Installation Manual for SPL Machine Control System

0794-5430 Rev A

5475 Kellenburger Road
Dayton, Ohio U.S.A. 45424-1099
Phone: (800) 767-4822

CAUTION: Installation is to be performed by trained and qualified personnel only.

Installation Preparations

To facilitate the installation of the Trimble Control System, it is necessary to have the following equipment and supplies available at the job site.

Arc Welder / Welding Rods
Volt/Ohm Meter
Mechanical and Electrical hand Tools
Clean Container for Hydraulic Oil
Clean Rags
Additionally, the machine should be steam-cleaned, concentrating on the points of hydraulic connections and welding areas.

Important Safety Information For Working On Mobile Hydraulics

Protective Equipment

Always wear protective glasses, protective shoes, and other protective equipment as required by job conditions and machines. In particular, wear protective glasses when using pressurized air to clean surfaces, or cleaning overhead areas. Use welder's gloves, hood or goggles, apron and other protective clothing appropriate to the welding job being performed.
Do not wear loose clothing or jewelry that can catch on machine parts or tools.

Pressurized Items

Lower the blade, ripper and other attachments to the ground before performing any work on the machine. Relieve all pressure in oil, air, or water system before any lines, fittings, or related items are disconnected or removed. Use caution when checking the machine for hydraulic leaks, and system operation. Do not use bare hands to check for leaks. Pin-hole leaks can result in a high velocity fluid stream that can penetrate the skin and cause serious injury.

Mounting and Dismounting

Use steps and handrails when mounting or dismounting a machine, facing the machine.

Important Safety Information For Working On Mobile Hydraulics (Cont.)

Hot Fluids

To avoid burns, be alert for hot parts and hoses on machines that have just been stopped. Be careful when removing fill caps, breathers, and hose connections on the machine. Hold a rag over the cap or fitting to prevent being sprayed by liquids under pressure.

Pre-Installation

Before starting to disconnect hydraulic and electrical components, disconnect the battery cable and attach a "Do Not Operate" or similar tag in the operator's compartment. A "lock-out" box should also be placed and locked onto the battery terminal to avoid the battery from being reconnected and the machine possibly started.

GENERAL INFORMATION

PLEASE READ THE COMPLETE INSTALLATION INSTRUCTIONS BEFORE STARTING INSTALLATION!

NOTE: The left and right sides of the machine is referenced while standing behind the unit, facing the normal direction of travel.

Do not tighten the hardware until instructed to in the assembly instructions.

Important: Be sure to use the hardware specified when using tapped holes as trying to install a metric bolt in an inch thread or an inch bolt in a metric thread will damage the threads.

Install flat washers over all slotted holes unless truss-head or carriage bolts are used. Install special hardened washers where specified.

Install a lock washer on all bolts unless a jam nut or self-locking nut is specified.

SYSTEM SPECIFICATIONS

DISPLAY KIT: SP-LTACK / SP-DLACK

CONTROL BOX: CB30

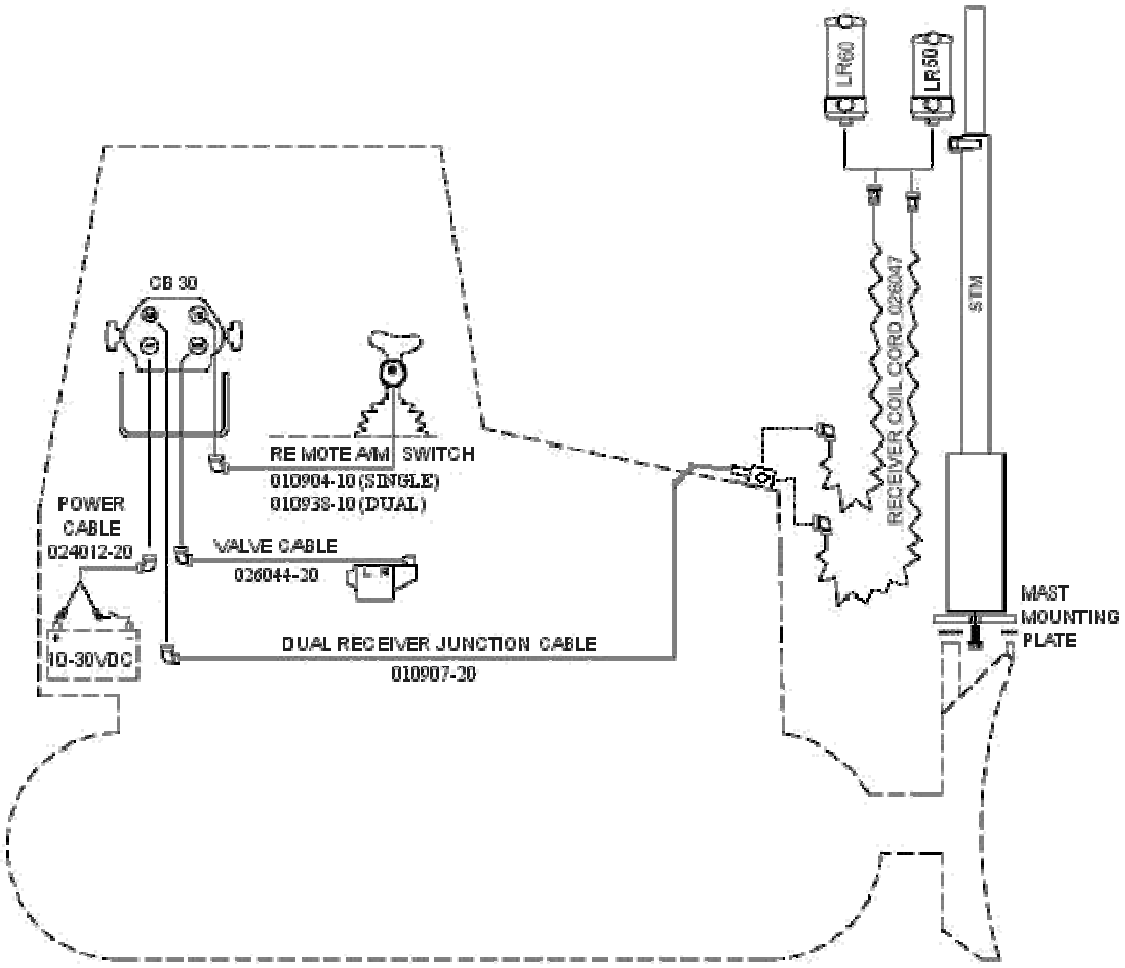
RECEIVERS: LR30, LR50, LR60

CABLES: POWER CABLE – 024012-20
DUAL RECEIVER JUNCTION CABLE – 010907-20
RECEIVER COILED CABLES – 026047 (Qty. 2)
VALVE CABLE – 026044-20
SINGLE REMOTE SWITCH – 010904-10 (SP-LTACK only)
DUAL REMOTE SWITCH – 010938-10 (SP-DLACK only)

Cables included in the display kit.

OPTIONAL MANUAL MAST(S): STM
MOUNTING PLATE – 0794-2320-S

WIRING DIAGRAM:



Mounting the Control Box

Mount the Control Box using the mount, (1) in a location that is easily visible and within the reach of the operator. Make sure that when mounting the Control Box that it doesn't interfere with the operation of the machine controls and that the cables can be easily routed to it. Use 3/8" hardware to mount the control box bracket to the machine.

Note: The Control Box has vented drain holes in the bottom of the unit that must face downward.

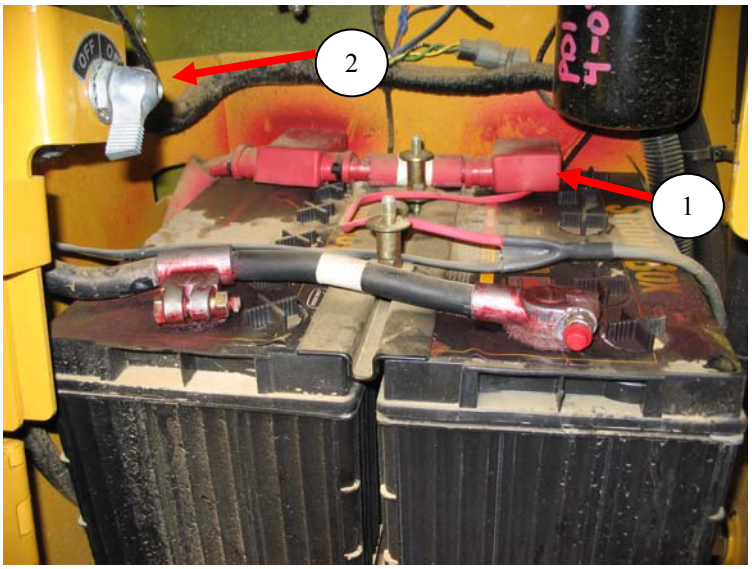
Installing Cables

Once the Control Box is mounted, locate a cut out or plugged hole in the sheet metal near the control box to pull the connectors through. On some machines it may be necessary to cut a hole using a hole saw in the sheet metal to route the connections to the control box.

Caution: When drilling a hole through the sheet metal, be sure not to drill into wiring harnesses and other components.

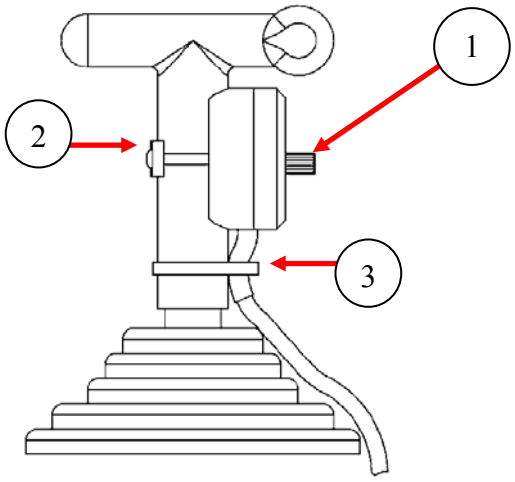
Note: If a hole needs to be made, grind or file all sharp edges off the metal and add edge grommet or wire loom to protect the cables from damage.

Connecting Power



To install the power cable route the cable from the control box, through the machine to the batteries. Connect the positive wire (1) to the positive terminal of the battery. Then connect the ground wire to the frame side of the master disconnect (2). Then connect the four pin connector of the cable to the back of the Control Box.

Remote Switch Installation

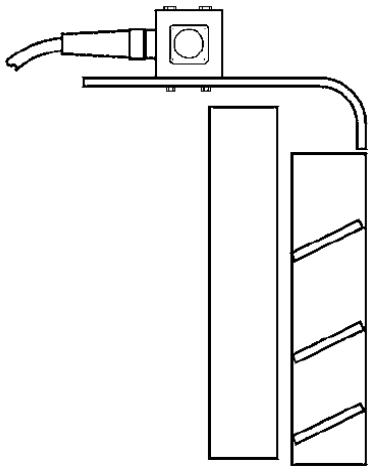


The remote switch(s) (1) is designed to mount to 3/8" – 1-1/8" diameter lever shafts. The assembly normally mounts to the blade lift / lower control lever for easy access during operation with the switch(s) pointing inward.

Before attaching the switch(s), remove any dirt or oils from the area where the switch(s) will mount with isopropyl alcohol or detergent cleaner. Then remove the adhesive liners on the double sticky tape and apply to the back of the switch(s). Attach the assembly to the lever with the screws and clamp(s) (2) provided in the kit. Route the cable downward from the switch housing(s), and then provide a strain relief to the cable by tie wrapping (3) it to the lever as shown.

Note: If mounted to a moving lever, ensure there is enough cable to permit full lever travel

Caution: Do not over tighten as this can distort the housing and clamp.



Dual Receiver Junction Block Cable Installation.

The Dual Junction Block can be mounted to the top of the hood by drilling two ¼" holes. After the holes are drilled, turn the junction block on its side and using the supplied ¼" hardware secure the block to the machine. The junction block is marked "L" for the left side and "R" for the right side. Then route the cable through the machine and connect it to the control box.

The Dual Junction block can also be mounted to the grill of the machine using ¼" hardware. Note though that it might require making minor grill modifications. To route the cable through the machine loosen the bolts on the grill. Route the cable around the radiator through the machine and connect it to the control box.

Caution: ***When routing the cable through the engine compartment wire tie the cable away from rotating parts and hot surfaces to protect the cable from damage.***

Valve Cable (optional)

Connect the valve cable's ten pin connector to the back of the control box and route the cable to the valve. Then connect the cable to the valve using the appropriate wiring diagram supplied in Appendix A.

Installing the Optional Mast(s)

GENERAL/WELDING SAFETY NOTES

Eye protection should be used for all welding operations to protect the eyes from bright light, heat, ultraviolet light, and flying sparks. For the best protection, wear face shields or helmets and goggles. To keep slag and particles out of your eyes when removing your face shield, tip your head forward and keep your eyes closed. Welding helmets, goggles, or other eye protectors must contain special filter plates or lenses for workers exposed to arc welding or cutting processes.

Protective clothing which should be worn during welding (by welders and nearby workers) includes: fire-resistant gauntlet gloves, head cap, high-top hard-toed shoes, leather apron, face shield, flame-retardant coveralls, safety glasses, and helmets, and leggings or high boots. Protective clothing should be made of wool, which does not ignite easily, or specially-treated cotton fabrics. Sleeves and collars should be kept buttoned, and pants and shirts should be un-cuffed. Capes and hard hats may also be required. Workers should use welding helmets (with appropriate filter lenses), **not** hand-held screens. When welding overhead, extra protection should be used, such as fire-resistant shoulder covers, aprons, head covers, leggings, and suits. Ear plugs should be worn when welding sparks or hot spatter may get in the ears.

Electrical hazards
Even though welding generally uses low voltage, there is still a danger of electric shock. The environmental conditions of the welder (such as wet or cramped spaces) may make the likelihood of a shock greater. Falls and other accidents can result from even a small shock; brain damage and death can result from a large shock.
Dry gloves should always be worn to protect against electric shock. The welder should also wear rubber-soled shoes, and use an insulating layer, such as a dry board or a rubber mat, for protection on surfaces that can conduct electricity.
The piece being welded and the frame of all electrically powered machines must be grounded. The insulation on electrode holders and electrical cables should be kept dry and in good condition. Electrodes should not be changed with bare hands, with wet gloves, or when standing on wet floors or grounded surfaces.
All welders should receive training on the safe use of equipment and processes, safe work practices, and emergency procedures.

Before starting, disconnect the battery cable and attach a “Do Not Operate” or similar tag in the operator’s compartment. A “lock-out” Box should also be places and locked onto the battery terminal to avoid the battery from being reconnected and the machine possibly started.

EQUIPMENT/SUPPLIES

To facilitate the construction of the mast base, it is necessary to have the following equipment and supplies available at the job site:

- Steel plate material for gussets
- AC/DC stick welder
- Shielded welding rod
- Oxy-acetylene cutting torch or plasma cutter
- Hi-speed angle grinder
- Cleaner/solvent
- Machine color aerosol paint
- Welding helmet
- Safety glasses
- Protective clothing
- Level

MAST MOUNT CONSIDERATIONS

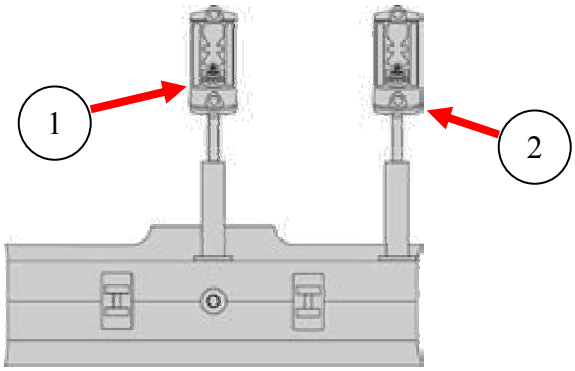
The mast for the SPL Machine Control System should be mounted on the top edge of the blade. The machine should be positioned on a flat level surface with the blade on the ground. Position the blade so that the top of the cutting edge is level. The mast mounting plate should be level when the blade is in its normal operating position. On tracked machines it may be necessary to use riser blocks under the blade that are the same height as the track grousers. The mast plate should be directly above the cutting edge of the blade. During construction of the mast mount, make sure that the mast mounting plate is level both front to back and side-to-side.

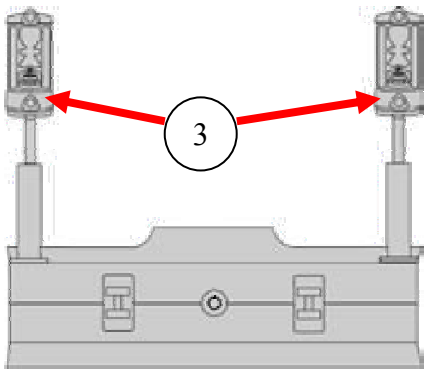
The primary consideration during the construction of the mast mount is strength and rigidity of the mount assembly. The size, shape, and position of the modified gusseting plates/standoff will affect the overall strength of the assembly. Quality welds with proper penetration, free of porosity and slag, will assure that the assembly is as strong as possible.

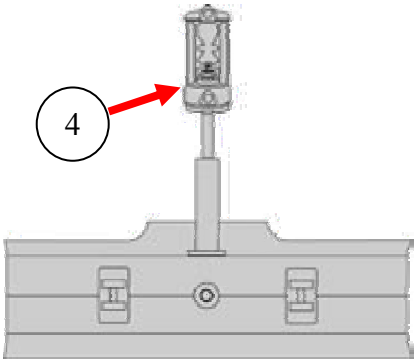
Make sure that all mast-mounting bolts are accessible with the appropriate tools when the mounting assembly is complete

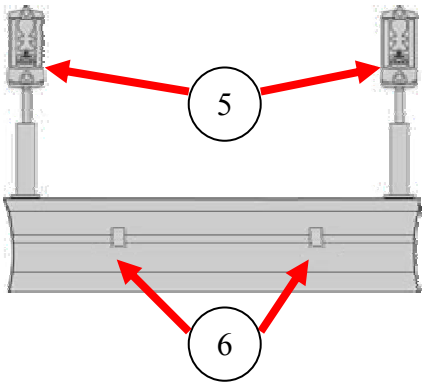


Mast Mounting Positions









Lift & Tilt: There are three different possible mast mounting locations for a machine that operates using lift and tilt type of blade control. Two of the configurations use dual LR laser receivers while the third uses a single laser receiver.

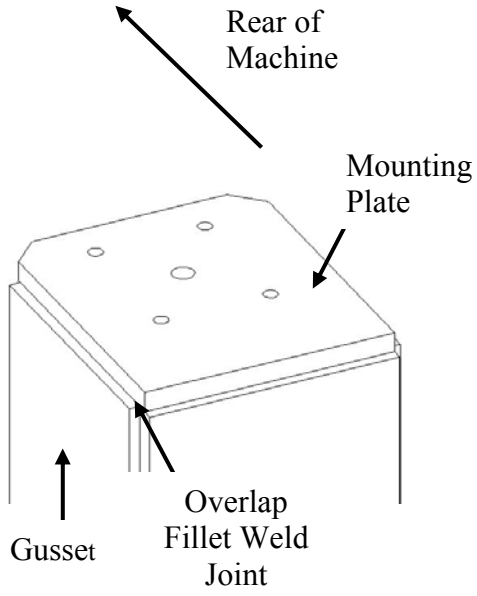
I. Traditional Mounting – The conventional method for utilizing dual laser receivers is to mount the left or lift laser receiver at the center of the blade (1) and the right or tilt laser receiver at the right side of the blade (2). Most of the time, the traditional setup will lead to a height difference in the two mast mounts.

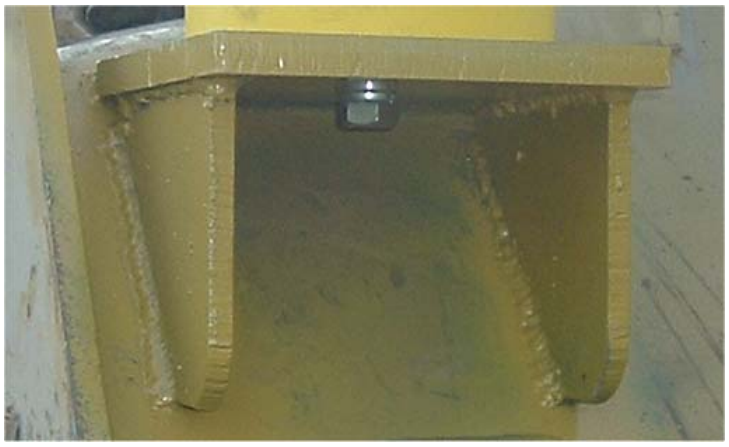
II. Wide Stance Mounting – Another option for mounting the masts for dual laser receivers is to have one at each end of the blade (3). This setup avoids having to fabricate a mount over the king pin and linkages at the center of the blade. It will also allow for both mast mounts to be the same height above the cutting edge.

III. Single Laser Receiver – If only a single laser receiver is being used, it needs to be mounted at the center of the blade (4). This allows for the receiver to be mounted over the pivot point of the blade. If using the internal slope sensor of the laser receiver to control the blade tilt, it needs to be mounted at the center of the blade as well.

Lift & Lift: For dual laser receivers, mount each receiver at its respective end of the blade (5). If the receiver is closer to the end of the blade it provides better accuracy. Conversely if the laser receiver is mounted closer to the blade pivot (6), it provides more stability.

CONSTRUCTING/WELDING THE MAST MOUNT(S)





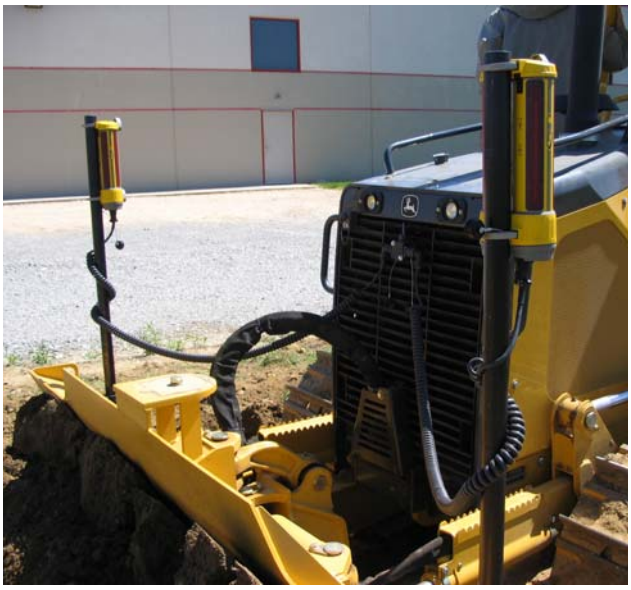
Caution: Before welding turn the master disconnect off and disconnect any computer modules.

Determine the final location of the mast mount plate(s) relative to the blade. Next, fixture the plate(s) in the location to be welded with the chamfered edges facing towards the rear of the machine. Place a spirit level on the plate to ensue the plate is completely plumb then tack weld the plate(s) in place.

Note: *Pay close attention to the mast mounting hole pattern of the plate to assure correct orientation. The four threaded hole mounting pattern is NOT square. The chamfered corners of the mounting plate are usually faced toward the rear of the machine, but can also face forward if required.*

Next, using cardboard, make templates to cut out gussets to reinforce the mast plate(s). Cut the cardboard templates so that the mast mount plate is located in the correct position and fits tightly against the blade surface. A riser gusset may have to be cut before tack welding on the mast plate to accommodate for blades having an angled top surface or to clear pivot pins. Also make sure when cutting out the gussets that enough material is left for an overlap as shown. This will provide a stronger joint when welded. After the gussets are cut out, tack weld the gussets in the appropriate locations. Check with a spirit level that the plate is level front to back and side to side. If the plate is correctly positioned weld all of the joints. When the welding is complete, wire brush all of the slag from the welds, clean with solvent and paint the mount.

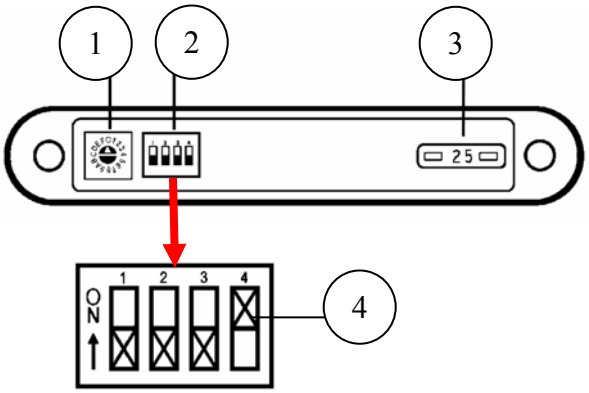
Once the mount is painted, mount the mast(s) using the ¾" bolt and lock washer supplied with the mast. Torque the bolt to 265 ft-lbs.



After the mast(s) is installed the laser receiver(s) can be mounted to the mast tube and the coil cord(s) can be connected.

Setup & Valve Calibration

To access the Technical Setup Menu for the initial installation the switches located on the bottom of the CB30, inside the thumb screw cover, are used.



- (1) Rotary Switch – Used for Factory Tests
- (2) DIP Switches – Used for Installation
- (3) Fuse – 25 amp, auto style

The rotary switch (1) is not used other than factory tests. The DIP switches (2) are used to access the technical setup menu by moving BAT number 4 (4) to the ON position. The operator does not need access to the Technical Setup Menu. From the four menu selections that first appear in the Technical Setup Menu, the two main menu items used to configure the system are System Setup and Valve Setup. The items within these two main menus that need to be configured are shown in the two tables below:

System Setup Menu	
Mach Arch	Select Machine Architecture
X-Couple Enable	Cross Coupling Enable
X-Couple Setup	Cross Coupling Compensation Setup
Slope	Slope Enable
Remote Config	Remote Switch Configuration
Remote A/M	Remote Switch Auto/Manual Enable
Remote R/L	Remote Raise / Lower Enable
Remote Offset	Remote Switch Elevation Offset Enable
Remote Match	Remote Switch Grade Match Enable

Valve Setup Menu	
Aux Vlv Drives	Auxiliary valve driver setup
Spool Profile	Exponential or linear valve spool
PC Valve Selected	
Pk % Dither	Dither amplitude for PC valves
Dither Hz	Dither frequency for PC valves
Max % On	Limits amount of power sent to PC valves
PT Valve Selected	
PT Period ms	Sets adaptive rate for PT valves
Max % On	Limits amount of power sent to PT valves
Raise Min	Raise valve minimum correction calibration
Lower Min	Lower valve minimum correction calibration
R/L Balance	Dynamic raise/lower balance
LH/RH Balance	Balance of left / right blade speeds
Valve Speed	Nominal gain for valves after applying balance
Slope%Elev Spd	Slope speed as a percentage of elevation speed

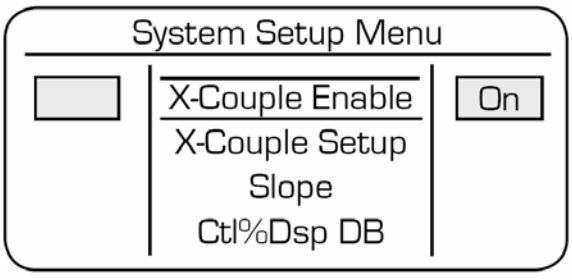
Machine Architecture

Each control side is setup independently for the control box. The left side can either be lift or off, while the right can be lift, tilt or off. Listed in the table below are the most common possible combinations and some common applications they might be used for:

Left	Right	Application
Lift	Tilt	Dozer setup or other similar single pivot blade type
Lift	Lift	Motorgrader or grader blade attachment
Lift	Off	Single lift only
Off	Lift	Single lift only

For more information refer to the Technical reference manual section 3.1.

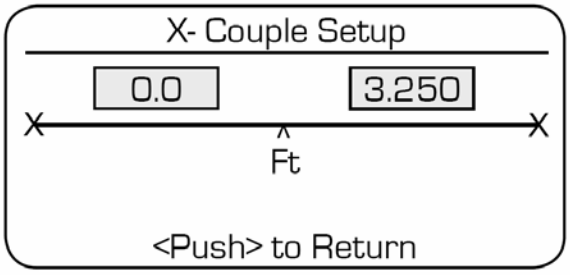
Cross Coupling Enable



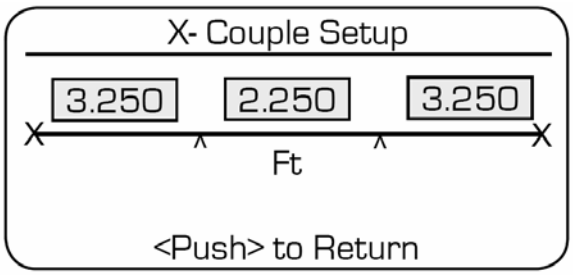
When enabled, it communicates corrections from one side to the other to stabilize the blade's movement. The cross coupling function is only used when both laser receivers are detecting a laser beam. The menu item is either On or Off, when turned On the Cross Couple Setup menu must be configured as well.

Cross Coupling Setup

To setup the cross coupling, the geometry of the blade must be entered which changes based upon the type of machine architecture selected. For measurement accuracy, ± 0.006 m (± 0.25 in or ± 0.02 ft) is sufficient.

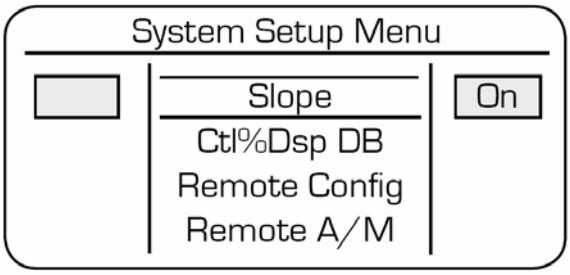


Lift and Tilt: The two measurements represent the horizontal distance along the blade between the center blade pivot and the respective laser receiver. For traditional lift and tilt setups, the left receiver would be mounted over the center pivot of the blade and so the left value would be 0.0. To change each value, scroll the respective multi-switch.



Lift and Lift: The left value represents the horizontal distance along the blade between the left laser receiver and the left blade pivot. The right value is the distance between the right blade pivot and right laser receiver and the center value is the distance between the two blade pivots. To edit the values, highlight the respective number and scroll the corresponding multi-switch. For the center value use the multi-switch that was used to highlight the center value.

Slope Enable



The Slope Menu item is used to enable the use of the internal slope sensor of the laser receiver mounted on the blade to control the slope of the blade. When enabled the internal slope sensor needs to be calibrated and oriented so that the LED panel is parallel to the length of the blade.

Remote Switch Configuration

The remote switches need to be configured based upon the type of remote switch(s) used and where it is mounted. Use the MULT setting for the multi-switch type of remote switch. If only one remote switch is configured, then that switch will control the functions for both left and right. For other options of switches that are available; refer to the Technical reference manual for more information.

Left	Right	Configuration
NONE	MULT	Single multi-switch mounted on the right pointing inward
MULT	MULT	Dual multi-switches mounted pointing inward
MULT	NONE	Single multi-switch mounted on the left pointing inward

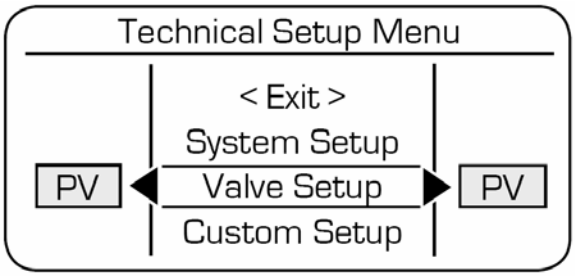
Other Remote Switch Settings

Remote Switch Auto / Manual Enable: Turns on and off the capability of the remote multi-switch to toggle between Auto and Manual states by moving the multi-switch forwards and backwards.
Remote Switch Raise / Lower Enable: Turns on and off the capability of the remote multi-switch to raise and lower the blade by moving the switch up and down. (Non-operational for tilt)
Remote Switch Elevation Offset Enable: Turns on and off the capability of the remote multi-switch to offset the elevation or slope (if applicable) by rotating the multi-switch.
Remote Switch Grade Match Enable: Turns on and off the capability of the remote multi-switch to set an off-center on grade dead band by pressing and holding the switch in for two seconds. The on-grade dead band can be returned to center by pressing and holding the multi-switch for five seconds.

Valve Selection

The Valve Setup menu item from the Technical Setup menu is used to select the type of valve to be driven by the CB30 Control Box. The following valves types are supported in the control box:

PT - Proportional Time -- On/off (bang-bang) valve drive
PV - Proportional Voltage -- Danfoss valve drive
PC - Proportional Current -- Various dither frequencies (Hz) and dither amplitudes (% of maximum correction)

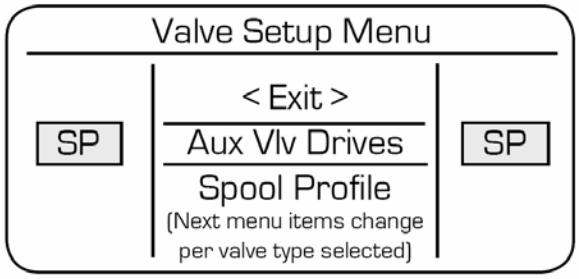


Toggle the multi-switch to highlight Valve Setup and rotate the left and right multi-switch to select PV, PC, or PT. Once the valve type is selected, press to enter the valve setup menu to set valve parameters and calibrate. Some menu items appear based upon valve selection, but if different valves are selected for each side, all menu items will appear.

For additional information on the types of valves supported, see Appendix C in the Technical reference manual. Also Appendix A in the technical reference manual can be referenced for a list of common valve models and their Control Box settings.

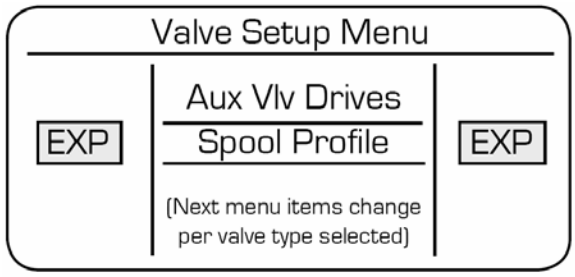
Auxiliary Valve Driver Setup

The Aux Vlv Drives menu item is used for valves that require machine power (Danfoss) or when an electric load sense signal is needed. If neither of these functions are needed, be sure to leave it in the off position to avoid unused live wires. The following options can be selected independently for left and right valves:



OFF – Inactive
SP – Machine voltage is supplied when the CB30 is on (Switched Power)
LS – Load sense power is supplied when the CB30 is in AUTO mode, raising and lowering, or when the laser receiver is in the laser beam and on grade
LSA – Load sense power is supplied when the CB30 is in AUTO mode or when raising and lowering

Spool Profile



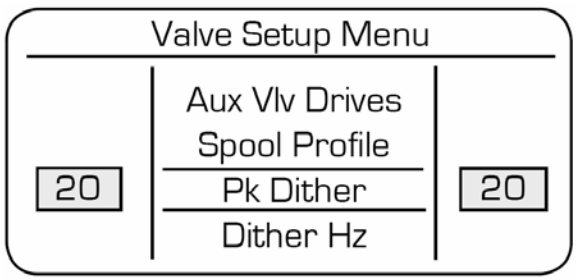
There are two different possible valve spool profiles available, exponential (EXP) and linear (LIN). PC valves usually have an exponentional (EXP) spool profile. Spool profile is not used by PT since the valve is either fully on or off.

Proportional Current Valves

When selecting a PC valve type, try to choose dither and current settings that are closest to the manufacturer's recommendations. Dither is a signal which is constantly sent to the valve that causes the spool to vibrate and stay lubricated. This reduces hysteresis and stiction. If the cylinder lines or cylinder are vibrating from dither, select a higher frequency and/or lower the % amplitude. Or if the valve is sticking or sluggish, select a lower dither frequency and/or higher % amplitude. Also if the valve's maximum current is less than the maximum supplied current, (machine voltage / coil resistance) then use the Max % On menu item to lower the maximum current supplied to the valve. This becomes a factor when 12V valves are put on 24V machines.

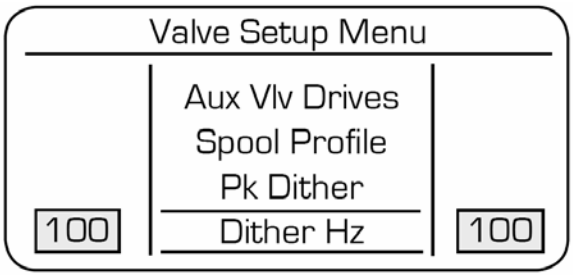
Note: The PC valves used in Spectra Laser Instrument hydraulic kits will primarily use the 100 Hz, 10% amplitude setting for the Proportional Current Valves.

Dither Amplitude



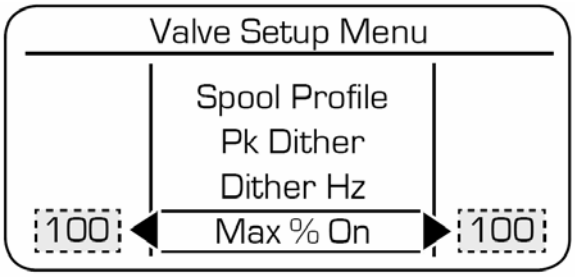
This menu item shows up for PC valves only. Select the dither amplitude according to valve settings recommended in Appendix B. Once the menu item is highlighted change each side's value by rotating the respective multi-switch. The values have a range of 0% to 25% in increments of 1%.

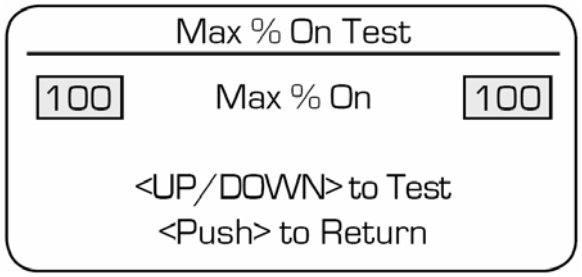
Dither Frequency



This menu item shows up for PC valve only as well. Select the dither frequency according to the settings recommended in Appendix B. Changing the values works the same as setting the amplitude by rotating the respective multi-switch.

Max Current



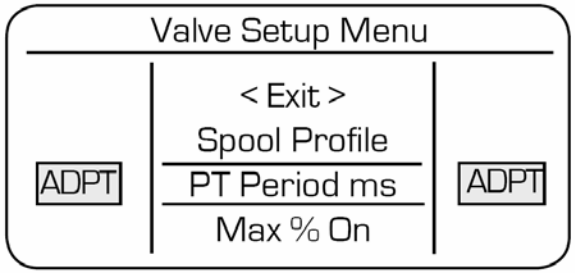


This menu item shows up for both PC and PT valves. The Max % On limits pulse width modulation (PWM) which limits current sent to PC valves at maximum correction. Select the percentage value based upon the settings recommended in Appendix B.

Caution: When in the test screen blade movement can occur by moving either multi-switch.

To change or adjust the value, highlight the above menu item and select it by pressing in on the multi-switch. This takes you to the test screen where by rotating the respective multi-switch it adjusts each value and by toggling it up and down it ensures that the valve raises and lowers the blade.

Proportional Time Valves



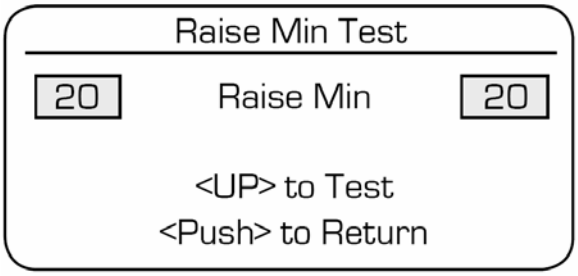
For PT valves the update rate can be adjusted from 100 to 250 ms in increments of 10. There is also an adaptive (ADPT) setting that optimizes the signal according to the laser transmitter RPM.

NOTE: Before proceeding, warm up the hydraulic system to operating temperature. Run the machine at operating RPM for approximately 15 minutes while cycling the blade lift cylinder. Check for proper hydraulic system operation. Ensure there are no leaks, excessive engine load or pressure relief valves continually opening. Check that all circuits function properly.

Valve Calibration – Setting the Valve Minimum Correction

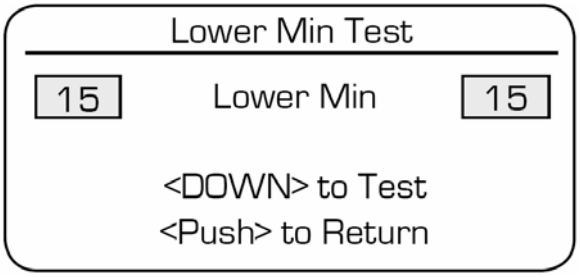
The Valve Minimum Correction (VMC) is set to provide output flow as soon as a correction signal is received providing for optimum system performance which accounts for spool overlap in the valve. To set the VMC, set the machines throttle to normal operating RPM and place the blade approximately 1 foot (0.3 m) above the ground. **No laser is required for this step**.

RAISE Minimum Correction



1. Select Raise Min from the Valve Setup menu using the multi-switch.
2. Toggle the left multi-switch switch to raise and hold.
3. If no blade movement, release switch. If there is movement, skip to step 6.
4. Increase the numeric value by rotating the multi-switch.
5. Return to Step 2.
6. Observe blade speed. Goal is 0.5 in. (13 mm) per sec.
7. If blade speed is too slow, continue increasing VMC and checking blade speed. If blade speed is too fast, rotate multi-switch to decrease VMC.
8. After proper VMC setting is obtained, note the value displayed. (See below)
9. Repeat the procedure for the right side.

LOWER Minimum Correction:

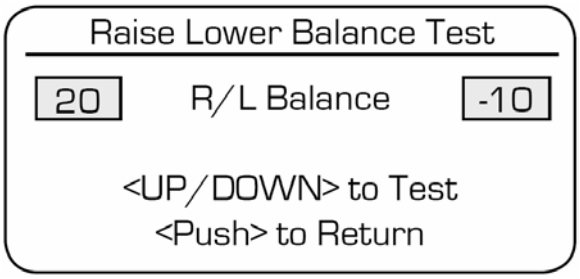


1. Select Lower Min from the Valve Setup menu
2. Toggle the left multi-switch to lower and hold.
3. If no blade movement, release switch. If there is movement, skip to step 6.
4. Increase the numeric value by rotating the multi-switch.
5. Return to step 2.
6. Observe blade speed. Goal is 0.5 in. (13 mm) per sec.
7. If blade speed is too slow, continue increasing VMC and checking blade speed. If blade speed is too fast, rotate the multi-switch to decrease VMC.
8. After proper VMC setting is obtained, note the value displayed.
9. Repeat the procedure for the right side.

Note: It is advisable to log the various settings for each particular machine.

Set Valve Raise / Lower Balance

The valve raise / lower balance set-up allows adjustment to compensate for different raise /lower blade velocities due to cylinder imbalance or for different hydraulic system responses to different loads. **No laser is required for this step.**



To set the valve balance, place the blade approximately 1 foot (0.3 m) above the ground and set the engine at normal operating RPM. Select R/L Balance from the Valve Setup menu and the screen shown should appear.

Left Side – Lift: Toggle the left multi-switch to raise and hold. The blade will oscillate up and down. Observe the blade drifting up or down during oscillation. Adjust the left side value to minimize the drift as follows:

Upward drift – decrease the left value.
Downward drift – increase the left value.

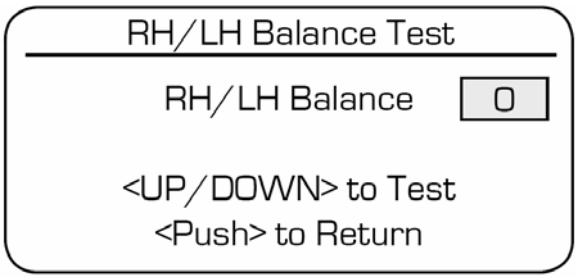
Right Side – Tilt: Toggle the right multi-switch to raise and hold. The blade will oscillate about the pivot point. Observe the right blade tip drifting up or down during oscillation. Adjust the right side value to minimize the drift as follows:

Right side upward drift – decrease the right value.
Right side downward drift – increase the right value.

Right Side – Lift: Same as the left side lift, just using the right multi-switch and adjusting the right value.

Set Right / Left Balance

The valves right / left balance allows adjustment to minimize imbalances in velocities between the left and right sides due to mechanical and hydraulic differences. The RH/LH Balance Test is selected from the Valve Setup Menu. **No laser is required for this step.** To optimize the value for a specific configuration use the following appropriate adjustment procedure:



Lift & Lift: Adjust the value so that the oscillation amplitude of the right and left blade tips is nearly equal during the test.

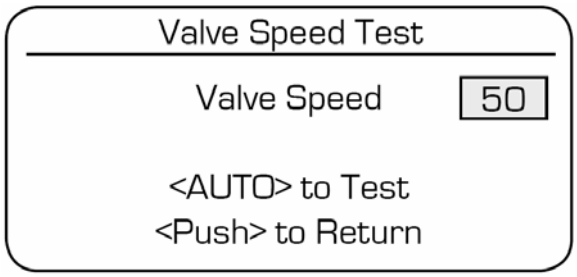
Lift & Tilt – Centered blade pivot: Adjust the value so that the oscillation amplitude of the left blade tip is minimized during the test.

Lift & Tilt – Not centered blade pivot: Adjust the value so that lift and tilt has nearly equal velocity at the blade tip furthest from the pivot when normally operating. The test is not used to optimize the value.

Set Performance Options and Valve Speed

Refer to the operator's manual for setting performance options that include deadband, valve speed, units, and control box LCD and LED brightness.

Presetting Valve Speed



Using the Blade in Air Method:

1. Select Valve Speed from the Valve Setup menu.
2. Set the machines throttle to normal operating RPM. Ensure the machine is on flat ground.
3. Place the blade approximately 1 foot (0.3 m) above the ground.
4. Set up the rotating laser at a typical working range. If a selectable rotation speed is available, set it to 600 RPM or faster.
5. Mount the receiver in its normal operating position to receive the laser.
6. Select an On-grade dead band of approximately 1/2 of the jobsite tolerance. If working at ranges that exceed 500 feet (150 m), this may be increased to compensate for the rotating laser's beam "bounce".
7. Select manual control.
8. Raise the blade to position the receiver at the lower edge of its vertical reception range, but still receiving the beam.
9. Select automatic control.

The blade and receiver will move towards on-grade. Note any overshooting of On-grade. Repeat the procedure for raise correction. Once again, note any overshooting of On-grade. Adjust the valve speed until there is a small overshoot for a full receiver length correction in both directions. The valve speed is adjusted by rotating the right multi-switch and is applied to both valves with a range of 0 to 100.

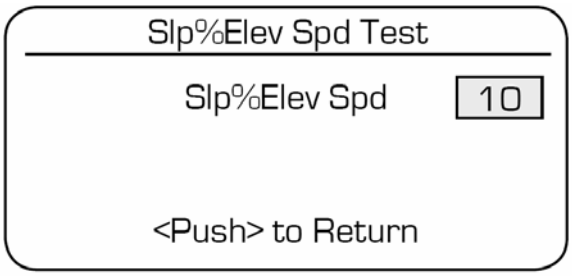
Increasing the valve speed - corresponds to a faster, but less stable correction.
Decreasing the valve speed - corresponds to a slower, but more stable correction.

If there is noticeable difference in reaction between the left and right sides, the right / left balance may need adjusted to even out the reactions.

Presetting Slope Speed Adjustment

The slope sensor cannot operate as fast as the elevation sensors and so it's correction speed is set as a percentage of the elevation speed. The reduced valve speed is only applied to the slope driven side of the blade.

Using the Blade in Air Method:



1. Select Slp%Elev Spd Test from the Valve Setup menu.
2. Set the machines throttle to normal operating RPM. Ensure the machine is on flat ground.
3. Place the blade approximately 1 foot (0.3 m) above the ground.
4. Set up the rotating laser at a typical working range. If a selectable rotation speed is available, set it to 600 RPM or faster.
5. Mount the receiver in its normal operating position to receive the laser.
6. Select an On-grade dead band between 0.3% and 1.0% depending on the jobsite tolerance.
7. Select manual control.
8. Tilt the blade to create a coarse correction (full arrow) lower correction.
9. Select automatic control.

The blade and receiver will move towards on-grade. Note any overshooting of On-grade. Repeat the procedure for the opposite direction. Once again, note any overshooting of On-grade. Adjust the Valve Slope%Elev until there is little or no overshoot for a coarse correction in both directions.

Increasing Slope%Elev speed - corresponds to a faster, but less stable correction.
Decreasing Slope%Elev speed - corresponds to a slower, but more stable correction.

Check System Performance

Set up the rotating laser at a typical working range. Select the RPM of the laser to 600 RPM or faster if available. Mount the receiver to the mast of the machine in a position to receive the beam. Select an On-grade deadband less than the jobsite tolerance. Typically 1/2 is the value used as a starting point.

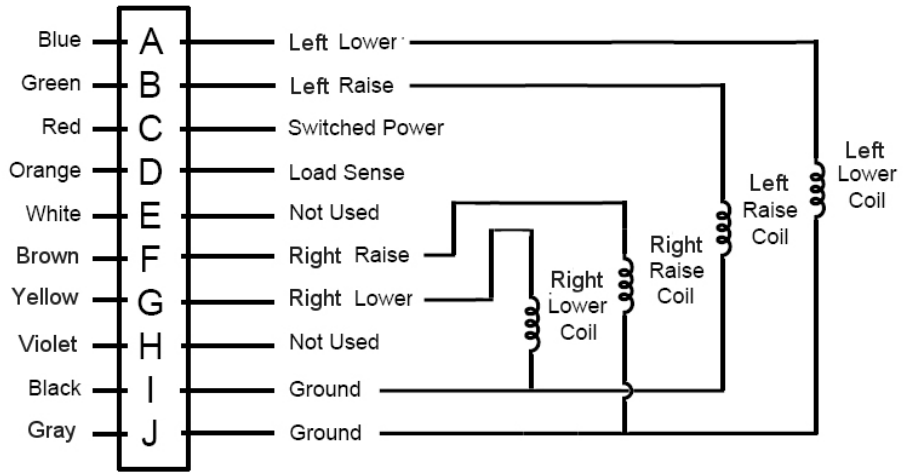
Fine tune the Valve Speed while working in typical material and operating conditions. If the system is over correcting or too jumpy, decrease the valve speed setting. If the system is not correcting fast enough or is sluggish, increase the valve speed. If one side is more reactive than the other then the Right / Left Balance will need to be adjusted.

Note: Environmental factors and laser set up can also affect system performance. Follow the set up procedures for your laser. Ensure proper tripods are used for stable laser operation.
Changing the laser RPM, laser strike averaging, deadband, spool profile, valve speed, valve balance, or valve minimum corrections can affect system performance. System operation should be rechecked after changing any of these parameters.

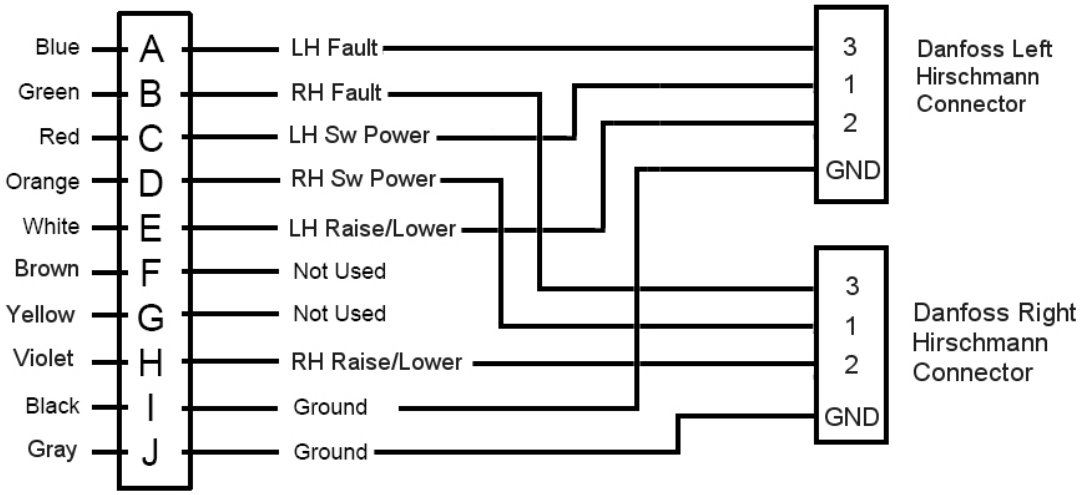
APPENDIX A

Hydraulic Valve Wiring

PT / PC Valve Wiring:



PV Valve Wiring:



APPENDIX B

PC Valve PWM & Current Settings

Recommended PC valve settings for Spectra Precision hydraulic kits:

CB30 Setting Recommendations

Valve Type	Machine Voltage (V)	Valve Driver	Dither Freq. (HZ)	Dither Amplitude %	% of Full Current Supplied
Vickers	12	PC	100	10	50
Vickers	24	PC	100	10	50
Parker	12	PC	100	10	50
Parker	24	PC	100	10	50
Bosch	12	PC	200	20	64
Bosch	24	PC	200	20	32

Note: These Recommendations are for Spectra Precision Laser Hydraulic Kits Only! For valve types by other manufacturers refer to the Technical Reference manual.