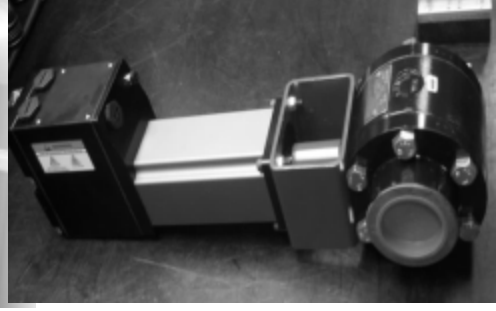
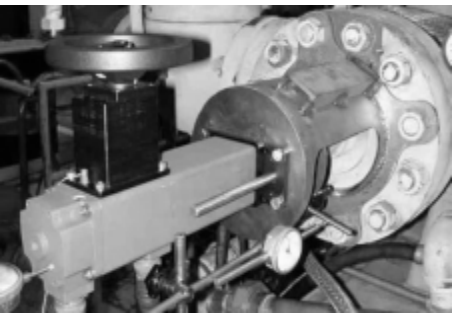
CURTISS-WRIGHT

EXLAR
Exlar Actuation Solutions



# Stop Venting Your Profits
# A New Alternate to Pneumatic Controllers



# A Few Pneumatic Controller Studies

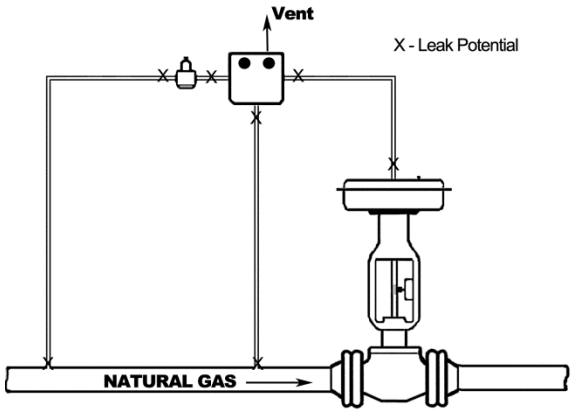
- Estimates of Methane Emissions from the U.S. Oil Industry (ICF Consulting, 1999) *445,900 MT /yr*
- Inventory of Greenhouse Gas Emissions and Sinks: 1990-2012 (U.S. EPA, 2014)
- Greenhouse Gas Reporting Program (U.S. EPA, 2013)
- Measurements of Methane Emissions from Natural Gas Production Sites in 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

# Maintenance of Natural Gas-Driven Pneumatic Controllers

- 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

# Time to Break the Status Que

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

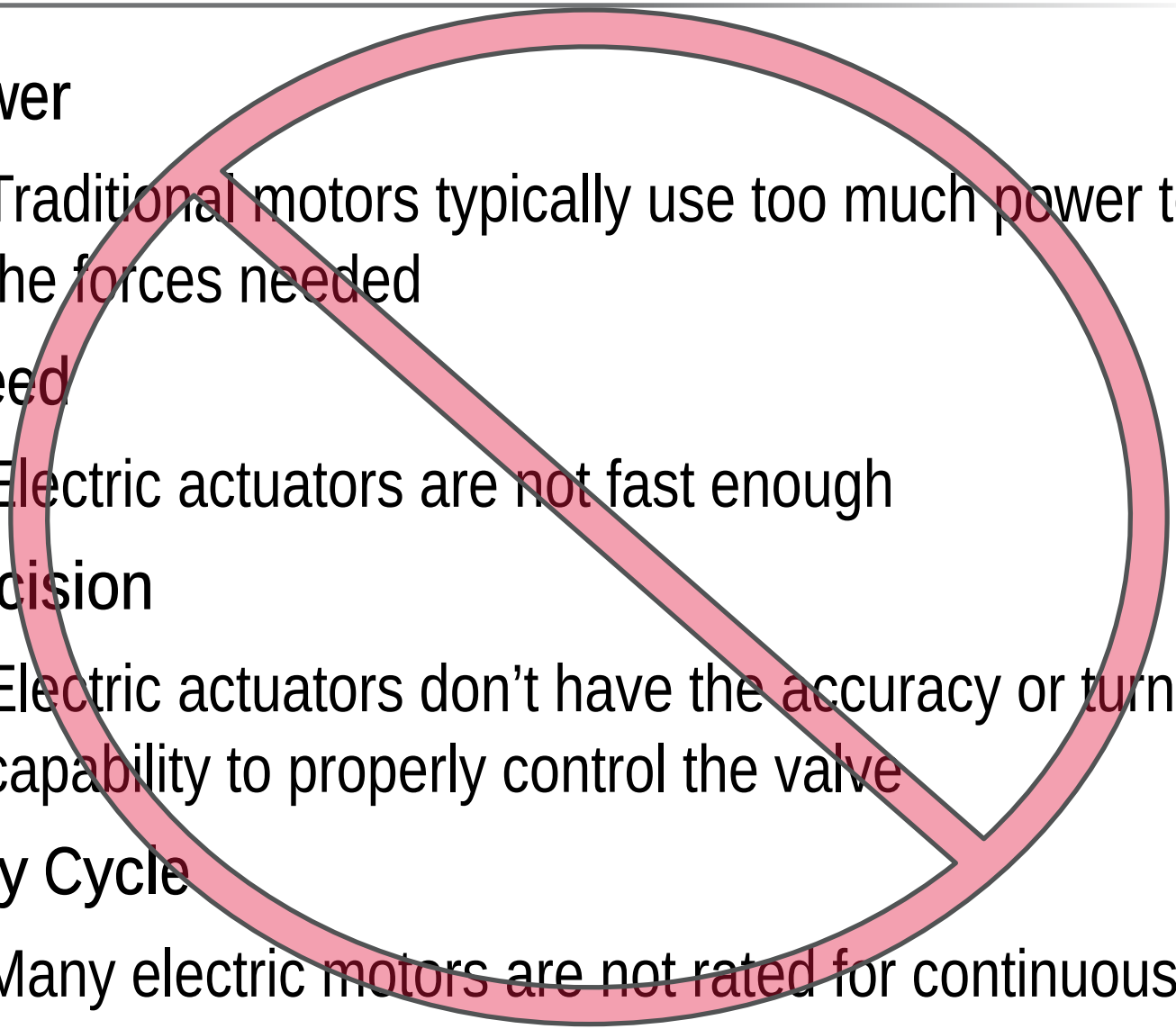
*New solutions now available*

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 ¼ turn valve

Easily integrated with the servo motor

## SERVO CONTROLS

Precisely controls the motors motion, and therefor 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

VS

## Servo Motor

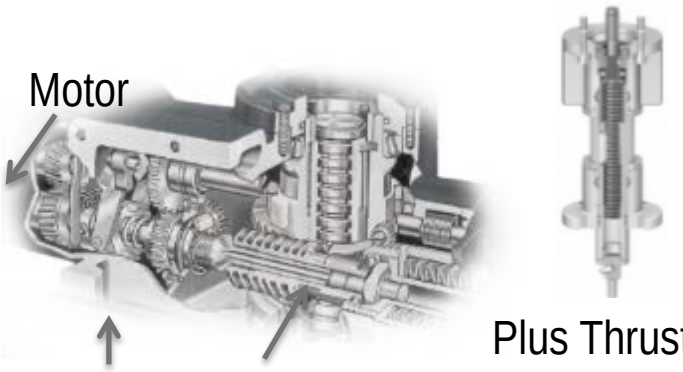
- High efficiency (90%)
- Position feedback
- Adapts to changing loads
- Faster positioning
- Reserve power
  - Capable of short bursts of peak current to improve positioning
- Quiet
- 100% Duty Cycle

# Traditional Gear Train vs Roller Screw

Linear Applications

## Traditional Actuator

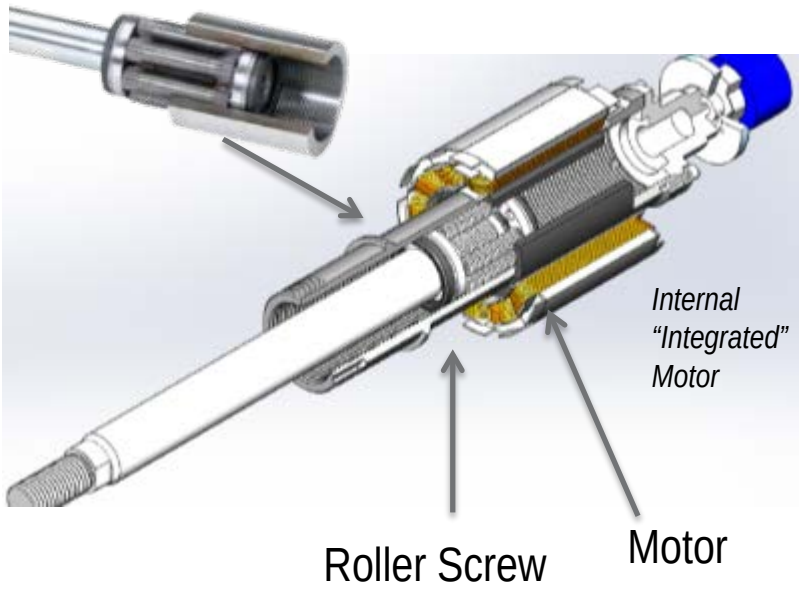
- Inefficient
- Low speed
- Severe wear in high duty apps
- Short Life: Measured in thousands of strokes




VS

## Roller Screw Actuator

- Direct conversion of rotary motion to a linear force
- Extreme Life 100+ million strokes
- High Shock Resistance
- Extreme Efficiency



# The Roller Screw

- Self-greases at down-stroke, which extends life of roller-screw
- Positioning accuracy
- Full motor (3000) rpm

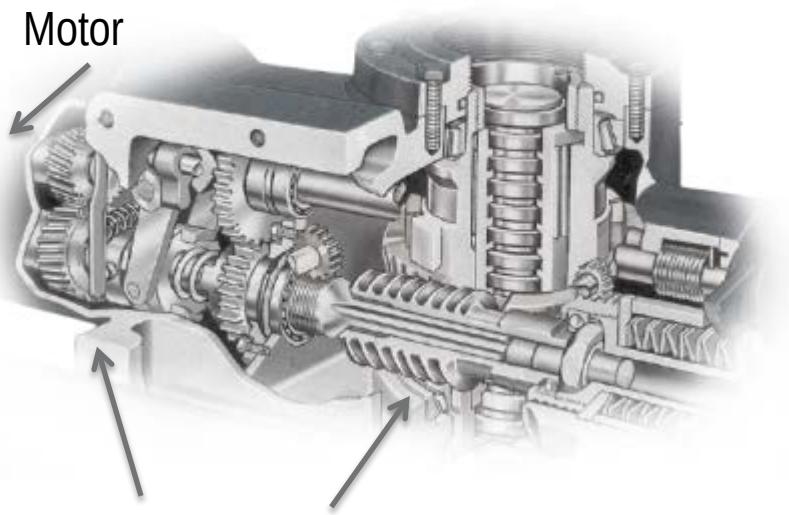
- 200 thread-to-thread full contact points allow increased power, precision and repeatability
- Continuous velocity at 1.5” per second ( 5 in/sec max )

# Traditional Gear Train vs Exlar Planetary Gearing

Rotary Applications

## Traditional Actuator

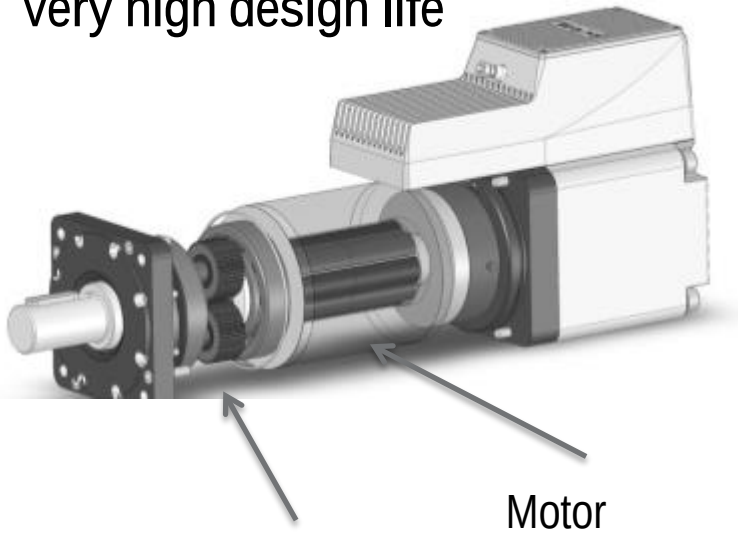
- Inefficient
- Low speed
- Short Life: Measured in thousands of strokes




VS

## Planetary Actuator

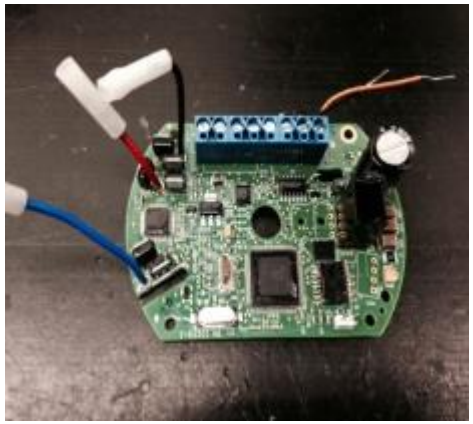
- Load shared uniformly with multiple planet gears acting in concert
- Capable of higher speeds and higher efficiency
- Very high design life



# 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

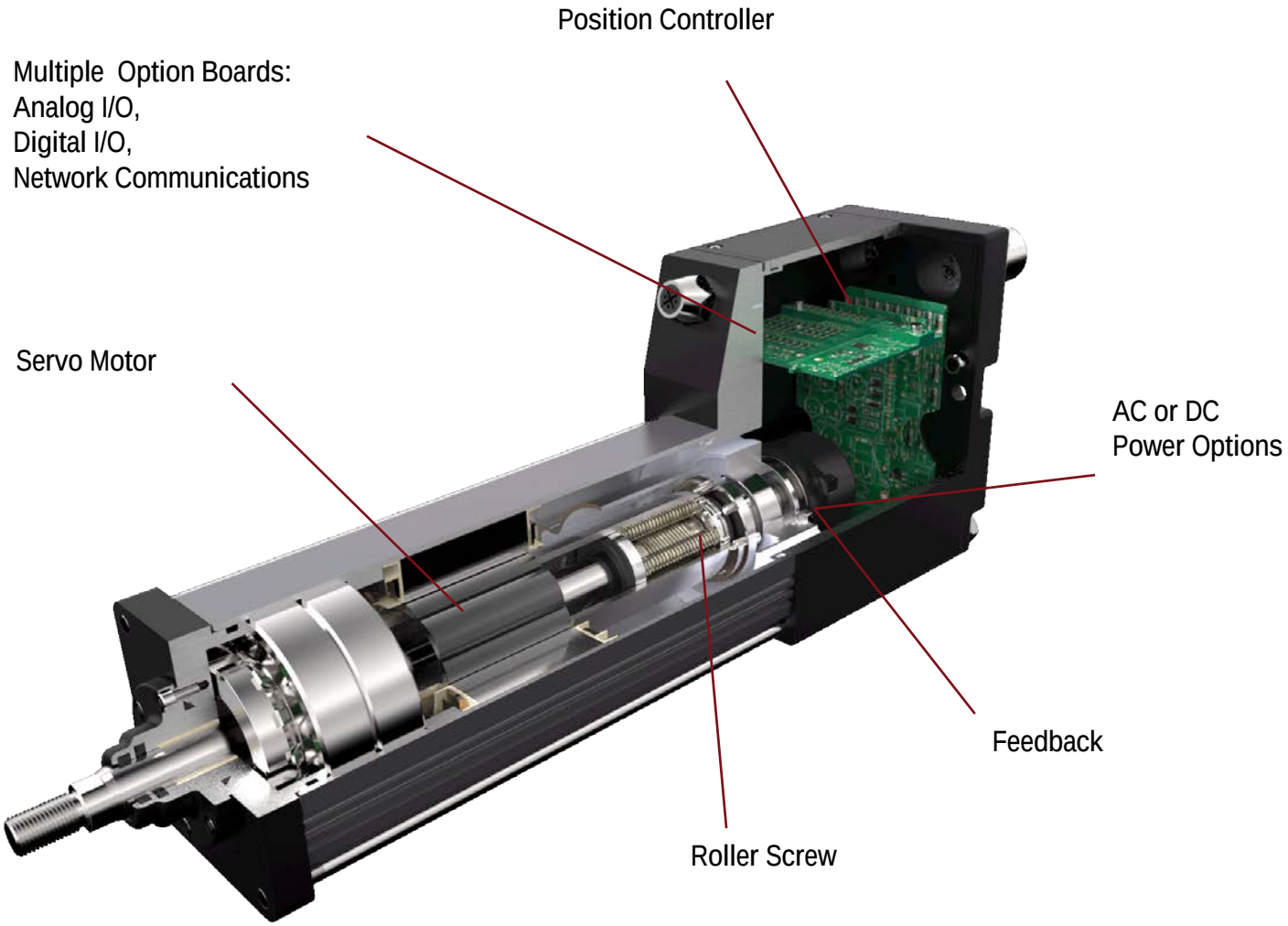


VS

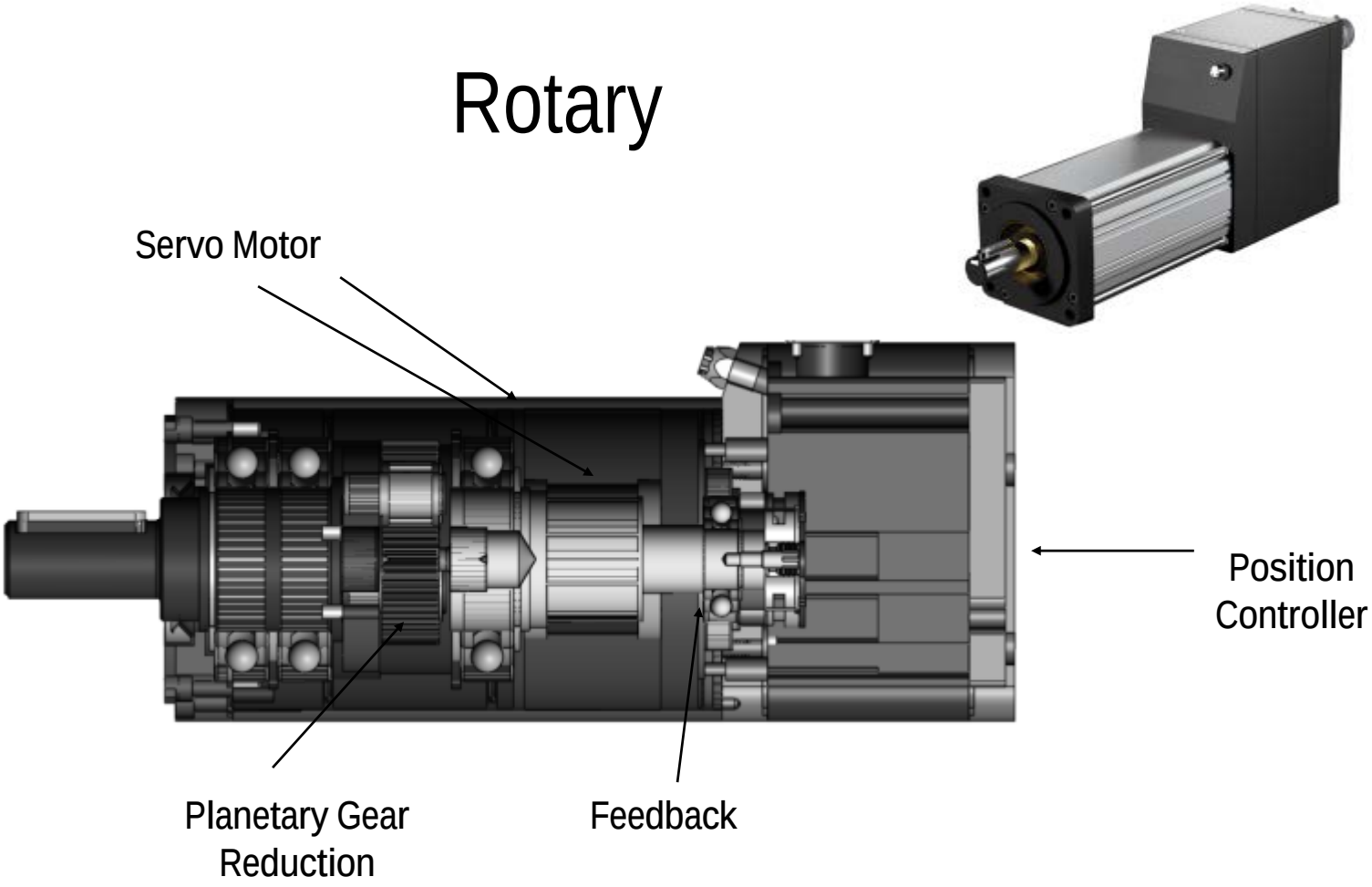
## Servo Electric Actuator

- 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



# Integrated Components = Rotary Electric Actuator

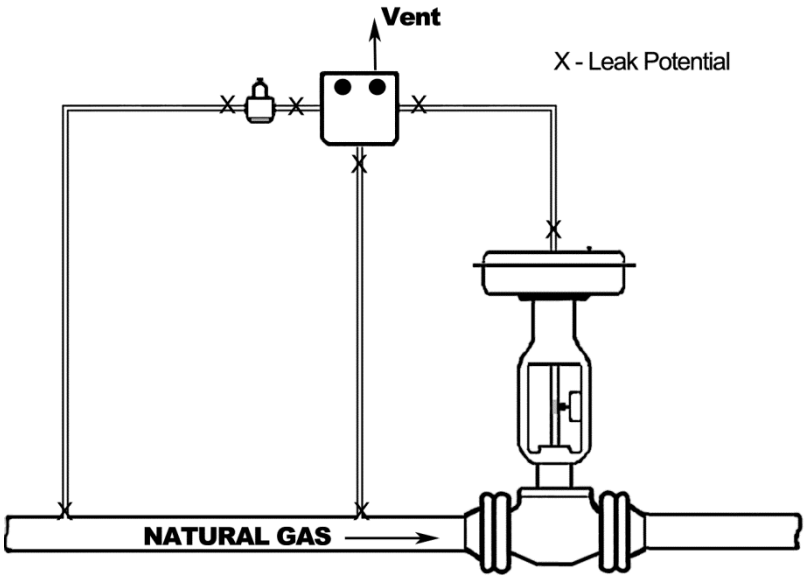


# Electric Servo Actuator Features

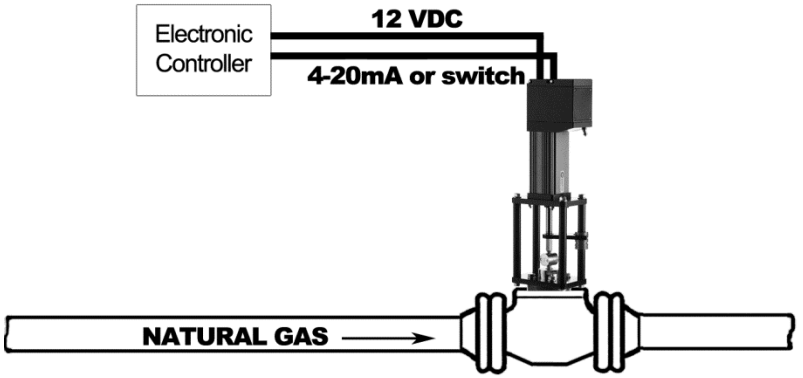
- Modulate or Open/Close
- Failure Modes
  - Voltage monitoring circuit allows configurable operation of the actuator at user selected voltage trip points
- Fieldbus Connectivity
  - Modbus RS-485 protocol for connection to PLCs or RTU systems
- Extends Life of Valve
  - Adjustable valve seating
- Low Power Consumption
  - 12 VDC Solar power capable

# Controller Changes

## PNEUMATIC SOLUTION EXAMPLE




## ELECTRIC SOLUTION EXAMPLE

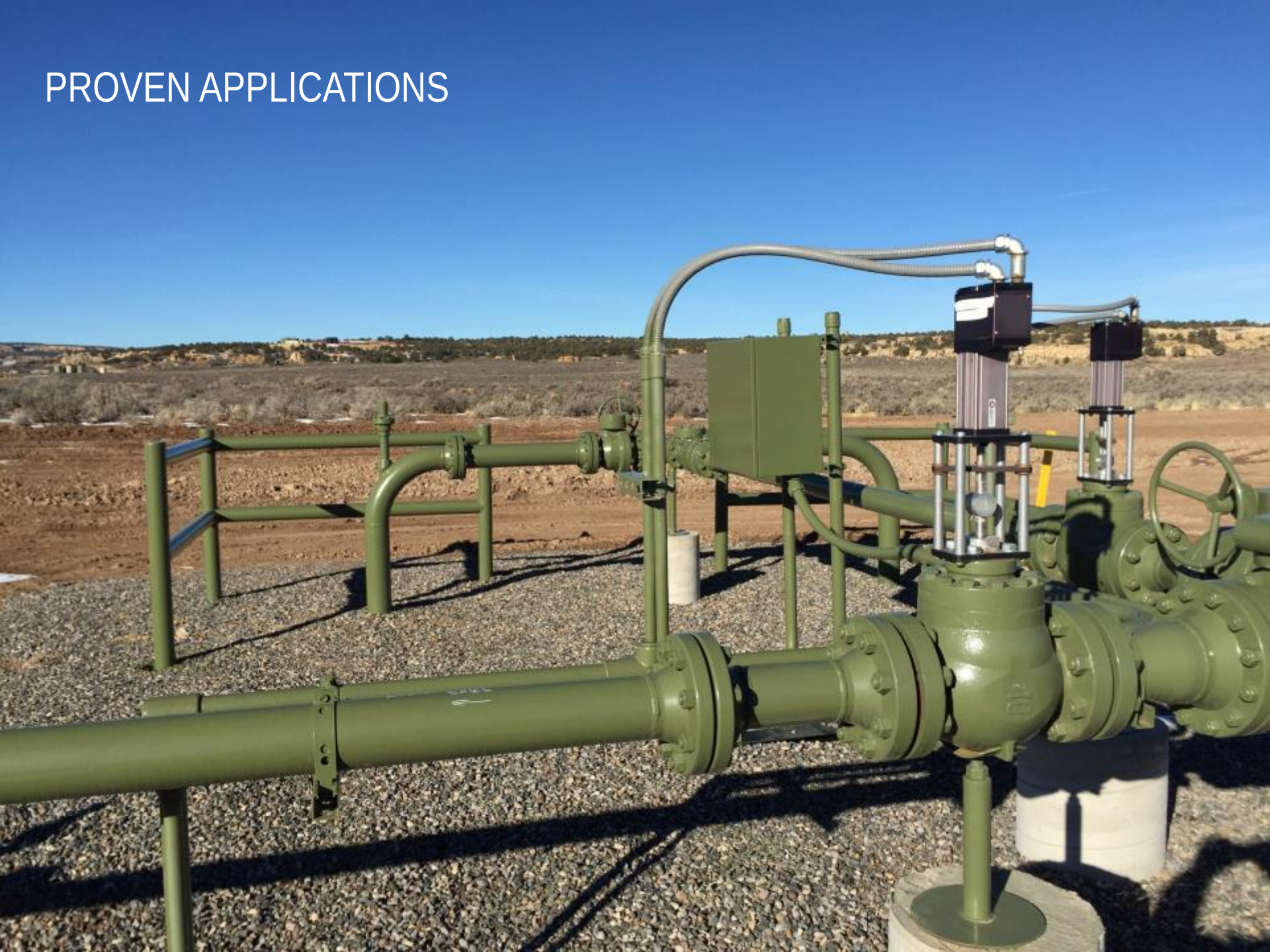



Electronic automation systems provide better process control through reduced time lag on the output plus feedback from the process

# 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

## SEPARATOR INLET CONTROL

## PIPELINE FLOW CONTROL

- New Mexico

# Vapor Recovery Units

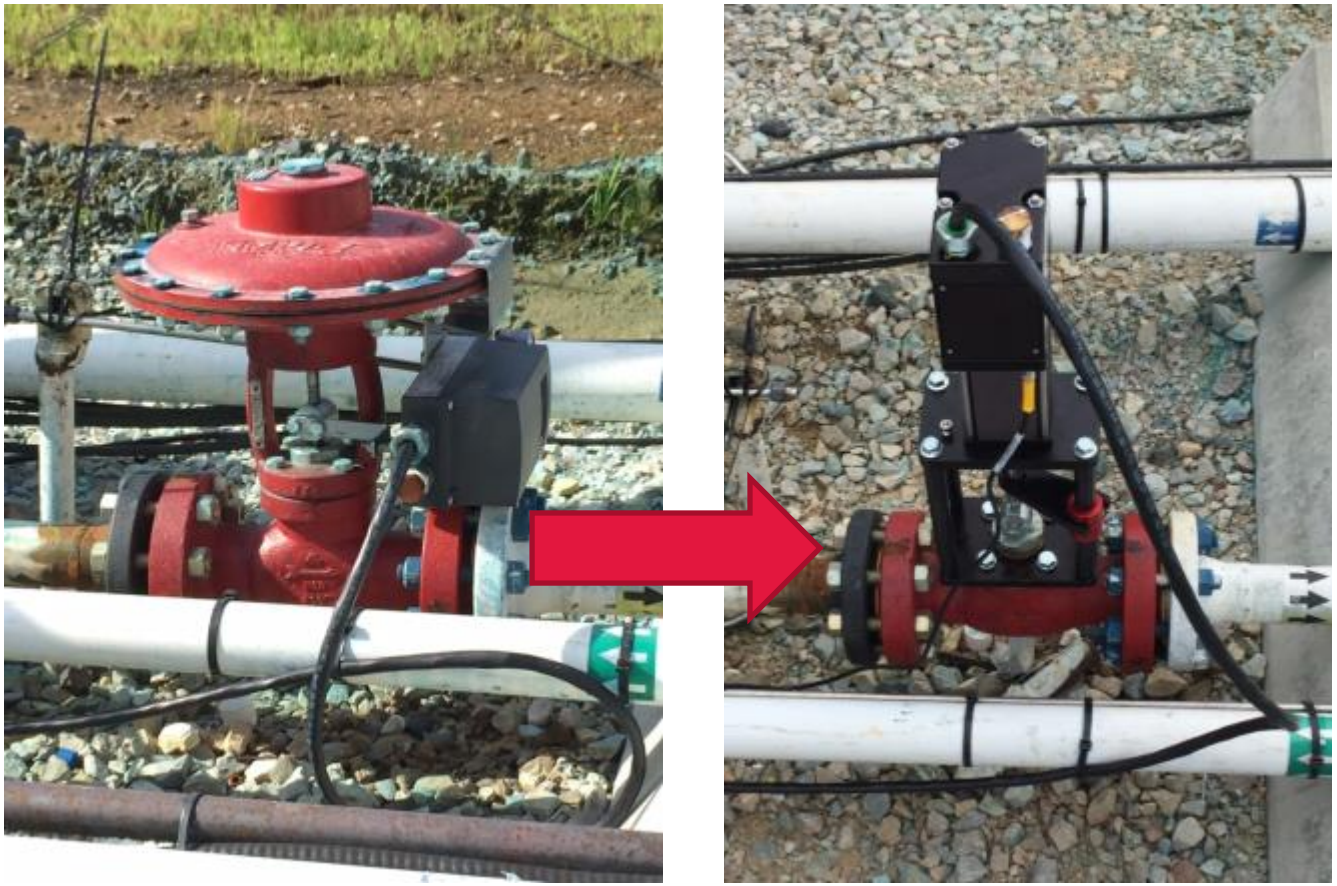

- New Mexico

# Gas Lift/Chemical Injection/Plunger Lift

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

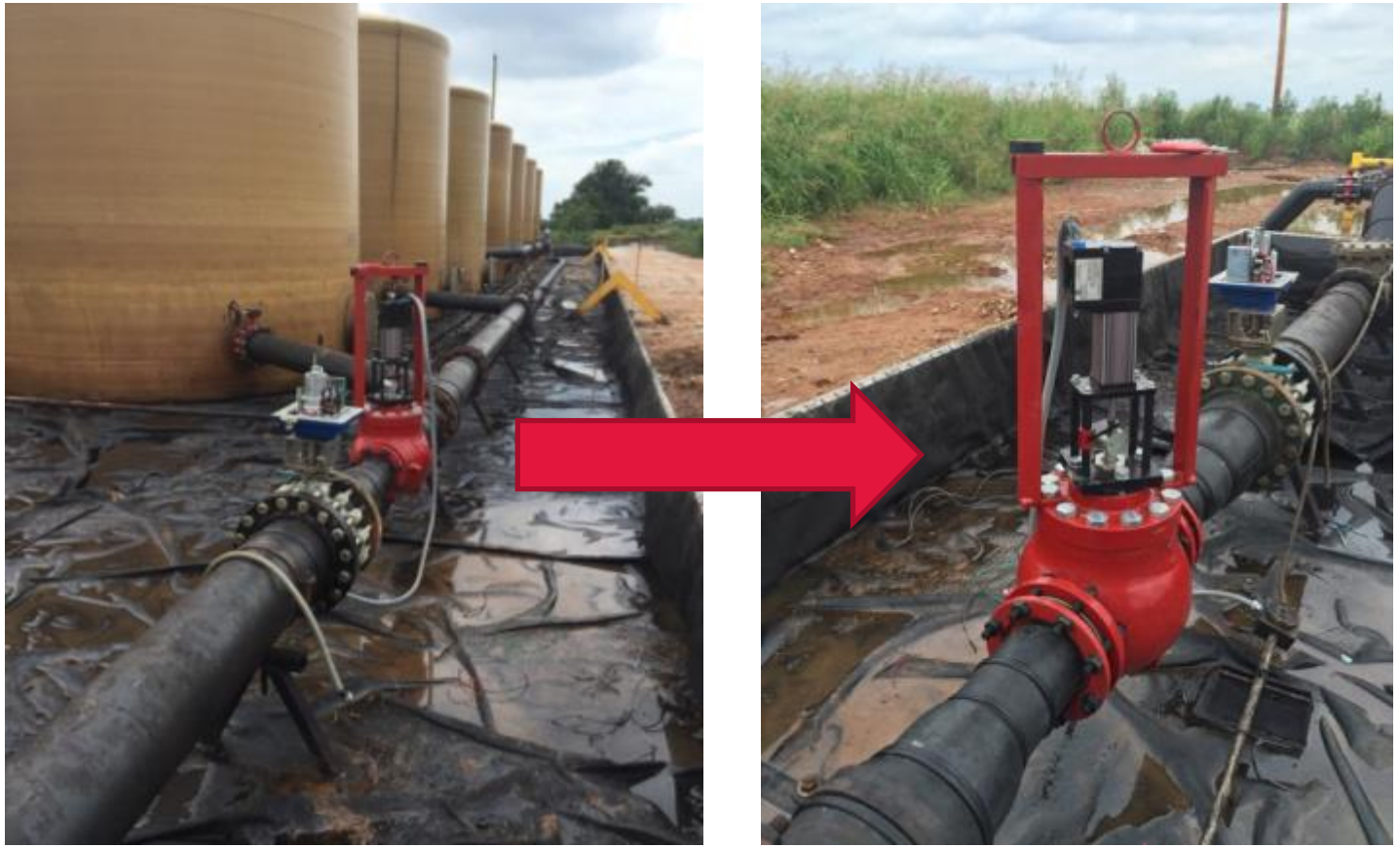
- Colorado

# Injection Well



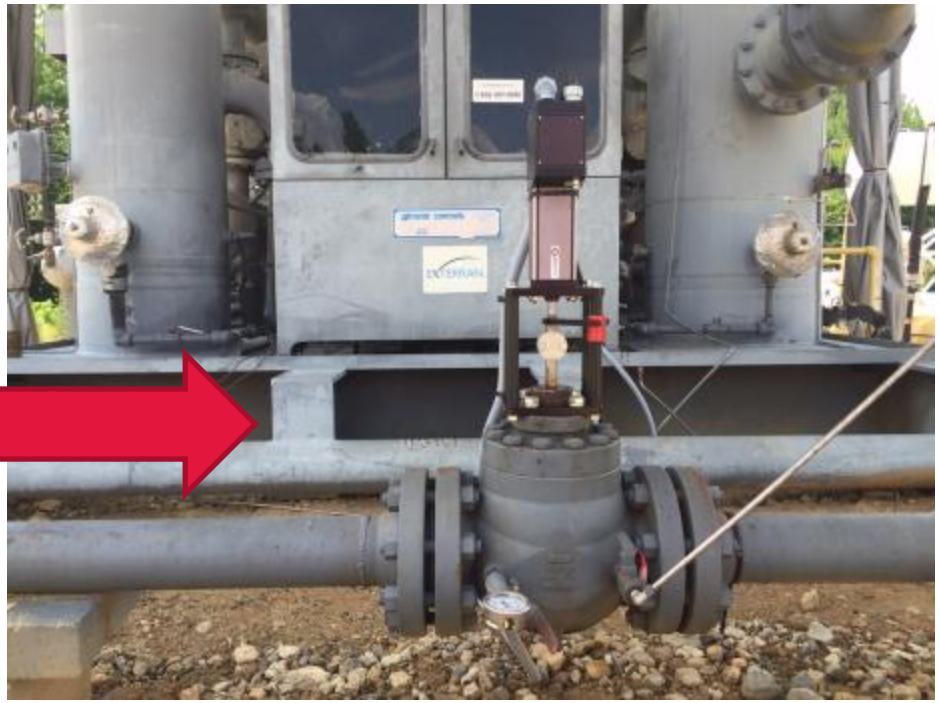
- Shreveport, La.

# 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

CVS Controls AC and DC Electric Chemical Pump

# FEQUENTLY ASKED QUESTIONS

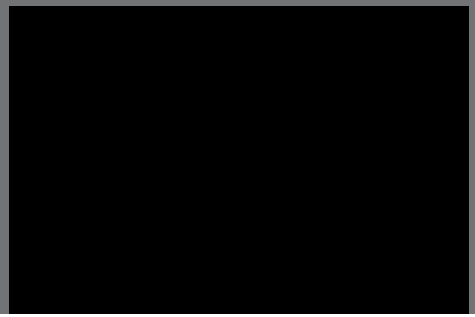
- How Fast is it?
  - Up to 5 in/sec
- What is the Fail position?
  - With a signal loss or dropping bus voltage, the fail position is programmable.
  - On total immediate power loss, the actuator fails in place
- What is the installed base?
  - Over 1800 units installed across Texas, New Mexico, Colorado, California, Oklahoma, Louisiana, North Dakota, and Pennsylvania
  - 7+ different producers using the technology
  - Valve independent, but standard option for Kimray and Norriseal

# FEQUENTLY ASKED QUESTIONS

## 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

Barb Boynton
Business Development Manager
Curtiss-Wright/Exlar Actuation Solutions
952-500-6200



Exlar.com