

4/3 Directional Control Valve

Objective:

This exercise will demonstrate the operation of 4/3 directional control valves


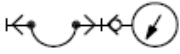
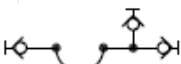
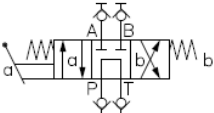
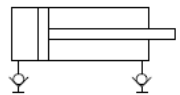
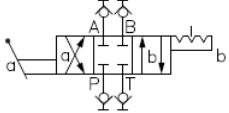
Fundamentals:

Four port directional control valves are typically used to control bi-directional actuators (cylinders or motors). We utilize a three position valve when we would like an actuator such as a cylinder to have the capacity to stop in some intermediate condition. In this case the positions of the valve could be identified as STOP (centre position) FORWARD and REVERSE.

The configuration (port connections) of the centre condition are determined by the type of pump we are using (fixed or variable displacement) and the type and operation of actuator being used.

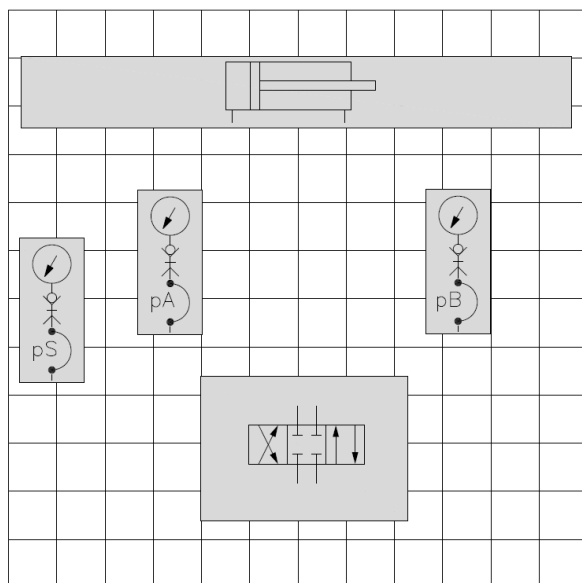
Components:

You will require the following components:

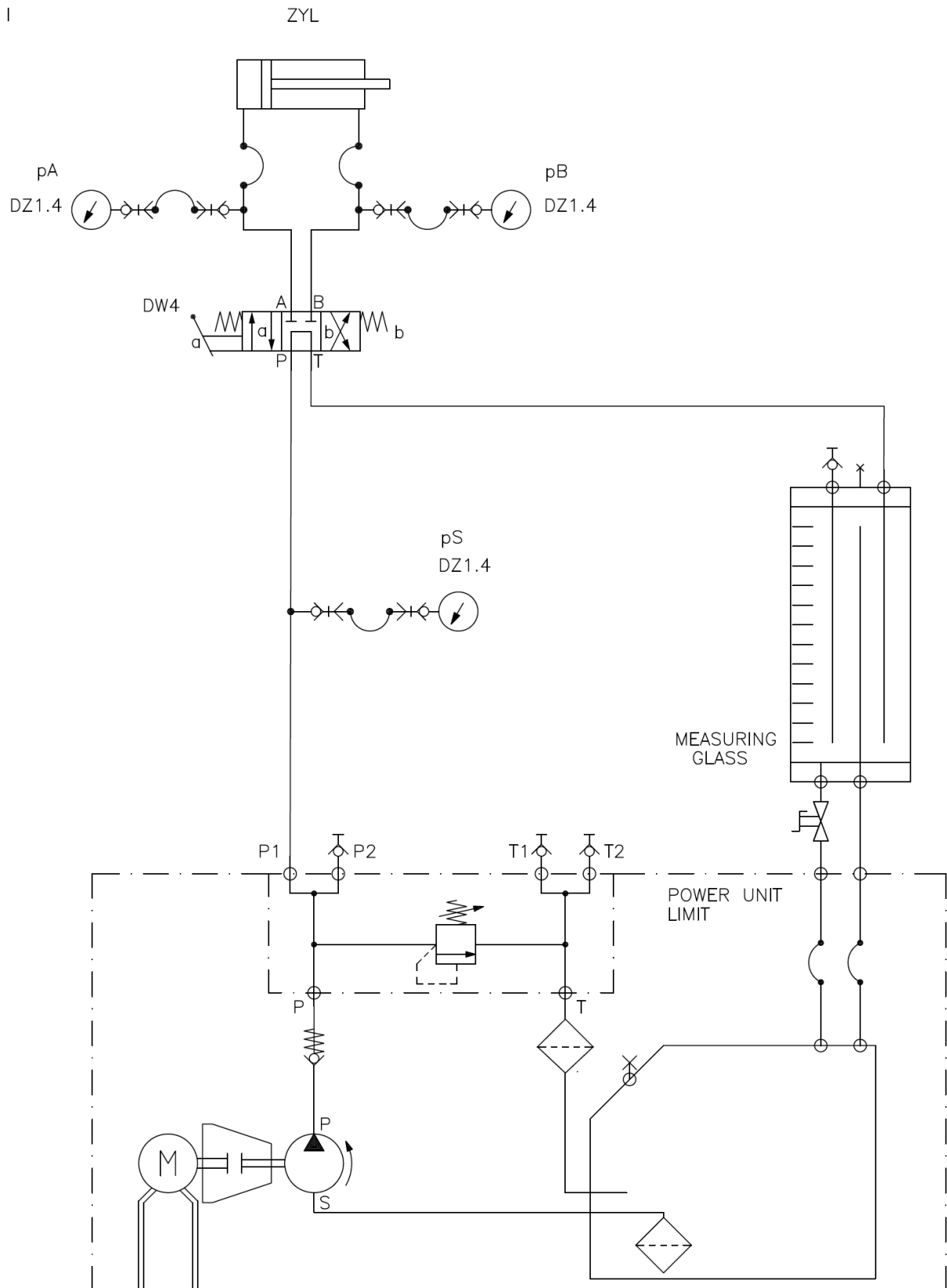
	Hose assembly					
3x	Hose assembly c/w gauge connection			3x	Pressure gauge DZ1.4	
1x	Directional control valve DW4 (part I)			1X	Hydraulic cylinder	
				1x	Directional control valve DW5 (part II)	

Procedure:

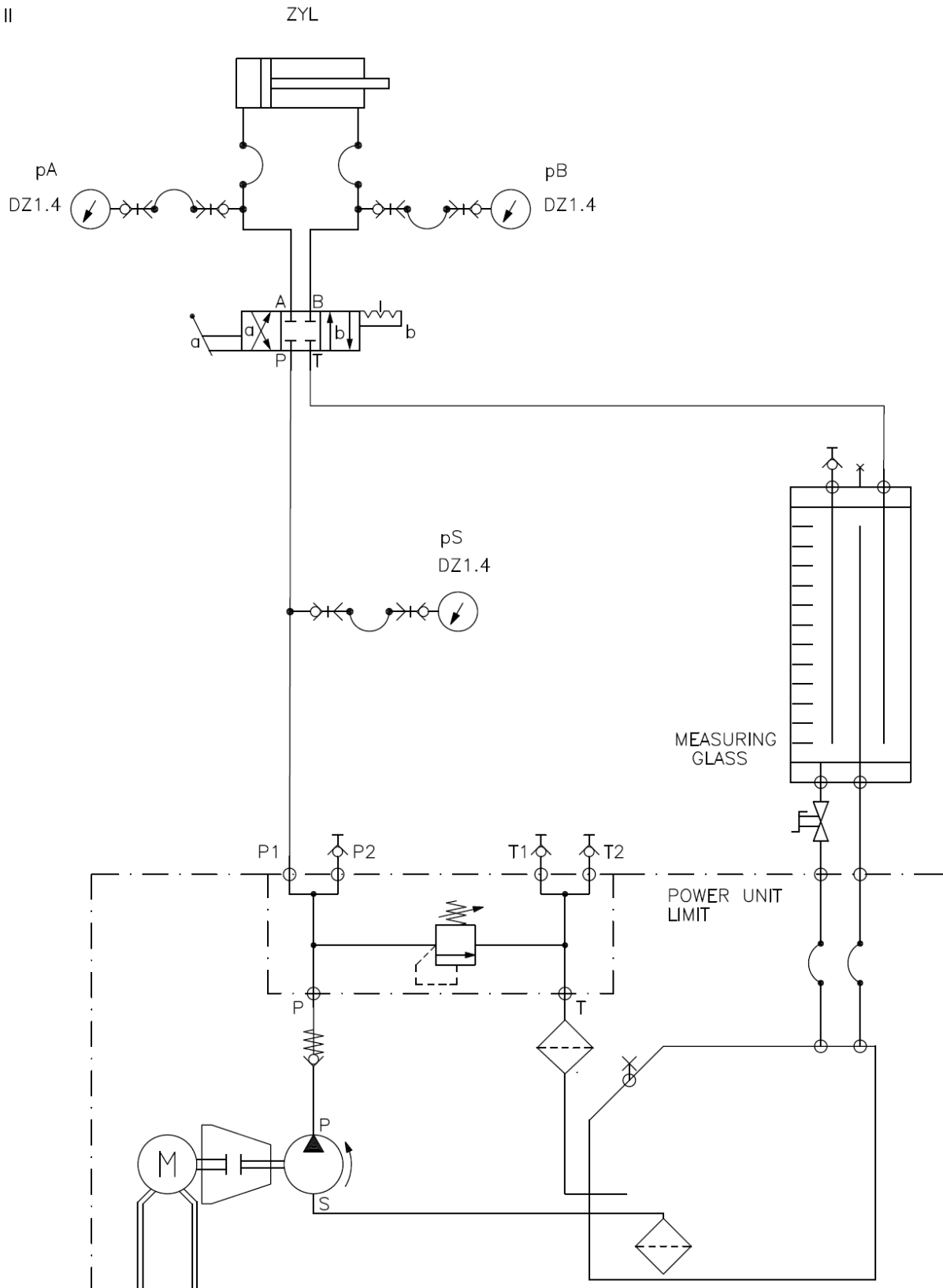
Mount the individual components on the training stand grid and connect them according to the circuit diagram. Compare the operation of the two circuits and answer the questions posed at the end of the exercise.



Part I



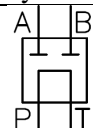
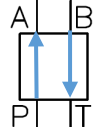

Part II



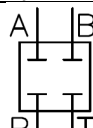
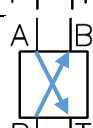
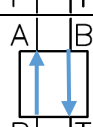
Instructions

- Prior to starting the power unit the directional control valve should be in its default position (position 0)
- Start the hydraulic unit and note and record in the following table the system pressures as well as any motion noted at the hydraulic cylinder
- Shift the directional control valve to the various positions and describe the resultant cylinder motion. Record the pressures while the cylinder is in motion.
- Change the circuit to match that shown in part II and repeat the above steps
- The last column in the table is for you to draw in the relevant valve envelope symbol for each position of the directional control valve based on the observed cylinder movement.

Part I

Lever position	pS	pA	pB	Cylinder movement	Valve symbol
Centred	100 psi	0 psi	0 psi	None	
Shifted left	175 psi	30 psi	30 psi	Extend	
Shifted right	600 psi	175 psi	500 psi	Retract	

Part II

Lever position	pS	pA	pB	Cylinder movement	Valve symbol
Centred	725 psi	0 psi	0 psi	None	
Shifted left	600 psi	175 psi	500 psi	Retract	
Shifted right	175 psi	30 psi	20 psi	Extend	

Do not disconnect the circuit.

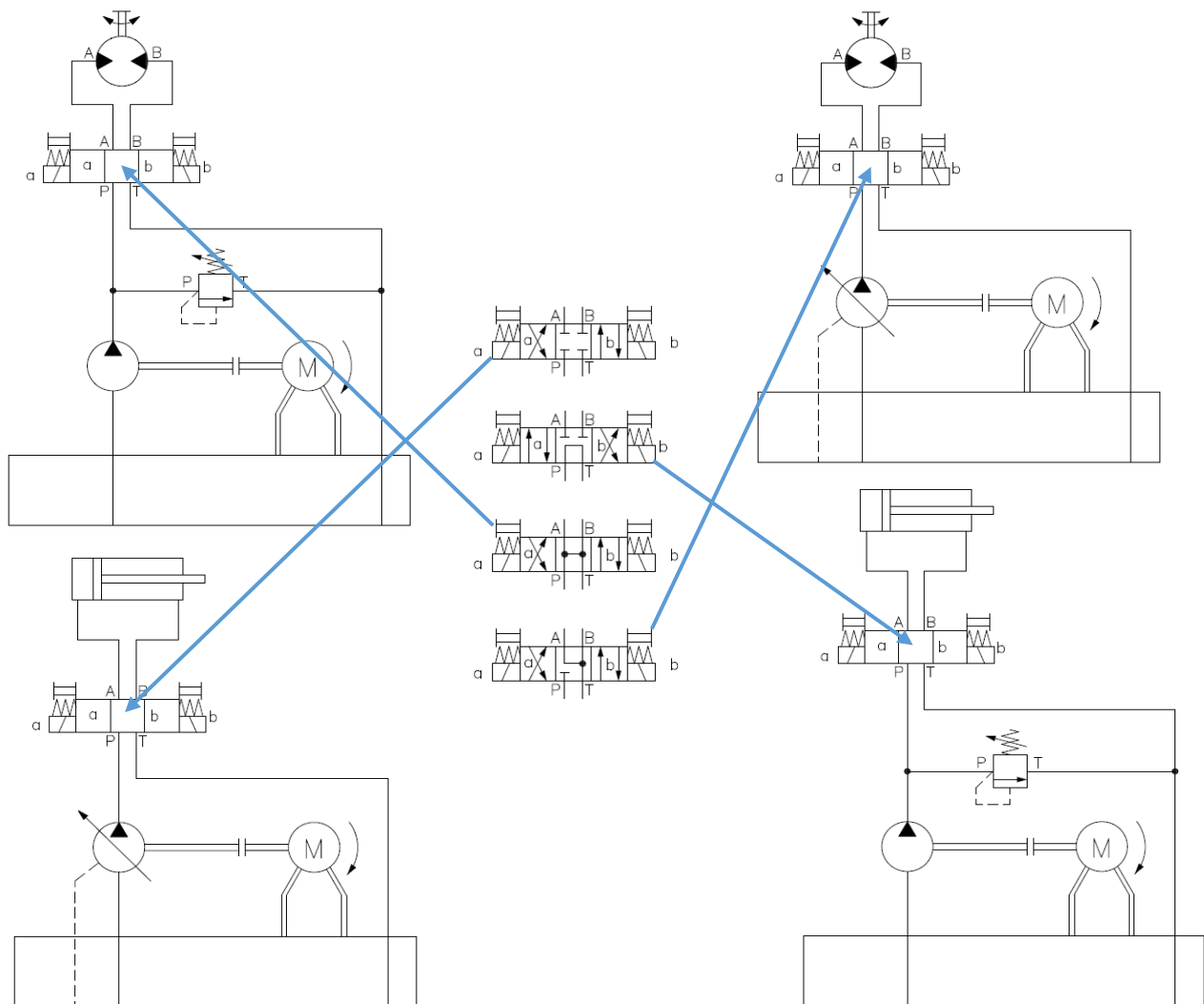
Conclusion

4/3 directional control valves control the START, STOP and direction of a bi-directional actuator.

When would it be advantageous to use a directional control with a valve centre condition similar to the one used in part I of the experiment?

When we are using a fixed displacement pump this spool allows the pump to go directly to tank in the neutral position saving energy. The blocked actuator ports will prevent the actuator from moving if an external force is applied

Match the most correct valve spool to each of the applications below



Part III

- Utilizing the circuit from part 2 start the hydraulic unit and move the cylinder until it is at some mid-stroke position
- Leave the handle of the directional control valve so that the valve remains in the centre condition
- Note and record the position of the cylinder from the scale as well as the pressures at gauges pS, pA and pB
- Allow the circuit to run in this condition for 5 minutes and then again note and record the position of the cylinder from the scale as well as the pressures at gauges pS, pA and pB
- Explain what you observe.

	pS	pA	pB	Cylinder position
Start	725 psi	0 psi	0 psi	reference
5 minutes	725 psi	425 psi	550 psi	Reference + 1"

Note to instructor:

The leakage across the valve spool and the differential area of the cylinder will cause the cylinder to slowly creep out over time. The speed of the creep and the final pressure values will vary depending on the valve clearance and how close the valve spool is to being perfectly in the centre.