Instructions for Installation and Operation

Type ABL-3905 and ABL-3907 24-Volt Brushless DC Motor Controls

Model 3905 up to 1/6 HP

Model 3907 up to 3/8 HP



SPECIFICATIONS

Power Supply Voltage: . . . . . 24 to 35 VDC

Output Current (Continuous): . . . . . Model 3905: 2.5 to 10.0 Amps

Model 3907: 0 to 20.0 Amps

Peak Current: . . . . . Model 3905: 13.5 Amps

Model 3907: 30.0 Amps

BODINE® ELECTRIC COMPANY

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QUALITY IN MOTION®

Part No. 07400185H

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 this control refer to the detailed sections of this manual and the specific control manual.

QUICK REFERENCE

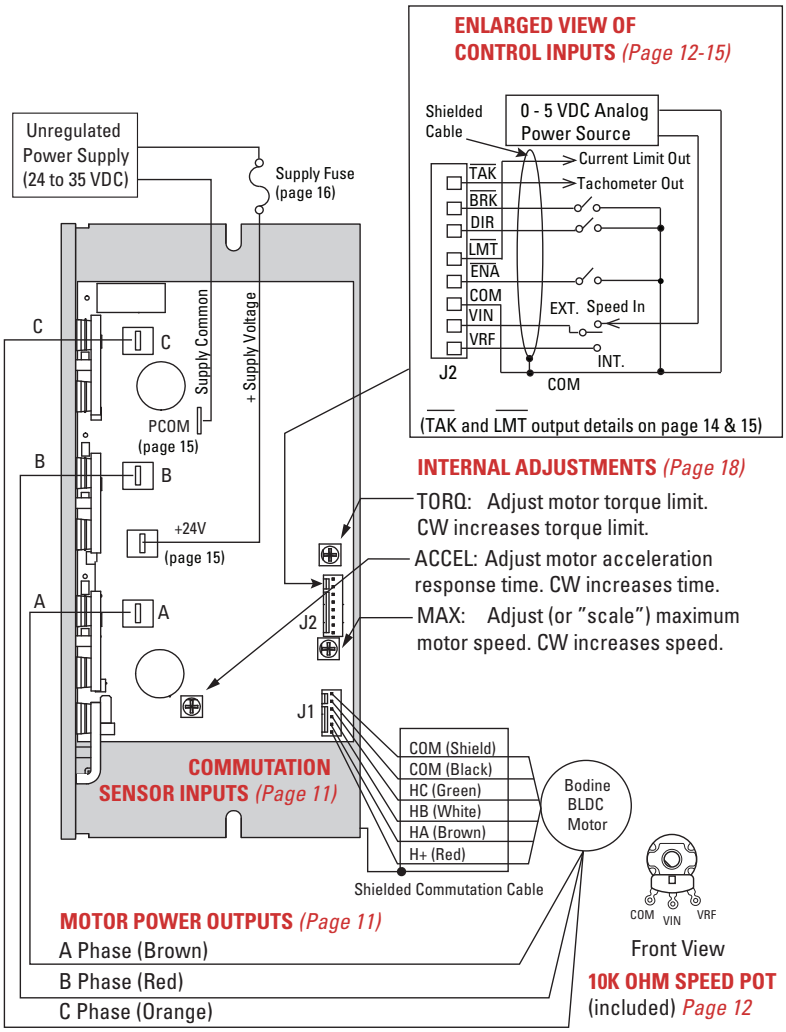


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GENERAL INFORMATION

Thank you for selecting a Bodine Type ABL-3900 Series Low-Voltage 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 the Bodine Model 3905, and 3907 Low-Voltage Brushless DC Motor Controls. 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).

Type ABL controls "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.

To access our UL Certifications, go to:
http://www.bodine-electric.com/products

CONTROL DESCRIPTION AND FEATURES

Models 3905 and 3907 Low-Voltage Brushless DC Motor Controls are chassis type, designed to be mounted in a separate enclosure supplied by the user. They operate from a 24-Volt power supply or from a 24-Volt battery. The controls provide the necessary electronic commutation and phase current switching to operate Bodine low-voltage brushless DC motors. Their brushless design assures quiet, clean maintenance-free operation.

Speed can be controlled by an external or on-board MAX speed trim potentiometer, or a 0 to 5 VDC analog input signal. Other features include adjustable maximum speed settings, torque, acceleration and deceleration times. A unique Smart Reverse™ circuit is employed which disables the motor, allowing it to brake to a stop before changing its direction. This technique prevents plug reversing and allows for quick direction changes. Specific Bodine motor sizes which can be used with these controls are listed on page 10.

Parameter	Specification
Product Type	ABL-3905C, ABL-3907C
Power Supply Voltage:	24 to 35 VDC
Power Supply Current (Continuous):	ABL-3905C: 2.5 to 10.0 Amps DC ABL-3907C: 0 to 20.0 Amps DC
Power Supply Current (Peak):	ABL-3905C: 13.5 Amps DC ABL-3907C: 30.0 Amps DC
Motor Output Horsepower	ABL-3905C: 1/6 ABL-3907C: 3/8
Output as % of Input Voltage	Up to 95%
Control Functions:	Dynamic Braking, Smart Reverse,™ Enable
Speed Regulation:	2% at 2500 RPM
Speed Range:	25:1 (100 to 2500 RPM) at rated load and 24 VDC supply voltage
Speed Control Method:	External Potentiometer, Analog Voltage, On-Board Potentiometer (MAX Speed trim pot)
Speed Control Scheme:	Pulse Width Modulation (PWM)
PWM Frequency:	20 kHz
Input Levels:	0 to 5 VDC
Acceleration Time:	0.35 to 8.0 seconds
Commutation:	60° Standard, TTL compatible
Ambient Operating Temperature:	0° to 50° C
Dimensions:	in: 8.0 L x 3.9 W x 2.0 H cm: 20.4 L x 9.9 W x 5.1 H

IMPORTANT SAFETY PRECAUTIONS

The following safety precautions must be observed during all phases of installation, operation, service, and repair of this control. 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 product. Bodine Electric Company assumes no liability for the customer's failure to comply with safety requirements and practices.

The use of electric motors and gearmotors, 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 and interface circuitry.

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 highlight procedures which present potential danger to people. **Cautions** highlight possible danger to equipment. Both are used through-out this manual and must always be followed.

WARNING

The chance of explosions, fires or electric shocks can be reduced with thermal and over-current protection, proper grounding, proper enclosure selection, and good maintenance. The following safety considerations are not intended to be all-inclusive. Specific references throughout the 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 Bodine Electric Company in advance. Failure to do so 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. Report parts errors 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 control; 40° C (104° F) for brushless DC motors and gearmotors.

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

Fusing
The control input should be fuse protected. The fuse must conform to the value and rating established by the fuse calculation formula on page 16.

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., environments of flammable or explosive gas, vapor, or dust). Bodine recommends using 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 the 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 components. To ensure continued compliance with the design specifications and safety standards, the control should be returned to Bodine Electric Company or an Authorized Distributor for servicing.

WARNING

To avoid injury because of unsuspected mechanical motion, always disconnect the power supply 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.

The user must provide a proper enclosure. Circuitry is not at ground potential. Do not perform work on or near the control while it is connected to the power supply.

CAUTION

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

MOUNTING THE CONTROL

Detailed mounting dimensions and CAD drawings are available online. The preferred mounting orientation for the control is vertical, but it can be mounted in non-vertical orientation as long as the ambient temperature does not exceed 50°C. Use the slots on either the narrow or wide surfaces of the heat sink. This arrangement provides optimum air flow around the control. Refer to Figure 2.

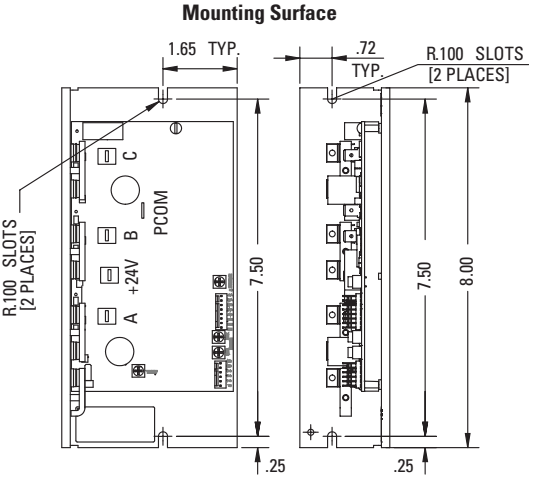


Figure 2– Heatsink preferred mounting orientation

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.

WARNING

The power supply should be the last connection made in order to prevent accidental start-up. Disconnect the power supply before making any other electrical connections.

The following instructions are based on the assumption that a Bodine 24-Volt Brushless DC motor or gearmotor is being driven by the control. Chart 1 lists the Bodine motors and gearmotors that are designed to operate with the ABL-3905 and ABL-3907 controls. If there is any doubt about the control and motor combination you are using for your application or if you are planning to drive a non-Bodine motor with the control, contact Bodine in advance.

Chart 1 - Bodine Motor/Gearmotor and Control Compatibility Guide

Bodine Motor Type Number	Bodine Motor Horsepower Rating	Control Model Number
22B2*EBL … 22B3*EBL … 22B4*EBL …	1/16 1/11 1/8	3905
34B3*EBL … 34B4*EBL … 34B6*EBL …	1/5 1/4 3/8	3907

* "B" or "F"

Figure 3 shows a detailed diagram of the control circuit board and the various connection points. The Bodine 24-Volt Brushless DC motors listed in Chart 1 are supplied with commutations leads terminated at connector J1. The Motor Power Leadsare also supplied terminated with female quick disconnect terminals. The control interface leads are the user's responsibility. An 8-pin interface connector J2 and pins are supplied for terminating the interface leads. If the leads supplied on the motor need to be extended follow the recommendations for wire sizes and maximum lengths listed in this section.

CAUTION

Only copper wire with a minimum 60° C rated insulation is recommended for all cable assemblies.

Chart 2 - Recommended Wire Sizes

Power supply Leads**	16 to 14 AWG
Motor Power Leads**	16 to 14 AWG
Commutation Leads	(J1 Connector)* 24 to 22 AWG
Control Interface Leads	(J2 Connector)* 24 to 22 AWG

* Control Interface and Commutation leads must be shielded
** Provided Terminals

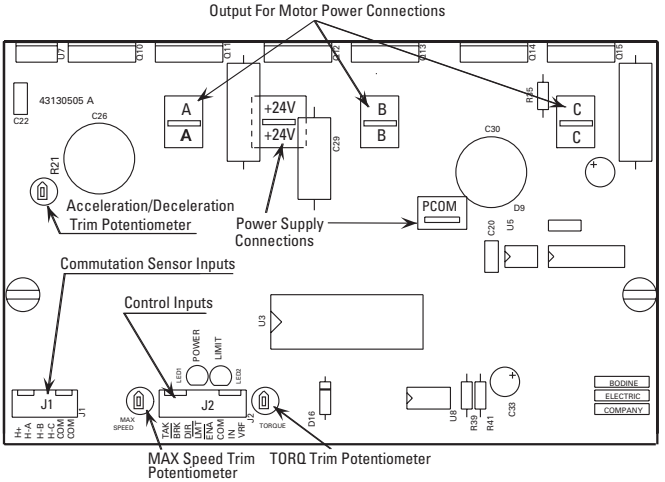


Figure 3 – Control Circuit Board

Terminals (Included on Both Models 3905 & 3907)

Two 16 AWG terminals are provided for the power supply connection to the control. Bodine's stock 24V BLDC gearmotors and motors are supplied with the appropriate size terminals for the motor power lead connections.

Also included are five terminals for 10-12 AWG wires. These are to connect the control to motors with larger power leads. Larger power supply leads will also be required.

Motor Power Connections

The motor phase outputs which provide power to the motor are labeled A, B, and C on the control board. See Figure 3. If the leads provided on the motor need to be extended, do not exceed a total length of 12ft.* (3.6 m) Connect the phase leads from the motor using the 1/4 inch quick disconnect terminals as follows:

- Brown lead to terminal "A"
- Red lead to terminal "B"
- Orange lead to terminal "C"

Commutation Sensor Connections

Connector J1 is used to terminate the commutation sensor leads from the motor to the control board. See Figure 3. Bodine 24-Volt Brushless DC motors are equipped with this connector. Simply mate the polarized connector with the pins on the control board. If these leads must be extended, do not exceed an overall length of 12 ft. (3.6 m)*

*Note: Because of high currents present in 24-Volt systems, long lengths of wire will reduce the voltage delivered to the motor phases.

Chart 3 - Commutation Sensor Pin Out (Connector J1)

Designation	Description	Lead Color
COM*	Drain Wire Connection	Shield
COM	Commutation Sensor Supply Return	BLK
H-C	Commutation Sensor C Input	GRN
H-B	Commutation Sensor B Input	WHT
H-A	Commutation Sensor A Input	BRN
H+	+12 V Commutation Sensor Supply	RED

* The COM terminal must not be used as a common for the external power supply.

Speed Control

Motor speed can be controlled in one of three ways:

1. An external 10 KΩ speed potentiometer (for applications where more frequent speed changes are required).
2. A 0 to 5 VDC analog input signal (for applications where the motor and control are part of a larger control system).
3. On-board speed potentiometer (for applications requiring infrequent adjustment of speed or fixed speed operation).

Controlling Speed With an External Potentiometer

A 10 KΩ potentiometer can be used to externally control motor speed. When connected properly, clockwise rotation of the potentiometer increases motor speed. Connect the potentiometer as follows:

1. Solder three leads of appropriate length to the potentiometer.
2. Terminate the other ends of the potentiometer leads with the pins supplied with the 8-pin interface connector.
3. Mount the potentiometer in the desired location.
4. Refer to Figure 4 and insert the potentiometer leads into the interface connector as follows:

   - High side (CW terminal) of the potentiometer to interface terminal VRF
   - Low side (CCW terminal) of the potentiometer to interface terminal COM
   - Center terminal of the potentiometer to interface terminal VIN *When connected as described above, the potentiometer on the control board may be used to scale the maximum speed of the control.*

Controlling Speed With an Analog Input Voltage

Motor speed can be controlled by applying a 0 to 5 VDC analog voltage across the VIN and COM terminals of the interface connector J2. Refer to Figure 4. Speed is increased by increasing the voltage level applied to VIN (Pin J2-2). 0 VDC = 0 RPM; 5 VDC = Max. RPM. VIN=J2-2; COM=J2-3.

This input may be configured for either internal or external speed command

operation. If the motor/control system is part of a larger motion control system, the speed may be controlled by a microprocessor or PLC provided a digital to analog converter is used to interface the output of the system control and the speed input of the Model 3905, or 3907 control.

Controlling Speed with the On-Board Trim Potentiometer
The on-board speed potentiometer labeled MAX on the control board (Figure 3) can be used to vary motor speed in lieu of an external speed control. Clockwise rotation of the trim potentiometer increases motor speed.

In order for the MAX potentiometer to function as a speed control, a jumper must be placed across terminals VRF and VIN on the interface connector as indicated by the dashed line in Figure 4. Form a jumper from a short length of wire terminated on each end with the pins supplied with the interface connector.

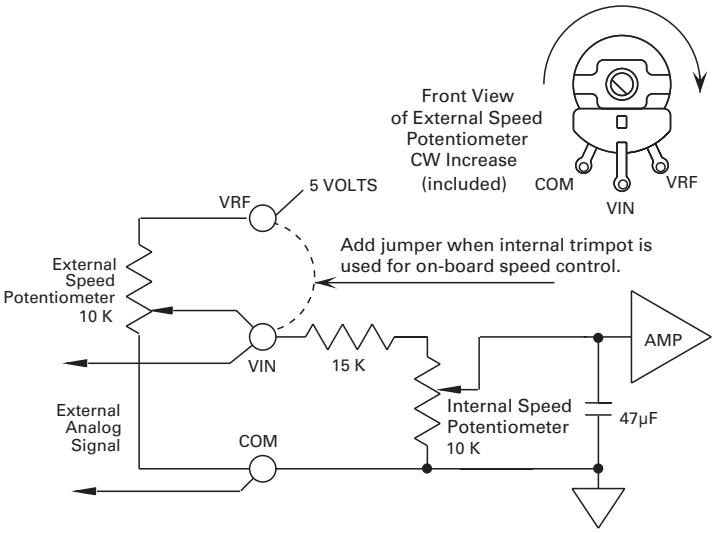


Figure 4 - Internal and External Speed Potentiometer Connections

Controlling Motor Enable, Braking, and Direction of Rotation:
Manual switches, relays or logic signals can be used to control motor braking, enable, and direction of rotation. Figure 5 shows the pin-out of the interface connector J2 as well as interface information for logic inputs. Chart 4, on the following page, lists the condition of the control input based on the open or closed condition of the relay contact or switch and the high or low state of the input signal.

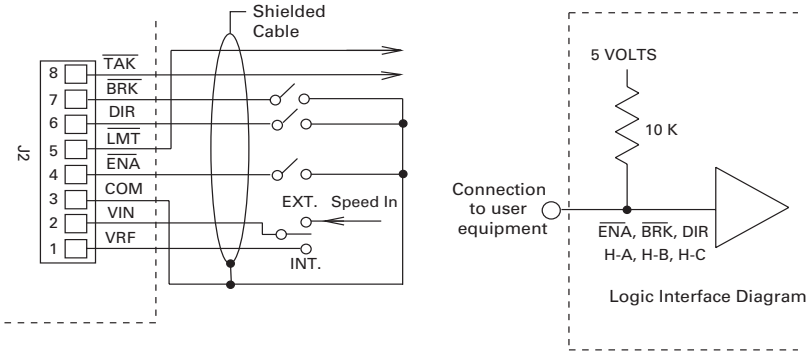


Figure 5 - Control Inputs

WARNING

Never rely on logic circuitry as a means of disabling the motor or control. To prevent unsuspected mechanical motion and potential injury, power leads should be physically disconnected from the control. The AC power should always be disconnected from the control power supply whenever logic circuits or the driven equipment are serviced. When a battery is used, the DC supply to the control should be disconnected.

Chart 4 - Pin-Out and Logic State of Control Inputs

Designation	Closed-Switch or Low Voltage State[1]	Open-Switch or High Voltage State[1]
$\overline{\text{ENA}}$[2]	Drive Enabled	Drive Disabled
DIR[3]	CCW Direction	CW Direction
$\overline{\text{BRK}}$	Brake	Run

1. Logic Low = 0.4 to 0.0 Volts: Logic High = 3.0 to 5.0 Volts
2. When $\overline{\text{ENA}}$ goes high, the motor will coast to a stop.
3. The output shafts of gearmotors with odd number of stages (for example, Bodine type designations ending with W3, E1, or E3) will rotate in the opposite direction. A "Smart Reverse Circuit" prevents plug reversing when the switch is opened or closed. The motor will coast to a low speed before changing direction.

Tachometer Output

The ABL-3905, and 3907 controls provide a digital tachometer output at the $\overline{\text{TAK}}$ terminal (J2, Pin 8) for monitoring motor speed. The output pulse levels are high to low to high. The pulse width is 0.8 msec. Twelve pulses correspond to one motor revolution. The $\overline{\text{TAK}}$ output provides an unterminated open collector output. A pull-up resistor or another logic device is required for measuring the output. Refer to Figure 6 for assistance in interfacing the $\overline{\text{TAK}}$ output.

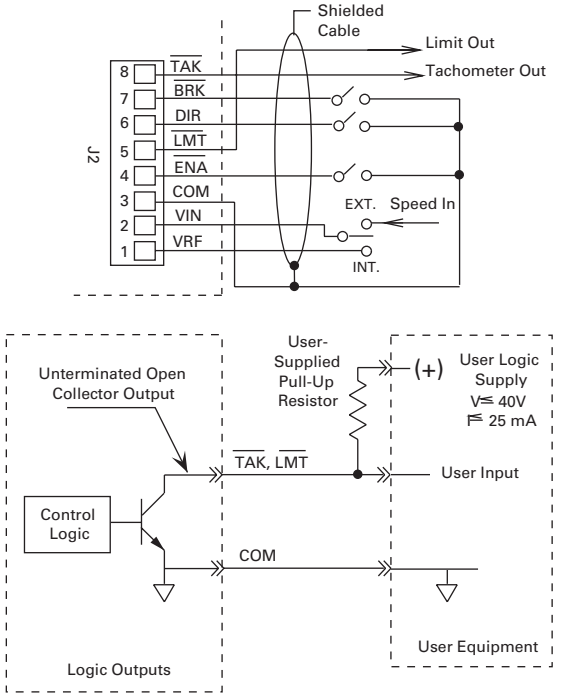


Figure 6 - $\overline{\text{TAK}}$ and $\overline{\text{LMT}}$ Outputs

Limit Output

If the ABL-3905, or 3907 controls are operated at the current limit for more than six seconds they will shut down automatically. Power must be turned off momentarily and then restored to reset the control.

When shutdown occurs the LIMIT LED on the control board is illuminated and remains ON until the control is reset. At the same time, the $\overline{\text{LMT}}$ terminal (J2- Pin 5) goes low. This low pulse can be used to trigger an external alarm or other fault indicator device. The $\overline{\text{LMT}}$ output provides an unterminated open collector output. A pull-up resistor or another logic device is required for measuring the output. Refer to Figure 6 for interface information.

Power Supply Connections

The ABL-3905 and 3907 controls require a 24 to 35 VDC unregulated external power supply.* The power supply must provide a minimum capacitance of 5000 µF per control. The supply must provide the required peak and continuous current for the type of control and motor being used. Refer to the Specifications on page 5 to determine the proper current capacity for your specific control. The controls can be powered by a 24-Volt battery provided it delivers sufficient current capacity to fulfill the duty cycle requirements of the application.

*Note: Max recommended length for power supply leads is 12 ft. (3.6 m)

Connect the power supply to the control using 1/4 inch quick disconnect terminals as follows:

1. Connect the +24 Volt lead from the power supply to the +24V terminal on the control circuit board.
2. Connect the power supply common to the PCOM terminal on the control circuit board.

CAUTION

The COM terminals on the Commutation Sensor (J1) and Interface Connector (J2) should never be used as the common for the external power supply.

Control Input Fuse Calculation

The control must be protected by a user supplied fuse. In a multi-control system each control must have a separate fuse. Make sure the fuse is connected in series with the +24 volt lead of the power supply. See Figure 1. The value of this fuse is dependent on the amount of input current drawn by the control when the motor is operated at full load. Determine the fuse value using the following formula:

Control Input Fuse Rating = 1.25 x (RMS Control input current at full load)

CAUTION

If the calculated rating does not correspond to a standard fuse use the next highest rated fuse.

OPERATING INSTRUCTIONS

WARNING

Explosions, fires, or electric shock hazards can be reduced through thermal and over-current protection, good maintenance, proper grounding and proper 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.
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.
5. If the motor/gearmotor does not start promptly and run smoothly, disconnect the AC power to the external power supply. Double check all wiring, and refer to "Troubleshooting" on page 19.
6. If the problem persists, contact your Bodine representative or a Bodine Authorized Distributor and describe the problem in detail. Include all the nameplate data. Do not disassemble the product unless authorized by Bodine. Performing unauthorized repairs or removing screws voids the warranty.

Operating the Control

WARNING

The AC power should be disconnected from the external power supply before starting.

1. Disconnect the AC power to the external power supply. If the power supply has an ON/OFF switch set it to OFF.
2. Set the speed potentiometer to ZERO (fully counterclockwise). If an $\overline{\text{ENA}}$ (Enable) switch is used, open the switch. If a Brake switch is used, open the switch. Refer to Chart 4 on page 14.
3. Connect the AC power to the external power supply.* If the power supply has an ON/OFF switch, set it to ON.
4. Set the Direction switch, if provided, for the proper direction of rotation. Refer to Chart 4 on page 14.
5. Close the $\overline{\text{ENA}}$ (Enable) switch if used.
6. Turn the speed potentiometer clockwise until the motor rotates. Then adjust the potentiometer to achieve the desired speed. If you wish to reduce the torque level refer to "Internal Adjustments" which follows.
7. If the motor does not operate, 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 19 and follow instructions. If the motor is overloaded, reduce the load and replace blown fuses with new ones of the proper rating. (See page 16.)

* Note: When power is applied to the control, the green "POWER" LED will light.

Internal Adjustments

To adjust the control for your specific application, 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.

Maximum Speed Trim Potentiometer

When used in conjunction with an external speed potentiometer, the lowest MAX trim potentiometer setting (fully counterclockwise) corresponds to zero speed and the highest MAX trim potentiometer setting (fully clockwise) corresponds to approximately 120% of rated speed.*

When used as an on-board speed potentiometer, the fully counterclockwise position corresponds to 0 RPM and the fully clockwise position corresponds to 2500 RPM.*

* Note: These ratings are based on the assumption that the input signal does not exceed a maximum of 5 Volts.

Scaling the Motor Speed to Correspond to a Given Input Voltage:

The MAX speed potentiometer can be used to adjust the maximum speed of the motor to correspond to a specific input voltage by performing the following procedure:

1. Apply the desired voltage across terminals VIN (J2-Pin 2) and COM (J2-Pin 3) of the 8-pin interface connector.
2. Adjust the MAX potentiometer until the motor RPM reaches the desired level. This adjustment assures that the motor will not exceed the calibrated speed provided the analog input voltage does not exceed the level applied in step 1.

Acceleration Adjustment

Trim potentiometer R21 (See Figure 3) can be used to adjust the motor's acceleration time. A counterclockwise adjustment decreases the acceleration time down to a minimum of approximately 0.35 seconds. A clockwise adjustment increases the rate up to a maximum of approximately 8 seconds.

Torque/Current Limiting Adjustment (Model 3907 Only)

The TORQUE trim potentiometer (Figure 3) has been calibrated (factory preset) to 23 Amps, peak. The operating torque limit should be set to no more than 150-200% of the motor's current rating. To prevent any equipment damage, please consult the factory for settings above 200% of motor nameplate current rating.

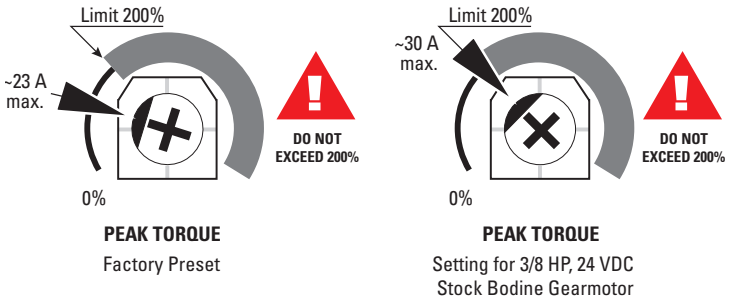


Figure 7 - Peak Torque Trim Pot Adjustments

The trim pot setting on the left shows the orientation of the TORQUE pot calibrated to 23 Amps, peak. To operate a 3/8 HP, 24 VDC stock gearmotor or motor from Bodine, set the TORQUE pot to the higher current limit, shown on right. Torque may be reduced on lightly loaded systems to protect drive mechanisms and gearing from damage due to overloads. Turn the TORQUE trim potentiometer counterclockwise to decrease the torque, and clockwise to increase the torque/current limit. Contact the factory with any questions regarding maximum ratings. Tel: 773-478-3515, E-mail: info@bodine-electric.com.

TROUBLESHOOTING

WARNING

Disconnect the AC power to the external power supply 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 or a Bodine Authorized Distributor 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.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
CONTROL BLOWS LINE FUSE	Incorrect power supply	Check connections, look for shorts and repair as required.
	Excessive power supply voltage	Check power supply voltage. If level exceed control rating, replace with a properly rated supply.
	Voltage transients on supply lines	Check for transients. If they are present, shield the supply lines and add surge suppressors. If problem persist contact Bodine.
	Shorted phase leads, wiring incorrect	Repair short; correct wiring.
	Damaged control Components	Contact Bodine or Authorized Distributor for assistance.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
MOTOR WILL NOT START "POWER" LED OFF	Open power supply fuse	Replace fuse. Refer to page 16 for proper value.
	Faulty power supply	Verify proper operation, check that power supply is turned ON.
MOTOR WILL NOT START "LIMIT" LED IS ON	Motor overloaded	Correct load or choose larger motor.
	TORQ trim pot is out of adjustment	Adjust TORQ trim pot, page 19.
MOTOR WILL NOT START "LIMIT" LED IS OFF	Speed potentiometer set to zero	Increase speed potentiometer setting.
	Brake switch closed	Open Brake switch
	Enable switch open	Close Enable switch
	Damaged motor	Repair or replace motor.
	Incorrect Motor Phase connections	Check motor phase connections. See page 11.
	Loose Commutation Sensor Connector J1	Check that connector is securely fastened to control board pins.
MOTOR WILL NOT COME UP TO SPEED	MAX trim pot set too low	Adjust trim pot, page 18.
	Speed potentiometer set too low	Increase speed potentiometer setting.
	Motor overloaded	Re-examine the load parameters.
	TORQ trim pot is out of adjustment	Adjust TORQ trim pot, page 19.
	Damaged component on the control board	Contact Bodine or Authorized Distributor for assistance.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
MOTOR SPEED IS UNSTABLE OR PULSATES	Motor and load not correctly aligned	Perform alignment.
	Incorrect motor and control combination	Verify motor and control compatibility, page 10.
	Damaged motor	Repair or replace motor.
	Speed potentiometer set too low	Increase speed potentiometer setting.
MOTOR WILL NOT MAINTAIN SPEED UNDER LOAD	Incorrect motor and control combination	Verify motor and control compatibility, page 10.
	TORQ trim pot is out of adjustment	Adjust TORQ trim pot, page 19
	Motor overloaded	Re-examine the load parameters.
MOTOR WILL NOT STOP WITH SPEED POT ADJUSTED AT ZERO*	Open speed connections on speed potentiometer	Check potentiometer connections.
	Defective speed potentiometer	Replace the potentiometer.
*Note: The enable input should be high or the enable switch opened when the motor is expected to remain stopped.		
NO SPEED ADJUSTMENT	Defective speed potentiometer	Replace the potentiometer.
	Open connection on speed potentiometer	Check potentiometer connections.
	Jumper mistakenly placed across VRF and VIN	Remove jumper, page 13.

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.



Visit www.bodine-electric.com for our large selection of 24 VDC brushless DC motors and gearmotors

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.

BODINE® ELECTRIC COMPANY

201 Northfield Road | Northfield IL 60093 U.S.A. | Tel: 773.478.3515 | Fax: 773.478.3232
info@bodine-electric.com | www.bodine-electric.com

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