AMERICAN CONTROL ELECTRONICS

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RGN Series

4Q PWM Chassis Adjustable Speed Drive (with Isolation) for PMDC Brush Motors

Full manual available online

Specifications

Model	Line Voltage (VAC)	Armature Voltage Range (VDC)	Continuous Armature Current (Amps)	Horsepower Range
RGN400-2	115	0 - 130	2.0	1/20 - 1/6
RGN401-2	230	0 - 240		1/10 - 1/3
RGN400-5	115	0 - 90	5.0	1/8 - 1/2
RGN401-5	230	0 - 180		1/4 - 1
RGN100-10	115	0-130	10.0	1/4 - 1
RGN101-10				

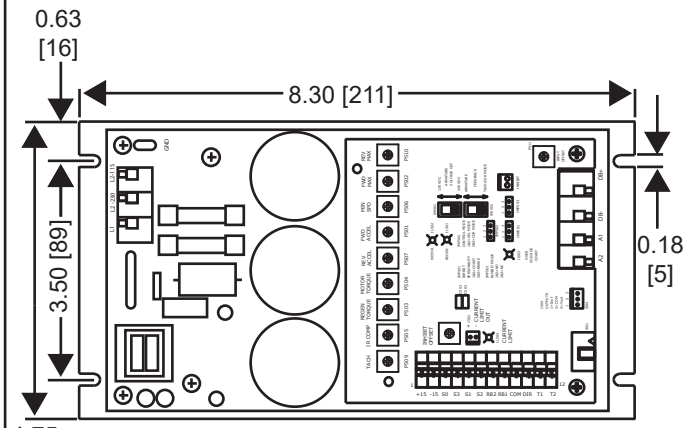
AC Line Voltage.....115 or 230 VAC ± 10%, 50/60 Hz, single phase
Form Factor.....1.05
Acceleration Time Range.....0.1 - 20 seconds
Deceleration Time Range.....0.1 - 20 seconds
Analog Input.....0 to ± 10 VDC
Input Impedance (S0 to S2).....47K ohms
Load Regulation *with Armature Feedback*.....1% base speed
with Tachogenerator Feedback.....0.1% base speed
Speed Range.....100:1
Vibration *(0 - 50 Hz)*.....0.5G maximum
(>50 Hz).....0.1G maximum
Ambient Temperature Range.....10°C - 40°C
Weight *RGN40x-2*.....1.64 lbs
RGN40x-5.....1.88 lbs
RGN10x-10.....1.72 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, 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 200% 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. 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.
- Change voltage switch settings only when the drive is disconnected from AC line voltage. Make sure both switches are set to their correct position. If the switches are improperly set to a lower voltage position, the motor will not run at full voltage and may cause damage to the transformer. If the switches 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's body. Grounding the input will cause damage to the drive.
- This product does not have internal solid state motor overload protection. It does not contain speed-sensitive overload protection, thermal memory retention, or provisions to receive and act upon signals from remote devices for over temperature protection. If motor protection is needed in the end-use product, it needs to be provided by additional equipment in accordance with NEC standards.

Dimensions



MODEL	HEIGHT
RGN40x-2	2.79 [71]
RGN40x-5	3.13 [80]
RGN10x-10	3.62 [92]

ALL DIMENSIONS IN INCHES [MILLIMETERS]

Installation

Mounting

- Drive components are sensitive to electrostatic discharge. Avoid direct contact with the circuit board. Hold the drive by the chassis only.
- 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 0.19" (5 mm) wide slots in the heat sink accept #8 pan head screws.
- The drive should be earth grounded. Connect the earth ground to terminal GND.

Wiring

Use 18 - 24 AWG wire for logic wiring.
Use 14 - 16 AWG wire for AC line (L1, L2-115, L2-230), motor (A1, A2) and regnerative dump circuit (DB+, DB-) 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. Refer to the user's manual for details on earth grounding shielded wires and filtering.

Fusing

The drive provides on board fusing for the AC line (L1, L2-115, L2-230). Fuses are fast acting fuses rated for 250 VAC. RGN400-2 models contain fuses rated for 8 amps. RGN40x-5 models contain fuses rated for 15 amps. RGN10x-10 models contain fuses rated for 20 amps.

Startup

SELECT SWITCHES

Armature Select (SW501): Select the maximum armature output voltage: 130 or 240 VDC.

Feedback Select (SW502): If using a tachogenerator feedback, set switch for TACH. If not, set it to ARM.

JUMPERS

Inhibit Personality (JMP501): JMP501 determines the stopping method when INHIBIT (SO501) is activated. Jumper pins 1 & 2 to coast to a stop. Jumper pins 2 & 3 to brake to a stop.

Control Mode (JMP502): JMP502 determines controlling method of the motor. Jumper pins 1 & 2 for Speed Mode (the drive will output whatever current/torque is necessary to achieve the commanded voltage/speed). Jumper pins 2 & 3 for Torque Mode (the drive will output whatever voltage/speed is necessary to achieve the commanded current/torque). Torque mode is typically used in applications that require tension control.

Inhibit Mode (JMP503): JMP503 determines if the INHIBIT (SO501) is open or close to activate. Jumper pins 1 & 2 to use a N.O. (normally open) switch. The motor will run when the switch is open, and inhibit when the switch is closed. Jumper pins 2 & 3 to use a N.C. (normally close) switch. The motor will run when the switch is closed, and inhibit when the switch is opened.

STARTUP

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

1. Turn the speed adjust potentiometer full counterclockwise (CCW).
2. Apply AC line voltage.
3. Make sure the drive is enabled.
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.

Wiring

AC Line Input: If using a 115 VAC line, connect to the L1 and L2-115 terminals. If using a 230 VAC line, connect to the L1 and L2-230 terminals. Use a double-throw, single-pole master power switch. The switch should be rated at a minimum of 250 VAC and 200% 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.

Speed Potentiometer: Use a 10K ohm, 1/4 W potentiometer for speed control. Connect the counter-clockwise end of the potentiometer to S0, wiper to S2, and the clockwise end to S1. If the potentiometer works inversely of desired functionality, (i.e. to increase motor speed, you must turn the potentiometer counterclockwire), power off the drive and swap the S0 and S1 connections. See the Connections section for alternative wiring setups.

Analog Input Signal Range: Instead of using a speed adjust potentiometer, the drives may be wired to follow an analog input signal of 0 to ±10 VDC. If using a RGNx00 drive, the signal must be isolated from ground. If using a RGNx01 drive, the signal may be grounded or ungrounded (floating). Connect the signal common (-) to S0 and the signal reference (+) to S2.

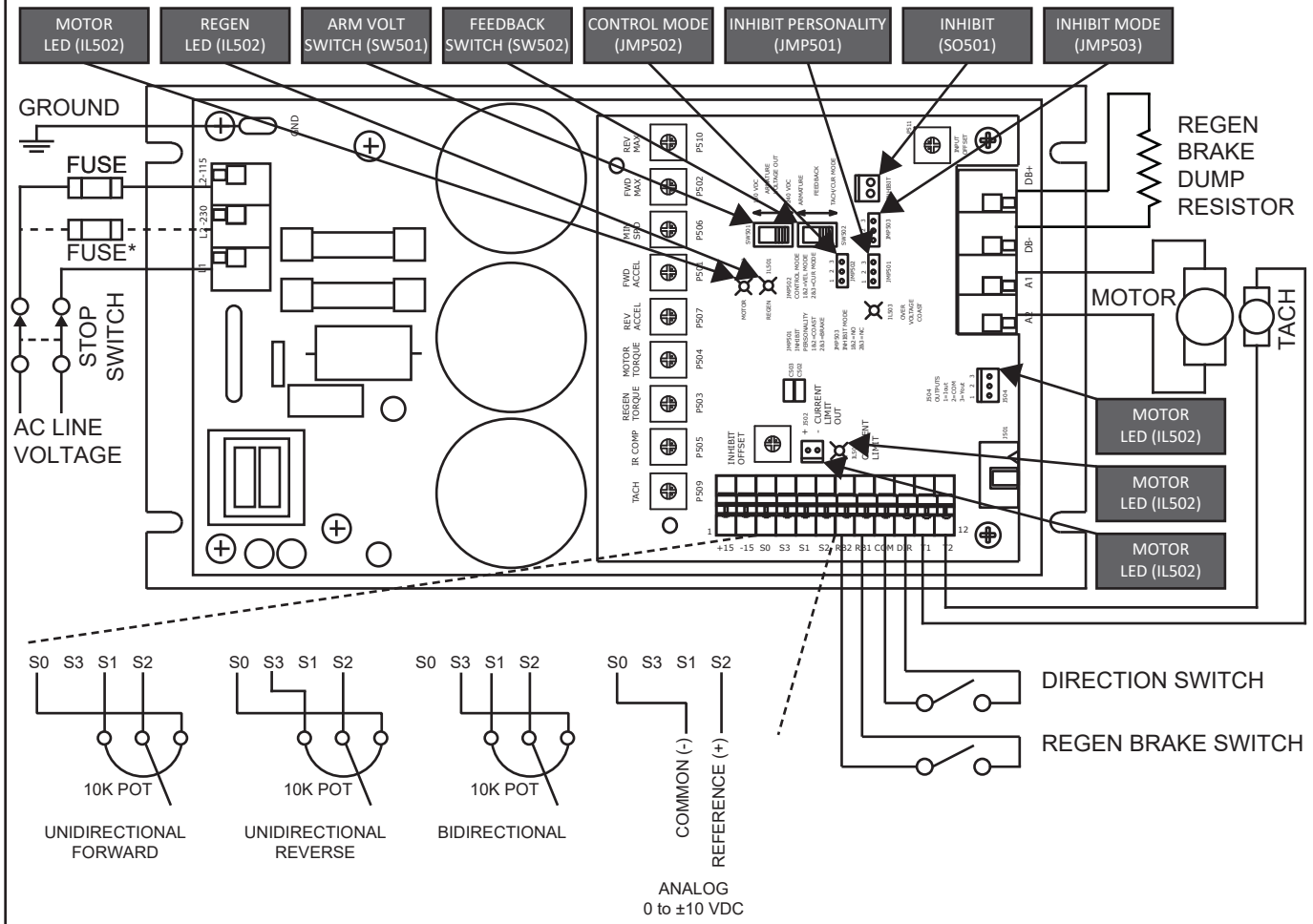
Inhibit: Activate the INHIBIT terminals to regeneratively brake the motor to zero speed. The INHIBIT terminals bypass the FWD ACC and REV ACC trim pots. See the Startup section for related jumpers. **Do not use the inhibit for emergency stopping.**

Regenerative Brake: Short terminals RB1 and RB2 to decelerate to minimum speed. The regenerative brake circuitry follows the FWD ACC and REV ACC trim pots. Open terminals RB1 and RB2 to accelerate the motor to set speed. **Do not use the regenerative braking for emergency stopping.**

Tachogenerator: Using tachogenerator feedback improves speed regulation from approximately 1% of motor base speed to 0.1% of motor base speed. Use tachogenerators rated from 7 VDC per 1000 RPM to 50 VDC per 1000 RPM. Connect the tachogenerator to terminals T1 (positive) and T2 (negative).

+15 and -15: RGN series drive can supply a regulated +15 and -15 VDC voltage (each sourcing 50 mA maximum) with respect to COM, RB1, S0, or T2 to power isolated, external devices.

Connections



LEDs

REGEN (IL501): Yellow LED lights when the drive is applying a regenerative braking current to the motor. The regenerative braking current is applied in the opposite direction of motor rotation to provide braking, instantaneous reversing, or to resist and overhauling load.
MOTOR (IL502): Red LED lights when the drive is applying a motoring current to the motor. The motoring curent is in the same direction of motor rotation to provide acceleration and torque.
OVER VOLTAGE COAST (IL503): Red LED lights when the drive's output to the regen dump circuit exceeds the dump circuit's maximum input voltage.
CURRENT LIMIT (IL504): Red LED lights when the motor is trying to pull more current than what is set for by the MOTOR TORQUE or REGEN TORQUE trim pot.

Operation

REGENERATIVE BRAKE RESISTOR

PWM drives are limited in their regenerative capability. The regenerative energy is returned into the drive's bus capacitor. When this capacitor is full, the drive can no longer regen until the capacitor begins to empty. During these periods, the motor actually coasts. While the regen/coast periods are frequent enough that the user may not see the transitions, it does result in a longer deceleration time. The solution is a regenerative brake dump resistor. When the capacitor is full, the drive will divert the regen energy through through the resistor. Connect the regenerative brake dump resistor across terminals DB+ and DB-. If using a 115 VAC line, use a 20 ohm resistor. If using a 230 VAC line, use a 40 ohm resistor. To determine the resistor power rating, use the following equation.

Resistor Wattage = 1.2 * Duty Cycle * Motor Power in Watts

To calculate the Motor Power in Watts, multiply the Horsepower by 746.
To calculate the Duty Cycle, divide the motor is spent regening by the sum of the time spent regening and motoring. Typical value is 100 watts. Use a lower-value, higher-wattage regenerative brake dump resistor to stop a motor more rapidly.

Please note that applications with light regenerative loads may not require the use of a regenerative brake dump resistor.

Calibration

Input Offset (INPUT OFFSET): The INHIBIT OFFSET adjusts out an internal voltage imbalances. To calibrate the INPUT OFFSET:
1. Remove the connection from S2.
2. If the motor drifts, adjust the input offset until the motor stops.

Inhibit Offset (INHIBIT OFFSET): The INHIBIT OFFSET sets the speed the motor will run at when the INHIBIT (SO501) is activated. To calibrate the INHIBIT OFFSET:
1. Activate the INHIBIT (SO501). Refer to the STARTUP section for related jumper settings.
2. Adjust INHIBIT OFFSET trim pot until the desired speed is reached.

Minimum Speed (MIN SPD): The MIN SPD setting determines the minimum speed for unidirectional operation or the zero offset for bidirectional operation. To calibrate the MIN SPD for minimum speed:
1. Set the MIN SPD trim pot at 12 o'clock.
2. Set the speed adjust potentiometer or analog signal for minimum speed (full CCW or 0 VDC).
3. Adjust MIN SPD trim pot until the desired minimum speed is reached or is just at the threshold of rotation.

To calibrate the MIN SPD for zero offset:
1. Set the MIN SPD trim pot at 12 o'clock.
2. Set the speed adjust potentiometer or analog signal for zero speed (12 o'clock or 5 VDC).
3. Adjust MIN SPD trim pot until the desired zero speed is reached.

Forward Maximum Speed (FWD MAX) and Reverse Maximum Speed: The FWD MAX and REV MAX settings determine the maximum motor speed in their respective directions. To calibrate the MAX SPD:
1. Set the FWD MAX or REV MAX trim pot full CCW.
2. Set the Direction Switch for the desired speed.
3. Set the speed adjust potentiometer or analog signal for maximum speed.
4. Adjust FWD MAX or REV MAX trim pot until the desired maximum speed is reached.

Motor Torque (MOTOR TORQUE) and Regen Torque (REGEN TORQUE): The MOTOR TORQUE determines the maximum torque for accelerating and driving the motor in either direction. The REGEN TORQUE setting determines the maximum amount of torque for braking. To calibrate the MOTOR TORQUE:
1. With the power disconnected from the drive, connect a DC ammeter in series with the armature.
2. Set the MOTOR TORQUE trim pot to minimum (full CCW).
3. Set the speed adjust potentiometer or analog signal to maximum speed.
4. Carefully lock the motor armature. Be sure that the motor is firmly mounted.
5. Apply line power. The motor should be stopped.
6. Slowly adjust the MOTOR TORQUE 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 line power.
9. Remove the stall from the motor.
10. Remove the ammeter in series with the motor armature if it is no longer needed.

Adjust the REGEN TORQUE trim pot to approximately the same setting as the MOTOR TORQUE.

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.

Forward Acceleration (FWD ACCEL): The FWD ACCEL setting determines the time the motor takes to ramp to a higher speed in the forward direction or to a lower speed in the reverse direction. To calibrate the FWD ACCEL, turn the FWD ACCEL trim pot CW to increase the forward acceleration time, and CCW to decrease the forward acceleration time.

Reverse Acceleration (REV ACCEL): The REV ACCEL setting determines the time the motor takes to ramp to a higher speed in the reverse direction or to a lower speed in the forward direction. To calibrate the REV ACCEL, turn the REV ACCEL trim pot CW to increase the reverse acceleration time, and CCW to decrease the reverse acceleration time.

Tachogenerator Feedback (TACH): The TACH setting, like IR COMP setting, determines the degree to which motor speed is held constant as the motor load changes. To calibrate the TACH trim pot:
1. Connect the tachogenerator to T1 and T2. The polarity is positive (+) for T1 and negative (-) for T2 when the motor is running in the forward direction.
2. Set the feedback select switch SW503 to ARM for armature feedback.
3. Set the speed adjust potentiometerto maximum speed. Measure the armature voltage across A1 and A2 using a voltmeter.
4. Set the speed adjust potentiometer to zero speed.
5. Set SW503 to TACH for tachogenerator feedback.
6. Set the IR COMP trim pot to full CCW.
7. Set the TACH trim pot to full CW.
8. Set the speed adjust potentiometer to maximum speed.
9. Adjust the TACH until the armature voltage is the same value as the voltage measured in step 3.

Check that the TACH is properly calibrated. The motor should run at the same set speed when SW502 is set to either ARM or TACH.