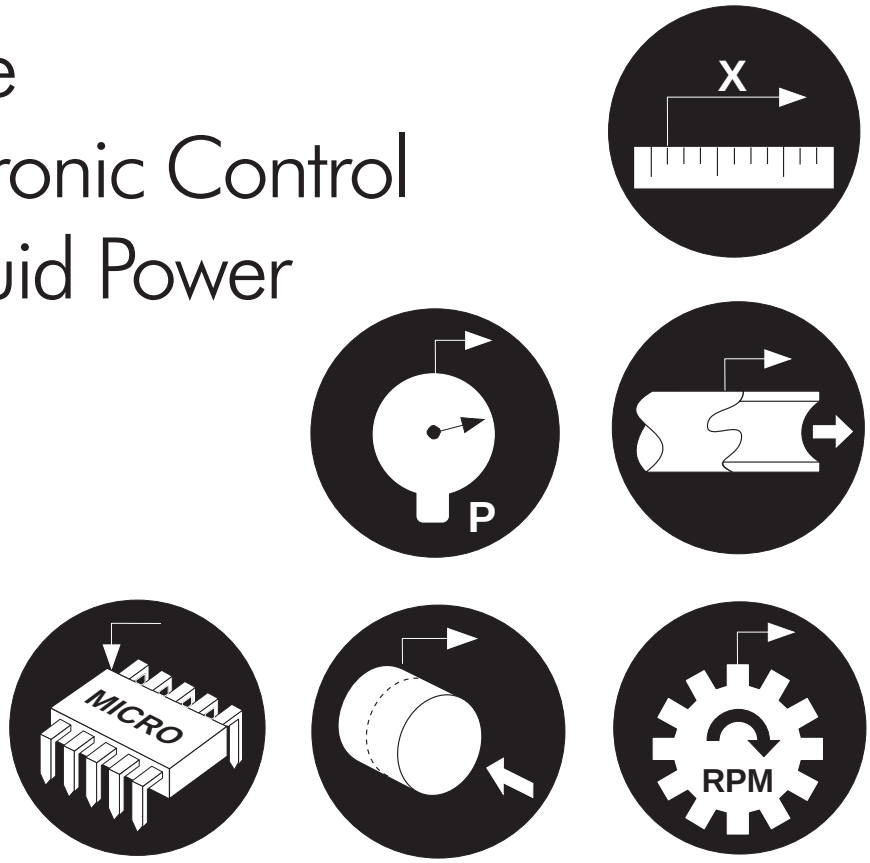
Your Guide to the Electronic Control of Fluid Power



The members of the National Fluid Power Association (NFPA) have prepared this application as an introduction to the electronic control of fluid power. The application and components described here are representative — electrohydraulics and electropneumatics can be effectively utilized in countless processes, and components are available in many different sizes and configurations.

NFPA's manufacturers invite you to contact them for additional information.

National FLUID POWER Association®

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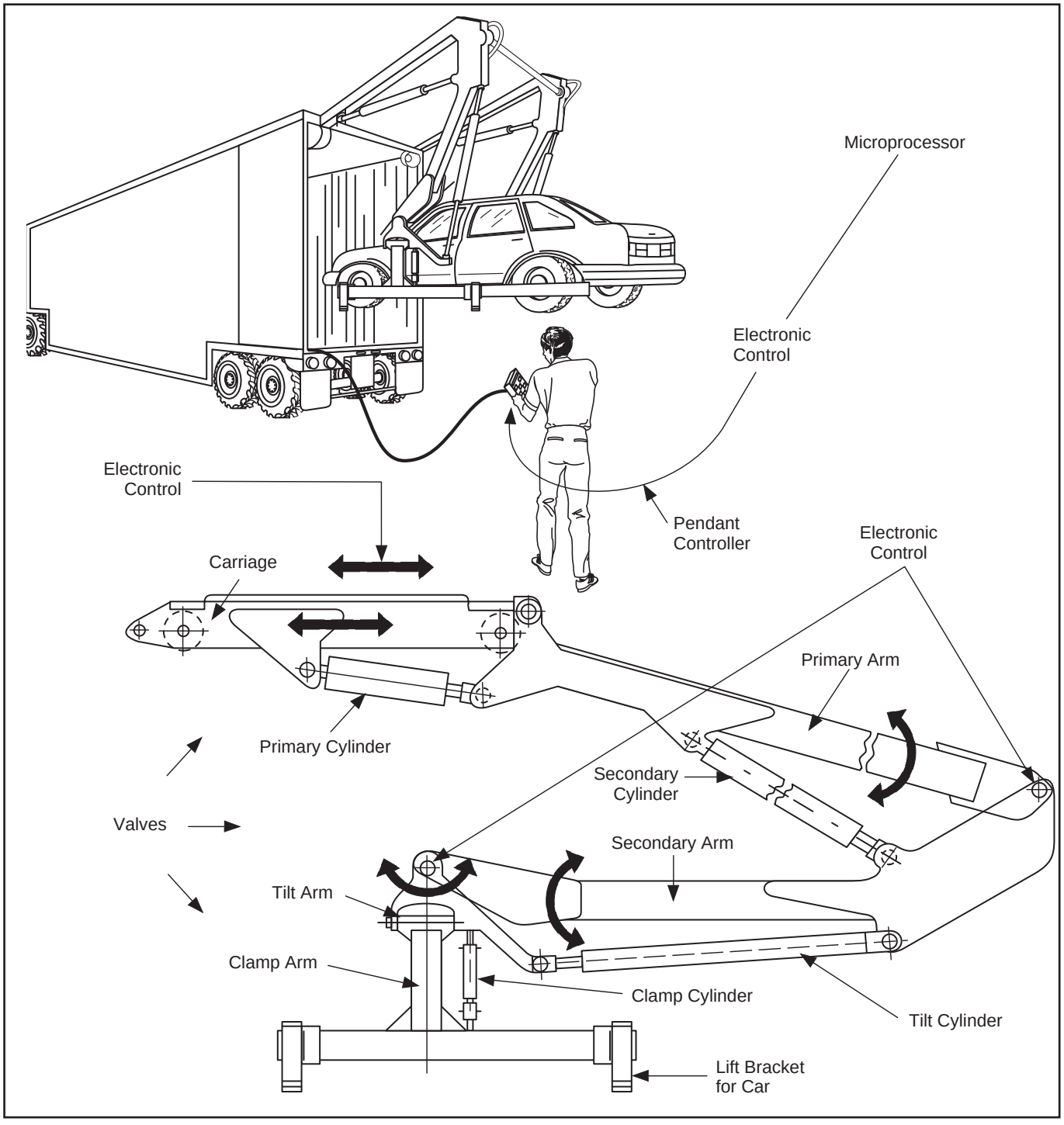
Electrohydraulics at Work

Jackknife Carloader

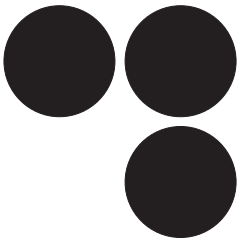


The Problem

Conventional car-transport trailers are difficult to load and keep secure, and the cars they carry are at the mercy of the environment. Yet how otherwise can cars be transported?

Its Solution

There happens to be a way. One manufacturer has built a few hundred transporters with a unique design that overcomes all the above problems. It is a closed trailer with a built-in electrohydraulic robotic system that picks



up the cars and inserts as many as eight of them into its interior. After the hatch is closed, the transporter looks like any other large truck and enclosed trailer rig, and the cars are totally protected.

Only electrohydraulics can do the job since electric motor driven cables or leadscrews don't generate sufficient forces and torques within the narrow envelopes allowed. The work is done with articulated arms, flush to the inside walls of the trailer, that reach out over eight feet to quickly lift and ingest a full-size automobile. The only manual steps required involve sliding a pair of aluminum support rails under the car to capture the tires—and then securing the car to the rails.

The robot carriage rides along horizontal tracks just under the trailer's roof. The robot carriage travels to the designated position and deposits its load on heavy pins which swing out automatically.

Eight hydraulic cylinders power the linkages, commanded by a integral microcomputer that is programmed with over 5000 lines of instruction. The keyboard is on a pendant, connected to the electrohydraulic system via a plug-in umbilical. The operator, standing alongside, may call for fully automatic response from liftoff to full insertion, or choose step-by-step motions such as *lift* and *tilt forward.*

Synchronization is under constant computer control because at every angular position of the multiple linkages there are greatly different fluid flows, fluid pressures, forces, torques, and link velocities.

Each parameter is calculated and controlled continuously to ensure that motion is accurate and smooth, with no sudden starts or stops. Proportional directional control valves adjust hydraulic flow to each cylinder. Electronic signals to the solenoids are purposely *ramped* by the microcomputer to control acceleration and deceleration.

All angular motions are carefully monitored with feedback signals from four precision rotary resolvers integral with the linkage elbow pins. An inductive linear position sensor along the wall of the trailer senses carriage position.

Linkage angles vary from nearly zero (folded flat) to over 90 degrees. The most highly stressed position occurs when the arms are at full extension from the rear opening of the trailer, where the primary cylinders ($4\frac{1}{2}$ inch bore) develop a force of over 32 tons. Transient peak pressures reach 2400 psig.

Related Applications

Electrohydraulic robots always are found where electromechanical robots haven't the strength or compactness to do the job. An example is the lifting and placement of extremely heavy parts for precision assembly of massive machinery.

How Electronics Improved This Application

- Speed
- Accuracy
- Automation
- Flexible placement of control
- Adjustable sequence and timing
- Standard components

Components Used in Mobile Hydraulic Systems*

Accumulators
Controls (electronic) and Software
Cylinders
Filters
Fittings
Flanges
Fluids
Gauges
Heat Exchangers
Hose
Hydrostatic Drives
Manifolds
Motors
Power Units
Pumps
Pump Drives
Reservoirs
Rotary Actuators
Seals
Shaft Coupling
Shock Absorbers
Switches
Tubing
Valves

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