



Troubleshooting Bosch Proportional Valves

An Informative Webinar
Developed by
**GPM Hydraulic
Consulting, Inc.**
Instructed By

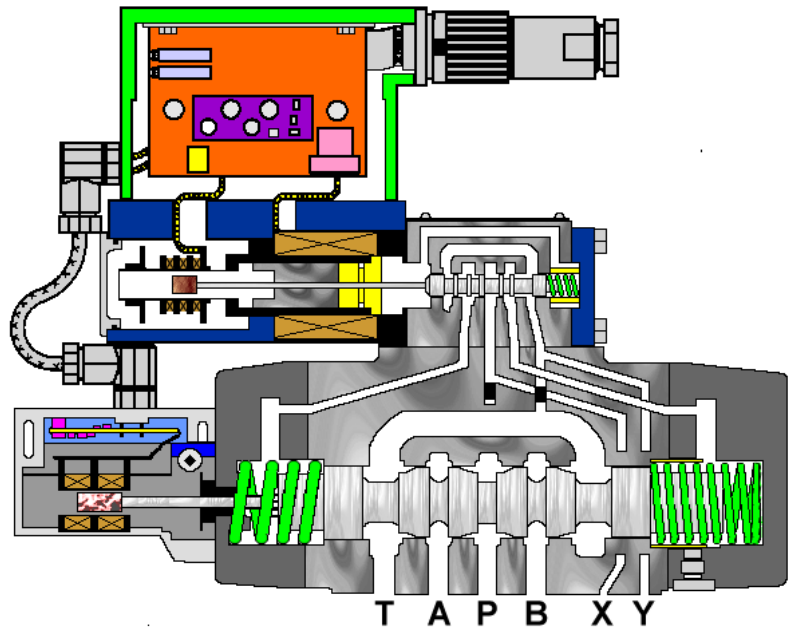


TABLE OF CONTENTS

Bosch Valves

Direct Operated Valves	1 – 7
Float Position Valves	8
Valve Amplifier for Direct Operated Valves	8 – 13
Troubleshooting the Direct Operated Valve	13 – 15
2 Stage Valves	16 – 21
2 Stage Valve Operation	22 – 26
Composite Symbol	26 – 27
Valve Amplifiers for 2 Stage Valves	27 – 31
Troubleshooting the 2 Stage Valve	31 – 32
Valves With Integrated Amplifiers	32 – 35
Test Boxes	36

Appendix

Test Box Instructions

Bosch Valves

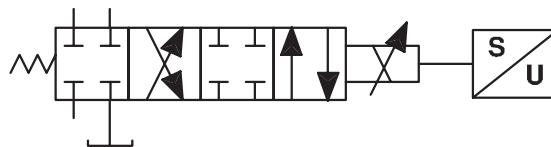
There are two types of valves normally in use in mills today:

- Direct Solenoid Operated
- Solenoid Controlled – Hydraulic Piloted



Direct Operated Valves

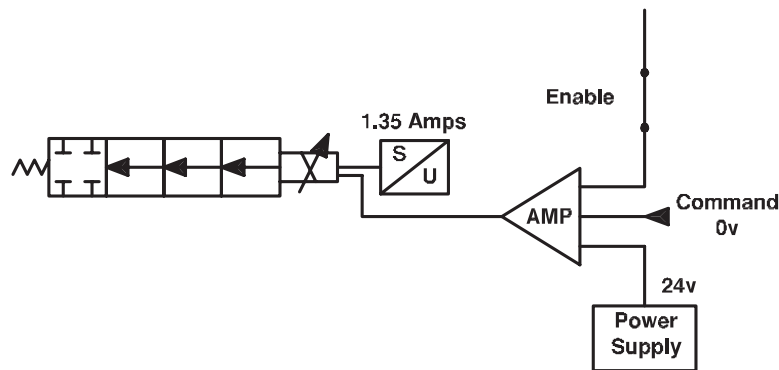
We will first discuss the direct operated valve. The valve shown below is called a four-position valve. When there is no power to the valve coil, the spring will shift the spool to the position shown on the far left. This is known as a “closed” position.



This position is commonly called the “fail-safe” condition. This position is used in the event of a power failure to the valve amplifier or loss of the “enable” signal from the PLC. The “enable” signal will be discussed later in this section.



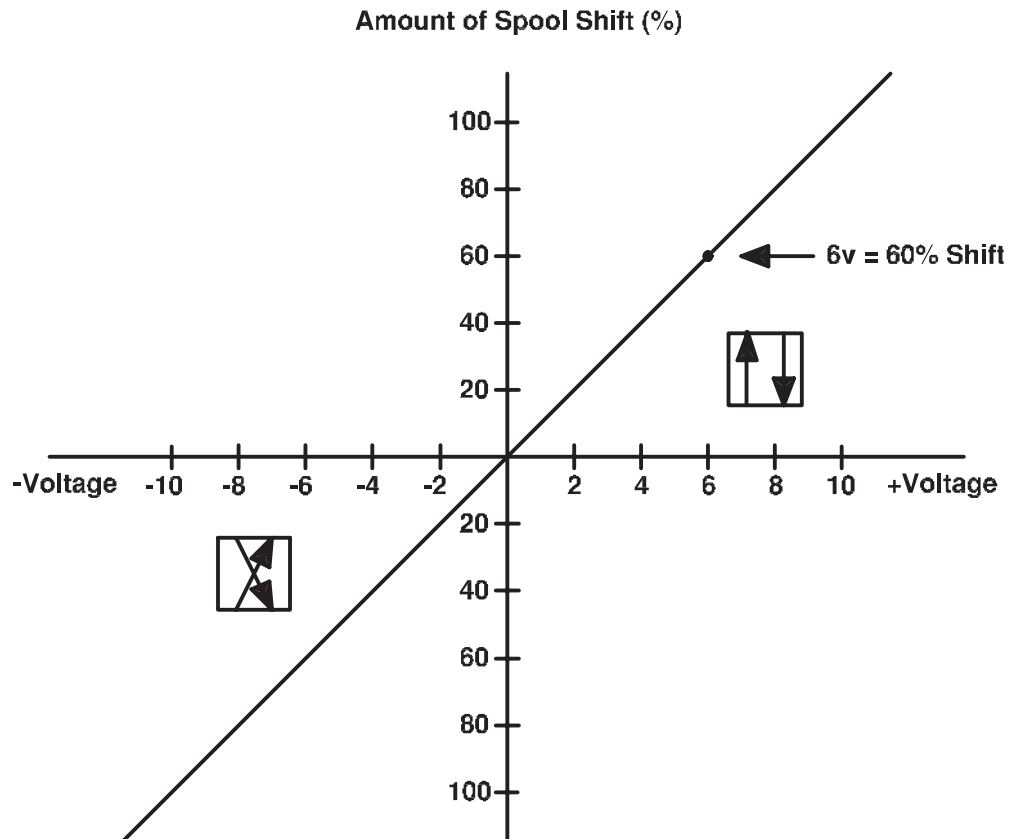
Once the power supply is turned on and the enable signal is received then a current of approximately 1.35 amps is applied to the valve coil. This applies a force to the valve coil, which shifts the spool into the “closed” position.



The current developed in the coil generates a magnetic field which shifts the valve spool. The spool compresses the spring as it shifts.

Notice that the “command” signal from the machine controller is 0 volts. When the motor is required to operate, a positive or negative 0 – 10-volt command signal will be applied. The strength and polarity of this voltage will determine the direction and speed of the actuator.

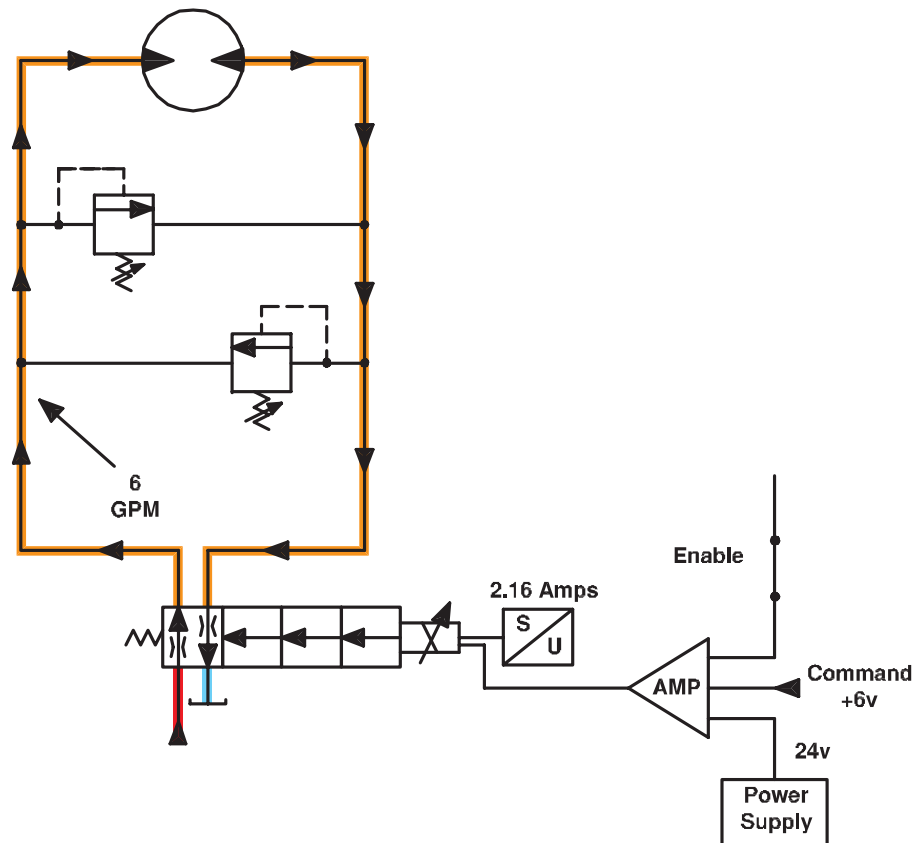
A positive voltage will shift the spool into the “A” position, a negative voltage will shift the spool into the “B” position.



The amplifier will alter the current generated in the coil by an amount proportional to that of the command voltage to shift the spool. With 1.35 amps holding the spool in the “closed center” position, the current must be increased to shift the spool into the “A” position. By increasing the current, more force is exerted to compress the valve spring.

By increasing the command voltage 60% from 0 to 6 volts, a corresponding increase in amperage must occur. In the example below, increasing the current 60% results in 2.16 amps being applied

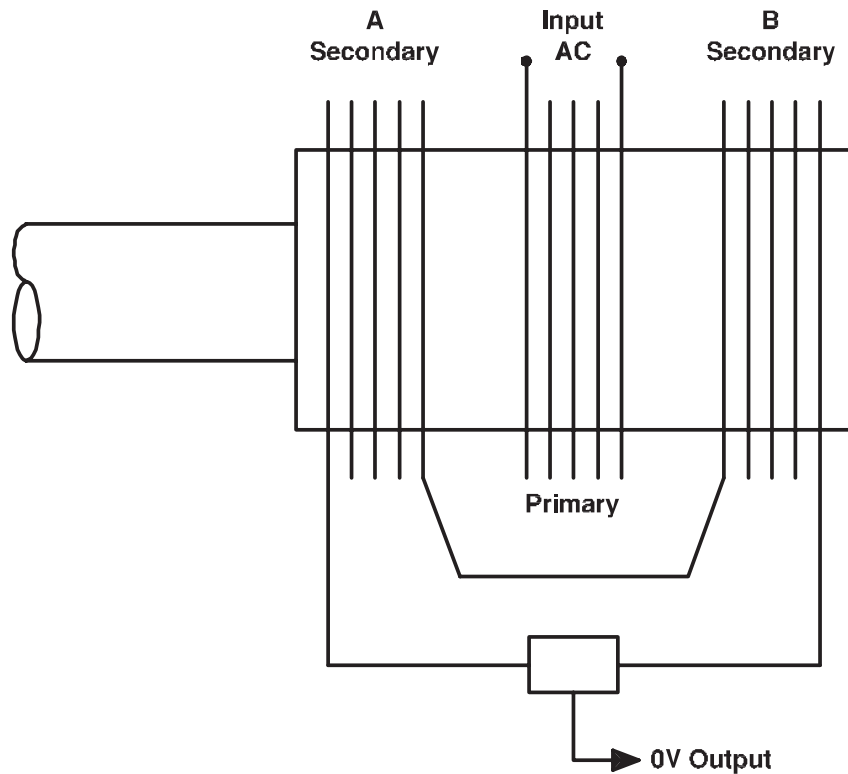
to the valve coil. Therefore 60% of the valve's total flow capability will be directed to drive the actuator. For example, if the valve has a maximum flow capability of 10 GPM then the valve would port 60% of 10 GPM (6 GPM) to the motor.



An LVDT (linear variable differential transformer) is used to convert the position of the spool into a proportional electrical signal. This will provide accurate positioning of the valve spool. The LVDT consists

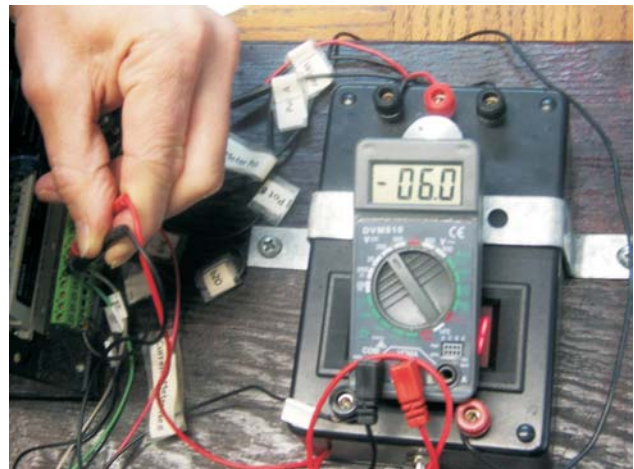
of an iron core, surrounded by a primary coil and two secondary coils that are connected in opposition.

A high frequency AC voltage is applied to the primary coil. The voltage creates a magnetic field in the iron core, which induces

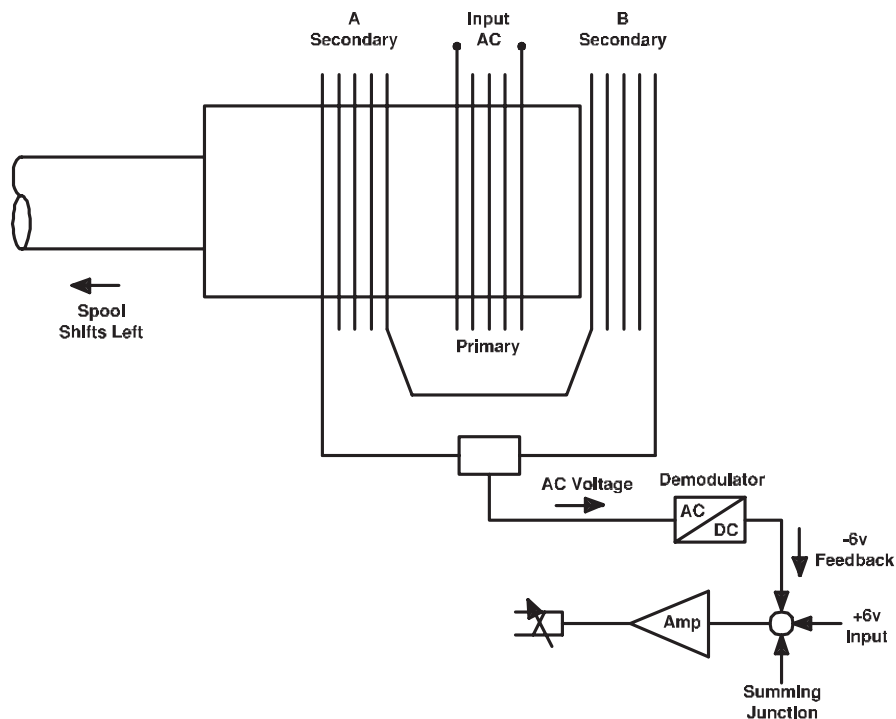


voltage to the secondary coils. When the iron core is centrally positioned the two secondary coils output signals cancel each other out producing a 0 volt output.

When the solenoid causes the valve spool to shift to



the left, an imbalance occurs. The voltage to the secondary coil “A” increases while the induced voltage to coil “B” decreases. This produces an output signal directly proportional to the amount that the spool shifts. The AC signal is sent to a demodulator that converts the signal from AC to DC. This is sent to what is known as the “summing junction” in the valve amplifier.



Once the LVDT sends back a -6 volt signal, the difference between the command voltage, +6 volts, and the feedback is now 0. The valve spool will then stop shifting.

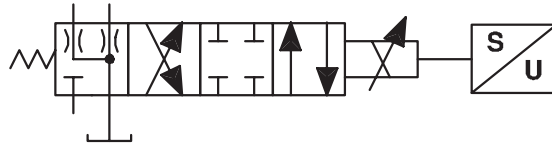
The amplifier will maintain only the amount of current to the valve coil required to keep the LVDT feedback at -6 volts.

This feedback signal can be checked at the amplifier card by placing the leads of the multimeter on the specific wiring connections on the card. A yellow light will illuminate on the front of the amplifier if the LVDT is bad.

Float Position Valves

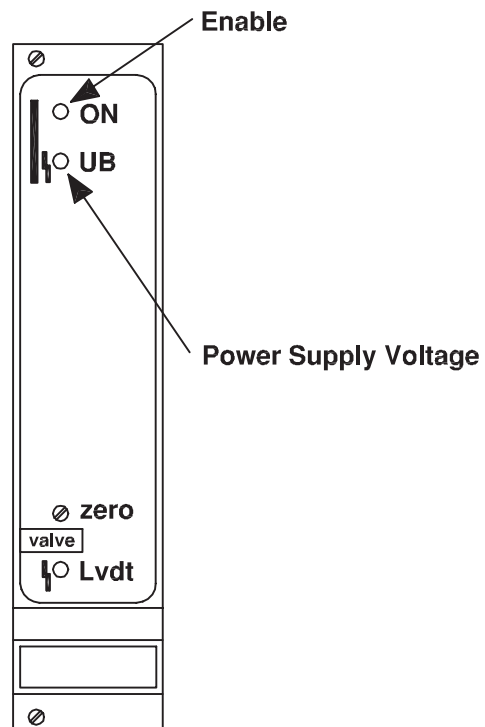
The other type of “fail-safe” position that is available on direct operated valves is the float position. The valve

operates identically to the one with the “closed” position used as the power off or fail-safe position. This valve is used when it is necessary to bleed the pressure in the actuator back to the tank when in the power off mode. The flow rate from the “A” and “B” ports back to the tank in this position is approximately 1.85 – 5.28 GPM, depending on the valve. The valve is also used as a pilot valve to direct oil for shifting the main spool in a two-stage valve.



Valve Amplifier for Direct Operated Valves

The PL10 amplifier will be used for explanation purposes. Other amplifiers that are used should operate similarly. On the front face of the amplifier there are three lights and one adjustment, which will be discussed here.



Enable

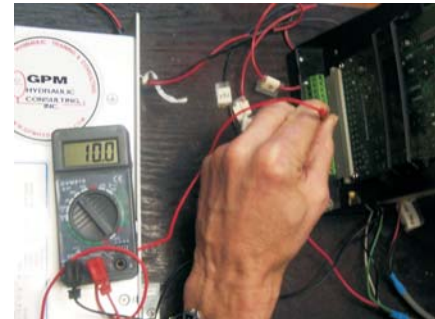
The enable LED is located at the very top and is labeled “on”. The enable signal relay is supplied from an external source such as the PLC, microprocessor or emergency stop. In order for the amplifier to supply an output to the proportional valve coil, the enable signal must be present. A 10-volt signal is normally used, however the voltage may be between 8.5 – 40 volts. On the amplifier, the positive 10 volt signal is connected from the Z32 pin to the relay, then to the Z16 pin. When the power supply is turned on and the enable signal is present the light will illuminate green. The enable signal is fed into the “safety logic” portion of the amplifier. If the enable light is not illuminated, check the power supply, the enable output and the enable input at the following terminals:

- | | | | | | | |
|---------------|---|-----------|---|-------------|---|-----|
| Power Supply | - | Z2 (red) | - | B2 (black) | - | 24v |
| Enable Output | - | Z32 (red) | - | B14 (black) | - | 10v |
| Enable Input | - | Z16 (red) | - | B14 (black) | - | 10v |

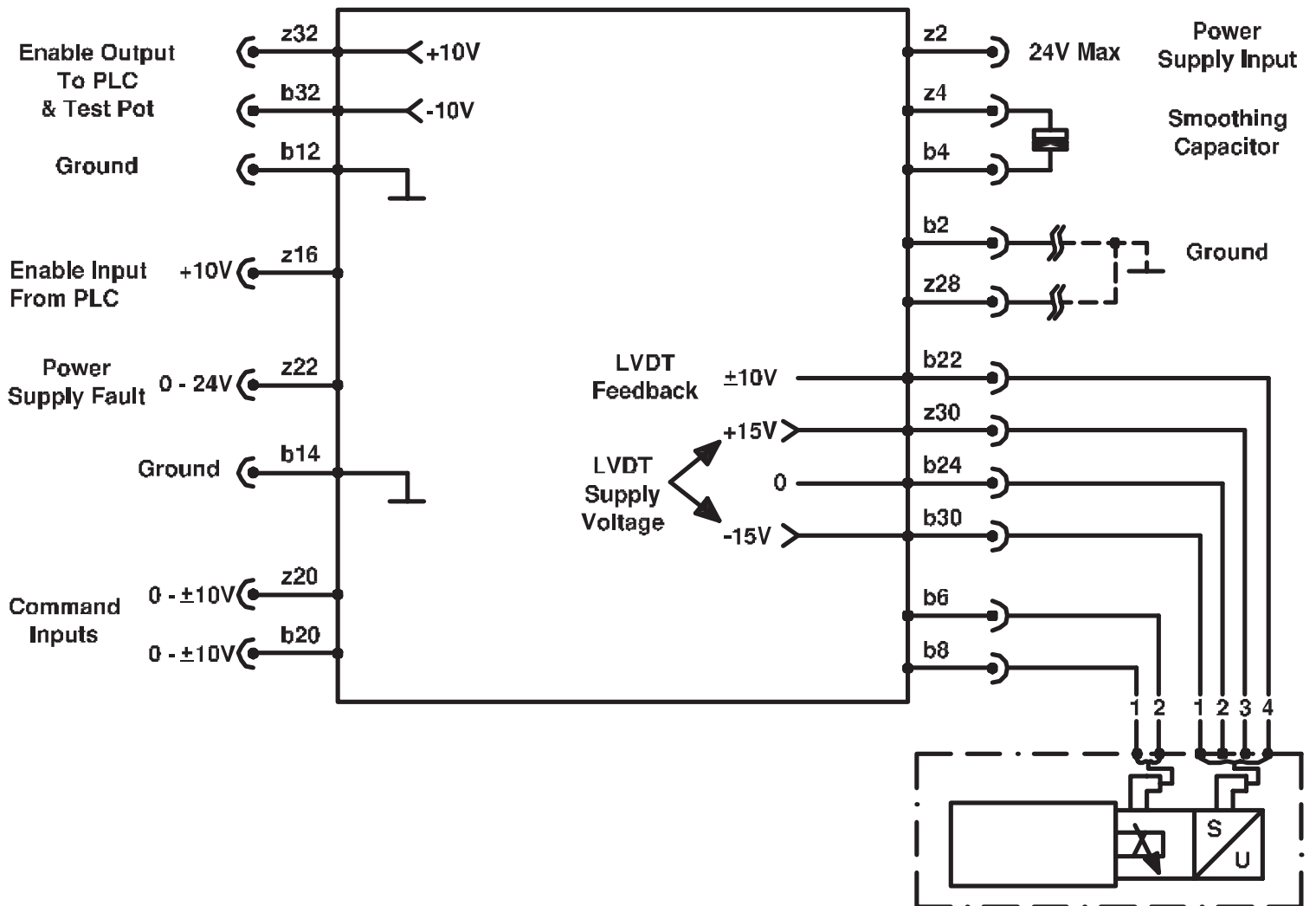
Power Supply Voltage

The LED labeled “UB” is used to indicate that adequate voltage is available to operate the amplifier, which drives the proportional valve solenoids and LVDT’s.

A 24-volt nominal voltage is connected to the z2 (input) and b2 (ground) terminals. Providing the voltage is 21 volts or higher, the LED will be off. The light will glow red when below that voltage.



Direct Operated Valve Amplifier Connections



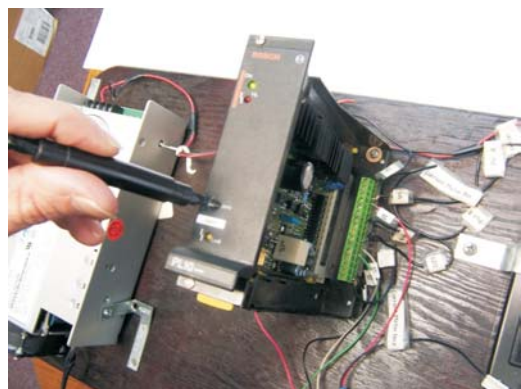
LVDT

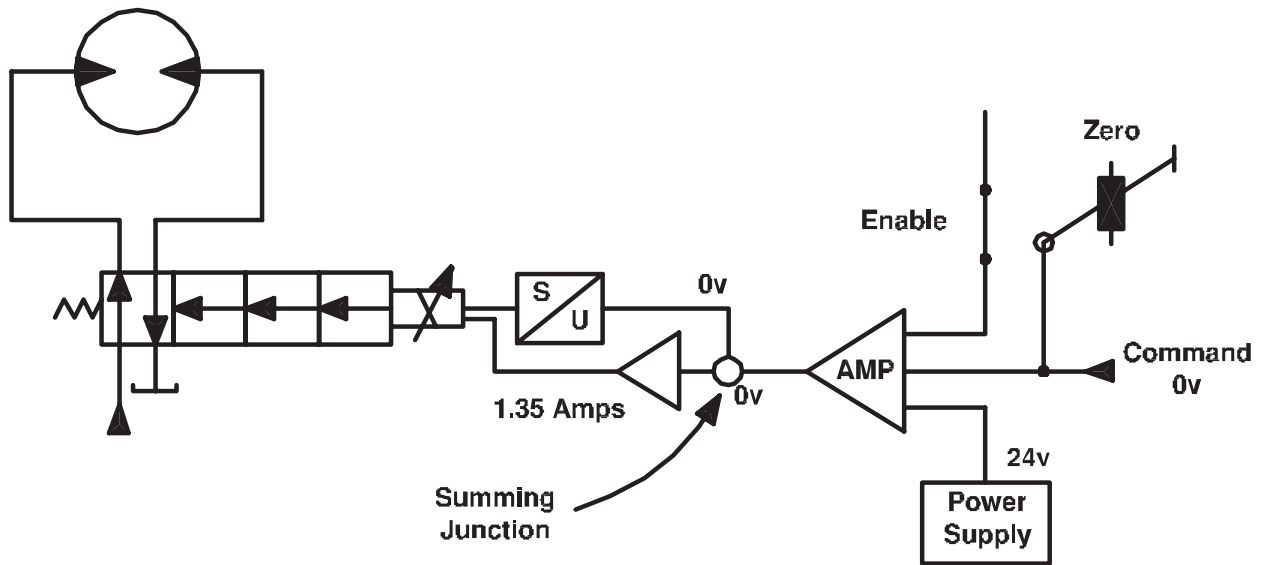
The yellow LED on the bottom of the amplifier face is used to indicate that there is an open circuit in the LVDT or a problem with the cables. The light will be off when the LVDT and cables are operating properly. The light will illuminate and glow yellow when the LVDT or cables fail. The easiest check to make is to unplug the cable(s) to the valve on the machine. Plug the cable(s) into a new valve. The new valve does not have to be installed on the machine for this test. If the light goes out then the new valve should be installed. If the light doesn't go out then the cable or connections are bad. If the light flickers, especially when the machine operates, this usually means the connections are loose.



Zero Adjustment

The zero adjustment is located on the front face of the amplifier. The adjustment is used to null or shift the spool to the closed position when the power supply is turned on. The adjustment needs to be made whenever the motor or cylinder is moving or oscillating with a 0 volt command signal input into the amplifier.

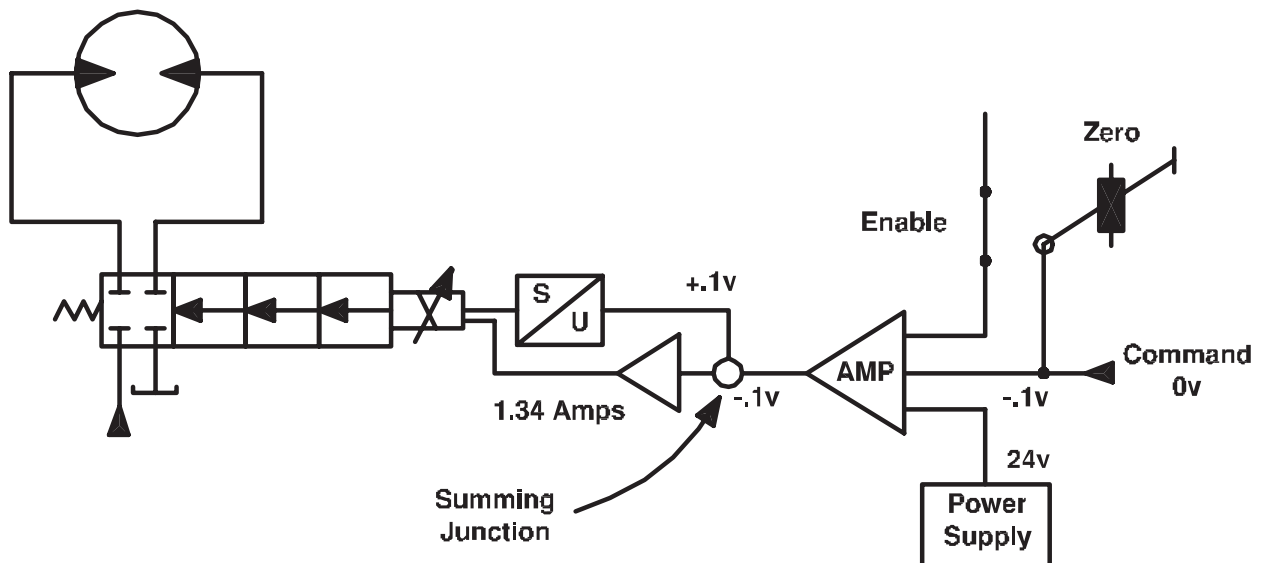




In the example, a 0 volt command is input into the amplifier. The signal is sent to the summing junction. With a 0 volt command input, 1.35 amps is applied to the valve coil. The spool will continue shifting until the LVDT feedback is 0.

Notice that the valve spool is actually in the “A” position, directing oil to the motor. The spool is in the “A” position because the LVDT coil assembly was not properly centered when the spool was in the fail safe position.

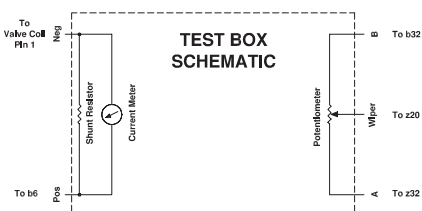
To shift the valve to the “closed” position, the zero adjustment should be rotated until the motor stops drifting.



In the example, the zero adjustment has adjusted the input signal to the amplifier to -0.1 volt. A corresponding decrease in current to 1.34 amps is applied to the valve coil. The valve spring shifts the spool until $+0.1$ volt is fed back. Flow is now blocked to the motor.

Troubleshooting the Direct Operating Valve

Test Equipment



The quickest and easiest method of troubleshooting the valve is to use a test box as shown near the end of this manual. If no test box is available, then one with a potentiometer can be assembled. Many times electrical supplies are available at the plant to build a test box. The test pot can be made by soldering a 3 conductor cable to a single turn potentiometer with a value of 2K - 10K ohms. Ensure that the cable is long enough so that the valve can be driven while the machine is operating.

Also, a digital or analog multimeter will be needed for checking the input and feedback voltages and a DC current meter capable of reading 5 amps will be required to check the current signal to the valve solenoid.

Initial Checks

The enable light must be lit and the yellow LVDT and red "UB" lights must be off in order for the valves to operate. If any of these conditions do not exist, make the tests outlined previously in the Valve Amplifier section.

If the cylinder or motor will not move, check the input command signal at the b20 and z20 connections. If this reads 0, check the analog output from the computer to the valve amplifier. Also check the wiring and cables.

System Set Up

Prior to testing the valve, configure the system and amplifier as follows:

1. Turn off the hydraulic pumps' drive motors. Check the pressure gauges to verify that all system accumulators have been bled down to 0 PSI.
2. Turn off the 24 volt power supply. Then disconnect the command input signal wires at terminals b20 and z20. Also disconnect the Enable input at the z16 connection.
3. Install a jumper from the z32 to the z16 connections. This will allow the necessary Enable signal to be present for operating the valve.
4. Install a jumper from b20 to b14 which will direct one side of the command input connections to common.
5. Connect the test potentiometer to the z32 and b32 connections. This will supply a positive and negative 10 volt signal to the pot when rotated to drive the valve. Then connect the test pot wiper to the z20 connection.
6. Do not turn on the power supply at this time.

Checking the Current to the Valve

1. It is not necessary to run the pump for this test, so do not start the drive motor.
2. Install the current meter in series with the solenoid at terminal b6.
3. Turn the power supply on and make sure that the green Enable light is on and the LVDT and UB lights are off.

4. The current meter should read approximately 1.35 amps, however this may be higher or lower depending on the “zero” adjustment setting. If no current is indicated, then either the amplifier cable or valve coil is bad. The continuity of the cable and coil should be checked first. The resistance of the valve coil should be about 2.4 ohms.

5. If current is indicated on the meter, rotate the potentiometer in both directions. The current should increase and decrease accordingly as the pot is rotated.

Checking the LVDT

1. The pump should remain off for this test as well.

2. Turn on the 24 volt power supply and verify that the green Enable light is on and the LVDT and UB lights are off.

3. With the test pot at 0, check the LVDT feedback voltage with the multimeter at connections b24 (black lead) and b22 (red lead). Near 0 volts should be indicated.

4. Remove the Enable jumper from z16. The green light on the amplifier should go out.

5. The valve spool will now spring return to the “fail safe” position. A reading of -12 to -14 volts DC should be indicated from b24 to b22.

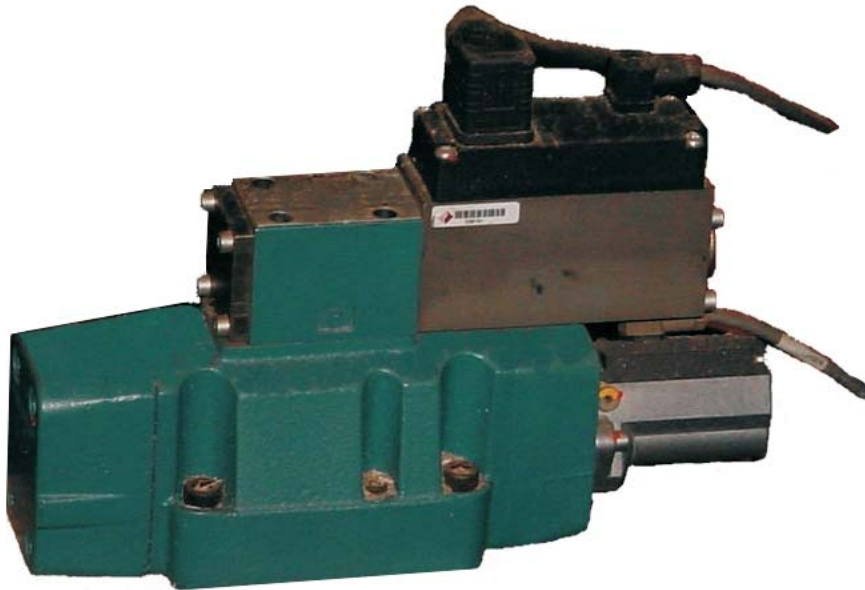


6. Connect the Enable jumper to z16 once again.

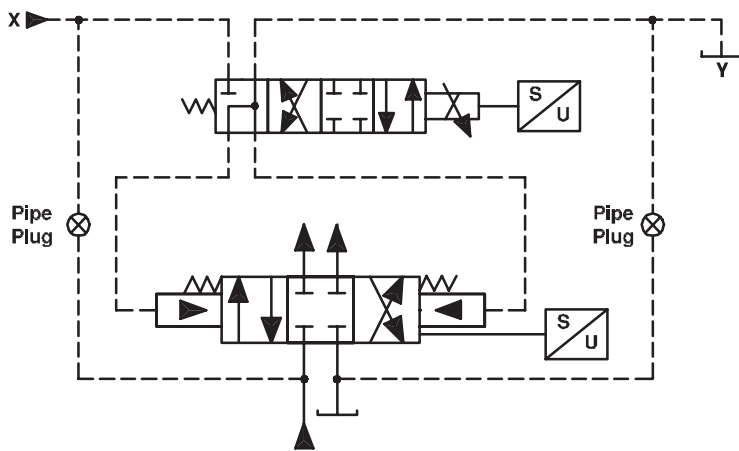
7. Rotate the test pot and observe the voltage feedback from b24 to b22. As the test pot is rotated, the feedback from the LVDT should increase and decrease accordingly. If the feedback signal does not change then the valve spool may be stuck.

Two Stage Valves

Two stage valves are used when a high volume of oil is required to operate a cylinder, motor or linear positioner.



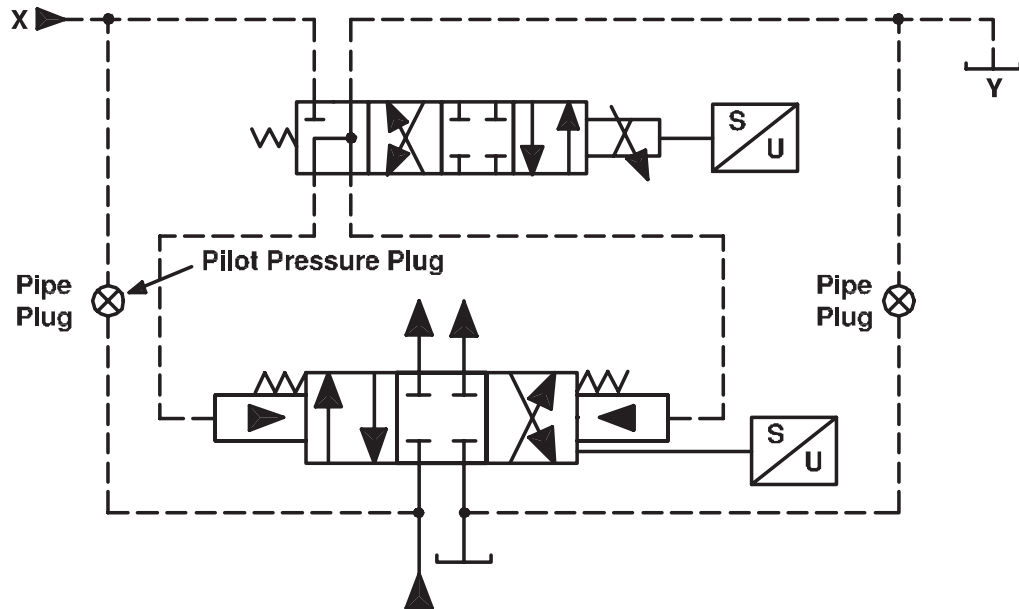
The two stage valve consists of a pilot valve and main spool. The pilot valve power off or fail-safe position is always the “float” position. This is necessary to allow the main spool to spring return to the center position.



In the power off condition as shown, any oil in the pilot cavities on both ends of the main spool is ported back to the tank through the pilot valve. The main spool on most two stage valves is of the closed center design. This means that all flow will be blocked to the actuator when the spool is in the center position.

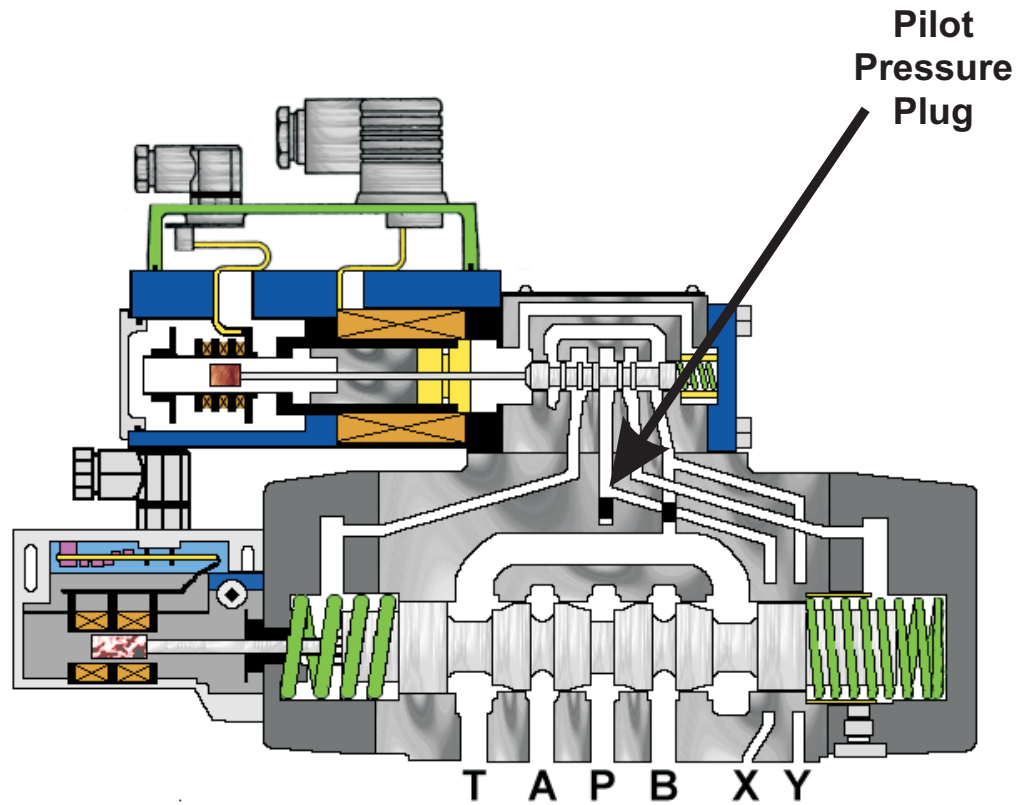
In order to shift the main spool, a pilot pressure of 8 BAR (118 PSI) or higher is required. The pilot fluid to the pilot valve may be directed internally from the “P” port of the main spool. On some systems, the

pilot source is supplied externally from a separate pilot pump, pressure-reducing valve or from another system.

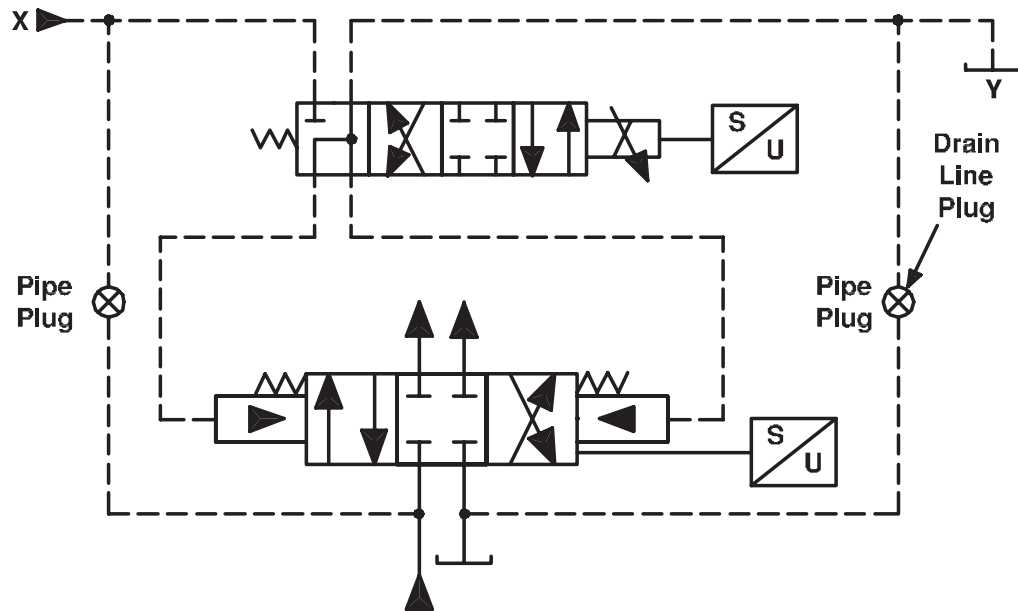


The Bosch two-stage valve can come from the factory internally or externally piloted. In many cases the original equipment manufacturer will convert an externally piloted valve in the field to an internally piloted valve without changing the part number. Therefore, when a new valve is ordered an externally piloted valve is installed and will not work.

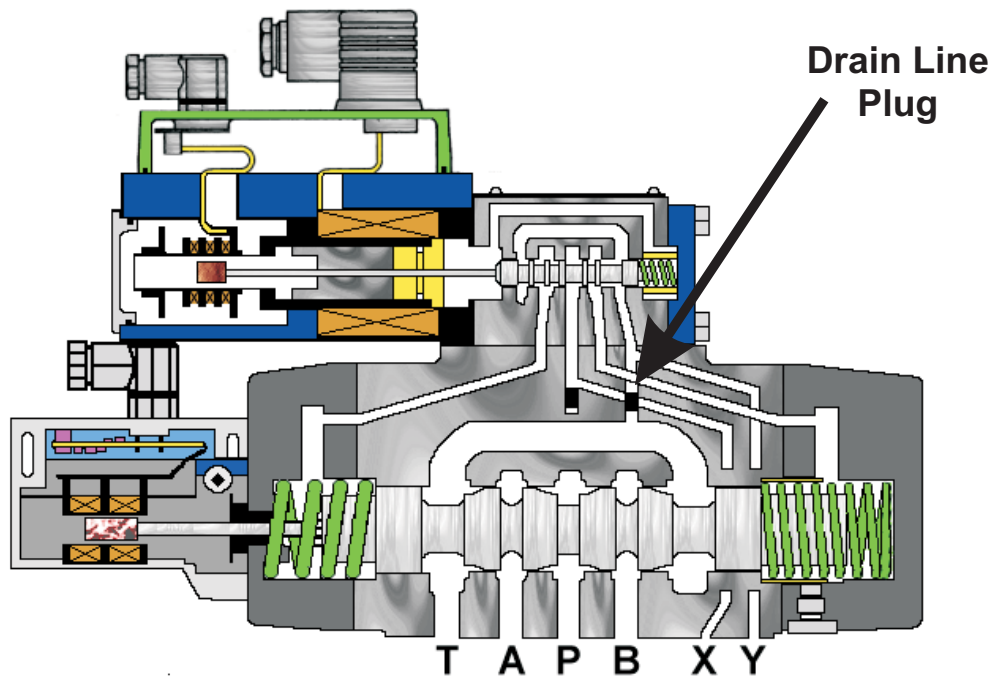
The valve shown on page 27 is for an external pilot and drain. Notice the pilot pressure plug in the pilot line, which blocks flow from the “P” port of the main spool to the “P” port of the pilot valve. This plug is located in the pilot passage underneath the pilot valve. An external line would be connected to the “X” port to direct oil to shift the main spool when the pilot valve is energized in this configuration.



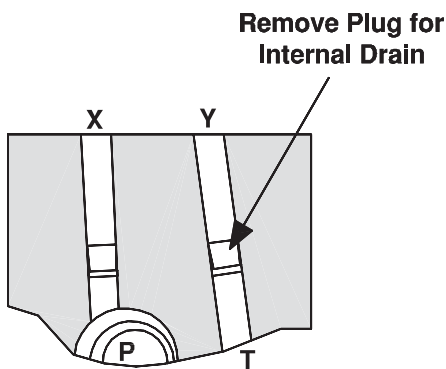
The valve may also come configured for an external drain. There is a pipe plug connected in the main valve body that blocks flow from the pilot valve tank port to the main spool tank port.



In this arrangement, the valve is drained externally. When the pilot valve shifts the main spool, oil is forced out the opposite end of the spool. The oil then flows through the pilot spool and out the “T” port of the pilot valve. With the drain plug installed the oil would flow out of the “Y” port and back to the tank. If there is no external drain line connected, the main spool will not shift. Again, the valve shipped from the factory may be configured for an external drain.

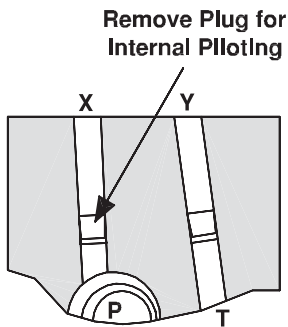


Externally Piloted and Drained Valve



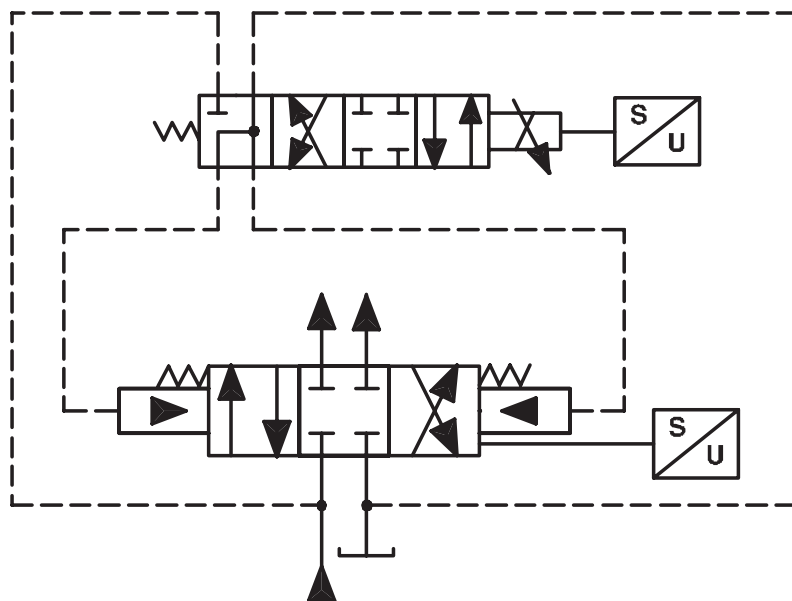
Many two stage valves are internally drained. To convert to an internal drain, the pilot valve should be removed and the drain line plug taken out.

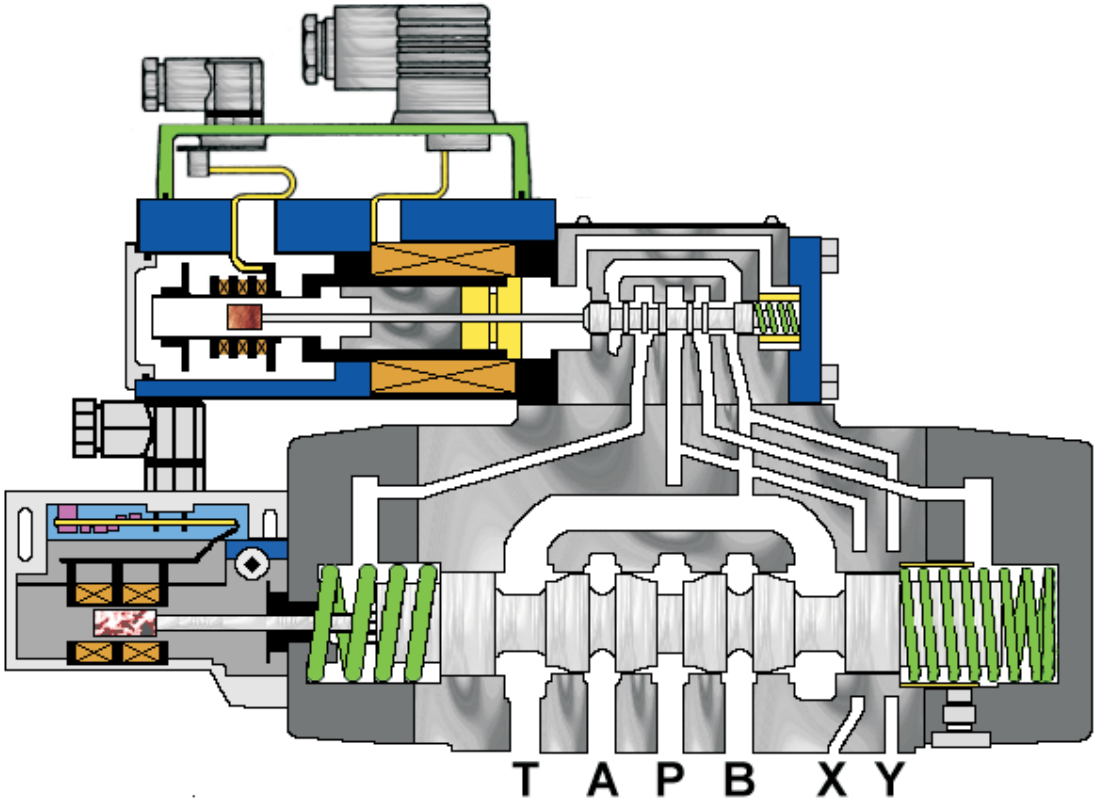
Many systems have valves that are internally piloted. To convert the valve from externally to internally piloted, the pipe plug should be removed. The pilot valve has to be removed to access the plug. On some newer valves, the plug is located in the “P” port of the main valve spool housing.



On more recent valves, the “X” port on the bottom of the main valve does not have to be blocked when an internally piloted valve is used. On older valves, the “X” port is threaded and a pipe plug is installed.

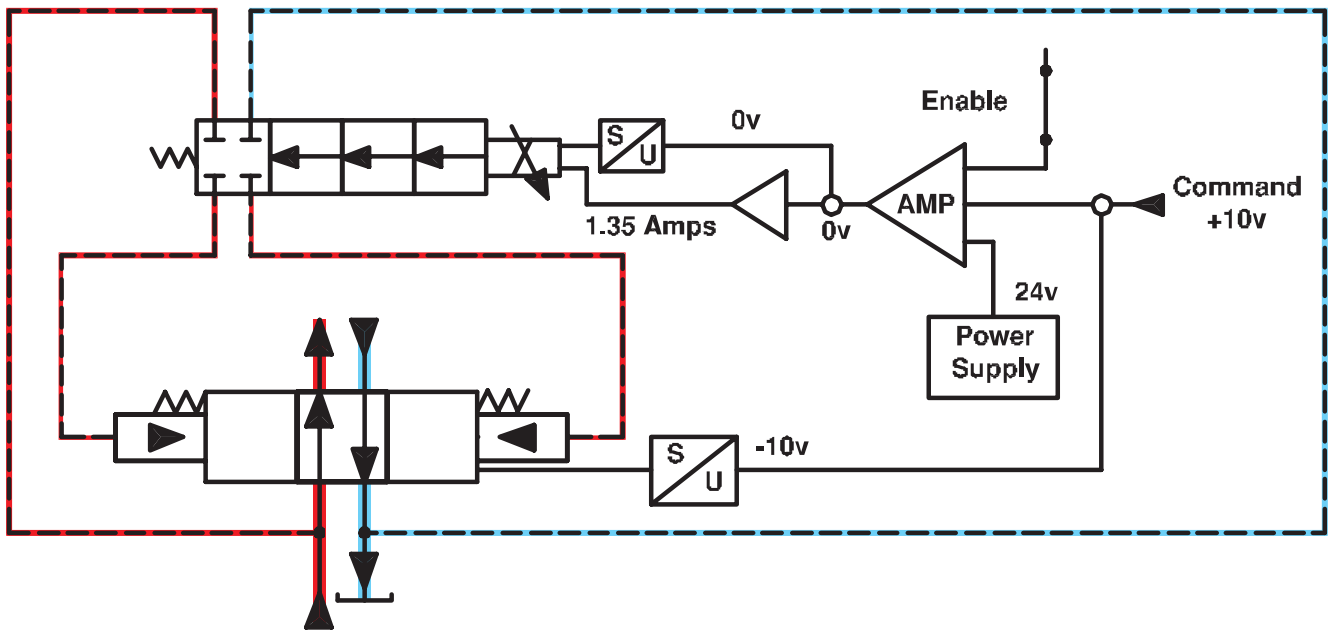
The valve is now configured for an internal pilot and drain. The schematic below shows an internally piloted and drained valve.





Internally Piloted and Drained Valve

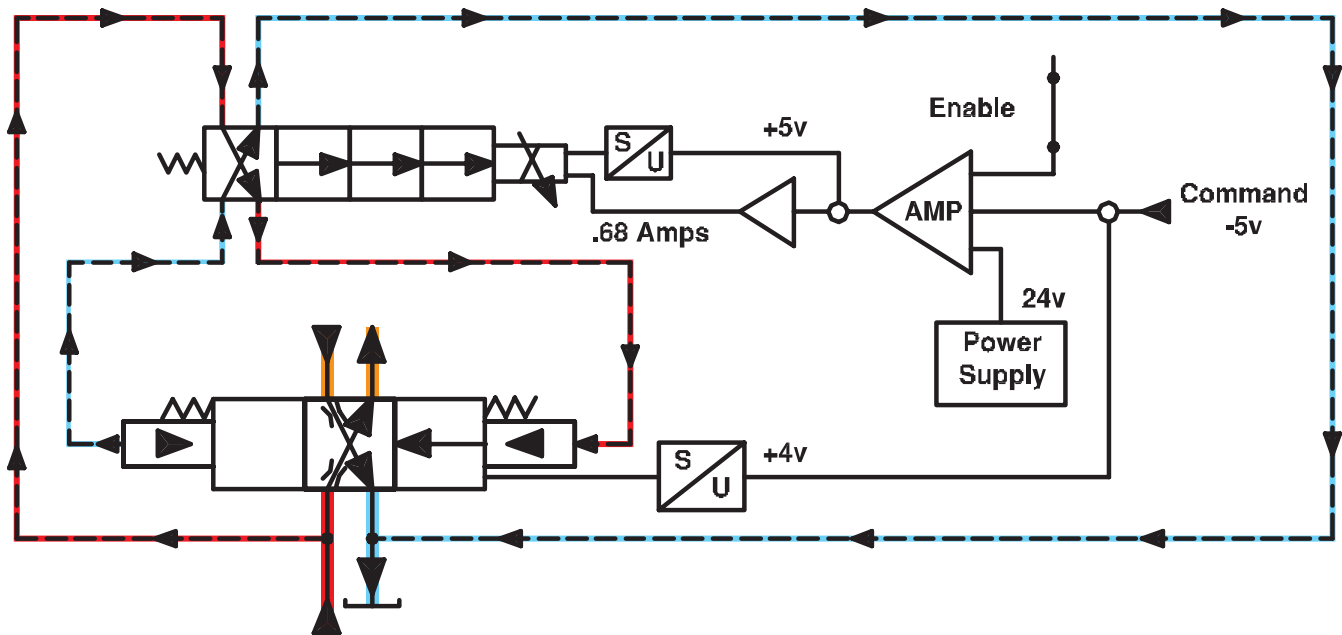
The main spool will continue shifting until -10 volts is sent back to the summing junction. The sum of the command voltage ($+10$ V) and the LVDT feedback voltage (-10 V) now equal 0 . With a 0 V input to the amp, current in the pilot valve coil is reduced to 1.35 amps and the pilot spool returns to its “closed” position.



The valve will remain in this position until the command voltage is changed. Maximum volume will be ported through the main valve at this time allowing maximum speed of the actuator.

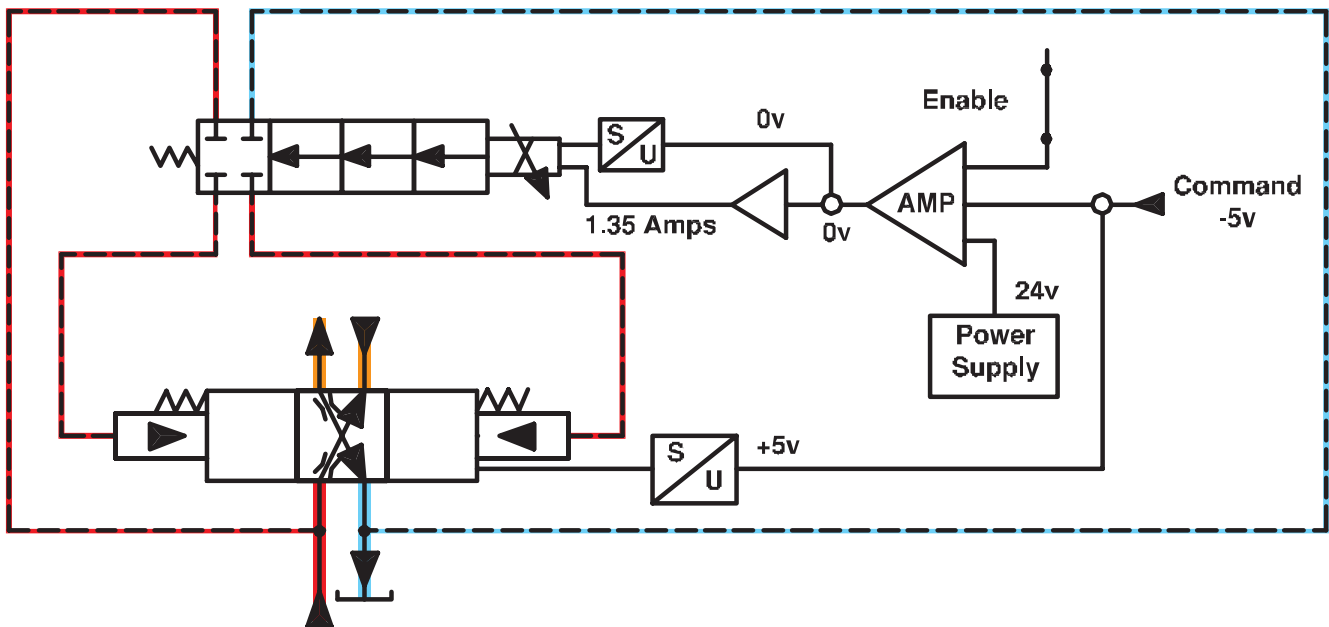
To shift the main spool into the “B” position for moving the actuator in the opposite direction a negative command voltage is input to the amplifier. In the example a -5 volt signal is applied. This voltage reduces the current developed in the coil to $.68$ amps

The compressed spring in the pilot valve now exerts a higher force on the spool than the solenoid. This forces the pilot spool into the “B” position. As the pilot spool shifts the pilot LVDT will send a voltage back of the opposite polarity than the command voltage. Once $+5$ volts is fed back then the pilot valve will stop shifting.



Internal pilot pressure is now ported through the pilot spool then to the right side of the main spool. The pilot pressure will build and overcome the centering spring on the opposite side of the spool. This causes the main spool to start shifting into the “B” position. As the spool shifts, the main valve LVDT will send a voltage back of the opposite polarity. In the example, the spool is in motion and the main valve LVDT has fed back $+4$ volts.

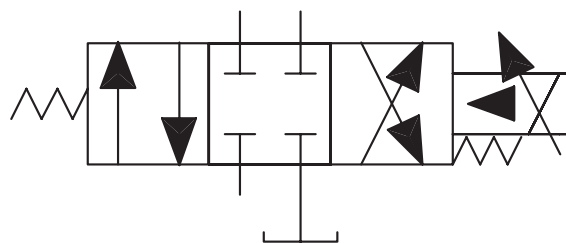
Once the spool shifts so that +5 volts are fed back by the main valve LVDT, the current developed in the pilot valve coil is increased to 1.35 amps. The pilot valve then shifts back into the “closed” position.



The main spool will remain in this position until the command voltage is changed.

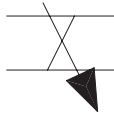
Composite Symbol

Many times on the hydraulic schematic the pilot and main valve spool are not shown separately. The symbol shown below is commonly used.

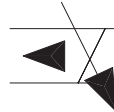




The three positions are shown only for the main spool. The pilot valve is represented by the symbol for a solenoid actuator.



The arrow through the solenoid symbol at 45° represents the variable DC signal applied to the pilot valve coil.



The black arrow inside the symbol represents that the valve is shifted by hydraulic pilot pressure.

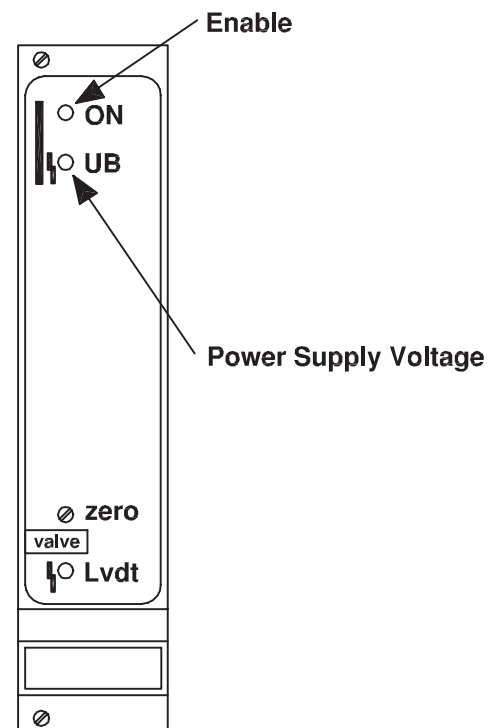


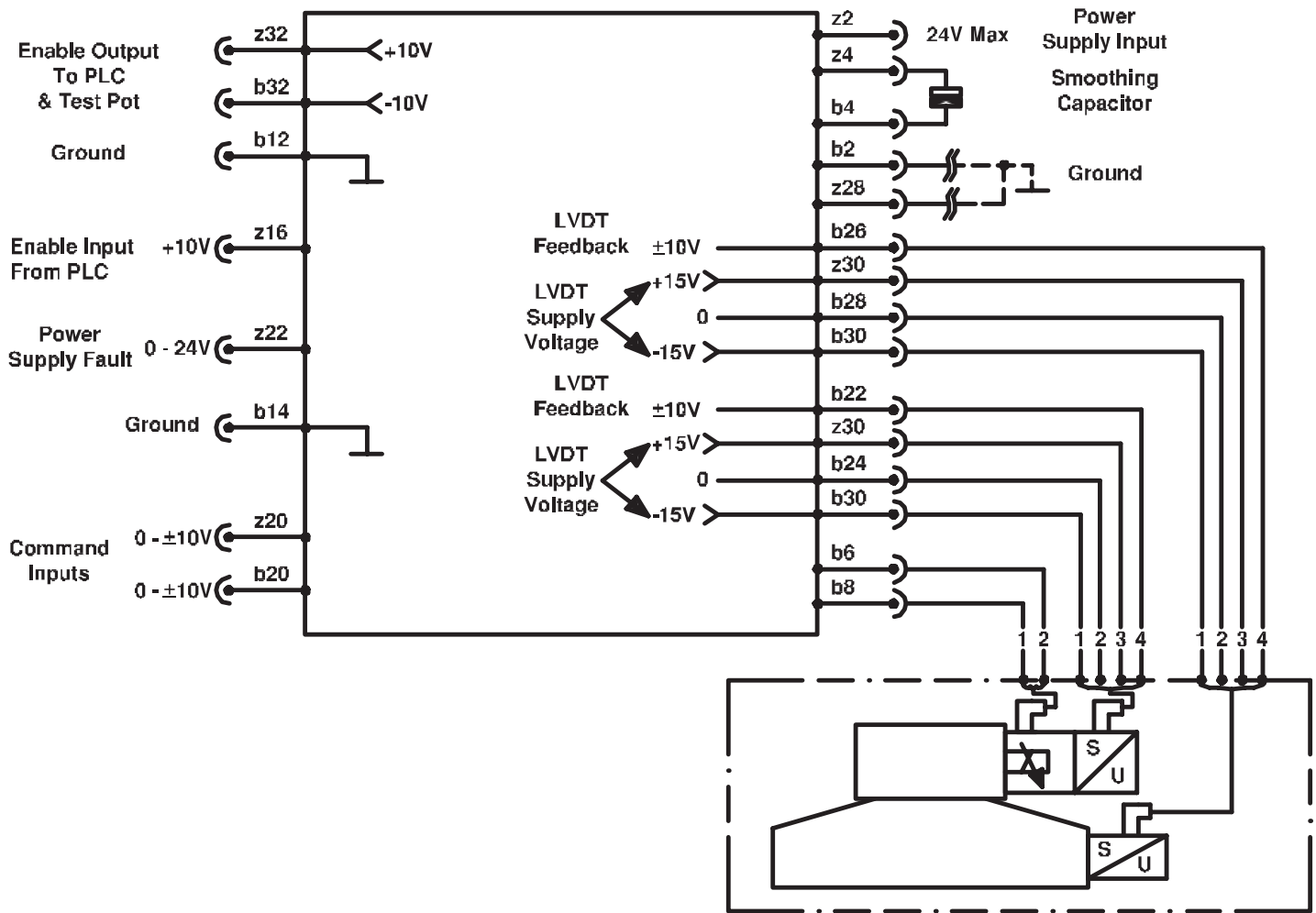
As discussed previously, this pilot pressure may be internal or external. When external pilot pressure is used, dashed lines are shown connecting to the valve symbol.

Pilot Pressure

Valve Amplifier for Two Stage Valves

The 2STV amplifier will be used for explanation purposes. Other amplifiers that are used should operate similarly. On the front face of the 2STV amplifier there are three lights and one adjustment, which will be discussed here.





Enable

The enable LED is located at the very top and is labeled “on”. The enable signal relay is supplied from an external source such as the PLC, microprocessor or emergency stop. In order for the amplifier to supply an output to the proportional valve coil, the enable signal must be present. A 10-volt signal is normally used, however the voltage may be between 8.5 – 40 volts. On the amplifier, the positive 10 volt signal is connected from the z32 pin, to the relay then to the z16 pin. When the enable signal is present the light will illuminate green. The enable signal is fed into the “safety logic” portion of the amplifier. If

the enable light is not illuminated, check the power supply, the enable output and the enable input at the following terminals:

Power Supply - Z2 (red) - B2 (black) - 24v

Enable Output - Z32 (red) - B14 (black) - 10v

Enable Input - Z16 (red) - B14 (black) - 10v

Power Supply Voltage

The LED labeled “UB” is used to indicate that adequate voltage is available to operate the amplifier, which drives the proportional valve solenoids and LVDT’s.

A 24-volt nominal voltage is connected to the Z2 (input) and b2 (ground) terminals. Providing the input voltage is 21 volts or higher, the LED will be off. The LED will glow red when below that voltage.

LVDT

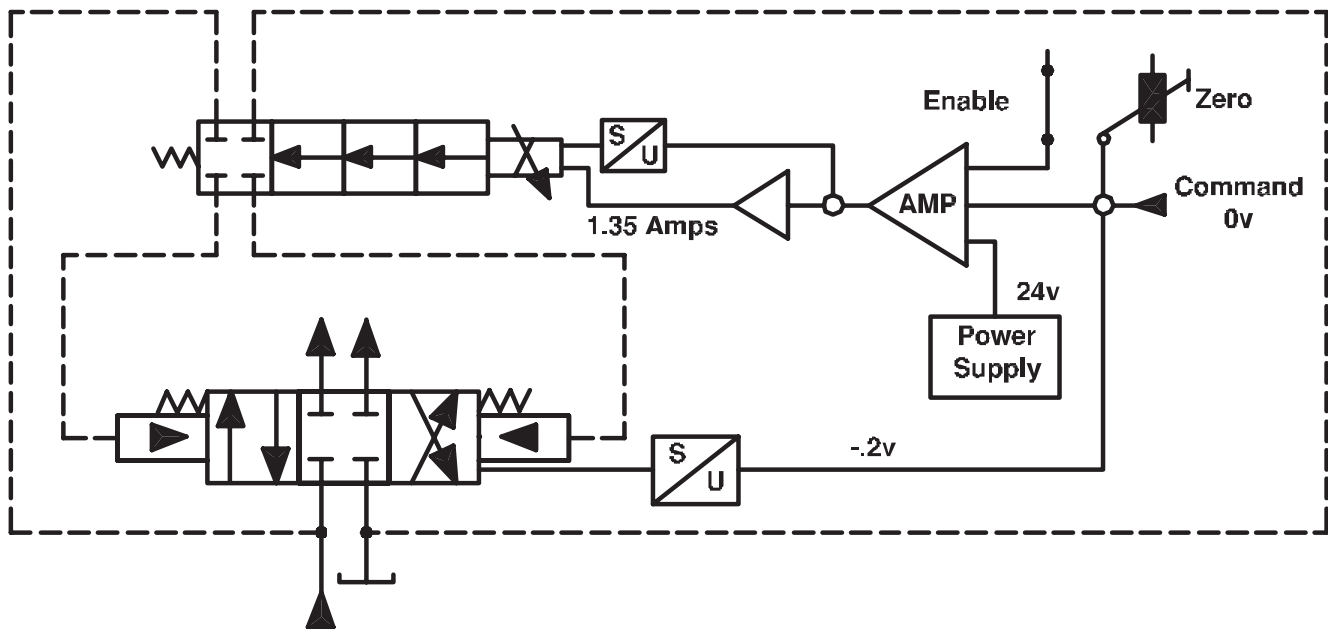
The yellow LED on the bottom of amplifier face is used to indicate when the pilot or main spool LVDT is bad or there is a problem with the connecting cables. The light will glow yellow when any of the above fail. If the light flashes, especially while the machine is in operation, it is likely that there is a loose connection somewhere. To check the feedback from the pilot valve the tester leads can be connected to B22 (signal) and B24 (0 reference) on the card. The test points for the main spool LVDT can be checked at B26 (signal) and B28 (0 reference). The continuity of the cables should also be checked to verify that they are not defective. One quick test to determine which LVDT is bad is to replace the main spool LVDT with one from a good valve. If the light remains on, the pilot valve LVDT is bad, providing that the cables have been checked. This can be

verified by plugging the cables into a new pilot valve. The pilot valve should then be changed on the valve to solve the problem.

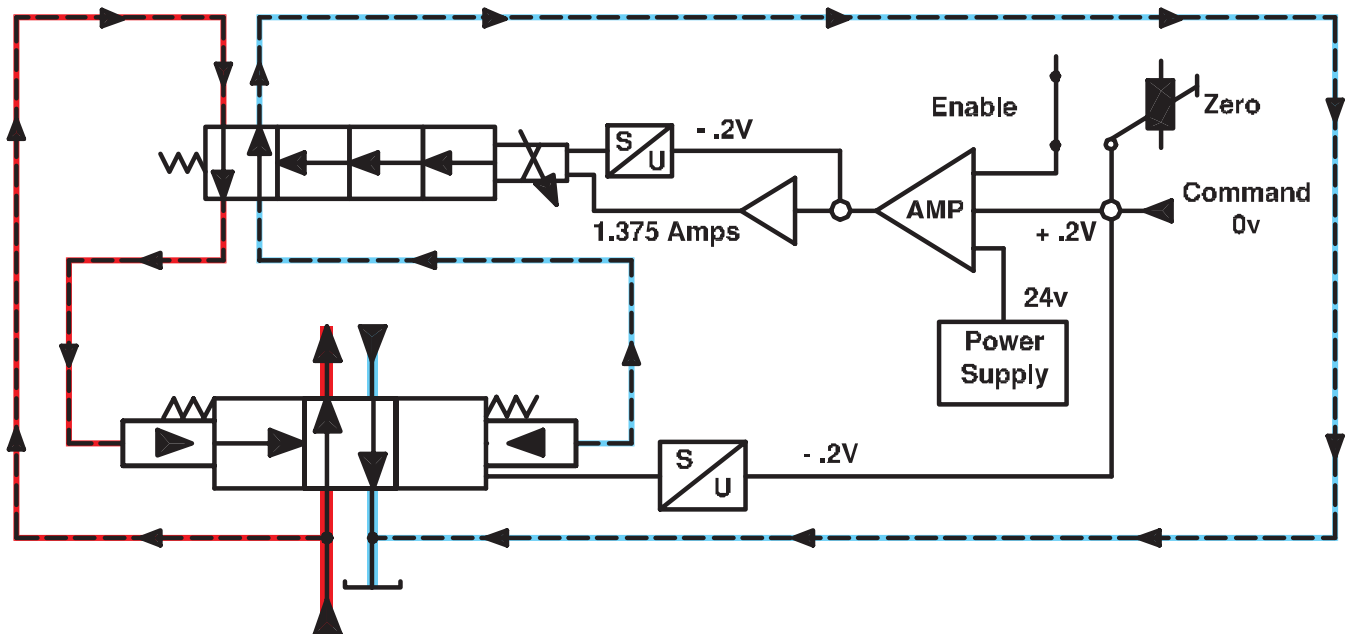
Zero Adjustment

The zero adjustment is located on the front face of the amplifier.

This adjustment should be made in the event the cylinder or motor is moving with a 0 command signal coming into the valve amplifier. If the load is moving, then either the pilot and/or main spools are not in the closed position. This is usually caused by the pilot or main spool LVDT being out of position.



In the example shown above, the main spool LVDT is sending back a -2 volt signal when the spool is in the center position to the summing junction in the amplifier. The summing junction recognizes that there is a difference between the command voltage, 0, and the feedback from the LVDT, -2 volt. A +.2 volt signal will be sent out of the summing junction.



This increases the amperage in the coil to 1.375 amps, which shifts the pilot valve spool into the “A” position. Pilot fluid is then ported to shift the main spool into the “A” position. Oil can now flow through the actuator allowing it to drift or oscillate.

The “zero adjustment” compensates for the LVDT being out of position. By rotating the adjustment screw, this prevents a voltage from being sent out of the summing junction to drive the pilot valve. The load should be observed when the adjustment is made. Once the movement stops then the procedure is complete.

Troubleshooting the Two Stage Valve

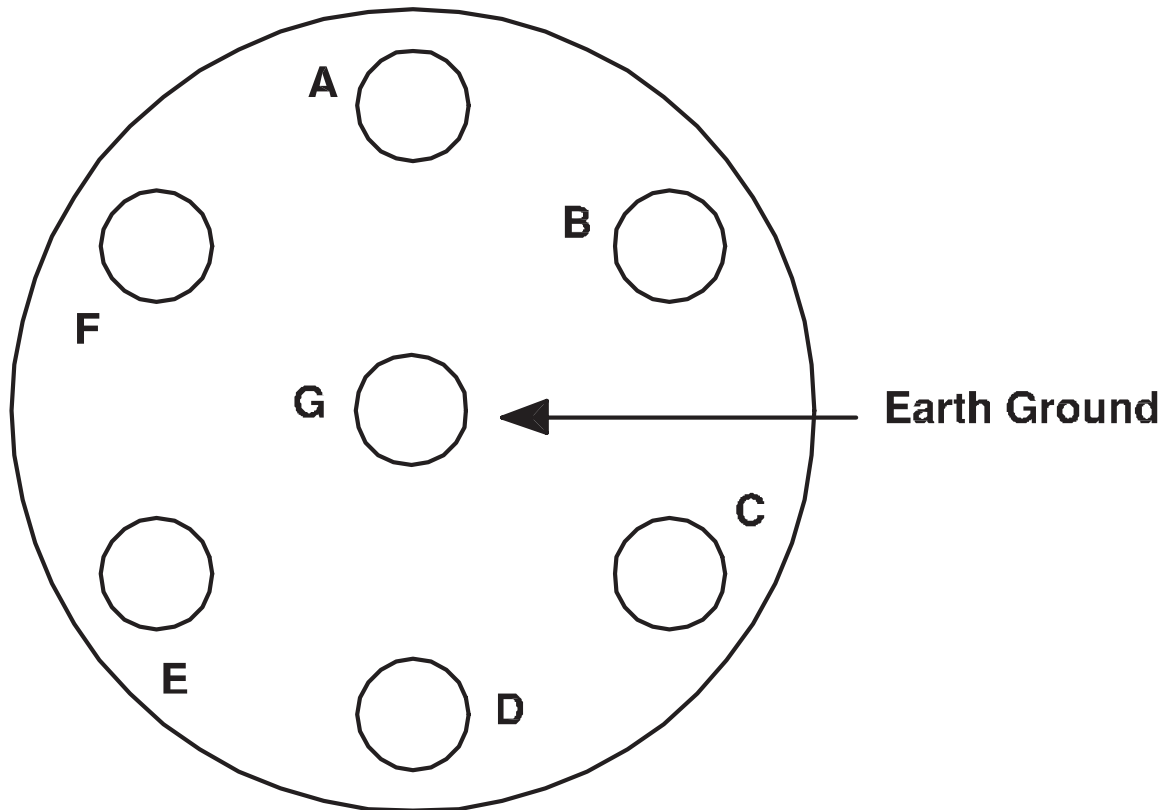
Prior to troubleshooting the main valve spool, make sure the pilot valve is operating properly. The procedure for checking the pilot valve is outlined earlier in this manual in the “Troubleshooting the Direct Operated Valve” section.

1. Once the pilot valve has been checked, turn the test pot to 0. Verify that all personnel are clear of the machine, then turn the pump on.
2. Turn on the 24 volt power supply if it is not already on. Check to make sure that the Enable light is lit and the LVDT and UB lights are off.
3. Place the leads on the multimeter to the B28 (black lead) and B26 (red lead) connections on the amplifier. With the test pot at 0, the feedback from the main spool LVDT should also be 0.
4. Have an assistant rotate the test pot knob while observing the machine operation. The LVDT feedback signal should increase as the cylinder or motor speed increases. The feedback signal should drop as the test pot is rotated more toward 0.
5. If the load is not moving when the test pot is rotated and the pilot valve is working properly, then the main spool is not shifting. This can be caused by a plugged pilot or drain line. The valve may be internally or externally piloted. If you are troubleshooting a new valve that has just been installed, the internal pilot plugs may need to be removed. This is discussed in detail earlier in this manual. The main spool may also not be shifting due to contamination in the valve.

Valves with integrated amplifiers

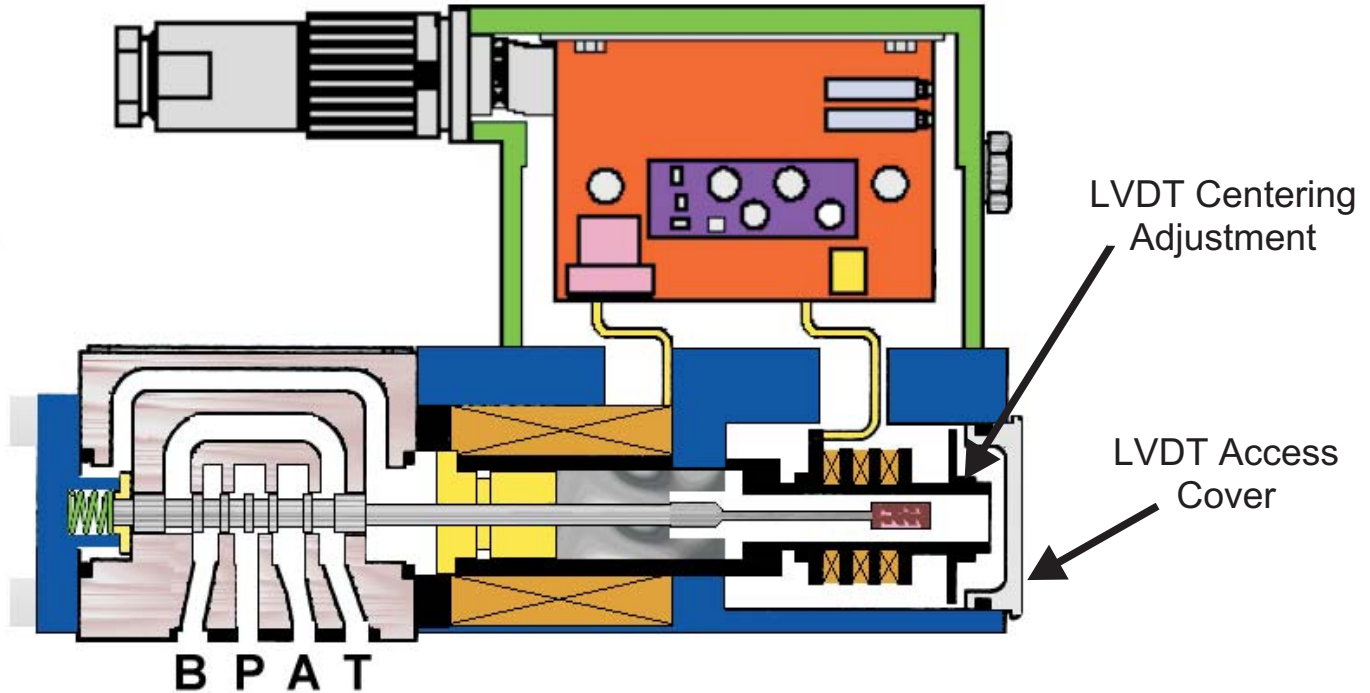
On many Bosch valves, the amplifier is mounted on the valve itself. This is commonly referred to as “On Board Electronics” (OBE). The Bosch valves have a seven pin connector. The pins are labeled on the next page.

7 Pin Connector



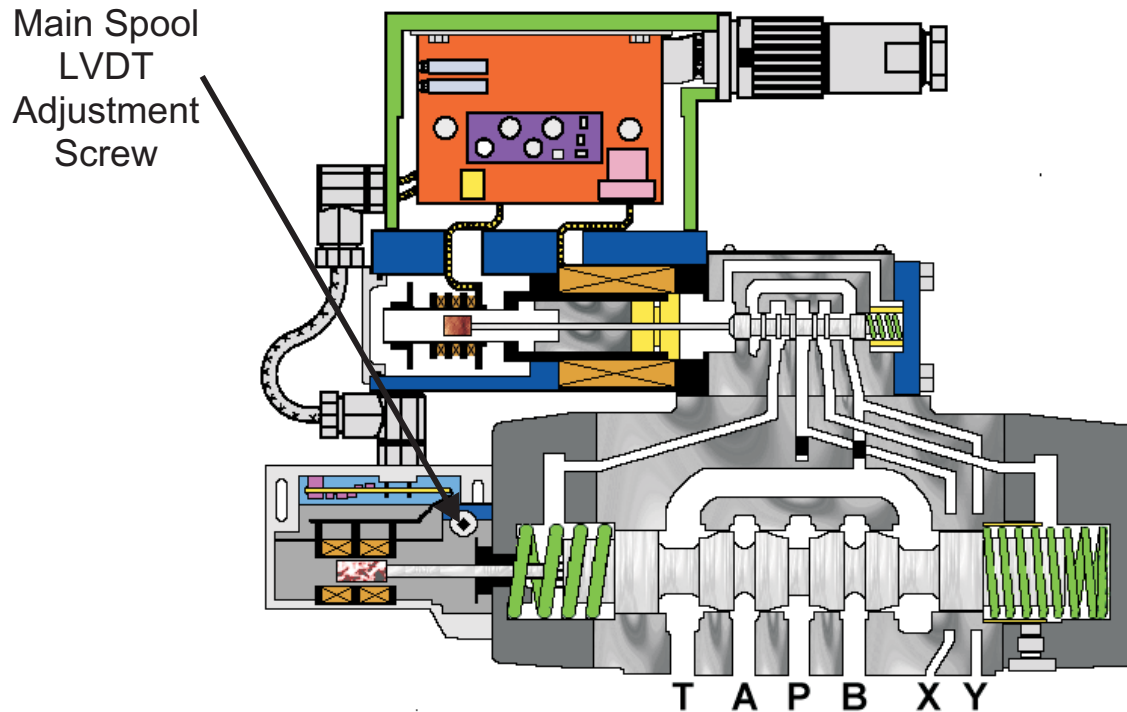
- A - Power Supply + 24 Volt**
- B - Power Supply 0 Volt**
- C - Reference 0 Volt**
- D - Signal Input 0 to + or -10V**
- E - Signal Input 0 to + or -10V**
- F - LVDT Feedback 0 to + or -10V**
- G - Earth Ground**

The power supply and command signal input voltages can be checked by removing the cable and inserting the multi-tester leads in the appropriate connections.



Direct Operated Valve with On Board Electronics

There is no “zero adjustment” on the card that can be accessed as on amplifiers that are mounted separately. If the load is drifting or oscillating with valves that use OBE, the LVDT should be mechanically centered. On valves that are direct operated, the round cover on the end of the LVDT housing should be removed. The nut should be adjusted until the actuator movement stops.



Pilot Operated Valve with On Board Electronics

On two stage valves with OBE, the position of the main spool LVDT should be adjusted if the load is moving with a 0 volt command. The adjustment is located on the side of the main spool LVDT housing. An allen head wrench will be needed for making the adjustment.

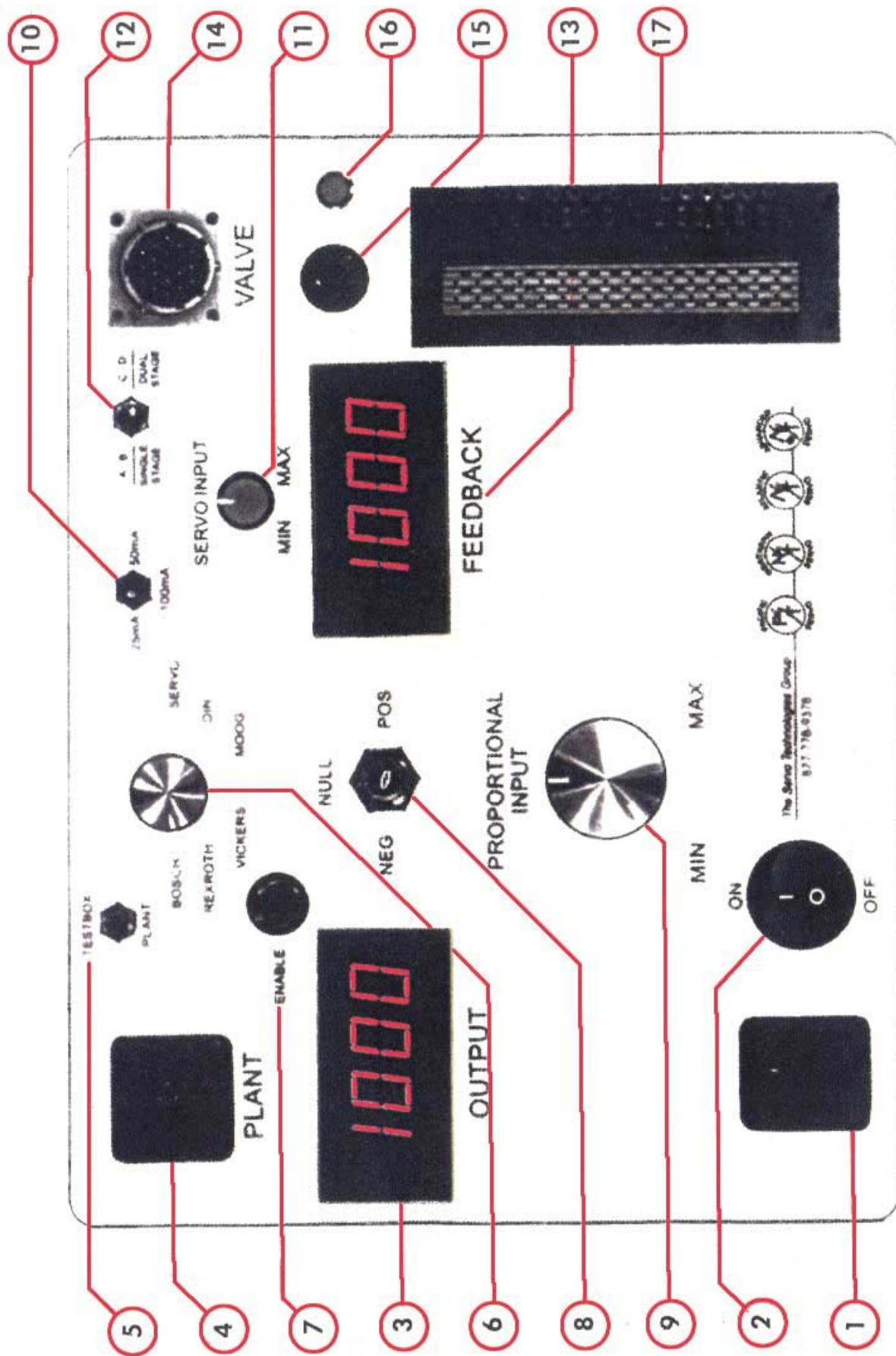


When turned, the allen head will rotate a worm gear drive inside the housing. As the driven gear rotates, the LVDT primary and secondary coil assembly is moved against a spring. Once the load stops drifting or oscillating, the adjustment is complete.

Test Boxes

Bosch and other companies make a variety of test boxes and adapters for checking all electrical connections including voltage supply, command inputs and feedback signals from the LVDT's. The test box contains a potentiometer for driving the valve exclusive of the machine controller. Digital readouts indicate the command and feedback voltages. By driving the valve with this box it can be determined if the valve is operating properly or the problem is elsewhere in the system. Information for using the test box shown can be found in the next section of the manual.





OBE 7 pin	BOSCH	REXROTH	VICKERS	MOOG	BOSCH DIN	SERVO	19 Pin Connect
A	(+) 24 vdc	(+) 24 vdc	(+) 15 vdc	(+) 15 vdc			N
B	0 volts	0 volts	(-) 15 vdc	(-) 15 vdc			P
C	feedback com	enable	N/C	0 vdc			R
D	(=/-) 10 vdc	(+/-) 10 vdc	(+) 24 vdc	(+/-) 10 vdc			S
E	signal common	signal common	common	common			T
F	(+/-) feedback	(+/-) feedback	0~10 vdc	(+/-)			U
G	earth ground	N/C	N/C	N/C			V
						Signal	C
						Common	E
						Common	J
						Signal	L
					(+) 15 vdc		A
					(+/-) 10 vdc		B
					Solenoid		D
					(+/-) 10 vdc		F
					(-) 15 vdc		G
					Signal		H
					Solenoid		K
					Signal		M

Controls, Indicators, and Connectors

1. **AC Power Inlet with .63 Amp Fuse**
 - Uses a molded SVJ three prong AC power cord
 - 0.63 amp time lag 5 x 20mm fuse
 - When AC power connected, Bosch plant cable power is disconnected
2. **AC Power Switch**
 - Apply AC power to test box
3. **Command Output Meter**
 - Displays the command output signal going to the valve, DIN card, or servo
4. **Bosch Plant Cable Connector**
FOR OBE'S WITH BOSCH WIRING ONLY
 - With plant cable disconnected from OBE, you can connect it to the test box and it will power up the unit without AC power
 - Valve's with same wiring as Bosch OBE can also be connected (check chart)
5. **Test Box/Plant Switch**
 - Plant mode allows you to view input signals on plant cable
 - Test box mode switches all functions to test box
6. **Selector Switch**
 - Allows user to select the different units the box can control

7. **Rexroth Enable Switch**
 - With the selector switch in the Rexroth position, depressing this switch will enable the valve
8. **Command Signal Selector Switch**
 - Allows you to select Negative, Positive, or No (Null) voltage signal to be applied to the proportional input pot
9. **Proportional Input Pot**
 - Varies the amount of the input signal going to the valve, or DIN card, from 0 to +/- 10 volts
10. **Servo Current Selector Switch**
 - Selects the max current going to the Servo Input level pot from 25mA, 50mA, 100mA
11. **Servo Input Level Pot**
 - Controls the signal level from zero to max selected
 - Signal is displayed on the command output meter
 - **With no load connected, meter will display the max signal selected and pot will have no effect**
12. **Servo / OBE Selector Switch**
 - When using the servo section of the test box, this switch controls which coils/ports are energized, i.e. A/B or C/D
 - When using a DIN card, this switch selects the LVDT signal displayed, single stage cards (reads the pilot) or dual stage cards (reads the main)

13. Feedback Meter

- Displays the amount of feedback from the valve. **There is no feedback in the servo mode.**

14. Valve Output Connector

- This connector is set up to handle various cables required for the different valves:
 - OBE – Bosch, Rexroth, Vickers, and Moog six or seven pin connectors
 - DIN – Bosch
 - Rugged – Bosch
 - Servo – Numerous manufacturers

15. OBE Output Fuse

- A 2.5 Amp 5 x 20mm time lag fuse to protect the test box from a shorted OBE

16. Blown Fuse Indicator

- Red LED indicator is on when fuse is blown

17. Bosch DIN Card Connector

BOSCH DIN / RUGGED TEST PROCEDURES

This unit was designed to test Bosch DC valves that have single stage (pilot) or dual stage (pilot/main) LVDT's.

1. Make sure AC Power Switch (#2) is off.
2. Plug AC power cord into the AC Power Inlet (#1).
3. Place Command Signal Selector Switch (#8) in the null (zero) position.
4. Turn Proportional Input Pot (#9) fully counterclockwise to zero position.
5. Turn Selector Switch (#6) to DIN position.
6. Connect cable to Output Connector (#14) and the hydraulic valve.
7. Place Servo/OBE Selector Switch (#11) into the single or dual position.
8. Insert Bosch DIN card into Connector (#17).
9. Turn AC Power Switch (#2) on.
 - Command Output (#3) and Feedback (#13) meters will come on

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Bosch DIN / Rugged Test Procedures continued:

10. Place Command Signal Selector Switch (#8) to positive or negative position.
 - This applies power to the Proportional Input Pot (#9)
11. Slowly turn Proportional Input Pot (#9) clockwise.
 - This increases signal to the valve and will display on the Command Output Meter (#3).
 - If valve is functioning correctly, the Feedback Meter (#13) will follow the signal on the Command Output Meter (#3). **Signal may be reverse polarity. Tolerance - 0.1 volts.**
Some cards have gain greater than one. In this instance the signal on the Command Output Meter (#3) will be less than the Feedback Meter (#13).
12. Turn Command Output Pot (#3) counterclockwise to zero and place Signal Selector Switch (#8) in the opposite position and repeat item #9. After test is complete, turn Command Output Pot (#3) counterclockwise to zero. Turn AC Power Switch (#2) off and disconnect valve and remove DIN card.

OBE TEST PROCEDURES

To test valves with on board electronics (OBE). Check the front page of this guide or inside the lid of the test box for the various electrical connections and corresponding selector switch positions. Valve manufacturers have valves that are electronically the same as other manufacturers. Example: Vickers has some valves that are wired the same as Rexroth and Bosch and use the same power. always check the label on the valve or the data sheet for correct hook up.

1. Make sure AC Power Switch (#2) is off.
2. Plug AC power cord into the AC Power Inlet (#1).
3. Place Command Signal Selector Switch (#8) in the null (zero) position.
4. Turn Proportional Input Pot (#9) fully counterclockwise to zero position.
5. Turn Selector Switch (#6) to the proper position for the valve under test.
6. Connect cable to Output Connector (#14) and to the hydraulic valve.
7. Turn Power Switch (#2) on.
 - Command Output (#3) and Feedback (#13) meters will come on
 - If you are testing a Rexroth valve that needs an enable signal, press the Rexroth Enable Switch (#7) at this time

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OBE Test Procedures continued:

8. Place Command Signal Selector Switch (#8) to positive or negative position.
 - This applies power to the Proportional Input Pot (#9)
9. Slowly turn Proportional Input Pot (#9) clockwise.
 - The signal going to the valve will increase and display on the Command Output Meter (#3).
 - If valve is functioning correctly, the Feedback Meter (#13) will follow the signal on the Command Output Meter (#3). **Tolerance of - 0.1 volts.**
10. Turn Command Output Pot (#3) counterclockwise to zero and place Signal Selector Switch (#8) in the opposite position and repeat item #9. After test is complete, turn Command Output Pot (#3) counterclockwise to zero. Turn AC Power Switch (#2) off and disconnect valve.

SERVO VALVE TEST PROCEDURES

Test Box will test a wide variety of servo valves from different manufacturers.

1. Make sure AC Power Switch (#2) is off.
2. Plug AC power cord into the AC Power Inlet (#1).
3. Turn Selector Switch (#6) to Servo position.
4. Place Servo Current Selector switch (#10) in desired position – 25mA, 50mA, or 100mA.
5. Turn Servo Input Pot (#11) fully counterclockwise to zero position.
6. Place Servo / OBE Selector Switch (#12) to the A-B or C-D position.
7. Connect cable to Output Connector (#14) and to the hydraulic valve.
8. Turn AC Power Switch (#2) on.
 - Command Output (#3) and Feedback (#13) meters will display
9. Slowly turn Servo Input Pot (#11) clockwise.
 - This increases signal to the valve and will display on the Command Output Meter (#3)
 - 0 to 25mA will display as 0.00 to 2.50
 - 0 to 50mA will display as 0.00 to 5.00
 - 0 to 100mA will display as 0.00 to 10.00
10. Turn Servo Input Pot (#11) counterclockwise to zero and place Servo/OBE Selector Switch (#12) in the opposite position and repeat step #9. After test is completed, turn Servo/OBE Selector Switch (#11) counterclockwise to zero. Turn AC Power Switch (#2) off and disconnect valve.

There will not be a feedback signal for this test