

POWERMAG

EDDY CURRENT VARIABLE SPEED DRIVE CONTROLLER - TYPE PM-07

When properly installed, operated and maintained, this equipment will provide a lifetime of optimum operation. It is mandatory that the person who operates inspects, and maintains this equipment thoroughly read and understand this manual.



Powermag EC Drive Controller
Type PM-07

IMPORTANT

The EC controller type PM 07 is designed to be used in conjunction with the eddy-current coupling drive units, termed Powermag EC Drive. It is an electronic type control unit, incorporating a thyristor amplifier as main component, and automatically controls the EC Drive speed according to the speed and torque references given from the various control components of the EC drive.

CONTENTS

Receiving	2	Control Principle	7
Mounting	2	EC Drive Circuit	8
Wiring	3	Withstanding Voltage Test and Megger Test	8
Trial Operation	4	Adjustments	8
Trouble Shooting Guide	6	Maintenance	9
Guide for Maintenance Personnel	7		

1. RECEIVING

This controller has been put through severe tests at the factory before shipped. After unpacking, however, check and see the following.

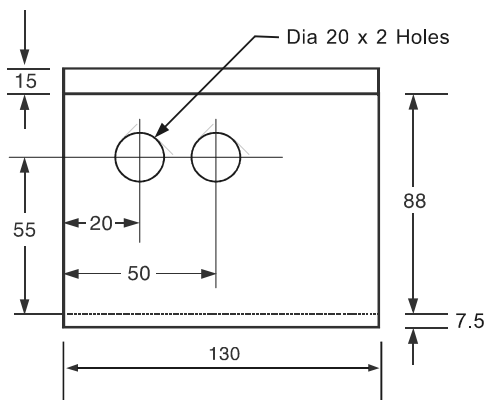
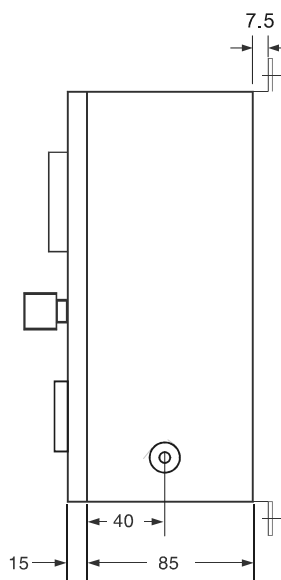
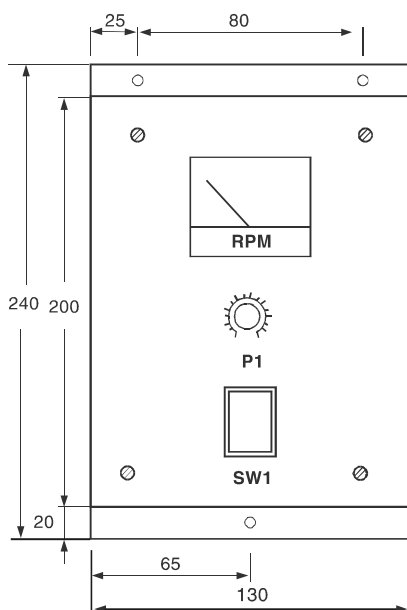
- Its nameplate rating meets your requirements.
- It has sustained no damage while in transit.
- Fastening screws are not loose.
- It has been provided with two spare fuses and two terminal screws.

If any part of the unit is damaged or lost, immediately notify us giving full details and nameplate data.

Neither megger test nor withstand voltage test is necessary for they have been finished at the factory before shipping.

2. MOUNTING

- Mount on the wall, or machine, or panel so that the casing becomes vertical to the floor to take advantage of natural air convection.
- Choose a clean location with proper temperature, and avoid exposure to any harmful gas, high temperature and humid, and frequent vibration.
- If the controller should be mounted in the enclosure containing any heat generating component, use care for the following points.
 - a. Avoid placing the controller next to the heat source unit in the pass of heated air flow.
 - b. Remove the EC Drive controller cover.
 - c. Keep the ambient temperature below 55°C.



All Dimensions are in mm

- SW1 - POWER ON/OFF SWITCH
- RPM - SPEED -O- METER 0-1500 RPM
- P1 - SPEED SETTING POTENTIOMETER

Fig.1 - Dimension EC Drive Controller

3. WIRING

Make the correct lead connections, referring to the connection diagram of the drive shown in Fig. 2. Defective wiring may cause motor burnout or damage controllers. Check carefully that the connections agree with the connection diagram. Terminal Guard indicating terminal numbers facilitates identifying the terminals to be connected. Place it on the top of the terminal block so that the numbers can be easily read.

CAUTION

An Electrical interlock should be provided so that the power supply to the terminals 1 & 2 of electronic controller will be available IF and ONLY IF the induction motor is 'ON'. An auxiliary N.O. contact of the motor starter may be made use of to provide this interlock.

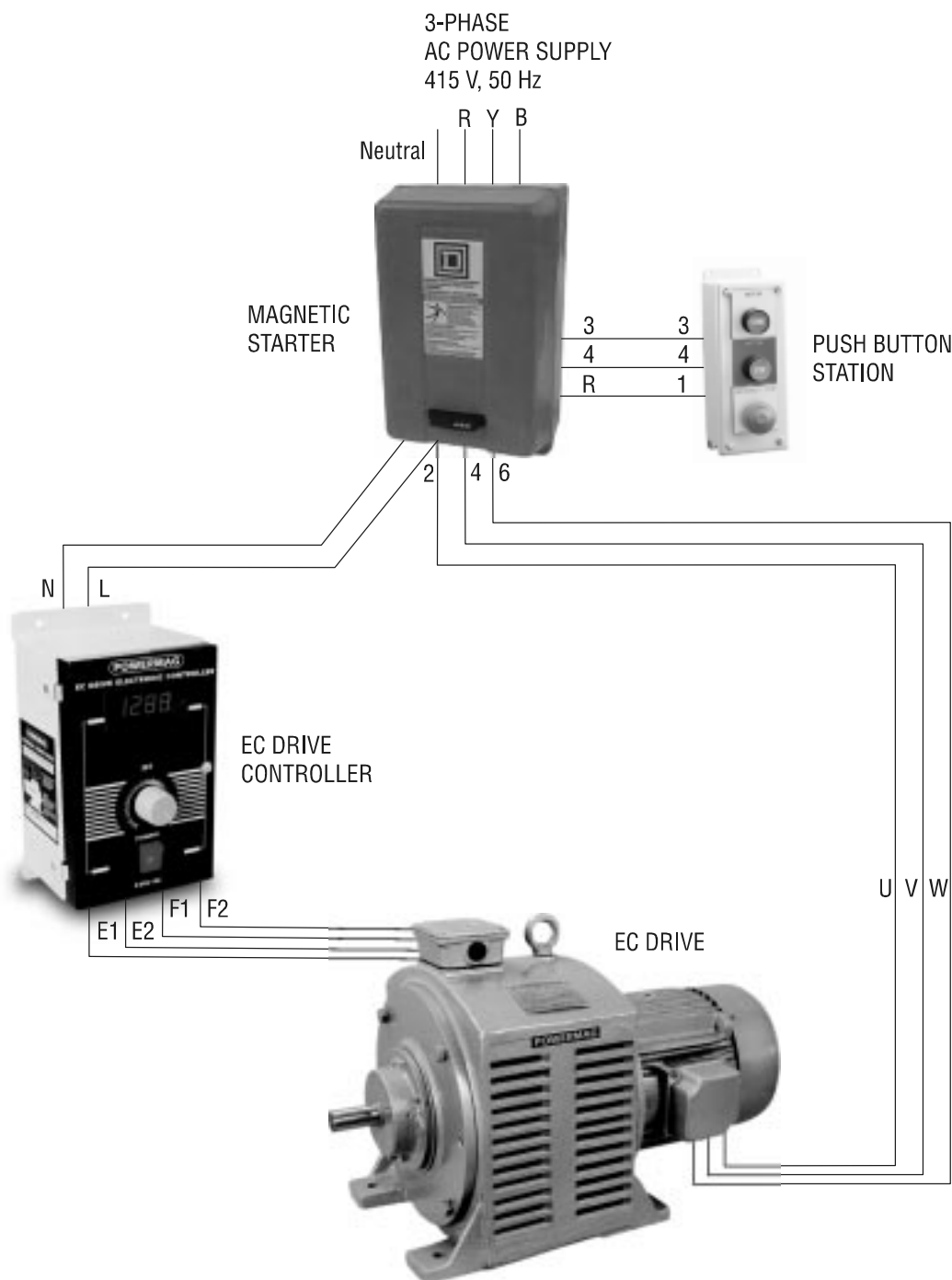


Fig.2 - Basic Wiring Diagram of EC Drive System

LEAD SIZE

For connections to the prime mover power supply, choose the proper lead size according to the capacity of the prime mover.

Use 2 to 5.5mm² of control power lead (connections to controller terminals 1, 2, 3, and 4) and 0.75 to 2mm² signal lead (connections to controller terminals 5, 6, 7, 8, 9). Both should be vinyl-sheathed lead. M4 terminal screws are used.

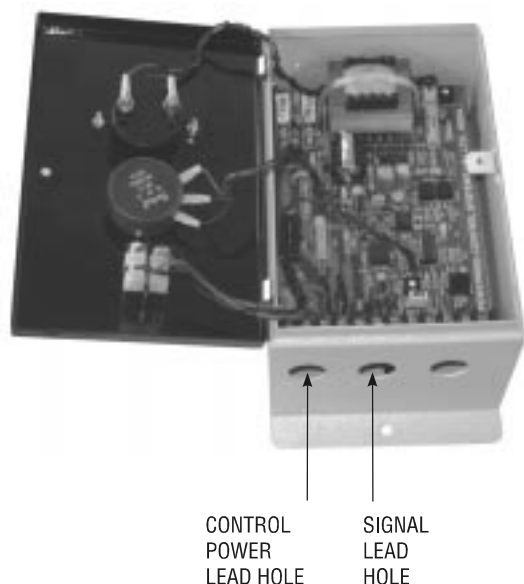
THERMAL RELAYS

To protect the motor from overload, connect a thermal overload relay (contained in magnetic starter) to EC Drive systems. Make a circuit so that main circuit power supply is interrupted when the thermal relay operates.

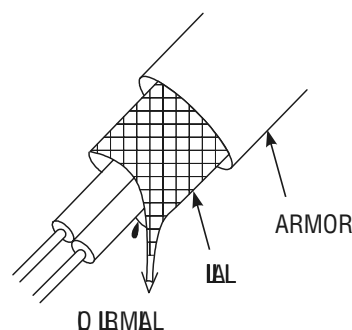
SEPARATION OF CONTROL POWER LINE FROM SIGNAL LINE

Signal leads, if affected by induced voltage, may cause erroneous operation of EC Drive controller. Use the two holes, with rubber bushings provided at the bottom of the controller casing so as to insure separation of signal leads from control power leads. See Fig. 3.

The signal leads should also be separated from the other power leads. Exceptions: Where they must be run in the same bundle, use two-core shielded cable for signal leads, and connect one end of the signal-lead shield to the controller GND terminal,



a. Controller Power Line and Signal Line in a Separate Bundle.



b. Two-core Shielded Cable

WIRING DISTANCE

EC Drive controller is high-sensitivity electronic unit and when the wiring distance is long, it may have inductive interference, wiring distance between EC Drive or and EC controller should not exceed 100 meters.

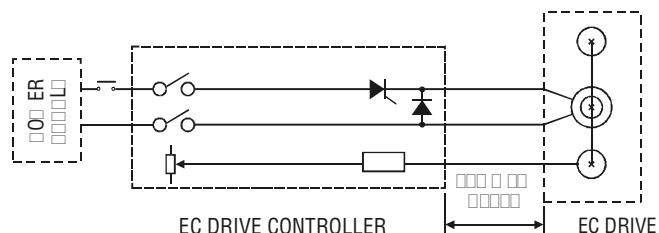


Fig. 4 - Wiring Distance

GROUNDING

Make a perfect grounding using a ground terminal E on the bottom of the enclosure.

4. TRIAL OPERATION

Before Operation

On completion of connections, check the following items before turning on power.

- Connections are correct.
- Check the connections with the terminal number plate covering the terminal board.
- Terminal screws are tight.
- EC Drive connected to driven machine is ready to operate.
- Connections to ground terminal are correct.

Measure the resistance across each external terminal and ground terminal with a tester ($\times 10^3$ range). If ∞ appears on the tester scale, it indicates that grounding has been correctly made.

Interlock between Motor Power Supply and Control power Supply

To protect EC Drive Excitation coil, check to see if the circuit is arranged so that the controller is powered after the prime mover starts.

Where prime mover power supply is separate from controller power supply, control power sets on after prime mover is started by turning on magnetic starter.

TRIAL OPERATION

Operate the EC Drive combined with EC Drive controller. If trouble is experienced in the operation of a motor, refer to troubleshooting guide on page 5. If desired performance is not obtained, make fine adjustments referring to ADJUSTMENTS on page 8.

1. Before operating the EC Drive, warn all personnel near the motor and make them move out of it.
2. Make sure that the power ON-OFF switch of EC Drive Controller is at OFF position and turn the speed setting potentiometer to LOW (full counterclockwise).
3. Start the induction motor by depressing START button of pushbutton station.
4. Check to be sure that POWER lamp is illuminated.
5. Direction of rotation

Check the direction of rotation by seeing the rotation of drum through EC Drive ventilation opening. The standard direction of rotation is counterclockwise viewing from the drive end. To change the direction, interchange any two of power leads R, Y and B of magnetic starter.

6. Set the power ON-OFF switch of EC Drive controller to ON to operate the EC Drive
7. Check to be sure that the ON lamp is illuminated.
8. Slowly turn the SPEED setting potentiometer clockwise. The EC Drive should rotate counterclockwise viewing from the drive end and increase its speed gradually.

RPM meter mounted on EC Drive Electronic Controller indicates 1000 to 1200rpm at 50Hz. To decrease the speed, turn the SPEED potentiometer to LOW (counterclockwise).

EC Drive operates with 4% speed regulation. Where more accurate speed control is required, make an adjustment referring to "ADJUSTMENTS" on page 8. If the load is 5% or below of full load, the motor speed may not be controlled accurately.

9. Turn the speed setting potentiometer of the operator full counterclockwise. Set the power ON-OFF switch to OFF position to stop the EC Coupling.
10. Depress STOP button of pushbutton station to stop the induction motor.



EC Drive Electronic Controller

Adjustment of Soft Starter

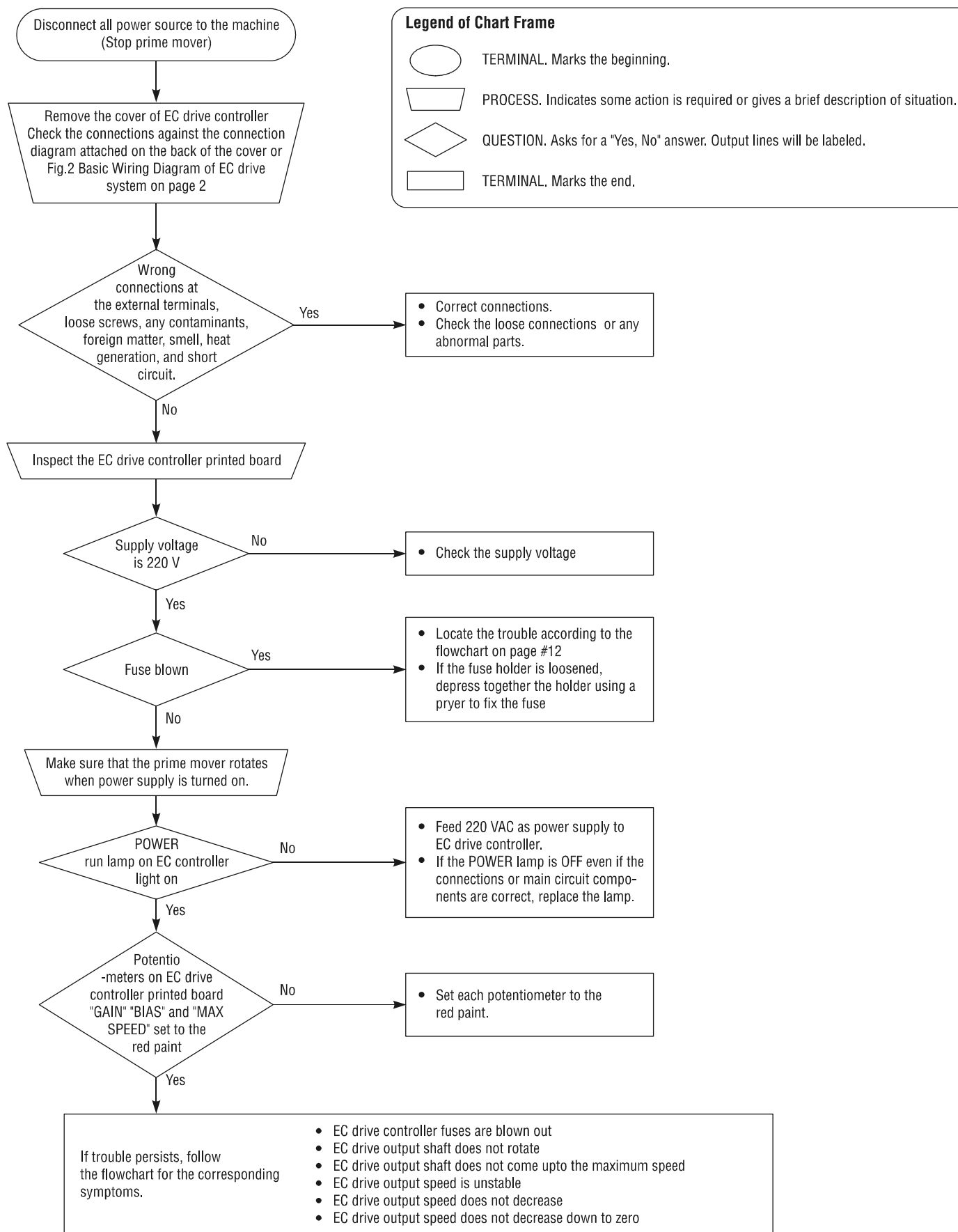
Set the optimum acceleration time for operation using ACCL. adjusting Preset. It has been factory adjusted at 5 seconds.

To restart the timed start operation, operate the motor a minute after stop. Failure to do so may prevent timed start operation.

5. TROUBLESHOOTING GUIDE

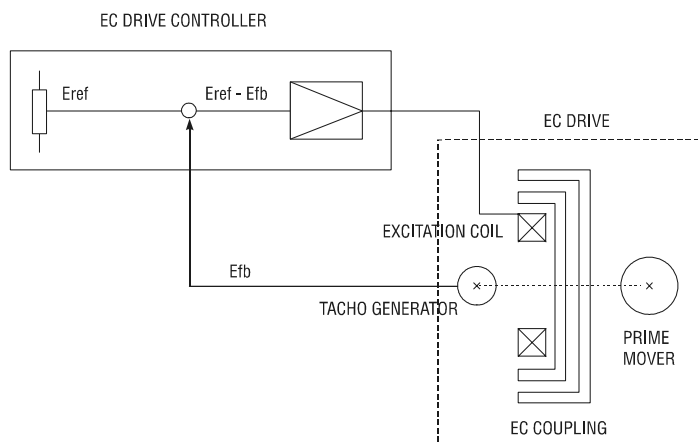
If trouble is experienced in the operation of a motor, refer to Initial Check of Troubles. If trouble still occurs, locate the trouble spot, referring to Troubles and Remedies for the specific trouble symptom on pages 12 to 17.

INITIAL CHECK FOR TROUBLES



7. GUIDE FOR MAINTENANCE PERSONNEL

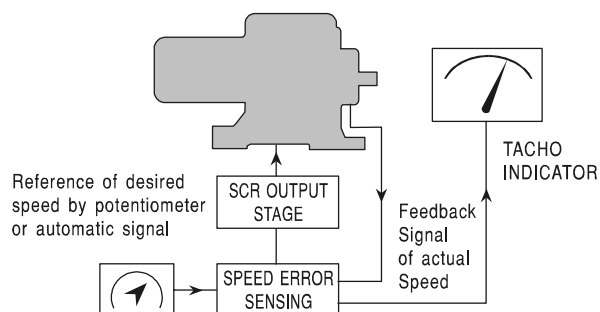
This guide intended for maintenance personnel gives the detailed instructions for getting more accurate speed, the regulating speed of 4% or below from the EC Drive controller, or locating the trouble in detail.



Block Diagram of EC Drive

8. CONTROL PRINCIPLE

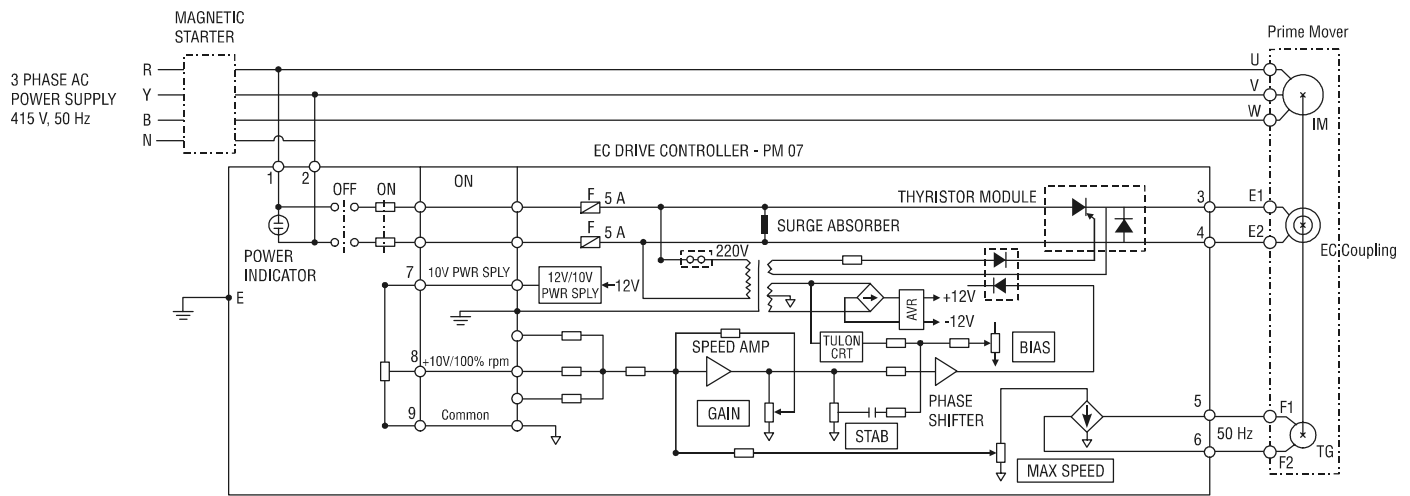
The tachometer generator on the EC Drive shaft produces Voltage E_{fb} in proportion to the speed of the EC Drive output shaft. The voltage E_{fb} is compared with the speed preset voltage E_{ref} from EC Controller, one of the control components of the EC Drive. Based on the results, the controller automatically regulates the current of exciting coil of the EC coupling and the drive motor is maintained at the predetermined speed.



RATINGS AND SPECIFICATIONS OF EC DRIVE CONTROLLER TYPE PM-07

PARAMETER	TERMINAL Nos.	RATING
Power Supply Voltage	1-2	220V AC $\pm$ 10%
Output Voltage	3(+) & 4(-)	80V DC
Output Current	3(+) & 4(-)	5 A DC
Output Capacity		400 W
Speed Reference	8(+) & 9(-)	0 to 10V DC Variable
Power supply for Control circuit (built-in)	7(+) & 9(-)	10V DC
Tacho Generator Output	5 & 6	30V AC 600 Hz / 1500 RPM 48 Pole Single Phase, 2 W
Speed Regulation		4% (Factory Adjusted) when load varies from 100% to 10%
Speed Range		1200 rpm to 120 rpm
Ambient Temperature		-6°C to +45°C
Altitude		100 meters

9. EC DRIVE CIRCUIT



EC Drive using Electronic Controller

10. WITHSTAND VOLTAGE TEST AND MEGGER TEST

Withstand Voltage Test

Withstand voltage test has been made before shipping. Never perform the test in the field.

Megger Test

Megger Test is not required in the field, for it has been finished before shipping. Exception : When megger testing at maintenance, the test voltage should not exceed 500V and all controller terminals must be short-circuited.

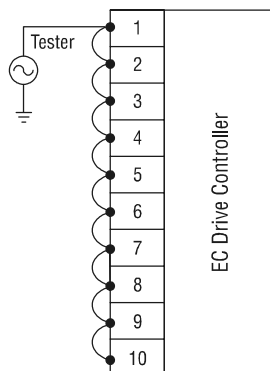


Fig.8 -Terminal Short-circuited for Megger Testing

11. ADJUSTMENTS

EC Drive controller adjusting potentiometers have been optimally pre-set at the factory. However, to operate the EC Drive exactly matching its load, adjust the potentiometers of EC Drive controllers and CAL Preset of EC Drive with a fine tune small screw driver.

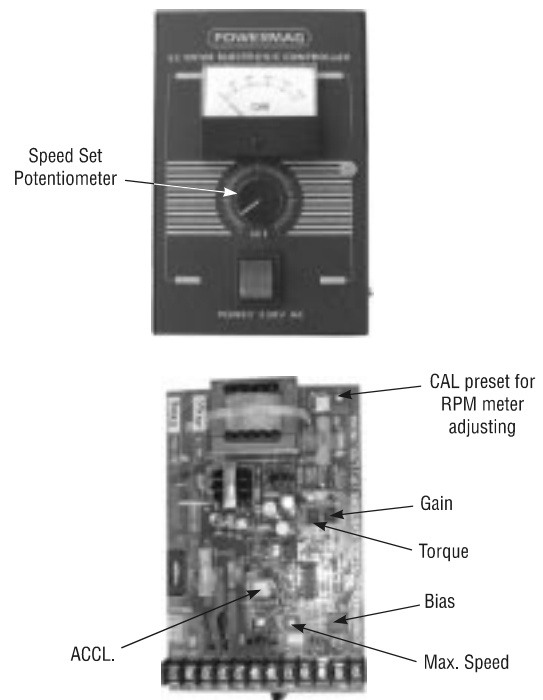


Fig.9 - EC Drive Controller Adjusting Presets

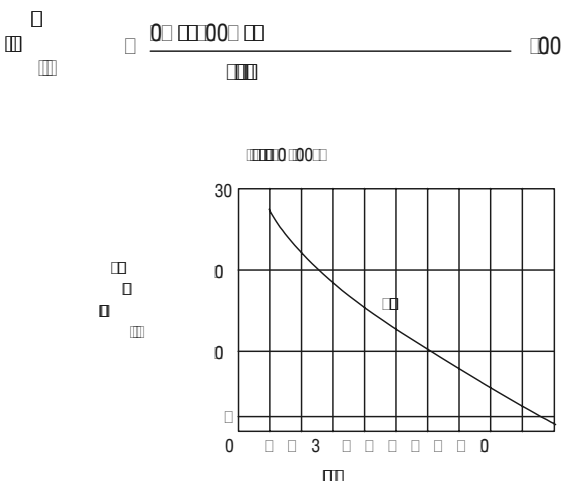
Adjustment of Reading of EC Drive Controller

Preset CAL adjustment has been pre-set at the factory so that the tachometer indicates 1500rpm at 30V. However, tachometer may not follow exactly the actual EC drive speed due to variation of tach-gen voltage. Measure the EC drive running speed during operation first to determine the actual EC drive speed by using digital Tachometer. If the measured speed does not coincide with meter reading, adjust the tachometer by use of CAL Preset. Turning CAL Preset clockwise moves the RPM meter pointer to the right. Turn it counterclockwise to move the RPM Meter to the left.



Gain Adjustment

GAIN preset located on EC Drive controller printed board has nine intermediate positions. It has been factory set at 8.5th position so that speed regulation be approximately 4% and the red paint indicates factory adjustment. If hunting is caused, minimize the speed fluctuation with GAIN *preset* counterclockwise to decrease gain. Since maximum EC Drive speed may change due to GAIN adjustment, adjust the MAX SPEED potentiometer.



Maximum Rated Speed Adjustment

The MAX SPEED preset has been factory-set to that EC Drive runs at 1200rpm at 50Hz. The red paint indicates factory adjustment.

When the EC Drive does not reach the maximum rated speed with the speed set potentiometer of the operator set fully clockwise, turn the MAX SPEED preset for feedback speed adjustment fully clockwise to increase the speed of the EC Drive.

Caution

NEVER OPERATE THE DRIVE AT THE SPEED EXCEEDING MAX RATED SPEED BY ADJUSTING MAX SPEED POTENTIOMETER, FOR THE EXCITATION COIL MAY BE BURNT OUT.

Stabilization of Motor Speed

Turn the GAIN preset fully counterclockwise. Then turn it slowly clockwise until the motor fluctuation is eliminated. Turning it excessively clockwise will cause hunting.

Bias Adjustment

Bias preset is preset at the factory optimally so that the controller output voltage generates 0V at 0V speed reference. The red paint indicates the factory adjustment. The preset should not be tampered unnecessarily.

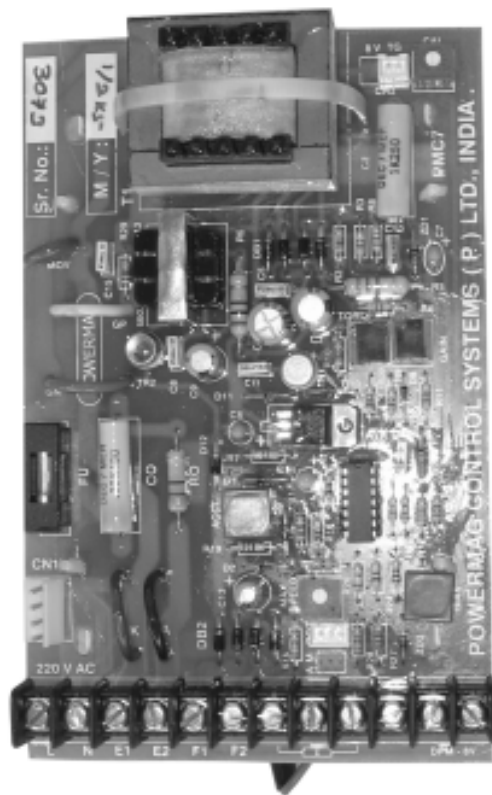
12. MAINTENANCE

EC controller consists of a printed-circuit board and requires no routine inspection and maintenance except for the following:

- Check of actual motor speed and the EC Drive controller speed indicator
- Tightness of terminal screws
- Number of spare fuses
- Dust and oil inside EC Drive Controller casing
- Casing cover positively set

Fuse Replacement

If the fuse is black-mottled, it indicates that the fuse has blown out. Remove the blown fuse by pulling out forcibly and replace it with a new one.



EC Drive Controller - Interior View

Checks of power modules

If the power module is proved to be failed, contact Powermag or the representative.

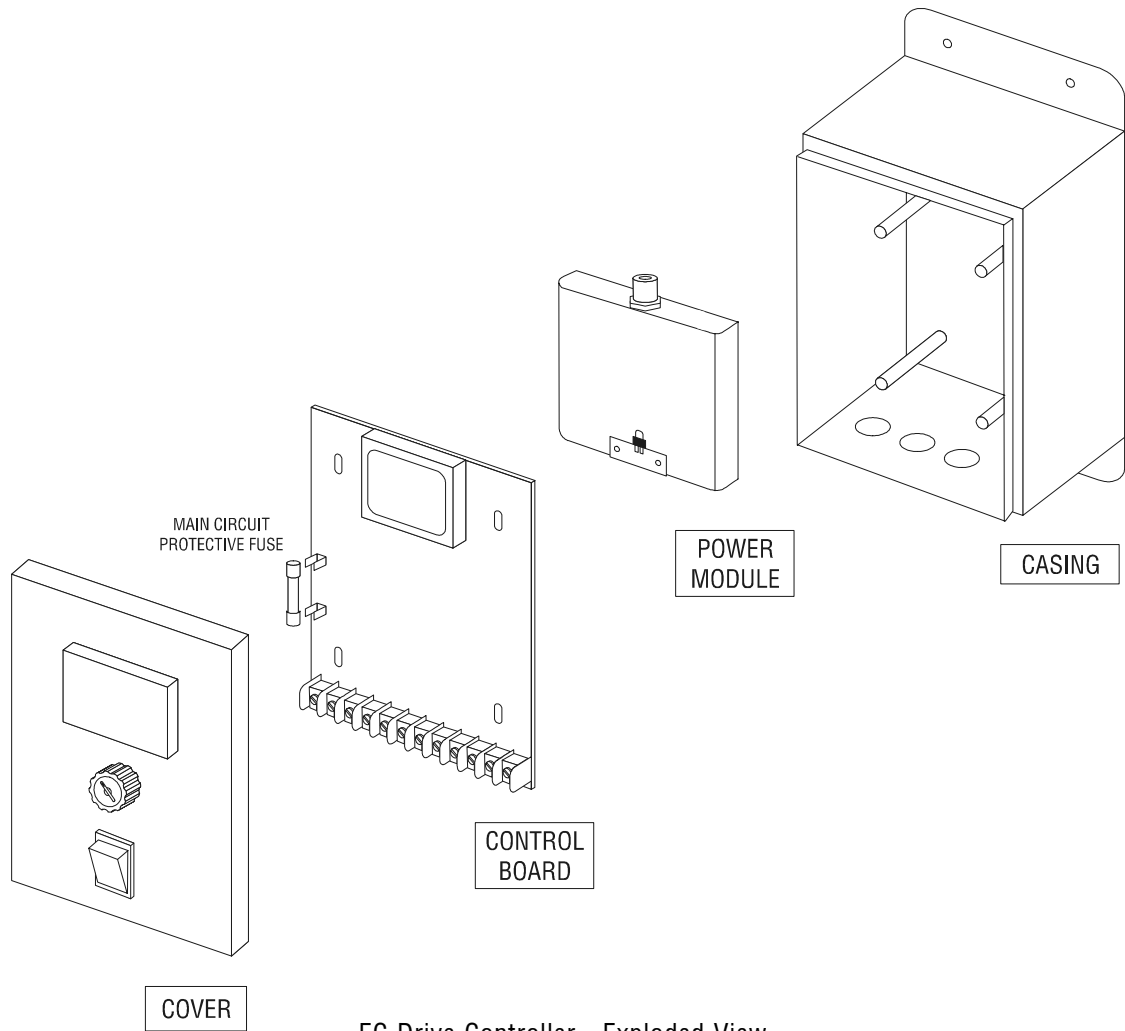
Measure the resistance of the controller terminals with a tester (x 1 Ω range) after removing supply voltage shunt selector. If the following data result from the measurement, they mean the power modules are correct.

- Resistance across terminals 1 and 3 respectively connected to minus and plus of the tester -- Approx ∞
- Resistance across terminals 1 and 3 respectively connected to plus and minus of the tester --- Approx ∞
- Resistance across terminals 3 and 4 respectively connected to minus and plus of the tester --- Approx ∞

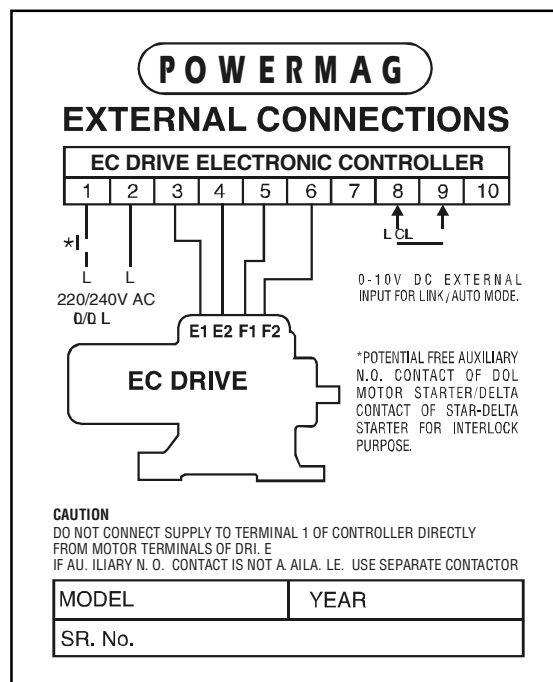
- Resistance across terminals 3 and 4 respectively connected to plus and minus of the tester --- Several ohms to approximate multiple of 10 ohms

Measure the resistance across EC Drive controller terminal 3 and gate connector with a tester (x 1 Ω range). If the following data are obtained from the measurement, they mean the power modules are correct.

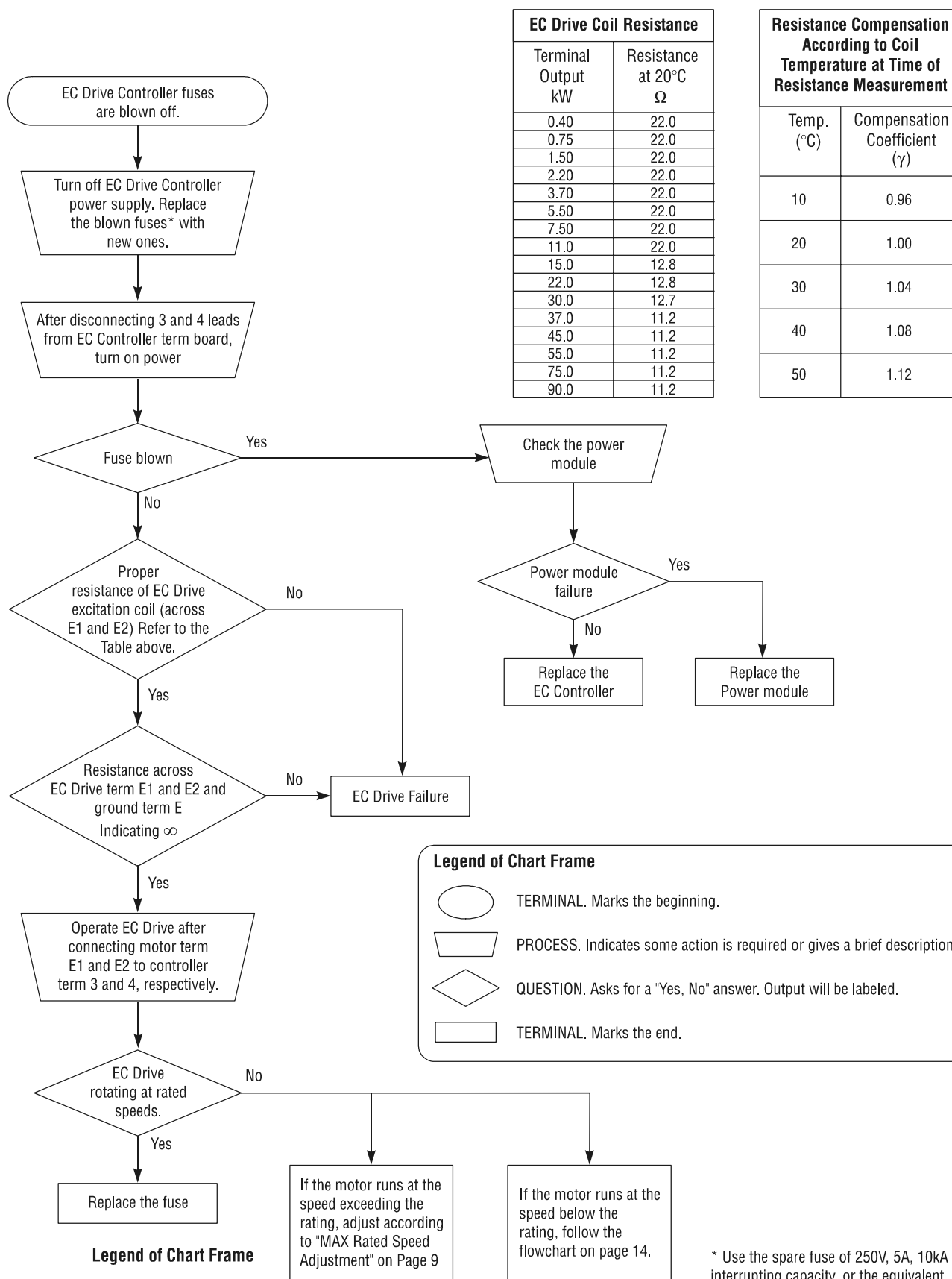
- Resistance across terminal 3 and gate connector respectively connected to minus and plus of the tester --- Approximate multiple of 10 ohms to several hundreds of ohms
- Resistance across terminal 3 and gate connector respectively connected to plus and minus of the tester --- Several ohms to 200 Ω

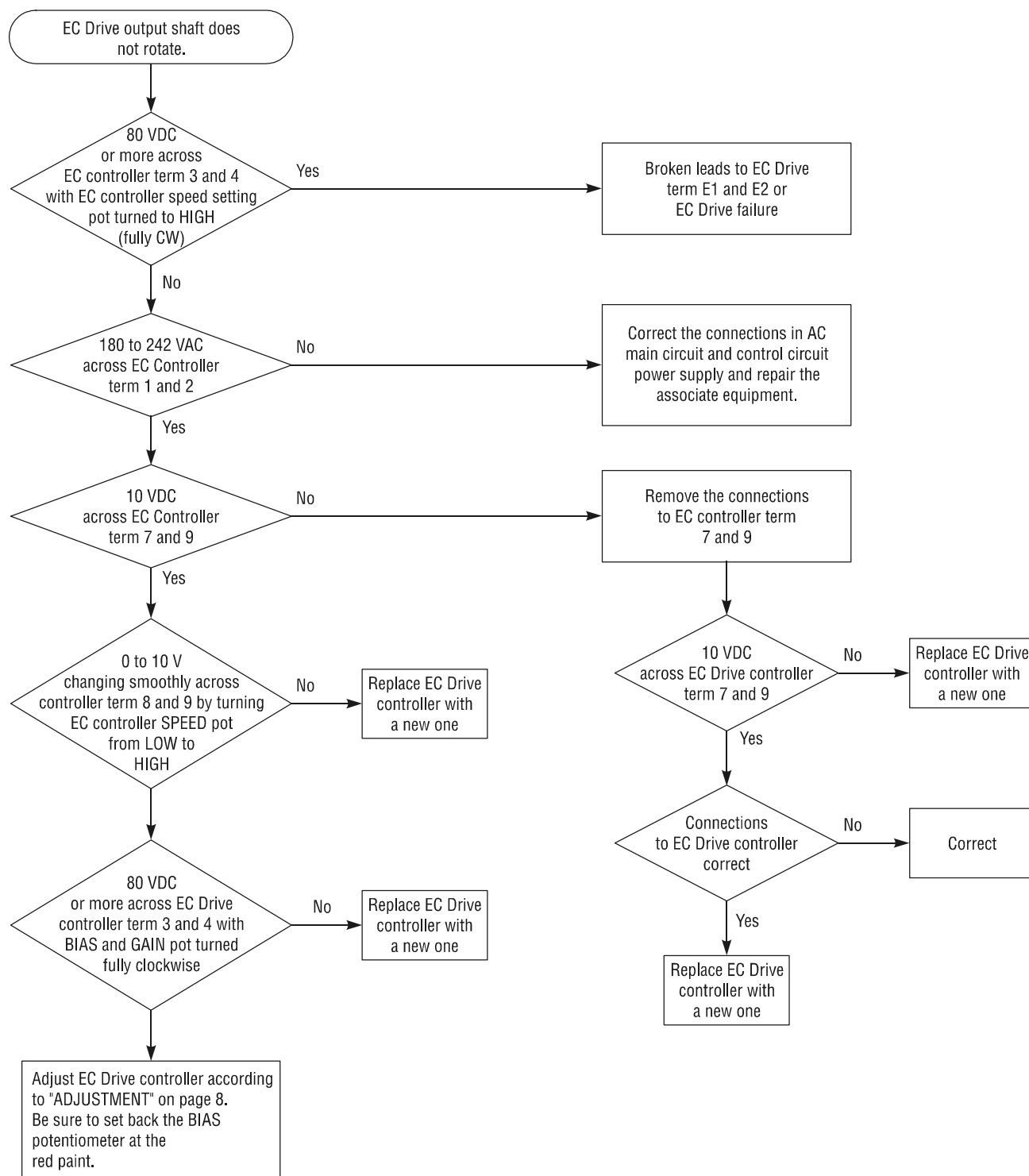


EC Drive Controller - Exploded View

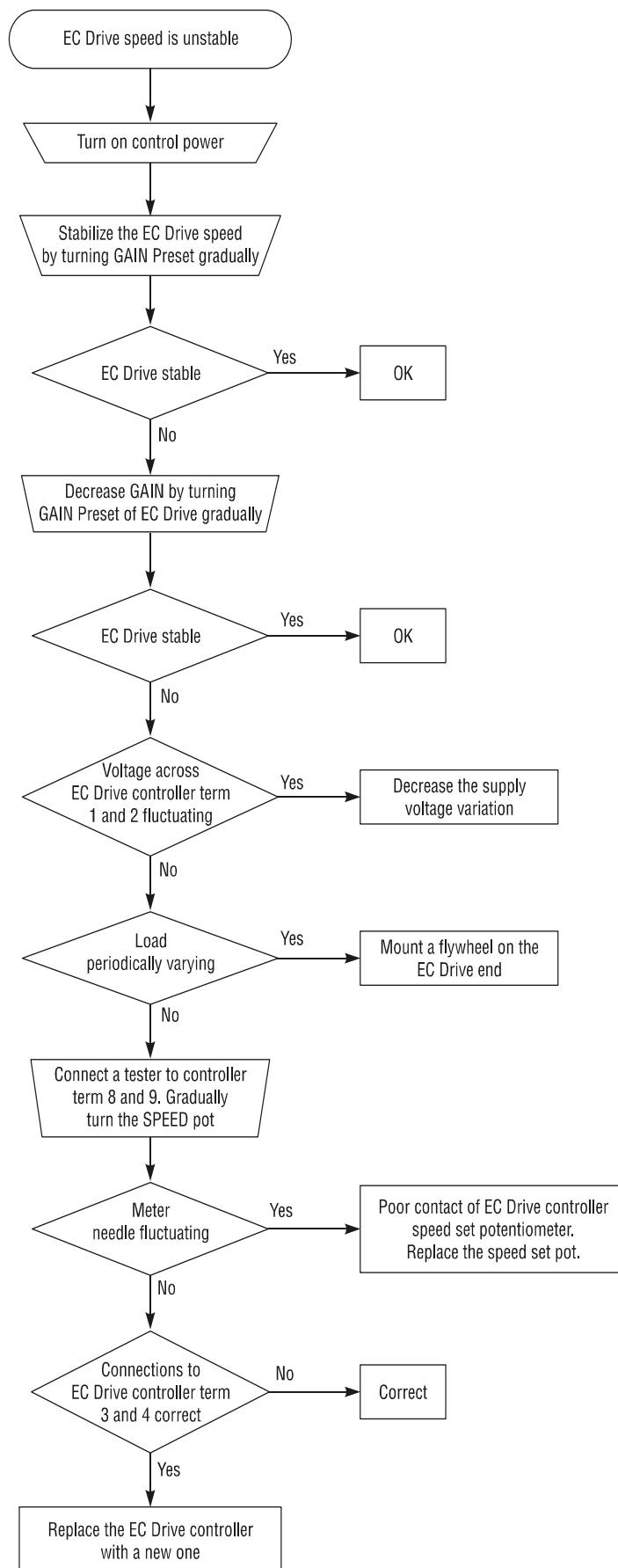


TROUBLES AND REMEDIES

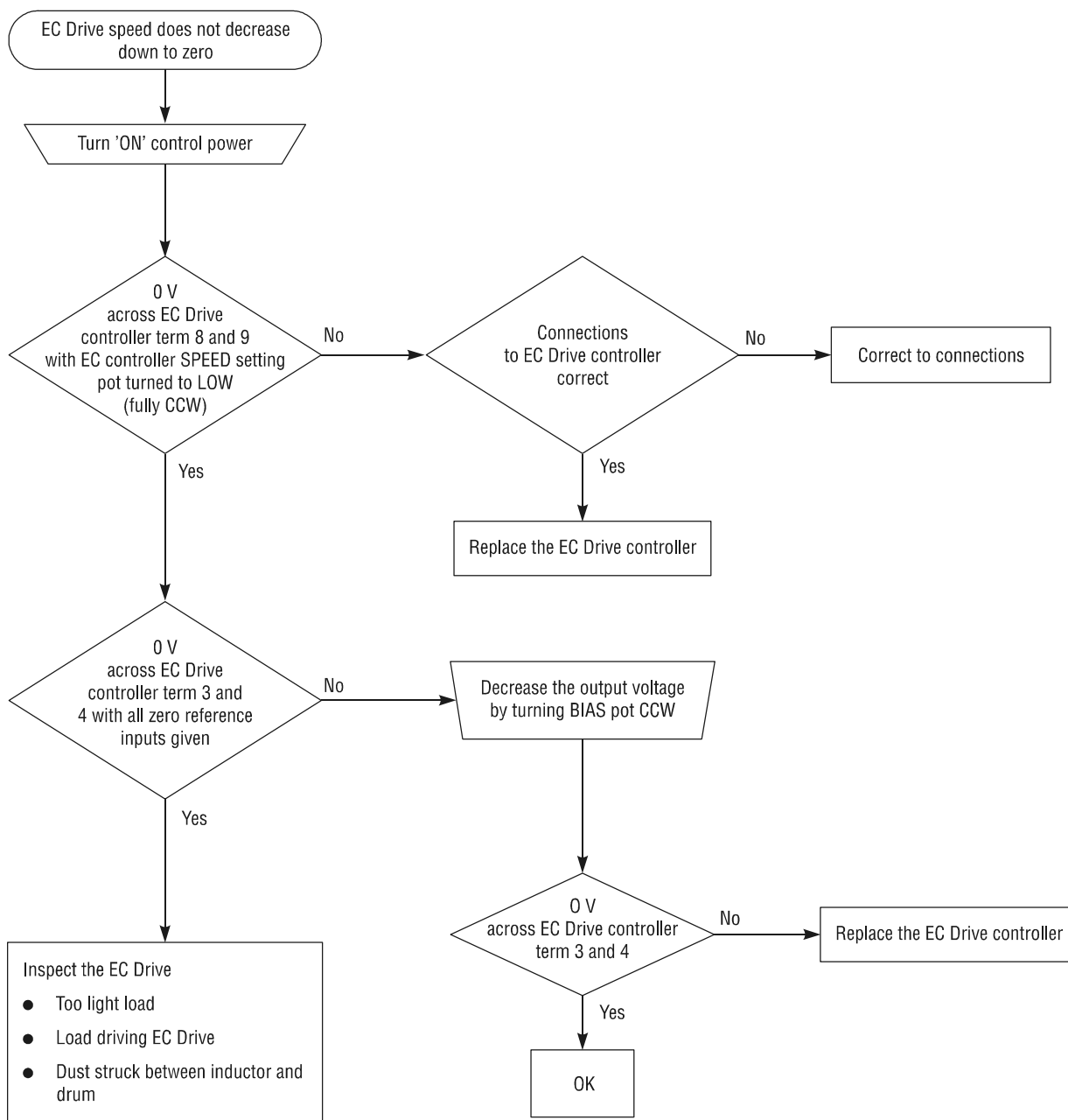












Incase of major fault, it is advisable to replace the controller and send to us for our prompt service. It is recommended to keep a standby Powermag Electronic Controller in critical applications to minimize down time.

Special Controllers

Powermag offers various range of Special Controllers in conjunction with EC Drive, to suit specific customer applications. For further details please visit our globalspace at www.powermagindia.com