



## Specifications

Model	Line Voltage (VAC)	Armature Voltage Range (VDC)	Continuous Armature Current (Amps)	Armature Horsepower Range
RG400-3	115 230	0 - 90 0 - 180	3.0	1/20 - 1/8 1/10 - 1/4
RG400-10	115 230	0 - 90 0 - 180	10.0*	1/4 - 1 1/2 - 2

\* Heat sink kit (part number HSK-0004) must be used when the output is over 7 amps.

AC Line Voltage.....	115/230 VAC ± 10%, 50/60 Hz, single phase
Form Factor.....	1.37 at base speed
Field Voltage with 115 VAC line voltage.....	50 or 100 VDC
with 230 VAC line voltage.....	100 or 200 VDC
Maximum Field Current.....	1 Amp
Acceleration Time Range.....	0.5 - 15 seconds
Deceleration Time Range.....	0.5 - 15 seconds
Analog Input Voltage Range (Signal must be isolated).....	0 to ± 10 VDC
Input Impedance (S0 to S2).....	32K ohms
Load Regulation with Armature Feedback.....	1% base speed
with Tachogenerator Feedback.....	0.1% base speed
Speed Range with Armature Feedback.....	50:1
with Tachogenerator Feedback.....	60:1
Vibration (0 - 50 Hz).....	0.5G maximum
(>50 Hz).....	0.1G maximum
Ambient Temperature Range.....	10°C - 55°C
Weight.....	1.7 lbs
Safety Certifications.....	UL/cUL Listed Equipment, file # E132235
	CSA Certified Component, file # LR41380

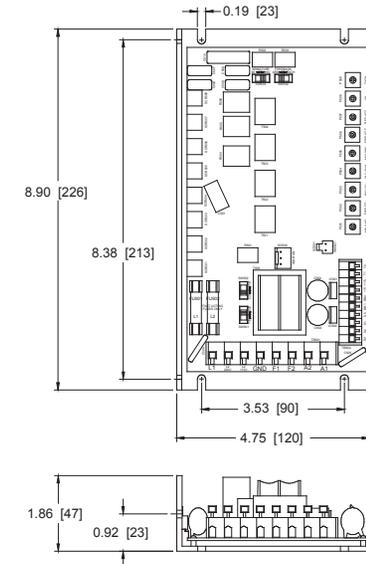
Drive Model	Short Circuit Current Rating		Types of Branch Circuit Protection	Maximum Rating of Overcurrent Protection
	Maximum Current, kA	Maximum Voltage, V		
RG400-10	10,000	240 V	Non-time Delay KS Fuse Inverse Time Circuit Breaker	30 A

## 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 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.
- The field output is for shunt wound motors only. Do not make any connections to F1 and F2 when using a permanent magnet motor.
- 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 not 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



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. Six 0.19" (5 mm) wide slots in the chassis accept #8 pan head screws. Fasten either the large base or the narrow flange of the chassis to the subplate.
- The chassis should be earth grounded. Use a star washer beneath the head of at least one of the mounting screws to penetrate the anodized chassis surface and to reach bare metal.

### Heat Sinking

The RGA400-10 requires an additional heat sink when the continuous armature current is above 7 amps. Use heat sink kit part number HSK-0004. Use a thermally conductive heat sink compound (such as Dow Corning 340® Heat Sink Compound) between the chassis and the heat sink surface for optimal heat transfer.

### Wiring

Use 18 - 24 AWG wire for logic wiring.

Use 14 - 16 AWG wire for AC line (L1, L2 115V, L2 230V) and motor (A1, A2, F1, F2) wiring.

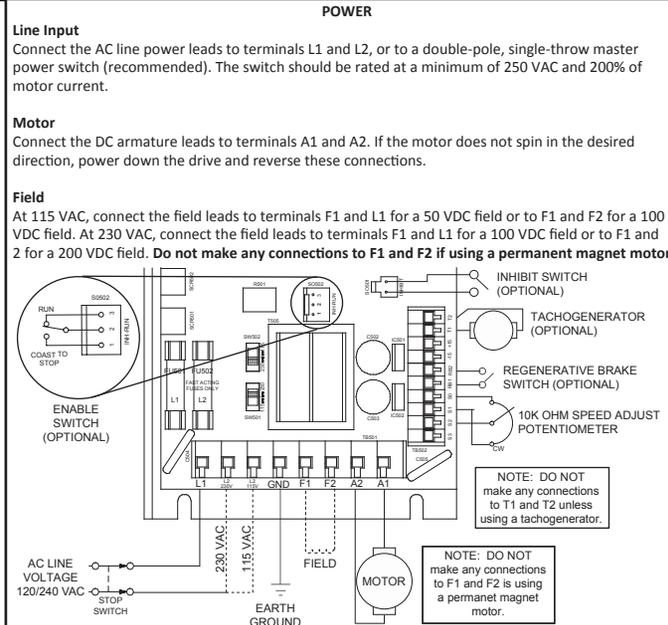
### Shielding Guidelines

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

RGA400 series drives provide on board fusing for the AC line (L1, L2 (230)). Fuses are fast acting fuses. RGA400-3 models contain fuses rated for 8A at 250 VAC. RGA400-10 models contain fuses rated for 20A at 250 VAC.

## 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 counterclockwise), power off the drive and swap the S0 and S1 connections. See the Operation section for alternative wiring setups.

### Inhibit

Short the INHIBIT terminals to regeneratively brake the motor to zero speed. The INHIBIT terminals bypass the FWD ACC and REV ACC trim pots. Open the INHIBIT terminals to accelerate the motor to set speed. ACE offers two accessory plug harnesses for connecting to the inhibit terminals; part number KTW-0001 [18 in (46 cm) leads] and part number KTW-0002 [36 in (91 cm) leads]. **Do not use the inhibit for emergency stopping.**

### Regenerative Brake

Short terminals RB1 and RB2 to regeneratively brake the motor to zero 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.**

### Enable (Inhibit-Run)

Short pins 1 and 2 on terminal S0502 to coast the motor to zero speed. Short pins 2 and 3 on terminal S0502 to accelerate the motor to set speed. If no Enable switch is desired, jumper pins 2 and 3 on S0502 (factory default). ACE offers an accessory plug harness for connecting to the enable terminals; part number KTW-0004 [18 in (46 cm) leads]. **Do not use the enable 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

RGA series drive can supply a regulated +15 and -15 VDC voltage (each sourcing 15 mA maximum) with respect to RB1 or T1 to isolated, external devices.

# Startup

## SELECT SWITCHES

### Input Voltage Select (SW501, SW502)

Set the voltage switches SW501 and SW502 to either 115 or 230 to match the AC line voltage.

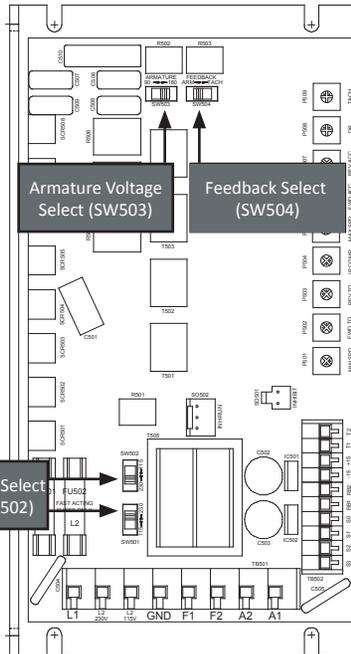
### Armature Voltage Select (SW503)

Set the voltage switch SW502 to either 90 or 180 to match the maximum armature voltage.

### Feedback Select (SW504)

Set the feedback select switch SW504 to either ARM for armature feedback or TACH for tachogenerator feedback.

Input Voltage Select (SW501, SW502)



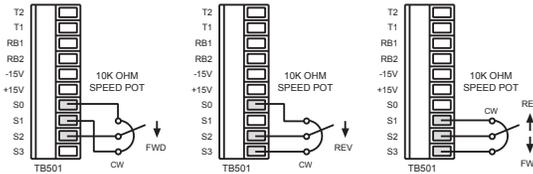
## STARTUP

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

1. Turn the speed adjust potentiometer full counterclockwise (CCW).
2. Apply AC line voltage.
3. Enable the drive if using an enable switch on SO502. Otherwise, make sure the factory installed jumper is in place.
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.

# Operation

## POTENTIOMETER WIRING



Unidirectional Forward

Unidirectional Reverse

Bidirectional

# 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. The minimum speed applies only when the drive is operating in unidirectional mode. 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 trim pot until the desired minimum speed is reached or is just at the threshold of rotation.

**Maximum Speed (MAX SPD):** The MAX SPD setting determines the maximum motor speed when the speed adjust potentiometer is set for maximum speed. To calibrate the MAX SPD:

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

**Forward Torque (FWD TQ) and Reverse Torque (REV TQ):** The FWD TQ and REV TQ settings determine the maximum torque for accelerating and driving the motor in the forward and reverse direction. To calibrate the FWD TQ:

1. With the power disconnected from the drive, connect a DC ammeter in series with the armature.
2. Set the FWD TQ 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 line power. The motor should be stopped.
6. Slowly adjust the FWD TQ 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.

To calibrate the REV TQ:

1. Follow the steps for calibrating the forward torque using the REV TQ trim pot and with the motor set to run in the reverse direction.

**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 ACC):** The FWD ACC 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 ACC, turn the FWD ACC trim pot CW to increase the forward acceleration time, and CCW to decrease the forward acceleration time.

**Reverse Acceleration (REV ACC):** The REV ACC 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 ACC, turn the REV ACC 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 SW504 to ARM for armature feedback.
  3. Set the speed adjust potentiometer maximum speed. Measure the armature voltage across A1 A2 using a voltmeter.
  4. Set the speed adjust potentiometer to zero speed.
  5. Set SW504 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 trim pot 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 SW504 is set to either ARM or TACH.

**Deadband (DB):** The deadband trim pot determines the time that will elapse between the application of current in one direction before current is applied in the opposite direction. The deadband trim pot affects the resistance that a motor has to changes in shaft position at zero speed. Deadband is factory calibrated to approximately the 3 o'clock position for 60 Hz AC line operation. Recalibrate the deadband to the 9 o'clock position for 50 Hz operation. If you hear motor noise (humming), the deadband might be set too high. Turn the deadband trim pot CCW until the motor noise ceases.