions	(See "Flags" - Table 1 Below)	BCD	0
51	Alarm1 Logical Inverters	(See "Flags" - Table 1 Below)	BCD	0
52	Alarm1 Logical "AND" Activation Conditions	(See "Flags" - Table 1 Below)	BCD	0
53	Alarm1 Output Style & Reset Mode	1 = Constant & Auto Reset 2 = Constant & Manual Reset 3 = Pulsed & Auto Reset 4 = Pulsed & Manual Reset		1
54	Alarm1 Reset Configuration	1 = No Silencing - Reset on Enter Button 2 = No Silencing - Reset on S2 High 3 = No Silencing - Reset on S2 Low 4 = Silencing - Reset on Enter Button 5 = Silencing - Reset on S2 High 6 = Silencing - Reset on S2 Low		1
55	Annunciator Alm1 Flash On Active Alarm1	0 = No Annunicator Flash 1 = Annunicator Flash		0
56	Alarm1 Output Pulse ON Time	1-3600	Secs.	1
57	Alarm1 Output Pulse OFF Time	1-3600	Secs.	1
58	Alarm1 Output Pulse Count	0-9999		0
59	Alarm1 Lower Limit	0-9999	(Eng. Units)	0
60	Alarm 1 Upper Limit	0-9999	(Eng. Units)	9999
65	Alarm1 Logical "OR" Activation Conditions	(See "Flags" - Table 2 Below)	BCD	0
66	Alarm1 Logical Inverters	(See "Flags" - Table 2 Below)	BCD	0
67	Alarm1 Logical "AND" Activation Conditions	(See "Flags" - Table 2 Below)	BCD	0
	Alarm Output #2 Setup Parameters			
70	Alarm2 Logical "OR" Activation Conditions	(See "Flags" - Table 1 Below)	BCD	0
71	Alarm2 Logical Inverters	(See "Flags" - Table 1 Below)	BCD	0

Parameter	Description	Value Range	Units	Default
72	Alarm2 Logical "AND" Activation Conditions	(See "Flags" - Table 1 Below)	BCD	0
73	Alarm2 Output Style & Reset Mode	1 = Constant & Auto Reset 2 = Constant & Manual Reset 3 = Pulsed & Auto Reset 4 = Pulsed & Manual Reset		1
74	Alarm2 Reset Configuration	1 = No Silencing - Reset on Enter Button 2 = No Silencing - Reset on S2 High 3 = No Silencing - Reset on S2 Low 4 = Silencing - Reset on Enter Button 5 = Silencing - Reset on S2 High 6 = Silencing - Reset on S2 Low		1
75	Annunciator Alm2 Flash On Active Alarm2	0 = No Annunicator Flash 1 = Annunicator Flash		0
76	Alarm2 Output Pulse ON Time	1-3600	Secs.	1
77	Alarm2 Output Pulse OFF Time	1-3600	Secs.	1
78	Alarm2 Output Pulse Count	0-9999		0
79	Alarm2 Lower Limit	0-9999	(Eng. Units)	0
80	Alarm2 Upper Limit	0-9999	(Eng. Units)	9999
81	Alarm2 Output Routing	1 = Reserved 2 = Use Slot 100 Alarm1 Output 3 = Use Slot 200 Alarm1 Output 4 = Use Slot 500 Alarm1 Output		3
85	Alarm2 Logical "OR" Activation Conditions	(See "Flags" - Table 2 Below)	BCD	0
86	Alarm2 Logical Inverters	(See "Flags" - Table 2 Below)	BCD	0
87	Alarm2 Logical "AND" Activation Conditions	(See "Flags" - Table 2 Below)	BCD	0
Parameter Memory Command Parameters				
95	Restore to Factory Defaults (Affects Drive Settings Only)	0 = Abort & Exit 5 = Restore Factory Default Settings		0
96	Restore Modular Bus Card(s) Settings to Factory Defaults - (Card Settings Only)	0 = Abort & Exit 100 = Restore Slot 100 Default Settings 200 = Restore Slot 200 Default Settings 500 = Restore Slot 500 Default Settings		0
98	Save to User Default Memory Save "Environment" (Drive & All Modular Bus Card Settings) to "User Save" Storage Area	0 = Abort & Exit 5 = Save User Settings 5 = Copy current Settings TO "Settings2" (or "Settings1" if using "Settings2")		0
99	Restore From User Default Memory Restore / Swap "Environment" (Drive & All Modular Bus Card Settings) from "User Save" Storage Area	0 = Abort & Exit 1 = Restore User Default Settings 5 = Copy (Restore) current Settings FROM "Settings2" (or "Settings1" if using "Settings2") 10 = Swap Between "Settings1" & "Settings2"		0
Maintenance Timer Setup Parameters				
100	Activate Maintenance Message - (After this amount of time)	0 = Off 1 = 1 ~ 9999	Hours	0
101	Reset Maintenance Timer	0 = Abort & Exit 5 = Reset		0
102	Current Value of Maintenance Timer	Read Only	Hours	0
103	Scale Timer	0 = Disabled 1-9999 = Scale Factor		0
120	Auto/Manual Slot Control	0 = Slot 100 1 = Slot 200 2 = Slot 500		1

Parameter	Description	Value Range	Units	Default
121	Follower Target Source	1 = Pickup 2 = Slot 100 3 = Slot 200 4 = Slot 500		1
122	Follower Percent Source	1 = Slot 100 2 = Slot 200 3 = Slot 500		1
Flags - Table #1				
0	No Active Flags			
1	Accel/Decel Ramp in Progress			
2	S1 (Main) Act Spd (Tach) Outside Alm Limits			
4	Target Speet Outside Alarm Limits			
8	Target Speed = 0			
16	S1 (Main) Pickup is Stalled			
32	S2 (Leader) Pickup is Stopped	(Valid Only in "Follower Mode")		
64	Jog Function Activated			
128	Inhibit Function Activated			
256	E-Stop Function Activated			
512	Drive is at Maximum Output			
1024	"Run" Condition			
2048	Reserved			
4096	Reserved			
Flags - Table #2				
0	No Active Flags			
1	Slot 100 Alarm1 Activated	(Valid Only if Modular Bus Card Installed)		
2	Slot 200 Alarm1 Activated	(Valid Only if Modular Bus Card Installed)		
4	Slot 500 Alarm1 Activated	(Valid Only if Modular Bus Card Installed)		
8	Maintenance Timer			
16	Reserved			
32	Reserved			
64	Reserved			
128	Reserved			
256	Reserved			
512	Reserved			
1024	Reserved			
2048	Reserved			
4096	Reserved			

GSDA-DP-D Software Parameter Descriptions

Parameter	Parameter Name	Description
0	Exit to Running Mode	When Parameter 0 is selected in Parameter-Selection Mode, the unit will return to Running Mode and, depending on the value of Parameter 12, will display the running (Target) or actual (Tach) value. This should be selected once changes to Parameters are completed.
Read-Only Identification Parameters		
1	Model Number	This number represents the base model number for the product.
2	Software Version	The software version is a code which identifies the software "build number" of the unit.
3	Hardware Version	The hardware version is a code which identifies which hardware was used to build the unit.
4	Modular Bus Protocol Version	The Modular Bus protocol version is a code which identifies the highest (most-recent) version of the Modular Bus protocol with which this unit is compatible.
5	Serial Number (Major)	These Parameters are reserved for future use as an electronic serial number and are unique to each manufactured unit.
6	Serial Number (Minor)	These Parameters are reserved for future use as an electronic serial number and are unique to each manufactured unit.
8	Drive Condition Flags	This is a Binary Coded Decimal ("BCD") representation of the currently active "Flags" representing certain real-time conditions and/or modes in which the drive is operating. This display is updated several times per second to reflect the up-to-the-second status of the drive and its Modular Bus cards, if any. See "Flags" table 1 in the Software Parameters (Parameters) table for the BCD values
9	Drive Condition Flags, Table 2	This is a Binary Coded Decimal ("BCD") representation of the currently active "Flags" representing certain real-time conditions and/or modes in which the drive is operating.This display is updated several times per second to reflect the up-to-the-second status of the drive and its Modular Bus cards, if any. See "Flags" table 2 in the Software Parameters (Parameters) table for the BCD values.
General Setup		
10	Operating Mode	This Parameter defines the operating mode for the entire unit. There are two basic modes of operation, master and follower. In master modes, the unit controls the load using either rate or time units. In follower mode, the unit controls the load in percentage of master rate. *NOTE: Power must be removed and re-applied to the GS-DA-DP-D for a change in Operating Mode to take effect. It is also strongly suggested the Target Speed be reduced to zero and the setting of Parameters 16, 17, 20, 21, 30 & 31 be reviewed carefully prior to doing so.* The following Operating Modes are available for the GSDA-DP-D: • Mode 1 – Master, Rate Mode In Rate Mode, the GSDA-DP-D displays in user-defined rate "Engineering Units" such as RPM, Gallons per Hour, or Feet per Second. • Mode 2 – Master, Time Mode In Time Mode, the GSDA-DP-D displays in time units using the format AA:BB. By default AA:BB represents minutes (AA) and seconds (BB). Optionally, it can be configured to represent hours (AA) and minutes (BB) or other user-defined units with a 1:60 relationship. When setting Parameters which are configured in engineering units, the programmed value is the determined by the formula (AA * 60) + BB. In HH:MM displays, this is the total number of minutes. In MM:SS displays, this is the total number of seconds. • Mode 3 – Follower Mode In Follower Mode, the GSDA-DP-D displays in percentage units, where 1000 equals 100.0 percent of the master rate. For example, if the display indicates 985, 98.5, or 9.85, the GSDA-DP-D will attempt to run at exactly 98.5 percent of the master rate. Display settings are always entered ignoring the decimal point's position.
11	Display Intensity	This Parameter adjusts the intensity of the LED display digits in the front panel of the unit. The values of 0 – 31 correspond to a gradual change from very dim to very bright. This is often useful when the GSDA-DP-D is used in the same panel as other pieces of equipment with LED displays and a uniform display brightness is desired. Simply adjust the GSDA-DP-D to match its surroundings.

Parameter	Parameter Name	Description
12	Display Mode	This Parameter selects what the GSDA-DP-D will show on its display during Run Mode. Note that it can "toggle" between whatever the Display Mode is set to and its "opposite" by briefly pressing and releasing the ENTER button. For example, if this Parameter is set to 1 (Target Speed/Time), pressing the ENTER button will briefly show the Actual (Tach) Display (and illuminate the "Tach" LED Annunciator). Conversely, if this Parameter is set to 2 or 3 (Main Tach or Leader Tach, respectively), pressing the ENTER button will briefly show the Target Speed/Time. The following Display Modes are available for the GSDA-DP-D: • Mode 1 – Target Speed/Time Display In Rate Mode, the GSDA-DP-D displays the Target Speed in user-defined rate Engineering Units such as RPM, Gallons per Hour, or Feet per Second. In Time Mode, the GSDA-DP-D displays the Target Time in time units using the format AA:BB. In Follower Mode, the GSDA-DP-D displays the Target Speed in percentage units, where 1000 equals 100.0 percent of the Master rate. • Mode 2 – S1 (Main Pickup) Actual Speed (Tach) Display In Rate Mode, the GSDA-DP-D displays the Actual Speed in user-defined rate Engineering Units such as RPM, Gallons per Hour, or Feet per Second. In Time Mode, the GSDA-DP-D displays the Actual Time in time units using the format AA:BB. In Follower Mode, the GSDA-DP-D displays the Actual Speed in percentage units, where 1000 equals 100.0 percent of the Master rate. • Mode 3 – S2 (Leader) Actual Speed (Tach) Display Mainly useful for diagnosing and setup of Master-Follower applications, selecting this Mode shows the Leader Speed (on the S2 Input) in RPM Units (only).
13	Decimal Point (DP) Position (used in Rate and Follower Modes Only)	This selects the format of the display with respect to the decimal point's position. This Parameter does not effect the value entry for other Parameters. For example, if the user desires to display 10.00 at 300RPM, then Parameter 30 would be set to 1000, Parameter 31 would be set to 300, and Parameter 13 would be set to 2. • Mode 0: Fixed XXXX • Mode 1: Fixed X.XXX • Mode 2: Fixed XX.XX • Mode 3: Fixed XXX.X • Mode 4: Fixed XXXX.
14	Keypad Mode	This Parameter selects the operating mode of the front-panel push buttons. In some applications, increasing or decreasing the scroll rate provides the user more controllability when entering settings. Parameters 14 and 15 affect only the Up and Down buttons when the user interface is in Running Mode. These settings also apply to remote Up / Down buttons which are attached via the -1 option board. • Mode 1: Linear, Constant Rate In linear mode, pressing and holding the Up or Down buttons will cause the display to continuously change value in the requested direction until either the Display Minimum or Display Maximum is reached. The displayed value will scroll at a constant rate which is specified using Parameter 15. • Mode 2: Non-linear, Accelerating Rate In non-linear mode, pressing and holding the Up or Down buttons will cause the display to continuously change value in the requested direction until either the Display Minimum or Display Maximum is reached. The displayed value will initially scroll at a slow rate and increase in speed until the maximum scroll rate is achieved. The initial scroll rate is specified using Parameter 15.
15	Keypad Scroll Delay	This Parameter sets the scroll speed for the front-panel push buttons. The function of this Parameter varies slightly depending on the Keypad Mode. See Parameter 14 for more details.
16	Power-up Target Speed	This Parameter determines the default Running Value when power is initially applied to the GSDA-DP-D-240-10x. • Mode 1: Default to Zero When in this mode, the unit will default to zero (engineering units). • Mode 2: Default to Power-Up Value When in this mode, the unit will default to the Power-up Value, Parameter 17. • Mode 3: Default to Previously Running Value When in this mode, the unit will default to the previous running value before power was removed. A previous running value must have been active for at least 3 seconds to be recalled after power has been disconnected and reapplied.

Parameter	Parameter Name	Description
17	Power-up Value	When Power-up Mode is set to 2, this Parameter will designate the default display value at power-up in the user's desired units of measure ("engineering units"), e.g. RPM, GPM, FPM, etc.
18	Front Panel DoubleClick Routing	This Parameter determines what happens if the user "Double-Clicks" the Enter Button (two button presses quickly) on the front panel of the GSDA-DP-D. • Mode 0: DoubleClick Ignored When in this mode, DoubleClicking on the Enter Button will have no effect. • Mode 1: Route DoubleClick to Inhibit When in this mode, Double-Clicking on the Enter Button when the drive is "running" will place the Drive in Inhibit, obeying the "accel/decel rules" found in Parameter 42. Additionally, if the S2 and/or UIN1 inputs are set up to provide Inhibit control, they are active as well, with the following rules. Either the DoubleClick and/or S2/UIN1 can cause the control to go into Inhibit, but both the DoubleClick AND S2/UIN1 have to be "negated" (set to allow the control to "run") before the control will exit "Inhibit" mode and begin to "run" normally again. Note that the DoubleClick action works as a "toggle", so the operation could be somewhat confusing if S2/UIN1 are "routed" to the Inhibit, along with the DoubleClick, but this behavior is necessary for "safety" reasons. • Mode 2: Route DoubleClick to EStop Same as Mode 1, but DoubleClick is Routed to the E-Stop function. • Mode 3: Route DoubleClick to Jog1 Same as Mode 1, but DoubleClick is Routed to the Jog1 function, causing the control to temporarily run at the Target Speed in Parameter 36. See, also, Parameter 36. • Mode 4: Route DoubleClick to Jog2 Same as Mode 1, but DoubleClick is Routed to the Jog2 function, causing the control to temporarily run at the Target Speed in Parameter 41. See, also, Parameter 41. • Mode 5: Auto/Manual 4-20mA Card Same as Mode 1, but DoubleClick switches the drive from manual to auto or vice versa and in manual mode the front keypad has control. The Auto/Man Annunciator indicates what mode the control is operating.
19	Reserved	n/a
Display and Control/PID Setup Parameters		
20	Display Minimum	This Parameter defines the lower end of the display range. This is the value which limits how low the user is able to scroll the displayed value in Running Mode. In Rate and Time modes, this value is set in engineering units. In Follower Mode, this is set in percentage (actually, 10ths of percentage) of the master rate. For example, in Follower Mode, a Target of 150 represents 15.0 percent of the master rate.
21	Display Maximum	This Parameter defines the upper end of the display range. This is the value which limits how high the user is able to scroll the displayed value in Running Mode. In Rate and Time modes, this value is set in engineering units. In Follower Mode, this is set in percentage (actually, 10ths of percentage) of the master rate. For example, in Follower Mode, a Target of 1250 represents 125.0 percent of the master rate.

Parameter	Parameter Name	Description
22	Motor Control Method	This Parameter controls two behaviors in the GSDA-DP-D, Low-Speed "Gain-Tracking", and Ultra-Low-Speed Control Mode ("gearbox" mode). When set to a value of 1 (or 3), this parameter automatically (and proportionally) reduces the "gain" of the PID values when the Target Speed (in RPMs) is less than 200. This greatly increases the overall stability at low speeds in applications that require a very wide range of Target Speeds, without having to unduly compromise control responsiveness at higher speeds. When set to a value of 2 (or 3), this Parameter adjusts the speed-control characteristics of the GSDA-DP-D to enhance the smoothness of speed control when in a situation where the "tach pickup" must be installed on the "low speed side" of a very slowly turning gear-motor output shaft. A rule of thumb would probably be that you may consider enabling this Mode if that shaft is turning less than 10 RPM, and the pickup produces less than 10 Pulses Per Revolution (PPR). Use this Mode only if speed stability can not be achieved by adjusting the PID settings (Parameters 26 – 28). • Mode 0: Disabled Both Low-Speed-Gain-Tracking and Ultra-Low-Speed Control Mode are Defeated. • Mode 1: Low-Speed-Gain-Tracking (Only) Enabled Low-Speed-Gain-Tracking is Enabled, Ultra-Low-Speed Control Mode is Defeated. • Mode 2: Ultra-Low-Speed Control Mode (Only) Enabled Low-Speed-Gain-Tracking is Defeated, Ultra-Low-Speed Control Mode is Enabled. • Mode 3: Low-Speed-Gain-Tracking and Ultra-Low-Speed Control Mode (Both) Enabled Both Low-Speed-Gain-Tracking and Ultra-Low-Speed Control Mode are Enabled.
23	Acceleration Setting	This Parameter determines how fast the GSDA-DP-D will accelerate toward the displayed target setting. This Parameter is set in engineering units of change per second, such as RPM, GPM, or feet per second. In Follower Mode, this Parameter is set in RPM units.
24	Deceleration Setting	This Parameter determines how fast the GSDA-DP-D will decelerate toward the displayed target setting. This Parameter is set in engineering units of change per second, such as RPM, GPM, or feet per second. In Follower Mode, this Parameter is set in RPM units.
26	Closed-Loop Proportional (P) Gain / Open-Loop Output Percentage Maximum	*Closed-Loop Operation (Item 22 set to a value < 32)* In Closed-Loop operation, the Proportional Gain is the first of three Items which define the responsiveness of the control with respect to how fast it responds to changing loads. Because the Accu-Set plus controls are true velocity-form PID control, the higher the P Gain, the more aggressively the unit will respond to a change in load or target speed. See the "Basic Operating Instructions" section of the manual for more details. *Open-Loop Operation (Item 22 set to a value = 32)* In Open-Loop operation, this Item sets the percentage (from 0% to 100.0%) of the voltage supplied across the LO (P1-5) and HI (P1-3) terminals that will be Output across the LO (P1-5) and WP (P1-4) terminals when the Target "Speed" setting is equal to (or less than) the Display Minimum (Item 20). See the "Basic Operating Instructions" section of the manual for more details.
27	Closed-Loop Integral (I) Gain / Open-Loop Output Percentage maximum	*Closed-Loop Operation (Item 22 set to a value < 32)* The Integral Gain is the second of two Items which define the responsiveness of the control with respect to how fast it responds to changing loads. The higher the I Gain, the more aggressively the unit will drive the load. However, it will sometimes be necessary to decrease the I Gain and/or increase the P Gain to prevent unwanted oscillation and instabilities. See the "Basic Operating Instructions" section of the manual for more details. *Open-Loop Operation (Item 22 set to a value = 32)* In Open-Loop operation, this Item sets the percentage (from 0% to 100.0%) of the voltage supplied across the LO (P1-5) and HI (P1-3) terminals that will be Output across the LO (P1-5) and WP (P1-4) terminals when the Target "Speed" setting is equal to (or greater than) the Display Maximum (Item 21). See the "Basic Operating Instructions" section of the manual for more details.
28	Derivative (D) Gain (Unused in Open-Loop operation)	The Derivative Gain is the third of the three Parameters which define the responsiveness of the control with respect to how fast it responds to changing loads. Although most applications will run fine with the D Gain set to zero, sometimes adding a little "D" will help minimize overshoot and undershoot. See the "Basic Operating Instructions" section of the manual for more details.

Parameter	Parameter Name	Description
29	Startup Lag Compensation	Somewhat analogous to a "Min. Speed" control on analog motor speed controls, this sets a "minimum output" that is applied as soon as the Target Speed is above Zero RPM. Careful use of this setting can help with "stiction" (the tendency for motors to require a bit more "oomph" to "break free" when starting from a dead stop). However, values that are too high will make the motor "creep" or even be unable to attain a desired target speed. In Follower Mode, this setting can also help the Follower start up in better "sync" with the Leader.
Signal Input #1 Setup Parameters		
30	Signal Input 1 (S1) (Main Pickup) Display Reference	This is the number to be displayed when at the user-specified motor Reference RPM. In Rate Mode, this value represents rate units such as feet, ounces, or revolutions. In Time Mode, this value represents the reference time measured in seconds or minutes. If the desired display is HH:MM, then all values should be entered in minutes. If MM:SS is desired, then all values should be entered in seconds. In Follower Mode, this value is the percentage of the master rate in 0.1% units. For example, 1000 equates to 100%.
31	Signal Input 1 (S1) Reference RPM	This is the reference RPM at which the Display Reference value should be displayed. In Rate and Time Modes, this value represents the RPM of the encoder to which the Display Reference corresponds. In Follower Mode, this value is not used.
32	Signal Input 1 (S1) Pulses per Revolution	This is the number of pulses per revolution for the signal input 1 (S1). The GSDA-DP-D supports pickups and encoders from 1 to 9999 pulses per revolution.
33	Signal Input 1 (S1) Initial Stall Timeout	When the Target Speed is above zero RPM, this Parameter determines the maximum time in units of seconds that can elapse before the first S1 pickup pulse before the GSDA-DP-D considers itself in a "Stall" Condition. It is not advisable to set this lower than approximately 10 seconds (a value of 10), or it may be difficult to achieve startup in a low-speed application. A value of zero defeats this timeout. (Note: This parameter will only work if the alarm is set for stall on any of the parameters 50, 51, 52, 70, 71, or 72.)
34	Signal Input 1 (S1) Running Stall Timeout	When the Target Speed is above zero RPM, this Parameter determines the maximum time in units of 0.1 Seconds that can elapse between S1 pickup pulses before the GSDA-DP-D considers itself in a "Stall" Condition. It is not advisable to set this lower than approximately 10 seconds (a value of 100), or it may be difficult to achieve startup in a low-speed application. Also note that the S1 Pulses Per Revolution (PPR) must be taken into account when determining the proper setting for this timeout. A value of zero defeats this timeout. (Note: This parameter will only work if the alarm is set for stall on any of the parameters 50, 51, 52, 70, 71, or 72.)

Parameter	Parameter Name	Description
Signal Input #2 Setup Parameters		
35	Signal Input 2 (S2) Input Configuration	This Parameter determines the operating mode of signal input 2 (S2). • Mode 1: Disabled (Follower Mode) The S2 input is inactive. This is the required setting for Follower Mode. • Mode 2: Emergency Stop When S2 High (Not Wired To Common) When the S2 input is at an electrically high (+5V) state or allowed to float disconnected, the GSDA-DP-D will enter emergency-stop mode. While in this mode, the armature output will immediately be turned off. Once the S2 input returns to an electrically low state or wired to the unit's common, the output will become active. • Mode 3: Emergency Stop When S2 Low (Wired To Common) When the S2 input is at an electrically low state or wired to the unit's common, the GSDA-DP-D will enter emergency-stop mode. While in this mode, the armature output will immediately be turned off. Once the S2 input returns to an electrically high (+5V) state or allowed to float disconnected, the output will become active. • Mode 4: Inhibit When S2 High (Not Wired To Common) When the S2 input is at an electrically high (+5V) state or allowed to float disconnected, the GSDA-DP-D will enter inhibit mode. While inhibited, the armature output will decrease according to the decel setting until zero output is reached. Once the S2 input returns to an electrically low state or is wired to the unit's common, the output will start to accelerate toward the previous running value. • Mode 5: Inhibit When S2 Low (Wired To Common) When the S2 input is at an electrically low state or wired to the unit's common, the GSDA-DP-D will enter inhibit mode. While inhibited, the armature output will decrease according to the decel setting until zero output is reached. Once the S2 input returns to an electrically high (+5V) state or allowed to float disconnected, the output will start to accelerate toward the previous running value. • Mode 6: (JOG1) Jog When S2 High (Not Wired To Common) When the S2 input is at an electrically high (+5V) state or allowed to float disconnected, the GSDA-DP-D will enter JOG1 mode. While in JOG1 mode, the speed will immediately change to the programmed JOG1 setpoint, Parameter 36. The unit will start accelerating or decelerating toward the JOG1 setting at the configured accel and decel rates. Once the S2 input returns to an electrically low state or is wired to the unit's common, the output will start to accelerate or decelerate toward the previous running value. In Follower Mode, the unit will operate as its own master. This allows an application to jog by overriding a stopped master. • Mode 7: (JOG1) Jog When S2 Low (Wired To Common) When the S2 input is at an electrically low state or wired to the unit's common, the GSDA-DP-D will enter JOG1 mode. While in JOG1 mode, the speed will immediately change to the programmed JOG1 setpoint, Parameter 36. The unit will start accelerating or decelerating toward the JOG1 setting at the configured accel and decel rates. Once the S2 input returns to an electrically high (+5V) state or allowed to float disconnected, the output will start to accelerate or decelerate toward the previous running value. In Follower Mode, the unit will operate as its own master. This allows an application to jog by overriding a stopped master.
36	Signal Input 2 (S2) Setpoint for JOG1 Function	When the S2 configuration, Parameter 35, is set to one of the JOG1 modes, this Parameter defines the JOG1 setpoint in engineering units. If the GSDA-DP-D operating mode is set to Follower Mode, then this Parameter is set in RPM units. This allows a follower control to be jogged when the master is stopped.
37	Signal Input 2 (S2) ("Leader") Pulses per Revolution (for Follower Mode Only)	When in Follower Mode, this is the number of pulses per revolution for the signal input 2 (S2) used as the "Leader" input. The GSDA-DP-D supports pickups and encoders from 1 to 9999 pulses per revolution (PPR).
38	Signal Input 2 (S2) ("Leader") Stopped Timeout (for Follower Mode Only)	When the Target Speed (percentage) is above zero, this Parameter determines the maximum time in units of 0.1 seconds that can elapse after the last S2 (Leader) pickup pulse before the GSDA-DP-D considers the Leader as "stopped". Setting this value too low may result in unstable low-speed "following". Setting it too high may result in Follower "run-on". A value of zero defeats this timeout.
39	Disable Signal Input 2 (S2) in Manual Mode	When setting this parameter to a value of 1, the S2 will be disabled when the unit is put into manual mode. If the value is set to 0 then the S2 will work in both manual and auto modes.

Parameter	Parameter Name	Description
User Input #1 (UIN1) Setup Parameters		
40	User Input 1 (UIN1) Configuration	This Parameter determines the operating mode of user input 1 (UIN1). • Mode 1: Disabled The UIN1 input is inactive. • Mode 2: Emergency Stop When UIN1 High (Not Wired To Common) When the UIN1 input is at an electrically high (+5V) state or allowed to float disconnected, the GSDA-DP-D will enter emergency-stop mode. While in this mode, the armature output will immediately be turned off. Once the UIN1 input returns to an electrically low state or wired to the unit's common, the output will become active. • Mode 3: Emergency Stop When UIN1 Low (Wired To Common) When the UIN1 input is at an electrically low state or wired to the unit's common, the GSDA-DP-D will enter emergency-stop mode. While in this mode, the armature output will immediately be turned off. Once the UIN1 input returns to an electrically high (+5V) state or allowed to float disconnected, the output will become active. • Mode 4: Inhibit When UIN1 High (Not Wired To Common) When the UIN1 input is at an electrically high (+5V) state or allowed to float disconnected, the GSDA-DP-D will enter inhibit mode. While inhibited, the armature output will decrease according to the decel setting until zero output is reached. Once the UIN1 input returns to an electrically low state or is wired to the unit's common, the output will start to accelerate toward the previous running value. • Mode 5: Inhibit When UIN1 Low (Wired To Common) When the UIN1 input is at an electrically low state or wired to the unit's common, the GSDA-DP-D will enter inhibit mode. While inhibited, the armature output will decrease according to the decel setting until zero output is reached. Once the UIN1 input returns to an electrically high (+5V) state or allowed to float disconnected, the output will start to accelerate toward the previous running value. • Mode 6: (JOG2) Jog When UIN1 High (Not Wired To Common) When the UIN1 input is at an electrically high (+5V) state or allowed to float disconnected, the GSDA-DP-D will enter JOG2 mode. While in JOG2 mode, the display will immediately change to the programmed JOG2 setpoint, Parameter 41. The unit will start accelerating or decelerating toward the JOG2 setting at the configured accel and decel rates. Once the UIN1 input returns to an electrically low state or is wired to the unit's common, the output will start to accelerate or decelerate toward the previous running value. In Follower Mode, the unit will operate as its own master. This allows an application to jog by overriding a stopped master. • Mode 7: (JOG2) Jog When UIN1 Low (Wired To Common) When the UIN1 input is at an electrically low state or wired to the unit's common, the GSDA-DP-D will enter JOG2 mode. While in JOG2 mode, the display will immediately change to the programmed JOG2 setpoint, Parameter 41. The unit will start accelerating or decelerating toward the JOG2 setting at the configured accel and decel rates. Once the UIN1 input returns to an electrically high (+5V) state or allowed to float disconnected, the output will start to accelerate or decelerate toward the previous running value. In Follower Mode, the unit will operate as its own master. This allows an application to jog by overriding a stopped master.
41	User Input 1 (UIN1) Setpoint for JOG2 Function	When the UIN1 configuration, Parameter 40, is set to one of the JOG2 modes, this Parameter defines the JOG2 setpoint in engineering units. If the GSDA-DP-D operating mode is set to Follower Mode, then this Parameter is set in RPM units. This allows a follower control to be jogged when the master is stopped.

Parameter	Parameter Name	Description
42	Inhibit Configuration	This Parameter determines the accel/decel profile of the GSDA-DP-D when it is going into and out of "Inhibit" Mode. There are 4 possible settings: • Mode 0: No Accel/Decel When going into Inhibit, the GSDA-DP-D will immediately shut off its output, disregarding any Decel setting, and when coming out of Inhibit, the GSDA-DP-D will immediately return to its Target Speed, disregarding any Accel setting. This is exactly like the "E-Stop" behavior. • Mode 1: Decel Only, No Accel When going into Inhibit, the GSDA-DP-D will Decel to a stop using the setting in Parameter 24, but when coming out of Inhibit, the GSDA-DP-D will immediately return to its Target Speed, disregarding any Accel setting. • Mode 2: Accel Only, No Decel When going into Inhibit, the GSDA-DP-D will immediately shut off its output, disregarding any Decel setting, but when coming out of Inhibit, the GSDA-DP-D will Accelerate to its Target Speed, using the Accel setting in Parameter 23. • Mode 3: Use Both Accel and Decel When going into Inhibit, the GSDA-DP-D will Decel to a stop using the setting in Parameter 24, and when coming out of Inhibit, the GSDA-DP-D will Accelerate to its Target Speed, using the Accel setting in Parameter 23.
Alarm Output #1 Setup Parameters		
50	Alarm 1 Logical "OR" Activation Conditions (Flags Table 1)	This Parameter, in conjunction with Parameters 51 & 52, defines which conditions will result in the Alarm 1 output being activated. The function is that of a Logical "OR"ing of the selected Drive Condition Flags. A setting of zero defeats this "OR" function entirely. Please see the sections "Setting and Reading Softswitches" and "Setting Alarm Conditions" for further details.
51	Alarm 1 Logical Activation Condition Inverters (Flags Table 1)	This Parameter, in conjunction with Parameters 50 & 52, defines which conditions will result in the Alarm 1 output being activated. The function allows selected Drive Condition Flags to be "inverted" before being presented to the "inputs" of the "AND" function (see Parameter 52). Please see the sections "Setting and Reading Softswitches" and "Setting Alarm Conditions" for further details.
52	Alarm 1 Logical "AND" Activation Conditions (Flags Table 1)	This Parameter, in conjunction with Parameters 50 & 51, defines which conditions will result in the Alarm 1 output being activated. The function is that of a Logical "AND"ing of the selected Drive Condition Flags. A setting of zero defeats this "AND" function entirely. Please see the sections "Setting and Reading Softswitches" and "Setting Alarm Conditions" for further details.
53	Alarm 1 Output Style & Reset Configuration	This setting configures the output mode and reset method for the Alarm 1 output. • Mode 1: Constant & Auto Reset In this mode, the alarm output will remain active until the alarm condition ceases to exist. The alarm will automatically reset when the conditions return to normal. • Mode 2: Constant & Manual Reset In this mode, the alarm output will remain active until the alarm is reset manually. See Parameter 54 for details. • Mode 3: Pulse & Auto Reset In this mode, the alarm output will pulse on and off until the alarm condition ceases to exist. The pulsed modes are commonly used for audible alarms where a constant output would be considered distracting or awkward. The alarm will automatically reset when the conditions return to normal. • Mode 4: Pulse & Manual Reset In this mode, the alarm output will pulse on and off until the alarm is reset manually. See Parameter 54 for reset details. The pulsed modes are commonly used for audible alarms where a constant output would be considered distracting or awkward.

Parameter	Parameter Name	Description
54	Alarm 1 Reset Configuration	This setting determines which actions will cause an active alarm to be silenced or reset. • Mode 1: No Silencing, Reset On ENTER Button Press In this mode, an active alarm cannot be silenced. Once the alarm condition ceases to exist, however, the ENTER button may be pressed to cause a manual reset. • Mode 2: No Silencing, Reset On S2 Input High (Not Wired To Common) Similar to Mode 1. Once the alarm condition ceases to exist, setting the S2 input to a high (+5V) state or allowing it to float disconnected will cause a manual reset. • Mode 3: No Silencing, Reset On S2 Input Low (Wired To Common) Similar to Mode 1. Once the alarm condition ceases to exist, setting the S2 input to a low (COM) state or wiring it to common will cause a manual reset. • Mode 4: Silencing Enabled, Reset On ENTER Button Press When the conditions for an active alarm persist, pressing any user-interface button will result in the alarm being silenced or deactivated, but not reset. A second attempt to reset the alarm must be made after the condition ceases to exist to clear the alarm. • Mode 5: Silencing Enabled, Reset On S2 Input High (Not Wired To Common) Similar to Mode 4. Setting the S2 input to a high (+5V) state or allowing it to float disconnected will cause the alarm to be silenced or reset depending on the current state of the alarm conditions. • Mode 6: Silencing Enabled, Reset On S2 Input Low (Wired To Common Similar to Mode 4. Setting the S2 input to a low (COM) state or wiring it to common will cause the alarm to be silenced or reset depending on the current state of the alarm conditions.
55	Alarm 1 Annunciator Flash On Alarm	When set to 1, this will cause the "Alm1" LED Annunciator to flash when an alarm 1 condition is active. A setting of zero defeats this function.
56	Alarm 1 Pulse "ON" Time	This Parameter defines the number of seconds the output should be enabled during the 'on' phase of an active pulsing alarm's output.
57	Alarm 1 Pulse "OFF" Time	This Parameter defines the number of seconds the output should be disabled during the 'off' phase of an active pulsing alarm's output.
58	Alarm 1 Pulse Count	This setting determines how many pulses are outputted when the alarm is activated and is configured in the pulse output style. When 0 is entered, the unit will be set for continuous pulses while the alarm is active.
59	Alarm 1 Lower Limit	This setting defines either the lower limit or the lower end of a range for the alarm region. Alarm limits are set in engineering units without regard to decimal point or colon position. In Rate and Follower Modes, a limit of 123 could represent a display value of 123, 12.3, 1.23, or 0.123. When in Time Mode, a limit of 123 would represent 1:23 on the display.
60	Alarm 1 Upper Limit	This setting defines either the upper limit or the upper end of a range for the alarm region. Alarm limits are set in engineering units without regard to decimal point or colon position. In Rate and Follower Modes, a limit of 123 could represent a display value of 123, 12.3, 1.23, or 0.123. When in Time Mode, a limit of 123 would represent 1:23 on the display.
65	Alarm 1 Logical "OR" Activation Conditions (Flags Table 2)	This Parameter, in conjunction with Parameters 66 & 67, defines which conditions will result in the Alarm 1 output being activated. The function is that of a Logical "OR"ing of the selected Drive Condition Flags Table 2. A setting of zero defeats this "OR" function entirely. Please see the sections "Setting and Reading Softswitches" and "Setting Alarm Conditions" for further details.
66	Alarm 1 Logical Activation Condition Inverters (Flags Table 2)	This Parameter, in conjunction with Parameters 65 & 67, defines which conditions will result in the Alarm 1 output being activated. The function allows selected Drive Condition Flags Table 2 to be "inverted" before being presented to the "inputs" of the "AND" function (see Parameter 67). Please see the sections "Setting and Reading Softswitches" and "Setting Alarm Conditions" for further details.
67	Alarm 1 Logical "AND" Activation Conditions (Flags Table 2)	This Parameter, in conjunction with Parameters 65 & 66, defines which conditions will result in the Alarm 1 output being activated. The function is that of a Logical "AND"ing of the selected Drive Condition Flags Table 2. A setting of zero defeats this "AND" function entirely. Please see the sections "Setting and Reading Softswitches" and "Setting Alarm Conditions" for further details.

Parameter	Parameter Name	Description
Alarm Output #2 Setup Parameters		
70	Alarm 2 Logical "OR" Activation Conditions (Flags Table 1)	This Parameter, in conjunction with Parameters 71 & 72, defines which conditions will result in the Alarm 2 output being activated. The function is that of a Logical "OR"ing of the selected Drive Condition Flags. A setting of zero defeats this "OR" function entirely. Please see the sections "Setting and Reading Softswitches" and "Setting Alarm Conditions" for further details.
71	Alarm 2 Logical Activation Condition Inverters (Flags Table 1)	This Parameter, in conjunction with Parameters 70 & 72, defines which conditions will result in the Alarm 2 output being activated. The function allows selected Drive Condition Flags to be "inverted" before being presented to the "inputs" of the "AND" function (see Parameter 72). Please see the sections "Setting and Reading Softswitches" and "Setting Alarm Conditions" for further details.
72	Alarm 2 Logical "AND" Activation Conditions (Flags Table 1)	This Parameter, in conjunction with Parameters 70 & 71, defines which conditions will result in the Alarm 2 output being activated. The function is that of a Logical "AND"ing of the selected Drive Condition Flags. A setting of zero defeats this "AND" function entirely. Please see the sections "Setting and Reading Softswitches" and "Setting Alarm Conditions" for further details.
73	Alarm 2 Output Style & Reset Configuration	This setting configures the output mode and reset method for the Alarm 2 output. • Mode 1: Constant & Auto Reset In this mode, the alarm output will remain active until the alarm condition ceases to exist. The alarm will automatically reset when the conditions return to normal. • Mode 2: Constant & Manual Reset In this mode, the alarm output will remain active until the alarm is reset manually. See Parameter 74 for details. • Mode 3: Pulse & Auto Reset In this mode, the alarm output will pulse on and off until the alarm condition ceases to exist. The pulsed modes are commonly used for audible alarms where a constant output would be considered distracting or awkward. The alarm will automatically reset when the conditions return to normal. • Mode 4: Pulse & Manual Reset In this mode, the alarm output will pulse on and off until the alarm is reset manually. See Parameter 74 for reset details. The pulsed modes are commonly used for audible alarms where a constant output would be considered distracting or awkward.
74	Alarm 2 Reset Configuration	This setting determines which actions will cause an active alarm to be silenced or reset. • Mode 1: No Silencing, Reset On ENTER Button Press In this mode, an active alarm cannot be silenced. Once the alarm condition ceases to exist, however, the ENTER button may be pressed to cause a manual reset. • Mode 2: No Silencing, Reset On S2 Input High (Not Wired To Common) Similar to Mode 1. Once the alarm condition ceases to exist, setting the S2 input to a high (+5V) state or allowing it to float disconnected will cause a manual reset. • Mode 3: No Silencing, Reset On S2 Input Low (Wired To Common) Similar to Mode 1. Once the alarm condition ceases to exist, setting the S2 input to a low (COM) state or wiring it to common will cause a manual reset. • Mode 4: Silencing Enabled, Reset On ENTER Button Press When the conditions for an active alarm persist, pressing any user-interface button will result in the alarm being silenced or deactivated, but not reset. A second attempt to reset the alarm must be made after the condition ceases to exist to clear the alarm. • Mode 5: Silencing Enabled, Reset On S2 Input High (Not Wired To Common) Similar to Mode 4. Setting the S2 input to a high (+5V) state or allowing it to float disconnected will cause the alarm to be silenced or reset depending on the current state of the alarm conditions. • Mode 6: Silencing Enabled, Reset On S2 Input Low (Wired To Common) Similar to Mode 4. Setting the S2 input to a low (COM) state or wiring it to common will cause the alarm to be silenced or reset depending on the current state of the alarm conditions.
75	Alarm 2 Annunciator Flash On Alarm	When set to 1, this will cause the "Alm2" LED Annunciator to flash when an alarm 2 condition is active. A setting of zero defeats this function.
76	Alarm 2 Pulse on Time	This Parameter defines the number of seconds the output should be enabled during the 'on' phase of an active pulsing alarm's output.

Parameter	Parameter Name	Description
77	Alarm 2 Pulse off Time	This Parameter defines the number of seconds the output should be disabled during the 'off' phase of an active pulsing alarm's output.
78	Alarm 2 Pulse Count	This setting determines how many pulses are outputted when the alarm is activated and is configured in pulse output style. When 0 is entered, the unit will be set for continuous pulses while the alarm is active.
79	Alarm 2 Lower Limit	This setting defines either the lower limit or the lower end of a range for the alarm region. Alarm limits are set in engineering units without regard to decimal point or colon position. In Rate and Follower Modes, a limit of 123 could represent a display value of 123, 12.3, 1.23, or 0.123. When in Time Mode, a limit of 123 would represent 1:23 on the display.
80	Alarm 2 Upper Limit	This setting defines either the upper limit or the upper end of a range for the alarm region. Alarm limits are set in engineering units without regard to decimal point or colon position. In Rate and Follower Modes, a limit of 123 could represent a display value of 123, 12.3, 1.23, or 0.123. When in Time Mode, a limit of 123 would represent 1:23 on the display.
81	Alarm 2 Output Routing	This setting allows the GSDA-DP-D to control the "Alarm 1" output of a selected Modular Bus "Slot", provided of course that there is a Modular Bus card that supports this function installed in the selected slot. The valid values for this Parameter are: • Mode 1: Not Used • Mode 2: Route Alarm 2 Output to Modular Bus Slot 100 Alarm 1 Output In this mode, the GSDA-DP-D Alarm 2 output will directly control the Alarm 1 output of a Modular Bus Card installed in Slot 100, if that card supports this feature. • Mode 3: Route Alarm 2 Output to Modular Bus Slot 200 Alarm 1 Output In this mode, the GSDA-DP-D Alarm 2 output will directly control the Alarm 1 output of a Modular Bus Card installed in Slot 200, if that card supports this feature. • Mode 4:Route Alarm 2 Output to Modular Bus Slot 500 Alarm 1 Output In this mode, the GSDA-DP-D Alarm 2 output will directly control the Alarm 1 output of a Modular Bus Card installed in Slot 500, if that card supports this feature.
85	Alarm 2 Logical "OR" Activation Conditions (Flags Table 2)	This Parameter, in conjunction with Parameters 86 & 87, defines which conditions will result in the Alarm 2 output being activated. The function is that of a Logical "OR"ing of the selected Drive Condition Flags Table 2. A setting of zero defeats this "OR" function entirely. Please see the sections "Setting and Reading Softswitches" and "Setting Alarm Conditions" for further details.
86	Alarm 2 Logical Activation Condition Inverters (Flags Table 2)	This Parameter, in conjunction with Parameters 85 & 87, defines which conditions will result in the Alarm 2 output being activated. The function allows selected Drive Condition Flags Table 2 to be "inverted" before being presented to the "inputs" of the "AND" function (see Parameter 87). Please see the sections "Setting and Reading Softswitches" and "Setting Alarm Conditions" for further details.
87	Alarm 2 Logical "AND" Activation Conditions (Flags Table 2)	This Parameter, in conjunction with Parameters 85 & 86, defines which conditions will result in the Alarm 2 output being activated. The function is that of a Logical "AND"ing of the selected Drive Condition Flags Table 2. A setting of zero defeats this "AND" function entirely. Please see the sections "Setting and Reading Softswitches" and "Setting Alarm Conditions" for further details.
Parameter Memory Command Parameters		
Rather than being a "setting" or a "switch" type Parameter, Parameters 95 through 99 are used to trigger a certain "Action" or "Script" that generally performs some Utility function for the GSDA-DP-D, and/or a Modular Bus card installed in the drive. The "value" settings are used as a kind of "key" to make sure these functions are not accidentally "triggered".		
95	Factory Default Drive Command	When set to a value of 5, and then pressing the ENTER button, the GSDA-DP-D (Drive only) will be reset to factory default settings. THIS ACTION CANNOT BE UNDONE! This Command can also be achieved by applying power to the unit with both the Enter and Down buttons depressed. The programming jumper must be in the "On" position for this Command to function. Any Modular Bus card settings are unaffected.

Parameter	Parameter Name	Description
96	Factory Default Modular Bus Card Command	When set to the desired Modular Bus Slot number (100, 200, 500) and the ENTER button is pressed, the Default settings for that Modular Bus card's Parameters will be copied to the selected Slot's "partition" in the non-volatile storage of the GSDA-DP-D. THIS ACTION CANNOT BE UNDONE! Note that the Parameter settings for a particular Modular Bus card are actually stored on its "host" GSDA-DP-D, rather than on the Modular Bus card itself. The advantage of this is that if a Modular Bus card fails, a replacement can be quickly installed without having to be (re)configured, provided it is installed in the same Slot. The valid values for this Parameter are: • Mode 100: Restore Factory Defaults for card in Modular Bus Slot 100 Assumes there is a card in Slot 100. • Mode 200: Restore Factory Defaults for card in Modular Bus Slot 200 Assumes there is a card in Slot 200. • Mode 500: Restore Factory Defaults for card in Modular Bus Slot 500 Assumes there is a card in Slot 500.
98	Save (copy) current "Environment" Settings TO User Save Area	When set to a value of 5, and then pressing the ENTER button, the GSDA-DP-D will prompt the user to Save the current "environment" (Settings for the drive and all installed Modular Bus cards) TO whichever User Save area ("Settings1" or "Settings2") that is not currently being used as the "Working" Settings. *NOTE: THIS ACTION CANNOT BE UNDONE!* Pressing the "Up" button will Save the settings; pressing any other button will Cancel the operation. TIP: This feature is often used by OEMs to save their customized settings to a "safe" area, that later can be easily Restored if the need arises. *NOTE: Unless a "Swap" command has been used (see Parameter 99), the "Working" area is "Settings1". Therefore, this command will normally Save to "Settings2".*
99	Restore/Swap current "Environment" Settings FROM User Save Area	When set to a value of 5 (for "Restore") or 10 (for "Swap"), and then pressing the ENTER button, the GSDA-DP-D will prompt the user to Copy the current "environment" (Settings for the drive and all installed Modular Bus cards) FROM whichever User Save area ("Settings1" or "Settings2") that is not currently being used as the "Working" Settings. or to "Change" (Swap) between using "Settings1" and "Settings2" as the "Working" Settings area. The "Copy" (Restore) is "destructive", but the "Change" (Swap) is not. The valid values for this Parameter are: • Mode 5: Restore Environment from whichever User Save area is not "Current" Will copy "Settings2" (or "Settings1") settings to the Current ("Working") settings. If the "Working" Settings are coming from "Settings1", then the values in "Settings2" will be used. If the "Working" Settings are coming from "Settings2", then the values in "Settings1" will be used. Either way, the result is that "Settings1" and "Settings2" will end up containing the same values. *NOTE: THIS ACTION CANNOT BE UNDONE!* • Mode 10: Swap "Working" Settings between "Settings1" and "Settings2" Non-Destructively "swaps" the "Working" Settings between using "Settings1" and "Settings2". This allows the user to easily play "what-if" type of speculation with one or more Parameters, without fear of "losing" their current settings. THE SWAP CAN BE DONE AS MANY TIMES AS DESIRED. TIP: The easiest way to find out which area "Settings1 or Settings2" is the "Working" (current) settings, is to enter this mode, and watch the "prompt" to see which area is being offered to "Change to". The current "Working" settings area is the one that is "opposite". For example, if the "prompt" offers to Change to "Settings2", then the GSDA-DP-D (and any Modular Bus cards) are currently using "Settings1" as the "Working" area, and vice versa. Then, "Cancel" the "Swap".
Maintenance Timer Setup Parameters		
100	Maintenance Timer ON/OFF	This parameter is used to turn on/off the maintenance timer and setting the length of time before the timer will trip. By setting this parameter to 0, the timer is disabled. By setting this parameter to a value of greater than 0, indicates the time (in hours) when the maintenance timer will trip. The display will show "MAIn" when the maintenance timer has exceeded it's set time (Parameter 100).
101	Reset Maintenance Timer	When the maintenance timer has reached its time limit, this parameter is used to reset the timer and start the timer from zero by setting this parameter to a value of 5.

Parameter	Parameter Name	Description
102	Current Time (In Hours)	This displays the current time in hours that the unit has been running.
103	Timer Scaler	This option can be used to extend the maintenance time of the device when the system is not working as hard as it could. Scaling allows the timer to be scaled when the motor is running below a pre-set value. If the value is set to 0, then the scaler is disabled. The timer will be scaled from 0 to 100% based on the speed from 0 to the value placed in Parameter 103. When the motor speed is at or above the pre-set value, the timer will be incremented at a 1:1 ratio (100% or one hour for each hour). If the motor is running below the pre-set value, then the overall percentage that the motor is running with respect to the pre-set value, will be used as the percentage when accumulating the time. Example: Parameter 103 set for 1600, motor is running at 800 RPM (50% of Parameter 103), then every 2 hours that the motor is running at 800 RPM will be 1 hour added to the maintenance timer.
120	Auto/Manual Slot Control	This setting determines what slot controls the Auto setting when switched to the Auto Mode. Power must be cycled Off/On after selection changes and Parameter 81 must match same slot selection.
121	Follower Target Source	Defines where the follower gets its target speed.
122	Follower Percent Source	When the drive is in follower mode, this determines what controls the percent of Master setting.

Application Examples

SCADA-driven Pump Controller with 4-20mA I/O, plus"Fault" and "Run" Relay Outputs

Description:

A GSDA-DP-D drive (with GSDA-AI-A8 installed) operating a waste pump control receives a target speed setting from the SCADA system, 4-20 mA output. The GSDA-DP-D drive will display the actual pump rate in liters per minute, and will continuously report the pump's actual flow rate to the SCADA system using the GSDA-AI-A8's 4-20 mA output. The display will indicate in the format "xxx.x" (LPM).

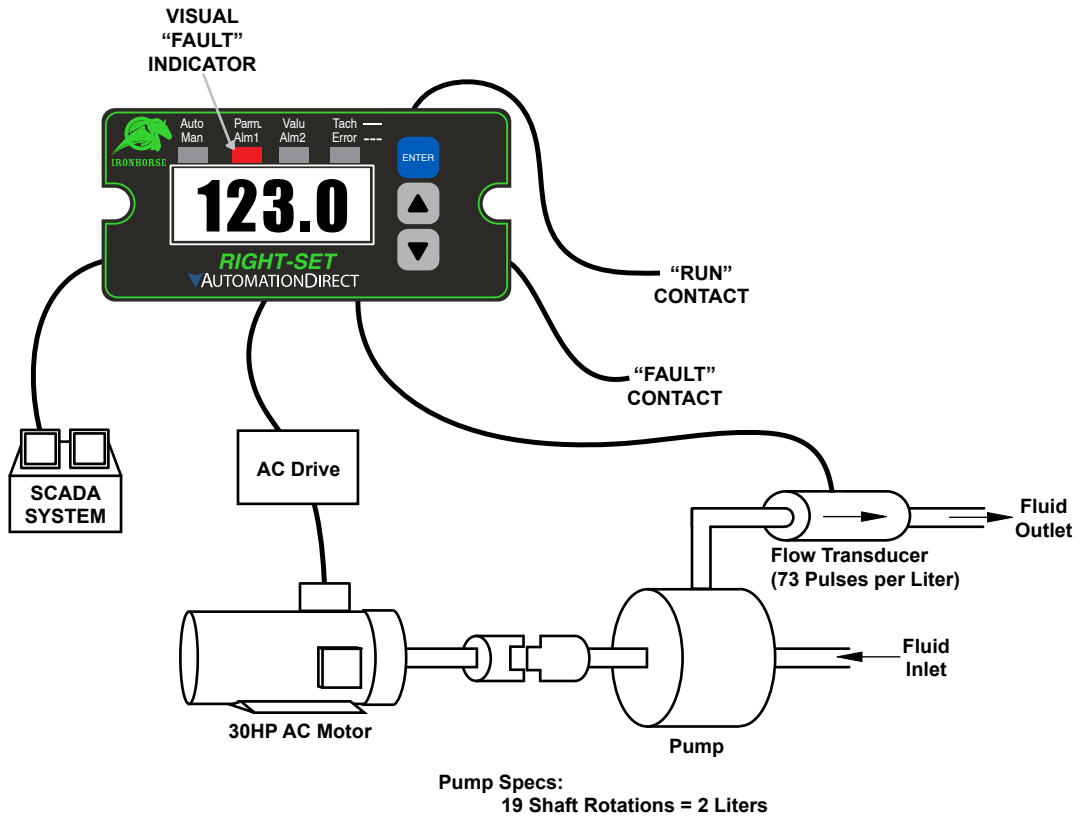
The system features a visual alarm (Annunciator) and dry relay contact output to warn the operator if any of the following "Fault" conditons have occurred: Actual or Target speed is outside specified limits, the waste flow has stopped, the GSDA-DP-D is at maximum output, or the 4-20 mA input signal has dropped below about 3mA (loop broken). Additionally, the "Fault" alarm will not activate if the Target speed is zero, the "Inhibit" input is active, or an accel/decel ramp is in progress. The alarm cannot be silenced but will reset automatically when flow rates have returned to normal.

Additionally, the system will provide a "Run" signal (as a dry relay contact) back to the SCADA to signal that the pump is running (or not, as commanded by the SCADA).

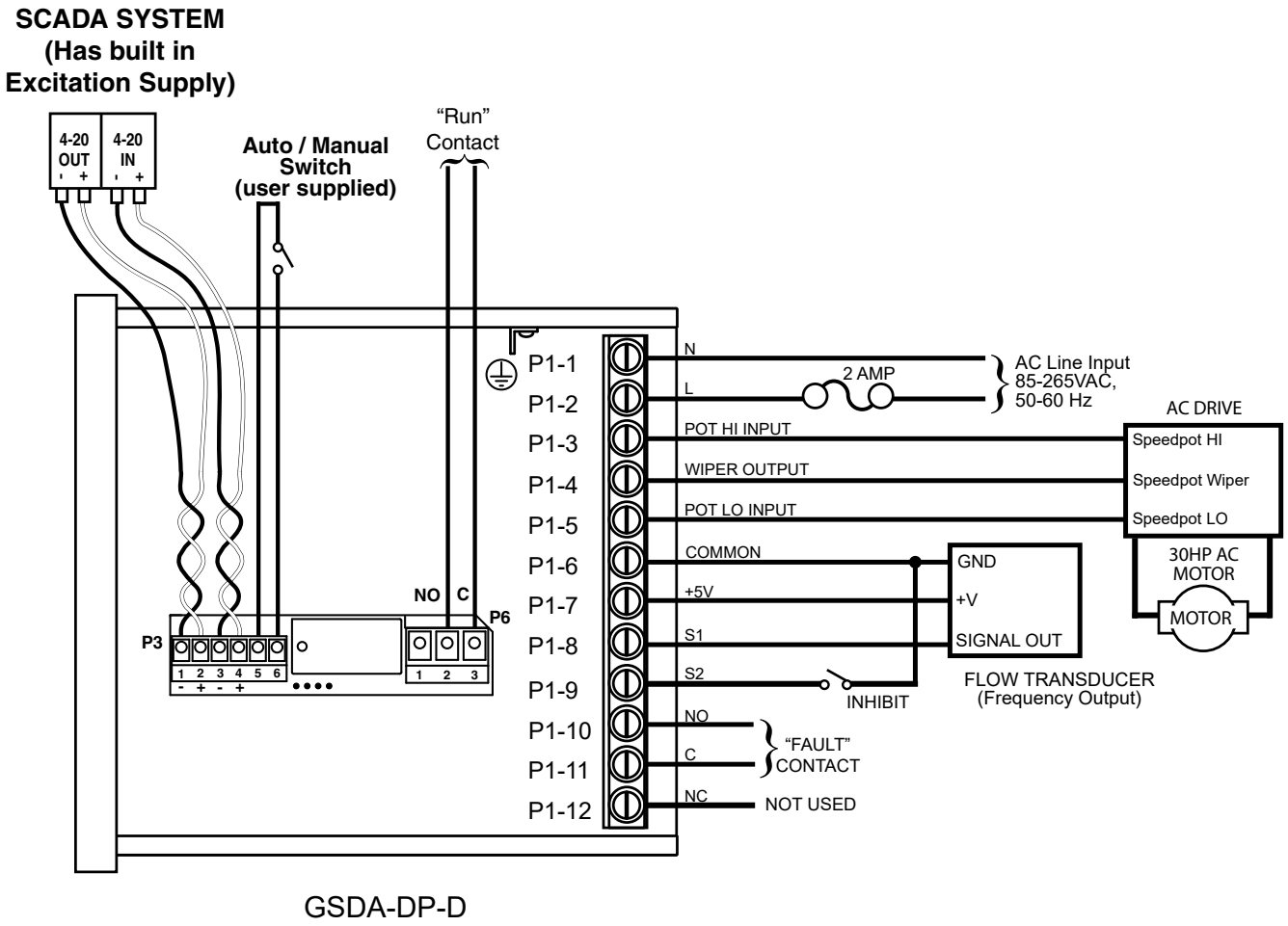
Motor, Pump and Flowmeter Specifications and Alarm Limits:

- Pump Output: 9.5 shaft rotations/liter
- Flow Transducer: 73 pulses/liter
- Desired Min. Flow Rate: 20 liters/minute, Max: 150 liters/minute
- Alarm Min.10 liters/minute, Max: 180 liters/minute
- Accel Rate: 100 liters/minute, Decel Rate: 50 liters/minute
- SCADA 4-20 mA scaling (both input and output): 4mA = zero LPM, 20mA = 200 LPM

Application Diagram:



WIRING DIAGRAM



RELEVANT MATH AND VARIOUS SETTINGS FOR THIS APPLICATION:

In this example, the pump turns 9.5 "shaft rotations" per liter. The maximum desired flow rate is 150.0 LPM, and the motor drives the pump at a 1:1 ratio, such that the motor speed at 150.0 LPM will be 9.5 x 150.0, or 1,425 RPM. Set parameter 31, S1 Reference RPM to 1425.

Set Parameter 30, Display Reference to 1500, which is the maximum flow rate (150.0 LPM, minus the decimal point) when the motor is running at the Reference speed of 1,425 RPM.

The flow transducer has a pulse output rate of 73 pulses per liter. Set Parameter 32, S1 Pulses Per Revolution to 73. The controller is "thinking" in LITERS per minute, but "controlling" the motor in REVOLUTIONS per minute.

The Accel and Decel rates are expressed in "Display Units" (Engineering Units) per second, so we have to divide our desired accel and decel rates by 60. Set Parameter 23, Accel Setting, to 17 (1000 / 60 and rounded up), and set Parameter 24, Decel Setting, to 8 (500 / 60).

The BCD settings for the "Fault" conditions are used to control the Alarm1 relay. The application requires that a "Fault" condition is "true" (active) when Actual Speed is Outside Limits, or Target Speed is Outside Limits, or waste flow has stopped (Main Pickup (Flowmeter) Stalled), or the GSDA-DP-D drive is at Max. Output, or the 4-20 mA Input loop appears "broken". Set Parameter 50, Alarm1 OR Activation Conditions, to a value of 2 + 4 + 16 + 512, which equals 534. Set Parameter 65, Alarm1 OR Activation Conditions, to a value of 2.

Conversely, we do NOT want "Fault" output to activate if any of the following conditions are true: Target speed (either through the 4-20 mA input or the "front panel") is set to zero, or an accel/decel ramp is in progress, or an "Inhibit" input is active (UIN1 will be set for use as an Inhibit input).

Here is where "negative logic" comes in: remember that "NOT" above? That implies that we will be

using the “inverters” (Parameter 51 in the case of Alarm1). In negative logic, a positive logic “AND” is actually a negative logic “OR”. So, to set up that “but NOT if this OR this OR this” condition, we simply set both the Inverters (Parameter 51 for Alarm1) as well as the AND conditions (Parameter 52 for Alarm1) to the BCD sum of the flags we wish to consider. Set Parameters 51 and 52 to a value of 137, which is the BCD sum of 1 + 8 + 128.

Referring to the “Alarm Logic Application Example” on page 18, there is an additional “implied AND” function that “ANDs” the result of the “OR” as well as the INVERT-AND cascade. Since an “AND” function is controlled by a false condition, (and since a logic “high” is “true”), any of the conditions selected in the INVERT-AND cascaded logic will make the result (output) be false (low), thus preventing any of the “OR” conditions from causing Alarm1, which we are using as our fault relay, to activate.

It is important to note that when Parameter 50 (or 70 for Alarm2) is set to zero, the implied “AND” is effectively removed, thus allowing for “AND-only” alarm condition logic. OR-only alarm logic is accomplished by setting both Parameters 51 and 52 (or 71 and 72 for Alarm2) to zero, which disconnects the output of the INVERT-AND logic, and instead substitues a “pull up” to a “logic true” (high) level, which satisfies the implied “AND”, and allows the “OR” conditions to control the Alarm output exclusively.

The BCD programming for Alarm2, which we are using to control the relay on the GSDA-AI-A8 to form a “Run” output, is much simpler. The GSDA-DP-D drive has a “Run” condition, which is true (active) when the Target Speed is greater than zero, AND the main pickup has received at least one pulse. Therefore, set Parameter 70, the Alarm2 “OR”, to the “Run” condition’s BCD value, 1024. Set Parameters 71 and 72 to zero. To have the GSDA-AI-A8’s relay output to be controlled by our “Run” condition (Alarm2), set Parameter 81, Alarm2 Output Routing, at its default value of 3 (assuming the GSDA-AI-A8 is in slot 200).

In addition to these settings, there are various other Parameters that control the Alarm Limits, Alarm “Reset” behavior, the Alarm1 “Annunciator”, the Displayed Decimal Point position, etc. See the Parameter Configuration table below for further details

TABLE: PARAMETER CONFIGURATION

All other parameters may be set to factory defaults, or as desired.

NOTE: PARAMETER NUMBERS ABOVE 999 ARE LOCATED IN THE GSDA-AI-A8 MODULAR BUS CARD OPTIONS MANUAL.

Parameter	Value	Notes
12	2	Set the Display to show ACTUAL (not "Target") Liters per Minute flow through the pump
13	3	Desired Decimal Point Display is XXX.X
20	200	Minimum Rate (Target Speed) is 20.0 LPM ("200" on the display)
21	1500	Maximum Rate is 150.0 LPM ("1500" on the display)
23	17	Accel rate is 17 Liters per SECOND, or 100 Liters per MINUTE
24	8	Decel rate is 8 Liters per SECOND, or 50 Liters per MINUTE
30	1500	This is the Display Reference value. 150.0 LPM ("1500" on the display)
31	1425	This is the calculated RPM speed of the pump motor at the Display Reference value, above
32	73	Output rate of 73 pulses per liter
33	10	Number of Seconds for "Initial" Stall Timeout
34	100	Number of tenths-of-seconds for the "Running" Stall Timeout
35	5	Using the S2 Input for an Active "Low" Inhibit Input (See Wiring Diagram, above)
42	3	Motor will decel to zero speed upon Inhibit, and accel back to speed when Inhibit released
50	534	"Fault" (Alarm1) will Activate on several conditions. See "Description", above, for details.
51	137	Along with Parameter 52, forms conditions that will SUPPRESS the "Fault" (Alarm1) from Activating
52	137	This "AND", with Parameter 51, forms a Neg. Logic "OR" to Suppress "Fault" (Alarm1) Activation
59	100	"Fault" (Alarm1) needs to Activate when Target or Actual "Speed" is less than 10.0 LPM.

Parameter #	Value	Notes
60	1800	"Fault" (Alarm1) needs to Acivate when Target of Actual "Speed" is greater than 180.0 LPM
65	1	"Fault" (Alarm1) will Activate on several conditions. (See "Description" above for details.)
70	1024	"Run" (Alarm2) is being used to reflect the "Run" condition Flag (Routed to GSDA-AI-A8 Relay)
2021	2000	Value to send from GSDA-AI-A8 to Host Drive when GSDA-AI-A8 receives 20mA on its Input terminals
2041	2000	Value from Host Drive to GSDA-AI-A8 that will cause 20mA to flow across its Output terminals

TROUBLESHOOTING

Problem	Possible Cause	Solution
Display is blank	1–Power not applied	1–Using a volt meter, verify that a voltage between 85 and 250 VAC is measure between the L and N terminal block positions.
	2–Defective unit	2–Contact technical support for additional help and instructions.
Display is dim	Display intensity parameter is too low	Increase the display intensity parameter to cause the display digits to become brighter.
When power is applied, “LF-L” is displayed	AC line supplying power to unit has too much noise	Review routing of power wires in machine to minimize electrical noise. Look for other devices which share the same circuit which may be producing unacceptable levels of line noise. In some applications, such as welding equipment, a careful regiment of applying an AC line filter, re-routing wires, dividing circuits, using shielded cable, and properly grounding devices will usually solve the problem.
	AC line supplying power to unit has an abnormally low frequency	The unit is designed to operate with AC lines from 48-62 Hz. This is typically not a problem because international standards are 50 and 60 Hz.
When power is applied, “LH-H” is displayed	AC line supplying power to unit has too much noise	Review routing of power wires in machine to minimize electrical noise. Look for other devices which share the same circuit which may be producing unacceptable levels of line noise. In some applications, such as welding equipment, a careful regiment of applying an AC line filter, re-routing wires, dividing circuits, using shielded cable, and properly grounding devices will usually solve the problem.
	AC line supplying power to unit has an abnormally high frequency	The unit is designed to operate with AC lines from 48-62 Hz. This is typically not a problem because international standards are 50 and 60 Hz.
The alarm output does not seem to function	Alarm output parameters not configured properly	Review alarm output parameters. The alarm relay output can be tested by selecting the “Always On” value for the Activation Condition parameters for the alarm output. When doing this, the relay click should be audible and the NC (normally closed) and C (common) terminals should become internally shorted at the terminal block.

Literature Number: LT183 Drawing Number: A-5-4167B