High Speed Motion Control: A Counterbalance System That Delivers

When a customer challenged us to deliver a precision counterbalance for a high-speed cutoff application, we didn't reach for an off-the-shelf solution; we built something smarter.

This wasn't just about moving a load. It was about balancing one.

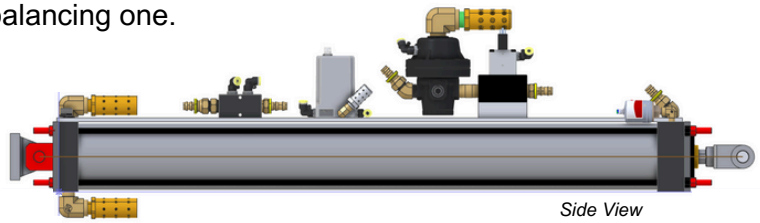
In real time.

With extreme accuracy.

No lag.

No overshoot.

Just clean, responsive motion, on demand.



Side View

Top View

And that's exactly what this 4" bore pneumatic counterbalance system delivers.

Let's break it down:

Application Details:

400 lbs load needed to be counterbalanced at +/- 5 lbs.

And react to position change at velocities up to 2 ft/second.

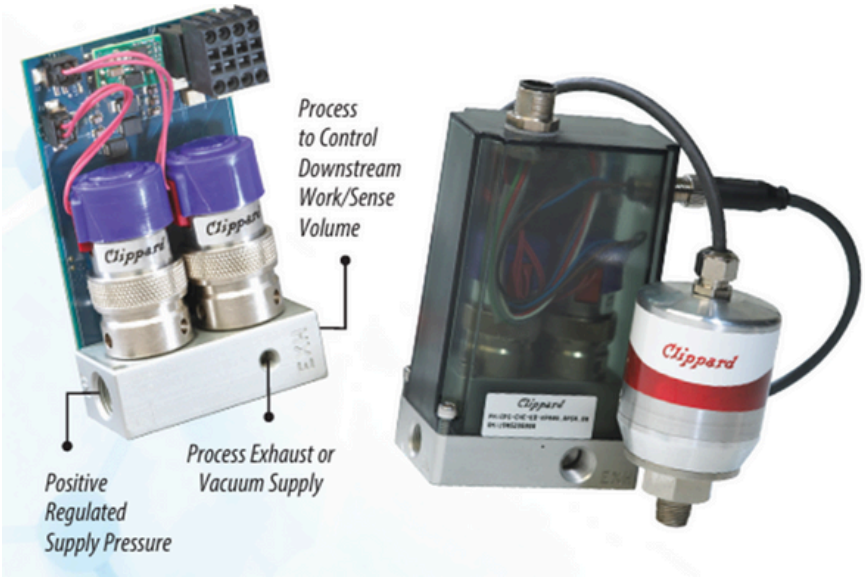
Utilizing a 4" bore cylinder with a 36" stroke and running on air.

Here is how we solved it:

We needed precision pressure control, so we looked to the Clippard Cordis.

1. Cordis is given a setpoint command via 0-5 or 0-10 VDC, 4-20 mA, or 3.3 VDC serial

2. Cordis compares the setpoint command to the feedback signal from the internal/ external sensor

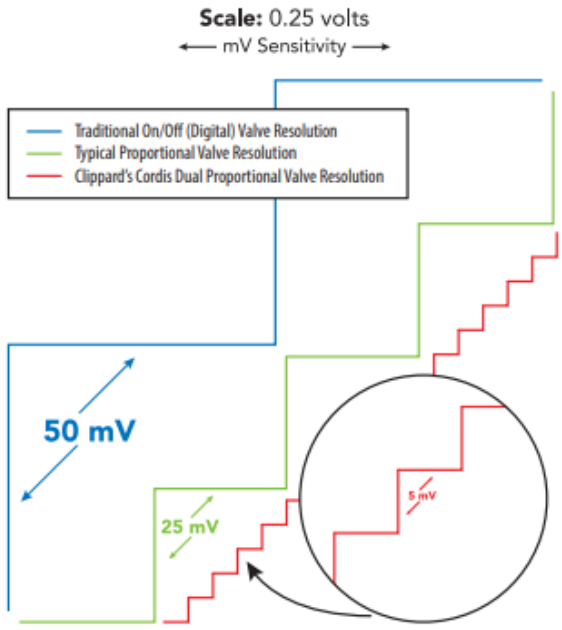


3. If the command is higher than the sensor feedback, the inlet valve opens (filling)

   If the command is lower than the sensor feedback, the exhaust valve opens (bleeding)

Clippard's dual proportional valve Cordis pressure controller provides 5 mV resolution using a 0-10 VDC command with 1,000 mV per volt. This means that at 5 mV, you'll have 200 potential steps or command changes that the Cordis will respond to within 1 volt.

For 4-20 mA command, the resolution would equal ≤0.008 mA, or 200 potential steps/commands within 1.6 mA (10% of 4-20 mA range).



What works great!

Clippard Cordis Precision Regulator when calibrated for a 0-100psi system allows for +/-2.95 lbs of force control, well within the +/-5lbs target.

Sensor	Accuracy +/- 0.25 psig	Hysteresis +/-0.05%	Resolution ≤5 mV
1 psig	0.0025 psig	0.0005 psig	0.0005 psig
5 psig	0.0125 psig	0.0025 psig	0.0025 psig
15 psig	0.0375 psig	0.0075 psig	0.0075 psig
100 psig	0.25 psig	0.05 psig	.05 psig

Where it fall's short:

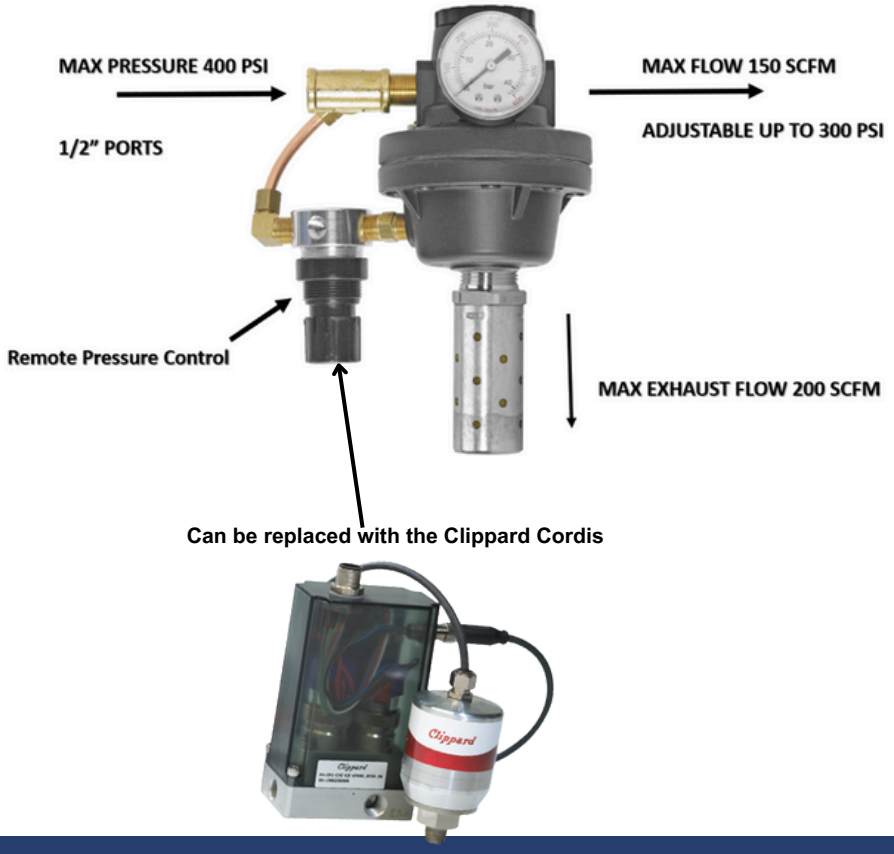
Maximum flow rate of 65l/min (2.3scfm) only allows for a max velocity of .05ft/s. Falls short of our target 2ft/sec.

To solve the problem of flow, we looked at the Ross Full Size Series Remote Pilot Regulators, specifically with remote pressure control.

Remote pressure control allows us to utilize the Clippard Cordis to change the pressure of the system and the larger Ross.

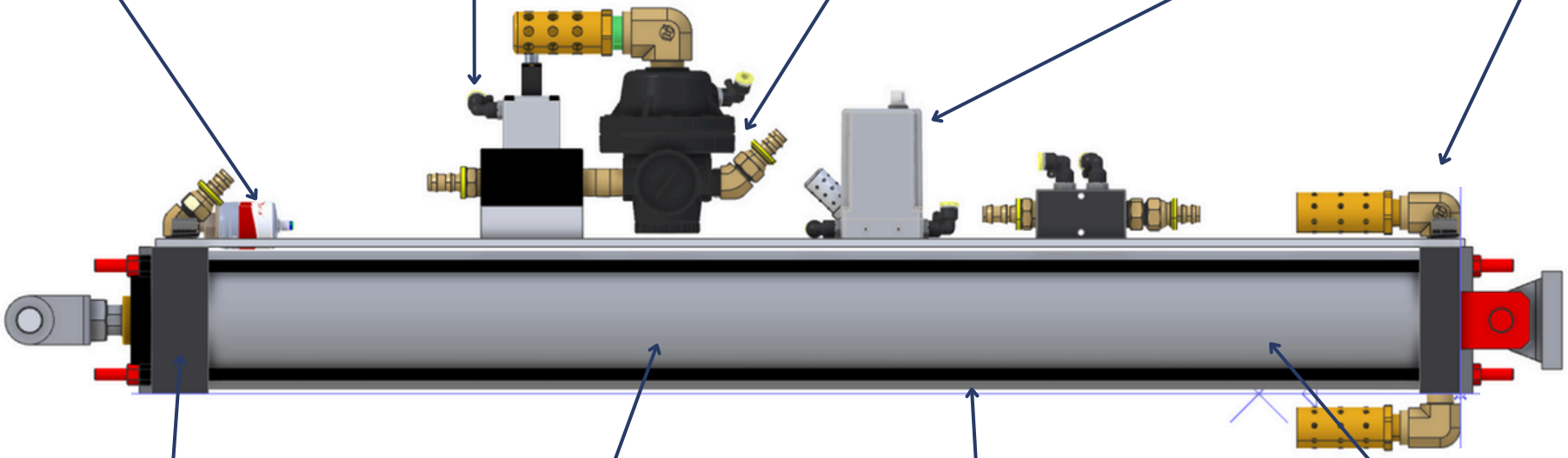
The remote pressure control, as the name implies, **allows for the high flow regulator to be remotely controlled by a variety of options,** as shown. In our case, specifically, the Clippard Cordis.

The Ross Full Size Series Remote Pilot Regulators are able to flow **150scfm at 100psi,** providing linear **velocities up to 4.2ft/s**. Well above our targeted 2ft/s speed target.



Key Features

This isn't just a cylinder, it's an engineered counterbalance system, designed for speed and stability.



Clippard
Remote transducers for live pressure indication

ROSS
Poppet style Dale valves lock the system in place

ROSS
Ross Full Size Series Remote Pilot Regulator at the cylinder port maximizes flow

Clippard
Clippard Cordis Proportional Regulator for ultra-fine control

Dual exhaust ports to prevent vacuum or backpressure

Custom mounting & porting for transducers, regulators, and sensors

milwaukee Cylinder

Optional air volume tank adds pressure stability

milwaukee Cylinder

4" Bore x 36" stroke cylinder with low-friction seals

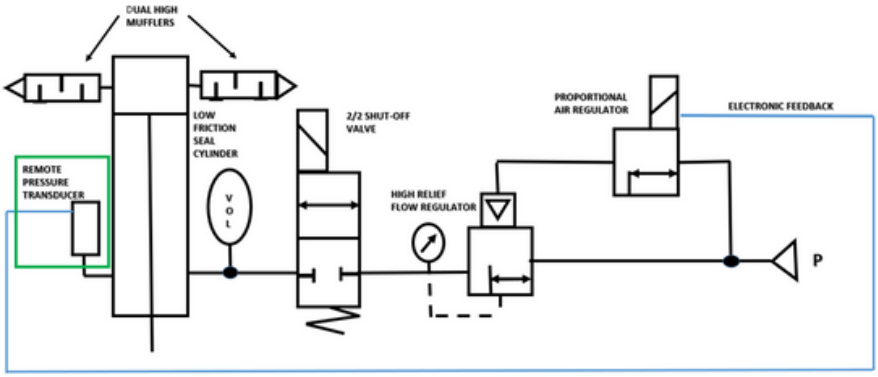
milwaukee Cylinder

Milwaukee Cylinder options: aluminum or chromed steel barrel cylinder for high-cycle applications

milwaukee Cylinder

HERE IS THE SECRET!

We don't measure the pressure at the Cordis, and we don't measure the pressure in the Ross regulator. **We measure the pressure in the cylinder**, this is possible with the Clippard remote pressure transducer.



By measuring the pressure in the cylinder, we by pass any pressure drops through valving, regulators, ports and hoses. **This provides the MOST accurate feedback to the Cordis and allows us to have accurate pressure control.**

What makes it different?

At the heart of the system is the **Clippard Cordis**, a high-speed proportional regulator known for low hysteresis, fast response, and repeatability, perfect for precision pressure control.

But while the Cordis offers incredible precision, it lacks the airflow needed to move a large air cylinder quickly. So we paired it with a **Ross Full Size Series Remote Pilot Regulator**, mounted near the cylinder port for faster reaction time.

ROSS

Clippard

The Cordis precisely controls the force, and Ross handles the fast fill and exhaust needed for high-speed moves!

This hybrid setup is ideal for cylinders 3-1/4" bore and larger. For smaller systems, we can often go direct with Clippard's High Flow Cordis, keeping things simpler while maintaining performance.

Built by Engineers, for Engineers

Developed to solve real-world challenges, this system blends precision with power. That's what we do! We provide custom solutions using components from our vendor partners.

Contact a Donald Engineering Technical Sales Engineer today!

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