SLX Series
THREE PHASE
ControLler

World class in design. World beating in function.
READ AND UNDERSTAND THIS MANUAL BEFORE APPLYING POWER TO THE SLX MOTOR DRIVE UNIT

The SLX motor drive controller is an open chassis component for use in a suitable enclosure

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 equipment
- Powerful rotating machinery with large stored energy
- Heavy components

... and your process may involve ...

- Hazardous materials
- Expensive equipment and facilities
- Interactive components

Always use qualified personnel to design, construct and operate 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 immediately. Do not proceed without doing so.

HEALTH AND SAFETY AT WORK

Electrical devices can constitute a safety hazard. It is the responsibility of the user to ensure the compliance of the installation with any acts or bylaws in force. Only skilled personnel should install and maintain this equipment after reading and understanding this instruction manual. If in doubt refer to the supplier.

DANGER

ELECTRIC SHOCK RISK

Note. The contents of this manual are believed accurate at the time of printing. The manufacturers, however, reserve the right to change the content and product specification without notice. No liability is accepted for omissions or errors. No liability is accepted for the installation or fitness for purpose or application of the SLX motor drive unit.

UG100986 ISS1C
The units employ closed loop control of both armature current and feedback voltage to give precise control of the motor torque and speed. The motor and drive are protected by a stall timer which automatically removes power after 30 seconds if the required speed cannot be achieved. The drives will provide up to 150% of the preset maximum current for up to 30 seconds allowing high short term torques during acceleration or other changes in load. Independent control of either the current or speed loops by external inputs allows torque or speed control applications with overspeed or overcurrent protection. The demand signal may be derived from a potentiometer, 0-10V signal or 4-20mA loop. The speed feedback signal may be selected to be the ARMATURE VOLTAGE or a shaft mounted TACHOMETER.

A fully regulated field bridge is provided. This may be switched to provide constant field current for accurate armature voltage feedback, or automatic field weakening for extended speed range. Both these functions are fully adjustable by on board presets, and the field output voltage is displayed.

Control of shaft direction may be by linear voltage signals or convenient pushbuttons. Direct connection to PLC logic controllers is also possible. Braking of the motor may be fast or ramped, and facilities exist which allow choice of action dependant on direction of rotation. Braking energy is returned to the supply. Independent adjustment presets are provided for FORWARD UP RAMP, FORWARD DOWN RAMP, REVERSE UP RAMP, REVERSE DOWN RAMP. The positive and negative current limit is also independently adjustable. Provision is made to adjust motoring and braking torque independent of rotation direction. There is a comprehensive range of extra inputs and outputs and the unit has electrically isolated control circuits to allow interfacing to external sources. The electronic control cards are manufactured using modern automation and surface mount techniques. This gives superb accuracy and stability and is only made possible by the high production volumes of SPRINT Electric drives.
This diagram shows a simple form of speed control wiring. Please refer to Appendix section 4 for more complex functions.

**FUSING AND EARTHING**

All incoming main power supply connections must be protected by the correct semiconductor fuses. A substantial earth connection must be made to the earth terminal of the drive. For systems involving frequent or continuous regeneration or high inertia loads, fit a DC rated semiconductor fuse in series with the armature (FUSE marked FA in diagram above). See page 29 for fuse rating tables.

**POWER ON/POWER OFF**

The POWER ON/OFF facilities integral to the drive must always be used to energise the main contactor. This ensures correct power sequencing. The armature current may not be commutated to zero and could cause damage if this advice is ignored. (See application sheet in Appendix. Section 4 page 7)
**SPECIFICATION**

**ELECTRICAL SPECIFICATION**

**SUPPLY VOLTAGE**

<table>
<thead>
<tr>
<th>Supply</th>
<th>Low Tap</th>
<th>High Tap</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 phase</td>
<td>±/- 5%</td>
<td>200/240</td>
</tr>
</tbody>
</table>

Separate in phase supply to stack

**ARMATURE VOLTS**

<table>
<thead>
<tr>
<th>Supply</th>
<th>AC</th>
<th>AV DC max</th>
</tr>
</thead>
<tbody>
<tr>
<td>240</td>
<td>265</td>
<td>380/415/480</td>
</tr>
</tbody>
</table>

1.1 times AC MAX.

**FIELD**

Output volts 0.9 times AC MAX

Adjustable output voltage with trend display

Current regulation for high accuracy AVF speed control

Automatic weakening mode switch selectable

Delayed quench for emergency dynamic braking

Economy mode for motor climate control

**TEMPERATURE**

0-50C operating, -10 to 50 storage

**ALTIMITUDE AND RELATIVE HUMIDITY**

3000M max, 85% non-condensing

**THYRISTOR BRIDGE**

3 Phase fully controlled anti-parallel

**ELECTRICAL ISOLATION**

High voltage power circuits are isolated from control circuits

**PUSHBUTTON INPUTS**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER ON</td>
<td>FORWARD</td>
</tr>
<tr>
<td>POWER OFF</td>
<td>REVERSE</td>
</tr>
<tr>
<td>STOP</td>
<td>JOG</td>
</tr>
<tr>
<td>START</td>
<td>SPEED 2</td>
</tr>
</tbody>
</table>

**PRESET CONTROLS**

<table>
<thead>
<tr>
<th>Function</th>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX SPEED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIN SPEED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FORWARD UP RAMP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FORWARD DOWN RAMP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REVERSE UP RAMP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REVERSE DOWN RAMP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPEED STABILITY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZERO SPEED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAXIMUM CURRENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIELD CURRENT</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LINK OPTIONS**

50% Stall level

S shaped ramps

0/4 - 20mA loop

Speed mode

Torque mode

Zero standstill

Zero ref. interlock

Quench mode

Current mode

**CONTACT RATINGS**

1A AT 240V AC

Main Contactor Slave

**PERFORMANCE SPECIFICATION**

**TYPE**

<table>
<thead>
<tr>
<th>Model</th>
<th>KW</th>
<th>HP</th>
<th>Armature Amps</th>
<th>Field Amps</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLX5</td>
<td>5</td>
<td>6.6</td>
<td>12</td>
<td>2.5</td>
</tr>
<tr>
<td>SLX10</td>
<td>10</td>
<td>13.3</td>
<td>24</td>
<td>2.5</td>
</tr>
<tr>
<td>SLX15</td>
<td>15</td>
<td>20</td>
<td>36</td>
<td>2.5</td>
</tr>
<tr>
<td>SLX20</td>
<td>20</td>
<td>26.6</td>
<td>48</td>
<td>2.5</td>
</tr>
<tr>
<td>SLX30</td>
<td>30</td>
<td>40</td>
<td>72</td>
<td>5.0</td>
</tr>
<tr>
<td>SLX40</td>
<td>40</td>
<td>53.3</td>
<td>96</td>
<td>5.0</td>
</tr>
<tr>
<td>SLX50</td>
<td>50</td>
<td>66.6</td>
<td>120</td>
<td>5.0</td>
</tr>
<tr>
<td>SLX65</td>
<td>65</td>
<td>90</td>
<td>155</td>
<td>10.0</td>
</tr>
<tr>
<td>SLX85</td>
<td>85</td>
<td>115</td>
<td>205</td>
<td>10.0</td>
</tr>
<tr>
<td>SLX115</td>
<td>115</td>
<td>155</td>
<td>270</td>
<td>10.0</td>
</tr>
</tbody>
</table>

**TYPICAL MAXIMUM OUTPUT RATINGS FOR 460 VOLT DC MOTOR**

**SPEED RANGE**

100:1 with tacho speed feedback

20:1 with armature volts feedback

**STEADY STATE ACCURACY**

0.1% with tacho feedback

**OVERLOAD CAPACITY**

150% full load current for 30 secs.

**TORQUE LIMIT CONTROL**

Positive Demand

Negative Demand

Stall

Timer

Field Voltage

Weakening threshold

**DYNAMIC INDICATORS**

Positive Demand

Negative Demand

Stall

Timer

Field Voltage

Weakening Threshold

**LATCHED INDICATORS**

Field Loss

Peak Current

Tacho Loss

Aux Input

All Latched with Individual Override and Internal or External Reset

**SIGNAL OUTPUTS**

Linear Isolated

Speed

Current

Setpoint Ramp

Total Setpoint

Field Current

Rectified Arm. Volts

Rectified Arm. Amps

Current Demand

**RAILS AND DRIVERS**

<table>
<thead>
<tr>
<th>Signal</th>
<th>RAILS AND DRIVERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>+10 +12 +24</td>
</tr>
<tr>
<td>Current</td>
<td>-10 -12 -24</td>
</tr>
<tr>
<td>Setpoint Ramp</td>
<td>1)stall 2)timer 3)zero 4)reverse</td>
</tr>
<tr>
<td>Total Setpoint</td>
<td>Field Loss Tacho Loss Peak Amps Aux Amps</td>
</tr>
<tr>
<td>Field Current</td>
<td></td>
</tr>
<tr>
<td>Rectified Arm. Volts</td>
<td></td>
</tr>
<tr>
<td>Rectified Arm. Amps</td>
<td></td>
</tr>
<tr>
<td>Current Demand</td>
<td></td>
</tr>
</tbody>
</table>
Four corner mounting slots are provided to mount the unit. Use M6 (1/4in) screws on models up to SLX50, and M8 (5/16in) on models SLX65/85/115. A substantial earth connection should be made to the stud provided. Nominal cooling air throughput is specified in the rating table page 29. NOTE: Do not block the heatsink fins. Allow at least 50mm (2in) space. Ensure connections to power terminals are tight.
Control card (isolated). Top edge terminal listing on page 26

A. Precision low drift speed pot reference
mon. Also accepts 4-20mA LOOP signals
0V. This input is ramped.

Output speed or torque
4Q/2Q/SPEED.

Open. Connect to
-12V via 4K7.

as tacho common.

Speed scaling by switches S3/4

ON RL1 de-energises if current demand > 105%
ON RL1 de-energises if stall timer latches out.
ON RL1 de-energises if speed remains below 1%
ON RL1 de-energises for zero or reverse rotation

START pushbutton input
JOG pushbutton input

If more than one switch is ON the functions are "ANDED"

3
18

+/10V, reference output on terminal 4

INVERTED) +/-10V, 1KOhm.

lected by RL2. see T13/14. Also JOG SPEED reference +/-1V 470K impedance

xed input +/-10V, +/-100% SPEED

5V for 0 to +/-100%

+/-10V, 1KOhm.

scale. 1K Ohm.

to 5V for 0 to 5 Amps up to SLX50. 0 to 5V for 0 to 10 Amps SLX65/85/115.

tance to 0V > 2K

LL when taken to 0V. 47K pull up to +24V.

25mA DC relay driver

POWER ON/OFF this configuration
causes contactor drop out if
any alarm is triggered. 24V DC
operating voltage on 28, 29, 30

See Application
notes in appendix.

A max. (suppression of the external contactor coil is recommended)
FUNCTION SWITCH CHECKING

FUNCTION SWITCH checking. Switches S1 to S8.

SWITCH 1
FIELD CONTROL switch. When OFF this sets the field control circuit to standard current regulation. For systems requiring field weakening, it is necessary to operate initially in the standard mode. (OFF). Refer to page 23 for field set up description.

SWITCH 2
When ON, de-energises relay 1 (T10/11/12) when stall timer commences. (See S5/6/7)

SWITCH 3 and 4
SPEED FEEDBACK SCALING.

<table>
<thead>
<tr>
<th>TACHO</th>
<th>3,4 off</th>
<th>30V - 60V</th>
</tr>
</thead>
<tbody>
<tr>
<td>or</td>
<td>3 on</td>
<td>60V - 125V</td>
</tr>
<tr>
<td>ARM</td>
<td>4 on</td>
<td>125V - 250V</td>
</tr>
<tr>
<td>VOLTS</td>
<td>3,4 on</td>
<td>250V - 500V</td>
</tr>
</tbody>
</table>

The MAX SPEED preset gives fine adjustment within the switch range.

FOR SYSTEMS UTILISING TACHO FEEDBACK, THE SAFEST PROCEDURE IS TO COMMISSION THE DRIVE FOR THE FIRST TIME IN ARMATURE VOLTAGE FEEDBACK MODE, WITH THE TACHOMETER CONNECTION REMOVED FROM TERMINAL 9. THIS WILL PREVENT A RUN-AWAY MOTOR IN THE EVENT OF INCORRECT TACHO POLARITY OR COUPLING. IT ALSO ALLOWS THE FULL SCALE TACHO VOLTAGE TO BE MEASURED PRIOR TO USE.

THE SUGGESTED STARTING POINT IS: S3 ON, S4 ON, MAX SPEED FULLY ANTI-CLOCKWISE. GIVES 250V MAXIMUM ARMATURE VOLTAGE.

SWITCH 5, 6 and 7
RELAY 1. (volt free changeover relay on T10/11/12). Switches 5, 6 and 7 (and S2) control the function of Relay 1. If more than one function is selected then these functions are logically ANDED.

<table>
<thead>
<tr>
<th>Switch 5, 6 and 7 Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,6 off</td>
</tr>
<tr>
<td>5 on</td>
</tr>
<tr>
<td>6 on</td>
</tr>
<tr>
<td>5,6 on</td>
</tr>
<tr>
<td>7 off</td>
</tr>
<tr>
<td>7 on</td>
</tr>
</tbody>
</table>

SWITCH 8
Switch 8 selects the method of feedback. When first commissioning start in armature voltage feedback (AVF). Ensure tacho is disconnected from terminal 9 when using armature voltage feedback.

<table>
<thead>
<tr>
<th>Switch 8 Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 off</td>
</tr>
<tr>
<td>8 on</td>
</tr>
</tbody>
</table>

JUMPERS AND LINKS

MAX CURRENT MODE JUMPER
The Max current mode jumper determines the mode of operation of the Max current presets. A full description is given on page 19 and 20, refer to this and select the mode required according to the application.
**JUMPERS AND LINKS**

**TORQUE/SPEED JUMPER**

The torque control operates by clamping the current demand from the speed loop. See block diagram. Hence the loop with the lower demand has control. This allows torque control with overspeed limiting, or speed control with over torque limiting. A full description of this function is given on page 19 and 20. It is recommended to set the drive up initially in SPEED mode and then when the speed operation is satisfactory, to commence the TORQUE commissioning. Temporarily park the jumper on one pin to disable.

**50% STALL THRESHOLD.** A full description of this function is given on page 21. Link the solder pads if the function is required.

**QUENCH JUMPERS**

These jumpers govern the behaviour of the drive inhibit logic. (FS fast quench of both speed and current loops, 1S 1 second delay to current loop quench, ZS speed and current loops quenched if setpoint and speed remain at zero for 1 second). Rapid stopping, ramped stopping and coasting to stop are enabled according to requirements. Please refer to the BLOCK DIAGRAM OF DRIVE INHIBIT CIRCUIT on page 17, and description of RAMP FUNCTIONS on page 18 in order to choose the correct mode for your application.

**S RAMP**

The S RAMP function is an option that allows the shape of the speed demand ramp to be modified.

To implement the S RAMP function
1) link the solder pads marked IP+
2) break the solder pads marked S R (de-solder)
3) add 2 10uF electrolytic capacitors. SC
4) add a 240K resistor

Note this function utilises the auxiliary input which appears on terminal 70. (the length of the S shaped tails is roughly proportional to the capacitor size. Other values may be used if desired. The 10uF caps give tails of 1 second approximately)

The S ramp output can be seen inverted on terminals 17 and 57.

**4-20mA SIGNAL INPUT LINK.**

Link the 2 pairs of solder pads to allow terminal 2 to become the loop input, terminal 5 the return and adjust MIN SPEED to change the gain. For 0-20mA signals link only the lower pair of solder pads.

**ALARM DEFEAT**

The drive has 4 fast latched alarms:

Field loss
Tacho loss
Peak amps
Aux. trip

If any one of these is triggered, then the drive is immediately inhibited and the main contactor is de-energised. Any alarm may be defeated by linking the appropriate jumper. A full description is given on page 15 and 16.
THERMISTOR or MICROTHERM.
Terminal 25 is an external trip input. If the resistance to 0V exceeds 2.0 KOhms, then the AUX. TRIP ALARM will trip the main CONTACTOR. This may be used for interpole motor protection devices. If not used, the feature must be inhibited by connecting T25 to COM. The alarm will not trip for resistances to 0V less than 200 Ohms.

SAFETY CONSIDERATIONS

Before proceeding to the next stages which involve applying power to the drive, check the following items:

All relevant safety precautions have been observed.

There must be no unqualified or unauthorised personnel allowed near the drive or machine or load.

Do not work on the drive without safety assistance.

PART 2 INITIAL POWER UP

The unit is now ready to receive auxiliary power. At this stage it is necessary to use a voltmeter to measure certain signals.

DISABLE CONTACTOR

Before applying power, check that the main CONTACTOR is still disabled. If there is any doubt about the integrity of a particular system, insert a high wattage resistor in series with the armature e.g. a fire element. The following checks will involve measuring certain signals with power applied to the drive.

APPLYING POWER

Verify that the supply jumpers match your supply. Also check drive rating label. The six supply jumpers can be seen at the lower right hand side of the power board. See page 25 for details for removing the top card. Note, new units are shipped from the factory with the jumpers in the STANDARD position (380-480V).

THE FIRST TIME YOU APPLY POWER BE READY TO TURN OFF QUICKLY IN THE EVENT OF A PROBLEM.

1) Apply Power
2) Observe illuminated bridge lamp
3) All alarm lamps should be off
4) Check the following voltages
SUPPLY CHECKING

All 3 auxiliary phases should match model and tap selection.

EL1-EL2  Correct phase to phase AC VOLTS
EL2-EL3  should be present 200-240V or 380-480V.
EL3-EL1

10 VOLT REFERENCES

The remaining measurements are taken with respect to 0V (com)

T4  -10V Reverse selected.
T4  +10V Forward selected.
T1  +10V
T3  +10V to -10V adjustable by speed demand pot. Leave at 0 volts.

POWER ON / OFF CIRCUIT

The next stage is to check the POWER ON/POWER OFF circuit.

WARNING. ENSURE THE MAIN CONTAC TOR IS STILL DISABLED.

When the POWER ON function is activated, the field voltage will increase to provide the preset field current. When
POWER OFF is selected the field voltage will stay on for a further 15 seconds and then go off. If the economy field
mode is selected the field current will reduce to 40% of the preset level.

Operate the POWER ON/POWER OFF buttons and check that the slave (T31-T32) opens and shuts.

The Slave Contact lamp comes on when the contact closes. The SLAVE CONTACT lamp is in the top right hand
corner. Note, if any alarm lamp is on, the POWER ON function is inhibited.

Check that any other contacts in the POWER OFF line operate correctly.

With POWER ON active, adjust the field see page 23

The next stage will establish that a current demand signal is present. To do this the run contact must be
temporarily shorted (T5-T7) and also START (T5-T13). Note, the STALL lamp may come on during this sequence
of tests, this is normal. To prevent this from causing interruptions, temporarily put the TORQUE jumper in the 4Q
position, activate POWER ON.

Increase the the speed demand and observe the RAMP (T22). This should follow the setpoint at the slowest rate.
The speed demand may be derived from numerous sources depending on application, and the analogue
processing inputs (T18, T19, T20) may be utilised. Refer to the BLOCK DIAGRAM and follow the signal path.
NOTE, the resultant RAMP output may be the bi-polar summation of more than one input. More accurate
adjustment of the up and down ramps is possible now.

Check that an inverted version of the RAMP output appears on the TOTAL SETPOINT OUTPUT (T17). If the S
RAMP function has been implemented, the inverted output can be monitored on T17.
After being satisfied that the the speed demand is functioning, it is possible to check the next stage. This compares the speed demand with the speed feedback and integrates the error to produce a voltage signal. (Current demand IDO on T 54, 0 to -7.5V represents 0 to 150%, This is the Torque demand.) The signal can be made to integrate up by arranging for a small speed demand.

Re-park TORQUE jumper on one pin to release current demand.

**TIMER LAMP**

The TIMER lamp should come on as the current demand exceeds -5.25V (105%).

**STALL LAMP**

The stall lamp should come on approximately 30 seconds later causing the slave contact to drop out and the TIMER lamp to latch on.

The stall alarm may be reset by removing and re-applying auxiliary power, or by momentarily shorting T61 to T62.

**TORQUE CONTROL**

For systems involving TORQUE control it should be possible at this stage to establish correct operation of a 0 to +10V input to T6. With the torque link in 2Q TORQUE position and a speed demand input (+) the current demand signal should be controlled between 0 to -5V.

Operating the POWER OFF button or opening the RUN line will reset the ramp and current demand circuits.

With the Torque link in the 4Q position and a speed demand of + or -, the current demand signal should be controlled between 0 to -5V for a 0 to +5V input on T6. The current demand lamps should change according to the sign of the speed demand during this test. The timer lamp should come on for an input of 5.25V on T6. (It is possible to allow a negative 4Q input signal, see pages 20, 22).

**PART 3 APPLICATION OF POWER TO THE MOTOR**

Turn off all power and refit the MAIN CONTACOR COIL SUPPLY FUSE.

**SLAVE RELAY**

The switching capability of the slave relay is 1A at 240V AC. For contactor coils with higher ratings, an intermediate slave relay should be utilised. A coil suppressor should be fitted to the main CONTACOR.

Ensure all speed demands are set to minimum. Turn on the supply to the drive. Press the POWER ON button. The main CONTACOR should pull in.
POWER OFF
Press the POWER OFF button. The main CONTACTOR should drop out.

SAFETY WARNING
WARNING. The main contactor should never be operated by any means other than the internal contactor control circuit provided. Any warranty will be invalidated if this warning is not heeded.

DO NOT PROCEED FURTHER UNLESS THE POWER ON/OFF CIRCUITS AND CONTACTOR OPERATE CORRECTLY.

POWER ON
POWER ON and close the RUN contact.

LOW SPEED CHECK
Press START and then set the speed demand to about +5%. Then slowly rotate the MAX CURRENT (POSI) clockwise to about 20%. The motor should rotate at 5% of full speed (initially full speed is 250V on armature). If the direction of rotation is incorrect, POWER OFF and remove the supply to the drive. Swap the field connections. Continue as before and progressively increase the speed DEMAND to 50%. During this stage an increase in MAX CURRENT may be required if the TIMER lamp remains on.

MAX SPEED
Increase the speed demand to 100% and adjust MAX SPEED to give the desired full speed. DO NOT ALLOW ARMATURE VOLTAGE TO EXCEED RATING. Monitor the armature voltage output on T56. 0 to 10V for 0 to +/-500V AV. The rating will be found on the motor rating plate. If the motor rating is excessive for the supply used, then do not exceed the ratings on page 2.

FOR SYSTEMS WITH TACHO FEEDBACK. With the motor at the correct max speed for the application (this need not be the maximum capable speed) check the tacho voltage and polarity. STOP THE DRIVE and POWER OFF. Re-connect the tacho with the -ve wire to T9. Select S3, S4 range to suit tacho voltage. Turn off S8. See worked example page 27. For a low voltage tacho, the full scale voltage ranges can be reduced by 50% by a link on the control card. There is also an optional tacho differential term mode. (see layout page 23).

ZERO SPEED
Temporarily remove the ZS jumper for accurate ZERO SPEED calibration. Re-adjust MAX SPEED for correct tacho voltage. Reduce the speed demand to zero and adjust the ZERO SPEED preset until the motor just turns, then back off until it just stops.

MIN SPEED and JOG SPEED
Reduce the speed demand to zero and rotate MIN SPEED to give the desired minimum motor speed. If the JOG SPEED function is required, operate the JOG mode (see section 4 page 11 for typical jogging systems) and adjust the JOG SPEED preset clockwise to the desired level. (+/-5% max)

MAX CURRENT
Refer to page 19 to determine the appropriate preset. Adjust the MAX CURRENT preset to the desired level. (Clockwise rotation gives a linear increase in current limit) Full rotation corresponds to the maximum nominal rating of the drive. (note, the TIMER lamp comes on if the current demand exceeds 105%. While adjusting the MAX CURRENT preset, the lamp may be used to approximate the load current. Note the preset rotation percentage as the lamp changes state)

UP AND DOWN RAMPs
Final adjustment of the up and down ramps can now take place.
The stability of the SPEED and CURRENT loops can be adjusted. The initial setting of midway is usually optimum for the speed STAB preset. Clockwise rotation of the STAB preset increases the response of the drive. Excessive rotation may cause instability. Adjustment of the current loop (TORQUE) stability should not be attempted without the aid of an oscilloscope. (Adjustment is not normally needed, anti-clockwise optimum)

CURRENT RESPONSE

Arrange for a small square wave perturbation (20%) to be imposed on the speed demand. This may be derived from a waveform generator and input via T6 in SPEED mode.

Ideal current response

![Ideal current response diagram]

10 ms

Excessive overshoot

![Excessive overshoot diagram]

10 ms

Overshoot may be reduced by anticlockwise rotation of the speed or current stability presets. Best strategy for adjustment is to set up speed response first with current stability anticlockwise (factory setting).

SPEED RESPONSE

a) Overshoot

b) Ideal response

c) Undershoot

Clockwise rotation of STAB to increase speed of response. Do not allow excessive overshoot to occur. Note if there is excessive overshoot in tacho feedback mode check tacho couplings are stiff and not slipping. Extra response can be gained by adding a 0.1uF capacitor in the DIFF position. (see block diagram page 28 and layout page 23). This provides feed forward of the tacho signal and allows the STAB preset further rotation. Re-check the current response after adding the differential term to make sure there is no excessive overshoot. If the tacho signal is noisy then adding the differential term may lead to erratic current stability. Ensure the tacho signal is clean by observing it on an oscilloscope before implementing the differential term.

CURRENT REDUCTION

When customer systems are being tested prior to shipping it is sometimes only possible to use a small unloaded motor. This may lead to speed instability. A current reduction jumper has been provided to reduce the current scaling by 50%. This will improve speed stability whilst testing is in progress. See layout on page 22.

Repeat the tests for negative speed inputs, Reverse ramps, NEG I. etc.
Start at the Power On section Page 13.

POWER OFF

The drive should now be set up and ready to operate. Press the POWER OFF button. The main CONTACTOR should drop out and the motor will coast to rest.

END OF PROCEDURE

These set up procedures are intended as a general guide and can not be expected to cover all possible configurations.
The drive provides protection for the system in the event of certain dangerous conditions. If an alarm is triggered the drive is instantly quenched followed by automatic de-energisation of the main CONTACTOR. The alarm condition remains latched and is indicated by a lamp on the drive. There is provision to defeat any individual alarm, and an external RESET terminal is provided. It is also possible to gain access to the individual lamp outputs for external indication if required. (page 23)

**ALARMS**

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**LAMPS**

- **FIELD LOSS**
- **TACHO LOSS**
- **PEAK AMPS**
- **AUX. TRIP** (heatsink temp)

**ALARM FUNCTION**

- **FIELD LOSS**: If the field current drops below 100mA on models up to SLX50 and 200mA on models SLX65/85/115, then this alarm will be triggered. This alarm is inhibited during a POWER off sequence.

- **TACHO LOSS**: If there is a loss of tacho feedback causing the motor to overspeed this alarm will trigger. An internal circuit continually monitors the current demand and the armature voltage and operates when both parameters indicate loss of feedback. This function is automatically inhibited in ARMATURE VOLTAGE feedback mode.

- **PEAK AMPS**: If the current reaches 400% of the maximum drive rating this alarm will trigger. If this occurs on initial power up, suspect a wiring fault. If it occurs during running suspect a motor fault. If it occurs repeatedly a damaged thyristor may be the cause. This alarm can only be reset by removing the supply.

- **AUX. TRIP** (heatsink temp): This alarm is provided for external use and is connected via terminal 25. The terminal possesses a 1K Ohm pull up resistor to +12V. The alarm will trigger when the resistance to 0V (com) exceeds 2K Ohm. It will not trigger if the resistance to 0V remains below 200 Ohms. It is also triggered by excessive heatsink temperature.

**DEFEATING THE ALARMS**

If an alarm is not required to operate it may be defeated.

A double row of pins located on the control card provides the function. Locate the jumper across the appropriate pair of horizontal pins. The COM pins are at 0V and used to park the jumper when the defeat function is not required. The pins may also be wire wrapped. Any number of alarms may be defeated. (NOTE: if the AUX. TRIP is defeated then the heatsink temperature alarm is also defeated)

**RESETTING ALARMS.**

A triggered alarm may be reset via terminal 26 and is achieved by momentarily shorting to 0V (com). T26 has a 47K Ohm pull up to +24V. (Remove supply for PEAK AMPS)

**WARNING! DO NOT DEFEAT ANY ALARM WITHOUT DUE CONSIDERATION TO SAFETY.**
The STALL alarm has the same effect as the other alarms, but due to the important nature of this alarm it is not able to be defeated or reset in the same way.

It is triggered by a timer according to the current demand. (150% for 30secs, 125% for 60secs, 110% for 120secs). The timer starts timing when the current demand exceeds 105%. This is indicated by the TIMER LAMP.

A number of conditions can lead to excess demand and hence STALL: Incorrect current calibration, incorrect speed calibration, underated motor, jammed or excessive load, incorrect feedback scaling, slipping tacho coupling, supply too low for required output, incorrect motor wiring, excessive speed demand input, in fact any reason that prevents the speed loop from achieving what it is being asked to do.

The only way to inhibit the STALL alarm is to prevent the current demand exceeding 100%. To do this the drive must be in TORQUE mode with the external current demand input via terminal 6 below 100%. The STALL alarm may be reset by momentarily shorting T62 (SS) to T61 (+12V)

These lamps indicate the polarity of the current demand. One lamp will remain on while the auxiliary supply is energised by two or more lines. WARNING: do not assume that the supply is disconnected if the lamp is off.

**FIELD VOLTAGE DISPLAY**

100% represents 0.9 times AC supply.

- **MIN**
  - This lamp starts to come on at 25% field voltage and gets brighter as the voltage increases beyond 25%.

- **REGULATED REGION**
  - The first two lamps are used to show a dynamic trend of the field voltage by changes in intensity.

- **FULL ON**
  - This lamp comes on at a field voltage of 95%.
  - Below 95% the lamp remains off. When it is just turning off, the regulated region has been entered.

- **MAX**
  - This lamp starts to come on at 50% field voltage and gets brighter as the voltage increases beyond 50%.

  - The third lamp has sharp action.
Refer to page 18 for a graphical representation of the stopping modes.

**OPERATION**

List of possible sources of inhibit request.
1) Stall timer latch is triggered due to overload
2) External run line is opened
3) Zero speed is attained
4) Latched alarm
5) Power off request

It is also necessary to be able to inhibit the drive quickly or wait until the motor has come to a controlled stop before inhibiting the drive.

**TABLE OF OPERATING MODES**

<table>
<thead>
<tr>
<th>JUMPERS</th>
<th>QUENCH CONDITION</th>
<th>FS = quenched by stall or run. The drive will be quenched after 1 sec. OR 1 sec. after zero speed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZS &amp; 15</td>
<td>Quench condition</td>
<td>The drive will be quenched immediately. The drive will not be quenched by zero speed.</td>
</tr>
</tbody>
</table>

NOTE: The ZS logic will not release the ZS function at zero speed until the ramp circuit has an input. If the speed input is direct via T6, the ZS jumper must be parked on one pin.
The above traces show the effect of opening the RUN terminal 7. The setpoint ramp is immediately reset, and the load regeneratively braked. In cases 1 and 2, the firing pulses are removed after 1 sec. In case 3, 1 sec. after reaching zero speed.

To ramp down under control of the DOWN RAMP preset, operate the STOP function on T13. This removes the speed setpoint.
**MAX CURRENT**

**MODE 1. LIMIT SET BY POSI LEFT PRESET, NEGI RIGHT PRESET**

- Thin line: typical speed profile, thick line: armature current required.

**MODE 2. LIMIT SET BY MOTOR LEFT PRESET, BRAKE RIGHT PRESET**

- Thin line: typical speed profile, thick line: armature current required.

**MODE 3. LIMIT SET BY FWD LEFT PRESET, REV RIGHT PRESET**

- Thin line: typical speed profile, thick line: armature current required.

**TORQUE FUNCTIONS**

**SIGNAL INPUT TERMINAL 6.**

**THE EXTERNAL SIGNAL IS SCALED TO GIVE 100% OF THE PRESET LIMIT FOR +10V. 0% FOR 0V.**

- Stall timer inhibited.

**THE EXTERNAL SIGNAL IS SCALED TO GIVE 100% OF THE PRESET LIMIT FOR +5V. 0% FOR 0V.**

- Thin line: typical speed profile, thick line: armature current required.

**NOTES.** The torque input signal is used to clamp the upper limit of the internal current demand signal before it is fed to the MAX. CURRENT presets. The relevant preset is set by the MODE jumper.

If the speed loop does not require current greater than the clamp level, then it will have control.

---

**MAX CURRENT**

<table>
<thead>
<tr>
<th>MODE</th>
<th>POSI</th>
<th>NEGI</th>
<th>MOTOR</th>
<th>BRAKE</th>
<th>FWD</th>
<th>REV</th>
</tr>
</thead>
</table>

**MAX CURRENT**

<table>
<thead>
<tr>
<th>MODE</th>
<th>POSI</th>
<th>NEGI</th>
<th>MOTOR</th>
<th>BRAKE</th>
<th>FWD</th>
<th>REV</th>
</tr>
</thead>
</table>

**MAX CURRENT**

<table>
<thead>
<tr>
<th>MODE</th>
<th>POSI</th>
<th>NEGI</th>
<th>MOTOR</th>
<th>BRAKE</th>
<th>FWD</th>
<th>REV</th>
</tr>
</thead>
</table>

**MAX CURRENT**

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<tr>
<th>MODE</th>
<th>POSI</th>
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<th>FWD</th>
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<th>MOTOR</th>
<th>BRAKE</th>
<th>FWD</th>
<th>REV</th>
</tr>
</thead>
</table>
TORQUE CONTROL

Facilities are provided for controlling the torque (current) instead of the speed (volts) of the motor. This is achieved by allowing the current demand to be clamped by an external input. NOTE the current demand is provided by the speed loop and hence the speed loop must always be asking for more current than the clamp level. This technique gives automatic overspeed limiting.

TORQUE / SPEED JUMPER

This is a 3 position jumper which controls the function of terminal 6 (AUX). A schematic is shown below.

Break the +/- link to allow a negative 4Q input. (see layout page 22)

The 4Q TORQUE mode can be used for load sharing by using the rectified current signal IOM on T69 from the master drive as the torque reference input. The negative current demand signal IDO on T54 may also be used by breaking the +/- link. (page 22)

The 4Q TORQUE clamp operates in all 4 quadrants on positive and negative currents.

The 2Q TORQUE clamp operates in 1 and 2 on the positive current only.

QUADRANT DIAGRAM

MAX CURRENT MODE

The electronic switches C and D select which MAX CURRENT limit preset is enabled according to the position of the current MODE jumper. see page 19. The sign of the setpoint ramp output determines the preset selection.

1 P6 POS I, quadrants 1 and 2
This is the classical mode of operation. The disadvantage of this arrangement is that the current limit for braking in the forward direction, becomes the same limit for motoring in the reverse direction.

2 P6 MOTOR, quadrants 1 and 3
This mode allows one preset to control the motoring current limit in both directions of rotation, and the other preset to control the braking current limit in both directions of rotation.

3 P6 FWD, quadrants 1 and 4
This mode allows one preset to control the current limit for both motoring and braking in one direction of rotation, and the other preset controls current in the other direction.

UG100828 ISS10
To achieve the desired speed, the outer speed loop provides the current loop with a CURRENT DEMAND signal. The timer itself is inhibited while the current demand signal lies below -5.25V (-5V represents 100%). Whenever the signal traverses into the area between -5.25V and -7.5V the stall timer starts to integrate. The rate of integration is proportional to the magnitude of the signal over 105%.

From page 20 current demand signal IDO

0V

-2.5V (50%)

-5.25V (105%)

-7.5V (150%)

TIMER ACTIVE

The time taken to integrate a 150% level is approximately 30 seconds, 125% for 60 seconds etc. Thus the stall timer allows smaller overloads for longer periods. When the current demand falls below 105% after being in overload, providing the timer has not timed out, the integrator starts to integrate back down again. This feature provides an historical store of the behaviour of the current demand. If the timer has come close to tripping, and then the demand falls below 105%, the demand will need to spend at least 30 seconds at 50% to totally reset the timer. The effect of this feature is to have the ability to provide complex overload behaviour, and trip only when the time average overload is exceeded.

50% STALL THRESHOLD

FUNCTION: TO ALLOW HIGH PEAK CURRENTS

This changes the level at which the stall timer integration starts to 52.5%. The advantage of this feature is it allows the 150%, current to be achieved, but provides protection above 50%. The stall time is reduced by half. When using this feature it is important to remember that the maximum current rating of any model is unchanged, and the trip level is reduced.

<table>
<thead>
<tr>
<th>RESISTOR</th>
<th>THRESHOLD</th>
<th>OVERLOAD</th>
<th>RATIO</th>
<th>PEAK %</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINK</td>
<td>50%</td>
<td>150%</td>
<td>1 : 3</td>
<td>300%</td>
</tr>
<tr>
<td>100K</td>
<td>60%</td>
<td>150%</td>
<td>1 : 2.5</td>
<td>250%</td>
</tr>
<tr>
<td>220K</td>
<td>70%</td>
<td>150%</td>
<td>1 : 2.1</td>
<td>210%</td>
</tr>
<tr>
<td>470K</td>
<td>80%</td>
<td>150%</td>
<td>1 : 1.87</td>
<td>187%</td>
</tr>
<tr>
<td>1M</td>
<td>90%</td>
<td>150%</td>
<td>1 : 1.66</td>
<td>166%</td>
</tr>
<tr>
<td>OPEN</td>
<td>100%</td>
<td>150%</td>
<td>1 : 1.5</td>
<td>150%</td>
</tr>
</tbody>
</table>

Other threshold levels can be implemented if a resistor is used instead of a link.
Rotate clockwise to increase speed. Change range with S3 and S4.

Rotate clockwise to increase minimum speed. Use to adjust 4-20mA loop burden resistor between 0 and 360 Ohms if 4-20mA mode is selected.

Rotate clockwise to increase drive acceleration in forward direction (+) span is approx. 1 to 30 seconds.

Rotate clockwise to increase drive deceleration in forward direction (+) span is approx. 1 to 30 seconds.

Rotate clockwise to increase drive acceleration in reverse direction (-) span is approx. 1 to 30 seconds.

Rotate clockwise to increase drive deceleration in reverse direction (-) span is approx. 1 to 30 seconds.

Rotate clockwise to increase response. Excessive rotation may cause instability.

Rotate clockwise to increase level of positive zero speed adjustment, and anti-clockwise for negative adjustment. (+/-5% span)

Rotate clockwise to increase current limit. Eg 50% rotation gives 50% current limit.

The position of the MODE jumper determines the PRESET function according to the table.

POSITIVE CURRENT | NEGATIVE CURRENT
MOTORING fwd/rev | BRAKING fwd/rev
FORWARD + and - | REVERSE + and -

TORQUE OR SPEED MODE JUMPER: This jumper alters the function of the AUX input on terminal 6.

4Q TORQUE: 0 to +5V for 0 to 100% positive and negative current limit.
2Q TORQUE: 0 to +10V for 0 to 100% positive current limit

SPEED: 0 to +/-10V for 0 to +/-100%

4-20mA. Link both pairs of pads and terminal 2 is input, 5 return. MIN SPEED to set zero. Link the lower pair of pads only for 0 - 20mA loop signals.

NOTE ON ZS JUMPER:
The drive remains quenched if the setpoint ramp AND the speed feedback remain below 1%. The quench will not be released once the motor has stopped unless the setpoint ramp exceeds 1%. Hence for systems utilising the direct speed input on terminal 6, the drive will remain quenched once the speed has returned to zero. To overcome this, either remove the ZS jumper, or arrange for a small ramp setpoint.

NOTE: this preset is not normally adjusted.

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**FIELD CONTROL ADJUSTMENTS**

**CURRENT REGULATION** (linear output on terminal 24 field current 0 - 5V for 0 - 100%)

- Rotate clockwise to increase field current. NOTE: When the MAX lamp on the field voltage display changes state the field voltage is at 95%. Any further clockwise rotation will be unable to increase the field current, and the constant current regulation facility will be over-ridden. If the field output is to be set up by referring to field voltage, then the current regulation preset may be used to move the initial voltage to the required level. The control loop will then regulate at the current that was initially established by the applied field voltage. This will provide an enhanced level of speed control when ARMATURE VOLTAGE FEEDBACK is being used, by eliminating field flux variations due to changes in the field current.

**AUTOMATIC WEAKENING S1 ON**

- This function monitors the armature voltage and after the preset level has been reached, any further speed demand reduces the motor field current. Thus the motor speed may be increased without exceeding the rated armature voltage. This function must only be used with TACHO feedback. To set up the system, first adjust the field current to the correct maximum using the current regulation preset. Then with the automatic preset fully clockwise and the drive set to provide maximum armature voltage at the reduced setpoint, rotate the AUTOMATIC WEAKENING preset anticlockwise until the field starts to reduce as shown by the display. Any further increase in speed demand should now result in a further reduction in the field volts. Typically the speed demand is 75% for full armature volts. (linear signal output on terminal 56, 0 - 10V for 0 to +/-500V armature)

**DELAYED FIELD QUENCH**

- The unit provides automatic control of the field output. When the main power contactor is de-energised by the POWER OFF function, the field current is reduced to zero. The quench action is delayed by 15 seconds to allow dynamic braking systems to operate.

**ECONOMY FIELD MODE** (the field current must be set up first for accurate operation)

- The field is quenched 15sec. after the main power contactor is de-energised. The economy field mode allows the quench level to be set to 40% rather than 0%. This feature is used in cold climates to keep the motor warm when it is not rotating. To implement the economy field mode, remove the resistor marked ‘ECONOMY FIELD’

**FIELD VOLTAGE DISPLAY** (page 16)

This indicates the approximate level of the motor field voltage. The MIN lamp starts to come on at 25% and gets brighter as the level increases. The middle lamp comes on at 50% and gets brighter as the level increases. The MAX lamp comes on at 95% at full brightness.

- NOTE: the maximum available FIELD VOLTAGE is 0.9 times the AC supply.

**INTERFACE CONNECTOR**

These four signals can drive an external LED to show alarm status.

**Not to automatic field weakening:**
1. If the acceleration rate of the drive is too fast, then the drive may over- weaken and trip the FIELD LOSS alarm. To prevent this, rotate the UP RAMP anticlockwise.

**MODE**

- The lamps indicate the approximate level of the motor field voltage. The MIN lamp starts to come on at 25% and gets brighter as the level increases.
If the problem is not covered by this chart, repeat the set up procedure and try to determine at which step the problem is highlighted.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>possible reason</th>
<th>page</th>
<th>possible remedy</th>
<th>page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 main contactor will not energise</td>
<td>1 alarm tripped</td>
<td>15</td>
<td>1 find alarm cause, use defeat if able</td>
<td>15</td>
</tr>
<tr>
<td>2 no alarms but still no main contactor</td>
<td>2 power on/off not properly configured</td>
<td>28</td>
<td>2 check system and wiring of T28/29/30</td>
<td>28</td>
</tr>
<tr>
<td>3 slave contact lamp comes on but no main contactor</td>
<td>3 wiring or contactor coil supply problem</td>
<td>3</td>
<td>3 coil supply fuse or wrong supply volts</td>
<td>3</td>
</tr>
<tr>
<td>1 speed too low stall timer trips</td>
<td>1 insufficient motor torque for load</td>
<td>19/20</td>
<td>1 check current cal. of drive and motor</td>
<td>19/20</td>
</tr>
<tr>
<td>2 same as above but current cal. correct</td>
<td>2 field current is too low</td>
<td>21/28</td>
<td>2 check field current calibration</td>
<td>21/28</td>
</tr>
<tr>
<td>3 speed too high and stall timer trips</td>
<td>3 excessive speed demand due to feedback cal.</td>
<td>28</td>
<td>3 check feedback source full scale</td>
<td>28</td>
</tr>
<tr>
<td>1 speed changes when ancillaries energised</td>
<td>1 interference coupled onto tacho feedback</td>
<td></td>
<td>1 suppress noise or screen/filter tach</td>
<td></td>
</tr>
<tr>
<td>2 incorrect speed and stall timer lamp off</td>
<td>2 speed calibration not correct</td>
<td>22/27</td>
<td>2 check feedback source full scale</td>
<td>22/27</td>
</tr>
<tr>
<td>3 incorrect speed and speed feedback cal. is correct</td>
<td>3 speed demand is incorrect</td>
<td>27/28</td>
<td>3 trace all speed I/P sources to total setpoint O/P, T17</td>
<td></td>
</tr>
<tr>
<td>1 deceleration too slow and timer lamp flashes</td>
<td>1 braking current too low for load inertia</td>
<td>18/20</td>
<td>1 re-check current calibration</td>
<td>18/20</td>
</tr>
<tr>
<td>2 deceleration too slow timer lamp stays off</td>
<td>2 down ramp preset needs adjustment</td>
<td>18/22</td>
<td>2 adjust down ramp preset clockwise</td>
<td>18/22</td>
</tr>
<tr>
<td>3 deceleration too fast and/or uncontrolled behaviour</td>
<td>3 the stopping mode is incorrect for the chosen application</td>
<td>17/18</td>
<td>3 rapid stopping with run line OR ramped using stop/start</td>
<td>17/18</td>
</tr>
<tr>
<td>1 intermittent stall trip after some months</td>
<td>1 original current setting marginal</td>
<td></td>
<td>1 re-check current calibration</td>
<td></td>
</tr>
<tr>
<td>2 field loss alarm in field weakening mode</td>
<td>2 armature voltage changing rapidly</td>
<td>16/23</td>
<td>2 limit acceleration, 10 secs. for 100%</td>
<td>16/23</td>
</tr>
<tr>
<td>3 aux. trip triggered, thermistor on T25</td>
<td>3 overheated motor OR heatsink temp.</td>
<td>15</td>
<td>3 increased cooling for motor or drive. (heatsink lamp L1)</td>
<td>15</td>
</tr>
</tbody>
</table>

For further information on the cause of problems, refer to the block diagram on page 28. This is surrounded by boxes from 1 to 24, which contain keynote comments relating to each section of the drive unit. OBSERVE SAFETY
Apart from relays, the unit is completely static and requires little routine maintenance. Periodic cleaning should be done with a vacuum cleaner and small soft paint brush. Check all connections for tightness and discoloration which might indicate localised heat.

It is recommended that units requiring service be returned to the supplier. However in the event that the unit must be dis-assembled, only qualified personnel familiar with power engineering should be employed.

To dis-assemble models up to SLX50, follow the sequence outlined below. Models SLX65/85/115 have more complex high current stack assemblies and it is recommended that units requiring service be returned to the supplier for inspection and servicing.

Plan view of unit with cover removed. To remove the cover, unclip top catches and apply slight outward force to side panels at hinge

1) To remove top control card, remove plastic screws 7/8, and release the retaining catches 5/6. Carefully lift off the top card vertically from the bottom card. Avoid stressing the 20 way interconnection plug 9.

STEPS 2 AND 3 REFER TO MODELS UP TO SLX50 ONLY

2) To remove the power card, remove plastic screws 1/2/3/4 and threaded pillars 7/8. Disconnect 12 faston plugs from thyristors. These may be fairly tight, avoid damaging the red and yellow wires. Remove 4 long busbars by removing thyristor screws. Remove remaining exposed thyristor screws.

3) Lift off power card, and recover 6 supporting pillars. Unscrew temp sensor for total removal. Assemble in reverse order taking care to observe correct torque (3.1 Nm, 0.31kpm, 2.3 lbf ft +/-20%) when tightening thyristors. Make sure interconnection plugs are properly mated.

MAIN FUSES
The main external supply fuses must be semi-conductor fuses of the correct rating. Use of any other type may not afford adequate protection and may result in damage to the unit. Product warranty will be invalidated unless the correct type and rating of fuse is used. See rating table for INPUT FUSE. (See Page 29)

SPARES
Recommended minimum spares for models up to SLX50
2 Thyristors MCC 72-16io1
5 Aux. Fuses 20mm 6.3A sand filled types
3 Main fuses (see rating table page 29)
1 Fan assembly (forced vent units)

LINE REACTORS
All thyristor 3 phase convertors commutate the load current between devices and lines. During the process of commutation which lasts approximately 100 microseconds, notching will appear on the incoming supply lines. To prevent possible disturbance to the supply it is necessary to use a 3 phase LINE REACTOR between the POWER connections of the drive and the supply lines. Sprint has developed a range of Line Reactors to suit all models in the SLX range. See section 4 page 17 for supply condition information.

It is essential that all three phase drive systems incorporate the appropriate Line Reactor. See rating table on page 29, dimensions page 30.
Top edge terminals

All models have terminals on the top edge of the control card, marked 51 to 70. NOTE the terminal numbering system is common to the whole range. The prefix T refers to a terminal.

T51 -24 24 volt rail. unregulated, unprotected, may vary between -35V and -18V depending on loading and supply. This rail is primarily provided to supply external signal relays used in conjunction with T52, T53, T59, T60. Output capability 25mA. Do not overload or short.

T52 ST Stall relay driver. PNP open collector output. -40V max voltage when off, 100mA max current when on. Note a flyback diode for the relay coil is included internally.

T53 ZS Zero speed relay driver. PNP open collector output. -40V max voltage when off, 100mA max current when on. Note a flyback diode for the relay coil is included internally.

T54 IDO Rectified current demand output. 0 to -5V represents 0 to +/-100% current demand. 1K series buffer resistor. Maximum output -7.5V for 150% demand.

T55 RO Ramp output. 0 to +/-10V represents 0 to +/-100%. 1K series buffer resistor. Short circuit protected.

T56 AV Armature voltage module output. 0 to +10V for 0 to +/-500V. 1K series buffer resistor

T57 DO Demand output. 0 to +/-10V represents 0 to +/-100% speed demand. This is the final summation of all the speed demand inputs. 1K series buffer resistor.

T58 COM Common. 0V for drive electronics.

T59 REV Reverse relay driver. PNP open collector output. -40V max. voltage when off, 100mA max. current when on. A flyback diode is included. This driver is de-energised for speeds below 5% OR reverse rotation.

T60 TIM TIMER relay driver. PNP open collector output. -40V max. voltage when off, 100mA max. current when on. A flyback diode is included internally. This driver is de-energised when the stall timer starts to integrate. (current demand exceeds 105% of preset level)

T61 +12 regulated rail. 10mA capability, short circuit protected. This rail provides power to the drive electronics, the drive will not function while this rail is shorted. If it is used for external circuitry please ensure that it is buffered from possible interference by inserting a series resistor as close as possible to T61. A value between 10 and 100 Ohms should be adequate.

T62 SS STOP/START this input can be used to latch or unlatch the stall circuit. It may be necessary to de-couple this with a 0.1uF capacitor to COM. To unlatch or reset the stall circuit, momentarily connect T62 to T61 +12V. To latch the stall circuit, momentarily connect T62 to T63 -12V.

T63 -12 regulated rail. 10mA capability, short circuit protected. This rail provides power to the drive electronics, The drive will not function while this rail is shorted. If it is used for external circuitry please ensure that it is buffered from possible interference by inserting a series resistor as close as possible to T63. A value between 10 and 100 Ohms should be adequate.

T64 XIP alternate speed input via RL2 de-energised. Also on terminal 18. 0 to +/-10V for 0 to +/-100% speed demand summing input. The JOG SPEED preset (0 to +/-1V) is connected to this terminal via a 470K resistor.

T65 +IP ramped aux inverting speed input +/-10V represents +/-100%. 100K input impedance summing input.

T66 IP ramped auxiliary speed input +/-10V represents +/-100%. 50K input impedance summing input.

T67 +24 volt rail. Unregulated, unprotected. may vary between 35V and 18V depending on loading and supply. Output capability 25mA. Do not overload or short this rail.

T68 COM common. 0V for drive electronics.

T69 IOM Modulus armature current output. 0 to +5V for 0 to +/-100% armature current. 1K series buffer resistor.

T70 IP Direct speed input. 0 to +/-10V for 0 to +/-100% demand. This input by-passes the setpoint ramp circuit. It is connected to the speed jumper pin so that the direct speed input may be used when the drive is in torque mode. (470K Ohms input impedance)

WARNING. TAKE CARE NOT TO TOUCH ANY HIGH POTENTIAL PARTS OF THE UNIT ON THE LOWER POWER CARD WHILST PROBING THESE TERMINALS. THE FOLLOWING TERMINALS ARE ALSO CONNECTED TO OTHER TERMINALS AS FOLLOWS:T17-T57 DO, T18-T64 XIP, T19-T66 IP, T20-T65 -IP, T22-T55 RO.
WORKED EXAMPLE

TO ILLUSTRATE SPEED SCALING CONSIDERATIONS

MOTOR DETAILS
Max. armature volts 460V. Field voltage 210V
Max. armature current 20 amps. Field current 1 amp
Max. speed at full armature volts is 1800 RPM.

SYSTEM DETAILS
The motor is driving a roller via a 3:1 reduction gearbox.
a tachometer is connected to the roller shaft.

TACHOMETER
90V per 1000 RPM

DESIGNED RESULT
Roller speed 450 RPM

step 1)
Calculate inferred motor speed (maximum). Roller speed 450rpm therefore motor speed must be 450 times 3 = 1350rpm.

step 2)
Calculate tachometer output voltage and inferred armature voltage.
Tachometer output = 90V times 450/1000 = 40.5V
Inferred arm. volts = 460 times 1350/1800 = 345V

step 3)
Calculate max. possible drive output voltages in order to find out if the supply is suitable for the application.

Armature. ac times 1.1 which is 415 times 1.1 = 460V
Field. ac times 0.9 which is 415 times 0.9 = 370V

Armature volts required 345, maximum available 460V hence OK
Field volts required 210, maximum available 370 hence OK

Note, in this case the maximum volts available exceed the required levels by a considerable margin, hence care must be taken to approach the limits from the right direction. Follow the set up procedure to ensure this.

Set up field regulator section to give correct output, refer to page 23.

step 4)
Commissioning according to preferred set up procedure.

Initially in armature voltage feedback mode with tacho wire removed (T9).

Set up to 345 armature volts for+10V speed demand. Measure tacho volts and confirm,
a) voltage is -40.5V measured with respect to common (terminal 8).
b) polarity is negative for positive demand, and correct rotation sense. Independant speed verification using hand held tachometer or known speed monitor is advisable.

Rescale S3, S4 for correct range (30-60) both off. Re-connect tacho and set feedback source to tacho. S8 off. Set MAX SPEED preset ACW. initially, then recalibrate final max speed to give tacho volts of -40.5.
### RATING TABLES

#### SEMICONDUCTOR FUSE RATING TABLE FOR SLX DRIVES

<table>
<thead>
<tr>
<th>MODEL</th>
<th>MAX DC FUSE</th>
<th>AC/FUSE AMPS</th>
<th>DC FUSE AMPS</th>
<th>LITTLE FUSE</th>
<th>BUSS UP TO 250V</th>
<th>BUSS UP TO 500V</th>
<th>IR American Style</th>
<th>IR BS88 UP TO 250V</th>
<th>IR BS88 UP TO 500V</th>
<th>FERRAZ UP TO 250V</th>
<th>FERRAZ UP TO 500V</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLX 5</td>
<td>600</td>
<td>10 12</td>
<td>12 L25S 12</td>
<td>L50S 12</td>
<td>FWX 12</td>
<td>FWH 12</td>
<td>XL25X15</td>
<td>XL50F015</td>
<td>L390-12</td>
<td>6611R0025</td>
<td></td>
</tr>
<tr>
<td>SLX 15</td>
<td>600</td>
<td>30 36</td>
<td>50 L25S 50</td>
<td>L50S 50</td>
<td>FWX 50</td>
<td>FWH 50</td>
<td>XL25X50</td>
<td>XL50F050</td>
<td>L390-50</td>
<td>6611R0050</td>
<td></td>
</tr>
<tr>
<td>SLX 20</td>
<td>5000</td>
<td>40 48</td>
<td>80 L25S 80</td>
<td>L50S 80</td>
<td>FWX 80</td>
<td>FWH 80</td>
<td>XL25X80</td>
<td>XL50F080</td>
<td>L390-80</td>
<td>6611R0080</td>
<td></td>
</tr>
<tr>
<td>SLX 30</td>
<td>5000</td>
<td>60 72</td>
<td>100 L25S 100</td>
<td>L50S 100</td>
<td>FWX 100</td>
<td>FWH 100</td>
<td>XL25X100</td>
<td>XL50F100</td>
<td>L390-100</td>
<td>6611R0100</td>
<td></td>
</tr>
<tr>
<td>SLX 40</td>
<td>5000</td>
<td>80 96</td>
<td>125 L25S 125</td>
<td>L50S 125</td>
<td>FWX 125</td>
<td>FWH 125</td>
<td>XL25X125</td>
<td>XL50F125</td>
<td>L390-125</td>
<td>6611R0125</td>
<td></td>
</tr>
<tr>
<td>SLX 50</td>
<td>11850</td>
<td>100 120</td>
<td>155 L25S 155</td>
<td>L50S 155</td>
<td>FWX 155</td>
<td>FWH 155</td>
<td>XL25X155</td>
<td>XL50F155</td>
<td>L390-155</td>
<td>6611R0155</td>
<td></td>
</tr>
<tr>
<td>SLX 65</td>
<td>108000</td>
<td>124 155</td>
<td>225 L25S 225</td>
<td>L50S 225</td>
<td>FWX 225</td>
<td>FWH 225</td>
<td>XL25X225</td>
<td>XL50F225</td>
<td>T390-225</td>
<td>6611R0225</td>
<td></td>
</tr>
<tr>
<td>SLX 85</td>
<td>108000</td>
<td>164 206</td>
<td>300 L25S 300</td>
<td>L50S 300</td>
<td>FWX 300</td>
<td>FWH 300</td>
<td>XL25X300</td>
<td>XL50F300</td>
<td>T390-300</td>
<td>6611R0300</td>
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<tr>
<td>SLX 115</td>
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<td>L50S 600</td>
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<td>FWH 600</td>
<td>XL25X600</td>
<td>XL50F600</td>
<td>T390-600</td>
<td>6611R0600</td>
<td></td>
</tr>
</tbody>
</table>

In general, the AC supply current per phase is 0.8 times the DC output current, and the fuse rating should be approx. 1.25 times the input current. The fuses specified in this table have been rated to include the 150% overload capability and operate up to 50°C ambient at the maximum drive rating. To select a fuse at other ratings for example when using a motor rated at a lower power than the drive unit or operating at a reduced maximum current setting, select a fuse with a current rating closest to the armature current and with an I²t rating less than the maximum shown in the table. If a DC fuse is fitted in series with the armature, it must be a DC rated semiconductor type with current rating 1.2 times the motor full load current, DC voltage rating suitable for the maximum armature voltage and with an I²t rating less than the maximum shown in the table.

#### RATING TABLE TO SLX50

(Rating depends on motor type) (35 cubic ft./min = 1 cubic m/min)

<table>
<thead>
<tr>
<th>DRIVE MODEL NUMBER</th>
<th>MOTOR O/P AT 460V</th>
<th>MAXIMUM CONTINUOUS AMPS</th>
<th>MAX FIELD AMPS</th>
<th>MAIN FUSES</th>
<th>TYPICAL CABLE SIZE</th>
<th>LINE REACTOR TYPE</th>
<th>COOLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLX5 5</td>
<td>6.6</td>
<td>10 AC 12 DC</td>
<td>2.5</td>
<td>600</td>
<td>4mm²</td>
<td>LR48</td>
<td>17 N 45</td>
</tr>
<tr>
<td>SLX5 10</td>
<td>13.3</td>
<td>20 AC 24 DC</td>
<td>2.5</td>
<td>600</td>
<td>4mm²</td>
<td>LR48</td>
<td>17 N 80</td>
</tr>
<tr>
<td>SLX5 15</td>
<td>20</td>
<td>30 AC 36 DC</td>
<td>2.5</td>
<td>600</td>
<td>6mm²</td>
<td>LR48</td>
<td>17 N 120</td>
</tr>
<tr>
<td>SLX5 20</td>
<td>26.6</td>
<td>40 AC 48 DC</td>
<td>2.5</td>
<td>5000</td>
<td>6mm²</td>
<td>LR48</td>
<td>17 N 120</td>
</tr>
<tr>
<td>SLX5 30</td>
<td>40</td>
<td>60 AC 72 DC</td>
<td>5.0</td>
<td>5000</td>
<td>16mm²</td>
<td>LR120</td>
<td>35 F 200</td>
</tr>
<tr>
<td>SLX5 40</td>
<td>53.3</td>
<td>80 AC 96 DC</td>
<td>5.0</td>
<td>5000</td>
<td>25mm²</td>
<td>LR120</td>
<td>35 F 300</td>
</tr>
<tr>
<td>SLX5 50</td>
<td>66.6</td>
<td>100 AC 120 DC</td>
<td>5.0</td>
<td>11850</td>
<td>35mm²</td>
<td>LR120</td>
<td>35 F 320</td>
</tr>
</tbody>
</table>

#### RATING TABLE SLX65/85/115

(Rating depends on motor type) (NOTE 60cfm = 2 cubic m/min)

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>MOTOR O/P AT 460V</th>
<th>MAXIMUM CONT. AMPS</th>
<th>MAX FIELD AMPS</th>
<th>MAIN FUSES</th>
<th>AUXILIARY FUSE RATING AMPS</th>
<th>LINE REACTOR TYPE</th>
<th>COOLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLX65 65</td>
<td>90</td>
<td>124 AC 155 DC</td>
<td>10 A</td>
<td>108000</td>
<td>12A 140</td>
<td>LR270</td>
<td>60cfm 350</td>
</tr>
<tr>
<td>SLX65 85</td>
<td>115</td>
<td>164 AC 205 DC</td>
<td>10 A</td>
<td>108000</td>
<td>12A 140</td>
<td>LR270</td>
<td>60cfm 475</td>
</tr>
<tr>
<td>SLX115 115</td>
<td>155</td>
<td>216 AC 270 DC</td>
<td>10 A</td>
<td>128000</td>
<td>12A 140</td>
<td>LR270</td>
<td>60cfm 650</td>
</tr>
</tbody>
</table>

Important warning. Do not allow armature current limit to exceed motor rating. If the motor current rating is less than the drive rating, use max current preset to reduce the current limit. Alternatively the drive may be re-rated by re-burdening the current transformers according to the formula: \( R (\text{KOhms}) = \frac{2}{\text{IMAX}} \). The burden resistors R100/R101/R102 are in parallel, and are found on the bottom edge of the lower power board.

U101901 IS130
LR48:
- RATING: UP TO 48A
- TERMINALS: M6 STUDS
- MOUNTING HOLES: 4 OFF, 4MM
- MOUNTING CENTRES: 137 X 44MM

LR120:
- RATING: UP TO 120A
- TERMINALS: M10 LUGS
- MOUNTING HOLES: 4 OFF, 5MM
- MOUNTING CENTRES: 190 X 63MM

LR270:
- RATING: UP TO 270A
- TERMINALS: M10 STUDS
- MOUNTING HOLES: 4 OFF M5
- MOUNTING CENTRES: 230 X 78MM

TOL. X +/-0.4 X.X +/-0.2 X.XX +/-0.1 HOLES < 7DIA 0.02 +0.07 ALL DIMENSIONS IN MM UNLESS OTHERWISE STATED.
These application notes are strictly for assistance in the general implementation of Sprint products, and are provided for general guidance in system applications. It is entirely the users responsibility to ensure that any system is suitable for the application in question and all due care is taken with regard to overall safety of the installation. Sprint Electric does not accept any liability in respect of the application.

### Section 4

**Application diagrams for model SLX**

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<td>1</td>
<td>Tacho feedback. Forward / Reverse by pushbutton. Direction memorised during stop</td>
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<td>Connection of motor thermistor</td>
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<td>Connection of auxiliary signal relays</td>
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<td>3</td>
<td>3</td>
<td>Motor thermistor with reset button</td>
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<td>4</td>
<td>3</td>
<td>Contactor in armature circuit</td>
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<td>Armature voltage feedback. Forward / Reverse on setpoint pot with centre zero</td>
</tr>
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</tr>
<tr>
<td>4</td>
<td>5</td>
<td>Digital panel meters showing speed and current</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>Connection of motor thermistor</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>Connection of auxiliary signal relays</td>
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<td>Using relay drivers for lamps</td>
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<td>7</td>
<td>Linking drives together, one trips, all trip</td>
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<td>2</td>
<td>7</td>
<td>Power on interlock</td>
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<td>3</td>
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<td>Motor thermistor with reset button</td>
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<td>4</td>
<td>7</td>
<td>Contactor in armature circuit</td>
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<tr>
<td>5</td>
<td>7</td>
<td>Power on with maintained contact</td>
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<td>Zero or reverse reference interlock</td>
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<td>Simple dancing arm circuits</td>
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<td>Jogging with start and power on functions combined</td>
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<td>Crawl or run select.</td>
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<td>9</td>
<td>Jogging on main contactor</td>
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<td>10</td>
<td>Jogging with main contactor permanently energised via direct speed input</td>
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<td>10</td>
<td>Jogging with start and power on functions combined and external jog speed reference</td>
</tr>
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<td>Jogging on main contactor with zero speed interlock</td>
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<td>11</td>
<td>4-20mA loop. Forward / Reverse</td>
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<td>2</td>
<td>11</td>
<td>Dual setpoint pots with pushbutton selection</td>
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<td>3</td>
<td>11</td>
<td>4-20mA loop with local speed pot selected by pushbutton</td>
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<td>11</td>
<td>Forward / Reverse with unipolar signal and direction switch</td>
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<td>Jogging with external jog with start and power on functions combined and external jog speed reference</td>
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<td>3</td>
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<td>4</td>
<td>13</td>
<td>Jogging on main contactor with zero speed interlock</td>
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<td>Ramping to crawl triggered by proximity detector, then coasting to zero by run contact</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>Ramping to crawl triggered by proximity detector, with automatic end of travel reversal</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>Braking to zero speed triggered by proximity detector</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
<td>Main contactor drop out enabled by zero speed</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>Low voltage supply with auxiliary supply step up transformer</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>AC supply with step down transformer for the power connections</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>Local transformer power supplies</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>Power supply condition</td>
</tr>
</tbody>
</table>
1) ARMATURE VOLTAGE FEEDBACK. FORWARD AND REVERSE ON SETPOINT POT, WITH CENTRE ZERO.

For high accuracy armature voltage feedback, the field regulator must be preset in linear mode. External IR compensation may be necessary for improved load regulation. Increase the IR COMP to overcome speed drop at full load. Excessive IR COMP may lead to instability.

2) TACHO FEEDBACK. FORWARD / REVERSE BY PUSHBUTTON, DIRECTION MEMORIZED DURING STOP MODE. RAPID BRAKING WITH RUN CONTACT, RAMPED BRAKING WITH STOP PUSHBUTTON.

(tacho polarity on terminal 9 must be negative for positive demand)

3) BASIC CONNECTION. DYNAMIC BRAKING

C1 normally open, C2 normally closed. The relays operate together. The peak braking current should not exceed 2 times the nominal armature current (refer to motor manufacturer). The resistor must be able to dissipate the waste heat.

4) TORQUE CONTROL, OVERSPEED LIMITING BY SEPARATE SPEED SETPOINT

If the speed exceeds the level programmed by the speed setpoint, the current demand comes out of limit and the speed loop takes control. The start function is initiated by the direction pushbuttons.
1) Digital panel meters showing speed and current

2) Motor thermistor connection.
   The aux alarm will trigger if the resistance of the thermistor exceeds 2K Ohms. The alarm will not trigger if the resistance of the thermistor remains below 200 Ohms.

3) Connection of auxiliary signal relays. Minimum coil resistance 1K. Stall, zero, reverse and timer functions available on terminals 52, 53, 59, 60. They are also switch selectable functions for the on-board relay.

4) Using relay drivers for lamps
   The relay drivers may also drive various types of indicators. Shown here are 3 types. The lamps maximum rating must be 24V, 25mA.
1) Drive healthy signal relay

2) Control via open collector PLC outputs

3) The drive speed is set by a remote 0 to +10 volt signal. The local min speed is set by the jog speed preset.

4) Local or remote speed demand selected by pushbutton, the drive will ramp between the setpoints.
WEB DRIVE IN SPEED MODE

WEB SPEED

REEL DRIVE IN TORQUE MODE

REEL DRIVE MUST BE IN TORQUE MODE.
THE 100% SPEED SCALING SHOULD ACCOMMODATE THE MAXIMUM WEB SPEED AT MINIMUM DIAMETER.

(SET THIS UP FIRST IN SPEED MODE INITIALLY) THE RELAY CAN BE USED TO INDICATE THAT THE REEL SPEED IS BELOW THE THRESHOLD FOR CALCULATION. THIS CAN EASILY HAPPEN.

100% CURRENT DEMAND FROM WINDER UNIT

CURRENT DEMAND FROM WINDER UNIT

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HEALTH AND SAFETY AT WORK. ELECTRICAL DEVICES CONSTITUTE A SAFETY HAZARD. IT IS THE RESPONSIBILITY OF THE USER TO ENSURE COMPLIANCE WITH ANY ACTS OR LAWS IN FORCE. ONLY SKILLED PERSONS SHOULD INSTALL THIS EQUIPMENT.
1) MASTER DRIVE WITH SLAVE FOLLOWING IN SPEED MODE. THE SPEED DEMAND FOR THE SLAVE CAN BE SELECTED TO BE THE RAMP OUTPUT FROM THE MASTER.

MASTER DRIVE

SPEED SETPOINT

SLAVE FOLLOWER

OR A LOCAL POT.

2) LOAD SHARING WITH TWO MOTORS MECHANICALLY LOCKED. THE MODULUS CURRENT OUTPUT SIGNAL FROM THE MASTER PROVIDES A TORQUE DEMAND INPUT TO THE SLAVE. THE SPEED LOOP OF THE SLAVE IS OFFSET POSITIVELY FOR OVERSPEED PROTECTION.

MODELS LX

COIL SUPPLY

Make speed scaling of both drives matched
then adjust ZERO SPEED clockwise to give
positive offset to speed demand

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THE RAMP SETTINGS ON THIS DRIVE WILL BE FOLLOWED BY THE OTHERS

THIS DRAWING SHOWS HOW THE BUFFER CARD CAN BE USED TO PROVIDE A MASTER SETPOINT TO MULTIPLE DRIVES WITH A RATIO POT FOR EACH OF THE FOLLOWERS

MASTER SETPOINT application.
Model SLX

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METHOD FOR ENABLING POWER ON FOR MULTIPLE DRIVES WITH ONE SET OF POWER ON, POWER OFF PUSHBUTTONS. NOTE. THE PROPAGATION DELAY FOR TRIPPING IS APPROX. 100 milliseconds PER DRIVE. (note, the main contactor can be rated AC1, thermal)

POWER ON INTERLOCK
THE MAIN CONTAC-TOR CAN ONLY BE ENERGISED IF C2 IS CLOSED AT POWER ON. EG. ZERO REFERENCE INTERLOCK.

THERMISTOR ALARM TRIPS IF THE RESISTANCE EXCEEDS 2k Ohms. IT WILL NOT TRIP IF THE RESISTANCE IS BELOW 200 Ohms.

1) Linking Drives together, one trips, all trip.
2) Power On interlock.
3) Thermistor with Reset button.
4) Contactor in Armature circuit.
5) Power On with maintained contact.

A SWITCH OR MAINTAINED CONTACT MAY BE USED. IF THE SWITCH IS CLOSED WHEN AUX. POWER IS APPLIED THEN THE MAIN CONTACCTOR WILL ENERGISE IMMEDIATELY. WARNING! THIS MAY BE DANGEROUS.

HEALTH AND SAFETY AT WORK. ELECTRICAL DEVICES CONSTITUTE A SAFETY HAZARD. IT IS THE RESPONSIBILITY OF THE USER TO ENSURE COMPLIANCE WITH ANY ACTS OR DIRECTIVES IN FORCE. ONLY SKILLED PERSONS SHOULD INSTALL THIS EQUIPMENT.
SLX

**ZERO or REVERSE REFERENCE INTERLOCK**

A common requirement to prevent drive enable on turn on if the setpoint reference is POSITIVE and greater than 5%.

Provision has been made on the MICRO ANALOG PROCESSOR to have this feature selectable.

The SLX is provided with a REVERSE or ZERO speed function. A link on the PROCESSOR is remade and the REVERSE speed detector becomes a REVERSE or ZERO reference detector.

To implement the zero or reverse reference function the S link must be opened and the R link made. The links are made by solder bridges. Take great care not to damage the tracks when removing the solder.

Once the link has been altered it can be tested by selecting the REVERSE speed relay function (S7) and then applying a setpoint to terminal 3. The relay output should change state at 0.5V. The relay will be energised for voltages > than 0.5V.

A layout of the MICRO ANALOG PROCESSOR is shown below. (Located on the top edge of the control card).

To implement a zero reference interlock it will be necessary to wire the relay in series with the POWER ON pushbutton as shown.

If this function is implemented by the user, please add a label to indicate the change.
OVERHAULING. Applications which require a force to be applied in opposition to the material direction

![Diagram of nip rolls and web direction]

The nip rolls are driven by drive 2 in stand-by speed mode. The setpoint ramp output is taken to drive 1. Drive 1 is used to control the overhauled nip rolls, in one of 2 modes. It is arranged to give forward rotation for a negative armature voltage.

1) As a speed follower
2) Applying reverse force to the web. A reduced speed demand causes the drive to try and slow down. To do this, it asks for positive current, which is limited by the external torque pot. Note, the stall timer is automatically inhibited in this mode.

---

**OVERHAULING DRIVE 1**

- Speed setpoint
- Torque setpoint
- Tension mode follow mode
- Power off power on control supply

**OVERHAULING DRIVE 2**

- Speed setpoint
- Run contact
- Start stop
- Power off power on control supply

---

**OVERHAULING APPLICATION.**

- Positive total speed demand T17 +ve
- Positive armature current controlled by external torque pot
- Negative armature current
- Switch to tension mode

---

**NOTICE:**

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SLX SIMPLE DANCING ARM

APPLICATION UTILISING DANCING ARM

THE CONTROL SYSTEM IS DESIGNED TO GIVE PROPORTIONAL CLOSED LOOP CONTROL OF THE POSITION OF THE DANCING ARM.

THE POSITIVE SETPOINT RAMP OUTPUT AND THE NEGATIVE SETPOINT OUTPUT ARE APPLIED ACROSS THE SENSOR POT. THIS GIVES A SENSOR POT STRENGTH PROPORTIONAL TO LINE SPEED.

THE CENTRE ZERO POT AND BALLAST RESISTOR ALLOW ADJUSTMENT OF THE NULL POSITION BY +/- 50% OF THE SENSOR POT TRAVEL. THEY CAN BE OMITTED IF THIS FUNCTION IS NOT WANTED.

THE GAIN POT ALLOWS ADJUSTMENT OF THE SENSOR POT SIGNAL STRENGTH BY 50% TO ALLOW STABILITY ADJUSTMENT AND GAIN CONTROL. HIGHER GAIN GIVES TIGHTER CONTROL BUT LESS STABILITY.

IF THE ARM STARTS TO RISE THE DRIVE RECEIVES A +VE SIGNAL INTO THE INVERTING INPUT, THIS GIVES A SPEED REDUCTION, WHICH CAUSES THE ARM TO RETURN TO THE NULL POSITION. A DROPPING ARM GIVES A SPEED INCREASE.

APPLICATION WHERE DANCING ARM POSITION IS CONTROLLED BY INPUT SPEED CHANGE.

MOTOR CONTROLLED BY DRIVE IS SETTING SPEED OF CONTINUOUS WEB OF MATERIAL ON THE INPUT TO THE DANCING ARM.

IN THIS CASE A RISING ARM CAUSES THE INPUT DRIVE 1 SPEED TO INCREASE.

Pivot point sensor pot clockwise rotation for a rising arm.

Moveable weight sets tension.
1) THE JOG BUTTON WILL RAMP THE DRIVE DOWN TO STANDSTILL IF MOMENTARILY PRESSED, AND THEN CONTINUE TO JOG AT THE XP SPEED.

2) CONTACTOR REMAINS ENERGISED DURING JOG. THE POWER ON AND START FUNCTIONS ARE COMBINED.

3) CRAWL OR RUN SELECT.

4) JOGGING ON MAIN CONTACTOR.
Reduce speed to minimum before selecting jog.

SPRINT Electric

SLX 1) JOGGING WITH MAIN CONTACTOR PERMANENTLY ENERGISED
2) JOGGING WITH START AND POWER ON FUNCTIONS COMBINED
3) CRAWL OR RUN SELECT
4) JOGGING ON MAIN CONTACTOR

SPRINT Electric Ltd. does not accept any liability whatsoever for the installation, fitness for purpose or application of its products. It is the responsibility of the user to ensure compliance with any acts or bylaws in force. Only skilled persons should install this equipment.
1) FORWARD AND REVERSE USING 4-20mA LOOP SIGNAL. 12mA REPRESENTS ZERO. The ramp output on T55 swings -5V to +5V. -5V = -100%, 0V = 0%, +5V = +100%.

2) DUAL SETPOINT POTS. SELECTED BY PUSH-BUTTONS. BOTH CENTRE ZERO. OPENING RUN LINE GIVES RAPID STOPPING.

3) FORWARD SPEED SET BY 4-20mA SIGNAL LOOP. LOCAL SETPOINT IS ADDED IN BY LOCAL BUTTON AND DESELECTED BY REMOTE BUTTON.

4) BI-DIRECTION CONTROL WITH A UNIDIRECTIONAL SETPOINT 0 TO +10V AND A POLARITY SWITCH.
A layout of the MICRO ANALOG PROCESSOR is shown below. (Located on the top edge of the control card.)

<table>
<thead>
<tr>
<th>Signal Pad</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCO</td>
<td>Ramp Control Output. This signal indicates the setpoint ramp status and is +1V when ramping up and 0V when the ramp has finished.</td>
</tr>
<tr>
<td>TCI</td>
<td>Torque Command Input. This signal pad is connected to terminal 6 and shows the level of the auxiliary reference 0 to +/-10V</td>
</tr>
<tr>
<td>IO</td>
<td>Field Output. This signal is connected to terminal 24 and shows the magnitude of the Field current. 0 to +5V for 0% -100% current.</td>
</tr>
<tr>
<td>RUN</td>
<td>Run. Shows the status of the RUN signal within the drive. 0 to +11.5V when the RUN terminal 7 is open or main contactor disabled, 0V to run</td>
</tr>
<tr>
<td>TDO</td>
<td>Torque Demand Output. 0 to +7.5V represents 0 to 150% torque demand (armature current). +5V represents 100%.</td>
</tr>
<tr>
<td>DO</td>
<td>Demand Output. 0 to -10V represents 0 to +100% speed demand. This signal is also on terminal 57 and terminal 17.</td>
</tr>
<tr>
<td>DIP</td>
<td>Direct speed Input. This signal is also on terminal 70, and terminal 6 if the drive is in speed mode. 0 to +10V represents 0 to 100% speed. +10V. ultra stable speed reference voltage. Also on terminal 1. Absolute value 10V +/-5%. Output capability 10mA maximum.</td>
</tr>
<tr>
<td>+10</td>
<td>-24V. Unregulated +24V power supply. May vary between -18V and -35V depending on unit supply voltage and loading. 25mA max. T67</td>
</tr>
<tr>
<td>-24</td>
<td>+24V. Unregulated +24V power supply. May vary between +18V and +35V depending on unit supply voltage and loading. 25mA max. T67</td>
</tr>
<tr>
<td>+12</td>
<td>Inverting ramped speed input. Also on T65 and T20. 0 to -10V represents 0 to +100% ramped speed demand. True bi-polar arithmetic summing.</td>
</tr>
<tr>
<td>-12</td>
<td>Offset speed input. 0 to +10V represer ts 0 to -25% speed demand. This input is used for the 4-20mA signal loc p offset function.</td>
</tr>
<tr>
<td>+10</td>
<td>Input terminal 3. This signal is the main speed demand signal normally input via terminal 3. 0 to +10V for 0 to -100% speed demand.</td>
</tr>
<tr>
<td>+10</td>
<td>Ramp input Auxiliary. Non-inverting speed input also on T66 and T19. 0 to +10V for 0 to +100% speed demand. True bi-polar arithmetic summing.</td>
</tr>
<tr>
<td>TDO</td>
<td>Ramp sum total. This signal is the summation of all the speed ramp inputs. 0 to +5V represents 0 to +/-100% speed demand prior to ramping.</td>
</tr>
<tr>
<td>+10</td>
<td>Ramp Output. This signal is the ramped I version of the signal on B5. 0 to +10V represents 0 to +100% speed demand. It is also on T55 and T22.</td>
</tr>
<tr>
<td>+12</td>
<td>AV output. This signal represents the armature voltage signal. Also on terminal 56. 0 to +10V represents 0 to +/-500V at the armature terminals.</td>
</tr>
<tr>
<td>COM</td>
<td>Common. Electronic 0V</td>
</tr>
<tr>
<td>+12</td>
<td>+12V regulated rail. 10mA maximum available. Tolerance 5%.</td>
</tr>
<tr>
<td>-12</td>
<td>+12V regulated rail. 10mA maximum available. Tolerance 5%.</td>
</tr>
</tbody>
</table>
1) The Jog button will ramp the drive down to standstill if momentarily pressed, and then continue to jog at the XIP speed via the direct speed input on T70. (Remove the ZS jumper; Jog speed preset has a maximum of 6% in this mode).

2) Contactor remains energised during Jog. The power on and start functions are combined. Jog speed is set by external pot.

3) Stop or run select. Regen down using 15 and/or 25 jumper.

4) Jogging on main contactor with automatic zero speed Jog interlock. (S6 on and S5/5/7 off).

---

**Typical Applications**

**SLX** 1) Jogging with main contactor permanently energised via direct speed input
2) Jogging with start and power on functions combined and external Jog speed reference
3) Stop or run select, Regen down
4) Jogging on main contactor with zero speed interlock

**HEALTH AND SAFETY**

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When the drive is being supplied from a local transformer, the commutation process in the thyristor bridge will cause high voltage overshoots to occur on the incoming supply. This is due to the inductance of the transformer and the lack of any other substantial load to absorb the high energy spikes.

The high energy spikes may cause damage to other equipment, the drive auxiliary inputs, the blower motor or unwanted thyristor triggering. To prevent this it is necessary to fit a supply conditioning BUCKET circuit to the drive supply.

The BUCKET circuit will soak up the spikes and prevent damage.

As a general rule a BUCKET circuit will be required with local transformer supplies unless the consumption of current by other non-inductive loads connected to the same transformer exceeds the drive current at any time.

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<tr>
<th>TOTAL SETPOINT OUTPUT 17</th>
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<td>FIELD CURRENT OUTPUT 24</td>
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</table>

+10 volts \( \pm 5V \) output. 10mA. Total current \( \leq 5 \) mA. TACHO feedback input. Full scale \( \pm 2V \) resistance to common.
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