

Instructions for Installation and Operation

Filtered PWM Speed Control for Permanent Magnet DC Motors

Model 0794 Speed and Direction Control up to 5/8 HP NEMA-1/IP-20



Specifications

Product Type:..... WPM-2148E1
Input Voltage: 115 VAC +/-10%, 50/60 Hz,
Single Phase
Output Voltage: Adjustable, 0 to 130 VDC



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This manual contains the basic information needed to install and operate Bodine Model 0794 DC Speed Control. This manual does not profess to cover all details or variations in equipment, or to provide for every possible contingency associated with installation, operation, or maintenance. 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.

IMPORTANT

Read this manual completely and carefully. Pay special attention to all warnings, cautions, and safety rules. Failure to follow the instructions could produce safety hazards that could injure personnel or damage the control, motor, or other equipment.

The 0794 control has been evaluated by Underwriters Laboratories for conformance to UL standard 508C and CSA standard C22.2 No. 14 and bear the UL Recognized Component mark.

The DC control is a power electronic device. For safety reasons, please read through this operations manual in detail and observe those paragraphs with the safety alert symbol, such as the following one.

WARNING

- *Do not touch printed circuit board (PCB) right after turning off power. Wait for six minutes after green LED turns off.*
- *Do not attempt to wire circuitry while power is on.*
- *Do not attempt to examine components and signals on the PCB while the control is operating.*
- *Do not attempt to disassemble or modify internal circuitry, wiring, or components of the control.*
- *Enclosure must be properly grounded.*

IMPORTANT

The control does not provide motor overload or over temperature protection. The user is responsible for providing this protection in the equipment where this control is used."

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SPECIFICATIONS

ABOUT THIS PRODUCT—The Bodine Model 0794 speed control is designed to provide variable speed control of standard permanent magnet DC motors. Adjustable acceleration and deceleration are provided, making the drive suitable for soft start applications. The full-featured drive is easy to install and operate. Simple trim pot adjustments eliminate the computer-like programming required on other drives. However, for most applications, no adjustments are necessary.

Table 1 – Control Specifications

Parameter	Specification
Product Type:	WPM-2148E1
Input Voltage:	115 VAC +/-10%, 50/60 Hz, Single Phase
Drive Type:	PWM
Output Voltage:	Adjustable, 0 to 130 VDC
Motor Type:	Permanent Magnet Brush DC
Max. Input Current, Continuous:	6.0 Amps RMS
Max. Output Current, Continuous:	3.7 Amps DC
Max. Output Current, Peak:	7.1 Amps DC
Max. Motor HP Rating, Motors rated 1725 RPM @ 90 VDC:	7/16 HP (.33 kW)
Max. Motor HP Rating, Motors rated 2500 RPM @ 130 VDC:	5/8 HP (.48 kW)
Operating Temperature:	0°C to +40°C (32°F to 122°F)
Speed Regulation Adjustment:	1% of rated speed obtainable with most DC motors
Diagnostics:	green power LED, red current limit LED
Direction Control:	YES

INSTALLATION

This control should only be installed by a qualified person familiar with its operation and associated hazards. The National Electrical Code (NEC), local electrical and safety codes, and when applicable, the Occupational Safety and Health Act (OSHA) should be observed to reduce hazards to personnel and property.

CAUTION

Do not connect the control to the power supply if there is any sign of damage. Notify the carrier and your distributor immediately.

Step 1: Mounting the Control

The control may be mounted using any two or all four mounting holes. The mounting holes will accommodate either 1/4-20 or M6 screws. See Figure 1 for distances between the mounting holes.

Although the control is designed for industrial applications, avoiding certain installation sites can prolong the lifespan of the control.

- Avoid areas where surrounding air temperature exceeds 40°C (direct sunlight or near heating equipment or inside a panel without a cooling fan).
- Avoid locations where the front panel dial and switch may be bumped and accidentally turned on/off or damaged.
- Avoid environments with corrosive gas.
- Avoid locations near radioactive matter or flammable material.
- Avoid locations near equipment that generate electromagnetic interference (soldering or power machinery).
- Avoid mounting the control to a surface that vibrates.

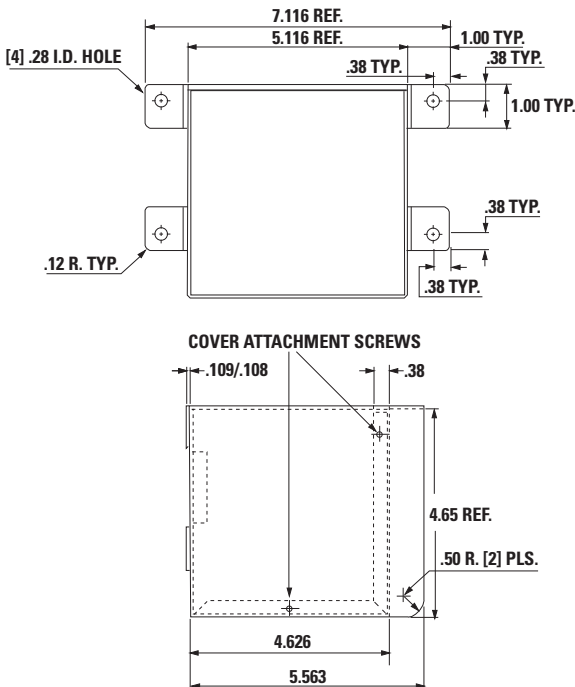


Figure 1—Control mounting dimensions

Step 2: Preliminary Setup

CAUTION

Exposed circuit boards must be protected from electrostatic discharge during handling to prevent component damage.

MOTOR SIZE SELECTOR SWITCHES—The Model 0794 control is packaged with the enclosure cover in place, but not attached. Remove the cover to set the motor size selector switches. Figure 2 shows the location of a bank of 8 dip switches. Set switches 1 through 6 to match the type, speed, and current ratings on the motor nameplate per Table 2.

Table 2—Setup of DIP Switches 1 through 6

Bodine Motor Type	Motor Ratings				Control Setup		
	Rated Volts (DC)	Armature Speed (RPM)	Rated Current (Amps)	Motor Power (HP)	DIP Switches ON (1-6)	Typical Current Range of TORQ. Potentiometer (DC Amps) ¹	Typical Input Current at Max. TORQ Setting (RMS Amps)
24A0	130	2500	0.22	1/50	— ²	1.2	0.62
24A2	130	2500	0.3	1/29	— ²	1.2	0.90
24A4	130	2500	0.48	1/17	— ²	1.2	1.30
24A4	90 130	2500	.56 .81	1/23 1/11	— ²	1.2	2.00
24A4	115	11,500	1.1	1/7	2,3,5	7.1 ³	2.38
33A3	90 130	2500	.78 1.0	1/16 1/8	1	1.5	2.38
33A3	130	2500	0.74	1/12	1	1.5	1.97
33A3	130	2000	0.71	1/12	1	1.5	1.80
33A5	130	2500	0.91	1/8	3	2.4	2.25
33A5	90 130	2500	1.4 1.8	1/8 1/4	3	2.4	3.86
33A5	90 130	2500	1.3 1.7	1/8 1/4	3	2.4	3.86
33A5	130	2000	1.4	1/6	3	2.4	3.18
33A7	90 130	2500	1.8 2.4	1/6 1/3	3,5	5.8 ⁴	4.75
42A3	130	2500	1	1/8	1,3	2.7	2.23
42A4	130	2000	1.3	1/6	2,3	3	2.82
42A5	90 130	2500	1.9 1.8	3/16 1/4	3,5	5.8 ⁴	3.61
42A5	90 130	2500	2.1 2.8	3/16 3/8	3,5	5.8 ⁴	5.29
42A5	130	2500	1.8	1/4	3,5	5.8 ⁴	3.61
42A5	130	2500	2.7	1/3	3,5	5.8 ⁴	5.11
42A7	130	2500	2.3	1/3	2,3,5	7.1 ⁴	4.68
42A7	130	2500	3.3	1/2	2,3,5	7.1 ⁴	6.71
42A7	130	2500	3.3	7/16	2,3,5	7.1 ⁴	6.53

1. May exceed the continuous load capability of the motor or gearing – it is the user's responsibility to make sure the application does not exceed continuous rating of motor or gearing.
2. DIP switches are factory preset with positions 1-6 off (DIP switch 7 is off; DIP switch 8 is on).
3. For 24A4 11,500 RPM motor, set TORQ pot. at 10 o'clock maximum!
4. May exceed the continuous rating of the control – it is the user's responsibility to make sure that the continuous control ratings are not exceeded

ACCEL/DECEL SELECTOR SWITCHES—Figure 2 shows the location of a bank of 8 DIP switches. Set switches 7 and 8 to select the acceleration and deceleration time range per Table 3.

TABLE 3 – Setup of DIP switches 7 and 8.

Switch Number		Acceleration/Deceleration Time Range (seconds) ¹	
7	8	ACC pot fully CCW (factory setting)	ACC pot fully CW
OFF	OFF	0.1	0.3
OFF ²	ON ²	0.5	2.0
ON	OFF	3.5	12.0
ON	ON	4.0	15.0

1. The time for voltage across A1 and A2 to ramp up from 0 to 130 VDC when voltage across S1 & S2 switches instantly from 0 to 5 VDC; or the time to ramp down from 130 to 0 VDC when voltage across S1 & S2 switches from 5 to 0 VDC.
2. DIP switches are factory preset with positions 7 off and 8 on.

Step 3: Electrical Connections

⚠ WARNING

Do not attempt to wire circuitry while power is on.

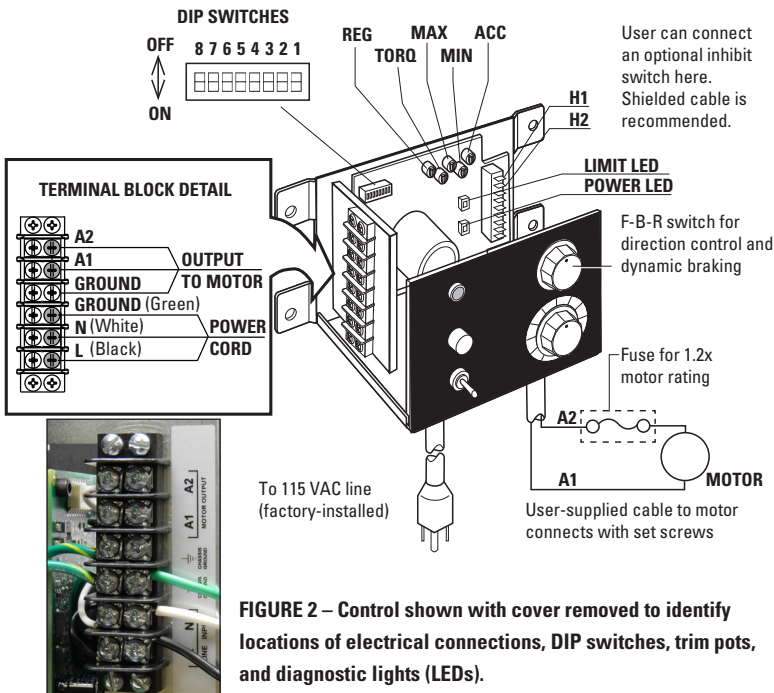


FIGURE 2 – Control shown with cover removed to identify locations of electrical connections, DIP switches, trim pots, and diagnostic lights (LEDs).

⚠ WARNING

The AC power line to the control should be the very last connection made.

INHIBIT SWITCH (OPTIONAL)—A mechanical switch or relay with low voltage contacts may be connected to 0.25" spade terminals "H1" and "H2". The motor will run with the switch open. Closing the switch will stop the motor.

⚠ WARNING

The inhibit switch should not be used to disable motor or control when servicing these or driven equipment. Disconnect AC power instead.

⚠ CAUTION

The control board signal common is not at ground potential. Any external signal or equipment connected to the control must be electrically isolated from ground.

MOTOR CONNECTIONS—User must supply cable to connect to the motor. Set screw connections are located in control. Add motor fuse to A2. The motor fuse should be sized 1.2-times the motor current rating.

LINE FUSE—The control has a fuseholder on the front panel of the enclosure. It uses a 15 amp fuse.

AC POWER CONNECTIONS—The control has a six foot long cable with a standard connector for a 115 VAC outlet. When all other connections are made, plug it in.

OPERATION

Step 4: Preliminary Checks Before Starting

1. Recheck all fuses, connections, and adjustments.
2. Check that motor is securely mounted.
3. Test the motor unloaded first to verify proper connections (follow instructions in Step 5). If the motor operates properly unloaded, then proceed with testing it loaded.
4. Check all rotating members. Be sure keys, pulleys, etc. are securely fastened and safety guards are in place.
5. Check for proper mounting and alignment of products, and verify safe loading on shafts and gears.

Step 5: Operating the Control

1. With AC power switch OFF, set the speed pot to ZERO (fully counterclockwise).
2. Turn the AC power switch ON. If an optional inhibit switch is being used, open it.
3. Turn speed pot until motor rotates at desired speed. Note that “SCR rated” motors (motors rated at 90 VDC) will run faster with a filtered control because of the 130 VDC max. output voltage.
4. If the motor does not start promptly and run smoothly, refer to “TROUBLESHOOTING” below.

Step 6: Internal Adjustments

Most users will find the factory settings of the control to be acceptable for their application. For those who want to fine-tune the control, four trim potentiometers on the PC board can be adjusted. First, remove the enclosure cover. Figure 2 shows the locations of the trim pots.

WARNING

Use a non-metallic or insulated adjustment tool for internal adjustments. Circuit components are at high potential and accidental short circuiting and shock hazard may occur with conductive tools.

MINIMUM SPEED LIMIT—Turn the MIN pot clockwise (CW) to make the motor run faster than 0 rpm when the speed pot is set at “0”. With MIN pot fully CW and speed pot set at “0”, control output will be about 50 VDC. Increasing the minimum speed will also increase the maximum speed, so the MAX pot may need to be adjusted.

MAXIMUM SPEED LIMIT—Turn the MAX pot counterclockwise to make the motor run slower than full speed when the speed pot is set at “100”. With the MAX pot fully counterclockwise and the speed pot set at “100”, the motor will run at about 60% of its full speed. The factory setting is for 130V motors.

TORQUE LIMIT—Turn the TORQ pot counterclockwise to reduce the peak torque capability of the motor. Most Bodine motors will produce about 200% of rated torque with the horsepower switches set per Table 2 and with the TORQ pot turned fully clockwise. The motor must be properly sized for the application so that it only produces this peak torque intermittently. Turning the TORQ pot fully counterclockwise will produce 0% torque (stall).

ACCELERATION & DECELERATION TIME— The ACC pot simultaneously adjusts both the acceleration and deceleration times within the range selected by DIP switches 7 and 8 per Table 3. Turn CW to increase times.

SPEED REGULATION—The REG pot sets the gain of the IR compensation. It is factory-set so that the speed of most Bodine motors varies no more than 2% from no load to full load at full speed when the horsepower switches are set per Table 2. The REG pot normally requires no adjustment by the user unless better speed regulation is needed or no speed regulation is needed. Turn the REG pot clockwise to increase IR compensation. Turning it too much will make the system unstable. If that happens, turn the REG pot counterclockwise to reduce IR compensation. When using the WPM control in a closed-loop system with another control device, turn the REG pot fully counterclockwise to eliminate IR compensation.

Step 7: Using the Forward-Brake-Reverse Switch

Bodine model 0794 includes a Forward-Brake-Reverse switch that provides dynamic braking for applications where the motor needs to be manually reversed infrequently or as a setup function in an application. Figure 2 on page 7 shows the location of the FBR switch.

When the FBR switch is in the “FORWARD” position:

The armature is connected such that the positive output from the control is connected to the white wire armature wire (A2) and the negative output is connected to the black armature wire (A1). A stock Bodine DC motor will turn CW when viewing the output shaft.

When the FBR switch is in the “STOP” position (dynamic braking):

The armature leads are disconnected from the control and a 100 Ohm, 10W braking resistor is connected across the armature terminals causing the motor to decelerate. The response time, or time to dynamically brake, is dependent upon the inertia of the armature, the inertia of the load, brake resistor value, initial speed and a number of other factors. Please contact our technical support team if you have further questions: info@bodine-electric.com.

When the FBR switch is in the “REVERSE” position:

The armature is connected such that the negative output from the control is connected to the white wire armature wire (A2) and the positive output is connected to the black armature wire (A1). A stock Bodine DC motor will turn CCW when viewing the output shaft.

TROUBLESHOOTING

WARNING

Disconnect the control from the AC power source and wait seven minutes before working on the control, motor, or driven equipment.

If the motor does not operate, first carefully remove the enclosure cover and observe the condition of the two diagnostic LEDs.

1. If the green “PWR” LED is not illuminated, the control is not getting power from the AC line. Turn the ON/OFF switch off and double check all connections and fuses.
2. If both the green “PWR” LED and the red “LMT” LED are illuminated, make sure the TORQ pot is not turned fully counterclockwise. If the motor is overloaded, reduce the load or use a larger motor.
3. If a fuse is blown and the motor is overloaded, reduce the load and replace the fuse with a new one of the same type and rating.
4. If a fuse is blown and the motor is not locked (stalled) or overloaded, do not replace the fuse. The control may be damaged.
5. If the problem persists, contact your source of purchase or a Bodine Authorized Service Center and describe the problem in detail. Include all nameplate data for both motor and control.

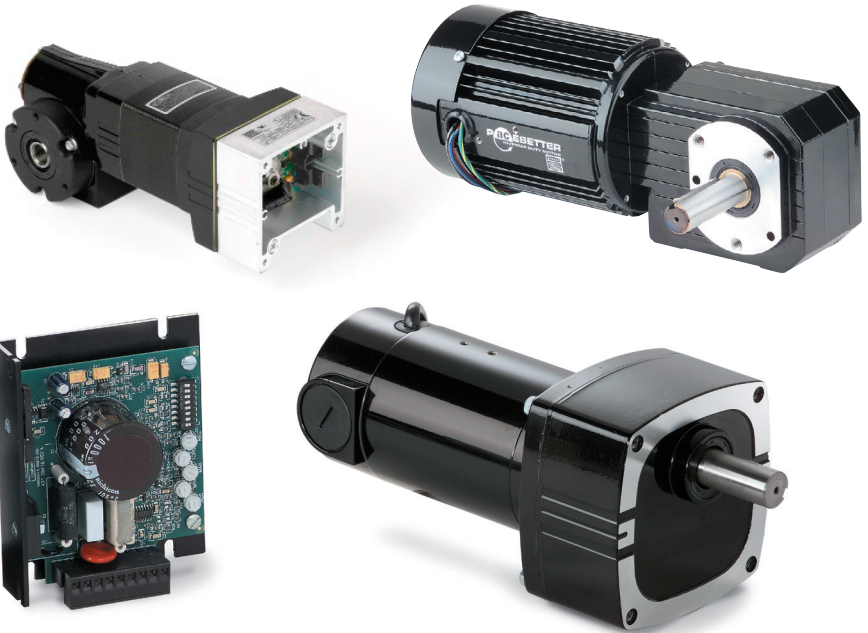
BODINE LIMITED WARRANTY

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:** _____

Bodine offers over 1,200 standard gearmotors, motors and system-matched speed controls.



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Bodine offers the widest selection of variable-speed AC, permanent magnet DC and brushless DC fractional horsepower gearmotors and motors in the industry. For complete specifications, 3D CAD drawings, or to order online, visit bodine-electric.com.



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