

MGC403

4Q SCR Chassis Microprocessor-based
Adjustable Speed Drive with Isolation
and Speed or Torque Modes
for PMDC or Field Wound Brushed Motors

Specifications

| Model | Line Voltage (VAC) | Armature Voltage Range (VDC) | Continuous Armature Current (Amps) | Armature Horsepower Range |
|------------|--------------------|------------------------------|------------------------------------|---------------------------|
| MGC403-1.5 | 115 230 | 0 - 90 0 - 180 | 1.5 | 1/50 - 1/8 1/25 - 1/4 |
| MGC403-11 | 115 230 | 0 - 90 0 - 180 | 11.0* | 1/8 - 1 1/4 - 2 |

* Heat sink kit 223-0159 must be used when the output is over 8 amps.

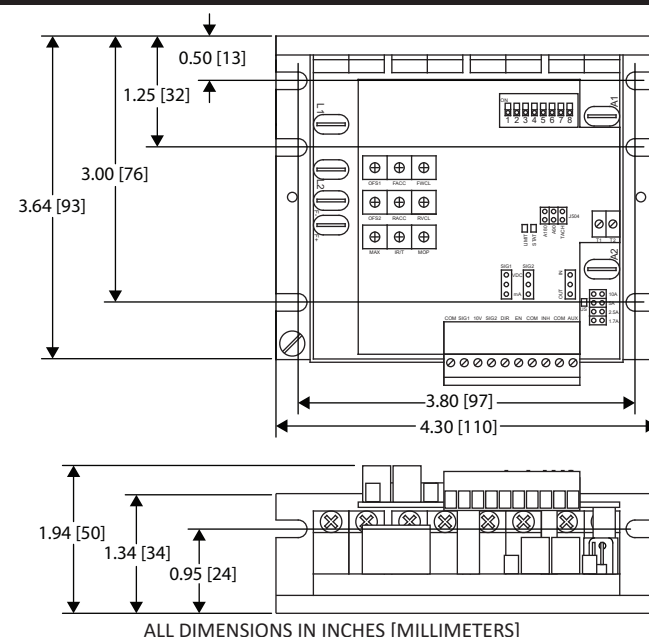
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|---|--|
| AC Line Voltage..... | 115/230 VAC ± 10%, 50/60 Hz, single phase |
| AC Line Current..... | 0 - 15 Amps |
| Field Voltage with 115 VAC line voltage..... | 50 or 100 VDC |
| with 230 VAC line voltage..... | 100 or 200 VDC |
| Maximum Field Current..... | 0.74 Amps |
| Form Factor..... | 1.37 at base speed |
| Tachogenerator Feedback Range..... | 0 to 7 - 50 VDC per 1000 RPM (Max 180 VDC) |
| 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 |
| Acceleration Time Range..... | 0.5 - 15 seconds |
| Deceleration Time Range..... | 0.5 - 15 seconds |
| I/O Isolation..... | 3 kV |
| Analog Input Voltage Range (Isolated or non-isolated signal)..... | 0 to ± 10 VDC; 4 - 20 mA |
| Input Impedance (COM to SIG1 / SIG2)..... | >100K ohms |
| Vibration (0 - 50 Hz)..... | 0.5G maximum |
| (>50 Hz)..... | 0.1G maximum |
| Surrounding Air Temperature Range..... | 10°C - 50°C |
| Weight..... | 0.70 lbs (0.32 kg) |
| Safety Certifications..... | cULus Listed, UL 61800-5-1, File # E132235 |

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



Installation

SCCR (Short Circuit Current Rating): MGC403 series drives are suitable for use on a circuit capable of delivering not more than 5,000 RMS symmetrical amperes, 115/230 volts maximum.

Branch Circuit Protection: The MGC403 has integral solid state circuit protection, this does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes. Class J, Class CC, or Class T fuses are to be rated with a minimum of 230 VAC and a maximum current rating of 40 amps. Circuit breakers are to be rated at a minimum of 230 VAC with a maximum current rating of 30 amps.

Mounting

- **Install the drive in a Pollution Degree 2 environment only.**
- 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. Eight 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. Connect the ground to the green screw on the chassis.

Heat Sinking: The MGC403-11 requires an additional heat sink when the continuous armature current is above 8 amps. Use heat sink kit part number 223-0159. 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: 60°C wire was used in UL evaluation of the power wiring terminals (L1, L2, A1, A2, F1, F2). Use 18 - 24 AWG wire for logic wiring. Use 14 AWG wire for AC line (L1, L2) 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.

LEDs

Status 1 LED (STAT): Green LED on Top Board

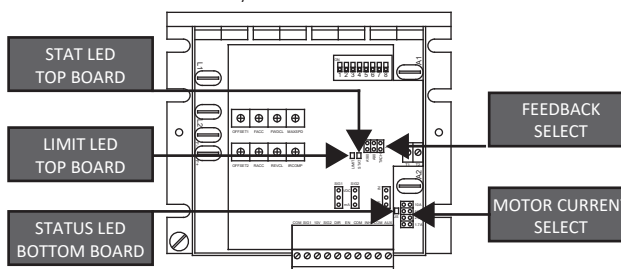
- SOLID: Normal operation
 1 FLASH: The drive is disabled. Refer to DIP Switches 6 and 7 and terminal EN.
 2 FLASHES: The drive is set for Auto Restart Prevention Mode and has experienced a fault. Cycle the AC power, enable, or inhibit. Refer to DIP Switch 4.
 3 FLASHES: The Operating Mode was changed and the drive power must be cycled.
 4 FLASHES: The drive tripped for Motor Overload Protection.
 5 OR MORE FLASHES: Contact the factory.

Limit LED (LIMIT): Red LED on Top Board

- SOLID: The drive is in current limit. The motor is asking for more current than what the drive is set for. Refer to FWDCL and REVCL trim pots.
 FLASHING: The drive is in Motor Overload Protection Calibration Mode.

Status 2 LED (STATUS): Green LED on Bottom Board

- SOLID: Normal operation
 1 FLASH: The power board is not receiving a run command from the top board.
 2 OR MORE FLASHES: Contact the factory.

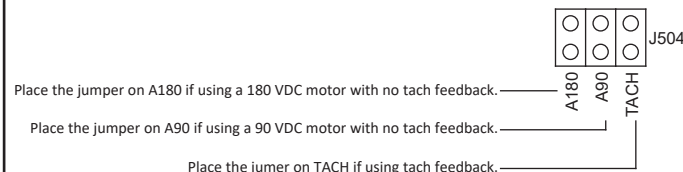


Setup

POWER JUMPERS

Feedback Select

If using tachogenerator feedback, set the feedback select jumper for TACH. If no tachogenerator feedback is used, set the feedback select jumper to A90 if using a 90 VDC motor or to A180 if using a 180 VDC motor.



Motor Current Select

Set the jumper for the lowest current base value that is still larger than the full load amperage rating of the motor. This adjusts the scaling of the current limit trim pots to allow for as small a range on the trim pot as possible for finer tuning.

- 10A Place the jumper on 10A if using a motor between 5 and 10 amps.
- 5A Place the jumper on 5A if using a motor between 2.5 and 5 amps.
- 2.5A Place the jumper on 2.5A if using a motor between 1.7 and 2.5 amps.
- 1.7A Place the jumper on 1.7A if using a motor smaller than 1.7 amps.

Operation

DIP SWITCH S0501

DIP Switches 1, 2, 3: Mode Selection

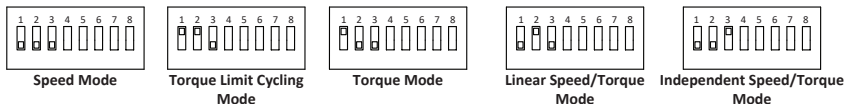
Speed Mode (Down-Down-Down): In speed mode, the drive will adjust the speed (voltage) supplied to the motor.

Torque Limit Cycling Mode (Up-Up-Down): Similar to Speed Mode above, in this mode the drive will automatically change direction if it enters into a current limit condition determined by trim pot FWCL for a period of time set by trim pot RVCL.

Torque Mode (Up-Down-Down): In torque mode, the drive will adjust the torque (current) supplied to the motor.

Linear Speed/Torque Mode (Down-Up-Down): In linear speed/torque mode, the drive will adjust the speed and torque of the motor proportionally.

Independent Speed/Torque Mode (Down-Down-Up): In independent speed/torque mode, analog signal 1 (SIG1) adjusts the speed (voltage) and analog signal 2 (SIG2) adjusts the torque (current) of the motor.



FOR CYCLING AND POSITIONING APPLICATIONS, REFER TO USER MANUAL MAN-0025 OR USE QR CODE IN TOP RIGHT CORNER ON PAGE 1.

DIP Switch 4: Auto Restart Prevention

DOWN - OFF: The drive will run to set speed upon power up if receiving a run command and the Enable and Inhibit are set to run.

UP - ON: Upon power up, the drive must see a one of the following stop commands before the drive will run the motor.

- The Enable must be set to "Disable" and then "Enable".
- The Inhibit must be set to "Brake" and then to "Run".
- The remote adjust potentiometer must be set to zero speed, then turned up to a speed command.

DIP Switch 5: Alarm Output Type

DOWN - Current Limit: The AUX output alarm will turn on whenever the drive is in current limit.

UP - Run Alarm: The AUX output alarm will turn on whenever the drive is actively trying to engage the motor.

DIP Switch 6: Enable/Inhibit or 3-Wire Start/Stop

DOWN - Enable/Inhibit: Terminals COM and EN are an Enable (run/coast) switch. Terminals COM and INH are an Inhibit (run/brake) switch.

UP - 3-Wire Start/Stop: Terminals COM and EN are a momentary Start switch and terminals COM and INH are a momentary Stop switch.

DIP Switch 7: Inhibit Configuration

DOWN - Close To Stop: In Inhibit Mode (see DIP Switch 6), terminal INH is open to run / close to brake to a stop.

In Start/Stop Mode (see DIP Switch 6), terminal INH is a normally open momentary pushbutton (ie momentary close to stop).

UP - Open to Stop: In Inhibit Mode (see DIP Switch 6), terminal INH is close to run / open to coast to a stop.

In Start/Stop Mode (see DIP Switch 6), terminal INH is a normally closed momentary pushbutton (ie momentary open to stop).

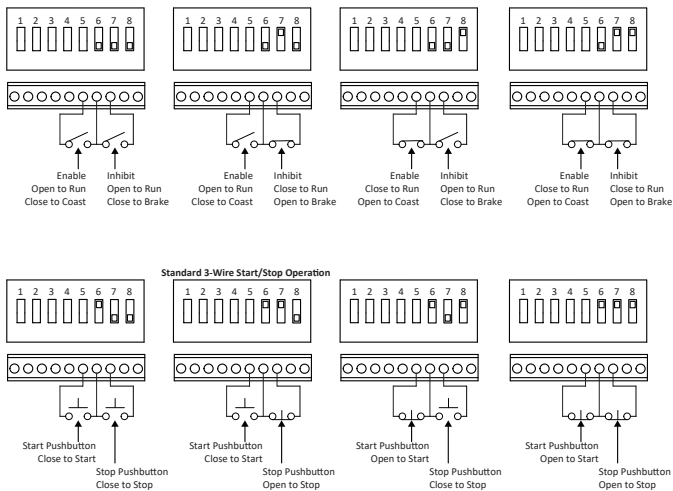
DIP Switch 8: Enable Configuration

DOWN - Default: In Enable Mode (see DIP Switch 6), terminal EN is open to run / close to coast to a stop.

In Start/Stop Mode (see DIP Switch 6), terminal EN is a normally open momentary Start pushbutton (ie momentary close to run).

UP - Inverted: In Enable Mode (see DIP Switch 6), terminal EN is close to run / open to coast to a stop.

In Start/Stop Mode (see DIP Switch 6), terminal EN is a normally closed momentary Start pushbutton (ie momentary open to run).



Forward Current Limit (FWCL): The FWCL trim pot determines the maximum amount of torque for accelerating the motor in the forward direction or for braking if running in the reverse direction. In "Torque Limit Cycling Mode", the FWCL trim pot determines the current limit for both directions. If using Motor Overload Protection, calibrate the MOP trim pot first. To calibrate FWCL:

1. With the power disconnected from the drive, connect a DC ammeter in series with the motor armature.
2. Set the FWCL trim pot to minimum (full CCW).
3. Set the speed adjust potentiometer or analog signal to maximum forward 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 FWCL 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.

Reverse Current Limit (RVCL): The RVCL trim pot determines the maximum amount of torque for accelerating the motor in the reverse direction or for braking if running in the forward direction. To calibrate RVCL, follow steps 1-10 in the Forward Current Limit trim pot calibration procedure, but use the RVCL trim pot with the drive set to run in the reverse direction. In "Torque Limit Cycling Mode", the RVCL trim pot sets the amount of time the drive must be in current limit before it automatically changes direction. The time range is 0.2 (full CCW) to 10 (full CW) seconds.

Calibration

Offset 1 (OFS1): In unidirectional mode, the OFS1 setting determines the motor speed when the Signal 1 speed adjust potentiometer or analog signal is set for minimum speed. To calibrate the OFS1:

1. Set the OFS1 trim pot at 50%.
2. Set the speed adjust potentiometer or analog signal for minimum speed.
3. Adjust OFS1 trim pot until the desired minimum speed is reached.

If a bidirectional / wigwag setup is desired, the OFS1 setting determines the position of the potentiometer or amount of analog signal that is the zero crossing / zero speed command. To calibrate the OFS1:

1. Set the OFS1 trim pot at 50%.
2. Set the speed adjust potentiometer to the desired position for a stop command, or set the analog signal to the desired level for a stop command.
3. Adjust OFS1 trim pot until the motor stops moving.

Offset 2 (OFS2): In unidirectional mode, the OFS2 setting determines the motor speed when the Signal 2 speed adjust potentiometer or analog signal is set for minimum speed. To calibrate the OFS2:

1. Set the OFS2 trim pot at 50%.
2. Set the speed adjust potentiometer or analog signal for minimum speed.
3. Adjust OFS2 trim pot until the desired minimum speed is reached.

If a bidirectional / wigwag setup is desired, the OFS2 setting determines the position of the potentiometer or amount of analog signal that is the zero crossing / zero speed command. To calibrate the OFS2:

1. Set the OFS2 trim pot at 50%.
2. Set the speed adjust potentiometer to the desired position for a stop command, or set the analog signal to the desired level for a stop command.
3. Adjust OFS2 trim pot until the motor stops moving.

Maximum Speed (MAX): The MAX setting determines the maximum motor speed in both the forward and reverse directions for both the Signal 1 and Signal 2 inputs. To calibrate the MAX:

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

Acceleration and Deceleration (FACC and RACC): The FACC trim pot sets the acceleration / ramp-up rate in the forward direction and deceleration / braking rate for the reverse direction. The RACC trim pot sets the acceleration / ramp-up in the reverse direction and the deceleration / braking rate for the forward direction. Turning the trim pots CW increases the amount of ramp-up or braking time.

Motor Overload Protection (MOP): The MOP trim pot is used to set the amperage trip point that will cause the drive to fault out. This is used to satisfy UL standard 61800-5-1 for motor overload protection. 200% current Motor Overload Protection is provided. Place the supplied Motor Overload Protection label on final enclosure. To calibrate the MOP trim pot:

1. With the power disconnected from the drive, connect a DC ammeter in series with the motor armature.
2. Set the MOP trim pot to maximum (full CW) and the FWCL trim pot to minimum (full CCW).
3. Set the remote adjust potentiometer or analog signal to maximum speed.
4. Lock the motor armature. Be sure that the motor is firmly mounted.
5. Apply AC line power. The motor should be stalled in order to pull the maximum amount of current possible.
6. Slowly adjust the FWCL trim pot CW until the ammeter reads the amount of current you want to set as the motor overload trip point.
7. Slowly adjust the MOP trim pot CCW. The red LIMIT LED should begin to flash slowly indicating the Motor Overload Protection trip point is above the current limit. Continue to adjust the MOP trim pot CCW until the red LIMIT LED becomes solid, indicating the Motor Overload Protection trip point is equal to the current limit. If it begins to flash quickly, the trim pot has been turned too far CCW and the Motor Overload Protection trip point is below the current limit.
8. Remove AC line power. Wait 30 seconds before reapplying power.

The Motor Overload Protection trip time is determined by how far over the trip setting the current draw from the motor is. When the Motor Overload Protection trip point is reached, the drive will begin a countdown until it decides to fault. The higher the amperage draw from the motor is over the trip point, the faster the drive will countdown. If no Motor Overload Protection is required, set the MOP trim pot fully CW. This means the Motor Overload Protection trip point will be above the current limits determined by the FWCL and RVCL trim pots and will never be reached. Since calibrating the MOP trim pot requires changing the FWCL trim pot, it is recommended to calibrate the MOP before calibrating the FWCL.

IR Compensation (IR/T) with no tach feedback: The IR/T setting determines the degree to which motor speed is held constant as the motor load changes. To calibrate the IR/T:

1. Set the IR/T 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 trim pot until the motor runs at the speed measured in step 2. If the motor oscillates (overcompensation), the IR trim pot may be set too high (CW). Turn the IR/T trim pot CCW to stabilize the motor.
5. Unload the motor.

IR Compensation (IR/T) with tach feedback: If using tach feedback, calibrate the IR/T trim pot as follows:

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 jumper J504 to A90 if using a 90 VDC motor or to A180 if using a 180 VDC motor.
3. Set the remote adjust potentiometer or analog input signal to maximum forward speed. Measure the armature voltage across A1 and A2 using a voltmeter.
4. Set the speed adjust potentiometer or analog input signal to zero speed.
5. Set J504 to TACH for tachogenerator feedback.
6. Set the IR/T trim pot to full CW.
7. Set the remote adjust potentiometer or analog input signal to maximum forward speed.
8. Adjust the IR/T 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 J504 is set to either A90/A180 or TACH.

Connections

Line Input (115 or 230 VAC, 0 - 15 amps)

Connect the AC line power leads to terminals L1 and L2, or to a double-throw, single-pole master power switch (recommended). The switch should be rated at a minimum of 250 VAC and 200% of motor current.

Motor Armature (Up to 200 VDC, 0 - 11 Amps)

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.

Field (Up to 200 VDC, 0.74 Amps)

At 115 VAC, connect the field leads to terminals F+ and L1 for a 50 VDC field or to F+ and F- for a 100 VDC field. At 230 VAC, connect the field leads to terminals F+ and L1 for a 100 VDC field or to F+ and F- for a 200 VDC field.

Do not make any connections to F+ and F- if using a permanent magnet motor.

Tach Feedback (Input up to 180 VDC)

If using a tachogenerator, connect to terminals T- (negative) and T+ (positive). See jumper settings in the Startup section.

Do not make any connections to T- or T+ unless using a tachogenerator.

Remote Adjust Potentiometer

Use a 10K ohm, 1/4 W potentiometer for control. Connect the counter-clockwise end of the potentiometer to COM, wiper to SIG1, and the clockwise end to 10V. 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 COM and +V connections.

Analog Signal

To use an analog signal instead of a potentiometer, connect the signal negative (-) to COM and the signal reference (+) to SIG. Set jumper SIG1 to VDC if using a potentiometer or analog voltage signal, or to mA if using a 4-20 mA analog signal.

Direction

Short terminals COM and DIR to change the direction of the motor. If no direction switch is desired, leave this connection open.

Enable

The enable is used to start the drive. It can be set for a normally open or normally closed configuration. Disabling the drive will cause the motor to coast to a stop.

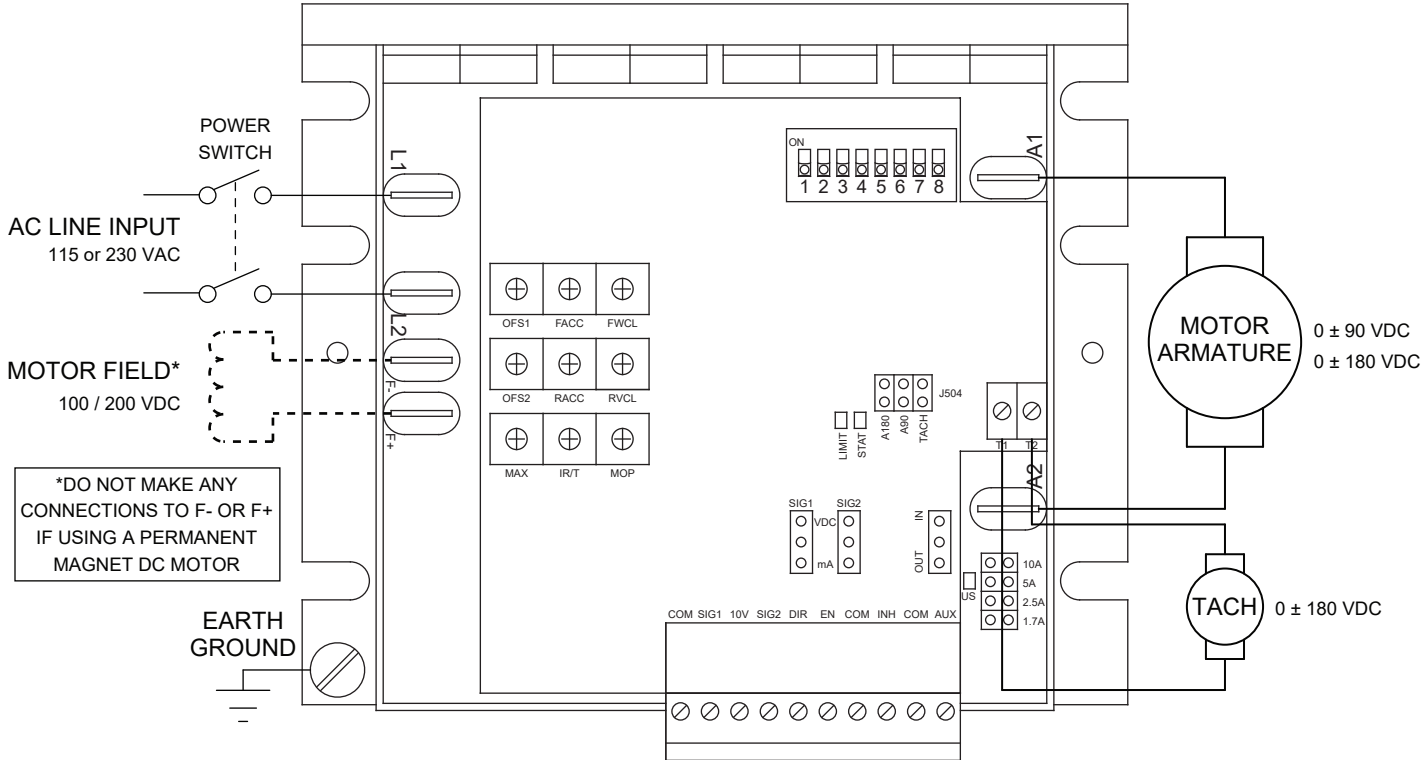
The enable can also be used as a Start switch in a 3-Wire Start/Stop setup.

Do not use the enable for emergency stopping.

Inhibit

Activating the inhibit will regeneratively brake the motor to a stop. It bypasses the FACC and RACC trim pots. It can be set for a normally open or normally closed configuration. The inhibit can also be used as a Stop switch in a 3-Wire Start/Stop setup.

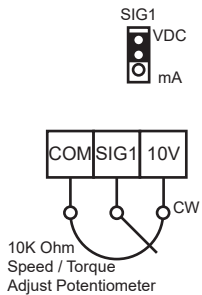
Do not use the inhibit for emergency stopping.



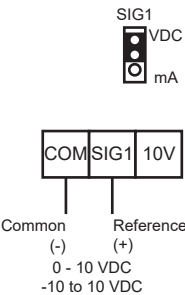
The logic connections on TB501 are isolated up to 3 kV.

Tightening torque value of screw terminals on TB501 for logic connections is 2.0 lb-in (0.23 N-m)
Tightening torque value of screw terminals on J501 for tach connections T1 & T2 is 1.7 lb-in (0.19 N-m)

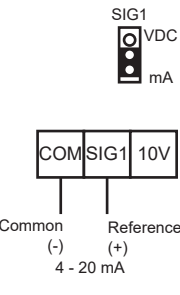
POTENTIOMETER



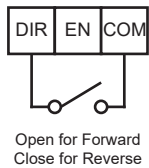
ANALOG VDC



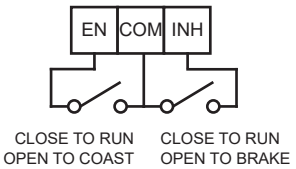
ANALOG mA



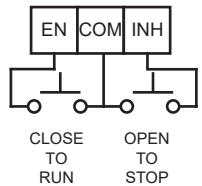
DIRECTION SWITCH



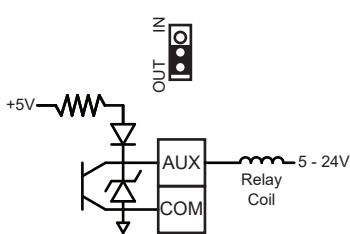
ENABLE / INHIBIT*



3-WIRE START/STOP*



AUXILLARY OUTPUT



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*Alternative wiring setups in Operation section