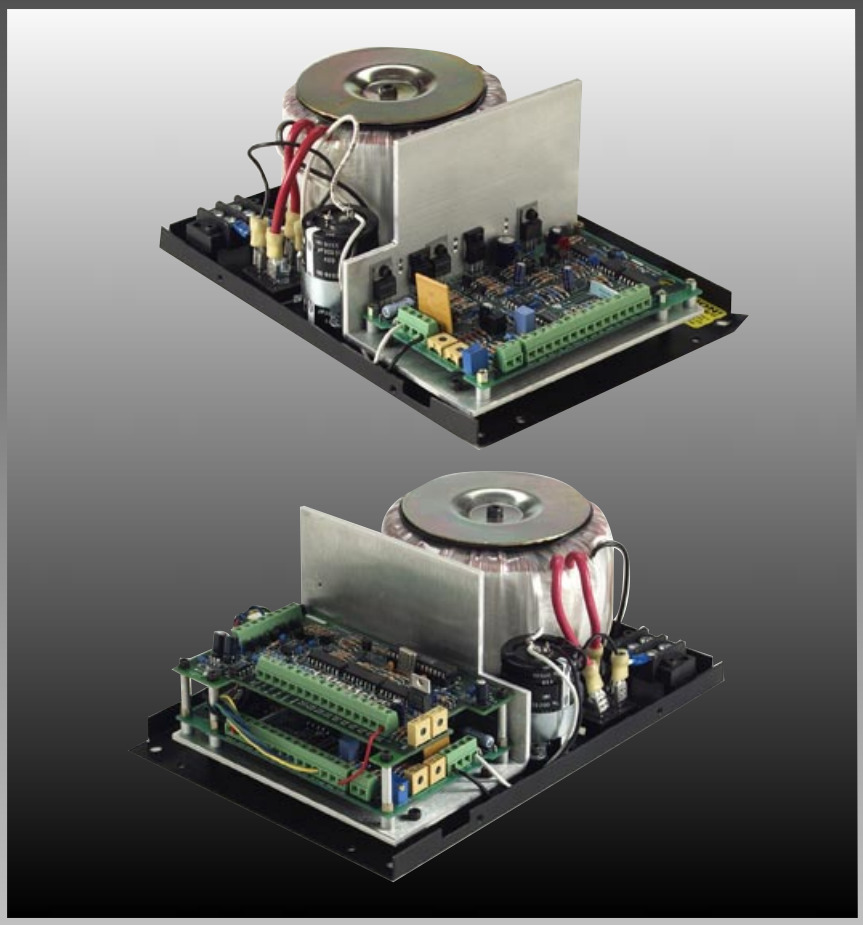
Axidyne®
ELECTRIC LINEAR MOTION PRODUCTS

DM 5/6 & DM5C/6C Dc Drive Module
and Basic Controller
USER'S MANUAL



TOL-O-MATIC, INC
Excellence in Motion®

3600-4048A

Contents

Basic Controller Module

About This Manual

INTRODUCTION

This manual provides the information necessary to configure and install your Axidyne Dc Drive Module or your Dc Drive Module with Basic Controller in a variety of applications.

If you experience any difficulty configuring or installing an Axidyne product, please contact your local Tol-O-Matic distributor, or call Tol-O-Matic at 1-800-328-2174.

SAFETY SYMBOLS

The following symbols are used throughout this manual to alert the user to potential safety hazards.

⚠ **Caution!** When this symbol appears, exercise care to avoid the possibility of sustaining slight operator injury or equipment damage.

☠ ***WARNING! When this symbol appears, exercise extreme caution to avoid an IMMEDIATE DANGER of sustaining severe operator injury or irreparable equipment damage.***

NOTE: Failure to comply with CAUTIONS and WARNING requirements in this manual, may result in damage to equipment not covered under Tol-O-Matic warranties.

Control Systems Overview

Typical electronic linear motion control systems consist of the following elements:

Motor - Provides the torque and speed necessary for an actuator to meet application requirements.

Drive - Converts the signals received from the controller or PLC to actually move the motor. In addition, the drive must convert the local power source (typically 115 V.a.c., 60 Hz) to the power input required by the motor. The power ratings (watts) of the motor and the drive must match the peak and RMS requirements of the application.

Controller - Features I/O connections to receive inputs from a programmable logic controller (PLC) or other operator interface and convert them to output signals to the drive module to properly control the motor and to achieve the required motion profile(s).

Operator Interface - An optional device used by the system operator to program or signal the controller remotely.

The performance of an electric linear actuator system is determined by the type of control system used with the actuator (i.e. dc, stepper, or servo). In general, dc systems represent a low-cost, mature technology easily applied to meet basic linear motion needs.

AXIDYNE DC CONTROL SYSTEMS

Tol-O-Matic offers brushless and brushed servo, stepper and open loop brushed dc drives and motors in the Axidyne product family. This manual provides installation and operating data for the open-loop dc drives and brushed dc motors which are designed to meet a wide range of simple needs and applications requiring adjustable acceleration, deceleration, speed and dwell times when driving screw and belt-drive actuators.

Open-loop dc systems represent a low-cost , mature technology easily applied to meet basic linear motion needs. Available in two power ratings, Axidyne dc drive modules match with a range of five motor ratings and may be ordered as a complete package with basic controller or as a drive only to interface with the customer's existing motion control system components (see Figure 1). This approach to dc control systems provides flexibility in control system design and helps provide the most cost-effective solution to a range of linear motion control requirements.

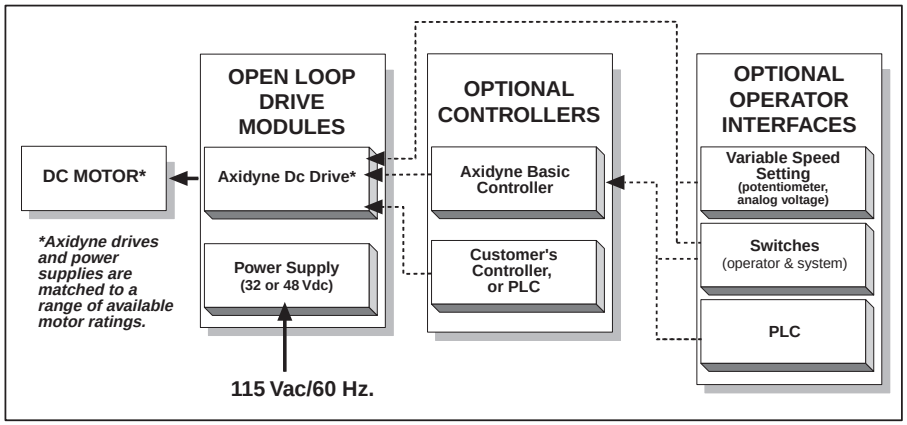


Figure 1

Dc Drive Module

Introduction

A Dc Drive Module (DM_) consists of a dc drive and one of two power supply options. DM's are available in open-chassis only (see Figure 2). In response to an input dc voltage set by a potentiometer or from an external analog voltage source, the module converts 115V/60 Hz supply power to the voltage level the motor requires to produce the desired speed.

Dc Drive

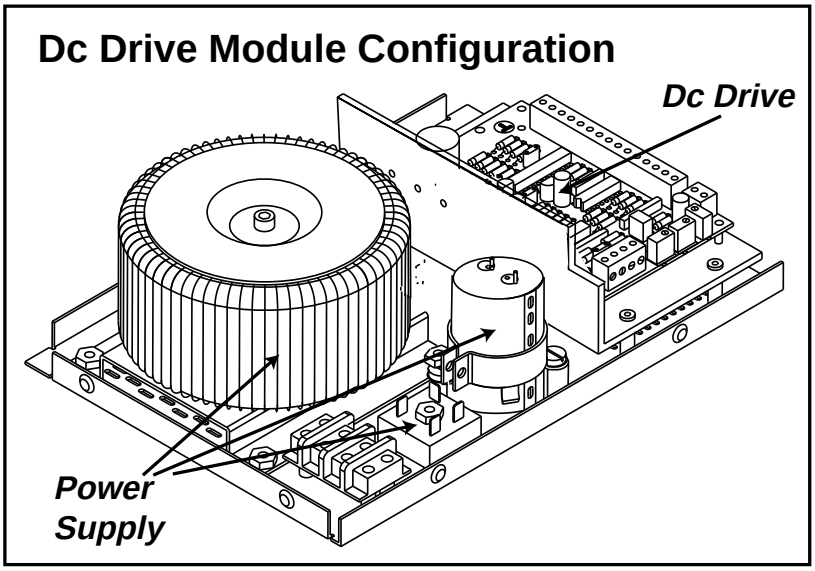


Figure 2

Using the latest technology in pulse-width-modulated (PWM), H-bridge MOSFET switching circuitry, the Dc Drive provides smooth, quiet motor operation at low speed, prolonged motor brush life, reduced heat build-up and reliable, repetitive solid-state reversing. The dc drive also provides independently-adjustable acceleration and deceleration, and a fast dynamic brake option.

Four inputs (ON/OFF, BRAKE, FWD/REV, ENABLE) are available for use with a Tol-O-Matic or customer-supplied controller, a PLC, or with manual control from separately-mounted switches. The inputs provide flexibility in customizing the motion profile for each application. Correct connection or sequencing of switching the inputs is necessary to insure proper drive operation. When used with an external power supply, these four inputs are optically-isolated for transient voltage protection and noise immunity.

Power Supply

Axidyne's dc drive power supplies use efficient toroidal transformers and packaged rectifiers to transform 120 Vac line power to 32 or 48 Vdc for input to the drive. The power supply isolates the drive from line power disturbances for higher reliability. Power supply ratings match available Axidyne dc motor ratings.

Dc Drive Module Features

- ***Choice of two voltage (speed) ranges.***
- ***Open-chassis configuration.***
- ***Drive overcurrent protection by self-resetting fuse***
- ***Jumper selectable speed control for external potentiometer or 1.5 to 4.1 Vdc analog signal from PLC or controller modules.***
- ***Switch inputs to solid state dynamic braking circuitry for end-of-move consistency.***
- ***Lockout fault protection for dc power supply output under-voltage.***
- ***Adjustable current trip level for over current (overload condition) protection.***
- ***Fault condition (lock out) output to L.E.D.***
- ***L.E.D. status indicators for enabled and fault.***
- ***Independent acceleration and deceleration adjustment.***
- ***Inhibit drive using ENABLE input terminal for immediate dc drive module shut down.***
- ***Transient-voltage-suppression circuitry to provide protection against fast transients on the ac power supply.***

Technical Specifications

Input Power 115 Vac/60 Hz (85-128 Vac range)

Output Power

Model	Nominal Voltage (Vdc)	Continuous Current (Amps)	Peak Current[1] (Amps)	Max. Power (Watts)
DM5	32	15	30	480
DM6	48	10	30	480

[1] *5 millisecond rating*

P.W.M. Frequency 20 kHz

Speed Control External Potentiometer: 10k Ohm or,
Analog input: 1.5 to 4.1 Vdc

% P.W.M. vs. Potentiometer Voltage Reference 0% PWM @ 1.5 Vdc to 100% PWM @ 4.1 Vdc

Acceleration/ Deceleration Range Up to 7 seconds

Over-Current 125% of rating for 0.2 seconds

Drive Status Indicators L.E.D.s (on dc drive board)
- Red - fault indication
- Green - power enabled indication

Fault output for external L.E.D. or PLC monitoring

Environment Temperature Range: 0° to 50° C. (32° to 122° F.)
Humidity: 10 - 95% non-condensing

Reset Normally closed momentary reset input

Inputs[1,2] Used to receive signals from programmable logic controller (PLCs), industrial computers, limit switches, push buttons, or other devices that send normally open, current sinking outputs.
- ON/OFF (25 mA. max. input current)
- BRAKE (25 mA. max. input current)
- FWD/REV (25 mA. max. input current)
- ENABLE (25 mA. max. input current)

1. Require external dc voltage supply (5 to 25 Vdc) at EXT VDC input for enabling optical-isolation.
2. Inputs can be powered from on-board LED + power supply to EXT VDC for operation without optical-isolation.

Inputs

CONTROL INPUT TERMINALS

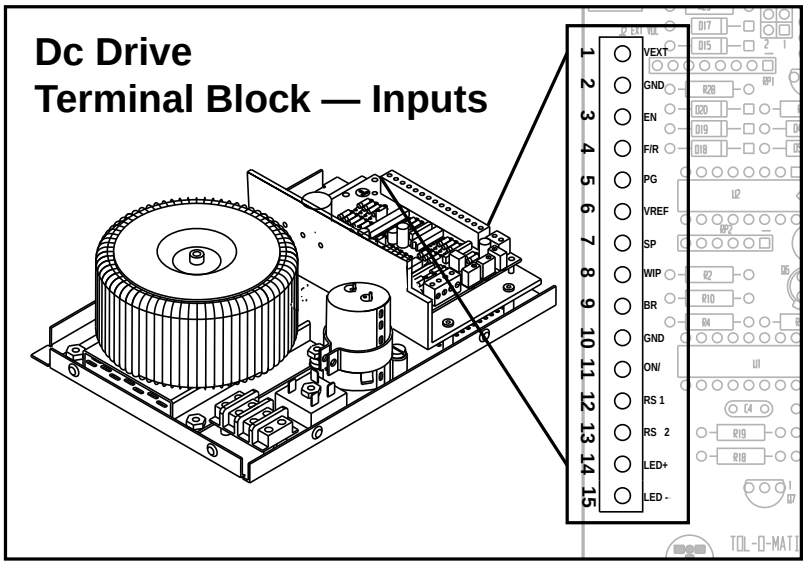


Figure 3

MOTION CONTROL INPUTS

The ENABLE, FWD/REV, BRAKE, and ON/OFF input terminals are used in conjunction with one another to customize individual motion profiles. The input signal to these terminals may be provided by a Tol-O-Matic Basic Controller, a PLC, or relay logic. End-of-stroke switches are used along with the input devices to control motion and positioning. (Refer to Chapter Three: Installation for coordinated use of these inputs.)

NOTE: Motion control inputs shown in parentheses pertain to open-chassis configurations.

ENABLE (EN)

Enables the Dc Drive Module. A “logic high” at this input enables the drive, allowing the motor to run. A “logic low” disables the drive, causing the motor to coast to a stop and activates the FAULT outputs and red LED ON.

FORWARD/REVERSE (F/R)

Sets the motor direction for run. A “logic high” at this terminal causes negative voltage at motor terminals (CCW rotation, facing motor shaft). A “logic low” causes positive voltage at the motor terminals (CW rotation, facing motor shaft).

BRAKE (BR)

Controls starting and stopping of the motor. A “logic low” at this terminal initiates run. A “logic high” initiates dynamic braking when running. The brake input has unconditional priority over all other inputs. Use of brake alone for start/stop precludes use of accel control.

ON/OFF (ON)

Used with potentiometer speed control. Initiates motor acceleration or deceleration. A “logic high” at this terminal causes motor to accelerate when brake is low. A “logic low” initiates a deceleration to stop when motor is running. Logic low resets the accel control circuit. ON/OFF is not used when speed control is provided by an external analog voltage.

NOTES:

⚠ Default power up condition for all logic input terminals is “logic high” (sourcing).

Inputs are optically isolated when used with external power supply (5 Vdc to 25 Vdc) to EXT VDC.

See use of Inputs on p. 39 for controlling operating profile.

☠ ***Failure to bring motor to a complete stop before reversing direction could result in severe damage to actuator and/or drive.***

SPEED CONTROL INPUTS

Motor speed control can be established with the use of a potentiometer or from an input analog voltage from an external source.

VREF

For use with an external potentiometer for speed control. (This input can NOT be used in conjunction with the analog SPEED input.)

POT WIPER (WIP)

Input for the variable resistance of the wiper on the external potentiometer. (This input can NOT be used in conjunction with SPEED input.)

POT GND (PG)

Connection for the low speed (CCW) end of the external 10k Ohm potentiometer. (Not a true ground.)

SPEED (SP)

Input terminal for positive analog voltage (1.5 to 4.1 Vdc) to provide speed control. Negative goes to Logic Ground. (This input can NOT be used in conjunction with a potentiometer.) (The Basic Controller accepts 0-5 Vdc, 0-10 Vdc or 4-20mA and provides this 1.5 to 4.1 V input.)

RESET CONTROL INPUTS

These input terminals allow the Dc Drive Module to be reset after a fault condition.

RS1/RS2

Reset is accomplished by opening and re-closing the normally closed contact connecting FAULT RESET 1 to FAULT RESET 2.

LOGIC POWER TERMINALS

Used to power the ENABLE, FWD/REV, BRAKE, and ON/OFF input terminals. Source can be external or from the fault L.E.D. + (15 Vdc) terminal.

VEXT

Connection for +5 to 25 Vdc to power the motion control input terminals. Source can be external or from the (Fault) L.E.D. + terminal. Use of external source provides optical isolation.

Ground (GND)

Dc Drive Module ground connection.

AC POWER INPUTS

115 Vac/Neutral/GND

Terminals for ac power (see *Installation* for wiring diagrams).

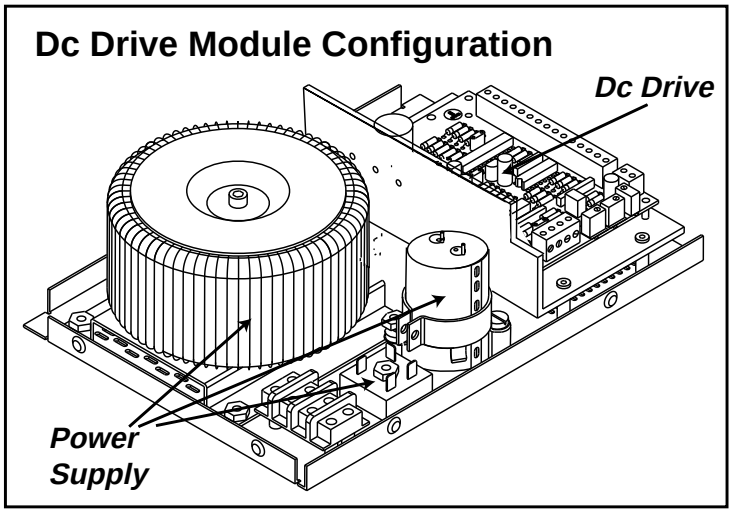


Figure 4

Outputs

OUTPUT TERMINALS

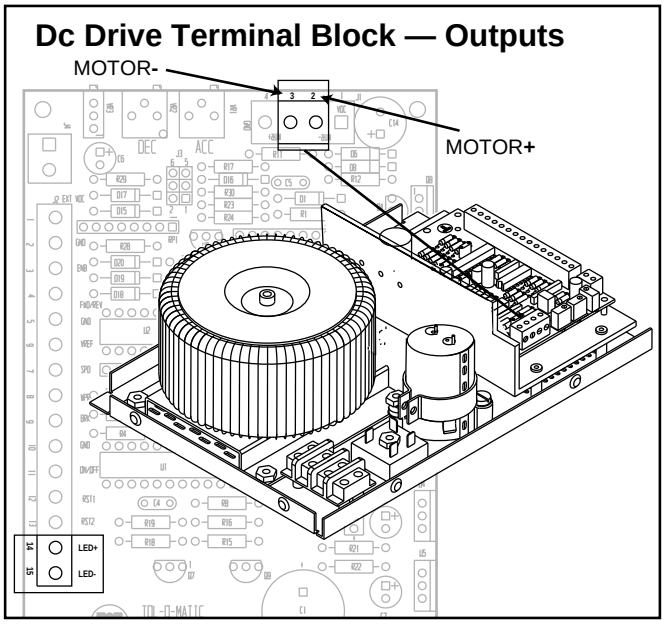


Figure 5

MOTOR+/MOTOR-

These outputs supply voltage to motor. Positive voltage at these terminals causes a right-hand screw drive actuator to move away from a direct coupled motor; negative voltage causes actuator to move toward a direct coupled motor. (See *Installation* page 34 for instructions on wiring Axidyne dc motors. If a motor package other than Axidyne is to be used, consult the manufacturer's product documentation for wiring instructions.)

FAULT L.E.D.+ (15 VDC/500 MA MAX.)/FAULT LED-

Provides output to external indicator device (i.e. LED) in the event of a system malfunction. FAULT output activates (red LED ON) when one or more of the following conditions exists:

1) Under-voltage lockout below 10 Vdc to protect PWM, H-Bridge MOSFET switching circuitry.
2) ENABLE input at "logic low."
3) Overcurrent condition longer than 0.2 seconds.

NOTE: When FAULT LED+ is used for internal power supply (connected to EXT VDC), optical isolation is disabled for ENABLE, FWD/REV, BRAKE and ON/OFF. (See pp. 39-41)

Potentiometers

ACCEL POT

Built-in potentiometer adjusts acceleration time up to 7 seconds. CCW rotation increases acceleration time; CW decreases acceleration time. This potentiometer is disabled when using the SPEED input terminal.

DECEL POT

Built-in potentiometer adjusts deceleration time up to 7 seconds. CCW rotation increases deceleration time; CW decreases deceleration time. This potentiometer is disabled when using the SPEED input terminal.

OVER CURRENT TRIP POT

Over current trip potentiometer is used to set the trip current level for over current. (Refer to *Installation* page 33 for setting.)

POTENTIOMETER LOCATIONS

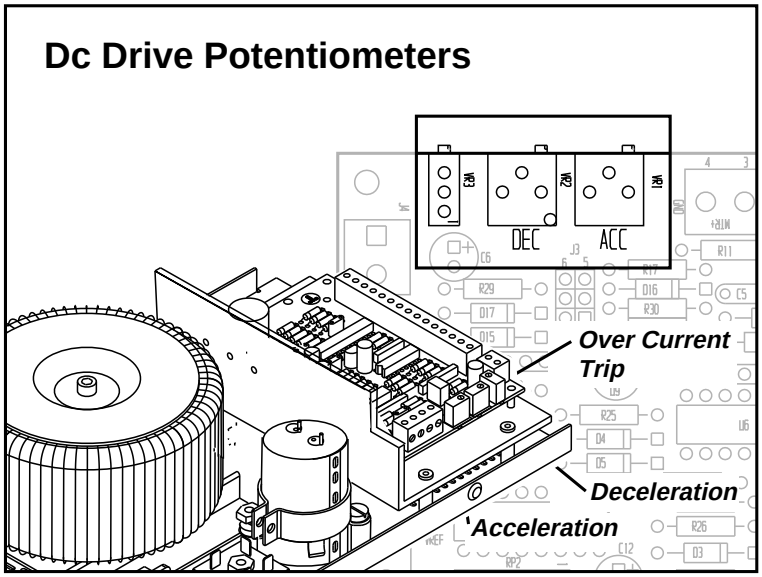


Figure 6

Dc Drive Protection Circuitry

OVER CURRENT TRIP CIRCUIT

Provides protection against overloading of motor and actuator system while allowing high starting torque for systems with high inertial load. The overcurrent detection circuit monitors motor current build-up above a set value at any time during operation. If current exceeds the threshold value for more than 0.2 seconds, the circuit causes a "logic low" at the ENABLE input to stop motion and activates the FAULT outputs and the red LED. Once activated, the circuit can only be reset by activating RESET input. (NOTE: If the overcurrent condition is present for less than 0.2 seconds, the circuit will NOT shut down the drive.) Proper adjustment of this potentiometer is essential for safe reliable operation of the drive. Refer to *Drive Module Installation* page 33 for adjustment information.

UNDER VOLTAGE LOCKOUT

When the circuit detects an under voltage (<10 Vdc) condition at the dc power supply, the FAULT outputs are activated (red LED ON in open-chassis configurations), and the drive is turned off. (Reset by opening and reclosing RESET 1, 2.)

TRANSIENT-VOLTAGE-SUPPRESSION

This circuitry provides additional protection against fast transients on the ac power supply. Such transients may be present when the local supply is of poor quality or if large electrical apparatus is frequently switched on the local system. Also, they are likely where powerful lightning storms are prevalent.

CAPACITOR DISCHARGE

A bleed resistor has been placed in parallel with the dc filter capacitor to speed the discharge of the capacitor when power is removed. (Allow 5-10 seconds) Drive will be reset when green L.E.D. is illuminated.

DRIVE OVER CURRENT

A self-resetting fuse (Polyswitch) has been used in place of a conventional fuse. The Polyswitch functions like a conventional fuse — when exposed to excessive current, it will quickly and safely interrupt the fault. The Polyswitch will self-reset when power is removed. The drive circuit will repair in a lock-out mode as a result of the under voltage and will require reset.

Accessory Items

EXTERNAL POTENTIOMETER (MODEL POT-001)

A potentiometer is provided for users optional use. It provides variable speed control by varying speed reference voltage to the dc drive. (See *Drive Module Installation* page 33 for wiring instructions.)

NOTE: Alternatively, speed control may be provided by a 1.5 to 4.1 Vdc external source.

Overview

The Axidyne Basic Controller Module (DM_C) is designed to provide a cost-effective, reversing motion control with symmetrical, independent end-of-stroke dwell times. Change of direction is achieved through end-of-stroke switch inputs (compatible switches include Tol-O-Matic or other manufacturer's reed, Hall-Effect, or 24 Vdc proximity switches).

Available in either open-chassis configurations for mounting in customers enclosure, DM_C consists of a d.c. drive, a basic controller board and one of two different power supply options to match the required motor speed/torque output.

BASIC CONTROLLER

This controller provides three modes of operation with adjustable motion profiles without the need for any outside control devices.

1. Continuous cycle: cycles continuously with adjustable end-of-stroke dwell time.
2. Single cycle mode: Makes one complete cycle (both directions) when commanded through an ACCEL input.
3. Single move mode: The actuator makes a move in one direction when commanded through the appropriate ACCEL input.

NOTE: Details of how to wire the controller up to accomplish these three modes are given in *Basic Controller Module Installation* on page 62.

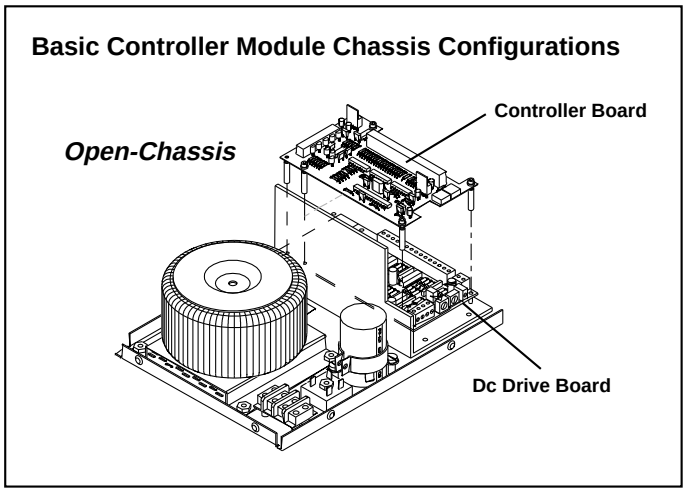


Figure 7

D.C. Drive

In response to input voltage from a potentiometer or external analog voltage reference, the Axidyne d.c. drive converts 115V/60 Hz. supply power to the voltage level the motor requires to produce the desired speed. Using the latest technology in pulse-width-modulated (PWM), H-bridge MOSFET switching circuitry, the Axidyne d.c. drive provides smoother, quieter motor operation at low speed, prolonged motor brush life, reduced heat build-up and reliable, repetitive solid-state reversing. The d.c. drive also provides independently-adjustable acceleration and deceleration with a fast dynamic brake option. Speed control can be provided by a potentiometer or d.c. analog voltage input.

Power Supply Options

Axidyne's d.c. drive power supplies use efficient toroidal transformers to transform and rectify 120 V.a.c. line power to 32 or 48 V.d.c for input to the drive. The power supply isolates the drive from line power disturbances for higher reliability. Two power supply ratings match available Axidyne d.c. motor ratings, namely 48V, 10A or 32V, 15A.

Features

D.C. DRIVE:

- *Choice of two power rating configurations (matched to Axidyne d.c. motor ratings).*
- *Self resetting fuse for dc supply to drive.*
- *Optional solid state dynamic braking circuitry for accuracy and consistency.*
- *Lockout fault protection for dc power supply under voltage.*
- *Adjustable current limit detection for over current (overload condition) protection.*
- *Fault condition (lock out) output for L.E.D.*
- *L.E.D. status indicators (open-chassis configuration only).*
- *Independent acceleration and deceleration adjustment.*
- *Inhibit drive using Enable input for immediate dc drive shut down.*

BASIC CONTROLLER

- *Operating Modes*
  - *A) Continuous cycle end-to-end with independently adjustable dwell (0.05 to 5 sec.) at each end.*
  - *B) Single complete cycle (both directions) in response to start command.*
  - *C) Single direction move in response to direction command.*
- *Predictable first move direction for all modes. Connection of limit switches selects move profile*
  - *A) Accel/Decel*
  - *B) Accel/Brake*
  - *C) Accel/Decel-Brake*
- *Different profiles can be used for each direction.*
- *Homing function after power-up or reset*
- *Accepts analog speed signal inputs and provides isolation (0-10V, 0-5V, 4-20mAdc)*

Technical Specifications

Input Power 115 Vac/60 Hz (85-128 Vac range)

Output Power

Model	Nominal Voltage (Vdc)	Continuous Current (Amps)	Peak Current[1] (Amps)	Max. Power (Watts)
DM5	32	15	30	480[2]
DM6	48	10	30	480[2]

[1] *5 millisecond rating* [2] *Includes cooling fan.*

P.W.M. Frequency 20 kHz

% P.W.M. vs. Potentiometer Voltage Reference 0% PWM @ 1.5Vdc to 100% PWM @ 4.1 Vdc

Auxiliary Speed Control 10K Ohm range for externally provided potentiometer
Analog input: 0-5 Vdc, 0-10 Vdc, or 4-20 ma.

Acceleration/ Deceleration Range Up to 7 seconds

Over-Current 125% of rating for 0.2 seconds

Drive Status Indicators L.E.D.s (open-chassis configuration)
- Red - fault indication
- Green - power enabled indication

Output for external L.E.D. or PLC monitoring

Environment Temperature Range: 0˚ to 50˚ C. (32˚ to 122˚ F.)
Humidity: 10 - 95% non-condensing

Reset Normally closed momentary reset input.

Outputs "End of Move" CW and CCW
Fault

Inputs
- ACCEL CW and CCW
- DECEL CW and CCW
- BRAKE CW and CCW
- HOME CW or CCW
- RESET (normally closed momentary contact)
- ENABLE
- Connection for speed potentiometer or analog speed control (0-5 Vdc, 0-10 Vdc or 4-20 mA).

NOTE: All inputs and outputs are opto-isolated.

Input/Output Terminals and Potentiometers

TERMINAL LOCATIONS

The terminals for the open-chassis drive/controller are located on the top (controller) and bottom (drive) boards as shown in Figure 8.

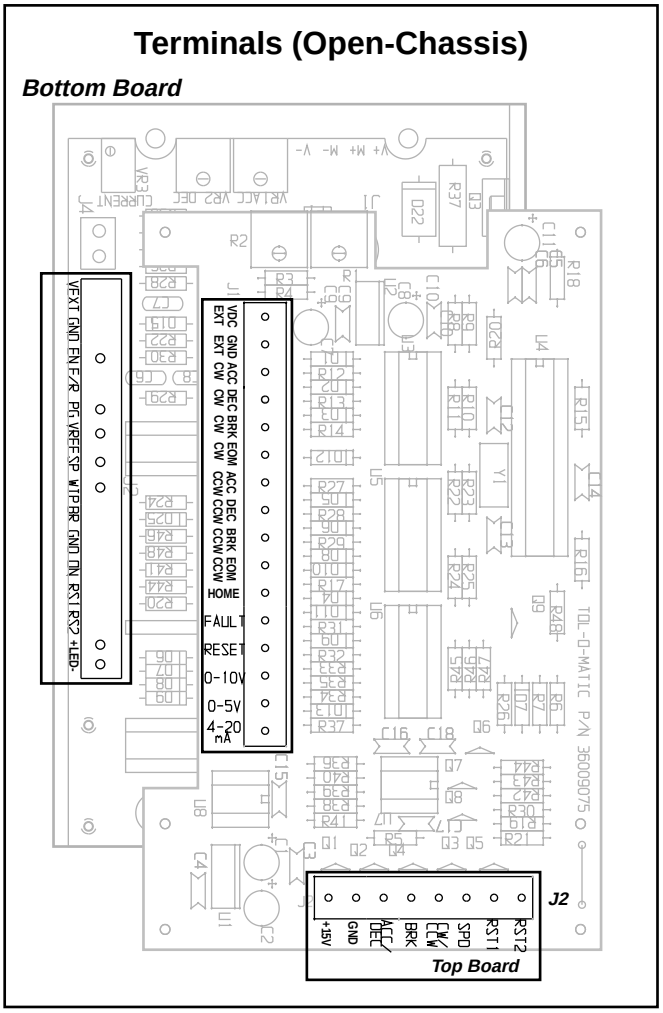


Figure 8

TERMINAL DESCRIPTIONS - TOP BOARD J1

Vdc EXT
Connection for a 5 to 25 Vdc external power supply to drive opto-isolation and/or external switches.

GND EXT
Connection for negative terminal on external power supply.

ACC CW
Switch input, when shorted to GND EXT, will initiate a move in the clockwise direction. Acceleration rate is controlled by the accel potentiometer adjustment.

DEC CW
Switch input, when shorted to GND EXT while the motor is moving in the clockwise direction, will cause the motor to decelerate to a stop. Deceleration rate is controlled by the decel potentiometer adjustment. This switch also activates the clockwise end of stroke dwell timer, which is controlled by the dwell CW potentiometer (VR1) setting.

BRK CW
Switch input, when shorted to GND EXT while the motor is moving in the clockwise direction, will cause the motor to brake to a stop. This input can also be used as an end of stroke limit to protect the equipment from damage.

EOM CW
Output that goes active (low) when the actuator has reached the end of move (EOM) when running in the CW direction. It is triggered when the DEC CW input goes active. It is cleared when motion starts in the CCW direction. It is intended to be used with an external control device (PLC, etc.) to synchronize the actuator's movements to something else. It can sink up to 50 mA and is rated for 50 Vdc.

ACC CCW
Switch input, when shorted to GND EXT, will initiate a move in the counter-clockwise direction, acceleration rate is controlled by the ACCEL potentiometer adjustment.

DEC CCW

Switch input, when shorted to GND EXT while the motor is moving in the counter-clockwise direction, will cause the motor to decelerate to a stop. Deceleration rate is controlled by the decel potentiometer adjustment. This switch also activates the counter-clockwise end of stroke dwell timer, which is controlled by the dwell CCW potentiometer (VR1) setting.

BRK CCW

Switch input, when shorted to GND EXT, while the motor is moving in the counter-clockwise direction, will cause the motor to brake to a stop. This input can also be used as an end-of-stroke limit to protect the equipment from damage.

EOM CCW

Output that goes active (low) when the actuator has reached the end of move (EOM) when running in the CCW direction. It is triggered when the DEC CCW input goes active. It is cleared when the motor starts in the CW direction device (PLC, etc.) to synchronize the actuator's movements to something else. It can sink up to 50 mA and is rated for 50 Vdc.

HOME

The motor will home after a power up or a RESET. If this terminal is left open, motor will home in the clockwise direction. If it is shorted to GND EXT, the motor will home in the counter-clockwise direction. It will home until either the DECEL or BRAKE limit switch is activated.

FAULT

This output goes active (low) when a current trip fault occurs in the drive. It is cleared by cycling power off and on, or by activating the RESET input. It can sink up to 50 mA and is rated for 50 Vdc maximum.

RESET

Requires a normally closed momentary contact to reset the drive remotely. The input is enabled by a momentary open contact between the RESET and GND I/O. For normal operation, the RESET line is shorted to GND EXT. The motor drive is off, the electronic brake is on, and any current trip fault is cleared while the RESET is active.

0-10 V
Terminal used if a 0-10 Vdc analog signal is used for speed control.

0-5 V
Terminal used if a 0-5 Vdc analog signal is used for speed control.

4-20 mA
Terminal used if a 4 to 20 mA analog signal is used for speed control.

TERMINAL DESCRIPTIONS - TOP BOARD J2

RST 2/RST1
Factory Wired

SPD
This terminal must be connected to the Bottom Board SP when one of the analog speed inputs is used from the POT+, POT GND supply.

CW/CCW
Factory Wired

BRK
Factory Wired

ACC/DEC
Factory Wired

GND
Factory Wired

15V
Factory Wired

TERMINAL DESCRIPTIONS - BOTTOM BOARD J2

V EXT
Factory Wired

GND
No wiring required

EN
Used to turn the drive on or off. When this input is shorted to GND EXT, the drive is disabled, causing the motor to coast with deceleration and activates FAULT output (red L.E.D. on for open-chassis configurations). If left open, this input allows the motor to run with acceleration.In response to either Acc CW or Acc CCW. Input is optically isolated when used with external power supply (5 Vdc to 25 Vdc).

F/R
Factory Wired

PG
Dedicated ground used with external speed potentiometer.

VREF
Voltage source terminal for use with the external 10 kOhm potentiometer for speed control.

SP
Factory Wired (see SPD Top Board J2)

WIP
Connected to the middle terminal of the external 10 kOhm potentiometer to provide variable speed control.

BR
Factory Wired

GND
Factory Wired

ON
Factory Wired

RS 1
Factory Wired

RS 2
Factory Wired

LED+
Factory Wired (15v supply to Top Board)

LED-
No wiring required

MOTOR+/MOTOR-
These outputs supply voltage to motor. Positive voltage at these terminals causes a right-hand screw drive actuator to move away from the motor; negative voltage causes actuator to move toward the motor. (See Chapter 5: Installation for instructions on wiring Axidyne d.c. motors. If a motor package other than Axidyne is to be used, consult the manufacturer's product documentation for wiring instructions.)

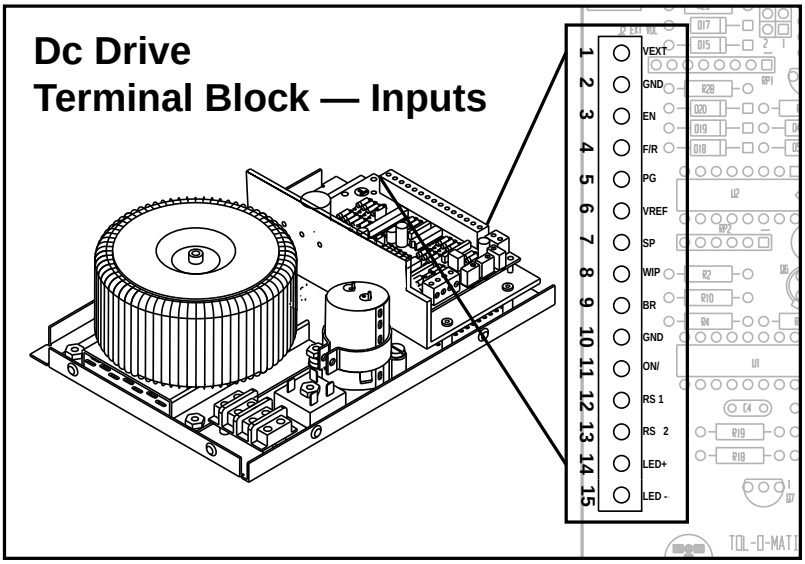


Figure 9

TERMINAL DESCRIPTION - CHASSIS

115 VAC/NEUTRAL/CHASSIS GND

Stud terminals for a.c. supply wire (see *Basic Controller Installation Figure 35* for wiring diagrams).

IMPORTANT NOTE: This input can NOT be used in conjunction with any of the analog speed inputs (0-5 Vdc, 0-10 Vdc, and 4-20 mA).

Potentiometers

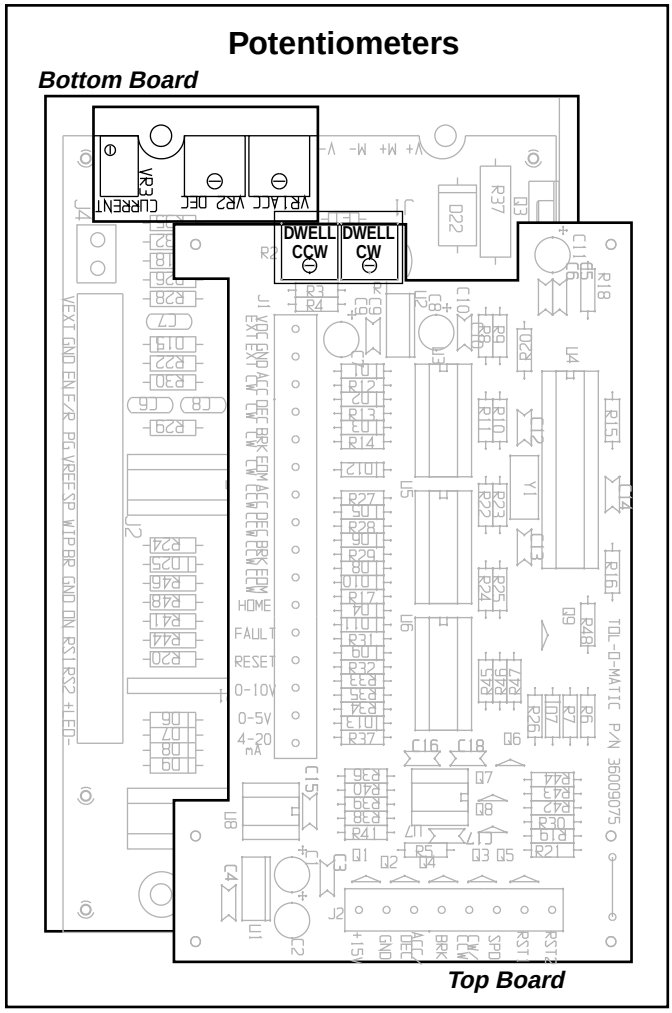


Figure 10

ACCEL (bottom board)

Built-in potentiometer adjusts acceleration time from 0 to 7 seconds. CW rotation decreases acceleration time; CCW increases acceleration time.

DECEL (bottom board)

Built-in potentiometer adjusts deceleration time from 0 to 7 seconds. CW rotation decreases deceleration time; CCW increases deceleration time.

CURRENT TRIP (bottom board)

Used to adjust the maximum current allowed before faulting the drive. This allows protection against overloading of motor and actuator system while allowing high starting torque for systems with high inertial load. The overcurrent detection circuit monitors motor current build-up above a set value at any time during operation. CW rotation increases current trip level, and CCW rotation decreases current level.

CURRENT LIMIT DETECTION CIRCUIT

Allows protection against overloading of motor and actuator system while allowing high starting torque for systems with high inertial load. The overcurrent detection circuit monitors motor current build-up above a set value at any time during operation. If current exceeds the threshold value for more than 0.22 seconds, the circuit disables the drive and activates the FAULT output (red L.E.D. ON in open-chassis configurations). Once activated, the circuit can only be reset by disconnecting and re-connecting power, or by activating RESET input. (NOTE: If the over-current condition is present for less than 0.22 seconds, the circuit will NOT shut down the drive.) Refer to drive module installation page 33*Basic Controller Installation* page 62 for adjustment information.

DWELL CW (top board)

This potentiometer controls how long the drive waits after completing a clockwise (CW) move, before moving in the counter-clockwise (CCW) direction. Range is .05 to 5 seconds. CW rotation increases dwell time, CCW rotation decreases dwell time.

DWELL CCW (top board)

This potentiometer controls how long the drive waits after completing a counter-clockwise move, before moving in the clockwise direction. Range is .05 to 5 seconds. CW rotation increases dwell time, CCW rotation decreases dwell time.

Optional Equipment

OPERATOR INTERFACES

Operator interfaces provide inputs necessary to operate an Axidyne D.C. Control System. The style of operator interface is a function of the level of complexity required by the application.

Operator interfaces range from manual switches and potentiometer to a PLC communicating to the D.C. Drive Module I/O.

Axidyne Operator Interfaces:

- External Potentiometer (Model POT-001) - Provides variable speed control by varying speed reference voltage to the d.c. drive. (See *Basic Controller Installation* page 62 for wiring instructions.)

Alternative Operator Interfaces:

- Externally-Provided Analog Voltage (0-5 Vdc, 0-10 Vdc, or 4-20 mA) - Used for setting speed.
- Customer-Provided Manual Switch Panel - A combination of switches used to signal end-of-stroke. (NOTE: Call your local Tol-O-Matic distributor for more information on Tol-O-Matic Reed and Hall Effect switches.)

ACCESSORY ITEMS

- Separately available
- Mounting Hardware Kit (Model SMK-100) - Used to mount DCDM. (See installation page 33)
- Motor Couplers - Used to link the motor shaft to the actuator shaft. (For complete details, see Tol-O-Matic Axidyne catalog).

Recommended Motors

Overview

Axidyne d.c. motors are brush-type permanent magnet motors with torque-speed characteristics selected to match Axidyne d.c. drive/power supply ratings and actuator performance requirements. The motors have permanent magnet poles on the stators and apply continuous power to the rotor through the brushes and commutator (see Figure 11).

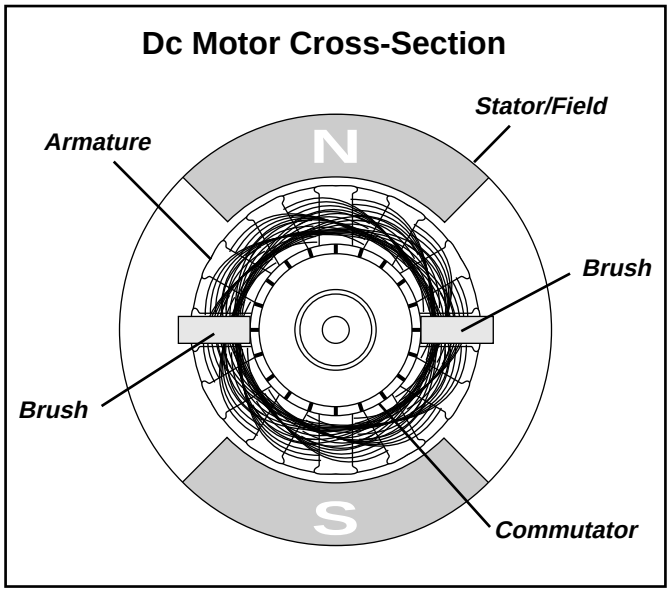


Figure 11

When driven by an open d.c. drive module the d.c. motor runs at a speed where the torque capability matches the load torque required (see performance charts for each available model). The motor draws current to develop this torque and speed is voltage dependent.

NOTE: Axidyne open loop d.c. drives do not provide holding torque at standstill.

Motors have been selected for the Axidyne open-loop control systems to have less than 1% speed change for a 5% load change when operating at rated speed and voltage. Line voltage changes will create an approximately corresponding percentage change in speed. For a given speed setting, there may be a 1%-5% speed differential in the two directions of motor rotation.

Features

- ***Precision balanced rotors***
- ***ABEC class bearings***
- ***Quiet motor designs***
- ***Precision machined dimensions***
- ***Common NEMA mechanical flanges simplify interfacings to standard gearboxes***

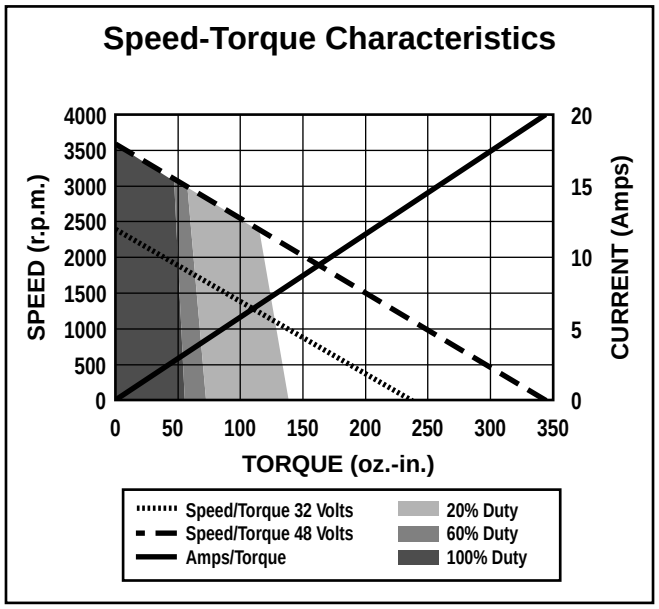
Motor Mounting

Mounting kits are used to attach Axidyne motors to Axidyne screw- and belt-drive actuators. The kits include standard mounting plate, spacer and fasteners. ***NOTE:*** A flexible coupler between the motor shaft and the load is recommended to isolate the motor from vibration and to compensate for possible slight shaft misalignment. See Axidyne product catalog for details, of motor mounting options for belt and screw actuators.

Motor Performance Data

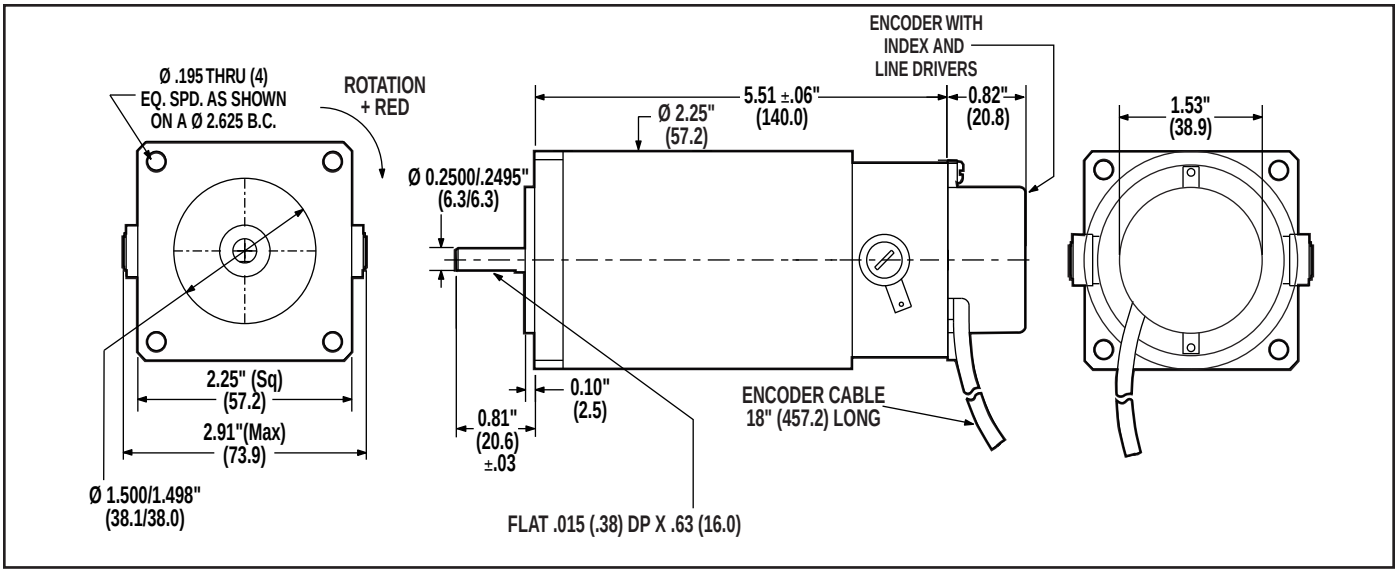
Motor speed-torque and duty cycle characteristics are shown in the following charts. Performance limit lines are for motor operation with Tol-O-Matic Open-Loop Drives.

Model MRB-231

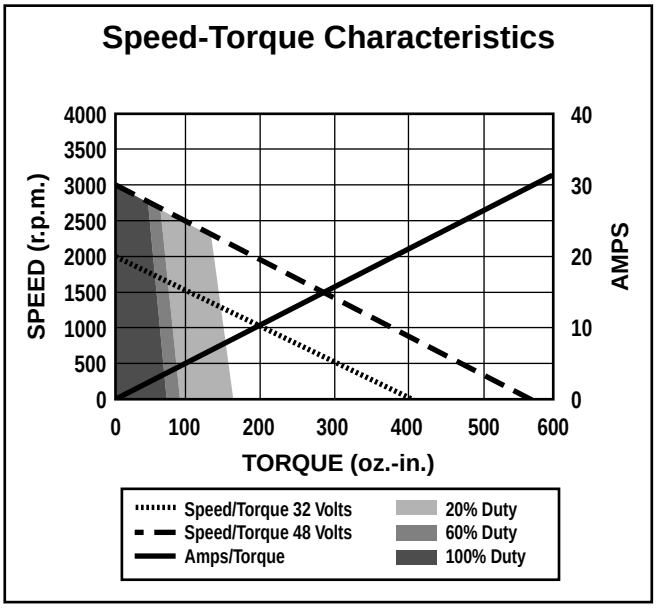


KE:	***12.7 Volts/1000 r.p.m.***
KT:	***17.1 oz.-in./Amp.***
Ra:	***1.7 Ohms***
Rotor Inertia:	***1.92 oz.in.2***
Max. Temp.:	***105° F.***
Weight:	***3.5 lbs.***

Dimensions

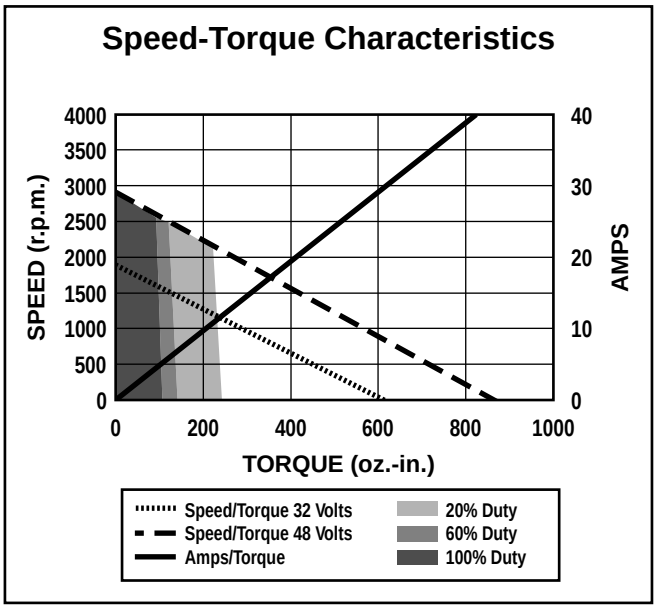


Model MRB-341



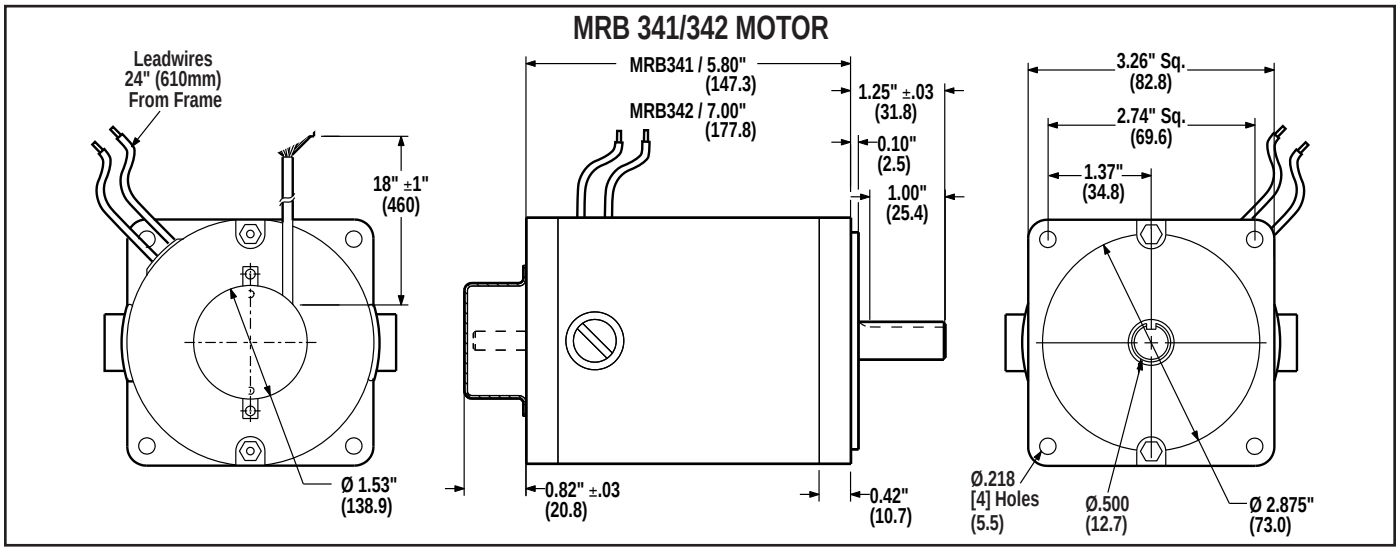
KE: *15.12 Volts/1000 r.p.m.*
KT: *19.75 oz.-in./Amp.*
Ra: *0.97 Ohms*
Rotor Inertia: *15.36 oz.in.2*
Max. Temp.: *105° F.*
Weight: *6.0 lbs.*

Model MRB-342

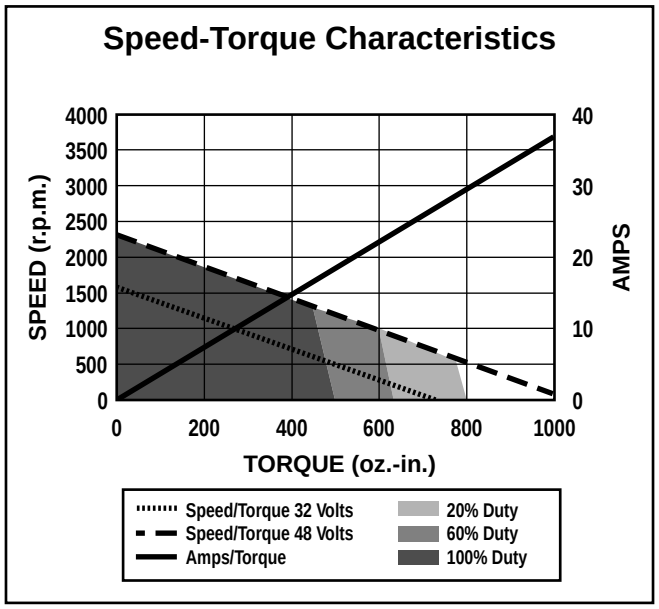


KE: *15.83 Volts/1000 r.p.m.*
KT: *20.35 oz.-in./Amp.*
Ra: *0.51 Ohms*
Rotor Inertia: *20.48 oz.in.2*
Max. Temp.: *105° F.*
Weight: *8.4 lbs.*

Dimensions

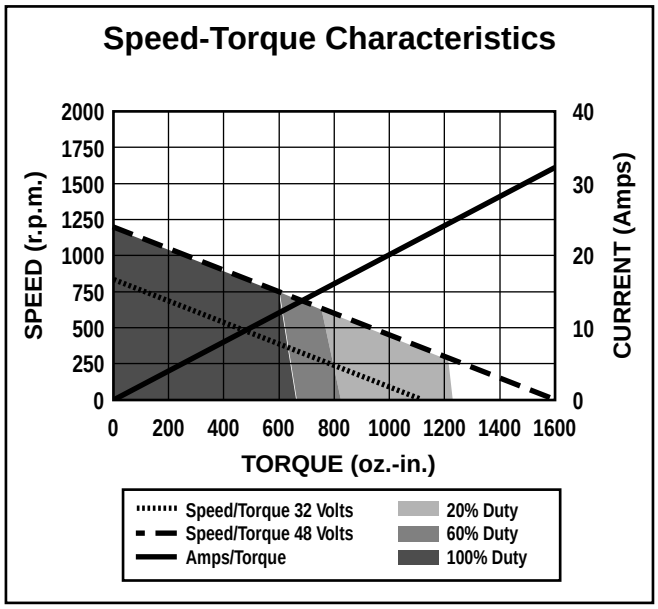


Model MRB-401



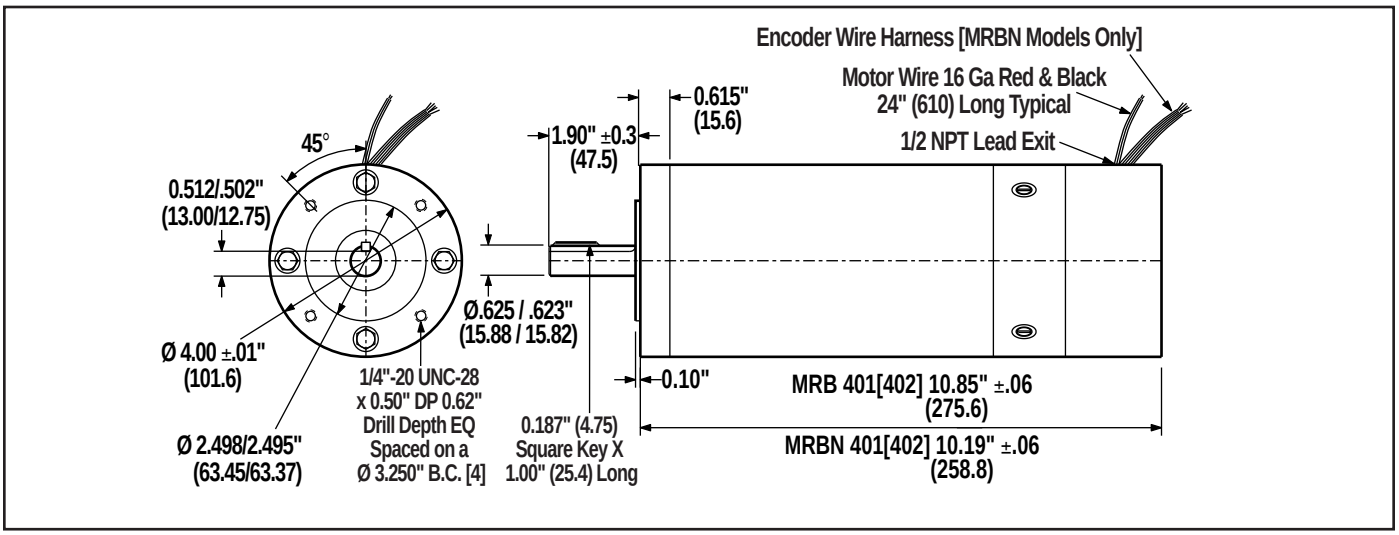
KE: *22.5 Volts/1000 r.p.m.*
KT: *30.5 oz.-in./Amp.*
Ra: *0.6 Ohms*
Rotor Inertia: *100.67 oz.in.2*
Max. Temp.: *105° F.*
Weight: *17 lbs.*

Model MRB-402



KE: *35.8 Volts/1000 r.p.m.*
KT: *48.4 oz.-in./Amp.*
Ra: *0.87 Ohms*
Rotor Inertia: *122.28 oz.in.2*
Max. Temp.: *105° F.*
Weight: *20 lbs.*

Dimensions



Before You Begin...

SAFETY CONCERNS

⚠ ***Caution!*** Safety should be a primary concern when installing any motion control system. All Axidyne hardware should be installed to conform with local and national electrical safety codes. Failure to observe safe working practices when installing or servicing this equipment can expose you to dangerous voltages and/or severely damage the equipment.

ENVIRONMENTAL CONSIDERATIONS

Axidyne Dc Control Systems are designed to operate in an industrial environment. However, severe atmospheric contamination, electrical noise, or temperature extremes can affect system performance. To help avoid performance problems, operate the DDM system within the following environmental guidelines:

Operating Temperature: 0°-50° C (32°-122° F)
Humidity: 10-95%, non-condensing

WIRING GUIDELINES

In general, all electrical components and enclosures must be connected to earth ground through a grounding conductor to provide a low impedance path for ground fault or noise-induced currents. The DDM enclosure features internal grounding for operator safety.

A single-point grounding setup is recommended and all earth ground connections must be continuous and permanent. Prepare all other components and mounting surfaces prior to installation so that good electrical contact is made between the component enclosure and the mounting surface. Remove the paint (if any) from equipment surfaces where the ground contact will be bolted to a panel and use star washers to ensure solid, bare metal contact.

The 115Vac supply should be fused or breakered at no more than 15A.

☠ ***WARNING! Disconnect all ac power prior to installation wiring.***

Wiring Ac Power

WARNING! All ac power must be disconnected prior to installation wiring. Failure to observe safe working practices when installing or servicing this equipment can expose you to dangerous voltages.

To connect the DM to an a.c. power supply:

1. Connect the BLACK lead to 115 Vac terminal.
2. Connect WHITE wire to NEUTRAL terminal.
3. Connect GREEN wire to GND terminal.

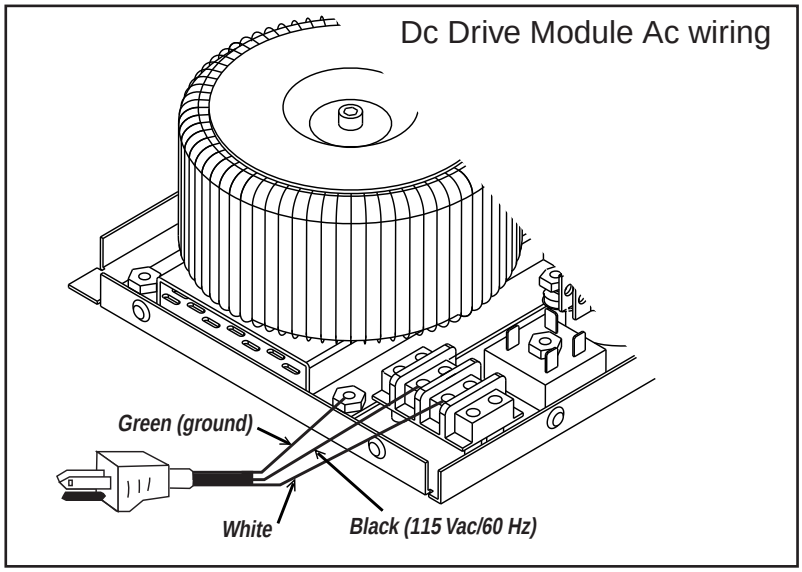


Figure 12

NOTE: The 115V source should be fused or breakered at no more than 15 Amps.

Motor Connections

NOTE: The following instructions apply to all Axidyne d.c. motors. If a motor package other than Axidyne is to be used, consult the manufacturer's product documentation for wiring instructions.

To connect motor:

1. Refer to Figure 13. Connect motor RED (positive) wire to MOTOR + (terminal 2).

2. Connect motor BLACK (negative) wire to MOTOR - (terminal 3).

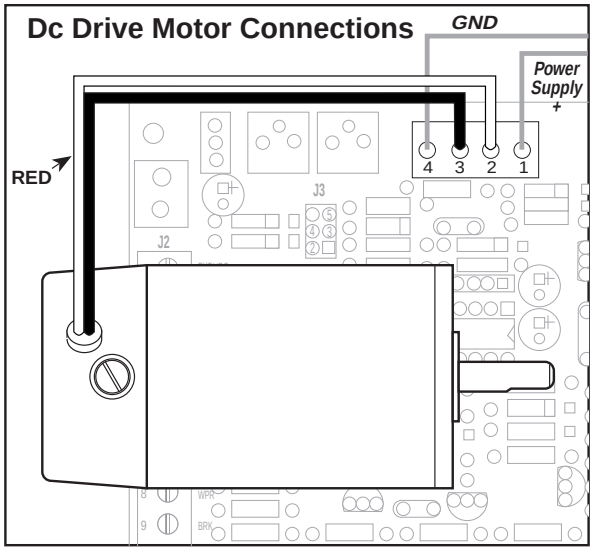


Figure 13

NOTE: When positive voltage is present at motor RED lead, motion will be away from a direct coupled motor on Axidyne screw-drive actuators configured with a right-hand lead screw.

Checking motor voltage:

1. Estimate motor voltage from speed/torque curve based on maximum drive rating (32 or 48 volts), required motor RPM and torque requirement. Use this value as approximate indicator.

2. Measure with a meter, maximum voltage reading across motor terminals while in motion.

3. Compare this dc voltage with calculated voltage shown below.

$$V\ (\text{motor}) = \left(\frac{T}{K_T} \times R_a\right) + (K_E \times N)$$

Where N = Required application motor speed (RPM/1000)
KE = Voltage constant (volts/1000 RPM)
T = Application torque (oz.-in.)
Ra = Motor armature resistance (ohm)
KT = Torque constant (oz.-in./Amp)

NOTE: Calculated and measured values may differ by 5-10% because of brush voltage and other circuit losses.

Connections

SETTING SPEED CONTROL JUMPERS

DM's provide for choice of speed control by potentiometer or by dc analog voltage input. Jumpers are provided to allow customer selection of speed control mode at installation.
NOTE: Dc drive modules are shipped with jumpers installed for potentiometer speed control.

To confirm setting for potentiometer speed control:

1. Disconnect power.
2. Locate Jumper J3.

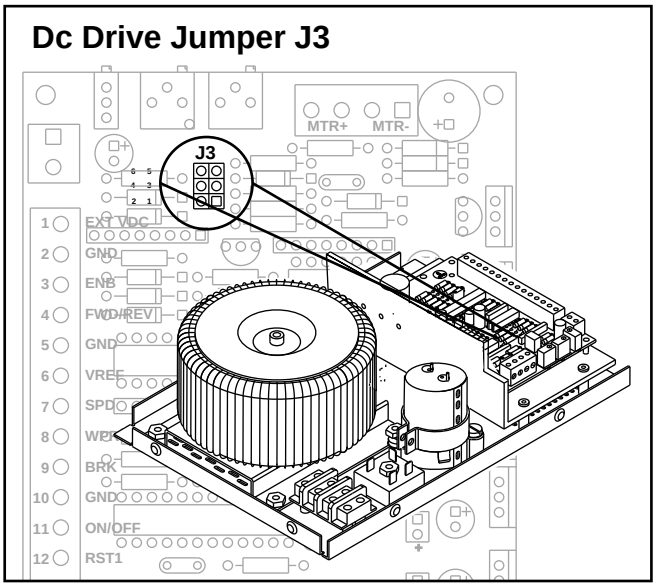


Figure 14

3. Confirm jumpers in place across pins 1-2, 3-4 and 5-6.
4. Connect 10k ohm potentiometer to POT WIPER, POT GND, and POT+ or VREF.
5. Reconnect power.

To select analog voltage speed control

1. Proceed as in 1, 2 and 3 above.
2. Remove all J3 jumpers
3. Connect analog speed signal (1.5 to 4.1Vac) to speed (SPD) (+ve) and to ground (GND) (-ve).
4. Reconnect power.

Checking Speed Control Voltage

Depending on speed control method being used, measure voltage at the analog speed or potentiometer input. Reference should be to a common ground not "Pot Grnd". Calculate speed control inputs to a scaled setting (1.5 to 4.1 Vdc) in order to equate motor voltage (0 to 32 or 48 Vdc) for required speed.

Reference dc voltage for these inputs are calculated as:

For 32 Volt Drive :

$$V\ (\text{input ref}) = \left(0.08 \times \left(\left(\frac{T}{K_T} \times R_a\right) + (K_E \times N)\right)\right) + 1.5$$

For 48 Volt Drive :

$$V\ (\text{input ref}) = \left(0.05 \times \left(\left(\frac{T}{K_T} \times R_a\right) + (K_E \times N)\right)\right) + 1.5$$

Where

N = Required application motor speed (RPM/1000)
KE = Voltage constant (volts/1000 RPM)
KT = Torque constant (oz.-in/Amp)
Ra = Motor armature resistance (ohm)
T = Required application torque (oz.-in.)

NOTE: V (input ref) will need to be increased/decreased as the load and frictional forces increase/decrease respectively to maintain a constant carrier speed on actuator.

Use of Inputs to Control Operating Profile

The Axidyne dc drive has four inputs for customizing the motion profile. The inputs may be provided by a Tol-O-Matic Basic Controller or by customer provided PLC or relay logic in conjunction with end-of-stroke switches. Examples are provided in the appropriate dc drive manuals.

The following information clarifies use of the inputs. Inputs can be optically isolated if an external 5-25 Vdc supply is available. Operating voltage can also be provided from the LED + terminal (15 Vdc) and the inputs will operate without isolation.

(ON)

Allows run when "high" if BRAKE is set "low", and ENABLE is "high". Initiates DECEL to stop if set "low" when running. Resets accel control when set low. (Only used with potentiometer speed control

(BR)

Initiates run if set "low" when ON/OFF is "high" and ENABLE is "high". Initiates dynamic braking if set "high" when running. Does not reset accel control.

(F/R)

Sets motor direction for run.

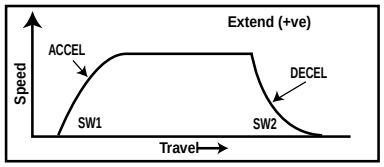
(EN)

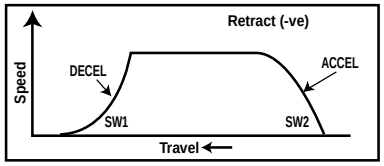
"High" allows PWM switching operation. "Low" shuts off switching causing motor to coast to stop without voltage and activates fault output.

Available Profiles

PROFILE 1.

This profile provides run between two switches with ACCEL and DECEL at each end. Actuator runs beyond switches depending on characteristcs.

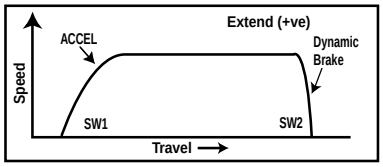


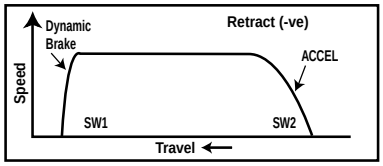


	ON/OFF	BRAKE	FWD/REV	ENABLE
DEFAULT	Hi	Hi	Hi	Hi
RESET 1	Lo	Hi	Hi	Hi
RUN (-ve)	Hi	Lo	Hi	Hi
DECEL (SW2)	Lo	Lo	Hi	Hi
RESET 2 (after stop)	Lo	Hi	Hi	Hi
RESET 3	Lo	Hi	Lo	Hi
RUN (+ve)	Hi	Lo	Lo	Hi
DECEL (SW1)	Lo	Lo	Lo	Hi
RESET 4	Lo	Hi	Lo	Hi
RESET 5	Lo	Hi	Hi	Hi

PROFILE 2.

Provides run between two switches with ACCEL at start and quick dynamic brake stop. Controls the stop position for low inertia, low lead actuators.

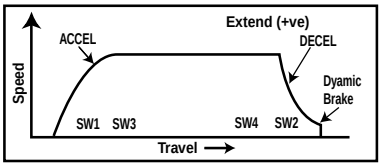


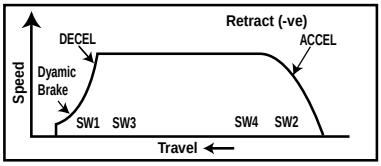


	ON/OFF	BRAKE	FWD/REV	ENABLE
DEFAULT	Hi	Hi	Hi	Hi
RESET 1	Lo	Hi	Hi	Hi
RUN (-ve)	Hi	Lo	Hi	Hi
STOP (SW2)	Hi	Hi	Hi	Hi
RESET 2	Lo	Hi	Lo	Hi
RUN (+ve)	Hi	Lo	Lo	Hi
STOP (SW1)	Hi	Hi	Lo	Hi
RESET 3	Lo	Hi	Hi	Hi

PROFILE 3.

Provides move between switches 1 and 2 with ACCEL at start and DECEL plus dynamic braking at STOP. DECEL is initiated by switches 3 and 4.





	ON/OFF	BRAKE	FWD/REV	ENABLE
DEFAULT	Hi	Hi	Hi	Hi
RESET 1	Lo	Hi	Hi	Hi
RUN (-ve)	Hi	Lo	Hi	Hi
DECEL (SW4)	Lo	Lo	Hi	Hi
STOP (SW2)	Lo	Hi	Hi	Hi
RESET 2	Hi	Hi	Lo	Hi
RESET 3	Lo	Hi	Lo	Hi
RUN (+ ve)	Hi	Lo	Lo	Hi
DECEL (SW3)	Lo	Lo	Lo	Hi
STOP (SW1)	Lo	Hi	Lo	Hi
RESET	4	Hi	Hi	Hi Hi

Figure 15

Notes:

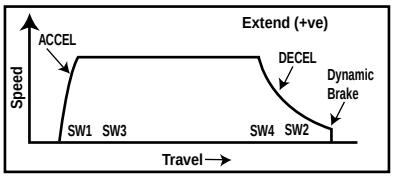
1. Default power up condition for all inputs is high.

2. Do not change FWD/REV status unless BRAKE is “high” or DECEL is complete. Change during run will fault the drive with possible damage to MOSFETS.

3. ACCEL and DECEL ramps of motion are the result of the ACCEL and DECEL potentiometer settings (Notes 3 and 4) in conjunction with load inertia, friction and actuator type.

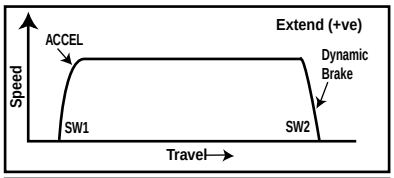
4. Accel time cannot be more than decel plus reset time.

PROFILE 4.
Provides move between switches 1 and 2 with maximum rate ACCEL at start and DECEL plus dynamic braking at stop. Decel is initiated by switches 3 and 4



	ON/OFF	BRAKE	FWD/REV	ENABLE
DEFAULT	Hi	Hi	Hi	Hi
RUN (-ve)	Hi	Lo	Hi	Hi
DECEL (SW4)	Lo	Lo	Hi	Hi
STOP (SW2)	Lo	Hi	Hi	Hi
RESET 1	Hi	Hi	Lo	Hi
RUN (+ve)	Hi	Lo	Lo	Hi
DECEL (SW3)	Lo	Lo	Lo	Hi
STOP (SW1)	Lo	Hi	Lo	Hi
RESET 2	Hi	Hi	Hi	Hi

PROFILE 5.
Provides move between switches 1 and 2 with maximum rate ACCEL at start and dynamic braking at stop.



	ON/OFF	BRAKE	FWD/REV	ENABLE
DEFAULT	Hi	Hi	Hi	Hi
RUN (-ve)	Hi	Lo	Hi	Hi
STOP (SW2)	Hi	Hi	Hi	Hi
RESET 1	Hi	Hi	Lo	Hi
RUN (+ve)	Hi	Lo	Lo	Hi
STOP (SW1)	Hi	Hi	Lo	Hi
RESET 2	Hi	Hi	Hi	Hi

Figure 16

5. ENABLE is set “low” internally if a fault condition triggers the internal fault circuit. If set “low” internally or externally, ENABLE must be reset by opening the connection between RESET 1 and RESET 2.

6. Reed or Hall-effect switches on the actuator provide momentary contact status as the carrier passes. Latching logic must be used to sustain the input to on/off or brake on the dc drive.

Sample Drive Connections

Following are sample drive module DM wiring configurations.

DYNAMIC BRAKING USING RELAY LOGIC AND REED SWITCHES (INTERNAL POWER SUPPLY)

Function

The application illustrated in Figure 17 uses two normally open contact closure switches and two relays (one single pole double throw and one double pole double throw) to extend and retract a screw-drive actuator carrier with the motion profile shown in Figure 18. Reed or Hall Effect switches on the actuator provide end limits to motion.

Operation

A light-emitting diode connected to the FAULT LED+ and FAULT LED- terminals indicates a fault condition. A normally closed momentary contact switch connected to the FAULT RESET 1 and FAULT RESET 2 terminals is used to reset the system. An external potentiometer provides variable speed control. An internal power supply (15 Vdc/500 mA. max.) is used to power external switches and relays. MOTOR+/MOTOR- terminals supply voltage to a d.c. brush-type permanent magnet motor mounted on an Axidyne cylinder-style screw-drive actuator.

Motion Profile

The motion profile for this application is illustrated in Figure 18. When either normally-open switch (extend or retract) is closed, maximum rate motor acceleration is initiated and continues until the required velocity (set by the speed setting potentiometer) is reached. The acceleration rate is determined by the speed setting voltage and the motor/load parameters. The motor then runs at constant velocity until the switch is closed at which point the BRAKE function is activated to dynamically brake the motor to a stop.

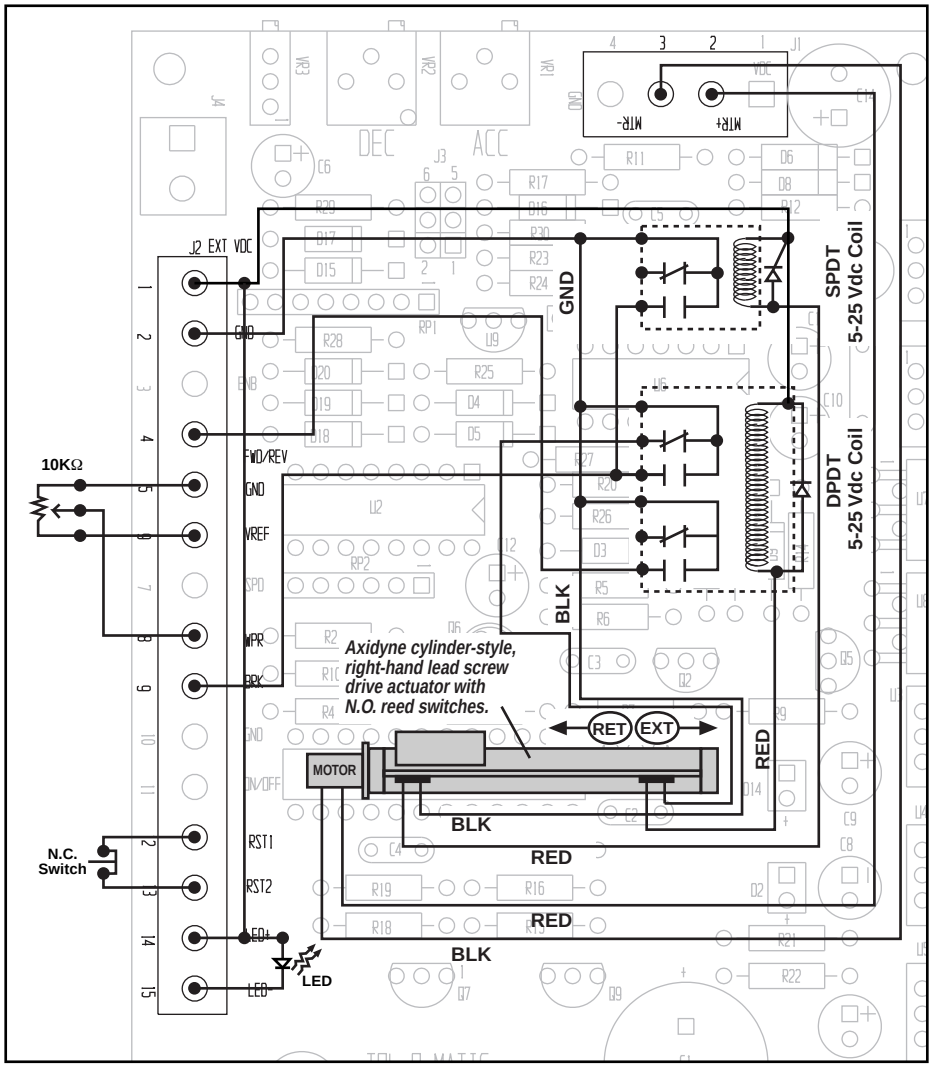


Figure 17

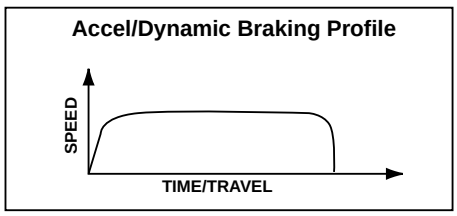


Figure 18

NOTES:

- The two normally open extend/retract switches can be substituted with PLC signals.
- When using the above logic, it is important to note that one switch at a time is selected to initiate motion, depending on direction of travel.

DYNAMIC BRAKING USING RELAY LOGIC AND REED SWITCHES (EXTERNAL POWER SUPPLY)

Function

The application illustrated in Figure 19 is the same as the previous application except that an external power supply is used. With the use of the external power supply, the optical isolation is implemented for the I/O signals.

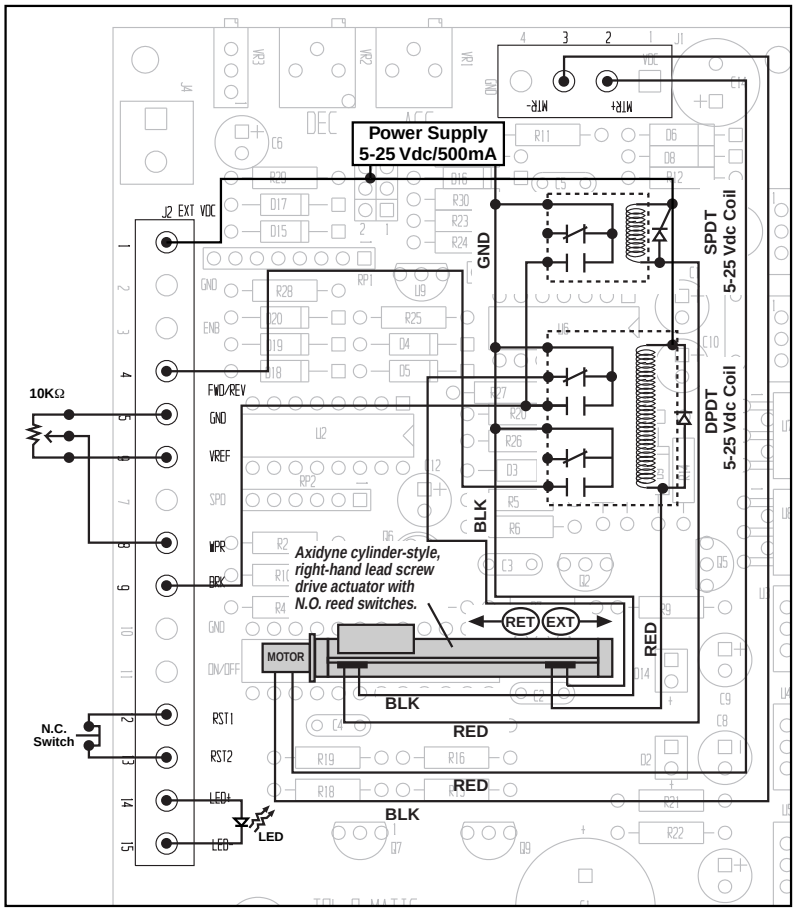


Figure 19

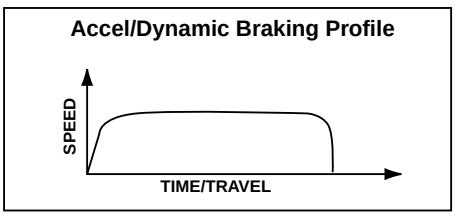


Figure 20

ACCEL/DECEL USING RELAY LOGIC AND REED SWITCHES (INTERNAL POWER SUPPLY)

Function

The application illustrated in Figure 21 uses two Form C switches and two relays (single pole double throw) to extend and retract a screw-drive actuator carrier with variable acceleration and deceleration as shown in Figure 22.

Operation

A light-emitting diode connected to the FAULT LED+ and FAULT LED- terminals indicates a fault condition. A normally closed momentary contact switch connected to the FAULT RESET 1 and FAULT RESET 2 terminals is used to reset the system. Variable speed control is provided by an external potentiometer. The internal power supply (15 Vdc/500 mA max.) is used to power external switches and relays. MOTOR+/MOTOR- supplies voltage to a d.c. brush-type permanent magnet motor mounted on an Axidyne cylinder-style screw-drive actuator.

Motion Profile

The motion profile for this application is illustrated in Figure 22. When either normally open switch (extend or retract) is closed, the ON/OFF input initiates maximum motor acceleration, at a rate determined by the speed setting voltage and the motor/load parameters, until constant velocity is reached. The motor then runs at constant velocity until:

1. A reed switch is triggered, in which case the motor will decelerate (at the rate determined by the internal DECEL potentiometer setting) and then stop;

OR

2. The switch is opened and the other switch is then closed, in which case the motor will decelerate (at the rate determined by the internal DECEL potentiometer setting) and then accelerate in the opposite direction of travel (at a rate determined by the speed setting voltage and the motor/load parameters).

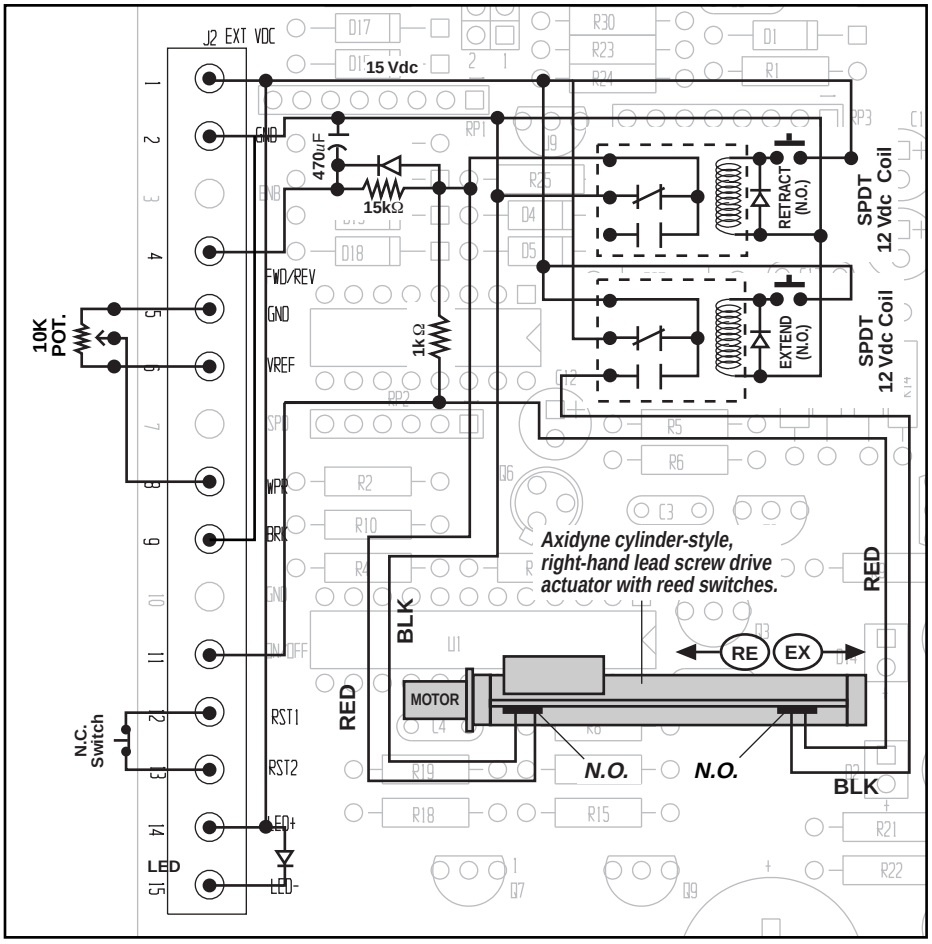


Figure 21

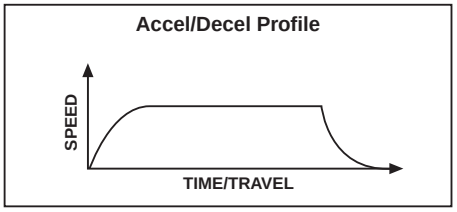


Figure 22

NOTES:

- The two normally open extend/retract switches can be substituted with PLC inputs.
- When using the above logic, it's important to note that one switch at a time is selected to initiate motion, depending on direction of travel.
- For applications using internal power supply, combined amperage draw of switches and relays may NOT exceed 500 mA.
- 15k ohm/470uf/Diode circuit prevents reversal during decel. 1k ohm prevents shorting Vdc.

ACCEL/DYNAMIC BRAKING USING RELAY LOGIC AND REED SWITCHES (INTERNAL POWER SUPPLY)

Function

The application illustrated in Figure 23 uses two normally closed reed switches and three relays (one single pole double throw and two double pole double throw) to extend and retract a screw-drive actuator carrier.

Operation

A light-emitting diode connected to the FAULT LED+ and FAULT LED- terminals indicates a fault condition. A normally closed momentary contact switch connected to the FAULT RESET 1 and FAULT RESET 2 terminals is used to reset the system. Variable speed control is provided by an external potentiometer. An internal power supply (15 Vdc/500 mA. max.) is used to power external switches and relays. MOTOR+/MOTOR- terminals supply voltage to a d.c. brush-type permanent magnet motor mounted on an Axidyne cylinder-style screw-drive actuator.

Motion Profile

The motion profile for this application is illustrated in Figure 24. When either normally-open switch (extend or retract) is closed, the ON/OFF input initiates motor acceleration at a rate determined by the internal accel potentiometer until constant velocity is reached (as limited by the speed setting potentiometer). The motor then runs at constant velocity until the end of travel reed switch is closed at which point the BRAKE function is activated to dynamically brake the motor to a stop.

NOTES:

- The two normally open extend/retract switches can be substituted with PLC signals.
- When using the above logic, it is important to note that one switch at a time is selected to initiate motion, depending on direction of travel.
- For applications using internal power supply, combined amperage draw of switches and relays may NOT exceed 500 mA.

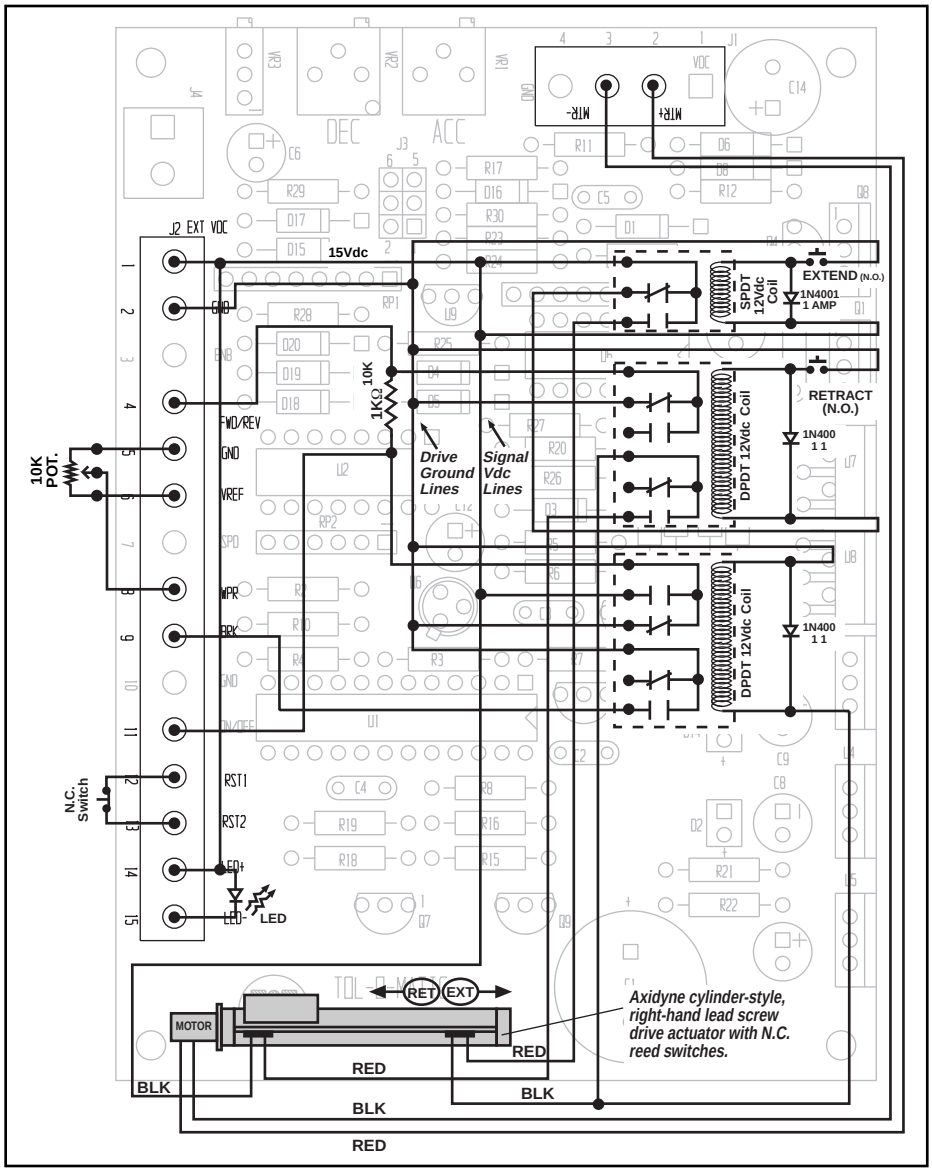


Figure 23

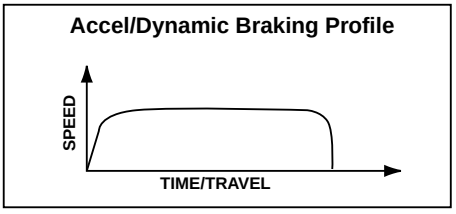


Figure 24

ACCEL/DYNAMIC USING RELAY LOGIC AND REED SWITCHES (EXTERNAL POWER SUPPLY)

Function

The application illustrated in Figure 25 is the same as the previous application except that an external power supply is used. With the use of the external power supply, the optical isolation feature is implemented for the I/O signals.

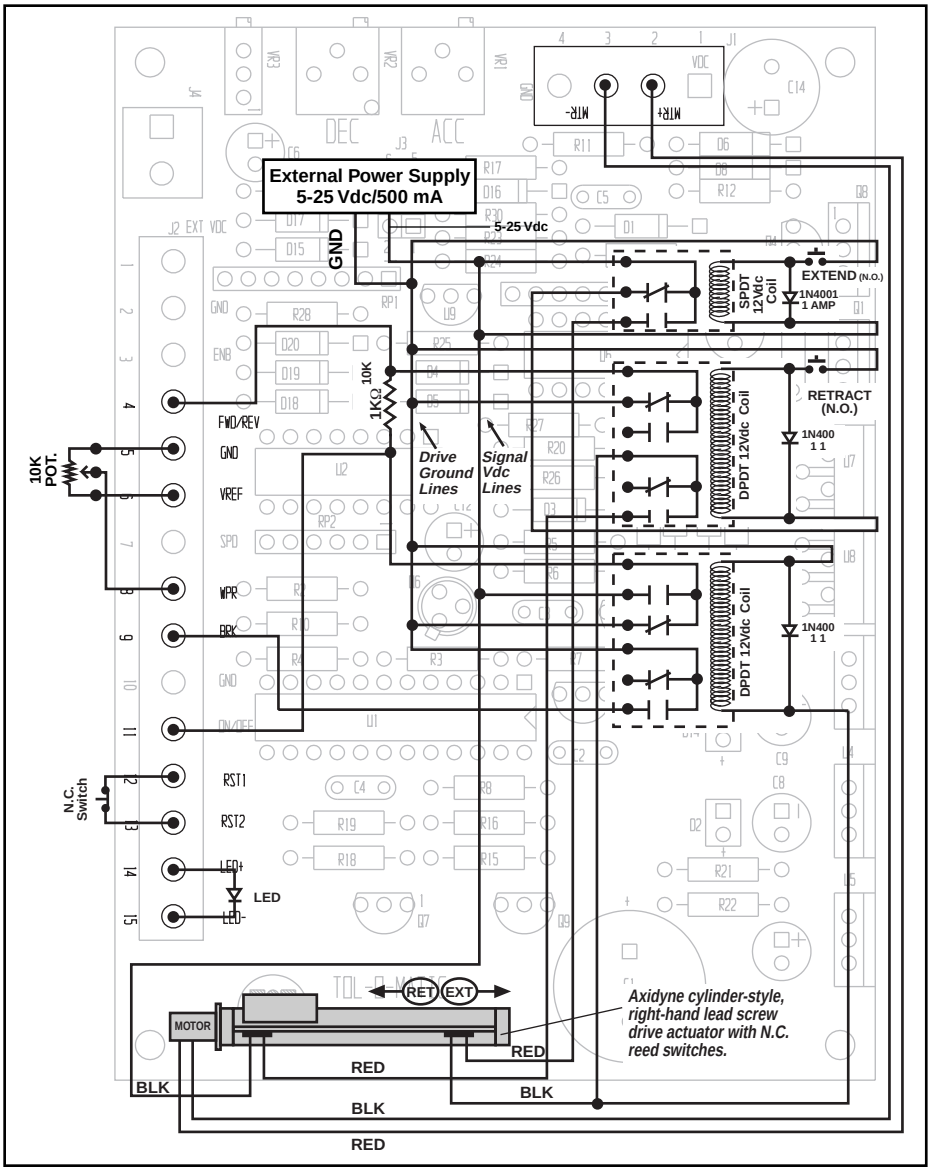


Figure 25

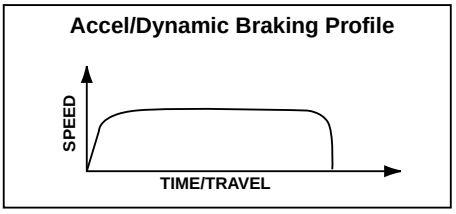


Figure 26

GENERIC PLC CONFIGURATION

Function

The configuration illustrated in Figure 27 is typical of many PLC applications. This configuration includes two end-of-stroke reed switches to provide signals to the PLC. Depending on the application requirements, the PLC may be programmed to provide one or more of the motion profiles shown in Figure 28.

Operation

A light-emitting diode connected to the FAULT LED+ and FAULT LED- terminals indicates a fault condition. A normally closed momentary contact switch connected to the FAULT RESET 1 and FAULT RESET 2 terminals is used to reset the system. Variable speed control is provided by an external potentiometer. Power is received externally from the PLC (5 to 25 Vdc) to power external switches and the drive's optical-isolation. Output power is connected to a d.c. brush-type permanent magnet motor mounted on an Axidyne cylinder-style screw-drive actuator.

⚠ **CAUTION!** PLC outputs to DDM inputs must be sinking devices capable of 25mA maximum.

NOTE: PLC wiring must be protected from noise. Contact factory for suppression and isolation options.

Motion Profile

Motion profile can be selected by PLC output switch sequence as described on page 39 "Use of Inputs to Control Operating Profile." Drive module inputs are high by default to inhibit motion. See page 40 for more information.

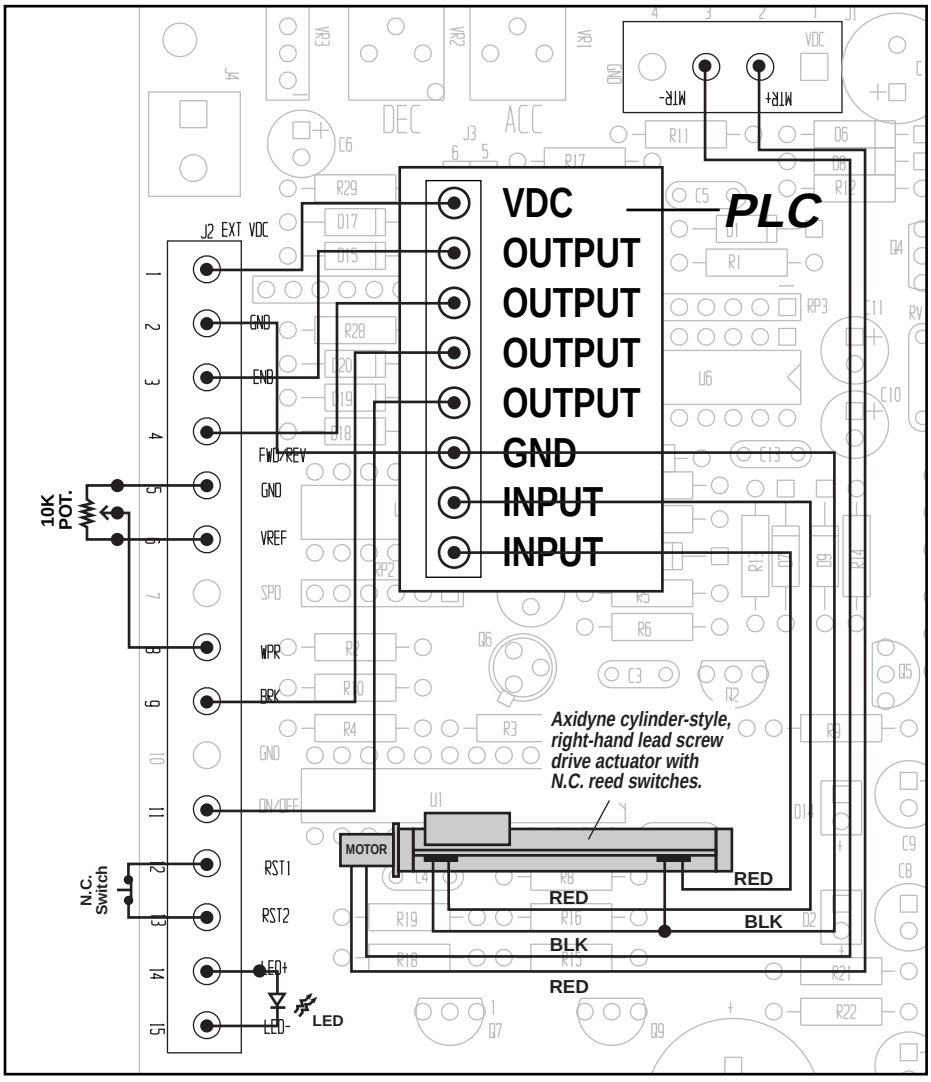
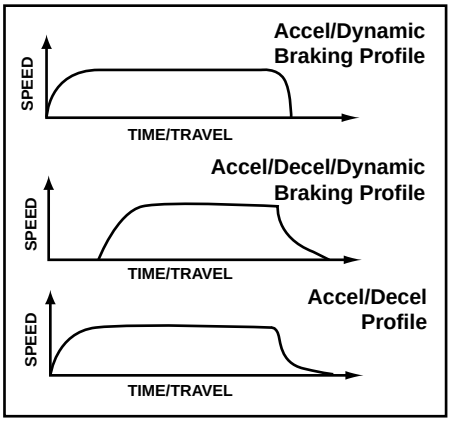


Figure 27

Figure 28



VARIABLE SPEED CONTROL USING PLC (EXTERNAL ANALOG SPEED CONTROL)

Function

The configuration illustrated in Figure 29 is typical of many PLC applications. This configuration includes two end-of-stroke switches to provide signals to the PLC. The PLC may be programmed to provide a customized motion profile to meet the requirements of the application.

IMPORTANT NOTE: For external analog speed control operation, all jumpers must be removed from Jumper J3 on the d.c. drive circuit board (see "Setting Speed Control Jumpers," page 37).

Operation

A light-emitting diode connected to the FAULT LED+ and FAULT LED- terminals indicates a fault condition. A normally closed momentary contact switch connected to the FAULT RESET 1 and FAULT RESET 2 terminals is used to reset the system. Variable speed control is provided by an analog signal from the PLC. Normally, power received externally from the PLC (5 to 25 Vdc) powers external switches and the drive's optical-isolation. However, since the PLC and drive share a common ground, the four inputs receive power but are not optically isolated. MOTOR +/MOTOR- terminals supply voltage to a d.c. brush-type permanent magnet motor mounted on an Axidyne cylinder-style screw-drive actuator.

Caution! PLC outputs to DDM inputs must be sinking devices capable of 25mA maximum.

Motion Profile

The motion profile is determined by the profile of the analog speed signal provided by the PLC, in conjunction with the programming of the outputs controlling the BRAKE, ENABLE and FWD/REV inputs to the drive module. ***NOTE:*** BRAKE inputs must be high when FWD/REV is switched.

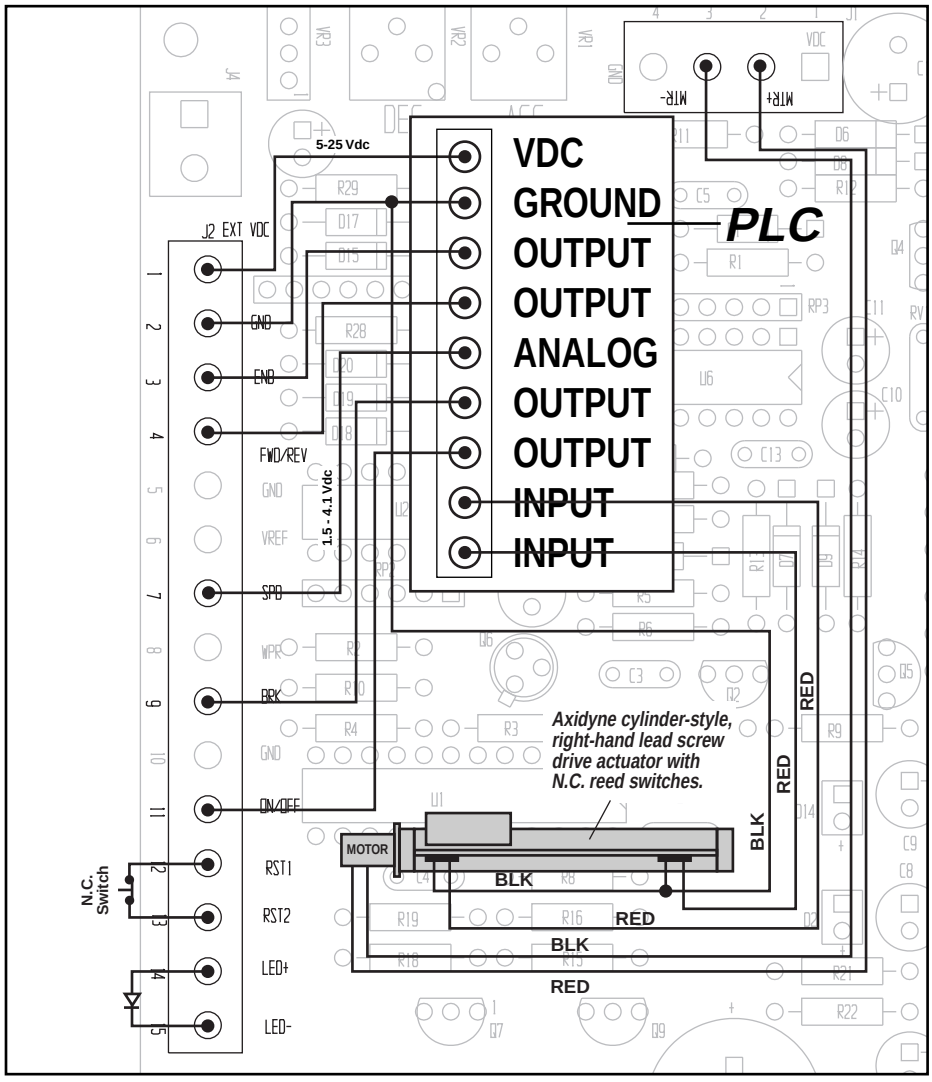


Figure 29

Using a PLC to Monitor Fault

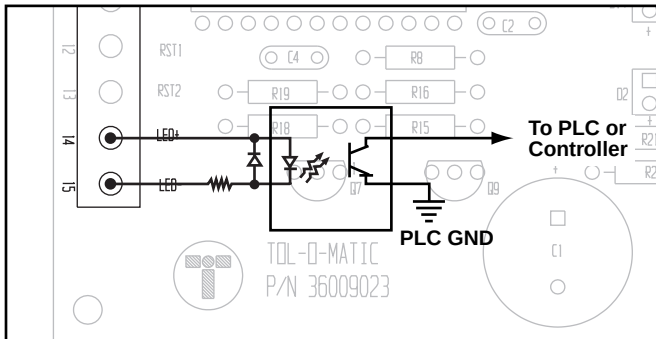


Figure 30

In some applications it may be advantageous to use a PLC or controller to monitor the drive's fault output for fault conditions. The diagram in Figure 30 illustrates the recommended circuit for connection to a PLC or logic controller.

Over Current Trip Potentiometer

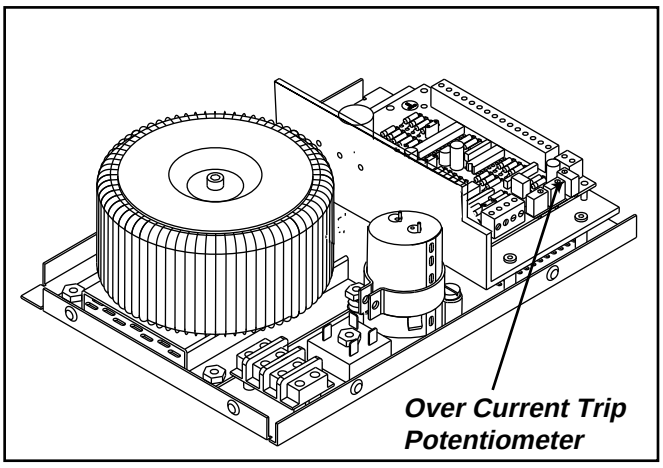


Figure 31

The over current trip potentiometer is a 25 turn potentiometer. This style of potentiometer incorporates a clutch mechanism that allows the potentiometer to continue turning even after the end of adjustment has been reached. A slight click indicates the end of the adjustment range.

ADJUSTMENT PROCEDURE

Caution! Make sure over current trip Potentiometer is set halfway (or lower) between CW and CCW setting before powering up system.

The potentiometer is connected so when turned CW, higher current is allowed to flow before tripping the drive. When turned CCW, less current is required to trip.

Drive faults out upon power-up at rated application duty requirement:

1. Increase the trip level by turning potentiometer to raise trip level (use 2-turn increments).

2. Run D.C. system at rated duty requirement. If drive faults, reset and repeat step 1 above.

3. Repeat step 2 above as necessary until drive is operational.

Drive is operational upon power-up at rated application duty requirement:

1. Decrease the trip level by turning potentiometer to lower trip level (use 2-turn increments)

2. If drive does not fault after 2 to 3 minutes of running, repeat step 1 until drive faults. If a jam or crash occurs during this test and drive does not fault, immediately remove power from the drive. Decrease trip level 5 turns.

3. When drive faults, reset and slowly increase trip level by turning potentiometer in small 2-turn increments.

4. If drive faults again when running, repeat step 3.

5. If drive remains operational, no further adjustment should be necessary.

Mounting

⚠ ***Caution!*** When mounting system components, do not place heat-producing devices underneath or near the DDM.

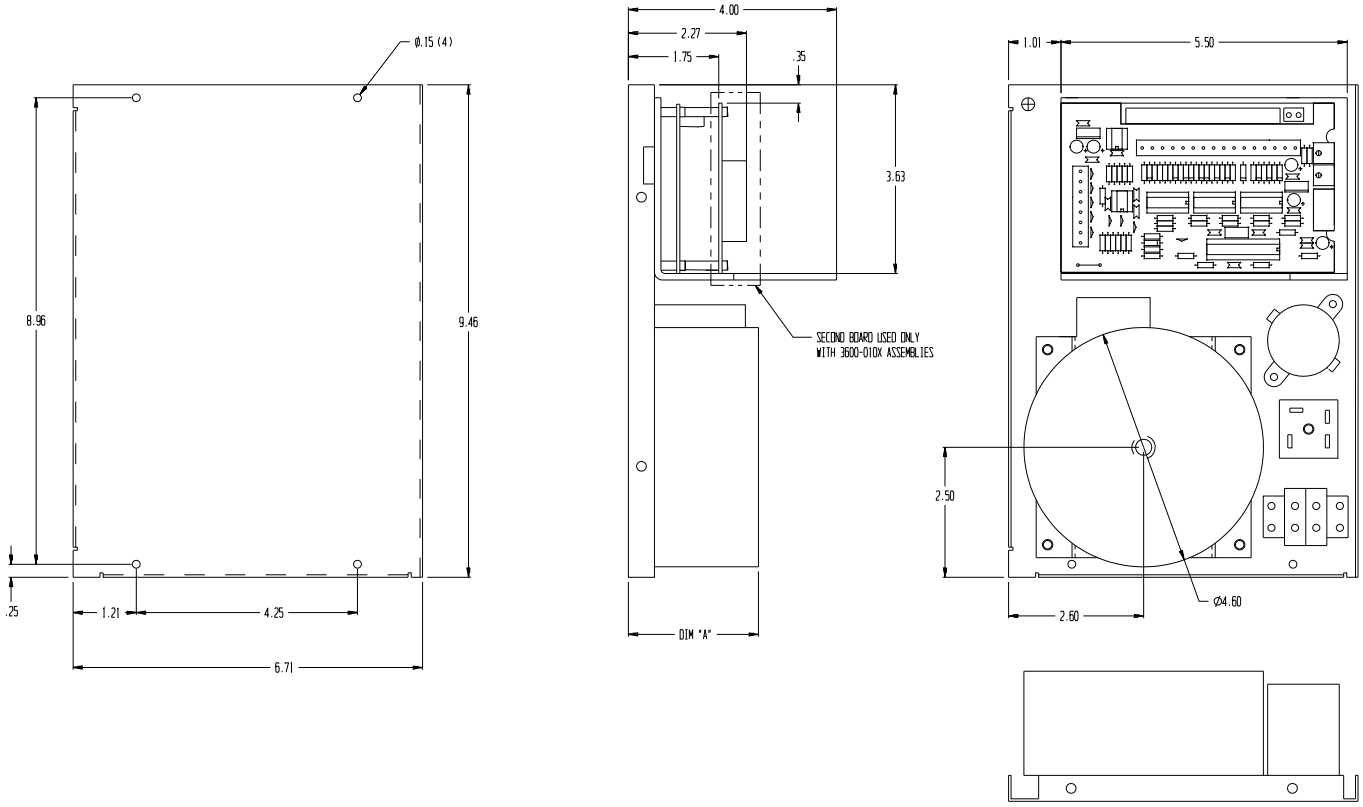


Figure 32

Good practice should be observed to protect the drive from dirt, dust, debris, moisture or inadvertent personal contact.

NOTE: All dimensions in inches

Symptom:	Probable Cause:	Corrective Action:
Motor runs excessively hot and motor torque seems to diminish. Motor end bell case temperature exceeds 180° F (82.2° C).	1. Excessive loading.	1. Determine if motor/drive torque, speed and duty cycle rating is correct for given application.
	2. High ambient temperature which exceeds motor temperature limit of 105° F (40.5° C).	2. Reduce surrounding ambient temperature.
	3. Excessive motor losses	3. Check armature temperature rise by calculation:

$$(\Theta_a - \Theta_A) = P_L R_{TH}$$

$$P_L = I_a \times (V - (0.74 K_T \times N))$$

where:

Θ_a = Armature temp. (°C)

Θ_A = Ambient armature temp.

P_L = Motor power loss (Watts)

V = Voltage across motor terminals (V)

I = Motor current (Amp)

K_T = Torque constant (oz-in/Amp)

N = RPM/1000

Specified values of R_{th} and K_T as a function of motor model:

MOTOR	R_{th}=	K_T=
MRB231	3.7	17.1
MRB341	2.3	19.75
MRB342	1.9	20.35
MRB401	2.0	30.5
MRB402	1.3	48.4

Consult factory if calculated rise exceeds 100° C.

Symptom	*Probable Cause*	*Corrective Action*
Erratic Speed	1. Excessive load variations greater than ±5% will cause noticeable speed change.	1. Check for motor misalignment or varying friction throughout stroke.
	2. Worn or sticking brushes.	2. Replace brushes. Clear carbon powder from brush holder area.
	3. Worn motor bearings.	3. Repair or replace motor.
	4. Analog or potentiometer reference voltage is varying.	4. Check 5 volt d.c. supply on terminal block "J2", "Pin 6" located on dc drive board.
		5. Check and replace potentiometer.

Symptom	*Probable Cause*	*Corrective Action*
Actuator carrier going in wrong direction. (Reversed motor rotation)	1. Motor leads wired to drive terminal blocks are reversed.	1. Reverse lead wires.
	2. Incorrect high/low signal to the drive Fwd/Rev. input.	2. Check signal state from motion controller, PLC, switch input or wiring for correct application logic. ***NOTE:*** A High signal at the Fwd/Rev input will cause the motor to rotate CCW and direct coupled actuator carrier to move away from motor end for a right-hand screw. A Low signal will be the opposite of the above description.

Symptom	*Probable Cause*	*Corrective Action*
Actuator shaft and actuator carrier will not move (carrier not at end of stroke). **Red LED off; Green LED on; Fault output is not activated.**	1. No speed reference voltage at analog speed or potentiometer wiper input.	1. Before trying the additional steps listed below, try to reset drive by momentarily opening up the normally-closed contact connecting the Reset inputs. Check to see if red LED on drive goes off and green LED illuminates.
	2. Brushes may be excessively worn and do not touch commutator or brushes stick.	2. Clean brushes and brush holder so brushes move freely. Replace if necessary.
	3. No voltage present at EXT Vdc input which powers the motion inputs on drive (Inputs: FWD/REV, ON/OFF, ENABLE and BRAKE).	3. EXT Vdc input should be powered by external I/O power supply capable of 5-25 Vdc @ 125mA required rating or I/O powered by internal power supply (i.e. "Fault LED+" output).
	4. Drive inputs are in wrong signal state (High/Low) or wired incorrectly.	4. For drive to be in run mode, the following conditions must exist at drive's four motion inputs: **DRIVE INPUTS** / **SIGNAL STATE** ON/OFF — HIGH BRAKE — LOW ENABLE — HIGH FWD/REV — HIGH/LOW ***NOTE:*** (Reference FWD/REV input) For a right-hand screw to drive carrier away from a direct coupled motor, FWD/REV input should be LOW. To drive carrier toward a direct coupled motor, Fwd/Rev inputs should be HIGH.
	5. Loose coupling.	5. Tighten or replace.

Symptom	*Probable Cause*	*Corrective Action*
Actuator shaft and actuator carrier will not move (carrier not at end of stroke). **Red LED on; Green LED on; Fault output is activated.**	1. Motor bearings tight or seized..	1. Replace.
	2. The load may be mechanically jammed causing the motor to stall or drive to fault.	2. Listen while placing hand on load to see if motor is trying to move load. If stalling, determine where jam has occurred. If jam appears to be inside the actuator, consult factory before disassembly. Check Fault output . If in LOW state, deactivate fault condition by the Fault RESET input (S.P.S.T. normally-closed momentary switch) to return to HIGH state. Green LED should remain activated on open-chassis models. ⚠ **CAUTION! Motion may restart on resetting.**
	3. Fault current trip setting too low.	3. Adjust setting.
	4. Dc drive board failure.	4. Confirm and replace.

Symptom	*Probable Cause*	*Corrective Action*
Motor shaft rotates but actuator carrier does not move.	1. Coupling which connects actuator lead screw to motor shaft has come loose.	1. Tighten jaw style coupling through the access hole located on the motor mount spacer.
	2. Failed nut or nut mounting on cylinder-style actuators.	2. Confirm and consult distributor.
	3. Main or reduction belt on belt-drive actuators or belt in reverse-parallel drive on screw-drive actuators broken or drive wheel(s) loose on shaft.	3. Confirm and consult distributor.
	4. Two tensioning screws on belt-drive actuator have loosened causing belt to slip around drive wheel.	4. Refer to assembly/disassembly instructions.

Symptom	*Probable Cause*	*Corrective Action*
Excessive Motor Brush wear.	1. Check for correct motor brush kit installed.	1. Check brushes and brush holder slots for proper size and/or spring tension. Replace with correct brush kit after removing excess carbon buildup from existing brushes.
	2. Application requirements exceeding motor/drive rating.	2. Reduce one or all of these application requirements: Load, speed, accel/decel rate and duty cycle.
	3. Excessive use of dynamic braking.	3. Use a secondary switch to the decel input prior to brake switch to reduce energy of moving mass.

Basic Controller Installation

Before You Begin...

SAFETY CONCERNS

⚠ ***Caution!*** Safety should be a primary concern when installing any motion control system. All Axidyne hardware should be installed to conform with local and national electrical safety codes. Failure to observe safe working practices when installing or servicing this equipment can expose you to dangerous voltages and/or severely damage the equipment.

ENVIRONMENTAL CONSIDERATIONS

Axidyne D.C. Control Systems are designed to operate in an industrial environment. However, severe atmospheric contamination, electrical noise, or temperature extremes can affect system performance. To help avoid performance problems, operate the BCM system within the following environmental guidelines:

Operating Temperature:	0°-50° C (32°-122° F)
Humidity:	10-95%, non-condensing

WIRING GUIDELINES

In general, all electrical components and enclosures must be connected to earth ground through a grounding electrode conductor to provide a low impedance path for ground fault or noise-induced currents.

A single-point grounding setup is recommended and all earth ground connections must be continuous and permanent. Prepare all other components and mounting surfaces prior to installation so that good electrical contact is made between the chassis0 and the mounting surface. Remove the paint (if any) from equipment surfaces where the ground contact will be bolted to a panel and use star washers to ensure solid, bare metal contact.

☠ ***WARNING! Disconnect all a.c. power prior to installation wiring.***

Connections

SETTING SPEED CONTROL

The Analog and SPEED terminals are factory-jumpered for analog speed control. However, if an external potentiometer is to be used for speed control, remove the wire between the SPD terminal on the controller (top board) and the SP terminal on the drive (bottom board).

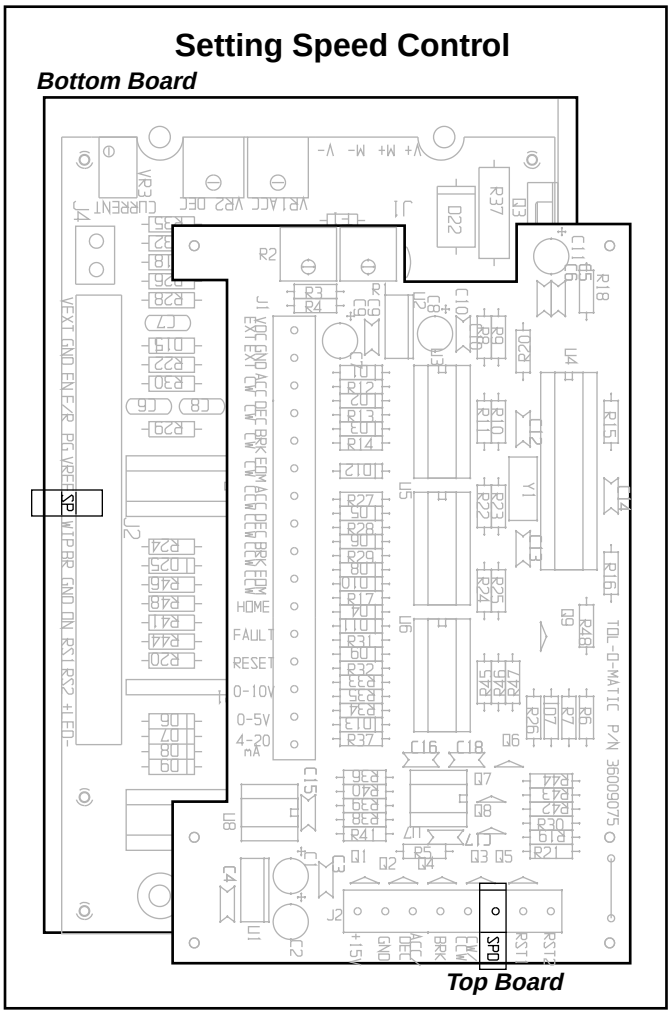


Figure 33

WIRING AC POWER

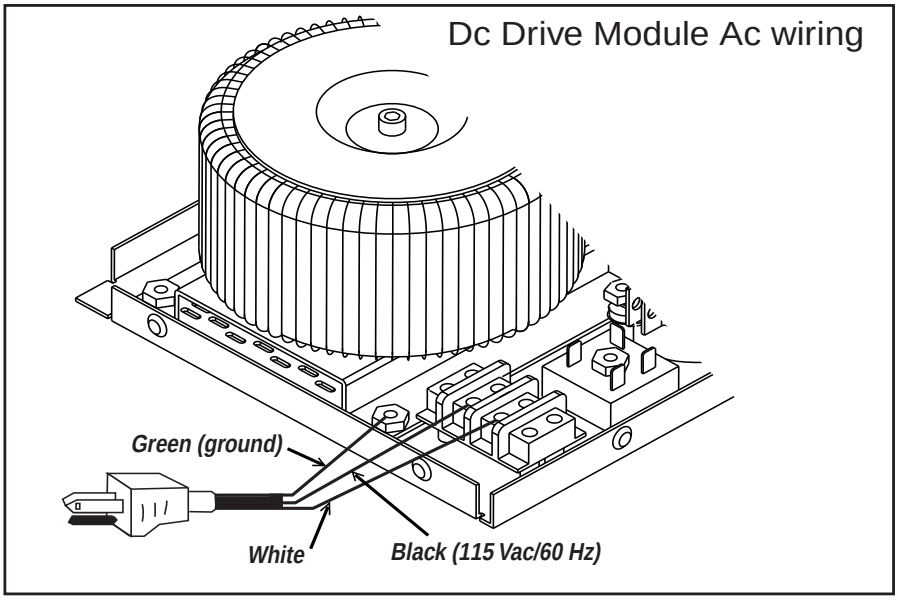


Figure 34

WARNING! All ac power must be disconnected prior to installation wiring. Failure to observe safe working practices when installing or servicing this equipment can expose you to dangerous voltages.

To connect the DM_C to an ac power supply:

1. Refer to Figures 5.2 and 5.3. Connect the BLACK lead to 120 Vac terminal.

2. Connect WHITE wire to NEUTRAL terminal.

3. Connect GREEN wire to CHASSIS GND terminal.

Motor and Drive Connections

MOTOR CONNECTIONS

NOTE: The following instructions apply to all Axidyne dc motors. If a motor package other than Axidyne is to be used, consult the manufacturer's product documentation for wiring instructions.

To connect motor:

1. Refer to Figures 39. Connect motor RED (positive) wire to MOTOR+ terminal on bottom board.

2. Connect motor BLACK (negative) wire to MOTOR- terminal.

NOTE: When positive voltage is present at motor RED lead, motion will be away from motor on Axidyne screw-drive actuators configured with a right-hand lead screw.

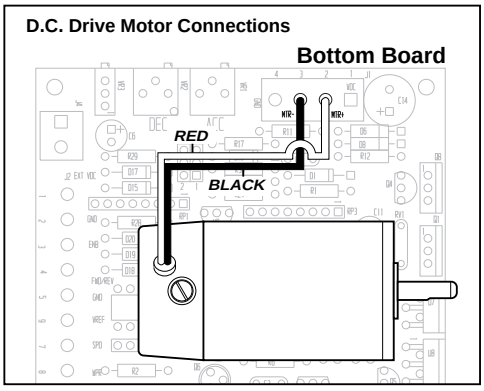


Figure 35

Motor terminals:

1. Estimate motor voltage from speed/torque curve based on maximum drive rating (32 or 48 volts), required motor RPM and torque requirement. Use this value as approximate indicator.

2. Measure with a meter, maximum voltage reading across motor terminals while in motion.

3. Compare this voltage with apparent calculated voltage shown below.

$$V\ (motor) = \left(\frac{T}{K_T} \times R_a\right) + \left(K_E \times N\right)$$

Where
- N = Required application motor speed (RPM/1000)
- KE = Voltage constant (volts/1000 RPM)
- T = Application torque (oz.-in.)
- Ra = Motor armature resistance (ohm)
- KT = Torque constant (oz.-in./Amp)

NOTE: Values should be reasonably close (within 5-10%) to allow for brush voltage and other circuit losses.

Sample Drive Connections

After the motor is connected to the drive, wire the drive terminal block to the BCM Controller Module. Following are instructions for sample drive/controller wiring configurations. It is important to note that in all examples, three modes of operation are available, without the need for any outside control devices:

1. Continuous cycle: Jumper both ACCEL CW and ACCEL CCW to EXT GND. End of stroke switches are used for DECEL inputs only, and system will cycle continuously with adjustable end-of-stroke dwell time.

2. Single cycle: Jumper either one of the ACCEL inputs to EXT GND, and use a normally open, momentary closed input to activate the other, which will command the system to make one complete cycle (both directions)

3. Single move: Connect normally open, momentary closed switches between EXT GND and both ACCEL CW and ACCEL CCW. The actuator will wait at both of the end of travel limits until these switches are active (closed).

ACCEL/DECEL USING REED SWITCHES

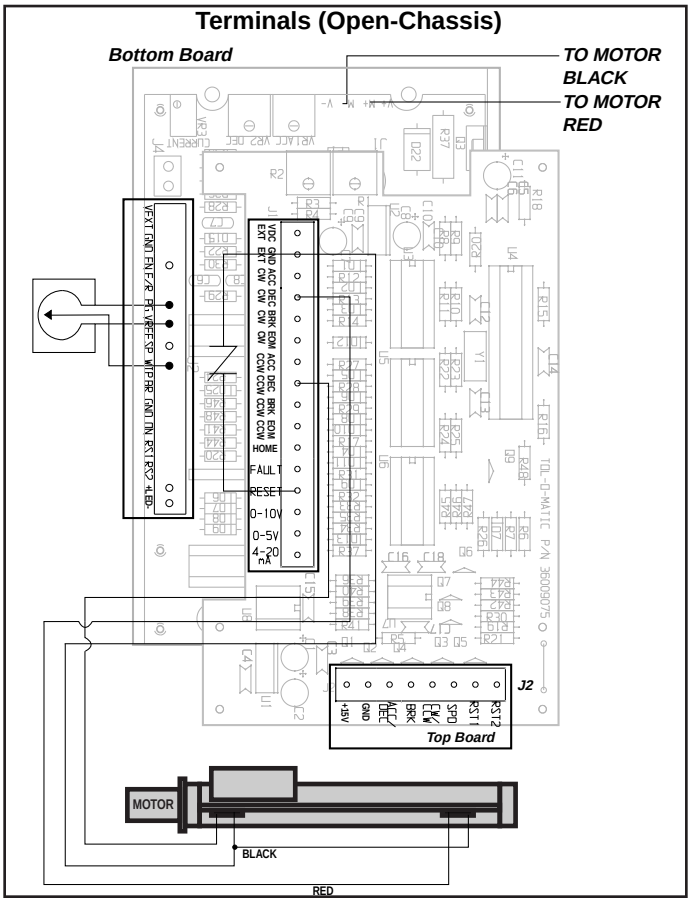


Figure 36

The application illustrated in Figure 36 uses two normally open reed switches (one in each direction) to initiate the DECEL (before end-of-travel). The motion profile for this application is illustrated in Figure 37.

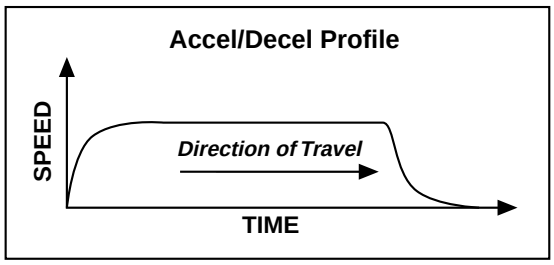


Figure 37

A light-emitting diode connected to the FAULT LED+ and FAULT LED-

terminals indicates a fault condition. A normally closed momentary contact switch connected to the FAULT RESET 1 and FAULT RESET 2 terminals is used to reset the system. An external potentiometer provides variable speed control. The internal power supply is used to power external switches and relays. MOTOR+/MOTOR- terminals supply voltage to a d.c. brush-type permanent magnet motor mounted on an Axidyne cylinder-style screw-drive actuator.

When the drive is enabled, and an ACCEL input is active, (shorted to GND) the motor accelerates (at a rate determined by the internal ACCEL potentiometer) until constant velocity is reached (as limited by the external potentiometer). The motor then runs at constant velocity until the first normally open reed switch is closed, in which case deceleration is initiated (at a rate determined by the internal DECEL potentiometer). At the same time, the DWELL timer begins counting down. When the dwell timer has timed out, the motor direction is reversed, and when the ACCEL input in the other direction is active (shorted to GND) acceleration in the opposite direction is initiated (at a rate determined by the internal ACCEL potentiometer).

NOTES:

- Variable time interval between direction changes is determined by internal DWELL potentiometer setting.
- For applications using internal power supply, combined amperage draw of switches and relays may NOT exceed 100 mA.
- On-board 15 Vdc power supply (LED+) for powering drive optical isolation (i.e. EXT. Vdc) and end-of-stroke Reed or Hall Effect switches only.

ACCEL/DECEL WITH DYNAMIC

BRAKING USING REED SWITCHES

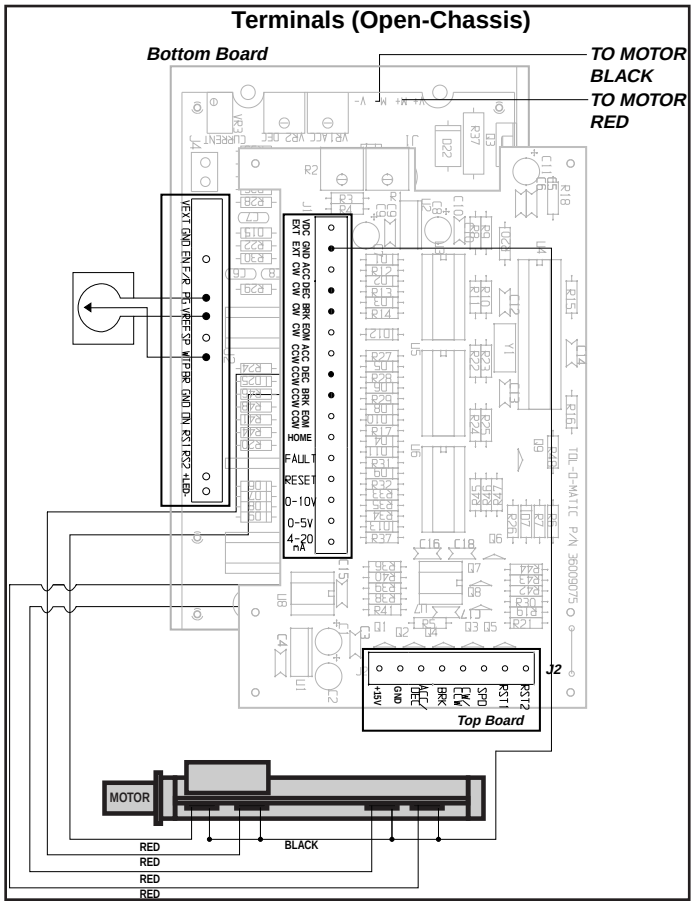
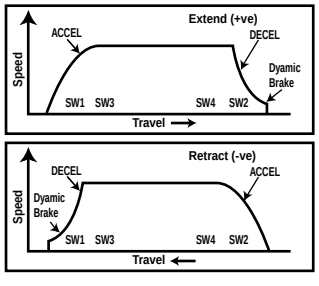


Figure 38

Provides move between switches 1 and 2 with ACCEL at start and DECEL plus dynamic braking at STOP. DECEL is initiated by switches 3 and 4.



	ON/OFF	BRAKE	FWD/REV	ENABLE
DEFAULT	Hi	Hi	Hi	Hi
RESET 1	Lo	Hi	Hi	Hi
RUN (-ve)	Hi	Lo	Hi	Hi
DECEL (SW3)	Lo	Lo	Hi	Hi
STOP (SW1)	Lo	Hi	Hi	Hi
RESET 2	Hi	Hi	Lo	Hi
RESET 3	Lo	Hi	Lo	Hi
RUN (+ ve)	Hi	Lo	Lo	Hi
DECEL (SW4)	Lo	Lo	Lo	Hi
STOP (SW2)	Lo	Hi	Lo	Hi
RESET 4	Hi	Hi	Hi	Hi

Figure 39

The application illustrated in Figure 38 uses four normally open reed

switches (two in each direction) to initiate the DECEL (before end-of-travel) and BRAKE (at end-of-travel). The motion profile for this application is illustrated in Figure 39.

A light-emitting diode connected to the FAULT LED+ and FAULT LED- terminals indicates a fault condition. A normally closed momentary contact switch connected to the FAULT RESET 1 and FAULT RESET 2 terminals is used to reset the system. An external potentiometer provides variable speed control. The internal power supply is used to power external switches and relays. MOTOR+/MOTOR- terminals supply voltage to a d.c. brush-type permanent magnet motor mounted on an Axidyne cylinder-style screw-drive actuator.

When the drive is enabled, and an ACCEL input is active, (shorted to GND) the motor accelerates (at a rate determined by the internal ACCEL potentiometer) until constant velocity is reached (as limited by the external potentiometer). The motor then runs at constant velocity until the first normally open reed switch is closed, in which case deceleration is initiated (at a rate determined by the internal DECEL potentiometer). At the same time, the DWELL timer begins counting down. The motor will decelerate (at a rate determined by the internal DECEL potentiometer) until the second reed switch in the direction of travel is closed to initiate the BRAKE, which will cause the motor to stop nearly instantaneously. When the dwell timer has timed out, the motor direction is reversed, and when the ACCEL input in the other direction is active (shorted to GND) acceleration in the opposite direction is initiated (at a rate determined by the internal ACCEL potentiometer).

NOTES:

- Variable time interval between direction changes is determined by internal DWELL potentiometer setting.
- For applications using internal power supply, combined amperage draw of switches and relays may NOT exceed 100 mA.
- On-board 15 Vdc power supply (LED+) for powering drive optical isolation (i.e. EXT. Vdc) and end-of-stroke Reed or Hall Effect switches only.

ACCEL/DYNAMIC BRAKING USING REED SWITCHES

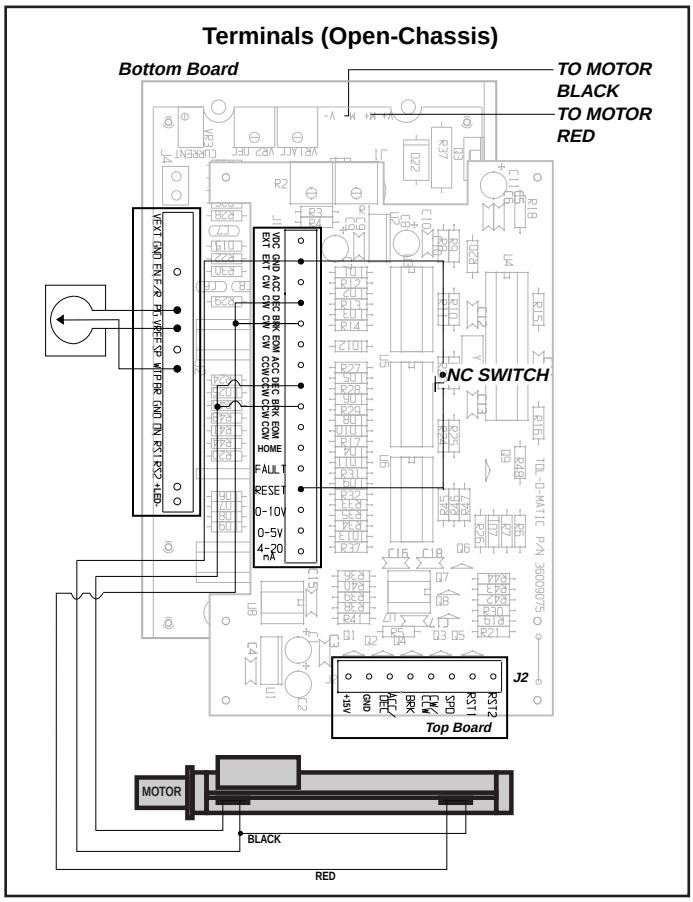


Figure 40

The application illustrated in Figure 40 uses two normally open reed switches to signal end of travel and initiate dynamic braking on a screw-drive actuator with variable acceleration. Each reed switch is connected to both the DECEL and BRAKE terminals for its direction of travel.

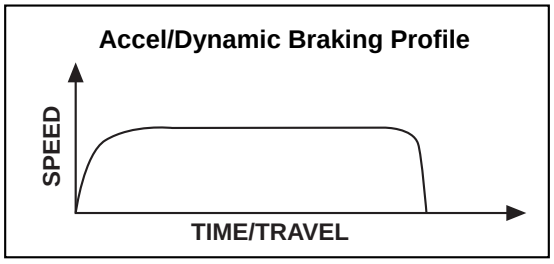


Figure 41

A light-emitting diode connected to the FAULT LED+ and FAULT LED- terminals indicates a fault condition. A normally closed momentary

contact switch connected to the FAULT RESET 1 and FAULT RESET 2 terminals is used to reset the system. An external potentiometer provides variable speed control. The internal power supply is used to power external switches and relays. MOTOR+/MOTOR- terminals supply voltage to a d.c. brush-type permanent magnet motor mounted on an Axidyne cylinder-style screw-drive actuator.

When the d.c. drive is enabled, the motor will accelerate (at a rate determined by the internal ACCEL potentiometer setting) until it reaches constant velocity (determined by the external potentiometer). The motor then runs at constant velocity until a normally open reed switch is closed, in which case, both DECEL and BRAKE are initiated, to stop the motor nearly simultaneously. At the same time, the DWELL timer counts down. When that has timed out, the motor direction is reversed, and when the ACCEL input in the other direction is active (shorted to EXT GND) acceleration in the opposite direction is initiated (at a rate determined by the internal ACCEL potentiometer).

NOTES:

- Variable time interval between direction changes is determined by internal DWELL potentiometer setting.
- For applications using internal power supply, combined amperage draw of switches and relays may NOT exceed 100 mA.
- On-board 15 Vdc power supply (LED+) for powering drive optical isolation and end-of-stroke reed or Hall Effect switches only.

Current Trip Potentiometer

ADJUSTMENT PROCEDURE

Caution! Make sure Current Limit Potentiometer is set halfway between CW and CCW setting before powering up system. (Located on drive board at VR3.)

Drive faults out upon power-up at rated application duty requirement:

1. Slowly increase amperage on Current Trip potentiometer (CW) in small increments.

2. Run D.C. system at rated duty requirement. If drive faults again, reset and repeat step 1 above.

3. Repeat step 2, above, as necessary until drive is operational.

Drive is operational upon power-up at rated application duty requirement:

1. Slowly decrease amperage on Current Trip potentiometer (CCW) in small increments.

2. If drive does not fault after 2 to 3 minutes of running, repeat step 1 until drive faults.

3. When drive faults, reset and slowly increase amperage on current trip potentiometer (CW) in small increments.

4. If drive faults again when running, repeat step 3.

5. If drive remains operational, no further adjustment should be necessary.

Mounting Guidelines

For mounting the open chassis DM_C see dimensional details in figure 32 on page 56.

CAUTION! When mounting system components, do NOT place heat-producing devices underneath or near the DM_C.

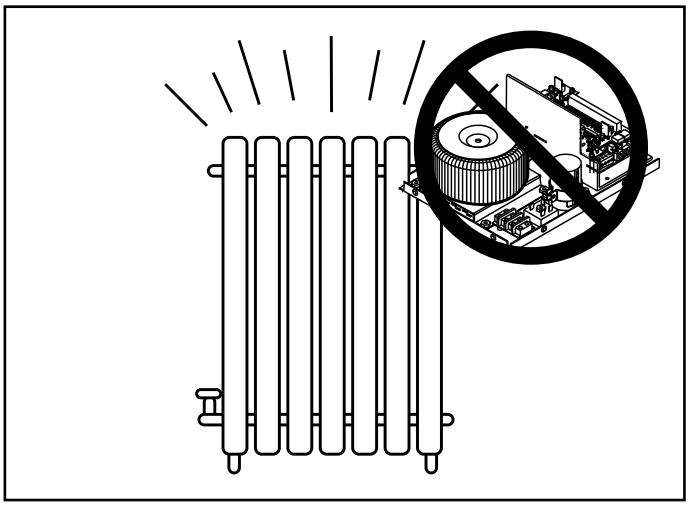


Figure 42

Symptom	Probable Cause	Corrective Action
Motor runs excessively hot and motor torque seems to diminish. Motor case temperature exceeds 180° F (82.2° C).	1. Excessive loading.	1. Reduce surrounding ambient temperature.
	2. High ambient temperature which exceeds motor temperature limit of 105° F (40.5° C).	2. Determine if motor/drive torque, speed and duty cycle rating is correct for given application.
	3. Excessive motor losses.	3. Compare apparent thermal resistance (Rth) value with actual thermal resistance limit:

Calculated R_{th}:

$$R_{th} = (\theta_a - \theta_A) \div P_L \quad (°C / Watt)$$

NOTE:

R_{th} (Apparent) should be ≤ R_{th} (motor specification) see below

$$P_L = I_a \times (V - (0.74 \times K_T \times N))$$

where:

θ_a = *Armature case temperature* (125°*C* max.)
θ_A = *Ambient temperature* (°*C*)
P_L = *Power loss in motor* (*Watts*)
V = *Measured voltage across motor terminal*
I_a = *Measured amperage into the motor*
K_T = *Torque constant* (*oz.–in./Amp*)
N = *RPM*/1000

Specified values of Rth and KT as a function of motor model:

MOTOR	Rth= °C/watt	KT= oz-in./amp.
MRB231	4.0	17.1
MRB241	2.8	19.75
MRB342	2.1	20.35
MRB401	1.09	30.5
MRB402	0.90	48.4

Symptom	*Probable Cause*	*Corrective Action*
Erratic Speed	1. Varying loads and/or external forces.	1. Readjust any load misalignment which may cause varying torque. If loads vary, then analog speed signal or potentiometer speed setting must be adjusted accordingly.
	2. Worn or sticking brushes.	2. Replace brushes. Check brush holder slots for obstructions.
	3. Worn bearings.	3. Repair or replace motor.
	4. Faulty potentiometer.	4. Check and replace 10K Ω potentiometer.

Symptom	*Probable Cause*	*Corrective Action*
Reversed motor rotation or actuator carrier going in wrong direction.	1. Motor leads wired to drive terminal blocks are reversed.	1. Reverse lead wires.

Symptom	*Probable Cause*	*Corrective Action*
Actuator shaft and actuator carrier will not move (carrier not at end of stroke). **Red LED on; Fault output is Low.**	1. No speed reference voltage at analog speed or potentiometer wiper input.	1. Before trying the additional steps listed below, try to reset drive by momentarily opening up the normally closed contacts on Reset input. Check to see if red LED on drive goes off.
	2. Motor bearings tight or seized.	2. Replace.
	3. Brushes may be excessively worn and do not touch commutator, or brushes stick.	3. Clean brushes and brush holder so brushes move freely. Replace if necessary.

Symptom	Probable Cause	Corrective Action
continued . . .	4. The load may be mechanically jammed causing the motor to stall or drive to fault.	4. Listen or place hand on load to see if motor is trying to move load. If stalling, determine where jam has occurred. If jam appears to be inside the actuator, consult factory before disassembly. Check Fault Output (if open chassis drive, red LED should be illuminated on drive board). If in low state, deactivate fault condition by the Fault Reset Input (S.P.S.T. normally-closed momentary switch) to return to high state. Green LED should be activated on open chassis models.
	5. Fuse blown on ac incoming power line.	5. Replace with cylinder style 5 Amp fuse.
	6. No voltage present at Ext. Vdc Input which powers the motion inputs on drive (Inputs: ACCEL CW, DECEL CW, ACCEL CCW, DECEL CCW, BRAKE CW, BRAKE CCW.)	6. Ext. Vdc Input should be powered by external I/O power supply capable of 5-25 Vdc @ 125 mA required rating or I/O powered by internal power supply (i.e. “Fault LED +” output.)
	7. Drive inputs are in wrong signal state (High/Low) or wired incorrectly.	7. The ACCEL input for the motor direction of travel must be shorted to GND. NOTE: (Reference CW/CCW Input) For a right-hand screw to drive carrier away from motor, rotation direction should be CCW. To drive carrier toward motor, rotation direction should be CW.
	8. Fuse blown on 5Vdc power supply.	8. Replace fuse.

Symptom	Probable Cause	Corrective Action
Motor shaft rotates but actuator carrier does not move.	1. Coupling which connects actuator to motor shaft has come loose.	1. Tighten jaw style coupling through the access hole located on the motor mount spacer.
	2. Actuator acme or ball nut has come loose from nut bracket on cylinder-style actuators.	2. Confirm and consult distributor.
	3. Main or reduction belt break on belt-drive actuators.	3. Confirm and consult distributor.
	4. Two tensioning screws on belt-drive actuator has loosened causing belt to slip around drive wheel.	4. Refer to assembly/disassembly instructions.

Symptom	Probable Cause	Corrective Action
Visible status LED's on drive board show Red ON and Green ON.	1. D.C. drive board failure.	1. Confirm and replace.

Symptom	Probable Cause	Corrective Action
Excessive Motor Brush wear.	1. Check for correct motor brush kit installed.	1. Check brushes and brush holder slots for proper size and or spring tension. Replace with correct brush kit after removing excess carbon buildup from existing brushes.
	2. Application requirements exceeding motor/drive rating.	2. Reduce one or all of these application requirements: Load, speed, accel/decel rate and duty cycle.
	3. Excessive use of dynamic braking.	3. Use a secondary switch to the decel input prior to brake switch to reduce energy of moving mass.

Symptom	*Probable Cause*	*Corrective Action*
Motor will not brake on switch input.	1. Jumper J1 selection improperly jumped. 2. Faulty wiring between Drive and Basic Controller.	1. Locate jumper J1 and check that pins 2-3 are jumped. 2. BRAKE Output on controller should be wired to BRAKE Input on Drive.

Symptom	*Probable Cause*	*Corrective Action*
Motor will not accel/decel with High or Low signal to ON/OFF Input.	1. Jumper J1 selection improperly jumped. 2. Faulty wiring between Drive and Basic Controller. 3. Faulty wiring to switch input or faulty switch.	1. Locate jumper J1 and check that pins 2-3 are jumped. 2. FWD/REV Output on controller should be wired to FWD/REV Input on Drive. 3. Check wiring from switch to BRAKE Input. Check switch for continuity.

TOL-O-MATIC, INC.
3800 County Road 116
Hamel, MN 55340
612.478.8000 Telephone
612.478.8080 Fax
http://www.tolomatic.com