

VALVCON ADC-Series

CONTINUOUS DUTY, UNIVERSAL
ON/OFF & MODULATING ELECTRIC ACTUATORS

With U2, UL2, UL3, U4, UL4, UL5, U6, UL6 & UL7 Options
With “-UP” In The Model Number

Installation, Maintenance and
Operating Instructions

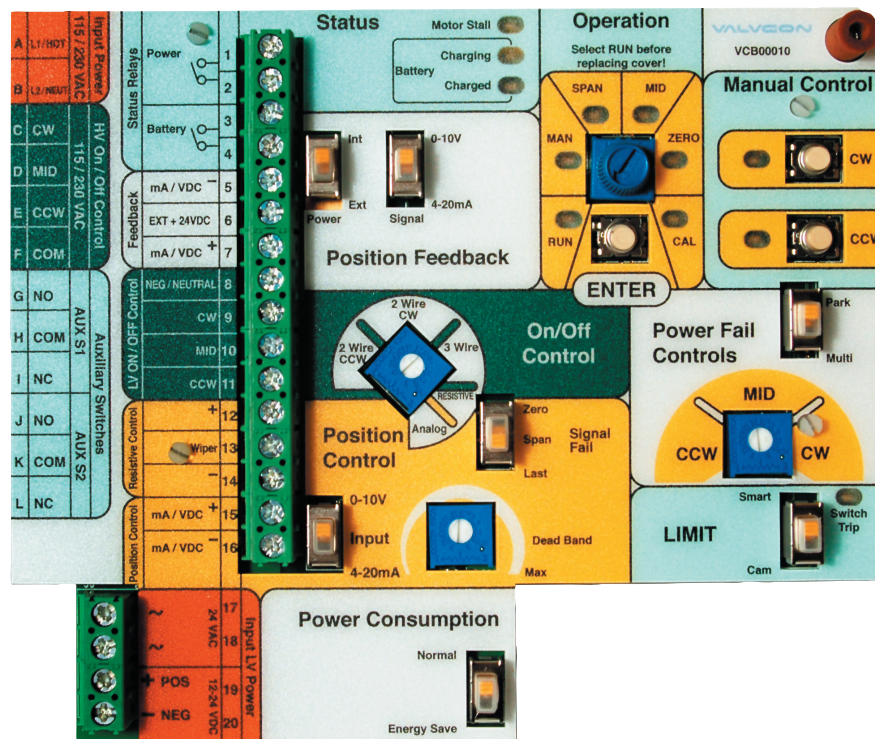


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READ THESE INSTRUCTIONS FIRST!

These instructions provide information about safe handling and operation of the actuator.
If you require additional assistance, please contact the manufacturer or manufacturer's representative.
Addresses and phone numbers are printed on the back cover.
See also www.metso.com/valvcon for the latest documentation.

SAVE THESE INSTRUCTIONS!

1 INTRODUCTION

1.1 ADC-Series Universal Control Actuators (with Optional Battery Back-up)

The ADC-Series consists of two different sized enclosures that cover different torque ranges. Model codes that start with "ADC" indicate the standard enclosure and a torque rating in the range from 150 to 600 in·lbs. "LADC" designates the larger enclosure and a torque rating in the range from 1000 to 3000 in·lbs.

The ADC-Series Actuators provide an optional internal battery pack to power the actuator in the event of a loss of external power. Actuators with battery back-up are identified in the model code by either a "UL2", "UL3", "UL4", "UL5", "UL6" or "UL7". The "UL2", "UL4" and "UL6" options are applicable in a standard ADC enclosure and the "UL3", "UL5" and "UL7" options are applicable in a LADC enclosure. The "UL4" and "UL5" options are factory-set for 180° operation with MID position factory set at 90°; and the "UL6" and "UL7" options are factory-set for 270° operation.

The ADC-Series Actuators' base electronic package consists of two separate boards; P/N VCB00010 Universal Control Board and the Switching Power Supply allowing for the choice of 115VAC, 230VAC, 12VDC, 24VDC or 24VAC actuator power.

1.2 Universal Control Board P/N VCB00010

The Universal Control Board can be configured for either "Two-Wire" or "Three-Wire" On/Off control, or "4-20mA Analog", "0-10VDC Analog", or a "Resistive" Positioner Control.

The Universal Control Board used in Positioner Control mode can be configured for Loss of Signal and has an adjustable input signal Dead Band.

The Universal Control Board allows independent 115VAC, 230VAC, 12VDC, 24VDC or 24VAC control signals from actuator power.

The Universal Control Board can provide analog position feedback, Power and Battery status and includes on-board battery status indicators.

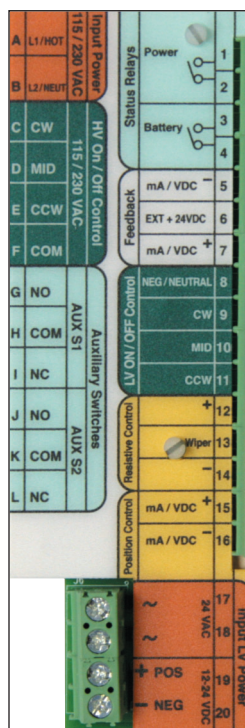
The Universal Control Board with the optional Battery Back-up installed will allow you to select power "Fail" position as well as to choose "Park" or "Multi" cycling upon loss of actuator power.

The Universal Control Board has locked rotor stall protection.

The Universal Control Board has manual push button control and simple digital smart set functionality for entering and saving precise end of travel positions for calibration to the application.

The Universal Control Board has an easy to navigate color scheme for its input and output wiring terminal blocks, detailed below:

Orange = Actuator Power
Green = On/Off Control
Yellow = Modulating Control
White = Analog Feedback
Light Blue = Status Feedback



2 SAFETY AND PRECAUTIONS

Caution: Dangerous Voltages Inside Actuator. Use extreme caution when working on the actuator with the cover removed.

Do not mis-apply high voltage to low voltage circuits or power the feedback if not in the externally powered mode. Damage may occur.

Adequately ground the actuator.

Use a dedicated power supply or an isolation transformer when using 24VAC actuator Input Power.

3 GENERAL

3.1 Interface

1 - CAL – A continuous yellow LED indicates that the CAL (calibration) mode has been selected. A flashing yellow LED displays to the user how close they are to hitting the CAL point depending on the speed of the flashes. The CAL mode allows the user to calibrate the position tracking potentiometer without the use of an ohmmeter or other electronic instruments. In CAL mode the actuator will travel beyond the saved settings for the Zero and Span stop positions.

2 - ZERO – A continuous yellow LED indicates that the ZERO mode has been selected. ZERO mode permits the user to set the desired Zero end-of-travel stop position with a corresponding control signal value. The Zero position is typically the fully clockwise position and minimum control signal value, but Zero may be set at any position.

3 - MID - A continuous yellow LED indicates that the MID mode has been selected. MID mode permits the user to save the desired "MID" position. The MID position may be set at any position inside (between) the saved Zero and Span end-of-travel positions. (MID is not typically used with the Position Control configuration but can be used as a mid-travel "fail" position upon loss of external power, provided the actuator is equipped with a back-up battery.)

4 - SPAN – A continuous yellow LED indicates that the SPAN mode has been selected. SPAN mode permits the user to set the desired Span end-of-travel stop with a corresponding control signal value. Typically, the Span position is the fully counterclockwise position and maximum control signal value, but Span may be set at any position.

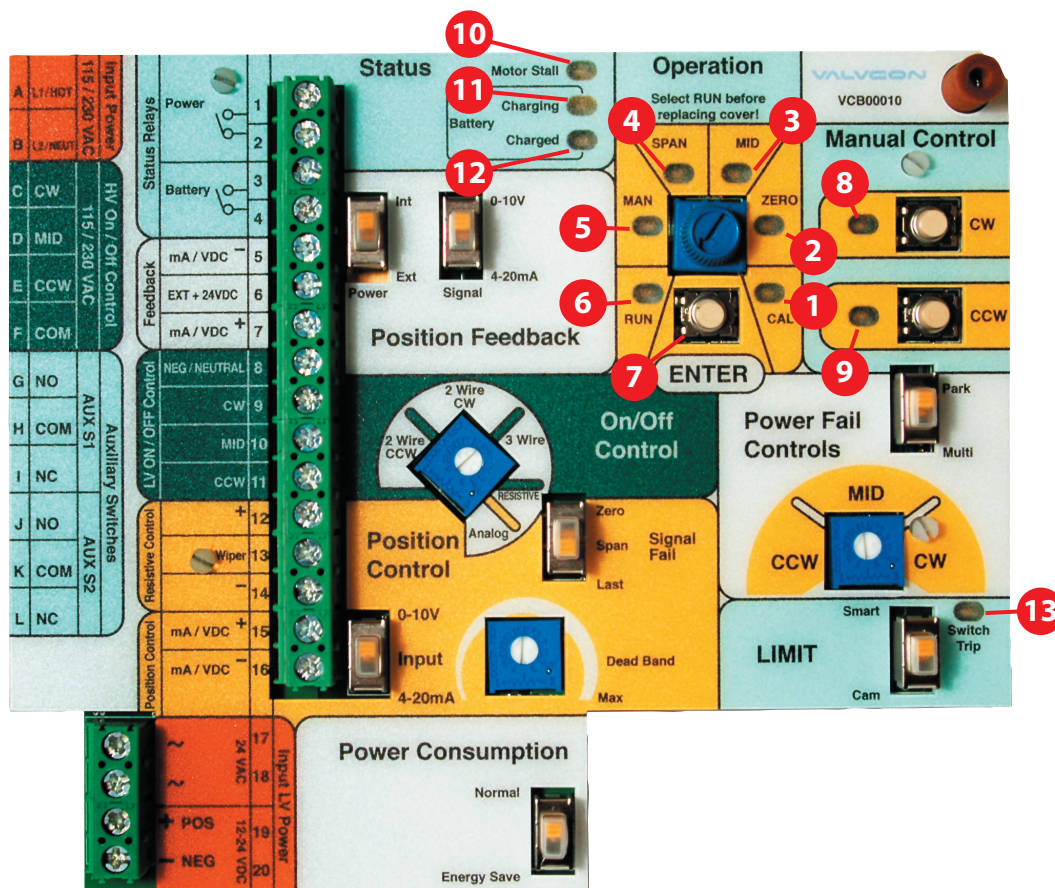
5 - MAN (MANUAL) – A continuous yellow LED indicates that Manual Control mode has been selected. The actuator will not respond to external control signals and the [CW] and [CCW] push buttons are enabled for manually driving the actuator in either direction. In Manual mode the actuator will not travel beyond the saved settings for the Zero and Span stop positions.

6 - RUN – A continuous green LED indicates that the normal operating mode has been selected. In RUN mode the actuator will respond external signals supplied to the Universal Control Board. This LED will turn off in Energy Save mode.

7 - ENTER – located directly below the mode selector and permits the user to activate modes and confirm settings by pressing the [ENTER] button.

8 - CW (CLOCKWISE) – A continuous yellow LED indicates that the actuator is driving in the CW direction. Located next to the Manual Control push button to drive the actuator in the CW direction.

VCB00010 Universal Control Board (Front)



9 - CCW (COUNTER-CLOCKWISE) – A continuous yellow LED indicates the actuator is driving in the CCW direction. Located next to the Manual Control push button to drive the actuator in the CCW direction.

10 - Motor Stall – A flashing red LED indicates a stall condition exists and that the actuator has been prevented from reaching the position commanded by the control signal. A STALL of more than several seconds will cause power to be automatically removed from the motor circuit, placing the actuator in a safe mode. A reverse signal or a manual mode [CW] or [CCW] movement is required to clear the stall condition. A STALL condition can be initiated by a blockage in the valve or damper, cam limit settings that are inside of the electronically saved travel stop positions, or some other increase in the torque load on the actuator.

11 - Battery Charging* – A continuous yellow LED indicates that the battery charging circuit is active to either charge or maintain the voltage on the Battery.

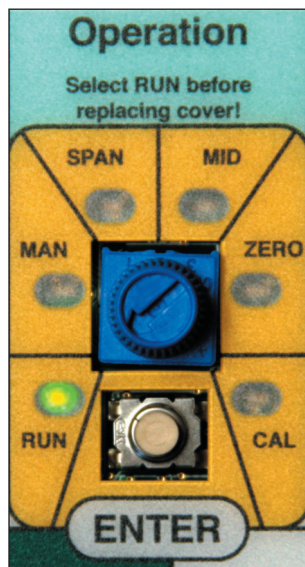
12 - Battery Charged* – A continuous green LED indicates that the battery is fully charged. A flashing green LED indicates the actuator is running on battery power. This LED will turn off in Energy Save mode.

* Note: Battery Charging and Battery Charged LEDs may be lit at the same time depending on the battery charge state.

13 - Switch Trip – A continuous red LED indicates that one of the end-of-travel limit switches has been “tripped” by the respective cam; this LED is intended to aid initial actuator set-up.

3.2 Operation Mode Selector Pot

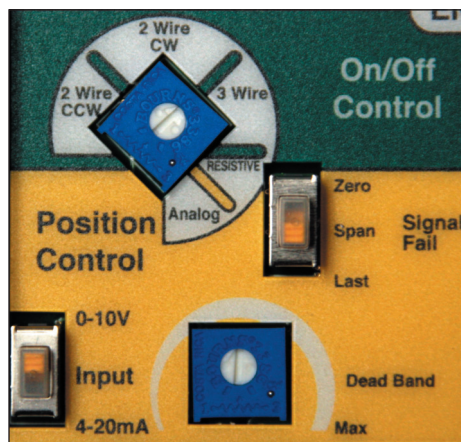
The Universal Control Board is equipped with an Operation Mode Selector Pot which allows the user to select the 6 modes of operation during calibration and set-up. LED indicators around the knob correspond to each of the modes; RUN, Manual (MAN), SPAN, MID, ZERO and Calibrate (CAL). When the Universal Control Board mode dial is set to any mode, the corresponding LED turns on, indicating the mode is selected.



In MAN (Manual) and CAL mode the unit will ignore any external control signals and respond only to the on-board push buttons (it should be noted that if the unit is equipped with an optional back-up battery and loss of power should occur while in MAN and CAL mode, the unit will drive to the selected “Power Fail” position).

3.3 Control Mode Selector Pot

The Universal Control Board is equipped with a Control Mode Selector Pot which enables the user to select between various “On/Off Control” and “Position Control” modes.



3.4 Travel Limit Cam and Switch Operation

With the Universal Control Board installed, the travel limit stops are set electronically as the Zero and Span position. Two limit switches operated by the cams on the output shaft are safety stops. Their intended function is to prevent damage in the event of a failure of the electronic limits. Therefore: Each cam must be set to operate the switch slightly outside of the electronic Zero and Span position range. Failure to set the cams properly may cause the actuator to stall when it cannot reach the commanded and electronically set end of travel position. The bottom limit switch determines clockwise safety stop position. The next limit switch up from the bottom determines the counter-clockwise safety stop position. Auxiliary switches and the corresponding cams will be the third and fourth up from the bottom.

Travel limits, also referred to as “end of travel stops”, are the precise positions to which the actuator will drive. For “2 Wire” or “3 Wire” On/Off operation, travel limits are set at the full clockwise (CW) and full counter-clockwise (CCW) ends of travel.

To simplify the process of setting the precise travel limit positions, the ADC-Series provides two On/Off travel limit types. CW, CCW and MID may be set electronically via the “Smart” limit utility or CW and CCW may be set mechanically by selecting the “Cam” limit type.

3.4.1 Smart Limit

When “Smart” is selected as the limit type, the micro-processor stores the exact positions where the actuator will stop at each end of travel or mid position. Setting the “Smart” limit positions for the ZERO, MID and SPAN positions is done with the selector knob and [ENTER] button in the Operation field of the Universal Control board. To use the Smart limit features, the Feedback Potentiometer must be installed, connected and calibrated and the travel stop cams must be set to trip the switches slightly beyond the desired “electronic” stop positions for ZERO and SPAN. The end-of-travel limits on ADC actuators can be entered and saved between 0° and 270° of travel. For 180° and 270° rotation alternate potentiometer gearing is required (refer to option code). For “Three-Position” operation, limits must be entered and saved using the “Smart” Limit!

3.4.2 Cam Limit

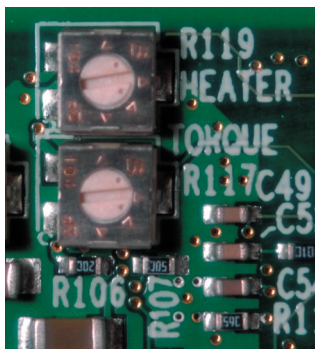
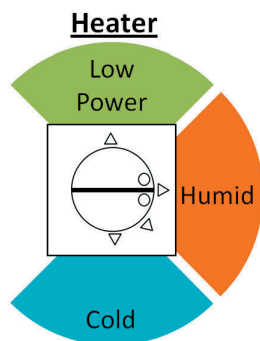
When “Cam” is selected as the limit type, two limit switches operated by the stainless steel cams on the output shaft extension are used to determine the exact positions where the actuator will stop at each end of CW and CCW travel. The bottom limit switch determines the clockwise stop position. The next limit switch up from the bottom determines the counter-clockwise stop position. The “end of travel limit” switches can be adjusted to provide from 5 to 320 degrees of actuator rotation. For “Three-Position” operation, limits must be entered and saved using the “Smart” Limit!

3.5 Built-In Heater/Thermostat Feature

The Universal Control Board is equipped with a built-in Heater/Thermostat Option that can be enabled for low-temperature use (environments where the temperature will drop below 32° Fahrenheit), high-humidity use (“tropical” environments), or disabled completely to conserve power, in environments where the climate is stable and/or controlled.

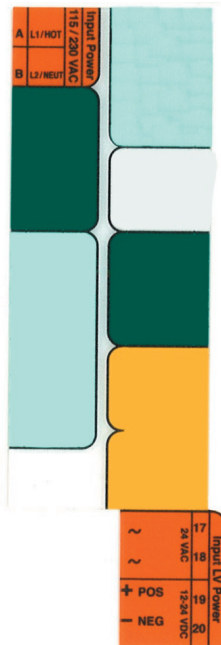
Note: All heater modes are disabled in “Energy Save” mode.

The Heater/Thermostat is enabled/disabled by turning a potentiometer on the Universal Control Board. See graphic below for proper positioning:



4 MAIN ACTUATOR POWER

The identification label on each actuator specifies the model number, serial number, actuator power voltage and current requirements for the actuator. It is important to verify the correct actuator voltage and control voltage prior to wiring the actuator.



4.1 115VAC or 230VAC Power Wiring

If using 115VAC or 230VAC as the MAIN Input Power: 115/230 VAC must be supplied constantly to the Universal Control Board as follows:

- Terminal A (AC L1/HOT)
- Terminal B (AC L2/NEUT)

4.2 24VAC Power Wiring

If using 24VAC as the MAIN Input Power: 24VAC must be supplied constantly to the Universal Control Board as follows:

- Terminal 17 (24AC HOT)
- Terminal 18 (24AC NEUT)

If using 24 VAC, each actuator must have a dedicated power supply and/or isolation transformer.

4.3 12VDC or 24VDC Power Wiring

If using 12VDC or 24VDC as the MAIN Input Power: 12/24 VDC must be supplied constantly to the Universal Control Board as follows:

- Terminal 19 (DC POS)
- Terminal 20 (DC NEG)

5 ON/OFF CONTROL

5.1 The three methods of On/Off Control:

The On/Off Control mode allows the actuator to drive in a desired direction in response to an application of voltage to the desired inputs. The different modes are as follows:

5.1.1 "2 Wire CW"

The actuator will default to the CCW position when main actuator power is present; the actuator will drive CW when the "CW" control power is energized.

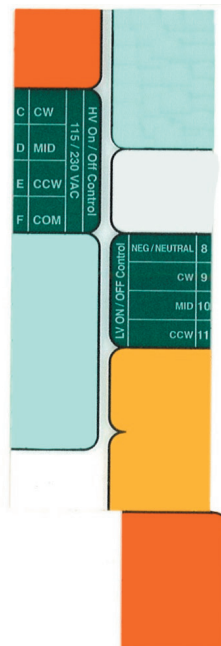
5.1.2 "2 Wire CCW"

The actuator will default to the CW position when main actuator power is present; the actuator will drive CCW when the "CCW" control power is energized.

5.1.3 "3 Wire" Open/Stop/Close Operation

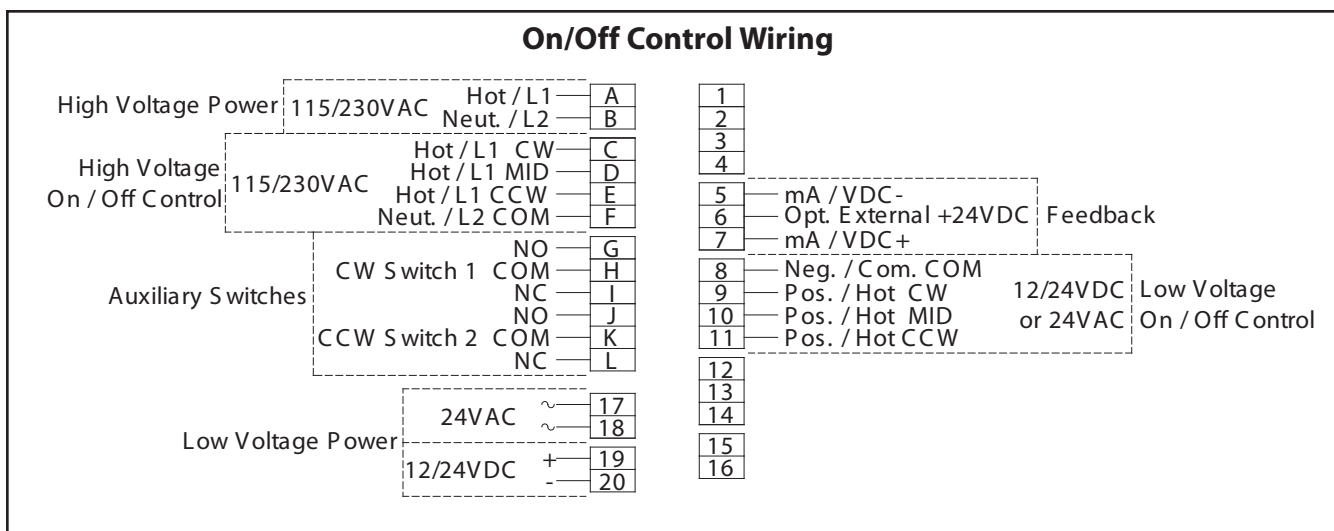
The actuator will drive CCW when the "CCW" control power is energized and drive CW when the "CW" control power is energized; if control power is removed mid-travel, the actuator will stop in position. The actuator will drive to the programmed "MID" position when the "MID" control power is energized. The "MID" position is optional and can be set anywhere inside of the CW and CCW end-of-travel positions settings to provide a Three-Position "Center-Off" position, or a "Dribble Feed" position.

5.2 On/Off Control Signal Wiring



5.2.1 High Voltage:

To control the actuator with a high voltage signal (115VAC or 230VAC): Connect AC L2/NEUT to terminal F on the Universal Control Board. Energize AC L1/HOT at terminal C on the Universal Control Board to drive the actuator clockwise (CW). Energize AC L1/HOT at terminal D on the Universal Control Board to drive the actuator to the "MID" position. Energize AC L1/HOT at terminal E on the Universal Control Board to drive the actuator counter-clockwise (CCW).



5.2.2 Low Voltage:

To control the actuator with a low voltage signal (12VDC, 24VDC or 24VAC): Connect 12/24DC NEG or 24AC NEUT to terminal 8 on the Universal Control Board. Energize DC POS or 24AC HOT at terminal 9 on the Universal Control Board to drive the actuator clockwise (CW). Energize DC POS or 24AC HOT at terminal 10 on the Universal Control Board to drive the actuator to the "MID" position. Energize DC POS or 24AC HOT at terminal 11 on the Universal Control Board to drive the actuator clockwise (CCW).

5.3 Set Up and Calibration

5.3.1 Initial Set Up

1. Remove actuator cover.
2. Select LIMIT type "Smart" or "Cam" by sliding the [Smart/Cam] switch down to select Cam or up to select Smart. Selecting Smart will enable other features on the board such as Position Feedback and "Three-Position" operation. Selecting Cam will allow the actuator to drive between the end-of-travel limit switch settings.
3. Select Control Method "2 Wire CCW", "2 Wire CW", or "3 Wire" by turning the selection potentiometer with a small flat blade screwdriver.

5.3.2 Potentiometer Calibration

Field installation of the Universal Control Board or replacement of the position tracking potentiometer requires calibration of the position tracking potentiometer prior to setting positions and values for ZERO, MID and SPAN. Universal Control Boards installed at the factory are fully calibrated at the factory and should not require further calibration.

To confirm proper potentiometer calibration:

1. Turn the Mode Selector Dial to [CAL] and press [ENTER] for 2 seconds.
2. Using the CW pushbutton, drive the actuator to the full clockwise position. - If the [CAL] LED is flashing, potentiometer calibration is required; proceed to step 3 below. - If the [CAL] LED remains on, calibration is not required; proceed to Setting ZERO, MID and SPAN Positions section below.
3. Loosen the set screw in the gear with a 1/16" hex wrench.
4. Rotate the gear until the LED remains on constantly; hold the gear in place and tighten the set screw. Ensure that the LED remains on after the set screw is tightened. Note: The LED assists the user in locating the proper calibration window; it will flash faster as you approach the calibration window and slower as you move away from it.
5. Press the [ENTER] button to save the potentiometer setting.

5.3.3 Setting ZERO, MID and SPAN Positions

Once (feedback potentiometer) calibration has been confirmed, set the desired "end of travel" positions. Make certain that the limit switch cams are set to operate the switches beyond the desired range for the ZERO and SPAN positions. ZERO and SPAN may be set at any position between 0° and 94° of travel (0° and 184° with "U4", "UL4" or "UL5" option; or 0° and 274° with "U6", "UL6" or "UL7" option).

Set ZERO:

1. Turn the Mode Selector Dial to [ZERO] and press [ENTER] for 2 seconds. The [ZERO] LED will begin to flash.
2. Drive the actuator to desired clockwise position using the CW or CCW push button. If the "STALL" LED begins to flash; check to see if the limit switch cam is preventing actuator from reaching desired ZERO end-of-travel (the "Switch Trip" LED will be illuminated). If necessary back the cam off so that it will trip the switch slightly beyond the desired end-of-travel and the "Switch Trip" LED will go out.
3. Press the [ENTER] button to save the ZERO setting.

Set MID: (if applicable)

1. Turn the Mode Selector Dial to [MID] and press [ENTER] for 2 seconds. The [MID] LED will begin to flash.
2. Drive the actuator to the desired MID or "THIRD" position using the CW or CCW push button.
3. Press the [ENTER] button to save the MID setting.

Set SPAN:

1. Turn the Mode Selector Dial to [SPAN] and press [ENTER] for 2 seconds. The [SPAN] LED will begin to flash.
2. Drive the actuator to desired counterclockwise position using the CW or CCW push button. If the "STALL" LED begins to flash; check to see if the limit switch cam is preventing actuator from reaching desired SPAN end-of-travel (the "Switch Trip" LED will be illuminated). If necessary back the cam off so that it will trip the switch slightly beyond the desired end-of-travel and the "Switch Trip" LED will go out.
3. Press the [ENTER] button to save the SPAN setting.

5.3.4 Verify End-Of-Travel Settings:

1. Turn the Mode Selector Dial to [RUN].
2. Apply various control signals to verify operation.
3. Verify that the "Switch Trip" LED is not illuminated at either the ZERO or SPAN positions (if it is, "back" the respective end-of-travel cam "off" of the respective limit switch).
4. Replace actuator cover.

5.3.5 Proper Actuator Cover Replacement

1. Remove the override shaft from the actuator cover bushing; if the actuator is equipped with a handwheel, remove the handwheel before removing the top piece of the "two-piece" shaft from the cover bushing.
2. Install the override shaft on the square motor shaft; if the actuator is equipped with a handwheel, install the bottom piece of the "two-piece" shaft on the motor shaft and then install the top piece of the shaft onto the bottom piece of the shaft.
3. Align cover so that the override shaft will pass through the override bushing and carefully push it down so that the cover flange contacts the base flange.
4. Once the cover is properly seated, tighten the screws to secure the cover; a cross pattern is recommended for uniform distribution of load.
5. If the position indicator is not seated to the output/cam shaft, turn until it drops into place in order to ensure accurate visual position indication.

6 POSITION CONTROL

6.1 The three methods of Position Control

The Position Control mode allows the actuator to modulate (change position) in response to a change in an analog or resistance control signal. The different modes are as follows:

6.1.1 “4-20mA Current Analog” Control

The actuator will modulate between positions in direct response to the change in the input current signal. Set 4 mA as the Zero position and 20mA as Span for normal operation or set 4mA as Span and 20mA as Zero for reverse acting.

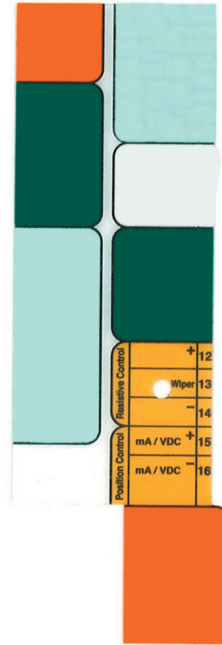
6.1.2 “0-10VDC Voltage Analog” Control

The actuator will modulate between positions in direct response to the change in the input voltage signal. Set 0VDC as the Zero position and 10VDC as Span for normal operation or set 0VDC as Span and 10VDC as Zero for reverse acting.

6.1.3 “Resistive” Control (up to 10K Ohm)

The actuator will modulate between positions in direct response to the change in the input resistive signal.

6.2 Position Control Signal Wiring



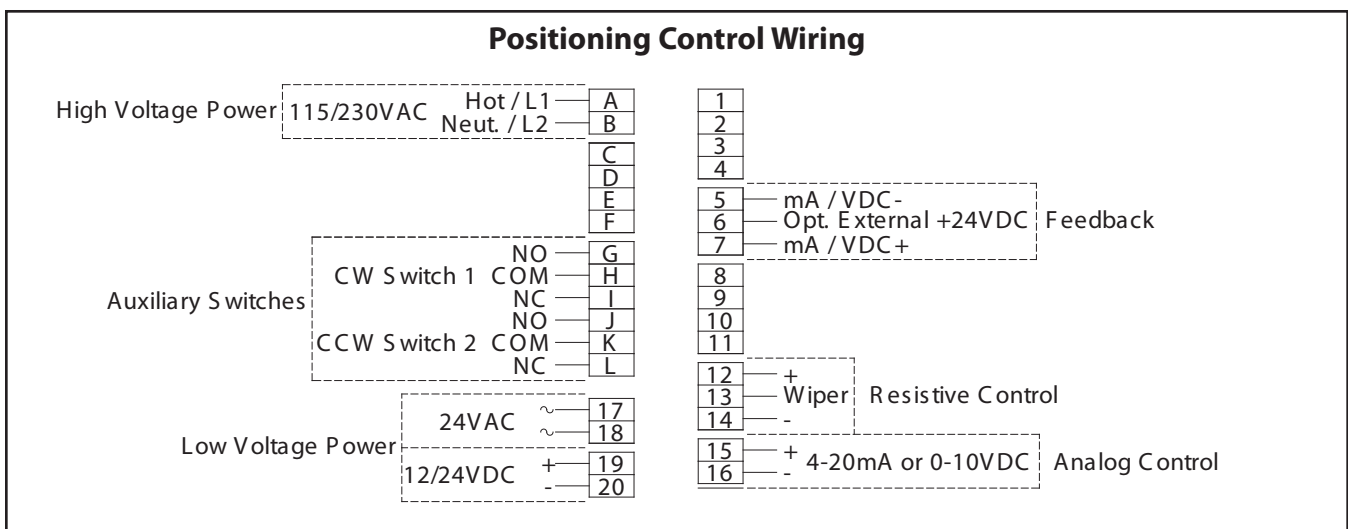
6.2.1 Analog Control Wiring

To control the actuator with a 4-20mA or 0-10V analog signal: Connect mA / VDC - (NEG) to terminal 16 and mA / VDC + (POS) to terminal 15 on the Universal Control Board.

Slide the [Input] switch up to select 0-10V or down to select 4-20mA.

6.2.2 Resistive Control Wiring

To control the actuator with a resistance signal such as 0-135 Ohms: Connect Resistance Signal - (NEG) to terminal 14, Resistance Signal Wiper to terminal 13, and Resistance + (POS) to terminal 12 on the Universal Control Board. The board will respond to resistance signals up to 10K Ohms (minimum SPAN signal is 100 Ohms; i.e. signal = 0-100 Ohms).



6.3 Set Up and Calibration

6.3.1 Initial Set Up

1. Remove actuator cover.
2. Select LIMIT type "Smart" by sliding the [Smart/Cam] switch up to select Smart. Selecting Smart will enable other features on the board such as Position Feedback
3. Select Control Method "Analog" or "Resistive" by turning the selection potentiometer with a small flat blade screwdriver.

6.3.2 Potentiometer Calibration

Field installation of the Universal Control Board option or replacement of the position tracking potentiometer requires calibration of the position tracking potentiometer prior to setting positions and values for ZERO, MID and SPAN. Universal Control Board options installed at the factory are fully calibrated at the factory and should not require further calibration. To confirm proper potentiometer calibration:

1. Turn the Mode Selector Dial to [CAL] and press [ENTER] for 2 seconds.
2. Using the CW pushbutton, drive the actuator to the full clockwise position. - If the [CAL] LED is flashing, potentiometer calibration is required; proceed to step 3 below. - If the [CAL] LED remains on, calibration is not required; proceed to Setting ZERO, MID and SPAN Positions section below.
3. Loosen the set screw in the gear with a 1/16" hex wrench.
4. Rotate the gear until the LED remains on constantly; hold the gear in place and tighten the set screw. Ensure that the LED remains on after the set screw is tightened. Note: The LED assists the user in locating the proper calibration window; it will flash faster as you approach the calibration window and slower as you move away from it.
5. Press the [ENTER] button to save the potentiometer setting.

6.3.3 Setting ZERO, MID, and SPAN Positions

Once (feedback potentiometer) calibration has been confirmed, set the desired "end of travel" positions. Make certain that the limit switch cams are set to operate the switches beyond the desired range for the ZERO and SPAN positions. ZERO and SPAN may be set at any position between 0° and 94° of travel (0° and 184° with "U4", "UL4" or "UL5" option; or 0° and 274° with "U6", "UL6" or "UL7" option).

Set ZERO:

1. Turn the Mode Selector Dial to [ZERO] and press [ENTER] for 2 seconds. The [ZERO] LED will begin to flash.
2. Drive the actuator to desired clockwise position using the CW or CCW push button. If the "STALL" LED begins to flash; check to see if the limit switch cam is preventing actuator from reaching desired ZERO end-of-travel (the "Switch Trip" LED will be illuminated). If necessary back the cam off so that it will trip the switch slightly beyond the desired end-of-travel and the "Switch Trip" LED will go out.
3. Apply the desired Analog Signal that will correspond with the Zero position (ie 4mA).
4. Press the [ENTER] button to save the ZERO setting.

Set MID: (if applicable)

1. Turn the Mode Selector Dial to [MID] and press [ENTER] for 2 seconds. The [MID] LED will begin to flash.
2. Drive the actuator to the desired MID or "THIRD" position using the CW or CCW push button.
3. Press the [ENTER] button to save the MID setting.

Set SPAN:

1. Turn the Mode Selector Dial to [SPAN] and press [ENTER] for 2 seconds. The [SPAN] LED will begin to flash.
2. Drive the actuator to desired counterclockwise position using the CW or CCW push button. If the "STALL" LED begins to flash; check to see if the limit switch cam is preventing actuator from reaching desired SPAN end-of-travel (the "Switch Trip" LED will be illuminated). If necessary back the cam off so that it will trip the switch slightly beyond the desired end-of-travel and the "Switch Trip" LED will go out.
3. Apply the desired Analog Signal that will correspond with the Span position (ie 20mA).
4. Press the [ENTER] button to save the SPAN setting.

6.3.4 Verify End-Of-Travel Settings:

1. Turn the Mode Selector Dial to [RUN].
2. Apply various control signals to verify operation.
3. Verify that the "Switch Trip" LED is not illuminated at either the ZERO or SPAN positions (if it is, "back" the respective end-of-travel cam "off" of the respective limit switch).
4. Replace actuator cover.

6.3.5 Proper Actuator Cover Replacement

1. Remove the override shaft from the actuator cover bushing; if the actuator is equipped with a handwheel, remove the handwheel before removing the top piece of the "two-piece" shaft from the cover bushing.
2. Install the override shaft on the square motor shaft; if the actuator is equipped with a handwheel, install the bottom piece of the "two-piece" shaft on the motor shaft and then install the top piece of the shaft onto the bottom piece of the shaft.
3. Align cover so that the override shaft will pass through the override bushing and carefully push it down so that the cover flange contacts the base flange.
4. Once the cover is properly seated, tighten the screws to secure the cover; a cross pattern is recommended for uniform distribution of load.
5. If the position indicator is not seated to the output/cam shaft, turn until it drops into place in order to ensure accurate visual position indication.

6.4 Deadband Adjustment

Dead Band is the window of control signal change which the actuator will ignore. The sensitivity of the actuator to respond to changes in the control signal is adjustable. Minimum Dead Band (1%) allows the actuator to respond to small control signal changes. Maximum Dead Band (3%) allows the actuator to ignore small control signal changes (such as noise on the control signal).

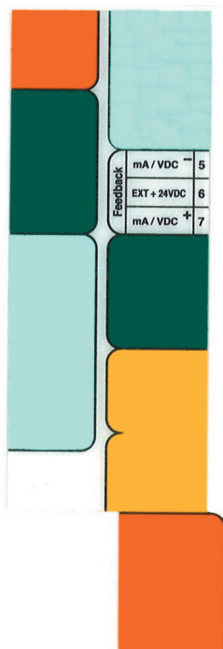
6.5 Signal Fail Options

In the event that the control signal to the actuator is lost and external power is still applied, the Signal Fail position selector switch on the Universal Control Board provides options for the actuator to drive to the Zero (minimum signal) position, the Span (maximum signal) position, or to remain at its "Last" (current) position. Note: If you use a 0-10VDC control signal, the actuator cannot differentiate between a 0VDC signal and an actual loss of signal; therefore it will drive to the "Zero" position regardless of the switch setting.

7 POSITION FEEDBACK AND STATUS INDICATORS

7.1 Position Feedback

The Position Feedback provides an analog indication of the actuator output position scaled between the configured Zero and Span positions.



7.1.1 4-20mA

The 4-20mA Feedback can be powered either internally (by the actuator) or externally (by the loop).

If the Position Feedback will be powered externally, it is extremely important to terminate the customer supplied +24VDC to the correct terminal on the Universal Control Board. The Position Feedback switches are also important. The Power Switch should be down into the "Ext" position and the Signal Switch should be down into the "4-20mA" position.

The 4-20mA Feedback circuit will power down if no impedance is measured on the output terminals in both Normal and Energy Save Mode operation. This is to stop any unnecessary power drain while the 4-20mA feedback circuit is not connected. Keep the metering circuit connected to ensure that the feedback will be present as needed. If the actuator position changes and there is a metering circuit present then the feedback circuit will resume operation and track the position.

7.1.2 0-10VDC

The 0-10V Feedback can only be used with internally (by the actuator) supplied power.

The Position Feedback switches are also important. The Power Switch should be up into the "Int" position and the Signal Switch should be up into the "0-10V" position.

7.2 Status Indicators

7.2.1 Auxiliary Switches

Two auxiliary limit switches will provide position indication for customer use. The switches are dry contacts that can be used to operate other devices. Switches are single pole, double throw; rated for 12/ HP, 11 amps @ 250VAC, CSA certified.

7.2.2 Power Status Relay

The Power Status Relay is "high" if external voltage (12-24VDC, 24VAC power inputs to the board and the output from the Switching Power Supply to the board) is greater than 12.5V. The relay is "low" if external voltage drops below 10.5V and will alternate between "high" and "low" if the motor is stalled.

7.2.3 Battery Status Relay

The Battery Status Relay is "high" if battery is present ($V_{bat} \geq 6V$) and fully charged (Charger current is $< 10mA$); if the relay switches to "low" the back-up battery should be checked/replaced. Note: After a loss of external power, the Battery Status Relay may show "low" for a period of time while the battery is charging.

8 POWER MANAGEMENT

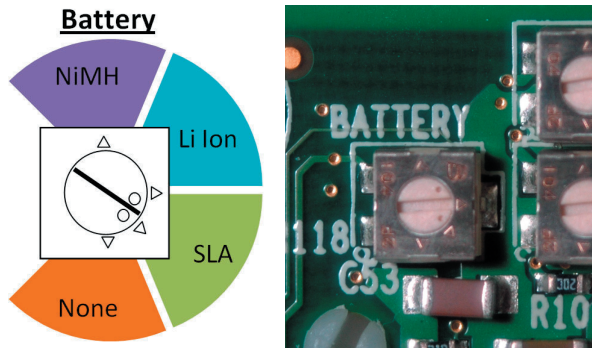
8.1 Battery

With the optional battery backup (included with options UL2, UL3, UL4, UL5, UL6 & UL7), the actuator will sense the loss of main input power to the Universal Control Board and immediately switch to internal battery power. When line power returns, the actuator will automatically resume normal operation.

The battery charging voltage has been designed for optimum battery performance. When the charging circuit is active (even when topping off charge or in sleep mode), the yellow Charging LED will light. After reaching full charge, the green Charged LED will light.* Fully charged, the battery voltage will reach approximately 13.6 volts. This voltage is designed to vary with temperature, and could be as high as 14.4 volts if in a very cold environment, or as low as 12.8 volts if in a very warm environment. This is normal operation. A battery case that is swollen or cracked must be replaced. Please consult the factory for replacement. If the battery does not reach full charge (the green Charged LED remaining on and the yellow Charging LED turning off) within 48hrs, consult the factory or your local representative.

* Note: Battery Charging and Battery Charged LEDs may be lit at the same time depending on the battery charge state.

Replacement battery packs should be stored only after a full charge and at less than 80°F. Temperature can affect battery shelf life. Generally lower temperatures will increase shelf life while higher temperatures will decrease shelf life. When recharging battery packs, they should only be recharged from the Universal Control Board charging circuit, which is calibrated to provide the proper voltage and current for maximum battery pack life, or from a Metso recommended battery charger.



The only suggested maintenance is to examine, and if necessary, replace the batteries every two years. Battery life can vary with temperature. Cooler environments will generally prolong battery life and under ideal conditions ADC batteries will last in excess of five years. To change the batteries, perform the following:

1. Disconnect power to the actuator.
2. Remove actuator cover and set aside carefully so as not to damage the machined flange.
3. Disconnect battery connection at the Universal Control board.
4. Unhook one side of the battery hold-down o-ring.
5. Remove the battery.
6. Install new battery and replace hold-down o-ring.
7. Plug battery connector into the connector into the Universal Control Board.
8. Replace actuator cover.
9. Apply power.

8.2 Power Fail Controls

The ADC-Series Universal Control Board is designed to be easily configured to drive to either the CW, CCW or MID position upon loss of actuator power. This is the power loss or "Fail" position.

When designating MID as the power loss or "Fail" position, the limit type must be set at "Smart" and the MID position must have been entered and saved in the "Operation" field otherwise the Actuator will calculate a default MID position between the calibrated Zero and Span positions.

The ADC-Series Universal Control Board is designed to provide continuing service in the event of a loss of external power. Upon power loss the ADC-Series actuator, equipped with an optional Back-Up Battery can be configured to drive the actuator and "Park" immediately at the designated power loss Fail position and "go to sleep".

In "Multi" mode it will continue to cycle on battery power while a control signal and adequate battery power remain available. When "Multi" is selected, the actuator will cycle until a low battery power condition is detected then automatically drive to and remain at the designated power loss or Fail Position.

In "Multi" mode a fully charged battery will provide up to ten complete 90 degree cycles under optimum conditions. Upon reaching the power loss position, the system will "go to sleep" until input power is restored.

8.3 Wake and Manually Drive Actuator

Manually Drive the Actuator (Using the Battery) During Power Outage (If using "Park" Power Fail Control selection) After the battery drives the actuator to the Power Loss Position, the Universal Control Board powers down and remains in "sleep" mode until external power returns. To "wake" the actuator, to control it with the external control signal or to enable the CW or CCW push buttons for manual control, move the Power Fail Controls switch to "Multi" mode and press [Enter]. This will "wake" the electronics and the actuator can be manually operated via the CW or CCW push buttons until low battery power level is detected. To "park" the actuator and revert it back to sleep mode flip the Power Fail switch back to "Park" mode and the actuator will drive to the fail position and go back to sleep.

8.4 Energy Save Mode

The ADC-Series Universal Control Board is equipped with an "Energy Save" mode in which the unit will "doze" when a control signal change is not detected after a one-minute time-out; this is especially beneficial in solar applications where the continuous power draw can be minimized considerably by using "Energy Save" mode. Once a signal change is detected, the unit will "wake" and respond; if no additional changes are made within one minute, the unit will again enter the "doze" cycle.

Selecting "Energy Save" Mode To select "Energy Save" mode, simply slide the Power Consumption switch down; to return to "Normal", simply slide the switch up.

Note: All heater modes are disabled in "Energy Save" mode.

9 DEFAULT SETTINGS AND MODES

Board Section	Function	Condition	State
Back of Board	Torque	Small Actuator	Pot Mid
		Large Actuator	Pot Full CW
	Heater	Low Power	Full CCW
	Battery (with battery installed)	Sealed Lead Acid	Pot 3/4 CW
	Battery (no battery installed)	None	Full CW
Position Feedback	Power	External	Switch Down
	Signal	4-20mA	Switch Down
On/Off Control	Control Mode	2 Wire CCW	Pot Full CCW
Position Control	Input	4-20mA	Switch Down
	Signal Fail	Zero	Switch Up
	Dead Band	Min	Pot Full CCW
Power Fail Control	Park/Multi	Park	Switch Up
	CCW/Mid/CW	CW	Pot Full CW
Limit	Smart/Cam	Smart	Switch Up
Power Consumption	Normal/Energy Save	Normal	Switch Up
Operation	Mode Selector	Run	Pot Full CCW

10 TROUBLESHOOTING

Symptom: Actuator Stall LED is blinking in a mid-travel position.

Fix: This could be due to hunting; increase actuator Deadband or adjust controller's setpoint tolerance

Symptom: Actuator does not respond to 4-20mA or 0-10V control signal.

Fix: Verify that Analog Position Control Mode has been selected. If the problem persists calibration is required.

Symptom: No Feedback in Energy Save mode.

Fix: If the Feedback wires are removed from the terminal block, even briefly, the Feedback signal is turned off; ensure the wires are connected and cycle power to reinitialize Feedback signal.

Symptom: LED's shut off after a minute.

Fix: Check to see if Energy Save mode has been selected; LEDs are turned off after one minute in Energy Save mode in order to reduce power consumption.

11 SPECIFICATIONS & TECHNICAL INFORMATION

Table 1

Torque (in-lbs)	Duty Cycle	12VDC		24VDC		24VAC		115VAC		230VAC	
		Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)	Cycle Time (sec/90°)	Current Draw (Amps)
150	100%	11	2.2	13	1.2	8	1.8	9	0.4	9	0.4
300	100%	17	2.5	13	1.4	12	2.1	13	0.5	13	0.4
600	100%	17	2.8	13	1.7	13	2.5	14	0.6	14	0.5
1000	100%	21	4	14	2.4	15	3.5	15	0.9	15	0.6
1500	100%	40	4	24	2.4	27	3.5	29	0.9	29	0.6
2000	100%	40	4.3	33	2.4	28	3.5	29	0.9	29	0.6
2500	100%	55	3.3	40	2	38	3.1	39	0.8	39	0.6
3000	100%	60	3.7	42	2.2	40	3.5	42	0.8	43	0.6

Table 2 - Specifications

Temperature Range	32°F to 130°F (0°C to 55°C) (without heater and thermostat enabled) -40°F to 130°F (-40°C to 55°C) (with heater and thermostat enabled)	
Conduit Connections	(2) 3/4" NPT all sizes (3/4" to 1/2" reducing bushings included)	
Output	150 to 600 in-lbs: ISO 5211 F05 and F07 bolt circles, 3/4" female square (14mm female square w/ "I" Option; 15mm female keyed output w/ "Y" Option). 1000 to 3000 in-lbs: ISO 5211 F07 and F10 bolt circles, 1" female square (1000 in-lbs: 19mm female square w/ "I" Option; 1500 - 3000 in-lbs: 22mm female square w/ "I" Option; 1000 to 3000 in-lbs: 20mm female keyed output w/ "Y" Option)	
Voltage	12 VDC: 10.8 to 13.2 VAC 24 VDC: 21.6 to 26.4 VDC 24 VAC: 21.6 to 26.4 VAC, 60 Hz or 50 Hz 115 VAC: 103.5 to 126.5 VAC, 60 Hz or 50 Hz 230 VAC: 207 to 253 VAC, 60 Hz or 50 Hz	Note: Operation at 50 Hz may result in a longer cycle time and an increased current draw.
Limit Switches	(2) Single pole, double throw switches rated for 1/2 HP, 11 amps @ 250 VAC, CSA certified.	
Motor	Brushless DC motor with Class B or better insulation; sub-fractional horsepower	
Lubrication	Permanently lubricated gear train and bearings	
Gear Train	Hardened steel, machine cut spur gears	
Approximate Weight	17 lbs for sizes up to 600 in-lb (ADC models) 31 lbs for sizes 1000 in-lb and above (LADC models)	
Enclosure	Die cast aluminum	

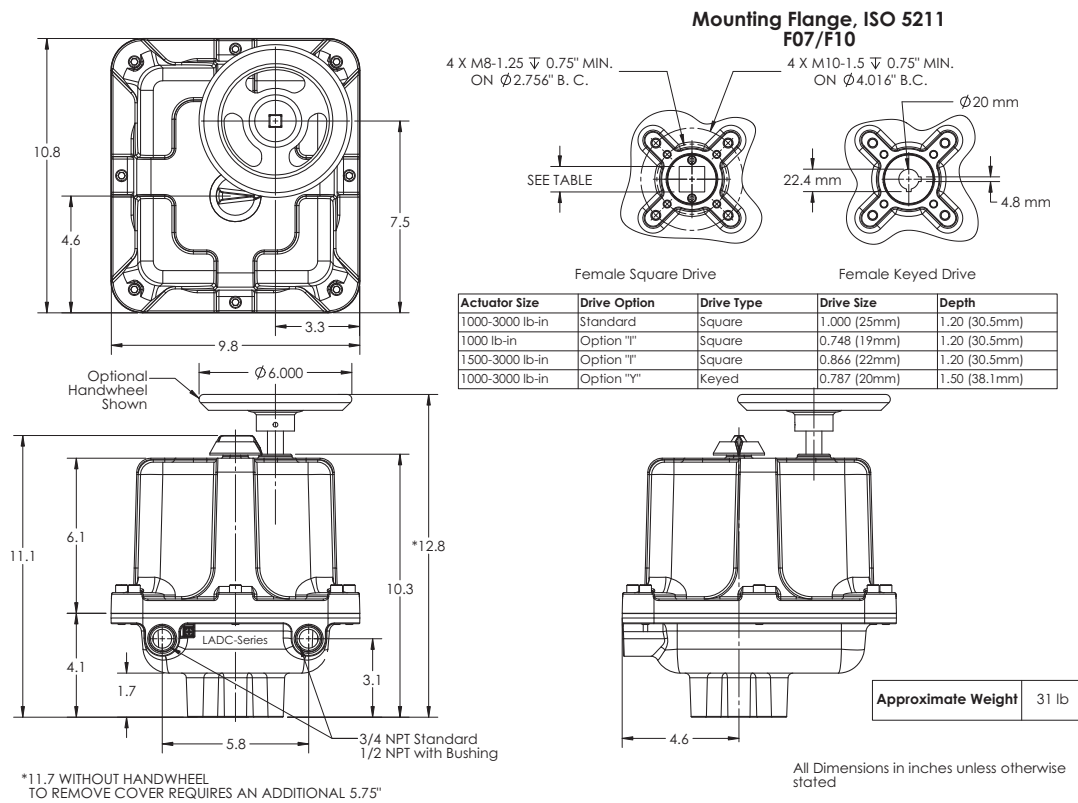
11.1 ADC-SERIES UNIVERSAL CONTROL BOARD

Table 3 - Control Board Specifications

Input Impedance (Analog Control)	Voltage Input: 35K ohms Current Input: 200 ohms
Analog Control Signal	May be either 4-20mA or 0-10VDC (selectable via on-board slide switch) Fully compatible with ISA-S50. 1 as a type 4, class L, power isolated device. Input minus (-) and transmit minus (-) are tied together and isolated from power and earth ground.
Resistive Control Signal	Board will accept a resistance control signal as low as 0-100 ohms and as high as 0-10K ohms.
Position Out Signal	May be either 4-20mA or 0-10VDC (selectable via on-board slide switch) Minimum resistive load for voltage output: 1K ohm Maximum resistive load for current output: 500 ohm
Stall Protection	If the actuator cannot achieve the position commanded by the control signal, this feature will remove all power to the motor after 5 seconds. The actuator will not restore power to the motor until the control signal commands the actuator to drive in the opposite direction.
Power Loss Position	In the event of a loss of main power, user can choose either the Zero position or the Span, or Mid position, via selector pot, as the power loss "Park" position.
Power Fail Park or Battery Cycle	In the event of a loss of main power, user can choose either to drive the actuator immediately to the "Park" Power Loss Position or continue to cycle (if control signal is available) until low battery level is detected before driving to the "Park" position.
Control Fail Position	In the event of a loss of control signal (with power still supplied), user can choose either the Zero, Span or the Last position via slide switch NOTE: <u>If</u> the the minimum control signal = 0, the fail position <u>must</u> be Last
Position Potentiometer	360° Rotation, 0 ohms to 1k ohms.
Local Supervisory Control	User can select manual (MAN) to override control signal and drive actuator by pushing the CW or CCW buttons. Actuator may be manually positioned to any location between the existing Zero and Span settings. For additional range, reset the ZERO and Span locations.
Split Range Control	Actuator will accept split range control signal (i.e. 4-12mA or 12-20mA; 0-5V or 5-10V) with no wiring changes.
Reverse Acting	With no wiring changes required, the actuator may be calibrated to drive clockwise upon an increasing control signal, and counter-clockwise upon a decreasing signal.
Dead Band	The amount of change in control signal that the actuator will ignore before the output shaft begins to move. Adjustable from 1% to 3%.

11.2 DIMENSIONS

LADC-SERIES



ADC-SERIES

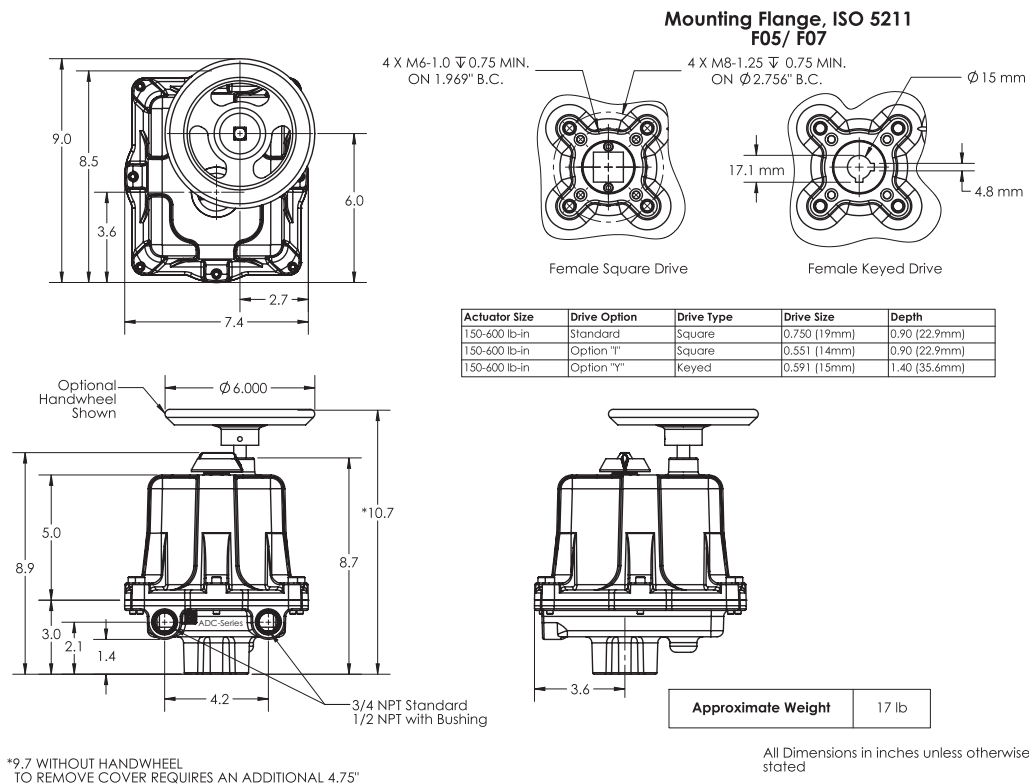


Figure 1

12 ENCLOSURE

Table 4
How To Order - ADC-Series Electric Actuators ¹

Series	Enclosure Type		Torque		Board Options ²		Other Options		Operating Voltage	
	Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
ADC	W	Weathertight NEMA 4/4X	150	150 in·lb	U2	On/Off / Positioner Board	I ³	ISO 5211 Output	-UP	Universal Power: 12/24 DC, 24 AC or 115/230 AC
			300	300 in·lb	UL2	On/Off / Positioner Board with Battery Back-Up	MB ⁴	Modbus Communication		
			600	600 in·lb	U4	On/Off / Positioner Board 180-Degree	Y ⁵	Keyed Output		
	WX	Weathertight & Explosionproof NEMA 4/4X/7&9			UL4	On/Off / Positioner Board 180-Degree with Battery Back-Up	Z	Handwheel		
					U6	On/Off / Positioner Board 270-Degree				
					UL6	On/Off / Positioner Board 270-Degree with Battery Back-Up				
LADC	W	Weathertight NEMA 4/4X	1000	1000 in·lb	U2	On/Off / Positioner Board	I ³	ISO 5211 Output	-UP	Universal Power: 12/24 DC, 24 AC or 115/230 AC
			1500	1500 in·lb	UL3	On/Off / Positioner Board with Battery Back-Up	MB ⁴	Modbus Communication		
			2000	2000 in·lb	U4	On/Off / Positioner Board 180-Degree	Y ⁵	Keyed Output		
	WX	Weathertight & Explosionproof NEMA 4/4X/7&9	2500	2500 in·lb	UL5	On/Off / Positioner Board 180-Degree with Battery Back-Up	Z	Handwheel		
			3000	3000 in·lb	U6	On/Off / Positioner Board 270-Degree				
					UL7	On/Off / Positioner Board 270-Degree with Battery Back-Up				

- Notes: 1. All ADC-Series actuators accept any of the following input voltages (12VDC, 24VDC, 24VAC, 115VAC and 230VAC), are rated for continuous duty cycle, include a holding brake, two auxiliary limit switches, 4-20mA or 0-10VDC position feedback, wrench-operated manual override, CSA "C US" certification, CE compliance, and a heater/thermostat that can be user-enabled on the option board.
2. Must select only one board option; all board options can be configured for On/Off or Modulating operation and a built-in Heater/Thermostat that can be activated for either Low-Temperature, or High-Humidity environments.
3. 150 - 600 lb-in models with I option are supplied with a 14mm female square (note that without option I the female square is 3/4"). 1000 lb-in models with I option are supplied with a 19mm female square and 1500 - 3000 lb-in models are supplied with a 22mm female square (note that without option I the female square is 1").
4. The Modbus Communication option allows for controlling, and polling the unit for diagnostic information using a Modbus communication signal (RS-485; Two-Wire).
5. 150 - 600 lb-in models with Y option are supplied with a 15mm female keyed output. 1000 - 3000 lb-in models with Y option are supplied with a 20mm female keyed output.

- **Enclosure "W"** (weathertight) is certified by CSA to meet specifications for NEMA 4/4X for weathertight and dusttight, environments and is CE compliant. It is intended for non-hazardous locations in indoor or outdoor use and provides a degree of protection against corrosion, windblown dust and rain, splashing water, hose-directed water, and damage from external ice formation. It is not designed to be submersible.
- **Enclosure "WX"** (weathertight & explosionproof) is certified by CSA to meet specifications for NEMA 7&9, Hazardous location environments as well as to meet NEMA 4/4X specifications. The enclosure is CE compliant and ATEX certified by Siras. Explosionproof means that an internal explosion will be contained, with no sparking that could ignite external atmospheric gases. The enclosure is rated for the following environments:
NEMA Class I, Division 1, Group C
NEMA Class I, Division 1, Group D
NEMA Class II, Division 1, Group E
NEMA Class II, Division 1, Group F
NEMA Class II, Division 1, Group G
NEMA Class III
Ex d IIB T6 Gb

Sample Model Code: ADCWX150UL2-UP

Actuator Series	ADC
Enclosure Type	WX
Torque	150
Board Option	UL2
Other Options (if applicable)	
Operating Voltage	-UP

(For enclosure specifications and dimensions see Table 2 and Figure 1).

- **Torque = Breakaway Torque** Valvcon Electric Actuators are rated at breakaway torque. This is the torque required to move a full load immediately upon power-up.

13 ADDITIONAL ACTUATOR PRODUCTS AND ACCESSORIES FROM METSO

V-Series

- Up to 3000 inch pounds for On/Off, Modulating or Automatic Cycling applications
- 115VAC and 230VAC voltages
- 75% Duty Cycle (55% on 3000 lb-in models)
- NEMA 4/4X and NEMA 4/4X/7&9 enclosures
- CSA (C US) Certified
- CE Compliant
- ATEX Certified: Ex d IIB ("WX" models only)
- Standard Features: manual override and visual position indicator
- Available Options: Modulating Control Board, Speed Control/Timer Board, Iso/Readback Board, extra limit switches, heater/thermostats, motor brake, feedback potentiometer, metric and "keyed" female outputs and handwheel override

ESR-Series

- Up to 600 inch pounds for true "Two-Wire" On/Off applications
- 80% Duty Cycle
- 115VAC and 230VAC voltages
- NEMA 4/4X and NEMA 4/4X/7&9 enclosures
- Available Options: dynamic brake, extra limit switches, heater/thermostats and metric and "keyed" female outputs

I-Series Network Capable

- Modbus®
- AS-Interface
- DeviceNet™
- Foundation Fieldbus
- Other fieldbus protocols (consult factory)

QX-Series

- Up to 3000 inch pounds for On/Off applications
- Economical NEMA 4/4X/7&9 solution
- 12VDC & 24VDC voltages
- 80% Duty Cycle
- CSA (C US) Certified
- Standard Features: auxiliary limit switches, dynamic brake, manual override and visual position indicator
- Available Options: metric and "keyed" female outputs, heater/thermostats and handwheel override

LCR Series

- Up to 600 inch pounds
- Economical actuators for Reversing applications
- 25% duty cycle (80% on 12VDC or 24VDC models)
- NEMA 4/4X enclosure
- 115VAC, 230VAC, 24VAC, 12 VDC and 24VDC voltages
- Options include extra limit switches and heater/thermostats
- Male output (standard) or female output (optional)

LCU Series

- Up to 600 inch pounds
- Economical actuators for Unidirectional applications
- 25% duty cycle (80% on 12VDC or 24VDC models)
- NEMA 4/4X enclosure
- 115VAC, 230VAC, 24VAC, 12 VDC and 24VDC voltages
- Options include extra limit switches and heater/thermostats
- Male output (standard) or female output (optional)

Q6-Series for Remote Solar Applications

- 600 inch pounds
- 12VDC
- Low current draw
- 80% Duty Cycle
- NEMA 4/4X/7&9
- CSA (C US) Certified

Subject to change without prior notice.

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