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CHAPTER 5. Conclusion

TEST
Lesson 13 – Part 3, deals with identifying the newer HWH computerized, automatic 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. The newer systems are fairly easy to identify but there are some operational differences that are subtle but important to understand for diagnostic purposes. Although all automatic leveling systems up to and including the 625S single step leveling system used jacks with single acting cylinders, some present day 725 series automatic computerized leveling systems will use jacks with a double-acting cylinder. Systems with double-acting cylinders will be discussed in a separate lesson.

The lever and touch panel controlled manual leveling systems are covered in Lesson 13-Part 1. The early computerized automatic leveling systems are discussed in Lesson 13-Part 2.

Touch panels, control boxes and other system features will be used in the identification of the systems. Due to the visual similarity of touch panels and control boxes, it is important to understand less obvious differences.

Probably the most reliable way to identify a specific system is with a control box, MIOM or touch panel part number. The parts manual has quick reference guides for some of the major components of our systems such as jacks, pumps, touch panels and control boxes. Refer to the quick reference guide for Control Units - Electronic for identification information using the control box or MIOM part number. Refer to Control Panels for information using the touch panels.

Most of the computerized hydraulic leveling 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 Systems and Lesson 9: Electronics and HWH Systems 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. These will be located under Service Manuals - All Systems after clicking on “Tech Support, Manuals, Online Schools” on the home page.
Operationally, the 625 series leveling systems were very much like the 610 central ground systems. The same jacks used with a 610 system could be used with a 625 but the control box for the 625 systems was completely different. The 625 still used a pump and manifold combination that was similar to the 610 but the control box became part of the power control unit that consisted of the pump, manifold and control box mounted in one assembly. It is important to note that due to space limitations, mostly with class C motor homes, the control box was removed and mounted in a different location. Usually within 3 or 4 feet of the power unit. The touch panel, although it looked the same, was not interchangeable with the panels used with the 610 systems. The 610 systems used an 11 pin MTA connector and had one pc board only. The 625 system touch panel has 2 pc boards and a 5 pin MTA connector. Another major difference is the level sensing unit. The 625 used the electronic sensing unit and was mounted in the control box. Figure 1

2-1. Hydraulic functions:
The 625 system is hydraulically the same as 310, 325 and 610 systems. This will be a review of what you have already seen many times but it can’t hurt reading it again. There is one valve for each jack. 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. Figure 2

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 2.
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 610 systems, timing in the program prevented this from happening. The manual touch panel systems use a 50 psi pressure switch on the manifold to take care of this issue. This was incorporated into the 625 system. 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 without a noticeable change if the 50 psi pressure switch had a problem.

2-2 Electrical functions:
The 625 system is a basic CAN system with the control box being the mother board and the touch panel being the only module on the CAN trunk line. Communication between the touch panel and the control box is a multi-plexed 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, yellow and green) and a bare shielding wire. Figure 3

PIN 1 – YELLOW – CAN HIGH TWISTED PAIR
PIN 2 – GREEN – LOW TWISTED PAIR
PIN 3 – NO COLOR – CAN SHIELD
PIN 4 – WHITE – GROUND FROM CONTROL BOX
PIN 5 – RED - +12 IGNITION FROM CONTROL BOX

There is a 120 ohm terminating resistor at each end of the twisted pair. This can be part of the cable or incorporated into the box and touch panel. The terminating resistors are part of the control box and touch panel with the 625 series leveling systems. A problem with the terminating resistors will cause the system to malfunction.
The 625 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. Pushing STORE puts a pilot dump suspension back in the travel mode. Figure 1

The touch panel has a red power on light. This light will be on when the panel is on. There is a red store light. This light will flash when the STORE button is pushed. There is a “NOT IN PARK/BRAKE” light on the touch panel, 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 1 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. Figure 1

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. Anytime the control box processor sees ignition power, the processor turns the master relay on. The master relay is on anytime the ignition is on with the park brake on or off. The main system ground comes from the ground stud on the power unit. A 10 gauge white wire is routed to a 4 pin plug on the back of the control box. This wire splits into two 12 gauge white wires at the plug. 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 switched side of the master relay. A 10 gauge black wire is routed to a 4 pin plug on the back of the control box. This wire splits into two 12 gauge black wires at the plug. Figure 4

Note: If the 625 system controls HWH slide-outs, the 4 pin connector will have two black wires from the switched side of the master relay, one white wire from the grounding stud and one red wire from the battery supply side of the master relay. The red wire supplies +12 for the pump control side of the room control switches. Figure 4

<table>
<thead>
<tr>
<th>PIN #</th>
<th>WIRE COLOR</th>
<th>WIRE NUMBER</th>
<th>WIRE DESCRIPTION AND FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BLACK</td>
<td>6800</td>
<td>SWITCHED +12V BATTERY POWER FROM MASTER RELAY</td>
</tr>
<tr>
<td>2</td>
<td>BLACK</td>
<td>6800</td>
<td>SWITCHED +12V BATTERY POWER FROM MASTER RELAY</td>
</tr>
<tr>
<td>3</td>
<td>WHITE</td>
<td>6230</td>
<td>GROUND FROM HWH GROUND STUD</td>
</tr>
<tr>
<td>4</td>
<td>WHITE</td>
<td>6230</td>
<td>GROUND FROM HWH GROUND STUD</td>
</tr>
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</tr>
<tr>
<td>4</td>
<td>RED</td>
<td>6100</td>
<td>+12 BATTERY FROM MASTER RELAY</td>
</tr>
</tbody>
</table>

When touch panel buttons are pushed, multiplexed information to control the different functions is routed back to the control box via the touch panel cable. Pushing the ON button turns the panel on. Pushing an UP ARROW sends information 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 information to the control box to turn the appropriate solenoid valves on, the pump does not run.
Pushing the ON button a second time starts the automatic leveling process. The ON light flashes during the automatic leveling procedure. The manual UP or DOWN arrow buttons and the DUMP button will not function when the system is in the automatic leveling mode. Pushing the STORE button sends multiplexed information to the control box to start the store mode.

The jack down warning switches and jack pressure switches are routed directly to the control box. The sensing unit is mounted in the control box. The warning switches, jack pressure 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 the 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.

2-3. 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, usually supplied by the chassis manufacturer, 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 625 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.

2-4. Control Box Information:
A feature of the 625 series is the control box printed circuit board is equipped with LEDs that can help with diagnostics when problems occur. The control box has a clear Plexiglas cover so the LEDs can be seen. 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 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, depending on the symptom. There are also several red, yellow and one green LEDs on the board to provide information such as power into the box, power out of the box, and different pressure switch or warning switch inputs. LEDs are not turned on to indicate an issue. LEDs are only used to indicate an input is present or there should be an output. The lack of an LED that should be on or a lit LED that should not be on helps with diagnostics. i.e. A jack is extended. The warning switch LED in the box is not on. If the ground signal is present, the issue is the box. If the ground signal is not present, the issue is the harness or switch.

The 625 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.
Refer to ML35669 at www.hwh.com for detailed information about the 625 control box pc board LEDs and fuses. It is important to note there is a 1st and 2nd generation pc board for the 625 system. The main difference is fuses F11 and F12 have been replaced with poly fuses (PF). The location for F12 has moved. F12 is now PF3 and F11 is now PF4. The location of LEDs 36, 37 and 38 have moved. Also, LED 39, the link light, is now LED 9. This is noted on the board diagram. Figure 5. Refer to Lesson 9: Electronics and HWH Systems, Section 2-4. Fuses, for a detailed explanation of a poly fuse.

**Level sensing unit.** A new feature of the 625 leveling system was the new style electronic level sensing unit is mounted in the control box. This was both a good feature and a feature that created some new issues not seen before. On the plus side, during system installation the mounting of the sensing unit was eliminated. This saved some time and issues with finding a good location for the sensing unit. And from a service standpoint, the tech never had to worry about finding the sensing unit. Aftermarket installations were usually not too bad to find but O.E.M. installations sometimes created a headache for the tech trying to find the sensing unit. The new style sensing unit also has four yellow LEDs so it can be adjusted without two people or running back and forth to the touch panel to see what the yellow lights are doing. These sensing unit lights are on anytime the ignition is on. The touch panel does not have to be on. But being mounted in the control box caused other issues. Like a remote mounted sensing unit, the complete power unit assembly needed a good solid mount that would not flex our allow shaking during the leveling process. Many times, a brace had to be added to eliminate “shaking”. Sometimes if the mounting was not solid, the torque from the pump motor turning off and on would shake the sensing unit causing the lights to flicker. This could cause erratic leveling during an automatic leveling procedure. Also, the shaking would frequently cause the sensing unit to go out of adjustment. The mounting mechanism for the sensing unit was re-designed to eliminate this issue. Older control boxes can be upgraded with this new equipment.

Another issue was the orientation of the power unit. The front of the vehicle is obviously always the front of the vehicle. But the power unit could be mounted in any of four directions. The glass front of the box can point to the front, rear, left side or right side. We call the front of the vehicle North, the rear is South, the driver side is West or left, (in the U.S., not the U.K. or Australia) and the passenger side is East or right. I will use directions for the rest of this discussion instead of sides, front or rear. This means the sensing unit has to be programmed to know where the front of the vehicle is. It also meant possibly having four different part numbers for control boxes, depending on how the power unit was mounted. To ease this at the replacement level, the sensing unit was designed with small jumpers that would allow the sensing unit to be programmed in the field. This allows a single part number for replacement control boxes or sensing units. The part number for a replacement box may not be the same as the original.

The new electronic sensing unit also allowed us to use a slightly tighter tolerance for vehicles with an air suspension as compared to a vehicle for a spring suspension. The sensing unit has four sets of programming jumpers. The jumpers are labeled JP1, JP2, JP3 and JP4. JP1 and JP2 are used to set the direction of the sensing unit. JP3 is used to determine the suspension type and JP4 is not used in the field.

![Diagram of Level Sensing Unit](image-url)

Figure 6. Refer to ML31215 at www.hwh.com for complete instructions on setting the jumpers to program the sensing unit.
The sensing unit has 6 wires, ground, +12, and four signal wires, front (N), rear (S), left side (W) and right side (E). The sensing unit switches a ground for the processor so the diagnostics for the sensing unit is simple. The sensing unit adjustment mechanism is on the outside of the control box. Figure 7 shows the adjustment mechanism. It has changed several times over the years but the basic adjustment procedure has not changed. Refer to ML47509 at www.hwh.com for complete instructions on adjusting the sensing unit. This sheet contains a procedure for systems with or without an adjustment enhancement that was added to some systems. NO 625 or 625S system has this enhancement feature.

2-5. Series-Parallel Operation Information:
During the automatic STORE procedure the system will go into a “series-parallel” situation with the jack solenoid valves. For all operations except the store mode, the solenoid valves have independent grounds and +12 controls. The valves run as a parallel circuit. The left front and left rear valves are grounded to the ground stud. The right front and right rear valve ground wires are routed to the control box. These valves are grounded through relays labeled CRX1 (right front) and CRX2 (right rear). When the STORE button is pushed, the two front valves are turned on. Two (2) seconds later, the CRX1 relay and the control relay for the left front solenoid valve is turned off. This routes power to the right front solenoid valve, back through the CRX1 relay and out to the left front solenoid valve. These two valves are now in a series circuit. The +12 power is now going through two coils, the right front and left front valve coils. The current draw is cut in half. Less power used and the valves run cooler. Three (3) seconds later the rear valves turn on. Two (2) seconds after that, the CRX2 relay and the control relay for the left rear valve is turned off. The two rear solenoid valves are now connected in a series circuit. Because the STORE mode normally runs longer than an automatic leveling procedure, the series-parallel operation allows the system to draw less power and the valves can stay on without getting hot.

The series-parallel operation can create some interesting diagnostic situations. If one coil is bad with an open spot in the winding, it will cause two jacks to not retract. But depending on which solenoid has a bad coil, the other jack will still extend in manual or automatic operations. That diagnostics is easy; the jack that won’t extend has the bad solenoid valve. Another situation is if a right front or right rear solenoid coil is shorted to ground. When this happens the jacks start to retract but after a few seconds, the left side jack will stop retracting. Because the power will take the path of least resistance, when the valves are put in a series circuit, the current path in the right side valve is through the short to ground in the coil.

Now there is no power for the left side valve so it turns off, that jack stops retracting. The jack with the bad valve will continue to retract. Simple diagnostics is covered in the 625 repair manual. A detailed explanation of the series-parallel operation, including schematics, is found in ML37940, available at www.hwh.com.

Complete electrical and hydraulic schematics for the 625 system along with a comprehensive repair manual (ML35963) and the series-parallel information manual (ML37940) are available from HWH and can be downloaded from the HWH web site; www.hwh.com.
The ignition should be in the ACC position and the park brake must set. Any time the ignition is in the ON or ACC position, the control box uses a +12 volt signal to turn the master relay on. 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 lights on at a time but never opposing yellow level lights. If the vehicle has an air suspension, the air should be dumped before starting the leveling procedure. See section 2-7. Air dump, for a detailed explanation of air dump procedures.

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 is exceeded. The computer only has to have one of those things happen. If there is a problem with the 50 psi. pressure switch, the valves will still open when the computer timing is exceeded. 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. Also the warning switches have changed a little and a jack may extend more or less than 1 inch depending on when the switch was made or replaced.

Push and hold the UP ARROW button until the jacks have extended enough to raise the vehicle and turn the yellow level light off. This is repeated with other UP ARROW buttons as needed until all of the yellow level 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. 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 ½ 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. It is not recommended to push the right side UP ARROW button to extend the right side jacks together. Because of weight and jack lifting capacity differences, the vehicle may be lifted too high at the front or rear, lifting the vehicle out of level.

2-7. Additional information for manual operation of the 625 systems.

Kick-down style jacks. 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. Push the “ON” button one time to turn the system on. Push the “ON” button a second time. The pump will come on and the system will extend the jacks to the vertical position on at a time. The order is the left front first, then the right front, right rear and finally the left rear. The system is looking for the jack down warning switch for each jack. When the jack swings vertical, its warning switch will come on. The system will move to the next jack in the sequence and turn on the red touch panel warning light. The ON light will flash while this is happening. When all four jacks are vertical with their warning light on, the pump will shut off and the ON light will be on steady, ready for manual leveling or automatic operation.
If any jack does not extend vertical or its warning light does not come on, the system will run the pump for 3 seconds then move to the next jack. After completing the sequence for all four jacks, the ON light will come on steady. The system will NOT continue any automatic function. The manual UP and DOWN arrows will function to extend or retract jacks. The touch panel jack down warning light for the jack(s) not vertical will flash while pushing the UP arrow button for that jack but the pump will run and the jacks can swing vertical and/or extend. The STORE button will still function.

**Master warning light/buzzer.** Most vehicles will have a master “JACKS DOWN” warning light that will be on anytime one or more individual touch panel warning lights are on. The master warning light is controlled with a switched ground from the control box. Power for the light can be supplied by the control box. 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 so the system can be operated without the buzzer sounding. There is a diode assembly in the power harness for the buzzer/light combination so the components must be connected properly. Normally this should not be an issue. The buzzer uses a ring terminal connection and the light uses a spade terminal connection.

**Air dump.** 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. If the system has a pilot air dump system, the engine can be running. 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.

2-8. How the 625 systems work, automatic operation.

The ignition should be in the ACC position and the park brake must set. Any time the ignition is in the ON or ACC position, the control box uses a +12 volt signal to turn the master relay on. 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 lights on at a time but never opposing yellow level lights.

Push the ON button a second time. The on light will start to flash. The pump will come on and the system will level the vehicle according to lit yellow level lights starting with any lit side light.

Note: If the vehicle is equipped with a HWH controlled air dump system, the air will start to dump from the suspension and the vehicle will start to lower. The +12 volt dump signal will remain on during the complete automatic leveling sequence. Approximately 20 – 25 seconds after pushing the ON button, the leveling sequence will begin.

During the automatic leveling sequence while leveling the vehicle, the system will always extend two jacks at a time, both side jacks, both front jacks or both rear jacks. As yellow level lights turn off, the system will pause briefly to allow the level lights to stabilize. The system can move back and forth between side and front or rear level lights several times while leveling the vehicle.

When all the yellow level lights are off, the system will again pause briefly to make sure the lights stay off, about 2 seconds. The system will then stabilize the vehicle. This is done by extending any jacks not used for leveling to the ground to “bump” the coach up slightly, about ½ inch.
Each jack has a pressure switch. This is a normally open, single wire switch. It switches a ground when the contacts close. The switch is adjustable to make sure the jack does not lift too much or lifts enough during the stabilize portion of the leveling sequence. When the contact closes, the switch sends a ground signal to the control box. There are LEDs in the control box to indicate jack pressure switches are made. If a rear jack pressure switch is not on, the system will open the solenoid valve for that jack so the jack can extend. When the jack has extended enough to “bump” the vehicle slightly and turn the switch on, the system will close the valve for that jack. The rear jacks stabilize independent of each other. If either front jack pressure switch is not on, the system will open both front jack solenoid valves. If one front jack is already extended to the ground, the check valve arrangement in the leveling manifold will keep that jack in place while the other jack extends to the ground to “bump” the vehicle up slightly. When the system sees both front jack pressure switches, the system will shut both valves off. When the system sees all four jack pressure switches, the pump shuts off and the on light will go out.

Note: Because the vehicle is lifted slightly during the stabilize sequence, if the touch panel is turned back on after auto leveling is completed, a yellow level light may be on. The vehicle is most likely not out of level but the manual UP and DOWN arrow buttons can be used to “tweak” the system slightly and turn the yellow light(s) off.

2-9. Additional information for automatic operation of the 625 systems.

Kick-down style jacks. If the vehicle is equipped with kick-down style jacks, all four jacks must be extended to the vertical position with the four red jack down warning lights on before the automatic leveling process can be started. Push the “ON” button one time to turn the system on. Push the “ON” button a second time. The pump will come on and the system will extend the jacks to the vertical position one at a time. The order is the left front first, then the right front, right rear and finally the left rear. The system is looking for the jack down warning switch for each jack. When the jack swings vertical, its warning switch will come on. The system will move to the next jack in the sequence and turn on the red touch panel warning light. The ON light will flash while this is happening. When all four jacks are vertical with their warning light on, the pump will shut off and the ON light will be on steady, ready for manual leveling or automatic operation. There were no 625 systems using kick-down style jacks that had air dump capabilities.

If any jack does not extend vertical or its warning light does not come on, the system will run the pump for 3 seconds then move to the next jack. After completing the sequence for all four jacks, the ON light will come on steady. The system will NOT continue any automatic function. The manual UP and DOWN arrows will function to extend or retract jacks. The touch panel jack down warning light for the jack(s) not vertical will flash while pushing the UP arrow button for that jack but the pump will run and the jacks can swing vertical and/or extend. The STORE button will still function.

Pushing the ON button a third time starts the automatic leveling sequence. From this point, the leveling process is the same as a system with straight-acting style jacks.

EXCESS SLOPE: The touch panel has an EXCESS SLOPE light. The EXCESS SLOPE light can only come on during automatic leveling. Excess slope happens when two jacks reach full extension and the yellow level light calling for those jacks does not go out. The leveling manifold has a 3000 psi normally open, single wire pressure switch. When the switch contacts close, a ground signal is sent to the control box. There is a board LED that indicates that switch is on. When the processor sees the 3000 psi switch and the yellow level light is still on, it stops the leveling process and turns the EXCESS SLOPE light on. There will probably be one or two jacks that have not extended. The system will not stabilize the vehicle.

The EXCESS SLOPE light will be on anytime the ignition is on. The system can be operated with the manual UP and DOWN arrows. The STORE button will still function and can be used to retract the jacks. The EXCESS SLOPE light will remain on until the park brake is released WITH the ignition on or the jacks are completely retraced with the red jack down warning lights out using the STORE button.
The EXCESS SLOPE light can also come on during the stabilize sequence in automatic leveling if there is a jack pressure switch malfunction. If a jack pressure switch will not come on during the stabilize sequence, that jack will go to full extension. The pressure in the manifold will build and trip the 3000 psi pressure switch. When the processor sees the switch on steady for 20 seconds, it will turn on the EXCESS SLOPE light and halt the automatic leveling process.

The EXCESS SLOPE light will be on anytime the ignition is on. The system can be operated with the manual UP and DOWN arrows. The STORE button will still function and can be used to retract the jacks. The EXCESS SLOPE light will remain on until the park brake is released WITH the ignition on or the jacks are completely retracted with the red jack down warning lights out using the STORE button.

2-10. Retracting jacks with the STORE button.
The 625 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 it is recommended to 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 system turns the travel relay off applying power to the travel output pin. 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 1 in. of being fully retracted, depending on the type of warning switch, 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 six minutes. After this six 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 for 30 minutes. Pushing the OFF button or moving the ignition key to off will stop the store mode and turn the panel off.

The system will perform the series-parallel operation when the STORE button is pushed. See section 2-5 for a detailed explanation of the series-parallel operation.

2-11. Additional 625 series leveling system information.
Pilot air dump “Travel”: For the 625 systems, the control box travel relay is installed to use the normally closed contacts of the relay. This means for the “Travel” output relay only, when the yellow LED is on, the red LED will be off. When the yellow LED is off, the red LED will be on any time the ignition is in the ON or ACC position. When the ignition is on and automatic leveling has been initiated or 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.

If the travel relay has been turned on, automatically or with the DUMP button, and the ignition is on with the park brake set, the travel relay will be 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. The vehicle can now return to ride height. 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. There will be a +12 volt travel signal anytime the STORE button has been pushed if the ignition is on or anytime the ignition is on and the park brake is released. The ignition must be on to have a +12 travel signal. The bulk of the pilot dump equipment is supplied by the vehicle or chassis manufacturer. HWH supplies only a connector with a travel, dump and ground wire.
**Thermal expansion and traveling.** The 625 series systems are designed to be able to combat the effects caused by thermal expansion of the fluid in the system when traveling. Warming of fluid causes thermal expansion. Fluid volume increases. Due to a temperature increase caused by an increase in tire temperature and the vehicle exhaust, all motorized vehicle will experience thermal expansion, even in cold temperatures. 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 older touch panel systems, manual and automatic. With a 625 system, thermal expansion will still cause the jacks to extend slightly but the 625 systems should 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 and then turn the touch panel warning light and the master warning light/buzzer on. The lights and buzzer will stay on until the jack is retracted or the ignition is turned off.

**Systems with HWH slide-out systems.** Most vehicles that use a combination of HWH slide-outs and the HWH 625 series leveling system will be set up to run the slide-outs through the leveling system control box. +12 power to run the pump is routed through the control box to the slide-out controls. When room extend or retract is called for, a +12 volt signal from the slide-out control is used to turn the pump on through the control box electronics. +12 power to operate the slide-out solenoid valves is routed through the control box to the side control switch and back through the control box to operate the slide-out solenoid valves.

When the control box sees the signal from a slide-out control switch asking for pump operation, the box processor will interrupt any leveling system function, manual or automatic, leveling or retracting the jacks. When the room switch is released, manual operation can be resumed. If the leveling system was performing an automatic function, that function, leveling or retracting, will automatically resume.

**CHAPTER 3. 625S SERIES TOUCH PANEL CONTROLLED BI-AXIS SYSTEMS**

Several years after introducing the 625 series leveling system, it was requested to turn the system into a single step system. That simply means the automatic leveling sequence is started with the first push of what was originally the ON button. This system is also called the single touch or one touch leveling system depending on the vehicle manufacturer.

The 625S touch panel has a different look than the original 625 panel. It does not have the “HYD” or “I” button for on and level. That button is now the “AUTO LEVEL” button. The symbol in the button is also different. The most noticeable difference is the white outline around the manual UP and DOWN arrow buttons. It is easy to see the difference between the 625 and 625S touch panels. BUT, the newer 725 leveling system touch panel looks the same as the 625S so you still need to pay attention to differences in those systems.

![Figure 8](image-url)
The control boxes and touch panels for the 625 and 625S are NOT interchangeable. Like all of our systems, there are multiple control boxes and touch panels for the 625S system. It is important to make sure you have the proper part numbers when replacing components. Other parts such as jacks, pressure switches, warning switches and the level sensing units are the same and interchangeable.

3-1. Hydraulic functions.
The hydraulic functions of the 625S systems are exactly the same as the 625 systems. If you review section 2-1, that is the same as the 625S system will be. Both systems use the same power unit (different control boxes). All of the manifold functions, check valves, shuttle valve and solenoid valves are the same.

3-2. Electrical functions.
Like the hydraulic functions, most of the electrical functions for the 625 and 625S systems are the same. The main difference is the single step operation of the 625S system. For all practical purposes, the 625S touch panel is “on” anytime the vehicle ignition is in the ON or ACC position and the park brake is set. The panel does not have an “ON” button. It is only an AUTO LEVEL button now. Figure 8 The MANUAL DUMP button and the UP and DOWN arrow buttons will function at anytime the ignition is on and the park brake is set. Like other systems, they will not function if the AUTO LEVEL or AUTO STORE lights are flashing but even if the AUTO LEVEL button has been pushed, when the leveling process is complete and the AUTO LEVEL light is off, the manual buttons can be used.

Another difference is the OFF button (625 system) and the CANCEL button (625S system). With the 625 system, the OFF button was really an off button. Pushing OFF did turn the touch panel off. For the 625S system, the panel is never really off so pushing the CANCEL button will cancel any automatic function, leveling or storing but the system is ready to be used manually or automatically as soon as the CANCEL button is pushed. Also if an automatic function is in process, leveling or storing, pushing the AUTO LEVEL button or AUTO STORE button will also cancel the automatic process that is running. Figure 8

IMPORTANT: Although pushing CANCEL, AUTO LEVEL or AUTO STORE will stop a leveling or store procedure, if the vehicle is equipped with a pilot air dump system controlled by the HWH leveling system, the pilot valve will not move to a different position. If auto leveling is started and then cancelled, the pilot valve will stay in the dump position and the vehicle will continue to lower as air is exhausted from the air bags. If auto store has been initiated and then cancelled, the pilot valve will remain in the travel position and the vehicle will continue to return to travel height.

Note: The CANCEL button may be labeled EMERGENCY STOP on early 625S touch panels.

Control box features. Although the programming is different, the 625S control box looks identical to the 625 control box. They have the same information LEDs and use the same level sensing unit mounted in the control box.

Series-parallel operation. The 625S uses the same series-parallel circuitry as the original 625 system.

Park brake circuit. The basic park brake circuitry for the 625S is the same as the 625 system but because the panel is “on” whenever the ignition is on and the park brake is set, the NOT IN PARK/BRAKE light will come on if the park brake is not set and the AUTO LEVEL button, DUMP button, any UP arrow buttons or DOWN arrow buttons are pushed. The light will go out when the button is released.

Remote AUTO LEVEL/STORE switch. Some 625S touch panels have a 6 pin UML connector on the back of the panel. This allows the use of a remote switch to start the automatic leveling or store procedure. The ignition must still be on with the park brake set. Pushing the remote switch to Level or Store after starting an automatic procedure will cancel that procedure. The switch may be equipped with a level light that will flash during automatic leveling. There is just a simple +12 signal to and from the rocker switch.
3-3. How the 625S system works, leveling operations.

For a complete explanation of how manual leveling is accomplished, see section 2-6 in this lesson. For a complete explanation of how automatic leveling is accomplished, see section 2-8 in this lesson. The only operational difference between the 625 and 625S system is the ON/LEVEL button on the 625 touch panels and the AUTO LEVEL button on the 625S panels.

**Manual leveling** can be done anytime the ignition is on and the park brake is set, even if the auto leveling feature has been used. There is no ON button to push. Like the 625 system, if a manual leveling or store process is in operation, the manual UP and DOWN buttons will not function.

**Automatic leveling.** The AUTO LEVEL button will function anytime the ignition is on and the park brake is set. One push of the AUTO LEVEL button starts the automatic leveling procedure. The rest of the automatic leveling sequence is the same as the 625 including the stabilize portion of the leveling sequence and EXCESS SLOPE situations. The master warning indicators are the same and air dump works the same as the 625 system.

Pushing the AUTO LEVEL, AUTO STORE, or CANCEL/EMERGENCY STOP buttons will cancel any automatic level or store procedure in process.

**Automatic store.** Like the 625 system, the AUTO STORE button for the 625S system will function on its own anytime the ignition is on. The park brake does not have to be set. Refer to section 2-10 in this manual for a detailed explanation of the store procedure.

3-4. Additional 625S information.

Review section 2-11 in this manual for additional information. Information concerning pilot air dump systems with HWH slide-outs is the same for both the 625 and 625S systems.

**Kick-down jacks.** There are no single step 625S systems that use kick-down style jacks. Manual leveling would become very complicated. Also, because the kick-down jack has a much smaller foot surface, most people will use a pad under the jack foot, especially on softer surfaces. A single step system would make the use of pads under the kick-down jacks harder to accomplish for automatic leveling.

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**CHAPTER 4. 725 SERIES TOUCH PANEL CONTROLLED BI-AXIS SYSTEMS**

As of January 2019, the 725 leveling system is the most recent leveling system offered by HWH. The 725 system is a single step system, one push of the AUTO LEVEL button to activate automatic leveling. One thing new with the 725 system is it is available with double-acting jacks (power extend/power retract).

The 725 leveling systems with double-acting jacks will be discussed in a separate lesson. The 725 system is available with kick-down style jacks but like the 625, it is not a single step system.

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**FIGURE 9**

<table>
<thead>
<tr>
<th>725 Kick-down Touch Panel</th>
<th>725 Straight-acting Touch Panel</th>
</tr>
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<tbody>
<tr>
<td><img src="image" alt="725 Kick-down Touch Panel" /></td>
<td><img src="image" alt="725 Straight-acting Touch Panel" /></td>
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</tbody>
</table>
4-1. Hydraulic functions:
The 725 system is hydraulically the same as 310, 325, 610, 625 and 625S systems but since we did not review this for the 625S, here it is again. There is one valve for each jack. 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. **Figure 10.**

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 the flow of liquid from an open solenoid valve into the pressure side of the manifold. The outer check valve prevents the flow of liquid 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 10.** 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 610 systems, timing in the program prevented this from happening. The manual touch panel systems use a 50 psi pressure switch on the manifold to take care of this issue. This was incorporated into the 625 system. 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. **Figure 10** 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 without a noticeable change if the 50 psi pressure switch had a problem.

The following information concerning 725 electrical functions is for systems that do not use the HWH cascading steps. (See 4-5, for information concerning 725 systems with cascading steps.)
4-2. Electrical functions.
The main difference with the 725 system is the electronics. The control box has been replaced with a **MIOM** (Multiplexed Input Output Module). There is still a touch panel and it looks like the 625S panel (straight-acting jacks). **Figure 9.** The 725, like the 625, is a basic **CAN** system. The touch panel and the MIOM communicate through a twisted pair of wires with a 120 ohm terminating resistor at each end. One difference between the 625 systems and the 725 system is the terminating resistors are part of the harness for the 725 systems opposed to being in the touch panel and control box.

**5 PIN MTA CONNECTOR**
- PIN 1 – YELLOW – CAN HIGH TWISTED PAIR
- PIN 2 – GREEN – CAN LOW TWISTED PAIR
- PIN 3 – NO COLOR – CAN SHIELD
- PIN 4 – WHITE – GROUND FROM CONTROL BOX
- PIN 5 – RED - +12 IGNITION FROM CONTROL BOX

**6 PIN UML CONNECTOR**
- PIN 1 – NO CONNECTION
- PIN 2 – RED - +12 IGNITION FROM CONTROL BOX (KICK-DOWN JACKS ONLY)
- PIN 3 – NO CONNECTION
- PIN 4 – NO CONNECTION
- PIN 5 – BLACK – SWITCHED GROUND – WARNING LIGHT AND BUZZER CONTROL
- PIN 6 – NO CONNECTION

Some 625S panels had a 6 pin UML connector on the back of the panel but that connector was for remote rocker switches to control the leveling system’s automatic functions. All 725 leveling systems have the 6 pin UML connector but for the 725 system, this connector is used for the master jacks down warning light and buzzer. **Figure 11.** Like the 625 control box and touch panel, the 725 MIOM and touch panel both have processors but where as the 625 control box had the decision making capabilities, the touch panel does the decision making for the 725 systems. There is also a Link Light on the back of the touch panel. This light should be blinking when the ignition is on. This indicates proper communication with the MIOM.

**Note:** The following information is for single step 725 systems with straight-acting jacks. Refer to section 2-9 for kick-down jack information.

The 725 series single step touch panels have an AUTO LEVEL button, a CANCEL 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 AUTO 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 MANUAL DUMP button. Pushing this button signals the MIOM to turn on HWH dump valves or to shift a pilot air dump valve to the dump position. Pushing AUTO STORE puts a pilot dump suspension back in the travel mode. **Figure 9.**

The touch panel has a AUTO LEVEL light. This light is now a blue light which is new with the 725 system. This light flashes during the auto leveling process and will only be on during auto level. There is a AUTO STORE light which is also now blue. This light will flash when the AUTO STORE button is pushed. There is a “NOT IN PARK/BRAKE” light on the touch panel, same as all other panels. 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 1 inch if the ignition is on. There are four yellow level lights; front, rear, left side and right side. The yellow level lights can be on anytime the ignition is on and the park brake is set. 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. **Figure 9.**
When the ignition switch is on, there is +12 volt power supplied directly to the MIOM. +12 volt power to
operate the touch panel is supplied from the MIOM to the touch panel. Anytime the touch panel processor
sees ignition power, the processor turns on the master relay. The master relay is on anytime the ignition
is on with the park brake on or off. The main system ground comes from the ground stud on the power
unit. A 10 gauge white wire is routed to a ¼ inch stud on top of the MIOM. Note: Early 725 systems had
a second smaller gauge white wire running from the pump ground stud directly into the MIOM. That white ground wire is no longer present. There is one ground wire in the touch panel cable that
supplies ground to the touch panel. +12 volt power for the MIOM outputs comes from the switched side
of the master relay. A 10 gauge black wire is routed from the MIOM to the master relay. This wire has a
40 amp blade fuse at the relay. Output connections to control the master and pump relay, the jack
solenoid valves and the dump/travel equipment come directly from the MIOM. The ground wires for this
equipment also come directly from the MIOM. The control wires for the master (8500) and pump (8600)
relays have a diode installed in the wire. Some systems are equipped with an auxiliary pump run switch.
When activated, this switch would back feed into the MIOM causing damage. The diodes in these wires
prevent that. All 725 systems have those diodes whether or not they are equipped with an auxiliary pump
run switch. Figure 12.

One end of the MIOM has a large 32 pin black connector. Touch panel connections, jack warning and
pressure switches connections including the ground wire for the warning switches, manifold pressure switch
connections and connections for the level sensing unit, including power and ground for the sensing unit, are all
in this connector. +12 volt power and the park brake connections for the MIOM are also in this connector.
Figure 12. This is a one piece harness with separate connectors for each component. The wires for +12
ACC power and the park brake are usually in the run going to the dash area for the touch panel. Always
check specific wiring diagrams for connection and routing information.

It is important to note here that the MIOM connector will be changing in early 2018 (not model
year) The new connector will be two different colors. MIOMs with a gray connector are for 12 volt
systems. MIOMs with a blue connector are for 24 volt systems. The connectors look somewhat
similar but the new connector has more pins and the arrangement is totally different. Pin out
information for the original connector will not work for the new connector. Again, it is important to
get the correct diagrams when working on these systems.

Level sensing unit. The level sensing unit is mounted separately from the MIOM and touch panel. It is normally referred to as just
the “sensing unit”. It can be mounted anywhere but should be protected from direct road spray. Compartments are ok but
mounted to the ceiling is better than the floor of a compartment. You don’t want anything lying on the sensing unit. This would
change the adjustment. The sensing unit must be mounted to a
good solid surface that will not flex or warp. The material the
surface is constructed of does not matter. The sensing unit is
electronic. There are 6 wires for the sensing unit, one wire to
supply +12 power, one for ground and four signal wires; front,
rear, left and right sides. The signal wires are switched grounds.
These wires go to the MIOM then the information is sent to the
touch panel. The sensing unit is mounted with three screws. The
mounting screws are also the adjustment screws. There is a
spring for each screw. It goes between the sensing unit and the
mounting surface.
The sensing unit can be mounted above or below the mounting surface but does have a top and bottom. “THIS SIDE UP” is labeled on the top of the sensing unit. It is also directional and the top has an arrow pointing to “FRONT”. The bottom side of the sensing unit has four yellow LEDs so the adjustment can be made by one person without running back and forth to the touch panel. The adjustment can be done with the ignition on and park brake set. There is also a small white hex cap that can be removed. There is a small “adjusting enhancement” pin under the cap that should be grounded with a small jumper wire during the adjustment process. This allows the sensing unit to be adjusted with a tighter tolerance so the repeatability of level is better. This should not be left hooked up after the adjustment is complete. Figure 13. Refer to ML47508/MI15.4571 at www.hwh.com. This has complete adjustment instructions including the enhancement pin. There are instructions in the 725 repair manual and usually every operator’s manual has the instructions.

When touch panel buttons are pushed, multiplexed information to control the different functions is routed back to the MIOM via the touch panel cable. Pushing an UP ARROW sends information to the MIOM to turn on the appropriate solenoid valves and the pump relay with switched +12 volts. Pushing a DOWN ARROW button sends information to the MIOM to turn on the appropriate solenoid valves.

Pushing the AUTO LEVEL button starts the automatic leveling process. The AUTO LEVEL light flashes during the automatic leveling procedure. The manual UP or DOWN arrow buttons and the DUMP button will not function when the system is in the automatic leveling mode. Pushing the AUTO STORE button sends multiplexed information to the MIOM to start the store mode.

4-3. 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, usually supplied by the chassis manufacturer, 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 725 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.

Because the panel is “on” whenever the ignition is on and the park brake set, the NOT IN PARK/BRAKE light will come on if the park brake is not set and the AUTO LEVEL button, DUMP button, any UP arrow buttons or DOWN arrow buttons are pushed. The light will go out when the button is released.

4-4. MIOM information:
The MIOM is often referred to as the I/O (input/output) module. The MIOM is sealed and cannot be repaired, only replaced. Other than the diagnostics that can be done when there are issues, the only thing on the actual MIOM you can “fix” is making sure the ¼” ground stud on top of the MIOM is tight. That should be tightened to 55 in. lbs., no more. You can do the normal things like checking for corrosion on connector pins, broken wires or bad pin connections but that is pretty much it.

The MIOM does not have any fuses to protect the outputs. The transistors used are the protection. When overloaded, the transistor will “open” and not pass current. To “reset” the transistor, not only do you have to remove the short or overload issue, you must remove power from the module, both the ignition (ACC) power and the high current from the master relay. Normally, turning the ignition off should accomplish this. But some applications use non-switched battery power, not ignition power for the module and touch panel. Unplugging the main connector will always take care of this requirement. Figure 14. Without doing this, when you remove a short or overload and then check the output, there will still be no power. This might seem like a module issue but until the ignition (ACC or non-switched battery) power is removed, the transistor will remain “open”.

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The MIOM is equipped with red LED indicator lights for the outputs. Whereas the 625/325 systems had LED indicators for about everything the control box dealt with, the 725 MIOM only has LEDs for the main loads; the master and pump relay outputs, the jack outputs and the dump and travel outputs. There is also a communication Link Light. **Figure 14.** If an output LED is on, that indicates there should be +12 volts on that output pin. If the Link Light is blinking, that indicates proper communication. The Link Light flashing and the master relay LED on also would indicate there is ignition (ACC) power to the MIOM. If the Link Light is not on that could be an issue with the ignition power. If the Link Light is on steady, there is an issue with communication between the MIOM and the touch panel. If there is ignition power to the MIOM and the Link Light is off, that also indicates an issue with communication.

There are two basic MIOMs for 725 series leveling systems. The only difference between these two modules is the length of the wires for the relays. Systems having a room manifold as part of the assembly have longer wires going to the relay. The MIOM with longer wires is used for all repairs. This eliminates an extra repair part number. There are also several other MIOMs that are used for 725 systems with the cascading steps and when rooms can be operated with the key off. All MIOMs will have a part number sticker so the best thing to do when ordering a MIOM is make sure you have the correct number.

Diagnostics for this system can be a little involved but everything is pretty much covered step by step in the 725 repair manual, **ML48380.** This of course is available at www.hwh.com in the service manual section of Tech Support.

### 4-5. Information for 725 systems equipped with the HWH cascading steps.
This system will be discussed in detail in a different lesson. But there are some important differences that must be noted here. This is a system that is available to any manufacturer but at this time (Feb. 2018) Newmar is the only RV manufacturer that uses this system. There are several things different about these systems. The plumbing is different. The hydraulic manifold for the step assembly is isolated from the other hydraulic systems. The main hydraulic manifold on the pump has what we call an isolation solenoid valve. It is a large solenoid valve and on the same side as the jack hose connections. This will always be a large valve no matter which valve is used for the leveling jacks. This valve allows the step to be operated without any pressure available for the leveling system, slide-outs or generator slide. We open the valve any time we want to operate any HWH hydraulic function except the step. The step electronics control this valve, not the touch panel. The step manifold gets direct hydraulic pressure from the pump.

The leveling system MIOM and touch panel have a constant battery power supply rather than ignition (ACC) power. This is needed so the step can operate with the ignition on or off. There is an ignition wire routed to the MIOM but is used only to inform the system the ignition is on. This allows us to require the ignition to be in the ON or ACC position to operate the leveling system.

Finally, the master relay is not on all the time with the ignition on. The master relay will only come on if there is a request for a hydraulic function or if the ignition is on and the park brake is released.

### 4-6. How the 725 series systems work, manual operation. Systems with straight-acting jacks.
The ignition should be in the ACC position and the park brake must set. Any time the ignition is in the ON or ACC position, the touch panel commands the MIOM to turn the master relay on. The master and pump relays are controlled with a +12 volt signal. With the park brake set, the touch panel lights will function and there can be one or two yellow level indicator lights on at a time but never opposing yellow level lights. The touch panel manual control buttons will also function.
If the vehicle has an air suspension, the air should be dumped before starting the leveling procedure. See Air dump, Section 4-7, for a detailed explanation of air dump procedures.

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 to the MIOM. The MIOM communicates with the touch panel with information as to which, if any, yellow level lights should be on. The touch panel will turn the appropriate yellow level light(s) 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 MIOM to turn on the appropriate control outputs for the pump relay and the corresponding solenoid valves. The solenoid valves will not be turned on until the MIOM sees a ground from the 50 psi manifold pressure switch or the computer timing for pump run time is exceeded. The computer only has to have one of those things happen. If there is a problem with the 50 psi. pressure switch, the valves will still open when the computer timing is exceeded. 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.

Push and hold the UP ARROW button until the jacks have extended enough to raise the vehicle and turn the yellow level light off. This is repeated with other UP ARROW buttons as needed until all of the yellow level 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. 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 ½ inch. The front or rear UP ARROW buttons should be used when stabilizing the vehicle.

**NOTE:** It is important to “bump” the vehicle up slightly when stabilizing the vehicle. As fluid cools, the volume will decrease. If the jacks are just touching the ground, the jacks could lift slightly due to thermal contraction and the vehicle may feel unstable. If the jacks lift too high, the vehicle will be out of level and the yellow level lights will be on.

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. Because of weight and jack lifting capacity differences, the vehicle may be lifted too high at the front or rear, lifting the vehicle out of level.

4-7. Additional information for manual operation of the 625 systems.

**Kick-down style jacks.** 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. As discussed earlier, the 725 touch panel for systems with kick-down style jacks is different from the touch panel for straight-acting jacks. The kick-down system cannot be a single step system. Push the “ON” button one time to turn the system on. Push the “ON” button a second time. The pump will come on and the system will extend the jacks to the vertical position one at a time. The order is the left front first, then the right front, right rear and finally the left rear. The system is looking for the jack down warning switch for each jack. When the jack swings vertical, its warning switch will come on. The system will move to the next jack in the sequence and turn on the red touch panel warning light. The ON light will flash while this is happening. When all four jacks are vertical with their warning light on, the pump will shut off and the ON light will be on steady, ready for manual leveling or automatic operation.
If any jack does not extend vertical or its warning light does not come on, the system will run the pump for 3 seconds then move to the next jack. After completing the sequence for all four jacks, the ON light will come on steady. The system will NOT continue any automatic function. The manual UP and DOWN arrows will function to extend or retract jacks. The touch panel jack down warning light for the jack(s) not vertical will flash while pushing the UP arrow button for that jack but the pump will run and the jacks can swing vertical and/or extend. The STORE button will still function.

**Master warning light/buzzer.** Most vehicles will have a master “JACKS DOWN” warning light that will be on anytime one or more individual touch panel 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 so the system can be operated without the buzzer sounding. There is a diode assembly in the power harness for the buzzer/light combination so the components must be connected properly. Normally this should not be an issue. The buzzer uses a ring terminal connection and the light uses a spade terminal connection.

**Air dump.** 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 MIOM to turn on the dump output. The dump and travel outputs are in a 3 pin Packard connector along with a ground wire. The dump and travel signals are +12 volt signals. 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 MIOM is only present when the DUMP button is being pushed. The DUMP button must be pushed and held until all air has been exhausted from the vehicle suspension. **If the system has a pilot air dump system,** the engine can be running. 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. Refer to Lesson 10: Air Suspension and HWH for detailed explanations of different air dump systems.

4-8. How the 725 systems with straight-acting jacks work, automatic operation.

The ignition should be in the ACC position and the park brake must set. Any time the ignition is in the ON or ACC position, the touch panel commands the MIOM to turn the master relay on. The master and pump relays are controlled with a +12 volt signal. With the park brake set, the touch panel lights will function and there can be one or two yellow level indicator lights on at a time but never opposing yellow level lights.

Push the AUTO LEVEL button. The blue LEVEL light will start to flash. The pump will come on and the system will level the vehicle according to lit yellow level lights starting with any lit side light. During the automatic leveling sequence while leveling the vehicle, the system will always extend two jacks at a time, both side jacks, both front jacks or both rear jacks. As yellow level lights turn off, the system will pause briefly to allow the level lights to stabilize. The system can move back and forth between side and front or rear level lights several times while leveling the vehicle.

Note: If the vehicle is equipped with a HWH controlled air dump system, the air will start to dump from the suspension and the vehicle will start to lower. The +12 volt dump signal will remain on during the complete automatic leveling sequence. Approximately 20 – 25 seconds after pushing the AUTO LEVEL button, the leveling sequence will begin.

When all the yellow level lights are off, the system will again pause briefly to make sure the lights stay off, about 2 seconds. The system will then stabilize the vehicle. This is done by extending to the ground any jacks not used for leveling to “bump” the coach up slightly, about ½ inch.
Each jack has a pressure switch. This is a normally open, single wire switch. It switches a ground when the contacts close. The switch is adjustable to make sure the jack does not lift too much or lifts enough during the stabilize portion of the leveling sequence. When the contact closes, the switch sends a ground signal to the MIOM. The MIOM will communicate with the touch panel. The touch panel will extend jacks according to the program to stabilize the vehicle.

Unlike the 625 & 625S leveling systems, the 725 stabilizing program has a specific order for checking and extending jacks. The system will first check the right rear pressure switch. If off, the system will extend the right rear jack until the pressure switch comes on. If the right rear pressure switch is on or when the right rear pressure switch comes on, the system will then look at the left rear pressure switch. If off, the system will extend the left rear jack until the pressure switch comes on. If the left rear pressure switch is on or when it comes on, the system will recheck the right rear, extending the jack if needed then the left rear, extending the jack if needed. After checking and rechecking the two rear jacks, the system then checks both front jack pressure switches at the same time. If both front pressure switches are on, the leveling process is complete. If either front pressure switch is NOT on, the system will turn on the pump and both front jack solenoid valves to extent the front jacks until both front pressure switches are on. The leveling process is then complete. The system does not recheck the pressure switches again.

Note: Even if one front jack is on the ground, the system opens both front valves with the pump on. The leveling manifold check valve arrangement will keep the jack that is already on the ground from lifting until the pressure between the two jacks is equal. At that time, the system should see both front pressure switches, turning the pump and both valves off.

Note: Because the vehicle is lifted slightly during the stabilize sequence, a yellow level light may come back on. After the leveling process is complete, the system inhibits any yellow level light from coming on until the ignition switch is cycled off and back on. Because the jacks only bump the vehicle up about a half inch during the stabilizing procedure, the vehicle is most likely not out of level but the manual UP and DOWN arrow buttons can be used to “tweak” the system slightly and turn the yellow light(s) off.

4-9. How the 725 systems with kick-down style jacks work, automatic operation.

Kick-down style jacks. If the vehicle is equipped with kick-down style jacks, all four jacks must be extended to the vertical position with the four red jack down warning lights on before the automatic leveling process can be started. Push the “ON/AUTO” button one time to turn the system on. Push the “ON/AUTO” button a second time. The pump will come on and the system will extend the jacks to the vertical position on at a time. The order is the left front first, then the right front, right rear and finally the left rear. The system is looking for the jack down warning switch for each jack. When the jack swings vertical, its warning switch will come on. The system will move to the next jack in the sequence and turn on the red touch panel warning light. The ON light will flash while this is happening. When all four jacks are vertical with their warning light on, the pump will shut off and the ON light will be on steady, ready for manual leveling or automatic operation. There were no 725 systems using kick-down style jacks that had air dump capabilities but we never say never to something like that.

Pushing the ON/AUTO button a third time starts the automatic leveling sequence. From this point, the leveling process is the same as a system with straight-acting style jacks.

If any jack does not extend vertical or its warning light does not come on, the system will run the pump for 3 seconds then move to the next jack. After completing the sequence for all four jacks, the ON light will come on steady. The system will NOT continue any automatic function. If the ON/AUTO button is pushed, the red jack down warning light(s) for the jack(s) not vertical will flash for 5 seconds but nothing will happen. The panel will shut off. If there is a jack or warning switch malfunction during the kick-down sequence, the manual UP and DOWN arrows will still function to extend or retract jacks. The touch panel jack down warning light for the jack(s) not vertical will flash while pushing any UP arrow buttons but the pump will run and the jacks can swing vertical and/or extend. The STORE button will still function.
4-10. Additional information for automatic operation of the 725 systems.

**EXCESS SLOPE:** The touch panel has an EXCESS SLOPE light. The EXCESS SLOPE light can only come on during automatic leveling. Excess slope happens when two jacks reach full extension and the yellow level light calling for those jacks does not go out. The leveling manifold has a 3000 psi normally open, single wire pressure switch. When the switch contacts close, a ground signal is sent to the MIOM. The MIOM lets the touch panel know the manifold switch is on along with one or more yellow level lights. The touch panel processor stops the leveling process and turns the EXCESS SLOPE light on.

The AUTO LEVEL light will be off. There will probably be one or two jacks that have not extended. The system will not stabilize the vehicle. The EXCESS SLOPE light will remain on for two minutes if the ignition is in the “ON” or “ACC” position. After the EXCESS SLOPE light turns off, the AUTO LEVEL button will function but it is not recommended to do auto leveling again until the vehicle is move to a position that will allow the vehicle to be leveled. The system can be operated with the manual UP and DOWN arrows while the EXCESS SLOPE light is on. The STORE button will still function and can be used to retract the jacks.

The EXCESS SLOPE light can also come on during the stabilize sequence in automatic leveling if there is a jack pressure switch malfunction. If a jack pressure switch will not come on during the stabilize sequence, that jack will go to full extension. The pressure in the manifold will build and trip the 3000 psi pressure switch. When the processor sees the switch on steady for 20 seconds, it will turn on the EXCESS SLOPE light and halt the automatic leveling process. The AUTO LEVEL light will be off. The “EXCESS SLOPE” light will remain on for two minutes if the ignition is in the “ON” or “ACC” position. The system can be operated with the manual UP and DOWN arrows. The STORE button will still function and can be used to retract the jacks.

4-11. Retracting jacks with the STORE button.

The 725 series touch panel has an “AUTO STORE” button. The AUTO STORE button will function anytime the ignition is in the “ON” or “ACC” position. If the vehicle has an air suspension with HWH air dump valves it is recommended to start the engine before retracting the jacks. Start the retract procedure as soon as the engine has been started. The suspension will start to come back to ride height as soon as there is sufficient air supply to lift the vehicle. If the vehicle has pilot dump, the engine can be started anytime. The suspension will not start to return to ride height until the leveling system is put into the store mode. When the AUTO STORE button is pushed, the touch panel starts the retract procedure. The suspension will begin to return to the proper travel height. 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. The pump DOES NOT run. 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 1 in. of being fully retracted, depending on the type of warning switch, 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 keeps all four solenoid valves open for an additional 1 minute. After this 1 minute period, the touch panel will shut off, closing all four solenoid valves.

If one or more red warning lights remain on, the AUTO STORE light will continue flashing with all four solenoid valves on for 10 minutes. The system then turns the valves off for 10 minutes, back on for 10 minutes, off again for 10 minutes and back on for a final 10 minutes. The AUTO STORE light continues to flash during the full 50 minutes of this process. At anytime during this 50 minute period all the red warning lights do go out, the AUTO STORE light will turn off and all valves will be turned off. Pushing the CANCEL button or moving the ignition key to off will stop the store mode. If a jack is not retracted, anytime the ignition is in the ON or ACC position, that touch panel red warning light will be on.

4-12. Additional 725 series leveling system information.

**Pilot air dump “Travel”:** The dump and travel outputs come directly out of the MIOM like the solenoid valve and relay wires. Figure 12. There is also dump and travel LEDs that indicate a +12 signal on the output pins. The travel output is not used if the air dump system uses the HWH air dump solenoid valves. Note: A few vehicles that have pilot dump have the dump side controlled by the HWH equipment but travel is not controlled by HWH. This is not the case with most pilot dump systems.
First, the ignition must be on for a +12 volt travel signal to be present. If the AUTO LEVEL button has not been used and the manual DUMP button was NOT pushed, there will be a +12 volt signal on the travel output anytime the ignition is in the ON or ACC position.

If the AUTO LEVEL button was used or the DUMP button was pushed, there are two ways to put the system back into the travel mode. 1. Pushing the AUTO STORE button will put the system into the travel mode and put +12 volts on the travel pin. 2. Releasing the park brake with the ignition on will put the system in the travel mode and put +12 volts on the travel pin. Releasing the park brake with the ignition on is a way to ensure putting the dump system in the travel mode incase the AUTO STORE button is not used to retract the jacks. **Anytime the ignition is on and the park brake is off, there will be a +12 volt signal on the travel pin.** The bulk of the pilot dump equipment is supplied by the vehicle or chassis manufacturer. HWH supplies only a connector with a travel, dump and ground wire.

**Thermal expansion and traveling.** The 725 series systems are designed to be able to combat the effects caused by thermal expansion of the fluid in the system when traveling. Warming of fluid causes thermal expansion. Fluid volume increases. Due to a temperature increase caused by an increase in tire temperature and the vehicle exhaust, all motorized vehicle will experience thermal expansion, even in cold temperatures. 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 older touch panel systems, manual and automatic. With a 725 system, thermal expansion will still cause the jacks to extend slightly but the 725 systems should take care of this issue without the warning buzzer coming on. 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 touch panel will turn the solenoid valve for that jack on. If the jack retracts within 30 seconds, turning the warning switch off, the touch panel turns the solenoid valve off. Neither the touch panel warning light nor the master warning light/buzzer come on as long as the jack(s) retract opening the warning switch contacts. If the warning switch contacts are still closed after 30 seconds, the touch panel will turn the solenoid valve off and then turn the touch panel warning light and the master warning light/buzzer on. The lights and buzzer will stay on until the jack is retracted or the ignition is turned off.

**Systems with HWH slide-out systems.** Most vehicles that use a combination of HWH slide-outs and the HWH 725 series leveling system will use the touch panel and MIOM to control the pump for slide-out operation. The +12 power for the slide-out controls can come from the HWH power unit assemble. Usually, battery power is used for pump control and switched +12 power for the valves comes from the switched side of the pump relay.

In most cases, the ignition must be on to operate a slide-out but that is not always the case. When room extend or retract is called for, a +12 volt signal from the slide-out control is used to turn the pump on through the touch panel and MIOM electronics. +12 power to operate the slide-out solenoid valves is a direct connection between the slide-out controls and the slide-out solenoid valves.

The main connector of the MIOM has a pin for pump request from the slide-out control. When the MIOM lets the touch panel know there is a pump request signal, the processor will interrupt any leveling system function, manual or automatic, leveling or retracting the jacks. When the room switch is released, manual operation can be resumed. If the leveling system was performing an automatic function, that function, leveling or retracting, will automatically resume.

It is important to remember there are about as many different ways to control a slide-out as there is motor home and specialty vehicle manufacturers, even when using both HWH leveling systems and slide-outs. Many manufacturers will use the HWH slide-outs and leveling systems but use a different control system to operate the slide-out. You must refer to specific wiring diagrams when working on slide-outs.
4-13. Last thing.
Starting with the 2014 model year, Tiffin Motor Homes began to offer a combo air and hydraulic system on the Allegro Bus models. By then we were well into the use of the 725 style leveling system. Tiffin decided to use Valid air leveling and only use one control system for the air leveling and the hydraulic leveling. The first few years it was offered as an option. You could have jacks only or air and hydraulic leveling. With the combo system, Valid is used to control the HWH leveling system. Starting with the 2017 model year, an air/hydraulic combo leveling system is all that is available on the Allegro Bus and also the Zephyr. Because the HWH equipment is controlled by Valid, there are no electronics or even wiring supplied by HWH for the leveling equipment. The only wiring supplied by HWH is a short harness for the slide-out systems. This is the important part. When there is a simple issue like a hydraulic leak or something like that, HWH can help with the diagnostics and repair. If there is an operational issue, HWH will be of no assistance with the repair. That is totally controlled by Valid and HWH is not equipped with the information needed to assist with diagnostics or the repair. You will have to contact Tiffin or Valid for assistance.

CHAPTER 5. CONCLUSION

Probably the most important thing to remember is that HWH has developed and distributed many different styles of leveling systems. Lesson 13 Parts 1, 2 and 3 cover most of the more common systems but when you throw in air leveling, leveling systems for towable or specialty vehicles and the active air systems, Lesson 13 is just a good start. Although many of the components work the same from system to system, how the individual systems control or put these components to use can vary. It is always very important to know exactly what you are working on. One of the best ways to do that is get the part number off the control box/MIOM and the touch panel. That way you can be sure to get the correct information to help with diagnostics.

Good luck with the test and remember, you can review the lesson to get the correct answers.