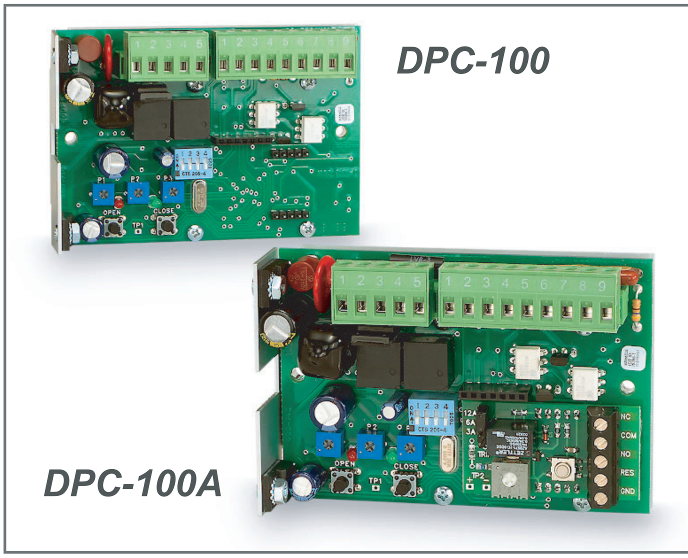
Features

- *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 multiple 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.

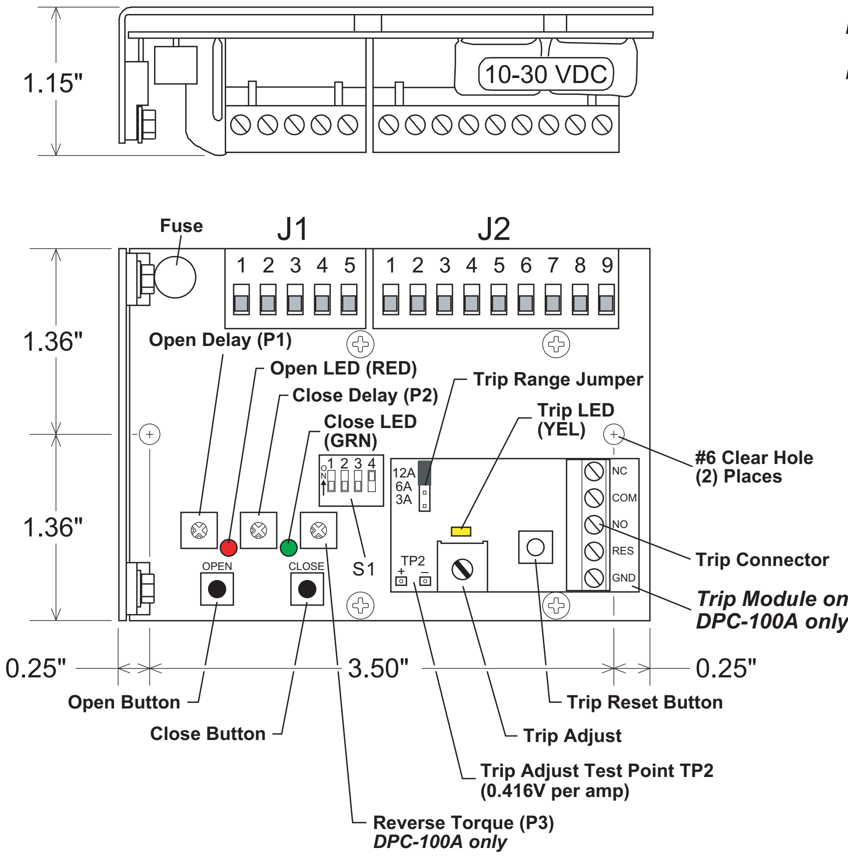
The unit also features a red LED indicator (for the open output), a green LED indicator (for the close output), a user replaceable fuse, two removable screw terminal strips for easy servicing, and on-board pushbuttons to manually open or close the actuator.

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

J1

To Motor
- MOTOR 1 — 1
- MOTOR 2 — 2

- LIMIT SW. COMMON — 3
- OPEN LIMIT SWITCH — 4
- CLOSE LIMIT SWITCH — 5

To Limit Switches

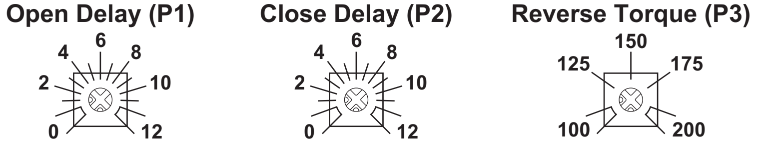
J2

To DC Power
- 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

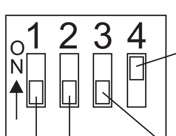
To Control Signal

P1 – P3 Pot Settings



(time in seconds) *(time in seconds)* *(percent of forward torque)* ***(DPC-100A only, 12A max)***

S1 Dip Switch Settings



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

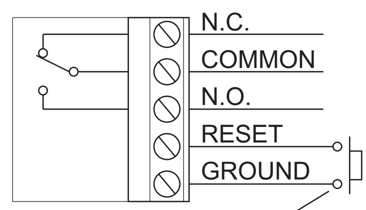
[S1-3] 2 or 3-Wire Control Enable:
On: 2-wire control enabled.
Off: 3-wire control enabled.

[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.

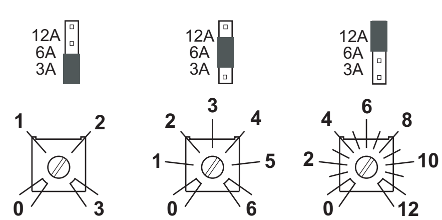
Trip Connector

(DPC-100A only)



Optional external reset button

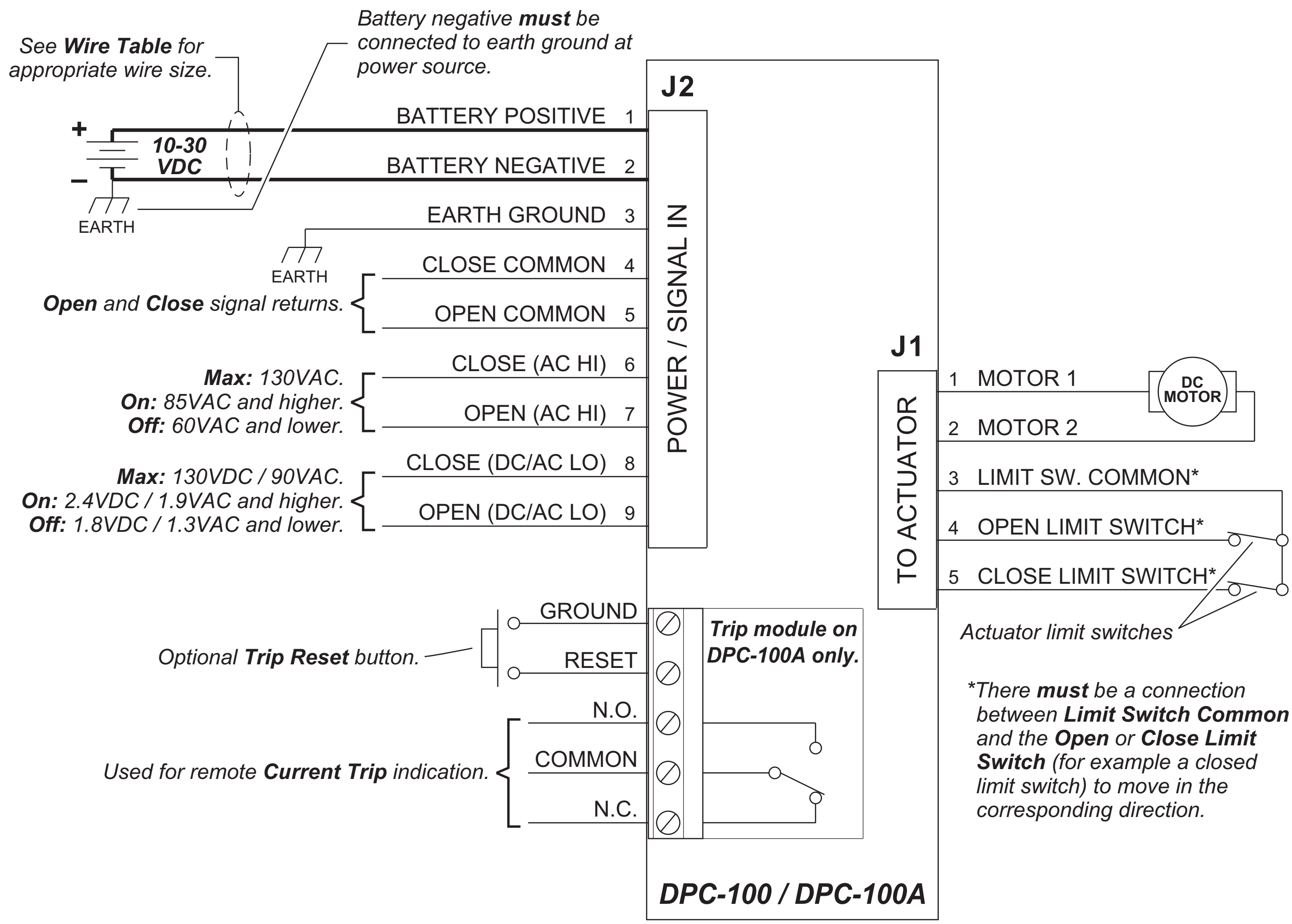
Current Trip Settings



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

Current trip amps = voltage measured across test point TP2 divided 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.

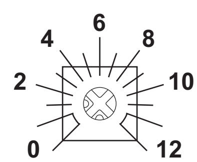
The limit switches are normally closed (conducting). The corresponding limit switch will open or break the connection when the actuator is driven fully open or closed. Therefore, the limit switch terminals (J1-4, J1-5) must be connected to LIMIT SWITCH COMMON (J1-3) for the DPC-100 to control the motor 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

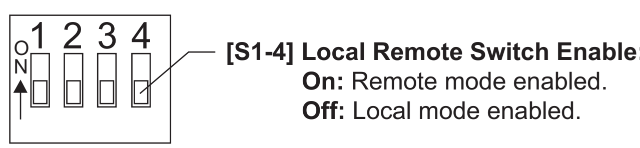
The DPC-100 provides independently adjustable input delays for both the open and close control signals. See *Control Adjustments* under *Specifications* for the delay period and *Outline* for the location. When both outputs are off and a control input signal is applied, the input delay setting causes 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.



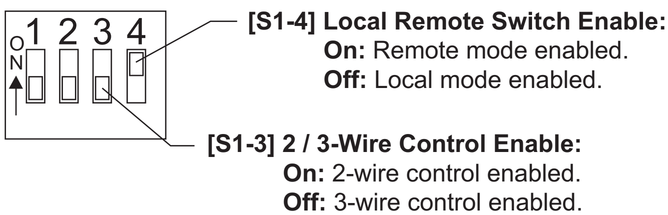
In local mode, pressing the open button will turn on the MOTOR 1 (open) output (J1-1), while pressing the close button turns on the MOTOR 2 (close) output (J1- 2).

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.



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) is on (+V)
Off	On	Motor 2 (close) is 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 opened 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 - If the supply voltage drops below 10V, the motor outputs are disabled and both LEDs will blink indicating a low voltage condition. After the voltage returns, there is a retry delay before normal operation resumes. In local mode the retry delay is always three seconds. In remote mode the delay time increases each time motor movement is interrupted by low voltage. This helps protect the battery and hardware. Once a movement is completed without a low voltage condition, the retry delay is reset to three seconds.

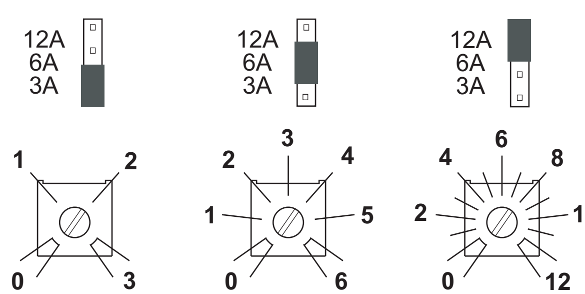
If the voltage exceeds 30V for more than a second, the motor outputs are disabled and both LEDs will turn on to indicate an overvoltage condition. Normal operation resumes after the voltage drops below 30V.

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.

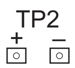
For actuators using smaller motors with less than 12A stall current, the DPC-100A, with it's adjustable current trip, may be helpful. The trip setting is useful for limiting the torque applied to the actuator's load.

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



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

The DPC-100A also has an on-board trip reset button and supports an external trip reset button. See *Outline*, *Block Diagram*, and *Specifications* for more information.

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 surge limiting of the DPC-100 combined with its current trip feature significantly reduces the maximum current needed by the motor, allowing for a less expensive and 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.

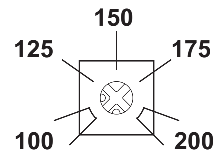
Torque Seating Valves (DPC-100A only)

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.

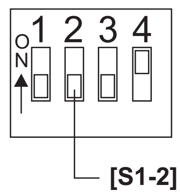
Once torque seated, some valves need extra torque to open reliably. The reverse torque pot (P3) is used to set the maximum torque that will be applied to open the valve. The reverse torque should be set to a level that reliably opens the valve while still protecting the actuator. The reverse torque pot (P3) is adjustable in a range from 100% to 200% of the torque used to close the valve (12A maximum).

Reverse Torque (P3)



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

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

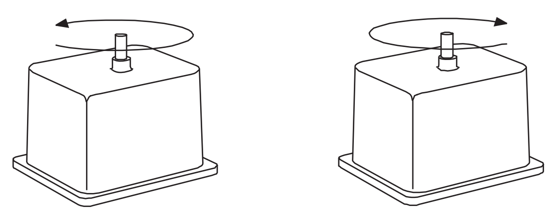


[S1-2] Increased Reverse Torque Direction:
On: Torque is increased in the **closed** direction.
Off: Torque is increased in the **open** direction.

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.

On-board trip reset switch*:
Pushbutton located on unit.

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

**One reset per button press or contact closure.*

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.

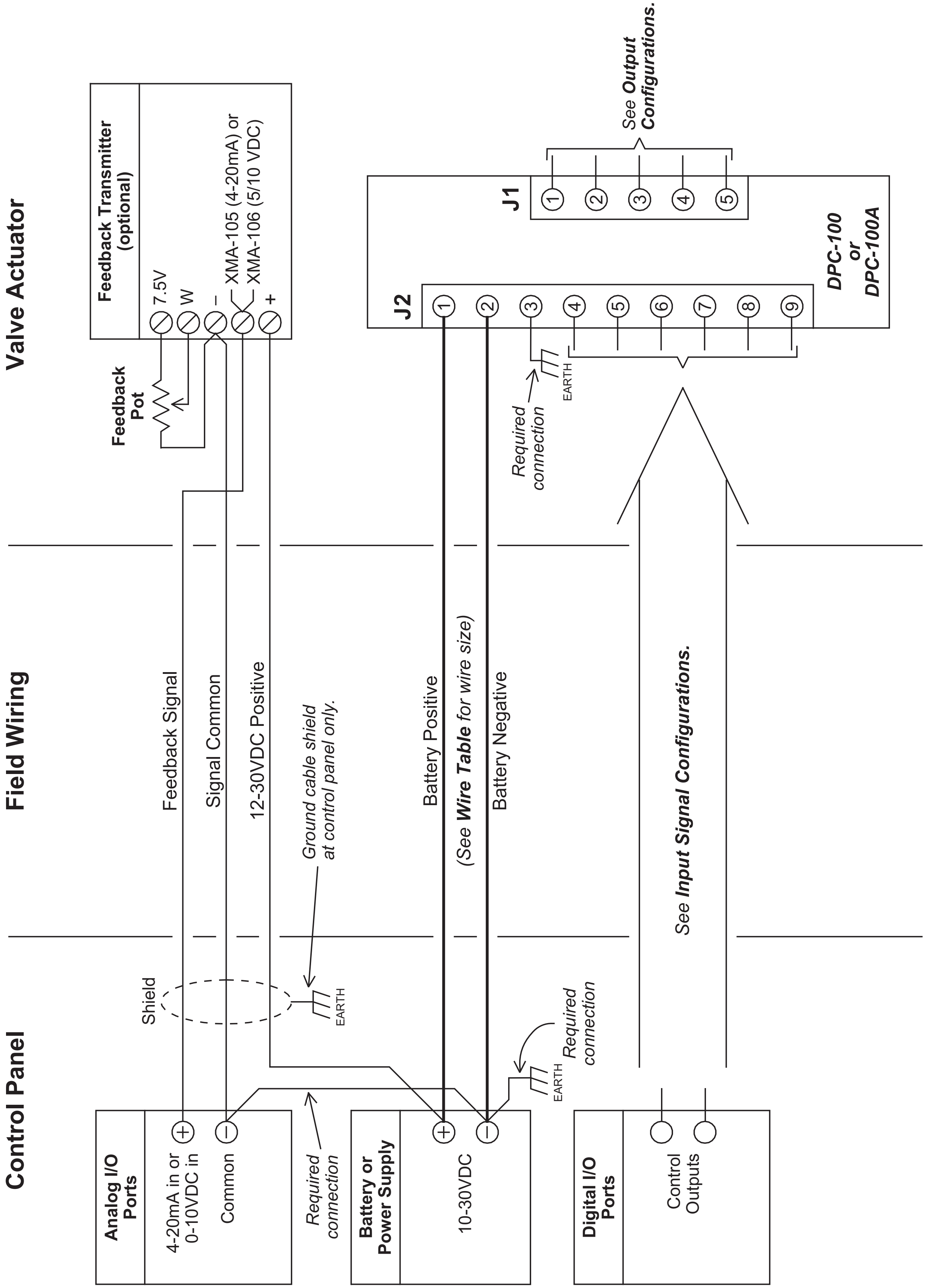
Environmental

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

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

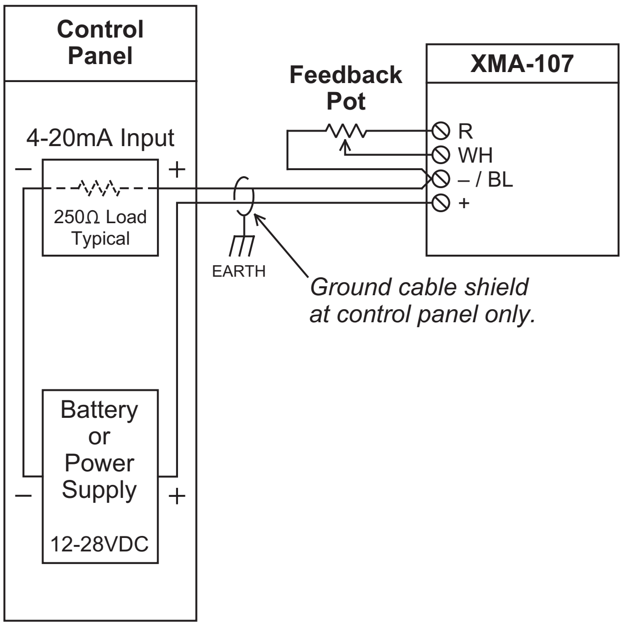
Relative humidity: 0% to 90% (noncondensing).

Recommended System Wiring

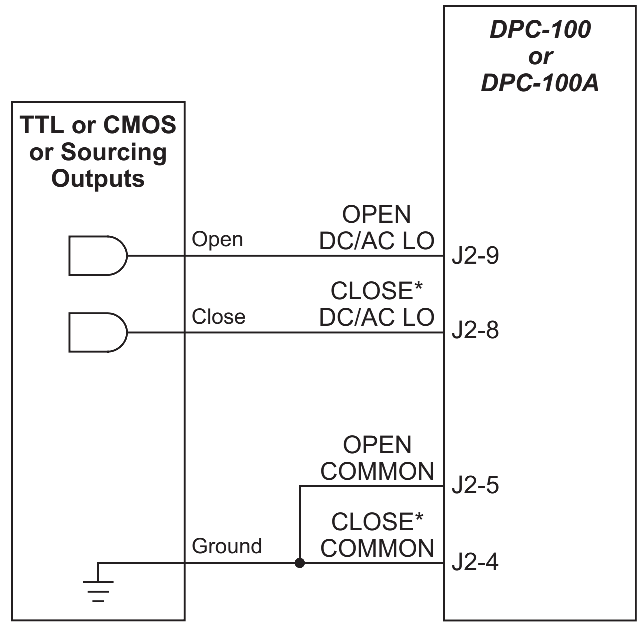


Wiring Diagrams

Feedback and Input Signal Configurations



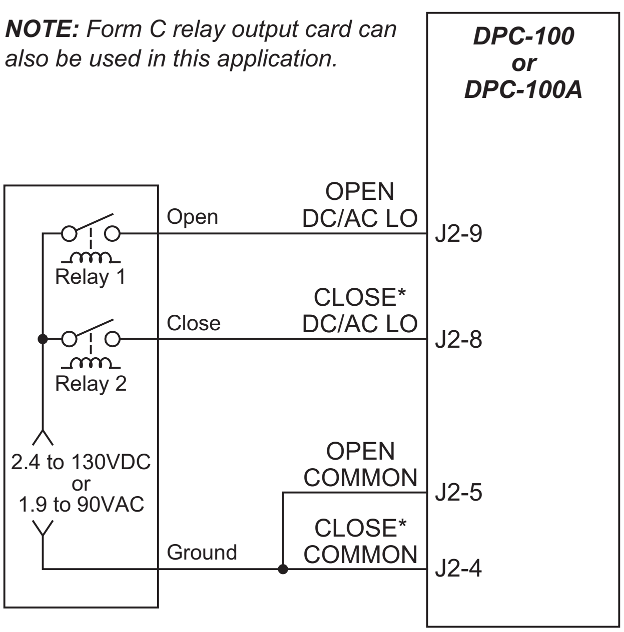
4-20mA Feedback Using XMA-107



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

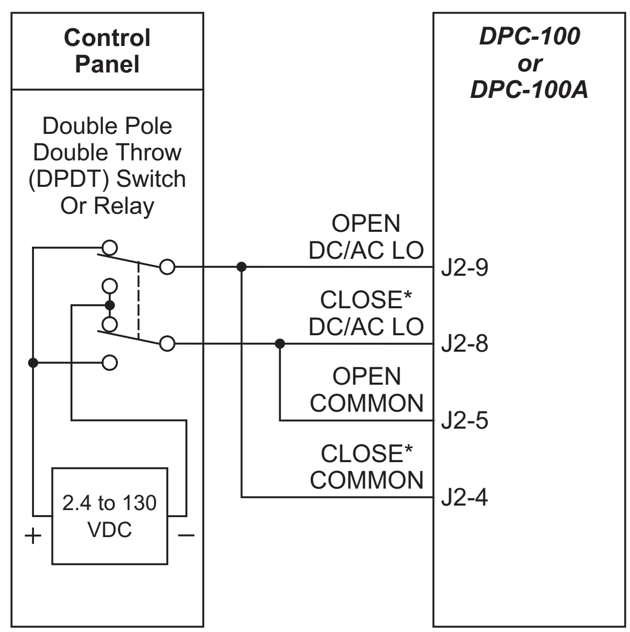
DC Control Inputs Using TTL, CMOS or Sourcing Outputs

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



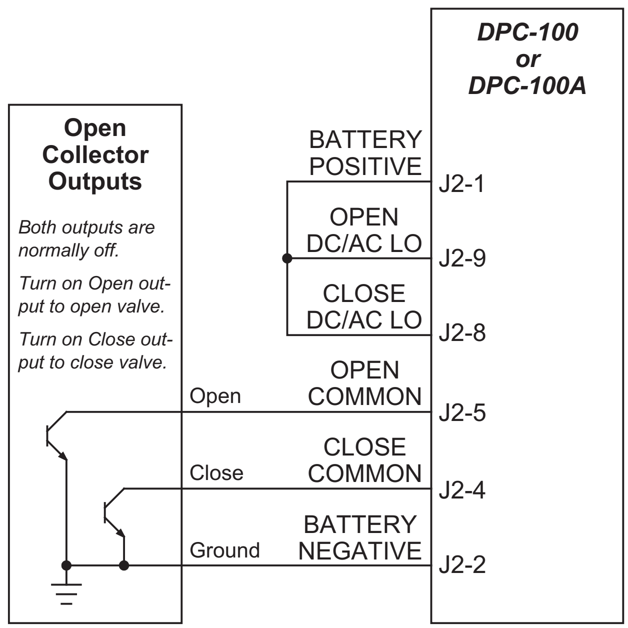
*Do **not** connect close input for 2-wire control.*

DC or AC Control Inputs Using Relays



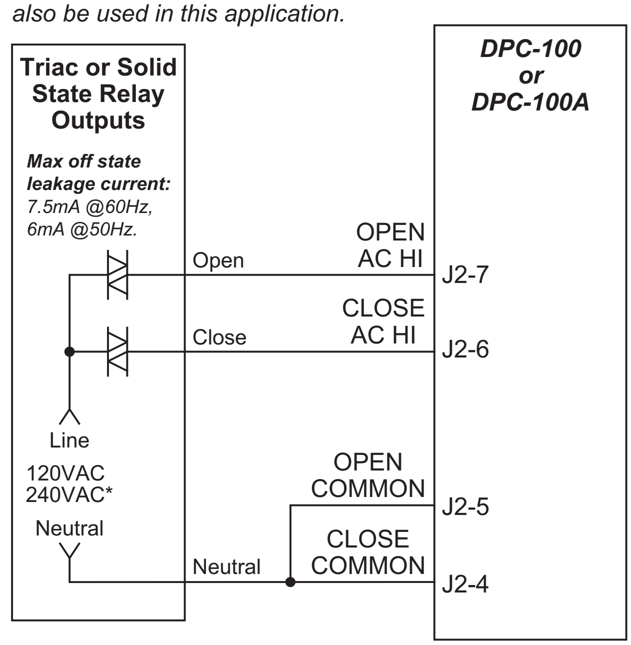
*Do **not** connect close input for 2-wire control.*

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.*

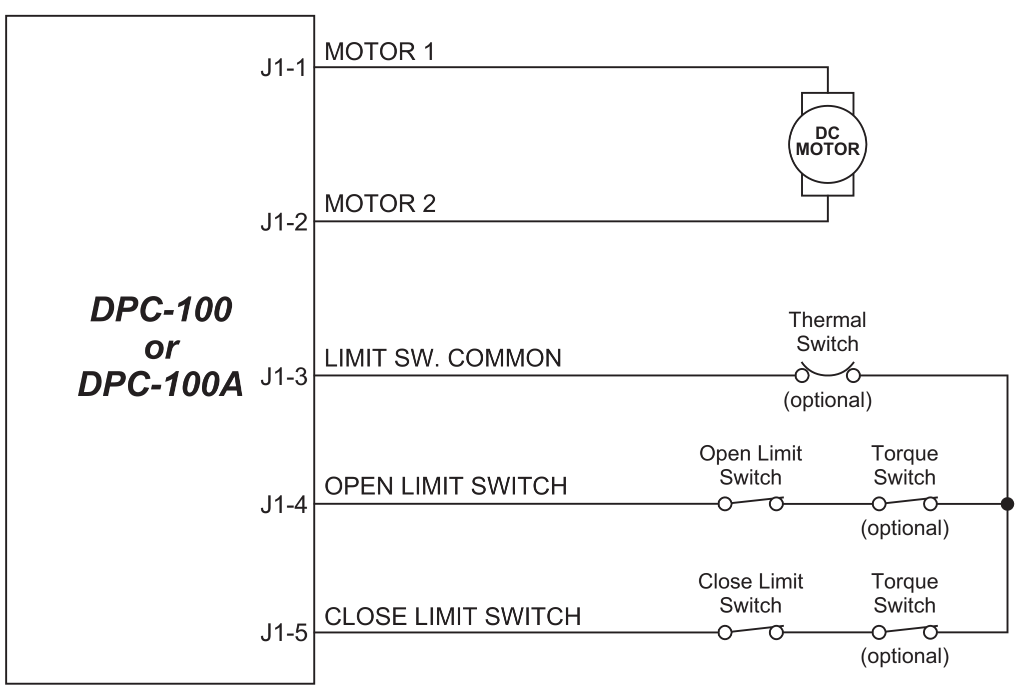


For 240VAC inputs use **SIG-101 Signal Adapter.*

AC Control Inputs Using 120/240VAC

Wiring Diagrams

Output Configurations



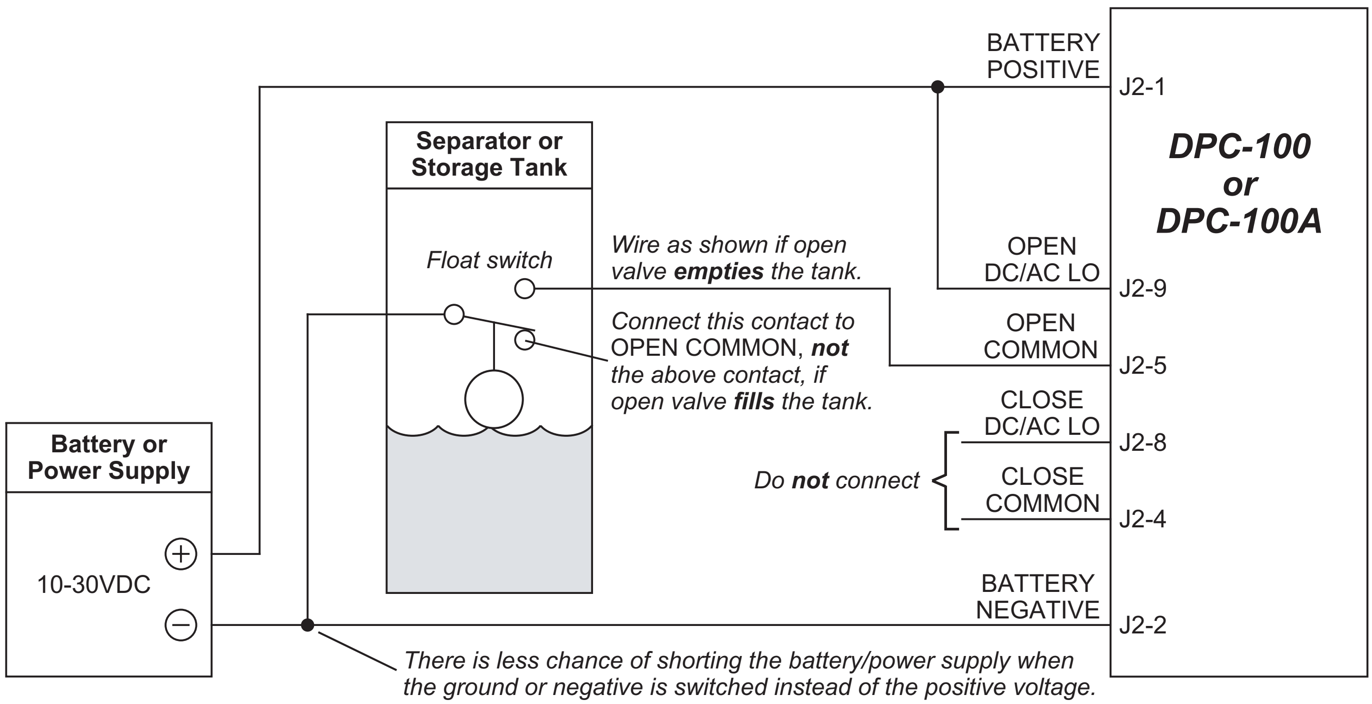
*When **Motor 1** is positive, the motor will run until the **Open Limit** is disconnected from **J1-3**.*

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

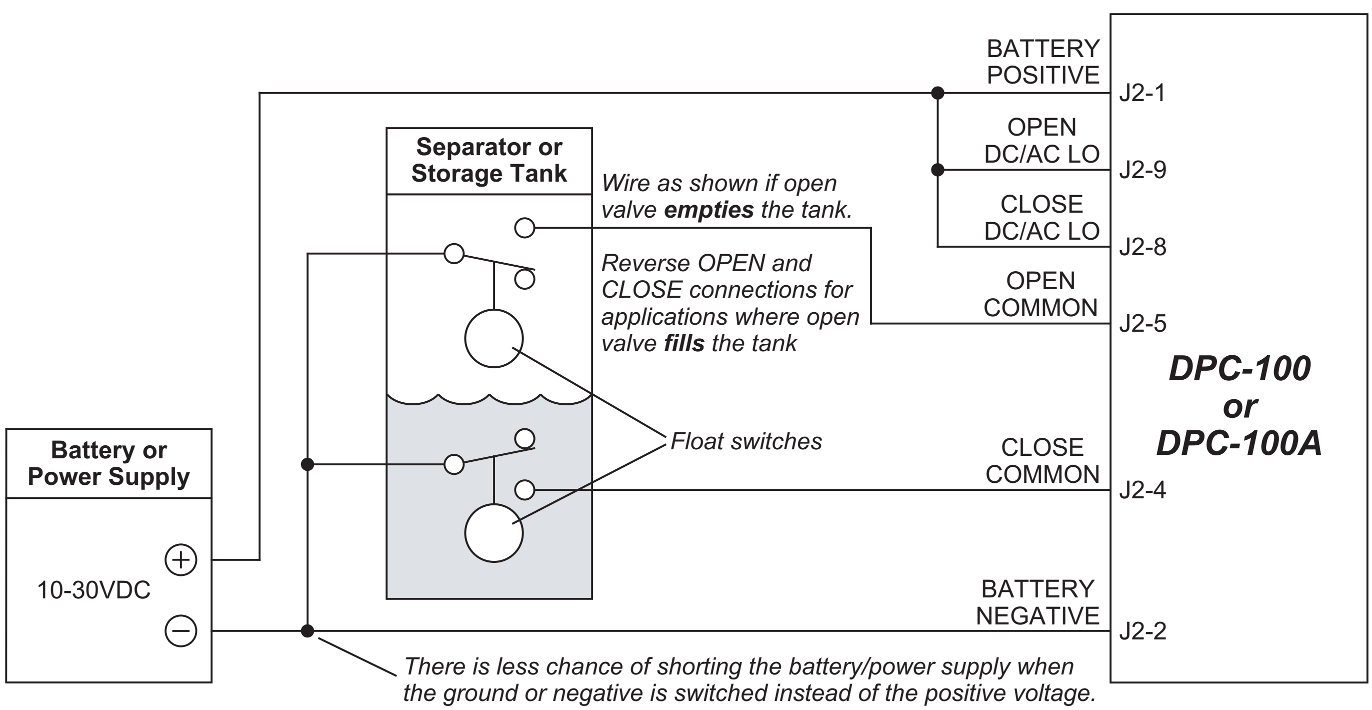
DC Motor Control Output

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.