Electro-hydraulic Remote Proportional Actuators

A Remote Proportional Actuator (RPA) produces output rod displacement proportional to an electrical input signal.

The RPA can be used to remotely control variable displacement pumps and motors. It can also stroke spools of large valves, throttle controls, clutches or brakes.

COMPACT DIRECT MOUNTING
The actuator is ideal where machine size or component location make it impossible to operate a component directly.
Compact size and direct mounting makes it easy to convert existing components for remote electro-hydraulic control.

ACCURATE REMOTE CONTROL
The RPA provides accurate control without additional electronic feedback. Movement of the rod is proportional to the electrical signal, with the maximum force determined by the supply pressure.
Complex tasks can be performed with high speed and accuracy, using position sensors or microprocessor input.
These actuators feature Mechanical Position Feedback. This patented design monitors and controls the position of the output rod.

SPECIFICATIONS
Maximum Stroke Options
Extend or retract 0.5 inch (12.7 mm), with change in polarity;
Extend 1.0 inch (25.4 mm) or retract 1.0 inch (25.4 mm), with current increase.

Supply Pressure
Minimum, 200 psi (15 bar);
Maximum, 3000 psi (210 bar)

Output Force
60 lb (0.27 kN) at 200 psi (15 bar) supply pressure;
1200 lb (5.33 kN) at 3000 psi (210 bar) supply pressure.

ELECTRICAL DATA

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Voltage</td>
<td>± 12 VDC</td>
</tr>
<tr>
<td>Full Stroke Voltage</td>
<td>± 9 VDC</td>
</tr>
<tr>
<td>Rated Input Current</td>
<td>± 490 ma</td>
</tr>
<tr>
<td>Resistance</td>
<td>24.5 Ohms</td>
</tr>
<tr>
<td>Wattage</td>
<td>5.9 Watts</td>
</tr>
<tr>
<td>Inductance at 1,0 KHz</td>
<td>± 60 MH</td>
</tr>
<tr>
<td>Recommended Dither(1)</td>
<td>± 2 V, 80 Hz Square Wave</td>
</tr>
<tr>
<td>Pulse Width Modulation Frequency(1)</td>
<td>100 to 120 Hz</td>
</tr>
</tbody>
</table>

(1) Dither not required except as noted: Actuators with 1.0 inch (25.4 mm) stroke when operated with a supply pressure below 1000 psi (70 bar), and all "High Response" models must have a dither signal superimposed on the input signal or be driven with a pulse-width modulated signal.

Required Flow
50 in³ (820 cm³) per minute at 200 psi (15 bar). See performance curves on page 3.

Maximum Return Pressure
10% of supply pressure.

Seals
Fluorocarbon (Viton® or Fluorel®) seals standard. Contact the Dynex sales department for information on other seals.
How the Actuator Works

The RPA consists of a force motor, a pilot stage (with a pilot spool and pilot sleeve) and an output rod.

Pilot supply passes through an internal filter and is routed directly to the pressure chamber $P_1$ and through the pilot stage to the control chamber $P_2$.

A force balance is achieved

In the absence of an electrical signal, the pilot stage maintains the control pressure $P_2$ at a level equal to one-half of the supply pressure $P_1$ (assuming no load at the output rod).

Since the control chamber has an effective area $A_2$ twice the effective area $A_1$ of the pressure chamber, a force balance is achieved by the pressures acting on the output rod.

Mechanical position feedback

The pilot spool rides within the pilot sleeve and is held in contact with the force motor armature by a spring. The pilot sleeve is held in contact with the follower cone by a spring. Likewise the follower cone is held in contact with the feedback cone on the output rod.

As the rod moves back and forth, the follower cone moves up and down forcing the pilot sleeve to move through a proportional distance.

Metered flow moves rod

The force motor moves the pilot spool in reaction to the variable electrical signal.

When the pilot spool is displaced relative to the pilot sleeve, it meters flow in or out of the control chamber causing a change in pressure $P_2$.

This results in unequal forces acting on the output rod (the force from pressure in the control chamber, plus any external force at the output rod, compared to the force from pressure in the pressure chamber). This imbalance causes the output rod to move.

As the output rod moves, the follower cone rides along the feedback cone moving the pilot sleeve until it realigns itself with the pilot spool.

At this point, a null condition is achieved and movement of the output rod stops. The output rod will always seek a force balance.

The result is accurate rod movement proportional to the electrical signal.

Actuator Installation And Performance

Typical Performance

See “Performance Curves” on page 3 for step response;

- Thermal null shift: \( \leq 1\% \text{ per } 100^\circ F (40^\circ C) \);
- Pressure null shift: \( \leq 3\% \text{ per } 1000 \text{ psi (70 bar)} \);
- Hysteresis: \( \leq \pm 3\% \text{ with dither, } \leq \pm 4\% \text{ without dither} \);
- Threshold: \( \leq 2\% \text{ with dither, } \leq 3\% \text{ without dither} \)

Fluid Recommendations

High grade premium petroleum-based oil, with a combination of anti-wear, demulsibility, rust protection, and oxidation resistance and foam resistance properties.

Guidelines for viscosity

- Minimum, 45 SUS (6 cSt);
- Maximum, 6000 SUS (1320 cSt)

Minimum Filtration Levels

- 10 microns nominal.

Mounting

To allow self-bleeding of air, the actuator must be mounted so the pressure port (P) is at the same level or below the return/tank port (T).

Hydro-static Transmission Applications

The actuator may be operated directly off the charge pump pressure of a hydrostatic transmission. No additional pressure supply is needed.

An RPA can be direct mounted to control the output of a variable displacement pump.
DIMENSIONS
Installation drawing dimensions are shown in inches (millimeters in parentheses) and are nominal.

Terminal Configuration Options
Two male stud terminals, No. 6-32 U.N.C.; 0.33 inch (8.4 mm) long;
Two wire leads with male spade terminals. Wires are approximately 6 inches (150 mm) long; Standard S.A.E. J-1128, 18 AWG Type SXL. Terminals are .250 (6.4 mm) wide x .032 (0.8 mm) thick.

PERFORMANCE CURVES

Performance curves for “High Response” models shown in gray. Typical curves based on 100 SUS (20 cSt) petroleum-based fluids.
Electro-hydraulic Pump Volume Control

The RPA can be used to control the output of Dynex mechanical variable delivery checkball pumps.

Kits shown below are available to mount the actuator to the pumps. These kits include a bracket and necessary hardware. The RPA must be ordered separately.

<table>
<thead>
<tr>
<th>Kit Number</th>
<th>Dynex Pump Series</th>
<th>Pump Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>KP4026-9047</td>
<td>PV4000</td>
<td>Variable Delivery</td>
</tr>
<tr>
<td>KP4020-9047</td>
<td>PV4000</td>
<td>Pressure Compensated</td>
</tr>
<tr>
<td>KP6046-9048</td>
<td>PV6000</td>
<td>Pressure Compensated</td>
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</tbody>
</table>

A Remote Proportional Actuator can control a Dynex mechanical variable delivery checkball pump. Output flow is controlled by stroking the spring-biased volume control stem at the back of the pump.

Typical Model Code

<table>
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<tr>
<th>SA</th>
<th>05</th>
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Product Type
SA — Remote Proportional Actuator

Design
05 — Standard

Maximum Stroke
05 — ± 0.5 inch (Rev. polarity)
10 — + 1.0 inch (Extends with Voltage Increase)
15 — – 1.0 inch (Retracts with Voltage Increase)

Rated Voltage
03 — 12 VDC (Single Coil, Wire Leads with Spade Terminals)
04 — 12 VDC (Single Coil, Stud Terminals)

Specifications shown were in effect when published. Since errors or omissions are possible, contact your sales representative for most current specifications before ordering. Dynex reserves the right to discontinue products or change designs at any time without incurring any obligation.