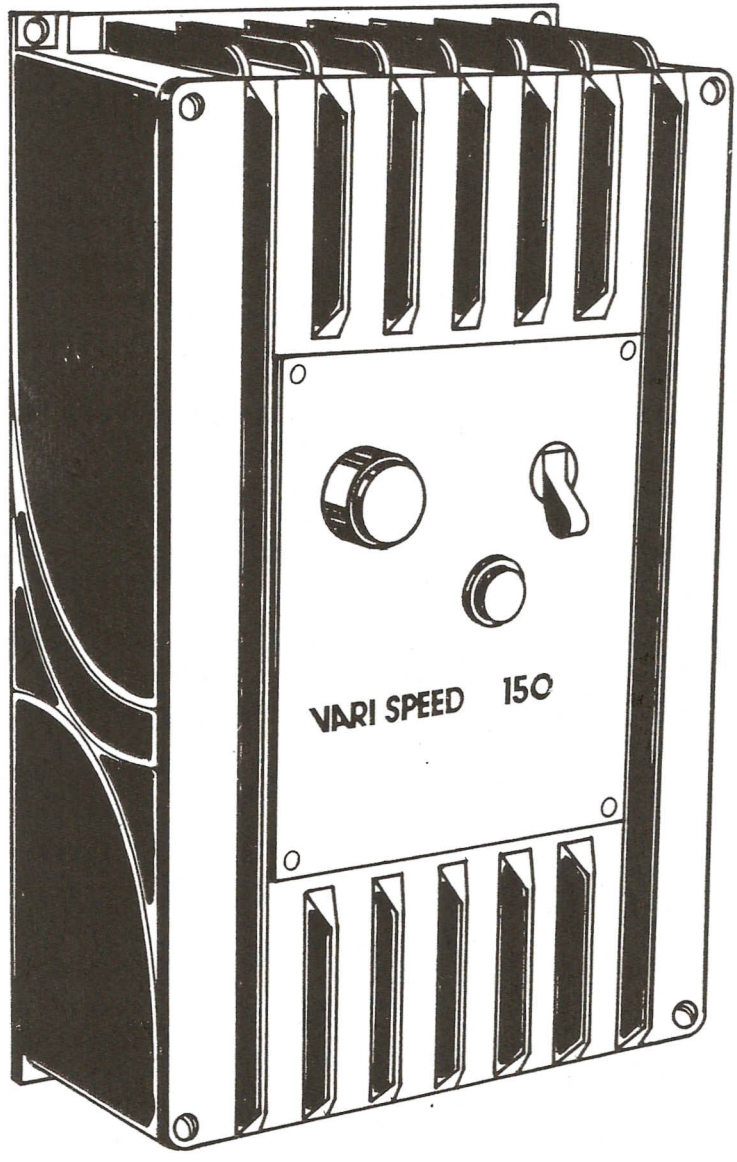
VARI SPEED 150
Instruction Manual



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INSTALLATION INSTRUCTIONS FOR VARI SPEED "150L"

HIGH PERFORMANCE VARIABLE SPEED CONTROL

SPECIFICATIONS

INPUT POWER	(115 VAC) or (230 VAC) 50/60 HZ, Single Phase
HORSEPOWER RATING	Subfractional to 2
ENCLOSURES AVAILABLE	Chassis Mount, NEMA 12 NEMA 4
AMBIENT TEMPERATURE RANGE	0 /50 C. (32 to 122 F)
MOUNTING POSITION	Vertical Wall Mounting
OPERATOR CONTROL PROVISIONS	Speed Adjustment
INTERNAL CONTROLS	Max. Speed, Min. Speed, Adjustable Current Limit, Adjustable Acceleration Control.
CURRENT LIMIT	Adjustable from 0% to 150% Motor will stall at any speed with a sustained load exceeding the current set point.
SPEED VARIATIONS DUE TO LINE VOLTAGE FLUCTUATIONS	The control will compensate to less than 2% speed change in less than 500 MS within input power range.
SPEED VARIATIONS DUE TO THERMAL DRIFT	Control: Less than 1% Motor: Less than 12%
SPEED VARIATIONS DUE TO LOADING (90% Load Change)	Armature Feedback: Typical application = 5% of Base Speed.
FULL TORQUE SPEED RANGE	50:1
ACCELERATION CONTROL	Acceleration is adjustable from .1 to 5 sec. to Set Speed. (Other ranges available)
MAXIMUM SPEED ADJUSTMENT RANGE	Approx. 50% to 110% of Base Speed.
MINIMUM SPEED ADJUSTMENT RANGE	Approx. 0% to 50% of Base Speed.
U.L. RECOGNITION (File #70524)	Part No. 300302,300317, 300327,400402,400417,400427.

OPERATIONAL CHARACTERISTICS

SPEED CONTROL: The Vari Speed "150L" provides for infinitely variable speed control of a permanent magnet D.C. Motor and uses a full wave bridge. (S.C.R. and Diode configuration.) There is compensation for line voltage variation and variations in motor loading. At a given speed potentiometer setting and with a constant load the motor speed will vary less than 1% with an input voltage change of ± 10% of nominal. The no load to full load variations will be typically 5%. A major design parameter of the Vari Speed "150L" was to limit overshoot, undershoot and settling time. These characteristics are more than adequate for almost all applications.

ADJUSTABLE CURRENT LIMIT The Vari Speed "150L" is provided with an adjustable current limit circuit which can be set to limit the torque output of the motor over a range of 10% to 150% of control rating. This circuit will not affect the motor speed until motor current (loading) increases to the set point. At the set point, the control will supply no more than 5% additional current (torque).

ADJUSTABLE ACCELERATION: The acceleration is adjustable. The time required for the motor to accelerate from zero speed to set speed can be adjusted from .1 sec. to 5 sec. as supplied. (Other ranges can be supplied. Consult Factory).

CAUTION

1. WARNING! Improper installation of motor and controller may cause Severe Personal Injury, or equipment failure. Follow instruction manual, local, state and national safety codes for proper installation.

2. Always disconnect power to controller before making any wiring changes or inspection of internal control.

3. During peak operation, the controller may reach temperatures HOT to the touch. This is normal and expected. However, under the most extreme conditions, the surface of the controller should never exceed 75°C.

4. All Electronic Controls are subject to line spikes and noise generated by equipment such as arc welders, solenoids, dielectric heaters, etc. Danfoss has provided all of the latest devices for protection against such an environment. However, it is suggested as an additional protection that shielded wire be used for run and speed control circuits into controller.

5. To insure avoiding personal injury, use seperate disconnect or controller circuit breaker to insure positive shutdown of controller and motor should semiconductors fail in the conducting mode.

6. When making internal adjustments, on NEMA 4 and 12 controllers, (e.g. min./max. speed) remount cover upside down as shown in Illustration on Page 15.

7. When remote mounting speed adjust potentiometer and function switches, keep in mind that all terminals are at line potential to ground and accidental grounding could cause permanent control damage.

8. Grounding- It is imperative that the controller, motor and remote operators stations (when used) be connected to building ground for the safety of the operation personnel.

9. Do not apply voltage to any terminals except AC1 and AC2. If voltages are applied to any other terminals permanent damage may occur. Use only isolated contact closures for all other connections as shown in Wiring Information.

10. All terminals may be Hot to ground.

11. All remote connections to controller should use shielded cable. Speed adjust potentiometers, voltmeters and ammeters.

WIRING DESCRIPTION OF CONTROLLER

A.C. INPUT — Connect rated input power to terminals AC1 and AC2 on circuit board. Be sure to ground control at circuit board mounting lug.

RUN* — Connect A "Normally Open" switch across the run terminals. The motor will run as long as the contacts are closed.

SPEED ADJUST — By rotating this knob, (located on the front cover of enclosed controller), a clockwise rotation will increase speed. "0" will be minimum speed, "100" will be maximum. See "Adjustments after startup: for minimum/maximum settings.

MOTOR ARMATURE — Connect the plus (+) terminal of the DC Motor Armature to A+ on circuit board and the minus (-) terminal of the DC Motor Armature to A- on the circuit board. On wound field motors connect the plus (+) terminal of the motor field to F+ on the circuit board and the minus (-) terminal of the motor field to F- on the circuit board. WARNING: 1.) It is imperative that motor is at ZERO speed before reversing direction. Permanent motor damage will occur if reversed during motor rotation. 2.) Always ground motor case to insure the safety of operating personnel. 3.) For safe motor reversing, ask for information on the Bi Directional Option.

CIRCUIT BREAKER — The Breaker on NEMA 4 and NEMA 12 models acts as an ON/OFF Switch to the controller as well as overload and short circuit protection. The circuit breaker has been carefully selected for instantaneous tripping under extreme overload and short circuit conditions. However, under momentary high loads, such as starting the motor, there will be no nuisance tripping. If the circuit breaker trips, something is wrong, do not attempt to reset breaker and hold in position. (If breaker trips, refer to Trouble Shooting, Section 1). Always wait at least five minutes before resetting circuit breaker.

* Contact Rating - A maximum of 15 volts DC and 15 milliamps will be across contacts. (Use contacts that are reliable at the above power levels).

START UP PROCEDURE

VARI SPEED "150L"

1.) Use caution during these procedures because line voltage will be present on the terminals and on the circuit board when the power is on.

2.) Recheck to make sure that all connections are made properly according to the Instruction Manual, state, local and national safety codes.

3.) Set speed pot to Zero Speed

4.) Turn on fused line disconnect (and circuit breaker if used.)

5.) Place jumper between the run terminals.

6.) Slowly advance speed pot. Motor should start slowly, and smoothly increase speed as pot is advanced.

ADJUSTMENTS AFTER START-UP

MAXIMUM SPEED ADJUSTMENT

This setting has been factory adjusted. However, if a higher or lower setting is required;

1.) Start motor and allow it to warm up at least 30 minutes fully loaded. (Motor speed will increase with a rise in motor temp.)

2.) With motor driving a full load and the speed pot turned all the way up, adjust the max. speed trimpot until desired speed is set.

3.) Go on to the minimum speed adjustment, as there may be some interaction.

MINIMUM SPEED ADJUSTMENT

1.) Turn speed adjustment potentiometer to minimum.

2.) Start control and adjust trimpot on board until desired minimum speed is set. If desired minimum speed is zero, adjust trimpot so that motor just barely stops turning. This setting will give the best speed setting to motor speed linearity.

3.) Recheck max. speed adjustment as some interaction is probable.

CURRENT LIMIT ADJUSTMENT

This setting has been adjusted at the factory for the maximum limit for the horsepower rating of the drive. If a lower current limit is desired, one of two methods may be used;

METHOD

1.) Disconnect power from the control, lock up motor shaft in such a way that no damage will occur. Place a DC amp meter in series with the motor armature. Turn current limit trimpot fully counter-clockwise. Turn speed pot up. Reapply power, start control, and adjust current limit pot for percentage of full load current required.

METHOD

2.) Start control and load machine to maximum. Turn current limit trimpot counter-clockwise slowly until motor begins to slow down, under the worst loading conditions you expect. At this point, turn pot slightly clockwise just until motor regains original set speed.

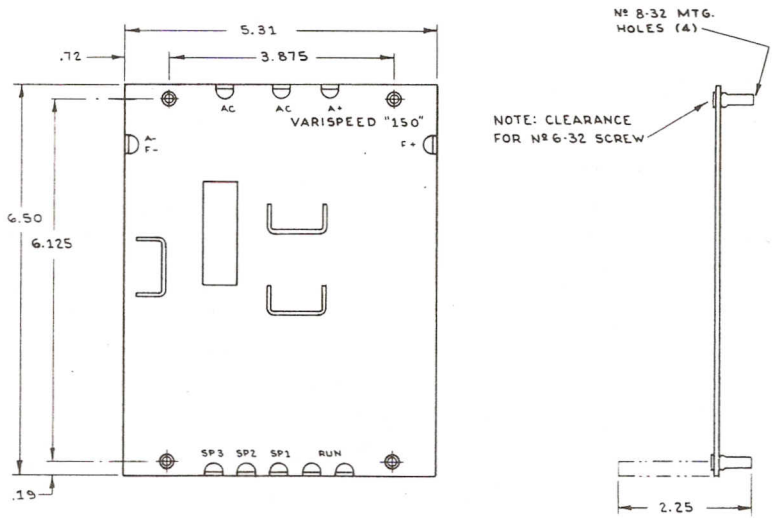
CONTROLLED ACCELERATION

This adjusts the rate of motor acceleration to set speed. The more clockwise the trimpot is set, the slower the acceleration.

OUTLINE DIMENSIONS

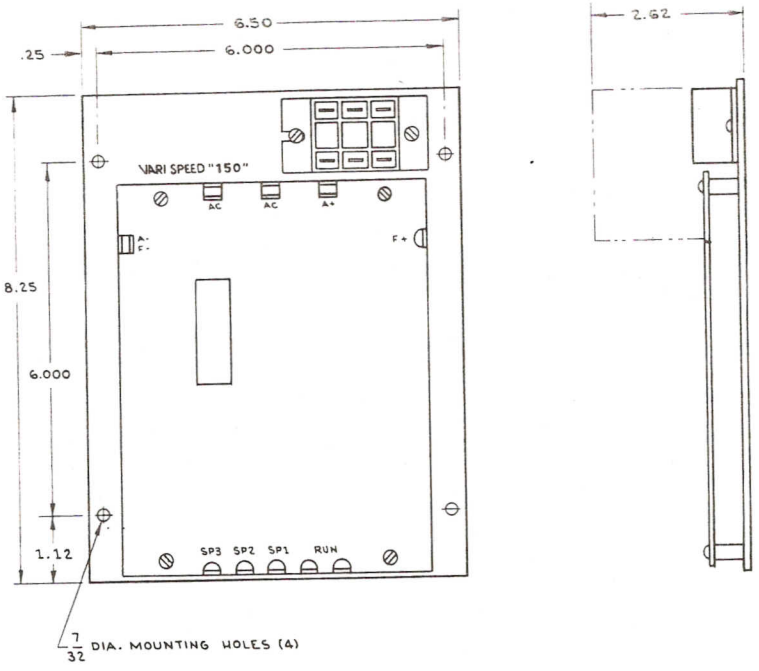
CHASSIS MOUNT

PART NO. 300302
300402



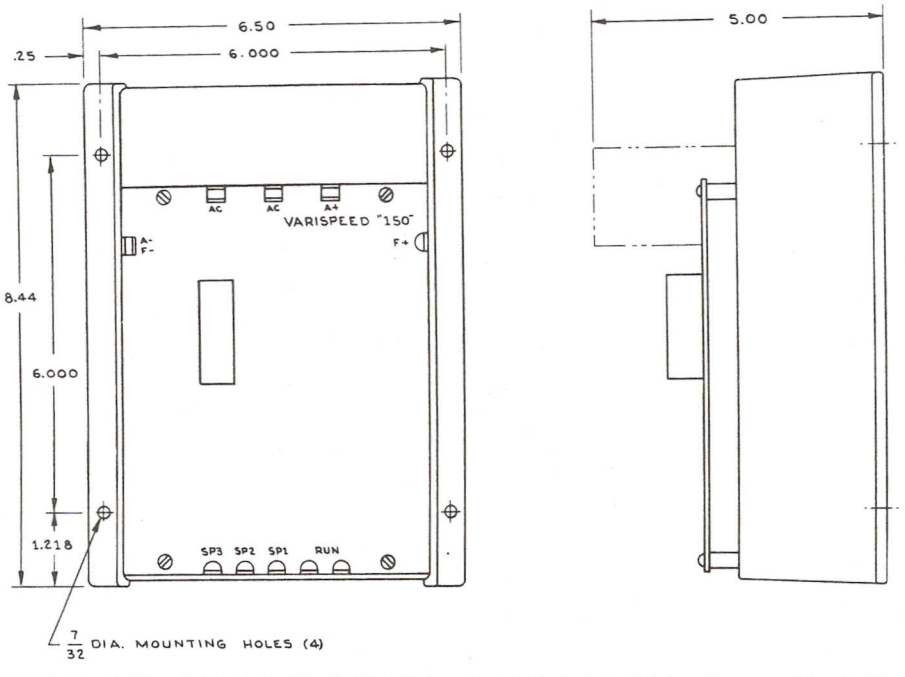
LOW PROFILE CHASSIS MOUNT

PART NO. 300317
300417



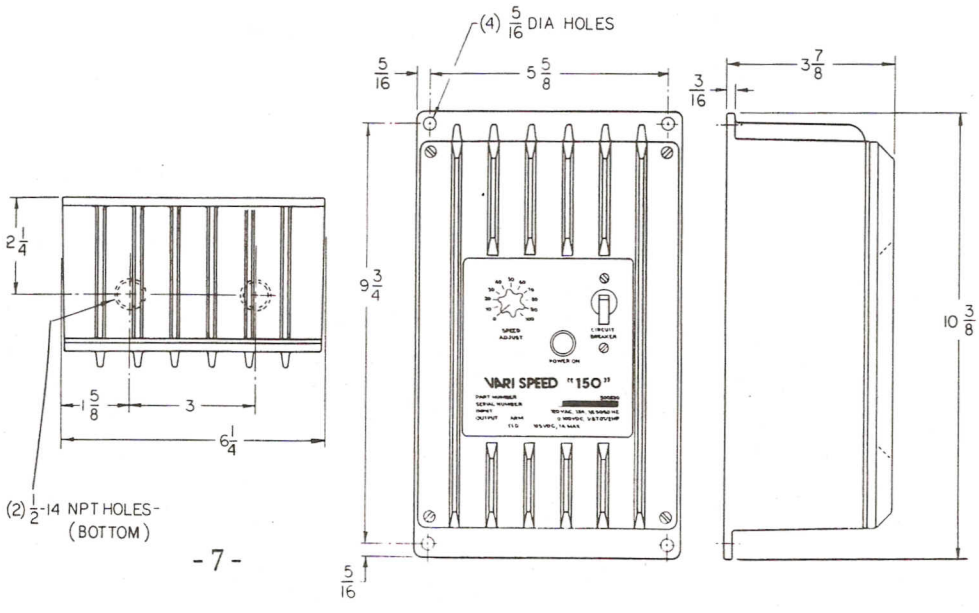
CAST ALUMINUM CHASSIS MOUNT

PART NO. 300327
300427



NEMA 12 ENCLOSURE

PART NO. 300337 300437
300347 300447



TROUBLE SHOOTING
VARI SPEED "150L"

SYMPTON	SOLUTION
MOTOR WILL NOT RUN	1.) Make sure circuit breaker and line disconnects are turned on. 2.) Check line fuses to see if they are good. 3.) Set speed adjust to 50%. 4.) With power OFF and motor leads disconnected check for worn or improperly seated motor brushes. (Brushes should be replaced when overall length is .575"). 5.) Faulty circuit board. 6.) Faulty power components.
CIRCUIT BREAKER TRIPPING	1.) Improper wiring - recheck wiring for shorts and shorts to ground. 2.) Motor brushes worn or improperly seated. 3.) Motor load is too heavy. Check for "Jam-up" or excessive load. 4.) Power component failure.
NO SPEED CONTROL	1.) Speed adjust potentiometer for wiring defective. 2.) Minimum speed adjust potentiometer (located on circuit board) misadjusted. Turn counter-clockwise to correct. 3.) Maximum speed adjust potentiometer misadjusted turn clockwise to correct. 4.) Faulty power component.
MOTOR WILL NOT RUN AT 1725 RPM	1.) Improper setting of maximum speed potentiometer. (Location on printed circuit board). TURN clockwise to increase speed. 2.) Motor may be overloaded. (Motor horsepower is less than required for load). 3.) Current limit may be set too low.
MOTOR JUMPS AFTER STOP AND BEFORE START SIGNAL	1.) CONSULT FACTORY

TROUBLE SHOOTING CONTD.

VARI SPEED "150L"

SYMPTON	SOLUTION
MOTOR SPEED ERRATIC	1.) Worn Brushes. (Inspect and replace if length is .575" or less). 2.) Speed adjust potentiometer or associated circuit may be defective. 3.) Defective circuit boards. (Consult Factory)
MOTOR WILL NOT SHUT OFF WITH RUN TERM OPENED	1.) Faulty wiring in control circuit. 2.) Faulty circuit board. 3.) Faulty power components.

TEST PROCEDURE FOR POWER COMPONENTS

NOTE: The following tests are to conclude that the components are good or bad.

CAUTION: Turn OFF all power for the following tests.

For the following controls, power module can be tested.

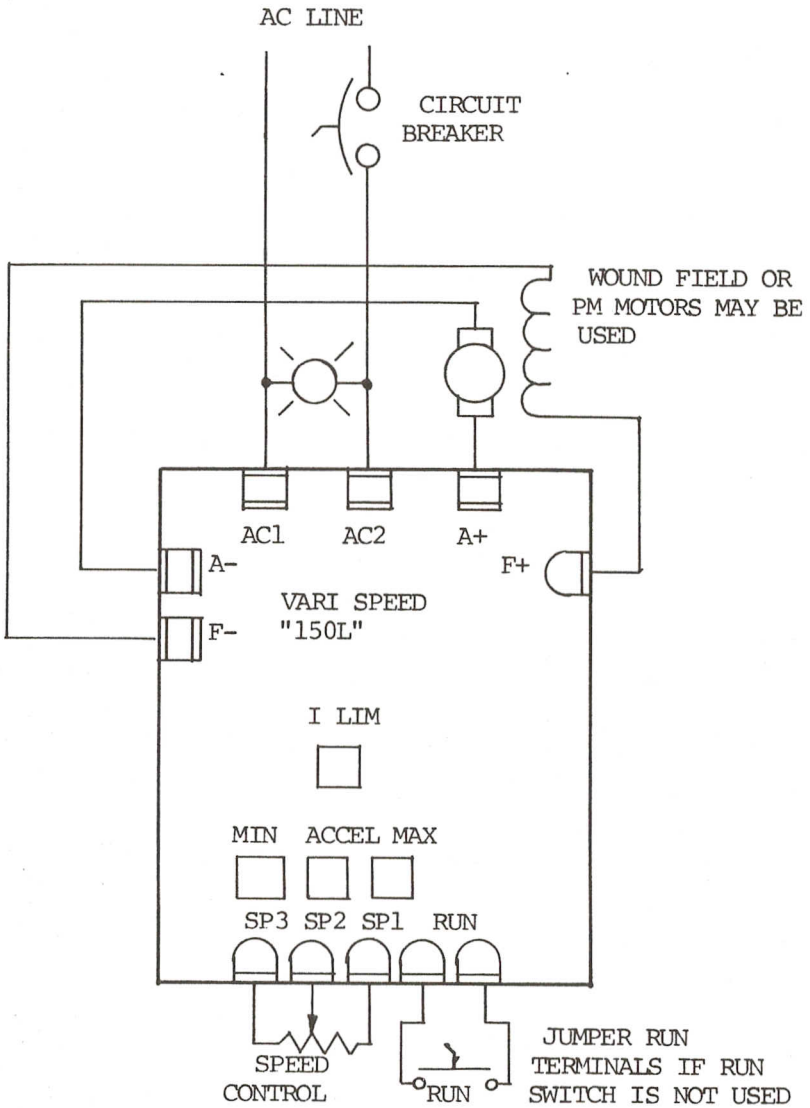
300437
300337
300417
300317
300327
300427

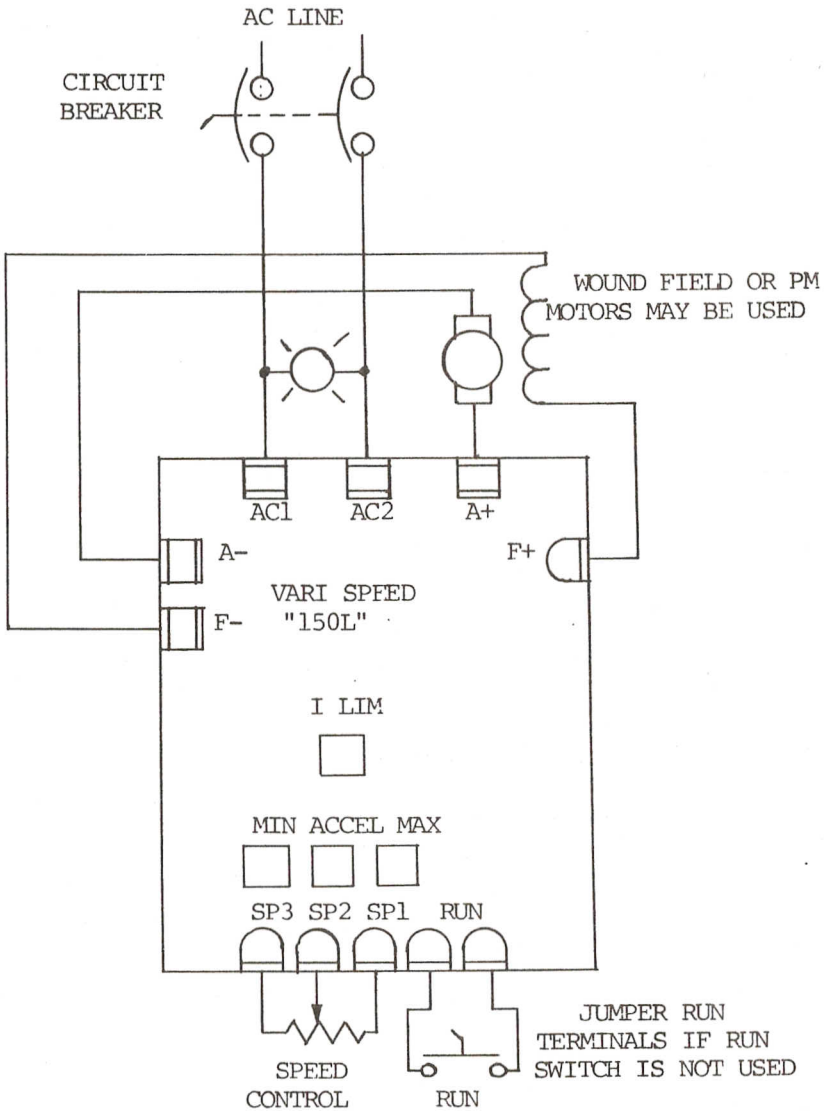
The 300302 and 300402 control tests are made on the circuit board terminals.

1.) Pull off all "fast on" connections. Set V.O.M. to R X 10K scale.
2.) Check resistance from both A.C. terminals to (+) terminal. Both directions resistance should be greater than 1 Meg OHM.
3.) Check resistance from both A.C. terminals to (-) terminal. Resistance should be greater than 1 Meg OHM in one direction and less than 50 K in the other direction.
4.) Check resistance from (+) terminal to (-) terminal. Resistance should be greater than 1 Meg OHM in one direction and less than 50 K in the other direction.

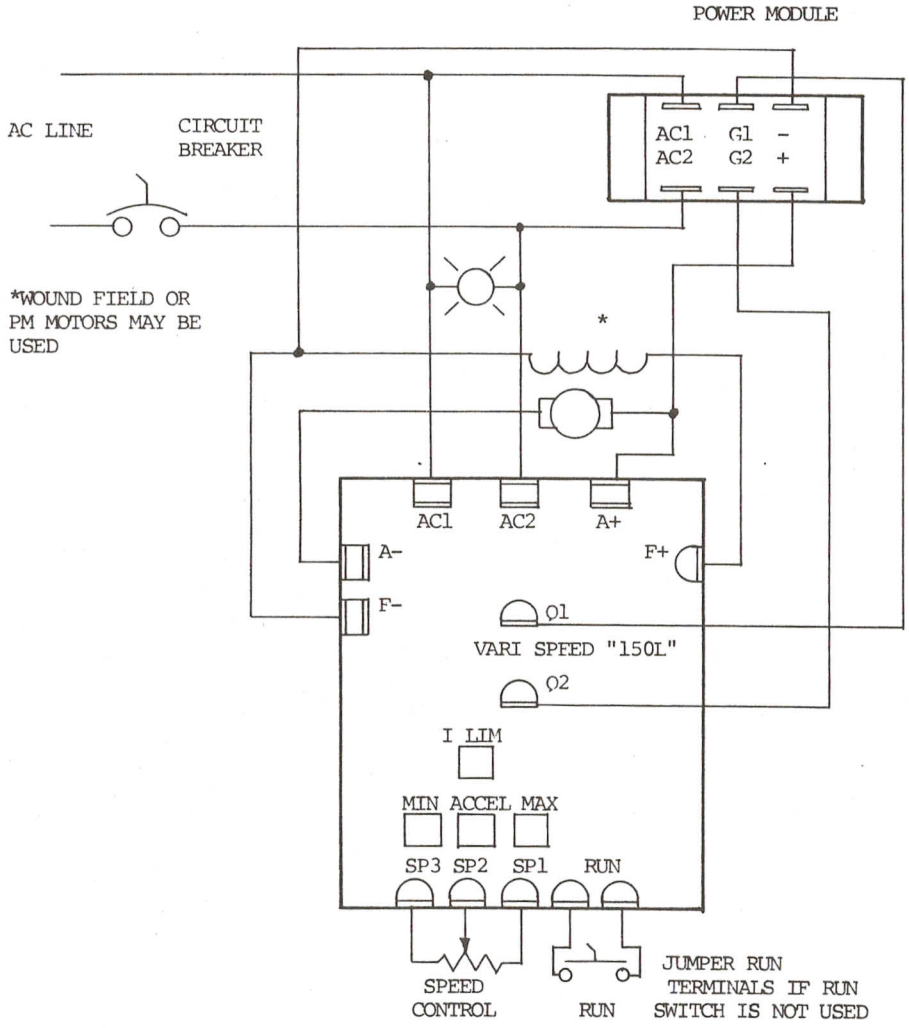
VARI SPEED "150L"
SPARE PARTS LIST

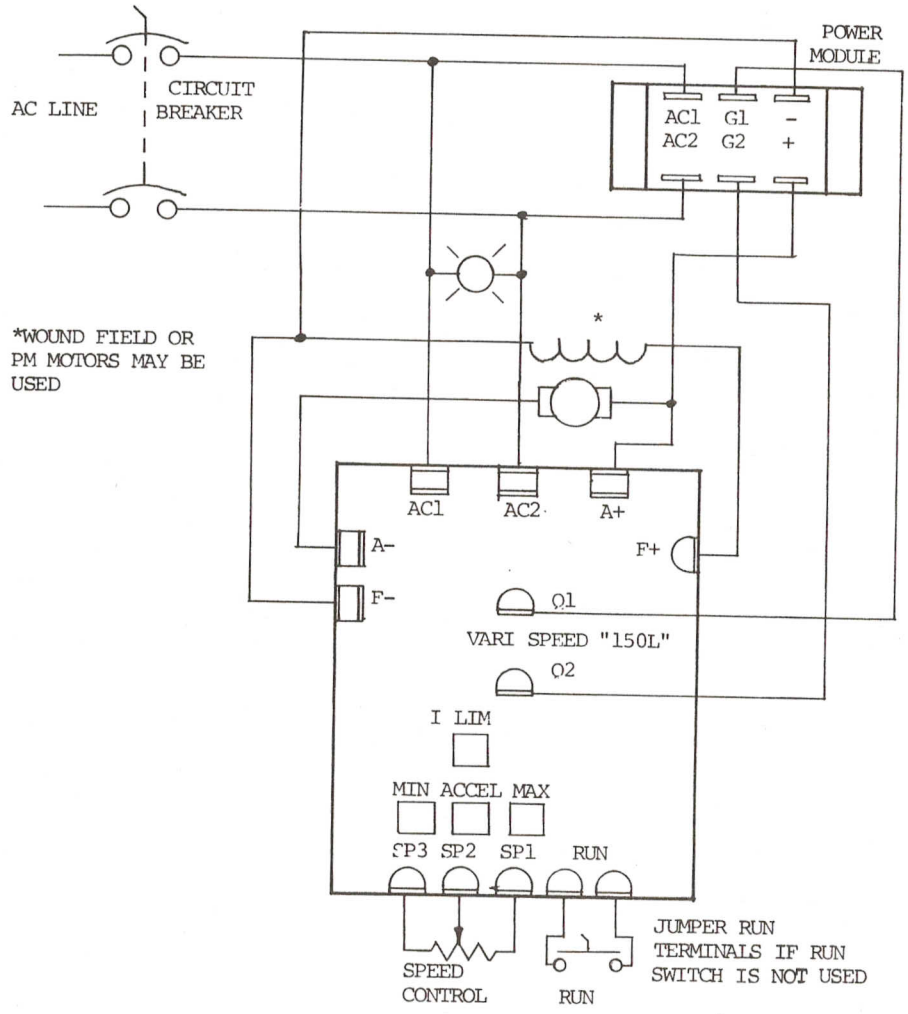
PART NO.	DESCRIPTION	LIST PRICE
944	Potentiometer 500K	
2006	Circuit Breaker (15A, 1 Pole)	
2011	Circuit Breaker (15A, 2 Pole)	
2319	Power Module (120V Control)	
2320	Power Module (240V Control)	
301302	Circuit Board (120V)	
301402	Circuit Board (240V)	





See Page 4 for complete wiring instructions.





See Page 4 for complete wiring instructions.

ILLUSTRATION
CHASSIS MOUNT — STAND ALONE

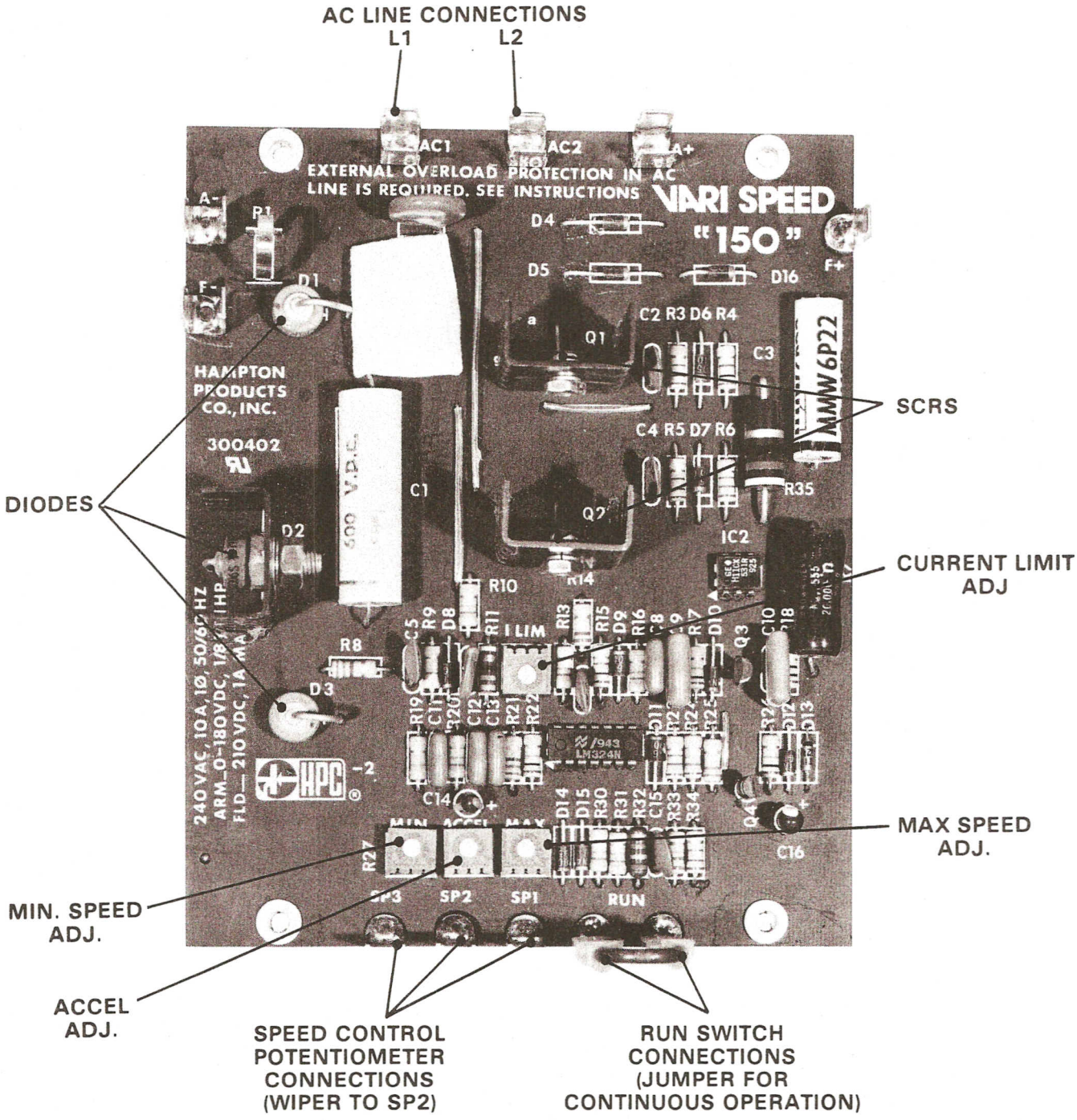


ILLUSTRATION
CHASSIS MOUNT

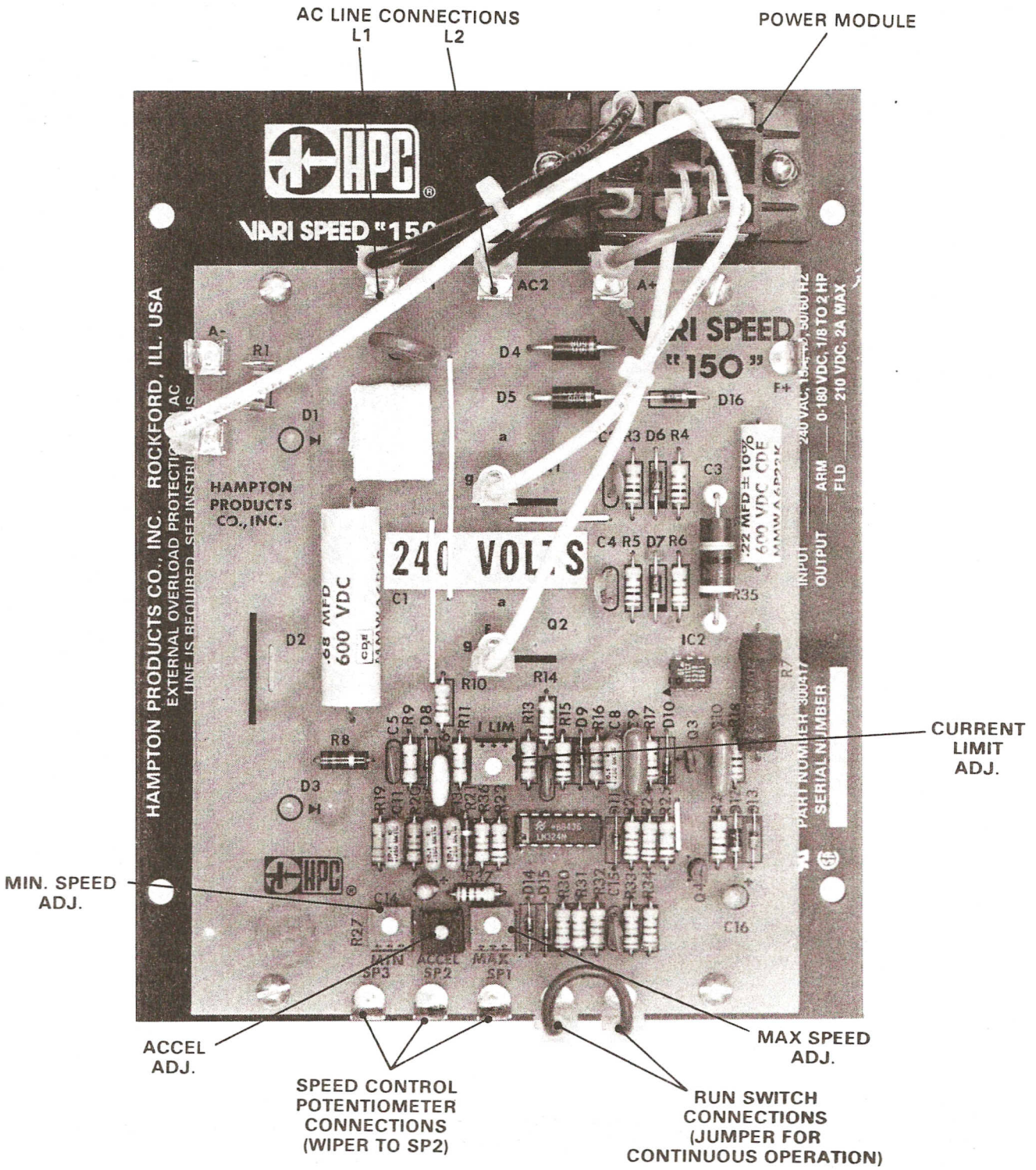


ILLUSTRATION
VS 150, NEMA 12, 120 VOLT

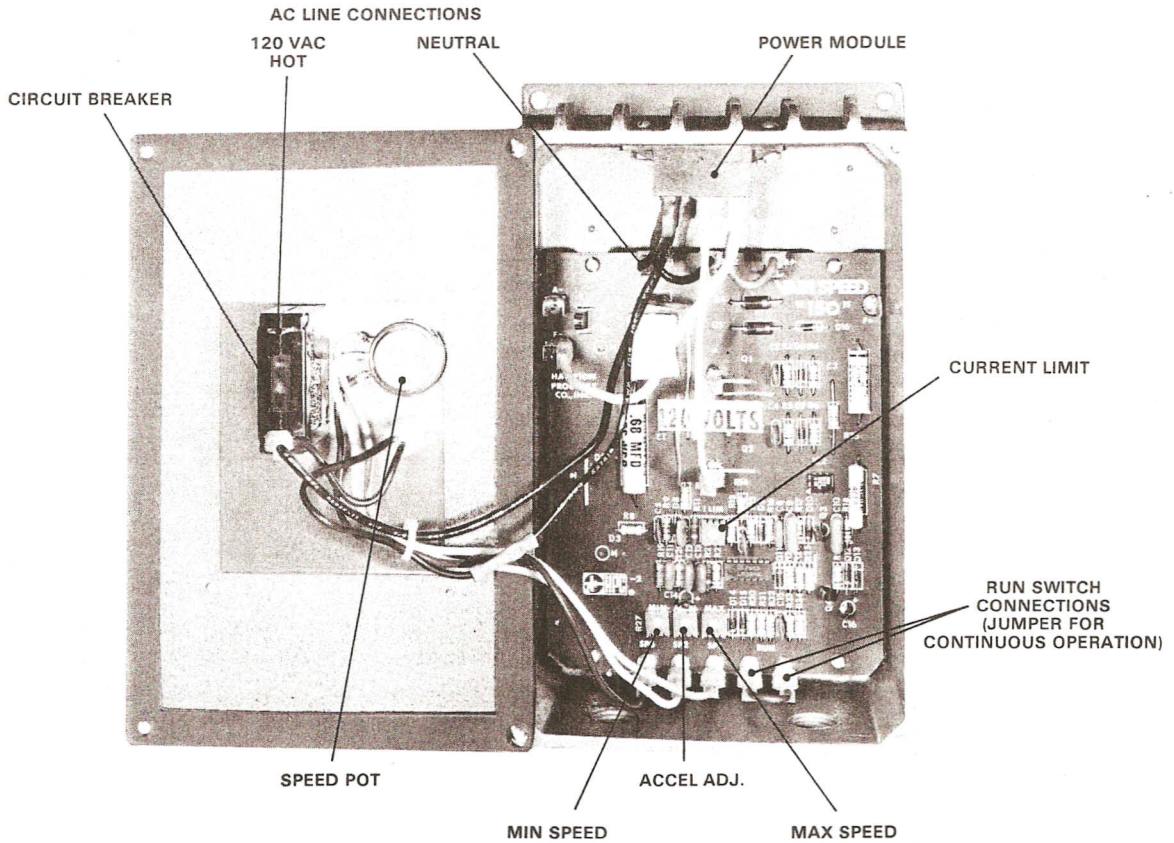
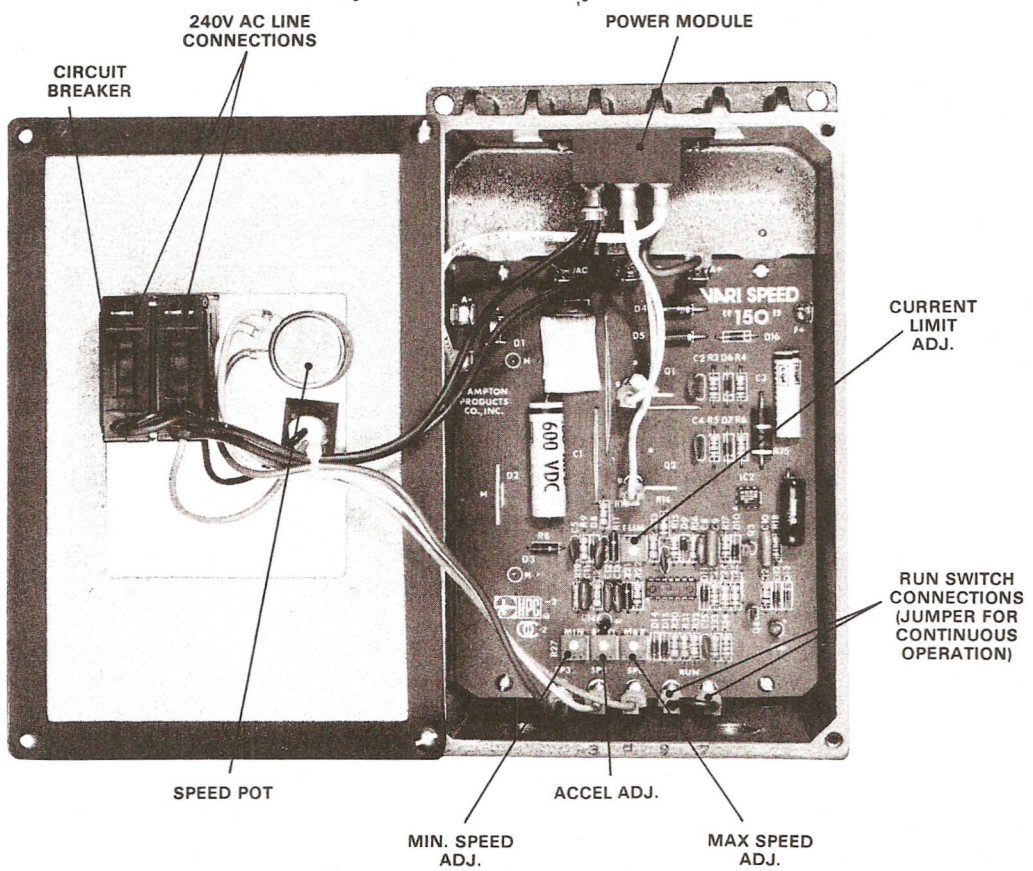


ILLUSTRATION
VS 150, NEMA 12, 240 VOLT



RECOMMENDED AC LINE PROTECTION

AC LINE VOLTAGE	MOTOR HP	DUAL ELEMENT FUSE AMPS	CIRCUIT BREAKER		
			AMPS	POLES	DANFOSS PART NO.
120	1/8	2-1/2	5	1	2008
	1/4	4	5	1	2008
	1/3	5	5	1	2008
	1/2	8	7 1/2	1	2014
	3/4	10	10	1	2007
	1	15	15	1	2006
240	1/8	1-1/2	5	2	2017
	1/4	2	5	2	2017
	1/3	2-1/2	5	2	2017
	1/2	4	5	2	2017
	3/4	5	5	2	2017
	1	8	7-1/2	2	2015
	1-1/2	10	10	2	2010
	2	15	15	2	2011

240 VAC LINE REQUIRES PROTECTION IN BOTH AC LINES