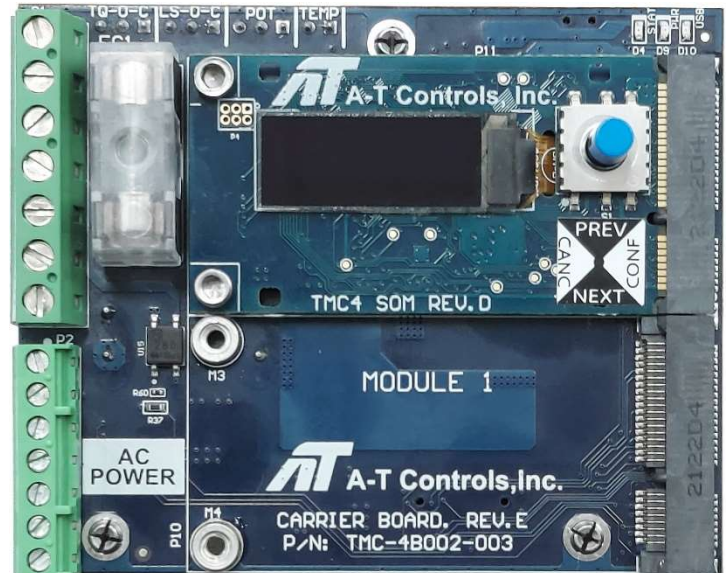


Installation and Operation Manual

TMC-4 Control Card (v3.00)

Features

- 4-20mA, 0-10VDC, 0-5VDC, Potentiometer, Open/Close command inputs
- 4-20mA or 0-10VDC self-powered transmitter
- Programmable fail positions on loss of command signal: In Place, CW, CCW, % Value
- LCD screen with 5-point joystick for menu navigation
- Expansion module slot
- External brake control for spring return actuators
- Motor temperature monitor by thermistor input
- Sleep mode



Overview

The Triac TMC4 control card is a motor controller intended to be used in electric actuators rated for running current loads up to 10 amps. The TMC4 control card is available in two versions. An AC version can drive reversible AC motors with a 85-250VAC supply voltage, or a DC version can drive DC motors with a 24VDC supply voltage.

The LCD screen provides easy viewing of status and configuration while a 5-point joystick allows easy navigation through the various configuration menus and settings. An optional module slot permits expansion on the capabilities of the controller to support various communication busses or other control and interface options.

The TMC4 provides two main positioning options; proportional or two position. When operated as a proportional controller, the TMC4 compares an external command signal to a position feedback from a potentiometer connected to the output shaft of the actuator. When the two signals differ by a given magnitude, the TMC4 controller will energize the motor to operate either clockwise or counterclockwise to reduce the difference between the two signals. When operated as two-position controller, the TMC4 receives an open or close command, and drives the actuator clockwise or counterclockwise until activation of a position limit switch is detected.

The TMC4 is designed to be mounted using PEM Snap-Top spacers for easy mounting and removal without the need for screws, while still providing a secure mount for most conditions.

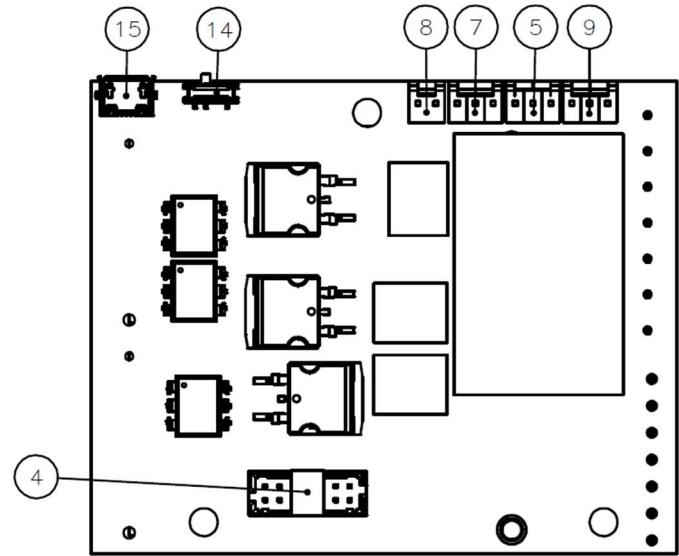
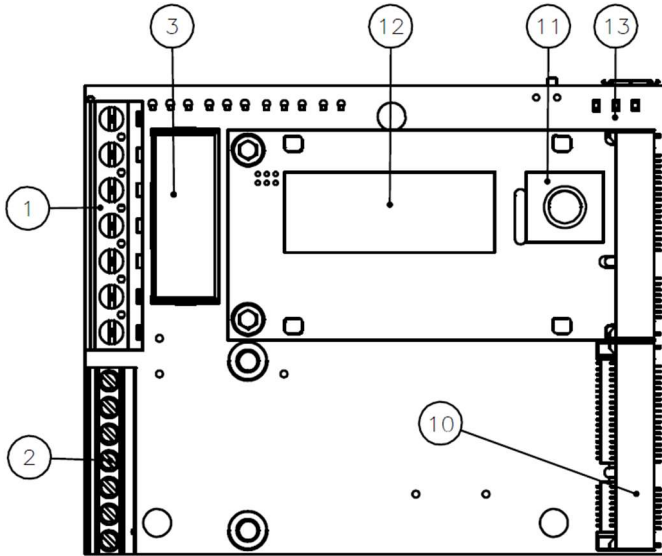


The TMC4 must be installed in an appropriate enclosure to avoid electrical shocks. When operating, high voltages will be present on the controller, requiring caution during the installation process. Power should be deenergized before making wire connections to the TMC4. A heater and thermostat should be used when possible, to prevent condensation.

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1. Layout



1 – Power / Motor Terminals (P1)

Terminals for connecting supply power, motor connections, enclosure heater, and for external brake for spring return actuators. Refer to 2.1 for details.

2 – Signal Terminals (P2)

Terminals for connecting control signal, analog feedback signal, +24VDC output and Earth/chassis ground connection. Refer to 2.1 for details.

3 – Fuse

The fuse is a standard 5x20mm time delay fuse rated for 10A, 250V. Replacement fuses shall not exceed this maximum rating.

4 – Expansion Header (P4) (option)

14 point connection header for optional accessory interfaces.

5 – Position Switches Header (P5)

3 point connection header for positioning limit switches when required for actuator control. Switches connected to this header provide position limits when operating as two-position actuator, and provide Open/Close status for the TMC4.

7 – Feedback Potentiometer Header (P7)

3 point connection header for feedback potentiometer when required for actuator control. This provides positioning feedback for when operating as a proportional control actuator.

8 – Thermistor Header (P8) (option)

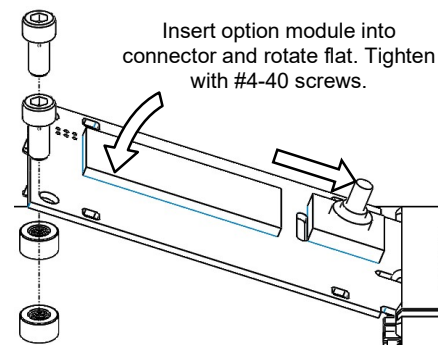
2 point connection header for optional motor temperature monitor thermistor to prevent motor overheating.

9 – Stop (Torque) Switches Header (P9)

3 point connection header for motor stop limit switches when required for actuator control. Switches connected to this header will stop the motor when activated, without providing Open/Close status. These switches are useful when driving motor directly with the control card, rather than driving the motor through limit or torque switches. This would typically be for DC motor applications, where operating motor through limit switches is not practical.

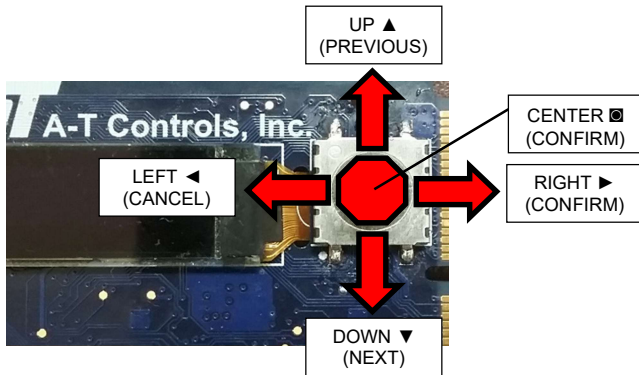
10 – Option Module Slot

mSATA / Mini PCI Express connection point for optional feature modules such as for serial communication or other control types. Option modules can be installed with (2) 4-40 screws, 3/16" to 1/4" in long.



11 – Joystick

5-way joystick (up, down, left, right, center) for menu navigation and adjustment of parameters and settings.



Direction	Function
UP ▲ [PREVIOUS]	<ul style="list-style-type: none"> Navigate up in menus. Choose previous setting selection or increase setting value. Motor CCW in Manual Mode or POSITION CONFIG calibrate settings.
DOWN ▼ [NEXT]	<ul style="list-style-type: none"> Navigate down in menus. Choose next setting selection or decrease setting value. Motor CW in Manual Mode or POSITION CONFIG calibrate settings.
LEFT ◀ [CANCEL]	<ul style="list-style-type: none"> Navigate left in menus. Return to previous menu screen or exit menu subgroup. Cancel or exit setting without saving.
RIGHT ▶ or CENTER ◼ [CONFIRM]	<ul style="list-style-type: none"> Navigate right in menus. Enter parameter screen to adjust setting. Parameter value will flash indicating it can be changed. Confirm or save setting when finished changing.

NOTE: When incrementing/decrementing a setting value, the value step increases in value every 6 presses for more rapid adjustment. Reset the step back to +1 by pressing back in opposite direction.

12 – Display

OLED screen to show actuator status and menu options. Display will enter a sleep mode where the display is shut off if joystick has not been used for 5 minutes. Remote functionality is still enabled while in sleep mode. Status LED will flash while in sleep mode. Pressing any direction on joystick will wake up display.

13 – LEDs



Status: Flashes 1 second on when in Sleep Mode.

Power: Solid to indicate the TMC4 is powered either by the supply terminals, or through the USB connector.

USB: Solid to indicate USB cable is connected to the micro USB connector.

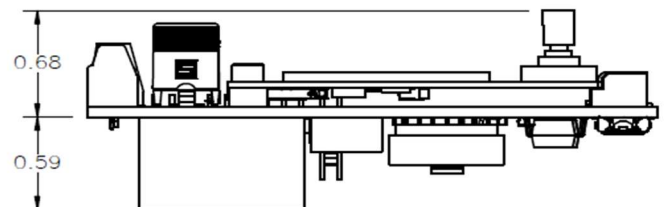
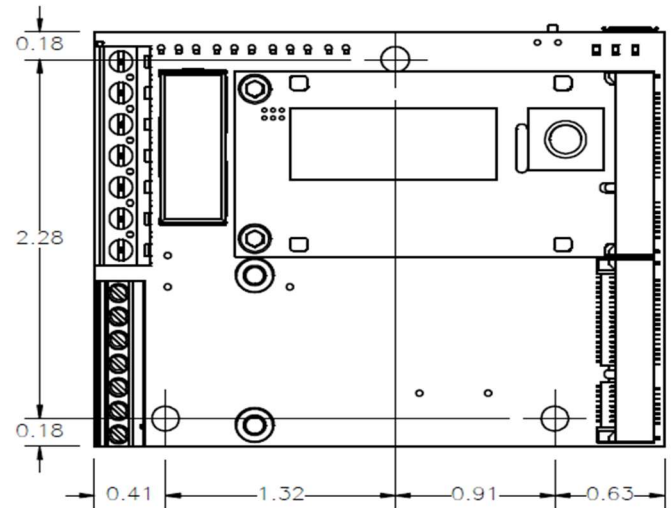
14 – Run/Program Switch

Used by factory for programming and setup. Switch should be in off position (pointed away from USB connector) for normal operation.

15 – USB Connector

Micro USB receptacle. Used by factory for programming and setup. Can be used to power board for configuration without having supply power connected.

1.1. Dimensions



2. Wiring and Operation

The supply voltage and motor should be connected as shown in the wiring section.

SUPPLY

Supply voltage is connected to terminals (P1-2) and (P1-3). Line/+ should be connected to (P1-2) and Neutral/- should be connected to (P1-3). The AC version can accept a single phase supply voltage of 85-250VAC, 50-60Hz, while the DC version can accept a supply voltage of 24VDC. An Earth ground connection is provided on terminal (P2-7).

MOTOR

For AC type motors, the winding that drives the actuator clockwise should be connected to the Motor CW terminal (P1-5), and the winding that drives the actuator counterclockwise should be connected to the Motor CCW terminal (P1-6). The motor neutral wire should be connected to the Motor N terminal (P1-7).

For DC type motors, the wires should be connected to the Motor CW (P1-5) and Motor CCW (P1-6) terminals only. When operating DC motors, the Motor CW and Motor CCW terminals switch polarity to the motor. A clockwise operation will apply the positive supply voltage to the Motor CW terminal (P1-5), and a counterclockwise operation will apply the positive supply voltage to the Motor CCW terminal (P1-6). The motor wires should be connected accordingly.

BRAKE

An external brake connection is provided on terminal (P1-4) to operate spring return type actuators that use a motor brake to hold the actuator in position. The output is the same voltage as the supply voltage. The maximum brake output rating of 300mW, 350V, 120mA continuous load must not be exceeded.

The AC version of the TMC4 keeps the external brake output energized until either of the motor outputs is activated, at which point, the external brake output deenergizes. The DC version of the TMC4 keeps the external brake output deenergized until the motor outputs are activated, at which point the external brake output energizes.

The brake setting is currently configured exclusively for use on Triac SRX series actuators and is not configurable. Care must be taken when using with other type of actuator motor brakes.



Using brake output on incorrect brake type may damage the TMC4 card, brake or actuator.

HEATER

The TMC4 also provides a dedicated terminal (P1-1) for a heater output that is internally connected directly to the Line/+ supply terminal (P1-2). An enclosure heater is strongly recommended to prevent moisture inside the actuator enclosure. The other heater connection should either be to motor neutral terminal (P1-7) or supply Neutral/- terminal (P1-3).

I/O

Standard analog control inputs for 4-20mA, 0-5V, 1-5V, 0-10V, 2-10V should be connected to signal input A1 terminals (P2-2) and (P2-3). 0-20mA and 0-10V analog feedback signals should be connected to A2 terminals (P2-4) and (P2-5). This feedback signal is self-powered by the TMC4 controller, so no loop power is required by the user.

The TMC4 can also be configured to operate by a variable resistor input, such as a slide wire or potentiometer by connecting the ends across the +24VDC (P2-1) and AGND (P2-3), and the wiper to the input A1 terminal (P2-2).

The +24VDC output across (P2-1) and (P2-6) is available to drive a single device up to 30mA or use with handheld loop calibrator set as 2-wire transmitter to locally control the actuator while conserving battery power. Refer to wiring diagrams in following section.

The input A1 and output A2 terminals also serve to operate as a two-position actuator when configured for ON-OFF command type using an external 12-24VDC signal, or using the internally supplied +24VDC output. In ON-OFF command type, A1 terminal (P2-2) functions as the Open/CCW input, and A2 terminal (P2-4) functions as the Close/CW input. This can be useful if driving AC motor with isolated low power command signal.

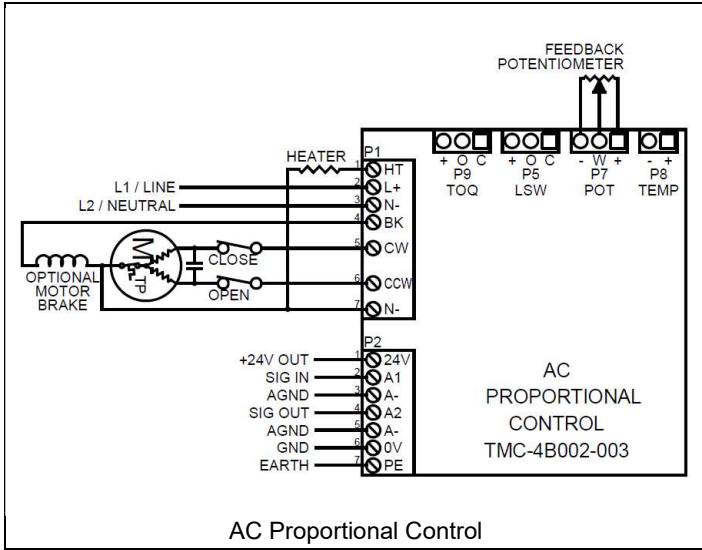
NOTE: If driving the motor through limit switches, the actuator can be operated like a standard on/off, but will not display end of position unless limit switches are wired to the on-board position limit switch connection header (P5).

2.1. Terminals

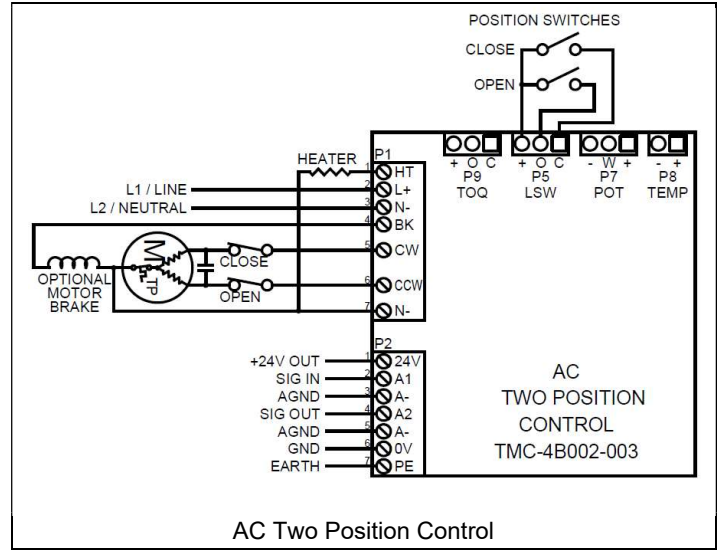
(P1) Power / Motor Terminals		Function
1	Heater L/+	Supply power output for heater. Internally connected to Supply L/+ terminal.
2	Supply L/+	Supply Power Line or (+)
3	Supply N/-	Supply Power Neutral or (-)
4	External Brake	Output for spring return electric actuator brakes. Switches supply power when motor outputs are energized. AC version: Switch off when motor on. DC version: Switch on when motor on.
5	Motor CW	AC version: Energize clockwise motor winding. DC version: Switch (+) supply voltage for clockwise operation.
6	Motor CCW	AC version: Energize counterclockwise motor winding. DC version: Switch (+) supply voltage for counterclockwise operation.
7	Motor N	Internally connected to Supply N/- terminal. Can be used for second heater connection. AC version: Motor neutral DC version: No motor functionality

(P2) Signal / Comm Terminals		Function
1	+24V Out	Auxiliary 24VDC output.
2	I/O 1 (A1) Signal In	Command signal input.
3	Signal GND	Command signal reference.
4	I/O 2 (A2) Signal Out	Feedback signal output.
5	Signal GND	Feedback signal reference.
6	GND / 0V	0V reference for +24V output.
7	Earth	Connected to enclosure through TMC4 mounting bracket.

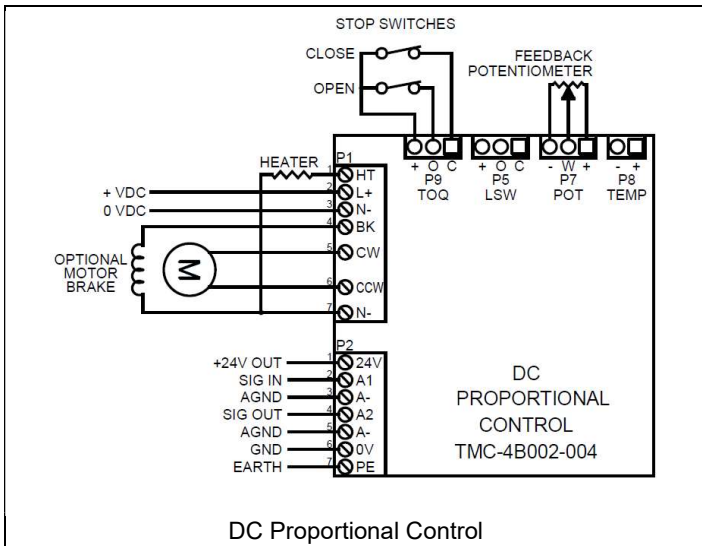
2.2. Wiring Diagrams



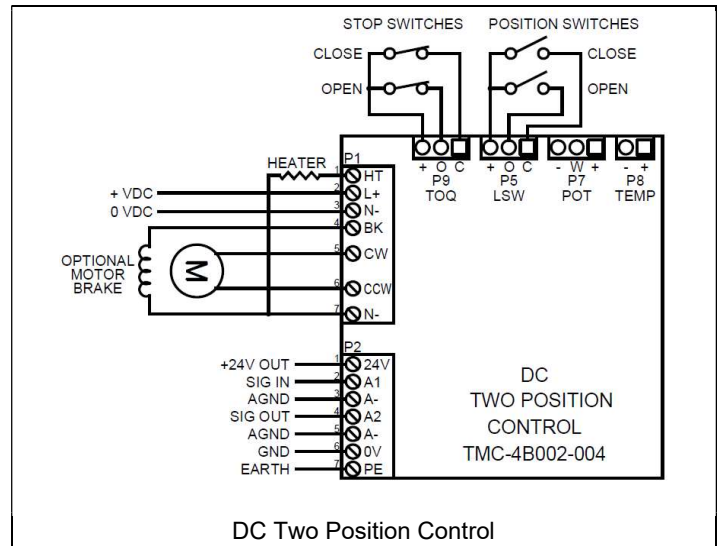
AC Proportional Control



AC Two Position Control

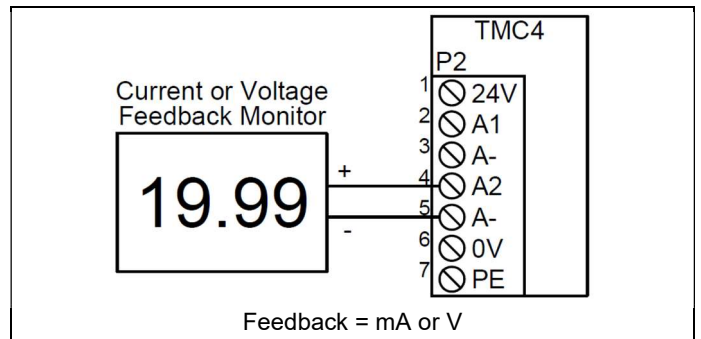
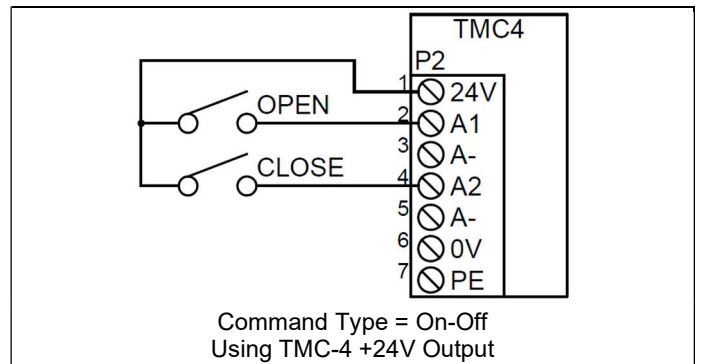
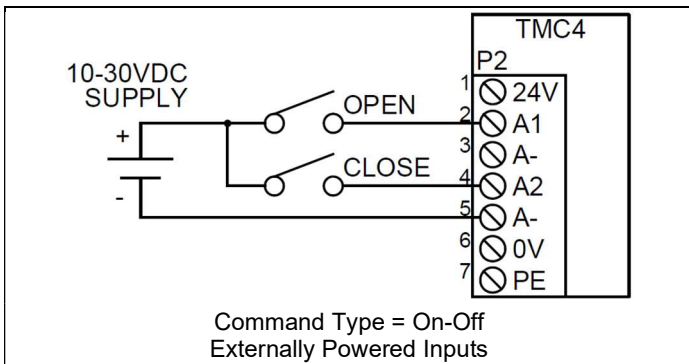
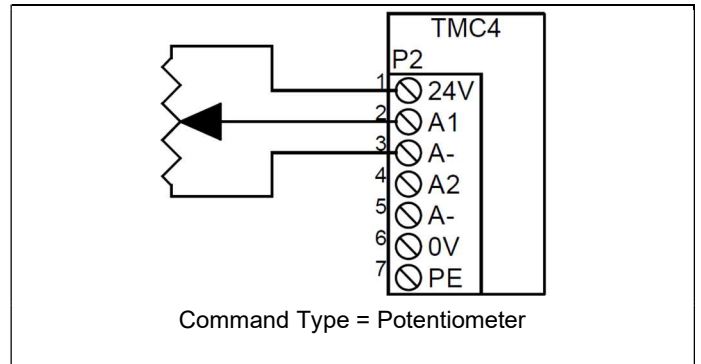
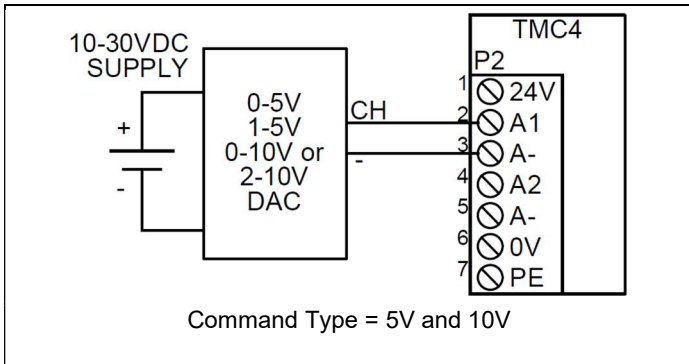
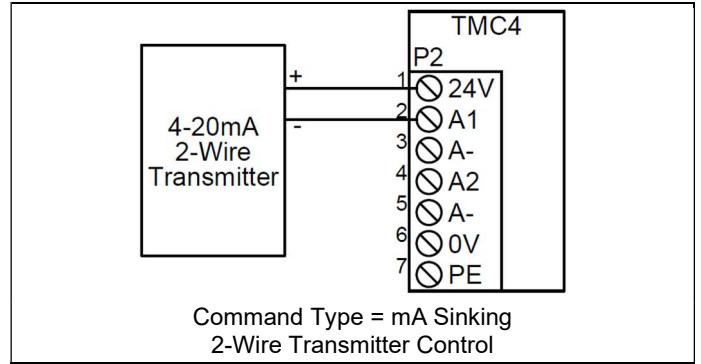
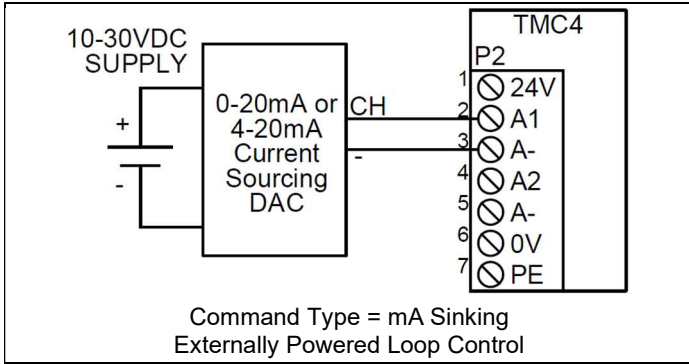


DC Proportional Control

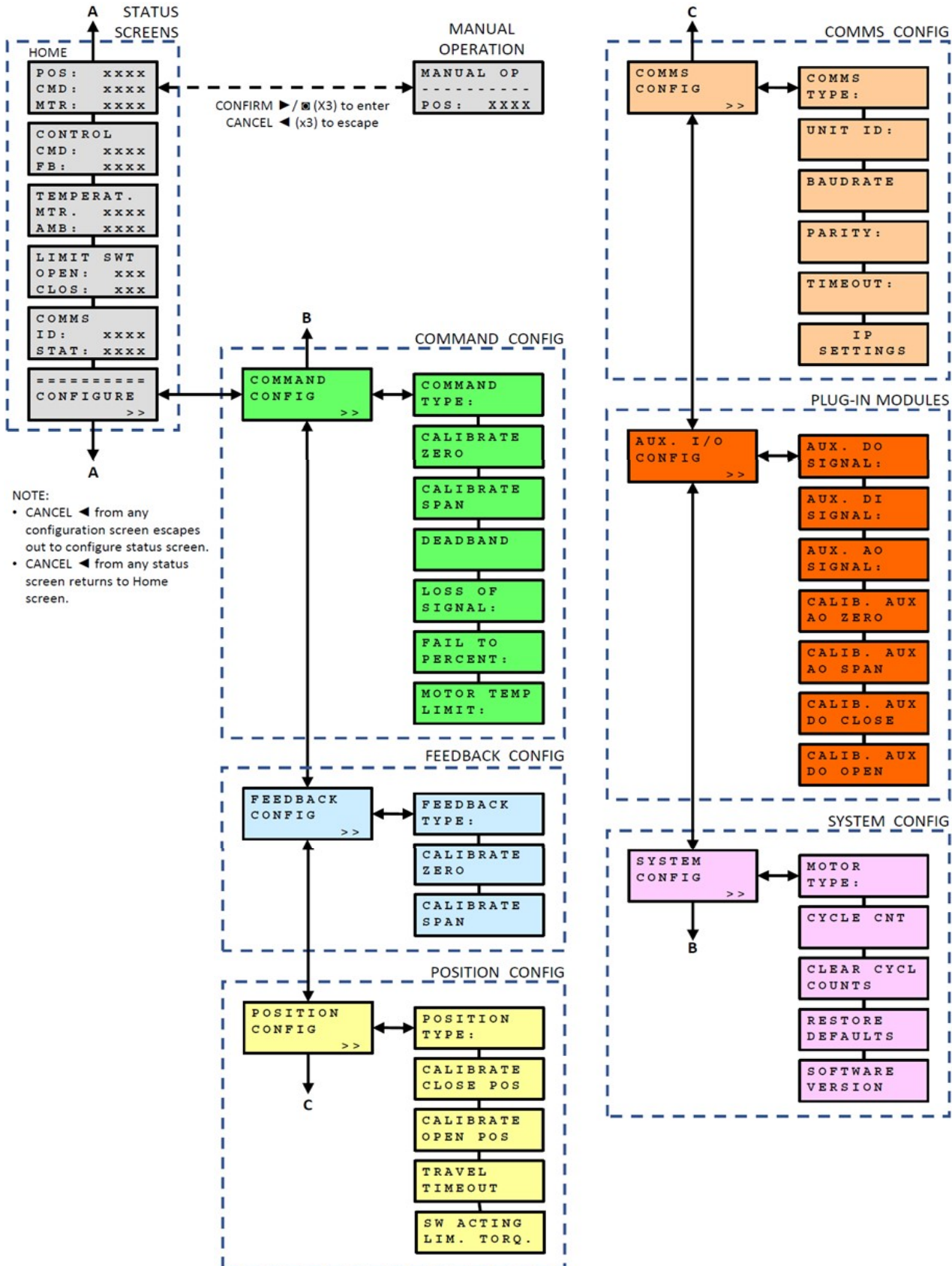


DC Two Position Control

2.3. Input / Output Signal Configurations



3. Menu



3.1. STATUS Screens / MANUAL Mode

The **STATUS** screen group contains various screens displaying functional information such as positioning values, motor status and control parameters. Pressing [CANCEL ◀] from any screen will return to the Home screen. Pressing [CONFIRM ▶/Ⓚ] three times from the Home screen will enter a manual control screen where the actuator can manually be controlled open or close with the joystick. Pressing [CANCEL ◀] three times from the manual control screen escapes back to the Home screen.

<pre> POS : xxxx CMD : xxxx MTR : xxxx </pre> <p>Home</p>	<p>POS: Current travel position. Percentage with "Position Type" set to Potentiometer positioning in POSITION CONFIG submenu. OPEN, N/A, or CLOSE with "Position Type" set to Limit Switch positioning in POSITION CONFIG submenu.</p> <p>CMD: Setpoint command position. Percentage with "Position Type" set to Potentiometer positioning in POSITION CONFIG submenu. 0.0%, 100.0% or STOP with "Position Type" set to Limit Switch positioning in POSITION CONFIG submenu. May show LOST if command signal is disconnected depending on command type.</p> <p>MTR: Motor status. OPEN, CLOSE or IDLE If motor temperature limit feature is enabled, will display as HEAT DELAY during forced motor off periods while traveling.</p>
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<pre> CONTROL CMD : xxxx FB : xxxx </pre> <p>Control</p>	<p>CMD: Command signal type set in "Command Type" setting in COMMAND CONFIG submenu</p> <p>FB: Feedback signal type set in "Feedback Type" setting in FEEDBACK CONFIG submenu.</p>
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<pre> TEMPERAT . MTR : xxxx AMB : xxxx </pre> <p>Temperature</p>	<p>MTR: Motor temperature. Only displays with motor temperature monitoring option connected and enabled.</p> <p>AMB: Ambient temperature of TMC4 electronics. Note this may be slightly higher than internal ambient temperature of the installation enclosure.</p>
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<pre> LIMIT SWT OPEN : xxx CLOS : xxx </pre> <p>Position & Stop Switches</p>	<p>Alternates between showing state of Position limit switches connected to (P5) and Stop/Torque switches connected to (P9). Switch state is determined by N.O. or N.C. contact logic set in POSITION CONFIG submenu.</p> <p>OPEN: State of Open Position or Stop limit switch. ON if limit switch activated. OFF if limit switch is not activated.</p> <p>CLOS: State of Close Position or Stop limit switch. ON if limit switch activated. OFF if limit switch is not activated.</p>
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<pre> COMMS ID : xxxxx STAT : xxxxx </pre> <p>Communication</p>	<p>ID: Value set in "Unit ID" setting in COMMS CONFIG submenu.</p> <p>STAT: Communication status. Indicates if communication is active, idle or lost. Shows time of last communication.</p>
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<pre> ===== CONFIGURE >> </pre> <p>Configure</p>	<p>Enters configuration submenus. Note, remote command signals will not operate actuator when entering configuration settings.</p>
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<pre> MANUAL OP ----- POS : xxxxx </pre> <p>Manual Mode</p>	<p>Manually operate actuator with joystick. Press [CONFIRM ▶/Ⓚ] 3x times to enter. Press [CANCEL ◀] 3x to escape back to Home screen. [PREVIOUS ▲] energizes CCW motor output. [NEXT ▼] energizes CW motor output.</p>
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3.2. COMMAND CONFIG submenu

The **COMMAND CONFIG** menu group contains various parameters associated with the control and response of the actuator. The command signal type and limits are set in this submenu, as are loss of signal behavior and deadband.

COMMAND TYPE: xxxxx	Sets type of command signal used. Zero and Span should be recalibrated when changed. <u>DEFAULT = mA Sink</u> 10V: 0-10V or 2-10V, configurable with the zero and span setting. 5V: 0-5V or 1-5V, configurable with the zero and span setting. mA Sink: 4-20mA sinking. Loop is powered by user. 135 Ohm: Variable resistance input. For typical 135 Ω slide wire. 1k Ohm: Variable resistance input. For 1 kΩ potentiometer. ON-OFF: Independent Open and Close inputs. Feedback is disabled. Comms: Communication protocol (e.g. Modbus RTU) Specific protocol must be selected in the COMMS CONFIG submenu.
-------------------------------	---

CALIBRATE ZERO xxxxx	Sets command signal zero digital count value. When selected, provide minimum command signal for direct action, and maximum control signal for reverse action. An input of this magnitude will drive actuator toward the programmed "Calibrate Close Pos" in the POSITION CONFIG menu. Value is scaled between 12 bit count of 0 and 4095 for the selected command type range. Typical values can be found in Section 4.2.1.
--------------------------------	---

CALIBRATE SPAN xxxxx	Sets command signal span digital count value. When selected, provide maximum command signal for direct action, and minimum control signal for reverse action. An input of this magnitude will drive actuator toward the programmed "Calibrate Open Pos" in the POSITION CONFIG menu. Value is scaled between 12 bit count of 0 and 4095 for the selected command type range. Typical values can be found in Section 4.2.1.
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DEADBAND x.x%	Sets deadband range by percent. <u>RANGE = 0.5% to 50.0% DEFAULT = 1.0%</u> This value determines the acceptable deviation from command setpoint the controller will recognize as valid position. If set to 1.0%, when provided a 50.0% setpoint, the controller will position to between 49.0% and 51.0%. A setpoint outside a value in this range must be provided to move. When selected, use [PREVIOUS ▲] or [NEXT ▼] to adjust value.
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LOSS OF SIGNAL: xxxxx	Sets behavior of actuator when command signal is lost. <u>DEFAULT = Fail Close</u> In Place: Remains in current position on loss of command signal. Open: Moves to programmed Open position on loss of command signal. Close: Moves to programmed Close position on loss of command signal. Percent: Moves to position specified in "Fail to Percent" setting.
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FAIL TO PERCENT: xxxxx	Sets percent position between 0% and 100% for actuator to control to on loss of command signal. Is only utilized if "Loss of Signal" type is set as "Position". <u>DEFAULT = 50.0%.</u>
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MOTOR TEMP LIMIT: xxxxx	Sets temperature ranges for the motor temperature monitor connected to (P8). Below values indicate duty cycle restriction. <u>DEFALUT = Disabled</u>				
Motor Temperature Monitor	Disabled: Ignores input to thermistor header (P8).				
	75C:	Below 75C = normal	75C to 90C = 60%	90C to 105C = 40%	Above 105C = 20%
	90C:	Below 90C = normal	90C to 105C = 60%	105C to 120C = 40%	Above 120C = 20%
	105C:	Below 105C = normal	105C to 120C = 60%	120C to 135C = 40%	Above 135C = 20%

3.3. FEEDBACK CONFIG submenu

The **FEEDBACK CONFIG** menu group contains parameters associated with the position feedback signal for the actuator. The analog feedback signal can be set and adjusted here.

FEEDBACK TYPE: xxxxx	Sets type of feedback signal. <u>DEFAULT = mA</u>	
Feedback Signal Type	mA:	0.0 to 21.5 mA
	Disabled: When command type is set for ON-OFF	

CALIBRATE ZERO xxxxx	Sets feedback signal zero digital count value. When selected, use [PREVIOUS ▲] or [NEXT ▼] to adjust feedback until desired value is measured. Note, this feedback will correspond to the programmed "Calibrate Close Pos" position in the POSITION CONFIG menu. If command is set for reverse action, set this value accordingly.	
Calibrate Feedback Zero	Value is scaled between 12 bit count of 0 and 4095 for the selected command type range. Typical values can be found in Section 4.2.1.	

CALIBRATE SPAN xxxxx	Sets feedback signal span digital count value. When selected, use [PREVIOUS ▲] or [NEXT ▼] to adjust feedback until desired value is measured. Note, this feedback will correspond to the programmed "Calibrate Open Pos" position in the POSITION CONFIG menu. If command is set for reverse action, set this value accordingly.	
Calibrate Feedback Span	Value is scaled between 12 bit count of 0 and 4095 for the selected command type range. Typical values can be found in Section 4.2.1.	

3.4. POSITION CONFIG submenu

The **POSITION CONFIG** menu group contains parameters associated with the positioning of the actuator. There are two types of positioning methods used; one using limit switches for two position operation, and the other using feedback potentiometer for modulating for proportional control operation.

When using limit switches, the open and close limits are set using the mechanical cams and limit switches in the actuator. These switches should be connected to (P5) Limit Switch header. When using feedback potentiometer, the open and close limits are programmed in this submenu and the potentiometer should be connected to (P7) Feedback Potentiometer header.

POSITION TYPE: xxxxx Position Type	<p>Sets type of feedback used for positioning. Default is set for potentiometer positioning.</p> <p>Limit SW: Uses position limit switches to detect discrete end of travel position for two-position on/off control. "Calibrate Close" and "Calibrate Open" settings are not used.</p> <p>Potent: Uses potentiometer to detect position for modulating and proportional positioning control. Limits are determined by the "Calibrate Close" and "Calibrate Open" position settings.</p>
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CALIBRATE CLOSE POS xxxxx Calibrate Close Position	<p>Only used with potentiometer feedback to set position limit when the CW motor output is energized to move actuator in clockwise direction. This position will correspond to the "zero" value set in COMMAND CONFIG submenu. When selected, use [PREVIOUS ▲] or [NEXT ▼] to drive motor to desired close/clockwise position. If limit switch position type is selected, this value is not used during operation.</p> <p>Value is scaled between 12 bit count of 0 and 4095 based on the measured feedback potentiometer position. There is no "correct" value to set to, but it is recommended to fall within the range of 400-3700.</p>
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CALIBRATE OPEN POS xxxxx Calibrate Open Position	<p>Only used with potentiometer feedback to set position limit when the CCW motor output is energized to move actuator in counterclockwise direction. This position will correspond to the "span" value set in COMMAND CONFIG submenu. When selected, use [PREVIOUS ▲] or [NEXT ▼] to drive motor to desired open/counterclockwise position. If limit switch position type is selected, this value is not used during operation.</p> <p>Value is scaled between 12 bit count of 0 and 4095 based on the measured feedback potentiometer position. There is no "correct" value to set to, but it is recommended to fall within the range of 400-3700.</p>
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TRAVEL TIMEOUT xxS Travel Timeout	<p>Only used with communication bus options. Value should be greater than the normal actuator travel time. The TMC4 begins a timer when the motor outputs are energized to control the actuator to the commanded position. If the timer exceeds the timeout value before the command position is reached, the motor output is turned off. When selected, use [PREVIOUS ▲] or [NEXT ▼] to adjust value. Can also be configured via communication protocol.</p> <p><u>DEFALUT = 60 seconds</u></p>
--	--

SW ACTING LIM. TORQ. xxxxx xxxxx Switch Action	<p>Sets contact logic of the position limit switches connected to header (P5) and stop/torque switches connected to (P9).</p> <p>N.O. indicates normally open action where input is activated when switch contact is closed.</p> <p>N.C. indicates normally closed action where input is activated when switch contact is opened.</p> <p><u>DEFAULT = N.O. / N.O.</u></p>
--	---

NOTE: Calibrate Close and Calibrate Open value is scaled between 12 bit count of 0 and 4095 based on potentiometer reading. It may increase or decrease depending on how potentiometer is wired, but should never jump between 0 and 4095 extremes.

3.5. COMMS CONFIG submenu

The **COMMS CONFIG** menu group contains parameters associated with the various communication protocols supported by the TMC-4 control card. While some parameters in other menus are configurable via communication link, the communication parameters necessary to establish the link such as device ID or address must be set here first.

COMMS TYPE : xxxx Communication Type	<p>Sets type of communication protocol when using one of the communication module options. "Comms" command type must be selected in the COMMAND CONFIG submenu.</p> <table border="0"> <tr> <td><u>Modbus RTU</u></td> <td>Modbus RTU</td> </tr> <tr> <td><u>Modbus TCP</u></td> <td>Modbus/TCP</td> </tr> <tr> <td><u>Profibus</u></td> <td>Profibus DP</td> </tr> </table>	<u>Modbus RTU</u>	Modbus RTU	<u>Modbus TCP</u>	Modbus/TCP	<u>Profibus</u>	Profibus DP
<u>Modbus RTU</u>	Modbus RTU						
<u>Modbus TCP</u>	Modbus/TCP						
<u>Profibus</u>	Profibus DP						

UNIT ID : xx Unit ID	<p>Actuator ID address. Selectable from 1 to 246. <u>DEFAULT = 1</u></p>
--	--

BAUDRATE xxxx Baud Rate	<p>Communication channel data rate. 9600, 19200, 57600, 115200 bps <u>DEFAULT = 9600</u></p>
---	--

PARITY : xxxx Parity	<p>Communication channel parity setting. None, Odd, Even <u>DEFAULT = None</u></p>
--	--

TIMEOUT : xx.xxs Timeout	<p>Communication timeout. Determines duration of time which the actuator must receive communication before entering fault condition. <u>DEFAULT = 10 seconds</u></p>
--	--

IP SETTINGS IP Settings	<p>Shows the IP settings for the actuator. Cycled through displaying the IP address, the IP subnet mask and the IP gateway. Note that this information is not adjustable and can only be viewed here. Refer to appropriate communication module instructions on how to set the IP address.</p>
--	--

3.6. AUX. I/O CONFIG submenu

The **AUX. I/O CONFIG** menu group contains parameters associated with additional I/O modules that can be added with specific options.

AUX. DO SIGNAL: x x x x	<p>Sets functionality of the auxiliary digital outputs.</p> <p>O-C Cmd Digital outputs provide programmable auxiliary limit switch outputs based on values set in the “Calibrate Aux. DO Close” and “Calibrate Aux. DO Open” settings. This setting can only be used with proportional control applications since it requires a percentage value based on using a feedback potentiometer. <u>DO1</u> = Programmed Aux Close position <u>DO2</u> = Programmed Aux Open position</p> <p>Lim SW Digital outputs mirror the position limits of the switches connected to position switch header (P5). <u>DO1</u> = Close position limit <u>DO2</u> = Open position limit</p> <p>Motor Out Digital outputs mirror the motor outputs. When specified motor output is energized, the corresponding digital output is activated. <u>DO1</u> = CW motor output <u>DO2</u> = CCW motor output</p>
---	--

AUX. DI SIGNAL: x x x x	<p>Sets functionality of the auxiliary digital inputs.</p> <p>Disable Digital inputs are disabled.</p> <p>Local Ctrl Digital inputs are configured for local/remote inputs. <u>DI1</u> = Local close switch input. When DI1 terminals are powered, the TMC4 commands a 0.0% signal and moves to programmed 0.0% position while DI3 detects local input. If operating as on/off actuator, it will drive to the close position limit switch. <u>DI2</u> = Local open switch input. When DI2 terminals are powered, the TMC4 commands a 100.0% signal and moves to programmed 0.0% position while DI3 detects local input. If operating as on/off actuator, it will drive to the open position limit switch. <u>DI3</u> = Local/remote switch input. When DI3 terminals are powered, the TMC4 goes into local control mode and disables remote signals. It will only operate with signals input to DI1 and DI2 terminals.</p>
---	---

AUX. AO SIGNAL: x x x x	<p>Sets functionality of the auxiliary analog outputs.</p> <p>Feedback Provides auxiliary 0-20mA analog output independent of standard feedback signal based on calibrated auxiliary output zero and span.</p> <p>4mA Provides constant 4mA analog output based on calibrated auxiliary output zero and span.</p> <p>20mA Provides constant 20mA analog output based on calibrated auxiliary output zero and span.</p>
---	---

CALIB. AUX AO ZERO x x x x	<p>Sets auxiliary analog output signal zero digital count value. When selected, use [PREVIOUS ▲] or [NEXT ▼] to adjust feedback until desired value is measured. Note, this feedback will correspond to the programmed “Calibrate Close Pos” position in the POSITION CONFIG menu. If command is set for reverse action, set this value accordingly.</p> <p>Value is scaled between 12 bit count of 0 and 4095 for the selected command type range.</p>
--	--

CALIB. AUX AO SPAN x x x x	<p>Sets auxiliary analog output signal span digital count value. When selected, use [PREVIOUS ▲] or [NEXT ▼] to adjust feedback until desired value is measured. Note, this feedback will correspond to the programmed “Calibrate Open Pos” position in the POSITION CONFIG menu. If command is set for reverse action, set this value accordingly.</p> <p>Value is scaled between 12 bit count of 0 and 4095 for the selected command type range.</p>
--	---

```
CALIB. AUX
DO CLOSE
  25%
```

**Calibrate Aux.
Digital Out Close**

Sets percentage value for when DO1 is activated when Aux. DO Output set for "O-C Cmd" function. DO1 is activated between this set value and the close (0%) position set in the **POSITION CONFIG** submenu. Default value of 25% meaning between 0% and 25%, DO1 will remain activated.

```
CALIB. AUX
DO OPEN
  75%
```

**Calibrate Aux.
Digital Out Open**

Sets percentage value for when DO2 is activated when Aux. DO Output set for "O-C Cmd" function. DO2 is activated between this set value and the open (100%) position set in the **POSITION CONFIG** submenu. Default value of 75% meaning between 75% and 100%, DO2 will remain activated.

3.7. SYSTEM CONFIG submenu

The **SYSTEM CONFIG** menu group contains information for the TMC-4 control card such as software version and cycle count as well as setting for selecting type of motor being operated and restoring factory defaults.

```
MOTOR
TYPE:   xx
```

Motor Type

Displays type of motor braking based on if AC version of TMC4, or DC version. AC indicates motor brake output turns off when either motor output is energized. DC indicates motor brake output turns on when either motor output is energized.

This option is not configurable and is designed for use with A-T Controls SRX series actuators.

```
CYCLE CNT
OPEN:   xxx
CLOS:   xxx
```

Cycle Count

Displays count for open and close position since power supplied to controller.

```
CLEAR CYCL
COUNTS
  >>
```

Clear Count

Clears cycle count. Press [CONFIRM ►/Ⓚ] to select, then press again to confirm and clear counts.

```
RESTORE
DEFAULTS
  >>
```

Restore Defaults

Restores all settings to their default value. Press [CONFIRM ►/Ⓚ] to select, then press again to confirm and reset to default values.

```
SOFTWARE
VERSION
  xx.xx
```

**Software and
Hardware
Version**

Alternates between showing current software version number and current generation of circuit board. Gen 2 circuit board will display if AC version or DC version.

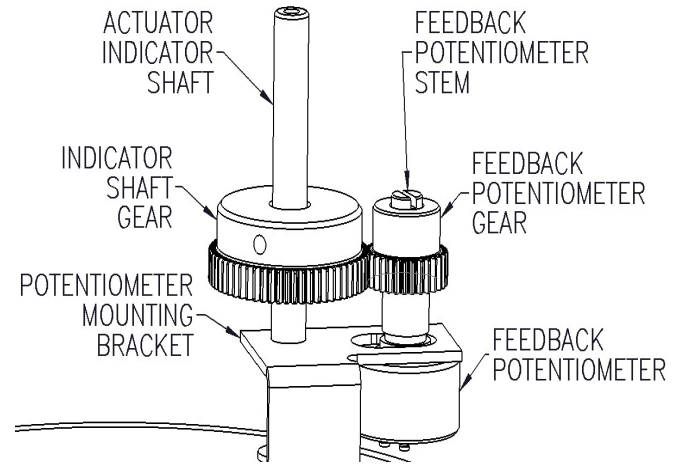
4. Setup and Calibration

4.1. Positioning Devices

4.1.1. Feedback Potentiometer (P7)

A feedback potentiometer connected to header (P7) is used to detect the position of the actuator between the 0% to 100% limits for modulating and proportional control applications. The feedback potentiometer is typically coupled to the actuator output indicator shaft by a set of gears.

To ensure the potentiometer remains within its limits through the actuator operating range, the actuator should first be moved to the halfway, or 50%, position. The feedback potentiometer is then adjusted to the midpoint of its effective electrical range. For example, a 1k Ω potentiometer should be adjusted to 500 Ω . If the potentiometer jumps from one end to another within the actuator's operation range, for example 0 Ω to 1000 Ω , the TMC4 may not be able to position correctly.



The potentiometer resistance is translated into a 12 bit count value of 0 to 4095 by the TMC4, and displayed in the "Calibrate Close Pos" or "Calibrate Open Pos" settings in the **POSITION CONFIG** submenu. When the feedback potentiometer is at its midpoint, the digital count value shown in either setting will be 2048, as this is the midpoint value between the limits of 0 and 4095.

It is not critical to adjust the potentiometer to exactly 2048 at the 50% position but should be close so that the value will not jump between the extremes of 0 and 4095 within the operating range. Centering the potentiometer approximately between 1900-2200 should be sufficient for most applications.

The effective electrical angle of the potentiometer, actuator rotation angle, and ratio of the feedback gears determine the maximum and minimum digital count values at the full open and full close positions, and the subsequent range that can be expected. Typical digital count values are shown below for different gearing ratios or operating angles with the 50% position set exactly to a value of 2048.

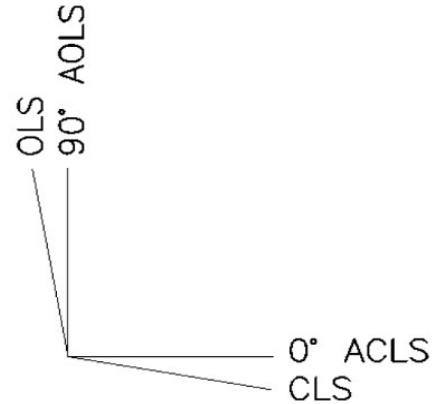
Gear Ratio / Actuator Rotation	Minimum	Maximum	Range
1:1 / 90°	1506	2590	1084
1:1 / 180° or 2:1 / 90°	964	3132	2168
1:1 / 270° or 3:1 / 90°	422	3674	3252

Note that the maximum and minimum values could be swapped depending on the rotation direction of the potentiometer in relation to the rotation direction of the actuator. The TMC4 will correctly interpret the readings when positions are calibrated. It is also not important to fall exactly at the values shown as long as the range of operation does not permit the digital count value to jump from 0 to 4095, or vice versa. However, as the gear ratio or actuator rotation angle increases, and the range increases, the allowance for deviation is reduced.

4.1.2. Position Limit Switch (P5)

Position limit switches connected to header (P5) are used to detect the Open and Close position of the actuator for two position and on/off applications. These switches will stop the actuator at the limits and provide Open or Close status indication to the TMC4 when "Position Type" is set for Limit Switch in **POSITION CONFIG** submenu.

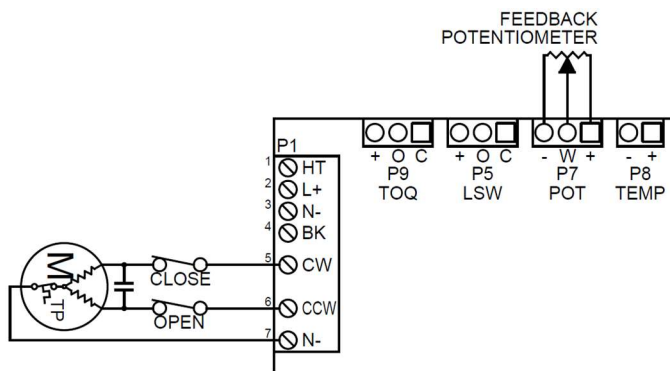
Typically, the auxiliary switches (AOLS and ACLS) in an actuator would be used, and the motor travel stop switches (OLS and CLS) would be set just outside of the operating range. The "Switch Action" setting in the **POSITION CONFIG** submenu must be set according to if using normally open contact (N.O. switch action) or a normally closed contact (N.C. switch action).



4.1.3. Stop/Torque Limit Switch (P9)

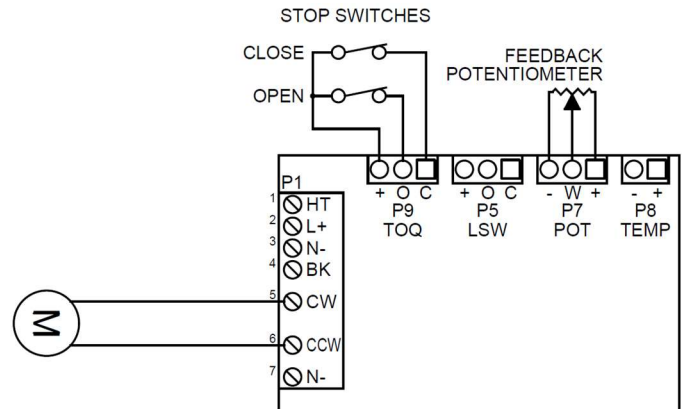
Motor travel stop or torque switches connected to header (P9) are used to stop the actuator regardless of set position limits. This switch input should be used when the TMC4 motor outputs are not wired through limit switches, such as for DC motors. This switch input provides no position indicator for the TMC4 since if an in-line switch stopped the motor from some over torque situation, a false Open or Close status may be given.

When the motor outputs are wired through limit or torque switches, the switches should be connected through the N.C. contact to open the motor circuit when activated. As such, the switches connected to the Stop/Torque input (P9) should preferably also use a N.C. contact configuration. Ensure "Switch Action" setting in the **POSITION CONFIG** submenu is set for N.C. action for the stop/torque switches.



AC

Motor outputs connected to motor through switches.
Stop/Torque switch input not required.



DC

Motor outputs connected directly to motor.
Stop/Torque switch input required.

4.2. Analog Control Calibration

For when operating as modulating actuator using some analog control input.

To change values or settings, press [CONFIRM ►/⏏] so value or setting flashes, change setting with [PREVIOUS ▲] or [NEXT ▼], press [CONFIRM ►/⏏] to save setting of value. To escape from setting without saving, press [CANCEL ◀].

1) Select and calibrate input command signal.

- Enter **COMMAND CONFIG** submenu.
- Select desired command signal type in “Command Type” setting and confirm.
- Connect command signal source to input terminals per appropriate wiring diagram.
- Enter “Calibrate Zero” setting, send 0% command signal and confirm.
- Enter “Calibrate Span” setting, send 100% command signal and confirm.

COMMAND
CONFIG: >>

→

COMMAND
TYPE: xxxxx

CALIBRATE
ZERO xxxxx

CALIBRATE
SPAN xxxxx

Typical command signal values are given in *4.2.1 Command and Feedback Values*.

2) Select and calibrate output feedback signal.

- Enter **FEEDBACK CONFIG** submenu.
- Select desired feedback signal type in “Feedback Type” setting and confirm.
- Connect feedback signal monitor to output terminals per appropriate wiring diagram.
- Enter “Calibrate Zero” setting and adjust feedback signal using [PREVIOUS ▲] or [NEXT ▼] until desired 0% feedback is achieved and confirm.
- Enter “Calibrate Span” setting and adjust feedback signal using [PREVIOUS ▲] or [NEXT ▼] until desired 100% feedback is achieved and confirm.

FEEDBACK
CONFIG >>

→

FEEDBACK
TYPE: xxxxx

CALIBRATE
ZERO xxxxx

CALIBRATE
SPAN xxxxx

Typical feedback signal values are given in *4.2.1 Command and Feedback Values*.

3) Set position limits.

- Enter **POSITION CONFIG** submenu.
- Set to “Potent” in “Position Type” setting.
- Adjust feedback potentiometer to center at 50% position.
 - In “Calibrate Close Pos” or “Calibrate Open Pos”, press [PREVIOUS ▲] or [NEXT ▼] to drive actuator to 50% position.
 - Rotate feedback potentiometer until display reads between 1900-2200, then tighten gears.
- In “Calibrate Close Pos”, press [PREVIOUS ▲] or [NEXT ▼] to drive actuator to desired clockwise position and confirm.
- In “Calibrate Open Pos”, press [PREVIOUS ▲] or [NEXT ▼] to drive actuator to desired counterclockwise position and confirm.

POSITION
CONFIG >>

→

POSITION
TYPE: Potent

CALIBRATE
CLOSE POS xxxxx

CALIBRATE
OPEN POS xxxxx

* Swap 0% and 100% signals for zero and span calibration in the above steps if setting up for reverse acting.

4.2.1. Command and Feedback Values


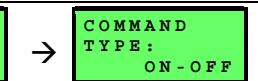
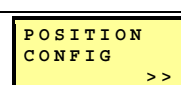
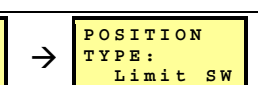
These are the approximate digital count values that will show according to command and feedback signals. Actual count value may differ slightly. Values will also differ depending on revision of the display board. Check display board revision level to confirm approximate values.

	0mA	4mA	20mA	0V	1V	2V	5V	10V
Command	0	750	3740	0	380	760	1900	3800
Feedback	280	925	3550					

4.3. Two-Position Control Calibration

For when operating as two position on/off actuator.

To change values or settings, press [CONFIRM ►/Ⓜ] so value or setting flashes, change setting with [PREVIOUS ▲] or [NEXT ▼], press [CONFIRM ►/Ⓜ] to save setting of value. To escape from setting without saving, press [CANCEL ◀].



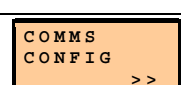
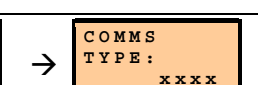

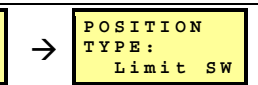
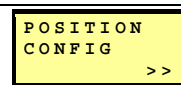
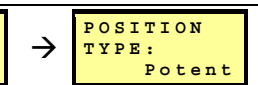
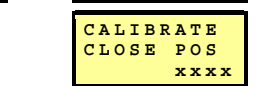

<p>1) Select On-Off input command type.</p> <p>a) Enter COMMAND CONFIG submenu.</p> <p>b) Select “On-OFF” command in “Command Type” setting.</p>		
<p>2) Set position limits.</p> <p>a) Enter POSITION CONFIG submenu.</p> <p>b) Set to “Limit SW” in “Position Type” setting.</p> <p>c) Set position limit cams in the actuator.</p>		

It is recommended to use the Manual Operation screen to manually drive the actuator when setting the limit switch cams since this will display “Open” or “Close” status when switches are connected to header (P5). However, it is possible to drive the actuator from the “Calibrate Close Pos” or “Calibrate Open Pos” settings, but this will not show position status. For either method, press [PREVIOUS ▲] or [NEXT ▼] to manually drive the actuator.

4.4. Communication Bus Control Calibration

For when using one of the optional communication bus add-on modules.

To change values or settings, press [CONFIRM ►/Ⓜ] so value or setting flashes, change setting with [PREVIOUS ▲] or [NEXT ▼], press [CONFIRM ►/Ⓜ] to save setting of value. To escape from setting without saving, press [CANCEL ◀].

<p>1) Select communication input command type.</p> <p>a) Enter COMMAND CONFIG submenu.</p> <p>b) Select “Comms” command in “Command Type” setting.</p>		
<p>2) Configure communication setting.</p> <p>a) Enter COMMS CONFIG submenu.</p> <p>b) Select communication protocol in “Communication Type” setting.</p> <p>c) Set address and other communication parameters in appropriate setting within the COMMS CONFIG submenu as needed.</p>		
<p>3) Set position limits if using Two Position Control.</p> <p>a) Enter POSITION CONFIG submenu.</p> <p>b) Follow instructions for setting position limits per <i>4.3 Two-Position Control Calibration</i>.</p>		
<p>4) Set position limits if using Proportional Control.</p> <p>a) Enter POSITION CONFIG submenu.</p> <p>b) Set to “Potent” in “Position Type” setting</p> <p>c) Follow instructions for setting position limits per <i>4.2 Analog Control Calibration</i>.</p>		  

4.5. Reverse Action / Direct Action

The TMC4 can be configured for reverse or direct action depending on the signal given when setting the command and feedback zero and span. For direct action, set the zero value to the minimum command signal and the span value for the maximum command signal. For reverse action, set the zero value to the maximum command signal and the span value to the minimum command signal.

The calibrated zero command or feedback value will correspond to the calibrated Close position in the **POSITION CONFIG** submenu, and the calibrated span command or feedback value will correspond to the calibrated Open position in the **POSITION CONFIG** submenu.

Direct Action	Signal	Command	Feedback	Position	Reverse Action	Signal	Command	Feedback	Position
	0%	Zero	Zero	Close/CW		100%	Zero	Zero	Close/CW
	100%	Span	Span	Open/CCW		0%	Span	Span	Open/CCW

5. Options

5.1. Motor Temperature Monitor

The TMC4 provides an optional motor temperature monitor using a thermistor connected to header (P8) to monitor the case temperature of the actuator motor. This is useful in high cycle applications to prevent excessive motor heating that may cause premature failure.

The thermistor provides a temperature-dependent resistance that the TMC4 inputs into an algorithm to establish a defined duty cycle limit depending on the measured temperature. As the temperature increases, the duty cycle is decreased to allow more time for the motor temperature to be reduced.

The default setting for the TMC4 is for the monitor to be disabled. The three temperatures allow for higher insulation class motors to operate before the need to limit the motor movement, but it is recommended to use the lowest level.

Temp. Level	Temp. Limit 1	Temp. Limit 2	Temp. Limit 3	Minimum Insulation Class
Disabled	n/a	n/a	n/a	
1	75°C	90°C	105°C	B
2	90°C	105°C	120°C	F
3	105°C	120°C	135°C	H
Duty Cycle	60%	40%	20%	

NOTE: The motor temperature monitor is intended to only serve as a backup to prevent motor overheating. The user should still ensure their controls are adjusted so the recommended duty cycle of the actuator is not exceeded and not solely rely on the motor temperature monitor.

MOTOR TEMP LIMIT: xxxxx	Sets temperature ranges for the motor temperature monitor connected to (P8). Selected value indicates threshold for restricted motor operation. Below values indicate duty cycle restriction. <u>DEFALUT = Disabled</u>				
Motor Temperature Monitor	Disabled:	Ignores input to thermistor header (P8).			
	75C:	Below 75C = normal	75C to 90C = 60%	90C to 105C = 40%	Above 105C = 20%
	90C:	Below 90C = normal	90C to 105C = 60%	105C to 120C = 40%	Above 120C = 20%
	105C:	Below 105C = normal	105C to 120C = 60%	120C to 135C = 40%	Above 135C = 20%

6. Troubleshooting

Problem	Cause	Solution
No Display	In Sleep mode.	Press joystick in any direction.
	Run/Program switch in wrong position.	Ensure switch is pointed <u>away</u> from USB connector.
	No power.	Confirm supply connected.
	Blown fuse.	Replace fuse.
Not responding to command signal	Incorrect wiring.	Check wiring.
	Incorrect command signal type.	Change command type.
	Incorrect command signal calibration.	Recalibrate command zero and span.
	Incorrect position calibration.	Recalibrate Open and Close position.
	Position feedback potentiometer gears loose.	Check potentiometer gears are tight. If loose, repeat position calibration.
	Position feedback potentiometer not set correctly.	Confirm potentiometer is at midrange at 50% position.
	Incorrect switch action setting.	Change switch action setting.
No feedback or feedback is not correct	Incorrect wiring.	Check wiring.
	Incorrect feedback type.	Change feedback type.
	Incorrect feedback calibration.	Recalibrate feedback zero and span.
	External loop power being provided.	Remove external loop power.
Actuator is hunting	Noisy input signal.	Check input signal.
	Deadband setting too low.	Increase deadband setting.
Not moving to set positions	Mechanical stops adjusted in too far.	Adjust mechanical stops outside of operating range according to actuator instructions.
	Limit switches adjusted in too far.	Adjust limit switch cams outside of operating range according to actuator instructions.
	Position feedback potentiometer gears loose.	Check potentiometer gears are tight. If loose, repeat position calibration.
Motor is pulsing when moving	Motor temperature too high. (if using motor temperature monitor option)	Slow operation to allow motor to cool.
Actuator moving in wrong direction	Open and close position set incorrectly.	Check open and close position calibration.
	CW / CCW wiring reversed.	Check wiring.
	Zero and span set reverse.	Check zero and span settings.
CMD = LOST	Incorrect Command Type.	Confirm Command Type setting is correct.
	Disconnected or reversed signal wires.	For voltage or mA command, disconnected input wires will read ~1-3. Reversed input wires will read 0.

7. Specifications

Power	
Supply:	AC: 85 – 250 VAC, 50/60Hz, 1 Phase DC: 24 VDC
Fuse:	10A, 250V, Time Delay, 5 x 20mm
Command Signal In	
Voltage:	-0.8 to 10.8 VDC
Current:	0 to 23 mA
Resistance:	135Ω Command: 150 Ω maximum (20mA excitation current) 1kΩ Command: 1.1 kΩ maximum (2.7mA excitation current)
On-Off:	24 VDC maximum < 10V = Off ≥ 10V = On
Resolution:	12 bit (4096 points)
Feedback Signal Out	
Voltage:	0 to 10.8 VDC, min 500Ω load
Current:	0 to 21.5 mA, max 980Ω load
Resolution:	12 bit (4096 points)
Position Feedback	
Voltage:	0 to 3.3 VDC
Potentiometer:	1kΩ
Limit Switches:	Normally Open or Normally Closed
Outputs	
+24V Out:	24VDC, 30mA maximum
Ext. Brake:	300mW, 350V, 120mA continuous load
Environmental	
Operating:	0°C to 60°C (32°F to 140°F)
Storage:	-40°C to 85°C (-40°F to 185°F)
Relative Humidity:	0 to 90% non-condensing
Connections	
Terminals:	(P2) Power/Motor: 0.2" pitch (5.08mm), 16 – 30 AWG (0.05 – 1.3 mm ²) (P1) Signal: 0.15" pitch (3.81mm), 16 – 30 AWG (0.05 – 1.3 mm ²)
Headers:	0.1" pitch, 2pos and 3pos
Expansion Header:	2x7 pos, 2mm pitch

A-T Controls product, when properly selected, is designed to perform its intended function safely during its useful life. However, the purchaser or user of A-T Controls products should be aware that A-T Controls products might be used in numerous applications under a wide variety of industrial service conditions. Although A-T Controls can provide general guidelines, it cannot provide specific data and warnings for all possible applications. The purchaser / user must therefore assume the ultimate responsibility for the proper sizing and selection, installation, operation, and maintenance of A-T Controls products. The user should read and understand the installation operation maintenance (IOM) instructions included with the product and train its employees and contractors in the safe use of A-T Controls products in connection with the specific application.

While the information and specifications contained in this literature are believed to be accurate, they are supplied for informative purposes only. Because A-T Controls is continually improving and upgrading its product design, the specifications, dimensions and information contained in this literature are subject to change without notice. Should any question arise concerning these specifications, the purchaser/user should contact A-T Controls.

For product specifications go to <http://download.a-tcontrols.com/>

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