



AMERICAN  
CONTROL  
ELECTRONICS

An ISO 9001:2008 Certified Company

# DCR300-20

4Q PWM Microprocessor-based Chassis  
Adjustable Speed Drive  
for Low Voltage PMDC Brush Motors

14300 De La Tour Drive  
South Beloit, IL 61080  
Phone: (800) AMCNTRL  
Fax: (800) 394-6334

www.americancontrolelectronics.com



## Specifications

| Model     | Source Voltage (VDC) | Armature Voltage Range (VDC) | Peak Armature Current (Amps) | Motor Horsepower Range |
|-----------|----------------------|------------------------------|------------------------------|------------------------|
| DCR300-20 | 12                   | Up to 95%                    | 20*                          | 1/75 - 1/9             |
|           | 24                   | of Source Voltage            |                              | 1/40 - 1/4             |

\* Peak current rating for 1 minute. Continuous current rating is 10 amps.

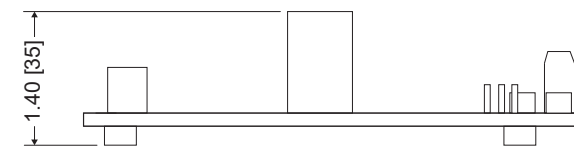
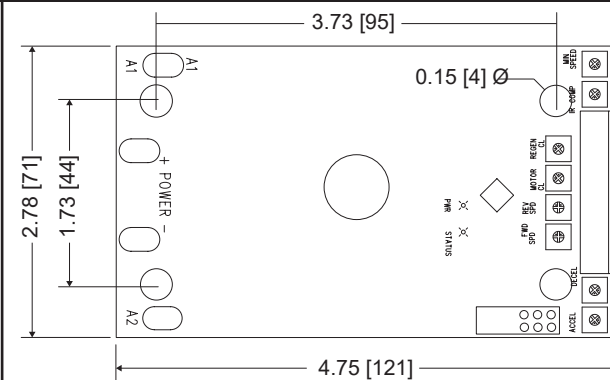
|                                 |                    |
|---------------------------------|--------------------|
| Source Voltage .....            | 7 - 30 VDC         |
| Form Factor.....                | 1.01 at base speed |
| Acceleration Time Range.....    | 0.5 - 15 seconds   |
| Deceleration Time Range.....    | 0.5 - 15 seconds   |
| Analog Input Voltage Range..... | 0 - 5 VDC          |
| Input Impedance (S1 to S2)..... | >100K 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.....  | 0°C - 40°C         |
| Weight.....                     | 0.18 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.
- 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.
- The drive is not diode-protected from reverse battery voltage. You must ensure that the positive terminal is wired to POWER+ and the negative terminal is wired to POWER-.
- 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.
- **Removing DC 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 DC power is the only acceptable method for emergency stopping.
- Applying and removing DC source 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. Frequent starting and stopping can produce high torque. This may cause damage to motors.
- **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.
- Under no circumstances should power and logic level wires be bundled together.
- Be sure potentiometer tabs do not make contact with the potentiometer's body. Grounding the input may 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 10 - 12 AWG wire for DC source (POWER +, POWER -) and motor (A1, A2) wiring.

### Shielding Guidelines

As a general rule, it is recommended to shield all conductors. If it is not practical to shield power conductors, it is recommended to shield 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

The drive requires an external line fuse for protection. Use fast acting fuses rated for at least 150% of the maximum armature voltage and current. Fuse the positive terminal.

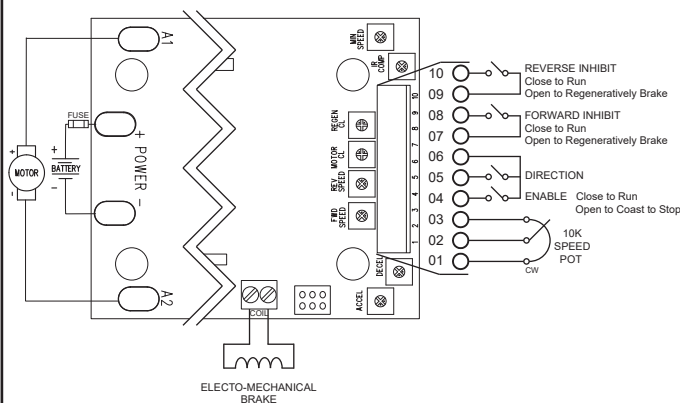
## Connections

### Input Power

Connect the DC input power leads to terminals +POWER (positive) and POWER- (negative). **Connecting the DC input power backwards will cause damage to the drive.**

### 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.



### 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. Refer to the Operations section for Bidirectional mode where the potentiometer sets both speed and direction.

### Forward & Reverse Inhibit

Connect a forward inhibit switch to terminals 7 and 8 and a reverse inhibit switch to terminals 9 and 10. Opening a 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 either the forward or reverse inhibit input. If no inhibit switches are desired, jumper terminals 7 and 8 and jumper 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 switch to run and open the switch 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 switch to change direction.

### Coil

The COIL terminals supply a voltage to an electro-mechanical DC brake when the drive is drive is engaged. The voltage is equal to the input power voltage. When the drive is disabled or the inhibit corresponding to the commanded direction is activated, the COIL voltage is removed after a short delay. Removing the voltage from the electro-mechanical brake should cause the brake to engage and hold the motor. The voltage is reapplied to the COIL terminals once the drive is enabled, un-inhibited and the motor is being commanded a speed other than zero. The COIL output is disabled if using Bidirectional Mode (see Operations section).

# Startup

## 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.

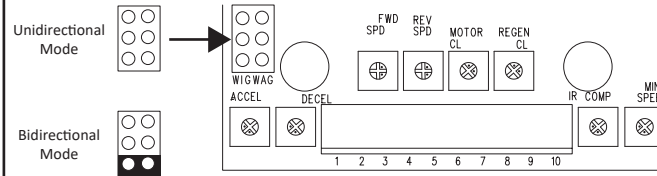
**Bidirectional Mode** - In bidirectional mode, the potentiometer determines the speed and the direction of the motor:

- 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.



# Calibration

**Minimum Speed (MIN SPD):** The MIN SPD 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 SPD:

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

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

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

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

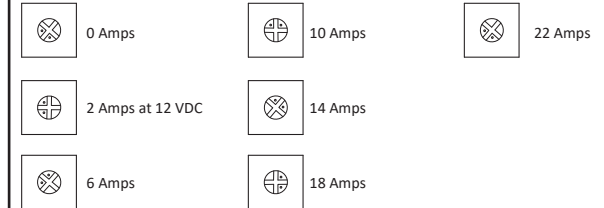
1. Set the REV SPEED trim pot full CCW.
2. Set the speed adjust potentiometer for maximum speed.
3. Adjust REV SPEED until the desired maximum speed is reached.

**Forward 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.

See the approximate settings below.

**Reverse 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.



**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.

# LEDs

## Power (PWR): Green LED

Off: The drive does not have power.  
Blinking: The source voltage is either below 7 VDC or above 32 VDC.  
Solid: The source voltage is within range and the drive is operating correctly.

## Status (FLT): Red LED

Solid: The drive is either in Torque Limit or Regenerative Torque Limit.  
Continuous Blinking: The drive is overheating. Provide more ventilation to the drive or decrease the load.  
2 Blinks: The drive is approaching an under-voltage trip or has entered an under-voltage trip.  
3 Blinks: The drive has entered an over-voltage trip.

