

# rotork

Redefining Flow Control



# Valve Actuator Types Discussion

Duane Hazen - Rotork

- Why do I want automated valves?

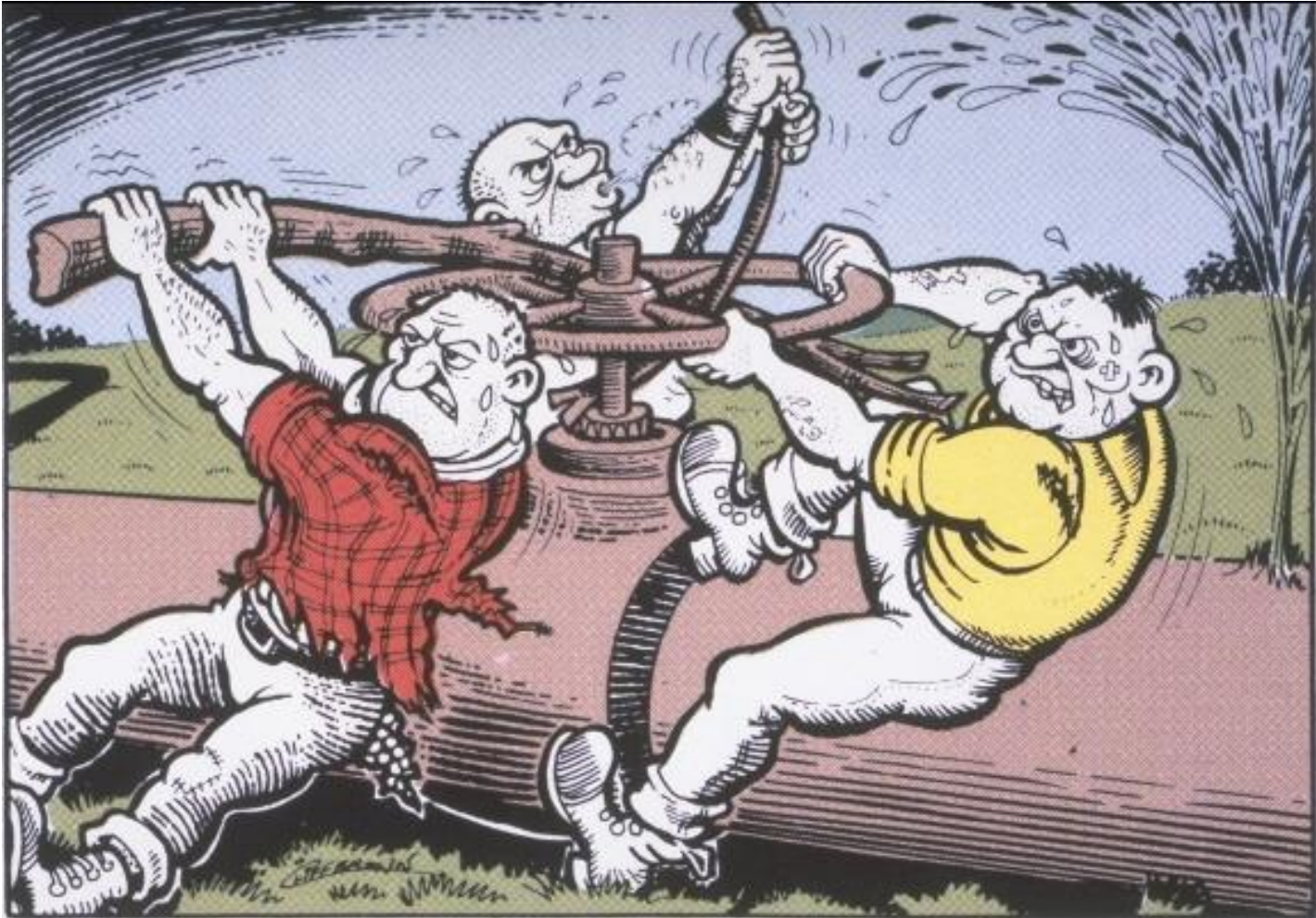


# Supervisory Control

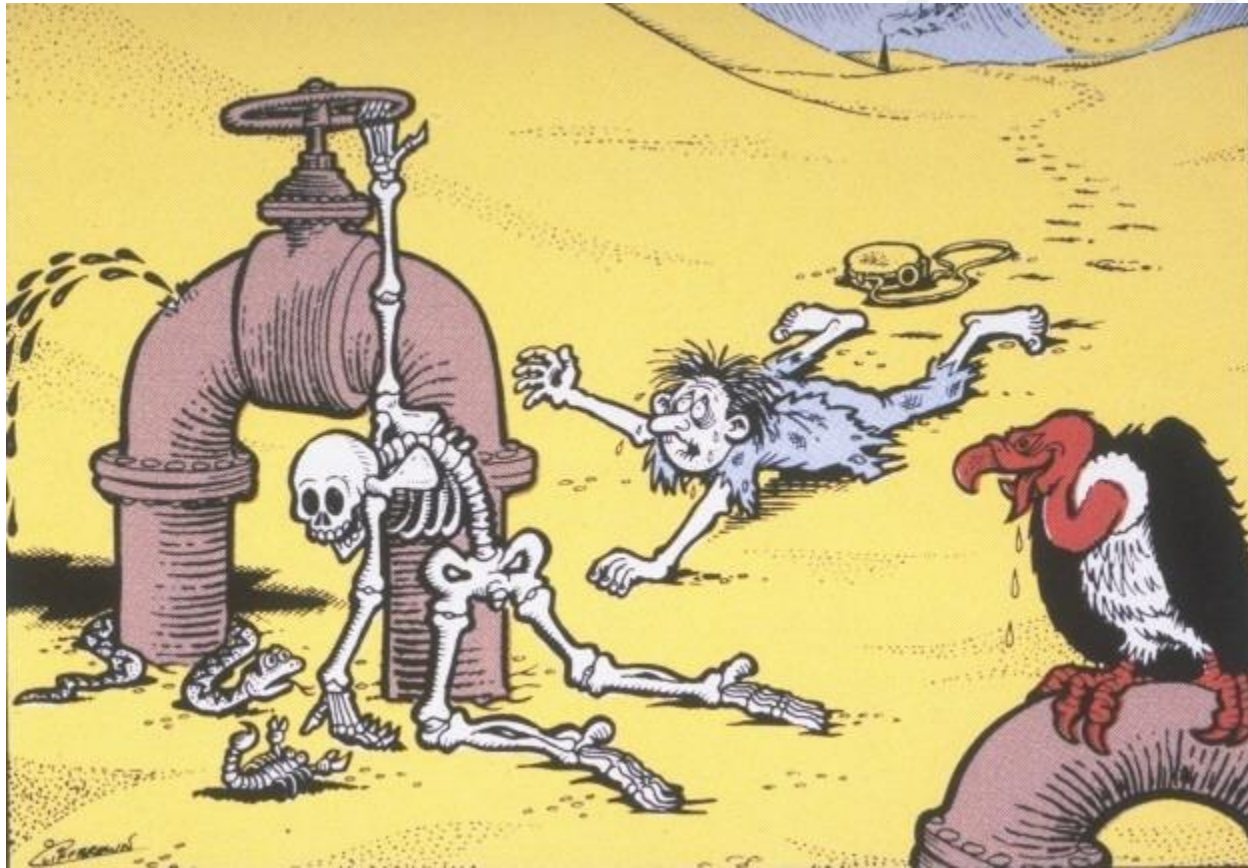




- Larger valves need high force's to operate



# Remote Locations are Difficult to Access Easily





Valves are Frequently Located in Hazardous Areas



# Typical Actuator Types





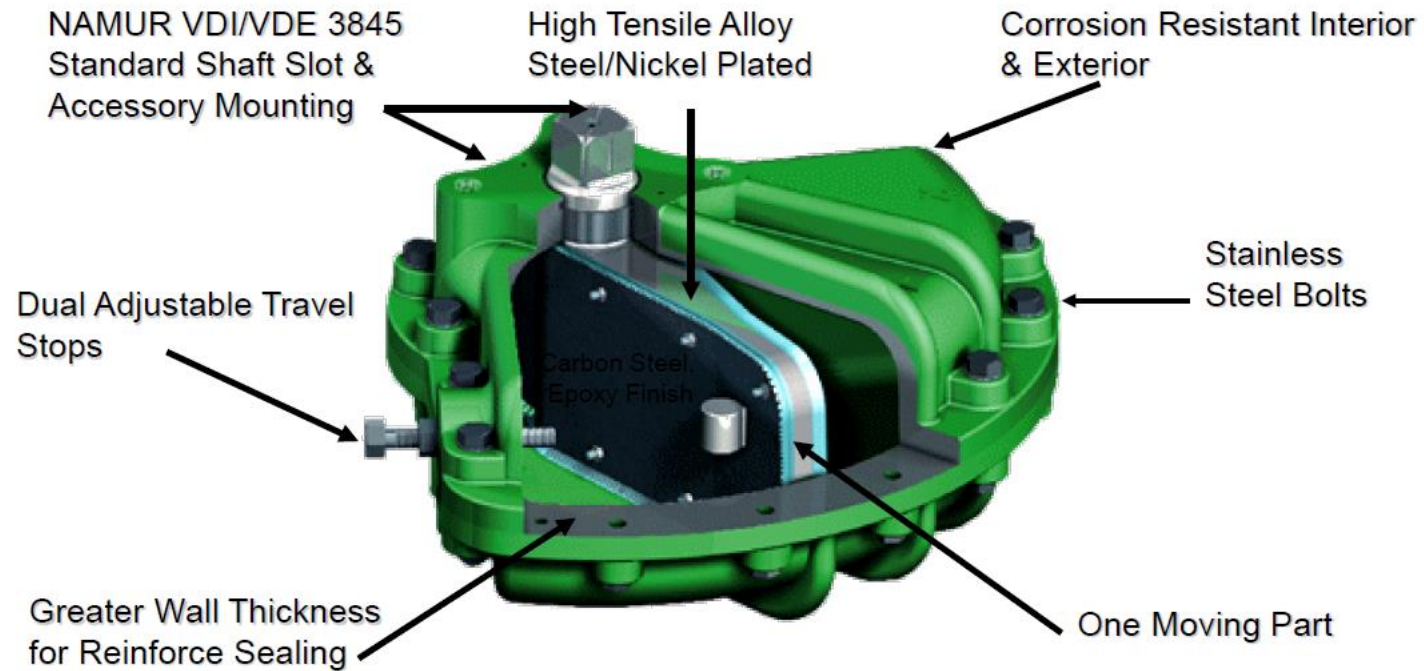
# Electric Actuators



# Pneumatic Actuators



## 3-D Construction





## Scotch Yoke Pneumatic



Applications

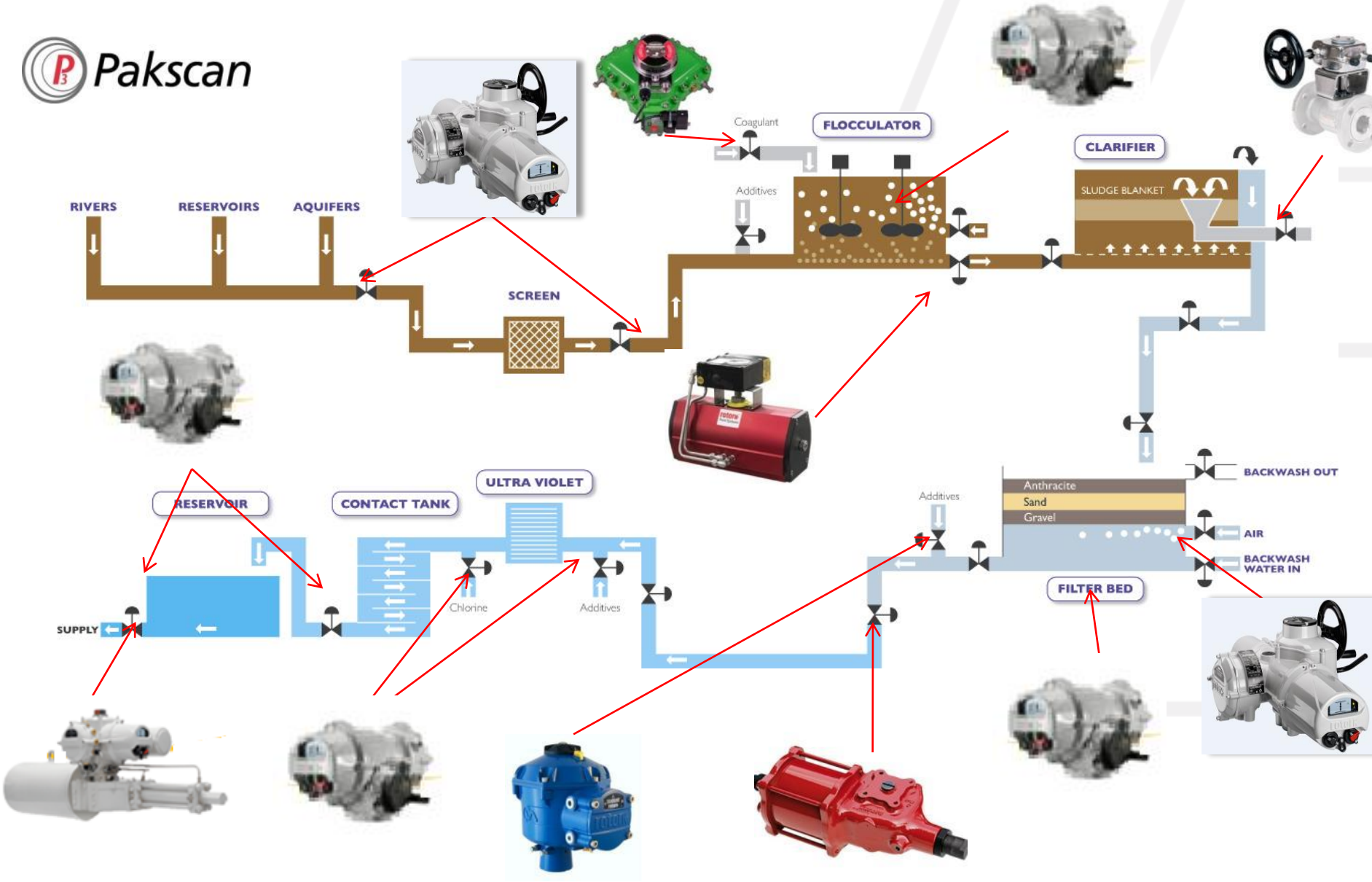


# Application Questions

- o/c or modulating?
- Power supply?
- Remote control?
- Indication needed?
- Enclosure rating?
- Fail safe?
- Valve type? Size? Torque? Thrust?
- Operating speed requirement?



Water





**Knife Gate  
Electric Actuator**

**Pinch Valve Electric Actuator**



## Pretty good sized Scotch Yoke Actuator







**Electric Actuators  
On Gates**

**Filter Gallery  
Electric Actuator on  
Butterfly Valve**



- Reservoir, Inlets and over flow Penstocks

- Actuation used on inlets and outlets and flood control
- Normally large multi-turn applications



- Filter applications



- Filter Influent Valve



Air Scour



Filter Gallery



Filter Console



- Filter applications

Each filter bed normally requires 5-10 actuators.

- Inlet Valve
- Outlet Valve
- Backwash water outlet
- Backwash water inlet
- Air Scour valve
- Drain





# Vane Pneumatic



- Very few parts
- Modulating duty
- Manual overrides
- Can be spring return

- Chemical Dosing

Control of the injection of chemicals into the filtered water to eliminate any remaining microorganisms in the water which could cause harm.

This process requires very accurate control and is a good application for Control Valve Actuators Which are small, but very accurate





Secondary Clarifiers



Scum Skimmer



Air Service

Effluent Valves



Grit Chambers



Grit Chambers







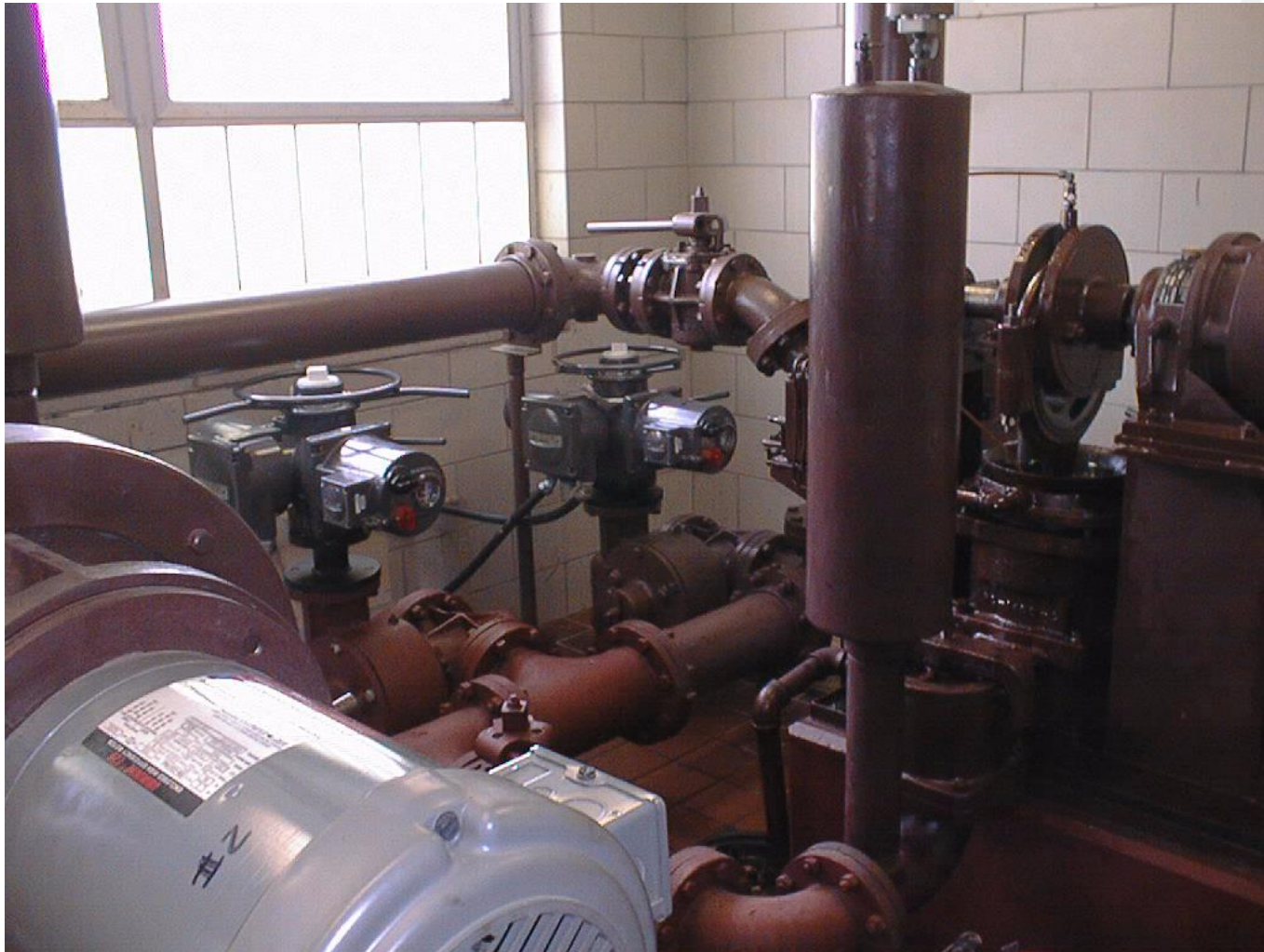
# Chemical Injection Control Valve Actuator on PVC Ball Valve



# Dual Stem Gates



# Automated Plug Valves





# Blower Vane Control





# Single electric actuator driving a dual stem gate



# Electrohydraulic - High Service Pump Valve





# Fireboat Water Cannons on butterfly valves



# Remote location for electric actuator – Vault Flooding concerns





Remote mount actuator for ease of access.  
Valve is located 20' into tunnel.



# Bring actuators out of vault – Safety Concerns





# Replace Linear Hydraulic Cylinder with Electric Actuator Solution





# Remote Mount Electric Actuator to Isolate it From Damaging High Vibrations



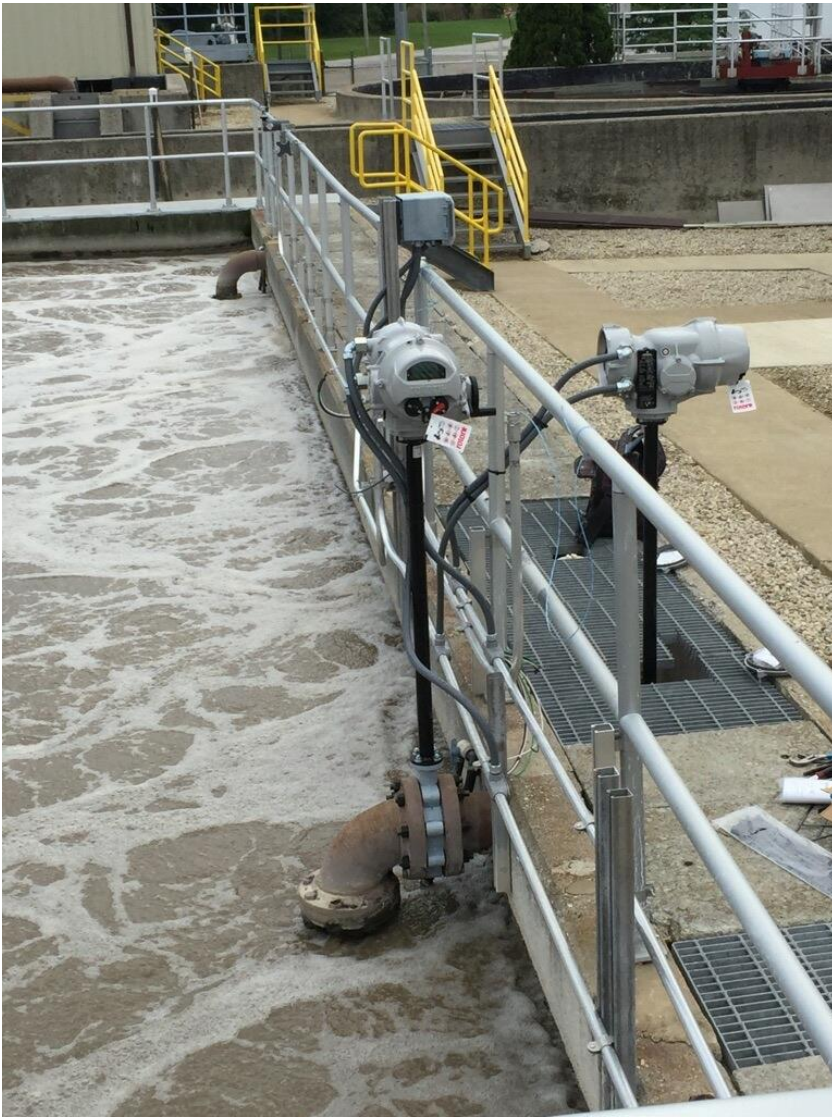
# Telescoping Valve











Oxygen Valves

Retrofitted with tall pedestals

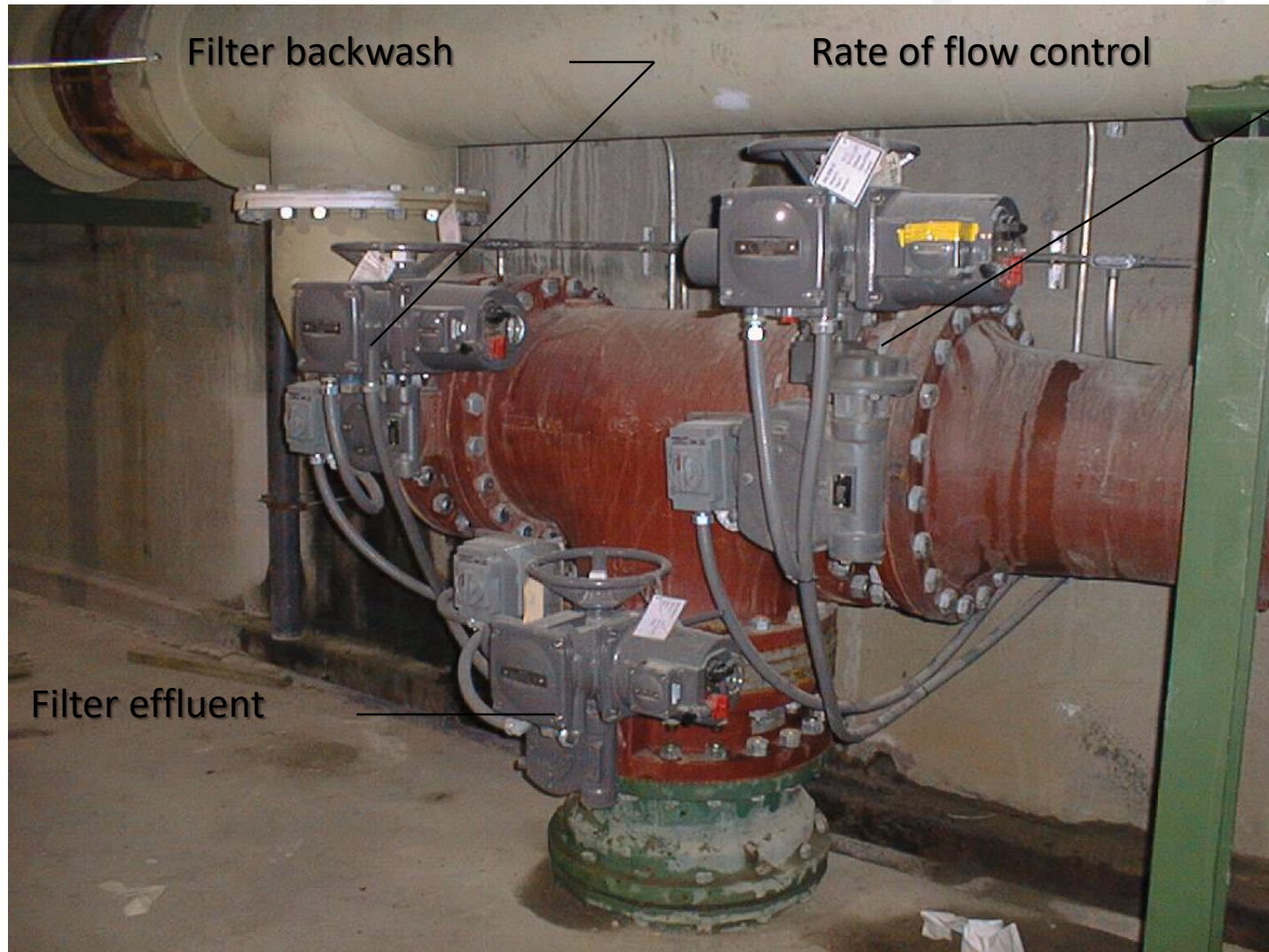
For easier access to actuators

# Filter Gallery





# Filter Valves





# • Pumping station

- There are two main pumping stations in the Water Plant. The low lift station brings water in to the plant & the High lift stations pumps out to the system.

- Ball valves / cone valves are used for free flowing applications. Butterfly/Gate & plug valves are also used.



# Pump Control

## Water Hydraulic Systems





# Pump Control using Self-Contained Fail Safe Solution





Self contained actuator on pump discharge valve

This replaced water a powered cylinder and associated controls.



# Retrofit

Remove 3 gallon remote oil storage tank, pumps, 3" oil supply piping.

Install self contained solution that operates on 120-1-60, and has less than 10 gallons of oil.



# Retrofit – Hi lift service





## DC power Failsafe

Fit the actuator with a DC motor, use either an internal battery pack or a separate UPS system for the stored energy needed to fail open or closed in a power fail event/emergency.



# DC Powered Actuator, Failsafe, RHS, UPS

Actuator is located under roadway



UPS Panel and RHS is in building



# Electric Actuator – Current Design

- Intelligent Actuators?





# IQ / IQT

**“Intelligent”  
“Non-Intrusive”  
“Electronic”**

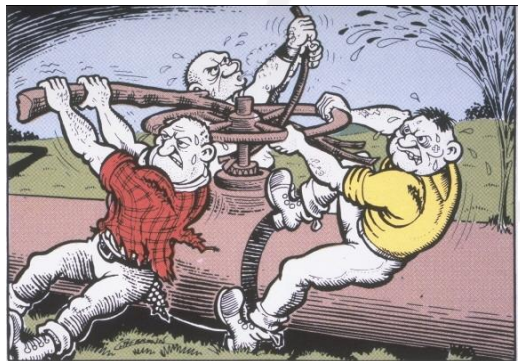
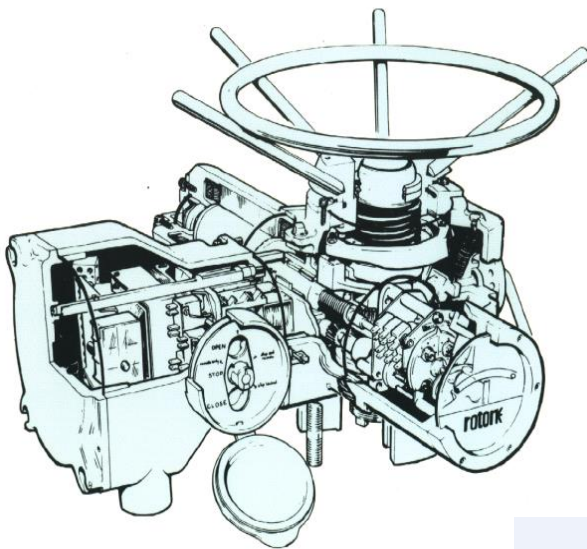
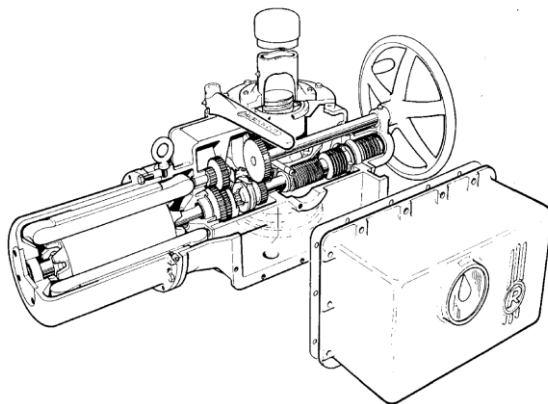
**Actuators**

**All terms are synonymous**

**Electronic Position, Torque sensing  
Non-Intrusive means of commissioning  
On Board Datalogging**



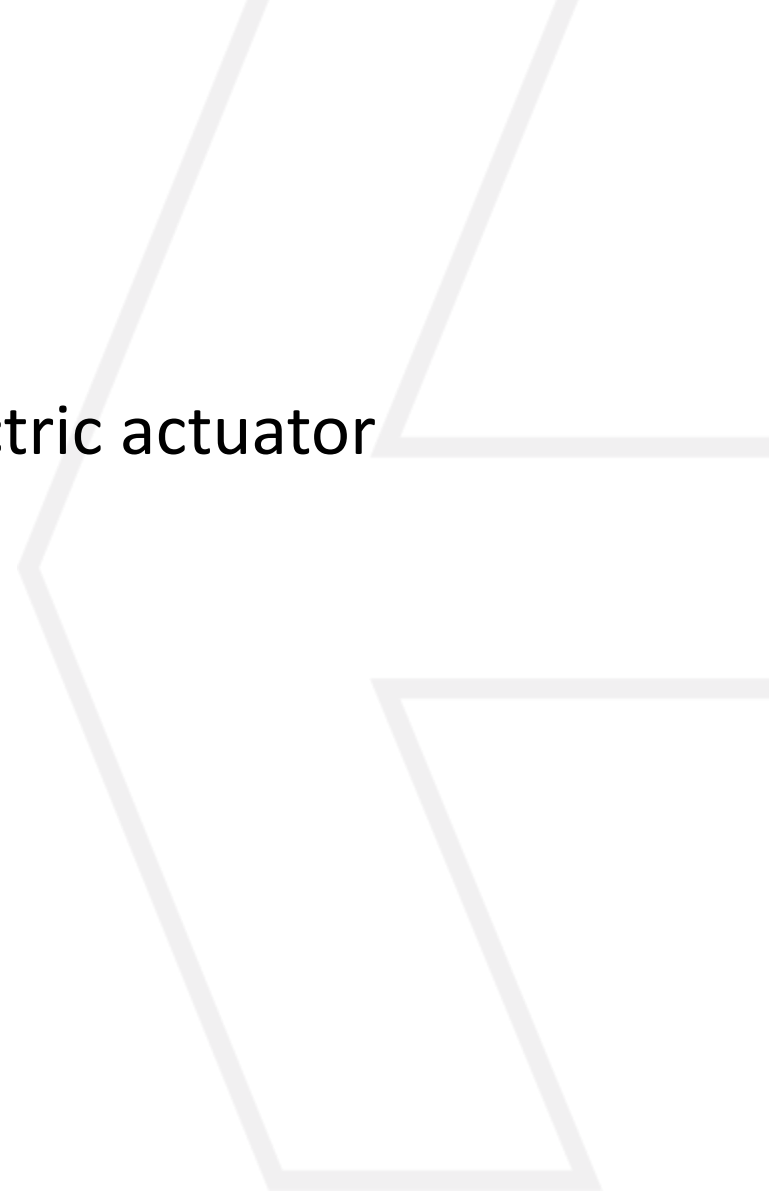
- Design Trend of Electric Actuators



The trend is from an all mechanical design to a design that uses current electronic technology practices. This increases reliability, performance, and ease of ownership.



- Whats the biggest cause of electric actuator failure?

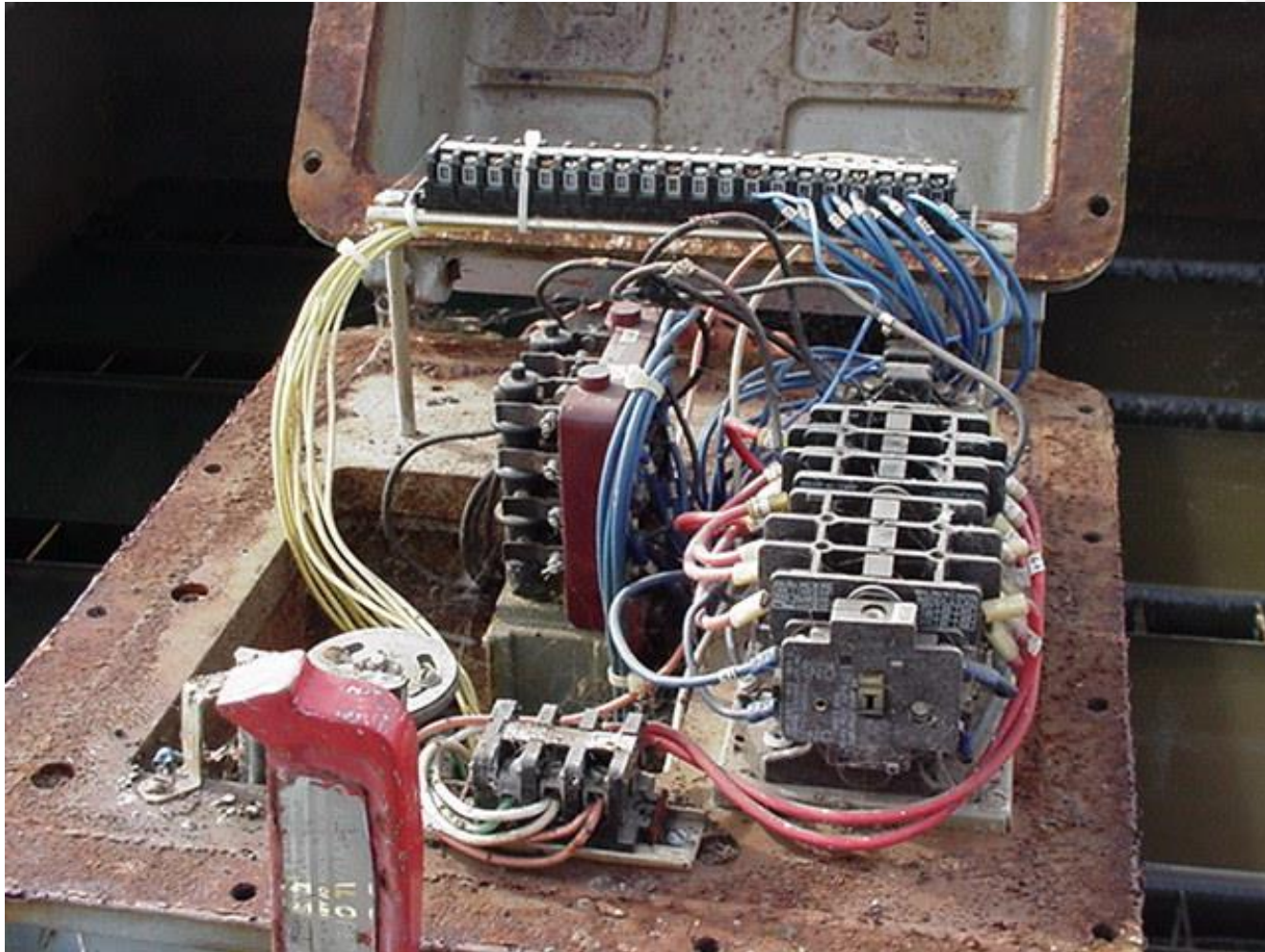




# #1 Cause of Electric Actuator Failure Moisture Ingress



# #1 Cause of Electric Actuator Failure Moisture Ingress





## Double Sealing Saved 80 Actuators





## Internals – Layout

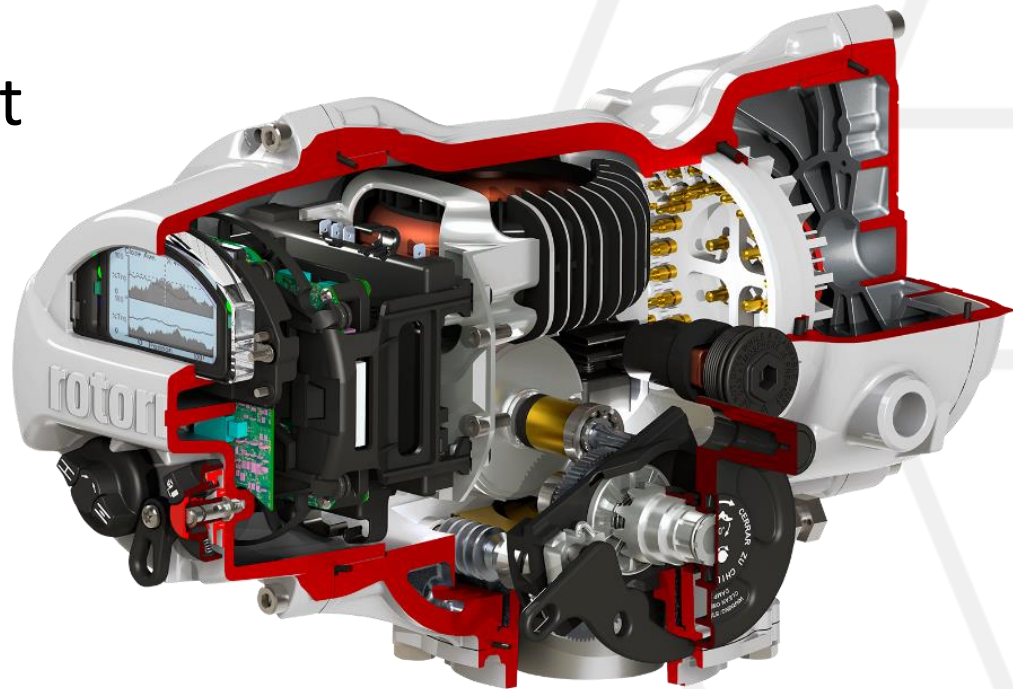
Current designs

Use separately

Sealed terminal

Compartments

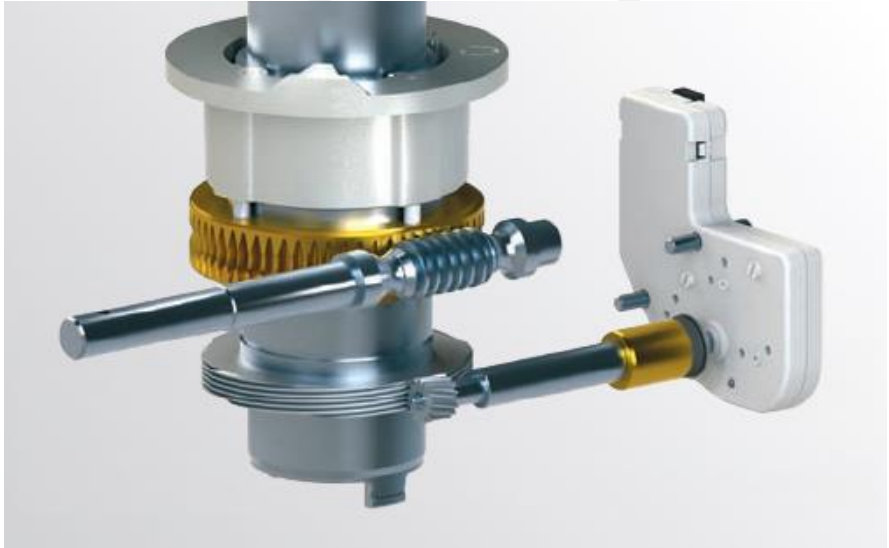
To keep water out of the main electrical compartment



Current designs use oil bath lubrication, which is much more efficient than the grease used in older actuator designs



Current Designs use current technology. Position tracking is now done using very few moving parts/gears. Simplicity = Reliability

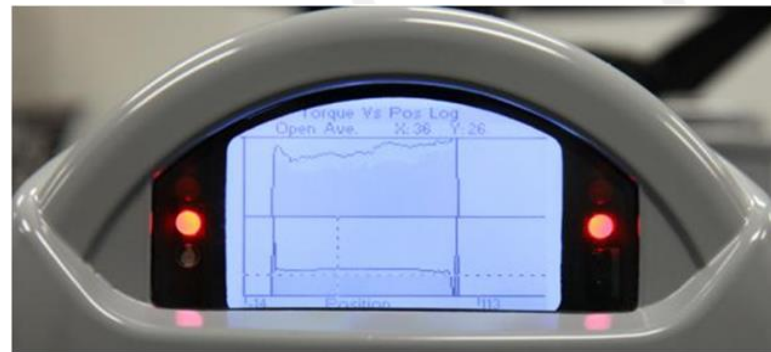
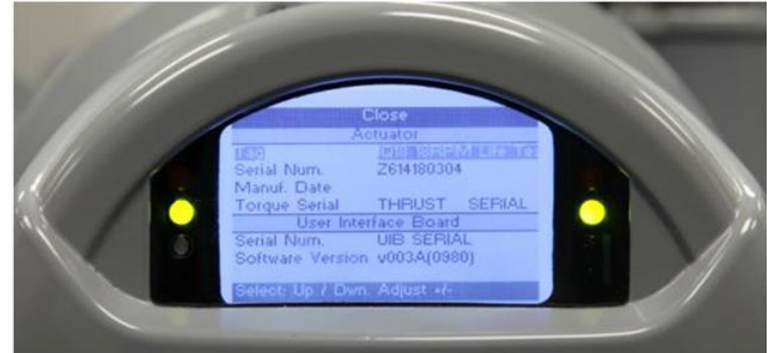
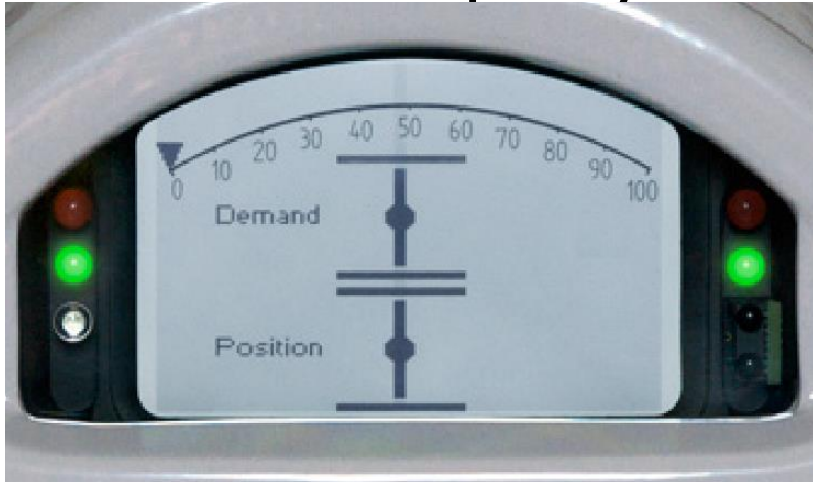




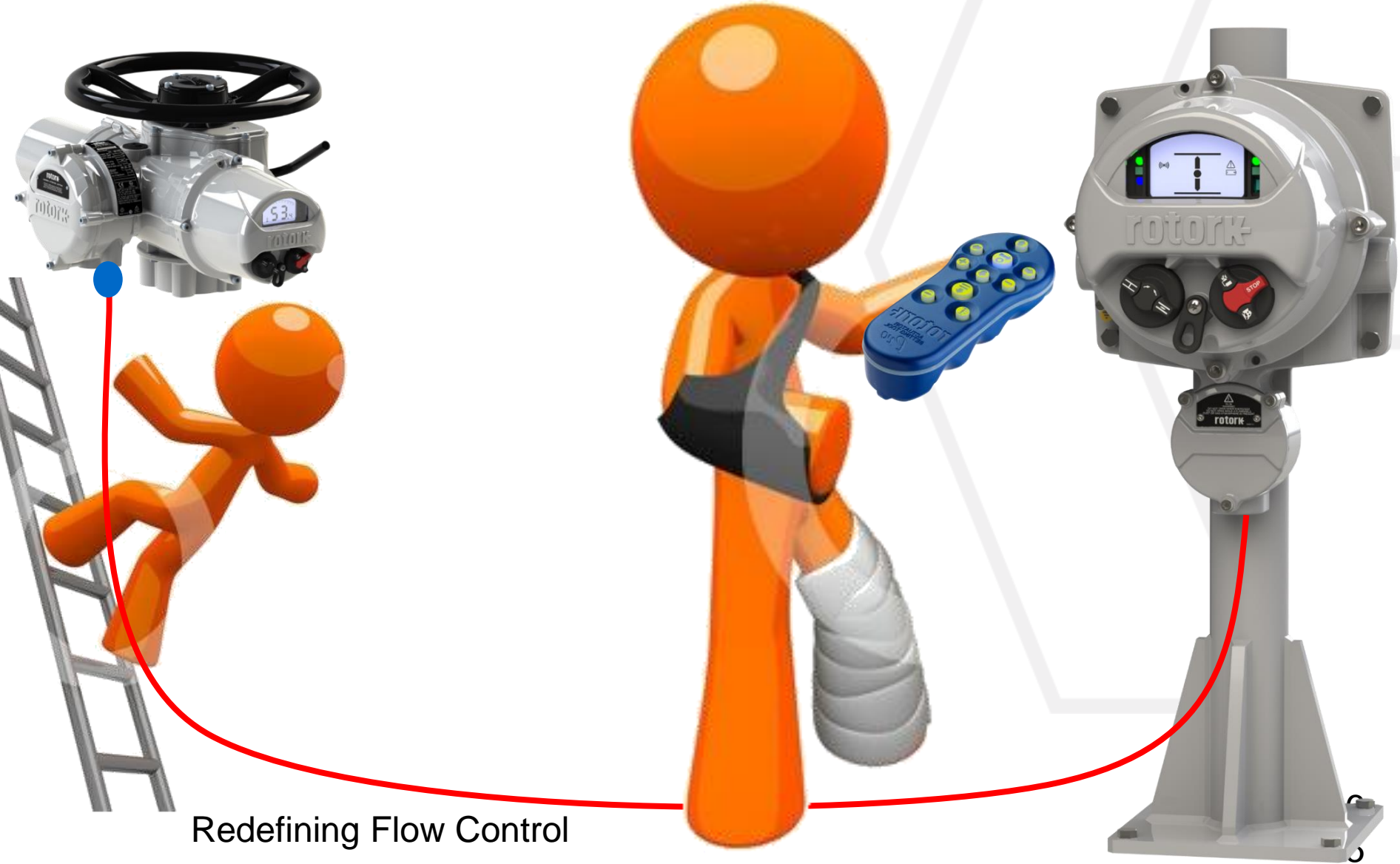
- **Easy calibration** None Intrusive Torque and Limit sensing
  - Setting tool with secured Bluetooth connection
- **Built in Intelligence**
  - Never loses its position in an unscheduled power outage
  - Valve actuator and process data is available on screen or in the control room
  - Onboard data logger records all activity
  - Data logger and other performance data is available to the user in several modes to suit his asset management
  - Orientation and Vibration sensor



# Local display



# Remote Network Hand Station



Redefining Flow Control



# Computer Diagnostics

- Insight 2
- Datalogger Screen – IQ3

**Insight 2**

File Connection Security Tools Help

Mode  
 OFFLINE  
 BLUETOOTH  
 Actuators  
 CVA  
 CVA-Quarter Turn  
 EHP  
 IQ3  
 Z614180903  
 Z614181002  
 FF Unit  
 Z614180904  
 Z614181401  
 Z61481001 Pakscan Convention  
 Actuator Information  
 Actuator Settings  
 Relay Settings  
 Torque Settings  
 Option Control  
 Control Settings  
 Z614180902  
 Z614181003  
 Z61418080  
 Z614180901  
 Z614180801  
 SIP  
 Bluetooth Setting Tool

Type: IQ3  
 SerialNumber: Z61481001  
 Valve Tag: Pakscan Convention 1

### Actuator Settings

Basic Settings		
Close action	<input checked="" type="radio"/> Position	<input type="radio"/> Torque
Open action	<input checked="" type="radio"/> Position	<input type="radio"/> Torque
Anticlockwise to close	<input checked="" type="radio"/> Disabled	<input type="radio"/> Enabled
ESD Configuration		
ESD Normally closed	<input type="radio"/> Normally closed	<input checked="" type="radio"/> Normally open
ESD Override interlock	<input checked="" type="radio"/> No	<input type="radio"/> Yes
ESD Override local stop	<input checked="" type="radio"/> No	<input type="radio"/> Yes
ESD Override thermostat	<input checked="" type="radio"/> No	<input type="radio"/> Yes
ESD Override Interrupter Timer	<input checked="" type="radio"/> No	<input type="radio"/> Yes
Remote Configuration		
Two Wire Priority	Open Priority	
Fast Remotes (DC Only)	<input checked="" type="radio"/> Disabled	<input type="radio"/> Enabled
Interlock disable	<input type="radio"/> Disabled	<input checked="" type="radio"/> Enabled
Conditional Control (NB: Disable Interlocks)	<input checked="" type="radio"/> Disabled	<input type="radio"/> Enabled
Conditional Control Error Indication Time (100ms)	- 2 +	
Motor Enable On Maintain	Disabled	
Push to run past limit	<input checked="" type="radio"/> Disabled	<input type="radio"/> Enabled
Remote Qualification Time (100ms)	- 1 +	
Local Configuration		
Local push to run	<input checked="" type="radio"/> Disabled	<input type="radio"/> Enabled
Local Qualification Time (100ms)	- 1 +	
Local Close Dominant Mode	<input checked="" type="radio"/> Disabled	<input type="radio"/> Enabled

Online : IQ3 Z61481001 Pakscan Convention 1 (via Bluetooth)    Actuator Login : Engineer    Insight 2 Login : Rotork Engineer

# Intelligent Actuator Benefits

- Double O ring Sealing
- Separately Sealed Terminal Compartment
- Synchrophase protection, Actuator always runs the right direction, preventing damage to valve actuator on power connection
- On board diagnostics / datalogging for ease of customer ownership
- Electronic torque and position sensing. Accurate. Reliable. Less parts needed.
- No special storage requirements



# Remote Control Options

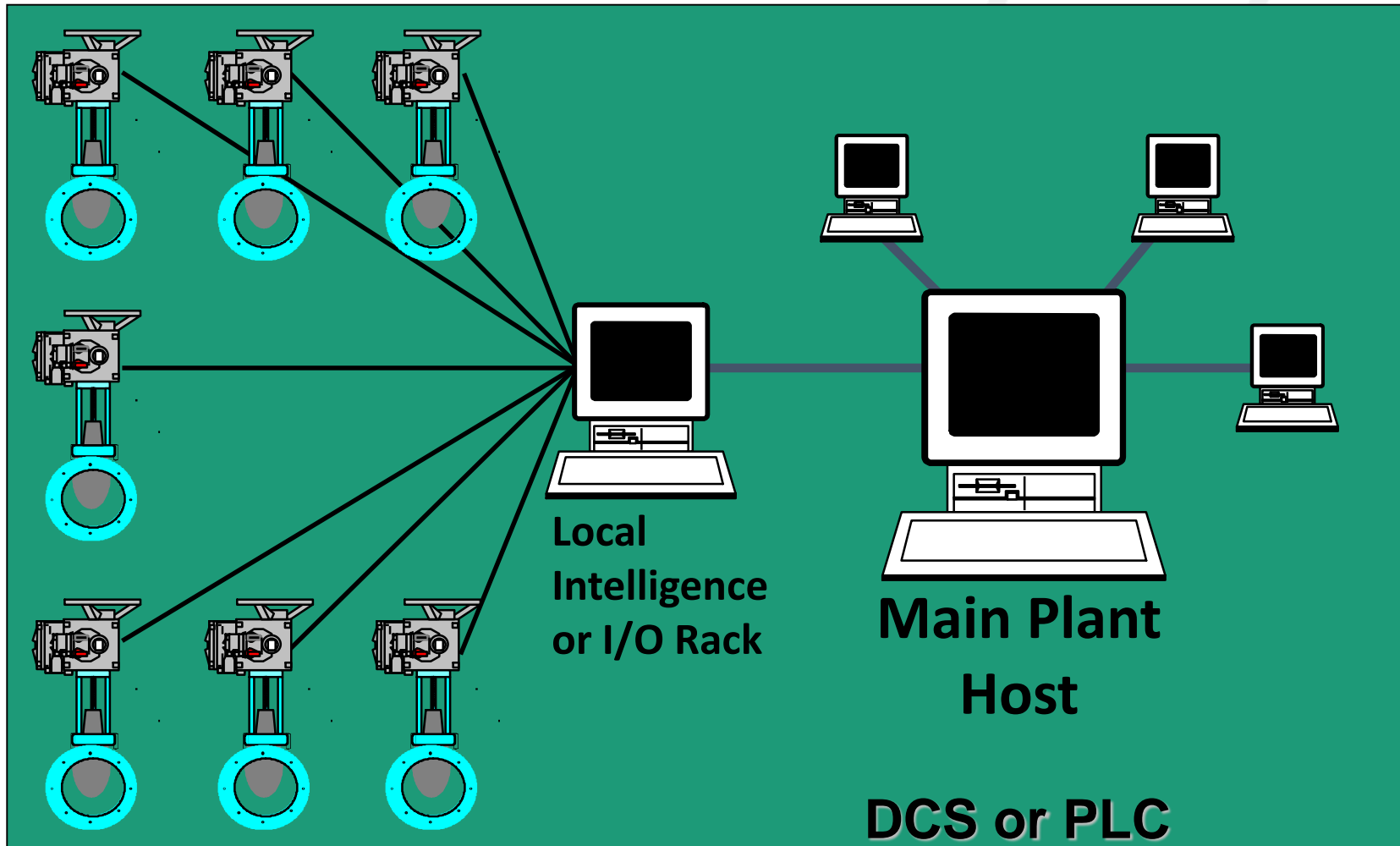
Traditional Hardwire Remote Control  
or  
Network control

- **Master Station Gateway BASED**
- **Modbus RTU/ TCP**
- **Profibus DP**
- **Foundation Fieldbus**
- **Ethernet IP**

# Traditional Remote Control

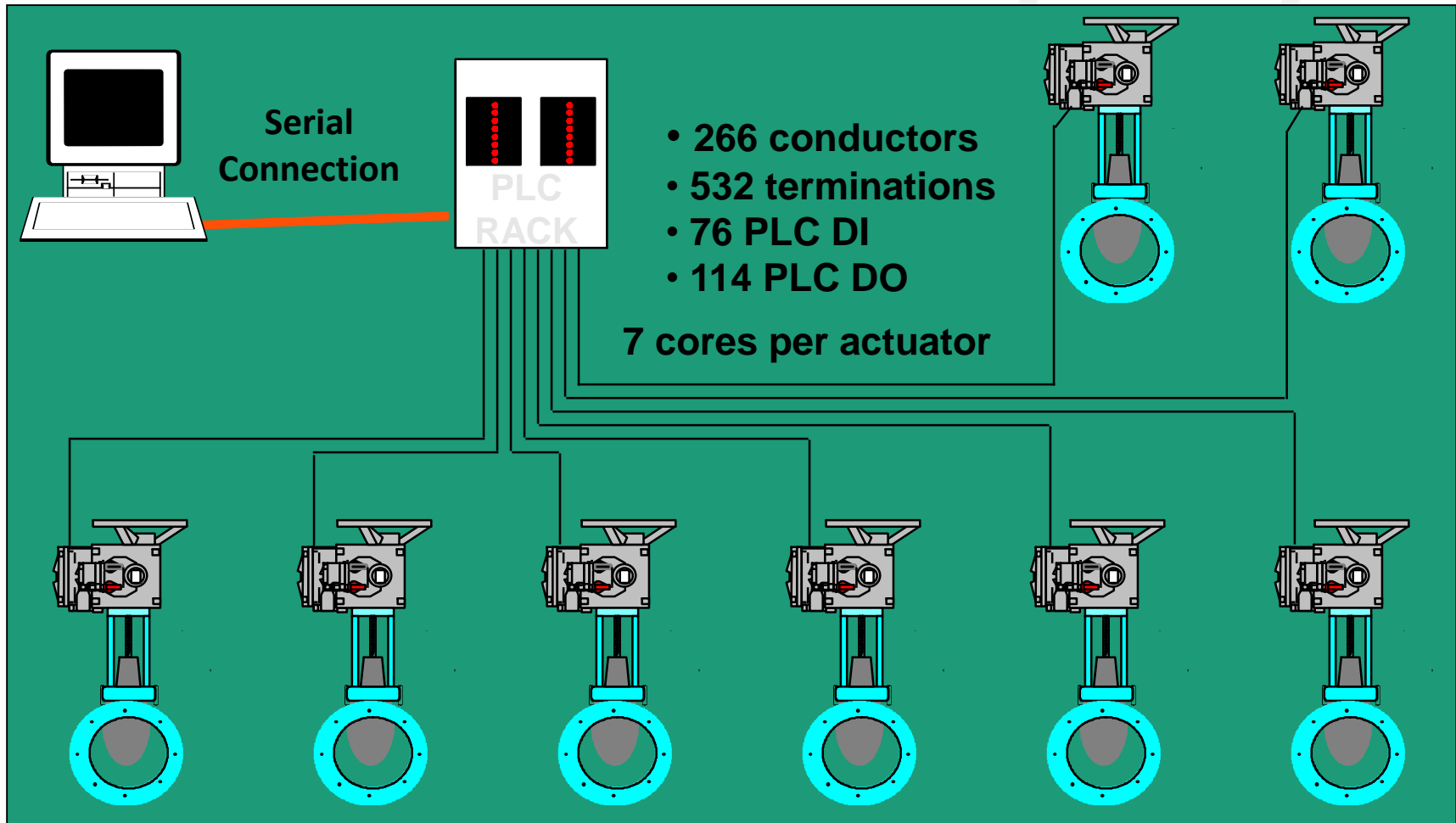


# Methods of connecting and controlling





# Basic PLC I/O connection to 38 valves (digital commands and indication)

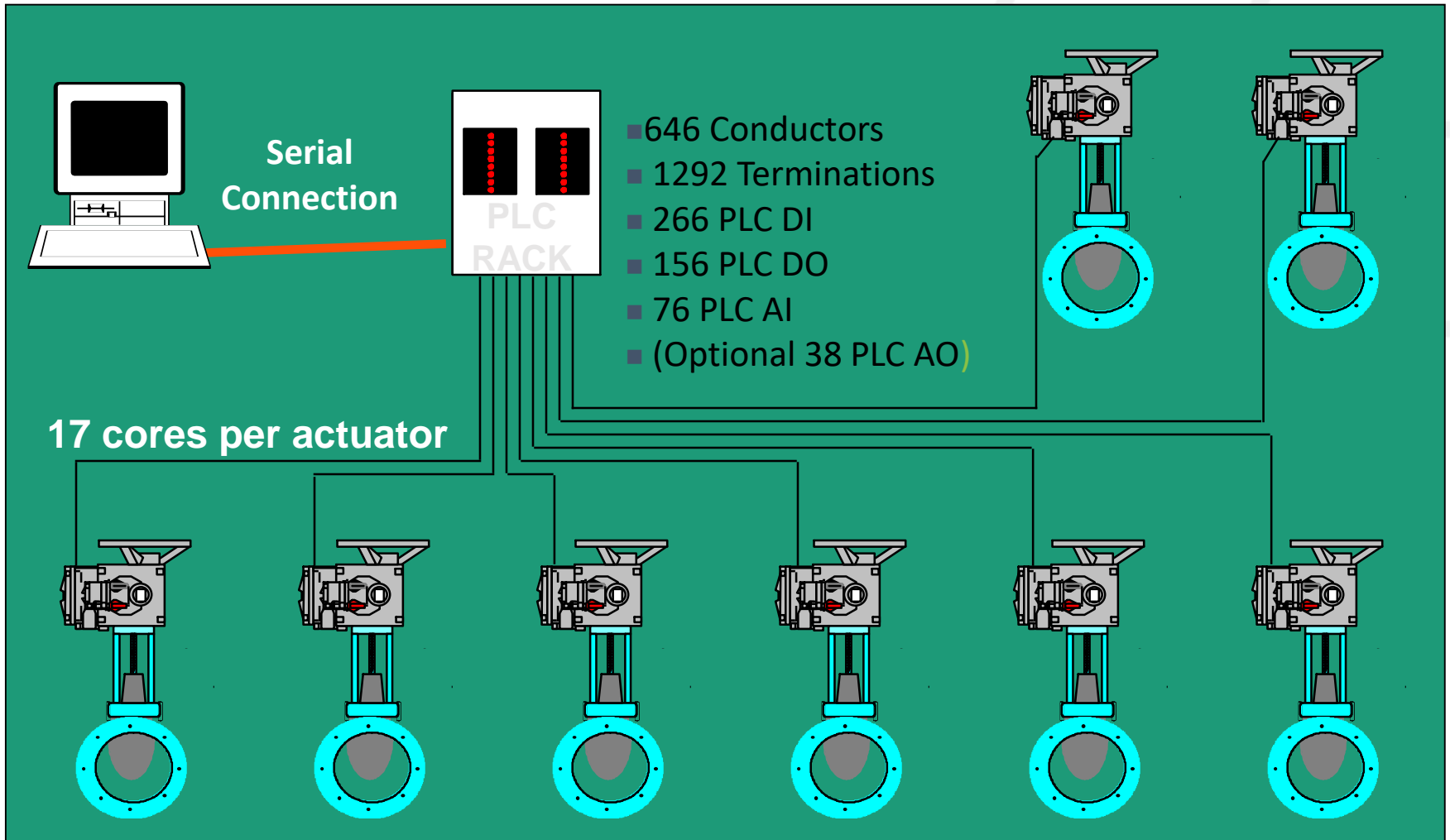


# Conductors for Monitoring..or why bother with smart valves?



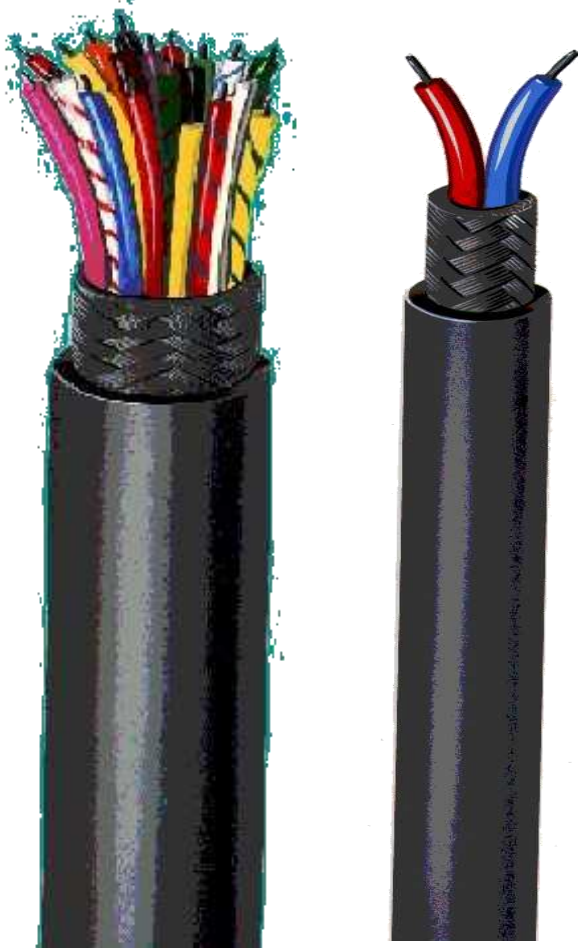
- End Position Indication 3
- Open Close Stop or proportional control 4
- Emergency shut-down 1
- Continuous valve position 2
- Available for control 1
- Local / Remote switch position 1
- Stop button pressed 1
- Motor running 1
- Torque switch tripped 1
- Torque throughout stroke 2
- Total conductors 17

.... and the same 38 valves with all commands, indications and alarms



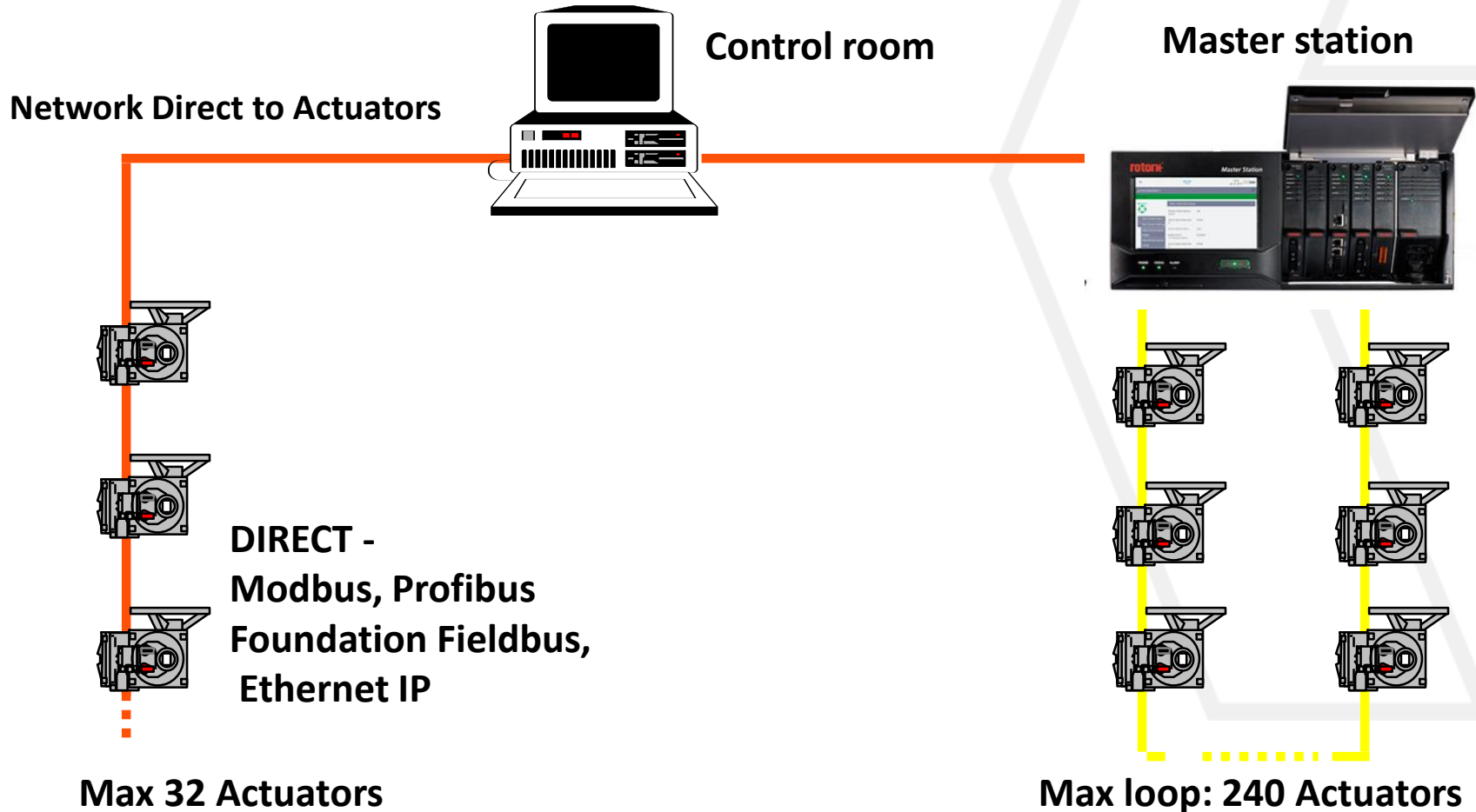


# Serial Communication Advantages



- Cable cost reduction
- Termination cost reduction
- Pre-defined communication formats

# Optional Digital Highways



# Factors that drive Network Control/Direct to Actuators

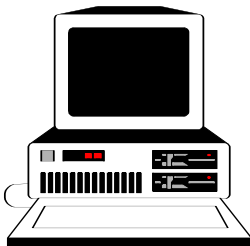
- Integrator or end user preferences
- PLC type/brand being used
- Quantity of actuators to be controlled
- Locations of actuators. Environmental concerns.
- Ease of integrating new equipment into existing control topology.

# Factors that drive Network Control with Master Station

- Desire to have an application specific HMI that provides detailed information to end user without the need to program them into the plc SCADA.
- Length of network. Longer distances can be a challenge for many direct network solutions.
- Built in standard communication redundancy.
- Ease of integration into existing network topology.



# Master Station Highway



**Host (DCS, PLC or PC)**

**RS232 / RS485/ OR ETHERNET**



**Masterstation**

**Shielded Twisted Pair**

**15 volt 20 mA Current Loop**



**Up to 240 Actuators – NO REPEATERS**

**10 - 12 miles**

# Master Station Based

Screen Navigation is via an easy to use touch screen HMI



# Data access (it's a window into your network):

- FCU parameters can be viewed, modified and stored
- Host communications analyzer
- Historical datalogger
- Communications network health
- This is a comprehensive control, indication, and alarm system.



# Network Control Benefits

## Cost Savings in Hardware and Assembly

Less hardware components (I/O, terminal blocks, barriers)

## Cost Savings in Engineering

Easier configuration

Easier preventive maintenance

Easier and faster system start-up

## Greater Flexibility

Improved functionality

Reduced down time

Accessible diagnostics throughout plant LAN or WWW

## Single Fault Tolerant (Break, Ground or Short)



# Thank You

- Thoughts, questions, concerns or disbeliefs?
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