Stop Venting Your Profits
A New Alternate to Pneumatic Controllers
A Few Pneumatic Controller Studies

- Greenhouse Gas Reporting Program (U.S. EPA, 2013)
- Measurements of Methane Emissions from Natural Gas Production Sites in the United States (Allen et al., 2013) 570,000 MT/yr
- Economic Analysis of Methane Emission Reduction Opportunities in the U.S. Onshore Oil and Natural Gas Industries (ICF, 2014)
Simple Facts from All Studies

- Pneumatic devices use gas pressure to control the opening and closing of valves (High bleed and Low Bleed)

- Their emissions are estimated to be among the larger sources of methane emissions from the gas supply chain.

- EPA reports 477,606 pneumatic (gas-actuated) devices in use at gas production sites

- In addition to known venting, many could also leak methane at supply lines or due to maintenance issues
Nozzle corrosion creating more flow through a larger opening.

Leak at fittings

Maintenance Issues including replacement of debris filter from the supply gas and replacement of O-rings and/or seals

Poor calibration of the controller

All can increase the release of methane emissions
EPA: Pneumatic Devices Review Panel April 2014

Replacing high bleed pneumatic with low bleed controllers is infeasible in situations where a process condition may require a fast or precise control response so that it does not stray too far from the desired set point.

*New solutions now available*

Zero bleed, mechanical, and solar-powered controllers can replace continuous bleed controllers in certain applications, but are not broadly applicable to all segments of the oil and natural gas industry.

*New solutions now available*
Past Electric Actuation Assumptions

- **Power**
  - Traditional motors typically use too much power to handle the forces needed

- **Speed**
  - Electric actuators are not fast enough

- **Precision**
  - Electric actuators don’t have the accuracy or turndown capability to properly control the valve

- **Duty Cycle**
  - Many electric motors are not rated for continuous duty
Introducing Electric Servo Actuation Technology to Oil & Gas

SERVO MOTORS
Technology commonly used in motion control applications
AC or DC

ROLLER SCREWS OR PLANETARY GEARS
Use to convert rotary motion to linear valve stem motion or increasing torque for a $\frac{1}{4}$ turn valve
Easily integrated with the servo motor

SERVO CONTROLS
Precisely controls the motors motion, and therefore the valves motion
High speed, high accuracy and feedback on valve position
How Does Servo Electric Technology Differ?

- The use of a servo motor to effortlessly move the actuator in any direction for 100% duty cycles
- Linear Actuation: The use of a roller screw to convert the rotary motion of a high speed motor directly to a linear force
- Rotary Actuation: Use of planetary gears to convert the rotary motion of a high speed motor to higher torque
- The use of direct feedback and controls to provide perfect positioning at all speeds and forces, plus provide feedback
Traditional DC Motor VS. Servo Motor

Traditional Motor
- Low efficiency
- Duty Cycle Limitations
- No Feedback
- Need for limit switches and torque switches
- High power consumption

Stepper Motor
- Consume current regardless of load
- Torque Decreases with Speed
- Noisy

Servo Motor
- High efficiency (90%)
- Position feedback
- Adapts to changing loads
- Faster positioning
- Reserve power
  - Capable of short bursts of peak current to improve positioning
- Quiet
- 100% Duty Cycle
Traditional Actuator
• Inefficient
• Low speed
• Severe wear in high duty apps
• Short Life: Measured in thousands of strokes

Motor
Spur Gears & Worm Gears

Plus Thrust Unit

Roller Screw Actuator
• Direct conversion of rotary motion to a linear force
• Extreme Life 100+ million strokes
• High Shock Resistance
• Extreme Efficiency

VS

Roller Screw

Motor

Internal “Integrated” Motor

Linear Applications
The Roller Screw

- Self-greases at down-stroke, which extends life of roller-screw
- Positioning accuracy
- Full motor (3000) rpm
- 200 thread-to-thread full contact points allow increased power, precision, and repeatability
- Continuous velocity at 1.5” per second (5 in/sec max)
Traditional Actuator
• Inefficient
• Low speed
• Short Life: Measured in thousands of strokes

VS

Planetary Actuator
• Load shared uniformly with multiple planet gears acting in concert
• Capable of higher speeds and higher efficiency
• Very high design life

Rotary Applications

Spur Gears & Worm Gears

Motor

Planetary Gearing

Motor
Traditional Electronics vs Servo Electronics

**Traditional Actuator**
- Open loop or comparator
- Limited I/O, if any
- Low temperatures require heaters
- Digital communication capabilities optional
- Feedback optional

**Servo Electric Actuator**
- Closed loop control of motor
- Digital/Analog feedback
  - No limit switches needed
  - 4-20 input and output
  - Additional I/O
- Digital, Analog, MODBUS control
- Precise position control
- Diagnostics
Integrated Components = Linear Electric Actuator

Multiple Option Boards:
- Analog I/O,
- Digital I/O,
- Network Communications

Servo Motor

Position Controller

AC or DC Power Options

Feedback

Roller Screw
Integrated Components = Rotary Electric Actuator

Rotary

- Servo Motor
- Planetary Gear Reduction
- Feedback
- Position Controller
Electric Servo Actuator Features

- **Modulate or Open/Close**
- **Failure Modes**
  - Voltage monitoring circuit allows configurable operation of the actuator at user selected voltage trip points
- **Fieldbus Connectivity**
  - Modbus RS-485 protocol for connection to PLCs or RTU systems
- **Extends Life of Valve**
  - Adjustable valve seating
- **Low Power Consumption**
  - 12 VDC Solar power capable
Electronic automation systems provide better process control through reduced time lag on the output plus feedback from the process.
Typical Applications

- Compression
- Separation
- Artificial Lift
- Choke Valves
- Dump Valves
- Flow Control
- Pressure Control
  - Upstream, Downstream and Differential
PROVEN APPLICATIONS
Oil & Gas Production: Separators

- **PCV (pressure control valve).** Relieves gas from the separator to maintain separator pressure.
- **LCV (level control valve or dump valve).** Controls flow of water/oil out of the separator. Receives signal from the level controller. Maintains appropriate level in the vessel.
- **Payline Valve**
- **Controls**
  - Fisher ROC
Separator Installations

- New Mexico

Separator Inlet Control
Pipeline Flow Control
Vapor Recovery Units

- New Mexico
Gas Lift/Chemical Injection/Plunger Lift

- Treatment chemicals are pumped downhole into the produced fluids of a well

- Colorado
Injection Well

- Shreveport, La.
Salt Water Disposal

- 6-Inch in Dacoma, Okla.
Suction Control for Compressors

- 3-Inch and 4-Inch in Kilgore, Texas
Additional Applications

Actuator for Compressor Seal Gas Booster Pump

Actuator for Chemical Injection Pumps
**Frequently Asked Questions**

- **How Fast is it?**
  - Up to 5 in/sec

- **What is the Fail position?**
  - With a signal loss or dropping bus voltage, the fail position is programmable.
  - On total immediate power loss, the actuator fails in place

- **What is the installed base?**
  - Over 1800 units installed across Texas, New Mexico, Colorado, California, Oklahoma, Louisiana, North Dakota, and Pennsylvania
  - 7+ different producers using the technology
  - Valve independent, but standard option for Kimray and Norriseal
Producer Feedback

• Eliminates methane emissions allowing gas to be sold
• Now have better control than with pneumatics
  • Improved accuracy and faster response time
• Ties into our RTU’s and provides feedback
• Same unit fits most applications (Dump and Control)
  • Stock one model for all applications