AMERICAN CONTROL ELECTRONICS

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# DC401-1.5

***4Q PWM microprocessor based Chassis Adjustable Speed Drive for Low Voltage PMDC Brush Motors***

## Specifications

| Model | Line Voltage (VAC) | Armature Voltage Range (VDC) | Continuous (Peak*) Armature Current (Amps) | Armature Horsepower Range |
|---|---|---|---|---|
| DC401-1.5 | 115 or 230 | 12<br>24 | 3.0 (4.0)<br>1.5 (2.0) | 1/50 - 1/25 |

* Peak current rating for 10 seconds.

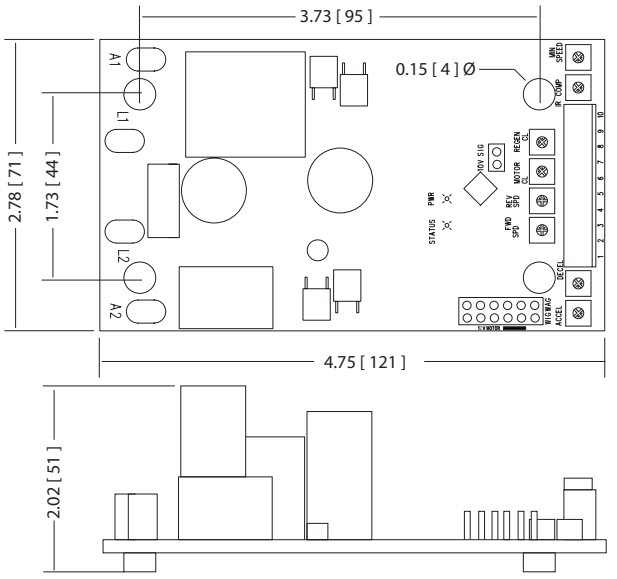
**AC Line Voltage**.....115/230 VAC ± 10%, 50/60 Hz, single phase
**Form Factor**.....1.05 at base speed
**Acceleration Time Range**.....0.5 - 15 seconds
**Deceleration Time Range**.....0.5 - 15 seconds
**Analog Input Voltage Range**.....0 - 5, 0 - 10 VDC
**Input Impedance (S1 to S2)**.....>1M ohms
**Load Regulation**.....1% base speed
**Speed Range**.....80:1
**Vibration** *(0 - 50 Hz)*.....0.5G maximum
*(>50 Hz)*.....0.1G maximum
**Ambient Temperature Range**.....10°C - 40°C
**Weight**.....0.26 lbs

## Safety Warnings

***READ ALL SAFETY WARNINGS BEFORE INSTALLING THIS EQUIPMENT***

- **DO NOT INSTALL, REMOVE, OR REWIRE THIS EQUIPMENT WITH POWER APPLIED.** Have a qualified electrical technician install, adjust and service this equipment. Follow the National Electrical Code and all other applicable electrical and safety codes, including the provisions of the Occupational Safety and Health Act (OSHA), when installing equipment.
- **Circuit potentials are at 115 or 230 VAC above earth ground**. Avoid direct contact with the printed circuit board or with circuit elements to prevent the risk of serious injury or fatality. Use a non-metallic screwdriver for adjusting the calibration trim pots. Use approved personal protection equipment and insulated tools if working on this drive with power applied.
- Reduce the chance of an electrical fire, shock, or explosion by using proper grounding techniques, over-current protection, thermal protection, and enclosure. Follow sound maintenance procedures.
- **ACE strongly recommends the installation of a master power switch in the line voltage input.** The switch contacts should be rated for 250 VAC and 150% of motor nameplate current.
- **Removing AC line power is the only acceptable method for emergency stopping.** Do not use regenerative braking, decelerating to minimum speed, or coasting to a stop for emergency stopping. They may not stop a drive that is malfunctioning. Removing AC line power is the only acceptable method for emergency stopping.
- Line starting and stopping (applying and removing AC line voltage) is recommended for infrequent starting and stopping of a drive only. Regenerative braking, decelerating to minimum speed, or coasting to a stop is recommended for frequent starts and stops.
- **Do not disconnect any of the motor leads from the drive** unless power is removed or the drive is disabled. Opening any one lead while the drive is running may destroy the drive.
- Change jumper settings only when the drive is disconnected from AC line voltage. Make sure all jumpers are set to their correct position. If the jumpers are improperly set to a higher voltage, the motor will overspeed, which may cause motor damage, or result in bodily injury or loss of life.
- Under no circumstances should power and logic level wires be bundled together.
- Be sure potentiometer tabs do no make contact with the potentiometer enclosure. Grounding the input will cause damage to the drive.

## Dimensions




ALL DIMENSIONS IN INCHES [MILLIMETERS]

## Installation

**Mounting**

- Drive components are sensitive to electrostatic discharge. Avoid direct contact with the circuit components.
- Protect the drive from dirt, moisture, and accidental contact.
- Provide sufficient room for access to the terminal block and calibration trim pots.
- Mount the drive away from heat sources. Operate the drive within the specified ambient operating temperature range.
- Prevent loose connections by avoiding excessive vibration of the drive.
- Mount the drive with its board in either a horizontal or vertical plane. Four 0.15" (4 mm) wide holes in the board accept #6 pan head screws.

**Wiring**

Use 18 - 24 AWG wire for logic wiring.
Use 14 - 16 AWG wire for AC line (L1, L2) and motor (A1, A2) wiring.

**Shielding Guidelines**

As a general rule, ACE recommends shielding of all conductors. If it is not practical to shield power conductors, ACE recommends shielding all logic-level leads. If shielding of logic-level leads is not practical, the user should twist all logic leads with themselves to minimize induced noise. It may be necessary to earth ground the shielded cable. If noise is produced by devices other than the drive, ground the shield at the drive end. If noise is generated by the drive, ground the shield at the end away from the drive. Do not ground both ends of the shield.

**Fusing**

ACE drives require an external line fuse for protection. Use fast acting fuses rated for 250 VAC or higher and 1 amp. Fuse the HOT leg of the AC line when using 115 VAC and both lines when using 230 VAC.

## Connections

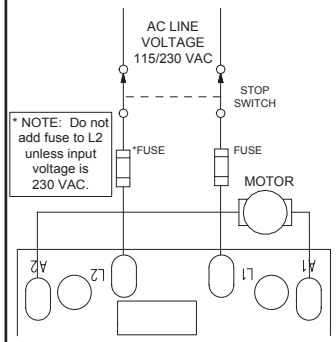
**POWER**

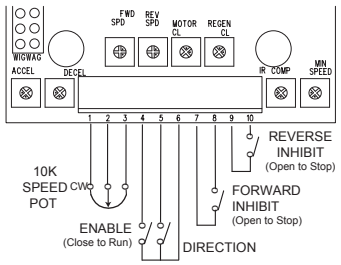
**Input Power**

Connect the AC line power leads to terminals L1 and L2. ACE recommends the use of a double-pole, single-throw master power switch. The switch should be rated at a minimum of 250 VAC and 150% of motor current.

**Motor**

Connect the DC armature leads to terminals A1 and A2. If the motor does not spin in the desired direction, power down the drive and reverse these connections. If using a 24 VDC motor, leave the 12V MOTOR pins open. If using a 12 VDC motor, jumper the 12V MOTOR pins. See the Startup section for jumper location.




**LOGIC**

**Speed Potentiometer**

Use a 10K ohm, 1/4 W potentiometer for speed control. Connect the counter-clockwise end of the potentiometer to terminal 3, the wiper to terminal 2, and the clockwise end to terminal 1. If the potentiometer works inversely of desired functionality, (i.e. to increase motor speed, you must turn the potentiometer counterclockwise), power off the drive and swap the terminal 1 and 3 connections. See the Operations section for the Wig Wag Mode option.

**Analog Input Signal**

Instead of using a speed adjust potentiometer, DCH401 series drives may be wired to follow an analog input signal. This signal can be in the form of a 0-5 VDC or 0-10 VDC (see Startup section for jumper settings). Because these drives have built in isolation, the input signal can be grounded or ungrounded (floating). Connect the signal common (-) to terminal 3 and the signal reference (+) to terminal 2.

**Forward & Reverse Inhibit**

Connect a forward inhibit switch to terminals 7 and 8 and a reverse inhibit switch to terminals 9 and 10. Opening an INHIBIT connection regeneratively brakes the motor to a stop. The inhibits bypass the DECEL trim pot. The forward inhibit switch has no effect if the motor is running in reverse, and vice versa. If the use of only one inhibit switch is desired, jumper terminals 7 and 9 and then connect the switch to terminals 7 and 8. If no inhibit switches are desired, jumper terminals 7 and 8 and terminals 9 and 10. **Do not use the inhibit functions for emergency stopping.**

**Enable**

Connect an enable switch to terminals 4 and 6. Close the connection to run and open the connection to coast the motor to a stop. The enable comes into effect regardless of direction. If no switch is desired, jumper terminals 4 and 6. **Do not use the enable function for emergency stopping.**

**Direction**

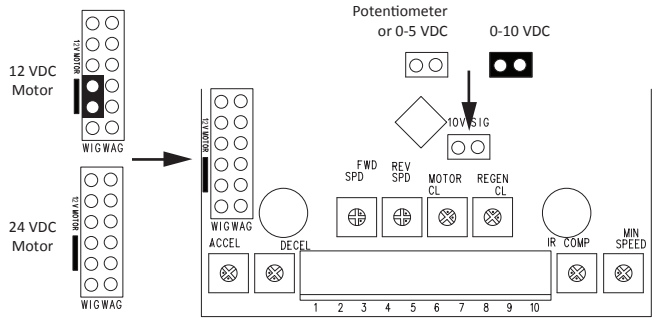
Connect a direction switch to terminals 5 and 6. Close the connection to change direction.

# Startup

**JUMPERS**

Output Motor Jumper - If using a 24 VDC motor, leave the pins open. If using a 12 VDC motor, place a jumper on the pins.

Potentiometer/ 5 VDC Analog Signal or 10 VDC Analog Signal - If using a potentiometer or a 0 - 5 VDC analog signal, leave the pins open. If using a 0 - 10 VDC signal, place a jumper on the pins.




**STARTUP**

- Verify that no foreign conductive material is present on the printed circuit board.
- Ensure that all jumpers are properly set.

1. Turn the speed adjust potentiometer full counterclockwise (CCW) if in Unidirectional Mode. Set to the mid-position if in Bidirectional Mode (if MIN SPD is at mid position, see Calibration Section.
2. Apply AC line voltage.
3. Close the Enable.
4. Slowly advance the speed adjust potentiometer clockwise (CW). The motor slowly accelerates as the potentiometer is turned CW. Continue until the desired speed is reached.
5. Remove AC line voltage from the drive to coast the motor to a stop.

# Operations

**Unidirectional Mode vs. Bidirectional (WigWag) Mode**

Unidirectional Mode - In unidirectional mode, the potentiometer determines the speed of the motor. The direction switch determines the direction. For Unidirectional Mode, leave the jumper on the WIGWAG header open.

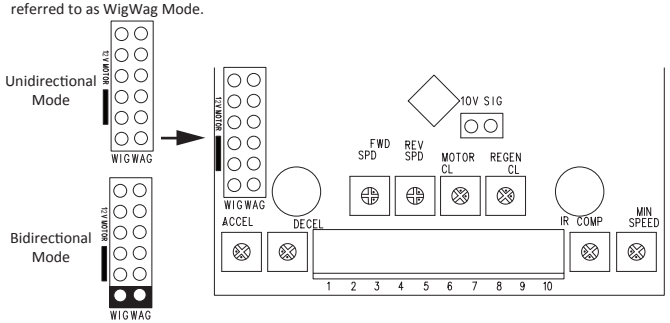
Bidirectional Mode - In bidirectional mode, the potentiometer determines the speed and the direction of the motor:

Full CCW = Full Speed Reverse
50% = Stop / Zero Speed
Full CW = Full Speed Forward

Closing the direction switch will invert the potentiometer.

Full CCW = Full Speed Forward
50% = Stop / Zero Speed
Full CW = Full Speed Reverse

For Bidirectional mode, place a jumper on the WIGWAG header. Bidirectional Mode can also be referred to as WigWag Mode.

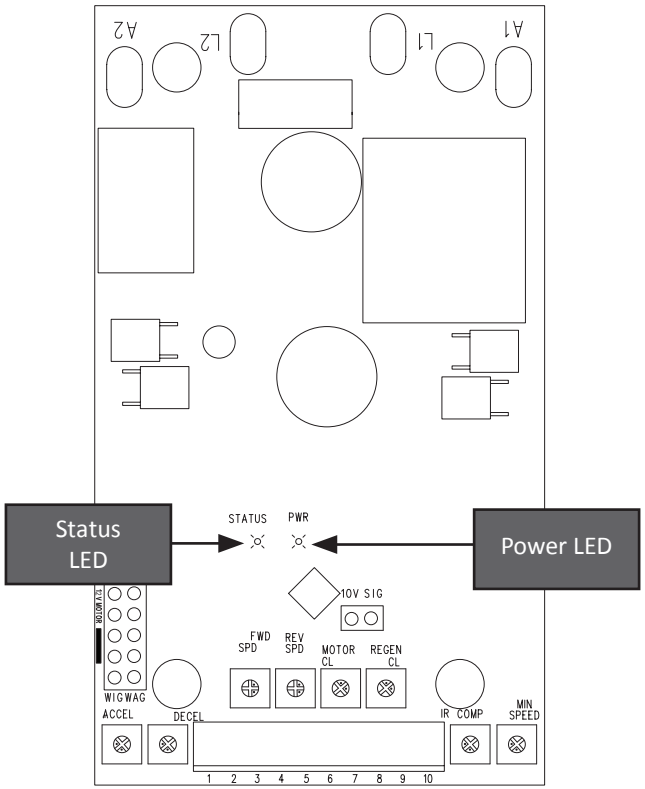





# LEDs

**Power (PWR):** Green LED
Off: The drive does not have power.
Solid: The source voltage is within range and the drive is operating correctly.

**Status (STATUS):** Red LED
Solid: The drive is either in Motoring Torque Limit or Regenerative Torque Limit.
3 Blinks: The drive has reached it's regenerative limit.




# Calibration

**Minimum Speed (MIN SPEED):** The MIN SPEED setting determines the minimum motor speed when the speed adjust potentiometer is set for minimum speed. It is factory set for zero speed. To calibrate the MIN SPEED in Unidirectional Mode:

1. Set the MIN SPEED trim pot full CCW.
2. Set the speed adjust potentiometer for minimum speed.
3. Adjust MIN SPEED until the desired minimum speed is reached or is just at the threshold of rotation.

To calibrate the MIN SPD in Bidirectional Mode:

1. Set the external speed pot to mid position. If using a 0-5VDC or a 0-10VDC, set the speed command signal to 2.5VDC or 5VDC respectively.
2. Adjust the Min Speed trim pot until the motor stops rotating.

**Forward Maximum Speed (FWD SPD):** The FWD SPD setting determines the maximum motor speed in the forward direction (when A1 is positive with respect to A2). To calibrate the FWD SPD:

1. Set the FWD SPD trim pot full CCW.
2. Set the speed adjust potentiometer for maximum speed.
3. Adjust FWD SPD until the desired maximum speed is reached.

**Reverse Maximum Speed (REV SPD):** The REV SPD setting determines the maximum motor speed in the reverse direction (when A2 is positive with respect to A1). To calibrate the REV SPD:

1. Set the REV SPD trim pot full CCW.
2. Set the speed adjust potentiometer for maximum speed.
3. Adjust REV SPD until the desired maximum speed is reached.

**Motor Torque (MOTOR CL):** The MOTOR CL setting determines the maximum torque for accelerating and driving the motor in the forward and reverse directions. To calibrate the MOTOR CL:

1. With the power disconnected from the drive, connect a DC ammeter in series with the armature.
2. Set the MOTOR CL trim pot to minimum (full CCW).
3. Set the speed adjust potentiometer to maximum forward speed (full CW).
4. Carefully lock the motor armature. Be sure that the motor is firmly mounted.
5. Apply power source. The motor should be stopped.
6. Slowly adjust the MOTOR CL trim pot CW until the armature current is 150% of motor rated armature current.
7. Turn the speed adjust potentiometer to minimum speed (full CCW).
8. Remove power source.
9. Remove the stall from the motor.
10. Remove the ammeter in series with the motor armature if it is no longer needed.

**Regen Torque (REGEN CL):** The REGEN CL setting determines the maximum torque for decelerating the motor and resisting an overhauling load in the forward and reverse directions. Turn the REGEN CL trim pot CW to increase the regen current limit and CCW to decrease the regen current limit. See the approximate settings below.


0.0 Amps at 12 VDC
0.0 Amps at 24 VDC


2.00 Amps at 12 VDC
1.00 Amp at 24 VDC


4.00 Amps at 12 VDC
2.00 Amps at 24 VDC


0.66 Amps at 12 VDC
0.33 Amps at 24 VDC


2.66 Amps at 12 VDC
1.33 Amps at 24 VDC


1.33 Amps at 12 VDC
0.66 Amps at 24 VDC


3.33 Amps at 12 VDC
1.66 Amps at 24 VDC

**IR Compensation (IR COMP):** The IR COMP setting determines the degree to which motor speed is held constant as the motor load changes. To calibrate the IR COMP:

1. Set the IR COMP trim pot full CCW.
2. Increase the speed adjust potentiometer until the motor runs at midspeed without load. A handheld tachometer may be used to measure motor speed.
3. Load the motor armature to its full load armature current rating. The motor should slow down.
4. While keeping the load on the motor, rotate the IR COMP trim pot until the motor runs at the speed measured in step 2. If the motor oscillates (overcompensation), the IR COMP trim pot may be set too high (CW). Turn the IR COMP trim pot CCW to stabilize the motor.
5. Unload the motor.

**Acceleration (ACCEL):** The ACCEL setting determines the time the motor takes to ramp to a higher speed. To calibrate the ACCEL, turn the ACCEL trim pot CW for a longer acceleration time and CCW for a shorter acceleration time.

**Deceleration (DECEL):** The DECEL setting determines the time the motor takes to ramp to a lower speed. To calibrate the DECEL, turn the DECEL trim pot CW for a longer deceleration time and CCW for a shorter deceleration time.