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SLX Series 4-QUADRANT, REVERSING, REGENERATIVE
SL Series 2-QUADRANT, NON-REVERSING

BASIC START MANUAL

3-PHASE, DC DRIVES, VERSION 3.1

Please read this manual completely before
attempting to install and start up the
drive.

In familiarizing yourself with the drives, it is
best to start with a basic speed controlled set
up before attempting to introduce more
features to your system. In this way the start
up can be accomplished safely and reliably in
progressive easy stages.

All drives are complex technical products
with different features, and safety
requirements. It is essential to follow these
instructions in detail to ensure successful
operation.

Safety ...

Drives and process control systems are a very important part of creating better quality and value in the goods for our society, but they must be designed, installed and used with great care to ensure everyone's SAFETY. Remember that the equipment you will be using incorporates ...

High voltage electrical devices
Powerful rotating machinery
Heavy components

... *involving* ...

Hazardous materials
Expensive equipment
Interactive processes

Always use qualified personnel to design, construct, operate and maintain your systems and keep SAFETY as your primary concern. Thorough personnel training is an important aid to SAFETY and productivity. SAFETY awareness not only reduces the risk of accidents and injuries in your plant, but has a direct impact on improving product quality and costs. If you have any doubts about the SAFETY of your system or process, consult an expert before proceeding with the project.

Environment ...

This equipment is designed as a component to be used in a variable speed DC motor control system, and must be installed in a suitable electrical protective enclosure together with the appropriate additional safety and control components. This equipment is suitable only for installation in a safe, clean, non-hazardous environment. It is assumed that the customer will take full responsibility for ensuring that the equipment supplied and the installation meet all the necessary codes and safety standards.

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This manual is intended to supplement the detail manuals for the SL and SLX series 3-phase DC drives by identifying the basic requirements for start-up. It is not intended to replace the detail manuals and it is important to refer to these manuals throughout the start -up and operation of the drives.

FOR SUCCESSFUL START-UP IT IS ESSENTIAL TO FOLLOW THESE BASIC STEPS COMPLETELY AND IN SEQUENCE

PLEASE CALL US AT (410) 604-3400 IF YOU NEED ANY ASSISTANCE

CONTENTS	PAGE
<u>STEP 1</u> BASIC SPECIFICATION	3
<u>STEP 2</u> BASIC START INSTALLATION	4
<u>STEP 3</u> BASIC POWER CONFIGURATION	5
<u>STEP 4</u> BASIC WIRING	7
<u>STEP 5</u> BASIC DRIVE CONFIGURATION	10
<u>STEP 6</u> ESSENTIAL CHECKS	15
<u>STEP 7</u> BASIC POWER UP	16
<u>STEP 8</u> CUSTOMIZED CONFIGURATION	19
 <u>REFERENCE INFORMATION:</u>	
APPENDIX 1: CALIBRATION AND FUSES	20
APPENDIX 2: POWER COMPONENTS	21
APPENDIX 3: DIAGNOSTIC TEST UNIT & BLOCK DIAGRAM	22
APPENDIX 4: DRIVE TERMINAL LISTS	26
APPENDIX 5: FACTORY OPTIONS	30
APPENDIX 6: TACHOMETER SETUP AND SPEED SCALING	32
APPENDIX 7: FIELD WEAKENING SETUP	33
APPENDIX 8: SERVICE & SALES	36

STEP 1: Basic Specification

Define the following data for reference in setting up and checking out the drive installation:

3-PHASE POWER _____ VOLTS, 50 - 60 Hz
SHORT CIRCUIT CAPACITY _____ AMPS (A.I.C.)

ENVIRONMENT MAX TEMP. INSIDE DRIVE ENCLOSURE _____ °C (50 °C max)
(40 °C max UL)
ATMOSPHERE: CLEAN - DUST - WET - HAZARDOUS
ALTITUDE: _____ (max 3280 feet/1000 meters without derating)

DC SHUNT MOTOR _____ HORSEPOWER
(Nameplate Data)
_____ BASE RPM _____ MAX RPM
_____ ARMATURE VOLTS _____ AMPS
_____ FIELD VOLTS _____ AMPS
TACH FITTED? YES - NO _____ VOLTS/1000RPM
_____ VOLTS AT FULL SPEED
THERMOSTAT FITTED? YES - NO

DRIVE MODEL NUMBER _____
SERIAL NUMBER _____

SECTION DESCRIPTION

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STEP 2: Basic Installation

It is essential to start with a basic installation which can be checked out thoroughly before proceeding to a customized system installation. Please follow all of the following steps carefully.

STEP 2.1 MAKE SURE THAT ALL ELECTRICAL POWER IS TOTALLY DISCONNECTED AND LOCKED OUT.

STEP 2.2 Drive Mounting

Mounting center information is provided in section 3 of the detail manual.

Leave free space for ventilation and access, above and below the unit. Leave 4" (100mm) above, and 7" (175mm) below. Refer to detail manual for heat dissipation and ventilation requirements.

NOTE: On models SL/SLX 185 and larger, special ventilation is required. Refer to detail manual. These units also require separate 110V control power for the internal fan.

STEP 2.3 Fuse Protection

It is essential to install the correct high speed fuses:

- Three (3) fuses to the three phase power terminals L1, L2, L3
- Three (3) fuses the control terminals EL1, EL2, EL3 (only on SL/SLX 65 and larger)
- One (1) fuse on all model SL and SLX drives, to the armature circuit.

The fuse specifications are shown in Appendix 1 and on the rating label inside the drive.

No alternative fuses are acceptable unless approved by Bardac. Use of any other fuse type will invalidate the product warranty.

IMPORTANT: It is essential to maintain the phase sequence between the power and control connections to ensure proper operation of the drive. Failure to do so will cause the drive to misfire and to blow fuses.

STEP 2: *Basic Installation (cont.)*

STEP 2.4 *Main Contactor*

The drives are designed to operate with either an AC contactor in the 3-phase supply, or a DC contactor in the armature circuit, or both. The recommended configuration is an AC contactor.

WARNING Refer to the factory if field weakening control is to be used with a DC contactor.

The drive is designed to ensure that the motor current is zero before opening or closing the main contactor. The contactor selection can therefore be made by "thermal" or "definite purpose" or "resistive" rating. The nominal current rating of the contactor should be equal to, or greater than the drive full load current.

The contactor control contact in the drive is rated for 240 volts AC, 1 amp maximum current, 960 VA maximum switching. An additional external control (interposing) relay must be used if the contactor coil rating exceeds the drive internal contact rating.

IMPORTANT: It is essential that the main contactor is operated only by the drive internal relay via terminals 31 and 32. All system sequencing, interlocks, stop/start switching, etc., must be implemented through the drive control terminals 28, 29, and 30. Uncontrolled operation of the main contactor can be unsafe and will cause serious damage to the drive.

STEP 2.5 *Power Quality Components*

It is strongly recommended that each three phase drive is installed with either a Line Reactor or a Drive Isolation Transformer. This will ensure a defined line impedance thereby reducing both the level of SCR induced "notching" on the supply and the total radiated RF noise. In most industrial systems the choice of line reactor or transformer will depend on other considerations such as the need for isolation to provide added system safety.

In many instances, it will also be necessary to install a 3-phase Line Filter, type LF3, to both reduce the effects of drive induced transients on the line, and improve the immunity of the drive to disturbances on the supply such as lightning induced surges, "brownouts", "blackouts", etc.. (See "Power Components" in Appendix 2. *Line Filters are required on all drives above 122A DC current output.*

See Appendix 2 for details of Line Reactors, Drive Isolation Transformers and Line Filters available from Bardac.

STEP 2.6 Uncouple the motor from the load so that it can rotate freely and safely.

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STEP 3: Power Configuration

STEP 3.1 Supply Voltage Configuration

The drives can be configured for two ranges of supply nominally 240 volts and 480 volts, 3-phase, 50/60Hz auto ranging.

Models SL/SLX185 and larger also requires a 115 volts, 1 amp control supply.

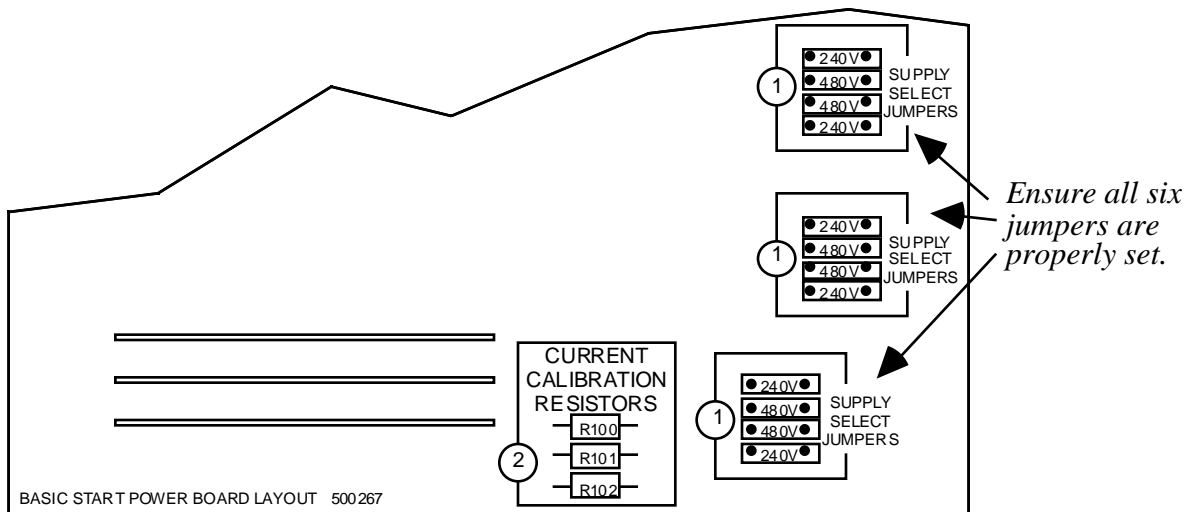
The 240 volts configuration covers the range 200 to 240V, +/-5%

The 480 volts configuration covers the range 380 to 480V, +/-5%

Unless otherwise specified the drive is shipped with the 480V taps selected. There are six voltage supply taps located on the Power (lower) printed circuit board. The location of the taps is shown on the diagram below at position 1.

NOTES:

- To access the lower Power Board:
 - remove the two plastic Control Board retaining screws adjacent to terminals 1 and 32,
 - release the two plastic catches on the top edge of the Control Board,
 - carefully remove the Control Board by unplugging it from the Power Board interface connector.
- There are 6 jumper plugs on the lower Power Board that must all be selected correctly for the required operating voltage.*** The jumper plugs must be pressed firmly into position to ensure a reliable long term connection.



STEP 3: Power Configuration (cont.)

STEP 3.2 Current Calibration

The basic drive current calibration is determined by three resistors (R100, R101 & R102) mounted on the lower edge of the power board (see above drawing position 2 and Appendix 1). The maximum full-load continuous current rating for a drive is identified by the last group of digits in the product model number. For example, a model SLX15/36 has a maximum full-load continuous current rating of 36 amps.

Lower standard current ratings can easily be obtained by removing calibration resistors as indicated in the table in appendix 1. The drive may have been custom calibrated at the factory and will have a handwritten calibration number located on the drive label.

Record the drive current calibration below:

Motor Amps _____	R100 _____ R101 _____ R102 _____	Final Drive Calibration _____
---------------------	----------------------------------------	----------------------------------

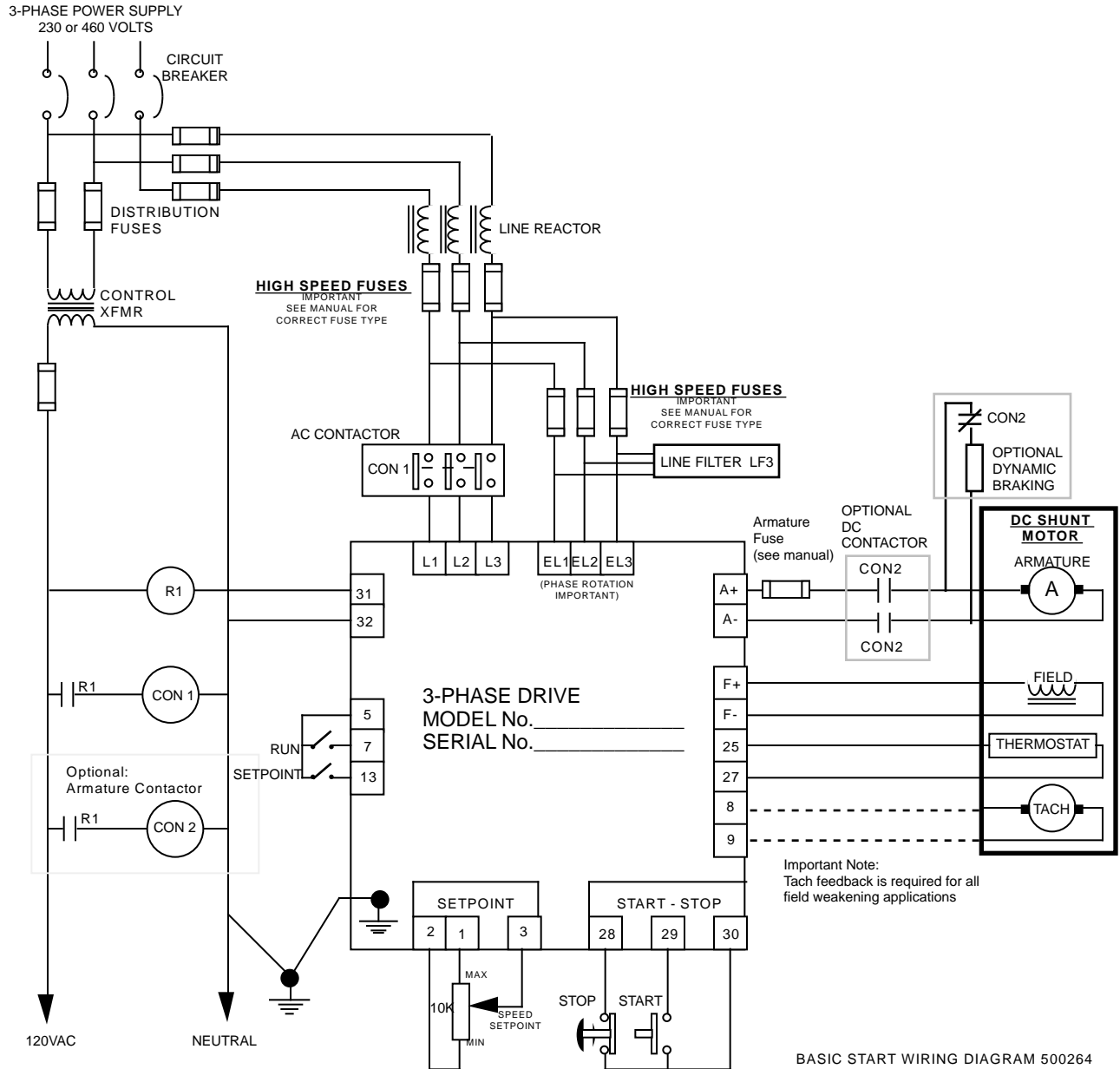
Custom calibrations are available. Please consult factory for details.

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STEP 4: Basic Wiring

STEP 4.1 Power & Control Wiring

The recommended Basic Start wiring diagram follows. A basic stop / start, speed controlled drive configuration is provided the following diagram for the SLX or SL drives:



Note: AC distribution fuses, breakers, power cabling, etc., should be rated for proper branch circuit protection.

NOTE: Tightening torque for 3-phase power and armature connections: 35 lbs. ins. (3.9 NM) Ensure that all connections are securely made. Poor connections or interruptions of either field or armature currents can be dangerous and can cause severe damage to the drive.

STEP 4.2 DC Motor

The armature currents for standard horsepower motors are given in Appendix 1, and the standard motor voltages are as follows:

<u>FOR 3-PH POWER VOLTS</u>	<u>ARMATURE VOLTS</u>	<u>FIELD VOLTS</u>
North America		
460-480 volts AC	500 Volts DC	300 Volts DC
220-240 volts AC	240 Volts DC	150 Volts DC
Europe		
380-415 volts AC	420-460 Volts DC	320-360 Volts DC

The built in field controller allows the field current to be set as required for the motor. The maximum field current ratings for the drives are as follows:

<u>MODELS</u>	<u>MAX FIELD CURRENT</u>
SL/SLX 15 & 20	2.5 Amps
SL/SLX 40 & 50	5.0 Amps
SL/SLX 65, 85, 115, & 145	10 Amps
SL/SLX 185, 225, & 265	10 Amps

Higher field current options are available. Please consult factory.

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STEP 5: Basic Drive Configuration

STEP 5.1 Control board setup

The Main Control (upper) printed circuit board has user definable features which must be set up before operation of the drive. The following tables list these features and show the required BASIC START SETTINGS. Match all pots, jumpers, and switches to the BASIC START SETTING before applying power to the drive. The CUSTOMIZED SETTINGS column is for you to record your final settings after the basic startup is complete. The locations of the various pots, jumpers, and switches are shown on the drawings which follow the tables.

SLX SERIES 4-QUADRANT REVERSING REGEN DRIVES

POTENTIOMETERS - CONTROL BOARD (UPPER) - SLX SERIES				
ITEM NO.	ITEM	DESCRIPTION	BASIC START SETTING	FINAL SETTING
1	MAX SPEED	Sets maximum drive voltage.	CCW	
2	MIN SPEED	Sets minimum drive speed if pot is used on T2.	CCW	
3	UP RAMP - FORWARD	Sets forward acceleration ramp rate Slow (30Sec) - Fast (0.5 Sec)	MID	
4	DOWN RAMP - FORWARD	Sets forward deceleration ramp rate Slow (30Sec) - Fast (0.5 Sec)	MID	
5	UP RAMP - REVERSE	Sets reverse acceleration ramp rate Slow (30Sec) - Fast (0.5 Sec)	MID	
6	DOWN RAMP - REVERSE	Sets reverse deceleration ramp rate Slow (30Sec) - Fast (0.5 Sec)	MID	
7	STAB - SPEED STABILITY	Sets speed loop stability. Normally not adjusted	MID	
8	ZERO SPEED (TRIM)	Sets zero speed. Normally only used with tach feedback.	MID	
9	MAX CURRENT (POS)	Sets maximum output current. Quadrants determined by current mode jumper.	CCW	
10	MAX CURRENT (NEG)	Sets maximum output current. Quadrants determined by current mode jumper.	CCW	
11	CURRENT STABILITY	Sets current loop stability. Normally not adjusted.	CCW	
12	FIELD CURRENT	Sets Base Field Current 0.2 - 2.5 Amps (SL/SLX 15 & 20) 0.2 - 5 Amps (SL/SLX 40 & 50)	Set to motor rating. Refer to step 7.4	
13	AUTO FIELD WEAKEN	Sets Field Weakening Breakpoint	CW	
14	JOG SPEED	Sets JOG speed	CCW	

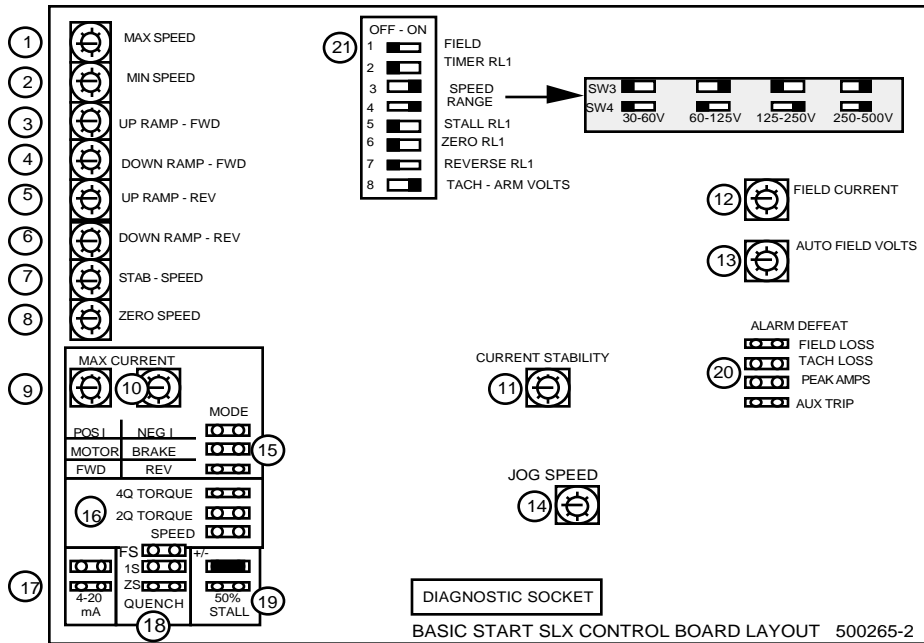
STEP 5: Basic Drive Configuration (cont.)

SLX SERIES 4-QUADRANT REVERSING REGEN DRIVES (cont.)

JUMPERS / SWITCHES - CONTROL BOARD (UPPER) - SLX SERIES				
ITEM NO.	ITEM	DESCRIPTION	BASIC START SETTING	FINAL SETTING
15	CURRENT MODE POS I NEG I MOTOR BRAKE FWD REV	See detail Manual	LINK OPEN OPEN	
16	TORQUE - SPEED 4Q TORQUE 2Q TORQUE SPEED	Sets drive control mode. 0-5 V signal for 0 - 100% current 0-10V signal for 0-100% current 0-10V signal for 0-100% speed	LINK OPEN OPEN	
17	4 - 20 mA	Drive accepts 4-20mA signal instead of 0-10V for speed control	OPEN	
18	QUENCH FAST STOP - FS 1 SEC - 1S ZERO SPEED - ZS	See detail manual	OPEN OPEN LINK	
19	50% STALL	See detail manual	OPEN	
20	ALARM DEFEAT FIELD LOSS TACH LOSS PEAK AMPS AUX TRIP	Defeats drive alarms. Defeats field loss detection (use for PM motors.) Defeats tach loss detection Defeats 300% overload detection Defeats thermostat trip input on Term 25 & 27. Also defeats drive heatsink thermostat.	OPEN OPEN OPEN OPEN	CAUTION see detail manual
21	OPTION SWITCHES 1 FIELD 2 TIMER RL1 3 SPEED RANGE 4 SPEED RANGE 5 STALL RL1 6 ZERO RL1 7 REVERSE RL1 8 TACH/ARM V	Turns on automatic field weakening Programmable relay switches whenever drive exceeds 105% current. 3 & 4 together set drive feedback scaling (either arm volts or tach) Programmable relay switches when drive stalls Programmable relay switches when drive is above zero speed Programmable relay switches when drive is above zero speed Sets Tach or Armature Volts feedback	OFF<< OFF<< Set to Arm Volts refer to chart on board layout. OFF<< OFF<< OFF<< >>ON	

STEP 5: Basic Drive Configuration (cont.)

SLX SERIES CONTROL BOARD LAYOUT



STEP 5: Basic Drive Configuration (cont.)

SL SERIES 2-QUADRANT, NON-REVERSING DRIVES

POTENTIOMETERS - CONTROL BOARD (UPPER) - SL SERIES				
ITEM NO.	ITEM	DESCRIPTION	BASIC START SETTING	FINAL SETTING
1	MAX SPEED	Sets maximum drive voltage.	CCW	
2	MIN SPEED	Sets minimum drive speed if pot is used on T2.	CCW	
3	UP RAMP	Sets acceleration ramp time Slow (30Sec) - Fast (0.5 Sec)	MID	
4	DOWN RAMP	Sets deceleration ramp time Slow (30Sec) - Fast (0.5 Sec)	MID	
5	STAB - SPEED STABILITY	Sets speed loop stability. Normally not adjusted	MID	
6	ZERO SPEED (TRIM)	Sets zero speed. Normally only used with tach feedback.	MID	
7	MAX CURRENT	Sets maximum output current.	CCW	
8	CURRENT STABILITY	Sets current loop stability. Normally not adjusted.	CCW	
9	FIELD CURRENT	Sets Base Field Current 0.2 - 2.5 Amps (SL/SLX 15 & 20) 0.2 - 5 Amps (SL/SLX 40 & 50)	Set to motor rating. See step 7.4	
10	AUTO FIELD WEAKEN	Sets Field Weakening Breakpoint	CW	
11	JOG SPEED	Sets JOG speed	CCW	

JUMPERS / SWITCHES - CONTROL BOARD (UPPER) - SL SERIES				
ITEM NO.	ITEM	DESCRIPTION	BASIC START SETTING	FINAL SETTING
12	TORQUE - SPEED 2Q TORQUE SPEED	Sets drive control mode. 0-10V signal for 0-100% current 0-10V signal for 0-100% speed	LINK OPEN	
13	4 - 20 mA	Drive accepts 4-20mA signal instead of 0-10V for speed control	OPEN	
14	QUENCH ZERO SPEED - ZS	See detail Manual	LINK	
15	50% STALL	See detail Manual	OPEN	

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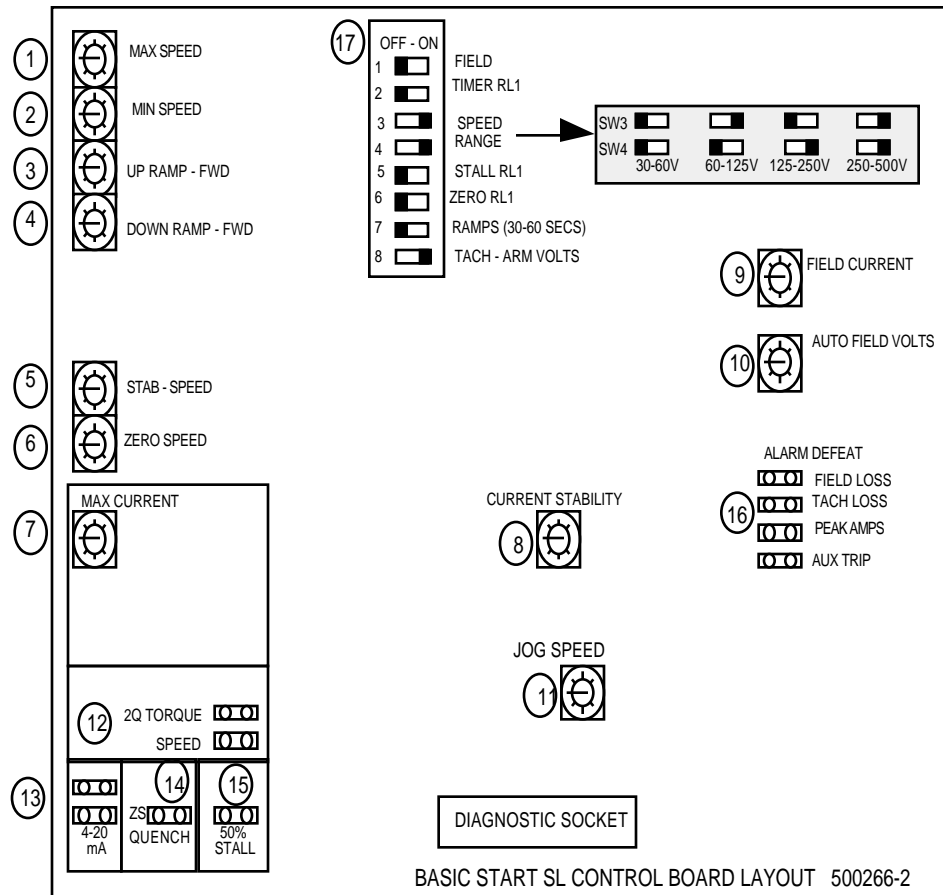
16	ALARM DEFEAT	Defeats drive alarms.		CAUTION see detail manual
	FIELD LOSS	Defeats field loss detection (use for PM motors.)	OPEN	
	TACH LOSS	Defeats tach loss detection	OPEN	
	PEAK AMPS	Defeats 300% overload detection	OPEN	
	AUX TRIP	Defeats thermostat trip input on Term 25 & 27. Also defeats drive heatsink thermostat.	OPEN	

STEP 5: Basic Drive Configuration (cont.)

SL SERIES 2-QUADRANT, NON-REVERSING DRIVES (cont.)

ITEM NO.	ITEM	DESCRIPTION	BASIC START SETTING	FINAL SETTING
17	OPTION SWITCHES			
	1 FIELD	Turns on automatic field weakening Programmable relay switches whenever drive exceeds 105% current.	OFF<<	
	2 TIMER RL1		OFF<<	
	3 SPEED RANGE	3 & 4 together set drive feedback scaling (either arm volts or tach) Programmable relay switches when drive stalls	Set to Arm Volts refer to chart on board layout OFF<<	
	4 SPEED RANGE			
	5 STALL RL1	Programmable relay switches when drive is above zero speed	OFF<<	
	6 ZERO RL1		OFF<<	
	7 RAMP (30-60 sec)	Extends drive ramps to 30-60 Sec. Sets Tach or Armature Volts feedback	OFF<<	
	8 TACH/ARM V		>>ON	

SL SERIES CONTROL BOARD LAYOUT



STEP 6: Essential Checks

Before powering up the drive it is essential to check the following:

1. Check that the motor can be safely rotated.
2. Check the 3-phase supply voltage and check drive voltage rating set up (red jumpers on power board.)
3. Check the drive current calibration (see Appendix 1).
4. Check the drive configuration (see STEP 5).
5. Check the high speed fuse specifications (see Appendix 1).
6. Check the wiring: For first time applications use BASIC START WIRING DIAGRAM page 8,

All connections tight,

All cables and components rated correctly and installed to required codes
7. Check the installation for short circuit fault conditions:

AC power wiring to ground, signal wiring and control wiring.

DC motor (armature and field) wiring to ground, signal wiring and control wiring.

Signal wiring to control wiring and ground.
8. Check the installation for cleanliness and ensure that it is free of debris such as wire clippings, metal chips, tools, etc.
9. Check that the enclosure is adequately ventilated with clean filtered air and that there is no risk of exposure to moisture or condensation or other hazardous materials.

STEP 7: Basic Power Up

- 7.1 Re-check the ESSENTIAL CHECKS in STEP 6!**
- 7.2 Plug in the model SP1020 Diagnostic Test Unit if available. (See Appendix 3)**
- 7.3 Turn on both the 115v control supply and the main 3-phase supply and carry out the following checks:**

IF THERE IS ANY DOUBT ABOUT THESE CHECKS OR IF ANY ALARM INDICATORS LIGHT, TURN THE POWER OFF IMMEDIATELY AND REPEAT THE BASIC START STEPS 1 THROUGH 6.

VOLT METER CHECKS	DIAGNOSTIC TEST UNIT CHECKS (see appendix 3)
1. Check the 3-phase supply volts at the drive terminals L1, L2, L3	1. Check the 3-phase supply volts at the drive terminals L1, L2, L3
2. Check the 115v control voltage	2. Check the 115v control voltage
3. Check the drive 24 volts DC supply terminals 67 (+24v) & 68 (common)	3. DP 10. 24 volts (20 to 30 volts DC)
4. Check the +12 volts rail terminals 61 (+12v) & 68 (common)	4. DP 18.
5. Check the -12 volts rail terminals 63 (-12v) & 68 (common)	5. DP 20
6. Check the +10 volts rail terminals 1 (+10v) & 5 (common)	6. Check the +10 volts rail terminals 1 (+10v) & 5 (common)
7. Check the -10 volts rail terminals 4 (-10v) & 5 (common)	7. Check the -10 volts rail terminals 4 (-10v) & 5 (common)
8. Check the SPEED SETPOINT REFERENCE terminals 3 & 5 (common)	8. DP 2

IMPORTANT!

IT IS ESSENTIAL TO STOP THE DRIVE AND DISCONNECT POWER BEFORE MAKING ANY ADJUSTMENTS OR CONFIGURATION CHANGES.

NEVER TURN THE 115V CONTROL SUPPLY ON OR OFF WHILE THE 3-PHASE POWER IS ON.

STEP 7: Basic Power Up (cont.)

7.4 Set up the field controller as follows:

1. Turn off all power.
2. Turn the MAX CURRENT potentiometer(s) down to zero (fully counter clockwise.)
3. Obtain the motor base field current from the motor nameplate. Note: Models up to SL/SLX 20 can provide up to 2.5 Amps, and models up to SL/SLX 50 can provide up to 5 Amps. Refer to factory for larger field currents.
4. Turn power back on.
5. Operate the drive "START", and observe that the field voltage LEDs come on.
6. Adjust the field current potentiometer to give the correct field current.

NOTE: if field current information is not available, set the field current pot to give the correct field voltage for the field at its normal operating temperature.

As the field current pot is increased the field current LEDs will turn on. The third (rightmost) LED indicates maximum obtainable field current, i.e. increasing the pot beyond this point will have no effect.

7. Check that the output voltage on F+ and F- does not exceed the rated voltage. If the motor is properly set up in field current control, the field voltage may be substantially less than rated voltage if the field is cold.

IMPORTANT

DO NOT ALLOW THE FIELD TO OPERATE FOR MORE THAN A FEW MINUTES AT VOLTAGES IN EXCESS OF THE RATED VOLTAGE. THIS CAN CAUSE SERIOUS DAMAGE TO THE MOTOR.

8. Operate the drive "STOP" and check that the field turns off within 30 seconds.

STEP 7: Basic Power Up (cont.)

7.5 Set up armature voltage control as follows:

1. It is recommended that the drive be run first with Armature Volts Feedback, and then switch to tachometer feedback, if required. To set up for Armature Volts Feedback:
 - a) Turn DIP SWITCH 8 to the ON position.
 - b) set DIP SWITCHES 3 and 4 to the appropriate position for the motor nameplate voltage (see control board diagram on page 12 or 14.)
 - c) disconnect the wire connected to terminal 9 from the motor tachometer (if present.)
2. Set speed setpoint pot to zero (Terminal 3 (DP2) = 0v)
3. Set Max current pot(s) to zero (fully counterclockwise)
4. Operate the drive "START", and observe main contactor operation.
5. Operate drive "STOP"
6. Move the TORQUE/SPEED link from the TORQUE position to the SPEED position.
7. Operate the drive "START" and close "RUN" and "SETPOINT." Increase the speed pot to 10%. The Stall timer light should operate and the motor should not turn.
8. Carefully increase the MAX CURRENT pot(s) to 10% and check that the motor starts to rotate in the right direction and at a controlled speed.

If not, immediately

- a) Operate drive STOP.
 - b) Turn off all power.
 - c) Reverse the field connections to reverse motor direction.
 - e) Turn on the power again and repeat armature voltage control set up procedure.
9. Operate drive "START" and observe motor rotation.
 - a) Increase speed setpoint slowly to full speed taking care to ensure that the motor does not go overspeed.
 - b) set the MAX SPEED pot for the correct full speed operation of the motor. Use a hand tach if available, or monitor armature volts.
 10. Operate the drive "STOP"
 11. Turn off all power. If the drive is to be run in armature voltage feedback, increase the MAX CURRENT pot(s) to full if the drive has been calibrated to maximum armature current. This ends the BASIC START procedure. For tachometer speed scaling, refer to Appendix 6.

STEP 8: Customized Configuration

Having completed the BASIC START procedure you may now proceed to customize your system to suit your specific application. It is important to refer to the Detail manuals throughout the process of designing and testing your system. The drives incorporate many powerful features to enable them to meet a wide variety of applications. Please do not hesitate to call us if we can provide any help or advice on how to best achieve your application requirements.

Feature	Location (see pg. 12 and 14)	
	SLX 4-Quad Reversing Regen	SL 2-Quad Non-Reversing
Speed / Current Scaling		
4 Speed Ranges (switch selectable cal. 30 - 500VDC)	Item 21 - (Switch 3 & 4)	Item 17 - (Switch 3 & 4)
Current Ranges for intermediate horsepowers	Current Scaling resistors. See Appendix 1	Current Scaling resistors. See Appendix 1
50% Stall Current Select	Link - see detail manual	Link - see detail manual
Potentiometer Adjustments		
Max Speed Set	Item 1	Item 1
Min Speed Set	Item 2	Item 2
Adjustable Up Ramp - Forward	Item 3	Item 3
Adjustable Down Ramp - Forward	Item 4	Item 4
Adjustable Up Ramp - Reverse	Item 5	N/A
Adjustable Down Ramp - Reverse	Item 6	N/A
Stability Set	Item 7	Item 5
Max Current Set - Positive	Item 9	Item 7
Max Current Set - Negative	Item 10	N/A
Field Current Set	Item 12	Item 9
Automatic Field Weakening Control	Item 21 - (Switch 1) and Item 13 (pot) adjustable from 200-500V	Item 17 - (Switch 1) and Item 10 (pot) adjustable from 200-500V
Terminal Inputs/Outputs		
Regen Brake Enable	N/A	Term 16 - see detail manual
Precision Tach Input	Term. 8 and 9	Term. 8 and 9
Ramped Speed Input (Optional S-Ramp)	Term. 3 - see detail manual for S-Ramp options	Term. 3 - see detail manual for S-Ramp options
Direct Speed Input	Term. 6 - see detail manual	Term. 6 - see detail manual
Torque Input	Term. 6 - see detail manual	Term. 6 - see detail manual
4-20mA Input	Term 2 - see detail manual	Term 2 - see detail manual
Inverting Speed Input	Term. 20	Term. 20
Aux Ramped Speed & Jog Inputs	Term. 18 & 19	Term. 18 & 19
Current Loop Input	Term. 6 - see detail manual	Term. 6 - see detail manual
Drive Run Input	Term. 7	Term. 7
Stall Relay (C-Face Relay Output)	Term. 10,11,12 Turn Switch 5 (Item 21) ON	Term. 10,11,12 Turn Switch 5 (Item 16) ON
Zero Speed Relay (C-Face Relay Output)	Term. 10,11,12 Turn Switch 6 (Item 21) ON	Term. 10,11,12 Turn Switch 5 (Item 16) ON
Configurable Relay (C-Face Relay Output)	Term. 10,11,12 Select Stall, Timer, or Zero Speed	Term. 10,11,12 Select Stall, Timer, Zero Speed, or Reverse
Stall Output	Term. 52	Term. 52
Zero Speed Output	Term. 53	Term. 53
Speed Output	Term. 23	Term. 23
Current Output	Term. 21	Term. 21
Setpoint ramp Output	Term. 22	Term. 22
Total Setpoint Output	Term. 17	Term. 17
10VDC Precision Reference Output	Term. 1	Term. 1

APPENDIX 1 Calibration & Fuses

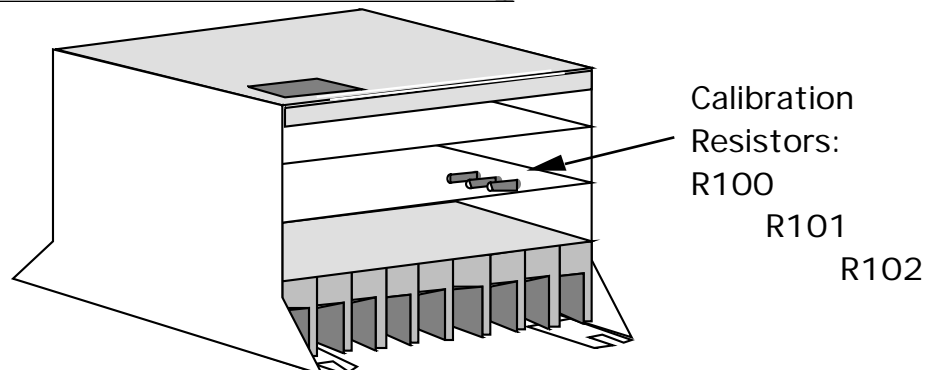
MOTOR HORSEPOWER RATINGS AT		DRIVE RATINGS AT 50°C WITH 150% LOAD FOR 30 SECS		ARMATURE CURRENT CALIBRATION RESISTORS			RECOMMENDED FUSES					
500v Arm	240v Arm	MODEL TYPE	Arm. Amps	R100	R101	R102	AC POWER			DC ARMATURE		
							Gould	Buss	Littelfuse	Gould	Buss	Littelfuse
							(fitted externally)			(fitted externally)		
5	2	SL/SLX15	9	220	remove	remove	A50QS30	FWH30	L50S30	A50QS30	FWH30	L70S30
7.5	3	SL/SLX15	13.6	remove	remove	147	A50QS30	FWH30	L50S30	A50QS30	FWH30	L70S30
10	5	SL/SLX15	22.6	220	147	remove	A50QS30	FWH30	L50S30	A50QS30	FWH30	L70S30
15	7.5	SL/SLX15	27	remove	147	147	A50QS30	FWH30	L50S30	A50QS30	FWH30	L70S30
20	10	SL/SLX15	36	220	147	147	A50QS30	FWH30	L50S30	A50QS40	FWH30	L70S40
7.5	3	SL/SLX20	13	remove	402	249	A50QS30	FWH30	L50S30	A50QS30	FWH30	L70S30
20	10	SL/SLX20	38	52.3	remove	remove	A50QS50	FWH50	L50S50	A50QS50	FWH50	L70S50
25	-	SL/SLX20	43	52.3	402	remove	A50QS50	FWH50	L50S50	A50QS50	FWH50	L70S50
30	-	SL/SLX20	51	52.3	402	249	A50QS60	FWH60	L50S60	A50QS60	FWH60	L70S60
25	-	SL/SLX40	44	remove	71.5	124	A50QS50	FWH50	L50S50	A50QS50	FWH50	L50S50
30	15	SL/SLX40	55	36.5	remove	remove	A50QS60	FWH60	L50S60	A50QS60	FWH60	L50S60
40	20	SL/SLX40	71	36.5	remove	124	A50QS80	FWH80	L70S80	A50QS80	FWH80	L70S80
50	25	SL/SLX40	83	36.5	71.5	remove	A50QS100	FWH100	L70S100	A50QS100	FWH100	L70S100
60	30	SL/SLX40	99	36.5	71.5	124	A50QS100	FWH100	L70S100	A50QS100	FWH100	L70S100
30	15	SL/SLX50	55	36.5	remove	remove	A50QS80	FWH80	L70S80	A50QS80	FWH80	L70S80
40	-	SL/SLX50	67	36.5	remove	154	A50QS100	FWH100	L70S100	A50QS100	FWH100	L70S100
60	30	SL/SLX50	110	36.5	36.5	remove	A50QS125	FWH125	L70S125	A50QS125	FWH125	L70S125
75	35	SL/SLX50	122	36.5	36.5	154	A50QS125	FWH125	L70S125	A50QS125	FWH125	L70S125
100	50	SL/SLX85	164	22	27	remove	(fitted externally)			(fitted externally)		
125	60	SL/SLX85	205	22	27	50	A50QS250	FWH250	L50S250	A50QS250	FWH250	L70S250
							A50QS250	FWH250	L50S250	A50QS250	FWH250	L70S250
125	60	SL/SLX115	205	20	20	remove	A50QS350	FWH350	L70S350	A50QS350	FWH350	L70S350
150	75	SL/SLX115	246	20	20	42	A50QS350	FWH350	L70S350	A50QS350	FWH350	L70S350
200	100	SL/SLX145	330	19	19	19	A50Q350	FWH350	L70S350	A50QS400	FWH400	L70S400

CONTROL FUSING REQUIREMENTS: All drives require three auxiliary fuses:
 SL/SLX 15 – SL/SLX 50 (internally fitted). SIBA part 701254020A or Bardac part CH00620A.
 SL/SLX 65 – SL/SLX 145 (externally fitted) Gould A50P15 or Buss FWH15.

IMPORTANT

It is essential to use only the fuses specified in the above table to ensure adequate protection of the drives. No substitutes are acceptable unless approved by Bardac Corporation. The use of any other fuses automatically invalidates the product warranty. If you need assistance with fuse information please call (410) 604-3400.

CURRENT CALIBRATION - SEE PAGE 5 FOR DETAILS



APPENDIX 2 Power Components

Three Phase Line Reactors

These are open construction for use only in a protected enclosure. Please refer to the detail manual for dimensions and detail specifications.

Drive	Line Reactor Part Number	Max. hp. at 230VAC	Max. hp. at 460VAC	Drive Max. DC Amps
SL/SLX 15, 20	LR48	15	30	48
SL/SLX 40, 50	LR120	35	75	120
SL/SLX 65,85,115	LR270	75	150	270
SL/SLX 145	LR330	100	200	330

Note: Larger Line Reactors are available. Please consult factory for specifications.

Three Phase Drive Isolation Transformers

All the three phase drive isolation transformers are in NEMA 1, floor standing, ventilated enclosures suitable for indoor use.

Standard Features: Windings: Delta Primary, Wye Secondary, 2 taps, +5% -5%

Please refer to the factory for dimensions and detail specifications and further options.

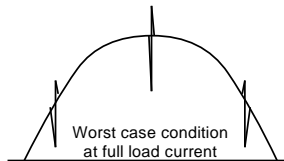
Primary Volts		230VAC		460VAC		575VAC	
Secondary Volts		230	460	230	460	230	460
hp	KVA	Catalog Numbers					
5	7.5	DIT722	DIT724	DIT742	DIT744	DIT752	DIT754
7.5	11	DIT1122	DIT1124	DIT1142	DIT1144	DIT1152	DIT1154
10	14	DIT1422	DIT1424	DIT1442	DIT1444	DIT1452	DIT1454
15	20	DIT2022	DIT2024	DIT2042	DIT2044	DIT2052	DIT2054
20	27	DIT2722	DIT2724	DIT2742	DIT2744	DIT2752	DIT2754
25	34	DIT3422	DIT3424	DIT3442	DIT3444	DIT3452	DIT3454
30	40	DIT4022	DIT4024	DIT4042	DIT4044	DIT4052	DIT4054
40	51	DIT5122	DIT5124	DIT5142	DIT5144	DIT5152	DIT5154
50	63	DIT5022	DIT5024	DIT5042	DIT5044	DIT5052	DIT5054
60	75	DIT7522	DIT7524	DIT7542	DIT7544	DIT7552	DIT7554
75	93	DIT9322	DIT9324	DIT9342	DIT9344	DIT9352	DIT9354
100	118	DIT11822	DIT11824	DIT11842	DIT11844	DIT11852	DIT11854
125	145	DIT14522	DIT14524	DIT14542	DIT14544	DIT14552	DIT14554
150	175	DIT17522	DIT17524	DIT17542	DIT17544	DIT17552	DIT17554
200	220	DIT22022	DIT22024	DIT22042	DIT22044	DIT22052	DIT22054

Note: Drive Isolation Transformers are available. Please consult factory for specifications.

APPENDIX 2 Power Components (cont.)

3-Phase Line Filter, LF3

This unit is a 3-phase Resistor/Capacitor/Diode Bridge network designed to reduce the drive induced switching transients on the power supply. The need for a line filter can be determined by performing a line analysis described below. In general, one LF3 Line Filter can be used with multiple drives to ensure that the power quality is satisfactory if, the (total horsepower) x (number of drives) is less than 150. Please call for further information.



Determining the need for a line filter:

Examine the three phases with an oscilloscope under worst case motor load conditions. Drive switching transients must never exceed an instantaneous max. voltage of 1.25 x the normal phase peak volts (1000 volts absolute maximum). If this is exceeded, a Line Filter will be required. Multiple units can be added to the 3-phase power lines to ensure that the power quality is satisfactory.

(Warning! be sure to use an isolated probe with the oscilloscope when working at high voltage)

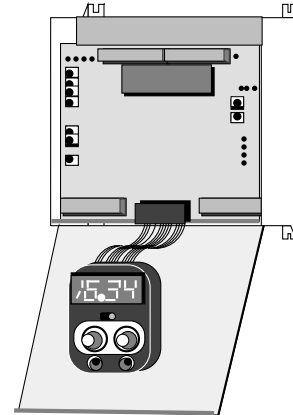
APPENDIX 3 Diagnostic Test Unit

The Diagnostic Test Unit plugs into the diagnostic test socket on the drive control board and provides safe access to most of the useful control signals in the drive. The unit aids in set-up and diagnostic analysis of the drive and associated controls.

The Diagnostic Test Unit should be plugged in only when the drive is in the "Power Off" condition.

Two selector switches allow the user to choose test points and show their value on the digital display.

The locations of the diagnostic test points are indicated on the drive block diagram which follows. Their descriptions are given in the following tables.



TEST POINT (DP)	SL/ SLX SERIES DESCRIPTION	OPERATING CONDITION	
		ENABLED / RUN (Contactor energized)	DISABLED OR FAULT (Contactor energized)
1	Ramp Output (Term 22)	+ 10 to -10 volts Ramps to total of speed ramp inputs	0 volts
2	Speed Input (Term 3)	+10 to -10 volts, equals 100% FWD to 100% REV speed	+10 to -10 volts, equals 100% FWD to 100% REV speed
3	Total Speed Command (Term 17 & 57)	-10 to +10 volts, equals 100% FWD to 100% REV speed	-10 to +10 volts, equals 100% FWD to 100% REV speed
4	Alternative/Jog Speed Input (Terms 18 & 64)	+10 to -10 volts, equals 100% FWD to 100% REV speed	+10 to -10 volts, equals 100% FWD to 100% REV speed
5	Speed Output (Term 23)	+ to - volts FWD to REV Scaled by MAX SPEED pot	Scaled tach volts or Armature volts = 0v
6	Auxiliary Input (Term 6)	+10 to -10 volts Speed or torque command	+10 to -10 volts Speed or torque command
7	Current Command (Term 54)	0 to -5 volts equals 0 to +/-100% armature current	0 volts
8	Run Signal (Term 7)	CLOSE = 0 volts OPEN = +11 volts	CLOSE = 0 volts OPEN = +11 volts
9	Current Output (Term 21)	+5 to -5 volts equals +100% to -100% armature current	0 volts
10	Drive Healthy	Healthy = +0.7 volts Fault = 0 volts	Healthy = +0.7 volts Fault = 0 volts
11	Relay RL1	Energized = 0 volts De-energized = -24v	Energized = 0 volts De-energized = -24v
12	Field Setpoint	0 to -5 volts equals 0 to 5 amps	0 to -5 volts equals 0 to 5 amps
13	Field Loss	Healthy = 0 volts Fault = +11 volts	Healthy = 0 volts Fault = +11 volts
14	Field Current (Term 24)	0 to +5 volts equals 0 to 5 amps	0 to +5 volts equals 0 to 5 amps
15	Tach Loss	Healthy = 0 volts Fault = +11 volts	Healthy = 0 volts Fault = +11 volts
16	0 Volts (Common)	0 Volts	0 Volts
17	Over Current Trip	Healthy = 0 volts Fault = +11 volts	Healthy = 0 volts Fault = +11 volts
18	+12 Volts Reference	+12 volts	+12 volts
19	Auxiliary Trip (Motor Temp)	Healthy = 0 volts Fault = +11 volts	Healthy = 0 volts Fault = +11 volts
20	-12 Volts Reference	-12 volts	-12 volts

APPENDIX 3 Diagnostic Test Unit

TEST POINT (DP)	SL SERIES DESCRIPTION	2-QUADRANT, NON-REVERSING DRIVES	
		OPERATING CONDITION	
		ENABLED / RUN (Contactor energized)	DISABLED OR FAULT (Contactor de-energized)
1	Ramp Output (Term 22)	0 to +10 volts Ramps to total of speed ramp inputs	0 volts
2	Speed Input (Term 3)	0 to +10 volts, equals 0 to 100% FWD speed	0 to +10 volts, equals 0 to 100% FWD speed
3	Total Speed Command (Term 17 & 57)	0 to -10 volts, equals 0 to 100% FWD speed	0 to -10 volts, equals 0 to 100% FWD speed
4	Alternative/Jog Speed Input (Terms 18 & 64)	0 to +10 volts, equals 0 to 100% FWD speed	0 to +10 volts, equals 0 to 100% FWD speed
5	Speed Output (Term 23)	0 to +volts Output scaled by MAX SPEED pot	Scaled tach volts or Armature volts = 0v
6	Auxiliary Input (Term 6)	0 to +10 volts Speed or torque command	0 to +10 volts Speed or torque command
7	Current Command (Term 54)	0 to -5 volts equals 0 to +/-100% armature current	0 volts
8	Run Signal (Term 7)	0CLOSE = 0 volts OPEN = +11 volts	CLOSE = 0 volts OPEN = +11 volts
9	Current Output (Term 21)	0 to +5 volts equals 0 to +100% armature current	0 volts
10	Drive Healthy	Healthy = +0.7 volts Fault = 0 volts	Healthy = +0.7 volts Fault = 0 volts
11	Relay RL1	Energized = 0 volts De-energized = -24v	Energized = 0 volts De-energized = -24v
12	Field Setpoint	0 to -5 volts equals 0 to 5 amps	0 to -5 volts equals 0 to 5 amps
13	Field Loss	Healthy = 0 volts Fault = +11 volts	Healthy = 0 volts Fault = +11 volts
14	Field Current (Term 24)	0 to +5 volts equals 0 to 5 amps	0 to +5 volts equals 0 to 5 amps
15	Tach Loss	Healthy = 0 volts Fault = +11 volts	Healthy = 0 volts Fault = +11 volts
16	0 Volts (Common)	0 Volts	0 Volts
17	Over Current Trip	Healthy = 0 volts Fault = +11 volts	Healthy = 0 volts Fault = +11 volts
18	+12 Volts Reference	+12 volts	+12 volts
19	Auxiliary Trip (Motor Temp)	Healthy = 0 volts Fault = +11 volts	Healthy = 0 volts Fault = +11 volts
20	-12 Volts Reference	-12 volts	-12 volts

APPENDIX 4 Drive Terminal Lists

TERM No.	SLX SERIES	4-QUADRANT, REVERSING, REGENERATIVE DRIVES	
	DESCRIPTION	OPERATING CONDITION	
		ENABLED / RUN (Contactor energized)	DISABLED OR FAULT (Contactor de-energized)
1	+10 Volts Reference	+10 volts	+10 volts
2	Min Speed	Max. 75% Term 3 volts	Max. 75% Term 3 volts
3	Speed Input - Ramped (Diagnostic Point 2) (50K input impedance)	+10 to -10 volts, equals 100% FWD to 100% REV speed	+10 to -10 volts, equals 100% FWD to 100% REV speed
4	-10 or +10 volts Reference	-10v if terms 15 & 16 open +10v if term 15 closed to drive common -10v if term 16 closed to drive common	-10v if terms 15 & 16 open +10v if term 15 closed to drive common -10v if term 16 closed to drive common
5	0 Volts - Common (Diagnostic Point 16)	0 Volts	0 Volts
6	Auxiliary Input - Ramped (Diagnostic Point 6) (50K input impedance)	+10 to -10 volts Speed or torque command	+10 to -10 volts Speed or torque command
7	Run Signal (Diagnostic Point 8)	CLOSE = 0 volts OPEN = +11 volts	CLOSE = 0 volts OPEN = +11 volts
8	0 Volts - Common (Diagnostic Point 16)	0 Volts	0 Volts
9	Tach Input	Tach volts	Tach volts
10	Relay 1 NC	See Manual	See Manual
11	Relay 1 NO	See Manual	See Manual
12	Relay 1 Arm	See Manual	See Manual
13	Start (Selects RL2)	START = 0 volts STOP = +24 volts	START = 0 volts STOP = +24 volts
14	Start Latch		
15	Forward (+10 volts Term 4)	Forward (+10 volts Term 4)	Forward (+10 volts Term 4)
16	Reverse (-10 volts Term 4)	Reverse (-10 volts Term 4)	Reverse (-10 volts Term 4)
17 & 57	Total Speed Command (Diagnostic Point 3) (1K output impedance)	-10 to +10 volts, equals 100% FWD to 100% REV speed	-10 to +10 volts, equals 100% FWD to 100% REV speed
18 & 64	Alt/Jog Speed Input - Ramped (Diagnostic Point 4) (50K input impedance)	+10 to -10 volts, equals 100% FWD to 100% REV speed. Selected by RL2 de-energize	+10 to -10 volts, equals 100% FWD to 100% REV speed. Selected by RL2 de-energize
19 & 66	Non-Inverting Speed Ramped input (50K input impedance)	+10 to -10 volts, equals 100% FWD to 100% REV speed	+10 to -10 volts, equals 100% FWD to 100% REV speed
20 & 65	Inverting Speed Ramped input (100K input impedance)	-10 to +10 volts, equals 100% FWD to 100% REV speed	-10 to +10 volts, equals 100% FWD to 100% REV speed
21	Current Output (Diagnostic Point 9) (10R output impedance)	+5 to -5 volts equals +100% to -100% armature current	0 volts
22 & 55	Ramp Output (Diagnostic Point 1) (1K output impedance)	+ 10 to -10 volts Ramps to total of speed ramp inputs	0 volts
23	Speed Output (Diagnostic Point 5) (1K output impedance)	+10 to -10 volts FWD to REV (Opt. scaled Max Speed pot)	Normalized tach volts or Armature volts = 0v
24	Field Current (Diagnostic Point 14) (1K output impedance)	0 to +5 volts equals zero to max field current	0 volts
25	External Trip (Motor Thermostat - trips with res to 0V > 2K ohms)	Healthy = 0 volts Fault = +11 volts	Healthy = 0 volts Fault = +11 volts
26	Alarm Reset (except stall)	Link to 0 volts to reset	Link to 0 volts to reset
27	0 Volts - Common (Diagnostic Point 16)	0 Volts	0 Volts
28	Power Off	0 Volts	Healthy = 0 volts Fault = +24 volts

APPENDIX 4 Drive Terminal Lists

SLX Series, continued ...

TERM No.	DESCRIPTION	ENABLED / RUN (Contactor energized)	DISABLED/FAULT (Contactor de-energized)
29	Power On	Power On = 0 Volts Power Off = +24 Volts	Power On = 0 Volts Power Off = +24 Volts
30	Power On Latch	Power On = 0 Volts Power Off = +24 Volts	Power On = 0 Volts Power Off = +24 Volts
31	Contactor Coil Switch		
32	Contactor Coil Switch		
51	-24 Volts Unregulated Max Load 25mA (Output unprotected)	-20 to -30 volts depending on external load	-20 to -30 volts depending on external load
52	Stall Relay Driver PNP Open Collector Max Rating, -30V, 50mA	-24V in STALL 0 V otherwise	-24V in STALL 0 V otherwise
53	Zero Speed Relay Driver PNP Open Collector Max Rating, -30V, 50mA	-24V at ZERO SPEED (< 1% speed) 0 V when above ZERO SPEED	-24V at ZERO SPEED (< 1% speed) 0 V when above ZERO SPEED
54	Current Command (Diagnostic Point 7) (1K output impedance)	0 to -5 volts equals 0 to +/-100% armature current	0 volts
55 & 22	Ramp Output (Diagnostic Point 1) (1K output impedance)	+ 10 to -10 volts Ramps to total of speed ramp inputs	0 volts
56	Armature Voltage Signal (1K output impedance)	0 to +5 Volts equals 0 to +500 or -500 Volts	0 to +5 Volts equals 0 to +500 or -500 Volts
57 & 17	Total Speed Command (Diagnostic Point 3) (1K output impedance)	-10 to +10 volts, equals 100% FWD to 100% REV speed	-10 to +10 volts, equals 100% FWD to 100% REV speed
58	0 Volts - Common (Diagnostic Point 16)	0 Volts	0 Volts
59	Reverse Relay Driver PNP Open Collector Max Rating, -30V, 50mA	-24V at REVERSE (< 5% FWD speed) 0 V at FORWARD (> 5% speed)	-24V at REVERSE (< 5% FWD speed) 0 V at FORWARD (> 5% speed)
60	Timer Relay Driver PNP Open Collector Max Rating, -30V, 50mA	-24V at overload (> 105% current demand) 0 V otherwise	1-24V at overload (> 105% current demand) 0 V otherwise
61	+12 Volts Reference (Diagnostic Point 18)	+12 volts	+12 volts
62	Stall Alarm Set/Reset	Connect to +12 volts to Reset Connect to -12 volts to Set	Connect to +12 volts to Reset Connect to -12 volts to Set
63	-12 Volts Reference (Diagnostic Point 20)	-12 volts	-12 volts
64 & 18	Alt/Jog Speed Input - Ramped (Diagnostic Point 4) (50K input impedance)	+10 to -10 volts, equals 100% FWD to 100% REV speed. Selected by RL2 de-energize	+10 to -10 volts, equals 100% FWD to 100% REV speed. Selected by RL2 de-energize
65 & 20	Inverting Speed Input Ramped input (100K input impedance)	-10 to +10 volts, equals 100% FWD to 100% REV speed	-10 to +10 volts, equals 100% FWD to 100% REV speed
66 & 19	Non-Inverting Speed Ramped input (50K input impedance)	+10 to -10 volts, equals 100% FWD to 100% REV speed	+10 to -10 volts, equals 100% FWD to 100% REV speed
67	+24 Volts Unregulated Max Load 25mA (Output unprotected)	+20 to +30 volts depending on external load	+20 to +30 volts depending on external load
68	0 Volts - Common (Diagnostic Point 16)	0 Volts	0 Volts
69	Armature Current Signal (1K Output impedance)	0 to +5 Volts equals 0 to +100% or -100% Armature Current	0 volts
70	Auxiliary Speed Input (470K input impedance with "Speed" jumper removed)	+10 to -10 volts Speed or torque command	+10 to -10 volts Speed or torque command

APPENDIX 4 Drive Terminal Lists

TERM No.	SL SERIES DESCRIPTION	2-QUAD, NON-REVERSING DRIVES	
		OPERATING CONDITION	
		ENABLED / RUN (Contactor energized)	DISABLED OR FAULT (Contactor de-energized)
1	+10 Volts Reference	+10 volts	+10 volts
2	Min Speed	Max. 75% Term 3 volts	Max. 75% Term 3 volts
3	Speed Input - Ramped (Diagnostic Point 2) (50K input impedance)	0 to +10 volts, equals 0 to 100% FWD speed	0 to +10 volts, equals 0 to 100% FWD speed
4	-10 volt Reference	-10 Volts	-10 Volts
5	0 Volts - Common (Diagnostic Point 16)	0 Volts	0 Volts
6	Auxiliary Input - Ramped (Diagnostic Point 6) (50K input impedance)	0 to +10 volts Speed or torque command	0 to +10 volts Speed or torque command
7	Run Signal (Diagnostic Point 8)	CLOSE = 0 volts OPEN = +11 volts	CLOSE = 0 volts OPEN = +11 volts
8	0 Volts - Common (Diagnostic Point 16)	0 Volts	0 Volts
9	Tach Input	Tach volts	Tach volts
10	Relay 1 NC	See Manual	See Manual
11	Relay 1 NO	See Manual	See Manual
12	Relay 1 Arm	See Manual	See Manual
13	Start (Selects RL2)	START = 0 volts STOP = +24 volts	START = 0 volts STOP = +24 volts
14	Start Latch		
15	0 Volts - Common (Diagnostic Point 16)	0 Volts	0 Volts
16	Regen Brake Enable (unit s up to 75hp only)	Close to 0 volts to Regen Brake to zero speed	Close to 0 volts to Regen Brake to zero speed
17 & 57	Total Speed Command (Diagnostic Point 3) (1K output impedance)	-10 to +10 volts, equals 100% FWD to 100% REV speed	-10 to +10 volts, equals 100% FWD to 100% REV speed
18 & 64	Alt/Jog Speed Input - Ramped (Diagnostic Point 4) (50K input impedance)	+10 to -10 volts, equals 100% FWD to 100% REV speed. Selected by RL2 de-energize	+10 to -10 volts, equals 100% FWD to 100% REV speed. Selected by RL2 de-energize
19 & 66	Non-Inverting Speed Ramped input (50K input impedance)	+10 to -10 volts, equals 100% FWD to 100% REV speed	+10 to -10 volts, equals 100% FWD to 100% REV speed
20 & 65	Inverting Speed Ramped input (100K input impedance)	-10 to +10 volts, equals 100% FWD to 100% REV speed	-10 to +10 volts, equals 100% FWD to 100% REV speed
21	Current Output (Diagnostic Point 9) (10R output impedance)	+5 to -5 volts equals +100% to -100% armature current	0 volts
22 & 55	Ramp Output (Diagnostic Point 1) (1K output impedance)	+ 10 to -10 volts Ramps to total of speed ramp inputs	0 volts
23	Speed Output (Diagnostic Point 5) (1K output impedance)	+10 to -10 volts FWD to REV (Opt.. scaled Max Speed pot)	Normalized tach volts or Armature volts = 0v
24	Field Current (Diagnostic Point 14) (1K output impedance)	0 to +5 volts equals zero to max field current	0 volts
25	External Trip (Motor Thermostat - trips with res to 0V > 2K ohms)	Healthy = 0 volts Fault = +11 volts	Healthy = 0 volts Fault = +11 volts
26	Alarm Reset (except stall)	Link to 0 volts to reset	Link to 0 volts to reset
27	0 Volts - Common (Diagnostic Point 16)	0 Volts	0 Volts
28	Power Off	0 Volts	Healthy = 0 volts Fault = +24 volts

APPENDIX 4 Drive Terminal Lists

SL Series, continued ...

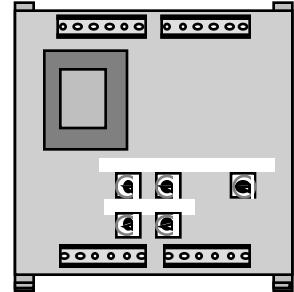
TERM No.	DESCRIPTION	ENABLED / RUN (Contactor energized)	DISABLED/FAULT (Contactor de-energized)
29	Power On	Power On = 0 Volts Power Off = +24 Volts	Power On = 0 Volts Power Off = +24 Volts
30	Power On Latch	Power On = 0 Volts Power Off = +24 Volts	Power On = 0 Volts Power Off = +24 Volts
31	Contactor Coil Switch		
32	Contactor Coil Switch		
51	-24 Volts Unregulated Max Load 25mA (Output unprotected)	-20 to -30 volts depending on external load	-20 to -30 volts depending on external load
52	Stall Relay Driver PNP Open Collector Max Rating, -30V, 50mA	-24V in STALL 0 V otherwise	-24V in STALL 0 V otherwise
53	Zero Speed Relay Driver PNP Open Collector Max Rating, -30V, 50mA	-24V at ZERO SPEED (< 1% speed) 0 V when above ZERO SPEED	-24V at ZERO SPEED (< 1% speed) 0 V when above ZERO SPEED
54	Current Command (Diagnostic Point 7) (1K output impedance)	0 to -5 volts equals 0 to 100% armature current	0 volts
55 & 22	Ramp Output (Diagnostic Point 1) (1K output impedance)	0 to +10 volts Ramps to total of speed ramp inputs	0 volts
56	Armature Voltage Signal (1K output impedance)	0 to +5 Volts equals 0 to +500 or -500 Volts	0 to +5 Volts equals 0 to +500 or -500 Volts
57 & 17	Total Speed Command (Diagnostic Point 3) (1K output impedance)	0 to -10 volts, equals Zero to 100% FWD speed	0 to -10 volts, equals Zero to 100% FWD speed
58	0 Volts - Common (Diagnostic Point 16)	0 Volts	0 Volts
59	Reverse Relay Driver PNP Open Collector Max Rating, -30V, 50mA	-24V at REVERSE (< 5% FWD speed) 0 V at FORWARD (> 5% speed)	-24V at REVERSE (< 5% FWD speed) 0 V at FORWARD (> 5% speed)
60	Timer Relay Driver PNP Open Collector Max Rating, -30V, 50mA	-24V at overload (> 105% current demand) 0 V otherwise	-24V at overload (> 105% current demand) 0 V otherwise
61	+12 Volts Reference (Diagnostic Point 18)	+12 volts	+12 volts
62	Stall Alarm Set/Reset	Connect to +12 volts to Reset Connect to -12 volts to Set	Connect to +12 volts to Reset Connect to -12 volts to Set
63	-12 Volts Reference (Diagnostic Point 20)	-12 volts	-12 volts
64 & 18	Alt/Jog Speed Input - Ramped (Diagnostic Point 4) (50K input impedance)	0 to +10 volts, equals 100% FWD speed. Selected by RL2 de-energize	0 to +10 volts, equals 100% FWD speed. Selected by RL2 de-energize
65 & 20	Inverting Speed Input Ramped input (100K input impedance)	0 to -10 volts, equals Zero to 100% FWDspeed	0 to -10 volts, equals Zero to 100% FWDspeed
66 & 19	Non-Inverting Speed Ramped input (50K input impedance)	0 to +10 volts, equals Zero to 100% FWD speed	0 to +10 volts, equals Zero to 100% FWD speed
67	+24 Volts Unregulated Max Load 25mA (Output unprotected)	+20 to +30 volts depending on external load	+20 to +30 volts depending on external load
68	0 Volts - Common (Diagnostic Point 16)	0 Volts	0 Volts
69	Armature Current Signal (1K Output impedance)	0 to +5 Volts equals 0 to +100% or -100% Armature Current	0 volts
70	Auxiliary Speed Input (470K input impedance with "Speed" jumper removed)	0 to +10 volts Speed or torque command	0 to +10 volts Speed or torque command

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APPENDIX 5 Factory Available Options

1. Master Setpoint Reference / Voltage Follower

If a reference signal from a single drive is to be distributed to more than three drives, a Master Setpoint Reference card must be used. The card also provides a voltage follower option, which allows the drive to follow an external DC voltage up to 100V. Bardac part number SP1070D.



2. Encoder feedback

Encoder or Ring-Tach pulse feedback up to 20 kHz can be converted to the necessary linear DC voltage signal using a Bardac frequency to voltage converter.

Bardac part numbers: SP1060MP007 - Single directional unit for use with SL drives.
SP1061D - Bi-directional unit for use with SLX drives.

3. AC Tach feedback

Traditional AC Tachs are comparable in performance to the accurate armature voltage feedback of the Bardac SL drives. If an AC tach is to be used, a AC - DC tach converter must be used. Bardac part number 500202. **AC tachometers cannot be used with 4Q (SLX) drives.**

4. Winder Card

The model 430D Constant Tension Center Winder is designed to give open loop control of web tension in center winding applications. The unit features digital diameter calculation, inertia and friction compensation, as well as taper tension to help prevent telescoping and core crushing.

5. High Current Field

High current field options can be ordered from the factory:

Drive Model	Standard Field Amps	Optional Field Amps
SL/SLX 15, 20	2.5	7.5
SL/SLX 40, 50	5.0	10.0
SL/SLX 65, 85	10.0	15.0
SL/SLX 115, 145	10.0	15.0
SL/SLX 185, 225	10.0	30.0
SL 265	10.0	30.0

Consult factory for additional details.

APPENDIX 5

Factory Available Options

6. PID

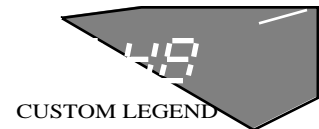
The SP1070PID PID controller can provide speed or tension control when used with a feedback device such as a loadcell or dancer. Consult factory for more details.

8. Detector Card

The SP1090D Detector Card is a two channel voltage level comparator. Two C-Face relays can provide contact closures for up-to-speed, overspeed, and other level comparison functions.

9. Digital Panel Meter

The DPM35 series digital panel meters can be utilized to display any of the isolated drive outputs. The display can be scaled to display absolute terms (0 - 10 V output displayed directly) or scaled for user units (0 - 10V is displayed as 0 - 1750 or 0 - 100 etc.) Unit can operate on either 120 or 240 VAC.



Bardac part numbers: DPM35S (3 1/2 digit)
 DPM35SD (4 digit)

APPENDIX 6 DC Tachometer Setup and Speed Scaling

Note: DC Tachometer feedback is a standard feature in the SL/SLX series drives. Please consult factory if an AC tach is to be used (see Appendix 5.)

1. Before setting up the drive for tach feedback the drive should first be run in armature volts feedback to ensure proper operation.
2. Turn off all power.
3. Turn the MAX CURENT potentiometer(s) and the MAX SPEED pot down to zero (fully CCW.)
4. Set DIP SWITCHES 3 & 4 for maximum tach voltage.

EXAMPLE: If a tach is rated 50 V/1000 and maximum desired speed of motor is 1750 RPM the maximum tach voltage is:

$$\frac{50V}{1000 \text{ RPM}} \times 1750\text{RPM} = 87.5V$$

So the maximum feedback of the tachometer is 87.5 volts. Dip Switches 3 & 4 should be set to the 50-100V range.

5. Turn DIP SWITCH 8 off to enable tach feedback.
6. Check tach wiring into terminal 8 & 9. Tach wires should be shielded with shield grounded at one end. Tach coupling should be stiff with no slip or backlash.
7. Set speed setpoint pot to zero (Terminal 3 (DP2) = 0v)
8. Turn power back on.
9. Operate the drive "START" and close "RUN" and "SETPOINT." Increase the speed pot to 10%. The Stall timer light should operate and the motor should not turn.
10. Carefully increase the MAX CURRENT pot(s) to 10% and check that the motor starts to rotate at a controlled speed. Be prepared to hit "STOP" if the drive begins to run away. Note: opening the "RUN" or "SETPOINT" may have no effect if the tach is reversed. If this happens:
 - a) Immediately operate drive "STOP" and turn off all power.
 - b) Reverse the tach connections to reverse feedback.
 - c) Turn on the power again and repeat set up procedure.
11. Once controlled operation is observed:
 - a) Increase speed setpoint slowly to full taking care to ensure that the motor does not overspeed by measuring armature volts or using a hand tach if available. At no time should the armature voltage exceed the nameplate rating on the motor.
 - b) increase the MAX SPEED pot until the correct full speed operation of the motor is reached. Use a hand tach, or monitor tach volts.

12. Operate the drive "STOP" and turn off all power.

SL & SLX SERIES, BASIC START MANUAL - VERSION 3.1

APPENDIX 7 Field Weakening Setup

1. A DC Tachometer is required for extended speed range operation.
2. Before setting up the drive for automatic field weakening:
 - a) Set up the drive for motor base field current (see section 7.4.)
 - b) Operate drive in armature volts feedback to ensure proper operation (see section 7.5.)
 - c) Operate drive in tach feedback to motor base speed to ensure proper tach polarity (see App. 6.)
3. Turn off all power.
4. Set DIP SWITCHES 3 & 4 scaled for max speed RPM tach voltage (see Appendix 6 for calculating tach voltage.)
5. Calculate field weakening setpoint as follows:
$$\frac{\text{Base speed RPM}}{\text{Top speed RPM}} \times 10 = \text{Field weakening setpoint voltage.}$$

EXAMPLE: $1750 \text{ (Base RPM)} / 2300 \text{ (Top RPM)} \times 10 = 7.6 \text{ volts.}$
6. Set operator speed setpoint pot to zero (Terminal 3 (DP2) = 0v)
7. Turn power back on.
8. Operate the drive "START" and close "RUN" and "SETPOINT." Increase the speed setpoint pot (Terminal 3 or DP2) to field weakening setpoint voltage. Watch to ensure controlled operation.
9. Set the MAX SPEED pot for the correct base armature voltage operation of the motor. This is about 5% less than the rated maximum voltage (230V for a 240V motor or 475V for a 500V motor.) Check the field current setup if the motor speed is not within 5% of rated base speed of the motor. Use a hand tach if available, or monitor tach volts.
10. Operate the drive "STOP" and turn off all power.
12. Turn DIP SWITCH 1 on to enable automatic field weakening. Rotate AUTOMATIC WEAKENING pot fully CW.
13. Turn power back on.
14. Operate the drive "START." Check to ensure that the speed pot is at the field weakening setpoint voltage. Watch to ensure controlled operation.
15. Rotate AUTOMATIC WEAKENING counter-clockwise pot until either:

Field Voltage Display begins to reduce *or* Voltage on T24 begins to drop (preferred method.)
16. Slowly increase the speed pot to maximum voltage. Watch to ensure controlled operation. At no time should the armature volts rise above rated voltage.

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APPENDIX 8 Customer Services & Sales

Customer Information Services

It is our policy to give customers all the help they need to apply and service their equipment. Detail information about the design and specification of all the drives and control modules is available from a comprehensive set of manuals, product guides and application notes. We do not encourage component level field repairs as, in our experience, the absence of specialized tools and test equipment makes this impractical and not cost effective. We do, however, think that a deep working knowledge of the equipment helps ensure successful application and use of the products and therefore we encourage system designers and users to acquire a complete set of product manuals.

Telephone Support

Never hesitate to call us if you need help or are in any doubt about the functioning of your drives. We will always be pleased to discuss your drive problem and we may be able to save you a lot of time and unnecessary expense!

We do not charge for this service!

Start-up, Training, Service and Customer Support

The Bardac / SPRINT Electric International Service Network is a group of organizations dedicated to providing the highest standard of support to our drives and systems users worldwide. The Network is constantly growing and includes facilities throughout the USA, Europe and Asia.

In the USA

California ... Florida ... Georgia ... Illinois ... Indiana ... Massachusetts ... Minnesota ...
Missouri ... New Jersey ... North Carolina ... Ohio ... Oregon ... Pennsylvania ... South
Carolina ... Texas ... Virginia ... Washington ... Wisconsin

International

Australia ... Belgium ... Canada ... France ... Germany ... Great Britain ... Hong Kong ... Israel
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INDEX

- Contactors requirements, 5
- Contents Table, 2
- Current calibration, 6, 7, 21
- Customized Configuration, 20
- Diagnostic Test Table
 - SL Series, 25
 - SLX Series, 24
- Diagnostic Test Unit, 17, 24
- DIP Switch Set Up
 - SL Series, 13, 14
 - SLX Series, 11, 12
- Environment, 1
 - essential checks, 16
- Factory Options, 30
- Field controller set up, 18
- Field current rating, 9
- Field Weakening, 33
- Fuse specifications, 21
- Fusing, 4
- Horsepower ratings, 21
- Installation, 4
- International Support, 34
- Jumper Plug Set Up
 - SL Series, 13, 14
 - SLX Series, 11, 12
- Line Filters, 5, 23
- Line Reactors, 5, 21, 22
- Potentiometer Set Up
 - SL Series, 13, 14
 - SLX Series, 10, 12
- Power Quality, 5
- Power Supplies checks, 17
- Power Up Procedure, 17, 18, 19, 20
- Safety
 - contactor requirement, 5
 - correct fusing, 4
 - essential checks, 16
 - notes, 1
 - power up precautions, 17
- Service & Support, 34
- Set Up
 - SL Series, 13, 14
 - SLX Series, 10, 11, 12
- Specification
 - field, 9
 - motor, 9
 - power supplies, 6
 - system, 3
- Speed Scaling, 32
- Tachometer Setup, 32
- Technical Support, 34
- Terminal List
 - SL Series, 28, 29
 - SLX Series, 26, 27
- Training, 34
- Transformers, 5, 22
- Wiring Diagram, 8