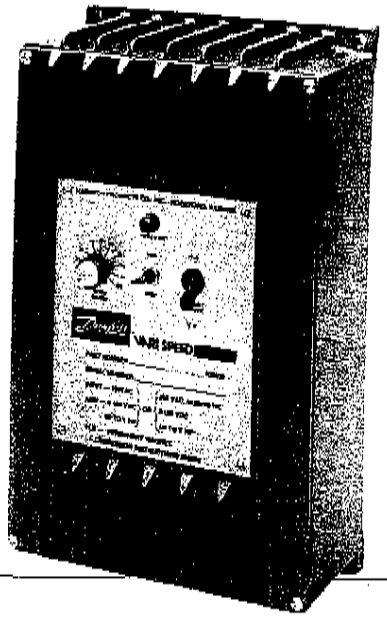


VARI SPEED "240"
Instruction Manual

TABLE OF CONTENTS

INSTALLATION INSTRUCTIONS FOR VARI SPEED 240

HIGH PERFORMANCE VARIABLE SPEED CONTROL

SPECIFICATIONS

INPUT POWER	(100 to 125 VAC) or (195 to 245 VAC) 50/60 HZ Single Phase
HORSEPOWER RATING	Subfractional to 5
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	Run, Stop, Jog, Overriding Stop, Speed Adjustment
INTERNAL CONTROLS	Max. Speed, Min. Speed, Current Limit, Acceleration Control.
PROCESS SIGNAL INPUT	0-10 V.D.C. Input Z 1 Meg. Shunted by .47 Microfarad. Also usable 0-5 MA, 0-20 MA, 0-50 MA
TACHOMETER GENERATOR INPUT	7 V.D.C./1000 RPM and 20.8 V.D.C./1000 RPM
CURRENT LIMIT	Adjustable from 10% to 150% of control rating. 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 1% speed change in less than 500 MS within input power range.
SPEED VARIATIONS DUE TO THERMAL DRIFT	Control: Less than 1/4% Motor: Less than 12% System with Tach. Feedback: Less than 1%
SPEED VARIATIONS DUE TO LOADING (90% Load Change)	Armature Feedback: Typical application ± 5% of Base Speed. Tachometer Feedback: Less than 1/2% of Set Speed or ± 1 RPM whichever is greater.
FULL TORQUE SPEED RANGE	Armature Feedback: 50:1 Tachometer Feedback: 200:1

SPECIFICATIONS (cont)

ACCELERATION CONTROL---------- Acceleration is linear and 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.

OPERATIONAL CHARACTERISTICS

LOGIC: The Vari Speed "240" inherently has many of the common switching functions that in the past have been performed by banks of relays. In most applications, there are substantial savings possible in relay cost.
The run function latches the control "on", and a maintained closure on run overrides all commands except override stop.
The jog function causes the control to run when a closure is made and stop when reopened.
The stop function latches the control into the stop condition when a contact closure is made. (NOTE: The stop function will not work if a closure is maintained across run or jog.)
Override stop will cause the control to latch into the stop mode and the control will ignore all start signals until the switch from 0. stop to V+ is closed.

SPEED CONTROL: The Vari Speed "240" 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 $\pm$ 10% of nominal. The no load to full load variations will be typically 5%, unless tachometer feedback is used in which case the speed variations will be less than 1/2% regardless of motor temperature or load. A major design parameter of the Vari Speed "240" was to limit overshoot, undershoot and settling time. These characteristics are more than adequate for almost all applications.

CURRENT LIMIT: The Vari Speed "240" 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 300% of motor rating. This circuit will not affect the motor speed until motor current (loading) increases to the set point. At the set point, the red L.E.D. comes on and the control will supply no more than 5% additional current (torque).

CONTROLLED ACCELERATION: The linear ramp for controlling 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)

PROCESS CONTROL SIGNALS: A control signal input is provided by connecting process signal (+) to SP2 and process (-) to SP3. With tachometer feedback, the motor speed will track the process voltage to less than 3% of linearity. The input voltage required is 0-10 V.D.C. The input impedance is approx. 1 MEG OHMS shunted by a .47 microfarad capacitor. A 0-5 MA. signal can be accomodated by shunting SP2 and SP3 with a 2K OHM 1/2 watt resistor, 4-20 MA. use a 500 OHM 1/2 watt, 10-50 MA. use a 200 OHM 1 watt.
Caution: SP2 and SP3 may be at line potential to ground, and the process control signal must be isolated.

CAUTION

1. Improper installation of motor and controller may cause 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. Run/Jog Switch is operable anytime AC is applied to controller. (See Override Stop for exception).

4. Switches or contacts used to operate Run, Jog, Stop and Override Stop must be capable of reliable operation switching 15MA at 15 V.D.C.

5. 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 80°C.

6. 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 all connections into controller. Also, whenever possible, isolate the AC line to the controller with an isolation transformer.

7. 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. (Override Stop will not serve as a positive stop in this mode of failure.)

8. When making internal adjustments, (e.g. min./max. speed) remount cover upside down as shown in Illustration on Page 16.

9. 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.

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

11. Do not apply voltage to any terminals except 1 and 2 on A.C./D.C. Terminal strip. 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. Exception: Process control voltage.

12. All terminals may be Hot to ground.

13. All remote connections to controller should use shielded cable. Speed adjust potentiometers, tachometer generator feedback, voltmeters and ammeters.

WIRING DESCRIPTION OF CONTROLLER

A.C. INPUT — Connect rated input power to terminals 1 and 2 on "POWER IN" terminal strip. Be sure to ground control at circuit board mounting lug just below barrier strip on circuit board.

START* — Connect a "Normally Open" limit switch or push button or both, in parallel across the run and common (com.) terminals. A momentary closure of 50 milliseconds minimum duration will start motor. Motor will then continue to run until a stop signal is given. Note: A.) Start overrides stop.

STOP* — Connect a "Normally Open" limit switch or push button or both, in parallel across stop and common terminals. A momentary closure of 50 milliseconds minimum duration will trigger motor to stop.

OVERRIDE* STOP — Wire an override stop button or limit switch or both with the normally closed contacts in series across the 0 stop and V + terminal. When any contact is opened, the control will stop. The motor cannot be restarted by start signal. If override stop is not used, strap 0 stop to V +.

SPEED ADJUST — By rotating this knob, (located on the front cover of 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 terminal 3 (DC+) to A1 or terminal marked + for clockwise rotation of motor viewing output shaft end. Connect terminal 4 (DC-) to other motor terminal. Be sure solid connection is made. If counterclockwise rotation is desired, reverse these two leads. For reversing during operation, use D.P.D.T. contacts. 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.

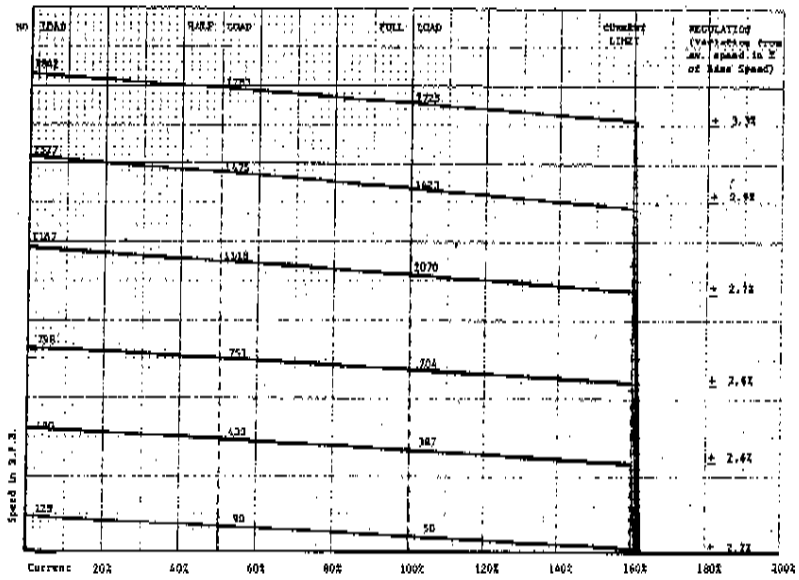
RUN/STOP/ JOG SWITCH** — Upward pressure will start motor and downward pressure and release will cause the motor to stop. This switch can be used to jog motor by pressing down for run and release to stop.

CIRCUIT BREAKER** — The Breaker 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 nimutes 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.)

** Supplied only on Option "A"

REGULATION AND CURRENT LIMIT



The above graph is representative of the typical performance one can expect using the Vari Speed "240" with only armature feedback. It shows the variations in speed due to loading as well as the extremely sharp roll off of speed after reaching the current limit set point. This test was performed with a 240 VAC Vari Speed "240" and a 1 HP 180V P.M.D.C. motor. The motor and control were selected at random from stock and were not pre-tested or "tweeked" in any way. The minimum speed potentiometer was set to zero speed and the maximum speed potentiometer was set to 1725 RPM. The current limit potentiometer was set to 7.5A or 160% of motor full load current. No other adjustments were made. (No hand selecting of resistors, capacitors, transistors, etc.) It is important to note that the regulation in our system does not depend on the customer's having to make a critical adjustment, (e.g. I.R. comp.), on a test stand, in order for it to make specifications.

Two common pitfalls in selecting the regulation required for an application are: 1) while the machine that the motor is driving may be unloaded, the motor is still driving the machine, therefore, the motor never sees the "no load" condition. In a large number of applications the motor never sees less than 30% load. 2) How difficult will it be to adjust the control so that it makes the required regulation specification? Will it do it right out of the box with any motor? The facts presented in the first pitfall have saved many an engineer from embarrassment by the questions posed in the second.

A common use of "specsmanship" as applied by the crafty motor control manufacturer is to rate his regulation as a percentage of base speed instead of a percentage of set speed. He is hoping you don't notice. Even as candid as we are, here in the Danfoss engineering department, you will notice that we buried the complete disclosure of this fact in here. (The odds are, that all but the most hearty will be asleep before they get this far.)

To illustrate the point, using the graph above, let's assume that you design and build a machine which piles rocks on a pile. You tell your customers that your machine will pile rocks at the rate of 90 to 1600 rocks per minute (RPM). Also, your rock piler will handle any rock from 10 lbs. to 100 lbs. You have made it convenient for him to tell how fast he is piling rocks because you have carefully calibrated the speed dial at 50% motor load and guarantee that the machine will perform to within + 5% of calibration. This parameter satisfies his union contract so he buys your rock piler. Meanwhile, someone else in your organization played golf with the Danfoss peddler last Saturday and bought a Vari Speed 240 for the job. He assures you that you don't have anything to worry about because he and the salesman from Danfoss checked the

regulation graph and the worst case regulation looked like it was less than ± 3.5% which is plenty of margin for other variables. The problem is that eventually the customer sends you a registered letter telling you that when he sets the machine at 90 rocks per minute, piling 100 lb. rocks, he gets 50 rocks per minute which is down 41% and out of spec., and what are you going to do about it? You were led to believe you had ± 2.2% regulation in this operating range. You do, but it is ± 2.2% of 1800 RPM, not 90 RPM.

Perhaps what we could have done here at Danfoss, upon completion of the test above, was to take out a full page ad in a major trade magazine showing you our regulation at 899 RPM and told you that we get ± 2.2% regulation using only armature feedback and all this with no adjustments to mess up. It is true! That spec. is based on fact and good test practices, but it will eventually get us both in trouble without a good understanding of the whole picture. On balance, it should be pointed out that many, many variable speed applications do not require close load regulation. Some are better off with soft regulation.

The tendency for the motor to speed up with added loading can be especially troublesome in applications with fast intermittant loading and unloading, (for example, cams and cranks). Controls that exhibit strong tendencies this way, will invariably overshoot badly when quickly unloaded, and many go into oscillation in some applications. Every control with an I.R. comp. adjustment that we have tested so far could be inadvertantly adjusted to strongly exhibit this characteristic. If this is a problem in your application it can usually be corrected by reducing the gain(turning down the I.R. com.) or by using a control that can't be missadjusted, but will still give excellent load regulation (such as our control).

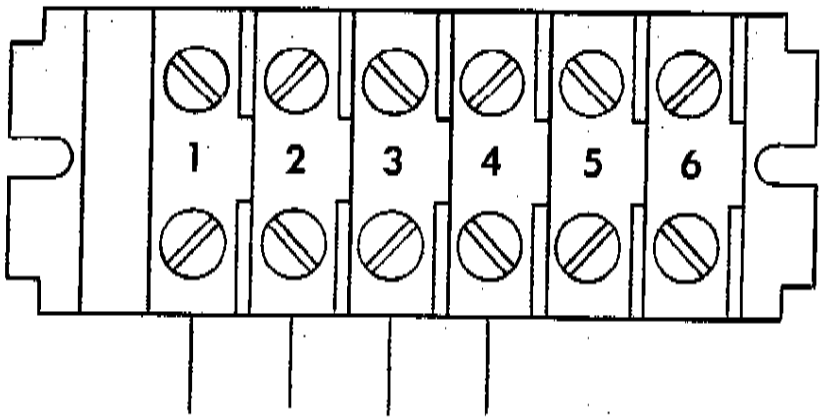
At the risk of disillusioning you completely with D.C. drives, there are a few other characteristics that need to be discussed here. The first is thermal drift. Most high performance controls have some compensation for temperature changes. (The Vari Speed "240" will have less than 1/4% of Set Speed change due to temperature excursions within it's operating range.) The motor, however, is the biggest offender. All D.C. motors, ours and everyone elses, do not turn at the same speed with the same load and the same voltage as the temperature changes. The information it sends back to the control says it is, but it is not. This thermal drift can be as high as 12%, (possibly in isolated cases, more).

This does not mean that D.C. motors are lackluster performers as prime movers. In fact, in a broad spectrum of industrial variable speed applications, the permanent magnet D.C. motor with the proper control is, by far, the best way to do the job. However, if you have an application that requires that motor speed be closely regulated, even with wide excursions in motor temperature, some provision for compensation must be made. To put it in stronger words, if your application really requires that the motor be turning within 3 or 4% of the same speed that you set it for in the morning (cold), that afternoon (warm) there must be some compensation for motor thermal drift. This factor can get you in trouble no matter whose control or motor you use.

The best answer we have found (judged on the basis of price and performance) is tachometer feedback. In the past, tachometer feedback has been expensive enough that it was only used when all else failed. In this regard, we find that we can offer systems with tachometer feedback for about the same cost as many competitive systems without it. What it means to you is reliable, dependable performance. It means motor speeds to within less than 1% of Set Speed under all worst case conditions combined. It means predictable performance in the morning, in the afternoon, and next year, regardless of load variations, temperature variations or line voltage variations.

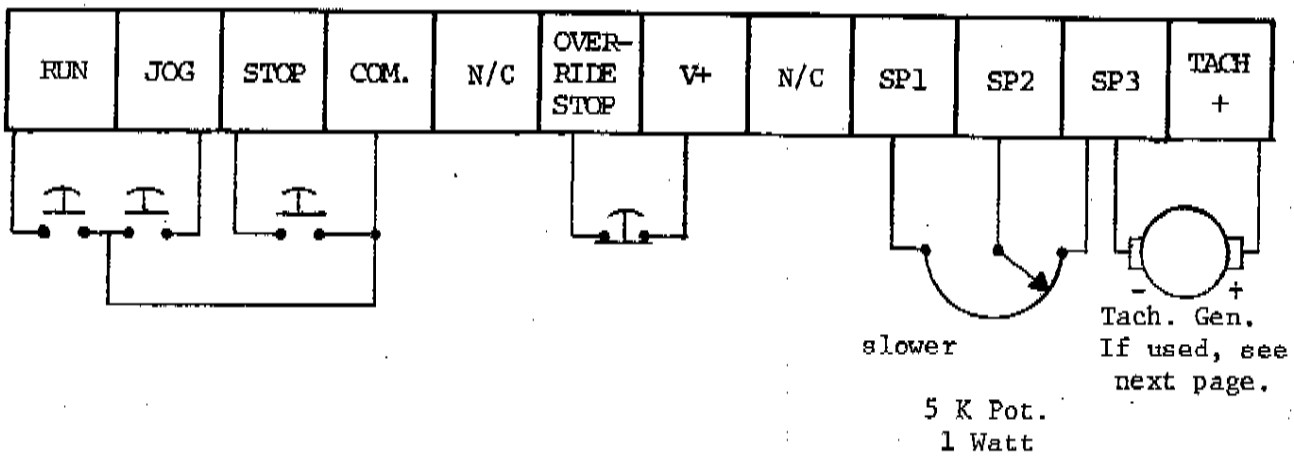
POWER CONNECTIONS

TERMINAL STRIP LOCATED ON INSIDE OF COVER ON OPTION "A"
AND ON ONE END OF MOUNTING PLATE ON OPTION "B" AND "C"



Connect Building Ground to box on Option "A", to base plate on Options "B" and "C".

CONTROL CONNECTIONS TERMINAL STRIP LOCATED ON CIRCUIT BOARD



Notes:

1) All terminals may be electrically hot.

2) If tach. gen. or process signal input are used, see next page.

3) Above diagram is only representative. Push buttons could be relays, limit switches, etc.

4) All functions need not be used. If override stop is not used, jumper 0. stop to V+. If run stop or jog are not used, make no connections to the unused function.

TACHOMETER FEEDBACK, TACHOMETER FOLLOWER AND PROCESS SIGNAL INPUT

The Vari Speed "240" is equipped to accept tachometer feedback and process signal inputs. The process input can be used to follow another tachometer generator to track speed changes originating elsewhere.

Tach. feedback is accomplished by: 1) Wiring the positive output of the tachometer generator to the tach. + input and the negative output of the generator to SP3. (If these wires are transposed, the motor will run wide open regardless of speed setting.) 2) Clip out the resistor located in the black box which is printed on the circuit board. (See illustration for positive identification.)

The face mounted tachometer generators manufactured by Danfoss are low inertia, precision, servo type generators, with an output of 20.8 volts D.C. per 1000 RPM. The Vari Speed "240" is set up at the factory for 7 volts D.C. per 1000 RPM tachometers. By clipping out resistor R11, in the lower right hand corner of the circuit board, (see illustration for positive identification) the tachometer input can be altered to accept the 20.8 volt D.C. per 1000 RPM generators. Nearly any direct current tachometer generator can be accomodated by the Vari Speed "240". (Consult factory)

To use a process input, wire the process signal positive to the SP2 terminal and the signal negative to the SP3 terminal. The Vari Speed "240" is directly compatible with a 0 to 10 volt D.C. input signal. By using the minimum speed trimpot, the process voltage required to turn on the motor can be adjusted from 0 volts to approximately .7 volts. The maximum speed trimpot can be used to adjust the maximum speed of the motor regardless of the process input voltage. This process input is very versatile and can be used to track most common transducer signal outputs. By using external shunting resistors it will work with 0-5 MA, 4-20 MA and 10-50 MA outputs or almost any DC tachometer generator. The input voltage requirements again are 0-10 VDC and the input impedance is approximately 1 MEG OHMS shunted by .47 MFD. For best results, the voltage source should have a source impedance of less than 1 K OHMS. We must caution you again that the process input terminals are at line potential so that the process signal source must have a high degree of isolation. If you have any questions regarding using the Vari Speed "240" on your application, please call us at 815-398-2770.

START-UP PROCEDURE

In spite of the fact that I know that my first recommendation may be painful, it would be prudent to read the pages prior to this one in the Manual and familiarize yourself with the Illustrations located in the back of the Manual.

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. Clip out the resistor in the white box if using tach feedback.

3.) Set speed pot to Zero speed.

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

5.) Green L.E.D. should light up demonstrating that power is being supplied to board and that the internal power supply is working.

6.) Give the control a start signal (a closure from run to com.) Yellow L.E.D. will come on. If not, jumper override stop.

7.) Slowly advance speed pot. Motor should start slowly,and smoothly increase speed as pot. is advanced. If motor runaway occurs, check tach. feedback polarity.

8.) Give stop command. Yellow L.E.D. goes off and motor comes to rest.

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. unless using tach feedback.)

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

The current limit trimpot is located near the max. and min. speed trimpots. The point at which the control starts current limit is identified by the red L.E.D. turning on.

Method

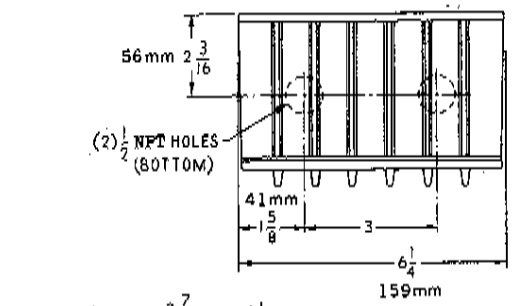
1.) Lock up motor shaft in such a way that no damage will occur. Place a D.C. amp. meter in series with the motor armature. Turn the current limit trimpot fully counter-clockwise. Turn speed pot up. Start control and adjust for the percentage of full load current required.

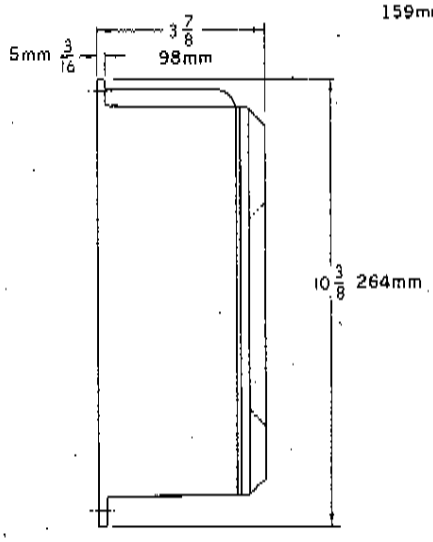
Method

2.) Start control and load machine to maximum. Set the current limit so that it is beyond the point that the red L.E.D. comes on under the worst loading conditions you expect.

CONTROLLED ACCELERATION

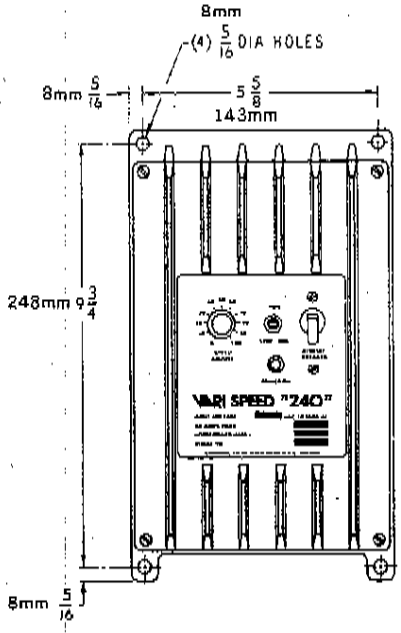
This adjusts the rate of motor acceleration to set speed. The more clockwise the trimpot is set, the slower the acceleration.

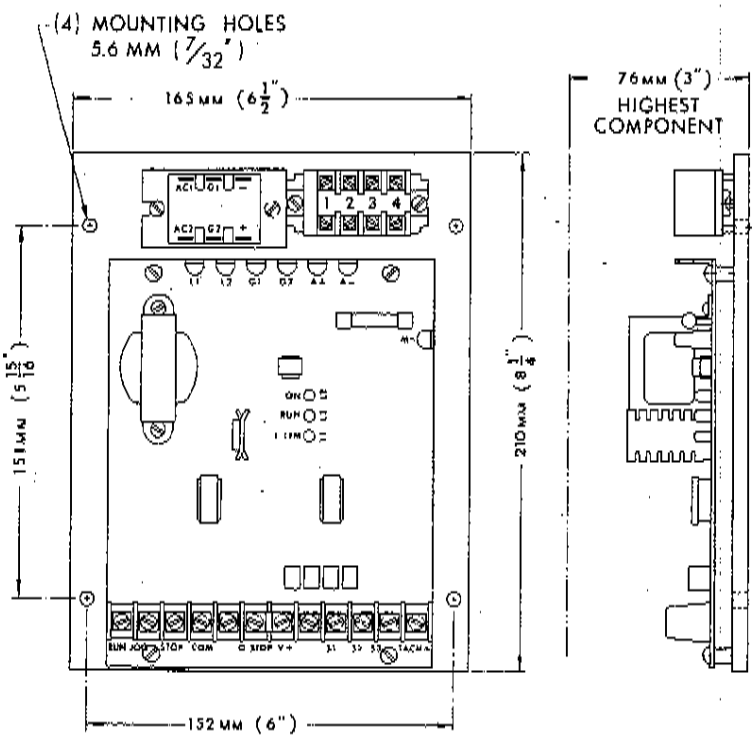




OPTION "A"

WEIGHT – 7 LBS.
MATERIAL – ALUMINUM



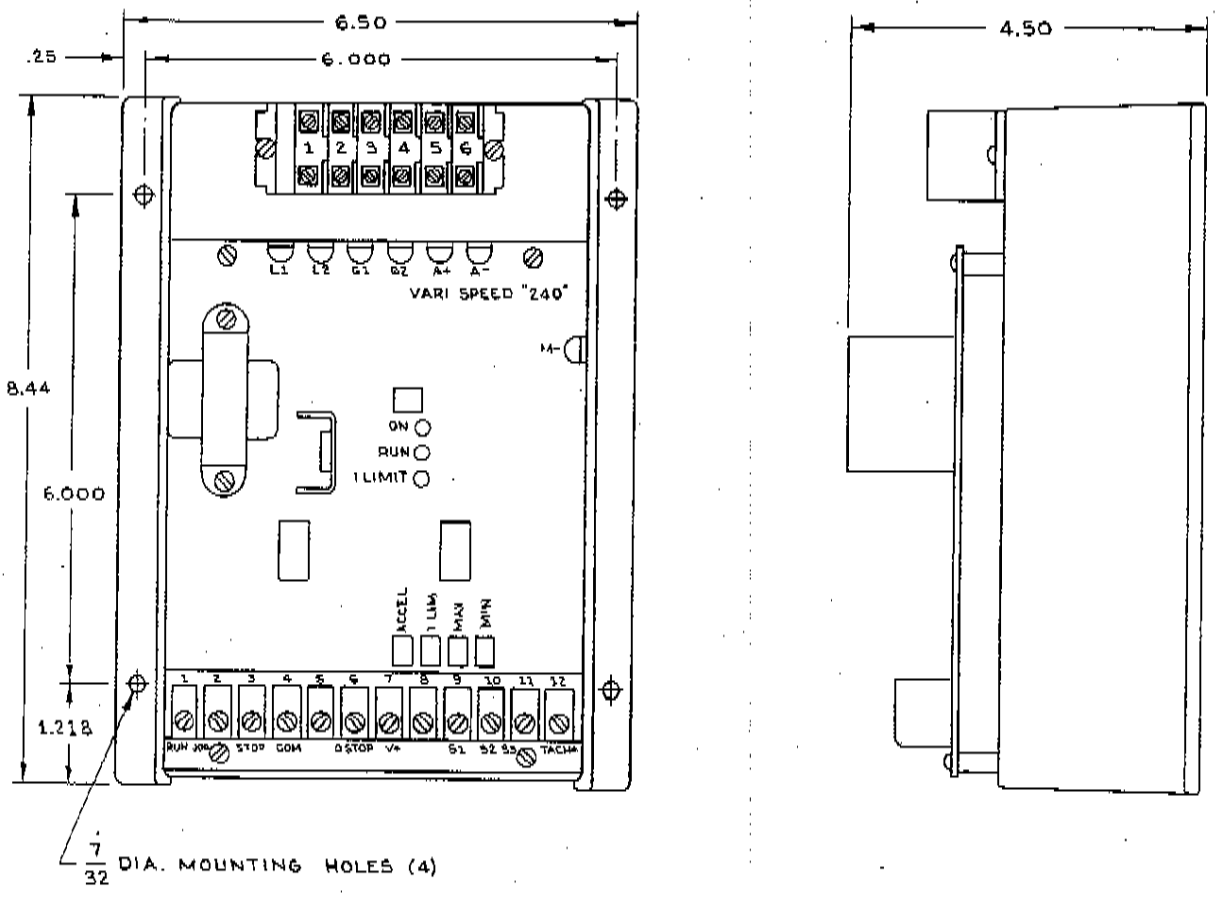


OPTION "B"

WEIGHT — 5 LBS.

MATERIAL — ALUMINUM

"240"



TROUBLE SHOOTING

SYMPTOM	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.) Make sure override stop (if used) is closed. 4.) Set speed adjust to 50%. 5.) With power OFF and motor leads disconnected check for worn or improperly seated motor brushes. (Brushes should be replaced when overall length is .575"). 6.) Faulty circuit board.
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 "Jamb-up" or excessive load. 4.) Power module failure.
No speed control	1.) Speed adjust potentiometer or wiring defective. 2.) Minimum speed adjust potentiometer (located on circuit board) misadjusted. Turn counterclockwise to correct. 3.) If using tach. feedback, check tach polarity.
Motor will not run at 1725 RPM	1.) Improper setting of maximum speed potentiometer. (Located 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.

TROUBLE SHOOTING

SYMPTOM	SOLUTION
Motor Jumps After Stop And Before Start Signal	1.) CONSULT FACTORY
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 Stop Command	1.) Faulty wiring in control circuit. 2.) Faulty circuit board.
Motor Will Not Stay On After Start Command	1.) Check wiring of stop functions. 2.) Faulty circuit board.

PLEASE FEEL FREE TO CALL OUR FACTORY FOR ASSISTANCE: 815-398-2770

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.

Power Module

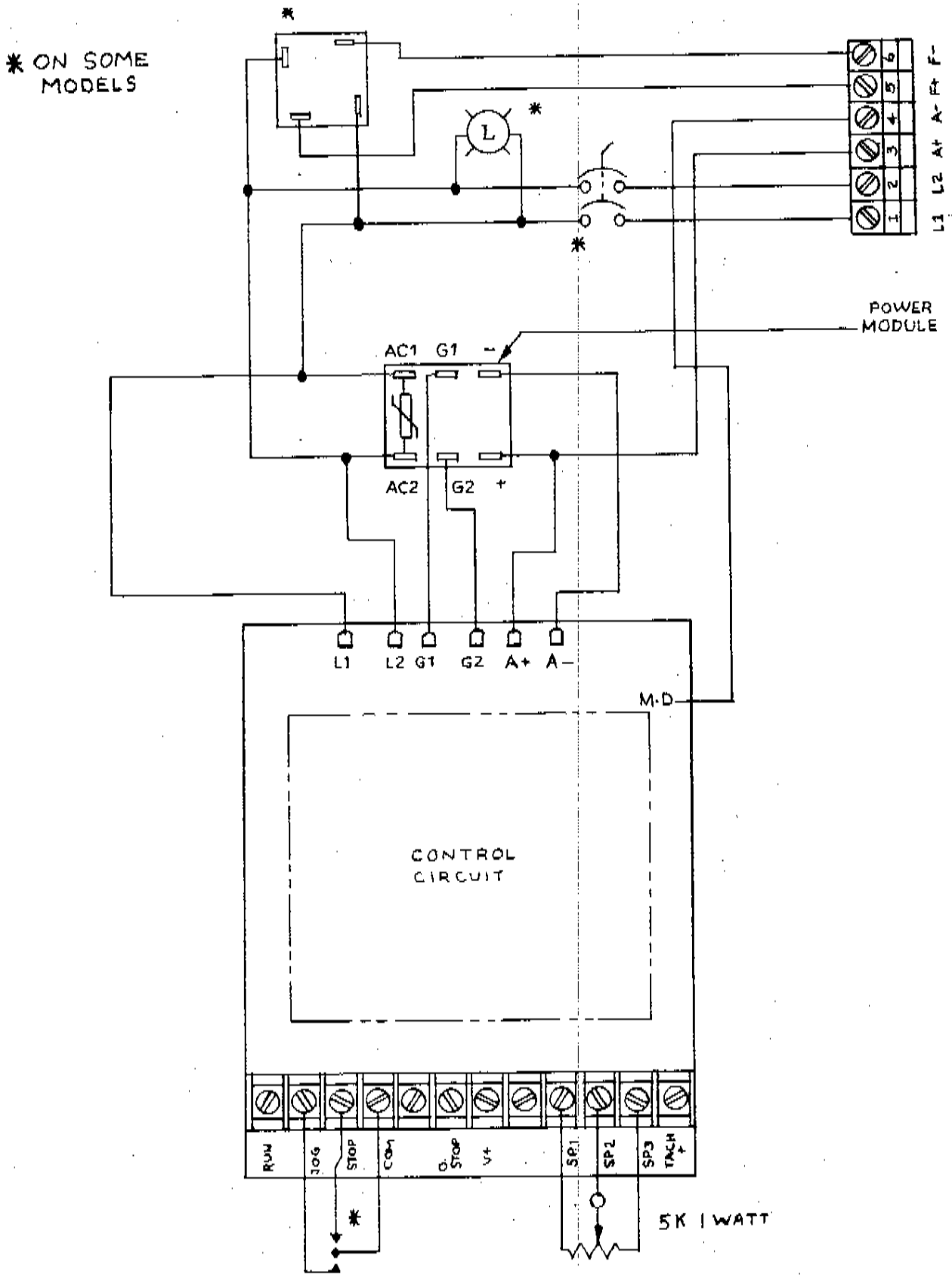
1.) Pull off all "fast on" connections. Set V.O.M. to R X 10K scale.
2.) Check resistance from both A.C. terminals to (+) terminal. Both directions resistance should be greater than 1 Meg OHM.
3.) Check resistance from both A.C. terminals to (-) terminal. Resistance should be greater than 1 Meg OHM in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

NOTE: If test results agree with above procedure and your problem is not solved, PLEASE FEEL FREE TO CALL OUR FACTORY FOR ASSISTANCE 815-398-2770.

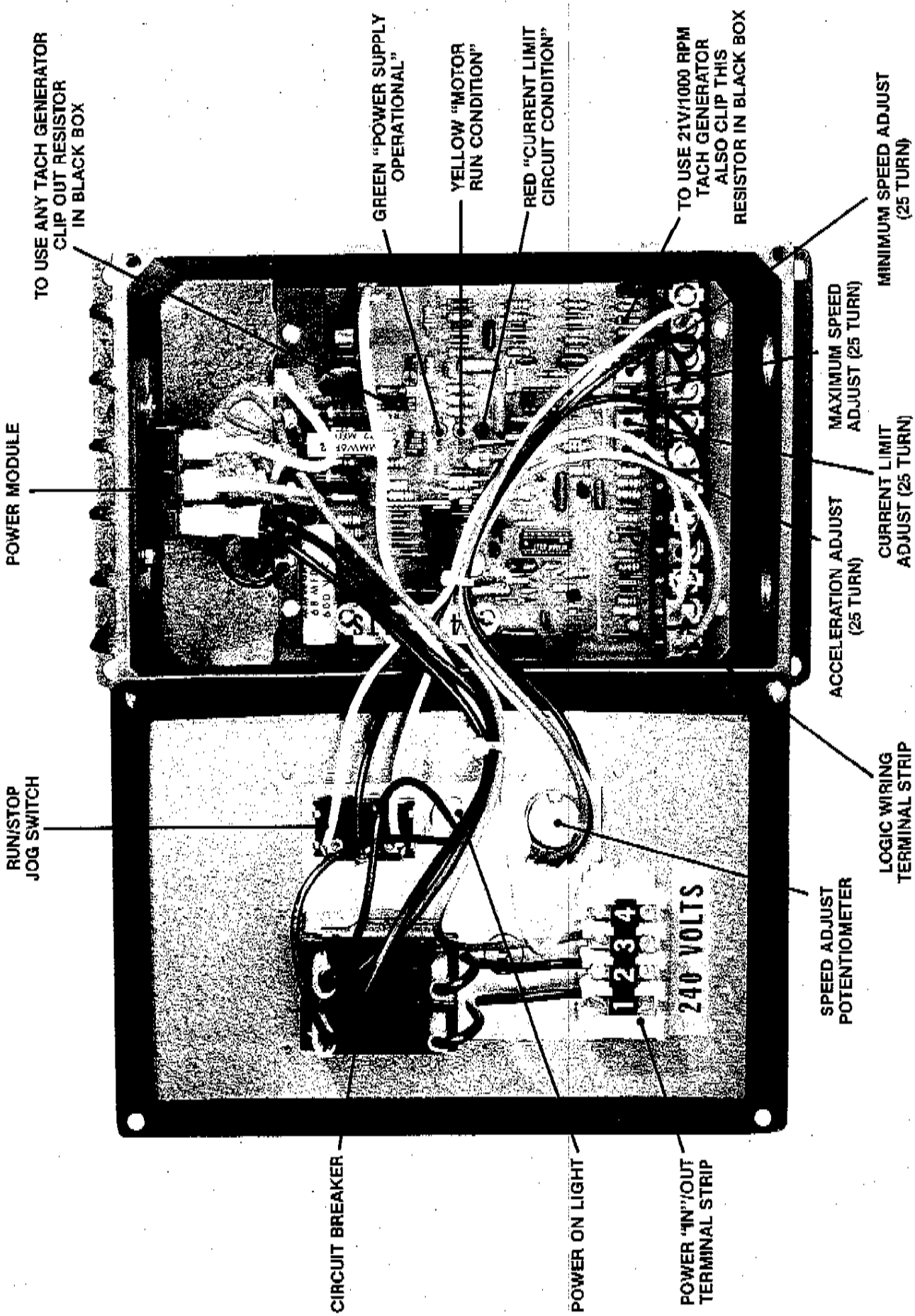
REPLACEMENT OR SPARE PARTS

Description	Part Number
POWER MODULE	
Serial numbers ending in 1300 or lower	
Power Module 120V, A.C., Input Control	(02304)
Power Module 240V, A.C., Input Control	(02306)
Serial Numbers ending in 1301 or higher	
700110 - 700111 - 700112	(02306)
700130 - 700185 - 700186	(02306)
700100 - 700101 - 700102	(02319)
700120 - 700285 - 700286	(02319)
1300 is approximate	
Circuit Board Sub Assembly	(Use S/N on Control)
Speed Adjust Potentiometer	(00943)
Run/Jog Switch	(02211)
Circuit Breaker	(Use S/N on Control)

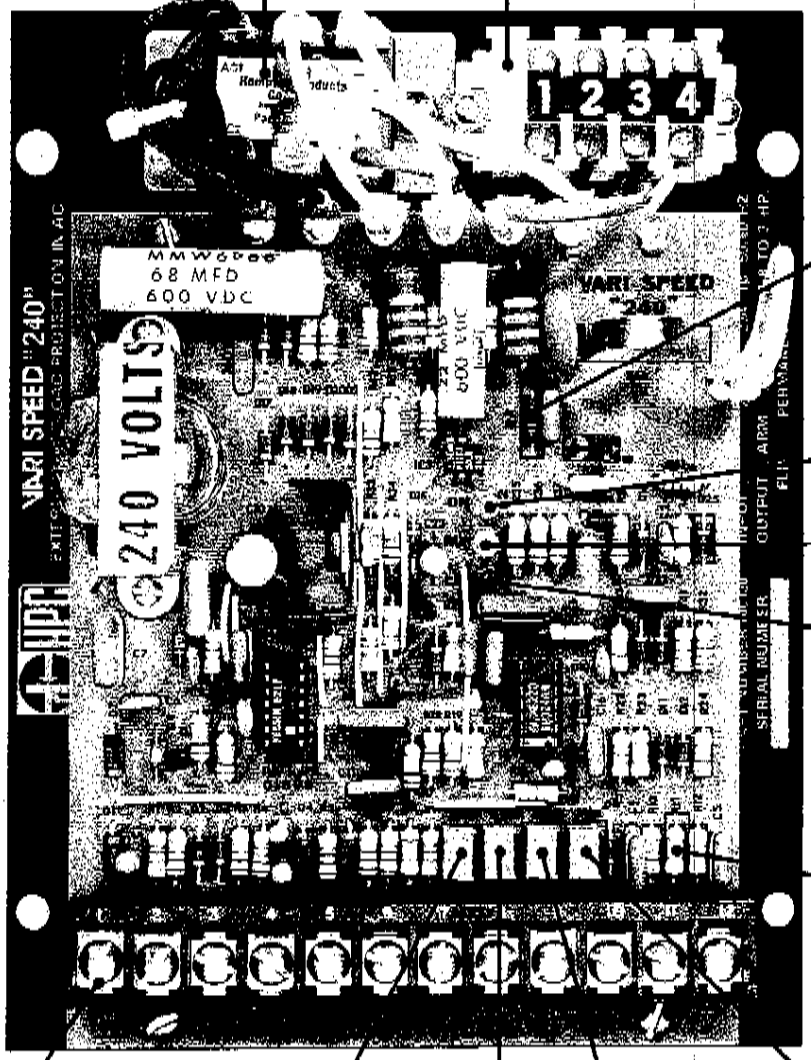
VARI SPEED 240 FUNCTIONAL DIAGRAM



VARI SPEED "240" — OPTION "A" ILLUSTRATION



VARI SPEED "240"
OPTION "B" ILLUSTRATION



POWER MODULE

POWER IN/OUT TERMINAL STRIP

TO USE ANY TACH GENERATOR CLIP OUT RESISTOR IN BLACK BOX

GREEN "POWER SUPPLY OPERATIONAL"

YELLOW "MOTOR RUN CONDITION"

RED "CURRENT LIMIT CIRCUIT CONDITION"

TO USE 21V/1000 RPM TACH GENERATOR ALSO CLIP THIS RESISTOR IN BLACK BOX

LOGIC WIRING TERMINAL STRIP

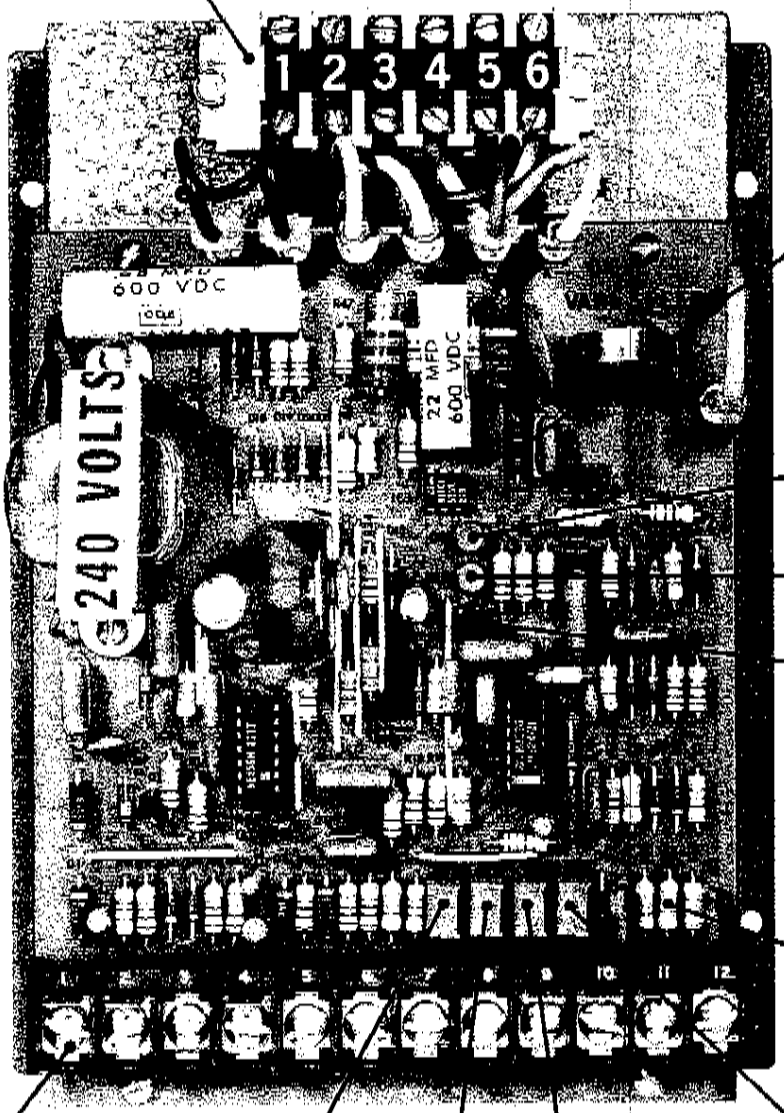
ACCELERATION ADJUST (25 TURN)

CURRENT LIMIT ADJUST (25 TURN)

MAXIMUM SPEED ADJUST (25 TURN)

MINIMUM SPEED ADJUST (25 TURN)

VARI SPEED "240"
CHASSIS MOUNT



POWER IN/OUT TERMINAL STRIP

TO USE ANY TACH GENERATOR CLIP OUT RESISTOR IN BLACK BOX

GREEN "POWER SUPPLY OPERATIONAL"

YELLOW "MOTOR RUN CONDITION"

RED "CURRENT LIMIT CIRCUIT CONDITION"

TO USE 21V/1000 RPM TACH GENERATOR ALSO CLIP THIS RESISTOR IN BLACK BOX

LOGIC WIRING TERMINAL STRIP

ACCELERATION ADJUST (25 TURN)

CURRENT LIMIT ADJUST (25 TURN)

MAXIMUM SPEED ADJUST (25 TURN)

MINIMUM SPEED ADJUST (25 TURN)

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
	3	20	20	2	2012
	5	35	35	2	2019

240 VAC LINE REQUIRES PROTECTION IN BOTH AC LINES