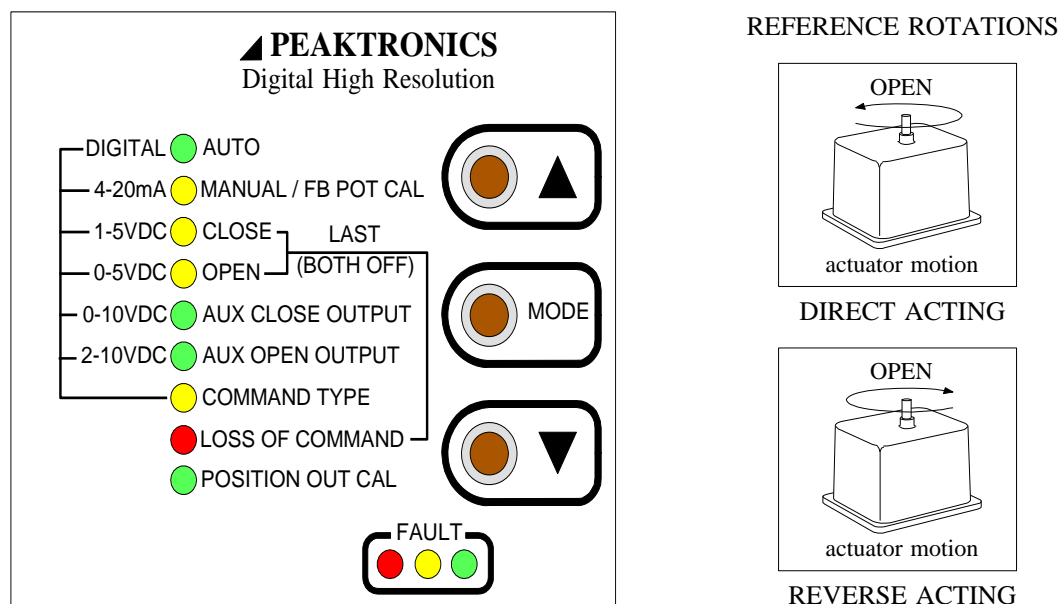


### Quick Calibration Procedure

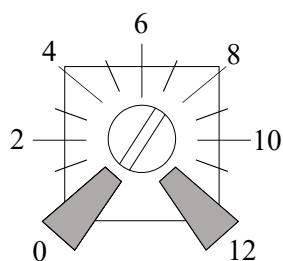
#### General

The MODE button selects a particular function, or mode, and the indicator for the selected mode turns on solid. Pushing the MODE button saves any new setting of the selected mode before switching to the next mode. The adjust up (▲) and adjust down (▼) buttons are used to make adjustments to the selected mode. For more details regarding calibration and features refer to the manual.

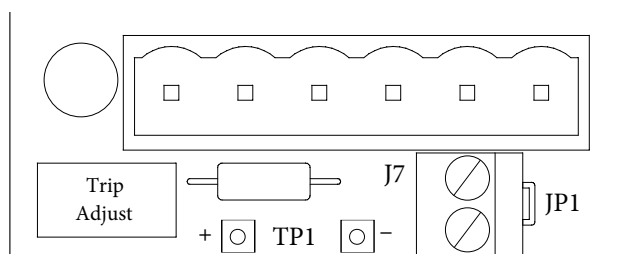


1. Before applying power, ensure that the unit is properly mounted and properly wired to the actuator. Refer to the pertinent MKT Data Sheet specified for the actuator. Ensure potentiometer gears are tight and properly meshed.
2. Apply power to the actuator on Connector J2: terminal #1 (positive), terminal #2 (negative), and terminal #3 (earth). There is no need for a signal connection during calibration.
3. Push the MODE button until the yellow “MANUAL/FB POT CAL” LED is illuminated. The LED may be flashing (at different speeds) through the next several steps. This is expected and will be explained.
4. Use the adjust buttons (▲ and ▼) to move the actuator and verify that the limit switches are set past the desired open and closed positions, but not so far as to interfere with the mechanical end stops, if the actuator has this feature. Then move the actuator to mid stroke.
5. If LED is solid, proceed to step 7.
6. If LED is flashing, loosen the gear on the actuator shaft and rotate the potentiometer gear until the LED is no longer flashing, but on solid - this indicates the center of the potentiometer’s travel. Note that the LED will flash at a slower rate the farther away from the mid position it gets. Once the LED is on solid tighten the actuator shaft gear and ensure that the gear engagement is tight and properly meshed.
7. Push the MODE button until the “CLOSE” LED is lit solid. Use the adjust buttons (▲ and ▼) to drive the actuator toward the desired closed position until the associated limit switch trips - the “CLOSE” LED will flash to indicate that the limit switch has tripped. Then tap the other adjust button to move the actuator just off the limit switch to the desired valve closed position.

8. Push the MODE button until the “OPEN” LED is lit solid. Use the adjust buttons (▲ and ▼) to drive the actuator toward the desired open position until the associated limit switch trips - the “OPEN” LED will flash to indicate that the limit switch has tripped. Then tap the other adjust button to move the actuator just off the limit switch to the desired valve open position.
9. If an OTR-101 option module is installed, follow **Auxiliary Open/Close Setup** (see page 3); otherwise continue to the next step.
10. Push the MODE button until the “COMMAND TYPE” LED is lit solid. Use the adjust buttons (▲ and ▼) to select appropriate input signal (4-20mA, 1-5VDC, 0-5VDC, 0-10VDC, 2-10VDC, or Digital). If 0-5VDC or 0-10VDC is selected, the LOSS OF COMMAND feature is not available, so proceed to step 12.
11. Push the MODE button until the “LOSS OF COMMAND” LED is lit solid; this sets the actuator to a predetermined position upon loss of command. Use the adjust buttons (▲ and ▼) to select appropriate position (OPEN, CLOSE, or LAST POSITION).
12. If an OTR-101 or OTX-101 option module is installed, follow **Position Output Mode Setup** (see page 3); otherwise continue to the next step.
13. The current trip setting is adjustable from 0-12 amps and is used to prevent permanent damage from the high torque available from DC motors. Use one of the following methods to set the current trip “below the locked rotor current” of the actuator for protection. (see current trip settings and TP1 location below)



Current trip amps	Voltage across TP1
0.5	0.104
1	0.208
2	0.416
3	0.624
4	0.832
5	1.040
6	1.248
8	1.664
10	2.080
12	2.496



### 1) IN FIELD METHOD:

Push the mode button until the yellow “MANUAL/FB POT CAL” LED is illuminated. Using the adjust (▲ and ▼) buttons, move the actuator open and close to identify where the actuator’s motor is most burdened from the load. Then, slowly turn the “current trip setting” (CCW) down from 12 amps towards 0 amps while moving the actuator back and forth through the area of greatest load until the motor stops and a motor current trip fault is observed on the led fault indicators. Using a DVM, measure the DC voltage across test point “TP1” then add 0.208V (i.e. 1 amp of safety margin) to the voltage measured across “TP1” and adjust the current trip setting to include the safety margin of 0.208V or by just increasing the current trip setting (CW) by 1 amp. Then, operate the actuator back and forth to confirm that the DHC-400 operates the actuator without a motor current trip fault.

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### 2) PRODUCTION METHOD:

Using the DC voltage setting obtained from the in-field method or an engineering recommendation, set TP1 to this DC voltage by adjusting the current trip setting while monitoring the voltage across TP1 with a DVM set to measure VDC.

14. Push the MODE button until the “AUTO” LED is lit solid. Your calibration is now **COMPLETE**. Connect the command signal wires to connector J2: terminal #4 (negative) and terminal #5 (positive). If a signal input was already connected, the actuator should have moved to that position.

### Auxiliary Open/Close Setup (for units with an OTR-101 option module only)

1. Push the MODE button until the “AUX CLOSE OUTPUT” LED is lit solid. Use the adjust buttons (▲ and ▼) to drive the actuator to the desired auxiliary close position.
2. Push the MODE button until the “AUX OPEN OUTPUT” LED is lit solid. Use the adjust buttons (▲ and ▼) to drive the actuator to the desired auxiliary open position.
3. Continue with Step 10 in the **Quick Calibration Procedure** (see page 2).

### Position Output Mode Setup (for units with an OTR-101 or OTX-101 option module only)

1. Push the MODE button until the green “POSITION OUT CAL” LED is lit solid **while** the “CLOSE” LED flashes.
2. Use the adjust buttons (▲ and ▼) to set the desired output current (mA) on the option module output for the closed position.
3. Push the MODE button so the “POSITION OUT CAL” LED remains solid **while** the “OPEN” LED flashes. Use the adjust buttons (▲ and ▼) to set the desired output current (mA) on the option module output for the open position.
4. Continue with Step 13 in the **Quick Calibration Procedure** (see page 2).

## FAULT INDICATORS

The DHC-400 detects various fault conditions that prohibit the unit from controlling the actuator. A combination of the three Fault indicators (red, yellow, and green) will turn on or flash to indicate a specific detected fault. If an appropriate relay option module is installed, the Fault relay output on the option module will turn off (indicating a fault) when any of the Fault indicators turn on or flash. A communications option module can also read the specific conditions causing a fault. Note that a fault condition DOES NOT disable the motor outputs when manually controlling the actuator with the adjust buttons; while useful for troubleshooting, care should be exercised when operating the motor under a fault condition. The OVERRIDE mode can also operate the motor when a fault condition exists.

Note that the indicators may not indicate all the fault conditions that may exist. This means that when the indicated fault is corrected, the unit may display another fault that has not been corrected. The table below provides a summary of the Fault indications which is followed by a description of each fault.

RED	YEL	GRN	FAULT
flash	OFF	OFF	Low Battery Voltage
flash	flash	OFF	Motor 1 Stall
flash	OFF	flash	Motor 2 Stall
flash	flash	flash	Double Stall
flash	ON	OFF	Motor 1 Current Trip
flash	OFF	ON	Motor 2 Current Trip
flash	ON	ON	Double Current Trip
ON	OFF	OFF	Battery Over Voltage
ON	flash	OFF	Motor 1 No Motion (Stall)
ON	OFF	flash	Motor 2 No Motion (Stall)
ON	flash	flash	Double No Motion (Stall)
OFF	OFF	flash	Feedback Alarm
OFF	flash	OFF	Loss of Command
OFF	ON	OFF	Command Out of Range
OFF	flash	flash	Feedback Alarm and Loss of Command
OFF	ON	flash	Feedback Alarm and Command Out of Range

**Low Battery Voltage** - When the DHC-400 detects that the battery/power supply voltage connected to BAT POS (J2-1) and BAT NEG (J2-2) drops below 10V, the motor outputs are turned off and all other operations are suspended in the manual mode followed by a three second flashing fault indication. In auto mode, a retry delay increases each time the motor movement is interrupted by low voltage. This helps protect the battery and hardware. Once a movement is completed without a low voltage condition, the retry delay is reset to three seconds. The fault indication provides warning of batteries in need of recharge or power supplies that have insufficient current for the application.

**Motor 1 Stall** - A *stall* condition is detected when no actuator motion is detected while the Motor 1 output is turned on and drawing more than 0.5A of motor current. The fault condition will disable the Motor 1 output only, and the fault is cleared when the DHC-400 detects a motion greater than 1.5° in either direction. The fault can be cleared if 1) the command signal commands a Motor 2 operation, 2) manual operation with the adjust buttons results in a motion greater than 1.5°, or 3) a mechanical manual override forces the 1.5° motion, provided the mechanical motion is monitored by the feedback pot.

**Motor 2 Stall** - A *stall* is detected when no actuator motion is detected while the Motor 2 output is turned on and drawing more than 0.5A of motor current. The fault can be cleared in the same manner as previously described for a Motor 1 Stall.

**Double Stall** - If the DHC-400 detects a *stall* condition in both directions, both motor outputs will be disabled. The command signal cannot clear this condition; only manual operation or a mechanical override can clear the fault. Alternatively, the DHC-400 can be powered off and then on to temporarily clear the fault; however, this practice should be avoided without permanently correcting the cause of such a fault.

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**Motor 1 Current Trip** - A *current trip* fault is detected when the motor current exceeds the current trip setting while the Motor 1 output is turned on. The fault can be cleared in the same manner as previously described for a Motor 1 Stall. NOTE: Successive attempts with manual operation using the adjust buttons can exceed the torque limit set by the Trip Setting.

**Motor 2 Current Trip** - A *current trip* fault is detected when the motor current exceeds the current trip setting while the Motor 2 output is turned on. The fault can be cleared in the same manner as previously described for a Motor 1 Current Trip.

**Double Current Trip** - If the DHC-400 detects a *current trip* fault in both directions, both motor outputs will be disabled. The fault can be cleared in the same manner as previously described for a Double Stall.

**Battery Over Voltage** - When the DHC-400 detects that the battery/power supply voltage connected to BAT POS (J2-1) and BAT NEG (J2-2) 30V, the motor outputs are turned off until the voltage returns to 30V or less. The fault indication will remain on for 3 seconds after voltage returns. **WARNING!** Exposing the DHC-400 to frequent or continuous voltages above 30V can damage the unit. The user should take steps to suppress or eliminate possible supply voltage conditions above 30V.

**Motor 1 No Motion** - A *no motion* fault is detected when no actuator motion is detected while the Motor 1 output is turned on and drawing less than 0.5A of motor current. The fault can be cleared in the same manner as previously described for a Motor 1 Stall. A *stall* usually indicates a heavy mechanical load or stall, while a *no motion* fault usually indicates a broken motor wire or disengaged feedback pot. Note that a *stall* cannot be detected in applications using very small motors (locked rotor currents less than 0.5A); only a *no motion* fault can be detected.

**Motor 2 No Motion** - A *no motion* fault is detected when no actuator motion is detected while the Motor 2 output is turned on and drawing less than 0.5A of motor current. The fault can be cleared in the same manner as previously described for a Motor 1 Stall. A *no motion* fault differs from a *stall* as previously describe for a Motor 1 No Motion fault.

**Double No Motion** - If the DHC-400 detects a *no motion* fault in both directions, both motor outputs will be disabled. The fault can be cleared in the same manner as previously described for a Double Stall.

**Feedback Alarm** - A fault condition is detected whenever the feedback signal is out of range (that is, less than 5% of the potentiometer value or more than 95% of the potentiometer value), or when any of the potentiometer connections are broken. Normal operation resumes when the potentiometer is reconnected or back in range.

**Loss of Command** - When using 1-5V, 2-10V, 4-20mA, or a Digital input type for the command signal, a *loss of command* condition is detected whenever the input is disconnected, the input is connected backwards, or the input becomes less than 0.75V (for 1-5V input), 1.5V (for 2-10V input) or 3mA. A loss of command cannot be detected for a 0-5V or 0-10V command signal. The fault indication will remain on until the signal is corrected or reconnected. The actuator moves to a default position, as set by the LOSS OF COMMAND mode, while a *loss of command* condition exists.

**Command Out of Range** - An out of range condition is detected whenever the input becomes greater than 5.25V (for a 0-5V or 1-5V input), 10.5V (for a 0-10V or 2-10V input), or 21mA. When using a 0-5V or 0-10V command signal, an out of range condition is detected if the input is connected backwards. The fault indication will remain on until the signal is corrected. The motor outputs are turned off while a *command out of range* condition exists.