

**HWH® Online Technical School**  
**Lesson 13: Hydraulic Leveling System Identification and Operation**  
**PART 1**  
**Manually Operated Leveling Systems**  
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## CHAPTER 1 - INTRODUCTION

Lesson 13 - Parts 1 & 2 deal with identifying the different HWH® hydraulic leveling systems and the basic operation of each system. To properly diagnose problems or obtain parts for repairs, you not only have to be able to identify which system you are working on, you also have to know how that system should function. For example, a 510 Series system with kick-down jacks functions differently than a 610 Series system with kick-down jacks. **All manually operated systems in lesson 13, Part 1, use jacks with single-acting (spring-retract) cylinders.** Some automatic computerized leveling systems will use a double-acting (power-retract) cylinder.

There are two basic types of leveling systems, the “manual” systems and the “automatic computerized” systems. With “**manual**” systems, leveling is controlled by the operator. The operator uses levers or buttons on a touch panel to extend jacks to level the vehicle. Although with most manually controlled leveling system, level indicator lights are provided, the operator decides which jacks are extended and how far they are extended. The operator can manually retract the jacks with all manually controlled systems but touch panel type manual systems have a “STORE” button that will automatically retract all the jacks. Air dump is manually controlled on vehicles with an air suspension. With “**automatic computer-controlled**” systems, all functions of the leveling procedure, including air dump, are decided by a computer that is part of the system. Store functions, like manual touch panel systems, are automatic. Automatic systems do have manual capability for operator control.

Control panels, control boxes, valves, and other system features will be used in the identification of the systems. **Due to the visual similarity of control panels and sometimes control boxes, especially with touch panel controlled systems, it is important to understand less obvious differences.** The differences may be (but not limited to) the style of touch panel cable, valve arrangements on the hydraulic manifolds or even the type of warning switch used.

Most of the hydraulic leveling systems, except the 100/110 systems, have a repair manual available but it is necessary to identify the system to obtain the correct manual. For example, there are two completely different 610 Series leveling systems. Each has its own repair manual. Much of the diagnostics for each system is not interchangeable. Using the wrong manual will probably result in an incorrect diagnosis of the issue.

**IMPORTANT: It would be very helpful to study Lesson 8 (Hydraulics and HWH®) and Lesson 9 (Electronics and HWH®) before continuing with this lesson or working on HWH® equipment. These two lessons identify the individual system components along with their function and some diagnostics. This lesson will deal with some component information but not in great detail. As you study this lesson, refer back to lessons 8 and 9 to get greater detailed information about specific components.**

If you want to review a specific system, return to the lesson directory and click on the system you wish to review. **This lesson only covers systems for motorized vehicles.**

**Note: For most systems (not all) there are complete schematics, diagrams, and/or comprehensive repair manuals on the HWH® web site at [www.hwh.com](http://www.hwh.com). These will be located under “Customer Support and Technical Service” on the home page.**

## CHAPTER 2 - 100 and 110 Series, Lever-Controlled Leveling Systems

The 100 and 110 Series lever controlled systems are identical in operation. They both have one lever per jack for individual control of each jack. The same lever is used to extend and retract the jack. The only difference between the two systems is the electrical control and light package. The 100 Series has a control and light panel that is mounted separately from the control valve assembly. The levers protrude through a plain bezel plate that covers the valve. The 110 system has a bezel plate that includes the electric controls and light package. Until 1989, some of the 100 and 110 bezel plates had an "A&E" label instead of the "HWH®" label. These panels are referred to as "light plates" or "light panels". The new style 100 and 110 light panels are available for both 12 volt and 24 volt systems.

### 2-1 The 100 Series, Lever-Controlled System.

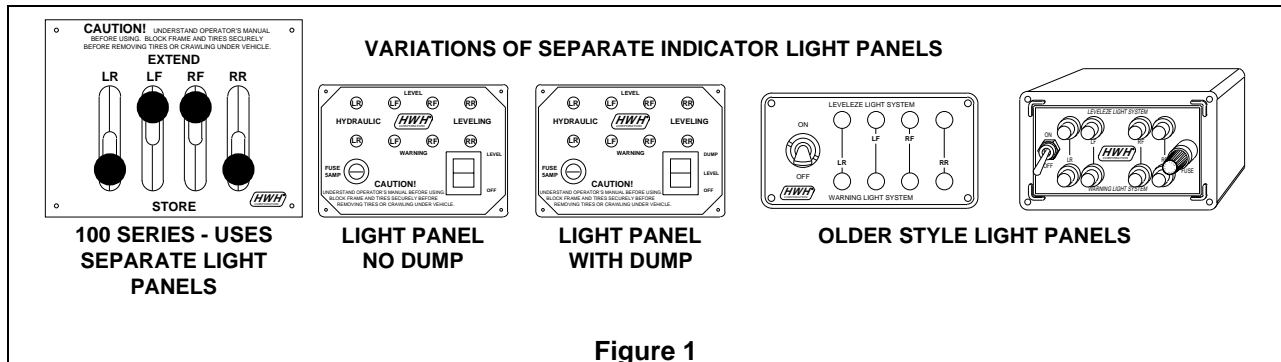


Figure 1

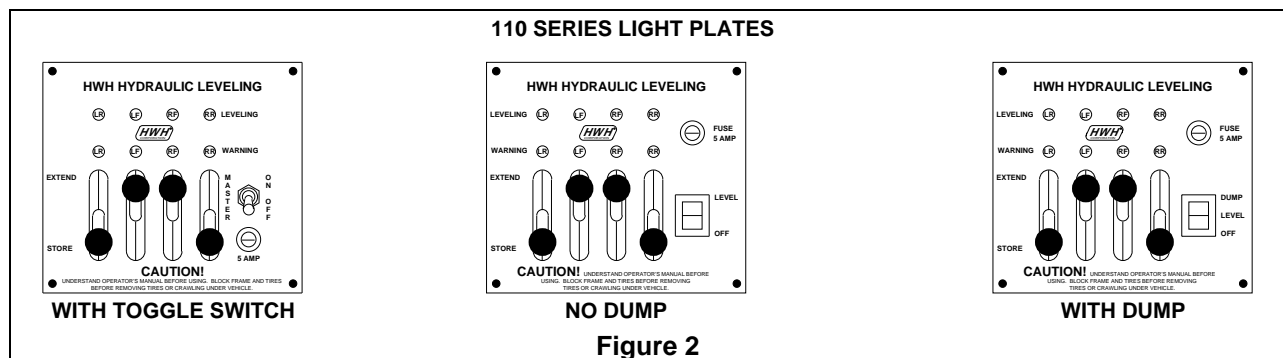
The 100 Series system is the original leveling system developed by HWH®. Thousands of these systems were sold, many of which are still in use today. This system, along with any needed repair parts, is still available. There were two basic valves in this style. The difference was the length of the valve body. The most common valve was 4 inches long. The other valve was used mainly on Blue Bird® coaches and some Newell®'s. This valve was 4 ½ inches long. The larger valve used larger hose fittings. These valves were normally used on vehicles that required larger capacity jacks such as 16,000 or 24,000 pound capacity jacks. **These valves could not be interchanged without changing fittings.**

All of the 100 Series valves had four levers except one valve that had two levers and one obscure valve made for a government vehicle that had six levers. We don't even have a part number for that valve. The valve levers have a bend that allow the levers for the two front jacks to point one direction and the levers for the rear jacks to point the other direction. Because of clearance issues or the desire of the manufacturer, the four levers can all be pointed in the same direction.

The 100 Series valves and light panels can be used with kick-down style jacks, fixed straight-acting jacks or the straight-acting/pivoting jacks.

The 100 Series system had an indicator light package separate from the valve. There were several early styles of light panels and some coach manufacturers supplied their own indicator lights on some early systems. The early HWH® panels had green lights for the level indicator lights instead of yellow lights like the newer panels. One of the early HWH® panels was actually a black hard plastic box. The present indicator light panel is available for coaches with spring or air suspensions. These panels have a three position rocker switch with the second position being momentary for air dump. The early panel did not have air dump capability but this feature could be adapted to these early panels. A separate rocker or toggle switch to control an air dump system could be used. Several manufacturers incorporated a dump system that would dump the air when the HWH® control panel was turned on. Wiring for air dump systems provided by the vehicle manufacturer was supplied by the vehicle manufacturer. Information pertaining to these dump systems must be obtained from the vehicle manufacturer.

### 2-2 The 110 Series, Lever-Controlled System.



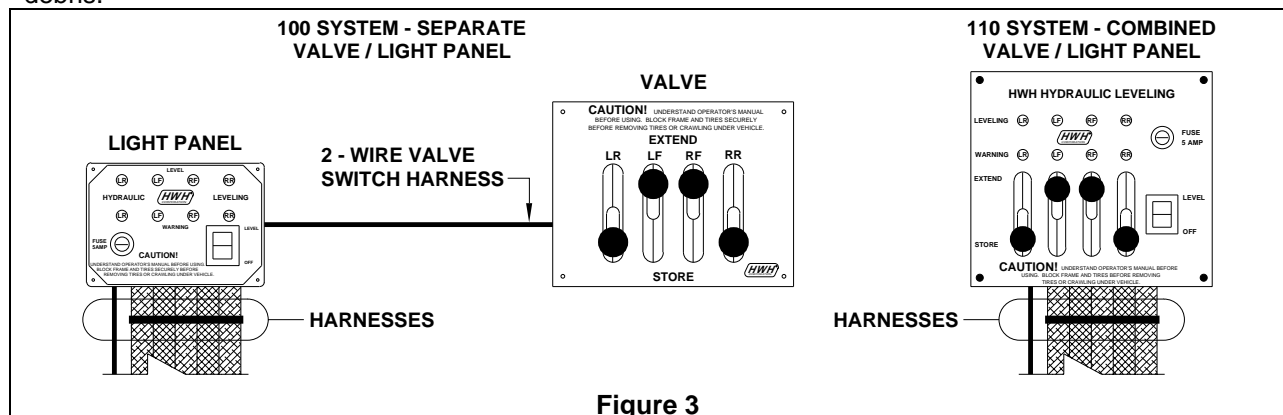
The 110 Series system was first introduced in early 1986. This was mainly an aftermarket system. Repair parts for the 110 Series systems are readily available and although discouraged, complete systems are still sold in some markets. A special valve for towable vehicles was developed but will not be discussed in this lesson. There is one basic valve for motorized vehicles with different fitting and handle arrangements. It is important to try and get the correct valve so fittings will not have to be changed. There is a two lever and three lever valve available. Like the 100 Series, the levers can be mounted in different directions.

The 110 Series valves and light plates can be used with kick-down style jacks, fixed straight-acting jacks or the straight-acting/pivoting jacks.

The system power control switch and light package are incorporated into the bezel plate that covers the valve. The early 110 plate had a toggle switch and had no provision for an air dump system. This plate is not available anymore but can be replaced with the new 110 plate. The new 110 plates have a rocker switch and are available for a two, three or four lever valve. The new 110 plate is also available with a three position rocker switch for air dump systems.

### 2-3 100 and 110 Series, Lever-Controlled System Functions.

Hydraulically and electrically, the two systems function identically. A physical difference is a two wire harness that connects the 100 valve to the light plate and all wiring harnesses are routed to the light plate. With a 110 system, the valve switch connects directly to the light plate and all wiring harnesses are routed to the valve assembly. Also, the 110 valve is mounted in a plastic box. Because the valves are normally mounted in the floor of the vehicle, this allows the wiring connections to be protected from moisture and debris that would be encountered under the vehicle. The 100 valves have end shields that must be installed to protect the top of the valve, which contains the valve switch, from moisture and debris.



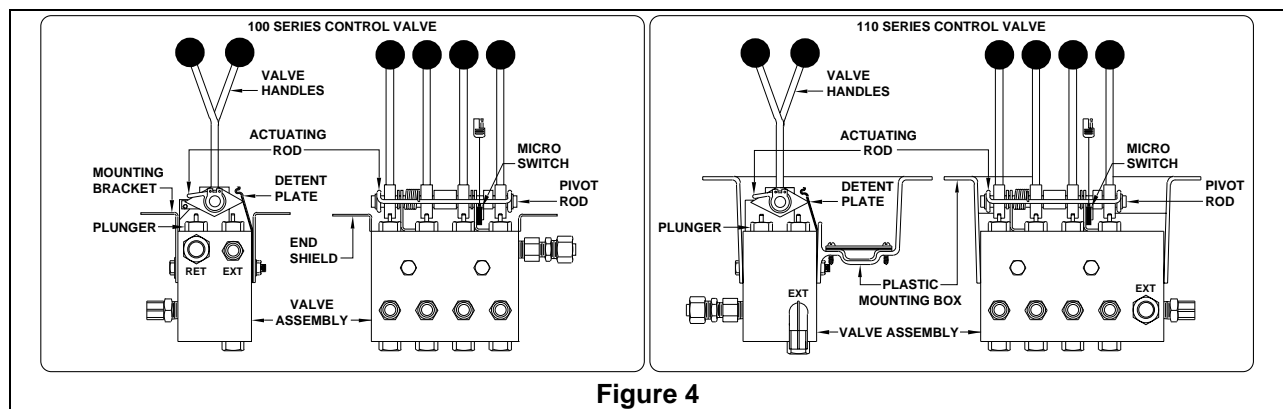


Figure 4

The valves for these systems are one manifold block with eight individual valves in each block. (The two lever valves would have four individual valves and the three lever valves would have six individual valves.) Each lever controls two valves, an extend valve and a retract valve. The valves are very simple ball and seat valves. When a lever is moved, it pushes on a plunger that pushes the ball away from the seat. One valve allows the fluid to flow from the pump to the jack to extend the jack. The other valve for the lever allows fluid to flow from the jack back to the pump reservoir when opened. Both valves are closed with the use of a spring arrangement under the ball. When extending a jack, the handles will return to a neutral center position when released. The valve assemblies have a set of detent plates that hold the levers in the retract position when pushed to the retract position as far as the levers will go. The levers can be “feathered” when extending or retracting to slow the extension or retraction of the jacks. The farther the lever is pushed, the more the valve is opened, increasing the flow of fluid to or from the jacks.

The pump is controlled with a single micro switch mounted on the top of the valve body. An activating rod lies across the micro switch and all of the valve levers. When any lever is pushed to extend, the activating rod is lifted off the micro switch. This allows the contacts of the switch to close and completes a +12 volt circuit to the pump relay. The pump should start to run as the valves start to open. Dirt and debris can interfere with the operation of the micro switch. It is also common for fluids such as coffee or soda to be spilled onto the top of the valve. This can cause the switch itself to become sticky. Cleaning the top of the valve and using WD-40 to clean the plunger of the micro switch will many times be all that is needed to make a 100/110 system function properly, if the issue is the pump not running or not turning off. Dirt and fluids can also cause problems with the valve plungers. Cleaning with WD-40 can sometimes take care of sticky valve plunger issues.

**How the 100/110 systems work.** Power for the light plate should be supplied by the ignition switch, preferably the ACC. side of the switch. With the ignition on, push the light plate switch to on. This supplies power to the indicator lights on the plate and to the micro switch on the valve. If the system has air dump capabilities, +12 volts is supplied to the dump valves when the rocker switch is pushed to “DUMP”. The level sensing unit for the 100/110 systems is mounted in a diagonal position. This allows the sensing unit to control yellow level indicator lights for each corner of the vehicle. Each lever has a yellow indicator light. When a corner is low, the sensing unit completes a ground circuit to the light plate to turn on the appropriate level indicator light. When a lever corresponding to a lit yellow level indicator light is moved to extend, the micro switch sends a +12 signal to the pump relay through the light plate. The pump relay supplies +12 volts to the pump motor. At the same time, the lever is depressing a plunger and opening a valve. With the pump running, fluid is supplied to a jack to extend the jack. As the jack extends approximately 1 inch, the jack down warning switch completes a ground circuit back to the light plate to turn on the appropriate red warning light. When the lever is released, the valve closes and the pump shuts off. This process is repeated until all yellow level indicator lights are off. When all the yellow level lights are out, any remaining jacks not used for leveling should be extended to the ground to stabilize the vehicle. The individual levers are pushed to extend until the vehicle is “bumped” up slightly. Jacks used to stabilize the vehicle should lift between  $\frac{3}{4}$  inch and 1 inch.

#### Additional operating information for the 100/110 systems.

If the vehicle is equipped with kick-down style jacks, all four jacks should be extended to the vertical position before beginning the leveling process or dumping air from the suspension if so equipped. Move each lever to the “EXTEND” position until the red warning light for that jack comes on. The jack should then be in the vertical position.

Most vehicles will have a master “JACKS DOWN” warning light that will be on anytime one or more individual light plate warning lights are on. The master warning light is controlled with a switched ground from the light plate. Power for the light is usually supplied by the light plate. If a vehicle has a straight-acting type jack, it is recommended that a buzzer is used. The controlling ground signal will come from the same wire that controls the master warning light. When a buzzer is used, the power for the buzzer and master warning light normally comes directly from the on side of the ignition switch.

The new 100 light plates and the 110 light plates have a logo in the center of the panel that serves as an “on” light when the light plate switch is turned on. It also as a jack down warning light if the light plate switch is off and the ignition is on.

Air should be dumped from the suspension before the leveling process is started and after the jacks have been extended to the vertical position, if so equipped. Most vehicles with a 100/110 system will be using the HWH® air dump valve system. The rocker switch must be held to the “DUMP” position until air stops exhausting from the suspension. The vehicle engine should not be running. If the air dump system is supplied by the vehicle manufacturer, refer to the manufacturer for instructions. The suspension air bags should be empty before leveling is started. Refer to Lesson 10 – Air Suspensions and HWH® for detailed explanations of different air dump systems.

Start with a lit rear yellow level indicator light for leveling. Do not extend a single jack too far as this can cause excessive twisting of the vehicle frame. Two jacks can be operated at once if desired and is a better way to level a vehicle to avoid twisting.

**Retracting jacks.** The jacks can be retracted with or without the ignition on. The ignition needs to be on only if it is desired to turn the panel on to check the red warning lights. It is best to retract the front jacks until the weight of the vehicle is off the jacks before starting to retract the rear jacks. The levers can be feathered to the retract position to make the vehicle drop slower. It is also preferable to retract both front jacks then both rear jacks together. If the vehicle has an air suspension, start the engine before retracting the jacks. Start the retract procedure as soon as the engine has been started. When a lever is moved to the “Retract” position, the retract plunger is depressed. This pushes the ball away from the seat and allows fluid to return to the pump reservoir as the jack springs pull the cylinder in and with kick-down jacks the springs pull the jacks into the horizontal position. When the levers are pushed fully to the retract position, the levers will “detent” in that position and keep the valves open. As a kick-down jack returns to the horizontal position and straight-acting jacks retract to within about 1 in of being fully retracted, the warning switch contacts open, breaking the ground circuit for the red warning lights. The warning lights should go out. All levers should be kept in the detent position when traveling. This will eliminate thermal expansion issues while traveling.

## CHAPTER 3 - 200-210-225 Series, Joystick-Controlled Leveling Systems

The Joystick Series leveling systems are BI-AXIS® leveling systems. That means the system operates two jacks at a time. The Joystick system was developed in 1993 and is still widely used today. The Joystick system can be used with kick-down, fixed straight-acting and straight-acting/pivoting jacks. The difference between the 200 and the 210/225 systems is like the 100 and 110 systems. The 200 system has a plain bezel plate that covers the valve and a separate light plate. The 210/225 systems have a light package that is part of the valve. The difference between the 210 and the 225 system is the level sensing unit. The 210 system used the old level sensing unit with mercury switches. The 225 system uses the new potted electronic level sensing unit. Another important feature of the 200/210/225 systems is they all use an interface with the vehicle park brake to inhibit the pump from operating when the park brake is not set.

### 3-1 The 200 Series Joystick-Controlled Systems

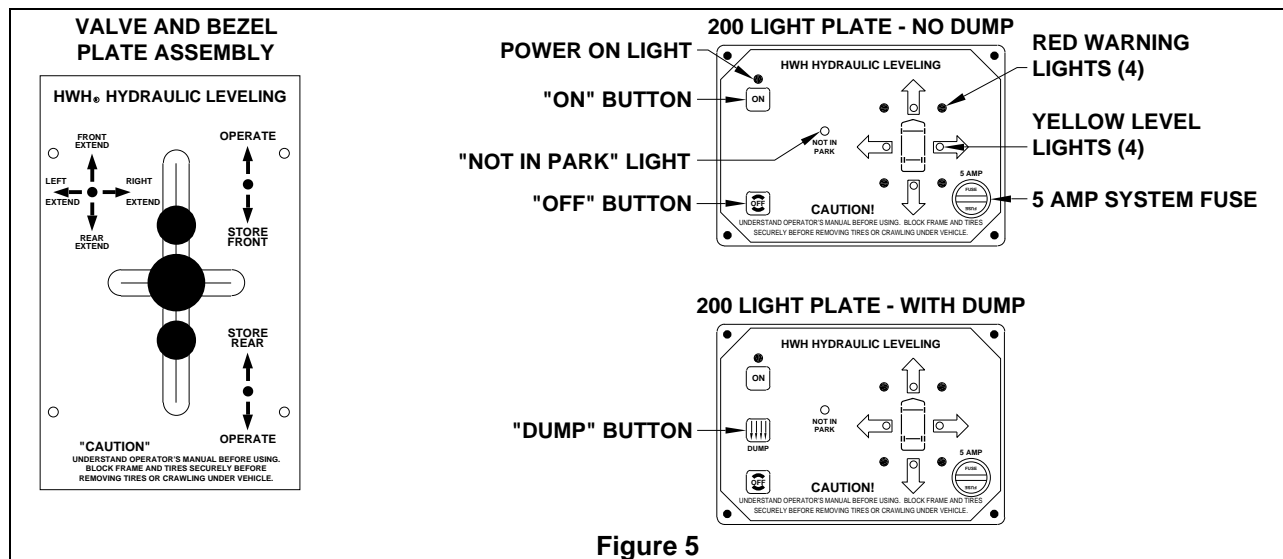


Figure 5

The 200 Series system hit the market several years before the 210 system was developed. The 200 Series has the separate light plate which controls power to the system and contains the four red jacks down warning lights and the four yellow level indicator lights. All 200 Series panels have an ON button with a power on light above the button and an OFF button. The panels also have a 5 amp fuse to protect the system and a NOT IN PARK light. When on, this light indicates the park brake is not set. This light will only come on while the ON button is being pushed. The panel will not turn on. The red warning lights and the yellow level lights are arranged differently than the 100/110 systems. The red warning lights are arranged to show a light at each corner of the vehicle; left front, right front, right rear and left rear. The 4 yellow level lights are arranged between the warning lights. There is a yellow light for the front, rear, right side and left side. This is because the system uses BI-AXIS® operation of the jacks, two jacks at a time; both front jacks, both rear jacks, the right front and right rear jacks or the left front and left rear jacks. Vehicles that are equipped with an air suspension using a HWH® air dump system will have a DUMP button. The DUMP button only works if the panel is on. You must push and hold the DUMP button until all air is exhausted from the suspension. The vehicle engine must be off. The two panels shown in **FIGURE 5** are available in 12 volt and 24 volt versions. **Due to the variations in light plates available, it is important to get the correct light plate, especially when dealing with a 24 volt system.**

The two panels shown in **FIGURE 6** are used for systems on vehicles with an air suspension that incorporate a pilot air dump system. This type of system must supply a +12 volt control to dump the air and to return the vehicle to ride height. The "Rabbit" button on the panel is the TRAVEL button. The panel without a DUMP button automatically supplies a +12 volt control signal to dump air from the suspension when the ON button is pushed. The panel with the DUMP button can be on or off to use the DUMP button. With the pilot air dump system, the dump button can be released after the air starts to dump from the suspension. Pushing the "Rabbit" button with the ignition on will return the suspension to the travel mode. Releasing the park brake with the ignition on will also return the suspension to the travel mode.

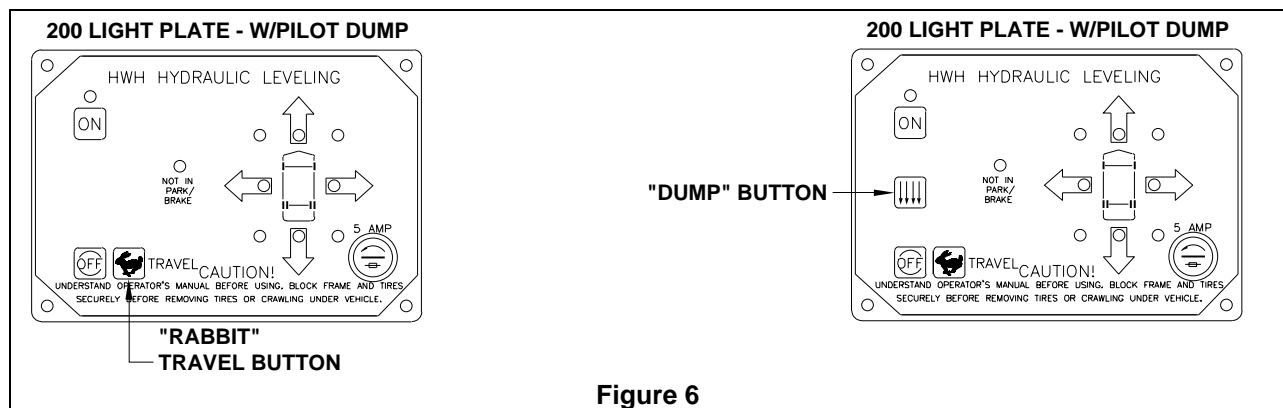


Figure 6

### 3-2 The 210/225 Joystick controlled systems

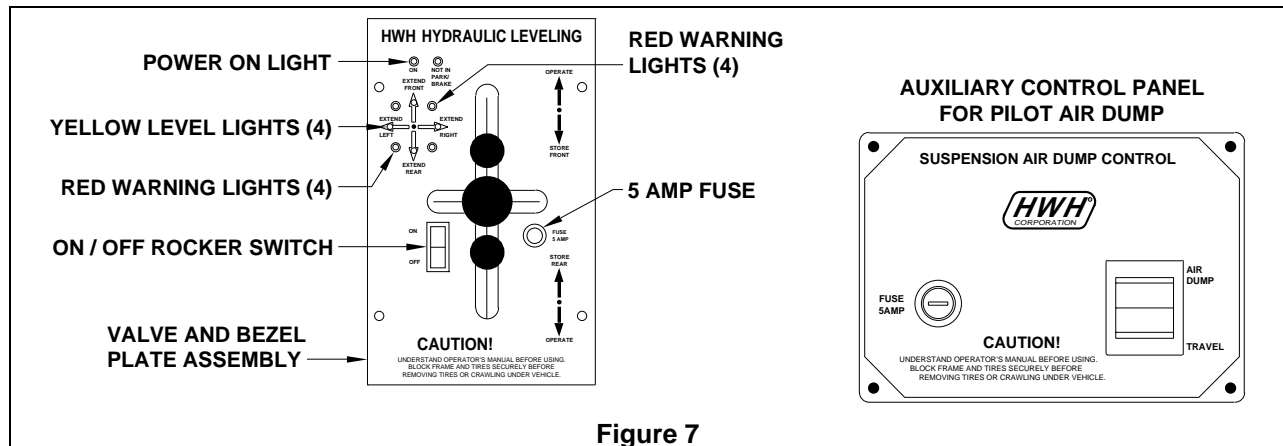


Figure 7

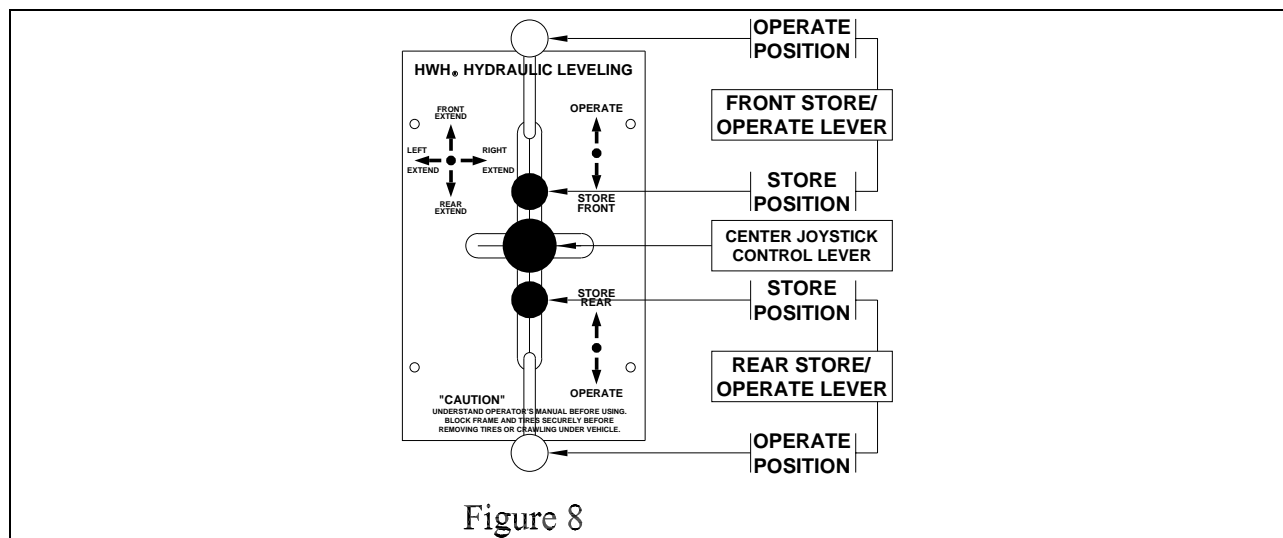
The 210/225 system uses the same valve and plastic valve box as the 200 system. The difference between the two styles of systems is the 210/225 systems have the system control switch, the 5 amp fuse and the indicator lights incorporated into the bezel plate that covers the valve. The light package for the 210/225 systems is actually a LED board that mounts to the plastic valve box. These LED boards are available for 12 volt and 24 volt systems. Three small contact springs mounted to the bezel plate connect the bezel plate control switch and fuse assembly to the LED board assembly mounted to the valve box. If the bezel plate is removed, the system cannot function. The red warning light and yellow level indicator light arrangement on the 210/225 bezel is the same as the 200 system light plates. The 210/225 bezel plate also has a power on light and a "NOT IN PARK" light.

The 210/225 system has no provisions for an air dump control switch in the bezel plate; either for an HWH® air dump system or a pilot air dump system. A momentary toggle or rocker switch must be used with an HWH® air dump system. For a pilot air dump system, HWH® can supply a panel such as shown in **FIGURE 7**. Power to operate either style of air dump system can come from the main leveling system wiring harness. The only difference between a 210 system and a 225 system is the type of sensing unit used. The old style round level sensing unit is no longer used due to the mercury switches used in the sensing unit. This sensing unit was used with the 210 system. The system was renamed the 225 system when the new rectangular electronic potted sensing unit was introduced. The new electronic sensing unit can be used to replace an older round sensing unit. An upgraded sensing unit harness will be needed.

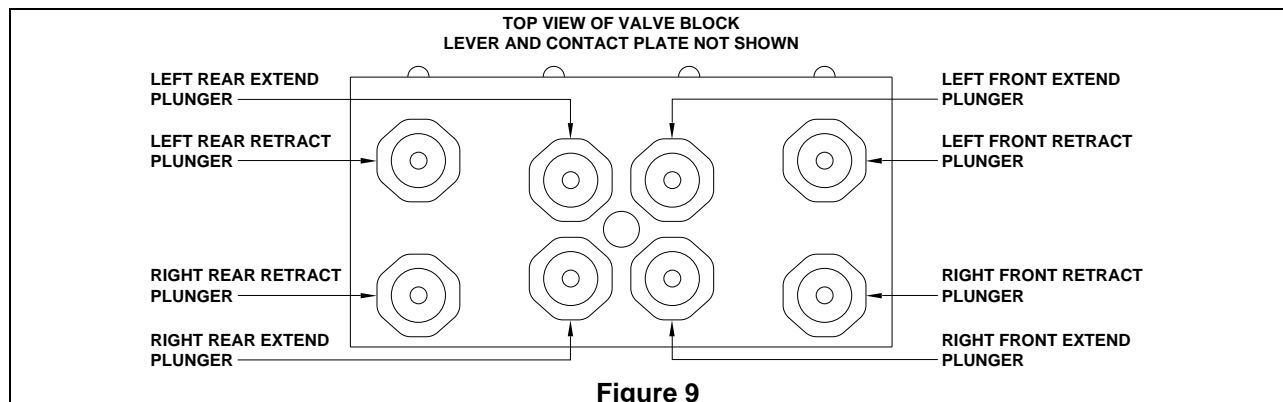
### 3-3 200/210/225 Series system functions.

The 200 Series light plates and the 210/225 bezel plate indicator lights, switches or buttons are described in **FIGURES 5, 6, and 7**. The lever functions are described in **FIGURE 8**.





**Hydraulic functions:** Lever operation is the same for all Joystick systems. The center lever has a larger knob and is the main control lever for extending the jacks. The two levers with the smaller knobs are the “Operate/Store” levers. These levers must be moved to the “Operate” position as indicated on the valve bezel plate. Once these levers are in the “Operate” position, the center Joystick lever can be moved to a forward, rearward, left side or right side position as allowed by the valve bezel plate. The valve is much like the 100/110 valve. There is one manifold block and eight individual valves in the block. There is an extend valve and a retract valve for each jack. The valves consist of a plunger/guide assembly with a ball and seat arrangement. When the center Joystick lever is pushed, the actuator ball at the bottom of the Joystick lever pushes the plungers of two extend valves. The plunger pushes the ball away from the seat. This allows fluid to flow from the pump to the jacks. When the lever is released, a spring arrangement pushes the ball back against the seat to close the valve. This also returns the Joystick lever to the center position. The pivot ball will always push two plungers at a time when the bezel plate is in place. The Joystick lever normally seems to be very loose. This is by design so there is no pressure from the Joystick lever on the plungers. There is also a check valve arrangement in the valve block that allows two jacks to be operated at the same time. The “Operate/Store” levers are also designed to push on two retract plungers at the same time. There is one “Operate/Store” lever for the front jacks and one for the rear jacks. **FIGURE 9** shows the arrangement of the plunger and guide assemblies.



**Electrical functions:** There are some differences between the **200** and **210/225** Series systems electrically:

The **200** Series system has a separate two-wire harness that connects the valve to the pump relay. These two wires are part of the main harness for the **210/225** Series systems.

The **210/225** systems have a hard wired single pole/single throw on/off rocker switch. The **200** system light plate has a latch in relay arrangement to control system power.

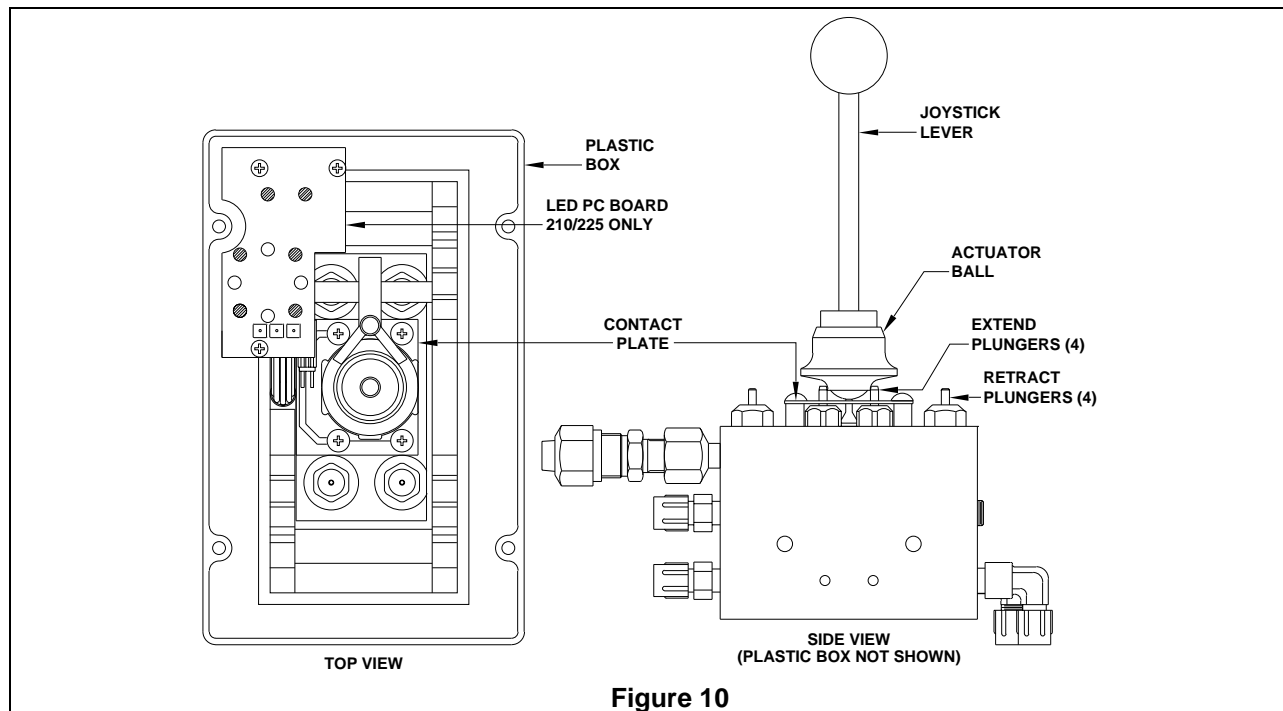
The red warning lights on the **200** Series light plate will only function if the light plate is on. The red warning lights in the **210/225** Series bezel plate will function any time the vehicle ignition is on.

If the park brake is not set, the **200** Series light plate will not turn on. The “ON” light will not come on and the “NOT IN PARK” light will come on only while the ON button is being pushed and go out when the ON button is released. No other lights on the light plate will function. If the park brake is not set, the **210/225** Series bezel will turn on when the power control rocker switch is pushed to ON. The “ON” light will come on, the “NOT IN PARK” light will come on but the pump will not run if the Joystick lever is pushed. The red warning lights and the yellow level lights can come on.

Pump operation is the same for both systems. Unlike most HWH® leveling systems, the pump relay is controlled by a switched ground. The +12 voltage is constant to the pump relay coil if the system is on and the park brake is set. There is a printed circuit board mounted on top of the valve assembly above extend plungers. See **FIGURE 10**. This is the contact plate for the Joystick lever. (Early valves may have a different style contact plate.) The contact plate has a 2 pin MTA connector mounted to the plate. One pin is used to ground the valve body. The other pin connects to the wire that will control the pump relay.

For the 200 Series system, a 2 wire pigtail connects the contact plate pins to a 2 wire harness that goes to the pump. One wire connects to the system ground at the pump, the other wire, #8600, connects to the pump relay to control the relay.

For the 210/225 Series system, 2 wires from the valve assembly LED pc board connect to the contact plate. One wire supplies ground to the contact plate. The other wire connects to wire #8600 in the main harness bundle. The #8600 wire connects to the pump relay to control the relay.



**Figure 10**

The center Joystick lever mounts to a special actuator ball. See **FIGURE 10**. The actuator ball mounts to a pivot ball that screws into the valve block. When the Joystick lever is moved, the actuator ball pushes against 2 plungers. As the plungers become fully depressed, the actuator ball comes in contact with the contact ring. The actuator ball is grounded through the valve body. When the actuator ball comes in contact with the contact ring, this completes a ground circuit to turn the pump relay on. Like the 100/110 valves, dirt, and debris can cause issues. A screw could create a short between the contact plate and the valve body. This could cause continuous pump operation. Dirt or carpet fibers may insulate the contact plate from the actuator ball causing the pump to not run.

**Park brake circuit:** The sole intent of the park brake circuit is to prevent the hydraulic pump from running if the vehicle is moving. When the park brake is engaged, a switch sends a signal to a “park brake on” indicator light on the vehicle dash. In most cases, that signal will be a switched ground but in a very few instances, the park brake signal can be a +12 volt signal. The 200 Series system requires a different park brake pigtail assembly. The 210/225 will require a relay to switch the +12 signal to a ground signal when the park brake is set. 200 Series system will not turn on if the park brake is not set. The 210/225 Series system will turn on but the pump will not function if the park brake is not set. A weak ground from the park brake switch or bad park brake wire connections can cause intermittent problems, especially with the 200 Series light plate. The park brake wire should never be connected directly to ground.

**How the 200/210/225 Series systems work.** Power for the 200 Series light plate or the 210/225 Series LED pc board should be supplied by the ignition switch, preferably the ACC. side of the switch. With the ignition on and the park brake set, push the 210/225 bezel plate rocker switch to "ON" or push the 200 Series light plate "ON" button. This supplies +12 power to the indicator lights on the plates and to the pump relay on the pump. If the system is equipped with an air dump system, the air dump controls will now function. The level sensing unit for the 200/210/225 Series systems is mounted in a BI-AXIS® position. This allows the sensing unit to control yellow level indicator lights for the front of the vehicle, the rear of the vehicle, the left side and the right side of the vehicle. When an end or side of the vehicle is low, the sensing unit completes a ground circuit to the light plate to turn on the appropriate level indicator light.

The valve bezel plate is slotted so the Joystick control lever can be moved to the front, rear, right side or left side.

**IMPORTANT: When using a BI-AXIS® procedure to level a motorized vehicle, you should always level the vehicle side to side before front to rear. The 200/210/225 Series light plates or LED pc boards are designed to inhibit the front or rear yellow level indicator lights from coming on if either side yellow level indicator light is also on. Example: The front and left side of the vehicle are low. Only the left side yellow level light will come on. The front yellow level light will only come on after the left side of the vehicle is raised enough to turn the left side yellow level light out. If the left side yellow level light comes back on while raising the front to turn the front level light off, the front yellow level light will go out again until the left side light is turned off.**

First the front and rear Operate/Store levers are moved to the "OPERATE" position. The Joystick lever can now be moved in a direction corresponding to a lit yellow level indicator light. When the Joystick is pushed fully to the appropriate position, the actuator ball touches the contact plate completing a ground circuit to turn the pump relay on. The pump relay supplies +12 volts to the pump motor. At the same time, the lever is depressing two plungers, opening two valves. With the pump running, fluid is supplied to the jacks to extend the jacks. As the jacks extend approximately 1 inch, the jack down warning switch for each jack completes a ground circuit back to the light plate to turn on the appropriate red warning light. When the lever is released, the valve closes and the pump shuts off. This process is repeated until all yellow level indicator lights are off.

After all yellow level lights are off; the jacks not used for leveling should be extended to the ground to stabilize the vehicle. Move the Joystick lever to extend jacks as needed until the vehicle is "bumped" up slightly. Jacks used to stabilize the vehicle should lift about ¾ inch to 1 inch. The Joystick control lever should always be moved to the front or rear position when stabilizing the vehicle. Example: The left side of the vehicle was low. The two left side jacks were extended to raise the vehicle and turn the left side yellow light off. All level lights are now off. Push the Joystick to the front to extend the right front jack to stabilize then move the Joystick lever to the rear to extend the right rear jack to stabilize. (The order does not matter.) DO NOT just move the Joystick lever to the right side position to extend the right side jacks.

#### **Additional operating information for the 200/210/225 systems.**

If the vehicle is equipped with kick-down style jacks, all four jacks should be extended to the vertical position before beginning the leveling process or dumping air from the suspension if so equipped. Move the Joystick lever to the front position until the two front red warning lights comes on. Then move the Joystick lever to the rear position until the two rear red warning lights come on. (Front or rear first does not matter.) The jacks should then be in the vertical position.

Most vehicles will have a master "JACKS DOWN" warning light that will be on anytime one or more individual light plate warning lights are on. The master warning light is controlled with a switched ground from the light plate. Power for the light is usually supplied by the light plate. If a vehicle has a straight-acting type jack, it is recommended that a buzzer is used. The controlling ground signal will come from the same wire that controls the master warning light. When a buzzer is used, the power for the buzzer and master warning light normally comes directly from the on side of the ignition switch.

Air should be dumped from the suspension before the leveling process is started and after kick-down jacks have been extended to the vertical position, if so equipped. If the vehicle is using the HWH® air dump valve system, the DUMP button must be pushed until air stops exhausting from the suspension. The vehicle engine should not be running. If the vehicle has a pilot air dump system, the DUMP button can be released after the air starts to dump. If the air dump system is supplied by the vehicle manufacturer, refer to the manufacturer for instructions. The suspension air bags should be empty before

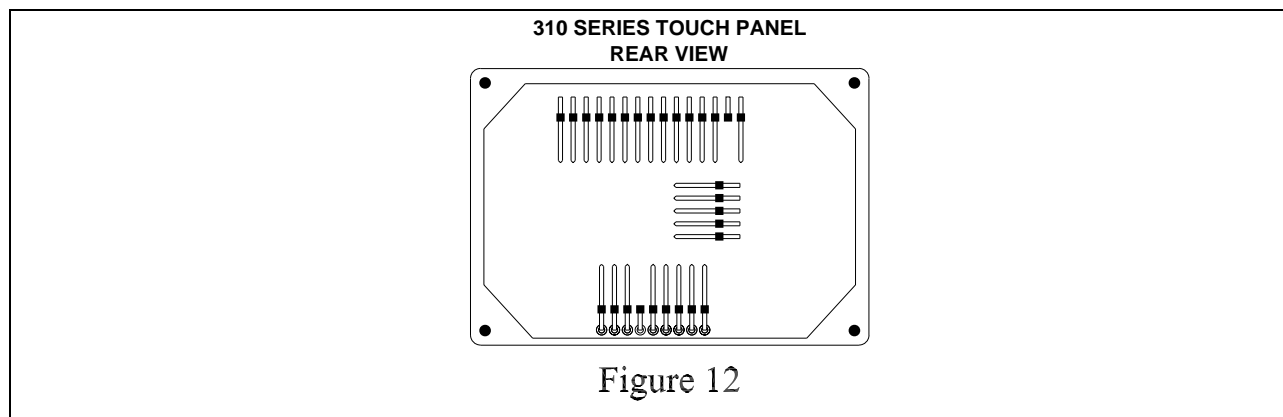
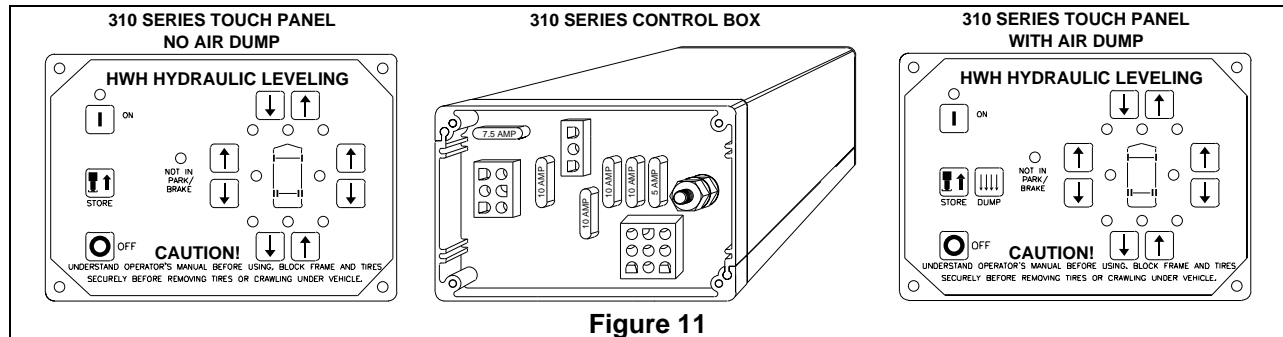
leveling is started. Refer to Lesson 10 – Air Suspensions and HWH® for detailed explanations of different air dump systems.

**Pilot Air Dump “Travel”:** If the vehicle is equipped with a pilot air dump system, the touch panel has a “Rabbit” button for travel. With the ignition on, pushing the “Rabbit” button will supply a +12 volt signal to the pilot dump valve to shift the pilot dump valve to the travel position. The light plate does not have to be on. If the park brake is released with the ignition on, the panel will supply a +12 travel signal to the pilot dump valve to shift the valve to the travel position. In either case, the +12 travel signal is constant when the ignition is on. The ignition must be on to have a +12 volt travel signal.

**Retracting Jacks.** It is best to retract the front jacks until the weight of the vehicle is off the jacks before starting to retract the rear jacks. The Operate/Store levers can be feathered to the “STORE” position to make the vehicle drop slower. If the vehicle has an air suspension with HWH® air dump valves, start the engine before retracting the jacks. Start the retract procedure as soon as the engine has been started. When a lever is moved to the “STORE” position, the retract plungers are depressed. This pushes the ball away from the seat and allows fluid to return to the pump reservoir as the jack springs pull the cylinder in and with kick-down jacks the springs pull the jacks into the horizontal position. When the levers are pushed fully to the “STORE” position, the levers will “detent” in that position and keep the valves open. As a kick-down jack returns to the horizontal position and straight-acting jacks retract to within about 1 in of being fully retracted, the warning switch contacts open, breaking the ground circuit for the red warning lights. The warning lights should go out. All levers should be kept in the “STORE” position when traveling. This will eliminate thermal expansion issues while traveling.

## CHAPTER 4 - 310 Series, Touch Panel-Controlled Leveling Systems

The 310 Series leveling system was the first touch panel controlled manual system. The jacks are extended or retracted using buttons on a touch panel instead of levers. The hydraulic fluid is directed to or from the jacks using electric solenoid valves instead of lever operated ball and seat valves. The 310 system can be used with straight-acting jacks or kick-down jacks. The 310 system is also compatible with an HWH® air dump system or a pilot operated air dump system. The 310 system is a BI-AXIS® system, operating two jacks at a time. There is also a three jack 310 touch panel system.



A **manual** touch panel system can always be identified by the label “HWH® HYDRAULIC LEVELING” at the top of the touch panel lexan. The problem is the same touch panel lexan, not complete touch panel, is used for the 310 and 325 Series leveling systems. The 325 system will be discussed a little later in this lesson. The touch panels are not interchangeable but are fairly easy to tell apart. The 310 touch panel has 3 MTA headers on the touch panel pc board. The 325 touch panel has only one 5 pin MTA header. The two systems also have completely different styles of control boxes. Although there are very few different touch panels and control boxes for the 310 Series leveling systems, it is important to know there are different panels and boxes. There are also 310 Series leveling systems for non-motorized vehicles. The control boxes and touch panels, especially control boxes used for these systems may be different from the equipment used for motorized systems and are not interchangeable. The best way to get the correct components is to locate the control box and get the correct AP part number off the box. Once the correct control box is identified, the correct touch panel can be determined. Sometimes the replacement control box will have a different AP part number than the existing box. HWH® will sometimes use a generic style control box as the replacement control box for several different control boxes. Example: The 310 control box with HWH® air dump capabilities is also used to replace the standard 310 Series control box with no air dump. The use of straight-acting or kick-down style jacks does not require a different touch panel or control box. Systems using the pilot air dump systems do need a different touch panel and control box.

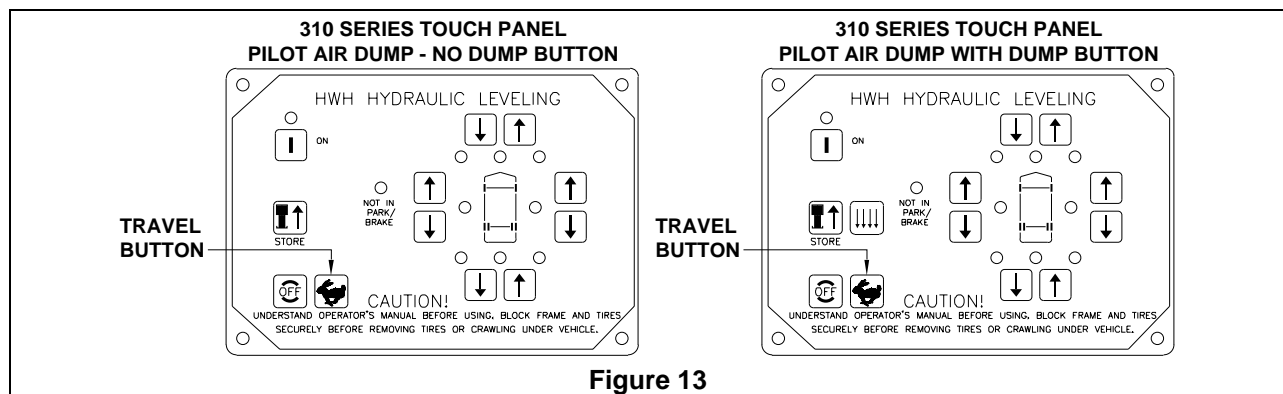


Figure 13

The 310 Series systems use the same jacks, warning switches and same style level sensing unit as the 200/210/225 Series systems. The level sensing unit will have a different electrical connector. The lever system valve assemblies are connected to the pump with one pressure hose and one return line. The 310 Series systems have a power unit assembly. (A pump with a hydraulic manifold mounted to the pump housing.) There are no connecting hoses except the hoses that connect the manifold to the jacks. There is one hose to each jack. The 310 system uses one pump relay to control the pump. (Remember, the 200 style systems use a ground signal to control the pump relay.) The hydraulic manifold has 4 electrically controlled solenoid valves, one shuttle valve, one 50 psi pressure switch and 8 check valves, 4 inner checks and 4 outer checks. The solenoid valves are normally closed and direct the fluid to or from the jacks. The shuttle valve and check valve arrangement allow the system to properly extend and retract the jacks. Without the check valves, the leveling process would be very jerky.

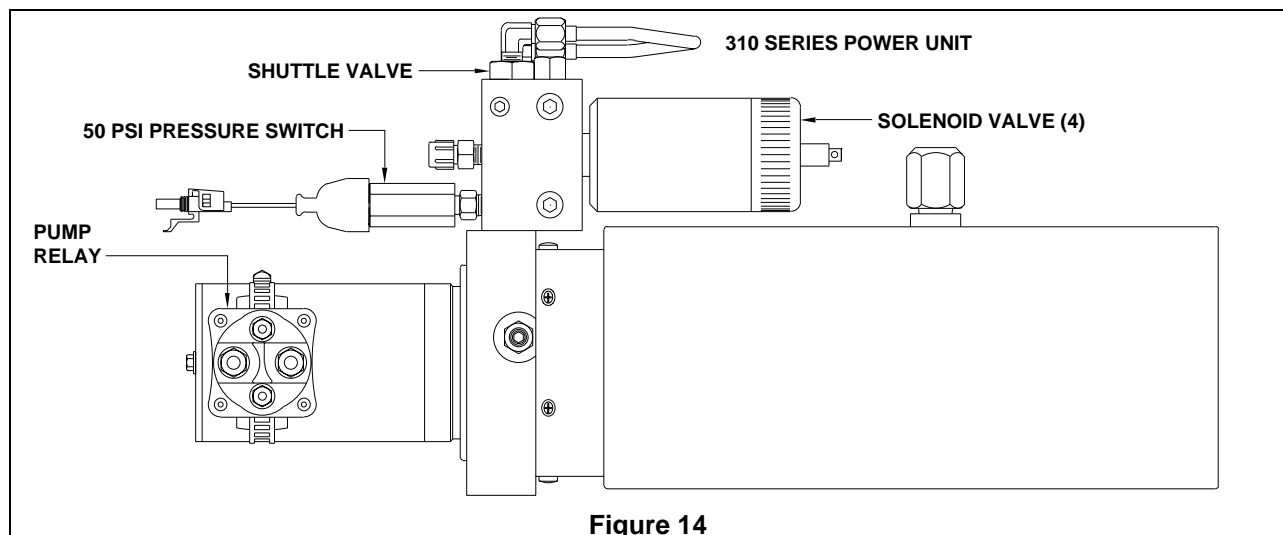


Figure 14

#### 4-1 310 Series System Functions.

**Hydraulic functions:** Because the same valve is used to extend or retract a jack, the hydraulic operation of the 310 system is more complicated than the lever controlled systems that had one valve to extend the jack and one valve to retract the jack. The pumps have a pressure output port and a fluid return port. These two ports need to be isolated from each other for the system to operate. This is accomplished with the shuttle valve. The shuttle valve is a pressure activated valve. When the pump is not running, the return port is open. When a solenoid valve is opened with the pump off, the fluid can flow from the jack back to the pump. When the pump is running, the shuttle valve shifts to open the pressure port and block the return port. This keeps the fluid in the manifold so the solenoid valves can direct the fluid to the jacks.

Extending two jacks at a time for BI-AXIS® leveling does create an issue. With BI-AXIS® leveling, it is common to have one jack under pressure that will be operated with a jack that is not under pressure. Example: The right front and rear jacks were extended to lift the right side of the vehicle. Then the front must be raised. Now, the right front and left front solenoid valves will be opened. The left front jack will not be under any pressure at this time. Because fluid will take the path of least resistance, when both valves are opened, fluid from the jack under pressure will want to flow to the jack that is not under pressure. This will cause the vehicle to drop. The inner and outer check valve arrangement in the

manifold prevents that from happening. Because there is a separate pressure side and return side in the manifold, each solenoid valve has two check valves. The inner check valve prevents fluid flow from an open solenoid valve into the pressure side of the manifold. The outer check valve prevents fluid flow from the return side of the manifold into an open solenoid valve. Thus, fluid cannot flow from a jack under pressure to a jack that is under low or no pressure.

The vehicle can also “drop” slightly if the solenoid valve is opened at the same time the pump is turned on. When the pump comes on, it takes a split second for the shuttle valve to shift to block the return port. If the solenoid valve is opened at the same time, some fluid can escape from a jack under pressure before the shuttle valve is completely shifted; the vehicle drops slightly. The 50 psi manifold pressure switch prevents this from happening. The pressure switch is hydraulically located on the manifold after the shuttle valve. The pressure switch cannot see pressure until the shuttle valve has shifted. The control box cannot open any solenoid valves until it receives a ground signal from the 50 psi pressure switch.

**Electrical functions:** The 310 Series system uses the touch panel buttons to control relays in the control box to operate the hydraulic solenoid valves and the pump relay. The touch panels have an ON button, an OFF button, four UP ARROW (extend jacks) buttons and four DOWN ARROW (retract jacks) buttons. An UP or DOWN ARROW button will always operate 2 jacks at a time. The touch panel has a STORE button. This button will retract all four jacks at the same time. If the system has an HWH® controlled air dump system, the panel will have a DUMP button. If the system uses a pilot air dump system, the panel will have a button with a rabbit symbol. This is the travel button. Touch panels used with pilot air dump systems may or may not have a DUMP button. Pilot air dump touch panels without a DUMP button will automatically put the air dump system in the dump mode when the ON button is pushed. Refer to **FIGURE 13** to view a “RABBIT” (travel) button.

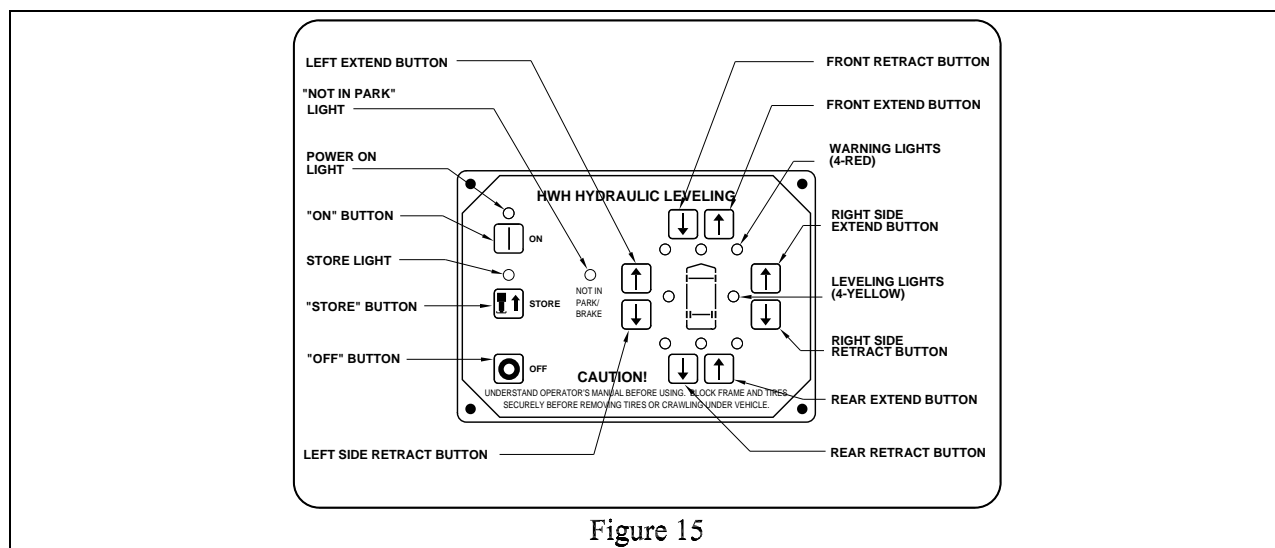


Figure 15

The touch panel has a power on light. This light will be on when the panel is on. There is a store light. This light will come on when the STORE button is pushed. There is a “NOT IN PARK/BRAKE” light. This light will be on if the panel is on and the park brake is not set. There are four red jack down warning lights, one for each jack. These lights will come on when a jack has extended approximately one inch. There are four yellow level lights; front, rear, left side and right side. The yellow level lights work if the panel is on. A lit level light means that side or end of the vehicle is low. If a side level light is on, a front or rear level light can not come on.

When the ignition switch is on, there is +12 volt power supplied to the touch panel from the control box. The main system ground comes from the ground stud on the power unit. A 10 gauge wire in the harness attaches to a ¼ inch stud on the fuse end of the control box. There is one ground wire in the touch panel cable that supplies ground to the touch panel. When touch panel buttons are pushed, +12 volt signals to control different functions are routed back to the control box via the touch panel cable. Pushing the ON button turns the panel on. Pushing the DUMP button if so equipped, sends a +12 signal to the control box to turn the dump valves on or shift the pilot dump valve. Pushing an UP ARROW sends a +12 signal to the control box to turn the appropriate solenoid valves on and to turn the pump relay on. The control box switches +12 volts to turn the pump relay on and to turn the corresponding solenoid valves on. Pushing a DOWN ARROW button sends a +12 signal to the control box to turn the appropriate solenoid valves on, the pump does not run. The STORE button sends a +12 signal to the control box when pushed, to control a latch up circuit that opens all four solenoid valves and keeps them open until the jacks are retracted with



their warning lights off. A timer circuit in the control box turns the system off two minutes after the last warning light goes out.

The jack down warning switches and the level sensing unit are routed directly to the touch panel. Both the warning switches and the level sensing unit switch a ground to turn the appropriate lights on. The grounds for the warning switches and the level sensing unit are supplied by the touch panel. The signal to control the master warning light/buzzer is a switched ground supplied by the touch panel. The touch panel supplies +12 volts for the master warning light if a buzzer is not used. If a buzzer is used, +12 volts comes from the ON side of the ignition switch.

**Park brake circuit:** The sole intent of the park brake circuit is to prevent the hydraulic pump from running if the vehicle is moving. When the park brake is engaged, a switch sends a signal to a “park brake on” indicator light on the vehicle dash. In most cases, that signal will be a switched ground but in a very few instances, the park brake signal can be a +12 volt signal. The 310 Series system is designed to use a ground signal for this operation. If the park brake supplies a +12 volt signal, the system will require a relay to switch the +12 signal to a ground signal when the park brake is set. The 310 Series system will turn on but the pump will not function if the park brake is not set. If the park brake is not set, the “NOT IN PARK/BRAKE” touch panel light will be on if the touch panel is on. The park brake wire should never be connected directly to ground.

**Complete electrical and hydraulic schematics along with a comprehensive repair manual are available from HWH® and can be downloaded from the HWH® web site; [www.hwh.com](http://www.hwh.com).**

### **How the 310 Series systems work.**

The ignition should be in the ACC position and the park brake must set. When the ON button is pushed, the power on light comes on, the other touch panel lights can function and the touch panel buttons will function. There should only be one yellow level indicator on at a time.

**IMPORTANT: When using a BI-AXIS® procedure to level a motorized vehicle, you should always level the vehicle side to side before front to rear. The 310 Series touch panel is designed to inhibit the front or rear yellow level indicator lights from coming on if either side yellow level indicator light is also on. Example: The front and left side of the vehicle are low. Only the left side yellow level light will come on. The front yellow level light will only come on after the left side of the vehicle is raised enough to turn the left side yellow level light off. If the left side yellow level light comes back on while raising the front to turn the front level light off, the front yellow level light will go out again until the left side light is turned off.**

The vehicle is leveled by pushing UP ARROW buttons to extend jack pairs according to a lit yellow level light. When a side or end of the vehicle is low, the sensing unit switches a ground for the touch panel to turn the appropriate yellow level light on. When an UP ARROW button is pushed, the touch panel sends a +12 volt signal to the control box to control the appropriate relays that turn the pump relay and the corresponding solenoid valves on. The solenoid valves will not be turned on until the control box sees a ground from the 50 psi manifold pressure switch. As the jack extends approximately 1 inch, the corresponding red warning light on the touch panel will come on. The master warning light and buzzer, if so equipped, will come on at this time if the ignition is in the ON position.

Note: The wiring for the master warning light and buzzer is determined by the installer. It is possible the light and buzzer will come on when the ignition is in the ACC position.

The UP ARROW button is pushed until the vehicle is raised enough to turn the level light off. This is repeated with other UP ARROW buttons as needed until the yellow level lights are all off.

After all yellow level lights are off; the jacks not used for leveling should be extended to the ground to stabilize the vehicle. Push and hold UP ARROW buttons to extend jacks as needed until the vehicle is “bumped” up slightly. Jacks used to stabilize the vehicle should lift about ¾ inch to 1 inch. The front or rear UP ARROW buttons should be used when stabilizing the vehicle. Example: The left side of the vehicle was low. The two left side jacks were extended to raise the vehicle and turn the left side yellow light off. All level lights are now off. The order does not matter but push the front UP ARROW button to extend the right front jack to stabilize then push the rear UP ARROW button to extend the right rear jack to stabilize. DO NOT just push the right side UP ARROW button to extend the right side jacks.

### **Additional operating information for the 310 systems.**



If the vehicle is equipped with kick-down style jacks, all four jacks should be extended to the vertical position before beginning the leveling process or dumping air from the suspension if so equipped. Push the front UP ARROW button until the two front red warning lights come on. Then push the rear UP ARROW button until the two rear red warning lights come on. The jacks should then be in the vertical position.

Most vehicles will have a master “JACKS DOWN” warning light that will be on anytime one or more individual light plate warning lights are on. The master warning light is controlled with a switched ground from the light plate. Power for the light is usually supplied by the light plate. If a vehicle has a straight-acting type jack, it is recommended that a buzzer is used. The controlling ground signal will come from the same wire that controls the master warning light. When a buzzer is used, the power for the buzzer and master warning light normally comes directly from the on side of the ignition switch.

If the vehicle has an air suspension, the air should be dumped from the suspension before the leveling process is started and after kick-down jacks have been extended to the vertical position, if so equipped. With either an HWH® air dump system or a pilot operated air dump system, the DUMP button will only function if the touch panel is on. If the vehicle is using the HWH® air dump valve system, the DUMP button must be pushed and held until air stops exhausting from the suspension. The vehicle engine should not be running. If the vehicle has a pilot air dump system, the DUMP button can be released after the air starts to exhaust. If the vehicle has a pilot air dump system and the touch panel has no dump button, the air will start to dump from the suspension when the ON button is pushed. The engine can be running with a pilot air dump system. If the air dump system is supplied by the vehicle manufacturer, refer to the manufacturer for instructions. The suspension air bags should be empty before leveling is started. Refer to Lesson 10 – Air Suspensions and HWH® for detailed explanations of different air dump systems.

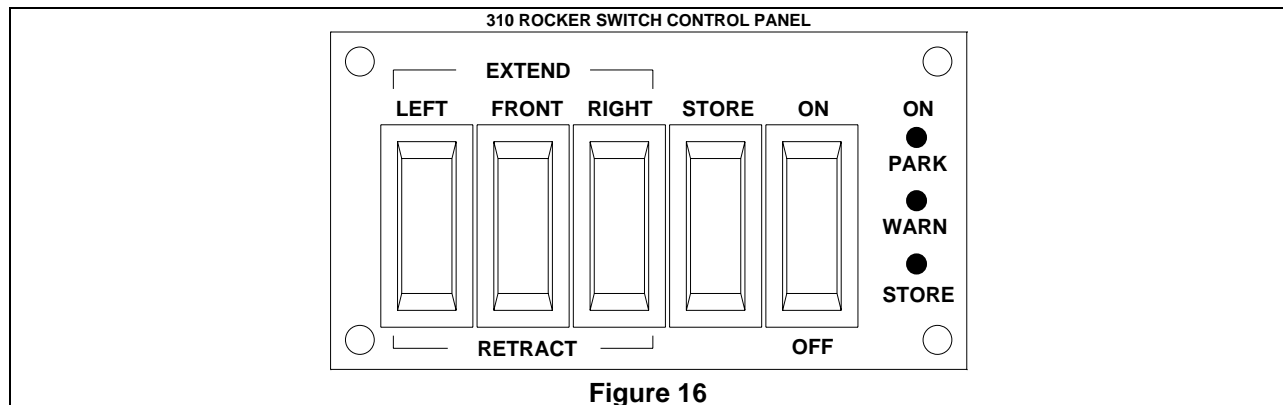
**Pilot Air Dump “Travel”:** If the vehicle is equipped with a pilot air dump system, the touch panel has a “Rabbit” button for travel. With the ignition on and the touch panel on, pushing the “Rabbit” button will supply a +12 volt travel signal to the pilot dump valve to shift the pilot dump valve to the travel position. If the park brake is released with the ignition on, the panel will supply a +12 travel signal to the pilot dump valve to shift the valve to the travel position. In either case, the +12 volt travel signal is constant when the ignition is on. The ignition must be on to have a +12 volt travel signal.

**Retracting Jacks.** The 310 Series touch panel has a “STORE” button. This button will function only if the touch panel is on, BUT the park brake does not have to be set. If the vehicle has an air suspension with HWH® air dump valves, start the engine before retracting the jacks. Start the retract procedure as soon as the engine has been started. When the “STORE” button is pushed, a +12 volt signal from the touch panel controls a latch in circuit in the control box. This circuit keeps all four solenoid valves open and allows fluid to return to the pump reservoir as the jack springs pull the cylinder in and with kick-down jacks the springs pull the jacks into the horizontal position.

As a kick-down jack returns to the horizontal position and straight-acting jacks retract to within about one inch of being fully retracted, the warning switch contacts open, breaking the ground circuit for the red warning lights. The warning lights should go out. When the last warning light goes out, a timer circuit in the control box starts a two minute timer circuit. After two minutes, the timer circuit interrupts the power on latch in circuit for the touch panel. The touch panel will turn off and the solenoid valves will close. If a red warning light will not go out, the system will stay in the store mode with the solenoid valves on until the OFF button is pushed or the ignition is turned off. The 310 system has no provision to combat the effects of thermal expansion. As fluid in the system warms when traveling, the expansion of fluid will cause jacks to extend slightly. This is why the jacks have about a one inch travel before the warning switch turns on. If the store mode is interrupted by pushing the OFF button or moving the ignition switch, one or more jacks may stay slightly extended. This will allow the master warning light and buzzer to come on while traveling when a jacks extends slightly due to thermal expansion of the fluid.

## CHAPTER 5 - 310 Series, Rocker Switch-Controlled Three-Jack Leveling Systems

The 310 Series rocker switch system was made for one RV company only, Safari Motor Homes. This system was developed for use with three jacks instead of four. It uses the same style of control box as the 310 systems but they are not interchangeable.



There are several major differences between the rocker switch controlled 310 system and the touch panel controlled 310 systems:

The jack control rocker switches on the control panel only control one jack at a time, not two like the 310 touch panel UP and DOWN ARROW buttons.

The rocker switch system has no level sensing unit. There are no level lights to aid in the leveling of the vehicle. Some type of bubble level or leveling device must be used to determine when the vehicle is level.

Although each jack has a jack down warning switch, the control panel does not have individual jack down warning lights. There is one warning light on the control panel to indicate one or more jacks are slightly extended. The control box also has a built in warning buzzer to indicate jacks are extended. The jack-down warning switches are routed to the control box, not the touch panel.

The system was designed to use two rocker switch panels, one at the front of the vehicle in the drivers area, the other was at the rear of the vehicle.

The system was only used with straight-acting jacks, two in the rear and one in the middle of the front of the vehicle.

**Hydraulic functions.** Hydraulically, the 310 rocker switch system was like the 310 touch panel system. The pump and manifold are one assembly, the power unit. The rocker switch system manifold had three jack solenoid valves instead of four. Like the 310 touch panel system, the fluid is directed to or from the jack through the same valve. The manifold had a shuttle valve, a 50 psi pressure switch and the same check valve arrangement as the touch panel hydraulic manifold.

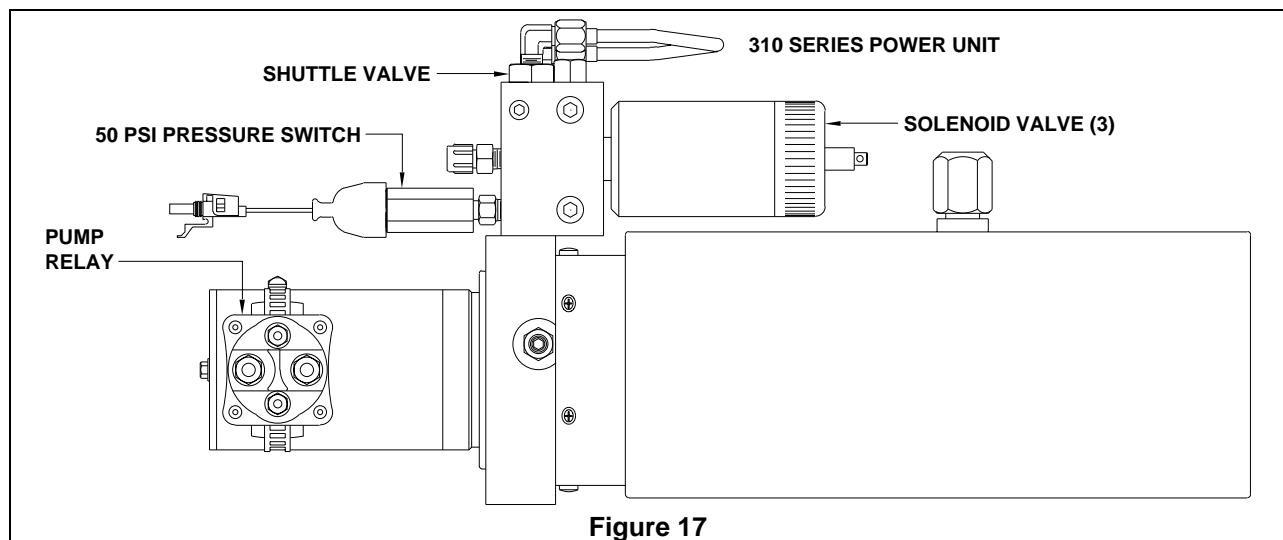


Figure 17

The pump has a pressure output port and a fluid return port. These two ports need to be isolated from each other for the system to operate. This is accomplished with the shuttle valve. The shuttle valve is a pressure activated valve. When the pump is not running, the return port is open. When a solenoid valve is opened with the pump off, the fluid can flow from the jack back to the pump. When the pump is running, the shuttle valve shifts to open the pressure port and block the return port. This keeps the fluid in the manifold so the solenoid valves can direct the fluid to the jacks.

Because there is a separate pressure side and return side in the manifold, each solenoid valve has two check valves. The inner check valve prevents fluid flow from an open solenoid valve into the pressure side of the manifold. The outer check valve prevents fluid flow from the return side of the manifold into an open solenoid valve. Thus, fluid cannot flow from a jack under pressure to a jack that is under low or no pressure.

The vehicle can also “drop” slightly if the solenoid valve is opened at the same time the pump is turned on. When the pump comes on, it takes a split second for the shuttle valve to shift to block the return port. If the solenoid valve is opened at the same time, some fluid can escape from a jack under pressure before the shuttle valve is completely shifted; the vehicle drops slightly. The 50 psi manifold pressure switch prevents this from happening. The pressure switch is hydraulically located on the manifold after the shuttle valve. The pressure switch cannot see pressure until the shuttle valve has shifted. The control box cannot open any solenoid valves until it receives a ground signal from the 50 psi pressure switch.

**Electrical functions:** The 310 rocker switch system uses momentary rocker switches to control relays in the control box to operate the hydraulic solenoid valves and the pump relay. The control panel has an ON/OFF rocker switch, three EXTEND/RETRACT jack control rocker switches, and a STORE rocker switch. The ON/OFF rocker switch turns the system on or off. The EXTEND/RETRACT rocker switches each operate one jack. The STORE rocker switch is used to retract all three jacks at the same time. All of the rocker switches switch a +12 volt signal to the control box to control the relays in the control box.

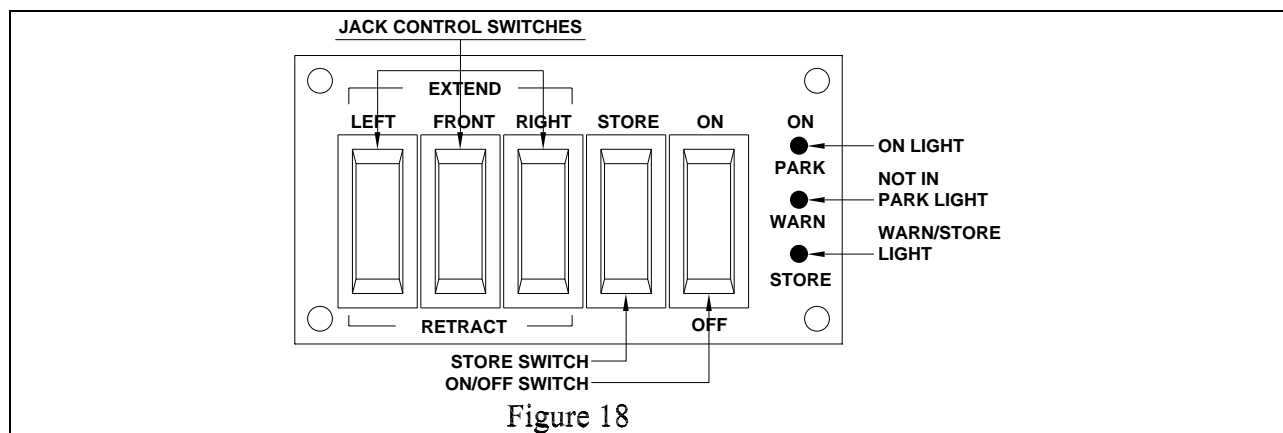


Figure 18

The touch panel has an ON light. This light will be on when the panel is on. There is a BRAKE light. This light will be on if the panel is on and the park brake is not set. The pump will not run if this light is on.

Jacks can be retracted if the BRAKE light is on. There is a WARN/STORE light. This is a two-color light. If the ignition is on and any jack is extended approximately one to two inches, the WARN/STORE light will be red. Any time the ignition is on and the jacks are fully retracted with all warning switched off, the WARN/STORE light will be green.

When the ignition switch is on, there is +12 volt power supplied to the control panel from the control box. The main system ground comes from the ground stud on the power unit. A 10 gauge wire in the harness attaches to a ¼ inch stud on the fuse end of the control box. When control panel rocker switches are pushed, +12 volt signals to control different functions are routed back to the control box via the control panel cable. Pushing the ON rocker switch turns the panel on. Pushing a jack rocker switch to EXTEND sends a +12 signal to the control box to turn the appropriate solenoid valves on and to turn the pump relay on. The control box switches +12 volts to turn the pump relay on and to turn the corresponding solenoid valves on. Pushing a jack rocker switch to RETRACT sends a +12 signal to the control box to turn the appropriate solenoid valves on, the pump does not run. The STORE rocker switch sends a +12 signal to the control box when pushed, to control a latch up circuit that opens all three solenoid valves and keeps them open until the jacks are retracted with their warning lights off. A timer circuit in the control box turns the system off two minutes after the last warning light goes out.

The jack-down warning switches are routed to the control box. The warning switches switch a ground to the control box. The control box routes the ground to the control panel to turn the WARN/STORE light green. The grounds for the warning switches are supplied by the control box. When the jack warning switches are all off, the control box switches a ground to the control box to turn the WARN/STORE light green.

**Park brake circuit:** The sole intent of the park brake circuit is to prevent the hydraulic pump from running if the vehicle is moving. When the park brake is engaged, a switch sends a signal to a “park brake on” indicator light on the vehicle dash. That signal will be a switched ground. The 310 Series system is designed to use a ground signal for this operation. The 310 rocker switch panel will turn on but the pump will not function if the park brake is not set. If the park brake is not set, the BRAKE light on the control panel will be on if the control panel ON light is on. The park brake wire should never be connected directly to ground.

### **How the 310 Series rocker switch system works.**

The ignition should be in the ACC position and the park brake must set. With the ignition on and the jacks retracted, the control panel WARN/STORE light should be on. When the ON/OFF rocker switch is pushed to ON, the ON light comes on. If the park brake is not set, the BRAKE light would now be on.

The 310 Series rocker switch system is not equipped with a level sensing unit. Some type of bubble level or other leveling device will be needed to determine when the vehicle is level. It is best to use the rear jacks to level the vehicle side to side before leveling the vehicle front to rear. Only extend the front jack first if the vehicle is level side to side and the front of the vehicle is low.

The vehicle is leveled by pushing the jack control rocker switches to EXTEND. When a jack rocker switch is pushed to EXTEND, the control panel sends a +12 volt signal to the control box to control the appropriate relays that turn the pump relay and the corresponding solenoid valves on. The solenoid valves will not be turned on until the control box sees a ground from the 50 psi manifold pressure switch. As the jack extends approximately one to two inches, the WARN/STORE light will turn red. The control box buzzer, if so equipped, will come on at this time if the ignition is in the ON position. The jack control switches are momentary switches and must be held to EXTEND until the vehicle is raised enough to level the vehicle.

After the vehicle is level; the jacks not used for leveling should be extended to the ground to stabilize the vehicle. Push and hold jack control rocker switches to EXTEND, to extend jacks as needed until the vehicle is “bumped” up slightly. Jacks used to stabilize the vehicle should lift about ¾ inch to 1 inch.

**Retracting jacks.** The 310 Series rocker switch control panel has a STORE rocker switch. This switch will function only if the touch panel is on, BUT the park brake does not have to be set. When the STORE rocker switch is pushed to RETRACT, a +12 volt signal from the control panel controls a latch in circuit in the control box. This circuit keeps all three solenoid valves open and allows fluid to return to the pump reservoir as the jack springs pull the cylinder in. As the straight-acting jacks retract to within about one to two inches of being fully retracted, the warning switch contacts open, breaking the ground circuit for the red WARN/STORE light. When the last warning switch turns off, the WARN/STORE light will turn green and a timer circuit in the control box starts a two minute timer circuit. After two minutes, the timer circuit

interrupts the power on latch in circuit for the control panel. The control panel will turn off and the solenoid valves will close. The ON light will be off but the WARN/STORE light will remain green until the ignition is turned off.

If a jack warning switch does not turn off, the WARN/STORE light will remain red and the system will stay in the store mode with the solenoid valves on until the ON/OFF button is pushed to OFF or the ignition is turned off. The 310 system has no provision to combat the effects of thermal expansion. As fluid in the system warms when traveling, the expansion of fluid will cause jacks to extend slightly. This is why the jacks have a one to two inch travel before the warning switch turns on. If the store mode is interrupted by pushing the ON/OFF rocker switch to off or moving the ignition switch, one or more jacks may stay slightly extended. This will allow the buzzer to come on while traveling when a jacks extends slightly due to thermal expansion of the fluid.

## CHAPTER 6 - 305/325 Series, Touch-Panel-Controlled Leveling Systems

### (Short PC Board)

The 305/325 short board system is the next generation manual system that replaces the 310 Series system. This system was originally presented as just the 305 Series manual touch panel system. The system was marketed without a level sensing unit; no yellow level lights. Level was determined with some type of bubble level supplied by the vehicle operator. This was done to bring the cost of a manual system down. The problem was that after a short production time, it was determined no one really wanted an HWH® leveling system without the yellow level lights. The 305 Series system touch panel and control box had been designed to accommodate a level sensing unit, so adding the sensing unit to the system was simple. 305 Series systems with the level sensing units were then designated 325 Series leveling systems. The term “Short Board” is used to distinguish the 305/325 Series leveling systems from the next generation 325 Series leveling system. That system is sometimes called the 325 “Long Board” system. This system is discussed in the next chapter, Chapter 7. The control box is the same size for both systems but the printed circuit board in the 305/325 control box is about half the size of the printed circuit board in the newer generation 325 system. See **FIGURE 19**.

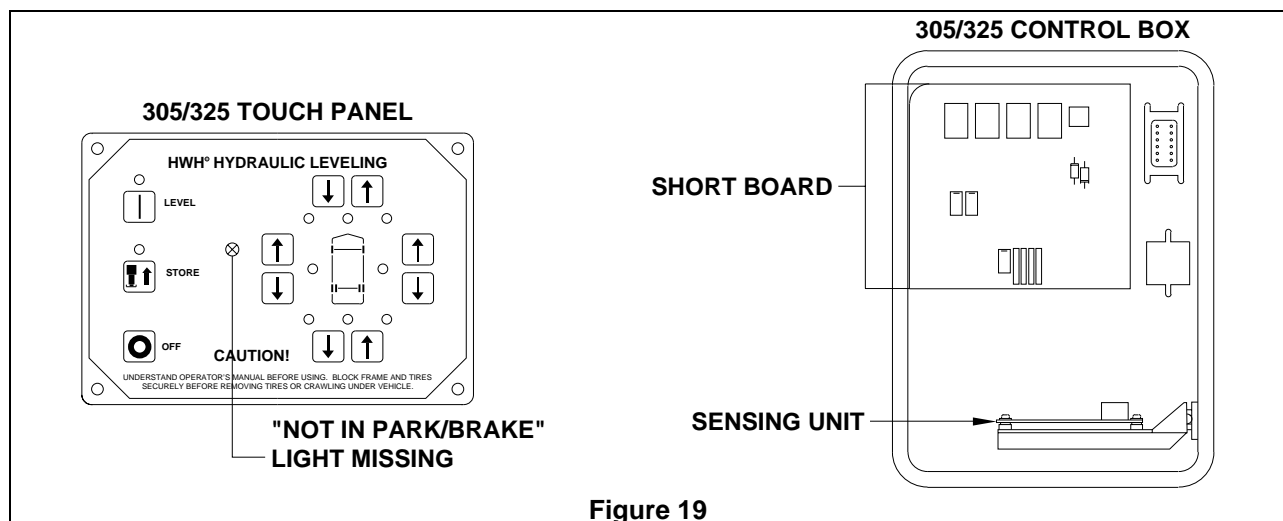
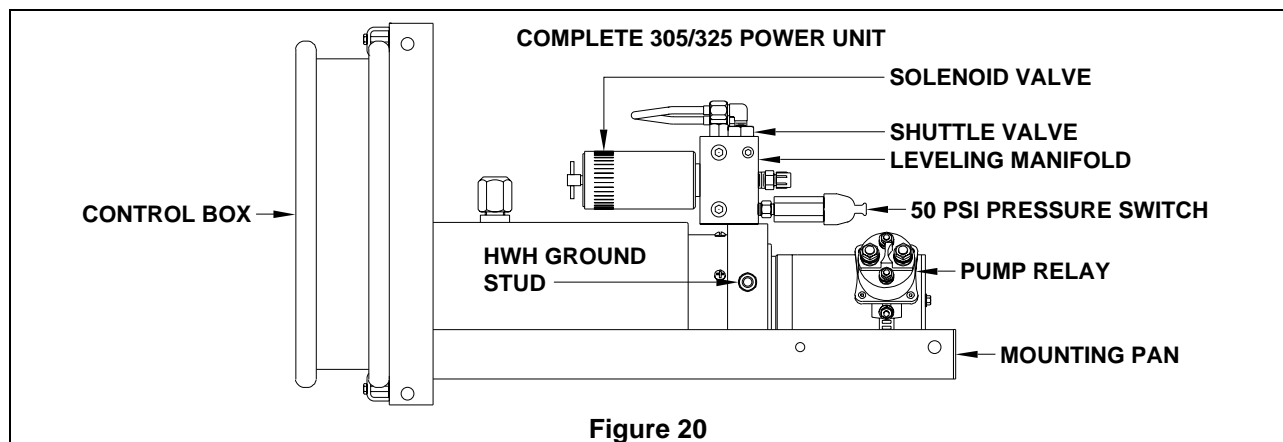


Figure 19

There is one thing that is unique to the 305/325 Series systems. Although there are quite a few different 305/325 control boxes, this is the only Series of leveling systems produced by HWH®, past or present, that has only one touch panel part number. Systems without air dump, systems with an HWH® air dump system or systems with a pilot air dump system all take the same touch panel. There were no 24 volt 305 systems.

The 305/325 Series system can easily be identified simply by looking at the touch panel. Like all manual systems, the heading at the top of the touch panel reads “HWH® HYDRAULIC LEVELING”. The touch panel identifies the system as a 305/325 system because **there is no “NOT IN PARK/BRAKE” light on the touch panel**. All other touch panels for manual or computerized leveling systems for motorized vehicles have a “NOT IN PARK/BRAKE” light. See **FIGURE 19**.

Hydraulically, there is no difference between the 310 systems and the 305/325 systems. The 305/325 system hydraulic manifolds have the same shuttle valve, solenoid valve and check valve arrangement as the 310 manifold. Electrically, there are both similarities and differences. Like the 310 system, the touch panel is basically hard wired to the control box. Signals from the touch panel control relays in the control box. These relays control +12 volt outputs to control the single pump relay on the pump motor and the leveling manifold solenoid valves. The 305/325 manifolds have the 50 psi pressure switch to inhibit valves from opening until the shuttle valve is shifted. Red warning light and yellow level light arrangements and operation are the same. One difference is the level sensing unit is mounted in the control box instead of a remote mounting. See **FIGURE 19**. The touch panel sends switched grounds to the control box instead of switched +12 volt signals. The control box is mounted directly to a power unit mounting framework or pan instead of being mounted remote from the power unit.



**Hydraulic Functions:** Like the 310 systems, the same valve is used to extend or retract the jacks. The pumps have a pressure output port and a fluid return port. These two ports need to be isolated from each other for the system to operate. This is accomplished with the shuttle valve. The shuttle valve is a pressure activated valve. When the pump is not running, the return port is open. When a solenoid valve is opened with the pump off, the fluid can flow from the jack back to the pump. When the pump is running, the shuttle valve shifts to open the pressure port and block the return port. This keeps the fluid in the manifold so the solenoid valves can direct the fluid to the jacks.

With BI-AXIS® leveling, it is common to have one jack under pressure that will be operated with a jack that is not under pressure. Example: The right front and rear jacks were extended to lift the right side of the vehicle. Then the front must be raised. Now, the right front and left front solenoid valves will be opened. The left front jack will not be under any pressure at this time. Because fluid will take the path of least resistance, when both valves are opened, fluid from the jack under pressure will want to flow to the jack that is not under pressure. This will cause the vehicle to drop. The inner and outer check valve arrangement in the manifold prevents that from happening. Because there is a separate pressure side and return side in the manifold, each solenoid valve has two check valves. The inner check valve prevents fluid flow from an open solenoid valve into the pressure side of the manifold. The outer check valve prevents fluid flow from the return side of the manifold into an open solenoid valve. Thus, fluid cannot flow from a jack under pressure to a jack that is under low or no pressure.

The vehicle can also “drop” slightly if the solenoid valve is opened at the same time the pump is turned on. When the pump comes on, it takes a split second for the shuttle valve to shift to block the return port. If the solenoid valve is opened at the same time, some fluid can escape from a jack under pressure before the shuttle valve is completely shifted; the vehicle drops slightly. The 50 psi manifold pressure switch prevents this from happening. The pressure switch is hydraulically located on the manifold after the shuttle valve. The pressure switch cannot see pressure until the shuttle valve has shifted. The control box cannot open any solenoid valves until it receives a ground signal from the 50 psi pressure switch.

**Electrical Functions:** The 305/325 Series system uses the touch panel buttons to control relays in the control box to operate the hydraulic solenoid valves and the pump relay. The touch panels have an ON button, an OFF button, four UP ARROW (extend jacks) buttons and four DOWN ARROW (retract jacks) buttons. An UP or DOWN ARROW button will always operate 2 jacks at a time. The touch panel has a STORE button. This button will retract all four jacks at the same time. If the system has an HWH® controlled air dump system, the panel will send a ground signal to a relay in the control box to turn on HWH® dump valves or to shift a pilot air dump valve to the dump position. There is no TRAVEL button. Pushing STORE puts the suspension back in the travel mode.

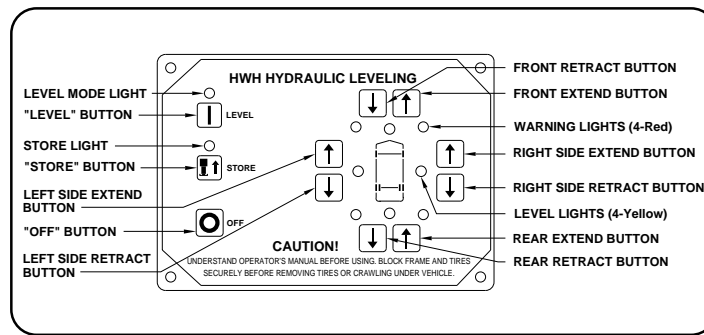


Figure 21

The touch panel has a power on light. This light will be on when the panel is on. There is a store light. This light will come on when the STORE button is pushed. There is not a “NOT IN PARK/BRAKE” light on the touch panel, but the pump will not run if the park brake is not set. There are four red jack-down warning lights, one for each jack. These lights will come on when a jack has extended approximately  $\frac{1}{4}$  to  $\frac{1}{2}$  inch if the ignition is on. There are four yellow level lights; front, rear, left side and right side. The yellow level lights work only if the panel is on. A lit level light means that side or end of the vehicle is low. One or two yellow level lights may be on at the same time, but never opposing lights.

When the ignition switch is on, there is +12 volt power supplied directly to the touch panel. +12 volt power to operate the control box is supplied from the touch panel to the control box. The main system ground comes from the ground stud on the power unit. A ten-gauge wire is routed to a four-pin plug on the back of the control box. There is one ground wire in the touch panel cable that supplies ground to the touch panel. +12 volt power for the control box outputs comes from the battery supply side of the pump relay. When touch panel buttons are pushed, switched ground signals to control the different functions are routed back to the control box via the touch panel cable. Pushing the ON button turns the panel on. When ever the touch panel ON light is on, if the park brake is set, there will be switched ground on the dump output pin of the touch panel no mater which control box is used. Pushing an UP ARROW sends a ground signal to the control box to turn the appropriate solenoid valves on and to turn the pump relay on. The control box switches +12 volts to turn the pump relay on and to turn the corresponding solenoid valves on. Pushing a DOWN ARROW button sends a ground signal to the control box to turn the appropriate solenoid valves on, the pump does not run. The STORE button controls a touch panel latch up circuit that opens all four solenoid valves and keeps them open until the jacks are retracted with their warning lights off. When a jack warning light goes out, the solenoid valve for that jack is turned off. If a warning light stays on, that solenoid valve remains on as long as the ignition is on.

The jack down warning switches are routed directly to the touch panel. If the system is equipped with a level sensing unit, the sensing unit is mounted in the control box. Wires from the sensing unit are routed to the touch panel as part of the touch panel cable. Both the warning switches and the level sensing unit switch a ground to turn the appropriate lights on. The grounds for the warning switches and the level sensing unit are supplied by the touch panel. +12 volts for the level sensing unit is supplied by the touch panel. The signal to control the master warning light/buzzer is a switched ground supplied by the touch panel. The touch panel supplies +12 volts for the master warning light if a buzzer is not used. If a buzzer is used, +12 volts comes from the ON side of the ignition switch.

**Park Brake Circuit:** The sole intent of the park brake circuit is to prevent the hydraulic pump from running if the vehicle is moving. When the park brake is engaged, a switch sends a signal to a “park brake on” indicator light on the vehicle dash. In most cases, that signal will be a switched ground but in a very few instances, the park brake signal can be a +12 volt signal. The 305/325 Series system is designed to use a ground signal for this operation. If the park brake supplies a +12 volt signal, the system will require a relay to switch the +12 signal to a ground signal when the park brake is set. The 305/325 Series system will turn on but the pump will not function if the park brake is not set. The park brake wire should never be connected directly to ground.

**Complete electrical and hydraulic schematics along with a comprehensive repair manual are available from HWH® and can be downloaded from the HWH® web site; [www.hwh.com](http://www.hwh.com).**

#### How the 305/325 Series systems work.

The ignition should be in the ACC position and the park brake set. When the ON button is pushed, the power on light comes on, the other panel lights can function and the touch panel buttons will function. If



applicable, air will start dumping from the suspension at this time. If equipped with a level sensing unit, there can be one or two yellow level indicator lights on at a time but never opposing yellow level lights.

The vehicle is leveled by pushing UP ARROW buttons to extend jack pairs according to a lit yellow level light if equipped with a level sensing unit. When a side or end of the vehicle is low, the sensing unit switches a ground for the touch panel to turn the appropriate yellow level light on. It is recommended to extend jacks to turn lit side lights out before extending jacks to turn a front or rear level light out. If the system is not equipped with a level sensing unit, some type of bubble level should be used to determine what "level" is.

When an UP ARROW button is pushed, the touch panel sends a ground signal to the control box to control the appropriate control box relays that turn the pump relay and the corresponding solenoid valves on. The solenoid valves will not be turned on until the control box sees a ground from the 50 psi manifold pressure switch. As the jack extends approximately  $\frac{1}{4}$  to  $\frac{1}{2}$  inch, the corresponding red warning light on the touch panel will come on. The master warning light and buzzer, if so equipped, will come on at this time if the ignition is in the ON position.

Note: The wiring for the master warning light and buzzer is determined by the installer. It is possible the light and buzzer will come on when the ignition is in the ACC position.

The UP ARROW button is pushed until the vehicle is raised enough to turn the level light off. This is repeated with other UP ARROW buttons as needed until the yellow level lights are all off.

After all yellow level lights are off or the vehicle is level according to some type of bubble level or other leveling device; the jacks not used for leveling should be extended to the ground to stabilize the vehicle. Push and hold UP ARROW buttons to extend jacks as needed until the vehicle is "bumped" up slightly. Jacks used to stabilize the vehicle should lift about  $\frac{3}{4}$  inch to 1 inch. The front or rear UP ARROW buttons should be used when stabilizing the vehicle.

Example: The left side of the vehicle was low. The two left side jacks were extended to raise the vehicle and turn the left side yellow light off. All level lights are now off. The order does not matter but push the front UP ARROW button to extend the right front jack to stabilize then push the rear UP ARROW button to extend the right rear jack to stabilize. DO NOT just push the right side UP ARROW button to extend the right side jacks together.

### **Additional operating information for the 305/325 systems.**

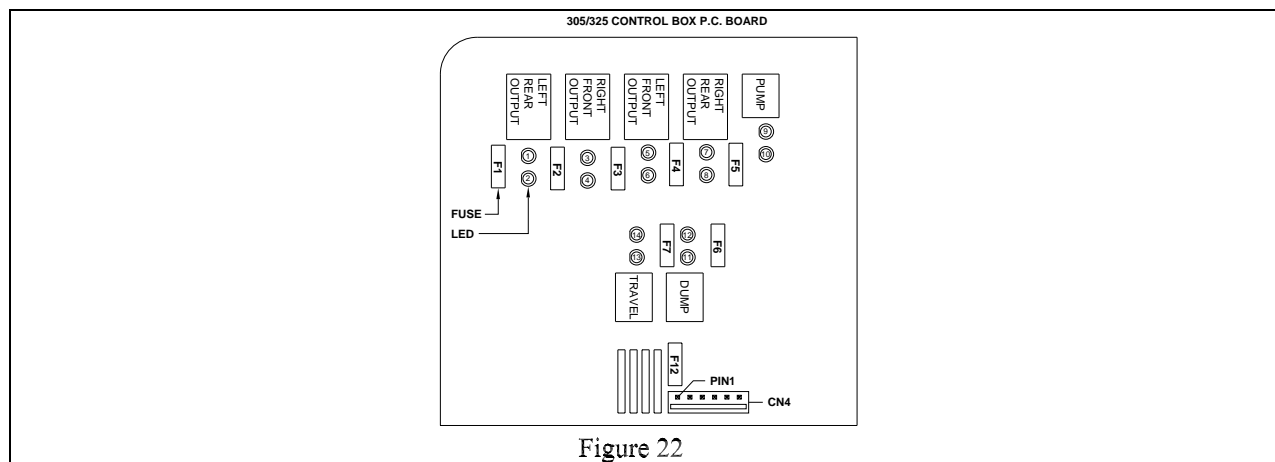
If the vehicle is equipped with kick-down style jacks, all four jacks should be extended to the vertical position before beginning the leveling process or dumping air from the suspension if so equipped. Push the front UP ARROW button until the two front red warning lights come on. Then push the rear UP ARROW button until the two rear red warning lights come on. The jacks should then be in the vertical position.

Most vehicles will have a master "JACKS DOWN" warning light that will be on anytime one or more individual light plate warning lights are on. The master warning light is controlled with a switched ground from the touch panel. Power for the light can be supplied by the touch panel. If a vehicle has a straight-acting type jack, it is recommended that a buzzer is used. The controlling ground signal will come from the same wire that controls the master warning light. When a buzzer is used, the power for the buzzer and master warning light normally comes directly from the on side of the ignition switch.

If the vehicle has an air suspension, the air should be dumped from the suspension before the leveling process is started. When the touch panel ON light is on, if the park brake is set, there is a ground signal on the dump output pin of the touch panel. This turns the dump relay on in the control box which supplies a +12 volt signal to the dump output pin of the control box. This works with HWH® air dump valves or a pilot air dump system. If the system is equipped with the HWH® dump valves, the vehicle engine should not be running. The engine can be running with a pilot air dump system. Leveling should not be started until the vehicle has stopped lowering. If the air dump system is supplied by the vehicle manufacturer, refer to the manufacturer for instructions. The suspension air bags should be empty before leveling is started. Refer to Lesson 10 – Air Suspensions and HWH® for detailed explanations of different air dump systems.

Note: When the touch panel STORE light is on, there will be a ground signal on the travel output pin of the touch panel. If the system is equipped with a pilot air dump system, this ground will turn the control box travel relay on. This will supply a +12 volt signal on the travel output pin of the control box. The vehicle suspension should return to the travel mode. If the park brake is released and the ignition is on,

this will also turn the control box travel relay on. The +12 volt travel signal on the control box travel output pin should be constant if the touch panel STORE light is on or if the ignition is on and the park brake is off.



A nice feature of the 305/325 Series systems is the control box printed circuit board is equipped with LEDs that can help with diagnostics when problems occur. There is a yellow and red LED for each output relay of the control box. If a yellow led is lit, that means the control box is receiving a ground signal from the touch panel to turn the relay on. If the red LED is lit, that indicates there is +12 volts on the output pin for that relay. If a yellow LED is lit but not the red, the fuse could be bad. If the fuse is good, the problem is most likely the control box. If the yellow LED is not lit, the problem could be the control box, the touch panel or touch panel cable.

**Retracting Jacks.** The 305/325 Series touch panel has a “STORE” button. **The STORE button will function only if the touch panel POWER ON light is OFF, the park brake does not have to be set.** The vehicle ignition must be on. If the vehicle has an air suspension with HWH® air dump valves, start the engine before retracting the jacks. Start the retract procedure as soon as the engine has been started. When the “STORE” button is pushed, a touch panel latch in circuit keeps all four solenoid valves open and allows fluid to return to the pump reservoir as the jack springs pull the cylinder in and with kick-down jacks the springs pull the jacks into the horizontal position. As a kick-down jack returns to the horizontal position and straight-acting jacks retract to within about ¼ to ½ in. of being fully retracted, the warning switch contacts open, breaking the ground circuit for the red warning lights. The warning lights should go out. When a warning light goes out, the corresponding solenoid valve for that jack will turn off. If a red warning light will not go out, the solenoid valve for that jack will remain on until the OFF button is pushed or the ignition is turned off. The STORE light will not automatically turn off. The OFF button must be pushed or the ignition must be turned off to turn the STORE light off.

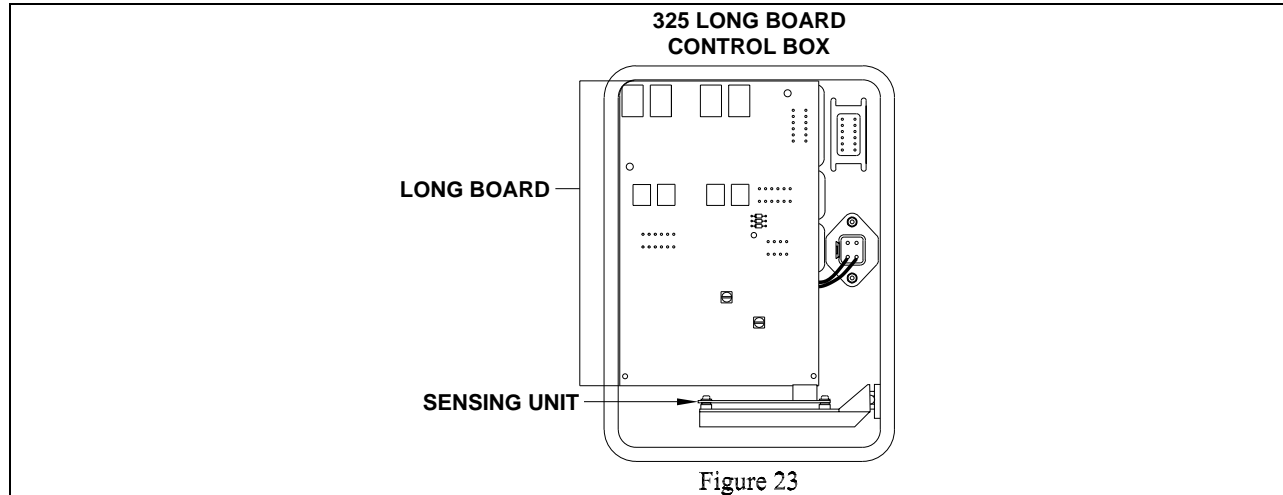
Note: If the STORE light is on, the touch panel will not turn on when the ON button is pushed.

**Pilot Air Dump “Travel”:** If the vehicle is equipped with an HWH® controlled pilot air dump system, pushing the STORE button with the ignition on sends a ground signal from the touch panel to the control box to turn the control box travel relay on. This provides a +12 volt signal on the travel output pin. This is a constant +12 volt signal if the ignition is on and the STORE light is on. If the park brake is released with the ignition on, the control box will have a constant +12 volt signal on the control box travel output pin no matter what state the STORE light is in, on or off. The ignition must be on to have a +12 volt travel signal.

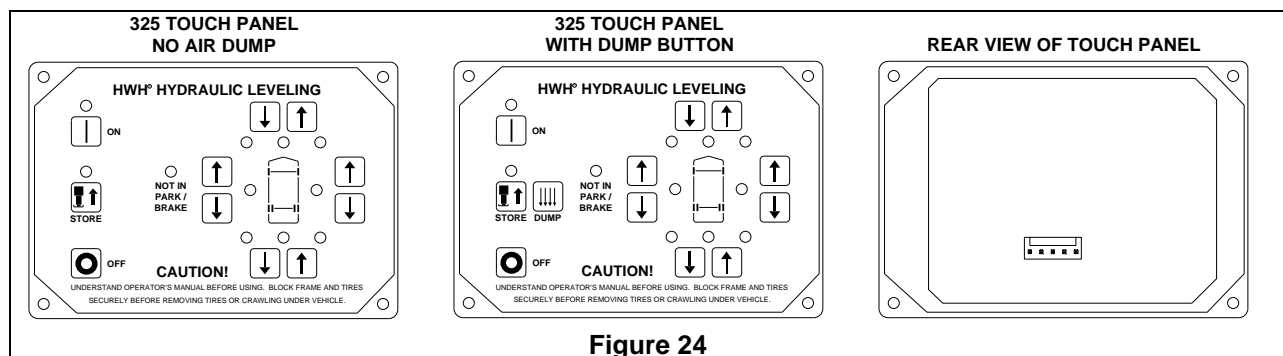
The 305/325 Series systems are designed to be able to combat the effects caused by thermal expansion of the fluid in the system when traveling. Thermal expansion of the fluid will cause the jacks to extend slightly while traveling. This is NOT a driving hazard but can cause the warning buzzer to come on. This was an occasional issue with the 310 Series systems. With a 305/325 system, thermal expansion will still cause the jacks to extend slightly but the 305/325 systems will take care of this issue without the warning buzzer coming on. First, the touch panel STORE light must be on when traveling. That means the OFF button should NOT be pushed when the jacks are completely stored and the red warning lights are off. If the engine is started after the jacks are stored, the STORE button should be pushed before traveling. In fact, the STORE button should always be pushed before traveling after the engine has been started. When the STORE light is on and a jack extends enough to turn the warning switch on, the system will turn the corresponding solenoid valve on. This valve will remain on until the jack retracts enough to turn the warning switch off. When the warning switch turns off, the solenoid valve turns off. A timer in the

circuit prevents the touch panel from supplying a ground signal to the master warning light and buzzer for approximately five seconds. The system will retract the jack without the buzzer coming on.

## CHAPTER 7 - 325 Series, Touch-Panel-Controlled Leveling Systems (Long PC Board)



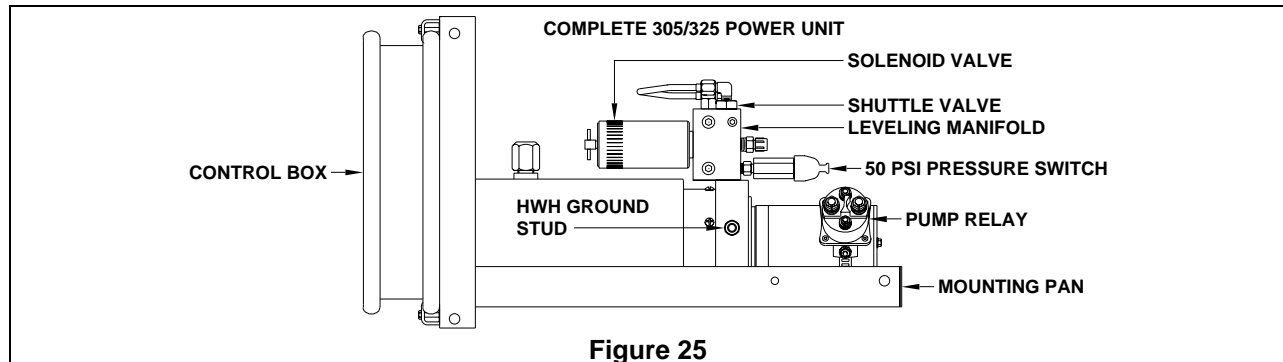
The 325 Series long board system is the last manual touch panel system that was produced by HWH® in large quantities. A hybrid of the 625 Single Touch Computer-Controlled System was developed a little later but was never produced in large quantities. Chapter 7 will give a brief description of that system. **FIGURE 23** shows the long board box. Refer back to **FIGURE 19** to see the difference between the 305/325 short board system and the 325 long board system control boxes. The main complaint of the 305/325 leveling systems was having to push the STORE button before traveling. Several motor home manufacturers determined this was unacceptable so the 305/325 system was redesigned and was never offered without a level sensing unit. Marketing factors dictated retaining the 325 system designation. The 325 Series system has only 2 different touch panels; one panel has a DUMP button the other panel does not. There were no 24 volt 325 systems. The 325 touch panel DOES have a “NOT IN PARK/BAKE” light. The 325 touch panels and the 310 Series touch panels use the same lexan but are totally different and are not interchangeable. You can easily tell the difference by looking at the back side of the touch panel. See **FIGURE 24** for a rear view of the 310 touch panel.



**Hydraulic Functions:** The 325 long board system is exactly like the 305/325 systems so the following is a review of the last chapter. Like the 305/325 systems, the same valve is used to extend or retract the jacks. The pumps have a pressure output port and a fluid return port. These two ports need to be isolated from each other for the system to operate. This is accomplished with the shuttle valve. The shuttle valve is a pressure activated valve. When the pump is not running, the return port is open. When a solenoid valve is opened with the pump off, the fluid can flow from the jack back to the pump. When the pump is running, the shuttle valve shifts to open the pressure port and block the return port. This keeps the fluid in the manifold so the solenoid valves can direct the fluid to the jacks.

With BI-AXIS® leveling, it is common to have one jack under pressure that will be operated with a jack that is not under pressure. Example: The right front and rear jacks were extended to lift the right side of the vehicle. Then the front must be raised. Now, the right front and left front solenoid valves will be opened. The left front jack will not be under any pressure at this time. Because fluid will take the path of

least resistance, when both valves are opened, fluid from the jack under pressure will want to flow to the jack that is not under pressure. This will cause the vehicle to drop. The inner and outer check valve arrangement in the manifold prevents that from happening. Because there is a separate pressure side and return side in the manifold, each solenoid valve has two check valves. The inner check valve prevents fluid flow from an open solenoid valve into the pressure side of the manifold. The outer check valve prevents fluid flow from the return side of the manifold into an open solenoid valve. Thus, fluid cannot flow from a jack under pressure to a jack that is under low or no pressure.



**Figure 25**

The vehicle can also “drop” slightly if the solenoid valve is opened at the same time the pump is turned on. When the pump comes on, it takes a split second for the shuttle valve to shift to block the return port. If the solenoid valve is opened at the same time, some fluid can escape from a jack under pressure before the shuttle valve is completely shifted; the vehicle drops slightly. On the early 325 systems, the 50 psi manifold pressure switch prevented this from happening. The pressure switch is hydraulically located on the manifold after the shuttle valve. The pressure switch cannot see pressure until the shuttle valve has shifted. The control box cannot open any solenoid valves until it receives a ground signal from the 50 psi pressure switch. In mid 2005, some timing was added to the computer program that prevents the solenoid valves from opening for a split second after the pump turns on. The 50 psi pressure switch programming stayed in place. The only real difference would be the system would still function if the 50 psi pressure switch had a problem.

**Electrical Functions:** The 325 long board system is actually a watered down version of the 625 Series computerized leveling system. The 325 long board system is also referred to as the 325A system, “A” coming from the 325 system using the same basic printed circuit board for the control box as the 625 computerized system. The 325 touch panels and control boxes have computer chips and all functions are controlled by the computer chips. Communications between the touch panel and the control box are not “hard wired” like the 310 or 305/325 systems. Communication between the touch panel and the control box is a multiplexed signal. The touch panel harness only has five wires to connect the touch panel to the control box; one +12 wire, one ground wire, one twisted pair of wires (the communication wires) and a shielding wire.

The 325 Series touch panels have an ON button, an OFF button, four UP ARROW (extend jacks) buttons and four DOWN ARROW (retract jacks) buttons. An UP or DOWN ARROW button will always operate 2 jacks at a time. The touch panel has a STORE button. This button will retract all four jacks at the same time. If the system has an HWH® controlled air dump system, the panel will have a DUMP button. Pushing this button signals the control box to turn on HWH® dump valves or to shift a pilot air dump valve to the dump position. There is no TRAVEL button. Pushing STORE puts the suspension back in the travel mode. Refer to **FIGURE 26**.

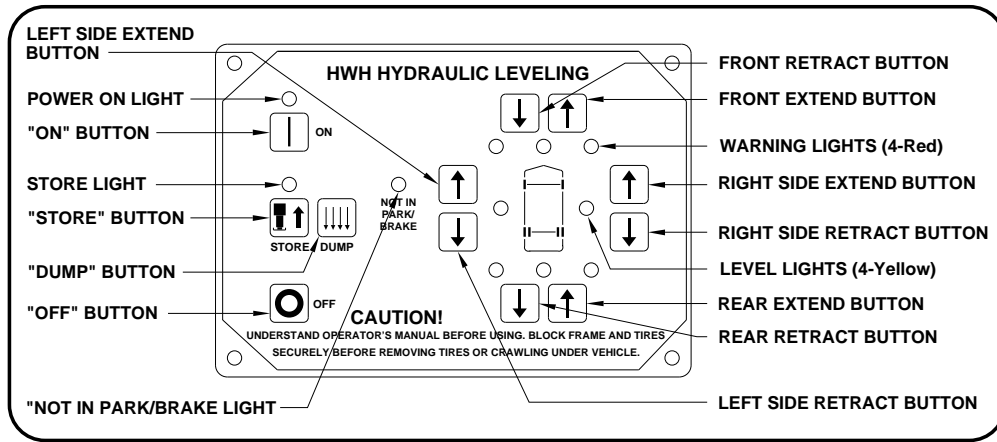


Figure 26

The touch panel has a power on light. This light will be on when the panel is on. There is a store light. This light will come on when the STORE button is pushed. There is a "NOT IN PARK/BRAKE" light on the touch panel, and the pump will not run if the park brake is not set. There are four red jack-down warning lights, one for each jack. These lights will come on when a jack has extended approximately  $\frac{1}{4}$  to  $\frac{1}{2}$  inch if the ignition is on. There are four yellow level lights; front, rear, left side and right side. The yellow level lights work only if the panel is on. A lit level light means that side or end of the vehicle is low. One or two yellow level lights may be on at the same time, but never opposing lights.

When the ignition switch is on, there is +12 volt power supplied directly to the control box. +12 volt power to operate the touch panel is supplied from the control box to the touch panel. The main system ground comes from the ground stud on the power unit. A ten-gauge wire is routed to a four pin plug on the back of the control box. There is one ground wire in the touch panel cable that supplies ground to the touch panel. +12 volt power for the control box outputs comes from the battery supply side of the pump relay. When touch panel buttons are pushed, multiplexed signals to control the different functions are routed back to the control box via the touch panel cable. Pushing the ON button turns the panel on. Pushing an UP ARROW sends a signal to the control box to turn the appropriate solenoid valves on and to turn the pump relay on. The control box switches +12 volts to turn the pump relay on and to turn the corresponding solenoid valves on. Pushing a DOWN ARROW button sends a signal to the control box to turn the appropriate solenoid valves on, the pump does not run. Pushing the STORE button sends a multiplexed signal to the control box to start the store mode.

The jack-down warning switches are routed directly to the control box. The sensing unit is mounted in the control box. Both the warning switches and the level sensing unit switch a ground for the control box to turn the appropriate touch panel lights on. The grounds for the warning switches and the level sensing unit are supplied by the control box. +12 volts for the level sensing unit is supplied by control box. The signal to control the master warning light/buzzer is a switched ground supplied by the control box. The control box supplies +12 volts for the master warning light, if a buzzer is not used. If a buzzer is used, +12 volts comes from the ON side of the ignition switch.

**Park Brake Circuit:** The sole intent of the park brake circuit is to prevent the hydraulic pump from running if the vehicle is moving. When the park brake is engaged, a switch sends a signal to a "park brake on" indicator light on the vehicle dash. In most cases, that signal will be a switched ground but in a very few instances, the park brake signal can be a +12 volt signal. The 325 Series system is designed to use a ground signal for this operation. If the park brake supplies a +12 volt signal, the system will require a relay to switch the +12 signal to a ground signal when the park brake is set. The 325 Series system will not turn on if the park brake is not set.

The touch panel "NOT IN PARK/BRAKE" light will come on only while the ON button is being pushed and go out when the ON button is released. The park brake wire should never be connected directly to ground.

**Complete electrical and hydraulic schematics along with a comprehensive repair manual are available from HWH® and can be downloaded from the HWH® web site; [www.hwh.com](http://www.hwh.com).**

**How the 325 Series systems work.**

The ignition should be in the ACC position and the park brake must set. When the ON button is pushed, the power on light comes on, the other touch panel lights can function, and the touch panel buttons will function. There can be one or two yellow level indicator on at a time but never opposing yellow level lights.

The vehicle is leveled by pushing UP ARROW buttons to extend jack pairs according to a lit yellow level light. When a side or end of the vehicle is low, the sensing unit switches a ground for the control box to turn the appropriate touch panel yellow level light on. It is recommended to extend jacks to turn lit side lights out before extending jacks to turn a front or rear level light out. When an UP ARROW button is pushed, the touch panel signals the control box to turn on the appropriate control box relays that turn the pump relay and the corresponding solenoid valves on. The solenoid valves will not be turned on until the control box sees a ground from the 50 psi manifold pressure switch or the computer timing for pump run time before the valves can open is exceeded. The computer only has to have one of those things happen.

As the jack extends approximately  $\frac{1}{4}$  to  $\frac{1}{2}$  inch, the corresponding red warning light on the touch panel will come on. The master warning light and buzzer, if so equipped, will come on at this time if the ignition is in the ON position.

Note: The wiring for the master warning light and buzzer is determined by the installer. It is possible the light and buzzer will come on when the ignition is in the ACC position.

The UP ARROW button is pushed until the vehicle is raised enough to turn the level light off. This is repeated with other UP ARROW buttons as needed until the yellow level lights are all off.

After all yellow level lights are off; the jacks not used for leveling should be extended to the ground to stabilize the vehicle. Push and hold UP ARROW buttons to extend jacks as needed until the vehicle is "bumped" up slightly. Jacks used to stabilize the vehicle should lift about  $\frac{3}{4}$  inch to 1 inch. The front or rear UP ARROW buttons should be used when stabilizing the vehicle.

Example: The left side of the vehicle was low. The two left side jacks were extended to raise the vehicle and turn the left side yellow light off. All level lights are now off. The order does not matter but push the front UP ARROW button to extend the right front jack to stabilize then push the rear UP ARROW button to extend the right rear jack to stabilize. DO NOT just push the right side UP ARROW button to extend the right side jacks together.

### **Additional Operating Information for the 325 Series Systems.**

If the vehicle is equipped with kick-down style jacks, all four jacks should be extended to the vertical position before beginning the leveling process or dumping air from the suspension if so equipped. Push the front UP ARROW button until the two front red warning lights come on. Then push the rear UP ARROW button until the two rear red warning lights come on. The jacks should then be in the vertical position.

Most vehicles will have a master "JACKS DOWN" warning light that will be on anytime one or more individual light plate warning lights are on. The master warning light is controlled with a switched ground from the touch panel. Power for the light can be supplied by the touch panel. If a vehicle has a straight-acting type jack, it is recommended that a buzzer is used. The controlling ground signal will come from the same wire that controls the master warning light. When a buzzer is used, the power for the buzzer and master warning light normally comes directly from the on side of the ignition switch.

If the vehicle has an air suspension, the air should be dumped from the suspension before the leveling process is started. If the suspension air dump is controlled by the HWH® system, the touch panel will have a DUMP button. Pushing the DUMP button signals the control box to turn the control box dump relay on. This supplies a +12 volt signal to the control box output pin for air dump. This works with HWH® air dump valves or a pilot air dump system. If the system is equipped with the HWH® dump valves, the vehicle engine should not be running. The +12 signal from the control box is only present when the DUMP button is being pushed. The DUMP button must be pushed until all air has been exhausted from the vehicle suspension. The engine can be running with a pilot air dump system. With a pilot air dump system, the DUMP button can be pushed and released. The pilot air dump valve will shift to the dump position and stay there. Leveling should not be started until the vehicle has stopped lowering. If the air dump system is supplied by the vehicle manufacturer, refer to the manufacturer for instructions. The suspension air bags should be empty before leveling is started. Refer to Lesson 10 – Air Suspensions and HWH® for detailed explanations of different air dump systems.

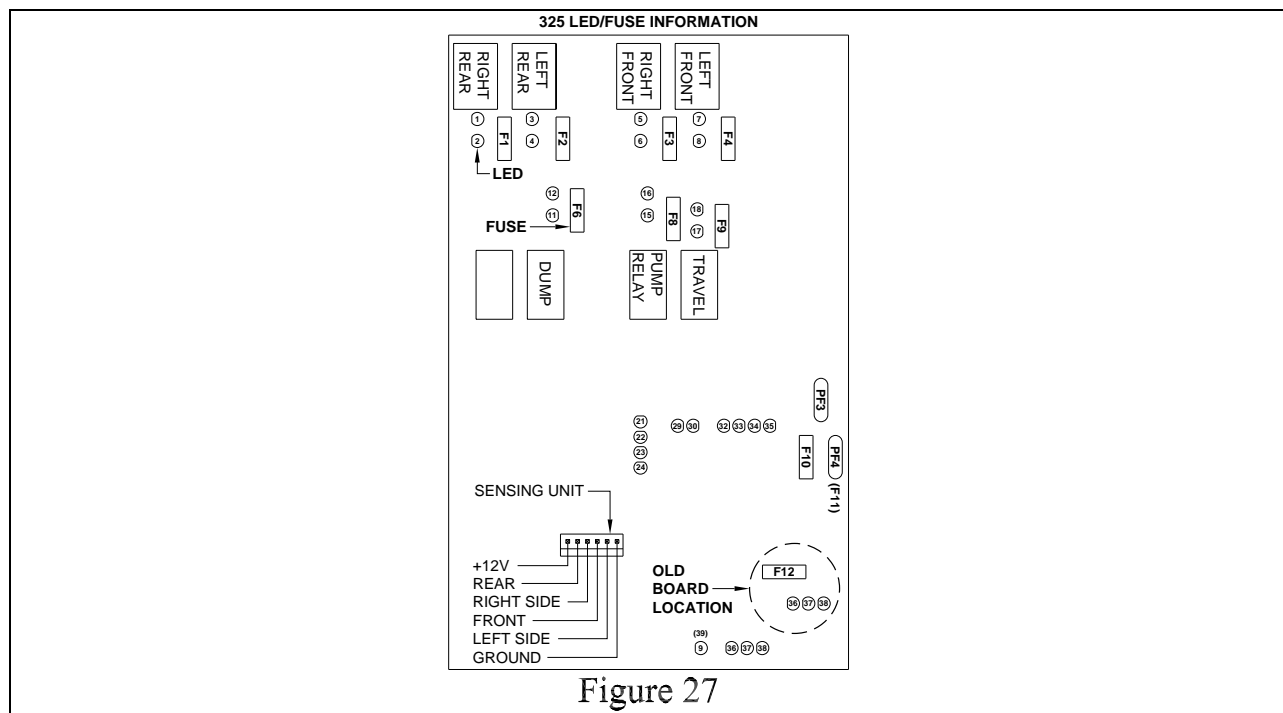


Figure 27

A nice feature of the 325 Series systems is the control box printed circuit board is equipped with LEDs that can help with diagnostics when problems occur. There is a yellow and red LED for each output relay of the control box. If a yellow led is lit, that means the control box processor is trying to turn that relay on. If the red LED is lit, that indicates there is +12 volts on the output pin for that relay. If a yellow LED is lit but not the red, the fuse could be bad. If the fuse is good, the problem is most likely the control box. If the yellow LED is not lit, the problem could be the control box, the touch panel or touch panel cable. There are also several red, yellow and one green LED on the board to provide information such as power into the box, power out of the box, the different pressure switch inputs and warning switch inputs. Refer to [ML35671](#) for detailed information about the 325 control box pc board LEDs and fuses.

**Retracting Jacks.** The 325 Series touch panel has a “STORE” button. **The STORE button will function if the touch panel POWER ON light is off or on, the park brake does not have to be set.** The vehicle ignition must be on. If the vehicle has an air suspension with HWH® air dump valves, start the engine before retracting the jacks. Start the retract procedure as soon as the engine has been started. When the STORE button is pushed, the touch panel signals the control box to start the retract procedure. The front two solenoid valves are opened first. Five seconds after the front valves are opened, the solenoid valves for the rear jacks are opened.

This allows fluid to return to the pump reservoir as the jack springs pull the cylinder in and with kick-down jacks the springs pull the jacks into the horizontal position. As a kick-down jack returns to the horizontal position and straight-acting jacks retract to within about ¼ to ½ in. of being fully retracted, the warning switch contacts open, breaking the ground circuit for the red warning lights. The warning lights should go out. When the last red warning light goes out, the system will keep all four solenoid valves open for an additional two minutes. After this two minute period, the touch panel will shut off, closing all four solenoid valves. If one or more red warning lights remain on, the touch panel will remain on with all four solenoid valves on until the OFF button is pushed or the ignition is turned off.

**Pilot Air Dump “Travel”:** For the 325 long board systems, the control box travel relay is installed to use the normally closed contacts of the relay. When the ignition is on and the DUMP button is pushed, the travel relay turns on. This opens the relay contacts and removes +12 from the control box travel output pin. After the DUMP button is pushed, anytime the ignition is on, the travel relay is on with its contacts open, even if the touch panel is off. Pushing the STORE button with the ignition on will signal the control box to turn the control box travel relay off. This will supply a +12 volt signal on the control box travel output pin. If the vehicle is equipped with an HWH® controlled pilot air dump system, this +12 signal will shift the pilot air dump valve into the travel position. If the park brake is released without pushing the STORE button and the ignition on, the control box will turn the travel relay off, closing the travel relay contacts. Any time the travel relay is off and the ignition is on, there is a constant +12 volt signal on the control box travel output pin. There will be a +12 volt travel signal anytime the STORE button has been pushed or anytime the ignition is on and the park brake is released. The ignition must be on to have a +12 travel signal.

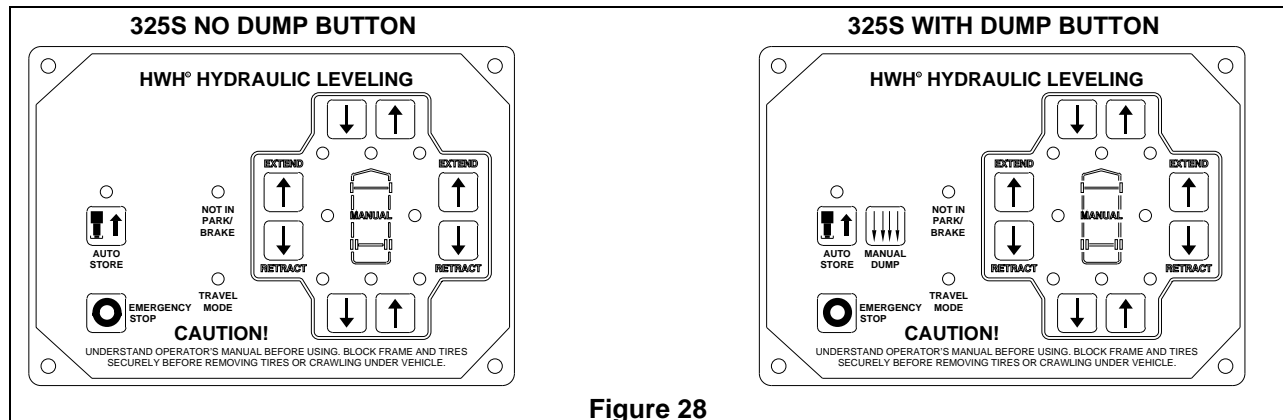


The 325 Series systems are designed to be able to combat the effects caused by thermal expansion of the fluid in the system when traveling. Thermal expansion of the fluid will cause the jacks to extend slightly while traveling. This is NOT a driving hazard but can cause the warning buzzer to come on. This was an occasional issue with the 310 Series systems. With a 325 system, thermal expansion will still cause the jacks to extend slightly but the 325 systems will take care of this issue without the warning buzzer coming on. First, if the ignition is turned on and any touch panel red warning light is on, the jacks must be completely retracted with all red warning lights turned off. This can be done with the STORE button or by using the manual DOWN ARROW buttons to retract the jacks. With the ignition on and all red warning lights out, releasing the park brake sets the thermal retract mode for traveling. If a jack extends slightly while traveling and the warning switch contracts close, the control box will turn the solenoid valve for that jack on. If the jack retracts within 30 seconds, turning the warning switch off, the control box turns the solenoid valve off. Neither the touch panel warning light nor the master warning light/buzzer ever come on. If the warning switch contacts are still closed after 30 seconds, the control box will turn the solenoid valve off then turn the touch panel warning light and the master warning light/buzzer on. The lights and buzzer will stay on until the warning switch is turned off or the ignition is turned off.

## CHAPTER 8 - 325S Series, Touch-Panel-Controlled Leveling Systems

### (No "ON" Button)

The 325S Series manual touch panel system was derived from the 625S Single Step Computer-Controlled system. The 325S system is easily identified by the touch panel lexan. This lexan has the heading "HWH® HYDRAULIC LEVELING" at the top of the lexan but unlike the other manual touch panel lexans, there is no ON button. There were two of the panels produced, one without a DUMP button, and one with a DUMP button. There were only several hundred of these systems sold and some of them were converted to an automatic system. Refer to **FIGURE 28** to view the different panels.



All operations of the 325S systems are the same as the 325 long board systems except for the missing ON button. All of the touch panel buttons and lights function if the ignition is on and the park brake is set. If the park brake is not set, the "NOT IN PARK/BRAKE" light will come on when an UP ARROW, DOWN ARROW or DUMP button is pushed. The only function of the CANCEL button would be to stop the store procedure if the STORE button was pushed. See CHAPTER 6 to review 325 operations.

Because of the low usage of this system, there will not be a detailed review of this system. Hydraulically, the 325S system is the same as the 325 system. Electrically, the 325S system is closer to the 625S single step system. In fact, the only difference between the 325S and the 625S systems is no automatic leveling function with the 325S system. Adding jack pressure switches and removing a jumper in the control box changes a 325S into a 625S. The repair manual, [ML41240](#) (625S) and the LED description sheet, [ML35669](#) (625/625S) can be used to diagnose the 325S systems. Refer to CHAPTER 14 in the second part of this lesson to review the 625S single step system.

### ADDITIONAL INFORMATION CONCERNING CHAPTERS 6, 7 AND 8

The following information is very important. As hopefully you learned in CHAPTER 6, when the 305/325 system was developed, the control box was designed to house the level sensing unit. This was the same for the 325 long board systems and the 325S systems as they use the same style control box. The sensing unit being in the control box created an installation issue. Remember when discussing the remote mounted sensing units for the 100 and 200 style systems there was a specific way the sensing unit needed to be orientated to work properly. The same is true for the electronic sensing units mounted in the control box. The sensing unit needs to be programmed to recognize where the front of the vehicle is. This is because the power unit assembly, which the box is part of, can be mounted in different positions. The control box could be facing the front, rear, left side or right side of the vehicle. This will change the orientation of the sensing unit.

When a vehicle manufacturer installed the system, HWH® could work with the manufacturer to know how the power unit would be mounted in the vehicle. We could then program the sensing unit accordingly. For installations where the orientation was not known, we supplied a control box with a sensing unit that could be easily programmed in the field. The programmable sensing unit allowed us to use one control box for four different mounting situations. It is very common that a control box with a programmable sensing unit is used to replace a control box with a factory programmed sensing unit. **It is important that the replacement control box has the sensing unit properly programmed before it is installed.** If not

properly programmed, the touch panel level lights will not match the level lights on the sensing unit. As an example, the left side touch panel level light may come on when the front is low. The information sheet [ML31215](#) gives complete details and diagrams for programming the sensing unit. This sheet can be downloaded from the HWH® web site at [www.hwh.com](http://www.hwh.com).

## CLOSING

This is the end LESSON 13 - PART 1.

There may be future additions to this if new systems are developed. Check the school outline from time to time. We will mark future additions as “New”. I hope this has been informative and helpful. Remember, this school is based on information pertaining to equipment and diagnostics that is used by HWH CORPORATION.

The following is a test that will cover a little of everything that was discussed in this school. Download the test and email it to [school@hwh.com](mailto:school@hwh.com), we will correct it and send it back to you.

We appreciate any input that will help make this and other online HWH® schools better. If you find mistakes or have suggestions, please contact us at [service@hwh.com](mailto:service@hwh.com).