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Compumotor

LE Drive User Guide

Compumotor Division
Parker Hannifin Corporation
p/n 88-004577-03 A

Parker

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PRODUCT NOTICE

Operating the L20 Linear Motor with the LE Drive

This product notice is a supplement to the LE Drive User Guide, part number 88-004577-03 A.

Performance Considerations

The LE Drive can be used in linear applications requiring low EMI emissions. The L20 forcer is normally run at 2.7A, producing an average static force of 20 lbs. The maximum current setting on the LE Drive is 2A; consequently, at 2A, the L20's static force is reduced to about 15 lbs. The maximum bus voltage of the LE Drive is ±24V; therefore, the maximum velocity of the L20 forcer is limited to about 25 inches/second (ips).

To ensure smooth operation and optimum microstep-to-microstep accuracy, the L20 linear motor is factory-tuned to the LE Drive with which it is ordered. For best performance, the L20 forcer must be used with the corresponding LE Drive. Both the LE Drive and the accompanying L20 forcer have the same serial number.

When an L20 forcer is run with another LE Drive, it may run rough, and the maximum cyclic error (measure of the microstep-to-microstep error) may double or triple. The maximum cyclic error is ±0.0003 inches (±7.6 microns).

To change the forcer's default direction of travel, exchange the Direction + input with the Direction - input coming into the drive. **Do not change the phasing on the forcer cable.** Changing the motor phasing makes the factory tuning invalid.

Cooling

The LE Drive heat sinking capability is marginal at 2A operation. The LE Drive, however, does not come with an optional fan kit; therefore, Compumotor strongly recommends you use a fan for extra cooling. You can also operate the LE Drive at a lower current to prevent thermo-related shutdowns.

If accuracy and/or repeatability are important, do not use the standby mode. This may change the motor's position slightly when the current is reduced. Do not use the current boost mode.

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LE Drive DIP Switch Settings

The use the L20 linear motor with the LE Drive, the LE Drive DIP switches must be set according to Table 1 below.

LE Drive DIP Switch Settings								Function
1	2	3	4	5	6	7	8	
ON	ON	ON	ON	----	----	----	----	2.0A Current Setting
----	----	----	----	OFF	----	----	----	Motor Standby Disabled
----	----	----	----	----	ON	----	----	Reserved (must be ON)
----	----	----	----	----	----	OFF	OFF	25,400 steps/in (1,000 steps/rev)
----	----	----	----	----	----	OFF	ON	20,000 steps/in (40,000 steps/rev)
----	----	----	----	----	----	ON	OFF	12,700 steps/in (500 steps/rev)
----	----	----	----	----	----	ON	ON	10,000 steps/in (20,000 steps/rev)

Table 1. LE DIP Switch Settings for the L20 Linear Motor

Connecting the L20 Forcer

Use Figure 1 below as a guide for connecting the L20 forcer to the LE Drive.

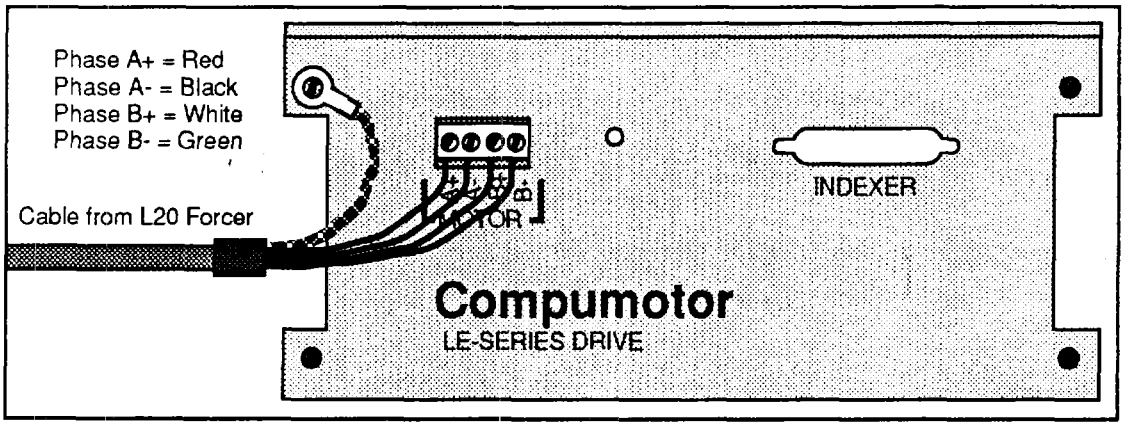


Figure 1. Connecting the L20 Forcer to the LE Drive

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TECHNICAL BULLETIN

PARKER COMPUMOTOR

No. 125

PRODUCT: LE Drive
DESCRIPTION: Temperature Specifications
SOFTWARE AFFECTED: n/a
NEXT SCHEDULED RELEASE: n/a

July 12, 1988

Recently it was discovered that the temperature specification for the LE Drive in both the manual and our catalog was incorrect. The manual and catalog specify a 50°C ambient operating temperature.

The actual ambient operating temperature should be 40°C. If it is not run at this temperature fan cooling may be necessary or the drive will fault due to overtemperature.

P/N: 88-006277-09

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LE-Series Operator's Manual

COMPUMOTOR CORPORATION

LE-Drive Operator's Manual

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DESCRIPTION

Compumotor's LE-Drive is a very low EMI (electro-magnetic interference) microstepping motor drive. The LE-Drive is a linear design intended for those applications where EMI must be kept to an absolute minimum. The LE-Drive is a "microstepping" drive: That is to say it gives a large number of small steps for each full step of the step motor it is driving. The standard resolution is 25,000 steps per motor revolution, or 125 steps per full motor step of a 200 step motor. 50,000 steps per revolution may be selected as shown below.

Two other features are included with the LE-Drive which were previously unavailable. These are the OVERDRIVE input and the stand-by operating mode. OVERDRIVE boosts the motor current from its set level to approximately double (three amps maximum) for as long as the OVERDRIVE input is held active. This allows a momentary increase in motor torque. The OVERDRIVE feature is activated by the indexer controlling the LE-Drive. The stand-by feature allows the current to the motor to be reduced after the LE-Drive has not received motor step pulses for about two seconds. The feature is enabled or disabled by using the configuration switches described in the Installation and Hookup Section.

The LE-Drive has two user selectable motor resolutions: 25,000 and 50,000 steps per revolution. Either resolution may be selected by the configuration switches described in the Installation and Hookup Section.

All inputs and outputs use industry standard connectors for ease of installation and low mean time to repair.

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INSPECTION

Your LE-Drive should be inspected upon receipt for obvious damage to its shipping container. Report any such damage to the shipping company as soon as possible, as Compumotor cannot be held responsible for damage incurred in shipment. The LE-Drive should then be carefully unpacked and inspected for the following items to be present and in good condition.

1. LE-Drive unit
2. Motor
3. AC power cord
4. Connector, 25D, solder type with shell

WARRANTY INFORMATION

Your LE-Drive is warranted against manufacturing defects for one year from the date of purchase. Should you have questions about operationg the LE-Drive, your Compumotor representatives and distributors stand ready to support your individual needs. Call Compumotor Corporation at the number listed below to get the name, address and phone number of the Compumotor representative nearest you.

Should return of your Motor Controller be required to effect repairs or upgrades, do the following,

1. Get the serial number of the defective unit (and a purchase order for repair costs if the unit is out of warranty.

2. Call Compumotor for a Return Material Authorization Number (RMA) at 800-358-9068 except in California. In California, call collect at 707-778-1244.

3. Ship the unit to: Compumotor Corporation
   1179 N. McDowell Blvd.
   Petaluma, CA 94928
   Attn: RMA# xxxxxxxx

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FUNCTIONAL CHECK

In order to make a functional check of the LE-Drive it is necessary to first attach motor, indexer and power leads to it as explained in the installation and hookup section, below. The indexer need not be used for an initial test. A square-wave generator may be attached to the Indexer inputs instead.

Using a square-wave generator instead of an indexer.

The positive or "hot" lead of the square-wave generator should be attached to the STEP+ input on LE-Drive. Ground from the frequency generator should be attached to STEP-. The output of the square-wave generator should be set to 3 volts peak. There is an 82 ohm resistor and LED in series between the STEP+ and STEP- inputs. The current through these components should not exceed 20 mA for reliable operation.

To verify that the LE-Drive is operating properly,

1. Attach the motor cable to the LE-Drive. Be sure the motor shaft is free to rotate.

2. Apply power to the LE-Drive (115 VAC) and apply a one kHZ square wave to the STEP inputs. This will cause a 25,000 steps per revolution motor to rotate at the rate of one revolution every 25 seconds in the counter-clockwise direction.

3. All other inputs may be left unconnected.

By increasing the frequency of the square wave you will increase the rotational velocity of the motor. The motor should be able to accept up to 125 kHZ (5 RPS) without stalling provided the motor has not been accelerated too quickly.

The direction of the motor can be changed by putting 20 mA of current through the DIRECTION+ and DIRECTION- inputs. Three volts applied to DIRECTION+ and signal ground applied to DIRECTION- will cause the motor to rotate in the clockwise direction. The motor will not be able to reverse direction instantly, however, it is necessary to slow the motor to less than one-half rev per second to allow a direction reversal without stalling the motor.

Checkout of the OVERDRIVE and SHUTDOWN inputs are not considered a portion of the basic functional checkout of the LE-Drive. These are covered under the Operation section of this manual.

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INSTALLATION AND HOOKUP

1. Mounting

A. Panel Mount

The LE-Drive has "L" brackets notched to accept screws on either end to facilitate mounting to flat panel surfaces. The unit should be securely mounted to prevent it from moving unexpectedly, as this could cause an unsafe condition to occur. Mounting it so that its heat sink fins run vertically will augment convection cooling.

B. Cooling

The LE-Drive should be mounted in an area that will allow air to circulate over its heat sink. Sufficient cooling may be derived from convection cooling provided the LE-Drive is mounted in free air (preferably with its heat sink aligned vertically). In a normal factory environment this will seldom be a problem. The LE-Drive is designed to operate in an environment ranging from 0°F to 122°F (0 to 50°C) without being actively cooled.

In a confined environment, however, the LE-Drive should be actively cooled with forced air such that the heat sink temperature never exceeds 149°F (65°C).

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2. Wiring

A. Motor Connections

The LE-Drive is normally supplied with a motor complete with cable and connector. Typically, plugging the motor cable into the drive is all that is required.

Contact the factory for further details about configuring the LE-Drive for motors other than provided by the factory.

B. Line Power Connections

120 VAC power is connected via the IEC power connector. The drive is supplied with the correct mating power cord. The user's 120VAC or 220 VAC power system must be a three wire system that includes an earth (safety) ground. If the power cord is modified or the user supplies his own cord, the wires should be connected as follows.

LE-Drive	Wire color
120 VAC or 220 VAC LINE	Black (blue)
120 VAC or 220 VAC NEUT	White (brown)
AC GND	Green (green with yellow)

See Appendix D to configure

C. Indexer Connections

STEP+ and STEP- both must be connected to run the motor. DIRECTION+ and DIRECTION- need only be connected if the motor need be run bi-directionally. SHUTDOWN+ and SHUTDOWN- must be connected if the motor is to be shutdown remotely without powering down the drive. A Comumotor indexer to LE-Drive cable is suplied with the LE-Drive. The Compumotor indexer to LE-Drive cable is connected as follows:

Indexer	Wire color	Pin #
STEP+	Red	1
STEP-	Black	14
DIRECTION+	Green	2
DIRECTION-	White	15
RPS+	Blue	16
RPS-	Brown	17
OVERDRIVE+	Violet	11
OVERDRIVE-	Yellow	23

D. Configuration Switches

The LE-Drive has a bank of eight switches mounted on its main printed circuit board. The switches may be accessed by removing

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the four screws securing the indexer/motor connection end of the LE-Drive as shown in Appendix C. The switches are defined as follows,

LE-Drive Switches		Factory Settings			
		LE 43-34	LE 57-40	LE 57-51	LE 57-83
1	Reserved	OFF	ON	ON	ON
2	Reserved	OFF	ON	ON	OFF
3	Reserved	ON	ON	OFF	ON
4	Reserved	OFF	OFF	ON	ON
5	on/off = motor stand-by is enabled/disabled				
6	Reserved - (must be ON)				
7	Motor resolution selection (See table below)				
8	Motor resolution selection (See table below)				

Switches 7 and 8 are defined as,

7	8	
on	on	25,000 steps per revolution
on	off	50,000 steps per revolution maximum smoothness
off	on	50,000 steps per rev. max. step-step accuracy
off	off	200 steps per revolution

The motor stand-by function allows programming of the LE-Drive to reduce the current to motor after receiving no step pulses for about 2 seconds. This allows the motor and LE-Drive to remain cool, minimizing heating effects in the immediate environment. Once switch S5 is activated the stand-by feature is completely automatic and may be disabled only by shutting off S5 or issuing motor step pulses to the LE-Drive.

No other user adjustable components are on the LE-Drive, for more information concerning LE-Drive adjustment consult the factory.

3. Fuses

The LE-Drive uses one fuse for AC power. Should the LE-Drive fail to function and the STATUS LED does not light, check the 120 VAC LINE fuse.

4. Environmental Considerations

The mounting location for the motor and driver must be free from all liquids and protected from all chips and dust. The motor is not suitable for explosive atmospheres, vacuum beyond 0.01 torr, or life-support equipment. The bearings in the motor are not sealed and must be protected from contaminants.

Ambient conditions for the driver are 32 to 122 degrees Fahrenheit (0 to 50 degrees Celsius) and 20 to 90% humidity (non-

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condensing.) The system can operate from 32 to 150 degrees Fahrenheit (0 to 70 degrees Celsius).

Coil any excess cable at the driver and secure it with a cable tie. All wire runs must conform to all applicable local electrical codes and OSHA requirements.

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OPERATION

1. Introduction

The following sections outline how to operate the LE-Drive. Although every effort has been made to provide enough information to successfully (and easily) operate the LE-Drive, there are bound to be ommissions (and, ugh, errors). If you find any errors or you think that something should be added to the manual, call Compumotor or one of its representatives to get the information you need.

To check to see if the LE-Drive is operating at all, refer to the "Initial Functional Check" section of this manual.

2. Visual Indicators

There is one bicolor STATUS LED (light emitting diode) indicator on the indexer connector end of the LE-Drive.

The STATUS LED is green any time the LE-Drive power supply is operational and no FAULT condition has been detected. If the STATUS LED is not illuminated, AC power is not applied or there is a drive failure (check the fuse).

The STATUS LED is red any time the LE-Drive shuts itself down because of an internally sensed error condition. This is most likely to occur as a result of over heating (the LE-Drive has a built in temperature sensor). A FAULT may be cleared by providing improved drive cooling and/or temporarily removing the AC power.

3. Indexer Inputs

The indexer inputs provide the normal control signals for the LE-Drive. Following is a functional description of how each is used.

A. Step Input

The STEP input causes the motor to be incremented one microstep. By applying STEPs at various rates the motor is made to rotate at proportional velocities. STEP pulses applied first slowly, and then more quickly has the effect of accelerating the motor. Accelerating the motor too quickly can cause the motor to stall.

The motor will STEP in the direction determined by the DIRECTION input.

B. Direction Input

The DIRECTION input (as you might guess) controls the direction of rotation of the motor. When this signal is not activated the

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motor rotates counter-clockwise as viewed from the flange end of the motor. The motor rotates clockwise if the DIRECTION input is activated.

C. Remote Power Shutdown (RPS) Input

Activation of the REMOTE POWER SHUTDOWN (RPS) input causes the LE-Drive to stop putting current through the motor. This will allow the motor to freewheel and as such is intended to allow manual positioning of the load.
It is not intended to act as an emergency stop for the motor. If RPS is used in this fashion the motor will very likely move beyond its desired stopping position.

D. Overdrive Input

The OVERDRIVE input causes the drive to double the current to the motor (three amps maximum). This may only be done for one minute maximum, or the LE-Drive will overheat and go into a DRIVE FAULT condition.

This feature should only be used to enable the motor to accelerate at rates it cannot achieve otherwise.

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4. Motor Compatibility

The LE-Drive is designed to be compatible with at least the following motor sizes:

Model number
LE43-34
LE57-40
LE57-51
LE57-83

The model number reflects the size of the motor in millimeters.

5. Line Power Considerations

The LE-drive includes internal line filtering and is isolated by an internal transformer. No external filters or transformers are required.

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SPECIFICATIONS

Physical Description

LE-Drive height: 4.75 inches (12.00 cm)
LE-Drive length: 12.00 inches (30.50 cm)
LE-Drive width: 8.00 inches (20.30 cm)

LE-Drive weight: 10 lbs (4.5 kg) without motor
14 lbs (6.4 kg) without motor, with shipping container

Environmental

Operating temperature: 32°F to 122°F (0°C to 50°C) when passively cooled. The heatsink should never exceed 149°F (65°C).
Humidity: 0-95%, non-condensing.

Electrical

Input power:
Voltage: 102-125 VAC, single phase
or 210-250 VAC, single phase. See Appendix D
Frequency: 47-66 Hz.
Current: 1 amp maximum continuous

Output power: (to motor)
Voltage: +/- 20 DC
Current: 0.125 amp to 2.0 amps per phase in 0.125 amp increments.

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Input and Output Description

Motor: (all outputs) 4 connection screw terminal block.

A+ Output. Phase A+ to motor. Return on A-.

A- Output. Return for phase A+.

B+ Output. Phase B+ to motor. Return on B-.

B- Output. Return for phase B+.

Power: (All inputs) IEC standard AC power connector.

115 VAC LINE AC power for LE-Drive. All power for the motor is derived from this input, as well as all DC power for the on-board logic. Fused to 1 amps maximum.

115 VAC NEUTRAL Return line for AC power.

AC GND AC ground. Also called Earth ground. For safety and EMI filtering. The LE-Drive case is connected to this input.

Indexer: (All inputs) 25 socket "D" connector.

STEP+ Input. Optically isolated current loop input. 15 mA, 500 nS pulse, minimum; 1 MHZ maximum. Rising edge of current pulse causes microstep.

STEP- Input. Return for Step+.

DIRECTION+ Input. Optically isolated current loop input. 20 mA nominal. Must be held active at least 10 microseconds prior to rising current edge of STEP+.

DIRECTION- Input. Return for STEP+.

RPS+ Input. Optically isolated current loop input. 20 mA nominal. Presence of current on RPS (Remote Power Shutdown) causes current to be removed from the motor phase outputs.

RPS- Input. Return for RPS+.

OVERDRIVE+ Input. Optically isolated current loop input. 20 mA nominal. Presence of current on OVERDRIVE causes the current to the motor to 3 amps maximum.

OVERDRIVE- Input. Return for OVERDRIVE+.

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APPENDIX A

CONNECTOR LISTING

MOTOR CONNECTOR 4 Connection screw terminal block.

1 -- A+
2 -- A-
3 -- B+
4 -- B-

POWER IEC standard AC power connector.

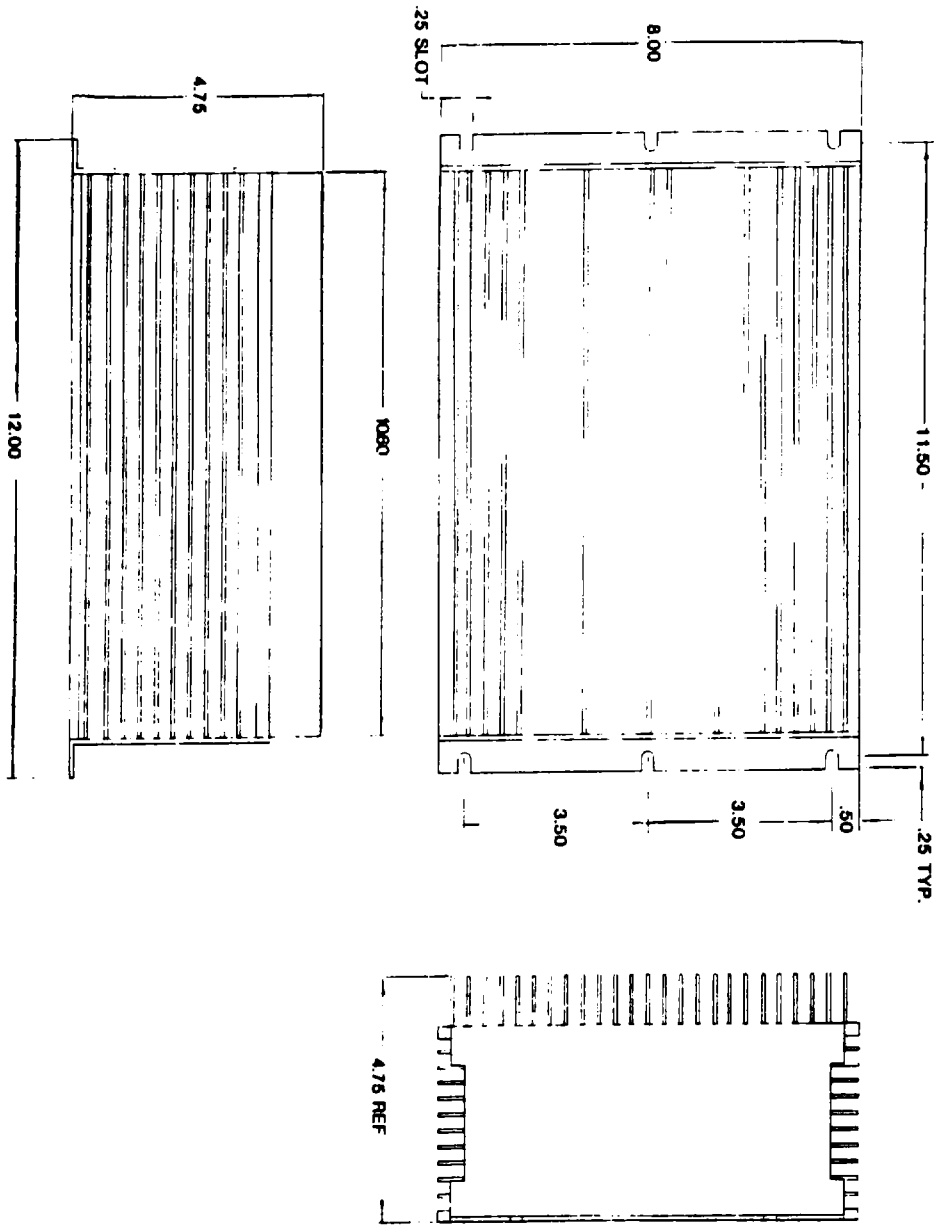
L -- 120 VAC LINE
N -- 120 VAC NEUT
G -- AC GND

INDEXER 25 socket "D" connector.

1 -- STEP+
14 -- STEP-
2 -- DIRECTION+
15 -- DIRECTION-
16 -- RPS+
17 -- RPS-
11 -- OVERDRIVE+
23 -- OVERDRIVE+

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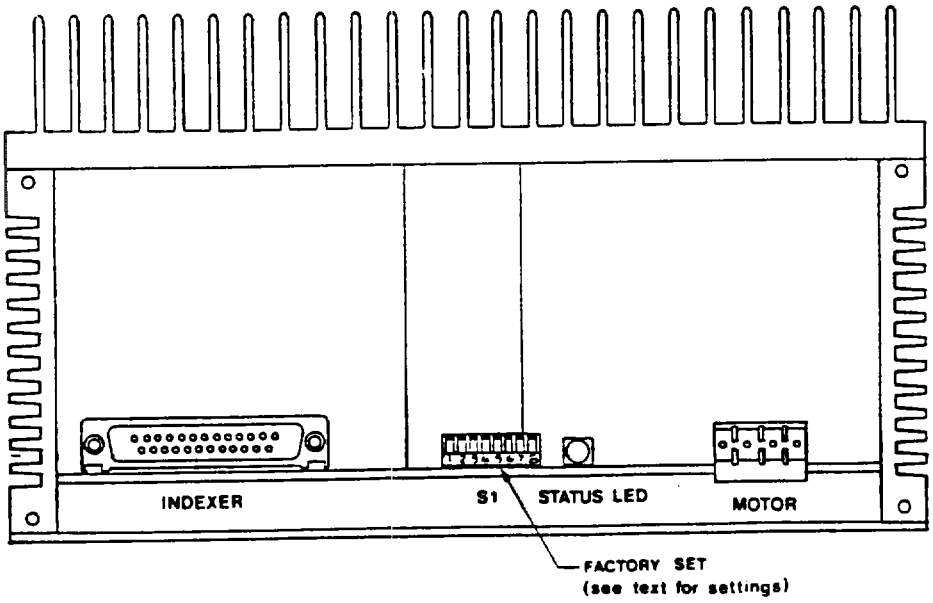
APPENDIX B



LE-Drive DIMENSIONAL DRAWING

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APPENDIX C

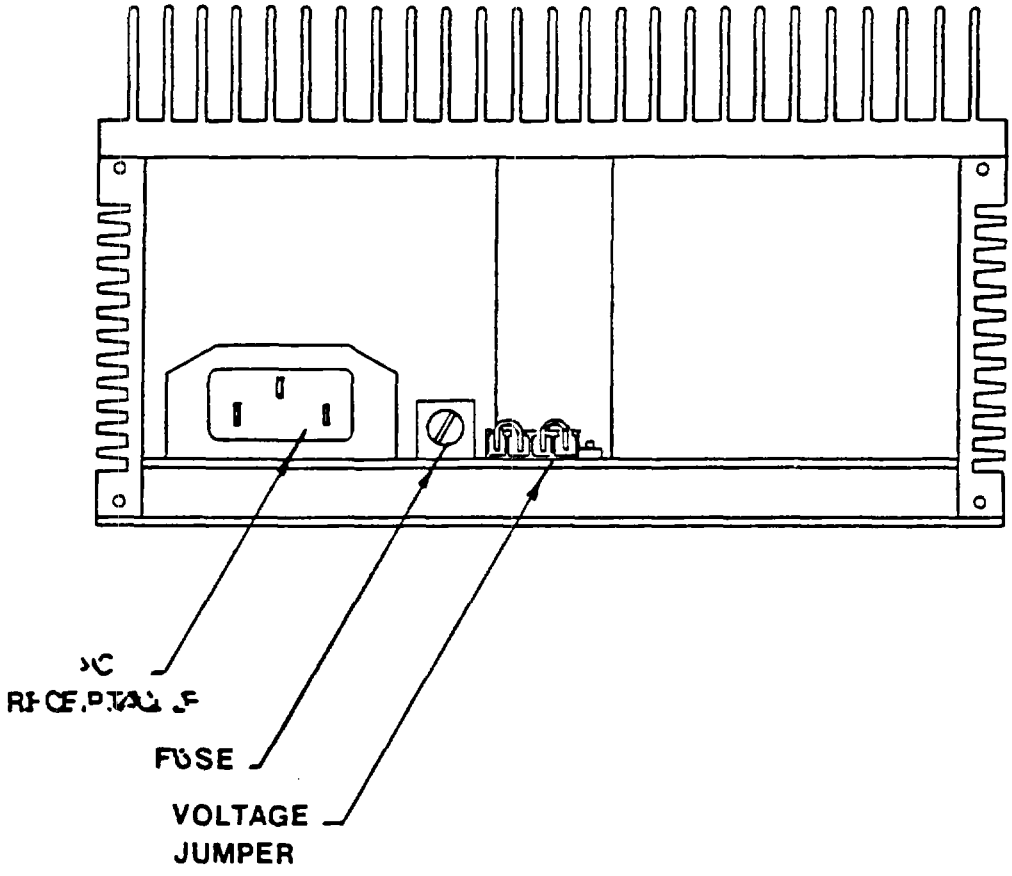


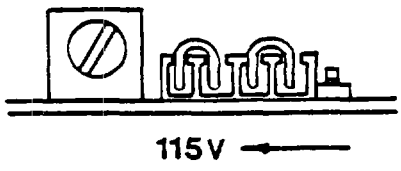
NOTE: End plate has been removed

LE-Drive SWITCH LOCATION DRAWING

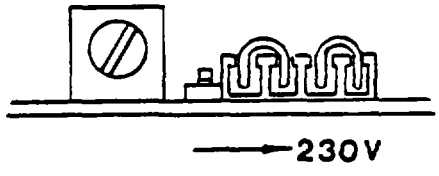
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APPENDIX D
VOLTAGE SELECTION INSTRUCTIONS





DRIVE SET FOR
115V OPERATION



DRIVE SET FOR
230V OPERATION

Remove the end plate that covers the end of the drive with the AC connector. You will notice a 4 position jumper connector on a 5-pin right angle header. For 115V operation the jumper connector should be installed even with the left edge of the header. For 230V operation the jumper connector should be installed even with the right edge of the header.

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