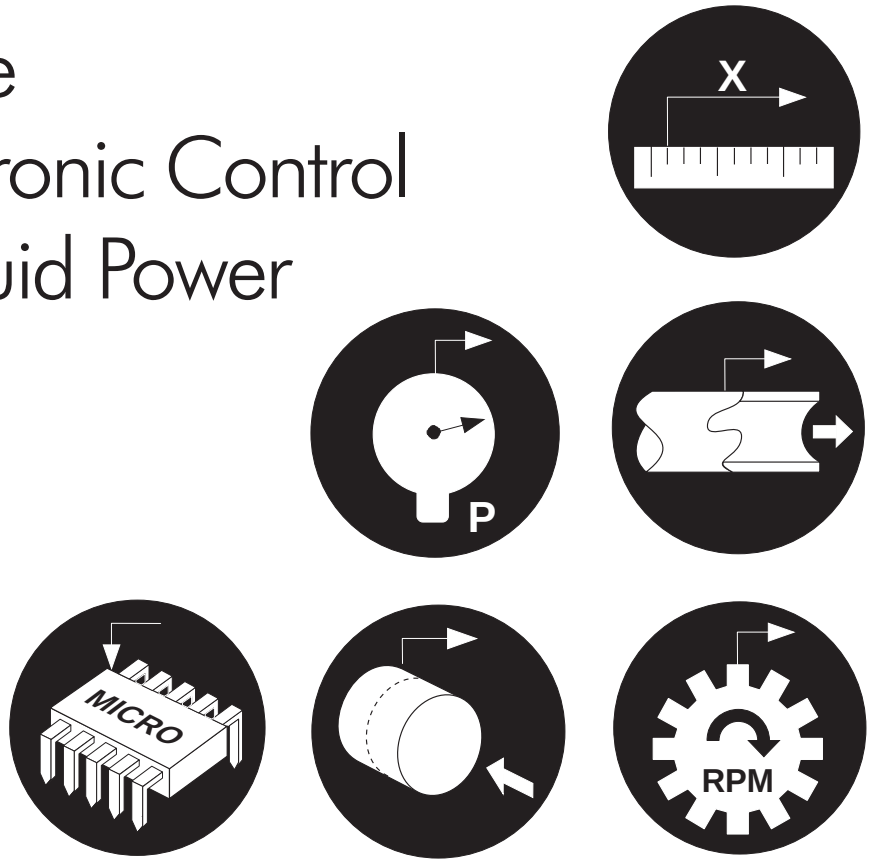
Your Guide to the Electronic Control of Fluid Power



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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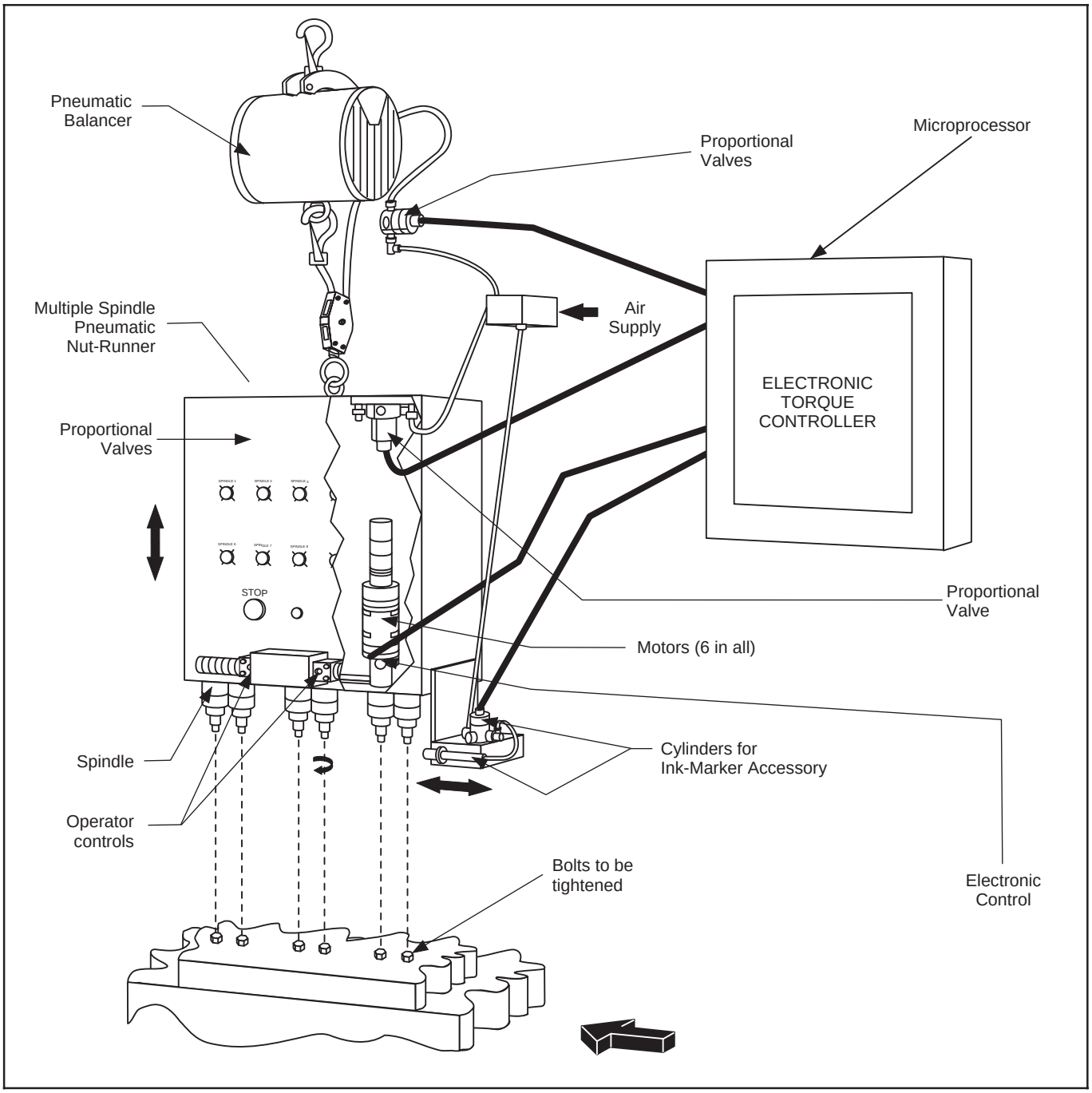
Electropneumatics at Work

Pneumatic Torquer for Engine Bolts



The Problem

Torquing of bolts is a universal problem in every industry. The end result is supposed to be a threaded joint that is perfectly *made up* and therefore safe and tight.

But hidden discrepancies, such as inadvertent *cross-threading* when the bolt is first inserted, give misleading signals to the mechanic or to the torquing-machine controller. For example, if a bolt is cross-threaded, the static torque reading will be high, yet the bolt may not be tightened down the entire way. This has serious implications because a mis-tightened bolted joint can fail and create hazardous conditions for the user of the vehicle or machine. Only dynamic measurements, carefully interpreted during the entire torquing operation, can uncover these discrepancies. It takes electronics combined with precise torquing to do it right.

Those challenges faced engineers when they started the design of a novel computerized *nut-running* (torquing) system for an assembly line of truck and bus engines. In this example, a turbo inlet duct was to be attached with six bolts to the intake manifold of a V-8 truck engine. Previous designs of nut runners had brushless electric motors doing the work of torquing, but the designers had become disenchanted with the complexity and service costs.

Its Solution

Their answer was to go fully electropneumatic and exploit the compressed air systems already available in most plants. It proved to be a good decision, and considerable money was saved by all concerned. Standard pneumatic motors, one for each of the six spindles, fit in perfectly, and readily available electronic hardware and software filled most of the need for monitors and control devices.

In operation, the software calls for pressurization of the pneumatic motors when an external signal is given, and torque transducers monitor the motor outputs when the bolts are being tightened. When the pre-programmed operating parameters (including dynamic checks of performance) are satisfied, solenoid valves are instructed automatically to shut off compressed air to the motors.

Final torque is prominently displayed along with checking values for high, low and accept status. The last 100 cycles of operation are stored for reference in computer memory.

Another feature is a pneumatic support system to raise and lower the nut-running apparatus. It automatically pressurizes a pneumatic motor to exactly support the nut-runner, and allows the operator to raise and lower the weight quickly by overriding the balance pressure command. When the apparatus has been lowered over the bolts to be torqued, the operator need only push the start button. The pneumatic support system automatically goes into the *drift down mode* to keep the spindles engaged to the fasteners, and begins the controlled torquing without operator intervention.

Data outputs are provided for coordination with anticipated plant-wide management systems, thereby allowing for statistical analyses. Addition of monitors and controls for the spindle motions to keep track of each fastener's angular and linear position would provide further upgrade.

Related Applications

Virtually any threaded fastener—including nuts, bolts and screws—can be driven with an instrumented fastening system. Logical applications include automotive, aerospace, appliance, ship-building, electric motors, machine tools and off-the-road equipment. (It would be easier to name the industries that DON'T need instrumented fastener technology.)

How Electronics Improved This Application

- Dynamic control of torque
- Automatic operation
- Complex monitoring and diagnostics
- Ties in with plant-wide management
- Enables use of low-cost air

Components Used in Pneumatic Systems*

Actuators
After Coolers
Air Compressors
Air Dryers
Air Line Lubricators
Controls (electronic) and Software
Cylinders
Filters
Filter/Regulators
FRLs
Fittings
Gauges
Grippers
Hose
Manifolds
Motors
Mufflers
Regulators
Rotary Actuators
Seals
Shock Absorbers
Slides
Switches
Tubing
Vacuum Products
Valves

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