Texas Commission on Environmental Quality (TCEQ)
Texas Emissions Reduction Plan (TERP)

New Technology Implementation Grant (NTIG) Program

ArkLaTex Valve Electrification Project Final Implementation Report for:

New Technology Implementation Grant (NTIG) Program

Contract No. 582-23-45836-NG

Submitted by:

Maverick Natural Resources, LLC

Designated Project Representative: Jeffrey Stovall

Date: July 1st, 2025

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1. Introduction/Background

Maverick Natural Resources, LLC (MNR) owns and operates thousands of oil and gas wellhead facilities in the ArkLaTex Basin, spanning Smith, Cherokee, Upshur, Gregg, and Harrison Counties, Texas. This project involved replacing intermittent bleed pneumatic valves with electrically actuated valves powered by solar energy and 343 wellheads.

The primary goal was to eliminate emissions of volatile organic compounds (VOCs) and hydrogen sulfide (H_2S) , and greenhouse gases (GHG) from these wellheads.

The ArkLaTex Basin is a mature production region with a high density of legacy infrastructure, much of which relies on pneumatic control systems that vent natural gas during operation. These emissions contribute to regional air quality concerns and greenhouse gas inventories. By transitioning to solar-powered electric actuation, this project aligns with broader industry trends toward electrification and automation, while directly supporting Texas' air quality improvement goals.

2. Project Objectives/Technical Approach

The project supports the NTIG program's objective to reduce emissions from upstream and midstream oil and gas operations. By replacing bleed pneumatic devices with electric actuators, MNR achieved:

- 476.82 TPY of VOCs eliminated
- 17.35 TPY of H_2S eliminated
- 46.21 TPY of CO_2 eliminated
- 547.33 TPY of CH_4 eliminated

Each electric actuator system consists of a low-voltage motorized valve, a solar panel with integrated battery storage, and a control module capable of remote actuation or local manual override. The systems were selected for their compatibility with existing valve configurations and their ability to operate autonomously in remote, off-grid environments. The design eliminated the need for compressed gas supply lines, significantly reducing potential leak points and maintenance requirements. No trenching or external power infrastructure was required, minimizing site disturbance.

3. Task Overview

Task 1: Implementation Period Reporting

During the Implementation Period Reporting, MNR successfully coordinated resources and met NTIG reporting requirements while providing deliverables underbudget. Key activities included:

- Staying under the initial proposed budget
- Submitting Biannual Progress Reports and the Final Implementation Report in a timely manner,
- Summarizing project tasks and documenting project milestones. MNR submitted the following reports:
    - Biannual Progress Report #1 – Submitted December 2023
    - Biannual Progress Report #2 – Submitted June 2024
    - Biannual Progress Report #3 – Submitted December 2024
    - Final Implementation Report – Submitted July 2025

Task 2: Secure Rights To Location

MNR demonstrated legal access and operational control over all project sites by providing Texas Railroad Commission (RRC) Lease Numbers in the original grant application. These lease numbers were cross-referenced with internal asset maps and verified against RRC public records.

Task 3: Secure All Necessary Permits and Insurance to Install and Operate Project

MNR submitted proof of general liability and contractor insurance coverage in compliance with NTIG grant requirements. Because the project involved replacement of existing valve infrastructure with non-emitting electric systems, no new air permits or environmental authorizations were required under state or federal regulations. The project was reviewed internally for compliance with applicable safety and environmental standards.

Task 4: Site Evaluation and Equipment Sourcing

After MNR received project approval, an authorization for expenditure (AFE) was set up, vendors were informed of the order, and internal engineering and lease operators coordinated how to proceed forward with the equipment installations.

Each site was evaluated for solar exposure, actuator mounting compatibility, and electrical routing. A standardized installation protocol was developed to ensure consistent disconnection of the pneumatic valve, safe depressurization, and secure mounting of the electric system. Equipment was sourced from approved vendors, and purchase orders were executed for all required components including actuators, lifters, and wiring.

Task 5: Installation

Following procurement, MNR initiated installation in April 2023. Installations were coordinated across six counties in the ArkLaTex Basin and completed by early 2024. Each wellhead was retrofitted with electric valve systems powered by solar panels. Installation steps included:

- Disconnecting and decommissioning pneumatic valves
- Mounting electric actuators
- Integrating solar and battery systems
- Routing electrical wiring
- Verifying mechanical and electrical performance

All installations were documented and tracked using a centralized Gantt chart.

Task 6: Emissions Reduction Impact Calculations

To quantify the environmental impact of replacing gas-operated intermittent pneumatic valves with electric actuators, MNR conducted emissions reduction calculations using the EPA's Subpart W emission factor for intermittent bleed devices. These calculations were performed using a structured Excel-based tracking system developed internally for this project.

MNR applied the standard emission factor directly to each valve replaced. Field gas composition data was used to break out the emissions into volatile organic compounds (VOCs) and hydrogen sulfide (H_2S), allowing for a more representative estimate of the types of emissions eliminated.

Because electric actuators do not use natural gas for operation, they eliminate the emission pathway entirely. Once installed, these devices no longer vent gas during actuation, effectively removing the potential for emissions from the valve system.

Task 7: Operation Period Reporting

MNR will operate and maintain the installed valve systems for a minimum of five years, as required by the NTIG contract. Annual Operation Status Reports will be submitted to TCEQ, documenting system uptime, maintenance activities, and any operational issues. Although the systems are not networked, field operators will perform periodic inspections and functional checks as part of routine lease operations. A Final Operation Report will be submitted at the end of the five-year period.

Discussion / Observations

The project was completed on time and within budget, with 343 valve systems successfully installed and commissioned. Coordination across multiple counties and field teams presented logistical challenges, particularly in aligning equipment deliveries with site access and weather conditions. These were mitigated through centralized scheduling, vendor coordination, and use of pre-assembled kits.

From a technical perspective, the project validated the feasibility of solar-powered valve actuation in a high-density production environment. The systems performed reliably under varying field conditions, including periods of low solar irradiance. Lessons learned include the importance of pre-installation site surveys for solar alignment, the benefit of modular wiring harnesses for rapid deployment, and the value of operator training in troubleshooting and manual override procedures.

Some sites originally selected for valve replacement were ultimately excluded from the final implementation due to changes in operational status. These included wellheads that were temporarily abandoned, divested, or otherwise deemed ineligible for upgrade during the project timeline. These adjustments were documented and reflected in the final installation count.

The project also demonstrated ancillary benefits, including reduced maintenance frequency, elimination of gas supply lines, and improved valve control precision. These outcomes support the scalability of this approach to other MNR assets and similar upstream operations across Texas and other states.

Summary/Conclusions

MNR considers the ArkLaTex Valve Electrification Project a technical and operational success. The project met all stated objectives, eliminated over 490 TPY of regulated emissions and over 593 TPY of GHGs,, and demonstrated a scalable, low-maintenance solution for valve actuation in remote oil and gas operations. The use of solar-powered electric actuators proved effective in reducing emissions, simplifying infrastructure, and enhancing operational control.

Based on the success of this project, MNR is evaluating additional electrification opportunities across its asset base, including expansion to other basins and integration with SCADA systems for remote monitoring. The project serves as a model for emissions reduction through practical, field-ready technology.

Acknowledgments

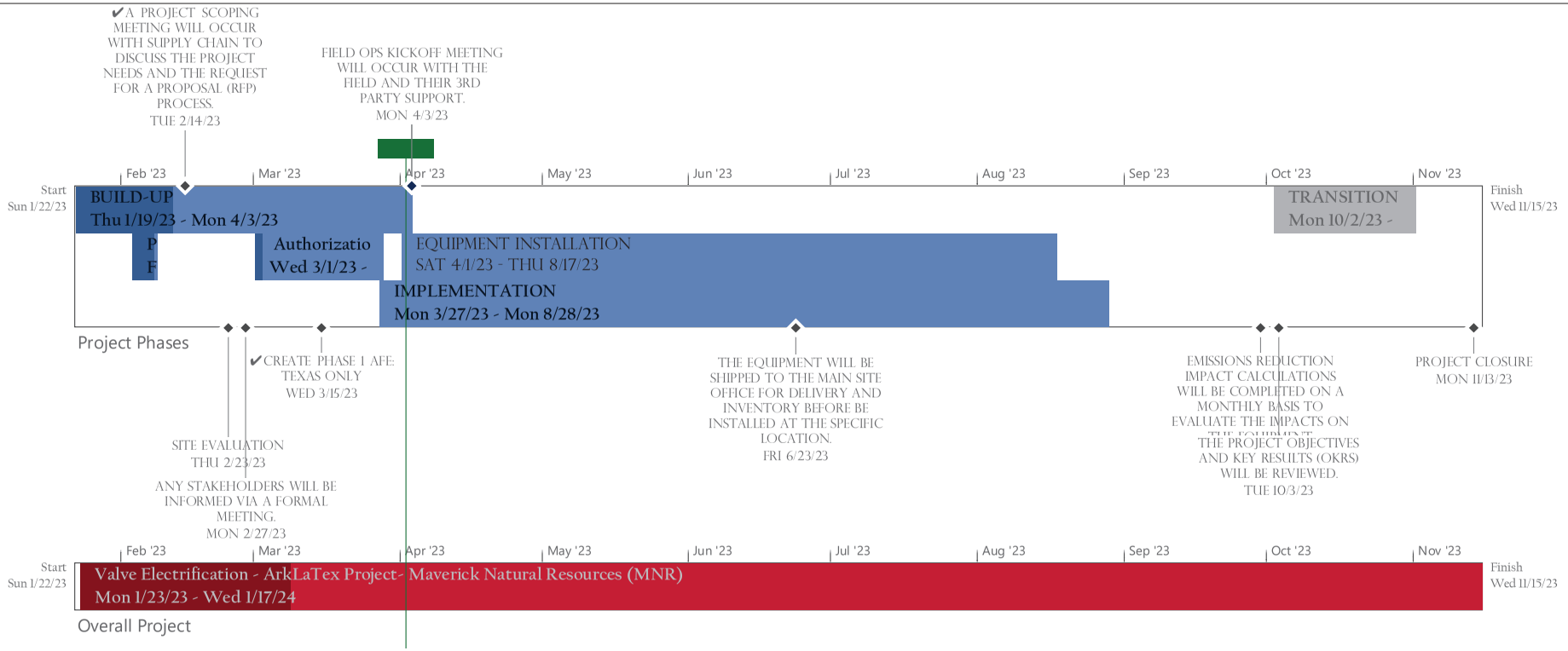
MNR acknowledges the support of the TCEQ and the TERP program team for their guidance and funding assistance throughout this project.

We also thank the MNR Engineering, Operations, and ESG teams for their coordination and execution efforts, as well as our key vendors and contractors whose contributions were essential to the successful implementation of the valve electrification systems.

Appendices

Appendix A – Project Timeline

ESG-MS Project-Valve Electrification
Project Manager: Jeffrey Stovall
Sponsor: Paul Espenan



Percent Complete:
100% Remaining Cost:

Appendix B – Project Pictures


CHIEF

Appendix C – Equipment Specifications

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FISHER E-BODY CONTROL VALVE

The Fisher E-Body sliding stem globe style control valve is a general purpose valve used for throttling or on-off service for gas and liquid applications. Types ET and ED valves includes a cage guided balanced valve plug, metal to metal seating, or PTFE (ET only) seating for bubble tight shutoff. Types Fisher EZ and ES contain unbalanced valve plugs with metal seating.

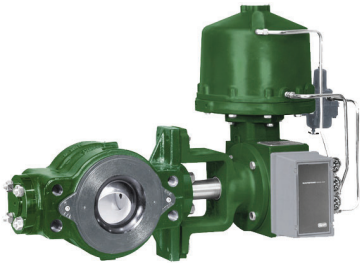
Types ET, ED, ES, EZ

- Quick-Opening, Linear, or Equal Percentage Flow Characteristics
- NPS 1, 1-1/2, 2, 2-1/2, 3, 4, 6, and 8 Inch Valve Sizes
- ANSI Class 150-600 Flanged, NPT (1-2"only), Butt Weld, and Socket Weld End Connections.
- WCC / WCB Carbon Steel or CF8M Stainless Steel Valve Bodies Available
- Whisper® I, Whisper III, Cavitrol® III Trim Available for ET, ED, and ES.
- Sour Service Capability – NACE MR0175.
- High-Temperature Service Capability

FISHER VEE-BALL®

The Fisher Vee-Ball Rotary Ball Valves provide a variety of metal or soft ball seals for different shut-off and temperature requirements. A splined drive shaft in combination with a power operated or manual actuator provide reliable, high-performance throttling or on-off operation for several different applications in the process industries. Noise-Attenuation trim is available, and all trim are interchangeable between the design V150, V200, and V300 which allows us to reduce our remanufactured lead times and easily configure the valve to meet the customer's needs. FCE offers these valves to be built to meet NACE-MR0175 standards upon request.

- Fisher Vee-Ball V150: NPS 1-20 Inch Flanged Valves That Mate with ANSI Class 150 Raised-Face Glanges
- Fisher V200 & V100: NPS 1-10 Inch Flangeless Valves That Mate with ANSI Class 150, 300, or 600 Raised-Face Flanges (depending on size)
- Fisher Vee-Ball V300: NPS 1-16 Inch Flanged Valves That Mate with ANSI Class 300 Raised-Face Flanges



FISHER V250

Heavy-duty, flangeless throttling ball valves. Often used for controlled flow applications in gas transmission lines, gas distribution, and liquid pipelines.

- Remanufactured or New Surplus Available
- NPS Sizes 4, 6, 8, 10, 12, 16, 20, 24
- Carbon Steel (LCC) with Chrome-Plated WCC Ball
- Flangeless ANSI Classes 600 and 900
- Linear Trim Characteristic
- Single or Dual (POM) or Flow Ring Seal
- Single or Dual Seal Class IV, Flow Ring 1% of Capacity

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FISHER HIGH PERFORMANCE BUTTERFLY

- Fisher Type 8560 Series
- Fisher 8532 Series
- Fisher 8550 Series E-Disc

FISHER V500 ROTARY CONTROL VALVE

The Fisher V500 is a flanged or flangeless rotary plug valve for throttling or on-off service. The V500's rugged trim selections allow this valve to be a perfect fit for corrosive applicaitons.

- NPS 1, 1-½, 2, 3, 4, 6, and 8 Inch (Flangeless Available Only in NPS 3 Through 8)
- ANSI Class 150/300/600. (Class 600 is Not Available in NPS 6 and 8 Flangeless Valve Bodies)
- NACE MR0175-2002 Compliance Upon Request.

FISHER HP SERIES

The Fisher HP Series control valves are single-port globe style valves designed for high pressure applications in various types of process control industries. Cavitrol® III and Whisper Trim III trims are available for the HP control valve to help eliminate cavitation damage in liquid service and attenuate noise in gas service. We offer both series HPT & HPD (balanced valve plug), and HPS (unbalanced valve plug), and the HPA angled body.

HPT, HPD, and HPA

- NPS 1, 2, 3, 4, and 6 Inch Valve Sizes
- ANSI Class 900, 1500, and 2500# Flanges
- Equal Percentage Flow, Modified Equal Percent, and Linear Flow Characteristics are Offered in the HPT and HPD Series
- The Type HPS offers Micro-Form, Micro-Flute, and Equal Percentage Flow Characteristics.

FISHER Y-BODY CONTROL VALVE

The Fisher YD and YS three-way cage-guided valves are designed for throttling or flow-switching service. The design YD contains a balanced valve plug and typically used for general converging (flow-mixing) and diverging (flow-splitting) service. The design YS has an unbalanced valve plug and generally used for converging service, but can be used for diverging service with on-off applications only.

YD and YS

- NPS 1-6 Inch Valve Sizes
- Carbon Steel, CF8M SST, and Cast Iron
- ANSI Class 150-600#
- High-Temperature Service

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FISHER EW SERIES CONTROL VALVE

The Fisher EW Series Easy-E sliding stem control valves feature large internal cavities with a large variety of sizes and end connections. The expanded end connections allow for installation into oversized piping without the need for piping reducers. The EW control valve Provides excellent control in high-capacity valve applications with a choice of balance and unbalanced valve plugs.

EWD, EWS, and EWT

- Remanufactured or New Surplus Available •NPS Valve Sizes: 4 x 2" to 24 x 20"
- ANSI Classes 150-600, Class 900 rating available for NPS 8×6 and 12×8 only
- Quick-Opening, Linear, and Equal Percentage Flow Characteristics
- Anti-Cavitation and Noise Attenuation Trim Available
- NACE MR0175 Compliant Upon Request

FISHER V260

Large, flanged throttling ball valves. Used for demanding pipeline applications such as pump bypass and pipeline take-off.

- Remanufactured or NEW Surplus Available
- V260A Aerodome, V260B Hydrodome Available
- NPS Sizes 8, 10, 12, 16, 20, 24
- Carbon Steel (LF2) Body with Chrome-Plated WCC Ball
- Raised Face Flanged ANSI Classes 150, 300 or 600
- Modified Equal Percentage Characteristic
- Single or Dual (PEEK/PTFE or POM) Seal
- Class VI Shutoff

FISHER V270

Full bore ball valve designed for automated control in bypass, batch, monitor, and emergency shutoff service applications.

- Remanufactured or NEW Surplus Available
- NPS Sizes 6, 8, 10, 12, 14, 16, 20, 24
- Carbon Steel (LF2) Body with LF2 Carbon Steel/ENP Ball
- Raised Face Flanged ANSI Classes 150, 300 or 600
- Modified Equal Percentage Characteristic
- Dual (POM) Seal
- Class VI Shutoff

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FISHER D4 DUMP VALVE

The Fisher type D4 is a rugged, compact sliding stem control valve designed for throttling or snap services. The D4 is an excellent valve for the oil & gas industry used for dump valves in separators, scrubbers, and other processing equipment. The D4 can accommodate severe service applications using tungsten carbide or Alloy 6 trim to meet NACE metallurgical requirements.

- NPS Sizes 1 and 2
- Carbon Steel Body
- ANSI Classes 150, 300, 600 and 1500
- Equal Percentage Characteristic
- Class IV Shutoff

FISHER D AND DA SERIES

Fisher D and DA single-port, high-pressure valves are widely used in oil and gas production industries. These valves are especially useful for either throttling or on/off control of liquids or gases which are gritty, sticky, or have a tendency to build-up on internal valve parts.

- NPS Sizes 1 and 2
- Angle Body DA Option
- Carbon Steel
- Threaded, Flanged, Socket Weld, or RTJ
- ANSI Classes 150, 300, 600, 1500
- Equal Percentage Characteristic
- Standard Class IV or Optional Class V Shutoff

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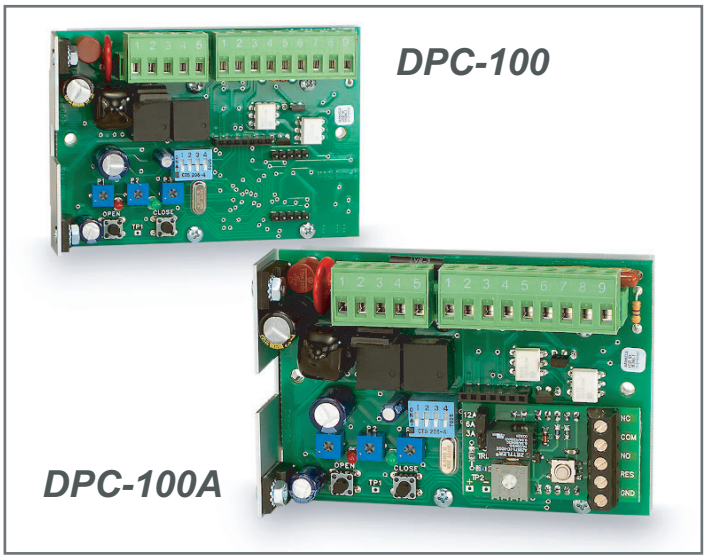
Features

- *The DPC-100 DC Production Controller is intended for **on/off or open/close control of DC valve actuators** rated for 10-30VDC and up to 10 amps of running current.*
- *This variant of our DMI-100 DC Motor Controller is intended for production environments where **independent open and close input delays** of up to 12 seconds are needed for your process, but a repeat cycle timer is not needed.*
- *The **DPC-100A** version has an **adjustable current trip** and **reverse torque setting** that is useful for wedge gate valves, expanding gate valves, needle valves, high performance butterfly valves, triple offset butterfly valves, or other valves that require torque seating instead of position seating.*
- *The **DPC-100** version has a **fixed 12 amp current trip** to protect the motor, actuator, and valve from excessive electrical current and mechanical force, but is not recommended for torque seating valves.*
- *A **wide range of AC and DC control inputs** ranging from 1.9VAC / 2.4VDC up to 130VAC / 130VDC can be used.*
- ***Electronics surge limiting** reduces motor inrush current allowing for smaller size batteries/power supplies and wire.*
- ***Low standby current** maximizes battery life.*



- *Switchable **2-wire or 3-wire control**.*
- ***Electrically isolated inputs** that allow multiply units to be **easily paralleled** to the same control signal.*
- ***Local/remote modes** allow for manual control using onboard buttons in addition to the external control signals.*
- ***Electronic brake** reduces the need for a mechanical brake.*

Introduction

The Peaktronics DPC-100 DC Production Controller is used to interface common electrical control signals to DC actuators. The wide operating range of the DPC-100 (10 to 30 VDC with loads up to 10A continuous or 60A locked rotor) allows for operation in a large number of actuator applications. The unit provides all necessary motor drive, protection, and interface circuitry. For added protection, motor outputs are electrically isolated from control inputs.

A wide range of external control signals can be used to open and close the actuator. The unit accepts commonly used 120VAC signals from PLC modules, relay circuits, triac outputs, or solid state relay circuits. Alternatively, signals from a number of electronic sources, including TTL, CMOS, analog drivers, open collector outputs, and other low voltage AC and DC outputs can be used.

An input delay of up to twelve seconds is independently adjustable for both open and close. As some DC motors cannot reverse direction instantaneously, there is a built-in one second delay after all motor movements.

The DPC-100A has a reverse torque setting that increases the torque in only one direction, allowing the unit to seat a valve to a preset torque (set by the current trip), while providing extra torque in the opposite direction to reliably open the valve – see Torque Seating Valves.

The unit can be configured for 2-wire or 3-wire control. In 2-wire control, the control signal is applied to the open input to drive the actuator open. When the control signal is removed, or driven to 0V, the actuator will close. In 3-wire control, both the open and close control signals are used to drive the actuator toward open or closed as desired. When both signals are removed, or driven to 0V, the actuator remains at its last position.

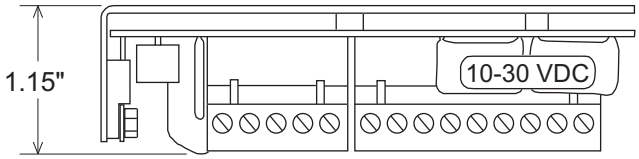
The unit also features a red LED indicator (for the open output), a green LED indicator (for the close output), a user replaceable fuse, two removable screw terminal strips for easy servicing, and on-board pushbuttons to manually open or close the actuator.

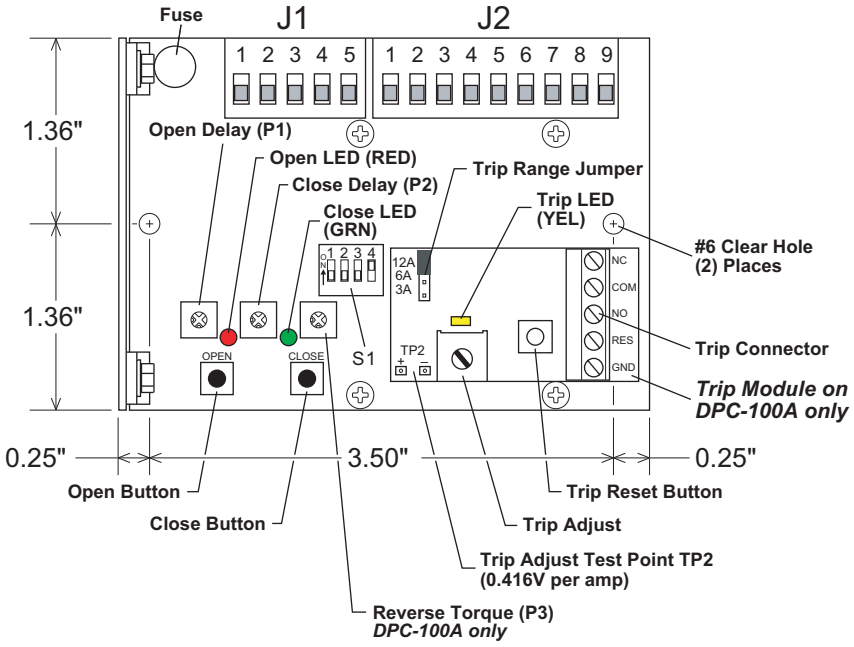
A feedback position transmitter (such as the Peaktronics XMA-105, XMA-106, or XMA-107) can be used to return a position feedback signal from a feedback potentiometer – see pages 8-9.

All options are easily set using on-board DIP switches and potentiometers. On-board LEDs indicate a variety of conditions: motor output on, limit switch reached, low battery voltage, and battery over voltage.

While the DPC-100 has a fixed 12A current trip feature, the DPC-100A allows the current trip to be adjusted from 0 to 12A. The adjustable current trip is useful for limiting torque, torque seating valves, and protecting motors that have less than 12A locked rotor current. The DPC-100A also has a yellow LED current trip indicator and a set of form-C contacts that can be used to power external trip fault alarms or lights.

Outline





DPC-100 ***(fixed 12 amp current trip)***
DPC-100A ***(adjustable current trip)***

Electrical Connections

To Motor — **J1**

MOTOR 1	1	⊘
MOTOR 2	2	⊘
LIMIT SW. COMMON	3	⊘
OPEN LIMIT SWITCH	4	⊘
CLOSE LIMIT SWITCH	5	⊘

To Limit Switches

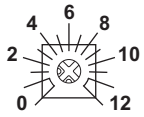
To DC Power — **J2**

BATTERY POSITIVE	1	⊘
BATTERY NEGATIVE	2	⊘
EARTH GROUND	3	⊘
CLOSE COMMON	4	⊘
OPEN COMMON	5	⊘
CLOSE (AC HI)	6	⊘
OPEN (AC HI)	7	⊘
CLOSE (DC/AC LO)	8	⊘
OPEN (DC/AC LO)	9	⊘

To Control Signal

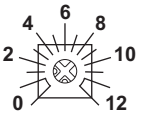
P1 – P3 Pot Settings

Open Delay (P1)



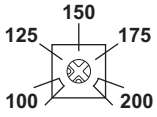
(time in seconds)

Close Delay (P2)



(time in seconds)

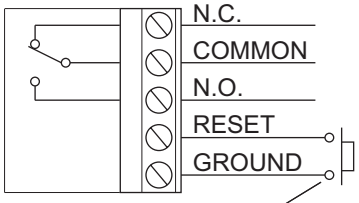
Reverse Torque (P3)



(percent of forward torque)
(DPC-100A only, 12A max)

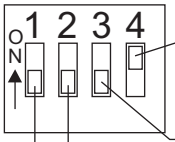
Trip Connector

(DPC-100A only)



Optional external reset button

S1 Dip Switch Settings



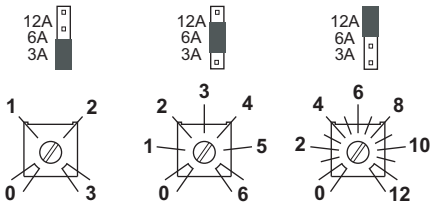
[S1-4] Local Remote Switch Enable:
On: Remote mode enabled.
Off: Local mode enabled.

[S1-3] 2 / 3-Wire Control Enable:
On: 2-wire control enabled.
Off: 3-wire control enabled.

[S1-2] Increased Reverse Torque Direction:
On: Torque is increased in the **closed** direction.
Off: Torque is increased in the **open** direction.

[S1-1] Not Implemented.

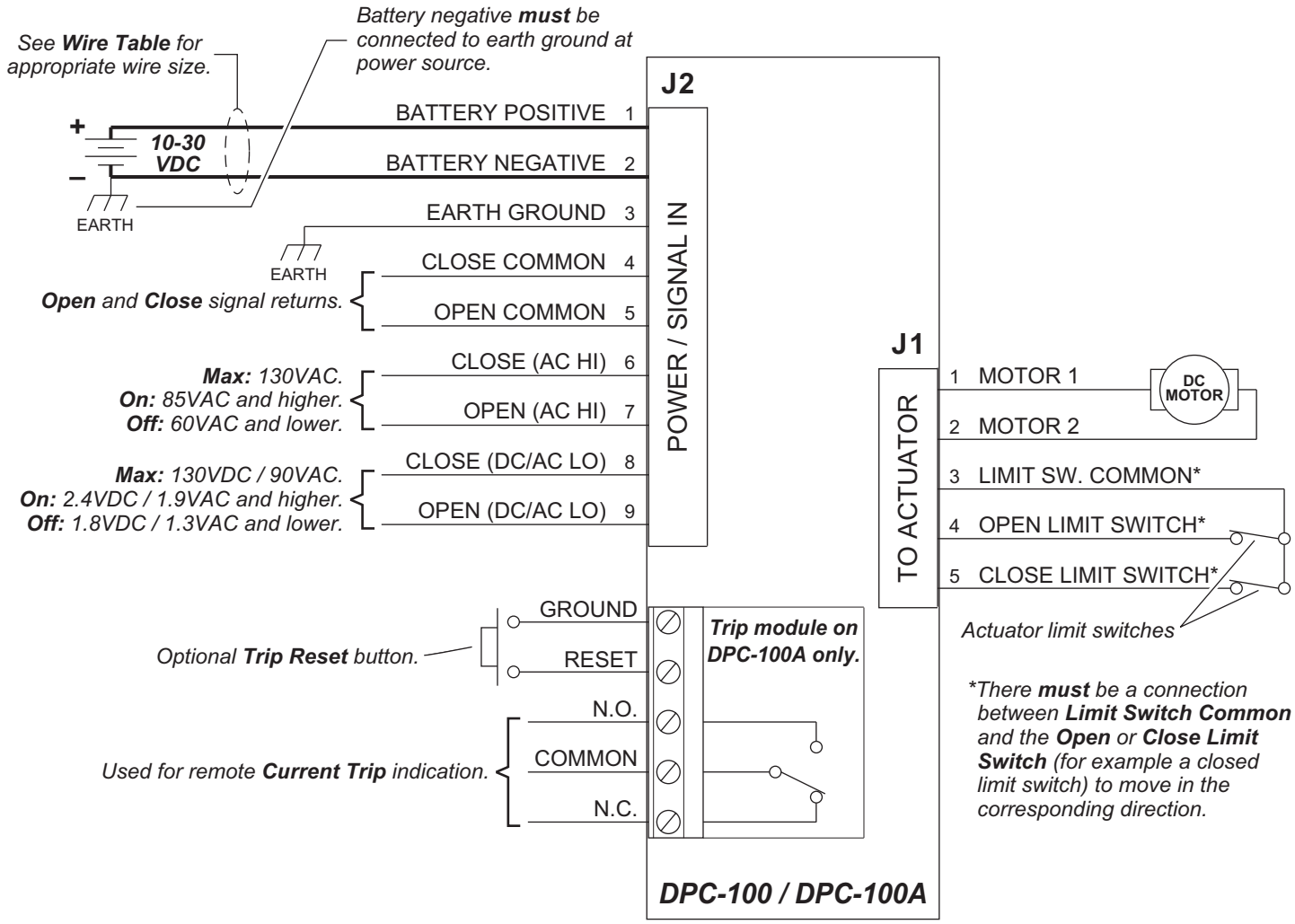
Current Trip Settings



*(**DPC-100A only**. Current trip in amps)*

Current trip amps = voltage measured across test point TP2 multiplied by 0.416 for all ranges (3A, 6A and 12A).

Block Diagram



Description

The DPC-100 is rated for motors with up to 60A locked rotor or 10A running current and requires 10-30VDC for power. The unit is easily mounted with two screws and is equipped with removable screw terminals that provide for easy field wiring. The unit's size and mounting allow for easy upgrade from the RCM-101x series.

The DPC-100A is the same as the DPC-100, but replaces the fixed 12A current trip with an adjustable 0-12A current trip. It also has connections for an external trip reset switch and a form-C contact current trip output.

The current trip setting can protect the motor from excessive loads. Once tripped, the current trip setting can be reset by reversing motor direction or connecting the reset input to GND.

Power / Signal (J2)

The DC power source positive terminal is connected to BATTERY POSITIVE (J2-1) while the negative is connected to BATTERY NEGATIVE (J2-2). When the DPC-100 is mounted to a metal bracket or a metal actuator case, the DPC-100 chassis provides an earth ground connection to the actuator body. When the actuator body is non-metallic or electrically isolated from earth ground, a suitable earth ground must be connected to the EARTH GROUND (J2-3) contact to prevent static voltage buildups.

Transferring DC power can be inefficient, therefore care should be taken to use adequate wire sizes. The size of wire required depends on the locked rotor motor current and the length of wire to be used – see the *Wire Table* for more information.

The control signal to open the actuator is connected to either OPEN AC HI (J2-7) or OPEN DC/AC LO (J2-9) (do not connect both inputs at the same time) using OPEN COMMON (J2-5) as the return. The close control signal is connected to either CLOSE AC HI (J2-6) or CLOSE DC/AC LO (J2-8) (do not connect both at the same time) using CLOSE COMMON (J2-4) as the return.

The AC HI inputs are suitable for 120VAC control signals, while the DC/AC LO inputs are used for either DC electronic signals (such as TTL, CMOS, etc.) or AC control signals up to 90VAC. Open collector control signals can also be used – see *Block Diagram, Wiring Diagrams, and Specifications*.

Actuator (J1)

The actuator motor and limit switches are connected to J1 as shown in the *Block Diagram*. The motor should be connected to MOTOR 1 (J1-1) and MOTOR 2 (J1-2), but polarity must be observed to ensure the motor turns in the correct direction – see *Reverse Acting Actuators* for more information. Limit switches should be wired to J1 pins 3, 4, and 5 as shown in the *Block Diagram*.

Note that when the DPC-100 moves the motor in the open direction, it applies positive voltage to MOTOR 1 (J1-1) and negative voltage to MOTOR 2 (J1-2). The motor polarity is reversed when moving in the close direction. Make sure to wire the motor with the correct polarity, and make sure the open and close limit switches are wired correctly as well.

Failure to wire either the motor or the limit switches correctly can cause the actuator to travel beyond the limit switches possibly damaging the actuator – see *Reverse Acting Actuators* for more info. Also, as MOTOR 1 (J1-1) and MOTOR 2 (J1-2) are connected directly to the battery or power supply when the motor is running, care should be taken not to connect these pins to any other terminals.

The open and close pushbuttons can be used to check the motor and limit switch wiring. With the actuator near the middle of travel (away from the limit switches), pressing the open button should move the actuator in the open direction. Pressing the close button should move the actuator in the close direction. If the motor moves in the wrong direction, reverse the two motor connections.

To test the limit switches, use the pushbuttons to move the actuator in the open and close directions while manually pressing the corresponding limit switch. Make sure that tripping the close limit switch stops the actuator from moving in the close direction, and the open limit switch interrupts movement in the open direction.

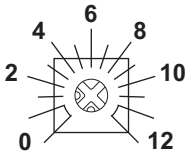
The limit switches are normally closed (conducting). The corresponding limit switch will open or break the connection when the actuator is driven fully open or closed. Therefore, the limit switch terminals (J1-4, J1-5) must be connected to LIMIT SWITCH COMMON (J1-3) for the DPC-100 to control the motor outputs – otherwise the DPC-100 will think a limit switch has tripped and will refuse to move farther in that direction. If there are no limit switches providing these connections, you must connect these terminals together for proper operation.

The DPC-100 provides a dynamic braking feature that can eliminate the need for a mechanical brake. When the DPC-100 turns off the motor outputs, MOTOR 1 and MOTOR 2 are internally connected to BATTERY NEGATIVE; this effectively shorts the motor leads, thus braking the motor. When power is removed from the DPC-100, the electronic braking feature is disabled.

In some applications, a brake is required for mechanical reasons, such as avoiding back driving the motor. The DPC-100 is suitable for powering most brakes – consult the actuator manufacturer for more information.

Input Delays

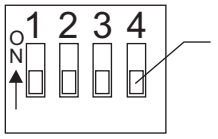
The DPC-100 provides independently adjustable input delays for both the open and close control signals. See *Control Adjustments* under *Specifications* for the delay period and *Outline* for the location. When both outputs are off and a control input signal is applied, the input delay setting causes a delay in turning on the associated output. If the control signal is removed before the end of the delay period, the associated output will not turn on.



(time in seconds)

Open and Close Pushbuttons

The DPC-100 allows for manual operation of the actuator by setting the S1-4 switch to local mode as shown below – see *Outline* for the switch location.



[S1-4] Local Remote Switch Enable:
On: Remote mode enabled.
Off: Local mode enabled.

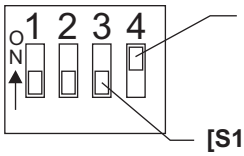
In local mode, pressing the open button will turn on the MOTOR 1 (open) output (J1-1), while pressing the close button turns on the MOTOR 2 (close) output (J1- 2).

The input delays continue to function in local mode, affecting button operation just like they do for a control signal – refer to *Input Delay* for more details. Also, the 2-wire mode setting will be ignored while in local mode to allow for better manual control of valve position.

To protect against turning on both outputs at the same time, the DPC-100 will not turn on one of the outputs until the other output has turned off. Additionally, if both control signals are applied at the same time, the unit will turn off both outputs.

2-Wire / 3-Wire Control Inputs

Setting S1-4 to the remote position disables the on-board open and close buttons and allows control of the actuator by the DPC-100 control inputs. S1-3 is used to configure the unit for either 2-wire or 3-wire control – see *Outline* for the location and setting of S1-3 and S1- 4.



[S1-4] Local Remote Switch Enable:
On: Remote mode enabled.
Off: Local mode enabled.

[S1-3] 2 / 3-Wire Control Enable:
On: 2-wire control enabled.
Off: 3-wire control enabled.

In 3-wire control, the open input signal is used to turn on the open output, and the close input signal is used to turn on the close output.

In 2-wire control, only the open signal is used, and the close input terminals must not be connected. In 2-wire control, the close output will always be turned on until the open signal is applied, at which time the close output is turned off and the open output turns on.

Indicators and Fault Conditions

The on-board green and red LED indicators provide the user with information about the status of the actuator. The table below provides a list of indications and their associated conditions.

Red	Green	Condition
On	Off	Motor 1 (open) on (+V)
Off	On	Motor 2 (close) on (+V)
Flash	–	Open limit switch is open
–	Flash	Close limit switch is open
Blink	Blink	Low battery voltage
On	On	Overvoltage

***Note: Blink** rate is 0.4 seconds on / 0.4 seconds off.*
***Flash** is much faster at 10 on/off cycles per second.*

Motor Output ON - When conditions are normal, the red LED indicator turns on when the MOTOR 1 (open) output is positive, and the green LED turns on when the MOTOR 2 (close) output is positive.

Limit Switch - Many actuators are equipped with limit switches at their open and closed positions which stop the motor to prevent mechanical damage. The actuator's limit switches should be set for the range of motion required by the application.

When the open limit switch disconnects OPEN LIMIT SWITCH (J1-4) from LIMIT SWITCH COMMON (J1-3), the red LED will flash and the MOTOR 1 (open) output is disabled. Likewise, when the close limit switch disconnects CLOSE LIMIT SWITCH (J1-5) from LIMIT SWITCH COMMON (J1-3), the green LED will flash and the MOTOR 2 (close) output is disabled.

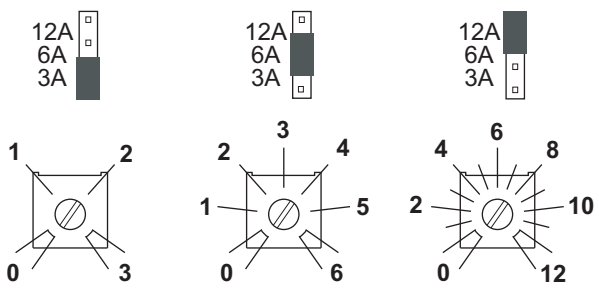
Low Battery Voltage and Overvoltage - The DC power connected to BATTERY POSITIVE (J2-1) and BATTERY NEGATIVE (J2-2) is monitored continuously. If the voltage drops below 10V, the motor outputs are disabled and both LEDs will blink to indicate a low voltage condition. The motor will remain off, and the LEDs will blink for three seconds once the voltage goes above 10V. If the voltage exceeds 30V for more than a second, the motor outputs are disabled and both LEDs will turn on to indicate an overvoltage condition. Normal operation resumes after the voltage drops below 30V.

Current Trip Setting

The DPC-100 monitors the motor current and turns off the motor if the motor current exceeds 12A. The motor remains off until the actuator is commanded to move in the opposite direction from the one that caused the current trip condition.

For actuators using smaller motors with less than 12A stall current, the DPC-100A, with it's adjustable current trip, may be helpful. The trip setting is useful for limiting the torque applied to the actuator's load.

The DPC-100A has a yellow LED to indicate a trip condition and an isolated set of form-C contacts that can be used to indicate trip faults. The trip adjust pot and trip range jumper set the trip setting as shown below – see *Outline* and *Block Diagram* for more information.



***DPC-100A only**. Current trip in amps.*

Current Trip Amps	Volts Across TP2
0.5	0.208
1	0.416
1.5	0.624
2	0.832
3	1.248
4	1.664
5	2.080
6	2.496
8	3.328
10	4.160
12	4.992

TP2 + −

***DPC-100A only**. Current trip amps = voltage measured across test point TP2 multiplied by 0.416 for all ranges (3A, 6A and 12A).*

The current trip setting should be adjusted to a comfortable level above the running current expected for the actuator **under load**. When the motor current exceeds the trip setting, the motor is turned off, the yellow LED is turned on, and the form-C contact switches.

The combination of the DPC-100's surge limiting and current trip significantly reduces the maximum current needed by the motor, allowing for a less expensive smaller battery/power supply and wire gauge than would normally be required.

Without this current reduction, a costly high capacity battery/power supply would be essential to avoid collapse of the supply voltage. The battery/power supply can now be rated for either 20% of the locked rotor current, or the running current of the motor, whichever is greater. See the *Wire Table* for the recommended wire gauge.

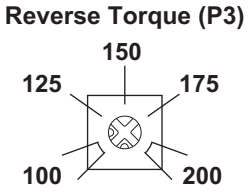
If the trip setting is used to limit torque, note that the actuator and valve components (gears, couplings, seats, etc.) also place a load on the motor. These components will vary with temperature and age, and therefore the torque on the load will vary accordingly.

Torque Seating Valves (DPC-100A only)

The DPC-100A has a reverse torque adjustment that is useful in projects where seating a valve to a consistent preset torque is needed. The valve seating torque is determined by the trip range jumper and trip adjust pot. Test point TP2 can be used to accurately set the torque to a consistent value in either the field or a production environment – see *Current Trip Setting*.

When torque seating a valve, the motor is driven until the current trip is activated. The close limit switch must be positioned just beyond the current trip point to ensure that the current trip is controlling the valve seating torque, and that the limit switch isn't stopping the motor before the desired torque is applied to closing the valve.

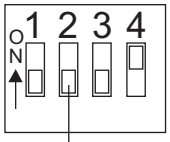
Once torque seated, some valves need extra torque to open reliably. The reverse torque pot (P3) is used to set the maximum torque that will be applied to open the valve.



(percent of forward torque)
(DPC-100A only, 12A max)

The reverse torque should be set to a level that reliably opens the valve while still protecting the actuator. The reverse torque pot (P3) is adjustable in a range from 100% to 200% of the torque used to close the valve (12A maximum).

The direction of the reverse torque is controlled by dip switch S1-2 as shown below – see *Outline* for the switch location.

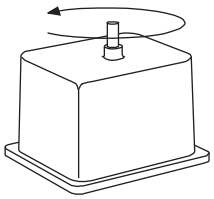


[S1-2] Increased Reverse Torque Direction:
On: Torque is increased in the **closed** direction.
Off: Torque is increased in the **open** direction.

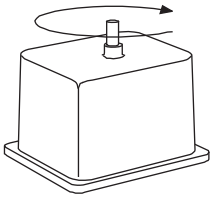
Reverse Acting Actuators

In reverse acting actuators, the motor turns clockwise (looking down from the top of the actuator) when opening the valve – see below.

(Arrows show direction of opening valve)



Direct Acting



Reverse Acting

When converting a direct acting actuator to a reverse acting actuator, three changes in wiring must be made:

1) Reverse the motor wires connected to MOTOR 1 (J1-1) and MOTOR 2 (J1-2).

2) Reverse the limit switch wires connected to OPEN LIMIT SWITCH (J1-4) and CLOSE LIMIT SWITCH (J1-5).

3) If you are using a feedback transmitter (XMA-10x series), reverse the feedback potentiometer's red and black wires at the transmitter and recalibrate the transmitter.

Specifications

Power Requirements

Operating voltage: 10 to 30 VDC.

Operating current (motor on): 74mA typical.

Standby current (motor off): 30mA typical.

Operating current (motor off, trip LED on):
56mA typical (DPC-100A only).

Fuse type: 10A TR5 time lag 374 (replaceable).

AC HI Control Signal Inputs

Maximum input voltage:
130VAC 50/60 Hz (20mA typical @ 60 Hz).

Minimum assured on state input voltage:
85VAC 50/60 Hz (13mA typical @ 60 Hz).

Maximum assured off state input voltage:
60VAC 50/60 Hz (8.8mA typical @ 60 Hz).

Maximum assured off state input current:
7.5mA @ 60 Hz / 6mA @ 50 Hz.

DC/AC LO Control Signal Inputs

Maximum input voltage:
130VDC (4mA typical).
90VAC 50/60 Hz (3.3mA typical).

Minimum assured on state input voltage:
2.4VDC (0.4mA maximum), TTL compatible.
1.9VAC (0.16mA typical).

Maximum assured off state input voltage:
1.8VDC.
1.3VAC.

Maximum assured off state input current:
DC: 0.25mA
AC: 0.20mA

DC Motor Outputs

Maximum running current: 10A.

Motor current trip threshold:
DPC-100: 12A (fixed).
DPC-100A: 0 to 12A (adjustable).

Motor current measurement resolution:
21mA typical.

Trip Connector (DPC-100A only)

Trip relay output (form C contacts):
1A @ 24VDC / 0.5A @ 125VAC.

Trip reset switch (local): located on unit.

External trip reset:
Normally open switch: 1mA @ 5VDC.
Open collector: V_{CE} < 0.5V @ 1mA.

Control Adjustments

Open delay (P1): 0.02 to 12 seconds.

Close delay (P2): 0.02 to 12 seconds.

Reverse Torque (P3): 100% to 200% of forward torque.

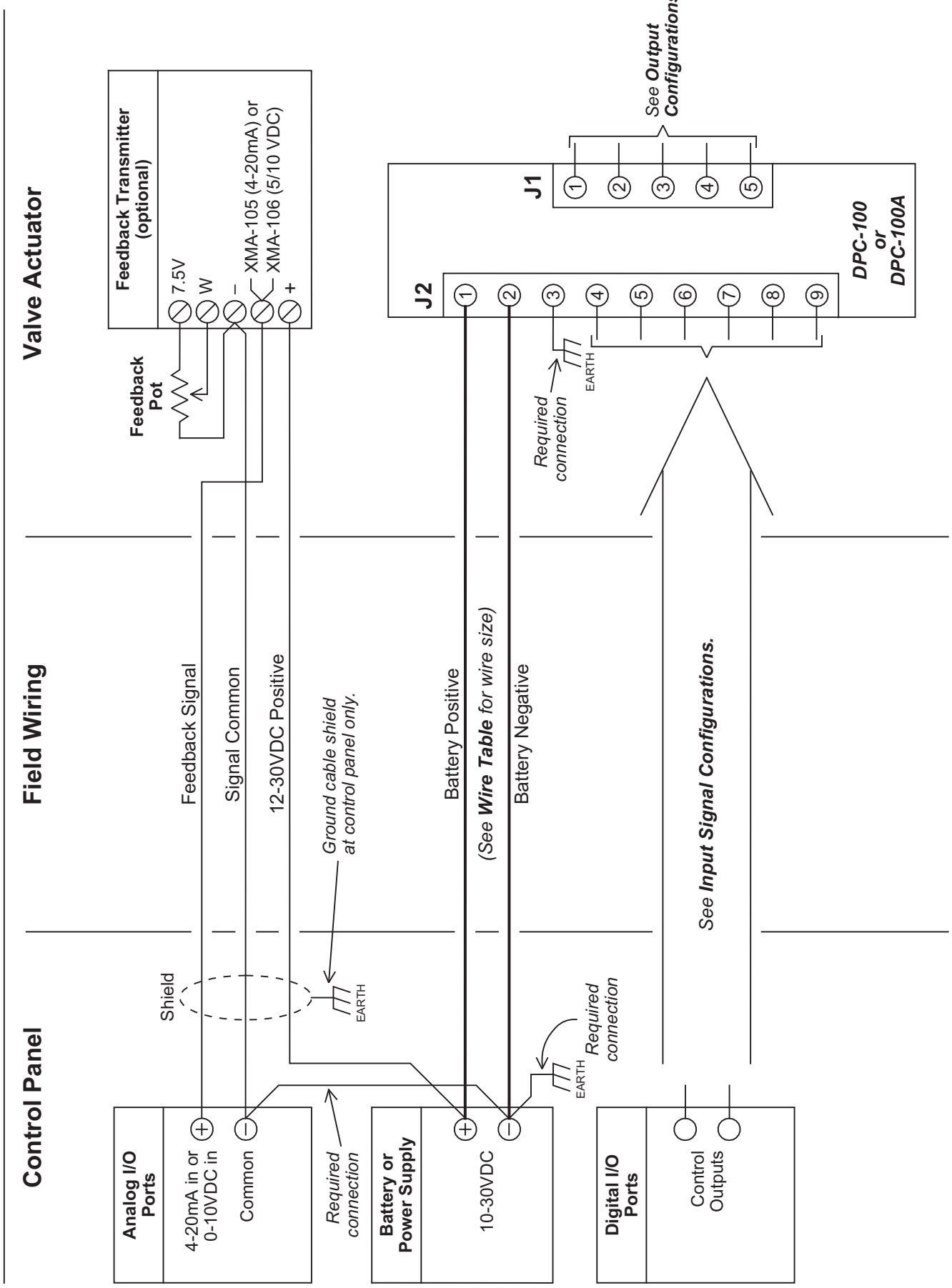
Environmental

Operating temperature range: 0°C to 60°C.

Storage temperature range: -40°C to 85°C.

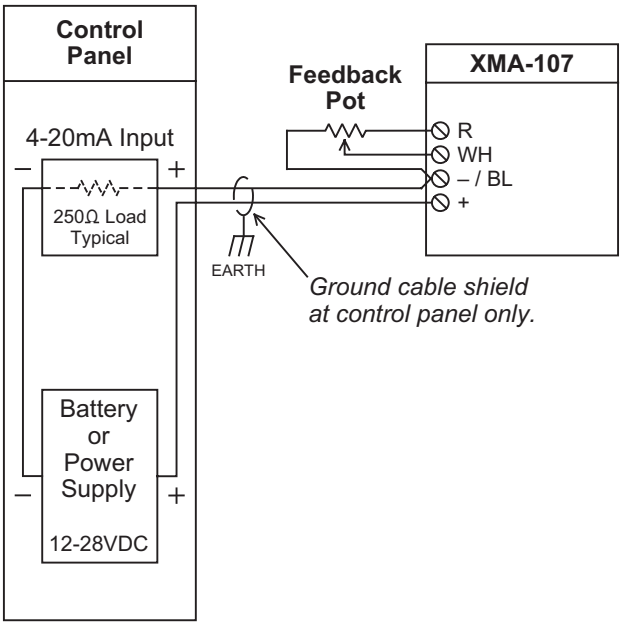
Relative humidity: 0% to 90% (noncondensing).

Recommended System Wiring

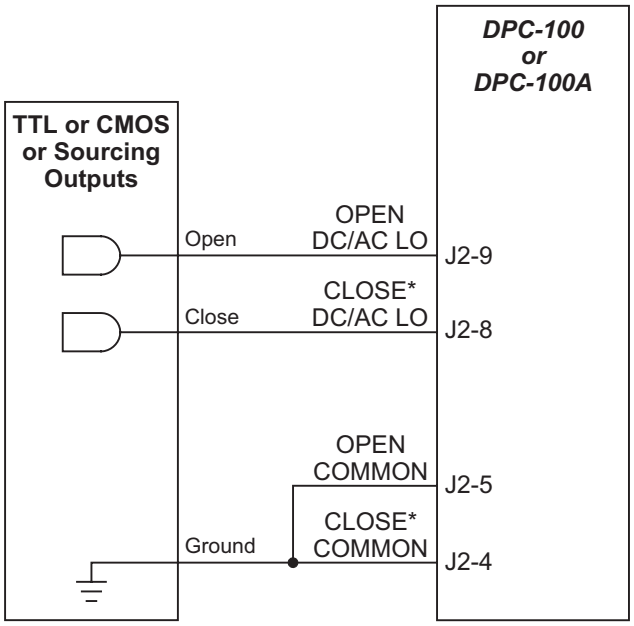


Wiring Diagrams

Feedback and Input Signal Configurations



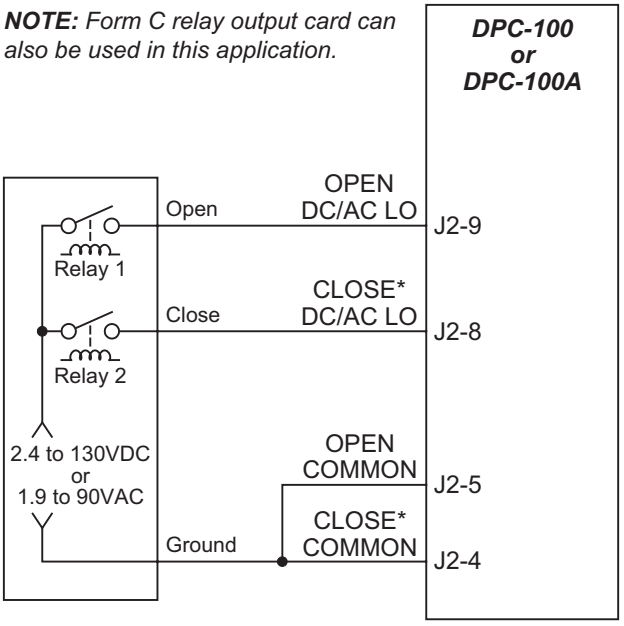
4-20mA Feedback Using XMA-107



Do **not connect close input for 2-wire control.*

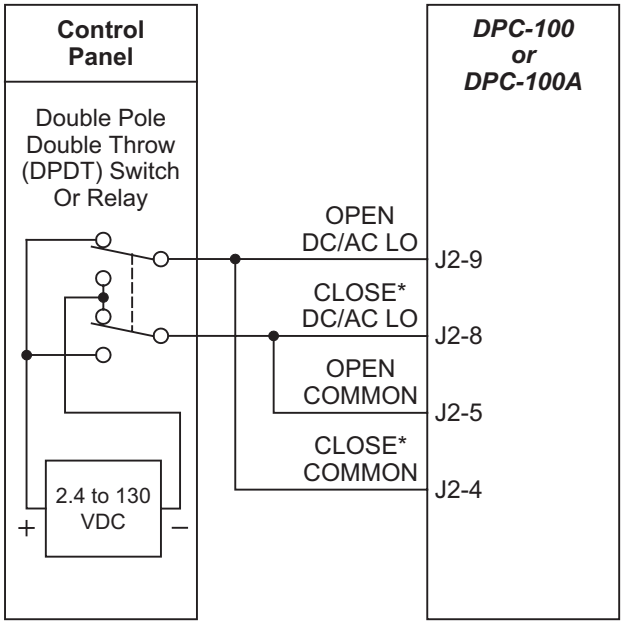
DC Control Inputs Using TTL, CMOS or Sourcing Outputs

***NOTE:** Form C relay output card can also be used in this application.*



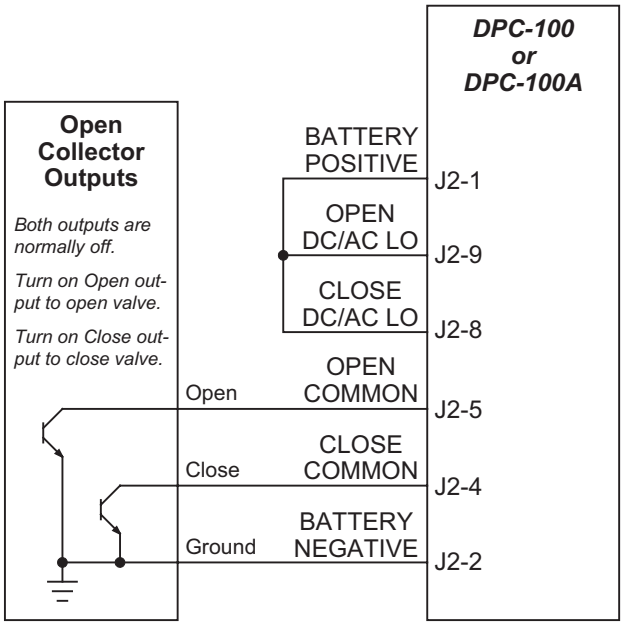
Do **not connect close input for 2-wire control.*

DC or AC Control Inputs Using Relays



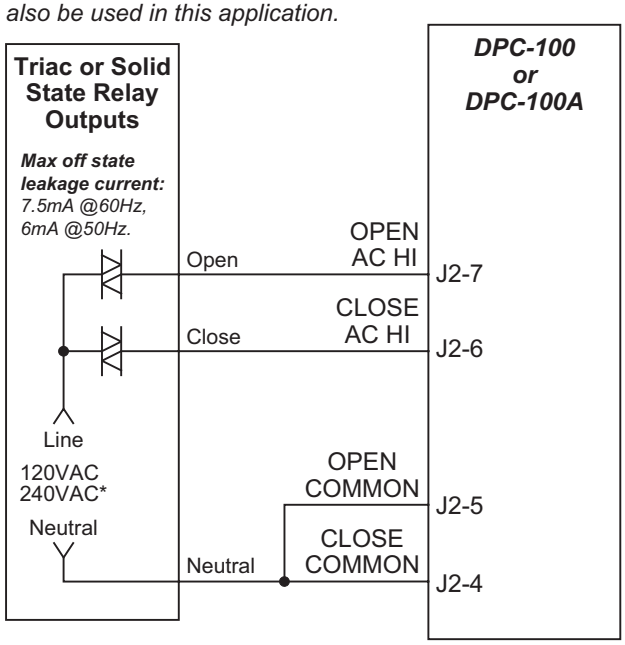
Do **not connect close input for 2-wire control.*

DC Control Inputs Wired Back To Back



DC Control Inputs Using Open Collector Outputs

NOTE: *Form C relay output card can also be used in this application.*

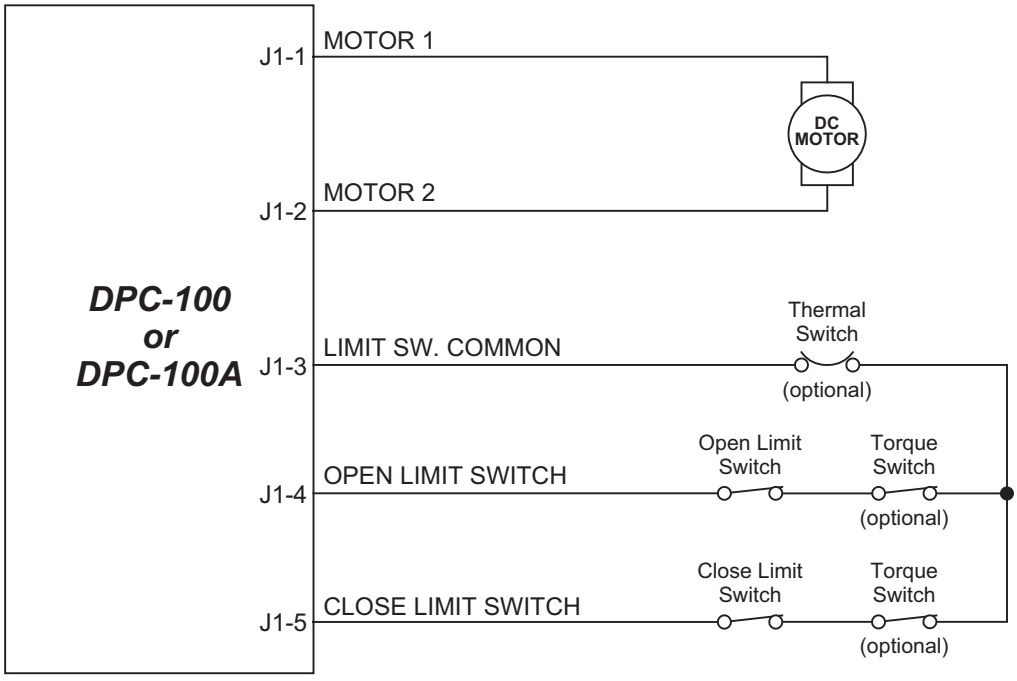


For 240VAC inputs use **SIG-101 Signal Adapter.*

AC Control Inputs Using 120/240VAC

Wiring Diagrams

Output Configurations



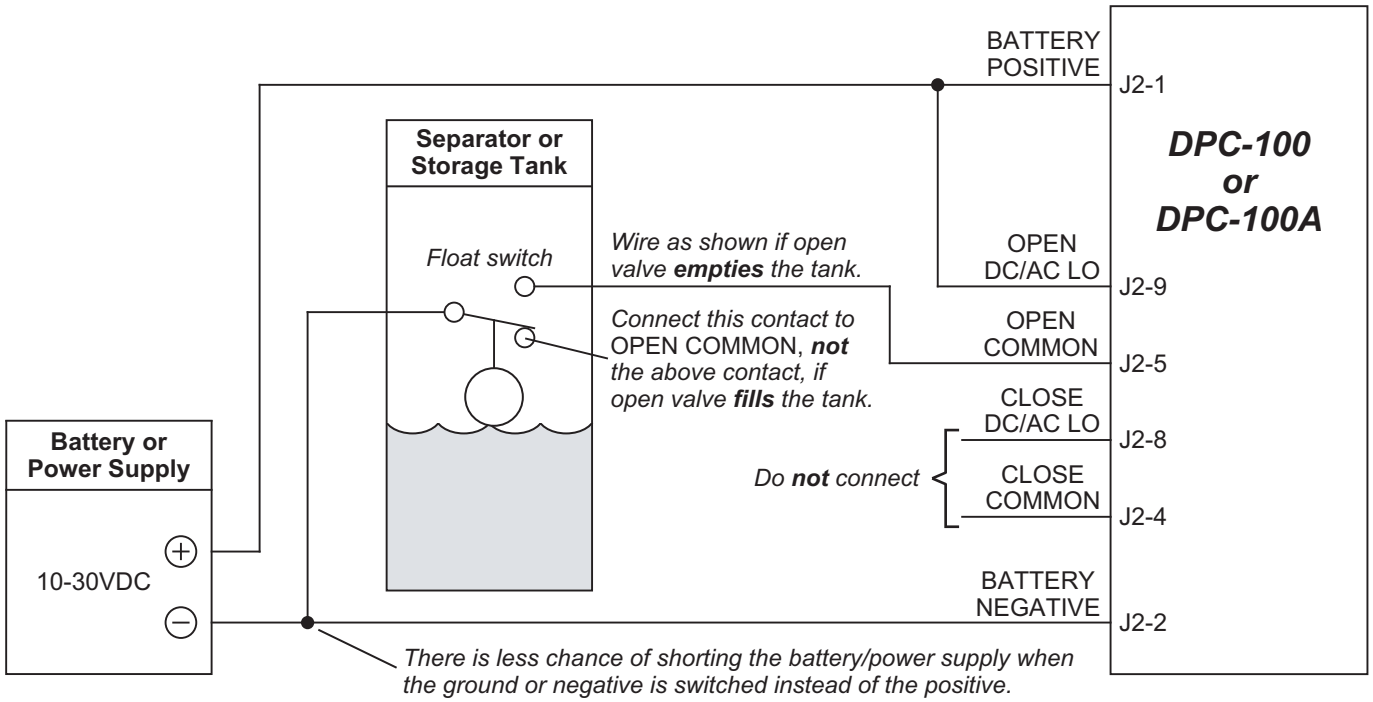
*When **Motor 1** is positive, the motor will run until the **Open Limit** is disconnected from **J1-3**.*

*When **Motor 2** is positive, the motor will run until the **Close Limit** is disconnected from **J1-3**.*

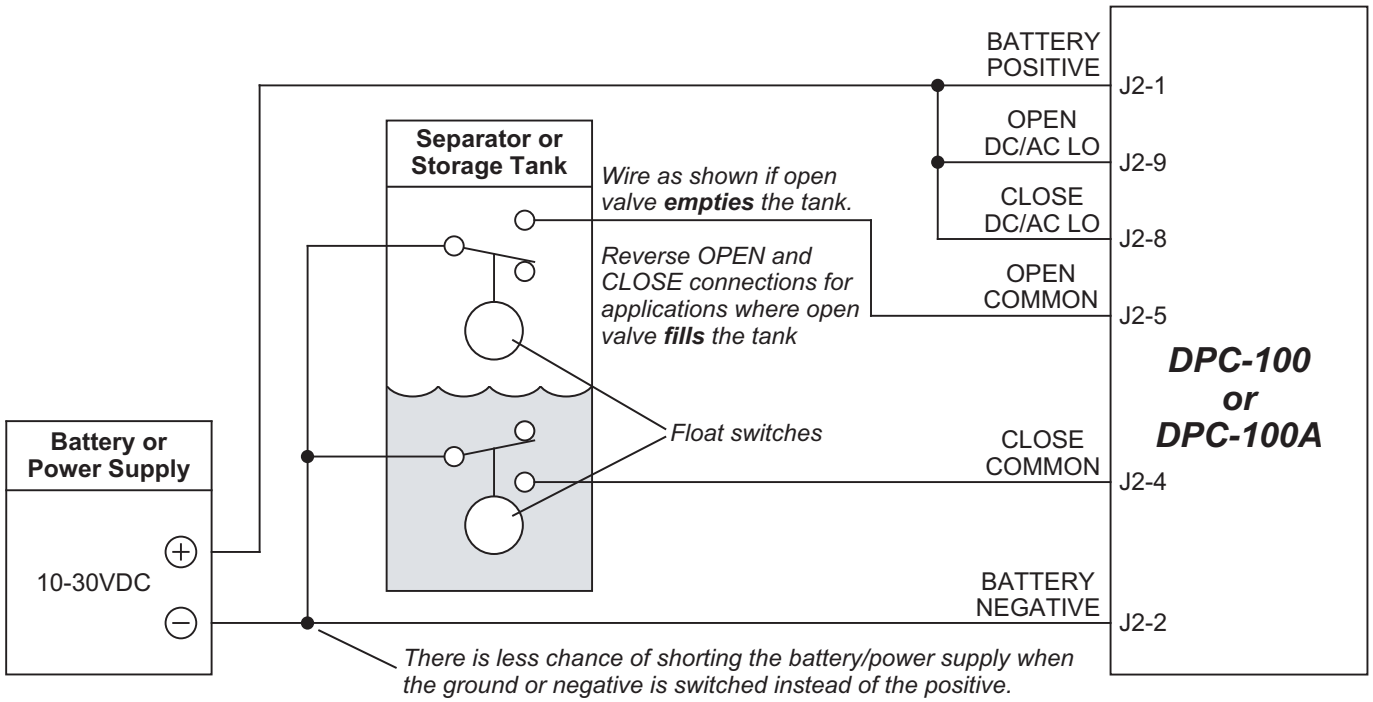
DC Motor Control Output

Wiring Diagrams

Special Applications



Connecting a Single Float Valve Using 2-Wire Mode and DC/AC LO Inputs



Connecting Dual Float Valves Using 3-Wire Mode and DC/AC LO Inputs

Wire Table

The table below shows the maximum recommended distance (in feet and meters) between the power source and the DPC-100. The maximum distance is limited by the wire size and the locked rotor current of the motor.

The surge limiting feature of the DPC-100/DPC-100A along with an appropriate motor current trip setting can significantly reduce wire size and power requirements – see *Trip Setting*. The wire distance is calculated for a maximum voltage drop of 1VDC with 20% of the locked rotor current, and assumes that the full load current of the running motor is less than 20% of the locked rotor current.

All signal wires on the DPC-100 should be connected with wire sizes ranging from 22 to 18 AWG.

Locked Rotor Current (amps)	Units	Wire Gauge						
		18 AWG	16 AWG	14 AWG	12 AWG	10[1] AWG	8[1] AWG	6[1] AWG
1	Feet	333	529	842	1337	2119	3383	5376
	Meters	101	161	257	408	646	1031	1639
2	Feet	167	264	421	668	1059	1692	2688
	Meters	51	80	128	204	323	516	819
5	Feet	67	106	168	267	424	677	1075
	Meters	20.4	32	51	81	129	206	328
10	Feet	33	53	84	138	212	338	538
	Meters	10	16	26	42	65	103	164
15	Feet	22	35	56	89	141	226	358
	Meters	6.7	10.7	17	27	43	69	109
20	Feet	17	26	42	67	106	169	269
	Meters	5.2	7.9	12.8	20.4	32	52	82
30	Feet	11	18	28	45	71	113	179
	Meters	3.4	5.5	8.5	13.7	21.6	34	55
40	Feet	8	13	21	33	53	85	134
	Meters	2.4	4.0	6.4	10	16	26	41
50	Feet	7	11	17	27	42	68	108
	Meters	2.1	3.4	5.2	8.2	12.8	20.7	33
60	Feet	6	9	14	22	35	56	90
	Meters	1.8	2.7	4.3	6.7	10.7	17	27

Notes:

1) The DPC-100 terminal strip will not accept wire sizes larger than 12 AWG. Use a short run of 12 AWG from the DPC-100 to an auxiliary terminal block when larger wire is needed.

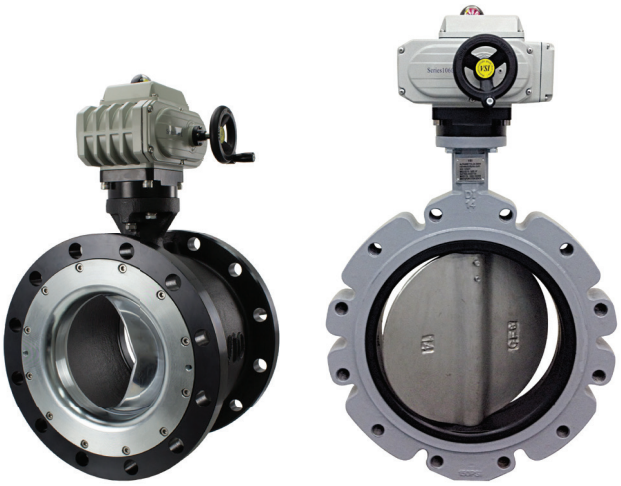
2) If the motor is located some distance from the DPC-100, add this distance to the overall wire length. Be sure to use an appropriate wire size to the motor.

3) When multiple actuators are powered by a common set of wires, use the sum of all the motor currents when determining wire size.

VSI

SERIES 1000-X
INDUSTRIAL ELECTRIC VALVE ACTUATORS

S1000X-102 R4
FEB 2022



Implementations

The Series 1000-X actuator is designed to be the most robust, space efficient, and easy to install package possible. The compact enclosure minimizes interference problems common in modern piping and control rooms. The actuator base conforms to international standards, and female drive allows the direct mounting on most valves without expensive and space hogging custom brackets. The heavy die cast aluminum alloy housing with large cooling fins ensure a life span that will exceed that of most valves.

An Actuator For Every Application

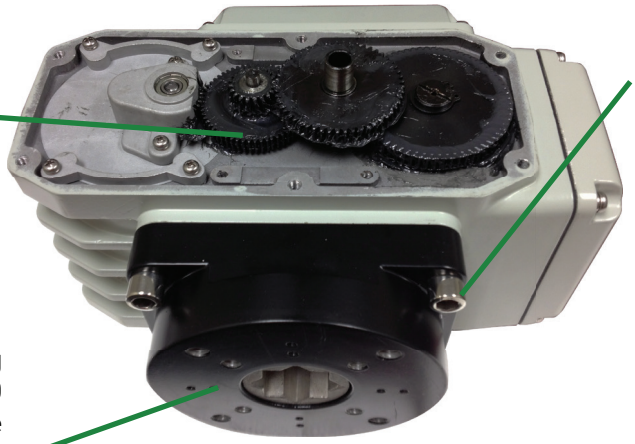
With 8 unit sizes from 443inlbs all the way to 22,127inlbs the Series 1000-X is the perfect solution to most valve actuation applications or other automation such as dampers. Everything from 1/4" ball valves all the way to 24" or larger butterfly valves can easily be automated with the Series 1000-X. The NEMA 4X housing can be used in control rooms or exposed to harsh sunlight and driving rain on building rooftops. Infrequently operated or typical isolation valves can use the economical open/close units while flow control applications operating at duty cycles of up to 80% are easily handled with the servo controlled modulating option.

Every application is different, and VSI or your authorized reseller are here to help you with an actuator to fit your needs. The Series 1000-X is available with simple options such as auxiliary limit switches all the way to project specific accommodations such as local controls, prewired cable connectors, battery backups, or special linkages for installations such as 3-way butterfly valves. We can help you find your Valve Solution.

Valve Solutions, Inc
1205 Alpha Drive, Alpharetta, GA 30004
T: 770.740.0800 F: 770.740.8777
E: sales@valvesolutions.com

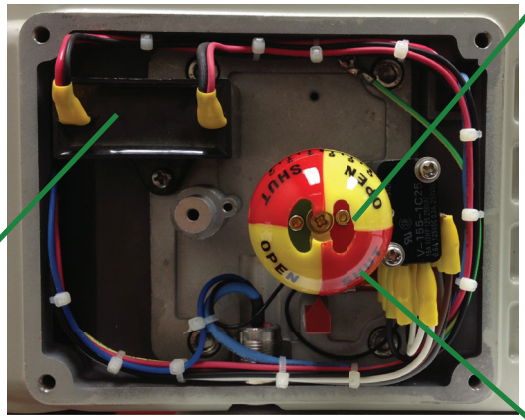
DURABLE DRIVE GEARS
The alloy steel spur gears and bronze worm gear are permanently lubricated and fully supported by bearings and bushings, designed to outlive the life of any attached valve

ISO 5211 MOUNTING
Each unit has multiple mounting patterns, each conforming to ISO 5211. This, combined with the female drive allows for the direct mounting on a wide variety of valves. Adapters are available for common valve shafts



CORROSION RESISTANT
Along with all stainless external hardware, the entire enclosure is polyester powder painted to ensure long life in extreme environments

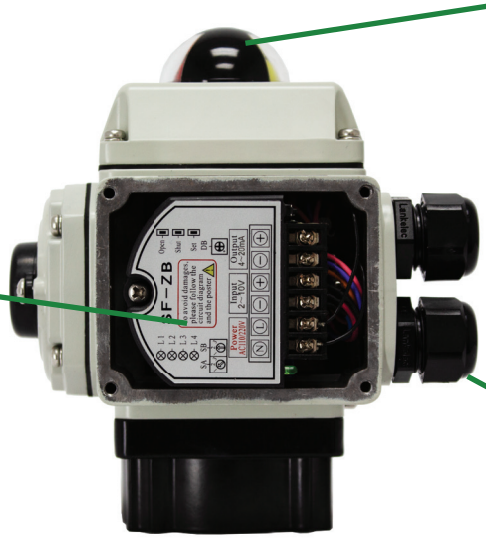
EASY FIELD SETTING
Open/Close units feature an easy to adjust cam operated limit switch set. Two Allen screws are turned from above to adjust position of limit switches



POWERFUL MOTOR
The induction type motor and run capacitor are specifically designed for valve actuator service and tested to CSA C22.2 No 139-13. There are no brushes to wear out and the duty cycle is rated up to 80%

HIGH VISIBILITY INDICATOR
Designed to be seen at a distance, the red and yellow position indicator provides positive visual position indication of the valve and actuator

UNIQUE SERVO CONTROL
The Series 1000-X family of servo controllers for modulating service are fully self contained, replaceable without disturbing the installation of the actuator. By isolating the delicate control electronics in a fully potted enclosure it is protected from accidental moisture ingress and easily replaceable in the event of failure by power surge or other unforeseen circumstances.



EASY FIELD WIRING
Each unit features two threaded conduit entries, one for power and one for control wiring. The wiring for Open/Close units terminate in an easy to access terminal block. Modulating unit servo controllers connect to the actuator wiring with push-to-connect connectors.

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ON-OFF ROTARY ELECTRIC ACTUATOR FEATURES

Standard Design Features

Torque Output Range	443 in-lb to 22,127 in-lb
Housing	NEMA 4/4X and IP67 watertight, corrosion-resistant, powder coated, robust die cast aluminum
Mounting	ISO 5211 Standard mounting configurations
Electric Motors	120VAC, single phase, 60Hz totally enclosed, non-ventilated, high starting torque, reversible capacitor run induction type with Class F insulation
Thermal Overload Motor Protection	Automatically resetting thermal switch permanently embedded in the motor winding - trips when the maximum winding temperature is exceeded and resets once temperature normalizes
Auxiliary Limit Switches	2x SPDT limit switches for Open and Close travel limit - easily adjustable. Switches are cam operated, direct coupled to output for accurate positioning. Adjustment of standard auxiliary limit switches is tied to end of travel switch adjustment. Rated 15A/250VAC and 0.6A/125VDC. (3A/250VAC for 1005-X model)
Position Indicator	Mechanical dome type with high visibility red/yellow colored open/close indicator
Terminal Strip	Heavy duty clamp type with Phillips head screw down, refer to wiring diagram
Conduit Entries	Two separate 1/2" NPT, one for power and one for control signal. Shipped with removable cable gland adapters to prevent environmental damage during short term storage
Power Gears	Alloy steel spur gears drive an aluminum bronze worm sector gear anti-backdrive final stage.
No Motor Brake Required	The anti-backdrive worm gear prevents back driving, hunting, and eliminates the need for a motor brake.
Bearings	All drive gears are supported by ball bearings, high quality alloy steel sleeve bushings, and bronze sleeve bushings
Manual Override	All units shipped with an Allen Handle manual override. A declutchable hand-wheel is an available option on 1010-X to 1250-X units
Ambient Temperature Rating	-22^{0}F to +140^{0}F (-30^{0}C to +60^{0}C)
Internal Heater	Internal heater prevents condensation buildup inside actuator
Certifications and Approvals	CE, NEMA 4/4X, NRTL, CSA File 226201, CSA C22.2 and UL 429

Optional Features

220VAC	220VAC 50/60Hz Power Option for all units
24VAC	24VAC 50/60Hz Power Option for models 1005-X thru 1040-X
24VDC	24VDC Power Option for select models
Torque Switches	Adjustable torque limit switches for close direction of travel
Feedback Potentiometer	Option for 1000ohm passive feedback potentiometer
Auxiliary Limit Switches	4x SPDT limit switches for Open and Close travel limit - Independently adjust-able from end of travel limit switches
Handwheel Override	Declutchable handwheel override with speed handle (not available on 1005-X models)

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ON-OFF TECHNICAL SPECIFICATIONS

MODEL	1005-X	1005-XL	1010-X	1020-X	1040-X	1060-X	1100-X	1160-X	1250-X
Output Torque (in-lbs)	443	443	885	1,770	3,540	5,310	8,851	14,616	22,127
Output Torque (Nm)	50	50	100	200	400	600	1000	1600	2500
Duty Cycle[1]	80%	80%	80%	80%	80%	80%	70%	70%	70%
Travel Speed @ 60Hz (Sec)	17	21	25	25	25[2]	37	25	40	63
Motor Power (W)	10W	10W	25W	40W	90W[3]	90W	140W[4]	140W	140W
Max Current (Amp @110 VAC)	0.34	0.34	0.81	1.68	3.41	3.60	3.80	3.93	3.95
Run Current (Amp @110 VAC)	0.27	0.27	0.64	0.73	1.22	1.27	2.39	2.36	1.73
Max Current (Amp @220VAC)	0.28	0.28	0.47	0.78	1.78	1.87	2.12	2.16	2.20
Run Current (Amp @220VAC)	0.19	0.28	0.32	0.45	0.64	0.66	1.16	1.18	1.19
Max Current (Amp @24VAC)	2.08	2.08	3.12	5.30	7.25	N/A	N/A	N/A	N/A
Run Current (Amp @24VAC)	1.56	1.56	2.16	3.24	4.55	N/A	N/A	N/A	N/A
Run Current (Amp @ 24VDC)	-	-	2.0	-	-	N/A	N/A	N/A	N/A
Enclosure Rating	WATERTIGHT NEMA 4/4X, IP67								
Turning Angle	90^0 Adjustable ± 5^0								
Ambient Temperature	-22^0F to $+140^0$F (-30^0C to $+60^0$C)								
Ambient Humidity	≤ 95% Relative Humidity								
Insulating Resistance	100MΩ/250VDC for 24V Units, 100/MΩ/500VDC for 110/220V Units								
Weight (lb)[2]	6.4	6.6	10	21	22	22	37	41	42
Weight (kg)	2.9	3.0	4.5	9.5	10	10	17	18.5	19

1. Duty cycle of 24VDC units are 70%
2. Run time of 1040-X 24VAC is 37 seconds
3. Motor power of 1040-X 24VAC is 40W
4. Motor power of 1100-X 110VAC is 120W

* Refer to the IOM for additional information

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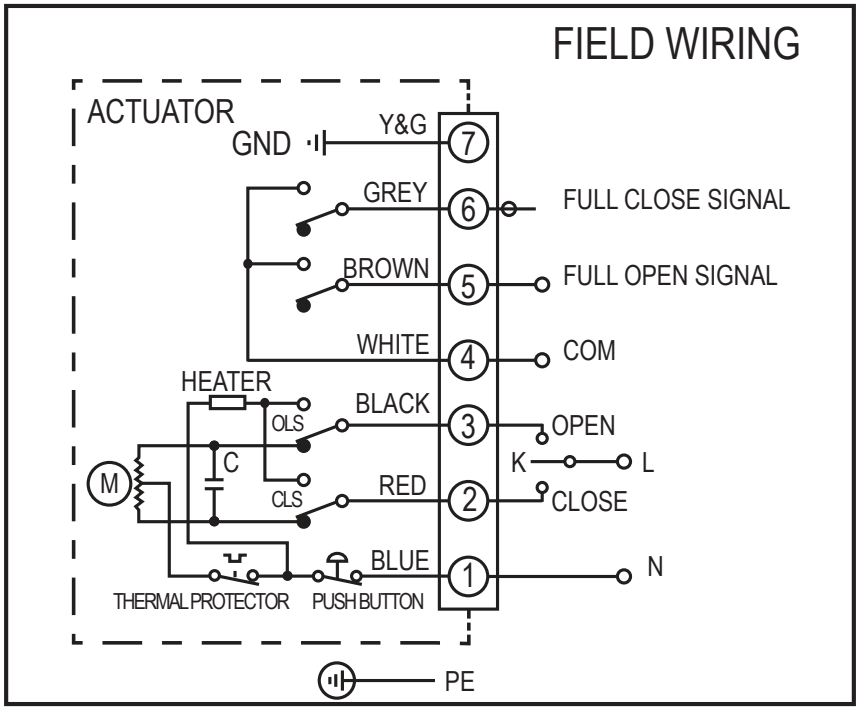
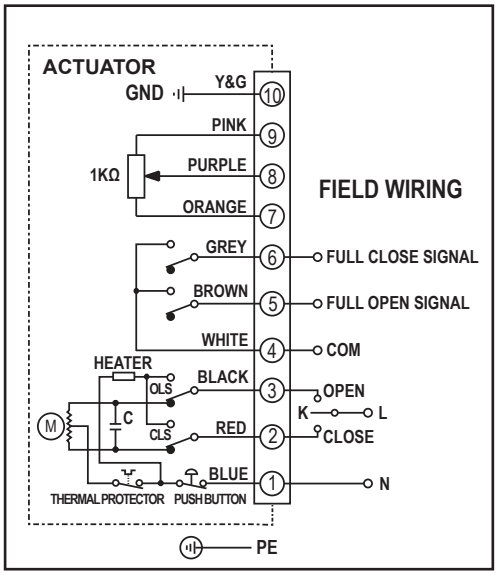
ON-OFF WIRING DIAGRAMS

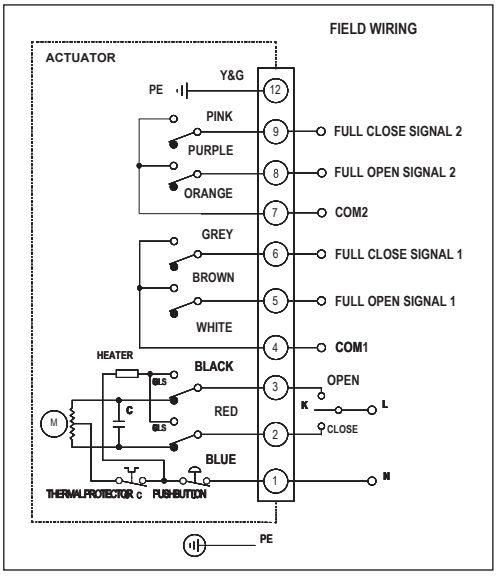
STANDARD EQUIPMENT



WITH POTENTIOMETER OPTION



WITH EXTRA SWITCH OPTION



1. Pushbutton disconnect not available on 1005-X or 24VAC models
2. Capacitor not present in 24VDC models

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MODULATING ROTARY ELECTRIC ACTUATOR FEATURES

Standard Design Features

Servo Control Module	Direct analog control input 4-20mA or 2-10VDC to controller for position control. Analog output of 4-20mA. Signals are reversible for direct or reverse acting
Torque Output Range	443 in-lb to 22,127 in-lb
Housing	NEMA 4/4X and IP67 watertight, corrosion-resistant, powder coated, robust die cast aluminum
Mounting	ISO 5211 Standard mounting configurations
Electric Motors	120VAC, single phase, 60Hz totally enclosed, non-ventilated, high starting torque, reversible capacitor run induction type with Class F insulation
Thermal Overload Motor Protection	Automatically resetting thermal switch permanently embedded in the motor winding - trips when the maximum winding temperature is exceeded and resets once temperature normalizes
Resolution	80 steps (0.2mA/1.1^0 for 4-20mA) or 200 steps (0.04VDC/0.5^0 for 2-10VDC) through 90^0 travel
Power at Rest	2VA
Position Indicator	Mechanical dome type with high visibility red/yellow colored open/close indicator
Control Pack	Refer to control pack information for details
Conduit Entries	Two separate 1/2" NPT, one for power and one for control signal. Shipped with removable cable gland adapters to prevent environmental damage during short term storage
Power Gears	Alloy steel spur gears drive an aluminum bronze worm sector gear anti-backdrive final stage.
No Motor Brake Required	The anti-backdrive worm gear prevents back driving, hunting, and eliminates the need for a motor brake.
Bearings	All drive gears are supported by ball bearings, high quality alloy steel sleeve bushings, and bronze sleeve bushings
Manual Override	All units shipped with an Allen Handle manual override. A declutchable hand-wheel is an available option on 1010-X to 1250-X units
Ambient Temperature Rating	-22^{0}F to +140^{0}F (-30^{0}C to +60^{0}C)
Internal Heater	Internal heater prevents condensation buildup inside actuator
Certifications and Approvals	CE, NEMA 4/4X, NRTL, CSA File 226201, CSA C22.2 and UL 429

Optional Features

220VAC	220VAC 50/60Hz Power Option for all units
24VAC	24VAC 50/60Hz Power Option for models 1005-X thru 1040-X
24VDC	24VDC Power Option for select models
Torque Switches	Adjustable torque limit switches for close direction of travel
Auxiliary Limit Switches	2x SPDT limit switches for Open and Close travel limit
Handwheel Override	Declutchable handwheel override with speed handle (not available on 1005-X models)

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MODULATING TECHNICAL SPECIFICATIONS

MODEL	1005/S-X	1005/S-XL	1010/S-X	1020/S-X	1040/S-X	1060/S-X	1100/S-X	1160/S-X	1250/S-X
Output Torque (in-lbs)	443	443	885	1,770	3,540	5,310	8,851	14,616	22,127
Output Torque (Nm)	50	50	100	200	400	600	1000	1600	2500
Duty Cycle[1]	80%	80%	80%	80%	80%	80%	70%	70%	70%
Travel Speed @ 60Hz (Sec)	17	21	25	25	25[2]	37	25	40	63
Motor Power (W)	10W	10W	25W	40W	90W[3]	90W	140W[4]	140W	140W
Max Current (Amp @110 VAC)	0.34	0.34	0.81	1.68	3.41	3.60	3.80	3.93	3.95
Run Current (Amp @110 VAC)	0.27	0.27	0.64	0.73	1.22	1.27	2.39	2.36	1.73
Max Current (Amp @220VAC)	0.28	0.28	0.47	0.78	1.78	1.87	2.12	2.16	2.20
Run Current (Amp @220VAC)	0.19	0.19	0.32	0.45	0.64	0.66	1.16	1.18	1.19
Max Current (Amp @24VAC)	2.08	2.08	3.12	5.30	8.40	N/A	N/A	N/A	N/A
Run Current (Amp @24VAC)	1.56	1.56	2.16	3.24	6.80	N/A	N/A	N/A	N/A
Run Current (Amp @ 24VDC)	-	-	2.0	-	-	N/A	N/A	N/A	N/A
Input Signal	(5)	(5)	Switchable 2-10VDC or 4-20mA[5]						
Output Signal	4-20mA								
Enclosure Rating	WATERTIGHT NEMA 4/4X								
Turning Angle	90^0 Adjustable ± 5^0								
Ambient Temperature	-22^0F to $+140^0$F (-30^0C to $+60^0$C)								
Ambient Humidity	≤ 95% Relative Humidity								
Insulating Resistance	100MΩ/250VDC for 24V Units, 100/MΩ/500VDC for 110/220V Units								
Weight (lb)	6.6	6.8	10	21	22	22	37	41	42
Weight (kg)	3	3.1	4.5	9.5	10	10	17	18.5	19

1. Duty cycle of 24VDC units are 70%
2. Run time of 1040-X 24VAC is 37 seconds
3. Motor power of 1040-X 24VAC is 40W
4. Motor power of 1100-X 110VAC is 120W
5. Series 1005/S-X and 1005/S-X models and all Series 1000/S-X 24VAC units have specific control packs for either 2-10VDC or 4-20mA control signals. Control signal must be specified at time of order.

* Refer to the IOM for additional information

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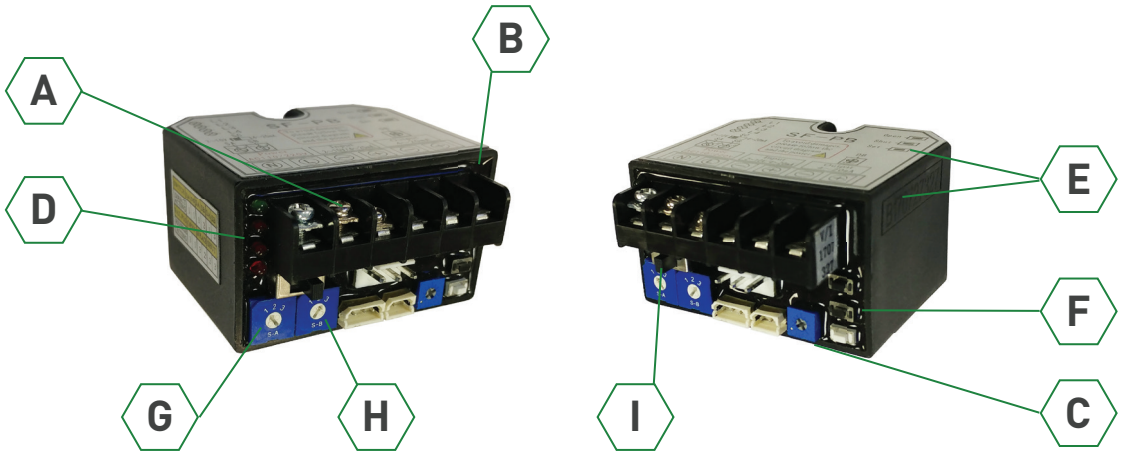
MODULATING SERVO CONTROLLERS

All modulating Series 1000/S-X units feature a removable/replaceable fully encapsulated digital servo control pack. The servo control pack vary by the actuator size and voltage, however all units feature:

A) Screw clamp terminals
B) Fully potted for vibration resistance and extended life
C) Adjustable control signal dead-band from 0.5% to 5%
D) Four diagnostic LED lights for troubleshooting
E) Permanent printed label and laser etched unique serial number
F) Setup buttons to move and program actuator
G) A switch, SA, to change the actuator to reverse or direct acting and enter setup mode
H) A switch, SB, to designate fail open or close on loss of control signal

Additionally the SF-PB, SF-PB-24VAC, and SF-ZC servo control pack features a switch, SC (I), to switch between acceptance of 4-20mA or 2-10VDC control signals.



Servo Controller Table

POWER	24VAC		110VAC/220VAC	
CONTROL	2-10VDC	4-20mA	2-10VDC	4-20mA
1005/S-X	SF-ZB-2-24VAC	SF-ZB-4-24VAC	SF-ZB-2	SF-ZB-4
1005/S-XL	SF-ZC-2-24VAC[1][3]	SF-ZC-4-24VAC[2][3]	SF-ZC	
1010/S-X			SF-PC[4]	
1020/S-X				
1040/S-X				
1060/S-X	NA			
1100/S-X				
1160/S-X				
1250/S-X				

1. Older 1010/S-X may utilize SF-ZB-2-24VAC
2. Older 1010/S-X may utilize SF-ZB-4-24VAC
3. Older 1020/S-X and 1040/S-X may utilize SF-PB-24VAC
4. Older units may utilize SF-PB

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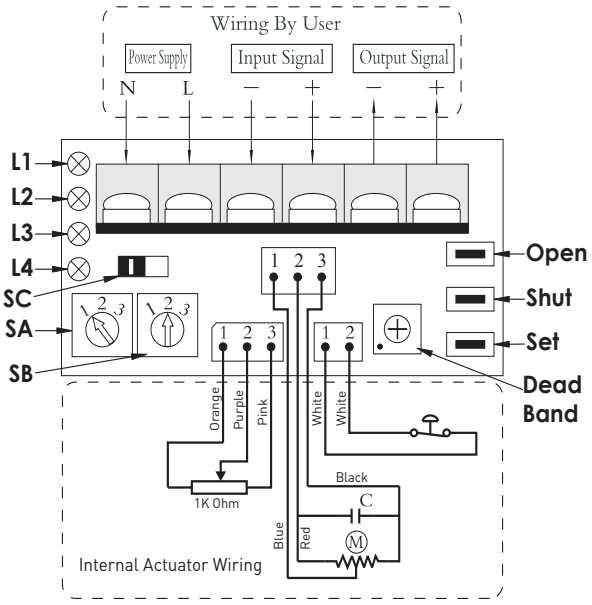
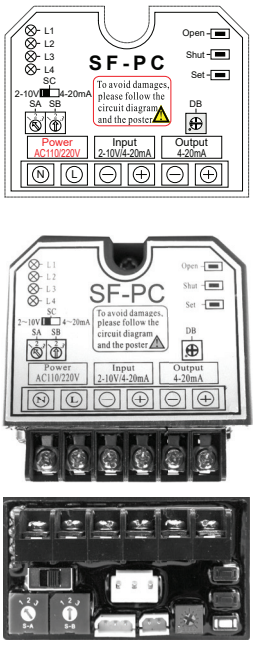
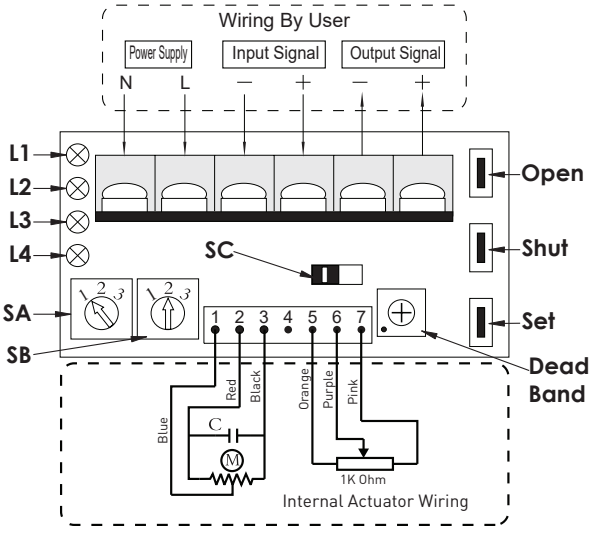
MODULATING SERVO CONTROLLERS (Cont.)

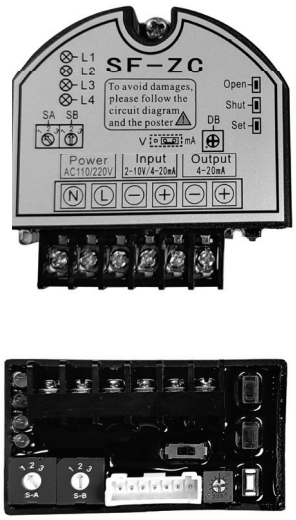
SF-PC for 1010/S-X thru 1250/S-X, 110VAC or 220VAC





SF-ZC for 1005/S-XL, 110VAC or 220VAC





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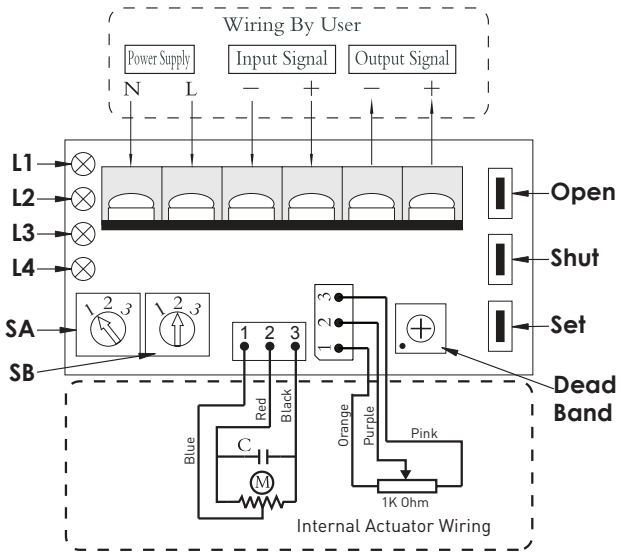
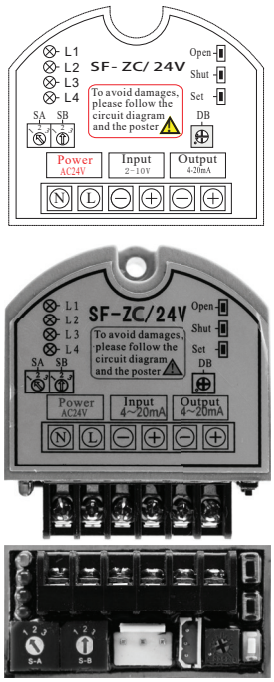
MODULATING SERVO CONTROLLERS (Cont.)

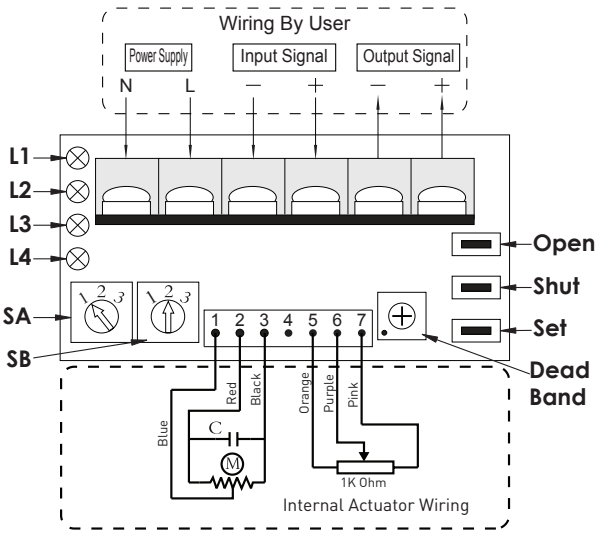
SF-ZC-24VAC, ALL 24VAC UNITS

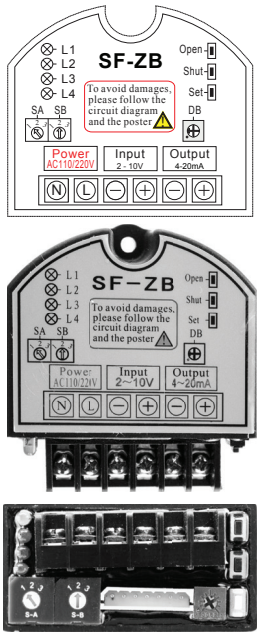




Part Num. SF-ZC-2-24VAC for 2-10VDC Input
Part Num. SF-ZC-4-24VAC for 4-20mA Input

SF-ZB for 1005/S-X, 110VAC or 220VAC





Part Num. SF-ZB-2 for 2-10VDC Input
Part Num. SF-ZB-4 for 4-20mA Input

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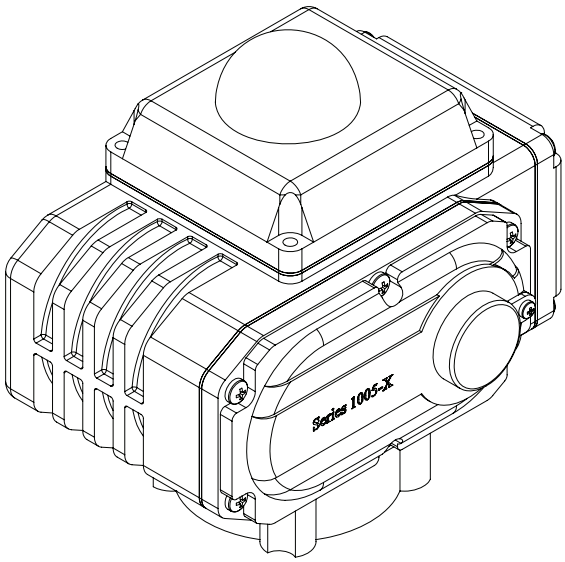
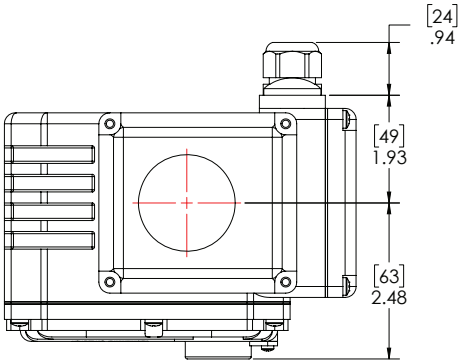
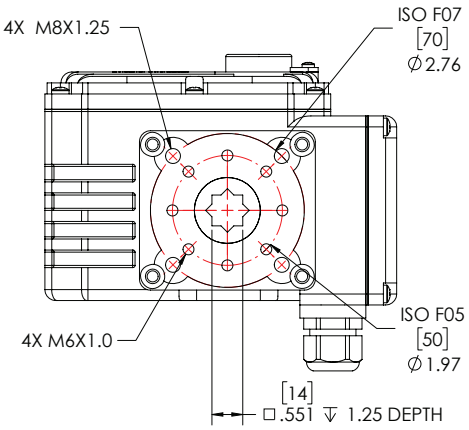
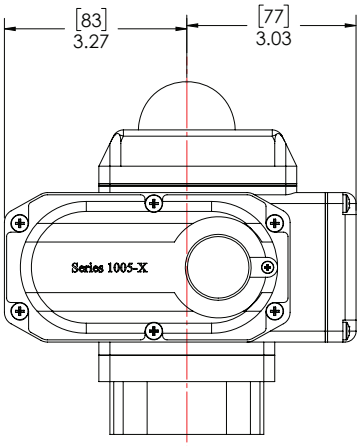
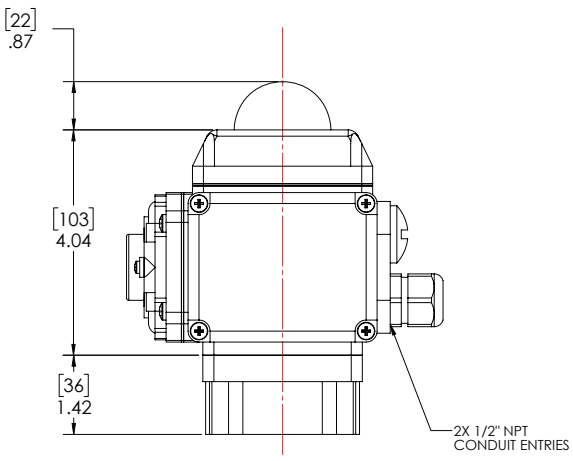
1005-X AND 1005/S-X DIMENSIONS











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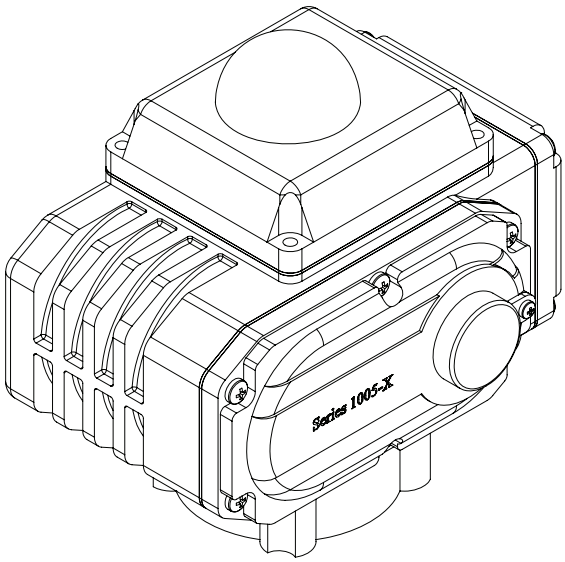
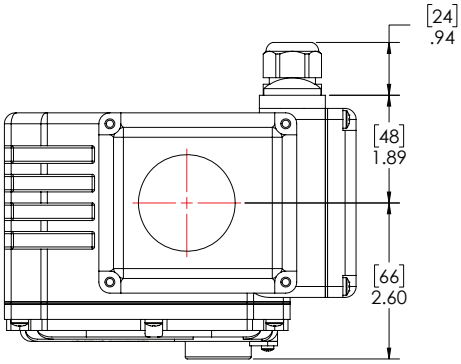
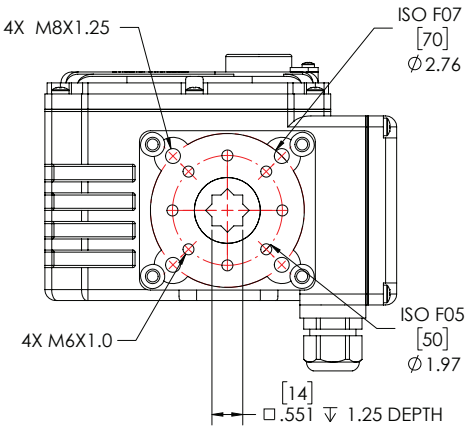
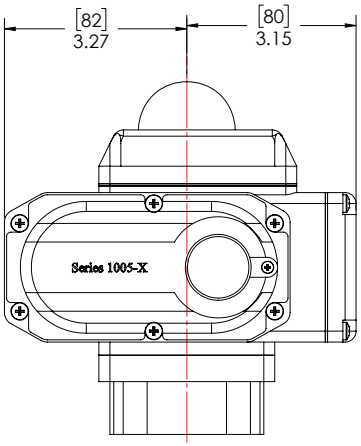
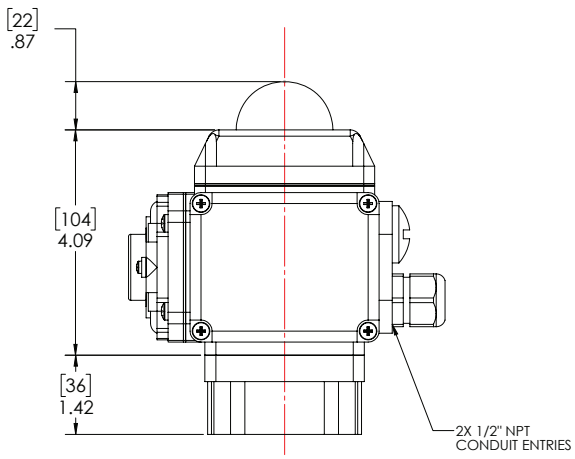
1005-XL AND 1005/S-XL DIMENSIONS











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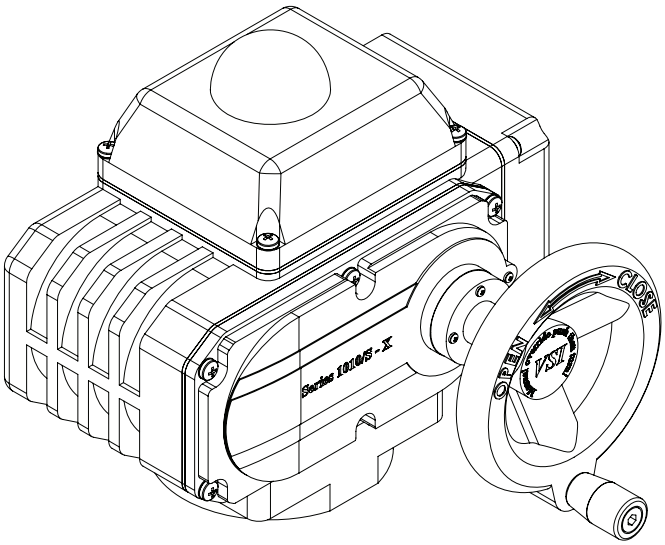
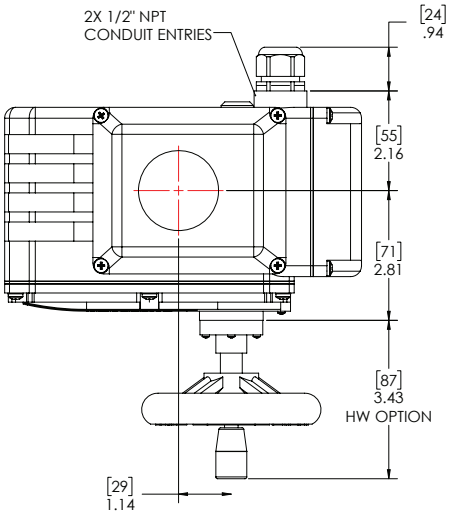
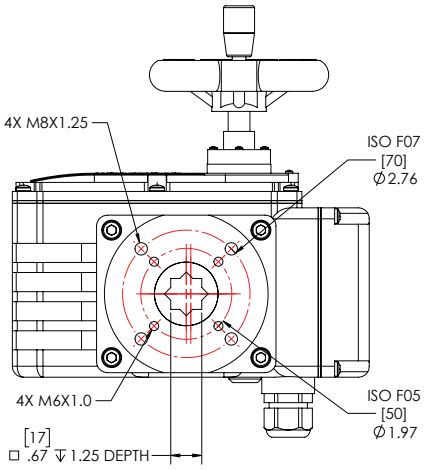
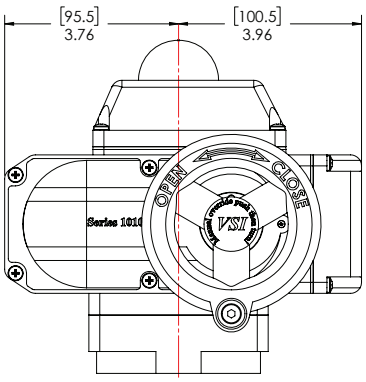
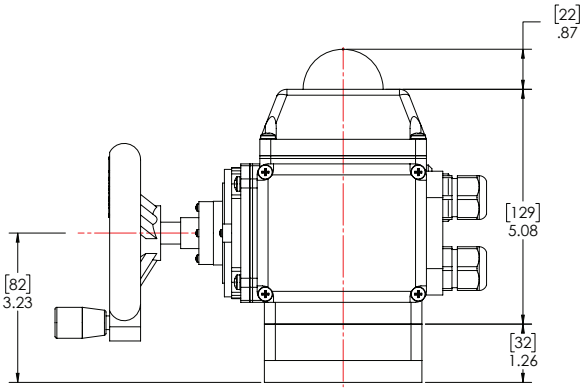
1010-X AND 1010/S-X DIMENSIONS











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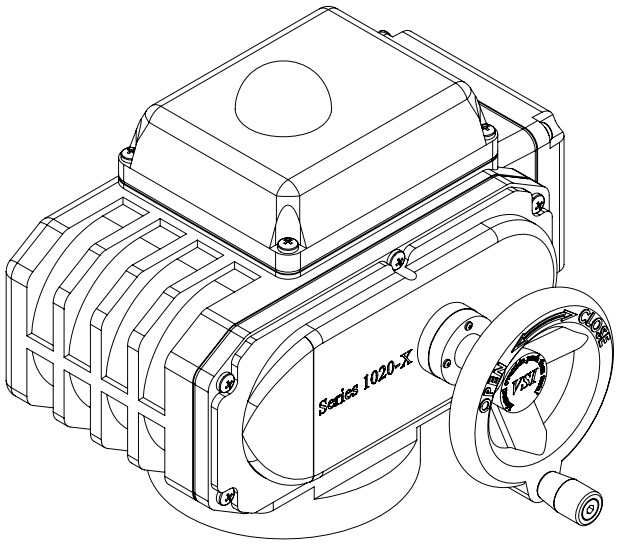
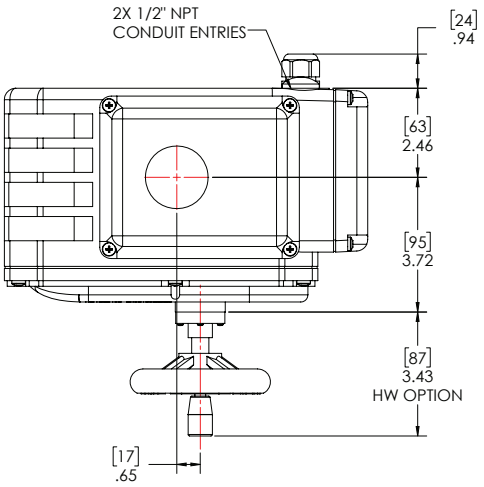
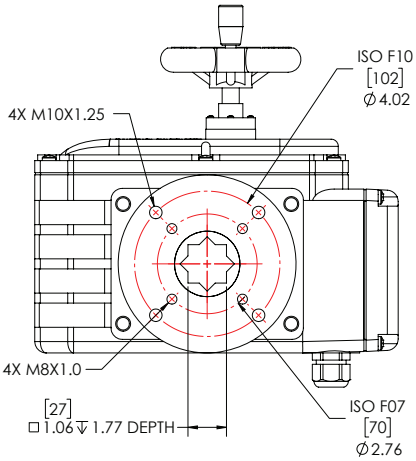
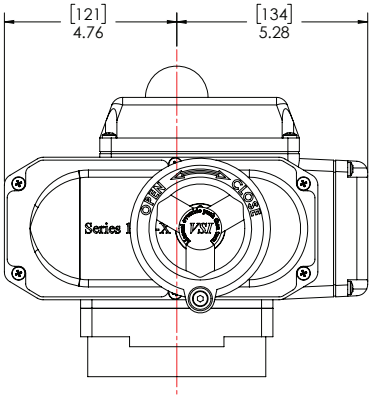
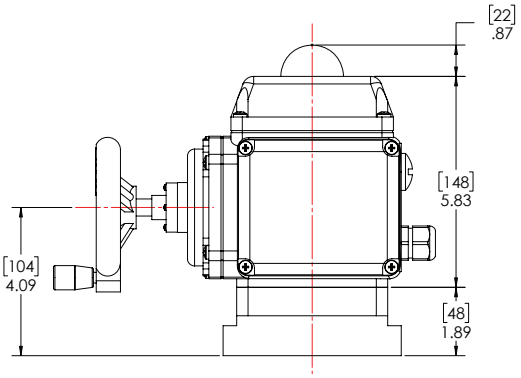
1020-X AND 1020/S-X DIMENSIONS
1040-X AND 1040/S-X DIMENSIONS
1060-X AND 1060/S-X DIMENSIONS











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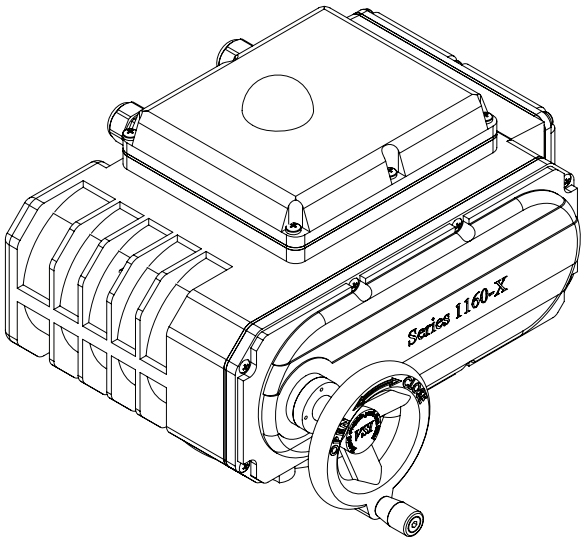
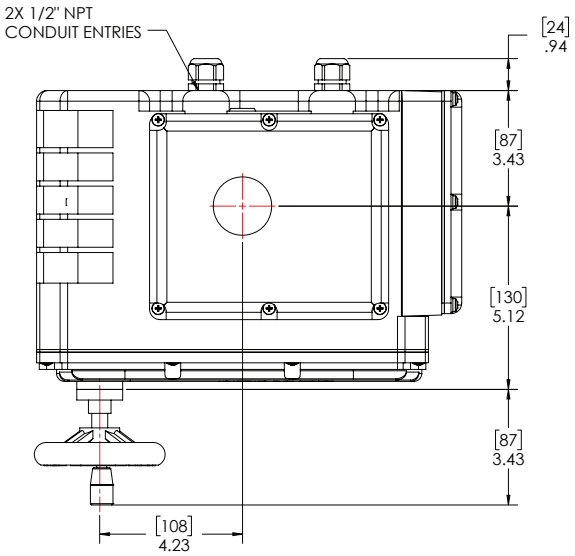
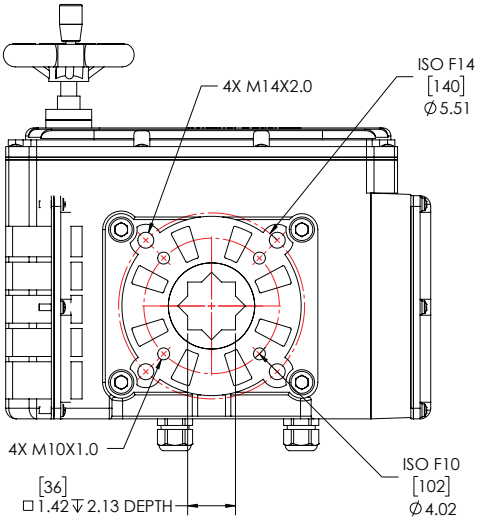
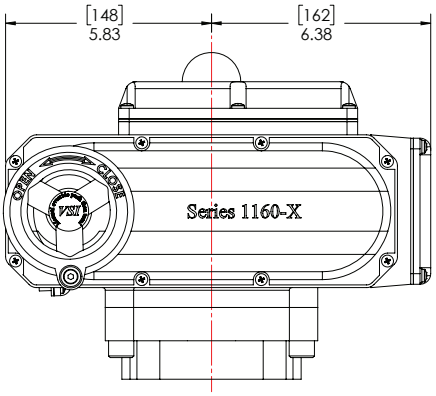
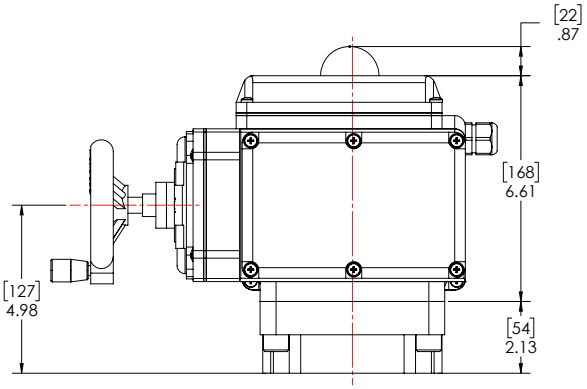
1100-X AND 1100/S-X DIMENSIONS
1160-X AND 1160/S-X DIMENSIONS
1250-X AND 1250/S-X DIMENSIONS











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Sample Specification

1. ELECTRIC ACTUATORS FOR QUARTER-TURN VALVES

1.1. This specification covers the design, manufacture, and testing of electric actuators for quarter turn valves.
1.2. Actuators shall be of the quarter turn type with a compact low profile design to minimize space requirements.
1.3. All actuators shall be designed to provide easy access for field wiring, setup, and inspection

2. ENCLOSURE

2.1. The enclosure shall be die-cast aluminum and anodized inside and out before painting and assembly
2.2. All actuator enclosures shall be coated with a heat cured polyester powder coating.
2.3. All access covers for wiring or adjustment shall be provided with captive cover bolts designed to stay coupled to the cover to prevent loss of hardware when the covers are removed.
2.4. The enclosure shall be rated NEMA 4 and 4X and IP67. All units shall be 100% tested by applying a positive internal pressure and submerging the entire actuator enclosure. Any bubbles shall deem the actuator defective
2.5. The actuator enclosure shall be supplied with a minimum of two threaded conduit entries, one for power wiring and one for control wiring. All conduit entries shall be fitted with a sealed plug during shipment and storage to ensure no moisture ingress before field wiring is installed.

3. MOTOR

3.1. The motor shall be of the single phase, permanent split capacitor induction type with Class F insulation. The motor shall be of the capacitor run type fitted with a capacitor designed specifically for motor control applications.
3.2. The motor shall have an automatic reset thermal overload protector embedded in the motor winding to prevent motor damage during stall conditions.
3.3. Motors shall be a minimum of 70% duty cycle, IEC S3-70%
3.4. Motor operating voltage shall be 120V-1-60Hz, 220V-1-60Hz, or 24V-1-60Hz as specified or required for the installation.

4. GEAR TRAIN

4.1. The actuator gear train shall consist of a set of alloy steel spur gears carried in bushings that drive a hardened alloy steel worm. The worm gear output shall be hard bronze alloy and shall be self-locking to prevent back-driving and eliminate the need for a motor brake.
4.2. The entire gear train shall be designed to withstand both locked rotor conditions or stalling of the connected valve with sufficient safety factor to prevent any actuator damage.
4.3. The actuator gear-train shall be equipped with adjustable mechanical stops. The stops shall positively stop the rotation of the actuator whether driven by the motor or the manual override. Mechanical stops shall be capable of being field adjusted without the need to disassemble any part of the actuator. A locking mechanism in the form of a jam nut shall be provided to prevent unintended changes in the mechanical stop adjustment.
4.4. The quarter turn actuator gearing shall be completely self contained. The use of secondary gearboxes for actuator outputs less than 22,000 inlbs shall not be accepted.

5. CONTROL OF OPEN/CLOSE APPLICATIONS

5.1. For open/close or floating applications the actuator shall be equipped with adjustable limit switches in the open and close directions, independently adjustable
5.2. Activation of limit switches shall be by a cam direct coupled to the output of the actuator. Use of gear sets, threaded rod, Oldham couplings, or any other mechanism other than direct coupling may impose hysteresis and shall not be accepted.
5.3. Each actuator shall be equipped with a SPDT limit switch for each direction wired in series with the motor winding to positively disconnect the motor from power at end of travel. An auxiliary SPDT limit switch shall be supplied in each direction for remote position indication.
5.4. All wiring shall terminate in a pre-wired terminal black for ease of access and field wiring

6. CONTROL OF MODULATING APPLICATIONS

6.1. For modulating applications the actuator shall be controlled by a servo controller. The controller shall be completely self contained and replaceable. The servo controller shall be housed in an ABS enclosure and fully potted. The use of exposed circuit boards shall not be allowed.
6.2. The servo controller shall accept either a 4-20mA or a 2-10VDC analog control command signal and output a 4-20mA analog feedback signal representing relative position of the actuator.
6.3. The servo controller shall feature a minimum of four diagnostic LED lights to indicate the presence of power, control signal out of range/missing, improper calibration, or an over-torque. The dead-band shall be adjustable by rotary dial.
6.4. The actuator shall be able to be configured by means of switches to be either direct acting or reverse acting.
6.5. The actuator shall be capable of being configured to fail in place, fail open, or fail close on loss of control signal.

7. MOUNTING

7.1. All actuators shall feature an integral mounting base complying with ISO 5211 to mount directly to valves without the need for any specialized brackets or couplings.

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Sample Specification (Cont.)

7.2. The output drive of each actuator shall be female. The output shall be in a star pattern to allow rotation of square stems at 45 degree increments.

6. OTHER FEATURES
   - 6.1. All units shall be capable of being driven by manual override. Override shall be by hex Allen key. Units over 500inlbs operating torque shall feature a declutchable handwheel option, where required by engineer.
   - 6.2. All units over 500inlbs for 110V or 220V shall feature a external mounted pushbutton to electrically isolate the actuator from moving for maintenance or manual override operation.
   - 6.3. All units shall have an integral self-regulating condensation heater
   - 6.4. Each actuator shall be equipped with a high visibility dome position indicator. The indicator shall have color flags red for shut and yellow for open to indicate at a distance the actuator position from any orientation.
   - 6.5. Each unit shall have a permanent data plate with the actuator model number, the power voltage rating, the current rating, and the actuator speed. Additionally each unit shall be laser etched with a unique traceable serial number.
7. OPTIONAL FEATURES
   - 7.1. Open/close units shall be capable of being supplied with a 1000 ohm passive potentiometer where required by the engineer.
   - 7.2. Open/close units shall be capable of being supplied with additional (total 4) auxiliary feedback switches where required by the engineer.
   - 7.3. Where required by the engineer, actuators shall be capable of being supplied with adjustable torque switches in the clockwise close direction.
   - 7.4. Modulating units shall be capable of being supplied with auxiliary feedback switches(2) where required by the engineer.
8. MANUFACTURER
   - 8.1. Quarter turn electric valve actuators shall be VSI Series 1000-X as manufactured by Valve Solutions, Inc., Alpharetta, GA USA or approved equal
   - 6.2. All valves shall be warranted by manufacturer for a minimum of 24 months.

WARRANTY

This limited warranty applies in the United States to products manufactured by VSI, LLC. VSI, LLC. warrants the product purchased from it or its authorized reseller to be free from defects in material and workmanship under normal use during the two year warranty period from the date of its purchase. Other products not manufactured by VSI, LLC. which are provided as part of an assembly may carry additional warranties from that manufacturer or supplier.

During the warranty period, VSI, LLC. will repair or replace defective parts of the product, or, at VSI, LLC. sole option, issue a credit for the original purchase price of the product. Repaired or replaced product will be warranted hereunder only for the remaining portion of the original warranty period. All exchanged products under this Limited Warranty will become the property of VSI, LLC. A proper Return Material Authorization (RMA) number will have to be obtained for all products to be returned under this Limited Warranty. Any claim under this Limited Warranty must include a description of the problem encountered and any relevant information that may assist VSI, LLC. in the replication or resolution of the problem.

This Limited Warranty is transferable during its term to the end user of the product. Any transfer shall not extend or alter the terms of this Limited Warranty.

This Limited Warranty extends only to products purchased from VSI, LLC. or its authorized reseller and does not extend to any product that has been damaged or rendered defective as a result of (a) modification, repair, alteration or improper installation by any person other than VSI, LLC. or its authorized representative; (b) unreasonable or improper use or storage, use beyond rated conditions, operation other than per VSI, LLC. or the manufacturer's instructions, or being otherwise subjected to improper maintenance, negligence or accident; or (c) any use of the product after purchaser has knowledge of any defect in the product.

The warranties provided above are in lieu of and exclude all other warranties, statutory, express or implied, including without limitation any warranty or merchantability or fitness for a particular purpose. VSI, LLC. expressly disclaims all warranties not stated in this limited warranty. Any implied warranties that may be imposed by law are limited to the terms of this limited warranty.

VSI, LLC. warranty liability shall not exceed the original purchase price of the defective product. VSI, LLC. is not liable for any damages caused by the product or other products or the failure of the product or other products to perform, including any lost profits, lost savings, incidental or consequential damages. VSI, LLC. is not responsible for charges resulting from the removal and/or replacement of the product. VSI, LLC. is not liable for any claims made by third parties or by the purchaser for a third party. This limitation applies whether damages are sought, or a claim is made, under the Limited Warranty or as a tort claim, product liability claim, contract claim, or any other claim. This limitation cannot be waived by any person. This limitation of liability will be effective even if VSI, LLC. or its authorized representative has been advised by the purchaser of the possibility of such damages.

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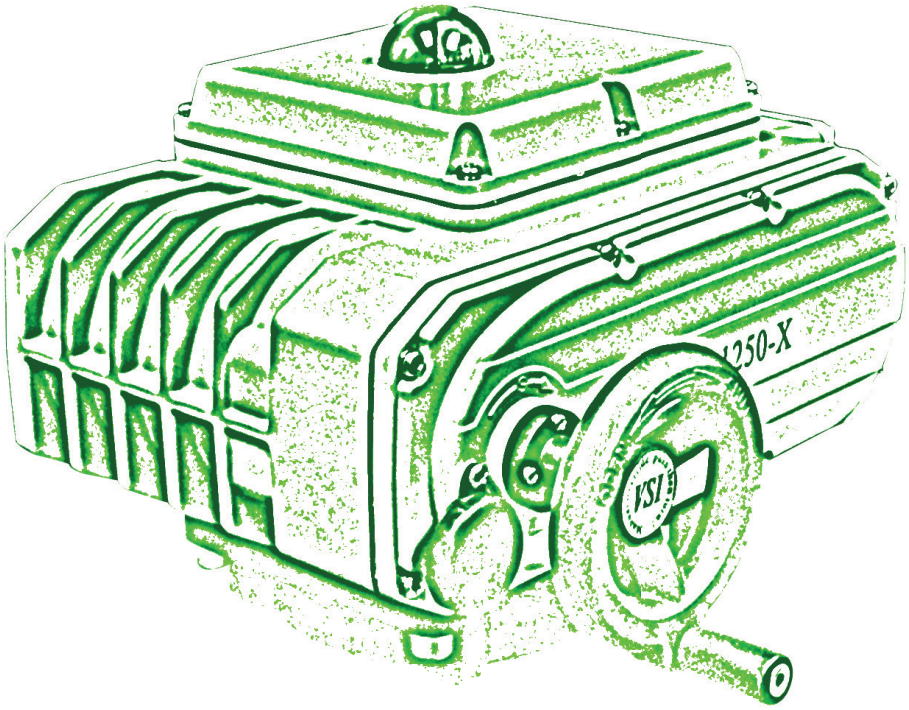

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