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Introducing -

M-Mac Actuators Inc.

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History

- 1990 - company formed to design & manufacture custom machinery and hydraulic systems
- Projects include automated ferry ramps, sub-sea pipeline manipulator, helicopter grapples, fibre-optic junctions, etc.
- 1999 - first M-Mac Electro-Hydraulic Actuator made
- 2002 - patents granted
- 2004 - two hundred actuators sold for use in diverse applications

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M-Mac Electro-Hydraulic Actuators

Custom Linear Actuators
(4,400 - 32,400 lb thrust)

Rotary Actuators
(up to 800,000 lb.in torque)

Small Linear Actuators
(up to 3,000 lb thrust)

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The M-Mac Electro-Hydraulic Linear Actuator

Slide 5

MH20-12-C-1

For continuous modulation of a scrubber damper in a Bowater Pulp Mill, Alabama

Internally-mounted absolute magneto-strictive position sensor for closed-loop control

Head-mounted

7,800 lb force

10” stroke

1 inch/sec

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MT25-C

Continuous modulation of flue-dampers at Kennecott Utah Power Plant

Slide 7

MC25-10

For automobile manufacture in Korea

12,200 lb force

10” stroke

1 inch/sec

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M40T
“Mighty - Mac”

32,000 lb thrust

Simulates earth-quake forces on buildings

Instrumented for absolute position (Temposonic sensor) and load-cell force measurement

Continuous Duty Cycle

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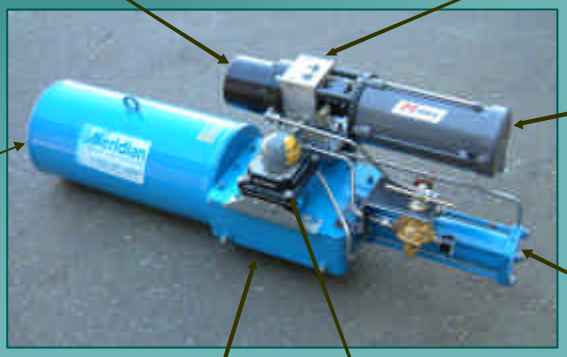
The M-MacRotary Actuators

Scotch-yoke 1/4 Turn Rotary Actuator

High start- and end-torques, up to 400,000 lb.in torque at 1,500 psi



Slide 10

M-Mac/Parker 3/4-Turn Rotary Actuator

Double-cylinder rack-and-pinion design

Up to 600,000 lb.in torque at 3,000 psi

For modulating valves, ESD valves, flue dampers, etc.

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The M-Mac Small Actuators

Lightweight aluminum construction

12 or 24 volts DC

Thrusts up to 3,000 lb

Direct replacement for screw actuators

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Key Features

- **Factory filled and hermetically sealed**
  leak-free in any orientation – quick to install
- **Self-contained - no separate power unit**
  no pipes or fittings to install or to leak
- **No solenoid or servo-valves**
  simple and reliable
- **Motor-Controlled Operation**
  precise positioning and speed
- **Load-lock on loss of power**
  check valves hold load indefinitely and safely
- **Quiet**
  no gear train noise

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Value Proposition:
M-Mac vs HYDRAULIC

- Fast & clean installation
- No leaks & no maintenance
- Same performance & life
- Same cost
- Other advantages:
  - High efficiency / low power draw
  - No solenoid valves
  - No hoses, pipes or fittings
  - No oil contamination of oxidation
  - Factory filled & sealed

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Value Proposition:
M-Mac vs PNEUMATIC

- Better reliability
- Better performance (stiff action and higher force)
- Less cost
- Other advantages:
  - Lower energy draw
  - No piping
  - No airlines to freeze
  - Internal corrosion/jamming eliminated
  - Less noise

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Value Proposition:
M-Mac vs SCREW ACTUATORS

- Twice the force density
- Five-to-ten times the life
- Same cost
- Other advantages:
  - Tougher (dirt, moisture, abuse, heat, shock)
  - Higher efficiency / lower power draw
  - Safer (load-lock by check valves)
  - Quieter

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Models Available

Model	Push Force (pounds)	Pull Force (pounds)	Strokes (inches)
MM15	3,000	2,500	4 to 12
M15	4,400	3,300	4 to 14
M20	7,800	5,700	4 to 20
M25	12,200	8,500	Up to 44
M30	17,600	11,600	Up to 44
M35	24,000	16,200	Up to 44
M40	31,400	23,500	Up to 44

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Typical Applications

Valve Actuators	Feed water valves, attemperating spray valves, emergency shut-down valves, choke valves
Process Control	Damper drives, turbine governors, air register drives, burner shut-off dampers, igniter gun drives, fuel atomizer drives)
Manufacturing	Robot arms, product-handling, lift-tables, conveyor diverters, etc.
Patient Handling	Hospital beds, operating tables, airline seat actuators
Test Equipment	Building materials, product testing
Steering Systems	Tractors, man-lifts, boats
Military Equipment	Tanks, aircraft launch systems

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User List

John Deere

US Navy

US Air Force

Kimberley Clarke

US Postal Service

Kennecott Copper

University of California, Berkley

Blue Circle Cement

Saskatchewan Wheat Pool

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Summary

M-Mac Actuators has:

- A technologically and economically advanced motion control product
- Patented technology
- A proven product - 4 years of field trials
- M-Mac can produce an EHA for your application

Questions ?

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Appendix

The following slides show common modes of actuator control followed by some general specifications.

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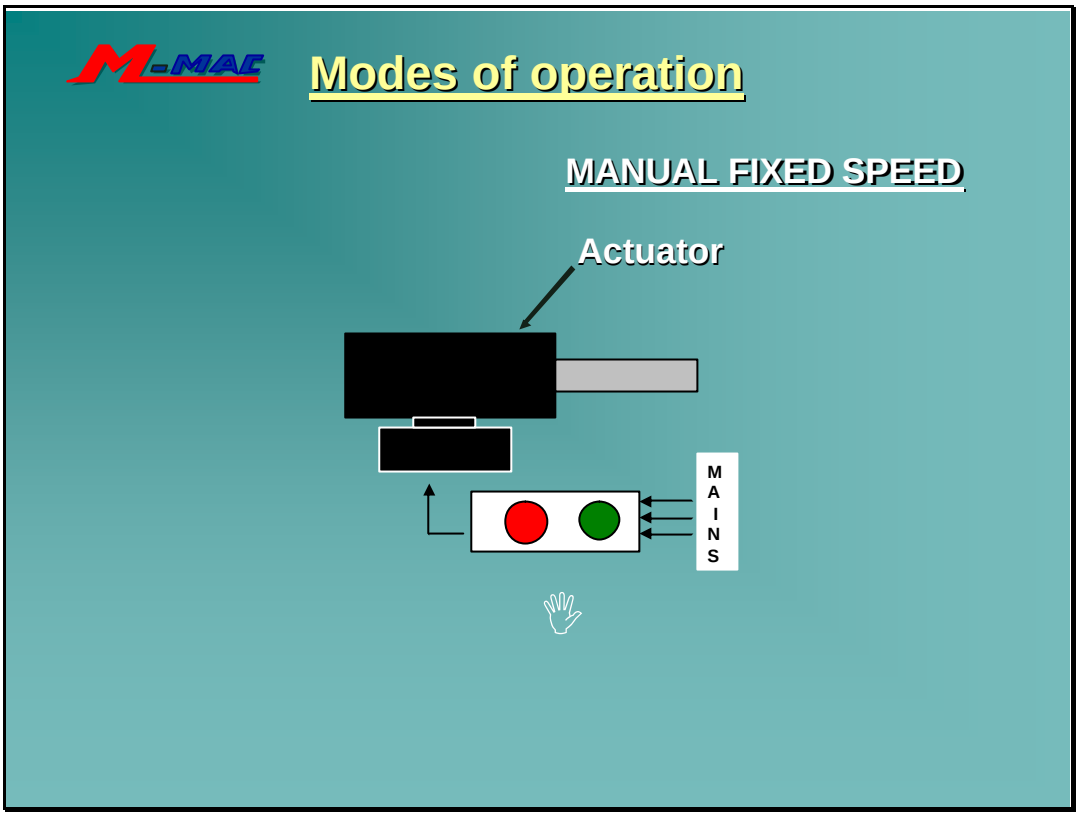

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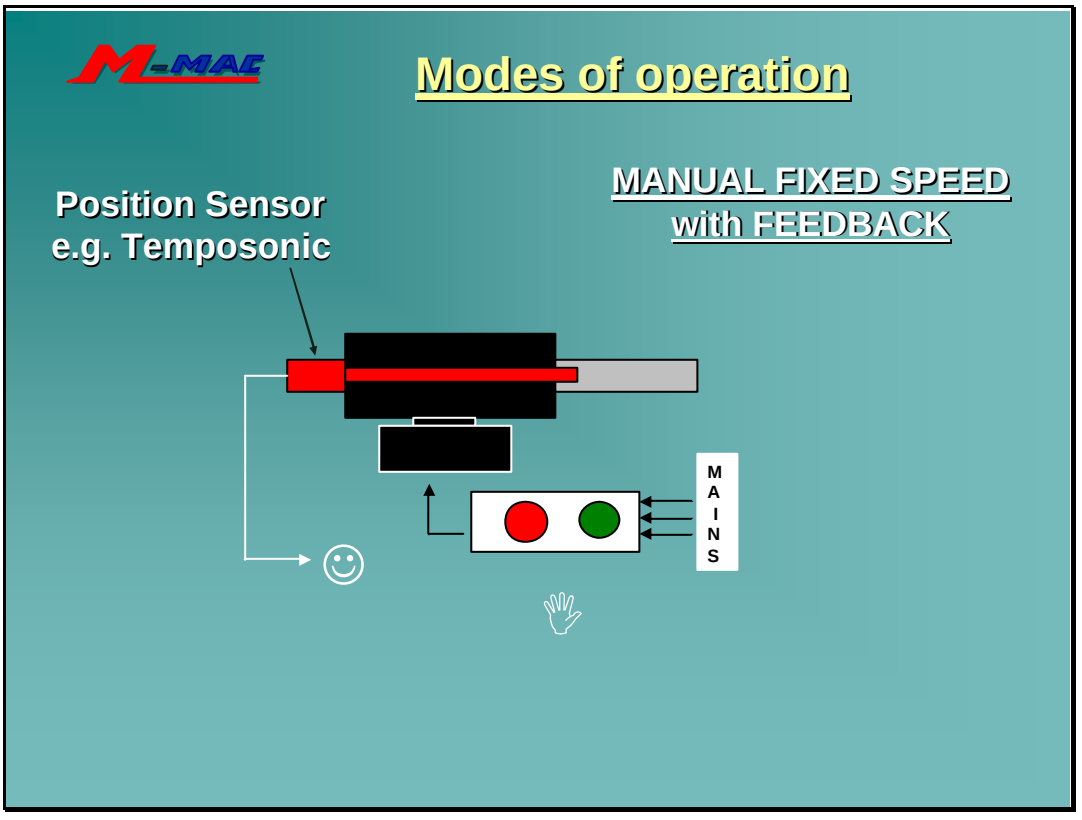

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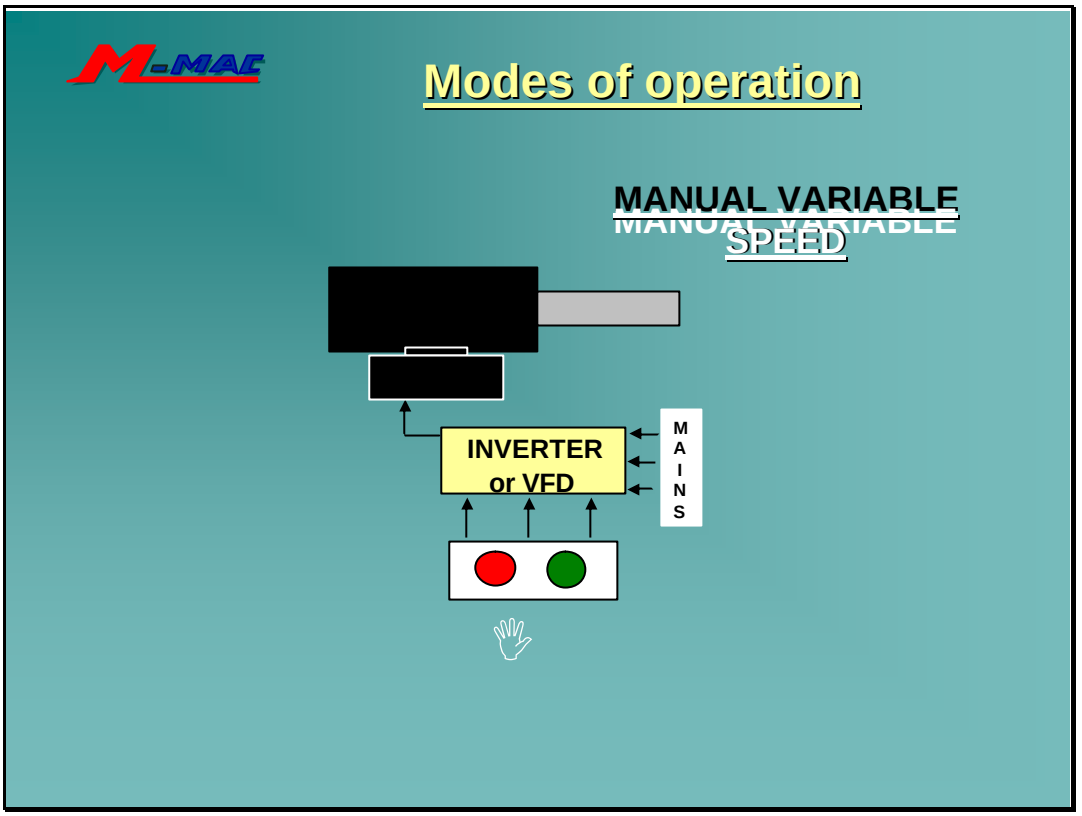

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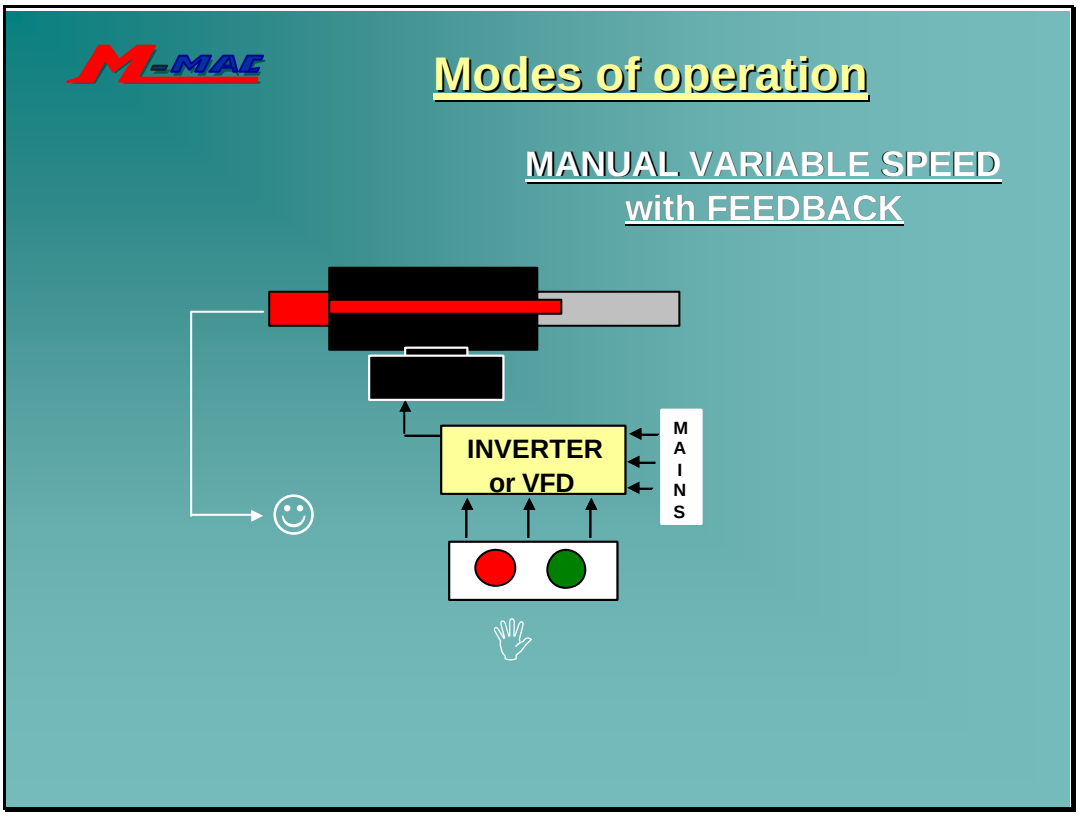

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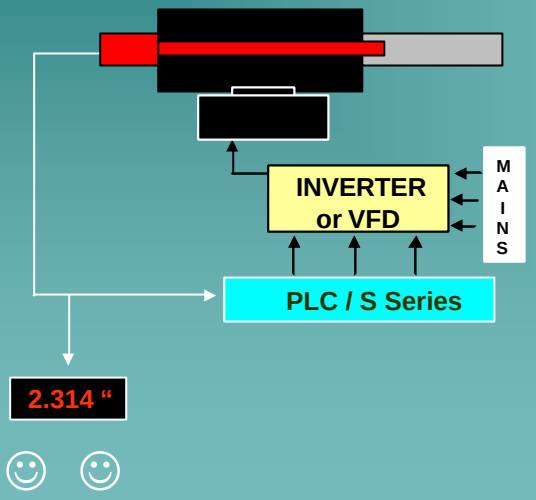
Modes of operation

FULLY CLOSED LOOP POSITION and SPEED CONTROL.



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Small Actuator Specification

Weight	1.5Kg
Stroke	200 mm
Force Output	2,600 N
Speed	Zero to 14 mm/s
Noise	38 dBa
Voltage	24 volts DC
Temperature	-55 C to 85 C, storage
Creep	1mm in 24 hours loaded
Manual Override	lever operated valve
Load Sensing	Pressure sensor/loadcell
Position Sensing	Absolute
Life	1E6 cycles minimum
Maintenance	Zero
Operating Pressure	Adjustable
Flammability	Customer defined
Abuse loads	Customer defined
Crash loads	Customer defined