Instructions for Installation and Operation

DC Motor Speed Control

Model 1865, for 115/230 VAC power supply,

with NEMA 4 enclosure and line filter for CE

Specifications

Product Type:	UPM-3318E4
Input Voltage:	115 or 230 VAC +/- 10%, Single Phase, 50/60Hz
Output Voltage:	Adjustable, 0 to 90 or 0 to 180 VDC

BODINE® ELECTRIC COMPANY

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QUALITY IN MOTION®

QUICK REFERENCE

This manual contains the basic information needed to install and operate Bodine DC Motor Speed Control model 1865. This manual 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.

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. If you have any doubts about how to connect the control or motor, refer to the detailed sections of this manual.

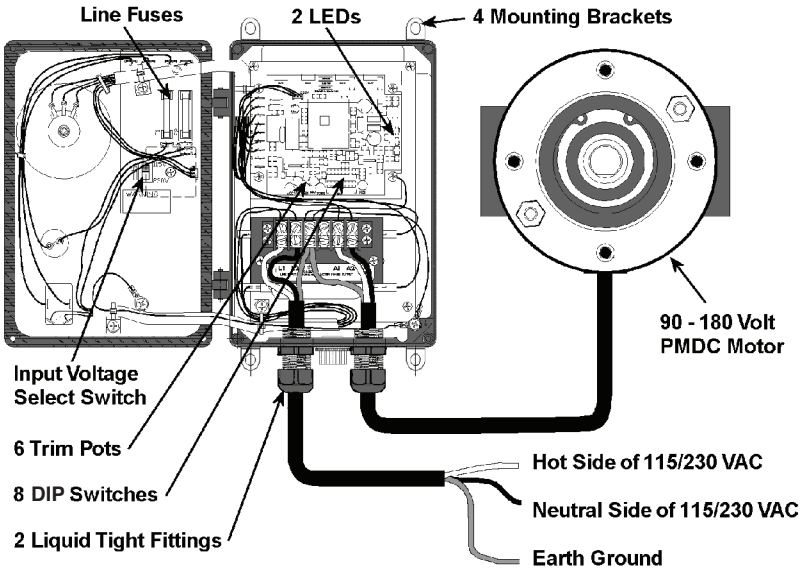

Figure 1 – Overview of installation for reference only and not be used as a replacement for the detailed instructions within this manual.

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PRODUCT SPECIFICATIONS

ABOUT THIS PRODUCT—Bodine's Model 1865 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 – Electrical Ratings

Parameter	Specification
Input Volts	115 or 230 VAC +/- 10%, Single Phase, 50/60Hz
Max. Continuous Input Current	3.4 Amps RMS
Output Volts	0 to 90 VDC or 0 to 180 VDC
Max. Continuous Output Current	2.1 Amps DC
Max. Peak Output Current	5.1 Amps DC
Max. Form Factor	1.6
Maximum Motor HP	1/5 HP @ 90V
	1/3 HP @ 180V

Table 2 - General Performance Specifications

Parameter	Specification	Factory Setting
Speed Signal Input Voltage	0 – 5 VDC (must be isolated from AC line)	N/A (speed pot)
Minimum Speed Trim Pot Range	0 – 50 VDC output to motor with input speed signal set at 0 VDC	0 VDC (full CCW)
Maximum Speed Trim Pot Range	60 – 100% of full motor speed with input speed signal set at 5 VDC	100%
Acceleration Trim Pot Range	.2 – 10 seconds to ramp output voltage up from 0 to 90 VDC and .2 – 20 seconds to ramp up from 0 to 180 VDC	2 sec. (0-90V) 4 sec. (0-180V)
Deceleration Trim Pot Range	.2 – 10 seconds to ramp output voltage down from 90 to 0 VDC and .2 – 20 seconds to ramp down from 180 to 0 VDC	2 sec. (90-0V) 4 sec. (180-0V)
Peak Current Limit Trim Pot Range	0 to 200 – 250% of motor name-plate rating with appropriate DIP switch settings	200 – 250% (full CW)
Speed Regulation (Change in motor speedfrom no load to full load)	Less than 2% of Rated Speed with most motors and less than 1% with many	1 – 2%
Operating Temperature Range	0 to +400C	N/A

IMPORTANT SAFETY PRECAUTIONS

Model 1865 has been evaluated by Underwriters Laboratories for conformance to UL standards 508 and 50 and CSA standard C22.2 No. 14 and bears 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.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

⚠ WARNING

- *Do not touch printed circuit board (PCB) right after turning off power. Wait until green LED on 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 inverter is operating.*
- *Do not attempt to disassemble or modify internal circuitry, wiring, or components of the inverter.*
- *Enclosure must be properly grounded.*

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.

NOTE: 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 (Remarque: La détection de la surchauffe du moteur n'est pas assurée par cette control).

Step 1. Examine before installation

Check that the model number on the control matches the model number ordered. The control model number is printed as part of the serial number on an adhesive label on the outside bottom surface of the control enclosure. Carefully examine the control for shipping damage. Parts errors should be reported to Bodine. Shipping damage claims should be made to the freight carrier.

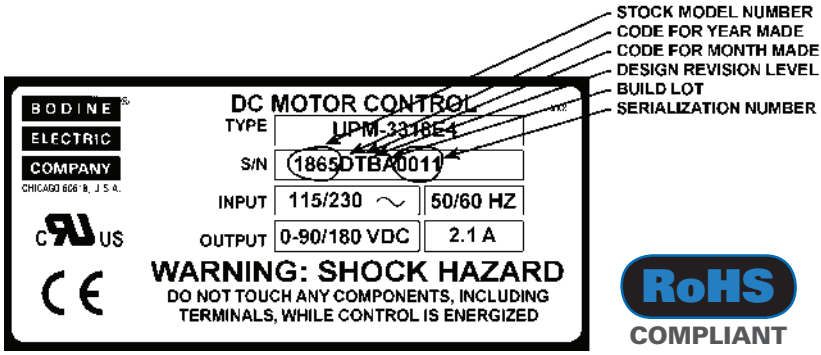


Figure 2 – Location of the model number on the nameplate.

⚠ 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 2. Choose a Suitable Location

The installation site directly impacts the functionality and 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.

Step 3 – Mount the Control

Prepare the mounting surface by drilling four holes with their centers located as shown in Figure 3. If #10 screws are to be used for mounting, then use a #6 (.204) clearance drill. If #10- 32 machine screws are to be used for mounting, then use a #20 (.161) tap drill. After the mounting surface has been prepared, mount the control with screws through the four mounting brackets (already attached to back of control enclosure).

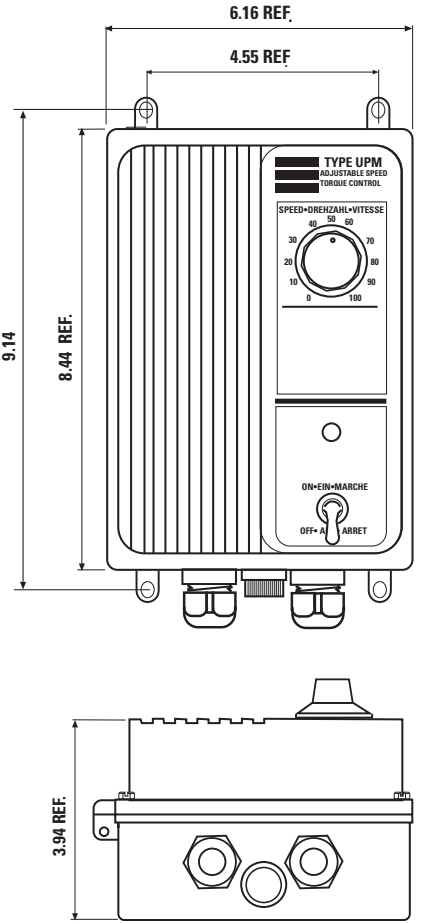


Figure 3 – Mounting Dimensions

CONNECTION

CAUTION

- *The PCB inside the control enclosure is vulnerable to static electrical charges. Avoid contact with the PCB.*
- *Choose an appropriate power source with correct voltage settings for the specification of the control.*
- *Do not use a separate device between control and motor to switch motor ON or OFF during operation.*

Step 4 – Preliminary Setup

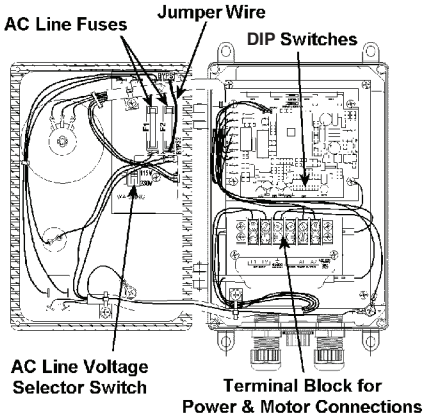


Figure 4 - Inside layout of control.

AC LINE VOLTAGE SELECTOR SWITCH – If the control is to be operated from a 230 VAC power supply, slide the selector switch from "115V" to "230V."

AC LINE VOLTAGE JUMPER – If the control is to be operated from a two-phase 230 VAC power supply, where both lines are hot (typically in the USA), then remove the jumper wire between the spades labeled "BYPS1" and "BYPS2."

DIP SWITCHES FOR MOTOR MATCHING – Figure 4 shows a bank of 8 DIP switches, factory-set with 4, 5, 6, and 7 ON. Set switches 1-7 to match the type, voltage, armature speed (not output speed of geared motor), current, and horsepower ratings on the Bodine motor nameplate per Table 3. For non-Bodine motors, or Bodine motors not listed in Table 3, identify the motor in Table 3 with the closest voltage, armature speed, current, and horsepower ratings and use those DIP switch settings. Leave switch 8 OFF for 0-90 VDC output or switch it ON for 0-180 VDC output (with 230 VAC input only).

Table 3 – DIP Switch Settings

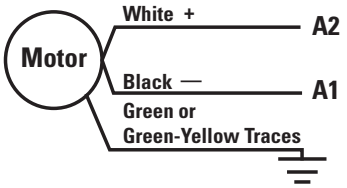
Bodine Motor Type	Rated Volts (DC)	Armature Speed (RPM)[1]	Rated Current (Amps)[2]	Motor Power (HP)	DIP Switches ON	Typical Current Range of TORQ. Pot. (DC Amps)[3]	Typical Input Current at Max. TORQ Setting (RMS Amps)[4]
24A0	130	2500	0.22	1/50	Consult Bodine Support		
24A2	130	2500	0.30	1/29	4,5,6,7	0-0.65	1.0
24A4	130	2500	0.48	1/17	3,4,6,7	0-0.8	1.3
24A4	90	2500	0.58	1/20	4	0-.98	1.3
24A4	90 | 130	2500	.56 | .81	1/23 | 1/11	4	0-0.92	1.3
24A4[6]	115	11500	1.1	1/7	3,5	0-1.5	8.2
33A3[5]	90 | 130	2500	.78 | 1.0	1/16 | 1/8	3,5	0-2.4	2.6
33A3	130	2500	0.74	1/12	4	0-0.92	1.3
33A3	130	2000	0.71	1/12	3	0-1.36	1.6
33A5[5]	130	2500	0.91	1/8	2,7	0-2.4	2.7
33A5	90	2500	1.6	1/7	2,4,5	0-3.0	3.8
33A5[5]	90 |130	2500	1.4| 1.8	1/8 | 1/4	3,4,5	0-2.2	2.5
33A5[5]	90 |130	2500	1.3 | 1.7	1/8 | 1/4	3,4,5	0-2.2	2.5
33A5	130	2000	1.4	1/6	3	0-1.38	1.8
33A7[5]	90 | 130	2500	1.8 | 2.4	1/6 | 1/3	2,4,5	0-3.0	3.8
42A3[5]	130	2500	1.0	1/8	2,5,7	0-3.0	4.9
42A4[5]	130	2000	1.3	1/6	2,5,7	0-2.7	4.3
42A5	90	2500	2.2[7]	1/4	2,3,4,5	0-4.0	5.4
42A5[5]	90 | 130	2500	1.9 | 1.8	3/16 | 1/4	1,3,4	0-4.3	6.9
42A5[5]	90 | 130	2500	2.1 | 2.8	3/16 | 3/8	1,3,4	0-4.3	6.9
42A5[5]	130	2500	1.8	1/4	2,4,5	0-3.0	3.9
42A5[5]	130	2500	2.7	1/3	2,4,5	0-3.0	4.2
42A7[5]	130	2500	2.3	1/3	2,3,4,5	0-3.8	5.3
42A7[5]	130	2500	3.4	1/2	1,2,3,4,5	0-5.9	7.5
42A7[5]	130	2500	3.3	7/16	2,3,4,5	0-3.8	5.3
24A2	180	1725	0.13	1/19	4,6,7,8	0-0.2	0.30
24A4	180	2500	0.30	1/19	4,6,7,8	0-0.5	0.8
24A4	180	1725	0.18	1/32	4,6,7,8	0-0.3	0.40
33A3	180	1725	0.33	1/23	4,6,7,8	0-0.6	0.80
33A3	180	1725	0.31	1/23	4,6,7,8	0-0.6	0.90
33A5	180	1725	0.41	1/14	3,4,5,6,7,8	0-0.8	1.3
33A5	180	1725	0.62	1/11	3,5,6,7,8	0-1.1	1.5
33A5	180	2500	0.80	1/7	1,2,3,6,8	0-2.1	2.2
33A5	180	3000	0.89	1/6	1,2,3,6,8	0-1.2	1.9
33A7[5]	180	3000	1.3	1/4	2,5,8	0-2.6	3.5
33A7	180	1725	0.88	1/6	3,5,8	0-1.7	2.0
42A5	180	1725	0.85	1/6	3,5,8	0-1.3	2.1
42A5	180	1725	0.85	1/5	3,5,8	0-1.71	2.1
42A5	180	2500	1.2	1/4	2,5,8	0-2.7	8.5
42A5[5]	180	3000	1.17	1/5	2,5,8	0-2.5	4.1
42A5	180	1725	0.85	1/6	3,5,8	0-1.7	2.1
42A7	180	1725	1.0	1/5	2,5,8	0-2.0	3.2
42A7[5]	180	3000	1.5	1/4	2,3,8	0-3.3	6.9

1. Armature speeds are based on 130VDC (or 180VDC). For armature speed of a geared motor, multiply the output speed at the drive-shaft by the gear ratio. Note that "PWM rated" motors, or motors rated at 130 VDC, will run about 69% slower with an unfiltered control because of the 90VDC max output voltage.
2. If the user desires to install their own armature fuse on the control output to protect the motor from continuous overloads, base fuse ratings on the motor current rating in this column. The fuse should be sized at 1.2 times the current rating in this column.
3. Peak current available with TORQ pot in fully CW position. This current may exceed the continuous rating of the motor, in which case it is intended for intermittent overload conditions only. It is the user's responsibility to make sure the application does not exceeds continuous rating of the motor or gearing.
4. Use this column for sizing a line fuse on the control input. The fuse should be sized at 1.2 times the current rating in this column.
5. These motors are capable of exceeding the continuous output rating of the control. The loading on these motors must be limited to keep their continuous current draw at 2.1A or less.
6. The REG potentiometer must be turned fully CCW (off) for high-speed type 24A4BEPM motor.
7. The load/current of our 42A5 "SCR Rated", 90V, 2500 rpm gearmotors may not exceed 2.1 amps (max) rating of control.

AC LINE FUSES – Model 1865 has a 12A fuse already installed in both the "F1" and "F2" fuse holders. A fuse is only really necessary in "F2" if a two-phase 230 VAC power supply (with two hot sides) is used.

Step 5 – Connect the Motor

A cord should be used for the motor connection in order to properly seal the liquid tight fitting. The fitting will accept cord diameters between 0.17" and 0.47" diameter. The length of the cord should be kept short for minimum voltage drop and only copper wire with 600 C rated insulation should be used. Loosen the nut from the liquid tight fitting and insert the cord through the fitting and into the enclosure. Connect the two motor power leads to "A1" and "A2" on the terminal block inside the control. The terminal block will accept wire sizes from 18 to 14 gauge. The terminal block screws should be tightened to 6 lb-in (0.678 Nm). Connect the motor frame ground to "CHASSIS GROUND" on the terminal block. Refer to the connection diagrams for Bodine DC motors in Figures 5 and 6. If the motor doesn't rotate in the desired direction as connected, switch the two motor wires. Note that these connection diagrams apply to Bodine motors only. When the connections are done, tighten the nut on the liquid tight fitting.



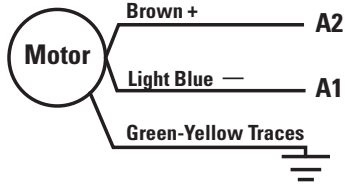


Figure 5 – Connection diagram for Bodine 130V DC motors.

Figure 6 – Connection diagram for Bodine 180V DC motors.

Step 6 – Connect AC Line Cord

A cord should be used for the AC power connection in order to properly seal against water through the liquid tight fitting. See Step 5 for cord and wire specifications. Connect the hot side of the line to "L1" and the neutral side to "L2." Connect earth ground to the terminal labeled "CHASSIS GROUND." The barrier terminal block screws should be tightened to 6 lb-in (0.678 Nm).

Step 7 – Close and Seal the Enclosure

Close the hinged cover and tighten the four screws, one at each corner.

Step 8 - Connect to AC Power

After all other connections are made and the control is closed, connect the AC line cord to the AC power supply.

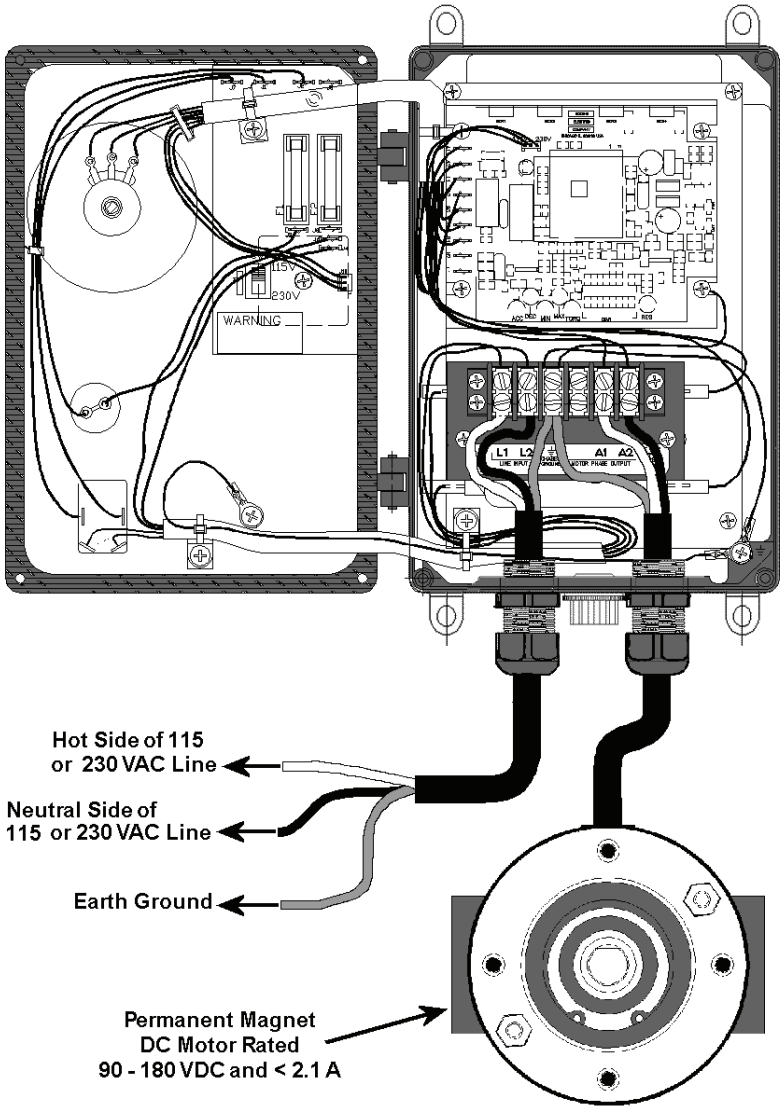


Figure 7 – Electrical connections for Model 1865.

OPERATION

Step 9 – Check System Before Starting

WARNING

- *Recheck all connections.*
- *Do not open the cover of the inverter when the power is ON to avoid injury caused by electrical shock.*
- *Do not attempt to wire circuitry while power is on.*

CAUTION

- *Recheck for proper setting of AC Line Voltage selector switch.*
- *Do not attempt to make or break connections between motor and control when the power supply is turned on, or the control may be damaged due to a surge peak.*
- *Check that motor is securely mounted.*
- *Test motor unloaded first to verify proper setup.*
- *Check all rotating members. Be sure keys, pulleys, etc. are securely fastened and safety guards are in place.*
- *Check for proper mounting and alignment of products, and verify safe loading on shafts and gears.*
- *The control can be easily operated from a low-speed to a high-speed. Reconfirm the operating speed range of the motor and the machinery you are controlling.*

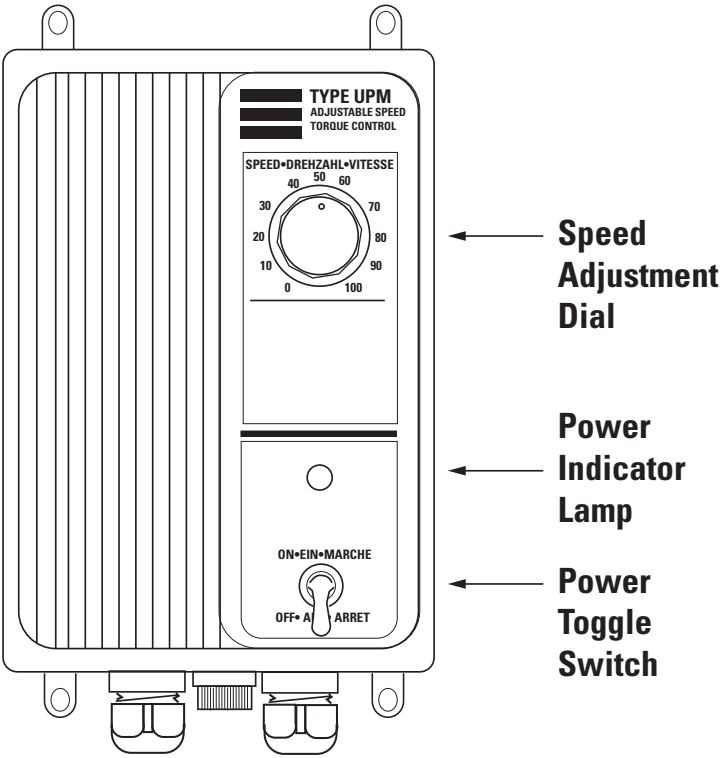


FIGURE 8 – Control panel layout

Step 10 – Operate the Control

The Model 1865 control is operated using the switch and speed dial on the front panel of the control. See Figure 8 for panel layout.

1) Turn the AC power ON using the power toggle switch. The power indicator lamp will illuminate.
2) Adjust speed by turning the speed adjustment dial. Turning the dial fully CCW will produce the minimum output speed, as set by the MIN trim pot inside the control. Turning the pot fully CW will produce the maximum output speed, as set by DIP switch #8 and the MAX trim pot inside the control.
3) To stop the motor, turn the AC power off using the power toggle switch.
4) If the motor does not start promptly and run smoothly, refer to the"TROUBLESHOOTING" section.

Step 11 – Adjust Trim Pots (Optional)

Model 1865 has trim pots which have been factory adjusted for most applications. Some applications may require readjustment of the trim pots in order to tailor the control to exact requirements. The control will have to be opened in order to adjust the trim pots.

WARNING

Do not adjust trim pots with main power on if possible. If adjustments are made with power on, insulated adjustment tools must be used and safety glasses must be worn. High voltage exists in this control. Electrocution and/or fire hazard can result if caution is not exercised.

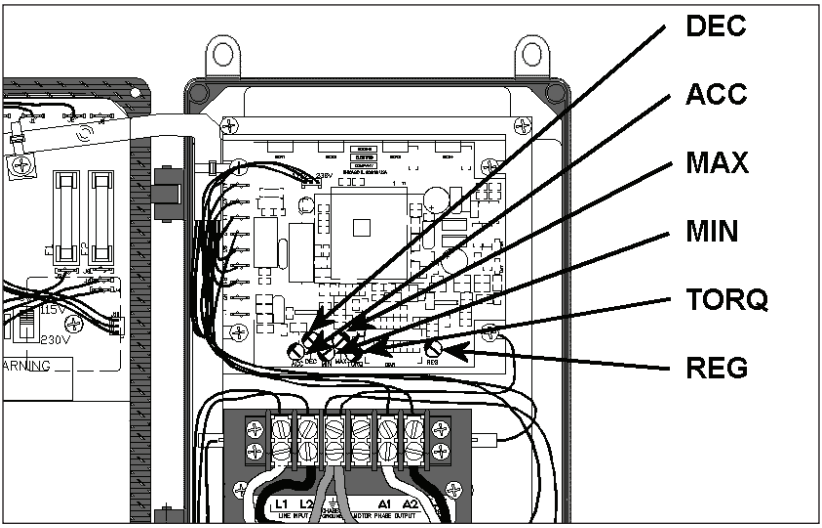


Figure 9 - Location of trim pots inside enclosure.

MIN: Minimum Speed Limit

The MIN trim pot can be adjusted if it is desired for the motor to run at a minimum speed higher than 0 rpm with the main speed dial set at "0." The maximum setting (fully clockwise) produces an output voltage of about 50 VDC. Note that increasing the minimum speed will also increase the maximum speed, so the MAX trim pot may need to be adjusted.

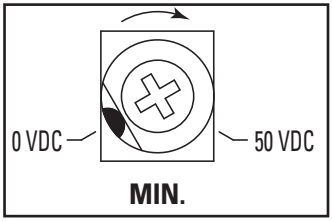


Figure 10 – Factory setting of MIN trim pot.

MAX: Maximum Speed Limit

The MAX trim pot can be adjusted if it is desired for the motor to run at a maximum speed lower than the motor rating with the main speed dial set at "100." The minimum setting (fully counterclockwise) produces an output voltage of about 60% of the full output (depends on whether control is set up for 90V or 180V maximum output).

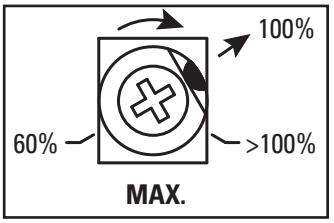


Figure 11 –
Factory setting of MAX trim pot.

ACC: Acceleration Time

Turn the ACC trim pot to change the acceleration time. The minimum setting (fully counterclockwise) produces a voltage ramp time of approximately 0.2 seconds. The maximum setting (fully clockwise) produces a voltage ramp time of approximately 10 seconds for a 0 to 90 VDC output and 20 seconds for a 0 to 180 VDC output. Certain loading conditions may prevent the motor from actually accelerating as quickly as the output voltage ramps up.

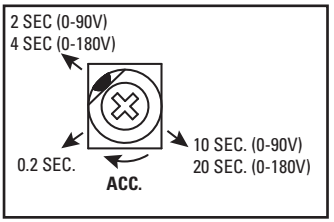


Figure 12 –
Factory setting of ACC pot.

DEC: Deceleration Time

Turn the DEC trim pot to change the deceleration time. The minimum setting (fully counterclockwise) produces a voltage ramp time of approximately 0.2 seconds. The maximum setting (fully clockwise) produces a voltage ramp time of approximately 10 seconds to ramp the output voltage down from 90 to 0 VDC and 20 seconds to ramp down from 180 to 0 VDC. Certain loading conditions may prevent the motor from actually decelerating as quickly as the output voltage ramps down.

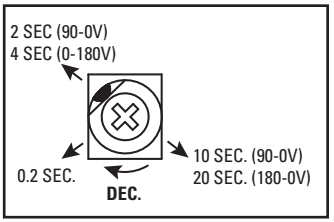


Figure 13 –
Factory setting of DEC pot.

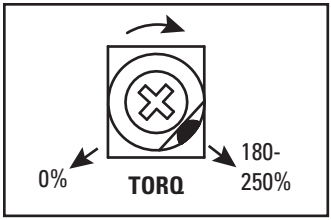


Figure 14 –
Factory setting of TORQ trim pot.

TORQ: Output Current Limit

The TORQ trim pot can be adjusted to change the output current limit. Since the current drawn by a DC motor is directly proportional to the output torque of the motor, limiting the current available to the DC motor will limit the load the motor is capable of driving and set the stall point. Turn the TORQ trim pot to set the stall point from 0% (fully counterclockwise) to roughly 180 – 250% (fully clockwise) of the motor's rated torque (assuming DIP switches are properly set). Note that the factory setting of the TORQ trim pot allows the motor to draw more than its rated current and will allow the motor to overheat if the overload condition is allowed to persist continuously. There is no shut-down function in the control to protect against a continuous overload. The red "LMT" LED will illuminate when the current limit set by the TORQ trim pot is reached.

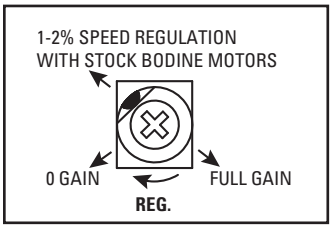


Figure 15 –
Factory setting of REG trim pot.

REG: IR Compensation for Speed Regulation

The REG trim pot sets the gain of the IR compensation. It is factory set so that motor speed varies no more than about 2% of rated speed from no load to full load with the DIP switches set properly. Increased IR compensation can be obtained by turning the REG trim pot clockwise. However, this may cause some systems to become unstable. If this happens, reduce the compensation by turning the REG pot counterclockwise.

TROUBLESHOOTING

WARNING

- *Do not open the cover of the control when the power is ON to avoid injury caused by electrical shock.*

This control does not require maintenance under normal conditions. If you encounter a problem, read all instructions provided with this control and double check the wiring. If problems persist, contact your source of purchase or a Bodine Authorized Service Center and describe the problem in detail. Performing unauthorized repairs will void the Warranty.

GENERAL EVALUATION – Knowing the circumstances under which the problem occurred can help to identify the root cause of the problem.

Has the system ever operated properly? If the control was just installed and doesn't work right, then something probably wasn't done correctly in the installation. However, if the system was working for an extended period of time and just recently stopped working, then the control probably was initially installed properly, but something has somehow changed.

Is the problem continuous or intermittent? If the problem always occurs and never goes away, then it would indicate something inherently wrong in the connections or a defective component. However, if the system operates properly most of the time and only occasionally does something wrong, then this might indicate loose connections or electrical noise interference.

Refer to Table 4 on the next page for a description of some of the more common problems and their causes.

Table 4 - General problem evaluation method

PROBLEM	CHECK POINT	IF "YES," THEN …
Motor does not run	Is main power lamp illuminated?	• Check that power source is switched on. • Reconfirm the power voltage level.
	Is the red "LMT" LED illuminated?	• Check that TORQ trim pot is not set too low. • Check that motor is not overloaded.
	Is the main speed pot damaged?	• Examine the speed pot and correct it.
Motor runs, but in wrong direction	Is wiring to the motor correct?	• Switch the two motor wires.
Motor runs, but speed can't be adjusted	Is the main speed pot damaged?	• Examine the speed pot and correct it.
	Is the red "LMT" LED damaged?	• Check that TORQ trim pot is not set too low. • Check that motor is not overlooked.
Motor runs, but speed is too high or too low	Is the motor specification correct?	• Reconfirm motor specification.
	Is the gear ratio correct?	• Reconfirm gear ratio.
	Is the MAX trim pot setting correct?	• Check MAX trim pot settings.
	Is DIP switch 8 set for proper output voltage?	• Set DIP switch 8 properly.
Motor runs but with abnormal speed variation	Is the loading variation too large?	• Reduce loading variation.
	Are DIP switches set properly to match the motor?	• Set DIP switches properly.
	Is REG trim pot set properly?	• Adjust REG trim pot.

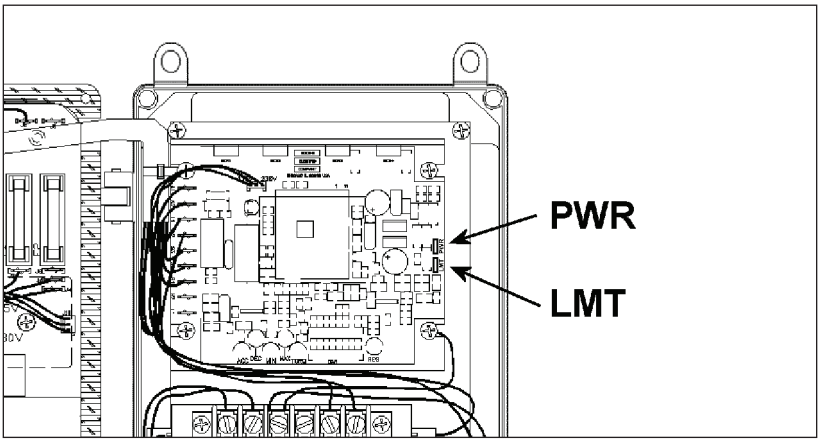


Figure 16 – Location of LED Status Indicators inside the enclosure

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.

Contact our customer support staff to request a **CE Declaration of Conformity** for this product. Please send an e-mail to: info@bodine-electric.com.

Control Type:_____ **Serial No.**_____

Date of Purchase:_____ **Place of Purchase:**_____

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