1. GENERAL DESCRIPTION

The Triac TMC3 is a proportional AC Motor Controller, intended for use with split phase AC actuator motors. The actuator is controlled by comparing an external command signal to a feedback signal from a potentiometer linked to the actuator. Depending on the magnitude of the two signals, the TMC3 controller will energize either the clockwise (cw) or the counterclockwise (ccw) motor output. This drives the actuator in the direction that will reduce the difference between the two signals. When the feedback signal equals the control signal, the controller will turn off the drive to the actuator.

The TMC3 controller can be used with a 4 to 20 mA command signal, a 1 to 5 mA command signal, a 0 to 10V command signal, a 1 to 5V command signal or a 0-135 Ohm command signal potentiometer.

The TMC3 controller provides actuator calibration without the use of a command signal. Programming of the controller is accomplished by a combination of push button switches and a seven position DIP-switch.

The power line input is 115VAC for TMC3-115 or 220VAC/1PH for TMC3-220 or 24VAC for TMC3-24. Power line frequency may be either 50 or 60 Hz. When properly mounted, the controller is capable of providing an output motor running current of 3A @ 120VAC.

PLEASE NOTE:

The WEM/XEM series electric actuators come standard with the TMC3 servo card already factory installed and calibrated. No additional settings need to be set prior to standard operation. This manual has been provided as a resource for information on calibration, maintenance and troubleshooting the TMC3 servo card.

2. MOUNTING

In order to avoid electrical shock, it is important to install the TMC3 in an appropriate enclosure. When operating, high voltage is present on the controller, necessitating care and caution during the installation process. In particular, all AC power wiring must be de-energized before connecting any wires to the TMC3.

To take full advantage of the 3A output rating of the controller, the unit must be mounted to a suitable metal plate or bracket (aluminum is the preferred material) using 6-32 (or M3) screws in all four mounting holes. The mounting surface must be flat, without any burrs or roughness. If the TMC3 controller is to be used where condensation can be anticipated, a heater and thermostat must be used.

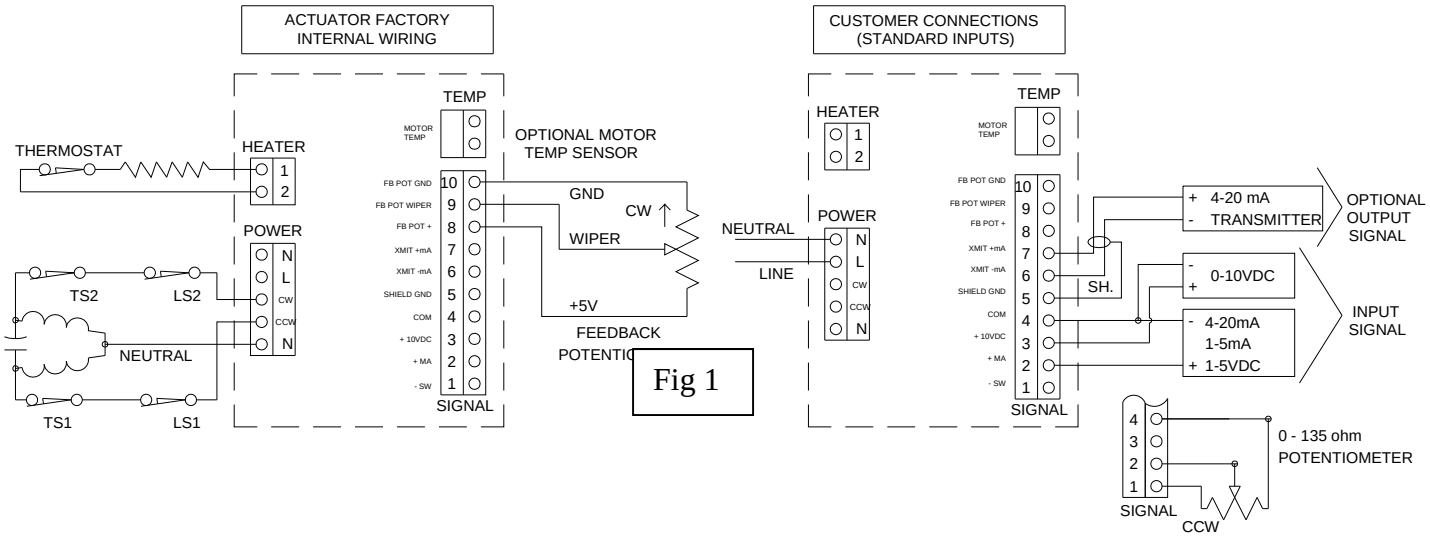


Fig 1

3. WIRING

All TMC3 wiring is connected using terminal blocks. Terminal block “POWER” is used for connections to 24VAC, 115 VAC or 220VAC power. Terminal block “SIGNAL” is used for signal connections.

3.1. ACTUATOR WIRING

The actuator motor and feedback potentiometer are connected to the controller as shown above.

Terminal “CCW” of “POWER” is connected to the motor winding that drives the actuator ccw.

Terminal “CW” of “POWER” is connected to the winding that drives the actuator cw.

Terminal “N” of “POWER” is connected to the neutral motor wire.

In most applications, limit switches will be used to set the maximum allowable range of the actuator. The switches should be wired to break the ccw and the cw motor connections. Set the switches so that motor power is interrupted at maximum travel in each direction.

The wiper of the feedback potentiometer is connected to terminal 9 of “SIGNAL” terminal block. One end of the potentiometer is connected to terminal 8 and the other end is connected to terminal 10. It is important to wire the potentiometer so that when the actuator moves toward the ccw position, the potentiometer resistance between terminals 9 and 10 of “SIGNAL” terminal block will increase.

A potentiometer that is wired in the wrong direction will drive the actuator to either the fully ccw or the fully cw position with no user control.

For proper operation, it is important to use a linear taper potentiometer with a value between 1000 ohms (1kohm) and 5000 ohms (5kohm). To ensure a stable and reliable feedback signal, the potentiometer must be securely mounted.

3.2. AC POWER WIRING

Terminal block “POWER” is used for AC power input to the TMC3 controller.

TMC3-115 Connect 115 VAC, Line to terminal “L” and Neutral to terminal “N”.

TMC3-220 Connect 220 VAC to terminals “L” and “N”.

TMC3-24 Connect 24VAC, Line to terminals “L” and Neutral to terminal “N”.

3.3. SIGNAL WIRING

As shown in Figure 1, all signal wiring is connected to terminal block “SIGNAL”.

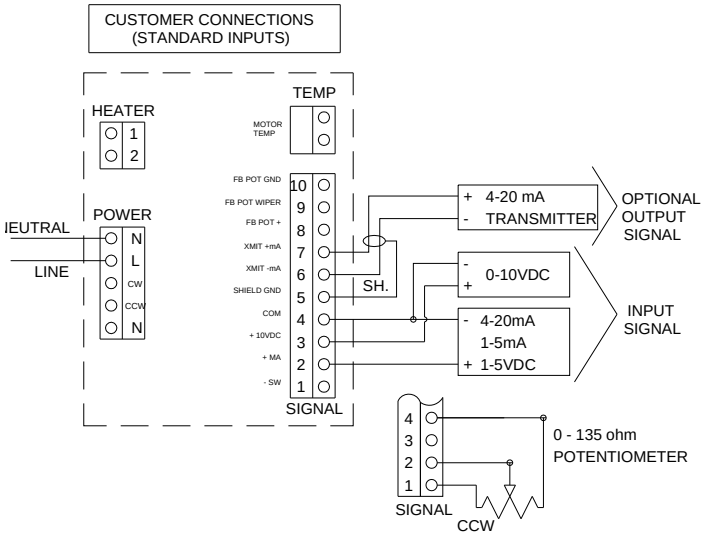
When using a 4 to 20 mA, 1 to 5 mA or 1 to 5 V command signal, connect the positive signal to terminal 2 and the common (negative) signal to terminal 4.

When using a 0 to 10 V command signal, connect the positive signal to terminal 3 and the common (ground) signal to terminal 4.

It is also possible to use a 0-135 Ohm potentiometer for the command signal. Connect the cw terminal of the potentiometer to terminal 1 of “SIGNAL” terminal block, the wiper to terminal 2 of “SIGNAL” terminal block and the ccw terminal of the potentiometer to terminal 4 of “SIGNAL” (ground).

Make sure “INPUT” jumper in on the 10V / SW and “GAIN” jumper is moved to SW. No transmitter option available with this setting.

The TMC3 controller can be equipped with an on-board 4 to 20 mA transmitter. The positive output signal will be available at terminal 7 and the common (negative) signal is connected to terminal 6.



WARNING

Please note that the current output does not need an external loop power supply and must not be connected to such a loop. The external load should be resistive without any excitation voltage present. An external voltage on terminals 6 and 7 will damage the transmitter and possible the circuit board.

If a shielded cable is used for the signal input wiring or the current output wiring, the shield can be connected to terminal 5. This terminal is connected to the actuator enclosure through the mounting bracket.

4. PROGRAMMING JUMPER

Before using the TMC3 controller, it is important to set the on-board programming jumper for the proper type of command signal. The type of command signal used is programmed using the “INP CONF” jumper. The jumper should be installed in the “4-20MA” position when using a 4 to 20 mA command signal. The jumper should be installed in the “1-5MA” position when using a 1 to 5 mA command signal. The jumper is installed in the

0-10V position when using a 0 to 10 V command signal or when using 0-135 Ohm command potentiometer. If a 1 to 5 V command signal is used, the jumper must be removed from JP1.

5. OUTPUT INDICATORS

When power is present the Blue LED will be lit. The TMC3 controller also makes use of two LED's to indicate the status of the actuator motor outputs. When the ccw output is on, the green LED is active. The red LED indicates an active cw output.

6. CALIBRATION MODE

Begin the calibration process by wiring the actuator as described in section 3.1. Next, wire the AC power input as described in section 3.2. Do not apply power at this stage. Push DIP Switch 1 to the ON position (this will select the calibration mode).

6.1. FEEDBACK SIGNAL

NOTE: This procedure is only required if the feedback potentiometer is out of calibration or you suspect the feedback potentiometer is out of calibration.

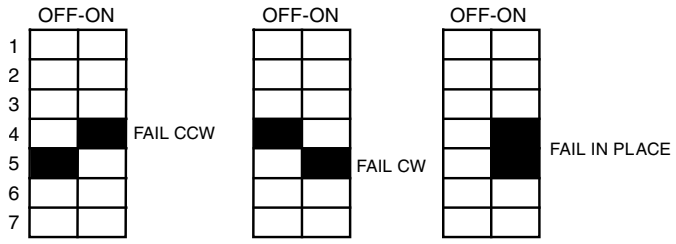
Before proceeding with the calibration, it is very important to center the travel of the feedback potentiometer. The following steps will ensure that the potentiometer is properly centered: Push DIP Switch 7 to the ON position. Using caution, turn on AC power. Position the actuator half way between the desired travel limits. To move the actuator in the ccw direction, use CCW button. The green LED will light. To move the actuator in the cw direction, use CCW button. The red LED will light. Near the 50% open position, the yellow LED will light. This indicates the center position of the feedback potentiometer and no further actions are required. The indicator is very sensitive, so care is necessary in order not to miss the center position of the potentiometer. If the yellow light didn't light near the 50% open position then loosen the set screw on the gear located on the cam shaft that drives the feedback potentiometer. Slowly turn the potentiometer while observing the PGM/Auto Cal LED . At some potentiometer position, the yellow LED will light. This indicates the center position of the feedback potentiometer. The indicator is very sensitive, so care is necessary in order not to miss the center position of the potentiometer. Without moving the potentiometer, re-tighten the set screw. Turn OFF DIP switch 7.

6.2. FULLY CW/CCW POSITION

Setting the fully ccw and fully cw positions of the actuator can be accomplished with or without a command signal. Both methods will be covered.

First, make sure that all switches on the DIP switch are OFF except DIP switch 1 that should be in the ON position. For information regarding the use of the DIP-switches in the run mode, please refer to the below diagram. Using caution, turn on AC power.

If using a command signal, proceed to section 6.2.2.



Note: DIP #4 & DIP #5 are not active when input jumper is on 10V / SW

6.2.1. NO COMMAND SIGNAL

When using a 1 to 5 mA command signal, the basic accuracy of the controller is compromised if the fully ccw and cw positions are set without a command signal present.
The accuracy that can be achieved without a command signal is approximately 1%. If the input is a 1 to 5 mA signal and maximum accuracy is desired, please proceed to section 6.3.
The first step is to make sure that there is no signal present on the command input. Any signal present may interfere with actuator accuracy.
Next, move the actuator to the desired fully cw position by using “CW” button (the cw output is active) or “CCW” button (the ccw output is active). If the actuator stops short, check the setting of the limit switch. It is very important that the fully cw position is located on the cw side of the actuator center position.
When the actuator is properly positioned, push PGM (the red push button) to save the fully cw position to memory. The red LED should light for about one second indicating a successful save. The red LED indicates that the position saved is the cw position (the position is on the cw side of center).
Move the actuator to the desired fully ccw position by using “CCW” button (the ccw output is active). If the actuator stops short, check the setting of the limit switch. It is very important that the fully ccw position is located on the ccw side of the actuator center position.
When the actuator is properly positioned, push PGM (the red push button) to save the fully ccw position to memory. The green LED should light for about one second indicating a successful save. The green LED indicates that the position saved is the ccw position (the position is on the ccw side of center).
Proceed to section 6.3.

6.2.2. WITH COMMAND SIGNAL

The fully ccw and fully cw positions can also be set with a command signal present. If a 1 to 5 mA command signal is used, calibration with a signal is necessary to obtain the highest accuracy.
Normally, there is no need to supply a command signal (see section 6.2.1), but there are some situations when it may improve the actuator accuracy. This is particularly true if the command signal source shows poor accuracy, supplying a signal that is not exactly 4mA to 20mA or 0V to 10V.
The first step in the calibration-with-command signal procedure is to make sure that there is an appropriate low command signal present on the command input. If the controller is using a 4 to 20 mA or a 1 to 5 mA signal, the low signal (typically 4 mA or 1 mA) must be present. If the controller is using a 0 to 10V signal, the low signal (typically 0V) must be present.
Move the actuator to the desired fully cw position (see section 6.2.1). It is very important that the fully cw position is located on the cw side of the actuator center position. When the actuator is properly positioned, push PGM to store the fully cw position together with the low command signal in memory. The red LED should light for about one second indicating a successful save. The red LED indicates that the position saved is the cw position (the position is on the cw side of center).
Change the command signal to 20mA/5mA or 10V.

Move the actuator to the desired fully ccw position (see section 6.2.1). It is very important that the fully ccw position is located on the ccw side of center. When the actuator is properly positioned, push PGM to store the fully ccw position together with the high command signal in memory. The green LED should light for about one second indicating a successful save. The green LED indicates that the position saved is the ccw position (the position is on the ccw side of center).
The TMC3 controller will use the stored values for low and high command signals until re-calibrated (with or without a command signal).

6.3. COMMAND SENSITIVITY

When in the run mode, the outputs of the TMC3 controller are activated by a change in the command signal. The magnitude of change necessary to activate the outputs is under user control and is set by potentiometer P2. The potentiometer setting is stored in memory and, once stored, is not affected by the setting of the potentiometer.
To calibrate the sensitivity, set DIP switch #1 and #4 to the ON position with all other switches set to the OFF position. Apply AC power. Adjust potentiometer “CAL POT” for the desired sensitivity . If “CAL POT” is set fully ccw, the controller is set for maximum sensitivity (this is the factory setting). If set fully cw, the controller is set for minimum sensitivity. Push PGM to store the sensitivity in memory. The yellow LED should light for about one second indicating a successful save.

7. RUN MODE

To enter the run mode, set DIP switch #1 to the OFF position. When in this mode, the TMC3 controller moves the actuator to a position which is calculated using the command input together with the stored fully ccw and cw positions. When using a 4 to 20 mA, 1 to 5 mA or 1 to 5 V command signal, it is also important to configure the signal loss mode.

7.1. COMMAND SIGNAL LOSS

If a 4 to 20 mA, 1 to 5 mA or 1 to 5 V command signal is lost, the TMC3 controller can be programmed to act in a predictable manner. The setting of DIP switches #4 and #5 controls the failure mode. The switches have no effect if jumper “INPUT” is configured for a 0 to 10 V input. A lost command signal is defined as a signal that is less than 75% of the low signal level (nominally 3mA, 0.75mA or 0.75V).
If DIP switches #4 and #5 are both in the ON position, the actuator will fail in place when the command signal is lost. If the actuator is moving when the signal is lost, it will stop when the command signal falls below the signal loss threshold.
If DIP #4 is in the ON position and DIP #5 is in the OFF position, the actuator will fail in the fully ccw position. This is true whether the controller is set for direct acting or reverse acting.
If DIP #5 is in the ON position and DIP #4 is in the OFF position, the actuator will fail in the fully cw position. This is true whether the controller is set for direct acting or reverse acting.
If DIP switches #4 and #5 are both in the OFF position, the controller will use the low (below 4mA or 1V) command signal as is. If the controller is set for direct acting drive, the actuator will move to the fully cw position. If

the controller is set for reverse acting drive, the actuator will move to the fully ccw position.

7.2. DIRECT/REVERSE ACTING

Normally, the actuator will move to the fully cw position when the command signal is low (4 mA, 1 mA or 0 V). This mode of operation is referred to as direct acting.

Sometimes it is desirable to have the actuator move to the fully cw position when the command signal is high (20 mA, 5 mA or 10 V) and to the fully ccw position when the command signal is low (4 mA, 1 mA or 0 V). This mode of operation is referred to as reverse acting.

To set the controller to the direct acting mode, switch DIP #3 to the OFF position. To change to the reverse acting mode, switch DIP #3 to the ON position. No other changes are necessary.

Please note that the controller is wired exactly the same for both direct and reverse acting mode. The calibration procedure for the fully ccw and fully cw positions is not affected by the choice of direct or reverse acting mode.

7.4. 4 TO 20 mA Optional Transmitter

The 4 to 20 mA output ("SIGNAL"-6 and "SIGNAL"-7) will track the position of the feedback potentiometer.

When the controller is operating in the direct acting mode, the output will be 4 mA at the fully cw position and 20 mA at the fully ccw position.

When the controller is operating in the reverse acting mode, the output will be 20 mA at the fully cw position and 4 mA at the fully ccw position.

WARNING

Please note that the current output does not need an external loop power supply and must not be connected to such a loop. The external load should be resistive without any excitation voltage present. An external voltage on terminals 6 and 7 will damage the transmitter and possible the circuit board.

7.5. Slide Wire Installation

Connect the slide-wire (135 ohm potentiometer)

1. Connect the Low Water Level side of the slide-wire to terminal 1. Connect the wiper of the slide-wire to terminal 2. Connect the High Water Level side of the slide-wire to terminal 4.
2. Put the INPUT jumper in the 10V/SW position. Put the GAIN jumper in the SW position.

Calibrating the span with a slide-wire. *(An example of a slide-wire would be a McDonnell & Miller water feeder)*

1. Move the actuator to the fully closed position (using the black push buttons). Set the wiper of the slide-wire to the High Water Level side. Push the red PGM/AUTO CAL push button. The red and yellow LEDs should flash.
2. Move the actuator to the fully open position (using the black push buttons). Set the wiper of the slide-wire to the Low Water Level side. Push the red PGM/AUTO CAL push button. The green and yellow LEDs should flash.
3. Please note that for a somewhat less accurate calibration it is possible to perform the procedure without the slide-wire connected.

Running the actuator with a slide-wire

1. Turn off DIP-switch 1 (run mode). In slide-wire mode filtering can be applied to the signal from the slide-wire. There are four possible settings for the filtering: slow, medium, fast and no-filter.
2. The slow setting is activated by turning DIP-switches 6 and 7 off. This will yield a first order filter response with a time constant of about 16 seconds (to 63%). This is the default setting.
3. The medium setting is activated by turning on DIP-switch 6. This will yield a first order filter response with a time constant of about 4 seconds (to 63%).
4. The fast setting is activated by turning on DIP-switch 7. This will yield a first order filter response with a time constant of about 4 seconds (to 63%).
5. The no-filter setting is activated by turning on DIP-switches 6 and 7. This will yield a response with no filtering.
6. When in the slide-wire mode, square and square root responses are not available (DIP-switches 6 and7 are used for filtering options).

8. SPECIFICATIONS

8.1. AC POWER

TMC3-24 = 24VAC/1PH ±10%, 50 or 60 Hz.
TMC3-115 = 115VAC/1PH ±10%, 50 or 60 Hz.
TMC3-220 = 220VAC/1PH ±10%, 50 or 60 Hz.

8.2. SIGNAL INPUTS

The inputs have a basic 10 bit accuracy.

0-10 VDC Command Input: 200 kohm input impedance.

Command Potentiometer Input: 5.25 VDC nominal voltage. 100 kohm input impedance. Use with 1 kohm potentiometer.

1-5 VDC Command Input: 100 kohm input impedance. Loss of signal threshold is 75% of low signal.

4-20 mA Command Input: 250 ohm input impedance. Loss of signal threshold is 75% of low signal.

1-5 mA Command Input: 1 kohm input impedance. Loss of signal threshold is 75% of low signal.

Feedback Input: 5.25 VDC excitation voltage (nominal value). Use with 1000 to 5000 ohm potentiometer.

8.3. 4 TO 20 mA OUTPUT

500 ohm maximum load impedance. 8 bit (1 in 255) basic accuracy.

8.4. AC MOTOR OUTPUTS

When properly mounted, the outputs will supply a load current of 5A @ 120VAC with less than 5 mA of leakage current.

8.5. FUSING

The TMC3 AC power is fuse protected. The fuse should be tailored to the demands of the actuator motor used. The rating of the fuse should not exceed 5A.

8.6. ENVIRONMENTAL

Operating temperature: 0ºC to 70ºC.
Storage temperature: -40ºC to 85ºC.
Relative humidity: 0 to 90% non-condensing.

A-T Controls, Inc. • 9955 International Boulevard, Cincinnati, OH 45246 • Phone: (513) 530-5175 • Fax: (513) 247-5462 • www.atcontrols.com