CHEMLINE Plastics Limited

Your Pipeline To Quality Valves, Strainers, Flowmeters and Controls

55 Guardsman Road
Thornhill, Ontario
L3T 6L2
Canada
Tel: 905-889-7890
Fax: 905-889-8553

INSTALLATION AND MAINTENANCE INSTRUCTIONS
For Chemline A- & Q-Series Actuator with Digital (DC) Positioner

General:

The DC analog position Controller is designed to control quarter-turn DC actuators. The wide operating range (10 to 30 VDC and loads up to 15A locked rotor) allows operation in a variety of applications. The unit can be configured for various command types (4-20 mA, 1-5 VDC, 0-5 VDC or 0-10 VDC) and its default operation upon loss of command signal (in 1-5 V or 4-20 mA mode) with jumper plugs. The unit has on-board LED indicators that show which direction it is attempting to move the actuator. The only other adjustments consist of Deadband and non-interactive Zero and Span trimmers, which allows for easy field calibration. These units also have a yellow LED trip indicator and a set of form-C contacts that can be used to power external alarms or lights.

Features:

- Dynamic braking eliminates need of mechanical brake to avoid motor coasting.
- Low standby current (20 mA typical) when actuator is not in operation.
- Multiple units are easily connected in parallel to a common command signal.
- Limit switch inputs referenced to ground allow optional limit indicators with form-C limit switches.
- Operating temperature range of 0^0 to 60^0C.

Requirements:

CAUTION: These units are intended for mounting in an appropriate enclosure to avoid electrical shocks. Power should be disconnected prior to any wiring of these units. The positioner comes with standoff mounts for direct mounting to a bracket, and an insulating Mylar sheet (included with the unit) must be used between the bracket and the positioner board. A heater/thermostat should be used where condensation or temperature variations may occur. Proper voltage must be supplied or resulting damage to the actuator and/or the positioner could ensue. The unit is easily mounted with 2 screws and is equipped with removable screw terminals for easy field wiring.

Calibration & Adjustment Instructions A- & Q- Series Actuator w/DC Positioner

Calibration Procedure:

The non-interactive zero and span adjustments of the positioner allow for easy calibration once the unit is installed. After insuring that the feedback potentiometer and motor outputs are wired to provide a proper signal, as described under "ACTUATOR (J1)", follow the following steps to calibrate the unit (see Outline Drawing for the location of the adjustments).

1. With DC power connected to terminals #9 (negative) and #10 (positive) at location J2, and the command input connected to the appropriate terminals depending on the command signal type, set the command input signal to minimum. (see Block Diagram) NOTE: negative connection must be grounded.

2. Adjust the "Zero" adjustment so that the actuator moves to the desired *closed* position. If the desired position cannot be achieved, check that the feedback potentiometer provides a feedback signal as described under "ACTUATOR (J1); also, check the position of the limit witches.

3. If the actuator is hunting for position, turn the "Deadband" adjustment clockwise until hunting stops. If the actuator is not hunting for position, turn the "Deadband" adjustment counterclockwise until the actuator begins to hunt, then turn the "Deadband" adjustment clockwise until hunting stops.

   WARNING: Actuator failure may occur if the "Deadband" adjustment is set to allow continuous hunting. This can cause excessive wear of motor bearings, geartrain, brake and feedback potentiometer. Hunting can also cause the internal temperature of the actuator housing to rise to a level that exceeds the maximum positioner rating of 60^0C.

4. Set the command input signal to maximum.

5. Adjust the "Span" adjustment so that the actuator moves to the desired *open* position. If the desired position cannot be achieved, check the position of the limit switch.
   NOTE: The "Zero" adjustment is an offset setting rather than an absolute setting. Should the "Zero" adjustment be changed, the "Span" adjustment should be rechecked for the desired *open* position. Setting of the "Span" adjustment has no effect on the "Zero" adjustment.

6. To check for proper operation and linearity, set the command signal to halfway and verify that the actuator's position is midway between the *open* and *closed* positions.

Reverse Acting Calibration Procedure:

When converting a direct acting actuator to a reverse acting actuator, make the following changes:

1. Reverse the feedback potentiometer wires connected to J1-1 and J1-3.

2. Reverse the motor output wires connected to J1-4 and J1-5.

3. Reverse the open and closed limit switch wires connected to J1-7 and J1-8.

NOTE: DO NOT REVERSE THE INPUT SIGNAL POLARITY.

After making the wiring changes, refer to CALIBRATION for setting the "Zero" and "Span" adjustments.

Power/Signal (J2):

The positive terminal of the DC power source is connected to pin 10 while the negative terminal connects to pin 9 (see Block Diagram). Transferring DC power can be inefficient, therefore care should be taken to use appropriate wire sizes. The wire size required depends on the locked rotor motor current and the length of wire to be used. See the Wire Table for more information.

An appropriate command signal, either 0-5V, 0-10V, 1-5V or 4-20 mA, should be connected to pin 5 or 6 (as shown in the Block Diagram) while using pin 4 as the return *signal ground*. See Wiring Diagrams, Input Configurations, for wiring details. The positioner must be configured for the type of command signal that is to be used – jumper plugs JP1 and JP5 are used for this; refer to the Outline drawing for proper installation of JP1 and JP5.

Pin 7 of J2 provides an auxiliary +5V output, which can be used to connect a command potentiometer. By connecting one end of a potentiometer to pin 7, the other end to pin 4, and the wiper to pin 6, a local control knob can be implemented.

For units that have a trip output, pins 1, 2 and 3 provide a form-C contact arrangement with pin 3 as the common terminal. During normal operation, pin1 is normally closed and pin 2 is normally open. Upon detecting a motor current above the trip setting, pin 2 will be closed while pin 1 is opened, and the on-board yellow LED will be turned on to indicate the tripped condition. The unit remains in the tripped condition until it is reset by either 1) pressing the on-board *trip reset* switch, 2) connecting pin 8 of J2 to pin 9 of J2 with a remote switch (see below), or 3) reversing the actuator direction using the command signal. For units that have a trip output, pin 8 of J2 provides an input for an optional remote *trip reset* switch (see Block Diagram). The remote switch is internally connected in parallel with the on-board switch; that is, both reset switches can be used.

Actuator (J1):

The actuator and feedback potentiometer are connected to J1. Pins 4 and 5 should be connected to a DC motor so that the actuator moves toward the *open* position with pin 4 being positive. Conversely, the actuator should move toward the *closed* position when pin 5 is positive.

Internally, the positioner connects pin 4 to BAT POS (J2-10) and pin 5 to BAT NEG (J2-9) when attempting to move the actuator toward the *open* position. The opposite occurs when the positioner attempts to move the actuator toward the *closed* position. Since pins 4 and 5 are alternately connected to BAT NEG (J2-9) and BAT POS (J2-10), care should be taken not to connect these pins to other terminals.

The positioner provides a dynamic braking feature that eliminates the need for a separate brake. When the positioner turns off the motor outputs, pins 4 and 5 are internally connected to BAT NEG (J2-9); this has the effect of shorting the motor leads together, thus braking the motor motion. This condition also holds true when power is removed from the positioner.

Limit switches should be wired to pins 6, 7 and 8 (see Wiring Diagrams, Output Configurations). If limit switches are not used, pins 7 and 8 must be connected to pin 6, otherwise the positioner will not be able to control the motor outputs.

The feedback potentiometer wiper must be connected to pin 2 of J1. One end of the potentiometer is connected to pin 1, and the other end is connected to pin 3. The potentiometer should be connected so that when the actuator moves toward the *open* position, the potentiometer's resistance between pins 2 and 3 will increase. This can also be measured as a voltage – the voltage between pins 2 and 3 should increase when the actuator moves toward the *open* position. If the potentiometer is wired incorrectly, the typical response of the unit will be to run the actuator to the full *open* or *closed* position, while the appropriate output indicator remains on, regardless of the command input signal.

The feedback potentiometer should be mounted to provide a proper feedback signal through the entire range between the *open* and *closed* positions. For best results, position the actuator to the midway point between the *open* and *closed* positions; then adjust the feedback potentiometer for approximately 2.5 VDC (or half of the potentiometer's resistance) between pins 2 and 3 of J1. Since the feedback potentiometer is crucial for proper operation of the positioner, the following items should be carefully observed:

1. Potentiometer resistance should be a value fro 1K to 10K ohms.
2. The potentiometer should be a linear taper type.
3. The potentiometer must be wired properly to provide the correct feedback signal.
4. The potentiometer must be properly and securely mounted in order to provide a reliable feedback signal.

Indicators:

The positioner has on-board LED indicators that identify when one of the motor outputs is turned on. When the MOTOR1 output is turned on, the red LED will turn on to indicate that the unit is trying to power the actuator toward the *open* position. When the MOTOR2 output is turned on, the green LED will turn on to indicate that the unit is trying to power the actuator toward the *closed* position. See the Outline Drawing for location of the LED's. Chemline actuators are equipped with limit switches at the *open* and *closed* positions, which are intended to disconnect power to the motor to prevent mechanical damage. It is therefore possible that the positioner will indicate that one of the motor outputs is turned on when the actuator is not in motion. The positioner also has a trip output and an on-board yellow trip indicator LED. Upon detecting a motor current above the trip setting, the trip indicator will turn on. The indicator will remain on until the unit is reset (see Power/Signal (J2)).

Trip Setting:

Adjusting the "Trip Adjust" clockwise will allow higher motor currents before tripping. Starting with the "Trip Adjust" set fully clockwise, the trip limit can be set by applying the maximum normal load to the actuator, and then adjust the "Trip Adjust" counterclockwise until the unit trips. (see Outline Drawing for location)

Loss of Input Signal:

When the 1-5V or 4-20 mA type command signal is used, the positioner can detect if the input signal has been disconnected. The unit can be configured to respond to the loss of command signal in one of three ways: 1) turn both MOTOR outputs off, leaving the actuator in the last position at the time the signal was lost; 2) turn on the MOTOR1 output to move the actuator to the *open* position; or 3) turn on the MOTOR2 output to move the actuator to the *closed* position. To select the desired response to a loss of input signal, install the jumper plug

JP2, JP3 or JP4 as shown in the Outline Drawing. NOTE: Power should be disconnected when installing or removing these jumpers. When using this feature, certain precautions should be observed. For applications using the 0-5V or 0-10V input signal type, the unit **cannot** detect a loss of signal; **do not** install jumper plugs J2, J3 or J4 for these applications. When JP3 or JP4 are installed, the unit will turn on one of the motor outputs when the signal is lost.

Wire Table:

The table below shows the maximum recommended distance (in linear feet) between the power supply and the positioner. The maximum distance is limited by the wire size used and the locked rotor current of the motor. All signal wires should be connected with wire sizes ranging from 22 to 18 AWG.

FEET	Wire Size						
Locked Rotor Current (Amps)	18 AWG	16 AWG	14 AWG	12 AWG	10 AWG (See Note 1)	8 AWG (See Note 1)	6 AWG (See Note 1)
1	133	211	337	535	847	1353	2151
2	66	106	169	268	424	677	1076
3	44	70	112	178	282	451	717
4	33	53	84	134	212	338	538
5	27	42	67	107	169	271	430
6	22	35	56	89	141	226	359
7	19	30	48	76	11	193	307
8	17	26	42	67	106	169	269
9	15	23	37	59	94	150	239
10	13	21	34	54	85	135	215
11	12	19	31	49	77	123	196
12	11	18	28	45	71	113	179
13	10	16	26	41	65	104	165
14	10	15	24	38	61	97	154
15	9	14	22	36	56	90	143

NOTES:

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

2) If the motor is located some distance from the positioner, add this length 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.

Calibration & Adjustment Instructions A- & Q- Series Actuator w/DC Positioner

Specifications:

Power requirements:

Operating Voltage:	10 to 30 VDC
Operating Current:	87 mA typical (motor on)
	40 mA typical (trip output on)
Standby Current:	20 mA typical (motor off, trip off)
Fuse Type:	8A, Bussmann ABC-8

Command signal input:

Common Mode Voltage (all inputs): -13 to +30 VDC

0-5 VDC Input

Input impedance: 10K ohms

External Command Potentiometer: 1K ohm

0-10 VDC Input

Input impedance: 20K ohms

1-5 VDC Input

Input impedance: 200K ohms

Loss of Command Signal Threshold: $\leq$ 0.75V

4-20 mA Input

Input impedance: 250 ohms +/- 1%

Loss of Command Signal Threshold: $\leq$ 3 mA

Feedback signal input:

Input voltage: 0 to 5 VDC

External feedback potentiometer: 1K ohm to 10K ohms

Command Potentiometer Power (J2-7):

5 VDC @ 5mA maximum

DC motor outputs:

Maximum load current: 15A locked rotor for 20 seconds typical

Control Adjustments:

Zero: adjustable throughout feedback signal range

Span: adjustable throughout command signal range

Deadband: adjustable linearly throughout signal range

Specifications (cont'd):

Motor Current Trip:
Trip Range: 0.2 to 5 A
Trip Setting: adjustable throughout specified range
Trip Relay Output: form-C contacts (1 A @ 30 VDC)
Trip Reset (local): switch located on unit
Trip Reset (external): connect Trip Reset Input (J2-8) to BAT NEG (J2-9) with dry contact or open collector (10 VDC @ 5 mA)

Environmental:
Operating temp range: 0^0C to 60^0C
Storage temp range: -40^0C to 85^0C
Relative humidity range: 0 to 90 % (non-condensing)

Troubleshooting Guide:

PROBLEM	POSSIBLE CAUSE	REMEDY
No reponse from unit.	Blown or missing fuse. Input power wires reversed. See "Actuator chatters" for additional possible causes.	Replace appropriate fuse; see "Specifications" above. Reverse input power leads.
No response when using 0-10 V input.	J2, JP3 or JP4 installed. Command potentiometer improperly wired. Input polarity reversed.	Remove JP2, JP3 or JP4. Check wiring. Reverse input wires.
No response when using 4-20 mA input.	Input polarity reversed. Input current < 3mA when JP2 is installed.	Reverse input wires. Refer to "Loss of Input Signal" above.
Actuator runs to open position when using 4-20 mA input.	Jumper JP1 not installed.	Install JP1.

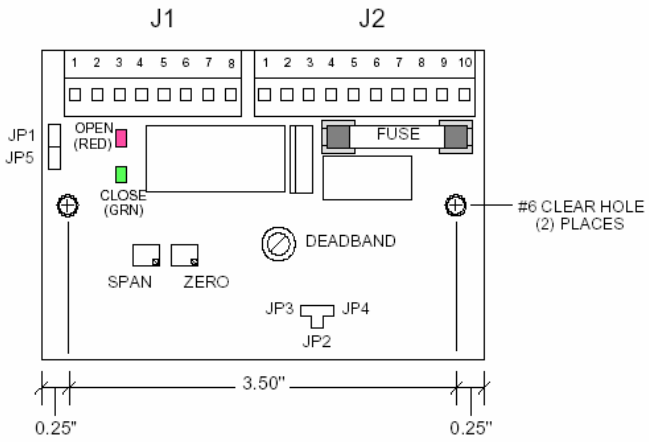
Troubleshooting Guide (cont'd):

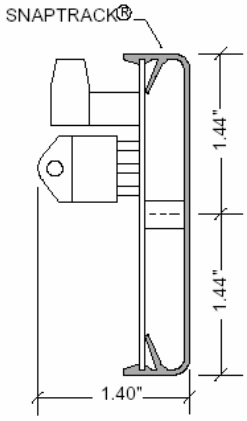
Actuator chatters and/or blows fuses.	Power supply used cannot maintain he rated voltage when motor is energized. Power supply negative not connected to system's ground. Undersized wire gauge. Signal ground does not have a separate wire to power supply's negative terminal. Exposure to moisture or liquids.	Replace power supply with higher current capability. Connect power supply negative to system's ground. Use recommended wire gauge for length of wire used (see Wire Table). Run separate wires from power supply's negative terminal to J2-4 and J2-9. Use heater/thermostat or provide separate sealed enclosure.
Actuator runs to limit switch.	Feedback potentiometer wired backwards.	Reverse wires at J1-1 and J1-3.
Actuator runs past limit switch.	Motor wired backwards.	Reverse wires at J1-4 and J1-5.
Actuator cannot be reversed after reaching limit switches.	Limit switches reversed.	Reverse limit switches or wiring.
Actuator hunts for position.	Deadband adjustment improperly set. Feedback potentiometer mechanically unstable. Unstable command input signal from PID control loop. Actuator load variations (i.e., 45-degree position on butterfly valve.) See "Actuator chatters" for additional possible causes.	See "Calibration" above. Repair as necessary. Adjust PID parameters for stable command signal. Increase deadband adjustment.

Troubleshooting Guide (cont'd):

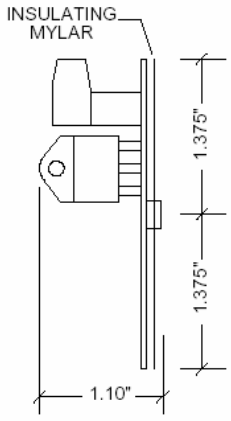
Output relay failures.	Excessive hunting or chattering. Locked rotor current over 15 A. Applying external power to motor connections J1-4 and J1-5.	See above. Contact actuator manufacturer. Remove J1 before applying external power.
Erratic operation.	JP1 not installed when using 0-10 V configuration. Bad feedback potentiometer. Exposure to moisture or liquids.	Install JP1. Replace feedback potentiometer. Install heater/thermostat or provide separate sealed enclosure.
Unit current trips excessively.	Actuator reverses quickly (hunting, erratic input, etc.)	Repair or adjust as necessary.

OUTLINE DIAGRAM

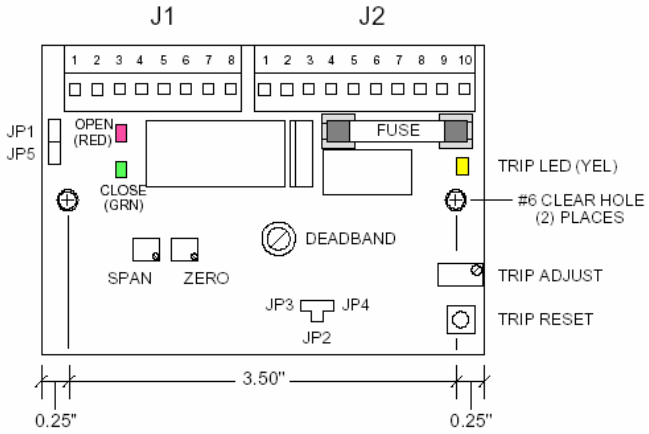


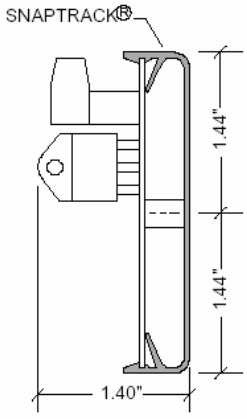


DMC-100 0-15A

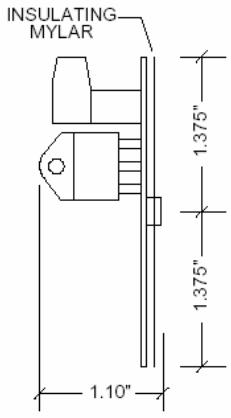


DMC-100A 0-15A



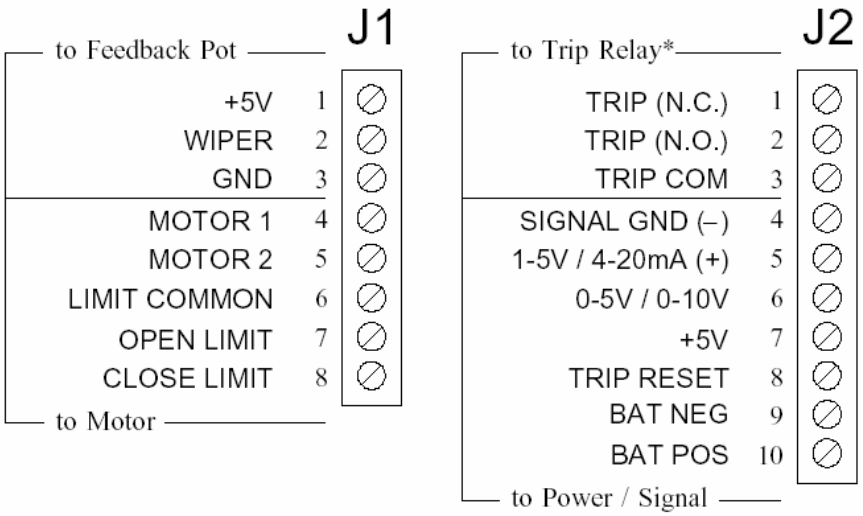


DMC-100B 0.2-5A
DMC-100D 2-15A



DMC-100C 0.2-5A
DMC-100E 2-15A

ELECTRICAL CONNECTIONS



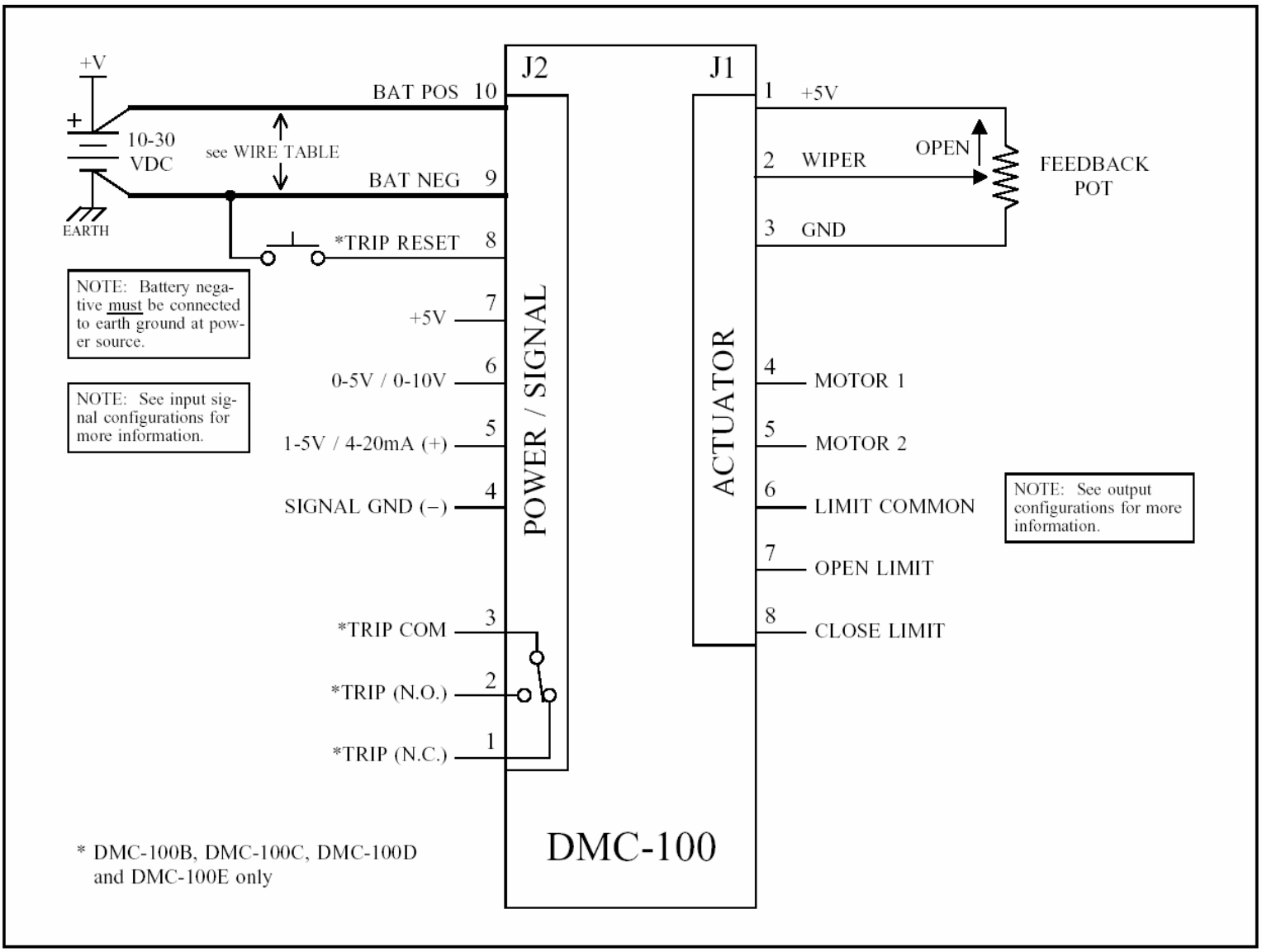
* DMC-100B, DMC-100C, DMC-100D, and DMC-100E only.

INPUT SIGNAL		
INPUT SIGNAL RANGE	JUMPER PLUG JP1	JP5
0-10V	install	remove
1-5V	remove	install
0-5V, 4-20mA	install	install

LOSS OF INPUT SIGNAL	
OUTPUT STATE	JUMPER PLUG
BOTH OFF	JP2
OPEN ON	JP3
CLOSE ON	JP4

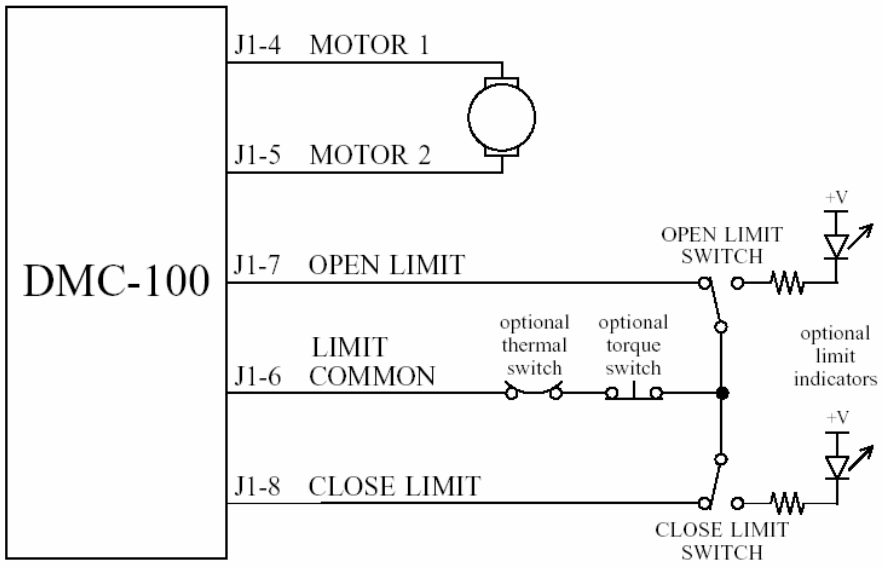
NOTE: Do not install JP2, JP3, or JP4 when using the 0-5V or 0-10V input signal range.

BLOCK DIAGRAM

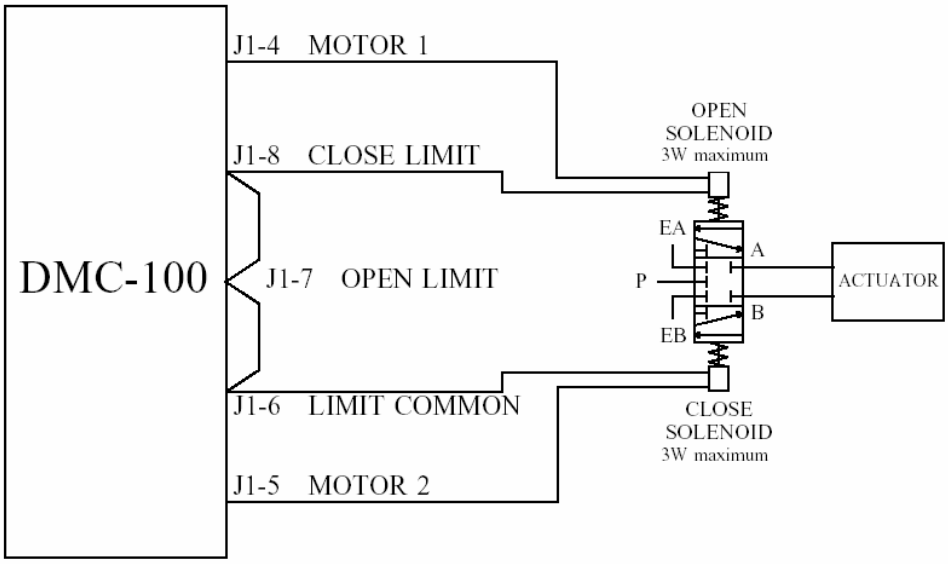


WIRING DIAGRAMS

Output Configurations



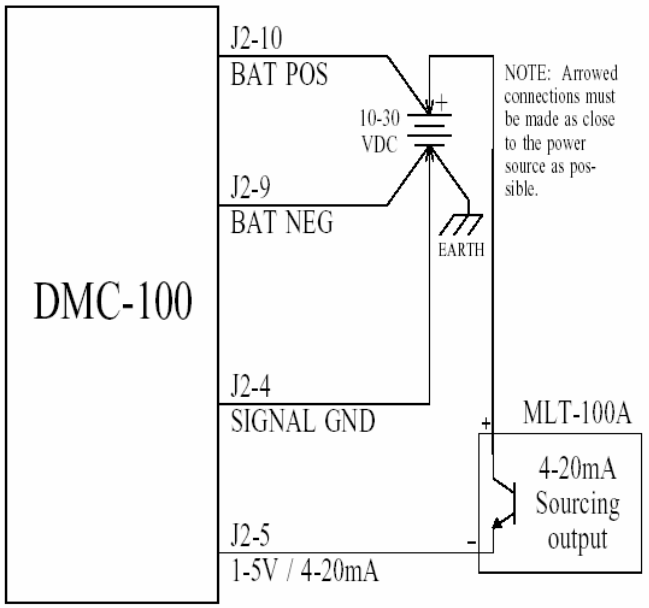
DC Motor Control Output



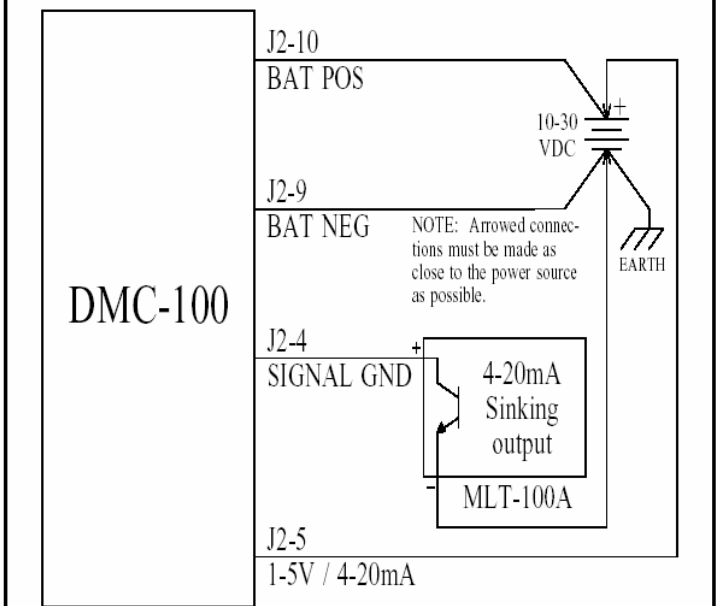
DC Solenoid Control Output

WIRING DIAGRAMS

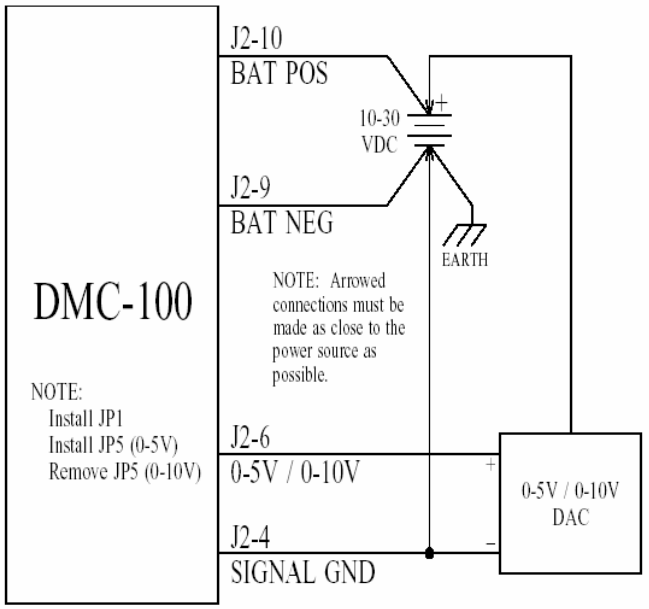
Input Signal Configurations



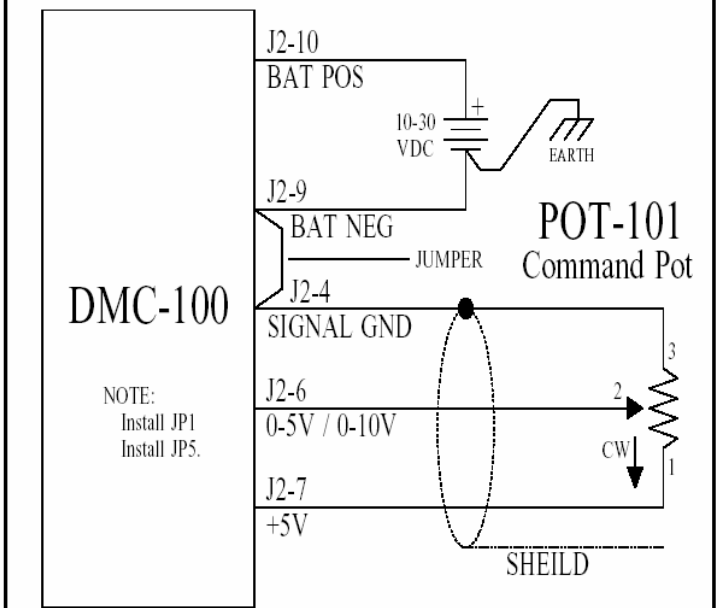
4-20mA Sourcing Input



4-20mA Sinking Input



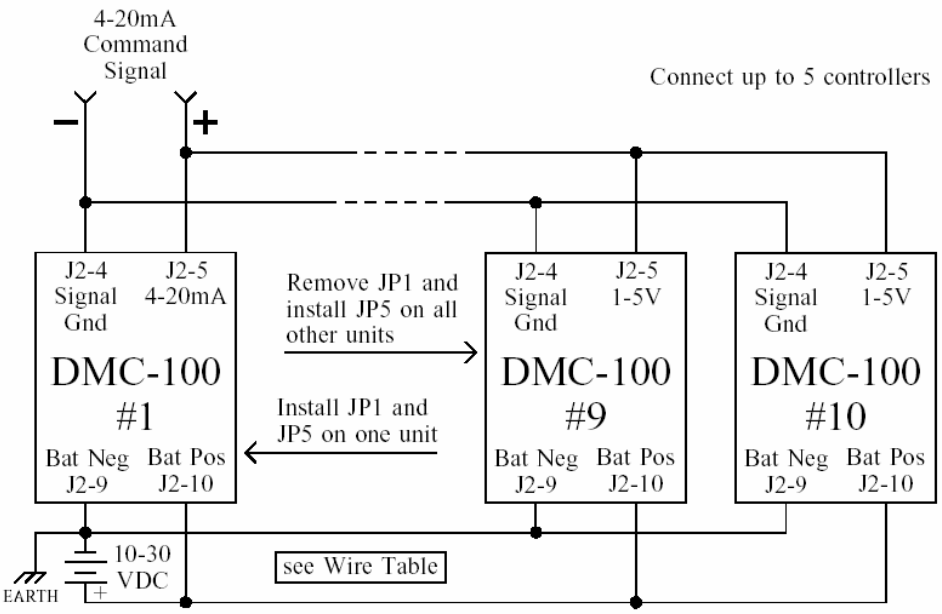
0-5V / 0-10V Input using digital-to-analog card



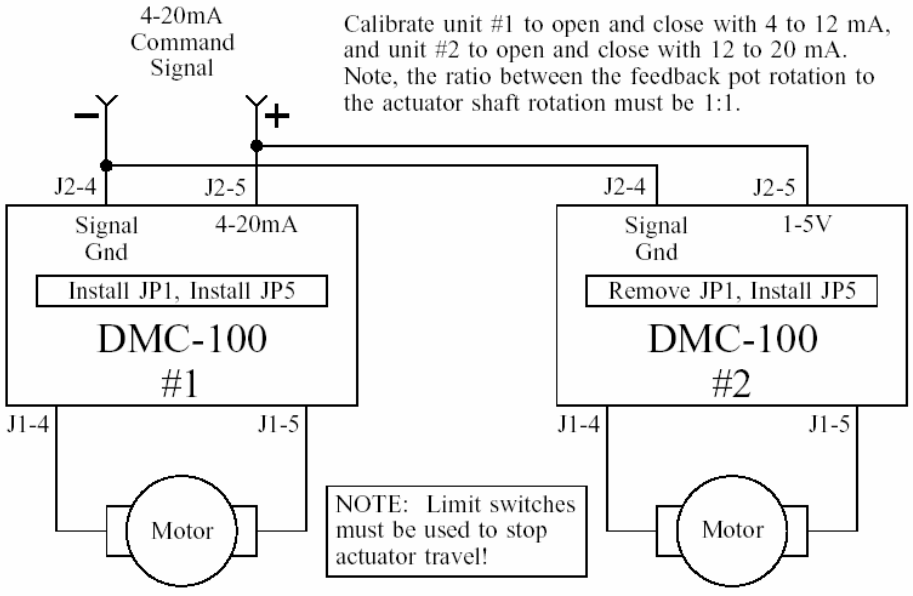
Command Pot using the 0-5V Input Signal

WIRING DIAGRAMS

Special Applications



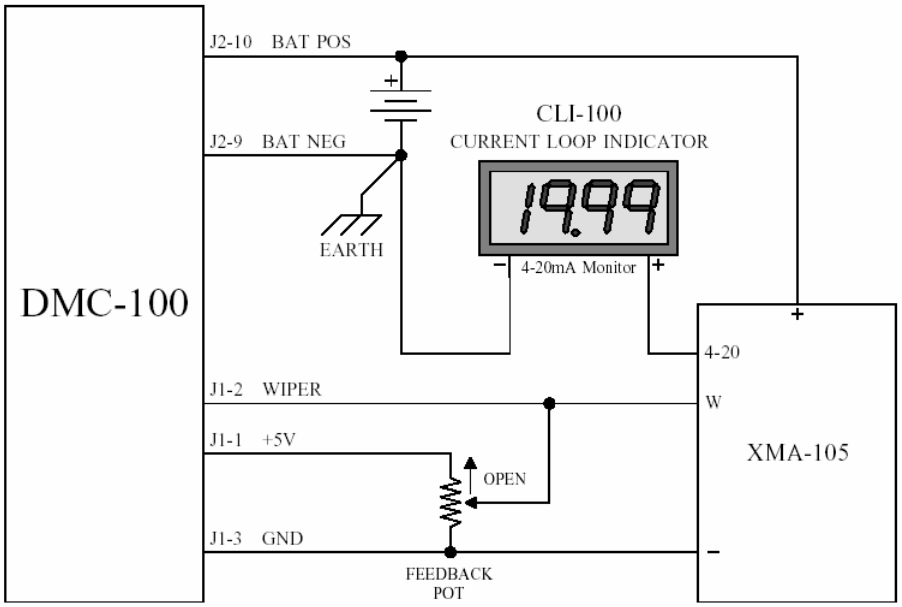
Controlling multiple units using a single 4-20mA signal



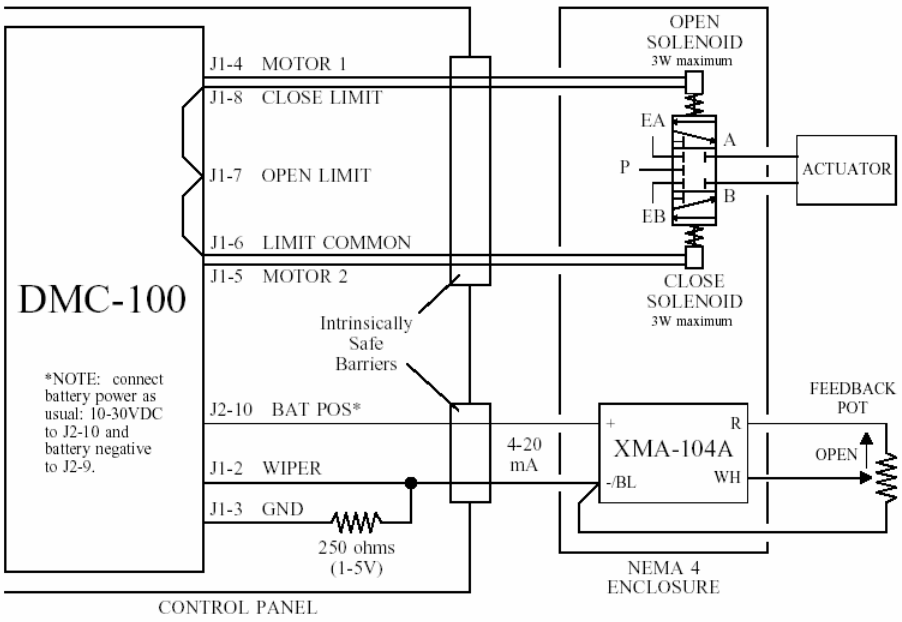
Split range control

WIRING DIAGRAMS

Special Applications



Connecting a Position Feedback Transmitter



Intrinsically Safe Solenoid Controller