Silencer® Series Brushless Controllers

BDP-Q2-50-10 , BDP-Q2-20-10

2-quadrant speed controller for brushless motors

Instruction Manual

GENERAL

- The BDP-Q2-50-10, BDP-Q2-20-10 controllers are 2-quadrant speed controllers for electronically commutating three-phase brushless motors with Hall sensors, which are arranged offset at 120 electrical degrees.
- The speed of the motor is preset by means of either an internal or an external potentiometer.
- The maximum constant current can be adjusted via an on-board potentiometer.
- The **Direction** of rotation of the motor can be preset by means of the **Direction** control input. The controller output stage can be activated and deactivated by means of the **Disable** control input.
- The controller is safeguarded against heat overload by means of an internal thermal cutoff.
- The controller output stage has been constructed using POWER-MOSFET technology, resulting in very high efficiency.

MOOG

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SPECIFICATIONS

ELECTRICAL DATA	BDP-Q2-50-10	BDP-Q2-20-10
Operating voltage **-+input and Gnd** Residual voltage < 5 %	20 - 50 VDC	12 - 20 VDC
Maximum constant current (adjustable)*	10 A	10 A
Supply voltage for Hall sensors	6 V / 20 mA	

** At higher input voltages, additional heat-sinking may be required for maximum current*

INPUTS

- Direction of rotation – **(REV)** open collector / TTL / CMOS / switch
- Disable output stage – **(DIS)** open collector / TTL / CMOS / switch

TEMPERATURE RANGE

Storage -104 to 185°F (-40 to +85°C)
Operation -50 to 113°F (-10 to +45°C)

MOISTURE RANGE

20 to 80% non-condensed

MECHANICAL DATA

Weight - 4.93 oz (140 g)
Dimensions - (L x W x H) - 2.17 x 3.70 x 1.54 in (55 x 94 x 39 mm)
Mounting - 4 x M3 with a distance between holes of 1.54 x 3.43 in (39 x 87 mm)
Drill Diameter - 4.0 mm - (4) places - M3 screw

ASSEMBLY NOTE

Optimum heat dissipation is achieved by mounting the BDP-Q2-50-10, BDP-Q2-20-10 controller on a heat sink, and through the use of a thermal conduction paste.

For longer distances between the motor and the control unit, > 12 in (30 cm), shielded cables should be used for the sensor cable and the motor cable.

SAFETY NOTE

Operating voltages exceeding the specified values, or reverse connection will destroy the controller and will void the product warranty.

Unauthorized opening and improper repairs will put the user in danger and will void the product warranty.

If the controller is brought from a cold environment into the operating environment, there can be condensation. Wait until the controller has reached the ambient temperature of the operating environment, and is absolutely dry before it is put into operation.

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TERMINATION TABLE		
Terminal #	*Nomenclature*	*Description*
1	GND	Gnd for Supply Voltage
2	Positive Input	Positive Supply Voltage
3	Phase A	Motor Phase A
4	Phase C	Motor Phase C
5	Phase B	Motor Phase B
6	S3	Hall Switch #3
7	S2	Hall Switch #2
8	S1	Hall Switch #1
9	VCC	Supply for Hall Switches
10	GND	Gnd for Hall Switches
11	DIS	Control Input - Disable
12	REV	Control Input - Reverse
13	GND	Gnd for Dis and Rev
14	SPD	Set Value Input for Speed

CONTROL INPUTS

Control inputs 12 (Reverse), 11 (Disable) can be enabled either by an external switch, an open collector transistor, or by means of TTL / CMOS components. This connection is made to **13 (Gnd)**.

Control input	Input open or high level	Input on Gnd or low level
Rev	Turning to the right (CW)	Turning to the left (CCW)
Dis	Controller active	Controller inactive

Note: For positive stopping of the motor it is advisable to use the **Disable input rather than setting the speed potentiometer to zero. Some drift may occur even at zero setting of the speed potentiometer; this will not be the case when the **Disable** function is used.*

SELECTING MOTOR DIRECTION-OF-ROTATION

Reversing the direction of motor rotation is easily accomplished. Using a switch, relay contact, or simply a jumper wire, connect the terminal labeled **Rev.** to the terminal labeled **Gnd**.
NOTE: Do not reverse motor direction while the motor is rotating. The controller is not designed for instantaneous reversing.

SPEED CONTROL

Motor speed may be controlled via one of the following three methods (see page 4 and 5 for detail instructions):

1. On-Board Speed Potentiometer
2. External Speed Potentiometer – (Recommend 10k – 10 Turn Precision Potentiometer)
3. External Control Voltage

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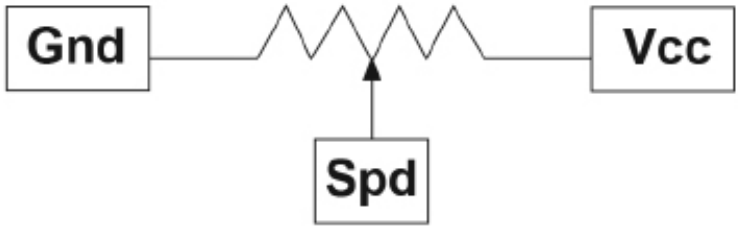
The following is a procedure for using each of the speed control methods mentioned on page 3.

1. **On-Board Speed Potentiometer**
   A. Place a jumper from terminal labeled **GND** to terminal labeled **Spd**.
   B. Rotate the trimpot labeled **Speed** fully **CW**.
   C. Rotate the trimpot labeled **nmax** fully **CW**.
   D. Apply the operating input voltage across **+ Input** and **Gnd**, being careful to observe polarity.
   Do not apply an incremental input voltage, but rather a single step voltage.
   E. Motor should now be running at full speed. Measure and record speed.
   F. Slowly rotate the **nmax** trimpot **CCW** until the motor speed decreases slightly, then slowly rotate the trimpot back **CW** until the motor is once again running at full speed (see value recorded in step **E**).
   G. The **nmax** trimpot is now "tuned" to the motor currently connected to the controller and will not require readjustment unless a different motor is connected to the controller, or the level of the input voltage is changed.
   H. Motor speed may now be varied by using the **Speed** trimpot.

2. **External Speed Potentiometer (optional)**
   NOTE: See Figure 1 for connection diagram for External Speed Potentiometer.
   A. Rotate the **External Speed Potentiometer** fully **CW**.
   B. Rotate the trimpot labeled **Speed** fully **CCW**.
   C. Rotate the trimpot labeled **nmax** fully **CW**.
   D. Apply the operating input voltage across **+ Input** and **GND**, being careful to observe polarity.
   Do not apply an incremental input voltage, but rather a single step voltage.
   E. Motor should now be running at full speed. Measure and record speed.
   F. Slowly rotate the **nmax** trimpot **CCW** until the motor speed decreases slightly, then slowly rotate the trimpot back **CW** until the motor is once again running at full speed (see value recorded in step **E**).
   G. The **nmax** trimpot is now "tuned" to the motor currently connected to the controller and will not require readjustment unless a different motor is connected to the controller, or the level of the input voltage is changed.
   H. Motor speed may now be varied by using the **External Speed Potentiometer**.

Figure 1

Connection Diagram for External Speed Potentiometer



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3. **External Voltage Control (Optional)**
   By applying a DC voltage between **14 (Spd)** and **13 (Gnd)**, the following conditions are observed:
   A. 0 to 0.5 volts – **speed = 0**.
   B. 0.5 to 5.0 volts – **speed range in control operation**.
   C. 5.0 to 10.0 volts – **no pulse-width-operation-control works in simple commutation mode**.
   D. Speed potentiometer should be fully **CCW**.
   E. Rotate the trimpot labeled nmax fully **CW**.
   F. Slowly rotate the **nmax** trimpot **CCW** until the motor speed decreases slightly, then slowly rotate the trimpot back **CW** until the motor is once again running at full speed (see value recorded in step **E**).
   G. The **nmax** trimpot is now "tuned" to the motor currently connected to the controller and will not require readjustment unless a different motor is connected to the controller, or the level of the input voltage is changed.

CURRENT LIMITING

Type	Max. Left Position	Max. Right Position
BDP-Q2-50-10	0 A	> 10 A
BDP-Q2-20-10	0 A	> 10 A

Note: The controller shuts down automatically when the temperature at the inside of the heat sink exceeds 80°C.

FUSING

Proper overcurrent protection (fusing) is required for the protection of this controller. We recommend a **10 amp , non-time delay** fuse. This fuse should be connected in series with the **+ Input** line going to the controller and should be of a value less than or equal to the maximum current rating of the controller (Max. Right Position).

Note: Considerations regarding the power supply:
Output voltage: **> 12 V and < + input** with a residual voltage of < 5%

Output Current: corresponding to the necessary torque and possible reserves for acceleration

Note: Procedure for calculating the necessary minimum supply voltage:

Default: Torque M_B [mNm]
Operating speed n_B [min^{-1}]
Rated voltage of the motor U_N[V]
Idling speed with UN n0 [min^{-1}]

Characteristic curve slope $\frac{\Delta n}{\Delta M}$ [min^{-1} mNm]

Result: $$Vcc = \frac{U_N}{n_0} * (n_B + \frac{\Delta n}{\Delta M} * M_B) + 4V$$

PUTTING INTO OPERATION

1. Connect motor connections **(φA, B, and C)**.
2. Connect Hall sensors **(S1, S2, and S3)**, as well as the Hall voltage supply **(Vcc and Gnd)** of Hall sensors.
3. Connect the control inputs according to the requirements **(Rev. and Dis.)**.
4. Connect the supply voltage **(+ input and gnd)**.
5. Set up the speed control for the controller **(depending upon which method of speed control is used - see Speed Control)**.
6. After completion of step #5, speed control is now active.
7. Set the maximum current via the on-board speed potentiometer **(current)**.

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