efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

EMERSON
Industrial Automation

Equipment Manual

Series 2230 MKII

Single-Phase

Adjustable-Speed

Regenerative

DC Motor Controllers

(1/6 – 5 HP)

FINCOR

Control Techniques
3750 East Market Street
York, PA 17402-2798
717-751-4200, FAX 717-751-4263
www.fincor.net

BOOK 0960-B

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

BOOK 0960-B

EMERSON
Industrial Automation

SERIES 2230 MKII
SINGLE-PHASE
ADJUSTABLE-SPEED
REGENERATIVE
DC MOTOR CONTROLLERS
(1/6 - 5 HP)

FINCOR

Control Techniques
York Drive Center
3750 E Market Street
York, PA 17402-2798
USA

Tel 717.751.4200
Fax 717.751.4263

www.fincor.net

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

TABLE OF CONTENTS

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

LIST OF TABLES

LIST OF ILLUSTRATIONS

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

Blank Page

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

WARNING

The following must be strictly adhered to at all times.

1. **YOU AS THE OWNER OR OPERATOR OF FINCOR EQUIPMENT HAVE THE RESPONSIBILITY TO HAVE THE USERS OF THIS EQUIPMENT TRAINED IN ITS OPERATIONS AND WARNED OF ANY POTENTIAL HAZARDS OF SERIOUS INJURY.**

2. **THE DRIVE EQUIPMENT SHOULD BE INSTALLED, OPERATED, ADJUSTED, AND SERVICED ONLY BY QUALIFIED PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THE EQUIPMENT AND THE HAZARDS INVOLVED INCLUDING THOSE DESCRIBED BELOW. FAILURE TO OBSERVE THIS WARNING CAN RESULT IN PERSONAL INJURY, LOSS OF LIFE, AND PROPERTY DAMAGE.**

3. **THE NATIONAL ELECTRICAL CODE REQUIRES THAT AN AC LINE FUSED DISCONNECT OR CIRCUIT BREAKER BE PROVIDED IN THE AC INPUT POWER LINES TO THE CONTROLLER. THIS DISCONNECT MUST BE LOCATED WITHIN SIGHT OF THE CONTROLLER. DO NOT OPERATE THE CONTROLLER UNTIL THIS CODE REQUIREMENT HAS BEEN MET.**

4. **THE DRIVE EQUIPMENT IS AT AC LINE VOLTAGE WHENEVER AC POWER IS CONNECTED TO THE DRIVE EQUIPMENT. CONTACT WITH AN ELECTRICAL CONDUCTOR INSIDE THE DRIVE EQUIPMENT OR AC LINE DISCONNECT CAN CAUSE ELECTRIC SHOCK RESULTING IN PERSONAL INJURY OR LOSS OF LIFE.**

5. **BE SURE ALL AC POWER IS DISCONNECTED FROM THE DRIVE EQUIPMENT BEFORE TOUCHING ANY COMPONENT, WIRING, TERMINAL, OR ELECTRICAL CONNECTION IN THE DRIVE EQUIPMENT.**

6. **ALWAYS WEAR SAFETY GLASSES WHEN WORKING ON THE DRIVE EQUIPMENT.**

7. **DO NOT REMOVE OR INSERT CIRCUIT BOARDS, WIRES, OR CABLES WHILE AC POWER IS APPLIED TO THE DRIVE EQUIPMENT. FAILURE TO OBSERVE THIS WARNING CAN CAUSE DRIVE DAMAGE AND / OR PERSONAL INJURY.**

8. **ALL DRIVE EQUIPMENT ENCLOSURES, MOTOR FRAMES, AND REMOTE OPERATOR STATIONS MUST BE CONNECTED TO AN UNBROKEN COMMON GROUND CONDUCTOR. AN UNBROKEN GROUNDING CONDUCTOR MUST BE RUN FROM THE COMMON GROUND CONDUCTOR TO A GROUNDING ELECTRODE BURIED IN THE EARTH OR ATTACHED TO A PLANT GROUND. REFER TO THE NATIONAL ELECTRICAL CODE AND LOCAL CODES FOR GROUNDING REQUIREMENTS.**

9. **THE ATMOSPHERE SURROUNDING THE DRIVE EQUIPMENT MUST BE FREE OF COMBUSTIVE VAPORS, CHEMICAL FUMES, OIL VAPOR, AND ELECTRICALLY CONDUCTIVE OR CORROSIVE MATERIALS.**

10. **SOLID-STATE DEVICES IN THE CONTROLLER CAN BE DESTROYED OR DAMAGED BY STATIC ELECTRICITY. THEREFORE, PERSONNEL WORKING NEAR THESE STATICSENSITIVE DEVICES MUST BE APPROPRIATELY GROUNDED.**

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

SECTION I

GENERAL INFORMATION

INTRODUCTION

This manual contains installation, operation, and maintenance and repair instructions for Fincor Series 2230 MKII Single-Phase Adjustable-Speed Regenerative DC Motor Controllers. A parts list, ratings and specifications, and drawings are also included.

GENERAL DESCRIPTION

Series 2230 MKII Controllers statically convert AC line power to regulated DC for adjustable-speed armature control of shunt-wound and permanent-magnet motors.

Applications include those requiring controllable bi-directional torque for overhauling loads, contactor-less reversing, and position control.

Series 2230 MKII Controllers comply with applicable standards established by the National Electrical Code and NEMA for motor and industrial control equipment. The controllers are Underwriters Laboratories Listed (File No. E184521) UL/cUL.

MOTOR SELECTION

Series 2230 MKII Controllers control the operation of general purpose DC motors designed for use with solid-state rectified power supplies. The motor may be shunt-wound, stabilized shunt-wound, or permanent magnet. For maximum efficiency, the motor should be rated for operation from a NEMA Code K power supply.

DESCRIPTION OF OPERATION

Series 2230 MKII Regenerative Controllers, also known as four-quadrant controllers, not only control motor speed and direction of rotation, but also the direction of motor torque.

Referring to Figure 1, when the drive (controller and motor) is operating in Quadrants I and III, motor rotation and torque are in the same direction and the drive functions as a conventional non-regenerative drive. In Quadrants II and IV, motor torque opposes the direction of motor rotation, which results in controlled braking. The drive can switch rapidly from motoring to braking modes while simultaneously controlling the direction of motor rotation. Under braking conditions, the controllers convert the mechanical energy of the motor and connected load into electrical energy, which is returned (regenerated) to the AC power source.

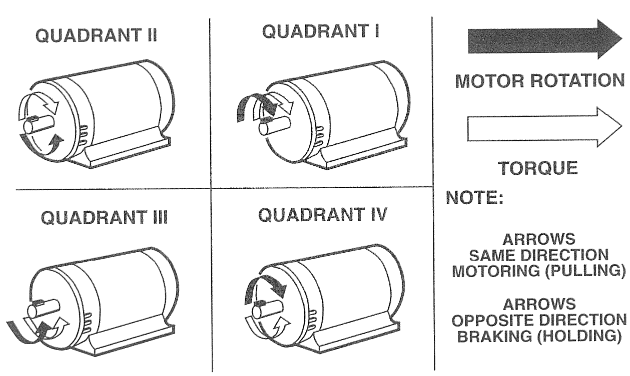

FIGURE 1. Four-Quadrant Operation

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

MODEL TYPES

TABLE 1. SERIES 2230 MKII MODEL MATRIX

MODEL	FUNCTION		CONFIGURATION		OPERATOR CONTROLS		POWER SOURCE[a] & HP RANGE	
	RUN/STOP JOG SWITCH[b]	ARMATURE CONTACT AND DB[c]	OPEN CHASSIS	ENCLOSED	LOCAL INTEGRAL	REMOTE	115V	230V
2231			X			X	1/6 -1	1/3 - 2
2231B		X	X			X		
2231P0				X		X		
2231P1	X			X	X			
2231BP0		X		X		X		
2231BP1	X	X		X	X			
2235			X			X		
2235B		X	X			X		
2232			X			X	1/6 - 1	1/3 - 3
2232B		X	X			X		
2236			X			X		
2236B		X	X			X		
2233			X			X	1/2 - 2	1 - 5
2233B		X	X			X		
2233P0				X		X		
2233P1	X			X	X			
2233BP0		X		X		X		
2233BP1	X	X		X	X			

a. Units are reconnectable
b. No armature contactor
c. Includes armature contactor

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

SECTION II

INSTALLATION

Before starting the installation, read this section thoroughly. In addition, a thorough review of the Ratings and Specifications (Section VI) is recommended. The following installation guidelines should be kept in mind when installing the controller.

INSTALLATION GUIDELINES

1. CONTROLLER MOUNTING - The controller may be mounted either vertically or horizontally. However, never mount the controller upside down, immediately beside or above heat generating equipment, or directly below water or steam pipes.

The controller must be mounted in a location free of vibration.

Multiple controllers may be mounted side by side, as close to each other as the mounting feet will allow.

The minimum clearance at the top and bottom of the controller may be as narrow as the conduit fittings allow.

2. ATMOSPHERE - The atmosphere surrounding the controller must be free of combustible vapors, chemical fumes, oil vapor, and electrically conductive or corrosive materials.

The air surrounding an enclosed controller must not exceed 40 degrees C (104 degrees F), and the air surrounding an open-chassis controller must not exceed 55 degrees C (131 degrees F). Minimum air temperature is 0 degree C (32 degrees F) for enclosed and open-chassis controllers.

3. CONTROLLER CONSTRUCTION - Enclosed controllers are totally enclosed, non-ventilated, and comply with NEMA Type 4 and 12 standards. There is an oil resistant synthetic rubber gasket between the cover and base. Those models with integral operator controls include flexible boots to seal the switches, and a seal for the MOTOR SPEED potentiometer.

Model 2235MKII and 2236MKII controllers are unenclosed open-chassis units with the printed wiring board mounted on an aluminum bracket.

The small controller base is made of die-cast aluminum with a powdered epoxy finish, and the cover is made of a die-cast aluminum alloy. The larger controller base is made of extruded aluminum and the cover is made of Noryl®, a strong engineering plastic with outstanding mechanical, thermal, and electrical properties.

4. LINE SUPPLY - The controller should not be connected to a line supply capable of supplying more than 5,000 amperes short-circuit current. Short-circuit current can be limited by using an input supply transformer of 50 KVA or less, or by using correctly sized current limiting fuses in the supply line ahead of the controller. Do not use a transformer with less than the minimum transformer KVA listed in Table 8, page 29.

If rated line voltage is not available, a line transformer will be required. If the line supply comes directly from a transformer, place a circuit breaker or disconnect switch between the transformer secondary and the controller. If power is switched in the transformer primary, transients may be generated which can damage the controller. See Table 8 (page 29) for minimum transformer KVA.
Do not use power factor correction capacitors on the supply line to the controller.

A 20 Joule metal oxide varistor (MOV) is connected across the controller terminals. If higher energy transients are present on the line supply, additional transient suppression will be required to limit transients to 150% of peak line voltage.

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

When a 115 VAC line supply is used, connect the white (common) wire to Terminal L2 and connect the remaining (hot) wire to Terminal L1.

5. ISOLATION TRANSFORMER - While not required, an isolation transformer can provide the following advantages:

a. Reduce the risk of personal injury if high voltage drive circuits are accidentally touched.

b. Provide a barrier to externally generated AC supply transients. This can prevent controller damage from abnormal line occurrences.

c. Reduce the potential for damaging current if the motor armature, motor field, or motor wiring becomes grounded.

6. GROUNDING - Connect the green or bare (ground) wire of the line supply to the ground screw located near the top conduit entry hole in the controller base. Then ground the controller base by connecting the ground screw to earth ground.

The motor frame and operator control stations must also be grounded.

Personal injury may occur if the controller, motor, and operator stations are not properly grounded.

7. WIRING PRACTICES - The power wiring must be sized to comply with the National Electrical Code, CSA, or local codes. Refer to the controller data label for line and motor current ratings.

Do not use solid wire.

Signal wiring refers to wiring for potentiometers, tachometer generators, and transducers. Control wiring refers to wiring for operator controls, e.g., switches and pushbuttons. Signal and control wiring may be run in a common conduit, but not in the same conduit as the power wiring. In an enclosure, signal and control wiring must be kept separated from power wiring and only cross at a 90 degree angle to reduce electrical noise.

If shielded wire (such as Alpha 2422 - two conductor, 2423 - three conductor, 2424 - four conductor) is used for the signal and control wiring, connect the shields to chassis ground (ground screw on the controller base) and tape the opposite ends of the shields. Twisted cable is also suitable for signal and control wiring.

The small base models provide two 3/4-14 NPT threaded holes for conduit entry, one each in the top and bottom of the controller.

The large base models provide two 3/4 inch conduit entry for the power in and out wiring, and one 1/2 inch conduit entry for signal wiring.

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

INSTALLING THE CONTROLLER

1. Remove the controller front cover (if used) by removing the four cover screws.

2. Check components in the controller for shipping damage. Report shipping damage to the carrier.

3. Check the controller and motor data labels to be sure the units are electrically compatible.

4. Be sure the controller has been calibrated correctly for the motor being used. The initial calibration is performed by changing the position of a Jumper J4 on the controller control board to comply with Table 2. To change the position of Jumper J4, pull the jumper from the control board and then push it onto the appropriate two pins on the board. Select the position closest, but not less then, the motor nameplate armature current rating. The final calibration can be fined tuned, if needed, by the current limit potentiometer. For the location of J4 and the current limit potentiometer, see Figure 20 (page 35).

TABLE 2. JUMPER J4 POSITION

JUMPER POSITION[a]	MOTOR ARMATURE CURRENT RATING (AMPERES)		
	2231 - 2235 2 HP Maximum	2232 - 2236 3 HP Maximum	2233 5 HP Maximum
100%	10	15	25
80%	8	12	20
60%	6	9	15
40%	4	6	10
20%	2	3	5

5. Check the positions of Jumpers J1, J2, and J3 on the control board. For the locations of J1, J2, and J3, see Figure 20, page 35. For a 230 VAC line supply and a 180V armature motor, Jumper J1 must be in the 230V position, and Jumpers J2 and J3 must be in the 180V position. For a 115 VAC line supply and a 90V armature motor, J1 must be in the 115V position, and J2 and J3 must be in the 90V position. To change the position of J1, J2, or J3 pull the jumper from the control board and then push it onto the appropriate pins on the board.

NOTE: If Option 1001 (Armature Contactor), or 1775 (Signal Interface) is to be installed in the controller, do not offset the five-position plug (supplied with the option) at Connector J1 on the control board. Do not confuse Connector J1 with Jumper J1. Refer to the Instruction Sheet (ISP0703, ISP0653, respectively) supplied with the option for connection instructions.

6. If the controller is to operate from a 50 Hz supply, set segment 6 of the DIP Switch (SW3) to the "OFF" position on the controller control board. For the location of DIP Switch SW3, see Figure 20, page 35.

7. The controller may be surface mounted or panel mounted as shown in Figure 1, page 7. Mount the controller. Mounting dimensions are shown in Figure 2, page 8.

8. Conduit entry is made by punching out the knockout at the top or bottom of the controller base. To prevent component damage from knockout fragments, apply masking tape to the inside of the knockout before punching.

9. Connect the power wiring to Terminals L1, L2, A1, A2, F+ and F-. Be sure to observe Installation Guidelines 4 and 7 on pages 3 and 4. If half-wave shunt field voltage is desired, connect one of the motor shunt field leads to Terminal L1 (see Table 12 on page 32).

Note: Low inductance motors require a full-wave field to prevent current instability.

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

10. If the controller contains any options that require external wiring, follow the wiring instructions in the instruction sheet supplied with the option.

11. If remote operator control wiring and/or signal wiring is required, connect the controller as shown in the appropriate connection diagram (Figures 3 through 18). Figures 3 through 9 show operator control connections, and Figures 10 through 18 show signal connections.

12. The controller can be programmed for various applications by throwing switches on dip switch SW3

TABLE 3. DIP SWITCH (SW3)

FACTORY DEFAULT SETTING IS UNDERLINED		
Switch Position		
1	<u>**ON**</u>	Selects anti-restart mode. Prevents controller from restarting automatically after an AC line power interruption.
	OFF	Disables anti-restart mode. Used for line starting applications (jumper TB2:9 to TB2:8 to enable drive).
2	<u>**ON**</u>	Selects internal Forward current (torque) reference pot.
	OFF	Selects use of an external Forward current (torque) reference pot. (Set internal Forward current limit pot at 100%)
3	ON	Adds ≈2% zero speed reference deadband to prevent motor creeping.
	<u>**OFF**</u>	No zero speed deadband; enabled drive may creep with zero speed reference
4	ON	Selects torque regulator mode.
	<u>**OFF**</u>	Selects speed regulator mode.
5	ON	Low voltage (3Vdc - 30Vdc) tachometer scaling
	<u>**OFF**</u>	High voltage (31 Vdc - 175Vdc) tachometer scaling.
6	<u>**ON**</u>	Selects 60Hz line input frequency.
	OFF	Selects 50Hz line input frequency.
7	<u>**ON**</u>	Selects internal Reverse current (torque) reference pot.
	OFF	Selects use of an external Reverse current (torque) reference pot. (Set internal Reverse current limit pot at 100%)

13. Install the controller cover, if used.

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

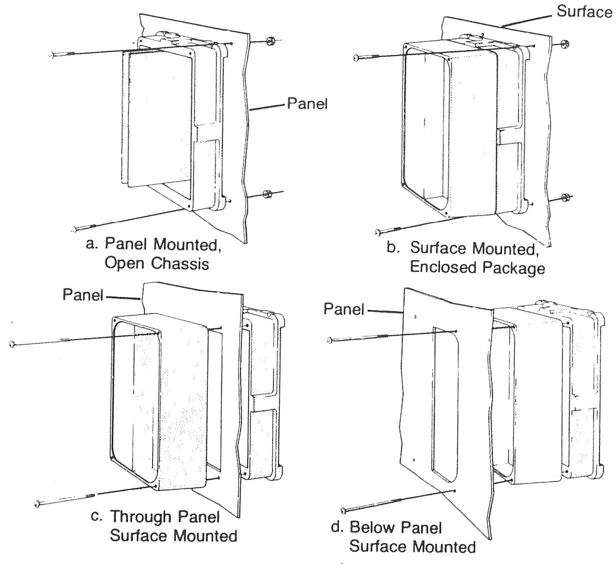

FIGURE 1. CONTROLLER MOUNTING CONFIGURATIONS

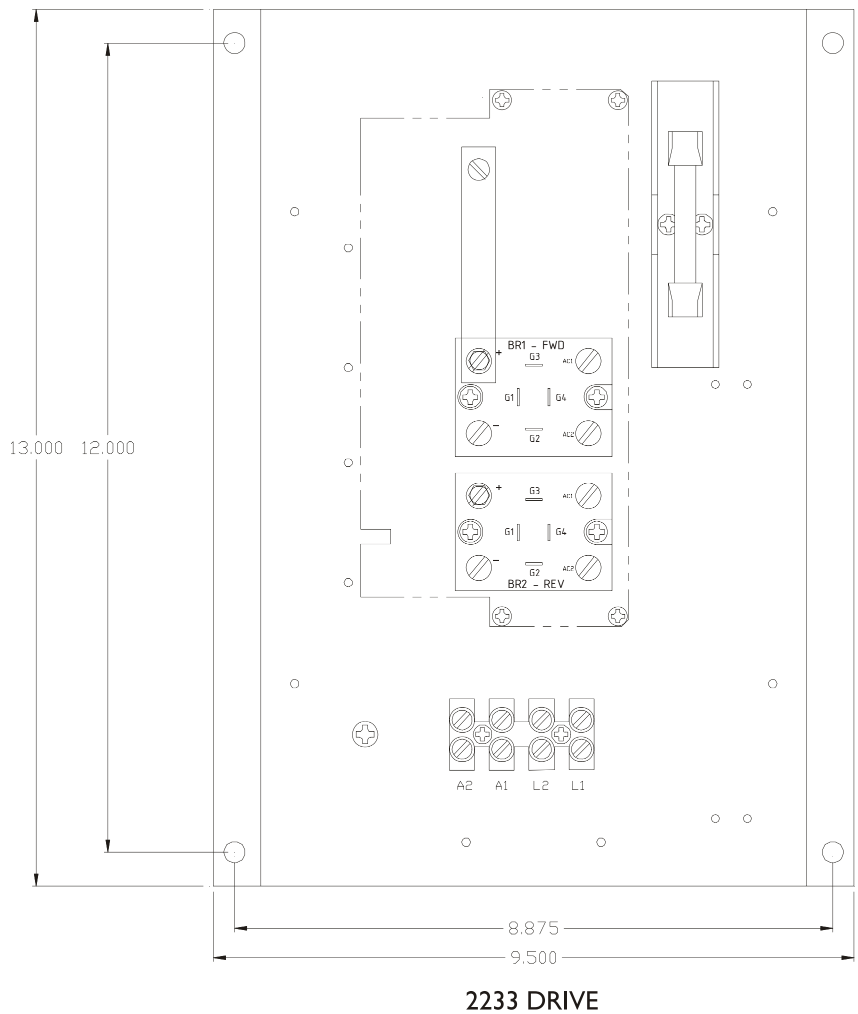

FIGURE 2. CONTROLLER MOUNTING DIMENSIONS

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

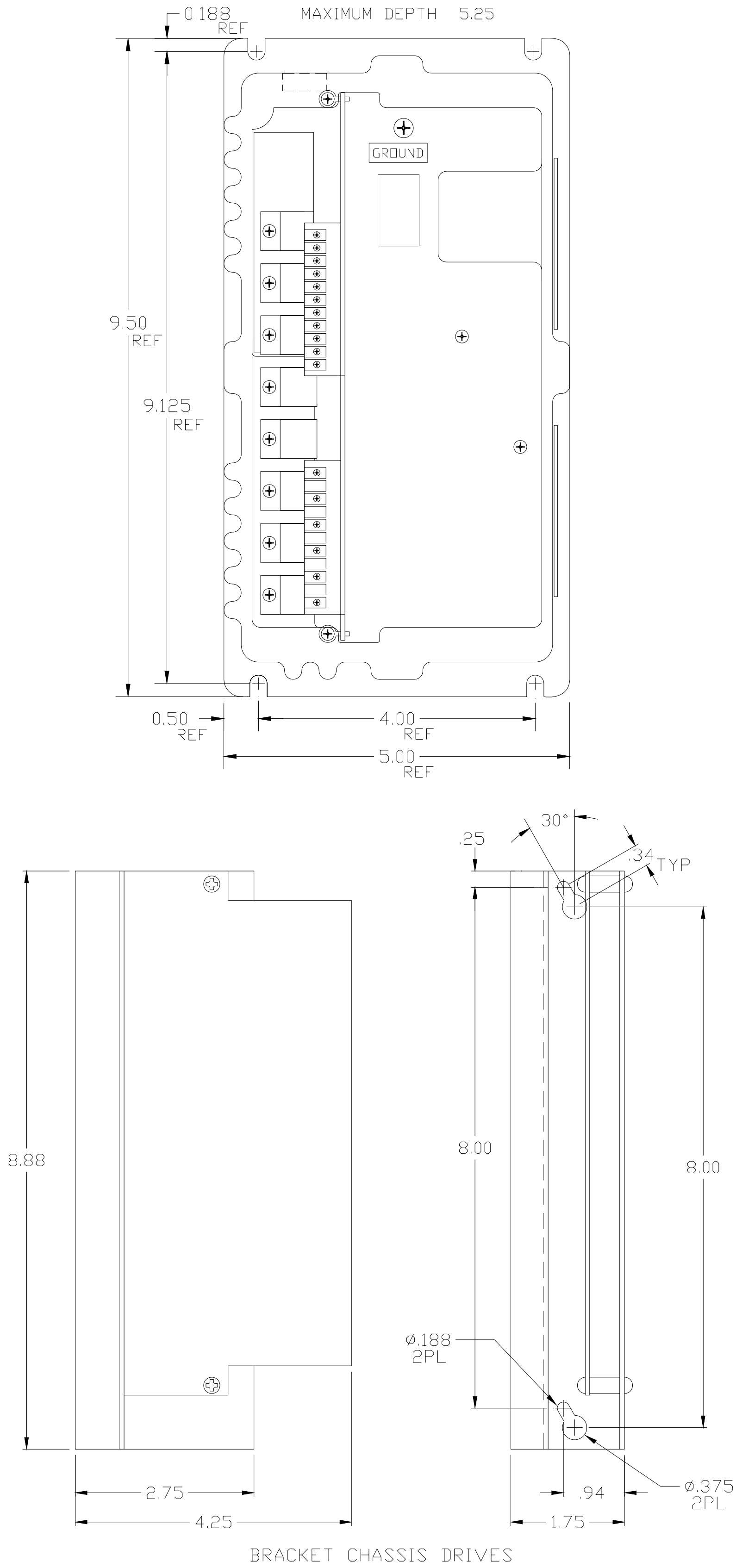

FIGURE 2. CONTROLLER MOUNTING DIMENSIONS

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

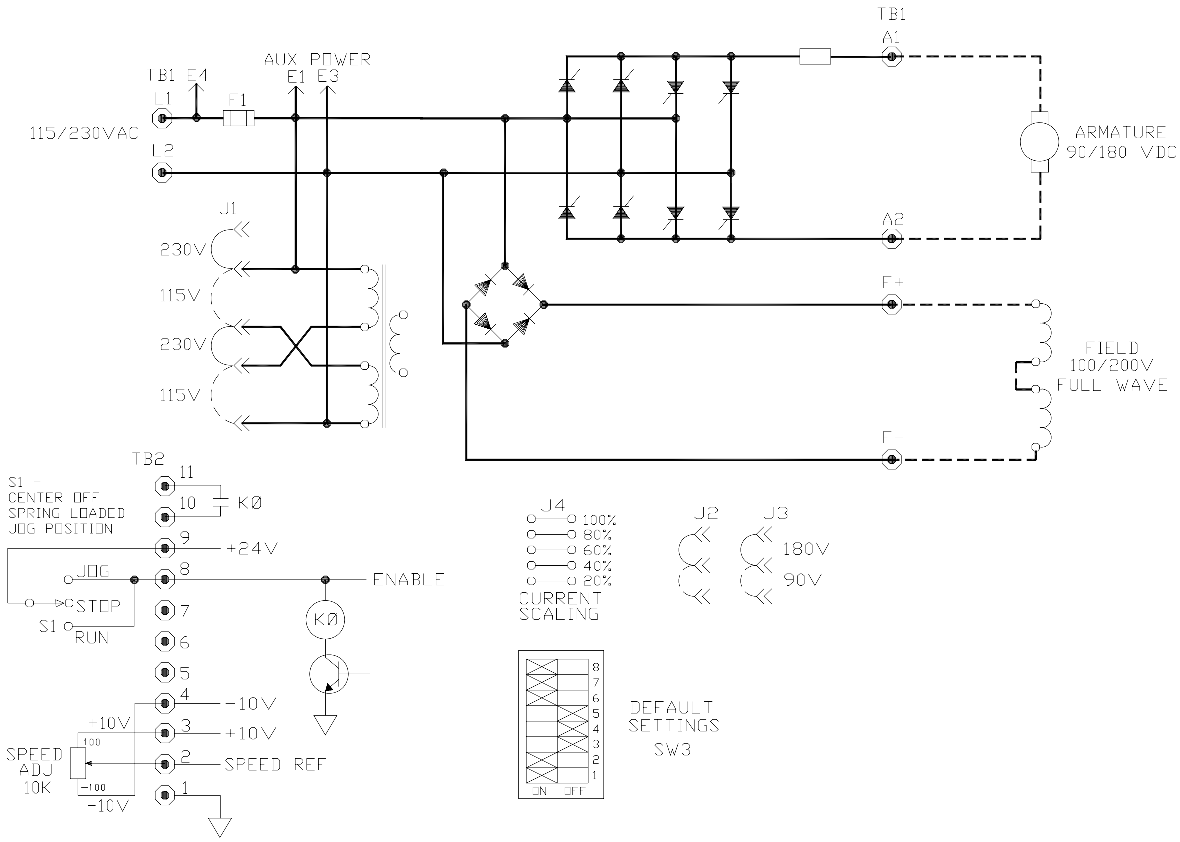

Figure 3. Logic connection diagram, Run-Stop-Jog Switch

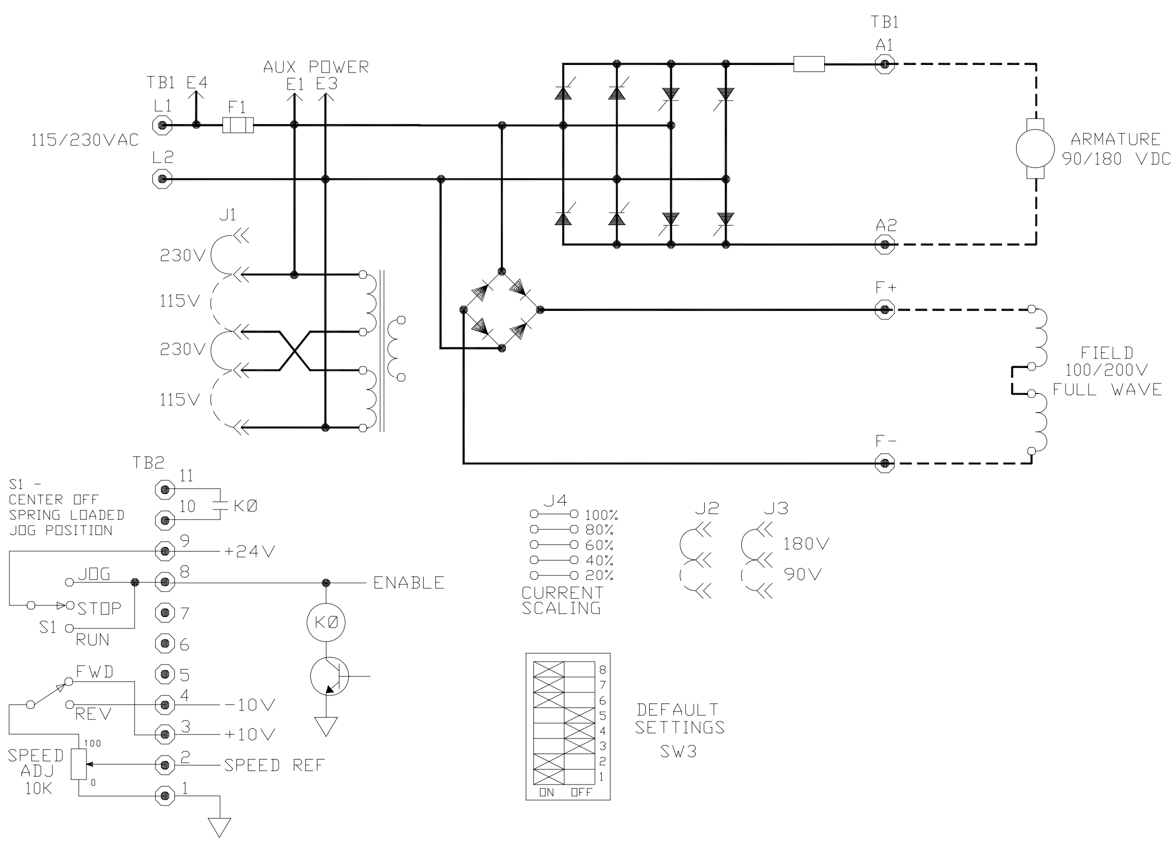

Figure 4. Logic connection diagram, Forward-Reverse Switch and Run-Stop-Jog Switch

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

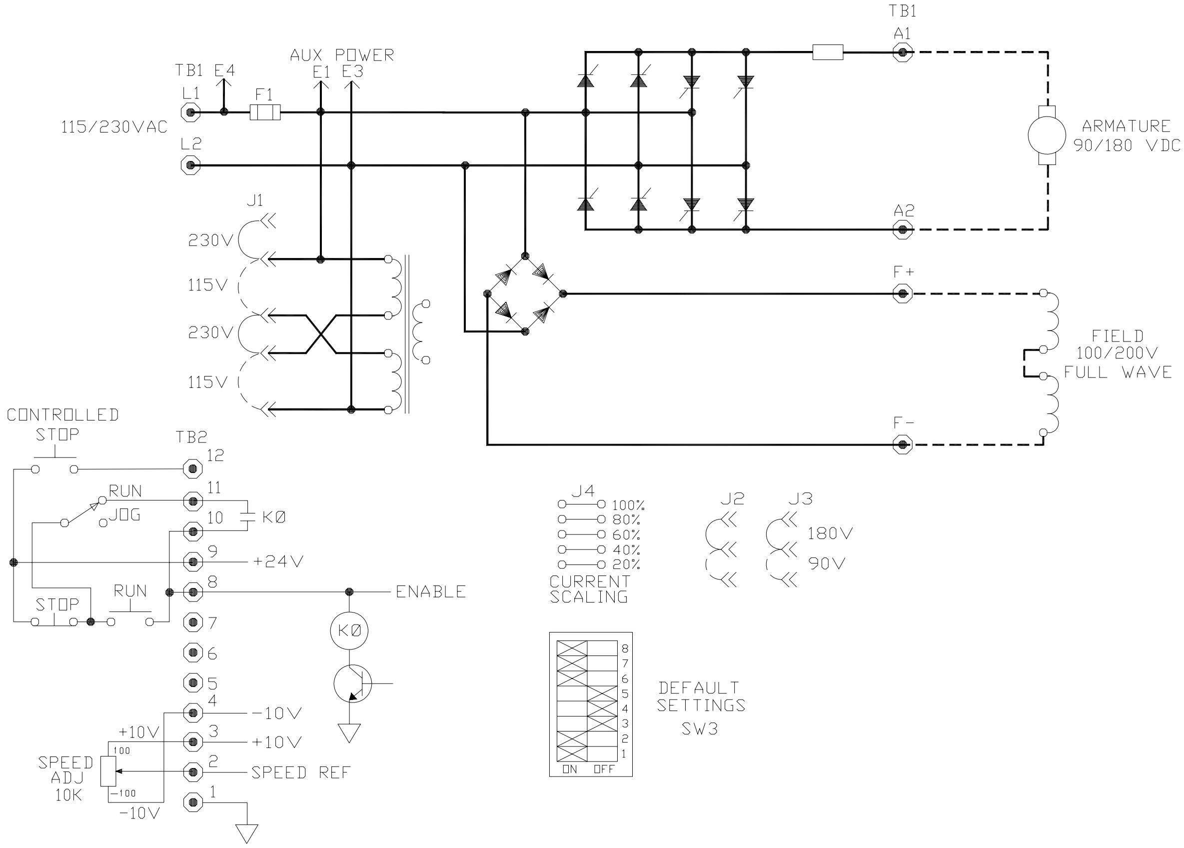

Figure 5. Logic connection diagram, Run-Stop Controlled Stop Pushbuttons and Run-Jog Switch

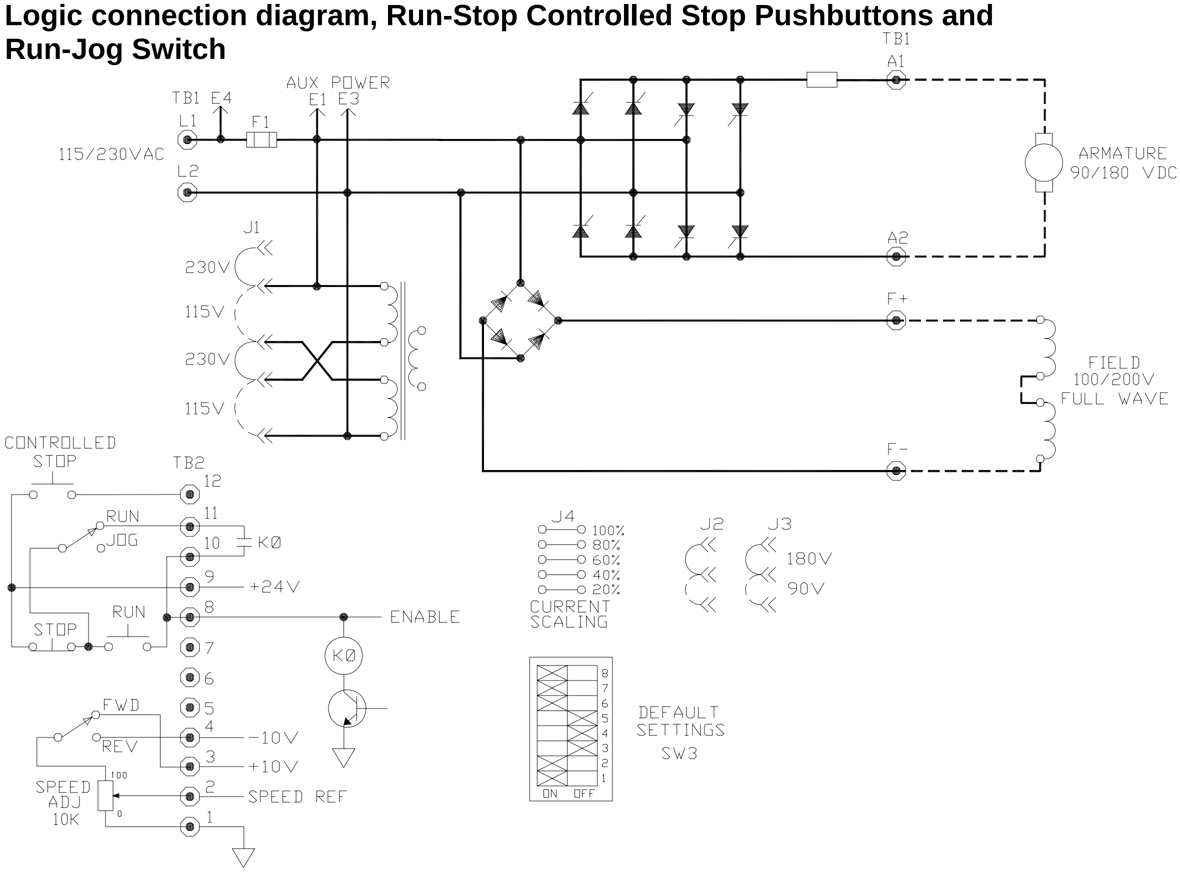

Figure 6. Logic connection diagram, Run-Stop-Controlled Stop Pushbuttons, Run-Jog Switch and Forward-Reverse Switch

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

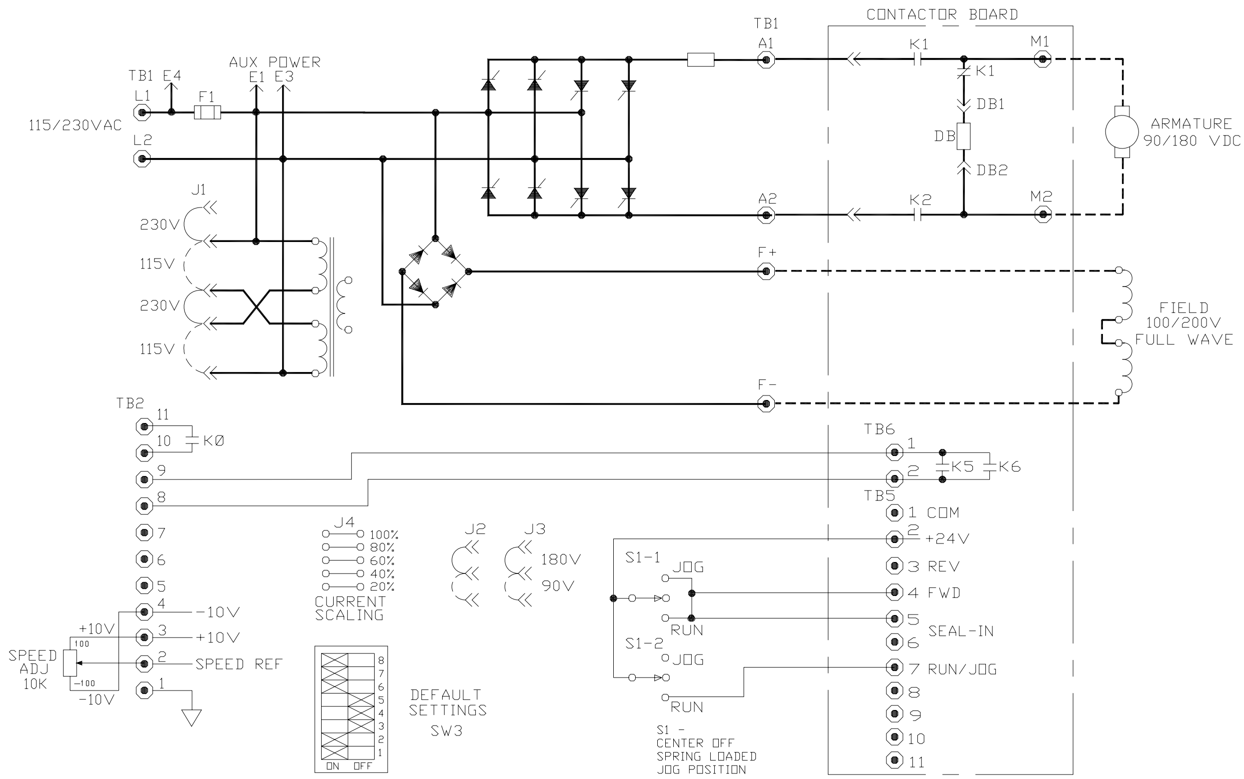

Figure 7. Logic connection diagram, Optional Contactor using Run-Stop-Jog Switch

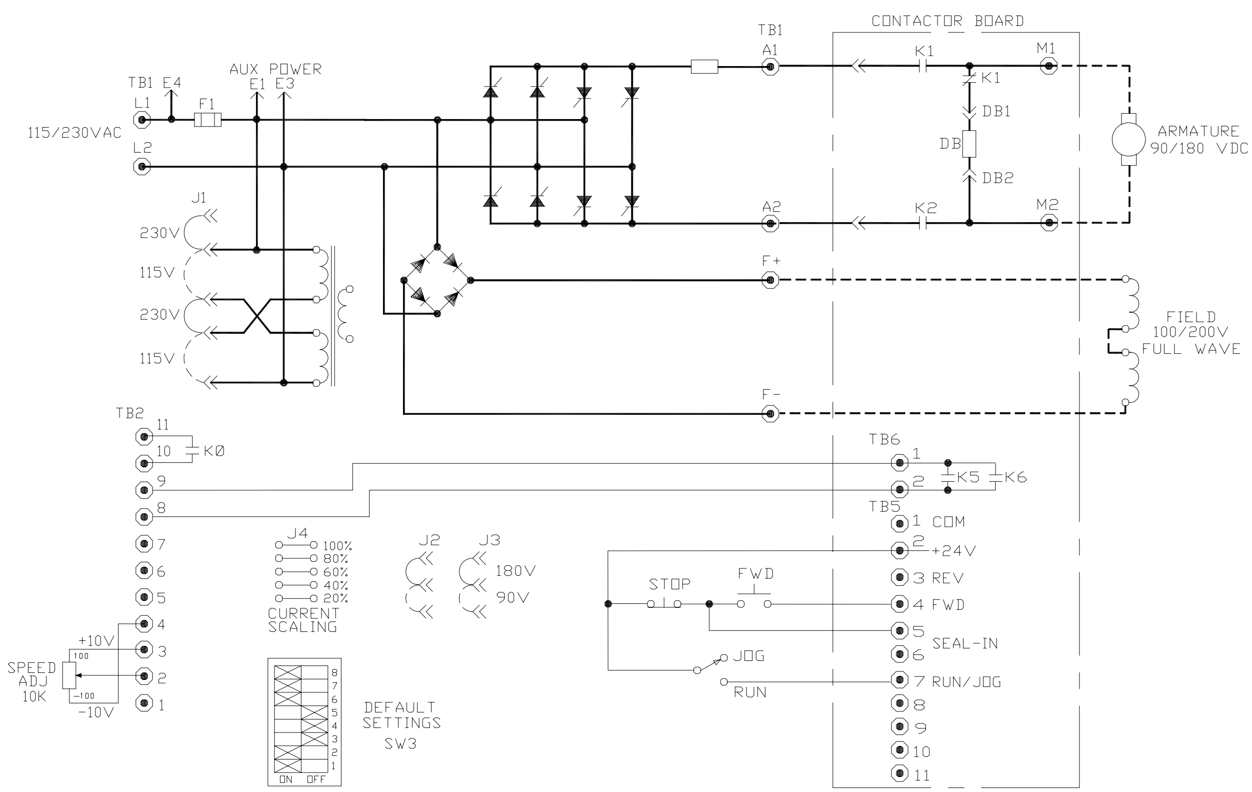

Figure 8. Logic connection diagram, Optional Contactor using Run-Stop Pushbuttons and Run-Jog Switch

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

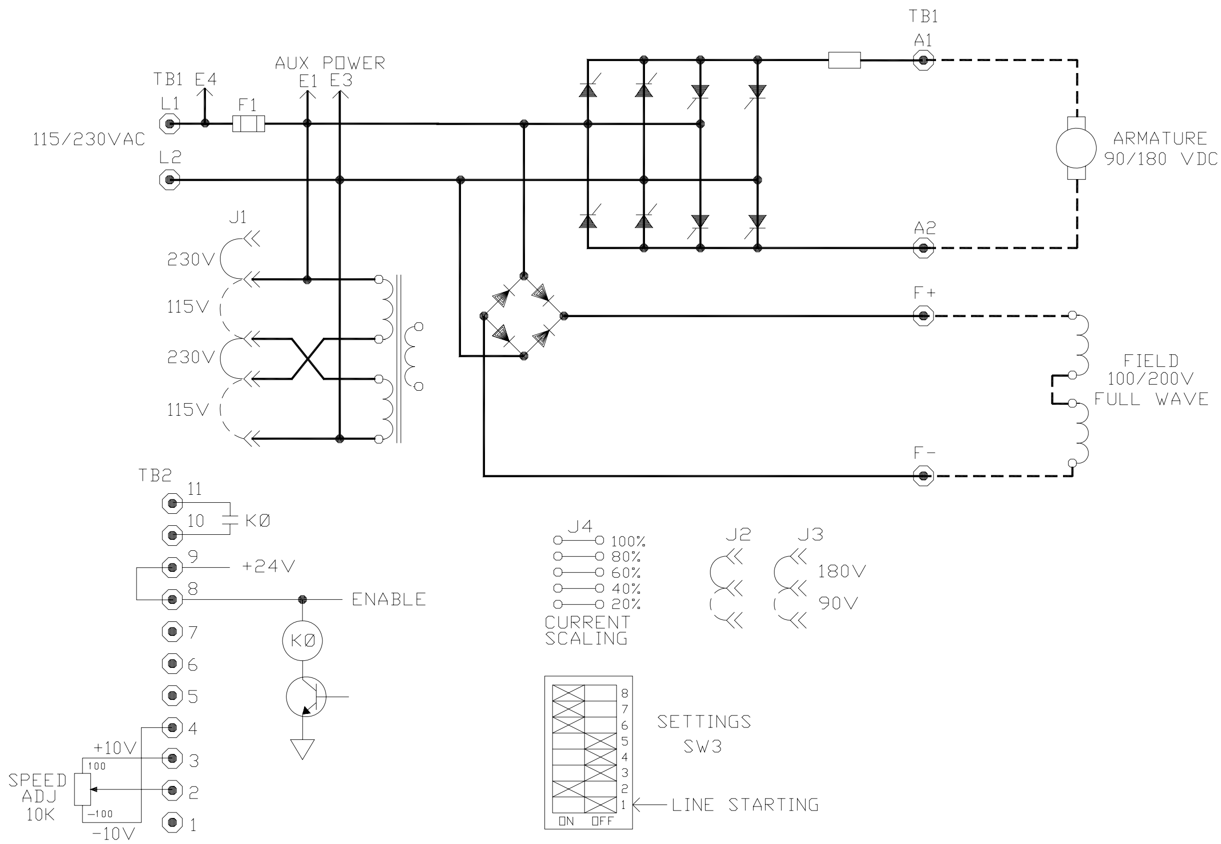

Figure 9. Logic connection diagram, Line Starting with Motor Speed Potentiometer

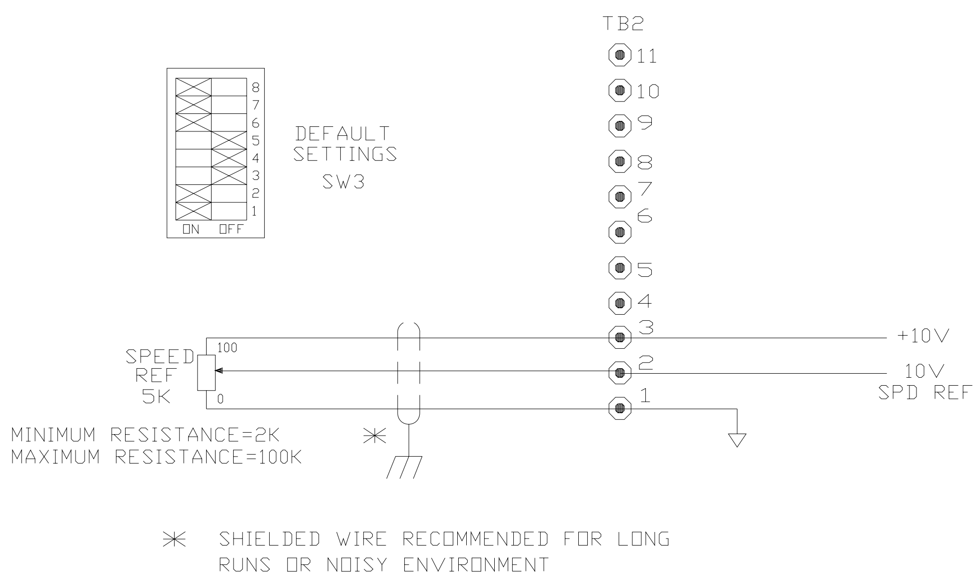

Figure 10. Signal Connection Diagram, Motor Speed Potentiometer, Unidirectional

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

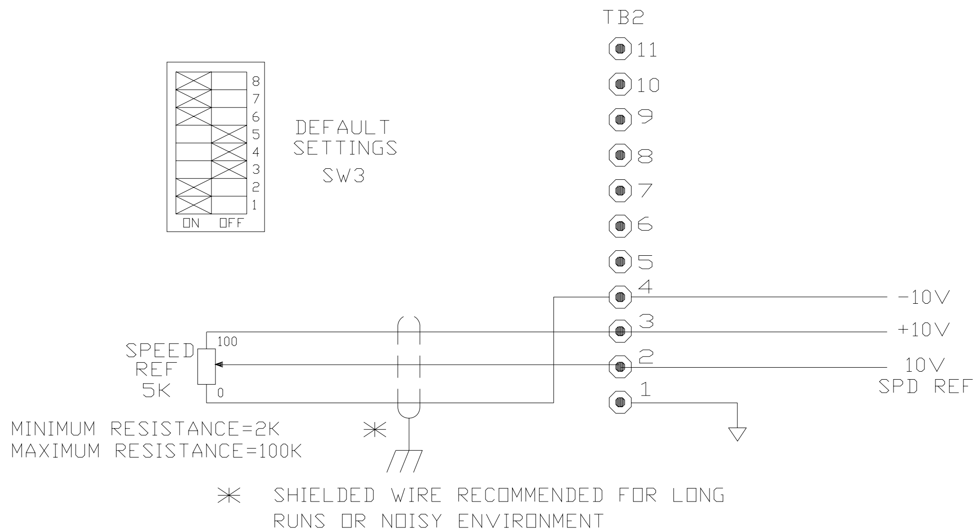

Figure 11. Signal Connection Diagram, Motor Speed Potentiometer, Bidirectional

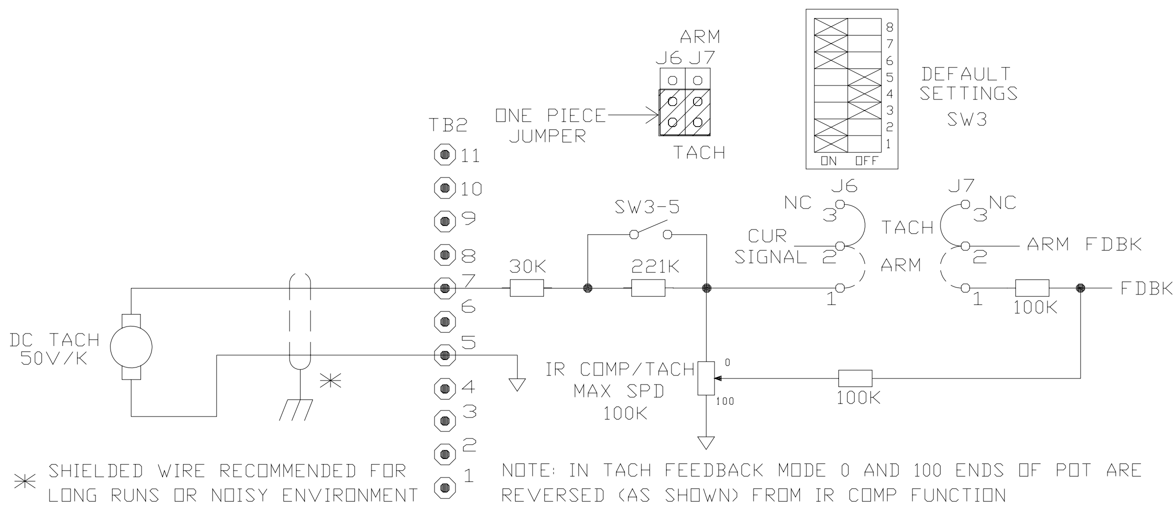

Figure 12. Signal Connection Diagram, Tachometer Feedback

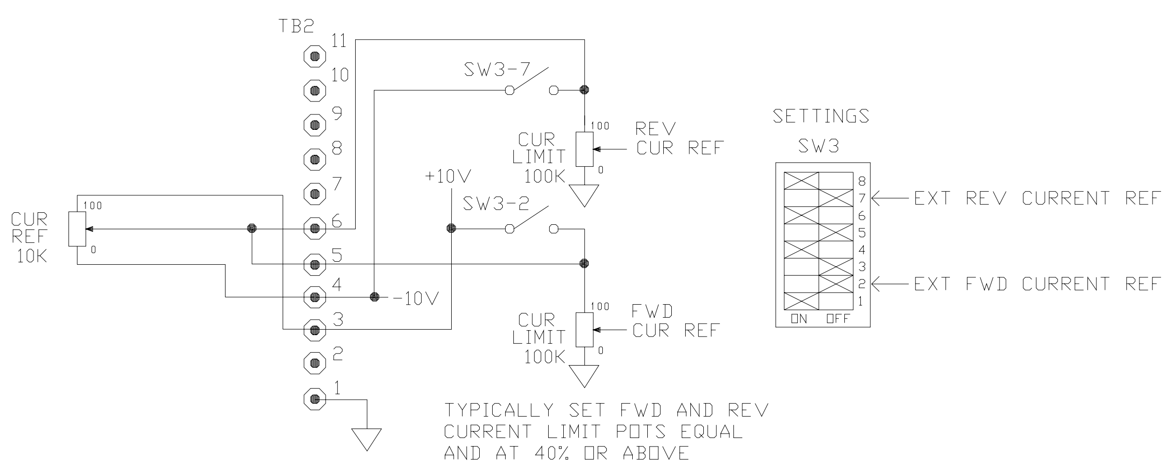

Figure 13. Signal Connection Diagram, External Current (Torque) Reference Potentiometer

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

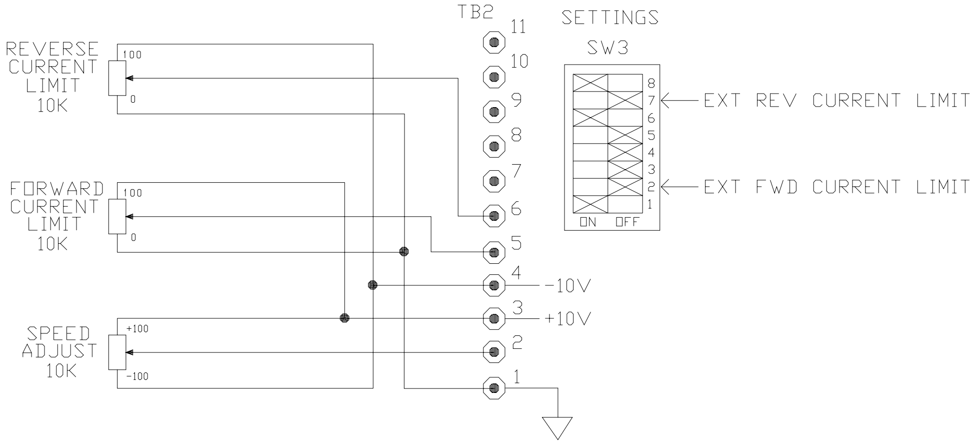

Figure 14. Signal Connection Diagram, External Current Limit Potentiometers

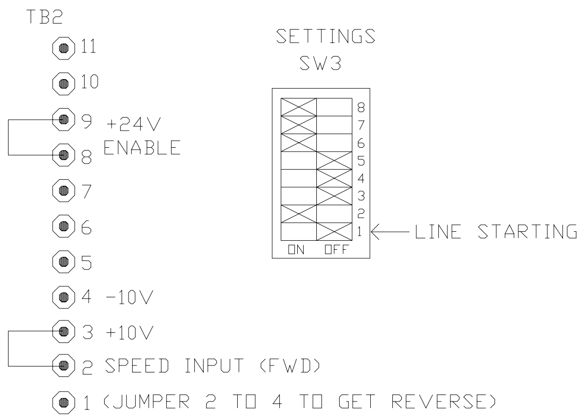

Figure 15. Signal Connection Diagram, Line Starting Without a Motor Speed Potentiometer

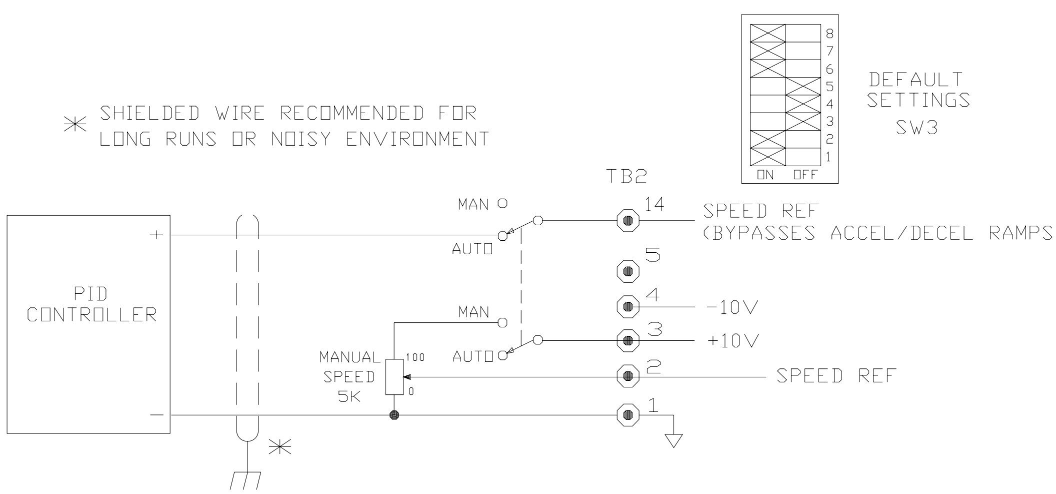

Figure 16. Signal Connection Diagram, External PID Controller input with Auto/Manual Switch

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

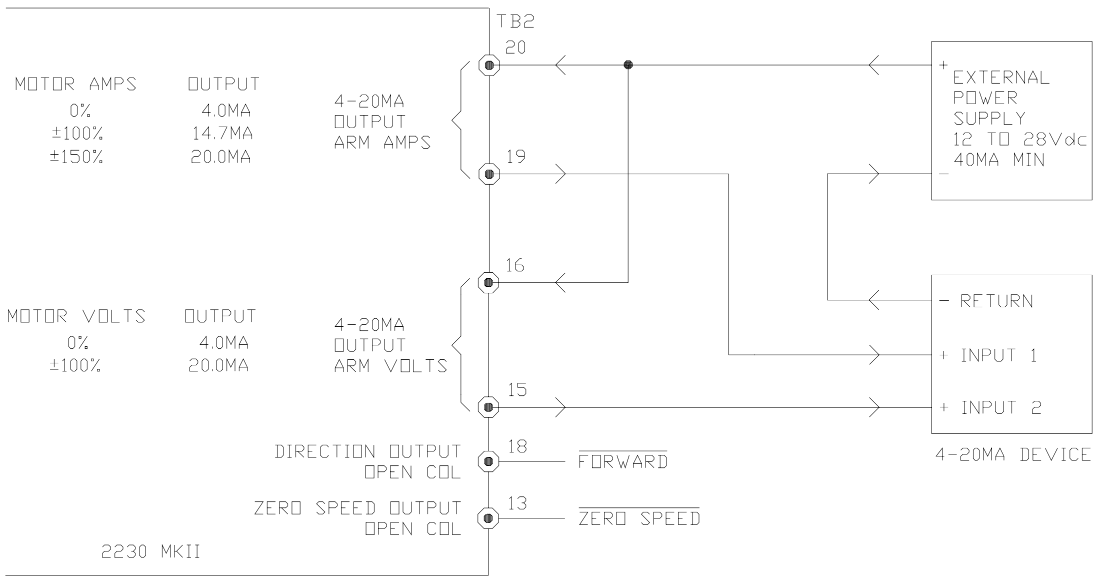

Figure 17. Signal Connection Diagram, 4-20mA Outputs – Armature Amps and Volts

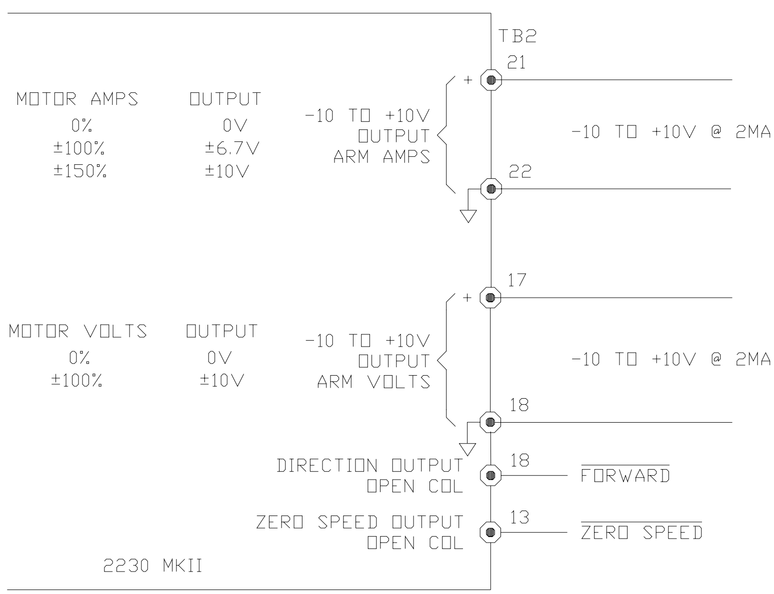

Figure 18. Signal Connection Diagram, 0 to ±10V Outputs – Armature Amps and Volts

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

INITIAL STARTUP

1. Open the controller cover (if used) by removing the four cover screws.

2. Be familiar with all options installed in the controller by reviewing the instruction sheets supplied with the options.

3. Be sure all wiring is correct and all wiring terminations are tightened securely.

4. Be sure the controller is calibrated correctly. See steps 4 and 5 under "Installing the Controller" on page 5. Be sure the AC supply voltage to the controller agrees with the controller data label.

6. The potentiometers in the controller are factory adjusted as shown in Table 4. These settings will provide satisfactory operation for most applications. If different settings are required, refer to "Adjustment Instructions" starting on page 21
.

TABLE 4. INITIAL POTENTIOMETER SETTINGS

POTENTIOMETER	SETTING	DESCRIPTION
ACCEL	1/3 Turn Clockwise	10 Seconds
DECEL	1/3 Turn Clockwise	10 Seconds
IR/TACH	Fully Counterclockwise (0%)	0% Boost
MAX SPD	3/4 Turn Clockwise	100% Speed
FWD CUR LMT	Fully Clockwise (100%)	150% Load
REV CUR LMT	Fully Clockwise (100%)	150% Load
SPD STAB	1/2 Turn Clockwise	Nominal Gain
FWD CUR STAB	1/2 Turn Clockwise	Nominal Gain
REV CUR STAB	1/2 Turn Clockwise	Nominal Gain

7. If the controller has a cover, place it on the controller and secure it with the four cover screws.

8. Turn-on the AC supply to the controller.

9. Check motor rotation, as follows:

   a. If a MOTOR SPEED potentiometer is used, turn it to zero on its dial. If an external signal is used for the speed reference, set it at minimum.

   b. If a RUN-STOP-JOG switch is used, place it in RUN position. Otherwise, initiate a Run command.

   c. Turn the MOTOR SPEED potentiometer clockwise or increase the speed reference signal, as applicable. To stop the motor, place the switch in STOP position or initiate a Stop command, as applicable.

If the motor rotates in the wrong direction, turn-off the AC supply to the controller, and then interchange the motor armature leads at the motor connection box or at the controller terminal board.

10. Refer to Section III, "Operation" for operating instructions on page 17.

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

SECTION III

OPERATION

POWER ON/OFF

To energize the drive, turn-on the AC supply voltage to the controller. When this occurs, the motor shunt field energizes with rated field voltage, and potentially hazardous voltage is present at the motor armature terminals. **These voltages can cause electric shock resulting in personal injury or loss of life.**

If the AC supply is interrupted, and the controller is **not** set up for line starting, the motor will not restart when the AC supply is restored until the controller is reset by initiating a Stop command and then a Start command. If the controller is set up for line starting, and the AC supply is interrupted, the motor will restart when the AC supply is restored, provided the external AC line contactor is pulled in.

RUN

If a RUN-STOP-JOG switch is used, place the switch in RUN position. Otherwise, initiate a Run command. A Run command will accelerate the motor to the setting of the MOTOR SPEED potentiometer or external speed reference signal, as applicable. The rate of acceleration is preset by the ACCEL potentiometer on the controller control board.

STOP

If a RUN-STOP-JOG switch is used, place the switch in STOP position. Otherwise, initiate a Stop command. A Stop command will stop the motor at a rate proportional to the stopping rate of the motor load.

If the controller has dynamic braking, the motor stopping time will be reduced. Dynamic braking provides exponential rate braking of the motor armature, which occurs when the circuit is opened between the controller and the motor armature, and one or more resistors connect across the motor armature.

The dynamic braking resistors provide initial braking torque and stops per minute as shown in Table 5.

CONTROLLED STOP

Controlled stop is designed to be used with pushbutton (momentary) control, and should always include an emergency stop (coast) pushbutton to guarantee removal of the +24V control voltage from the enable input (TB2:8). When a controlled stop is initiated by momentarily applying +24V to TB2:12 input, the drive will decelerate the motor from set speed to zero speed at the Decel pot setting rate, and then drop out run relay K0 at zero speed (≈2% or less), determined by armature voltage. Note that if an overhauling load continues to rotate the motor above ≈2% speed, the zero speed detection circuit will not drop out K0.

ZERO SPEED DETECTION

The zero speed detection circuit used for controlled stop is also buffered and brought out to TB2:13 for use as an active low Zero Speed Output function (≈2% or less). The output is rated at 60V and 50ma @100°C, sufficient for switching 24Vdc loads (although the drive +24V power supply cannot supply this much customer current; it must be customer supplied).

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

TABLE 5. DYNAMIC BRAKING CHARACTERISTICS[a]

COMPONENT	MODEL	RATED VOLTAGE	RATED HORSEPOWER									
			1/6	1/4	1/3	1/2	3/4	1	1-1/2	2	3	5
BRAKING TORQUE (%)	2231 2235	115V	180	129	103	66	44	34	NA	NA	NA	NA
		230V	NA	NA	400	278	190	130	88	62	NA	NA
	2232 2233	115V	300	215	170	110	75	60	NA	NA	NA	NA
		230V	NA	NA	NA	400	320	220	145	105	85	96
STOPS PER MINUTE	2231 2235	115V	15	12	11	8	6	2	NA	NA	NA	NA
		230V	NA	NA	12	8	6	1	1	1	NA	NA
	2232 2233	115V	9	6	5	5	4	4	NA	NA	NA	NA
		230V	NA	NA	NA	5	4	4	3	3	2	2

a. HIGH INERTIA LOADS MAY EXTEND BRAKING TIME AND CAUSE THE WATTAGE RATING OF THE DYNAMIC BRAKING RESISTORS TO BE EXCEEDED.

An antiplug feature is included with optional Dynamic Braking. This feature prevents restarting the motor before the motor has braked to a stop.

SPEED CONTROL

Set Dip Switch SW3 position 4 to “OFF” (factory default). Motor speed is directly proportional to the setting of the MOTOR SPEED potentiometer or the magnitude of an external speed reference signal, as applicable. This potentiometer or the speed reference signal may be adjusted while the motor is running or may be preset before the motor is started.

The rates of acceleration and deceleration are preset by the ACCEL and DECEL potentiometers, respectively, located on the controller control board.

Maximum speed is preset by the MAX SPD potentiometer, located on the control board.

TORQUE CONTROL

Set Dip Switch SW3 position 4 to “ON”. Motor torque is directly proportional to the setting of the Forward and Reverse Current Limit potentiometers. A single torque reference input for an external torque signal or an external torque potentiometer may be set up by setting Dip Switch SW3 positions 2 and 7 to “OFF” and connecting the external torque signal to TB2 positions 5 and 6, or connecting an External Torque Reference potentiometer as shown in Figure 13 on page 13 . The internal Forward and Reverse current limit pots should be typically set at 100%, or can be used to trim the external Torque reference differently for Forward and Reverse torque (note, do not set either internal potentiometer below ≈40%).

The external Torque potentiometer or the current reference signal may be adjusted while the motor is running or may be preset before the motor is started. Note that setting SW3 position 4 “ON” to select Torque Mode saturates the Speed Amplifier in the forward direction (A1 positive) and if the process demands less torque then the torque reference is commanding, motor speed will continue to increase up to maximum speed as set by the Max Speed potentiometer.

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

JOG

If a RUN-STOP-JOG switch is used, place the switch in JOG position. Otherwise initiate a Jog command. Jog is momentary, causing motor rotation only while the switch is held in JOG position or while a Jog command is active. Release the switch to stop the motor.

Normally, jog speed is directly proportional to the setting of the MOTOR SPEED potentiometer. If a separate JOG SPEED potentiometer is used, jog speed will be directly proportional to the setting of the JOG SPEED potentiometer.

REVERSE

When a bidirectional (zero center) MOTOR SPEED potentiometer is used, turning it in one direction past zero rotates the motor in a particular rotating direction at a speed directly proportional to the potentiometer setting. Turning the potentiometer in the opposite direction past zero rotates the motor in the opposite direction at a speed directly proportional to the potentiometer setting. If the motor is running when the potentiometer is turned in the opposite direction, the motor will first brake to a stop by means of regenerative braking before reversing rotation. When the potentiometer is in the center (zero) position, motor speed is zero. Note that motor may creep and if true zero speed is desired, enable Deadband by setting SW3 position 3 to "ON".

The rates of acceleration and deceleration (braking) are preset by the ACCEL and DECEL potentiometers, respectively, located on the controller control board.

Maximum speed is preset by the MAX SPD potentiometer, located on the control board. Forward and reverse maximum speeds are identical.

ARMATURE VOLTAGE AND CURRENT OUTPUTS

In DC motors, armature voltage and armature current correspond to motor speed and motor load respectively. The drive armature voltage and current feedback signals are isolated, scaled, filtered, and buffered for use as output signals to other customer equipment such as follower and ratio applications or driving indicating meters, etc.

Armature voltage is converted to a 0 to ±10Vdc (@2ma) output at TB2:17 and to a general purpose two-wire 4 to 20ma at TB2:15 and 16.

Armature current is converted to a 0 to ±10Vdc (@2ma) output at TB2:21 and to a general purpose two-wire 4 to 20ma at TB2:19 and 20.

The voltage outputs are bipolar and are positive (+10V @ 100% speed) for the forward direction (A1 positive) and negative (-10V @ 100% speed) for the reverse direction (A1 negative).

The 4 to 20ma outputs are unipolar for either polarity of motor output voltage or current with the Direction Output available to indicate polarity, if needed. Note that 20ma equals 150% of rated motor output current, therefore, nominal 100% motor load current equals 14.7ma.

Also note that diode arrays make the 4 to 20ma outputs insensitive to the external power supply polarity. The 4 to 20ma outputs must be external loop powered (≈8min to 36Vmax).

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

LOAD MONITOR

UL approved as a motor protection device. The threshold for inverse timed overload will not exceed 120% of rated current and will shut down the drive (drop out K0) in about 60 seconds at 150% load current. The drive may be reset by cycling the enable line, or cycling input line power. Note that the timing capacitor is not reset by this, and that if the drive is immediately restarted into an overload, it will not take the full time to trip.

DIRECTION OUTPUT

The internal FORWARD direction command is buffered and brought out to TB2:18 for use as an active low output function. The output will be active low whenever running in the forward direction and off when running in the reverse direction. The output is rated at 60V and 50ma @100°C, sufficient for switching 24Vdc loads (although the drive +24V power supply cannot supply this much customer current; it must be customer supplied).

SPEED REGULATOR INPUT

The internal speed regulator input node is brought out to TB2:14 for typical use as an input from an external PID process controller. This input bypasses the accel/decel ramps to provide quicker response then using the standard speed reference input.

INOPERATIVE MOTOR

If the motor stops and/or won't start, turn-off the AC supply to the controller, remove the controller cover (if used), and check the AC line fuse on the controller control board. For the location of the fuse, see Figure 20 or 21, page 35/36. If the fuse is blown, refer to the Troubleshooting Table (Table 6).

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

SECTION IV

MAINTENANCE AND REPAIR

GENERAL

1. Keep the controller dry and free of dust, dirt, and debris. No parts require periodic replacement.

2. Periodically turn-off the AC line supply to the controller and check all wire terminations to be sure they are tight.

3. Visually check components for damage due to overheating or breakage. All damaged and/or faulty components must be replaced for satisfactory operation.

4. Maintain the motor according to maintenance instructions supplied by the motor manufacturer.

ADJUSTMENT INSTRUCTIONS

ACCELERATION

1. Set the MOTOR SPEED potentiometer at 100% or the external speed reference signal at maximum, as applicable.

2. Initiate a Run command and observe the time required for the motor to reach maximum speed.

3. Adjust the ACCEL potentiometer for the desired rate. Full counter clockwise rotation is the fastest acceleration (0.1 second), and full clockwise rotation is the slowest acceleration (30 seconds).

DECELERATION

1. With the motor running at maximum speed, quickly reset the MOTOR SPEED potentiometer to zero, or quickly decrease the speed reference signal to minimum, as applicable, and observe the time required for the motor to reach minimum speed.

2. Adjust the DECEL potentiometer for the desired rate. Full counter clockwise rotation is the fastest deceleration (0.1 second), and full clockwise rotation is the slowest deceleration (30 seconds).

IR COMPENSATION

IR compensation is used only for armature feedback. The IR/COMP potentiometer is factory set at zero (full counterclockwise rotation) for satisfactory operation with most motors. If improved speed regulation is desired, readjust IR compensation as follows:

1. If the motor is shunt-wound, run it at rated base speed. If the motor is a permanent-magnet type, run it at about 1/3 speed.

2. Turn the IR/COMP potentiometer clockwise *slowly* until motor speed becomes unstable.
Then turn the potentiometer counterclockwise until motor speed stabilizes.

MAXIMUM SPEED

The MAX SPD potentiometer is factory set to provide 90 VDC armature voltage with a 115 VAC line, or 180 VDC armature voltage with a 230 VAC line.

To readjust maximum speed, run the motor at maximum speed and adjust the MAX SPD potentiometer for the desired maximum speed.

NOTE: If the MAX SPD potentiometer is turned too far counterclockwise, speed instability may occur.

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

CURRENT LIMIT

1. Turn the FWD CUR LMT and REV CUR LMT potentiometers fully clockwise (100%) to limit motor armature current at 150% of rated (factory default).

2. Turn the FWD CUR LMT and REV CUR LMT potentiometers counterclockwise as required to reduce maximum motor armature current.

Notes:

a. The GREEN power on LED indicator will change to RED whenever the controller is limiting (or regulating) current to the motor.

b. External 10K ohm Current (Torque) Limit potentiometers can be used as shown in Figure 14 on page 14. If an external Forward Current (Torque) Limit potentiometer is desired, Segment 2 of DIP Switch SW3 must be in "OFF" (open position). If an external Reverse Current (Torque) Limit potentiometer is desired, Segment 7 of DIP Switch SW3 must be in "OFF" (open position).

SPEED AND CURRENT STABILITY

Potentiometer R152 (VOLTSTAB) provides gain adjustment to the speed (voltage) amplifier while potentiometers R153 (F CURSTAB) and R154 (R CURSTAB) provide gain adjustments to the torque (current) amplifiers. An increase in gain (clockwise) speeds up response, although excessive gain may cause unstable speed or vibrations, while a decrease in gain (counterclockwise) will slow down or delay the response, which may be needed for some processes. Best response for a given process can be achieved while monitoring the armature voltage and current output signals at TB2 17 and 21 respectively with an oscilloscope and making adjustments to minimize overshoot and undershoot while commanding speed or torque changes.

TACHOMETER FEEDBACK SETUP

1. Before connecting or configuring tachometer feedback, follow the instructions to install and perform initial startup, then run drive with maximum input speed reference and adjust the MAX SPEED potentiometer (R10b) for the desired maximum motor speed. Note that for best performance, this should be within +/-20% of the motor nameplate maximum speed or stability problems may occur.

2. Connect the tachometer wires to TB2:7 (+ for forward) and 1 (common) and move the one piece jumper on J6 and J7 from the ARM position to the TACH position (Figure 20 on page 35).

3. Select the tachometer voltage scaling at max speed by dip switch SW3:5 as follows:

TABLE 13. TACHOMETER FEEDBACK VOLTAGE SELECTION

TACH VOLTAGE	SW3:5
8Vdc - 30Vdc	ON
31Vdc - 175 Vdc	OFF

4. Adjust the IR/TACH MAX SPEED potentiometer fully clockwise, this will provide minimum speed with tachometer feedback.

5. Run the motor with maximum speed reference and start adjusting the IR/TACH MAX SPEED potentiometer counterclockwise until motor speed increases to the desired maximum speed with tachometer feedback. If the motor is not controllable, check for incorrect tachometer feedback voltage polarity. Note that if the tachometer signal is lost, the drive will automatically revert back to armature feedback.

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

TROUBLESHOOTING

TABLE 6. TROUBLESHOOTING

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
1. Motor won't start (See "Inoperative Motor," page 20)	AC line open	Be sure rated AC line voltage is applied to the controller.
	Operator controls inoperative or connected incorrectly	Repair accordingly.
	Controller not reset	Initiate a Stop command and then a Start command.
	Line Voltage Selection Jumper J1 in wrong position	See Step 5 on page 5 under, "Installing The Controller."
	Controller not enabled	Be sure +24 VDC is applied to Terminal TB2 8.
	Loss of speed reference signal	Check for 0 - ±10 VDC speed reference signal.
	Controller not adjusted correctly	See Adjustment Instructions, Section IV.
	DIP Switch SW3 not set correctly.	See Table 3 on page 6.
	Current limit set too low.	Turn FWD CUR LMT and REV CUR LMT potentiometers clockwise.
	Open shunt field winding or wiring to the motor shunt field, causing loss of torque[a]	Check the motor shunt field and associated circuitry for a loose connection or a broken wire. Repair accordingly.
	Motor failure	Repair or replace the motor.
	Control board failure	Replace the control board.
2. Controller line fuse blows when AC line power is applied to the controller	Wiring faulty or incorrect	Check all external wiring terminating in the controller. Correct accordingly.
	Circuit, component, or wiring grounded	Remove ground fault.
	Two or more SCR's shorted	Replace shorted SCR's or the control board.
	Varistor RV1 shorted	Replace RV1 or the control board.
	Shunt Field Diode D39, D40, D41, or D42 shorted [a]	Replace shorted diode or the control board.
	Motor shunt field shorted or grounded[a]	Repair or replace the motor.
	Control board failure	Replace the control board.
Cont'd on next page		

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

TABLE 6. TROUBLESHOOTING

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
3. Controller line fuse blows when a Start command is initiated	One SCR shorted	Replace shorted device or the control board.
	Motor shorted or grounded	Repair or replace the motor.
	Control board failure causing SCR's to turn-on fully	Replace the control board.
4. Controller line fuse blows while the motor is running	Motor overloaded	Check shunt field current.[a] Low shunt field current causes excessive armature current. If field current is adequate, check for a mechanical overload. If the unloaded motor shaft does not rotate freely, check motor bearings. Also check for a shorted motor armature. Motor overload can also be caused by incorrect gear ratio. Correct accordingly.
	Loose or corroded connection. Wiring faulty, incorrect, or grounded	Check all terminals, connections, and wiring between the line, controller, and motor.
	Motor shorted or grounded	Repair or replace the motor.
	One or more SCR's breaking down (shorting intermittently)	Replace faulty devices or the control board.
	Control board failure causing SCR false firing or misfiring	Replace the control board.
5. Maximum speed excessive	Maximum speed set too high	Turn the MAX SPD potentiometer counter clockwise.
	Controller not calibrated correctly	Refer to Steps 4 and 5 on page 5.
	Open shunt field winding or wiring to the motor shunt field[a]	Check the motor shunt field and associated circuitry for a loose connection or a broken wire. Repair accordingly.
	Motor field demagnetized[b]	Replace the motor.
	Tachometer faulty (if used) or connected incorrectly	Repair accordingly

Cont'd on next page

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

TABLE 6. TROUBLESHOOTING

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
6. Motor won't reach top speed	Low line voltage	Check for rated line voltage, ±10%, on the controller line terminals.
	Motor overloaded	Check shunt field current.[a] Low shunt field current causes excessive armature current. If field current is adequate, check for a mechanical overload. If the unloaded motor shaft does not rotate freely, check motor bearings. Also check for a shorted motor armature. Motor overload can also be caused by incorrect gear ratio. Correct accordingly.
	Maximum speed set too low	Turn the MAX SPD potentiometer clockwise.
	Current limit set too low	Turn the FWD and REV CUR LMT potentiometers clockwise.
	Current scaling jumper J4 in wrong position	See Step 4 and Table 2 on page 5.
	Motor field demagnetized[b]	Replace the motor.
	Control board failure	Replace the control board.
7. Unstable speed	AC line voltage fluctuating	Observe line voltage with a voltmeter or oscilloscope. If fluctuations occur, correct condition accordingly.
	Loose or corroded connection. Wiring faulty, incorrect, or grounded	Check all terminals, connections, and wiring between the line, operator controls, controller, and motor.
	Oscillating load connected to the motor	Stabilize the load. Turning the IR/TACH potentiometer counterclockwise may minimize oscillations.
	Voltage Selection Jumpers J1, J2 or J3 in wrong position	See Step 5 on page 5 under, "Installing The Controller."
	IR compensation not adjusted correctly	See the IR Compensation adjustment instructions on page 21.
	Maximum speed not adjusted correctly	See the Maximum Speed adjustment instructions on page 21.
	Motor faulty	Check motor brushes. Replace if needed. Repair or replace the motor.
	Tachometer generator or coupling faulty (if used)	Repair accordingly.

Cont'd on next page

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

TABLE 6. TROUBLESHOOTING

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
8. Line and motor armature current excessive	Motor overloaded	Check shunt field current.[a] Low shunt field current causes excessive armature current. If field current is adequate, check for a mechanical overload. If the unloaded motor shaft does not rotate freely, check motor bearings. Also check for a shorted motor armature. Motor overload can also be caused by incorrect gear ratio. Correct accordingly.
9. Shunt field current [a] too low	Open shunt field winding or wiring to the motor shunt field	Check the motor shunt field and associated circuitry for a loose connection or a broken wire. Repair accordingly.
	Shunt field connected for incorrect voltage	Check motor rating and refer to Table 12 on page 32.
	Diode D39, D40, D41, or D42 failure	Replace faulty diode or the control board.
10. Shunt field current [a] too high	Shunt field connected for incorrect voltage	Check motor rating and refer to Table 12 on page 34.
	Shunt field windings shorted	Measure the shunt field resistance and compare with the motor rating. Repair or replace the motor.
11. Motor thermal guard tripped (if used)	Ventilation insufficient	Remove dirt, dust, and debris from the motor intake and exhaust screens.
	Excessive motor load at low speed	Reduce the load or increase the speed.
	Line and motor armature current excessive	See Indication 9.
	Motor overheating from friction	Check for misalignment. Realign the motor.
	Shorted motor windings or faulty bearings	Repair or replace the motor.

a. Does not apply to permanent-magnet motors.
b. Does not apply to shunt-wound motors.

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

SECTION V

PARTS LIST

TABLE 7. PARTS LIST, SERIES 2230 MKII CONTROLLERS

PART	RATING	FACTORY PART NUMBER		
		MODEL 2231 2235	MODEL 2232 2236	MODEL 2233
Control Board	NA	106737301	106737302	106737303
Fuse, Line	20A, 700V (A070GRB20T13)	3002552	NA	NA
	30A, 700V (A070GRB30T13)	NA	3002553	NA
	60A, 500V (SC-60)	NA	NA	3002526
SCR	15A, 600V	3302201	NA	NA
	55A, 800V	NA	3302231	NA
	50A, 800V Module	NA	NA	3301172

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

Blank Page

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

SECTION VI

RATINGS AND SPECIFICATIONS

RATINGS

1. Duty .... Continuous
2. Horsepower Range .... 1/6 - 5 HP (See Table 1, Page 2)
3. Line Fuse Interrupting Capacity .... 100,000 Amperes
4. Line Power .... 115V Or 230V ±10%, Single-Phase, 50 Or 60 Hz
5. Motor Speed / Current Reference Potentiometers .... 10K Ohms, 1/2W
6. Overload Capacity, Armature Circuit .... 150% For 1 Minute
7. Timed Overload Threshold 120%
8. Service Factor 1.0
9. Reference Power Supplies .... ±10Vdc

TABLE 8. TYPICAL APPLICATION DATA

COMPONENT			RATINGS									
RATED HORSEPOWER (HP)			1/6	1/4	1/3	1/2	3/4	1	1-1/2	2	3	5
RATED KILOWATTS (kW)			0.124	0.187	0.249	0.373	0.560	0.746	1.120	1.492	2.238	3.730
1-PHASE AC INPUT (FULL-LOAD)	Line Amps	115V Unit	3.9	5.0	6.0	8.7	12.4	15.8	NA	NA	NA	NA
		230V Unit	NA	NA	NA	4.2	5.9	8.8	12.6	15.8	22.0	32.0
	KVA		0.48	0.58	0.71	1.00	1.40	2.00	3.00	4.00	5.00	8.00
DC OUTPUT (FULL-LOAD)	Motor Armature Amps	90V	2.0	2.8	3.5	5.4	8.1	10.5	NA	NA	NA	NA
		180V	NA	NA	NA	2.6	3.8	5.5	8.2	11.6	15.1	25.0
	Motor Field Amps (Maximum)	Model 2231 2235	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
		2232 2236 2233	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
FULL-LOAD TORQUE (lb-ft) with 1750 RPM Base Speed Motors			0.5	0.75	1.0	1.5	2.2	3.0	4.5	6.0	9.0	15.0
MINIMUM TRANSFORMER KVA FOR VOLTAGE MATCHING OR ISOLATION			0.5	0.75	0.75	1.0	1.5	2.0	3.0	5.0	7.5	10.0

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

TABLE 9. OPERATING VOLTAGES AND SIGNALS

POWER SOURCE (Single-phase)	OUTPUT VDC		SPEED REFERENCE SIGNAL	MAGNETIC CONTROL VOLTAGE
	Armature	Field		
115V ±10%, 50 or 60 Hz	0 - 90	50/100	0 - ±10 Vdc	24 VDC
230V ±10%, 50 or 60 Hz	0 - 180	100/200		

TABLE 10. CONTROLLER WEIGHTS

CONTROLLER MODEL	WEIGHT - LBS (KG)		
Rated Horsepower (HP)	1/6 - 2	3	5
2233	10.59 (4.81)		
2233B	11.25 (5.11)		
2233P0, P1, P7	11.69 (5.31)		
2233BP0, BP1, BP7	12.35 (5.61)		
2232	7.70 (3.50)		NA
2232B	8.50 (3.86)		NA
2236	2.00 (0.91)		NA
2236B	2.25 (1.02)		NA
2231	7.70 (3.50)	NA	NA
2231B	8.50 (3.86)	NA	NA
2231P0, P1	11.60 (5.26)	NA	NA
2231BP0, BP1	12.40 (5.62)	NA	NA
2235	2.00 (0.91)	NA	NA
2235B	2.25 (1.02)	NA	NA

OPERATING CONDITIONS

1. Altitude, Standard .... 1000 Meters (3300 Feet) Maximum[1]
2. Ambient Temperature .... 0 - 40°C (32°F - 104°F)[2]
3. Line Frequency Variation .... ± 2 Hz Of Rated
4. Line Voltage Variation .... ±10% Of Rated
5. Relative Humidity .... 95% Noncondensing

1. Controller can be derated by 1% per 100 meters to operate at higher altitudes.
2. 55°C (131°F) maximum in enclosed areas where open-chassis controllers are mounted.

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

PERFORMANCE CHARACTERISTICS

1. Controlled Current (Torque) Bandwidth 11Hz
2. Controlled Speed Range .... 0 to Motor Base Speed
3. Output Current Ripple Frequency 120Hz (60Hz); 100Hz (50Hz)
4. Displacement Power Factor (Rated Speed/Rated Load) 87%
5. Efficiency (Rated Speed/Rated Load)
   a. Controller Only 98%
   b. Controller With Motor, Typical 85%
6. Speed Regulation .... See Table 11

Regulation percentages are of motor base speed under steady-state conditions

TABLE 11. SPEED REGULATION CHARACTERISTICS

REGULATION METHOD	VARIABLE				
	Load Change (95%)	Line Voltage (±10%)	Field Heating (Cold/Normal)	Temperature (±10°C)	Speed Range
Standard Voltage Feedback with IR Compensation	2%	±1 %	5 - 12%	±2%	50:1
Optional Speed (Tach) Feedback	0.5%	±1 %	0.2%	±2%	200:1

ADJUSTMENTS

1. Acceleration, Linear .... 0.1 - 30 Seconds
2. Deceleration, Linear .... 0.1 - 30 Seconds
3. IR (Load) Compensation .... 0 - 10% Boost
4. Jog Speed .... 0 - 100% of Motor Base Speed
5. Maximum Speed .... 50% - 100% of Motor Base Speed
6. Deadband .... ±2% or 0% (of full speed)
7. Forward or Reverse Torque (Current) Limit .... 10 - 150% of Full-Load Torque

SPECIFICATIONS

1. AC LINE PROTECTION - A 100,000 ampere interrupting capacity AC line fuse provides instantaneous protection from peak loads and fault currents. This line fuse is located inside the controller.

2. AUXILIARY CONTACT - A normally-open Form A relay contact, rated .5 ampere @115 VAC and 2A at 30 VDC, is available for external use. The relay energizes when a Run command is initiated, and de-energizes when a Normal Stop command is initiated, the overload monitor trips, or the anti-restart circuit is activated.

3. FIELD SUPPLY - A half-wave or full-wave shunt field supply is available as shown in Table 12, page 32.

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

TABLE 12. SHUNT FIELD DATA

CONTROLLER RATING (VAC)	SHUNT FIELD VOLTAGE (VDC)		MOTOR SHUNT FIELD LEAD CONNECTIONS	
	Half-Wave	Full-Wave[a]	F1	F2
115	50		L1	F –
		100	F+	F –
230	100		L1	F –
		200	F+	F –

a. Low inductance motors require a full-wave field to prevent speed instability.

4. MOTOR CONTACTOR - Controller model numbers with an 'B' suffix, e.g., 2231B, 2231BP0, have a DC magnetic armature contactor, which disconnects both motor armature leads from the controller. An antiplug circuit ensures that the contactor does not make or break DC.

5. POWER CONVERSION - The DC power bridge consists of eight SCR's configured as dual back to back full-wave converters. Each device is rated at least 600 PIV. The controller base forms an integral heat sink, with the power devices electrically isolated from the base.

6. CONTROL VOLTAGE - A transformer coupled 24 VDC power supply provides line-isolated control power for all magnetic control logic and operator controls.

7. STATUS INDICATOR - A bicolor LED glows red when motor armature current is being limited (or regulated) by the controller, and glows green when armature current is not being limited (power on indication).

8. VOLTAGE TRANSIENT PROTECTION - A metal oxide suppressor (varistor) across the AC line is combined with RC snubbers across the power bridge to limit potentially damaging high voltage spikes from the AC power source.

9. SELECTABLE CAPABILITIES – DIP switch SW3 allows the user to select various modes of operation, as follows:

LINE STARTING – SW3:1 "OFF" disables the anti-restart feature, and the controller may be started and stopped with an external AC line contactor. However, a wire jumper must be connected between TB2-8 and TB2-9. If full speed operation is desired, connect another wire jumper between TB2-2 and TB2-3.

INTERNAL / EXTERNAL CURRENT REFERENCE - SW3:2 "OFF" enables the use of an external Forward Current Reference while SW3:7 "OFF" enables the use of an external Reverse Current Reference.

TACHOMETER FEEDBACK - To use tachometer feedback with armature feedback backup, connect the tachometer generator signal to TB2-7 and TB2-1, move one piece jumper on J6 and 7 to TACH, and select the tachometer generator voltage at maximum speed by using SW3:5 according Table 13 on page 22

TORQUE REGULATOR - The controller will function as a torque regulator when SW3:4 is "ON". This allows an external potentiometer(s) to set maximum motor torque (0 - 150% of rated). Motor speed will seek a level from 0 to 100% of rated depending on the load torque.

50/60 HERTZ OPERATION – SW3:6 "ON"selects 60Hz line power operation while "OFF" selects 50Hz line power operation.

DEAD BAND - SW3:3 "ON" enables a 2% dead band around zero speed reference to prevent motor creeping.

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

SECTION VII

DRAWINGS

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

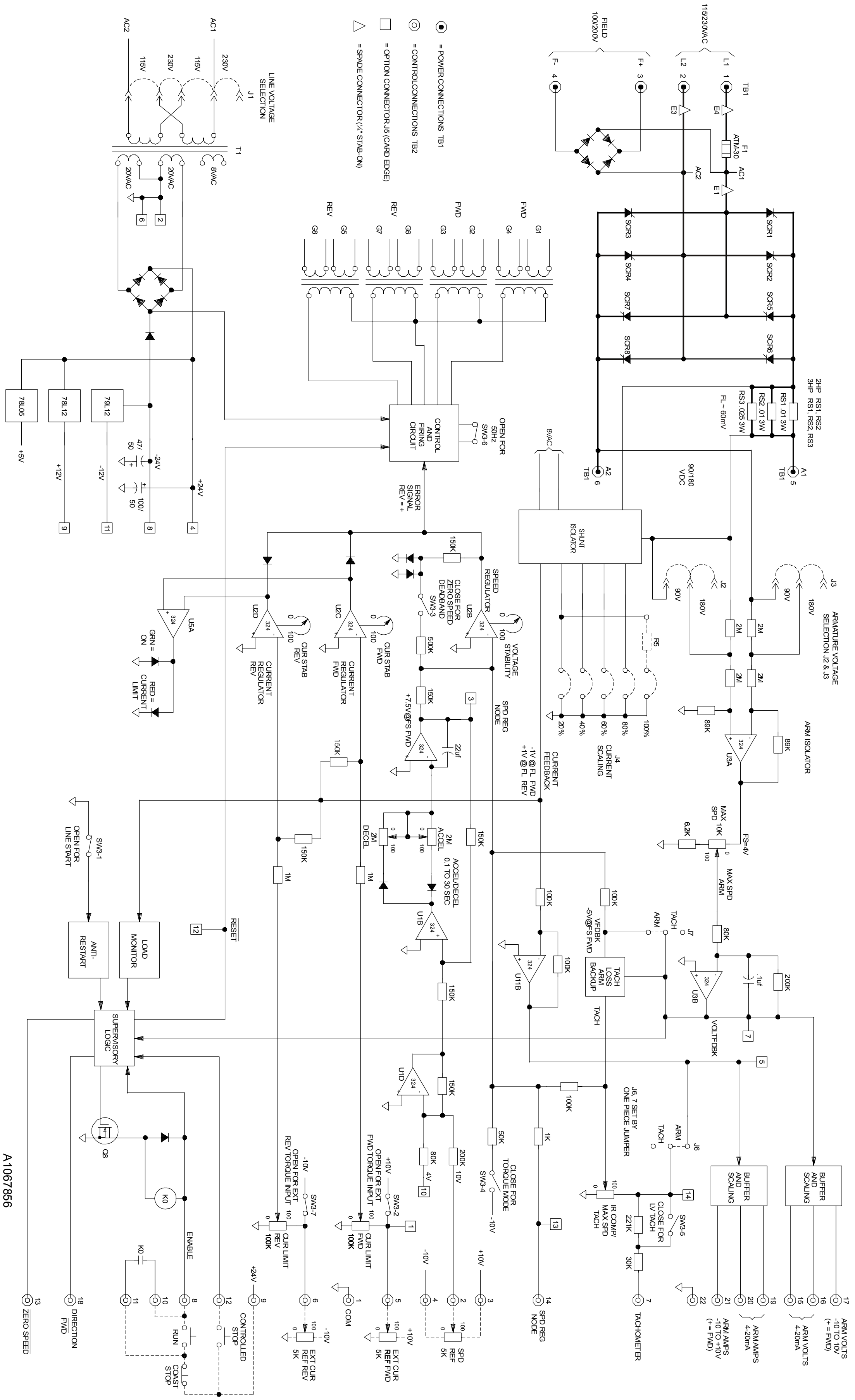

Figure 19. Functional Schematic, Series 2230 MKII

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

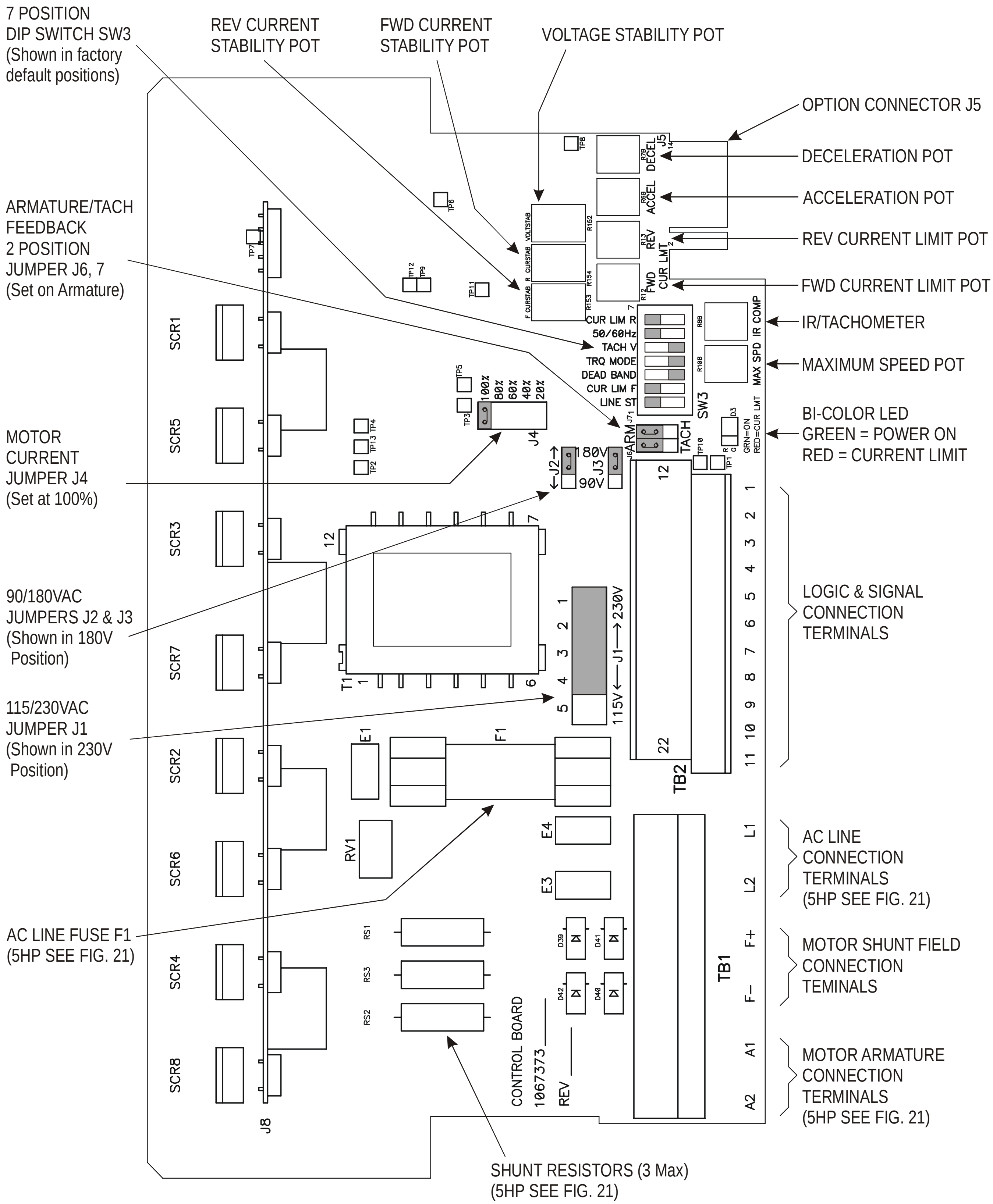

Figure 20. Series 2230 MKII Control Board, 1/6 – 3HP

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

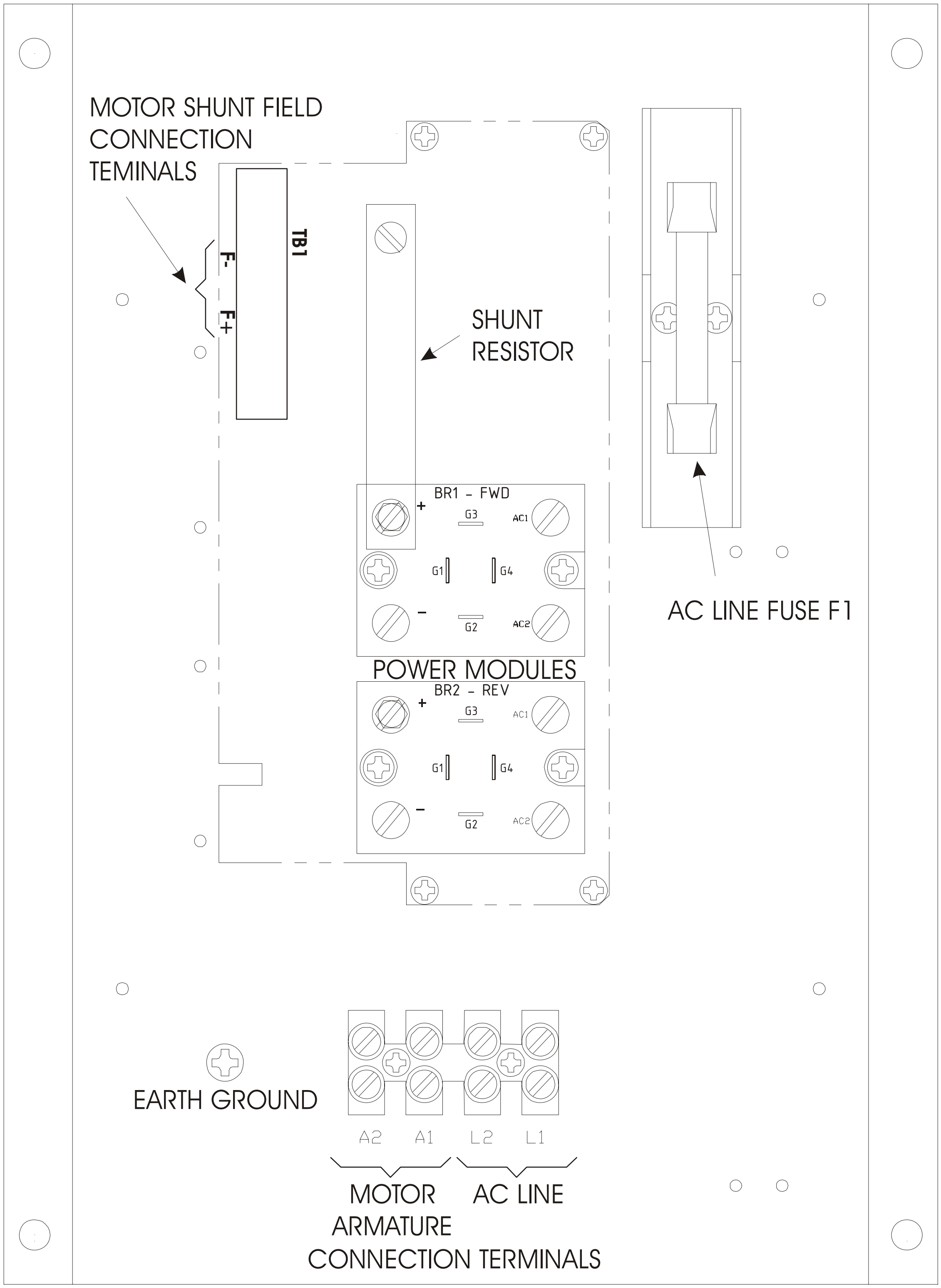

Figure 21. 2233MKII Connection Terminals, 5HP

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

A

C

D

E

F

G

H

I

J

L

M

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

efesotomasyon.com - Control Techniques,emerson,saftronics -ac drive-servo motor

FINCOR

www.fincor.net