RELIANCE ELECTRIC

Using the SP200 AC Drive Demo Unit

M/N D1SP2001

Instruction Manual D2-3474

Rockwell Automation

The information in this manual is subject to change without notice.

Throughout this manual, the following notes are used to alert you to safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.

ATTENTION: Only qualified personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, and/or service this equipment. Read and understand this document in its entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: After disconnecting input power, wait three minutes to insure that DC bus capacitors are discharged. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: The user is responsible for conforming with all applicable local and national codes. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: Checking the direction of motor rotation requires rotating parts and/or electrical circuits to be exposed. Stay clear if the motor must be running. Disconnect, lockout, and tag the power source if contact must be made. Failure to observe this precaution could result in severe bodily injury or loss of life.

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CHAPTER 1

Introduction

This manual describes how to use the SP200 demo unit.

For complete product information, refer to Installing and Operating the SP200 AC Drive (D2-3408).

1.1 What Is a Variable-Speed Drive?

A variable-speed drive is an electronic device that controls the speed, torque, horsepower, and direction of an AC or DC motor.

Variable-speed drives offer:

- Improved process control by enabling you to control virtually any process variable and to control your process remotely with electrical interfaces.
- Reduced operating costs by enabling you to match the motor speed to the load requirements.
- Reduced maintenance by providing a "soft-start" capability that limits inrush current to reduce stress on mechanical parts.

1.2 About the SP200 Drive

Typical applications for the SP200 AC drive include fans, pumps, conveyors, and other small machines where inside panel or inside machine mounting is available.

The SP200 drive is best suited for applications with these requirements:

- A three-phase 1/2 to 2 HP AC induction motor is used.
- Single-phase input ratings (up to 1.5 HP) operate on 115 V or 230 V and produce 230 V, three-phase output in both cases.

- Three-phase ratings available in both 230 V and 460 V.
- Operator control options include local keypad or remote keypad. A CopyCat keypad is available for applications where quick editing and transfer of settings to multiple drives is desired.

The SP200 drive comes in three different control models to match specific needs:

- Model A: Single Channel Analog - for control from one analog signal or a speed pot.
- Model B: Preset Speed - for up to eight specific speeds controlled by three on/off digital inputs.
- Model C: Dual Channel Analog - for applications that can take advantage of an operation between two analog signals. Choose from PI, add, or multiply functions.

CHAPTER 2

Setting Up the Demo Unit

Before running the demo, take a moment to become familiar with the demo unit components and how the unit is wired.

2.1 Demo Unit Components and Wiring

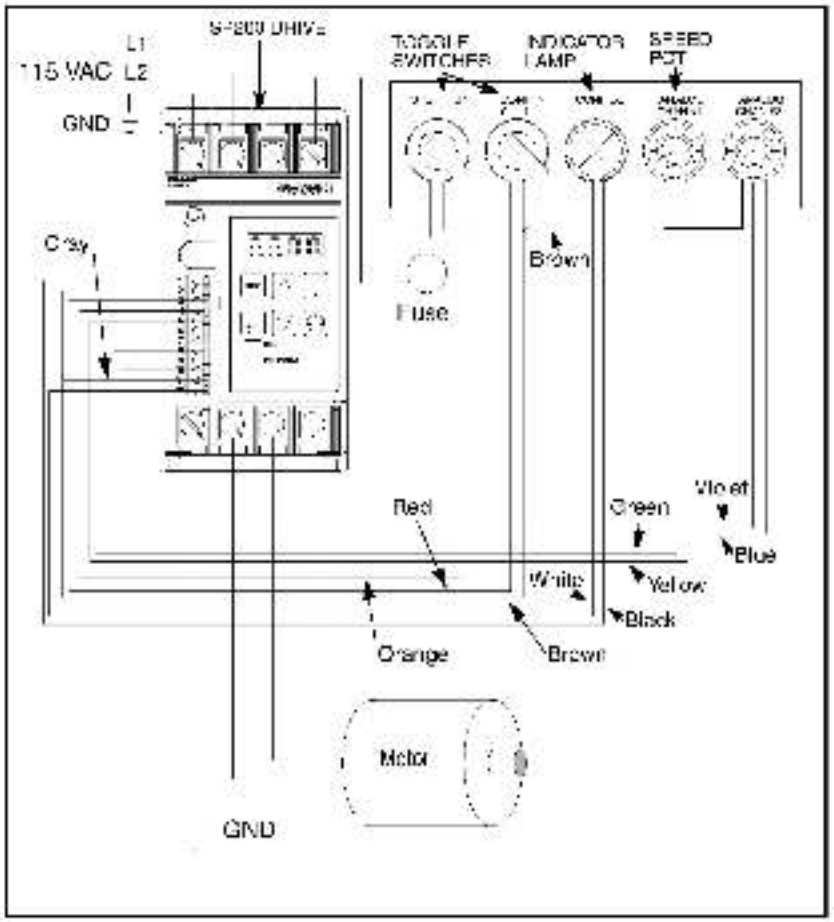


Figure 2.1 – SP200 AC Drive Demo Components and Wiring

2.2 Connecting Power to the Demo Unit

The SP200 AC drive demo unit is powered by a grounded 115 VAC input. Follow these steps to connect the power cord to the demo unit.

Step 1. Stand the demo unit on a flat surface with the handle and cover latches facing you.

Step 2. Open both latches and lift the cover. Then slide the cover to the right to remove.

Step 3. The power cord is stored in the cover of the demo unit. Press down on the spring-loaded fasteners inside the cover to access the power cord.

Step 4. Turn the demo unit around and stand it on its feet so that it faces you.

Step 5. Plug the power cord into the receptacle on the left side of the demo unit.

Step 6. Plug the power cord into a grounded 115 VAC outlet.

Step 7. Use the on/off switch located next to the power cord to apply power to the unit, if necessary.

CHAPTER 3

Programming Basics

To program the drive for a specific application, you display the appropriate parameter and adjust it as required. The parameters are used to define characteristics of the drive.

3.1 Parameter Menu Structure

The SP200 drive has two kinds of parameters: program parameters (P-xx), which configure the drive operation, and display parameters (d-xx), which display information regarding the drive status.

Table 3.1 – Parameter Organization

Range	Parameter Group	Parameter Type
P-00 to P-05	Protection	Program Parameters
P-10 to P-13	Digital Input/Output	
P-20 to P-29	Speed Reference	
P-30 to P-38	Dynamic Control	
P-40 to P-48	Fixed Speeds	
P-50 to P-55	V/Hz Curve	
P-60 to P-64	Utility	
d-00 to d-09	Display Parameters	Display Parameters

3.2 Parameter Types

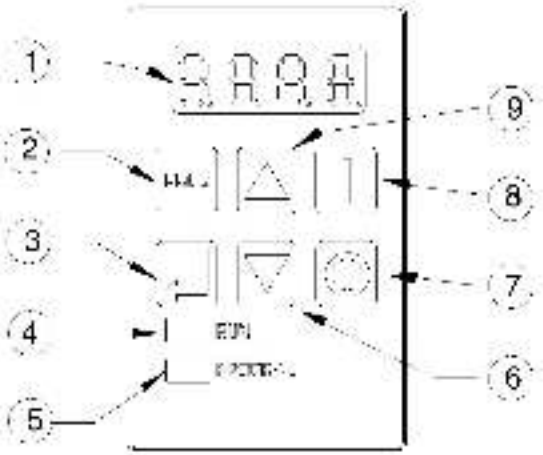
There are three types of parameters:

- **Tunable** parameters can be adjusted or changed while the drive is running or stopped.
- **Configurable** parameters can be adjusted or changed only while the drive is stopped.
- **Read-only** parameters cannot be adjusted.

3.3 How To Display and Adjust Parameter Values Using the Keypad

The keypad is located on the front panel of the drive demo unit.

Table 3.2 – Keypad Description



1	The display shows either a parameter number or a parameter value. The parameter numbers are preceded by either a "P-" or a "d-".
2	The [PRG] key toggles between display and program modes. The PROGRAM LED (5) turns on when the drive is in program mode and turns off when the drive is in display mode.
3	In display mode, the ↵ key scrolls through the display parameters. In program mode, this key toggles between the parameter number and parameter value.
4	The RUN LED turns on when the drive is running in either the forward or reverse direction. The RUN LED flashes while the drive is changing direction.
5	The PROGRAM LED turns on when the drive is in program mode and turns off when the drive is in display mode.
6	In display mode, the ▼ key decrements the local speed reference. In program mode, this key decrements the parameter number or parameter value.

Table 3.2 – Keypad Description

7	The STOP/RESET key issues stop and fault reset commands to the drive.
8	The RUN key issues start commands to the drive when P-10 = 1.
9	In display mode, the ▲ key increments the local speed reference. In program mode, this key increments the parameter number or parameter value.

The following table provides detailed steps for keypad operation.

Table 3.3 – Keypad Operation

Desired Action	User Steps
Start the unit	Press RUN to start the drive. Note that for RUN to work, a connection must be present between terminals 2 and 3. In addition, parameter P-10 must be set to 1.
Stop the unit	Press STOP/RESET to stop the drive.
Increment the local speed reference	While in display mode (PROGRAM LED is off), press ▲ to increase speed.
Decrement the local speed reference	While in display mode (PROGRAM LED is off), press ▼ to decrease speed.
View the value of the present display parameter	While in display mode (PROGRAM LED is off), the value of the present display parameter is normally displayed.
View the number of the present display parameter	While in display mode (PROGRAM LED is off), press and release ↵ once. The present display parameter number will be displayed for 2 seconds. The display will then return to the present parameter value.
Increment the display parameter number	While in display mode (PROGRAM LED is off), press ↵ until the desired parameter is displayed. Following a 2-second delay, the parameter value will be displayed.

Table 3.3 – Keypad Operation

Desired Action	User Steps
Increment the program parameter number	1. Press PROG until the PROGRAM LED turns on to enter program mode. 2. Press ▲ until the desired number is displayed.
Decrement the program parameter number	1. Press PROG until the PROGRAM LED turns on to enter program mode. 2. Press ▼ until the desired number is displayed.
Increment the current program parameter value	1. Press PROG until the PROGRAM LED turns on to enter program mode. 2. Press ↵ while the desired program parameter number is displayed. 3. Press ▲ until the desired value is displayed.
Decrement the current program parameter value	1. Press PROG until the PROGRAM LED turns on to enter program mode. 2. Press ↵ while the desired program parameter number is displayed. 3. Press ▼ until the desired value is displayed.
Clear faults	Press RESET.

CHAPTER 4

Running the Demo Unit

The demo consists of five step-by-step labs to acquaint you with the basic operation of the drive.

Purpose of the labs:

Lab 1	This lab has two parts: a. Learn the steps required to reset the drive to factory defaults. b. Learn how to set up a basic configuration that uses external I/O. This lab sets the drive up for the next four labs. Run Lab 1 first.
Lab 2	Learn how to use the display parameters to view drive status.
Lab 3	Learn how to use configured inputs and outputs.
Lab 4	Learn how to set up various stopping methods.
Lab 5	Learn how to set up an avoidance frequency.

4.1 The Labs

Lab 1a: Resetting the drive to factory defaults.

Tools required: None

Step 1. Turn on the demo unit using the power switch.

Step 2. Press PROG until the PROGRAM LED turns on to enter program mode.

Step 3. Press ▲ or ▼ until P-60 [RESET TO DEFAULTS] is displayed.

Step 4. Press ↵ to display the value of P-60 (0 should be displayed).

Step 5. Press ▲ to change the value to 1(Reset All Values to Factory Defaults).

Step 6. Press ↵ to accept the value.

The drive's factory defaults have been restored.

Lab 1b: Setting up a basic drive configuration that uses external I/O control.

Step 1. Press PRG until the PROGRAM LED turns on to enter program mode.

Step 2. Press ▲ or ▼ until P-00 [MINIMUM SPEED] is displayed.

Step 3. Press ↵ to display the value of P-00.

Step 4. Press ▲ or ▼ until the value 5 is displayed. This sets the minimum speed to 5 Hz.

Step 5. Press ↵ to accept the value.

Step 6. Press ▲ until P-01 [MAXIMUM SPEED] is displayed.

Step 7. Press ↵ to display the value of P-01.

Step 8. Press ▲ or ▼ to change the value to 60, if necessary.

Step 9. Press ↵ to accept the displayed value.

Step 10. Repeat this process for all of the parameters listed in table 4.2. The parameter settings are based on the demo unit's motor nameplate data listed below. Note that the demo unit contains a Model CSP200 drive.

- 1600 RPM
- .22 A FLA
- 60 Hz

Table 4.1 – Parameter Values for Basic Configuration

No.	Parameter Name	Value
P-00	MINIMUM SPEED	5 Hz
P-01	MAXIMUM SPEED	60 Hz
P-02	MOTOR OVERLOAD CURRENT	0.4 A
P-03	REVERSE DISABLE	0
P-05	CURRENT LIMIT	150%
P-10	START CONTROL	2 (2-Wire Start)
P-20	MAIN SPEED REFERENCE	0 (Analog Input 1)
P-30	ACCELERATION TIME 1	3.0 sec
P-31	DECELERATION TIME 1	3.0 sec
P-34	STOP CONTROL	0 (Ramp-to-Rest)
P-50	BASE VOLTAGE	100 V
P-51	BASE SPEED	60 Hz

The drive is now programmed with a basic configuration that uses external I/O control.

Step 11. Turn the CONFIG switch to 1.

Step 12. Turn the STOP/RUN switch to RUN. Notice that the drive starts and the RUN LED turns on.

Step 13. Turn the ANALOG CHAN #1 switch (the main speed reference) fully clockwise to run the drive at maximum speed (60 Hz).

Step 14. Turn the ANALOG CHAN #1 switch fully counter-clockwise to run the drive at minimum speed (5 Hz).

Step 15. Turn the STOP/RUN switch to STOP to stop the drive.

Step 16. Change the value of parameter P-10 to 1 (Keypad Control).

Step 17. Turn the STOP/RUN switch to RUN. Note that the drive does not start because the start control is now the keypad. Also notice that the RUN LED does not turn on.

Step 18. Turn the STOP/RUN switch to STOP.

Step 19. Press [RUN]. Notice that the drive starts and the RUN LED turns on.

Step 20. Press [STOP] to stop the drive.

Step 21. Change the value of parameter P-10 back to 2.

Lab 2: Using the display parameters to view drive status.

Tools required: None

Step 1. Press PROG until the PROGRAM LED turns off to enter display mode.

Step 2. Press ↵ once. The letter "d" will be displayed along with a two-digit number.

Step 3. Continue to depress ↵ (multiple times) to cycle through all the display parameters.

Note: When you stop or pause at a display parameter for more than 2 seconds, the value of that parameter is displayed.

Step 4. Press ↵ until parameter d-01 [OUTPUT FREQUENCY] is displayed.

Step 5. Turn the CONF IN switch to 1.

Step 6. Turn the STOP/RUN switch to RUN.

Step 7. Turn the ANALOG CHAN #1 switch fully clockwise to run the drive at maximum speed. The display should read at or near 60.0 Hz.

Step 8. Turn the ANALOG CHAN #1 switch fully counter-clockwise to run the drive at minimum speed. The display should read 5.0 Hz.

Step 9. Press ↵ until parameter d-00 [COMMAND FREQUENCY] is displayed. The display should read 5.0 Hz, which is the value of the main speed reference, ANALOG CHAN #1.

Step 10. Turn the STOP/RUN switch to STOP to stop the drive.

Lab 3: Using configured inputs and outputs.

Tools required: None

A configured input is an input that can be programmed to perform various functions. On the demo unit, the CONF IN switch is wired as the configured input to terminals 2 and 6 on the drive's terminal strip.

A configured output is an output that can be programmed to indicate various conditions. On the demo unit, the red CONF OUT indicator lamp is hardwired to the configurable output terminals on the drive's terminal strip (terminals 11 and 12).

In this lab, you will program the configured input as a function loss interlock and as a reversing switch. You will program the configured output to indicate various conditions.

Before proceeding with this lab, do the following:

Step 1. Be sure the drive is stopped and the STOP/RUN switch is in the STOP position.

Step 2. Verify that P-10 [START CONTROL] is set to 2. This will set the start control to 2-wire control.

To set P-10, use the following procedure:

a. Press PROG until the PROGRAM LED turns on.

b. Press ▲ or ▼ until P 10 is displayed.

c. Press ↵ to display the value of P 10.

d. Press ▲ or ▼ until 2 is displayed.

e. Press ↵ to accept the value.

Lab 3a: Programming the input as a function loss interlock.

A function loss is a hardwired input to the drive that can act as an interlock from some other equipment. If that other equipment fails or stop operating, this will cause a Function Loss fault in the drive (fault code FL is displayed). This fault will keep the drive from starting or will stop the drive if it is operating.

The switch labeled CONF IN is wired as the configured input.

Step 1. Verify that the CONF IN switch is in the 1 position.

Step 2. Verify that the STOP/RUN switch is in the STOP position.

Step 3. Set P-11 [CONFIGURABLE INPUT] to 0 (Function Loss).

Step 4. Turn the STOP/RUN switch to RUN. The motor should rotate to the commanded speed selected on the speed pot (ANALOG CHAN #1).

Step 5. Turn the CONF IN switch from 1 to 0. Note the following things that occur:

- The drive faults, and the motor coasts to a stop.
- The drive displays the fault code FL (Function Loss).
- The drive status LED changes from green (OK) to red (problem exists).
- The RUN and PROGRAM LEDs turn off.

Step 6. Turn the CONF IN switch back to 1, and turn the STOP/RUN switch back to STOP. Notice that nothing happens because the fault condition prohibits the drive from running.

Step 7. Press | ✲ | to reset the fault and note the following:

- The FL fault code is not displayed.
- The drive status LED changes from red to green.

Lab 3b: Programming the input as a reversing switch.

Step 1. Set P-11 [CONFIGURABLE INPUT] to 1. This programs the drive to run in the opposite direction when the configurable input is on.

Step 2. Verify that the STOP/RUN switch is in the STOP position and that the CONF IN switch is in the 0 position.

Step 3. Turn the STOP/RUN switch to RUN, and notice the direction of motor rotation. Turn the STOP/RUN switch to STOP to stop the drive.

Step 4. Turn the CONF IN switch to 1, and notice that the direction of motor rotation is reversed. Turn the CONF IN switch to 0 to stop the drive.

Important: If you set the STOP/RUN SWITCH to RUN while the CONF IN switch is set to 1, or vice versa, a drive fault will occur and CF will be displayed. The drive stops if more than one input (forward, reverse, or jog) is on.

If this fault occurs, turn the STOP/RUN switch to STOP and the CONF IN switch to 0. Then press

to reset the fault.

Lab 3c: Programming the configurable output.

The red indicator lamp (CONF OUT) on the demo unit is hardwired to the configurable output on the terminal strip (terminals 11 and 12).

Step 1. Set P-12 [CONFIGURABLE OUTPUT] to 0 (No Fault). This programs the output to turn on when the drive is not faulted.

Step 2. Turn the STOP/RUN switch to RUN. (The motor should rotate).

Step 3. Turn the CONF IN switch to 1. Notice the drive now displays a CF fault code. Also note that the red indicator lamp is off.

Step 4. Turn the CONF IN switch to 0, and the RUN/STOP switch to STOP.

Step 5. Press , to reset the fault. Notice that the CF code on the display is gone, and the red indicator lamp is now on.

Step 6. Set P-12 to 2 (Running). This programs the output to turn on when the drive is commanded to run.

Step 7. Turn the STOP/RUN switch to RUN, then back to STOP. Turn the CONF IN switch to 1, then back to 0. Notice when the red indicator lamp turns on and off.

Step 8. Set P-12 to 3 (At Frequency). This programs the configured output to turn on when the output from the drive equals the speed set by the speed reference pot, ANALOG CHAN #1 (commanded frequency speed).

Step 9. Turn the STOP/RUN switch to RUN. Notice that the red indicator lamp does not turn on immediately, but remains off until the output is equal to the speed reference. Rotate the speed pot clockwise and counter-clockwise and watch the red indicator lamp.

Step 10. Set P-12 to 4 (Above Frequency). This programs the configured output to turn on when the drive exceeds a specified frequency.

Step 11. Set P-13 [CONFIGURABLE OUTPUT LEVEL] to 30.0. This sets the level at which the output will turn on to 30.0 Hz.

Step 12. Turn the speed pot (ANALOG CHAN #1) fully clockwise. The red indicator lamp should be on.

Step 13. Press DSP to enter display mode.

Step 14. Press ↵ until d-01 [OUTPUT FREQUENCY] is displayed.

Step 15. Slowly turn the speed pot counter-clockwise. Notice that the red indicator lamp turns off when the frequency drops below 30.0 Hz.

Step 16. Set the STOP/RUN switch to STOP.

Lab 4: Programming various stopping methods.

Tools required: None

This lab consists of three parts:

a. Programming the drive for a coast-to-rest stop.

b. Programming the drive for a ramp-to-rest stop.

c. Programming the drive for DC injection braking.

Lab 4a: Programming the drive for a coast-to-rest stop.

Step 1. Press PRG until the PROGRAM LED turns on to enter programming mode.

Step 2. Press ▲ or ▼ until P-34 [STOP CONTROL] is displayed.

Step 3. Press ↵ to display the value of P 34.

Note: The drive may be at the default value of 0 (Ramp-to-Rest), which means the output voltage and frequency is lowered based on the decel time. During the previous labs, you may have noticed how quickly the drive stopped.

Step 4. Set P 34 to 1 (Coast to Rest).

Step 5. Turn the STOP/RUN switch to RUN and turn the speed pot (ANALOG CHAN #1) fully clockwise.

Step 6. Press DSP to enter display mode.

Step 7. Press ↵, if necessary, until d-01 [COMMAND FREQUENCY] is displayed.

Step 8. Turn the STOP/RUN switch to STOP. Notice that the output frequency immediately drops to 0. Notice how long it takes the motor to stop.

Lab 4b: Programming the drive for a ramp-to-rest stop.

Step 1. Press PRGM to enter program mode.

Step 2. Set P-34 to 0 (Ramp-to-Rest).

Step 3. Press DSPL to enter display mode.

Step 4. Press ↵, if necessary, until the value of d-01 [COMMAND FREQUENCY] is displayed.

Step 5. Turn the STOP/RUN switch to RUN. ANALOG CHAN #1 should be turned fully clockwise. Wait for the drive to reach full speed.

Step 6. Turn the STOP/RUN switch to STOP. Notice that the output frequency and voltage decreases over time (ramps down) to zero.

Lab 4c: Programming the drive for DC injection braking.

DC injection braking is a stopping method whereby DC current is applied to a single winding in a motor.

Step 1. Set P-34 to 2 (DC Injection).

Step 2. Set P-35 [DC BRAKE CURRENT] to 100. This specifies the output current level in percent.

Step 3. Set P-36 [DC BRAKE TIME AT STOP] to 3.0. This sets the amount of time in seconds that the current specified in P-35 is applied to the motor. The DC injection begins when the drive is commanded to stop.

Step 4. Press PRGM to enter display mode.

Step 5. Press ↵, if necessary, until the value of d-01 [COMMAND FREQUENCY] is displayed.

Step 6. Turn the STOP/RUN switch to RUN. ANALOG CHAN #1 should be turned fully clockwise. Wait for the drive to reach full speed.

Step 7. Turn the STOP/RUN switch to STOP. Notice that the output frequency and voltage dropped to 0 immediately.

Step 8. Reset the following parameters:

P-34 to 1

P-35 to 10

P-36 to 0.0

Lab 5: Setting up an avoidance frequency.

Tools required: None

Avoidance frequency parameters are used to prevent the drive from continuous operation within a range (band) of frequencies.

Step 1. Set P-37 [AVOIDANCE FREQUENCY] to 30.0 Hz. This specifies the midpoint of the band.

Step 2. Set P-38 [AVOIDANCE FREQUENCY BAND] to 20.0 Hz. This sets the width of the band. In this case, the width of the band is set from 20.0 Hz to 40.0 Hz.

Step 3. Turn the speed pot to zero (ANALOG CHAN #1 should be turned fully counter-clockwise).

Step 4. Press $\overline{\text{MON}}$ to enter display mode. Press ↵, if necessary, until the value of d-01 [COMMAND FREQUENCY] is displayed.

Step 5. Turn the STOP/RUN switch to RUN.

Step 6. Slowly turn the speed pot clockwise, and watch the display.

Notice that the motor holds up at 20.0 Hz and speeds up at 40.0 Hz.

Step 7. Press ↵ until d-00 [COMMAND FREQUENCY] is displayed.

Step 8. Turn the speed pot to zero, and then slowly turn the speed pot up and down.

Notice when the motor increases in speed, holds speed, and decreases speed.

Step 9. Reset the following parameters:

P-37 to 0

P-38 to 0

Step 10. Turn the RUN/STOP switch to STOP.

CHAPTER 5

Troubleshooting the Demo Unit

Use table 5.1 to troubleshoot any problems you may have with the demo unit.

For technical assistance, call 1-800-726-8112.

Table 5.1 – Troubleshooting Table

Problem	Corrective Action
Display or LEDs are not on.	• Check power source. • Check power cord connection. • Check on/off switch. • Check fuse.
Demo unit does not react as described in labs.	• Verify that parameter defaults were restored. • Verify that parameters were set correctly.
Cannot change parameter value.	• If the drive is running, verify that the parameter is a tunable parameter.
Fault or alarm code is displayed.	• Refer to the troubleshooting section in Installing and Operating the SP200 AC Drive (D2-3408).

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