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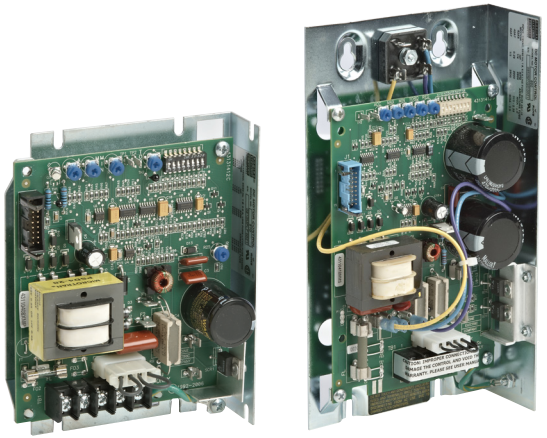
Find the *Bodine Electric 810* at our website: *Click HERE*

Instructions for Installation and Operation

Type FPM 0810, 0830, and 0850 Permanent Magnet DC Motor Controls

(with driver board only, or with F-B-R board)

Model 0810 up to 1/17 HP
Model 0830 up to 1/6 HP
Model 0850 up to 1/3 HP



SPECIFICATIONS

Input Voltage:. . . . . 115 VAC±10%; 50/60 Hz, single phase
Input Current:
Model 0810 . . . . . 2.9 Amps AC
Model 0830 . . . . . 4.2 Amps AC
Model 0850 . . . . . 9.0 Amps AC
Armature Voltage (nominal) . . . . . 0-130 VDC
Amrature Current (max. continuous)
Model 0810 . . . . . 0.50 Amps
Model 0830 . . . . . 1.25 Amps
Model 0850 . . . . . 2.30 Amps

BODINE® ELECTRIC COMPANY

www.bodine-electric.com

QUALITY IN MOTION®

Part No. 07400156.G

BODINE LIMITED WARRANTY

The Bodine Electric Company warrants all products it manufactures to be free of defects in workmanship and materials when applied in accordance with nameplate specifications. Bodine motors and gearmotors purchased with and used only with appropriately applied Bodine controls are covered by this warranty for a period of 24 months from the date of purchase or 30 months from date of manufacture, whichever comes first. Bodine motors and gearmotors used with non-Bodine controls and Bodine controls used with non-Bodine motors and gearmotors are covered by a 12 month warranty period. The Bodine Electric Company will repair, replace, or refund at its option, any of its products which has been found to be defective and within the warranty period, provided that the product is shipped freight prepaid, with previous authorization, to Bodine or to a Bodine Authorized Service Center. Bodine is not responsible for removal, installation, or any other incidental expenses incurred in shipping the products to or from Bodine. This warranty is in lieu of any other expressed or implied warranty – including, but not limited to, any implied warranties of merchantability and/or fitness for a particular use. Bodine's liability under this warranty shall be limited to repair or replacement of the Bodine product and Bodine shall not be liable, under any circumstances, for any consequential, incidental or indirect damages or expenses associated with the warranted products. Proof of purchase of motor or gearmotor and matching control as a system must be provided with any claim.

Control Type _____Serial No._____

Date of Purchase _____ Place of Purchase_____

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CONGRATULATIONS!...and thank you for selecting a **Bodine Type-FPM Adjustable Speed PM Motor Control**. Your new control will provide the same excellent performance and reliability that have been characteristic of Bodine products since 1905. We call it ADE (After Delivery Economies).

Bodine Electric Company takes pride in the quality of its products and in the ultimate satisfaction of its customers. Every effort is made to provide products free of defective design, workmanship, and materials. It will be considered a favor to have cases of unsatisfactory service from Bodine products brought to our attention.

ABOUT THIS MANUAL

This manual contains the basic information needed to operate a Bodine Type-FPM SCR Driver Board or Driver/F-B-R control combination. It is organized in a systematic, step-by-step fashion so that the system may be set up *safely* in the shortest possible time.

IMPORTANT

Read this manual completely and carefully. *Pay special attention* to the *warnings*, *precautions*, and *safety* rules listed. Failure to follow the instructions could produce safety hazards to personnel or lead to damage of the control and/or feature boards.

PRODUCT DESCRIPTION

Bodine's versatile Type-FPM SCR controls are intended for use with Bodine's 130VDC Permanent Magnet (PM) 1/50 to 1/3 Hp motors. Each control can cover a range of horsepowers, and can be adjusted for use with a particular Bodine motor by simply setting a "DIP switch" and selecting the proper armature fuse (See pages 12 and 13). Models are also available with integral Analog or Digital interface boards, or electronic Forward-Brake-Reverse (F-B-R) boards.

Type-FPM controls provide pure DC (negligible ripple, Form Factor 1.0) to the motors. Compared to unfiltered 90VDC SCR controls (Form Factor 1.6), Bodine's FPM controls can provide as much as *92%* more continuous motor torque output or *46%* lower motor operating temperature, longer brush and commutator life, and smoother low-speed motor rotation.

SPECIFICATIONS

INPUT VOLTAGE[1] ..... 115VAC ± 10% 50/60 Hz SINGLE PHASE
INPUT CURRENT
- Models 810 thru 819 ..... 2.9 Amps AC
- Models 830 thru 838 ..... 4.2 Amps AC
- Models 850 thru 858 ..... 9.0 Amps AC

ARMATURE VOLTAGE (Nominal) 0-130VDC
ARMATURE CURRENT (Max. Continuous)
- Models 810 thru 819 ..... 0.50 Amps DC
- Models 830 thru 833 ..... 1.25 Amps DC
- Models 850 thru 853 ..... 2.30 Amps DC

AMBIENT TEMPERATURE (Max.)
- Chassis ..... 0 to 50°C
- Encased ..... 0 to 40°C

SPEED REGULATION (Typical) 2%
SPEED RANGE (Typical) ..... up to 42:1
LINE VOLTAGE COMPENSATION 1.5%
ELECTRONIC F-B-R BOARD ..... 10 reversals per minute MAX.[2]
ACCELERATION TIME ..... 0.5 to 10 seconds (adjustable)

Notes:

[1] For 220/240VAC single-phase operation, a 2:1 step-down isolation transformer may be used. Signal Transformer Type DU-1 (1 KVA) is recommended for models 850 to 858 and Type DU-1/2 (.5 KVA) for models 810 to 838.

[2] The number of reversals are limited to 4 max. with model 858 when using motor Type 42D7, unless brake resistor is mounted outside the enclosure

Standard Features Include:

- Industrial Quality Enclosure (Encased Models 815-8, 835-8, 855-8)
- Terminal Block for Easy Electrical Connections
- L-Bracket/Heat Sink for Simplified Mounting
- Inhibit Function Standard on Models 810, 830, and 850
- Temperature Compensation
- Line and Armature Fuses
- Tight Speed Regulation
- Line Voltage Compensation
- Optical Isolation with Interface Boards
- On-board Torque (Current) Limiting, Speed Regulation, and Min/Max Speed Adjustments
- Wall Mounting Provisions for Encased Controls
- Adjustable Acceleration

Optional Features Include:

- Mechanical F-B-R Kits for Chassis Controls Only
- Electronic F-B-R Kit (for Chassis Controls and Encased Models 815, 835, and 855)
- Local/Remote Control Kit (for Chassis Models 811, 812, 831, 832, 851, 852, standard on Encased Models 816, 817, 836, 837, 856, 857)

SAFETY PRECAUTIONS

The following safety precautions must be observed during all phases of operation, service, and repair of this electronic drive/motor product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture and intended use of the products. Bodine Electric Company assumes no liability for the customer's failure to comply with safety requirements and practices.

Warnings, such as the example below, highlight potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

> ***WARNING***
>
> **Dangerous voltages capable of causing death may be present in the electronic control and motor. Use extreme caution when handling, testing, and adjusting. Properly guard the electronic control and motor to prevent accidental contact by both knowledgeable and unknowledgeable persons.**

"The use of electric motors and generators, like that of all other utilization of concentrated power, is potentially hazardous. The degree of hazard can be greatly reduced by proper design, selection, installation, and use, but hazards cannot be completely eliminated. The reduction of hazard is the joint responsibility of the user, the manufacturer of the driven or driving equipment, and the manufacturer of the control or motor or generator." *

Bodine products are designed and manufactured to comply to applicable safety standards and in particular to those issued by ANSI (American National Standards Institute), NEMA (National Electrical Manufacturers Association), U.L. (Underwriters Laboratories, Inc.), and CSA (Canadian Standards Association).

> *Standards Publication No. ANSI C5.1/NEMA MG-2. "Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators."
>
> Available from:
>
> www.nema.org

Most Bodine products are "third party approved" with respect to construction. Type-FPM chassis controls "recognized by U.L., Inc." are designated by having a "" symbol in the upper right corner of their nameplates. In addition, most products are CSA certified, identified by a "" symbol. If you need specific information regarding the "third party approval" status of Bodine products, contact the nearest Bodine representative, or the home office.

However, since even well-built apparatus can be installed or operated in a hazardous manner, it is important that safety considerations be observed by the user. With respect to the load and environment, the user must properly select, install, and use the apparatus—for guidance on all three aspects see safety standards publication No. ANSI C5.1/NEMA MG-2 (footnoted on page6).

WARNING

The chance of explosions, fires, or electric shocks can be reduced through thermal and over-current protection, good maintenance, and proper grounding and enclosure selection. The following safety considerations are not intended to be all-inclusive, and the references mentioned elsewhere in this manual should be consulted.

GROUNDING

Both electronic controls and motors must be securely mounted and adequately grounded. Failure to ground properly may cause serious injury to personnel.

FUSING

Both the control input and output are fused. If fuses must be replaced, they must always conform to the values and ratings specified on the control's nameplate.

LIVE CIRCUITRY

Open-type electronics should be properly guarded or enclosed to prevent accidental human contact with live circuitry. No work should be performed on or close to the control or motor (including brush examination or replacement) while the control is connected to the AC line. If an AC line switch is used, it should be a Double Pole Single Throw (DPST), so that both sides of the AC line can be disconnected.

ENVIRONMENT

Sparking of brushes in commutated DC motors occurs during normal operation. In addition, open controls or controls in ventilated enclosures may emit flame during failure. Bodine's totally enclosed products are not explosion-proof, and Bodine does not offer an explosion-proof motor, gearmotor, or control for hazardous locations (e.g., in an environment of flammable or explosive gas, vapor, or dust). Bodine recommends use of only *approved* explosion-proof products in hazardous locations. Exceptions are allowed by the National Electric Code (NEC), but NEC and NEMA safety standards should be studied thoroughly before exercising this option. Moisture will increase the electrical shock hazard of electrical insulation. Therefore, open-type or unsealed controls not specifically designed for such use, should be protected from and should not come into contact with liquids or moisture.

VENTILATED PRODUCTS

Open, ventilated products are suitable for clean, dry locations where cooling air is not restricted. Do not insert anything into a product's ventilation openings.

SERVICING

Emergency field repairs must be made only by qualified electronic personnel. Repairs made by persons not authorized by the Bodine Electric Company will void the warranty. Normal field repairs must be limited to replacing an entire printed circuit board assembly. Because of the danger of introducing safety hazards, do not install substitute parts or perform any unauthorized modifications to electronic PC boards or motors. Return the electronic control or motor to Bodine Electric Company for servicing to ensure continued compliance with the design precautions against potential fire and/or shock hazards.

This manual does not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance—and no warranty of fitness for purpose is expressed or implied. Should further information be desired or should particular problems arise which are not covered sufficiently for the user's purpose, the matter should be referred to the Bodine Electric Company.

The issuance of this manual does not confer to the recipient any license to manufacture under any patents owned or controlled by the Bodine Electric Company.

PREPARING THE CONTROL

REVIEWING YOUR CONTROL SELECTION

Before proceeding with the installation, review the application to confirm that the proper motor and speed control have been selected. This should be done after reading this manual and all applicable safety standards. If in doubt, contact your Bodine Representative, or the Home Office if there is no Representative in your area. Any selection or application suggestions made by Bodine Electric Company are only to assist the customer—and in all cases, determination of fitness for purpose or use is solely the customer's responsibility.

Unless otherwise agreed to by Bodine Electric Company, all control nameplate ratings are based on the following normal operating conditions:

1. Duty—8 hours per day; 5 days per week, without frequent reversals or starts and stops.

2. Ambient temperature should not exceed 40°C (104°F) for all *encased* controls. The maximum ambient temperature is 50°C (122°F) for chassis controls.

3. Voltage—Within 10% of nameplate rating.

4. Frequency—Within 5% of nameplate rating.

5. Combined variation of voltage and frequency—Within a total of 10% providing frequency variation does not exceed 5%.

Consult Bodine Electric Company if variations from the above conditions are contemplated.

INSPECTING THE CONTROL

Please examine your control (and any option kits, if ordered) carefully for shipping damage. Check to be certain that the control you ordered is the one in front of you. Also check any option kits you received. Any claim(s) for shipping damages should be made to the freight carrier.

INSTALLING THE CONTROL

WARNING

It is the responsibility of the equipment manufacturer or individual installing the apparatus to take diligent care in installing it. The National Electrical Code (NEC), sound local electrical and safety codes, and when applicable, the Occupational Safety and Health Act (OSHA) should be followed when installing the apparatus to reduce hazards to persons and property.

MOUNTING THE CONTROL PROPERLY

The mounting template (provided in the shipping box) can be used to facilitate mounting the control. The control may be mounted in any position. Please refer to the mounting template packed with your particular control for instructions.

WARNING

User must provide a proper enclosure for chassis type controls. Circuitry is not at ground potential. No work should be performed on or close to the control while it is connected to the AC line.

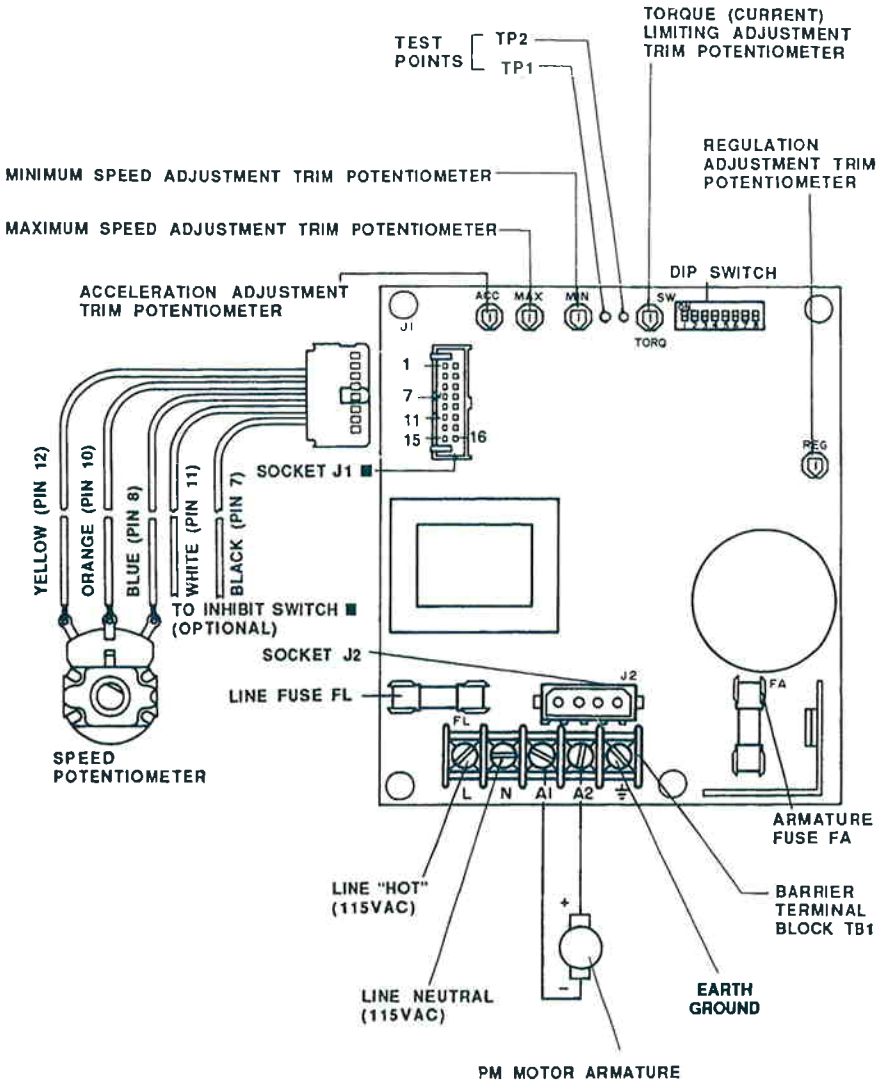
CONNECTING THE DRIVER BOARD

WARNING

Disconnect the 115VAC power line to the control before making electrical connections or replacing motor brushes. Connection of the power line should be the very last connection made. Please follow the instructions carefully.

NOTE: Any exposed circuit boards should be handled in a static-protected area. The feature boards use CMOS circuitry. Static discharge into the feature boards must be avoided.

Encased controls accept 1/2-inch liquid tight conduit fittings. For wire sizes and electrical connections refer to the National Electrical Code (NEC)—Article 430—"Motors, Motor Circuits, and Controllers" and/or applicable local area codes. If extension cords are used, they should be kept short for minimum voltage drop and optimum performance. Only copper wire with 60°C rated insulation is recommended. The terminal block will accept leads up to 14 gauge (18 gauge is the smallest recommended size). Please also review the safety notes on pages 6, 7, 8, and 10. The barrier terminal block (TB1) screws should be tightened to 6 lb-in.



■ When pin 11 is pulled low (connected to pin 7--the signal common) the SCRs will be disabled and the motor will coast to a stop.

Figure 1
Top View of FPM Driver Board.

The Circuit Connection Diagrams in **Fig. 3** show all electrical control connections.

1. Identify the Driver Board as shown in **Fig. 1**, and identify the fuse-holder labeled **"FA"** (Armature Fuse). Refer to **Fig. 2** (or the label on the side of the Type-FPM control) for the proper fuse rating, and select the fuse with this rating from the bag of fuses provided. Then, install this fuse in fuse-holder **"FA."**

2. The line fuse, labeled **"FL"** in **Fig. 1** and on the driver board, has been installed. Its rating is shown on the control's nameplate should it need to be replaced.

3. Next, locate the **"DIP switch"** on your control's driver board (**Fig. 1**). There are eight switch levers (numbered 1 through 8) on the **"DIP switch."** The "ON" positions for these levers are clearly marked on the **"DIP switch."** **Fig. 2** identifies which of the eight levers should be set in the "ON" position, depending on the control and motor or gearmotor selected. Locate your control and motor type in **Fig. 2** and then set only those levers specified in **Fig. 2** to the "ON" position. Be certain that the remaining levers on the **"DIP switch"** are in the "OFF" position. An insulated alignment tool may be used to adjust the switch settings.

4. If you have a driver-only chassis control (Model No. 810, 830, or 850) add a speed pot by (A) trimming the yellow, orange, and blue leads (if necessary), (B) attaching the leads to the speed pot (**Fig. 1**), and (C) inserting the connector into **J1** on the driver board. Turning the potentiometer clockwise increases speed (counterclockwise decreases speed).

   On Models 810, 830, and 850, two additional wires (one white, one black) are provided in the speed pot kit to access the control's "Inhibit" or "Stop" function. You may take advantage of this function by inserting the wires into positions **7 and 11** on the connector and by attaching a .5A, 24VDC minimum switch (not supplied) to the white and black wires. When the switch is closed, the SCRs will be disabled and the motor will coast to a stop. Refer to **Fig. 1** for more information.

FPM DRIVER BOARD FUSE SELECTION AND DIP SWITCH SETTINGS

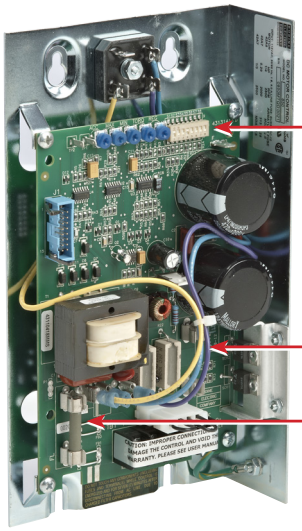
This insert replaces **Figure 2** on page 13 of manuals 07400156 and 07400157

Figure 2: FPM driver board – Fuse selection and DIP switch settings.

Control Model Number	Motor/ Gearmotor Product Type	Motor Speed @ 130 VDC	Rated Motor Amps	Motor/ Gearmotor Power [HP]	DIP Switches in "On" Position	Armature Fuse (FA)	Line Fuse (FL)
0810 through 0818	24A0BEPM	2500	0.22	1/50	2,4,5,6,7	239.200[1]	235.005[1]
	24A2BEPM	2500	0.3	1/29	1,2,3,5,8	239.300[1]	
	24A4BEPM	2500	0.48	1/17	1,2,3,4	239.500[1]	
0830 through 0838	24A4BEPM	2500	0.56 | 0.81	1/23 | 1/11	1,2,3,7	MDA 1.25[2]	ABC 6[2]
	33A3BEPM	2500	0.78 | 1.0	1/16 | 1/8	1,2,7		
	33A3BEPM	2000	0.71	1/12	1,2,5,6		
	33A3BEPM	2500	0.71	1/12	1,2,7		
	33A5BEPM	2500	0.91	1/8	1,2,5		
	42A3BEPM	2500	1	1/8	1,2,5		
	42A4BEPM	2000	1.3	1/6	1,2,4		
0850 through 0858	24A4BEPM	11,500	1.1	1/7	1,2,3,4,5	MDA 2[2]	ABC 12[2]
	33A3BEPM	2500	0.78 | 1.0	1/16 | 1/8	3,4,5	MDA 1.25[2]	
	33A5BEPM	2000	1.4	1/6	3,4	MDA 1.5[2]	
	33A5BEPM	2500	1.4 | 1.8	1/8 | 1/4	2,3,4,5,8	MDA 2[2]	
	33A5BEPM [WX]	2500	1.3 | 1.7	1/8 | 1/4	2,3,4,5,8	MDA 2[2]	
	33A7BEPM	2500	1.8 | 2.4	1/6 | 1/3	1,2,4	MDA 2.5[2]	
	42A5BEPM [5N]	2500	1.9 | 1.8	3/16 | 1/4	1,4	MDA 2[2]	
	42A5BEPM	2500	1.8	1/4	1,4	MDA 2[2]	
	42A5BEPM [FX]	2500	2.1 | 2.8	3/16 | 3/8	1,4	MDA 2.5[2]	
	42A7BEPM	2500	2.3	1/3	1,2,8	MDA 2.5[2]	

[1] Littelfuse [2] Bussmann

APPLICATION NOTE: Select 42A5-FX (90/130V) models may exceed type FPM control current limit. Consult Bodine technical support for more information. E-mail: info@bodine-electric.com.



BODINE ELECTRIC COMPANY

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5. Referring to **Fig. 1,** identify the **barrier terminal block (TB1)** on your control's driver board. Connect the ground wire and motor armature wires to the **terminal block.** Finally, attach the 115VAC power line to the **terminal block.** DO NOT connect the 115VAC power line to an external power source at this time. (This should always be the very last connection you make.)

Terminal Descriptions:

L ..... Hot side of 115VAC line

N ..... Neutral side of 115VAC line

A1 ..... Negative* motor armature supply voltage

A2 ..... Positive* motor armature supply voltage

⏚ ..... Earth ground for control and motor

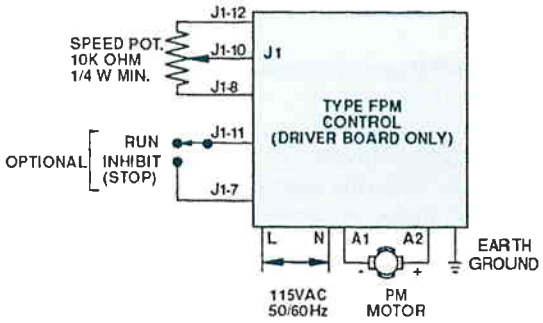
* In **Fig. 1,** the armature is connected for clockwise (CW) rotation. For counter-clockwise rotation (CCW), simply reverse the connections at **A1 and A2.**The connections at A1 and A2 can be reversed with the Electronic F-B-R Board or mechanical F-B-R switches.

Speed Regulation is adversely affected by the length of the leads from terminals **A1 and A2** to the motor. Lead lengths of 25 feet or more can produce measurable degradation, especially at lower armature speeds. Shorter leads and heavier guage wire will improve speed regulation.

WARNING

The control and motor must be securely and adequately grounded, as shown in *Fig. 1.* Failure to ground properly may result in serious injury.

A. FPM Driver Board with External Speed Potentiometer.



B. FPM Driver with Forward-Brake-Reverse Board and External Controls.

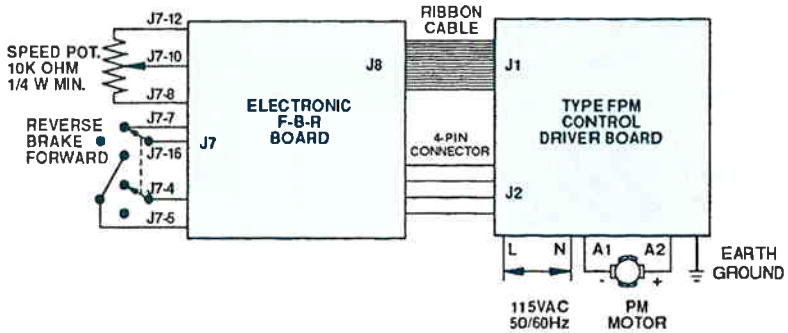


Figure 3
Circuit Connection Diagrams.

CONNECTING AN F-B-R KIT

If you have purchased a separate electronic Forward-Brake-Reverse Kit (Model 890) or a mechanical F-B-R Kit (Model 891, 892, or 894) read the installation instructions provided with the Kit and install the Kit before proceeding.

CONNECTING THE ELECTRONIC F-B-R BOARD

If you are not using an F-B-R Board, proceed to *"Operating the Control"* on page 20.

The electronic Forward-Brake-Reverse (F-B-R) Board (**Fig. 4**) controls the motor's direction of rotation. When the direction signal is changed, the motor will decelerate, approach zero speed, reverse direction, and then accelerate to the selected speed. This protects the motor, gearing, and other drive components from damage from high reversing torques.

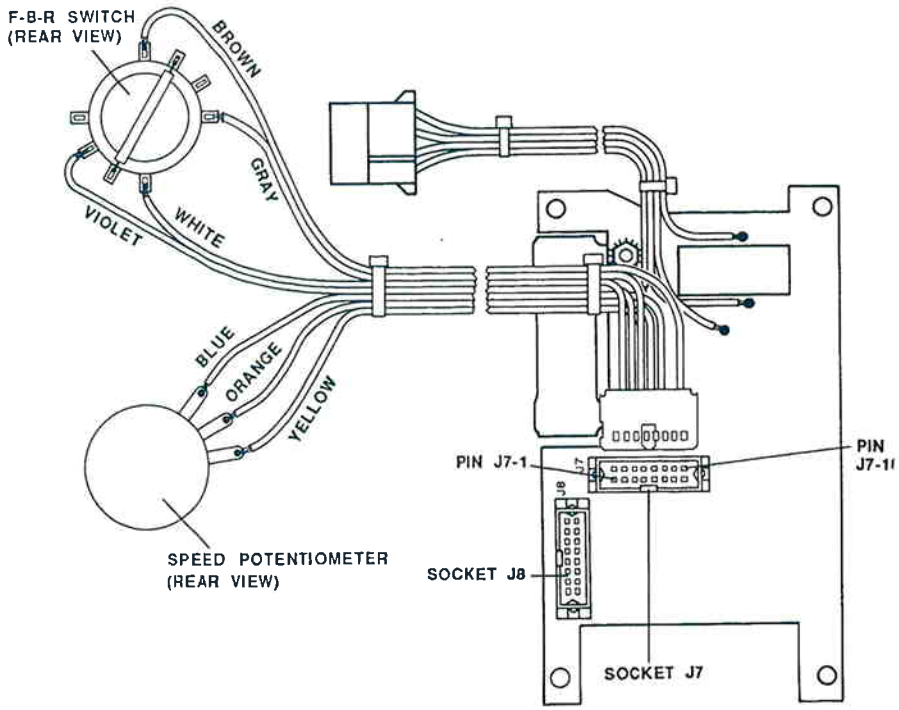


Figure 4
Electronic Forward-Brake-Reverse Board, Showing Connections to Speed Potentiometer and F-B-R Switch (also refer to **Fig. 3B**, p.15).

WARNING

Always disconnect all power to the control before changing the F-B-R Board's braking resistor or installing the F-B-R kit.

All connections described in these instructions are made to socket **J7** (on the F-B-R Board) using the color-coded wires from the pre-wired connector provided with your control or F-B-R Kit. **Fig. 5** describes the functions of the pins on **J7**, and matches each pin to a corresponding colored wire from the pre-wired connector.

Connect wires securely, keep them short, and bundle the power and control leads separately so as to minimize noise pickup. Long or unterminated leads may pick up extraneous signals that could affect the performance of the motor and control.

Figure 5
Description of Pins on **J7** of the F-B-R Board.

Pin	Description	Corresponding Wire Color
4	INPUT -- Brake Signal	Violet
5	OUTPUT -- +12 VDC	White
7	OUTPUT -- 0 VDC*	Gray
8	Speed Pot Connection	Blue
10	INPUT -- Speed Signal	Orange
12	Speed Pot Connection	Yellow
16	INPUT -- Direction Signal	Brown

* Non-isolated common for driver board

A. Manual (Mechanical) Control

The electronic F-B-R Board can be operated manually. Encased models 818, 838, and 858 are wired at the factory for manual control. On chassis control Models 813, 833, and 853 simply adjust the length of the leads from the pre-wired connector, connect the 10K speed pot and 2-pole, 3-position rotary switch to the proper color-coded leads, and insert the connector into **J7** (**Figures 4 and 5**). If you have the Model 890 F-B-R Kit, you must supply your own speed pot and switches for manual control. **Fig. 8** shows how "Forward/Reverse" and "Run/Brake" switches may be added to the F-B-R Board.

B. Electronic Control

WARNING

Because the driver board's signal common is not at ground potential, any external signal or equipment connected to the control must be electronically (e.g., optically) isolated. Using signals which are not isolated will damage the control and/or external equipment.

Optional Analog and Digital Interface Boards are available to conveniently interface FPM controls' driver boards to externally generated electronic signals for control of motor speed, direction of rotation, and braking. The Interface Boards provide optical isolation between the input signal and the control's circuitry, and are recommended for applications requiring electronic control. However, if the user is certain that isolated inputs are available, they may be used without an interface board.

To Control Speed:

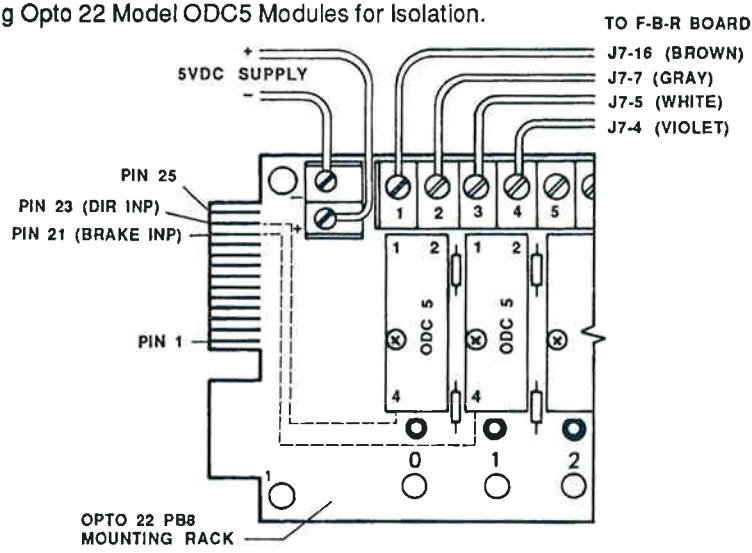
A 0-5VDC ***isolated*** signal with 0.05 mA current capability may be used to control speed in lieu of the speed potentiometer. This speed control input should be connected to **terminal 10** of socket **J7** (**J7-10**) using the **orange** wire from the pre-wired connector that fits in socket **J7**. The common side of the signal must also be isolated and connected to **terminal 8** (**J7-8**) using the **blue** wire.

To Control Braking and Reversing Using Logic Signals:

Direction and braking can be controlled using optically isolated logic signals from a programmable controller, personal computer, or other electronics. Optical isolation must be provided between the F-B-R Board and the input signal when an interface board is not used.

Two 5-60VDC Opto 22 modules (Model ODC5) and a mounting board (Opto 22 Model PB8 8-position single-channel mounting rack) may be used to provide the required isolation (**Fig. 6**). Some other manufacturers' isolation modules will not perform properly because of their high output leakage currents. Simply insert the modules into the mounting board and connect the modules as shown in **Fig. 6**. When **Pin 23** is brought low, rotation will be in the reverse direction. Otherwise, rotation will be in the forward direction. When **Pin 21** is brought low, the motor will brake, regardless of the state of **Pin 23**. The circuit in **Fig. 7** may alternately be used to provide the required isolation.

Figure 6
Using Opto 22 Model ODC5 Modules for Isolation.



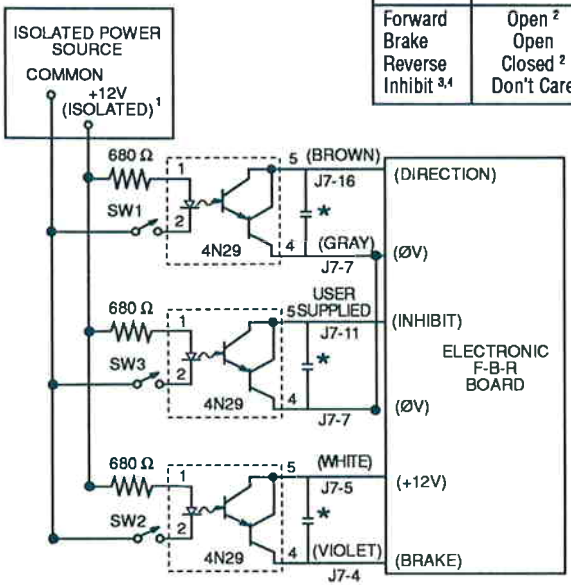
NOTE: A 0.1 µF (25V minimum) capacitor can be connected across **J7-16** and **J7-7** to reduce noise sensitivity (optional).

To Control Braking and Reversing Using Relays or a Programmable Controller with an Isolated Relay Module or Solid State Output Module:

Exercise extreme caution when using programmable controllers. Although some may claim to have optically isolated output modules, their output commons may be connected to other circuitry of the PLC. In such cases, the PLC outputs should be isolated from the F-B-R Board to prevent damage to the PLC or FPM control.

Figure 7
Optical Isolation Circuit.

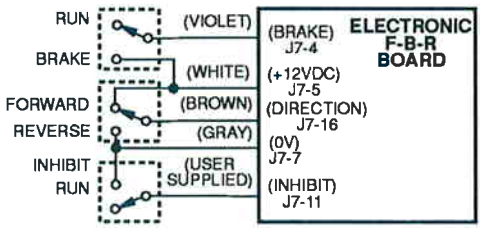
Function	Switch Position		
	SW1	SW2	SW3
Forward	Open [2]	Open	Open
Brake	Open	Closed	Open
Reverse	Closed [2]	Open	Open
Inhibit [3,4]	Don't Care	Don't Care	Closed



[1] For a 5 volt level, change the resistor value from 680Ω to 330Ω.
[2] When the switch SW1 is changed (and SW2 is open), the motor will brake and rotate in the opposite direction.
[3] Drive will be inhibited when SW3 is connected to common.
[4] Inhibit automatically activates the brake function.
* A 0.1 µF (25V minimum) capacitor can be connected across J7-16 and J7-7 to reduce noise sensitivity (optional).

If a Programmable Controller with a relay output module is not available, relays can be hard-wired. Relay contacts can then be controlled using signals from a computer or programmable controller. **Fig. 8** describes the required relay connections. For forward direction connect **J7-16 (brown wire)** to **J7-5 (white wire)**. For reverse direction, connect **J7-16 (brown wire)** to **J7-7 (gray wire)**. For braking, connect **J7-4 (violet)** to **J7-5 (white)**.

Figure 8
Relay (or Switch) Connections for Forward-Brake-Reverse and Inhibit.



OPERATING THE CONTROL

WARNING

The chance of explosions, fires, or electric shocks can be reduced through thermal and over-current protection, good maintenance, and proper grounding and enclosure selection. The safety considerations mentioned in *"SAFETY PRECAUTIONS"* and *"INSTALLING THE CONTROL"* should be consulted.

SAFETY PRECAUTIONS

1. Before starting the control, check all fuses and connections.

2. Proper consideration should be given to all rotating members. Before starting, be sure keys, pulleys, etc. are securely fastened. *Proper guards should be provided to prevent hazards to personnel while the equipment is rotating.*

3. Other mechanical considerations include proper mounting and alignment of products, and safe loads on shafts and gears. Do not depend upon gear friction to hold loads.

4. The motor or gearmotor should be securely mounted (because of possible reaction torque). Test the motor/gearmotor unloaded to be certain that proper connections have been made.

5. If the motor/gearmotor does not start promptly and run smoothly, disconnect the AC power to the control. Double check all wiring, and refer to *"TROUBLESHOOTING"* on page 26.

6. If the problem persists, contact your source of purchase or a Bodine Authorized Service Center and describe the problem in detail. Include all the nameplate data. Do not disassemble the product unless authorized by Bodine. Removing screws voids the Warranty.

OPERATING INSTRUCTIONS

WARNING

Be certain that the 115VAC line to the driver is switched off before starting.

1. With input power OFF, set the speed potentiometer at ZERO. If an optional F-B-R switch is used, set it at the BRAKE position. (The F-B-R Kits are sold separately. Controls with integral electronic F-B-R Boards are available as Models 813, 818, 833, 838, 853, and 858.)

2. Connect the 115VAC power line attached to terminal block **TB1** to the external power source. Then turn ON 115VAC line input power to the control.

3. If an optional F-B-R switch is used, set it to FORWARD or REVERSE.

4. Turn speed potentiometer knob until rotation occurs. Then adjust to achieve the desired speed. If you wish to reduce the torque level (optional):

   A) Record the factory-set position of the **TORQ** trim pot.
   B) Turn the **TORQ** trim pot counterclockwise, until the motor slows down
   C) Turn the **TORQ** pot back clockwise until motor drives the load, **but not further than its original factory-set position.**

5. When wired according to directions the motor should turn clockwise. If the desired rotation is CCW, first disconnect 115VAC line power to the control, and then reverse the connections to terminals A1 and A2 on terminal block **TB1** on the driver board (**Fig. 1**).

6. If an optional Forward-Brake-Reverse (F-B-R) switch is used, direction can be reversed by changing the switch position.

7. If the motor does not operate, check all connections and fuses **FA** and **FL** (**Fig. 1**). If a fuse is blown and the motor *is not* locked (stalled) or overloaded, **DO NOT REPLACE THE FUSE—THE CONTROL MAY BE DAMAGED.** Refer to *"TROUBLESHOOTING"* and follow instructions. If the motor **is** overloaded, reduce the load and replace blown fuses with those of the proper type and rating as specified on the control's nameplate.

MAKING INTERNAL ADJUSTMENTS

Your control has been factory-adjusted and normally does not require readjustment. If you do not need to readjust the control, proceed to *"TROUBLESHOOTING."*

> ***WARNING***
>
> **Use only a non-metallic or insulated adjustment tool (such as a TV alignment tool) for internal adjustments. Circuit components are not at ground potential and accidental short circuiting and shock hazard may occur with conducting tools. Adjustment should be made *only* by qualified service personnel.**

MINIMUM AND MAXIMUM SPEED ADJUSTMENT

The **"MIN" and "MAX" trim potentiometers (Fig. 1)** have already been adjusted so that the lowest **speed pot** setting corresponds to 0 RPM and the highest setting corresponds to motor nameplate speed (2500 or 2000 RPM).

To decrease the maximum speed: turn the **MAX** trim potentiometer counterclockwise. This adjustment will not affect the factory-set minimum speed of 0 RPM.

To increase the minmum speed: turn the **MIN** trim potentiometer counterclockwise. This adjustment will increase the maximum speed beyond nameplate speed (2500 or 2000 RPM). The **MAX** trim potentiometer will need to be readjusted.

To allow motor operation at *very* low speeds: turn the **MIN** potentiometer *slightly* counterclockwise. If the motor will not stop with the speed input signal or speed potentiometer at zero, turn the **MIN** potentiometer clockwise until the motor stops.

> ***WARNING***
>
> **To avoid damage to the control or motor, and to assure the best high speed motor performance possible, the maximum armature speed should not exceed the rated nameplate speed of the motor.**

Adjustment of the **"MIN" and "MAX" trim potentiometers** may have to be repeated several times to arrive at the desired speeds.

Control Model Number	Motor or Gearmotor Type	HP	Rated Speed (RPM)	Voltage Across A1 and A2 (Adjust "Reg" Pot)	Voltage Across TP1 and TP2 (Adjust "Max" Pot)
810 thru 819	24D0BEPM	1/50	2500	104VDC	2.3VDC
	24D1BEPM	1/32		112VDC	2.5VDC
	24D2BEPM	1/29		111.6VDC	2.6VDC
	24D3BEPM	1/19		113.8VDC	
	24D4BEPM	1/17		114.5VDC	2.8VDC
830 thru 838	32D3BEPM	1/12		116VDC	2.3VDC
	32D4BEPM	1/12	2000		
	32D4BEPM	1/10	2500		
	32D5BEPM	1/8		120VDC	
	42D3BEPM	1/8		123VDC	
	42D4BEPM	1/6	2000		
850 thru 858	42D4BEPM	1/6	2500		2.2VDC
	42D5BEPM	1/4			
	42D7BEPM	0.29	2000		
	42D7BEPM	1/3	2500	128VDC	

Figure 9
Table for Regulation Adjustment.

TORQUE (CURRENT) LIMITING ADJUSTMENT

The **"TORQ" trim potentiometer** (**Fig. 1**) has already been adjusted so that the motor will never see more than 225 to 250 percent of its rated current input. **To reduce the maximum current available to the motor:** turn **TORQ** trim potentiometer counterclockwise. In this manner, the motor's torque output can be limited to as little as 25% of its nameplate rating. This adjustment is covered in *"OPERATING INSTRUCTIONS"*, page 21.

> ***WARNING***
>
> **Avoid turning the *"TORQ"* trim potentiometer clockwise. An increase in the maximum current output could damage the control, the motor, gearing if present, or the equipment driven by the motor/control system.**

If for any reason the **TORQ** trim potentiometer has been turned out of adjustment, and you wish to return the **TORQ** potentiometer to its factory setting, return the control to Bodine Electric. This adjustment is inherently dangerous, since it could result in damage to the output shaft and/or gearing.

SPEED REGULATION ADJUSTMENT

Speed regulation has been factory-adjusted for your motor. It is a very critical adjustment which can affect the control's stability and the **MIN** and **MAX** trim potentiometer settings. *Consequently, the **REG** trim potentiometer (**Fig. 1**) should not be readjusted.* If for any reason the **REG** trim pot has been turned out of adjustment, use the following procedure to arrive at the proper setting:

1. Turn the 115VAC power off to the control.

2. Connect an external 10K ohm (1/2 W min.) speed potentiometer as shown in **Fig. 1** (or use an external speed control signal).

3. Check for proper DIP switch settings as shown in **Fig. 2**. The proper motor, as specified on the control nameplate, must be connected to the control with no load.

4. Supply power to the control (*exactly* 115VAC).

5. Turn the **MIN** trim potentiometer fully clockwise. (This gives zero no-load speed at the "zero" external speed input level.)

6. Turn the external speed potentiometer to its highest setting (or increase the speed control signal to the maximum value allowed).

7. Locate test points **TP1** and **TP2** at the top of the Driver Board (**Fig. 1**). Attach a voltmeter across these terminals and read the DC voltage. Adjust the **MAX** trim potentiometer to arrive at the voltage specified in **Fig. 9**.

8. Locate terminals **A1** and **A2** on the driver board **terminal block** (**Fig. 1**). Measure the DC voltage across these terminals. Adjust the **REG** trim potentiometer to arrive at the voltage specified in **Fig. 9**.

ACCELERATION ADJUSTMENT

The **ACCEL** trim potentiometer (**Fig. 1**) controls the speed input response time, thus influencing the motor's acceleration and deceleration time. The **ACCEL** trim pot will have an effect when a speed signal is reduced or increased. When braking or reversing direction with the electronic F-B-R Board, the deceleration time will be determined primarily by the braking resistor value. Although the **ACCEL** pot will control acceleration and deceleration, deceleration is also influenced by motor speed and system inertia, which will vary with the application.

To decrease acceleration time: turn the **ACCEL** trim potentiometer clockwise. The minimum acceleration time, with the pot fully clockwise, is approximately 0.5 seconds.

To increase acceleration time: turn the **ACCEL** trim potentiometer counterclockwise. The maximum acceleration time, with the pot fully counterclockwise, is approximately 10 seconds.

TROUBLESHOOTING

WARNING

Disconnect the control from the power source before working on the control, motor, or driven equipment.

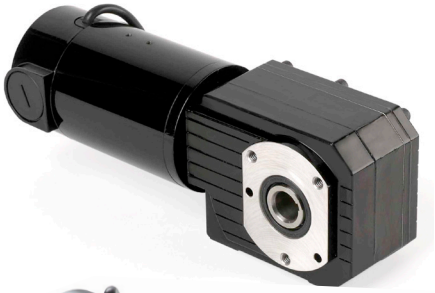
Your control should not require maintenance under normal conditions. If you encounter a problem, follow the advice contained in this section. If the problem persists, contact your source of purchase or a Bodine Authorized Service Center and describe the problem in detail. Include all the nameplate data. Do not disassemble the product unless authorized by Bodine Electric Company. Performing repairs not authorized by Bodine Electric Company or removing screws will void the Warranty. Read all applicable instruction literature provided with your control and accessories, and double-check your wiring.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
CONTROL BLOWS LINE FUSE "FL"	Shorted SCR, Power Bridge	Replace the PC board or Varistor (V1) or power bridge.
	Control or Motor Shorted to Earth Ground	Check for shorts and repair as required.
MOTOR WILL NOT START	Blown Line Fuse (FL) or Armature Fuse (FA)	Replace fuse. Refer to Fig. 2 for recommended fuse value.
	J2 Jumper Assembly is missing on the driver	Install the jumper assembly, see Fig. 1.
	SCR Inhibit Function is activated	Check to be sure that Pin 11 of J1 on driver board is 2.7 VDC above PIN 7 (0 VDC), see Fig. 1.
	Defective Motor or Worn Brushes	Repair or replace motor.
MOTOR WILL NOT COME UP TO SPEED	Maximum speed adjustment is set too low	Turn the MAX. trim pot (R10) CW to increase speed, refer to "Minimum and Maximum Speed Adjustment" page 22.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
MOTOR WILL NOT COME UP TO SPEED (continued)	Motor Overloaded	Re-examine the load parameters.
	Regulation is set too low	Check the DIP switch settings (Fig. 2) and refer to "Speed Regulation Adjustment", page 24.
	Defective component on the driver board	Contact Distributor or Bodine for assistance.
	Torque adjustment is set too low	Contact Distributor or Bodine for assistance.
MOTOR SPEED IS UNSTABLE OR PULSATES	Regulation is set too high	Check the DIP switch settings (Fig. 2) and refer to "Speed Regulation Adjustment" page 24.
	Defective Motor	Repair or replace motor.
MOTOR WILL NOT MAINTAIN SPEED UNDER LOAD	Regulation is set too low	Check the DIP switch settings (Fig. 2) and refer to "Speed Regulation Adjustment" page 24.
	Torque adjustment is set too low	Contact Distributor or Bodine for assistance.
	Motor Overloaded	Re-examine the load parameters. Armature current should not exceed motor's nameplate current.
MOTOR WILL NOT STOP WITH SPEED POTENTIOMETER ADJUSTED AT ZERO	Minimum speed adjustment is set too high	Turn the MIN pot (R15) CW until motor stops.
	Defective speed potentiometer	Replace the potentiometer.
NO SPEED ADJUSTMENT	Defective Speed Potentiometer	Replace the potentiometer.
	No connection to PIN 10 on J1 of the driver	Check connections to J1. Refer to Fig. 1.

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