

Instructions for Installation and Operation

Filtered SCR Brushless DC Motor Speed Controls (NEMA-12)

Model 3912, 0-2,500 rpm

Model 3913, 0-10,000 rpm



SPECIFICATIONS

Product Type	ABL-3912E/ABL-3913E
Input Voltage:	115 VAC \pm 10%, 50/60 Hz (Single Phase)
Input Current:	12 Amps rms
Output Voltage:	0 to 130 VDC
Continuous Output Current	3.0 Amps
Peak Output Current	6.0 Amps
Ambient Temperature:	0° to 40° C (Maximum)
Control Hp Range:	Up to 3/8 Hp
Control Speed Range:	Up to 30:1



www.bodine-electric.com



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 which could injure personnel or damage the control, motor, or other equipment. If you have any doubts about how to connect the control or motor, refer to the detailed sections of this manual.

QUICK REFERENCE

HAVE YOU?

- ☐ Read the installation and operation instructions contained in this manual.
- ☐ Read and understood all of the precautions outlined in this manual pertaining to potential hazards to personal safety and equipment.
- ☐ Mounted the control properly. Details on Page 9.
- ☐ Connected the circular connector on the control output cable to the corresponding circular connector on the Bodine Brushless DC motor. Details on Page 9.
- ☐ Selected the proper control horsepower settings for the motor being used. Details on Page 9.
- ☐ Installed the motor fuse. Details on Page 11.
- ☐ Provided an adequate grounded source of AC power. Details on Page 11.
- ☐ Refer to the Operation Section of this manual for preliminary start-up details and specific control functions. Page 12.

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GENERAL INFORMATION

Thank you for selecting a Bodine Type ABL Encased Brushless DC Motor Control. Your new control will provide the same excellent performance and reliability that have been a Bodine tradition since 1905. Bodine Electric Company takes pride in the quality of its products and in satisfying its customers. Every effort has been made to provide you with a product free of defects in design, workmanship, and materials. In order for us to maintain our tradition of quality, please report any cases of unsatisfactory service or products to Bodine Electric Company promptly.

About This Manual

This manual contains the basic information needed to install and operate a Bodine Type ABL-3912E and ABL-3913E Brushless DC Motor Control. It is organized in a systematic, step-by-step fashion so that the system may be set up safely in the shortest possible time. It does not profess to cover all details or variations in equipment, nor 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.

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.

Safety Standards

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).

Bodine equipment "recognized by U.L., Inc." are either labeled with the UR or cURus marks. In addition, products that are CSA certified are identified by the CSA mark. If you need specific information regarding the third-party approval status of Bodine products, contact the nearest Bodine representative, or the home office.



CONTROL DESCRIPTION AND FEATURES

The ABL-3912E, and ABL-3913E Brushless DC Motor Controls are encased style controls. They are supplied in their own enclosure to simplify mounting. The controls operate from a nominal 115 VAC, 50/60 Hz. power source. They provide electronic commutation and phase current switching needed to

operate brushless DC motors. DIP switch selectable current limit settings allow the ABL-3912E and ABL-3913E to be used with a wide range of fractional horsepower motors and gearmotors.

The ABL-3912E and ABL-3913E provide a 130-Volt filtered output for improved form factor, plus a built-in dynamic braking module. Motor speed is controlled by a speed potentiometer mounted on the enclosure front panel. Direction of rotation and braking are controlled from a “Forward-Brake-Reverse” (F-B-R) switch also located on the front panel. Trim potentiometers on the control circuit board allow additional fine tuning of minimum and maximum speed settings, torque, acceleration and deceleration times. A built-in “Smart Reverse™” circuit prevents plug reversing by dynamically braking the motor to a stop before changing its direction. A built-in shutdown circuit disables the control during over-voltage, under-voltage, or invalid commutation sensor state conditions. Specific Bodine motor sizes which can be used with these controls are listed in the Chart in Figure 3.

Accessory Items

- Model 3982 Extension Cable – extends cable between motor and control by six feet. Both ends equipped with circular connectors for simplified connection. Length: 6 ft.
- Model 0895 Enclosure Sealing Kit – seals the ABL-3912E enclosure to provide IP-44 level splash proof protection.
- Model 3984 Isolation Module – isolates the control from system controller inputs, which may be at different potentials. This module is not required unless the ABL-3912E is connected to a separate control system. See the “Specialized Application Wiring” section of this manual.

Parameter	Specification
Product Type	ABL-3912E/ABL-3913E
Input Voltage:	115 VAC \pm 10%, 50/60 Hz (Single Phase)
Input Current:	12 Amps rms
Output Voltage:	0 to 130 VDC
Continuous Output Current	3.0 Amps
Peak Output Current	6.0 Amps
Ambient Temperature:	0° to 40° C (Maximum)
Control Hp Range:	Up to 3/8 Hp
Control Speed Range:	Up to 30:1
Control Speed Regulation:	Less than 1% of rated (Typical)
Line Voltage Compensation:	Negligible speed change with changes in line voltage
Acceleration Time Range:	(Model 3912): 0.2 to 10 seconds (0 to full speed)
	(Model 3913): 0.5 to 30 seconds (0-full speed)
Dimensions:	inches: (6.2 W x 4.0 D x 8.5 H);
	cm: (15.8 W x 10.2 D x 21.6 H)
Net Weight:	7.5 lbs. (3.4 kg.)

IMPORTANT SAFETY PRECAUTIONS

The following safety precautions must be observed during all phases of installation, operation, service, and repair of this motor control 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.

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

The user should refer to 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:

National Electrical Manufacturers Association
www.nema.org

Warnings (such as the example below) highlight procedures which present potential danger to people. **Cautions** highlight possible danger to equipment. Both are used throughout this manual and must always be followed.

WARNING

Dangerous voltages may be present in the electronic control and motor. These voltages could cause serious injury or death. Use extreme caution during handling, testing, and adjusting. Properly guard the electronic control and motor to prevent accidental contact by all persons.

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

CAUTION

These controls are designed to provide optimum performance when used with Bodine Electric Company motors. They should not be used with other manufacturer's motors without first contacting the Bodine Electric Company. Failure to contact Bodine in advance could cause damage to the control or the motor.

Inspecting the Control

Check the items you received against your purchase order. Carefully examine the control (and any optional kits or parts) for shipping damage. Parts errors should be reported to Bodine. Shipping damage claims should be made to the freight carrier.

Before installation, review the application to confirm that the proper motor and 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. Although Bodine Electric Company assists its customers in selecting motors and controls for specific applications, determination of fitness for purpose or use is solely the customer's responsibility.

Normal Operating Conditions

Unless otherwise agreed to by Bodine, all control nameplate ratings are based on the following normal operating conditions. Consult Bodine Electric Company if variations beyond these limits are anticipated.

1. *Continuous Duty*: without frequent reversals or starts and stops.
2. *Maximum Ambient Temperature*: 50° C (122° F) for chassis controls; 40° C (104° F) for all encased 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%.

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. When fuses are replaced, they must always conform to the values and ratings specified on the control's nameplate or in the fuse chart in Figure 4.

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 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 are disconnected

Note: Motor over temperature sensing is not provided by this control.

Environment

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. The National Electric Code (NEC) allows exceptions, but NEC and NEMA safety standards should be studied thoroughly before exercising this option.

Moisture increases the electrical shock hazard of electrical insulation. Therefore, open-type or unsealed controls not specifically designed for such use, should be protected from 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 authorized Bodine service representatives. Repairs made by persons not authorized by the Bodine Electric Company will void the warranty. 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, components or motors. To ensure continued compliance with the design specifications and safety standards, the electronic control or motor should be returned to Bodine Electric Company or an Authorized Service Center for servicing.

WARNING

To avoid injury because of unsuspected mechanical motion, always disconnect the 115 VAC power to the control before performing any service procedures on the motor, control, or driven equipment.

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 — 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.

INSTALLATION INSTRUCTIONS

WARNING

This control should only be installed by a qualified technician, electrician, or electrical maintenance 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. Circuitry is not at ground potential. Do not perform work on or near the control while it is connected to the AC line.

CAUTION

Exposed circuit boards should be protected from electrostatic discharge. The control board uses CMOS circuitry. Static discharge into the control board must be avoided to prevent component damage.

Mounting the Control

Detailed mounting dimensions and CAD drawings are available online. The control should be mounted vertically so that the control panel is readable and the cabling extends from the bottom of the enclosure. This arrangement provides optimum air flow around the control.

Electrical Connections

Read the following instructions as well as all of the applicable safety recommendations, before making any electrical connections between the control, motor, or other motion control electronics.

Motor Cable Connection

All electrical connections for motor phase outputs and commutation sensor control inputs are prewired and terminated in a circular connector and cable assembly attached to the control enclosure. To connect the ABL-3912E or ABL-3913E controls simply mate the circular connector from the control to the circular connector on the associated Bodine motor.

Horsepower (DIP Switch) Settings

Figure 1 shows the Horsepower Select switch on the main control board. It contains eight switch levers numbered 1 through 8. The chart in Figure 3 shows the proper DIP switch settings for various Bodine motor types. Determine the first four digits of the motor's type number from the nameplate. Find the same four digits in the chart in Figure 3 to determine the proper settings of the DIP switches. An insulated tool should be used to adjust the switch settings.

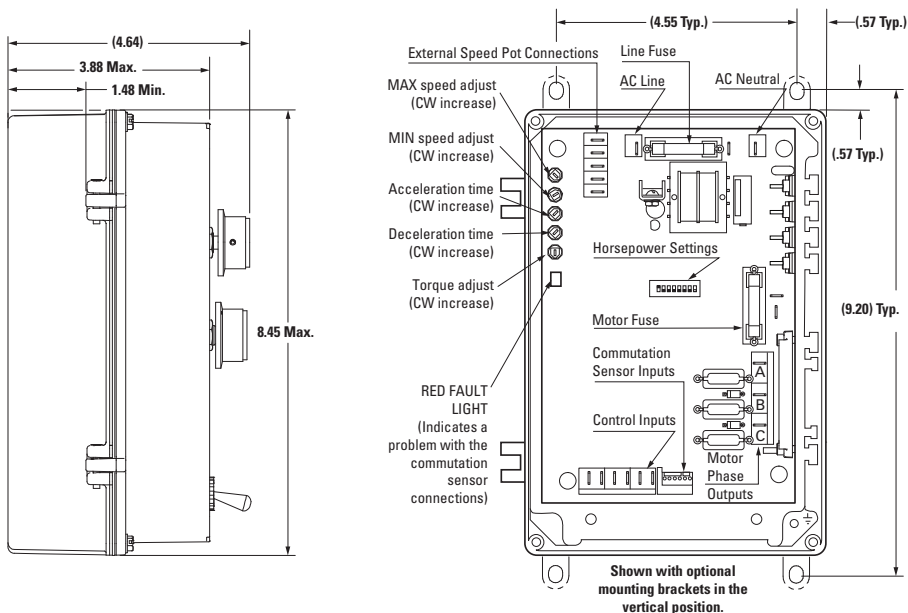


Figure 1 - Detail of Control Circuit Board in Enclosure.

Typical MAX Motor Speeds with 10 K Speed Pot						
	DIP Switch 7	DIP Switch 8	CCW MAX Pot	Calibrated MAX Pot	CW MAX Pot ¹	T-Out Pulse Width (μS)
	ON	ON	4400	6600	8800	275
	ON	OFF	6600	10,000	13,000	190
Factory Setting	OFF	ON	6600	10,000	13,000	190
	OFF	OFF	13,000	20,000	26,000	90

1. Max. Speed obtainable is dependent on motor winding (voltage, speed rating, resistance), line voltage and load conditions.

Figure 2 – DIP Switch 7 and 8 Speed Range Settings

Control Model Number	Motor or Gearmotor Type	Hp	Rated Speed (RPM)	DIP Switch Levers in the "On" Position	Line Fuse (F1)	Motor Fuse (F2)	AC rms Input Current
ABL-3912E	22B2...	1/16	2500	2, 6, 8	ABC 15	MDA 6/10	2.7
	22B3...	1/11		1, 2, 6, 8		MDA 8/10	3.6
	22B4...	1/8		1, 3, 6, 8		MDA 1-1/4	4.8
	34B3...	1/5		1, 2, 3, 6, 8		MDA 1-1/2	6.7
	34B4...	1/4		2, 4, 6, 8		MDA 2	8.0
	34B6...	3/8		1, 5, 6, 8		MDA 2-1/2	11.1
ABL-3913E	22B4...	1/5	10,000	1, 2, 3, 6, 8	ABC 15	MDA 1-1/2	6.7
	34B4...	1/3		1, 3, 4, 6, 8		MDA 2-1/2	9.5

Figure 3 - Horsepower (DIP Switch) Settings and Fuse Selection Chart

Motor Commutation Phasing (60° standard)

All standard (stock) brushless DC motors and gearmotors manufactured by Bodine Electric Company are designed for 60° commutation. The factory setting for our BLDC speed controls is also for 60° commutation. It is possible to configure our BLDC stock controls to operate non-Bodine BLDC motors and gearmotors with 120° commutation angle. To change the sensor phasing output on our stock controls for 120° commutated gearmotors or motors, set DIP switch number 6 to the "Off" position. Please note that further application details must be considered to properly match a non-Bodine BLDC motor with one of our stock BLDC controls. To avoid damage or system performance issues, please consult our Technical Support staff at 773-478-3515 or via E-mail: info@bodine-electric.com.

Line Fuse Installation

The control input is protected by factory-installed fuse (F1) shown in Figure 1. It should always be replaced with a fuse of the same type and rating as indicated in the chart in Figure 3.

Motor Fuse Installation

The control output contains a motor fuse (F2) shown in Figure 1. The rating of F2 will vary with the size of the motor used. To determine the proper rating, locate the first four digits of your motor's type number on the motor nameplate. Find the same four digits in the chart in Figure 3 and use only the fuse which is recommended. The ABL-3912E and ABL 3913E are supplied with a motor fuse kit containing all of the fuses listed in Figure 3.

Control Input Connections

The controls on the front panel of the ABL-3912E and ABL-3913E are used to adjust motor speed, braking and direction of rotation. The controls are pre-wired at the factory. Refer to the Operating Instructions for additional details.

AC Power Connections

AC power is supplied to the control through a pre-wired power cord. The power cord should be the last connection made during installation and always be disconnected first before servicing.

WARNING

The ABL-3912E and ABL-3913E must be plugged into a grounded AC outlet using the power cord supplied. The outlet should be capable of providing a continuous current of 12 amps. Do not defeat the safety feature of the three-pronged plug. If your outlet is not a grounding-type AC outlet, have a licensed electrician replace it with one that is.

OPERATING INSTRUCTIONS

WARNING

Explosions, fires, or electric shock hazards can be reduced through thermal and over-current protection, good maintenance, proper grounding, and enclosure selection. Review safety considerations outlined in "Safety Precautions" and "Installing the Control."

Preliminary Checks

1. Before starting the control, check all fuses, connections, and adjustments such as horsepower DIP switch settings.
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. Mechanical considerations such as proper mounting and alignment of products, and safe loads on shafts and gears should be reviewed. 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.

Operating the Control

WARNING

The 115 VAC line cord should be disconnected before starting

1. Toggle the input power switch to OFF and set the speed potentiometer to ZERO (fully counterclockwise).
2. Set the F-B-R switch to the "Brake" position.
3. Connect the 115 VAC power cord to the external power source. Then toggle the 115 VAC input power switch to the ON position.
4. Set F-B-R switch to forward or reverse depending on the direction of shaft rotation you require.
5. Turn speed potentiometer knob until motor rotates. Then adjust the potentiometer to achieve the desired speed. If you wish to reduce the torque level, refer to Internal Adjustments below.
6. If the motor does not operate, check first if the POWER lamp on the outside of enclosure and the red FAULT light on the inside are on. Then disconnect the AC power cord and check all connections and fuses. 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 on page 15 and follow instructions. If the motor is overloaded, reduce the load and replace blown fuses with new ones of the proper type and rating. (See Figure 3.)

Internal Adjustments

Your control has been factory-adjusted for the following settings:

Minimum speed: 0 RPM

Maximum speed: ABL-3912E: 2500 RPM; ABL-3913E: 10,000 RPM

Acceleration: ABL-3912E: 2 seconds; ABL-3913E: 5 seconds

Deceleration: ABL-3912E: 2 seconds; ABL-3913E: 5 seconds

Torque: 200% of rated (based on DIP switch settings)

Refer to Figure 1 for the trim potentiometer locations and approximate initial settings. If you need to readjust the control for your specific applications, proceed as follows:

WARNING

Use a non-metallic or insulated adjustment tool (such as a television 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:

The MIN and MAX trim potentiometers have been factory calibrated. The lowest MIN trim potentiometer setting (fully counterclockwise) corresponds to 0 RPM and the highest MIN setting (fully clockwise) corresponds to approximately 30% of rated speed.

The lowest MAX trim potentiometer setting (fully counterclockwise) corresponds to 60% of rated speed and the highest MAX trim potentiometer setting (fully clockwise) corresponds to approximately 120% of rated speed.

Refer to Figure 1 for trim potentiometer location and settings. Adjustment of the MIN and MAX trim potentiometers may have to be repeated several times to arrive at the desired speeds.

NOTE: Increasing the MIN potentiometer setting will increase the maximum speed beyond nameplate speed. The MAX trim potentiometer will need to be readjusted.

Torque (Current) Limiting Adjustment

The TORQ trim potentiometer (Figure 1) has been calibrated so that the motor will never see more than 200% to 250% of its rated current input. The motor's torque output can be reduced to zero or stall torque. Set the torque based on the system load requirements. Torque may be reduced on lightly loaded systems to protect drive mechanisms, such as gearing, from damage due to overloads. Turn the TORQ trim potentiometer counterclockwise to decrease the torque and clockwise to increase the torque.

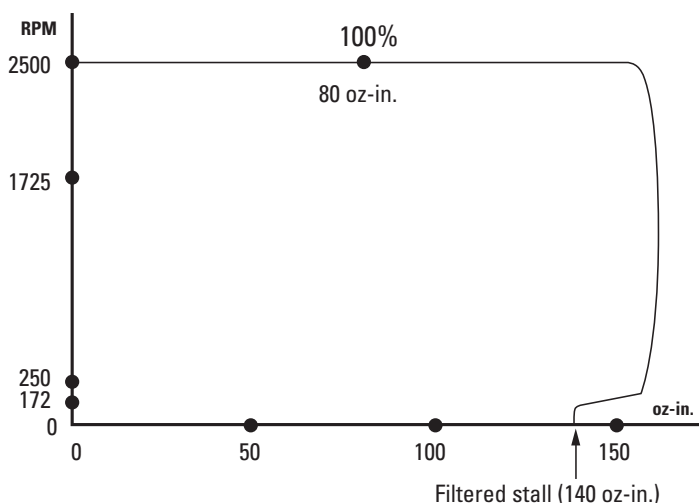


Figure 4 - Speed/Torque Curve Showing Reduced Torque at Lower Speeds

Acceleration Adjustment

Adjusting the ACCEL trim potentiometer (See Figure 1) counterclockwise decreases the motor's acceleration time down to a minimum of approximately 0.2 seconds (ABL-3912E) or 0.5 seconds (ABL-3913E). A clockwise adjustment increases the rate up to a maximum of approximately 10 seconds (ABL-3912E) or 30 seconds (ABL-3913E).

Deceleration Adjustment

Adjusting the DECEL trim potentiometer (See Figure 1) counterclockwise decreases the motor's deceleration time down to a minimum of approximately 0.2 seconds (ABL-3912E) or 0.5 seconds (3913E). A clockwise adjustment increases the rate up to a maximum of approximately 10 seconds (3912E) or 30 seconds (3913E).

TROUBLESHOOTING

WARNING

Disconnect the 115 VAC power cord from the power source before working on the control, motor, or driven equipment.

All Bodine controls undergo extensive testing and calibration procedures to detect and eliminate defects. Your control should not require maintenance under normal conditions. If you encounter a problem, read all applicable instruction literature provided with this control and accessories, and double check the wiring. The charts on the following pages provide assistance in troubleshooting common problems which occur during normal installation and operation.

If the problem persists, contact your source of purchase and describe the problem in detail. Include all the nameplate data. Do not disassemble the product unless authorized by Bodine Electric Company. Performing unauthorized repairs or removing screws will void the Warranty.

ABNORMALITY	CHECK POINT	COUNTERMEASURE
CONTROL BLOWS LINE FUSE	Control or motor connected to or shorted to earth ground	Check for shorts and repair as required.
	Shorted phase leads, wiring incorrect	Correct wiring.
	Damaged control Components	Contact Bodine for assistance.
MOTOR WILL NOT START	Open line fuse or motor fuse	Replace fuse. Refer to Figure 3 for proper value.
	Open power switch	Set power switch to ON
	Motor overloaded	Correct load or choose larger motor.
	TORQ trim pot is out of adjustment	Visually check setting (Figure 1). Adjust TORQ trim pot, page 14.
	Speed potentiometer set to zero	Increase speed potentiometer setting
	F-B-R switch in BRAKE position	Set switch to FORWARD or REVERSE.
	Damaged motor	Repair or replace motor.

ABNORMALITY	CHECK POINT	COUNTERMEASURE
MOTOR WILL NOT COME UP TO SPEED	MAX trim pot set too low	Adjust trim pot, page 13.
	Speed potentiometer set to low	Increase speed potentiometer setting.
	Motor overloaded	Re-examine the load parameters
	TORQ trim pot is out of adjustment	Visually check setting (Figure 1) Adjust TORQ trim pot, page 14.
	Wrong horsepower setting	Check DIP switch setting, page 10.
	Damaged component on the control board	Contact Bodine for assistance.
MOTOR SPEED IS ADJUSTABLE OR PULSATES	Wrong horsepower setting	Check DIP switch setting, page 10.
	Motor and load not correctly aligned	Perform alignment.
	Damaged motor	Repair or replace motor.
	Speed potentiometer set too low	Increase speed potentiometer setting.
MOTOR WILL NOT MAINTAIN SPEED UNDER LOAD	Wrong horsepower setting	Check DIP switch setting, page 10.
	TORQ trim pot is out of adjustment	Visually check setting (Figure 1). Adjust TORQ trim pot, page 13.
	Motor overloaded	Re-examine the load parameters.
MOTOR WILL NOT STOP WITH SPEED POT ADJUSTED	MIN trim potentiometer is set too high	Turn the MIN trim pot CCW until motor stops.
	Open connection on speed potentiometer	Check potentiometer connections.
	Defective speed potentiometer	Replace the potentiometer. Contact Bodine for assistance.
NO SPEED ADJUSTMENT	Defective speed potentiometer	Replace the potentiometer. Contact Bodine for assistance.
	Open connection on speed potentiometer	Check potentiometer connections.

SPECIALIZED WIRING APPLICATIONS

The Bodine ABL-3912E and ABL-3913E encased controls provides optimum performance and easy installation when used with Bodine Brushless DC motors and gearmotors. The control can be used with brushless DC motors from other manufacturers provided electrical specifications and performance requirements are compatible. The user bears the responsibility for determining if another motor is fit for use with the ABL control. If you have doubts, Bodine will assist you in determining if another motor is fit for use with this control.

The ABL-3912E and ABL-3913E are designed for applications where the motor and control act as a stand-alone system. **If the motor and control are to be part of a larger motion control system requiring electronic control or operation from a remote control panel, the model ABL-3910C or ABL-3921C or ABL-3911C Chassis Type Controls are recommended.**

If however, the ABL-3912E, and ABL-3913E must be adapted to fit a unique situation, the following information should be reviewed carefully and understood before proceeding with any wiring changes.

WARNING

The 115 VAC power line to the control should be the very last connection made. Disconnect the power line before making any other electrical connections.

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 (e.g., relay or optically isolated). Nonisolated signals will damage the control and/or associated external equipment.

CAUTION

Read the following instructions as well as all of the applicable safety recommendations, before making any electrical connections between the control, motor, or motion control electronics.

Motor Cable

The ABL-3912E, and ABL-3913E Encased Controls are equipped with a prewired cable which mates with the cable on associated Bodine Brushless DC Motors. If the cables supplied with the motor and control are not long enough, they can be extended using the Bodine Model 3982 Extension Cable. No more than one 3982 extension should be used. This assures that the 12 ft. maximum recommended distance between the control and the motor will be maintained.

The pin designations for the circular connector are as follows:

Pin No.	Lead Color	Wire Gage	Circuit Designation
1	Brown	18	Motor Phase A
2	Red	18	Motor Phase B
3	Orange	18	Motor Phase C
4	Grn/Yel Tracer	24	Chassis ground
10	Black	24	Circuit Common
12	Brown	24	Hall Sensor A
9	Red	24	+12 VDC
13	White	24	Hall Sensor B
14	Green	24	Hall Sensor C
11	Shield	24	Drain*
* The drain is terminated at the control board. Do not terminate the drain at the motor.			

WARNING

The shield common is at a dangerous potential above ground and presents a voltage hazard. Contact with the shield could cause serious injury or death. If a non-Bodine cable is used or if a special cable is fabricated, care should be taken to insulate all exposed shield to avoid serious injury. The shield should only be connected to COM terminal on the Commutation Sensor Input Connector at the control. No other shield connection should be made.

CAUTION

Only copper wire with a minimum 60° C rated insulation is recommended if Bodine cable assemblies are not used.

Connecting Control Inputs From Remote Locations

CAUTION

The INTERFACE connector on the main control circuit board must be disconnected if the ABL front panel controls are overridden by remotely located controls or by a system controller. See Figure 5.

NOTE

The red plastic plug at the bottom of the ABL enclosure may be removed to accommodate remote signal cables. It should be replaced with a IP-44 grade cord grip. If IP-44 splash protection is not required, any cord grip or strain relief designed to fit a 3/8-18 NPT tapped hole may be used.

Remotely Located Speed Control:

To connect a remote speed potentiometer, proceed as follows:

1. Solder the three leads of appropriate length to a 10K ohm potentiometer as shown in Figure 6.
2. Attach 1/4" female quick disconnect terminals to the other ends of the three potentiometer leads.
3. Mount the potentiometer in the desired location.
4. Connect the speed pot leads to the ABL control board as follows:

- Blue to Terminal "S1"
- Orange to Terminal "S2"
- Yellow to Terminal "S3"

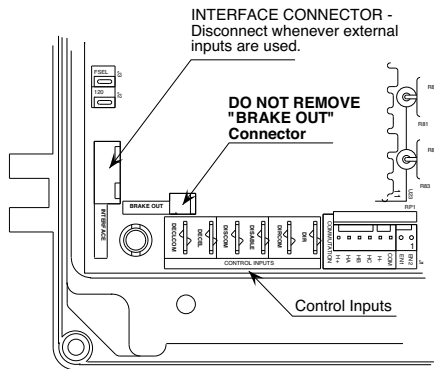


Figure 5 - Interface Connector Detail

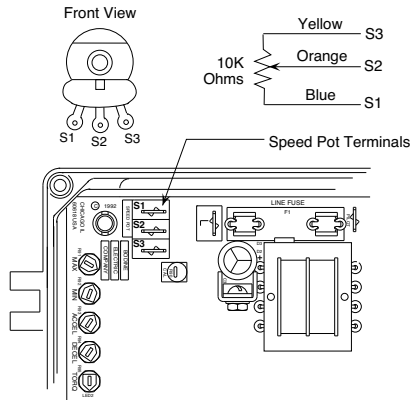


Figure 6 - Remote Speed Control Connections

Remotely Located Braking (Disable), Direction of Rotation, and Deceleration Controls

Mechanical switches or relays can be used to switch the control inputs shown in Figure 5. Figure 7 shows a schematic representation of manual or relay switched inputs.

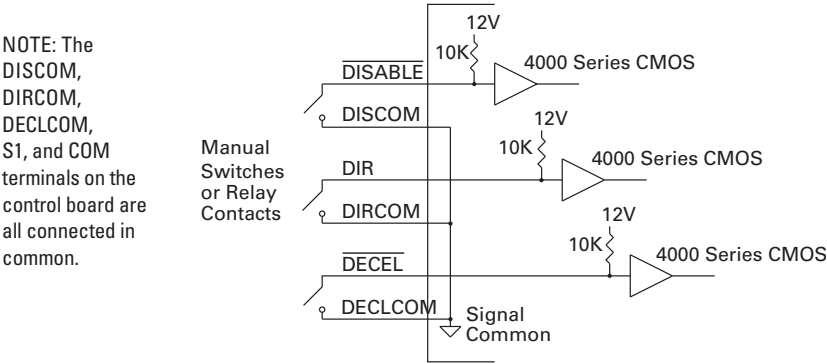


Figure 7 - Manual Switch and Relay Control Inputs.

The following chart lists the control functions relative to the state of the mechanical switches or relays.

Switch	Closed	Open
$\overline{\text{DISABLE}}^1$	Stop	Run
$\overline{\text{DIR}}^2$	CW ⁴	CCW ⁴
$\overline{\text{DECEL}}^3$	Decelerate	Accelerate

1. When the $\overline{\text{DISABLE}}$ switch is closed the motor will be dynamically braked.
2. A “Smart Reverse Circuit” prevents plug reversing when the DIR switch is opened or closed. The motor will brake to a stop before changing direction.
3. The $\overline{\text{DECEL}}$ switch controls soft stops and starts. The degree of acceleration and deceleration can be varied with the trim potentiometers on the control board. See Page 14.
4. The output shafts of gearmotors with odd number of stages (Bodine type designations ending with W3, E1, or E3) will rotate in the opposite direction.

Electronic Control Input Connections

Optional Interface Boards are available from Bodine and other manufacturers. They provide electrical isolation between the input signal and the brushless DC motor control circuitry, and are recommended for motion control applications requiring electronic control of motor speed, rotational direction, deceleration, and braking.

Electronic Speed Control

Motor speed can be controlled with a 0 to +10 VDC isolated signal with 0.1 mA current capability in lieu of the manual speed potentiometer. This speed control input should be connected to terminal S2 on the control board. The common side of the signal must also be isolated and connected to terminal S1 on the main control board.

Logic Signal Control of Braking, Direction of Rotation, and Deceleration

Motor braking (or disable), direction of rotation and deceleration can be controlled using optically isolated logic signals from a programmable controller, personal computer, or other electronics.

WARNING

Never rely on logic circuitry as a means of disabling the motor or control. To prevent unsuspected mechanical motion and potential injury, the 115 VAC power should always be disconnected whenever logic circuits or the driven equipment are serviced.

Exercise extreme caution when using Programmable Logic Controllers (PLCs). Although some may claim to have optically isolated output modules, their output commons may be connected to other circuitry either within or connected to the PLC. In such cases, the PLC outputs should be isolated from the ABL control, by a relay or by an electronic isolation module, to prevent damage to the PLC or the ABL control.

If a Programmable Controller with a relay output module is not available, AC or DC outputs from the PLC can be used to drive separate relay coils. See PLC user's manual for application information. See Figure 6 to determine how to connect relay contacts to the ABL-3912E and ABL-3913E.

Signal Isolation Using a Bodine Model 3984 Interface Module:

Follow the installation instructions provided with the module to isolate the input signals between the control electronics and the ABL Control. See Figure 7 for control input connections and Figure 8 for speed control interface details.

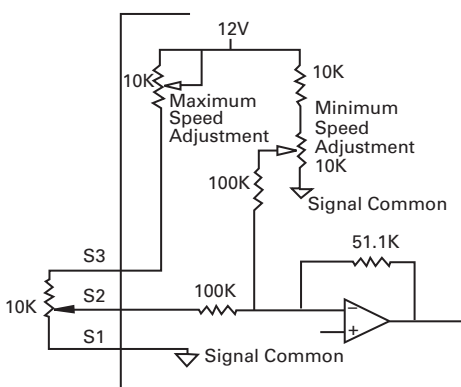


Figure 8 - Manual Speed Potentiometer/ Interface Details

NOTES

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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