

Using Proportional Valves (UPV) *Developed for Industrial Mechanics, Electricians and Controls Technicians*

- Proportional valve fundamentals
- Proportional valve schematic symbols (on-going throughout the seminar)
 - Compare and contrast standard directional control valves and electro-hydraulic proportional valves
 - Modulating valve vs. non-modulating – “bang-bang” vs. controlled spool opening
 - “automatic” speed controlling DCV
 - Valve sizing for efficient and accurate control is an important consideration
 - All proportional valves require an electronic driver amplifier – on board or separately installed
 - Proportional DCV valves are manufactured in various ANSI/ISO patterns and most sizes have multiple (designer) selectable flow rates
 - The solenoid/s for proportional valves are DC powered and do not develop “in-rush current and therefore are virtually burn out proof
 - The solenoids for direct operated non-feedback DCV’s develop a constant force over their entire useable (spool) stroke.
 - The solenoids for direct operated spool position feedback DCV’s do not develop a constant force over their entire useable (spool) stroke. The spool position feedback transducer accurately controls the valve’s spool position
 - Proportional valves have been available for almost 100 years. DCV do not need to be proportional solenoid controlled
 - Hand operated DCV’s are proportional valves
 - Pilot pressure controlled valves can be proportional i.e. controlled by reducing valves
 - Understanding of throttle valve principle – the method by which actuator speed control actually works – valve sizing is very important for well a controlled actuator and its load
 - Proportional DCV’s control actuator direction, speed, load, acceleration & load deceleration (smooth shockless actuator-load starts and stops) *warning: Mother nature’s laws of physics still apply regarding the minimum time for acceleration & deceleration*
 - Proportional valve speed control works by the principles of throttle valve speed control except that proportional valves meter-in and meter-out at the same time
 - The purpose and application of 2:1 DCV spools
 - Understanding proportional DCV spool types and their intended application
 - On-board electronic driver amplifiers vs. separately installed electronics
- Understanding proportional relief valves
 - Direct-operated vs. pilot operated relief valves – with and without feedback
 - Uses
 - Variable, adjustable, automated control of (pump) system pressure
 - Pilot pressure signally for pumps and other pilot pressure spool shifted DCV’s
- Understanding proportional relief valve construction
- Drive amplifier control of proportional relief valves – on board vs. separately installed
- Functional operation of relief valve drive amplifiers
- Understanding proportional pressure reducing valves
- Compare and contrast prop. relief valves to prop. reducing valves – operation and application
- Understanding proportional flow control operation and application

- Proportional valve pump and motor applications
 - Remote pressure control – optimizing system pressure for the immediate needs of the hydraulic system
 - Controlling pump displacement – hydraulic system flow for the immediate ‘speed’ needs of a hydraulic actuator, actuator accel/decel rates
 - Controlling hydrostatic transmission flow direction, actuator accel/decel rates, speed, starting and stopping of the hydraulic motor that is connected to the pump
 - Controlling hydraulic motor displacement for the purpose of controlling hydraulic motor torque (and hydraulic motor HP demand)
- For Bosch Rexroth valve users – understanding the requirements if any for changing to new series valves
- Understanding the functional operation of separately installed valve driver amplifiers – voltage signals – use for monitoring operation and troubleshooting (specific information provided for each valve for each lab exercise)
- Lab exercises
 - Operation and control of a proportional PO relief valve
 - Operation of a direct operated proportional relief for the control of a variable displacement pressure regulating pump’s system pressure
 - Function, operation of a direct operated non-feedback DCV valve + voltage measuring exercise
 - Function and operation of a spool position feedback direct operated DCV
 - Using a ‘breakout’ box for troubleshooting on-board electronic valves
 - Function and operation of a non-feedback pilot operated DCV
 - Lab or demonstration of a proportional pressure reducing valve
 - Lab or demonstration of a proportional flow control
- Ideas for proper valve selection that will meet the performance needs of the hydraulic axis
- Compare and contrast open process loop control vs. closed process loop control – fundamental understanding of the difference between valve driver amplifier and a hydraulic axis controller – PID
- Why is valve sizing so critical and what does this mean for the maintenance person?