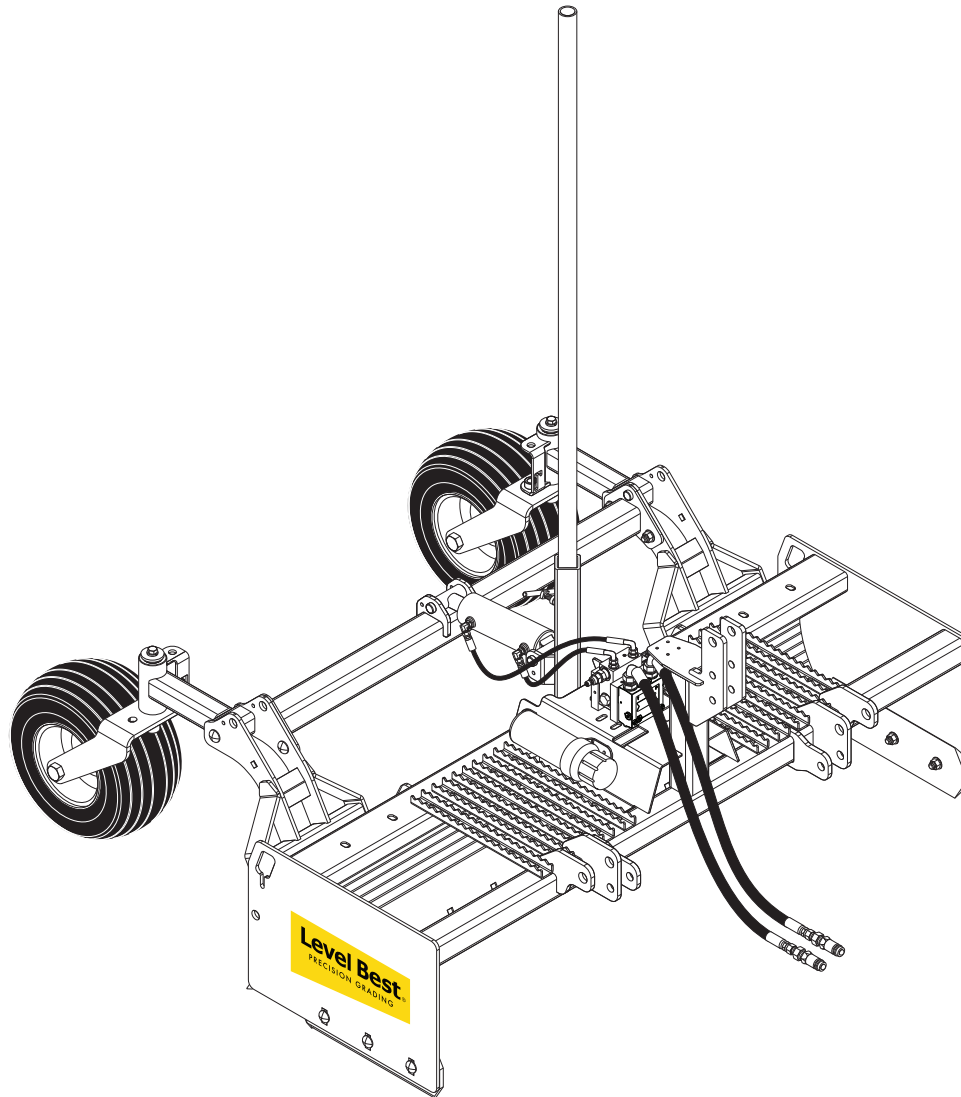


OPERATORS & PARTS MANUAL

TS - SERIES TRACTOR BOX



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New Holland, PA 17557
1-800-342-0905
www.LevelBestGrading.com

GENERIC
ASN 4521

JUNE 2022
CAT.# TS-O&PM 06/01/22

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ATI Corporation
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New Holland, PA 17557 U.S.A.

DISCLAIMER

THE INFORMATION IN THIS MANUAL IS PROVIDED TO PROMOTE THE SAFE USE OF, AND ASSIST THE OPERATOR IN ACHIEVING THE BEST PERFORMANCE FROM, PARA-LEVEL GRADING BOX DESCRIBED HEREIN, FOR THEIR INTENDED APPLICATIONS.

NOTES

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WARRANTY

This Para-Level Grading Box is designed and manufactured to high quality standards. ATI Corporation, therefore, guarantees this Para-Level Grading Box to be free from defect in workmanship and materials for one year from purchase date. **If the machine is used for rental purposes, the warranty is limited to ninety (90) days.**

Vendored Components and Control Valve Parts are warranted separately by their respective manufacturers.

Does not cover normal wear or failure due to hydraulic oil contamination.

Misuse, abuse, misapplication, and unauthorized alterations will void this warranty.

All warranty work must be performed by an approved Level Best dealer, and authorized by ATI Corporation.

SAFETY INFORMATION

This manual is furnished to you, the owner/operator, as a guide to get the greatest benefit from your Grading Box. ATI Corporation wants you to be able to get the most use out of your Grading Box through safe and efficient operation.

Before attempting to operate the Grading Box, carefully read all sections of this manual. Be sure that you thoroughly understand all of the safety information and operating procedures.

SAFETY PRECAUTION DEFINITIONS

Dangers, Warnings, Cautions, and Notes are strategically placed throughout this manual to further emphasize the importance of personal safety, qualifications of operating personnel, and proper use of the grading box in its intended application. These precautions supplement and/or complement the safety information decals affixed to the unit and include headings that are defined as follows:

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a potentially hazardous situation or practice which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation or practice which, if not avoided, will result in damage to equipment and/or minor injury.

NOTE: Indicates an operating procedure, practice, etc., or portion thereof, which is essential to highlight.

- Always use caution and safe operating practices when operating this equipment.
- Always set the Automatic/Manual Switch on the Control Panel to MANUAL before leaving the operator's seat or whenever the machine is not moving.

- Always allow for clearance under the cutting edge of the machine when tuning the system or when switching to automatic control. Insufficient clearance could cause the machine to lift itself off the ground as its cutting edge attempts to achieve the programmed slope.
- Never adjust the position of the Laser Receiver when the system is in automatic control.
- Never perform service work on your machine or the Automatic Control System when the system is in automatic control.
- Install all safety panels and guards before operating your equipment.
- Stay clear of all moving parts when the machine is in operation.
- Keep all people clear of the machine when it is running.
- Keep feet and other body parts from under the cutting edges of the machine at all times.
- Read and comply with all safety recommendations of your Tractor/Skid Steer manufacturer, as outlined in its operator and service manuals.

NOTE: References made to left, right, front, and rear are those directions viewed from behind the power unit and grading box.

NOTE: Some equipment depicted in illustrations may not reflect exact production model configurations.

NOTE: All safety, operating, and servicing information reflects current production models at the time of publication of this manual.

NOTE: ATI Corporation reserves the right to discontinue models at any time, change specifications, and improve design without notice and without incurring obligation on goods previously purchased and to discontinue supplying any part listed, when the demand does not warrant production.

(for future use)

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SYSTEMS FEATURES AND BASIC OPERATION

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SYSTEMS FEATURES AND BASIC OPERATION

PURPOSE

The Level Best Laser Grading Box is a cost-efficient method for fine grading. Various capacities sized to fit your tractor with a choice of Automatic Control Systems are available.

Laser-guided depth control provides unmatched measurement of plane from a single Rotating Laser. Grade information from the Rotating Laser is processed and automatically directs the grading box's hydraulics to maintain the elevation of the cutting edge.

The Laser Grading Box "rides" on gauge wheels at the rear of the frame. Each gauge wheel is attached to a hydraulic cylinder and "floats" independently of the other. By using a separate cylinder with an independent control system for each gauge wheel, the double-cylinder Laser Grading Box is able to provide a more accurate side-to-side grade than boxes with a single cylinder.

Grade Position LEDs on each Laser Receiver indicate the location of the box's cutting edge relative to the required finished grade (the Control Panel has a set of LEDs that mimic the Laser Receiver's LEDs).

- In manual control, the operator watches the Grade Position LEDs and uses the box's controls to keep the center LEDs lit, thereby keeping the box "On Grade".

- In automatic control, the Automatic Control System controls the box's hydraulic cylinders to keep the center LEDs lit, thereby keeping the box "On Grade". Each end of the cutting edge responds separately to the inputs appropriate Automatic Control System installed on that end.

COMPONENTS

The control system consists of 4 components:

Rotating Laser – Provides a reference Plane of Laser Light over the job site (refer to Figure 1-1). The light plane may be level or set at an angle to match the slope of the ground.

Laser Receivers – Mounted at a specific height on a mast on the Laser Grading Box, it determines the difference in depth based on the Plane of Laser Light.

Control Panel – Mounted on the tractor within easy reach of the operator, the Control Panel process data received from their connected Laser Receiver and from the operator. LEDs indicate the location of the box's cutting edge relative to the desired finish grade. If set to Automatic, it provides a signal to the Valve Assembly to either raise or lower the appropriate end of the Laser Grading Box.

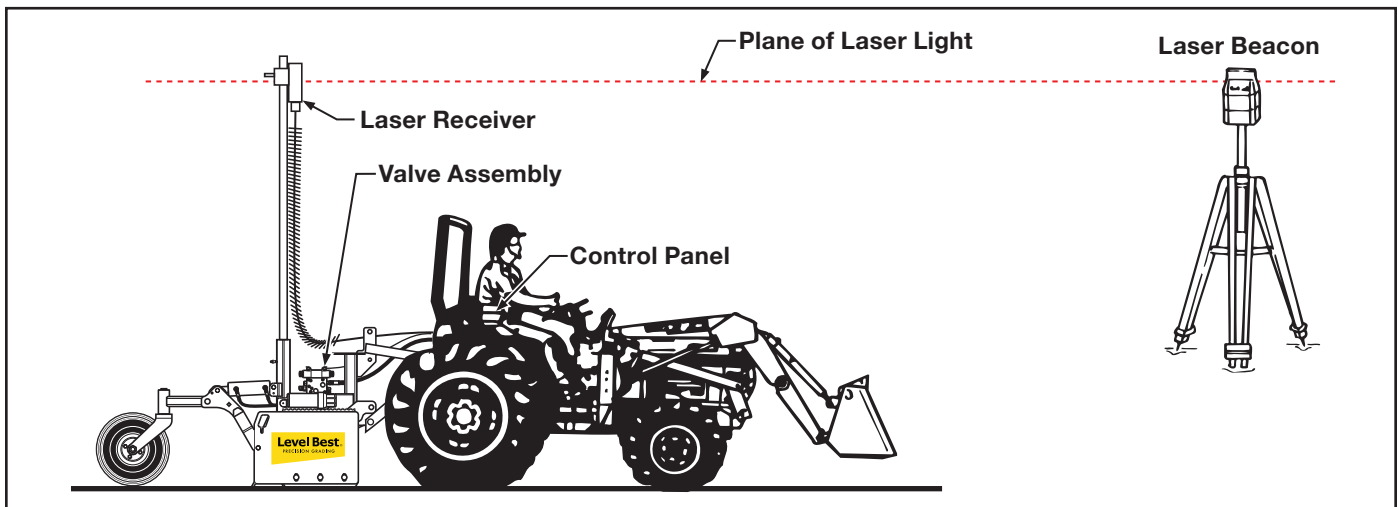


Figure 1-1. Plane of Laser Light with Components of the Automatic Control System

SYSTEMS FEATURES AND BASIC OPERATION

ROTATING LASER

The Automatic Control System can operate with many models of Rotating Lasers. The beacon must have a 360° rotating head with invisible or red beam and a speed of 8-40 RPS (Revolutions per Second). The faster the beacon's speed the more optimally the system will perform.

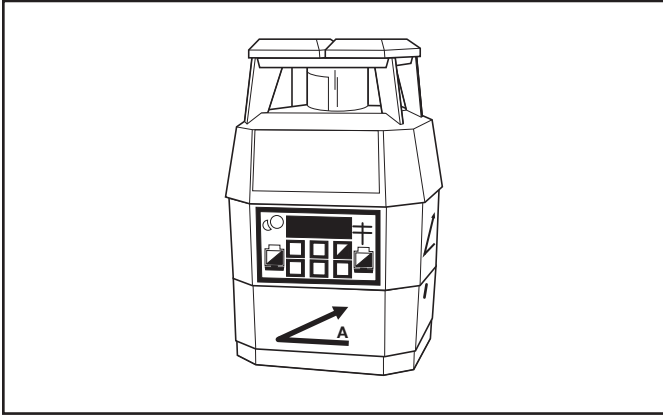


Figure 1-2. Rotating Laser

The Rotating Laser is mounted on a tripod, which is located on the job site near where the box is operating. The Rotating Laser is the unit that creates the plane of laser light detected by the Laser Receivers.

The Rotating Laser transmits a focused plane of laser light approximately 1000 feet (300 meters), optimal range for most Rotating Lasers, as it rotates.

Rotating Lasers are available in single grade, dual grade, and steep slope versions. They can be quickly and easily aligned to job site requirements without complicated calculation of angles.

A dual slope Rotating Laser can be configured for level, single slope, or dual slope applications. Simply enter the required percent of grade and align the Rotating Laser to the axis (direction) to be graded.

- Percent of Grade. The change in elevation for every 100 feet (30 meters) graded.
- Slope. The change in elevation per foot (meter).

tal exposure of the laser to the eye will not do damage. However, avoid looking into the beam whenever possible. Use a target for viewing the laser spot.

! WARNING

Use of any laser on a worksite is controlled by OSHA regulations found at 29 CFR 1926.54. Be familiar with these regulations before using any laser beacon used in conjunction with this system. Review and understand all literature provided with the Laser System before operating.

! WARNING

Laser protection devices must be provided to all workers in the area if the laser system exceeds five (5) milliwatts. Refer to the literature provided with the system to determine the power output. If unsure of the strength of the laser system, anti-laser eye protection should be provided to all workers.

CABLES

Cables connect the various components together into a system. A single cable is provided with "open" wires at one end for attachment to the automatic control system or an electric switch. The other end has a 4-pin connector that mates with the hydraulic valve connector.

! WARNING

Never look directly into a laser light or serious injury to the eye may occur. In general, inciden-

SYSTEMS FEATURES AND BASIC OPERATION

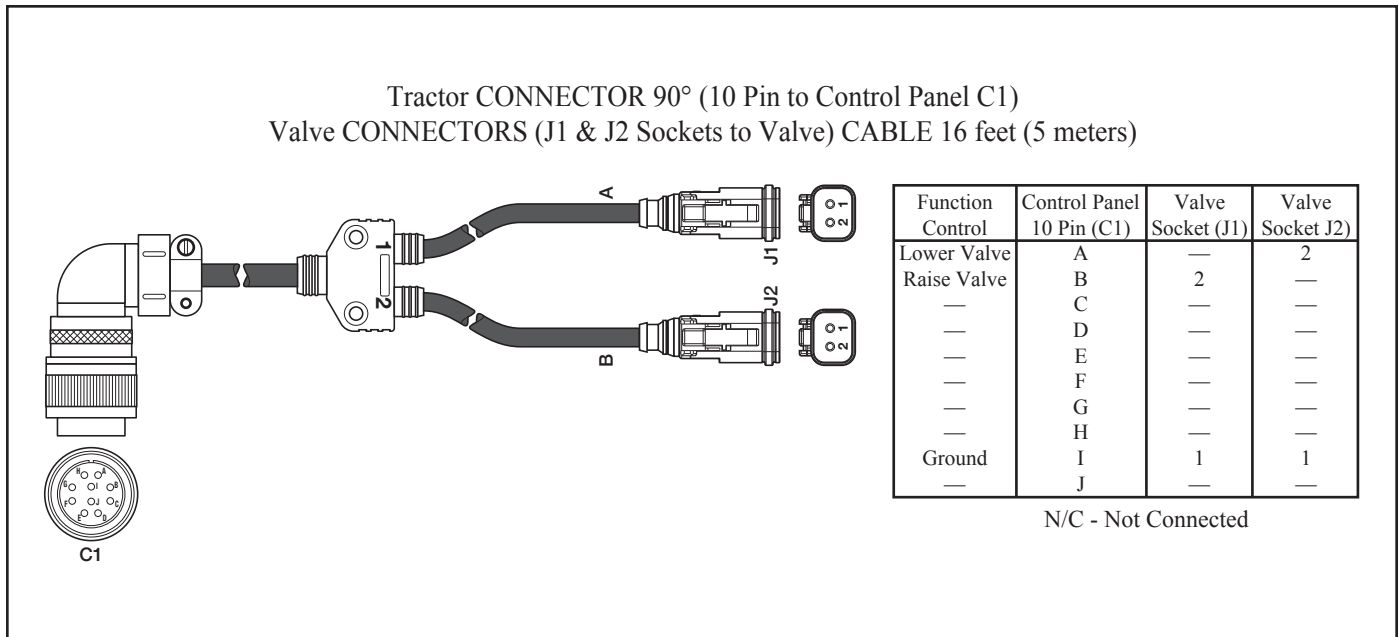


Figure 1-3. Valve Cable

EQUIPMENT SET-UP

1. Connect the Power Cable to battery power supply. Place the connector end of each cable near the driver's seat for later connection to the Control Panel.

NOTE: The red wire is positive and the black wire is negative.

2. Position the Laser Grading Box on a level area for attaching to the tractor. Start the tractor and back up to Laser Grading Box. Attach the unit with the hitch pins supplied.
3. After attaching, ensure the Laser Grading Box is level by adjusting the top link and lower link arms. The front of the Laser Grading Box (closest to tractor) should be approximately 1/2" higher than the rear of the Laser Grading Box which should be level with the ground. Turn off tractor.
4. Mount the Control Panel bracket on the right rear fender of the tractor using the necessary hardware (not supplied). Install the Control Panel on the bracket using the side knobs to secure the unit.

5. Connect the Laser Grading Box's hydraulic hoses with quick couplers to the tractor quick couplers. The Laser Grading Box's hydraulic manifold is marked with a "P" and a "T" where the pressure and return (tank) hoses enter.

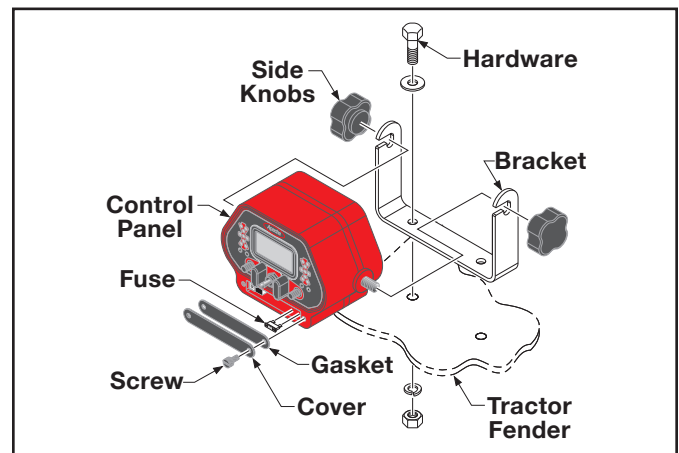


Figure 1-4. Control Panel Mounting

NOTE: "P" means pressure (supply) and "T" means tank (return). Refer to the Tractor Owner's Manual for identifying the "P" and "T" auxiliary hydraulic ports.

SYSTEMS FEATURES AND BASIC OPERATION

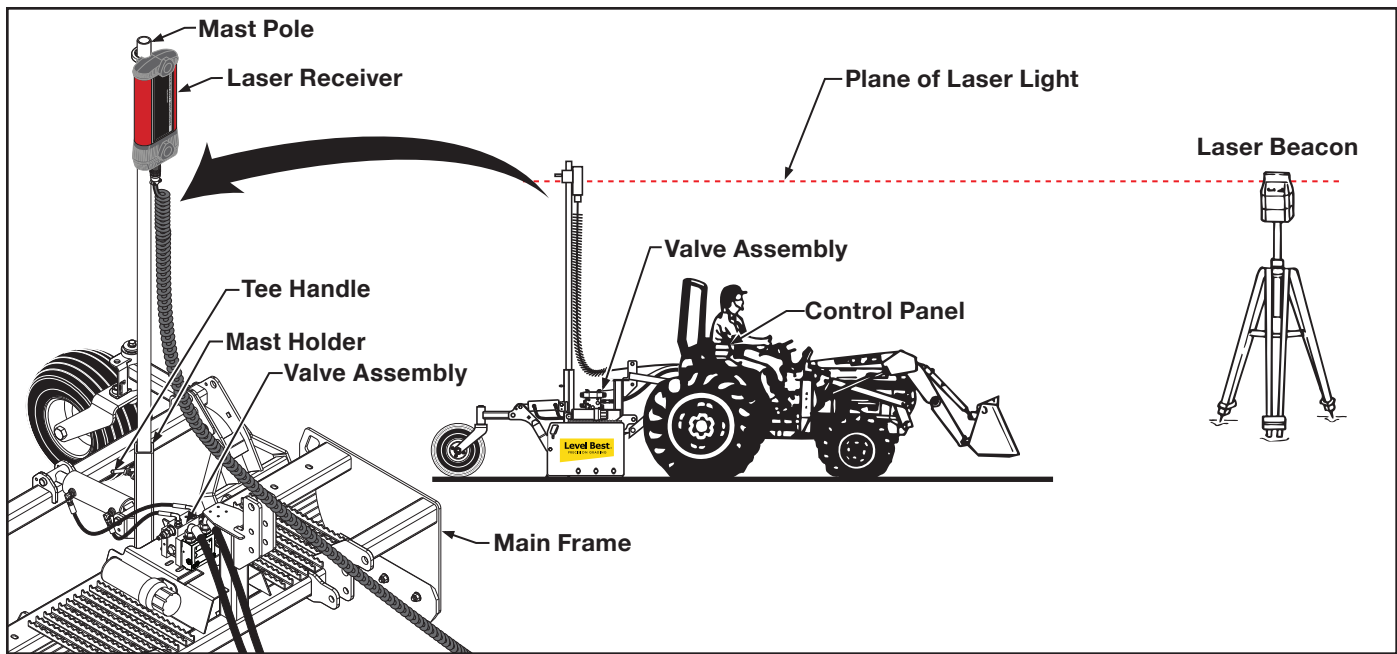


Figure 1-5. Components of the Automatic Control System

6. Insert the two mast poles into the holders on each side of the Laser Grading Box until they rest on the bottom of tube and tighten the tee handle to secure. Clamp one Laser Receiver near the top of each Mast so it is higher than any local obstructions including the tractor cab or fall protection devices. (Refer to Figure 1-5).
7. Connect the 90° end of the Junction Block/ Receiver cable to the Control Panel. Attach the Junction Block to the Tractor Fender using the included hardware.
8. Connect the straight end of a Receiver Cable to the base of a Laser Receiver and the 90° end to the Junction Block. Be sure to connect the Left Receiver Cable to the Junction Block connector marked L. Connect the Right Receiver Cable to the Junction Block connector marked R.
9. Connect the straight ends (molded) of the Solenoid Cable to the directional valve solenoid (the connector for the Right valve is marked) and the 90° connector (10-pin) to the back of the Control Panel.
10. Connect the 90° connector end of the Power Cable to the back of the Control Panel. The terminal ends were previously wired to the battery.

CAUTION

Do not connect left-side Laser Receiver to right-side valve or vice-versa.

NOTE: When connecting cables to the Control Panel, the left-side system must be connected together and vice-versa for the right side. If necessary, mark the Control Panel and associated cabling to ensure proper action during operation.

8. Connect the straight end of a Receiver Cable to the base of a Laser Receiver and the 90° end to the Junction Block. Be sure to connect the Left Receiver Cable to the Junction

WARNING

Always have the system in MANUAL when not operating the tractor.

JOB SITE SET-UP

The following are guidelines for setting up the Rotating Laser for both level job sites and sloped job sites:

- Choose a location for the Rotating Laser where obstructions, such as trees and buildings, can not block the plane of laser light. The Laser Receivers need to be able to sense the plane of laser light at all times.

SYSTEMS FEATURES AND BASIC OPERATION

- Whenever possible, set up the Rotating Laser and Laser Receivers at a height above the machine's cab. This prevents the cab or rollover structure from blocking the plane of laser light as the machine moves around the job sites.
- The recommended head speed for the Laser Receivers is 20 RPS (Revolutions per Second). At 20 RPS, the Rotating Laser updates the Laser Receivers 20 times per second.

Set-Up for Level Grading

If the job site is to be level, the set-up of the Rotating Laser is simple. Since no slope is required in either axis, the Rotating Laser does not need to be aligned. The Rotating Laser will provide a level plane of laser light in all directions.

1. Locate the Rotating Laser following the previously stated guidelines.
2. Apply power to the Rotating Laser. Level the Rotating Laser (some Rotating Lasers will automatically level, others will need manual adjustment).
3. Set the counters for both axis at 0.000% (If needed, see the Rotating Laser Operation Manual).
4. Bench the machine. See the "Benching and Operating" procedure in this section.

Set-Up for Sloped Grading

If the job site is to be graded for a single or dual slope, the Rotating Laser requires its axis to be aligned for the job site. The Rotating Laser will then provide a plane of laser light at the required slope(s).

The following procedures are for two typical examples of job sites requiring sloped grades. Remember, each job site is unique, so consider the following methods as guidelines and not as the only methods possible.

Method One:

1. Set a minimum of two grade stakes exactly in line with one of the axis to be graded.
2. Place the Rotating Laser in line with the two grade stakes.

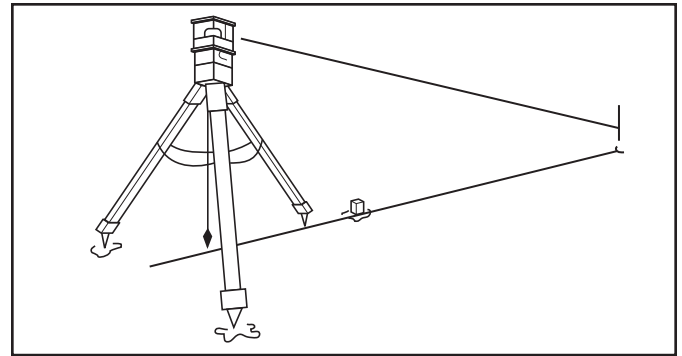


Figure 1-6. Method One: Align Rotating Laser with Grade Stakes

3. Switch on the Rotating Laser. Level the Rotating Laser (some Rotating Lasers will automatically level, others will need manual adjustment).
4. Set the counter on the Rotating Laser for both axis to 0.0000% (If needed, see the Rotating Laser Operation Manual).
5. Roughly align one of the axis to the grade stakes by sighting over the top of the Rotating Laser (Refer to Figure 1-6).

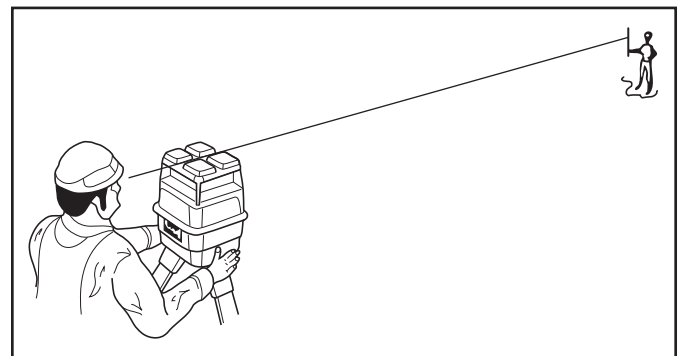


Figure 1-7. Sight over Rotating Laser

6. Align the plane of laser light.
 - a. Set a grade Rod with Rod Eye Receiver on the far grade stake and adjust the rod until the Rod Eye Receiver indicates "On Grade."
 - b. On the axis not aligned with the stakes, enter on the Rotating Laser: 5.000%.
- Allow the Rotating Laser to level itself to this new position, if needed.
- c. Check the Rod Eye Receiver again.
 - If the Rod Eye Receiver indicates "On Grade", the plane of laser light is aligned correctly.

SYSTEMS FEATURES AND BASIC OPERATION

- If the Rod Eye Receiver indicates the plane of laser light is too high or too low, have a second person rotate the Rotating Laser on the tripod in small steps until the Rod Eye Receiver indicates “On Grade.”
7. Enter on the Rotating Laser the required percent of grade for each axis and allow the Rotating Laser to level itself again.
 8. Bench the machine. See the “Benching and Operating” procedure in this section.

Method Two:

1. Set a minimum of two surveyed grade stakes. The stakes must have elevation information (Refer to Figure 1-8).

NOTE: This procedure requires that the elevation of the grade stakes are correct and aligned to the slope or percent of grade required.

2. Place the Rotating Laser a few feet (meters) behind the first grade stake and in line with one of the far grade stakes (It is not critical to align the Rotating Laser exactly) (Refer to Figure 1-9).

NOTE: Follow the guidelines at the beginning of this section when placing the Rotating Laser.

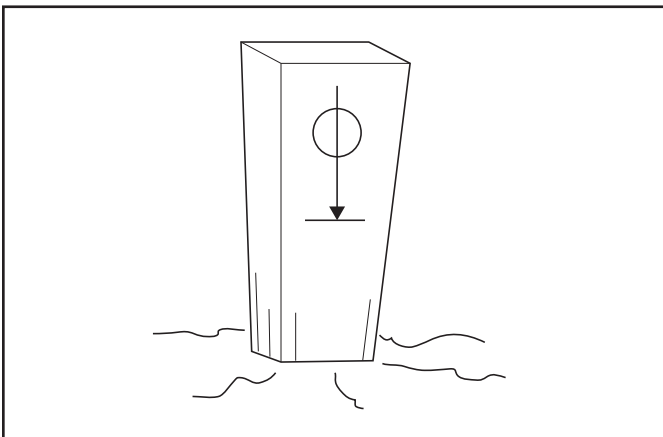


Figure 1-8. Grade Stake with Elevation Mark

3. Switch on the Rotating Laser. Level the Rotating Laser.

4. Roughly align one of the axis to the grade stakes by sighting over the top of the Rotating Laser (Refer to Figure 1-6).

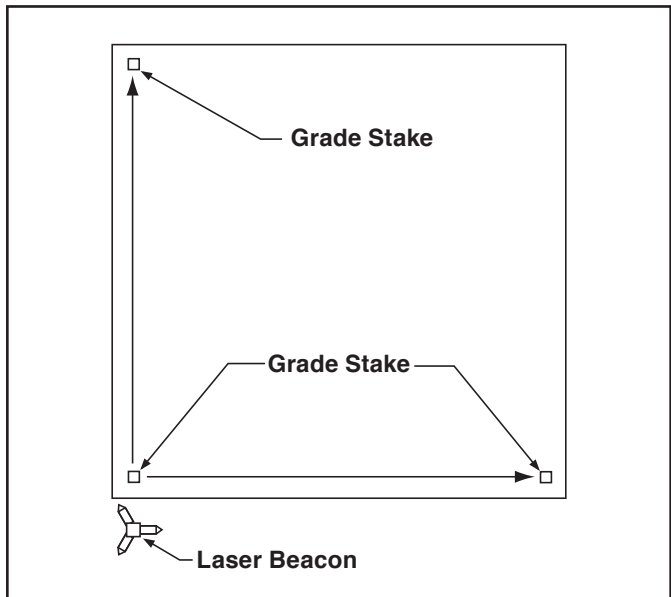


Figure 1-9. Method Two: Align Rotating Laser with Grade Stakes

5. Set both the counters on the Rotating Laser to the required percent of grade (If needed, see the Rotating Laser Operation Manual).

NOTE: The Grade Rod must be held plumb for each of the readings taken in the following steps.

6. Establish the H.I. (height of the instrument) for the plane of laser light.
 - a. Align the bottom of the Grade Rod to the mark on the near grade stake.
 - b. Adjust the Rod Eye Receiver up and down until it indicates “On Grade.”
 - c. Adjust the Rod Eye Receiver for any cut or fill amount indicated by the grade stake.
 - If the grade stake shows a cut, extend the Grade Rod and Rod Eye by the amount shown as a cut.
 - If the grade stake shows a fill, lower the Rod Eye by the amount shown as fill.
7. Align the plane of laser light.
 - a. Align the bottom of a Grade Rod to the mark on the far grade stake.
 - b. Check the Rod Eye Receiver.

SYSTEMS FEATURES AND BASIC OPERATION

- If the Rod Eye Receiver indicates “On Grade,” the plane of laser light is aligned at the correct slope.
- If the Rod Eye Receiver indicates the plane of laser light is too high or too low, have a second person rotate the Rotating Laser on the tripod in small steps until the Rod Eye Receiver indicates “On Grade.”

NOTE: If it was necessary to rotate the Rotating Laser a significant amount at the far stake, then the original reading at the near stake may be out of tolerance. Check the setting again and make minor adjustments as required.

8. Bench the machine.

NOTE: If needed, check the elevations on both the plane of laser light and the grade stake elevations by setting the bottom of the Grade Rod at any stake's grade mark and checking the Rod Eye Receiver for the “On Grade” indication.

BENCHING AND OPERATING

Before benching, the plane of laser light must be set at its proper slope. Benchng is the process of setting the relationship between the Laser Receivers and Rotating Laser, or benchmark. Failure to properly bench the system before grading will result in an unacceptable grade.

The goal is to have the Laser Grading Box approximately 1/2 full during operation. If, during rough grading, a lot of material needs to be removed from a site, the Laser Receivers should be set several inches higher than finished grade. As material is removed, the Laser Receivers can be lowered and the site regraded. This may need to be repeated several times until finished grade is achieved.

Benching

1. Move the machine to an area which is close to finish grade or, using the manual controls on the control system, grade a small area close to finish grade.

NOTE: Finish grade can be checked several times during the grade process to “zero” in on final grade.

2. Set the Auto/Manual Switches to MANUAL.
3. Turn the Laser Receivers and Rotating Laser ON.
4. Raise the Power switch and hold in the I position for 1 second to access the User Setup menu.
5. From the User Setup screen on the Control Panel, highlight the Deadband (Accuracy) icon and press the joystick.
6. Select the next to narrowest deadband setting.
7. Press the joystick twice to exit the deadband setup.
8. Adjust the height of the Laser Receivers until the center (On-Grade) Grade Position LED clusters are lit. The mast pole tee handle is NOT to be loosened, loosen the Laser Receiver clamp and move the Receiver on the mast pole.

NOTE: Most materials graded must later be compacted. To compensate for the compacting distance, lower both Laser Receivers equally. This raises the box's cutting edge by the same distance. The distance the Laser Receivers are lowered depends on the material.

Benching with a Rod Eye

To bench the Laser Receivers using a Rod Eye, follow the process listed below:

1. Turn on the Rotating Laser. Attach a Rod Eye to a measuring pole and turn on. Set the base of the measuring pole on the benchmark and adjust the measuring pole so the Rod Eye emits a solid “On Grade” tone (compensate for slab thickness and compaction if needed).
2. Find an area to be graded that is close to specified grade. Start the tractor, engage the auxiliary hydraulics and position the unit so one end of the cutting edge is in that location. Manually raise or lower the Laser

SYSTEMS FEATURES AND BASIC OPERATION

Grading Box's cutting edge until it is even with the bottom of the measuring pole when the Rod Eye is emitting the "On Grade" tone or resting on the ground if already at grade.

3. Making sure the Control Panel's Automatic/Manual Switch is on Manual and the On-Grade Deadband is set correctly (refer to steps 4 thru 7 in Benching) move the Laser Receiver to a height on the mast pole where it indicates the beam in the "On Grade" position and is unobstructed by any object.

NOTE: Operator may prefer to turn the face of the Laser Receiver towards the operator for easy viewing.

4. Repeat steps 2 and 3 for the other end of the cutting edge, moving either the machine or the measuring pole.

The Laser Grading Box Automatic Control System is now calibrated.

Operation

After the Laser Grading Box is connected and the Automatic Control System is calibrated, operation can begin.

The operational goal is to drive over the area to be graded with the box 1/2 full of material and the Control Panel's green light always illuminated.

1. When seated in the Operator's seat, start the tractor and set both Auto/Manual switches to AUTO.
2. Set the Deadband to a mid range setting.

NOTE: Most materials graded must later be compacted. To compensate for the compacting distance, lower both Laser Receivers an equally. This raises the box's cutting edge by the same distance. The distance the Laser Receiver is lowered will depend on the material.

3. Drive the machine forward. The Automatic Control System constantly senses the plane of laser light, raising and lowering each end of the grading box to maintain the cutting edge at the required elevation. Note the following during operation:

- In some situations, the Automatic Control System may require a cut deeper than the machine can handle. The machine may lose traction, stall the engine, or the wheel frame will be lifted off the ground to the maximum stroke of the cylinder as the cutting edge tries to reach finished grade. If this occurs, set the Auto/Manual switches to MANUAL and use the Raise/Lower switches to raise the cutting edge until the machine can push the material. Make multiple passes to cut the area closer to finished grade and then go back to AUTO control. This allows the high spots to be gradually removed.
- If one of the Control Panel's or Laser Receiver's grade lights are blinking, it indicates the direction of the last elevation prior to passing out of the laser beam. Readjust the height of the Grading Box manually until the signal is found. The Laser Receiver or Rotating Laser height may need to be adjusted if this situation continues to occur or switch to MANUAL operation until you get closer to grade.

NOTE: In rough grading situations, use the Automatic Control System as an "Indicate Only" system and operate the machine under manual control. After the area has been rough graded, switch to automatic control.

4. After several passes with the Laser Grading Box, stop and turn off the tractor. Place the base of the measuring pole on the graded area and check grade elevation.
5. After a rough grade is achieved, the On-Grade Deadband setting may be changed to a narrower setting as required to meet the job tolerance requirements. With a tighter deadband, the speed of the tractor needs to be decreased for optimum finish.

SYSTEMS FEATURES AND BASIC OPERATION

SPECIFICATIONS AND MAINTENANCE

SPECIFICATIONS

Dimensions

Model	TD72	TD84	TD96	TD108
Box Width	72 in. (183 cm)	84 in. (213 cm)	96 in. (244 cm)	108 in. (274 cm)
Overall Width	73.8 in. (187 cm)	85.8 in. (218 cm)	97.8 in. (248 cm)	109.8 in. (279 cm)
Total Length	69.7 in. (177 cm) 118 in. (300 cm) with optional drawbar			
Box Capacity	17.0 ft ³ (0.48 m ³)	19.9 ft ³ (0.56 m ³)	22.8 ft ³ (0.65 m ³)	25.7 ft ³ (0.73 m ³)
Weight	1060 lbs. (481 kg)	1200 lbs. (544 kg)	1320 lbs. (599 kg)	1565 lbs. (710 kg)

SYSTEMS FEATURES AND BASIC OPERATION

MAINTENANCE

The rugged and durable Automatic Control System is built to last, but as with all equipment, a few minutes of routine care, maintenance, and cleaning can extend the life of the system.

Storage and Transport

Most often the grading box and its hydraulic controls remain on your machine. However, you should store the Control Panel, Laser Receiver, Coiled Receiver Cable and Solenoid Cable in a safe place when not in use. Protect the cable connections by installing the covers supplied.

Cleaning

The Laser Receiver is completely sealed and purged with dry nitrogen. It requires no maintenance other than periodic checking to be sure its mounting structure is tight and secure.

The Control Panel is water resistant. It can be cleaned with mild soap and water, and a soft cloth. Do not submerge the Control Panel or direct high pressure spray at it. Do not use a dry cloth to wipe the Laser Receiver or Control Panel as scratching may occur.

Cables and Hoses

Check all cables and hoses regularly for signs of wear and damage. Keep cable connections clean and free from dirt and corrosion. If a cable has been damaged, do not attempt to repair. Incorrect or poor connections can cause damage to your Automatic Control System.

When applicable, check the hydraulic hoses. Look for areas where the hoses could rub against each other or another object as they expand and contract under pressure. Check the hydraulic fittings for tightness.

Machine

Check areas that affect the Automatic Control system function and accuracy, such as looseness or play in the cylinders or wear on the box's cutting edge. Looseness in the connection to the tractor, such as in the 3-point hitch, will cause inaccurate depth positioning.

Also check the tractor routinely for wear to its components, such as the 3-point linkage, ensuring it is operating properly.

Calibration

Perform periodic calibration checks of the Rotating Laser System, as outlined in its Operation Manual, to ensure accurate performance.

SERVICE

If the Automatic Control System is not functioning properly, the first step is to determine the problem component. Use the Troubleshooting Chart to determine possible causes and remedies. The following test equipment is needed:

- Voltage/Ohm Meter
- Rotating Laser or Laser Simulator

The Control Panel provides diagnostic codes to aid in troubleshooting and diagnostics. If a 5-digit code appears, contact ATI Corporation for assistance in diagnosing the code.

If the code 1505 appears, it indicates communication with the laser receiver(s) has been lost. Check the cable connections.

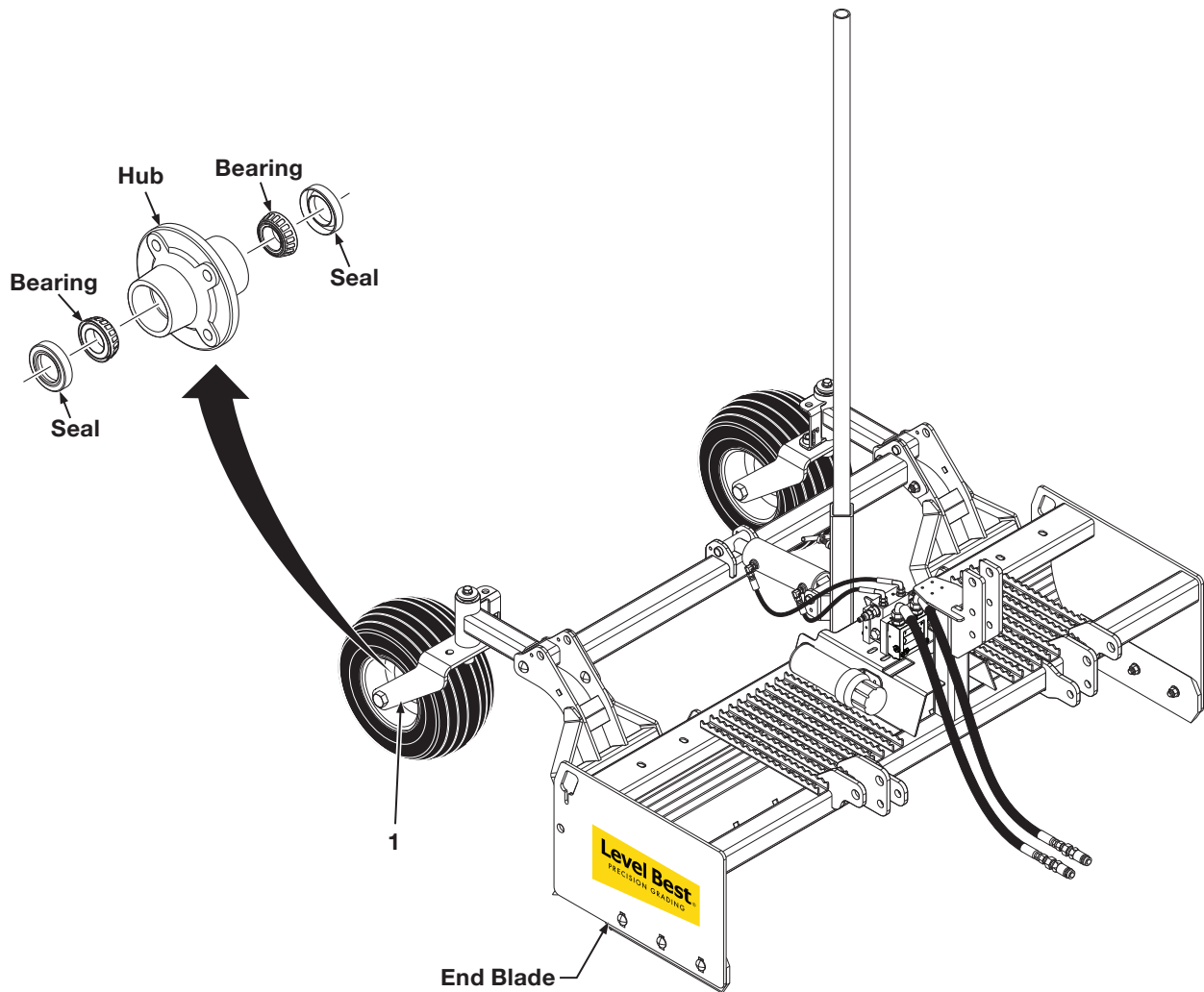
CAUTION

To prevent serious damage to the Automatic Control System, never replace a fuse with a fuse that has a higher amperage value.

CAUTION

The Automatic Control System is a highly sophisticated electronic system. Do not attempt repairs to the components. Contact your local dealer if you have any problems.

SYSTEMS FEATURES AND BASIC OPERATION



ITEM	NAME	FREQUENCY	LUBE TYPE
1.	Wheel Hub (2)**	Annually	EP*
<p>* EP - Multi-Purpose Grease.</p> <p>** Bearings must be pulled apart cleaned and packed once a year. Inspect grease seals and replace if necessary.</p>			

NOTES:

1. Check Hydraulic System Components for wear and/or leaks.
2. Check and tighten all bolts and nuts for scraper blade and end blades, weekly.

Figure 1-10. Lube and Maintenance Chart

(for future use)

APACHE/SPECTRA CONTROLS

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APACHE/SPECTRA CONTROLS

NOTES

[illegible]

CONTROL PANEL

The Control Panel is essentially a computer with built-in logic for the inputs and outputs connected to it. The Control Panel provides many adjustments to allow compatibility with different machinery and application requirements.

The Control Panel uses an LCD screen to provide information to the operator. The left side of the screen displays elevation, for the left side of the LGB and the right side is for elevation at the right-side of the LGB.

NOTE: This manual references the Tractor's ability to follow slope. This does not imply that a slope laser Receiver is required to provide this functionality. The tilt capability is obtained by measuring elevation at two different positions relative to the rotating laser.

The Control Panel has two modes accessible to the user; Operation and User Setup. In User Setup mode, items such as valve speed and LCD brightness can be adjusted. Operation mode allows operation of the LGB either automatically, with the Control Panel controlling depth, or manually, with the operator controlling the blade depth.

NOTE: The CB52/CB30 Control Panel can be configured several different ways. This manual assumes the ATI factory default setting displaying the left-side laser Receiver data, on the left side of the LCD and right-side laser Receiver data, on the right side of the LCD. Apache Technologies references this as dual elevation mode because both laser Receivers reference elevation and the LCD displays elevation data.

Controls

The CB52/CB30 Control Panel has joysticks (5 & 9) for operation of the raise, lower, functions and selection of automatic or manual control.

The following identifies the indicators, switches and type of switch on the Control Panel.

Front Control Panel Switches

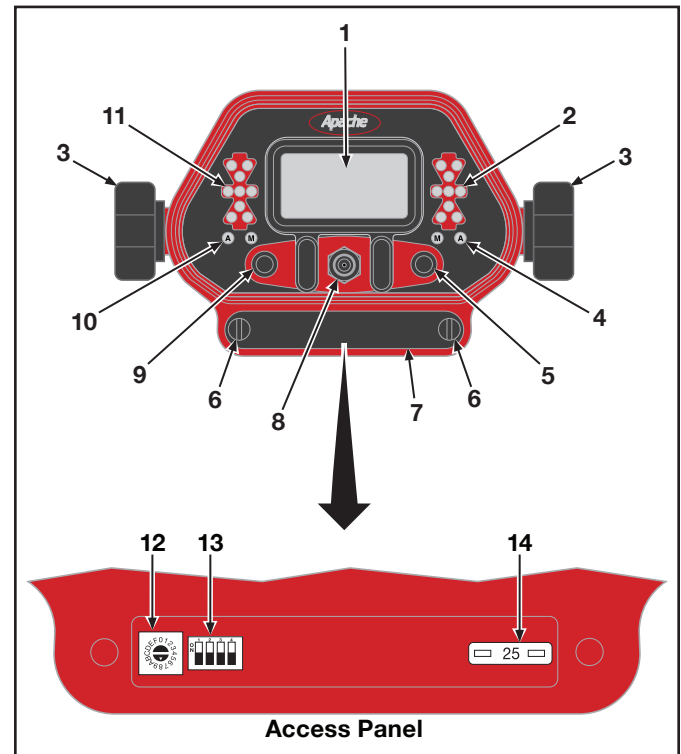


Figure 2-1. Control Panel Model CB52/CB30, Front View

LCD Display (1) – indicates the various operation and configuration modes. The items displayed change based on the mode and User Setup parameters chosen. Refer to the section on LCD display for more specific information.

LED Grade Display for Right-Side Elevation (2) – indicates where the cutting edge is in relation to the on-grade position. Refer to the section on Grade Indicators for more information.

Mounting Knobs (3) – secures the control panel to the mounting bracket.

Auto/Manual LED for the right-side (4) – green “A” LED illuminates when in Automatic operation and amber “M” LED illuminates when in Manual operation.

Right-Side Joystick (5) – left/right movement selects Auto/Manual control for the right-side and up/down movement raises and lowers the right side of the blade. Rotation increases/decreases the control setpoint. Pressing “in” enables elevation matching. When released, the joystick returns to a center, neutral position.

This joystick also navigates through the User Setup menus.

Access Panel Screws (6) – Retains access panel to the Control Panel.

Access Panel (7) – Panel contains a fuse, rotary switch and DIP switch used in factory setups.

Power Switch (8) – Turns power on and off. Also provides access to Help screens by pressing up while operating.

Left-Side Joystick (9) – left/right movement selects Auto/Manual control for the left-side and up/down movement raises and lowers the left side of the blade. Rotation increases/decreases the control setpoint. Pressing “in” enables elevation matching. When released, the joystick returns to a center, neutral position.

This joystick also navigates through the User Setup menus.

Auto/Manual LED for the left-side (10) – green “A” LED illuminates when in Automatic operation and amber “M” LED illuminates when in Manual operation.

LED Grade Display for Right-Side Elevation (11) – indicates where the cutting edge is in relation to the on-grade position. Refer to the section on Grade Indicators for more information.

⚠ CAUTION

Do not change or modify the Rotary or DIP switch positions. These switches are set at the factory before shipment. Contact the installation technician for additional information, if required.

Rotary Switch (12) – Used for factory setup. Do not adjust this unless directed to by ATI Corporation service department.

DIP Switch (13) – Used for factory setup. Do not adjust this unless directed to by ATI Corporation service department.

Fuse (14) – Automotive-style, 25 amp fuse protects against power surges.

Rear Control Panel Connections

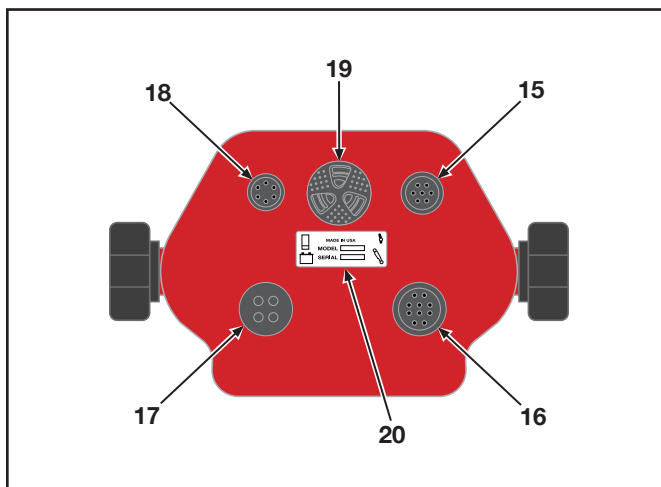


Figure 2-2. Control Panel, Model CB52/CB30, Rear View

Remote Switch (15) – 7-pin connector for the remote switch wire harness.

Hydraulic Valve Output (16) – 10-pin connector for the valve wire harness.

Machine Power Input (17) – 4-pin connector for the power wire harness.

Laser Receiver (18) – 7-pin connector for laser Receiver input. This connects to the junction box.

Beeper (19) – beeper for audible indication of alarms and switch engagement. A single beep is activated when a switch command is accepted. A double beep is activated when a selected function is not available or is incorrect. Beeper volume can be adjusted by rotating the beeper.

Serial Number Plate (20) – records build and model data for troubleshooting purposes.

Control Panel Display

The Control Panel Display provides information to the operator for efficient control of the LGB in either Automatic or Manual control. Inputs from the joystick located on the left side are displayed on the left side of the screen and vice-versa.

The default ATI Corporation setup of the control system displays data as two different elevations. Elevation information for the left laser Receiver is shown on the left side of the Control Panel LCD and elevation information for the right laser Receiver is shown on the right side of the LCD.

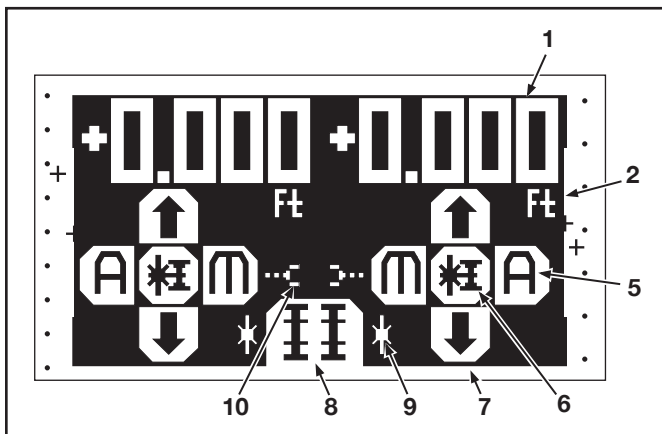


Figure 2-3. Control Panel Display

Reference Elevation (1) – indicates the reference elevation. The value is referenced from the last bench mark.

Units (2) – displays the units of the reference elevation. Can be changed in User Setup mode.

Receiver Position Indicator (3) – indicates the elevation relative to the vertical reception range of the receiver. The + indicator blinks when reception is lost.

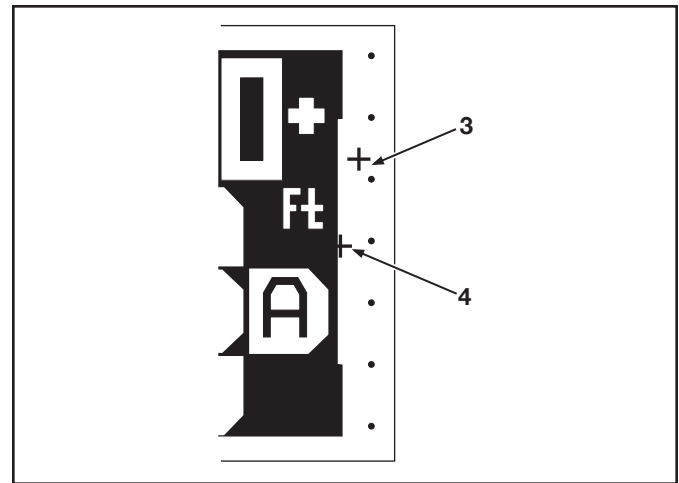


Figure 2-4. Receiver Position Indicator

The on-grade set range will vary depending on the width of the deadband. The smaller the deadband, the larger the range. The larger the deadband, the smaller the range.

Control Setpoint (4) – indicates where on-grade is set relative to the vertical reception range.

Automatic/Manual Indicator (5) – indicates if the control system is in manual (M) or automatic (A) mode.

Joystick Function Icon (6) – indicates the current mode of the joystick. Pressing the joystick alternates control between slope matching/benching and slope control setpoint.

Raise/Lower Indicator (7) – indicates the direction of movement of the blade.

Operating Mode Indicator (8) – indicates the operating mode of each side of the Control Panel. Dual elevation control is shown.

Control Source Indicator (9) – indicates the source of control. Starburst icon indicates input is being received from a laser receiver.

Linked/Unlinked Elevation Mode (10) – only used in dual elevation mode.

Grade Indicators

On each side of the LCD is a grade indicator. The grade indicator is a set of red and green LEDs that indicate relative position to grade. When a laser is striking the Receiver, there are 5 possible positions of grade information indicated.

High Coarse - 3 top red LED's forming down arrow.

High Fine - 3 top red LED's and 3 green on-grade LED's.

On-Grade - 3 green LED's forming horizontal bar.

Low Fine - 3 bottom red LED's and 3 green on-grade LED's.

Low Coarse - 3 bottom red LED's forming up arrow.

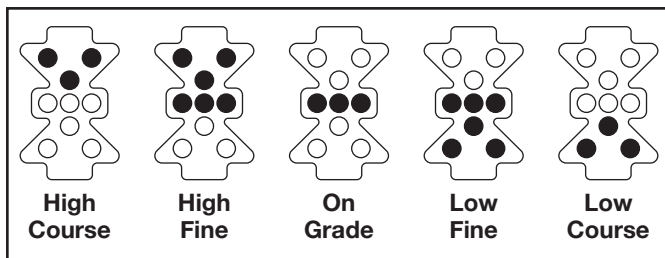


Figure 2-5. LED Grade Display

If the laser moves off the reception range of the Receiver, an out-of-beam will be indicated on the LEDs. If the last laser reception was on the bottom of the Receiver, the top 3 LEDs will flash indicating to move the Receiver down. If the last laser reception was on the top, the bottom 3 LEDs will flash indicating to move the Receiver up. The out-of-beam indication lasts for 2 minutes.

OPERATION

Control of the Laser Grading Box is accomplished through the Control Panel. The operator places the system in either Automatic control, where the system raises/lower/tilts the LGB based on inputs from the laser system, or Manually, where the operator moves the LGB using the controls on the Control Panel.

WARNING

Always turn the system to manual before leaving the tractor. Move both joysticks toward the middle (inward) to activate manual mode.

To turn the system on, toggle the Power switch to the I (on) position. The LEDs and LCD will light to confirm power. The Control Panel will perform a diagnostic check to ensure the system components are present and responding correctly.

If the laser Receivers are present, the LEDs on the Receivers will light as a system check. If components are not found, a “No Receivers Found” message is displayed.

NOTE: The system must be restarted if Receivers or components are connected/added.

Automatic/Manual Control



To place the LGB under Automatic control, move the left joystick to the left (outward) and the right joystick to the right (outward) and release each to neutral. The green “A” LEDs on the Control Panel will light to indicate Automatic control.

Under Automatic control, the Control Panel sends the appropriate signals to the valve to raise and lower the LGB to obtain and maintain an on-grade position. If the Receiver is outside the range of the laser signal, it must be moved within range to start receiving signals.

To place the LGB under Manual control, move the left joystick to the right (inward) and the right joystick to the left (inward) and release each to neutral. The amber “M” LEDs on the Control Panel will light to indicate Manual control.

Under Manual control, the LED Grade Display will indicate grade information but will not send adjustment signals to the valve. Adjustment of the LGB elevation and slope can be accomplished manually.

Raise/Lower



The left-side joystick raises or lowers the left side of the LGB when under Manual control. Move the joystick up to raise the blade and down to lower the blade.

When under Automatic control, the left-side joystick will temporarily raise or lower the left side of the LGB. When the joystick is released, the LGB returns to Automatic control.

The raise and lower functions are duplicated for the right side of the LGB by the right-side joystick.

Elevation Offset (Reference Adjustment)



The CB52 has the capability to adjust the on-grade point without adjusting the laser Receiver(s) to within one inch of the end of its range. This feature can be used to raise the grade for initial rough-cut and then return the LGB to desired grade for finishing.

The on-grade reference point is adjusted from the Control Panel by rotating the appropriate joystick. Rotate the joystick clockwise increases the elevation, counterclockwise decreases the elevation. The offset will not go beyond a limit programmed into the laser Receiver.

When the reference is adjusted, the LCD displays the actual elevation change from the benchmark.

If linking is enabled, either joystick can be rotated and the on-grade reference is adjusted equally for both sides. When under Automatic control, the LGB will begin to move immediately. When under Manual control, the blade will not move until placed under Automatic control.

Elevation



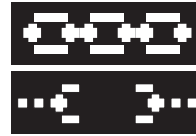
Elevation matching allows the current laser signal to be temporarily set to the on-grade reference. This allows adjustment of the on-grade elevation for an initial cut of the area to be graded at a set distance above the engineered plane.

When the laser strike signal is within range of the laser Receiver and at least one inch from the outer limit, press and hold the appropriate joystick for approximately 1 second and release when a single beep is heard from the Control Panel. The LCD and grade LEDs will indicate the LGB is on-grade. If outside the acceptable laser Receiver range, two beeps are sounded to indicate the command was not accepted.

To reset the elevation to the default center on-grade position, press and hold the joystick for five seconds. The first beep is heard at approximately one second and the second beep is heard at 5 seconds, when the elevation is reset to the default. The

elevation control setpoint returns to the center position and the LCD indicates the elevation in relation to the default.

Link



The Link capability within the Control Panel allows the two different elevations of the LGB to be adjusted/moved simultaneously. When activated, this function applies to changing Automatic/Manual control, adjusting elevation offset, and adjusting or resetting the elevation matching features.

Before linking, set the LGB in the desired position to ensure the relative positioning of the two laser Receivers. This is usually parallel to the laser plane. With the Control Panel in dual elevation mode (default), move both joysticks inward (manual position) and hold for 3 seconds. The link icon on the LCD will change from a broken link to a connected link (chain).

Audio Alerts

The beeper on the back of the Control Panel can be rotated to adjust the volume of the tones emitted.

A single, short beep is sounded to indicate an input, or command, is accepted. A double beep indicates a command was not accepted. A triple beep is sounded when the Control Panel is first powered up.

User Setup

When purchased from ATI Corporation, the control system is setup specifically for the unit purchased. Some items may be customized to suit the operator's specific needs or operating conditions. Up to three separate configurations can be saved. A fourth configuration returns the unit to the factory default settings.

To access the User Setup screen, hold the Power switch in the UP position for 1 second. When the setup screen appears on the display, release the switch. The Control System automatically enters manual mode when the User Setup screen is accessed.

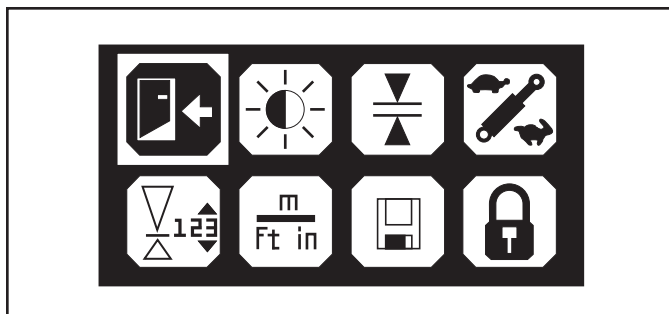


Figure 2-6. User Setup Display Screen

The User Setup screen has eight icons. The various icons and setup functions are accessed via either the joystick, rotating or moving the switch until the desired function is highlighted. Press either joystick to enter the selected function.



To return to the Operation screen, highlight the Return icon and press either joystick.

NOTE: Help screens are available within each function. Hold the power switch in the up position to access the help screen.

LCD Brightness and Contrast



Using the joysticks, highlight the LCD icon and press a joystick to enter the Brightness and Contrast edit mode. When in edit mode:

The left side indicates the brightness level and ranges from 5 to 100. Rotate the left-side joystick clockwise to increase the brightness level and counterclockwise to reduce the brightness level. Changes are made in increments of 5.

The right side indicates the contrast level and ranges from 0 to 100. Rotate the right-side joystick clockwise to increase the contrast and counterclockwise to reduce the contrast. Changes are made in increments of 1.

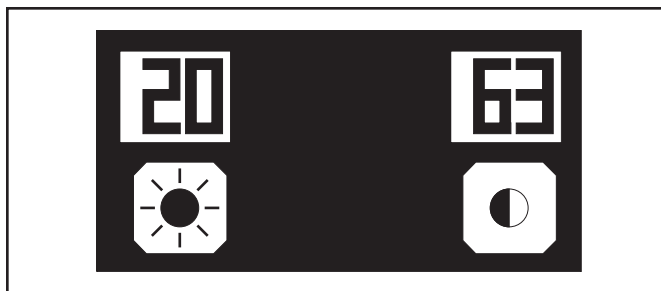


Figure 2-7. LCD Brightness and Contrast Edit Mode

Deadband (Accuracy)



Deadband refers to how tight a tolerance, or accuracy, is desired. Although a greater accuracy is normally desired, if the system becomes unstable, overreacting between above grade and below grade, the deadband should be increased to minimize overreaction.

Using the joysticks, highlight the deadband icon. Press a joystick to enter the Deadband edit mode.

When in edit mode, the left side of the LCD displays the elevation deadband in ft. The maximum elevation deadband is 0.170 ft. (2.00 in.). Rotating the left-side joystick changes the deadband for the elevation.

CAUTION

Setting the Deadband too narrow may cause the Grading Box to become unstable. If this happens, increase the deadband or decrease the valve speed.

NOTE: Adjustment is for display deadband. Default control deadband is the same but may be set smaller during installation.

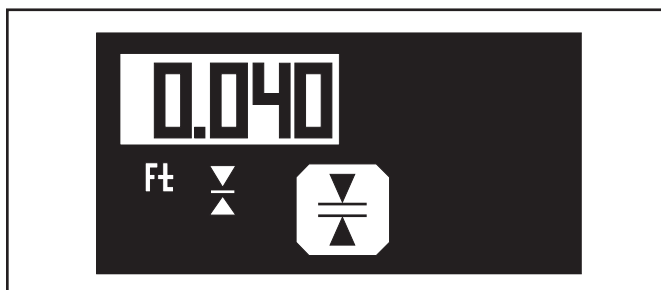


Figure 2-8. Deadband Edit Mode

Valve Speed



Valve speed relates to gain, or the speed at which the control system adjusts the LGB. When operating in sandy or loose materials, decrease the valve speed for slower hydraulic speed. When operating in clay, dirt or tighter materials, increase the valve speed for a faster hydraulic speed. If the system becomes unstable, overreacting between above grade and below grade, decrease the valve speed.

Using the joysticks, highlight the valve speed icon. Press the joystick to enter the valve speed edit mode. When in edit mode a single number appears, indicating the valve speed as a percentage between 0 and 100%.

Rotate either joystick to adjust the valve speed. The factory default is 50%.



Figure 2-9. Valve Speed Edit Mode

Reference Elevation



This sets a reference elevation, displayed on the edge of the operation mode display.

Using the joysticks, highlight the reference elevation icon. Press the joystick to enter the reference elevation edit mode. When in edit mode a single number appears on the left side of the display indicating the overall range of the display in operating mode. The units shown reflect the units selected.

Rotate the left-side joystick to adjust the range.

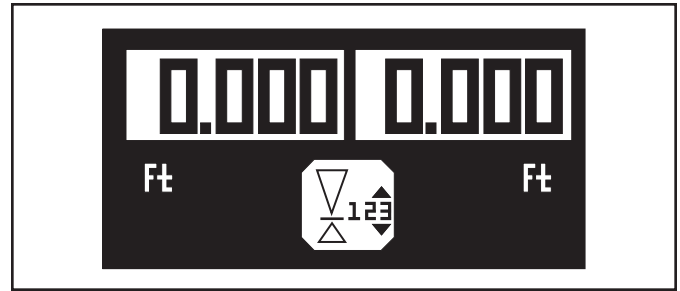


Figure 2-10. Reference Elevation Edit Mode

Units of Measure



The units used to display information to the operator can be changed.

Using the joysticks, highlight the units of measure icon. Press the joystick to enter the edit mode. When in edit mode, the currently selected units appear.

To adjust the elevation units, displayed on the left side of the screen, rotate the left-side joystick.

To adjust the slope units, displayed on the right side of the screen, rotate the right-side joystick.

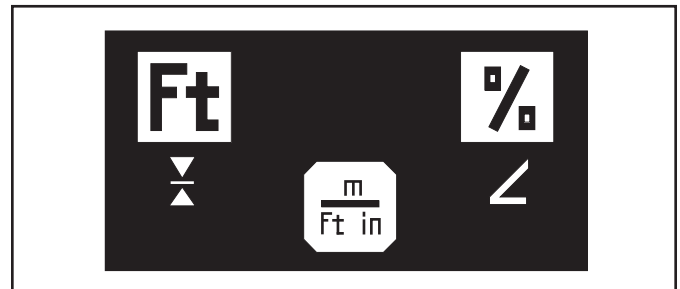


Figure 2-11. Units of Measure Edit Mode

The available units are shown in Table 1.

Table 2.1. Units

Elevation		Slope	
Display	Units	Display	Units
Ft	feet	%	Percentage of slope
in	inches	°	Degrees of slope
m	meters		

Store and Recall Setup



This allows the operator to store three different setup configurations for future recall.

Using the joysticks, highlight the store and recall configuration icon. Press the joystick to enter the edit mode. When in edit mode, the left-side display and joystick manages the store function and the right-side display and joystick manages the recall function. Checksum values are also displayed to check copied setups.

To store the current configuration, rotate the left-side joystick to the desired number on the display. When selected, press the joystick to store the setup configuration. A message appears asking "Do you want to store?" Select YES to store and NO to return to the previous menu.

When YES is selected, a new name can be entered. Rotate the left-side joystick to scroll through the character choices. Move the joystick to the right to move to the next character. Up to 7 characters may be entered. Once entered, the named setting appears on the store and recall screen for future selection.

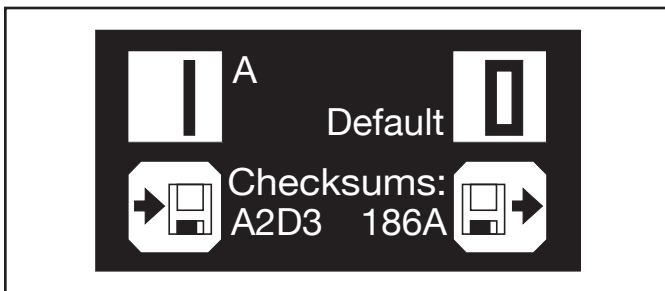


Figure 2-12. Store and Recall Edit Mode

To recall a saved configuration, rotate the right-side joystick to scroll through the selections. Highlight the desired configuration and press the right-side joystick to select it. A message appears asking "Do you want to recall the setup?" Select YES to recall and make the stored configuration the current configuration. Select NO to return to the previous menu.

Lock Setup



The current settings can be locked so changes to certain settings cannot be made without unlocking.



Using the joysticks, highlight the lock icon. Press the joystick to lock the configuration. The icon changes to indicate it is locked.

When locked, the following settings cannot be changed:

- deadband
- valve speed
- elevation and slope matching reference
- elevation values
- units of measure
- store and recall settings
- link sides

If changes are attempted to these settings, a "Locked" message appears on the screen.

LASER RECEIVER

The Apache B5MC Laser Receiver is a rugged, 360° electronic Receiver that detects laser light generated by rotating lasers. The unit is designed to work with all common rotating laser beacons and detects both visible and invisible beams.

The Receiver does not have any on-board switches. All settings are made on the Control Panel. Power to the B5MC Receiver also comes from the Control Panel. A small, built-in LED display provides grade elevation position, plus high and low lost beam indication.

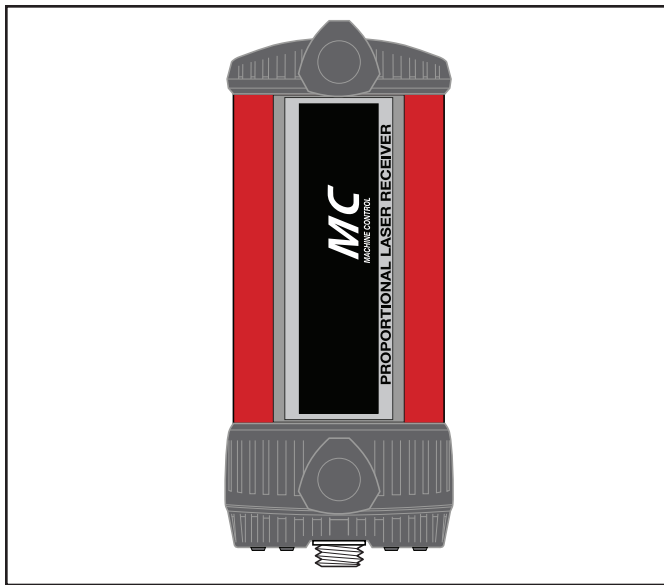


Figure 2-13. Laser Receiver, 5MC Front View

The Laser Receiver is mounted on the mast pole directly above the cutting edge of the box. The Receiver is the unit that detects the plane of laser light produced by the Rotating Laser. The Laser Receiver sends to the Control Panel the location of the plane of laser light. The Control Panel then has the valve assembly drive the Grading Box's hydraulics accordingly.

CABLES

Cables are provided to connect the various components together into a system. Each connector uses a unique number of pins or sockets to prevent the components from being connected incorrectly.

CAUTION

Never force a connector into a socket.

CAUTION

All cables must be secured with adequate cable length to avoid pinching, stretching and tight bending. Do not clamp cables to pipes or hoses that may generate high heat.

Cable Configurations:

Receiver Cables - powers the Receiver and communicates grade information between the Laser Receiver and Junction Block. The Junction Block end uses a 90° connector to differentiate it from the

Laser Receiver end. This is a coiled cable that can hang freely between the Junction Block and Laser Receiver mounted on the mast.

NOTE: The Junction Block is marked L & R for the Left and Right Receiver Cables.

Power Cable - supplies power to the system. The Control Panel supports both 12 and 24 volt machine systems.

NOTE: The Control Panel supports both 12 and 24 volt machine systems. However, the valve is 12 volt only. Contact ATI Corporation for additional information when using a 24 volt system.

Junction Block/Receiver Cable - provides a connection method for two Receiver cables and the one connector on the Control Panel. The junction block end of the cable attaches to the Control Panel mounting bracket.

Information from each laser Receiver is coded to identify the Receiver and, when the information is received, the Control Panel decodes the signals. This allows the signals to be passed to the Control Panel through a single connector.

Valve Cable - communicates grade information between the Control Panel and the hydraulic valve. There is one connector for the Control Panel and two connectors for the valve. One connector goes to each valve solenoid. Labels located on the cable identify the solenoid to connect to.

Valve Assembly

The valve assembly is an aluminum block manifold with two electrically-actuated valve sections. The valve actuates the cylinders, raising and lowering the gauge wheels, based on input from the Control Panel.

When connecting, the left side of the Control Panel and left side Laser Receiver must be connected to the left side valve and the right side of the Control Panel and right side Laser Receiver must be connected to the right side valve.

NOTE: Left and right sides are determined as if sitting in the tractor seat facing forward.

APACHE/SPECTRA CONTROLS

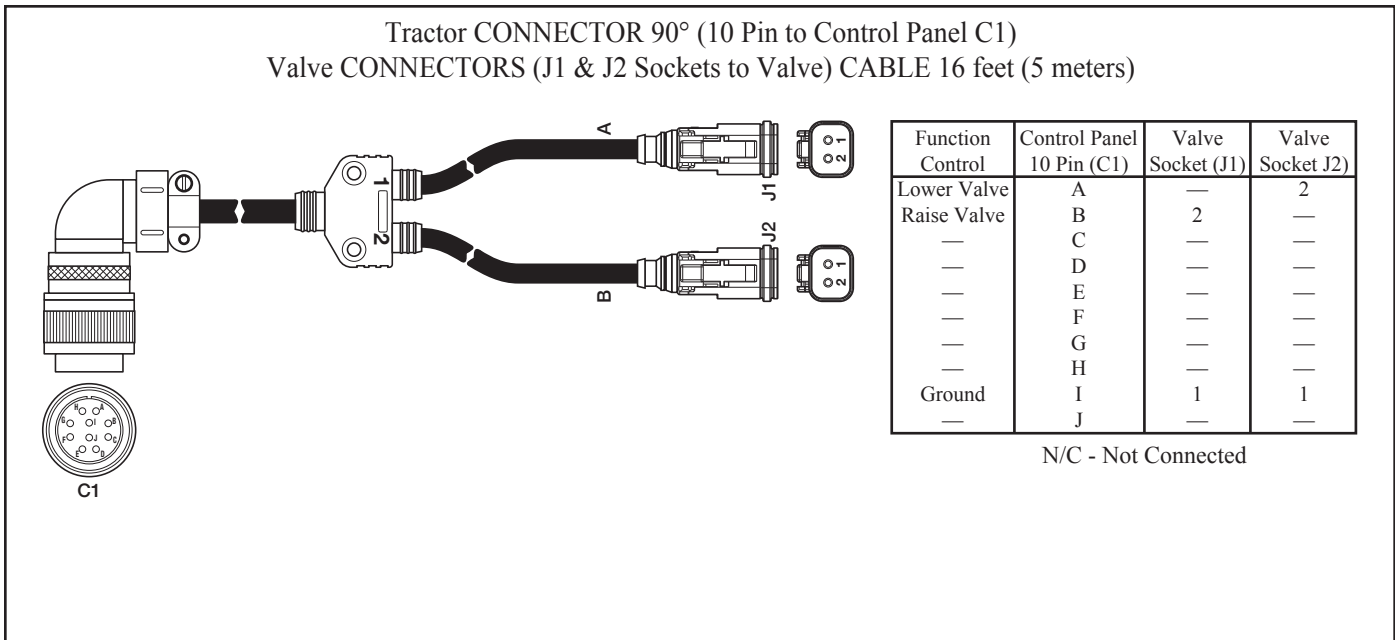


Figure 2-15. Valve Cable

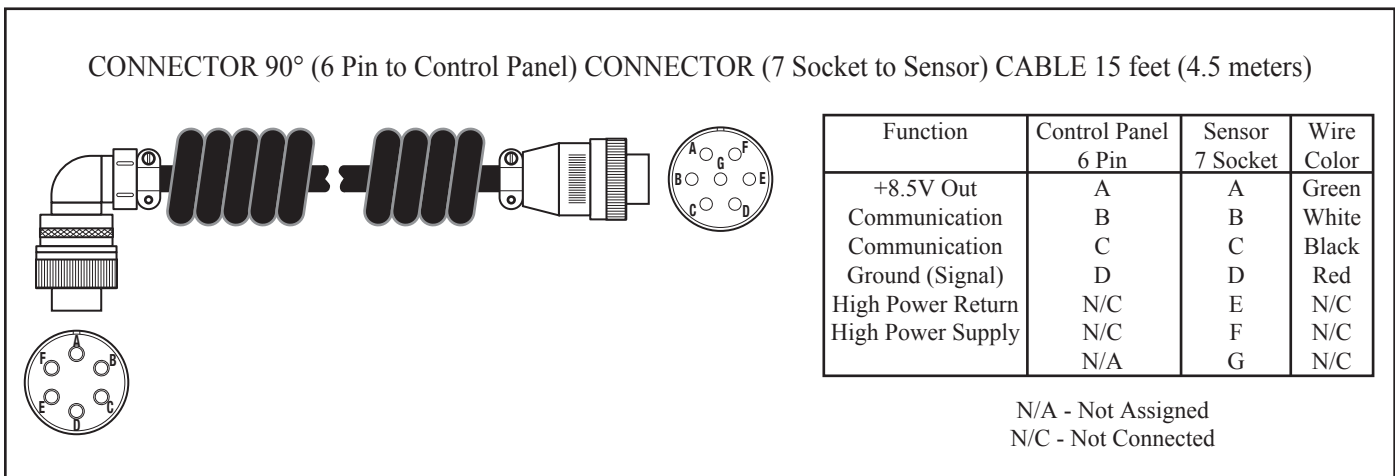


Figure 2-16. Receiver Cable

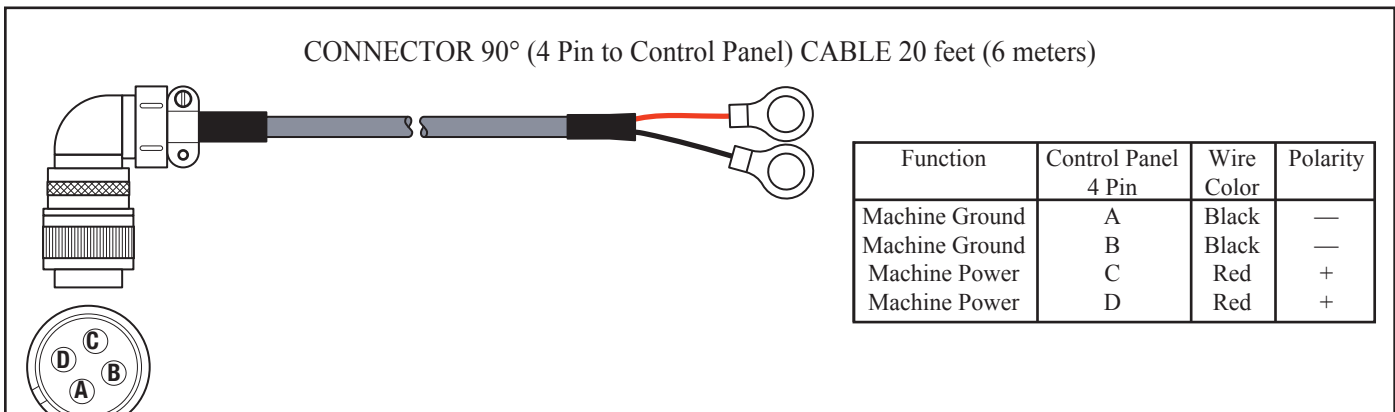


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Figure 3-41. Receiver Cable Detail.	3.21
Figure 3-42. Solenoid Cable Detail.	3.22

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal grey lines across its entire width, providing a template for writing or drawing. The margins are consistent on all sides.

PRODUCT OVERVIEW

Product Description and Features

General

The control panel has keys surrounding the screen for user input. The 3.5" color display, incorporates a state of the art LCD color screen, making it easy to use, even in bright, sunny conditions.

The rugged IP56 enclosure is designed for harsh environments.

Power supply, communication

The control panel is powered from a cradle based on a sophisticated induction solution, while data is transferred wirelessly via infrared between the cradle and the control panel. Leica Geosystems recommends to use the “MMB1300 Cradle for control panel”. “Cradle” will be used throughout this manual.

Control Panel

The Control Panel is essentially a computer with built-in logic for the inputs and outputs connected to it. The Control Panel provides many adjustments to allow compatibility with different machinery and application requirements.

The settable functions on the Control Panel can be categorized as Operation or Installation. Installation functions configure communication with the Laser Receiver and valve and other items which, once configured, never require modification. Operation functions are typically adjusted often, either on a job site basis or during operation.

Functions which are typically changed during operation are accessible on the face of the Control Panel while other switches which do not require frequent adjustment are under an access cover.

The following identifies the indicators, switches and type of switch on the Control Panel.

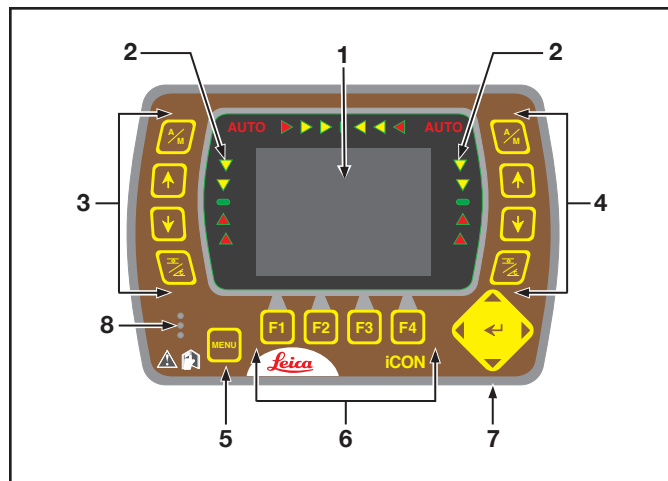


Figure 3-1. Control Panel, Front View.

1. Graphical display
2. Grade indication led's
3. Left side sensor setup
4. Right side sensor setup
5. Menu key
6. Function keys
7. Enter key
8. Speaker

⚠ WARNING

This product may be installed on construction machinery only by an appropriately trained and qualified specialist.

⚠ WARNING

Unauthorized modification of machines by mounting the product may alter the function and safety of the machine.

NOTE: Follow the instructions of the machine manufacturer. If no appropriate instruction is available, ask the machine manufacturer for instructions before mounting the product.

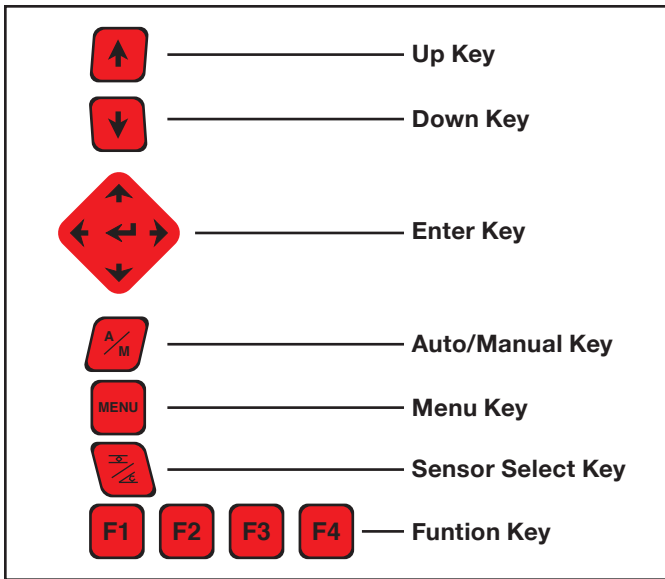


Figure 3-2. Special keys.

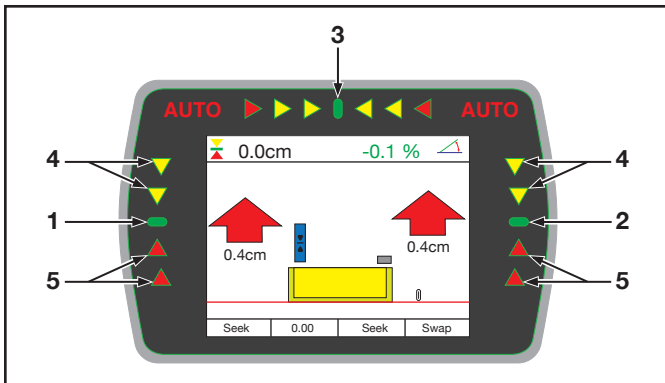


Figure 3-3. Display.

1. Left on-grade indication
2. Right on-grade indication
3. Side shift alignment indication
4. Above grade
5. Below grade

Cradle

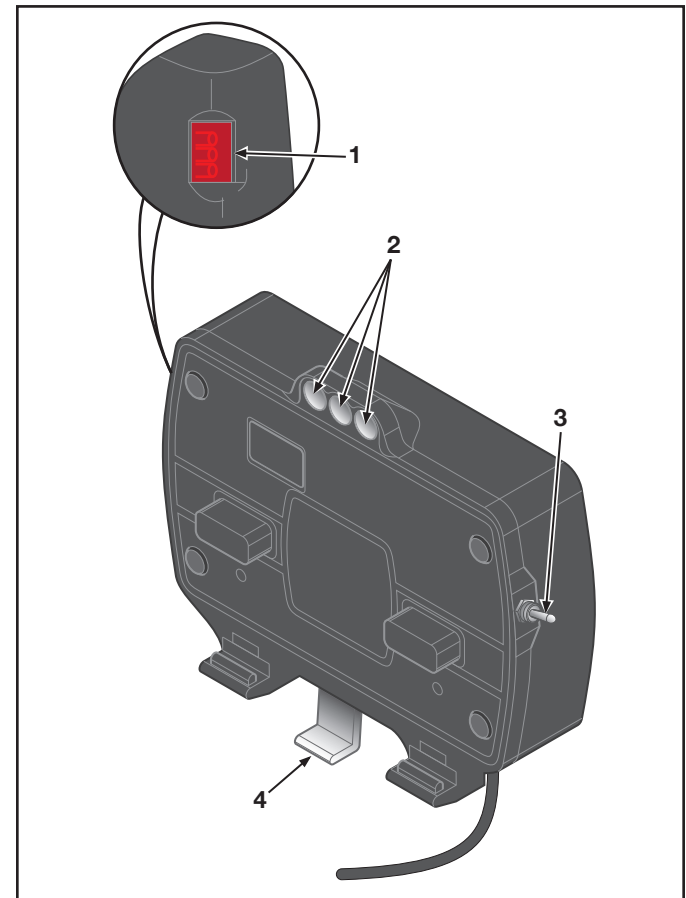


Figure 3-4. Cradle.

1. Power and data transfer LED indicators
2. Holding magnets
3. On/off switch
4. Release key for control panel

Getting Started

System start

To get the system started complete the following steps:

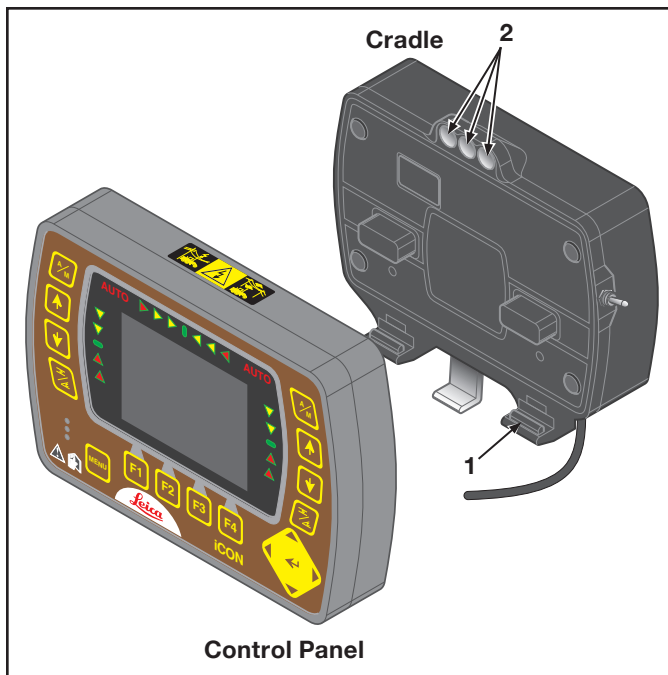


Figure 3-5. Snap control panel onto cradle.

To connect the control panel to the cradle:

1. Put the control panel on the holding hooks in the bottom of the cradle.
2. Then snap the control panel onto the cradle by pressing it towards the cradle.

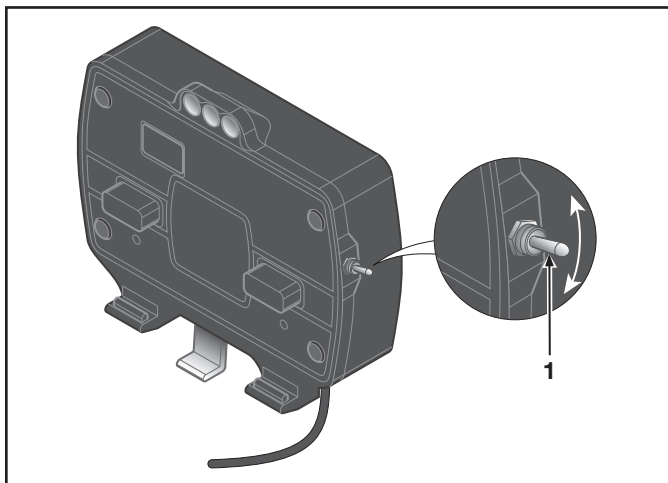


Figure 3-6. Turn on the control panel.

To turn the system on and off, use the power switch 1 on the right side of the cradle. This is the master switch for the entire system.

NOTE: Removing the panel will also turn off the power.

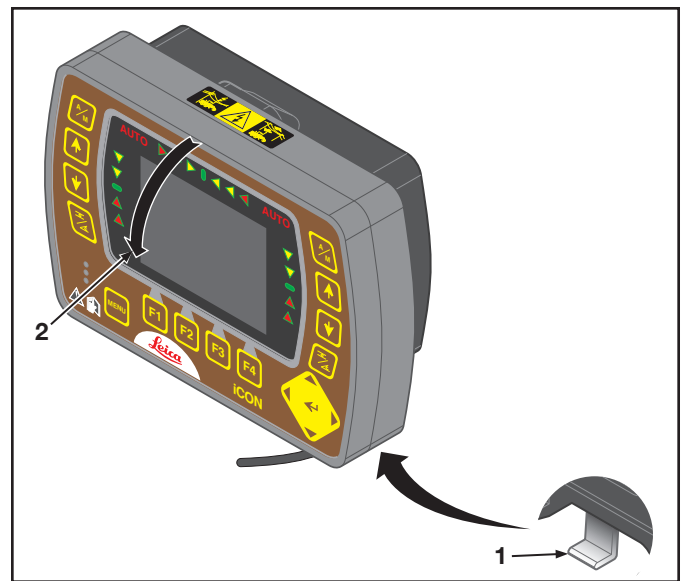


Figure 3-7. Remove control panel from Cradle.

To release the control panel simply press the Release Key 1 at the bottom of the cradle, pull the Control Panel towards you 2 and then lift it away from the Cradle.

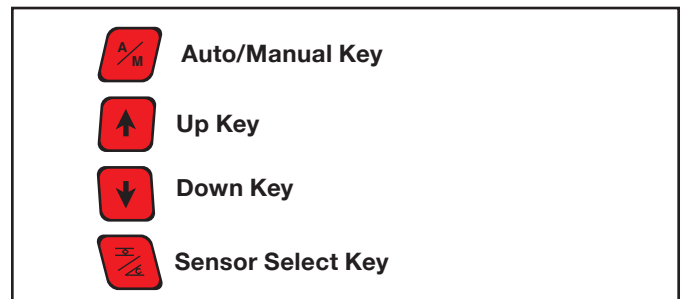


Figure 3-8. Sensor setup keys.

The sensor setup keys are used to choose the type of sensor that the system should run with, and to find and set the reference point for that sensor.

The left and right hydraulic channel has four sensor setup keys each:

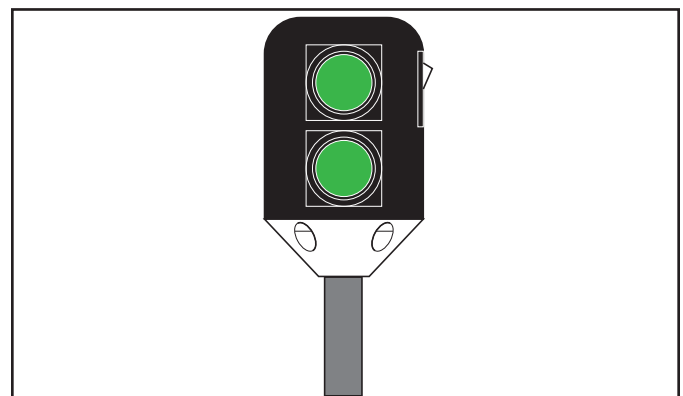


Figure 3-9. External Multi Switch for Skid Steer.

The system can also be fitted with an External Multi Switch. This switch has three keys on it. One Auto/Manual key (Red) and Increment/Decrement (and/or hydraulic Raise/Lower depending on selected operating mode) keys (green). These keys can be configured to have the same function as the corresponding keys on the control panel, but can also be configured to control the hydraulics.

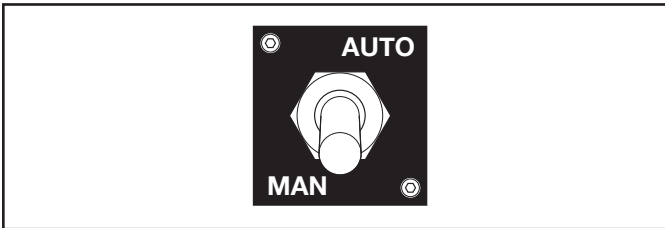


Figure 3-10. External switch for Skid Steer.

Toggle the master switch to AUTO to enable automatic control on all channels selected on the control panel. Toggling the master switch to MAN (Manual) places all channels in manual control regardless of selection on the control panel.

OPERATION

Select the Grade/Slope Sensor Input Source

Sensor selection

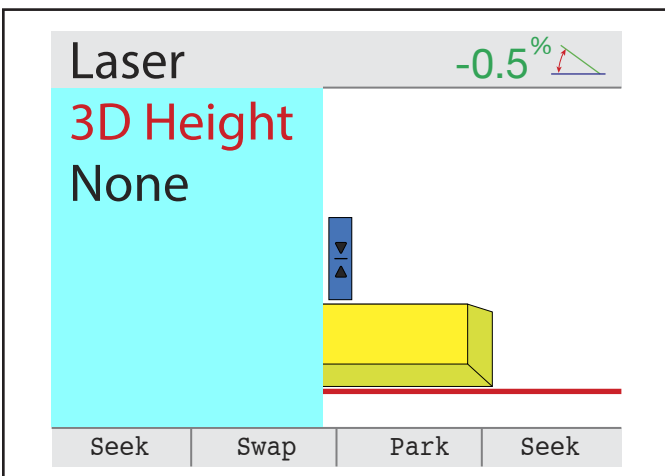





Figure 3-11. Sensor selection.

1. Push the left or right  key to open the sensor selection menu. Following screen appears:
2. Use the  /  keys to scroll through the available sensors.

- a) If the sensor is connected and active it will show up in black.
- b) If it's not connected or inactive, it will be hidden and cannot be selected when in User Mode.

If a selected sensor gets disconnected, an error message **Sensor not connected** will be displayed.

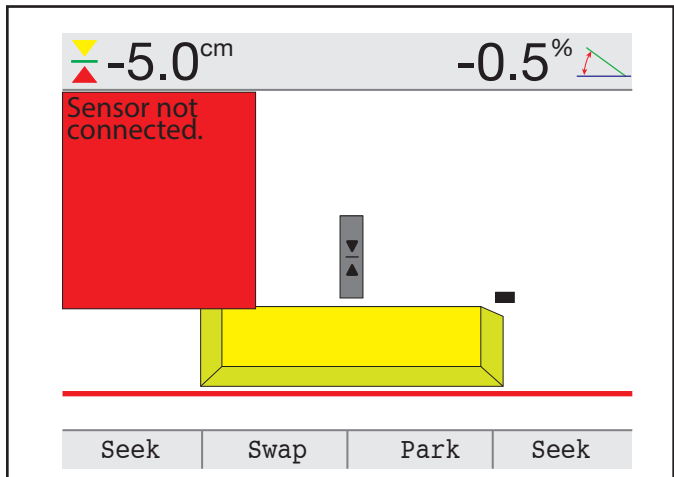




Figure 3-12. Sensor not connected.

3. Highlight the sensor that is going to be used and exit the sensor selection menu by pressing  or .
4. The chosen sensor is indicated by a small icon in the upper corner of the display, and by an icon shown on the blade in relation to the actual placement of the sensor.

Example:

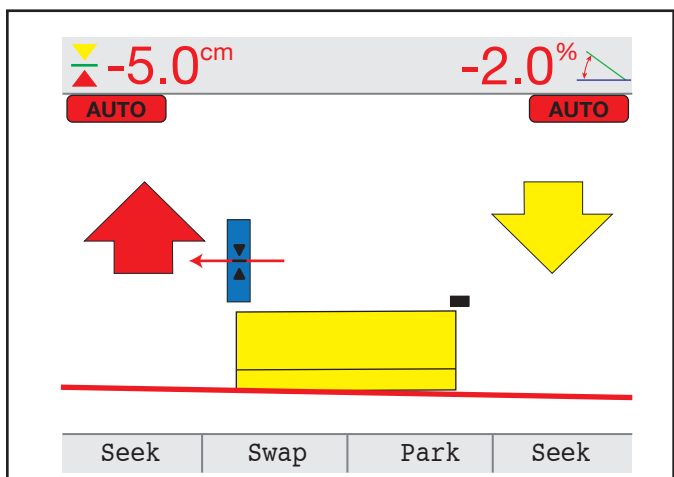


Figure 3-13. Selecting sensor.

A cross slope is selected on the right channel and on the left side a Laser Receiver is selected.

Setting a Reference Height

Inspection

When a sensor is selected the control panel automatically uses the last set reference height for that sensor.



There are two ways to change the reference:

- Manual mode
- Seek mode

Manual mode

Use the  /  keys to change the reference height up or down.

Seek mode

Press the  and  keys simultaneously to enter the seek mode. In seek mode the screen shows the current sensor value of the selected sensor.

Pressing both keys simultaneously again exits the seek mode.

Or press  for seek mode.

While in Seek Mode, the height values at the top of the screen will be green.

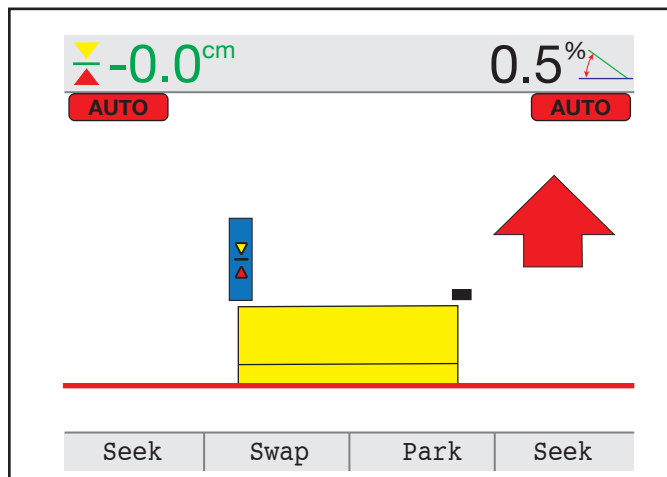




Figure 3-14. Seek Mode.



NOTE: If both keys are pressed, and held for more than three seconds, the control panel will take the current sensor value and store as the new reference height.

Absolute height

Press and hold the Seek function key. At the same time, adjust the offset using the  and  keys. Once the desired offset has been reached, release the Seek function key and the offset number will be saved.

Automatic detection of the laser beam

For systems with a PowerMast, entering seek mode will start an automatic search for the laser beam.

If the Laser Receiver is out of beam the operator can select in which direction the mast should start moving to look for the laser beam using the  and  keys. The mast will move in that direction until the Laser Receiver has the beam centered.

If the mast, during a seek reaches its top or bottom limit it will automatically reverse direction, and continue to seek for the laser beam until it is found or it hits the next end point.

The mast will automatically exit seek mode when the laser beam is found.

TRI-SONIC SENSOR

Installation and Set Up Tri-Sonic Sensor

Mounting the Tri-Sonic

The Tri-Sonic can be installed quickly and easily. Mount a support in a suitable location that is adjustable for height and lateral motion. This will enable setting up of the Tri-Sonic over any reference. The support may differ according to the machine and reference.

NOTE: In case of large differences in temperature between the storage and working environments, allow 30 minutes for the sensor to adapt to the working environment prior to operation.

The direction of movement of the Tri-Sonic sensor

While ground and curb scanning, the Tri-Sonic should move longitudinally for the averaging of the scanned values.

For Stringline and Edge the Tri-Sonic should be placed at an angle of 90° to the reference with the face plate orientated to back of the machine.

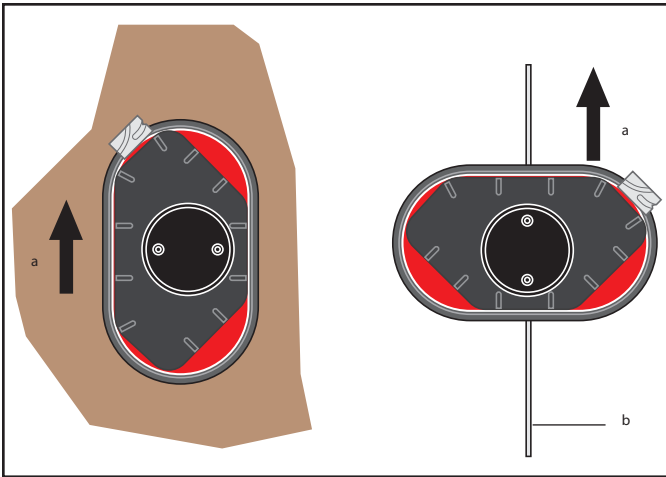


Figure 3-15. Ground-sensing and String modes.

1. Working direction.
2. Stringline.

Stringline and Edge sensing For stringline sensing, the Tri-Sonic must be positioned across the reference wire. The Automatic Side Shift control of the Tri-Sonic will keep the sensor always over the reference using the hydraulics of the third valve section to regulate the Blade in and out.

Mounting the Tri-Sonic on the support

Normal Operation

1. Release the clamping screw on the support.
2. Insert the round centering pivot on the top of the sensor housing vertically into the support.
3. Rotate the sensor to the required sensing mode (refer to previous page).
4. Lock the centering pivot of the sensor with the clamping screw.

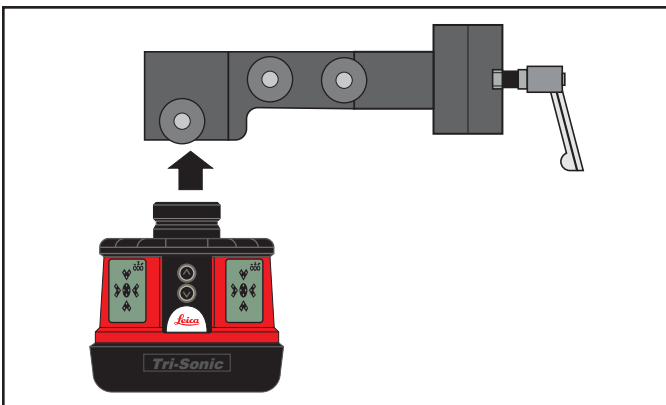


Figure 3-16. Normal Operation.

Edge Operation

For sensing curb-edge it is important for best performance to tilt the sensor slightly towards the edge, as shown in the picture. Slacken the knob on the bracket, tilt the bracket and tighten the knob again.

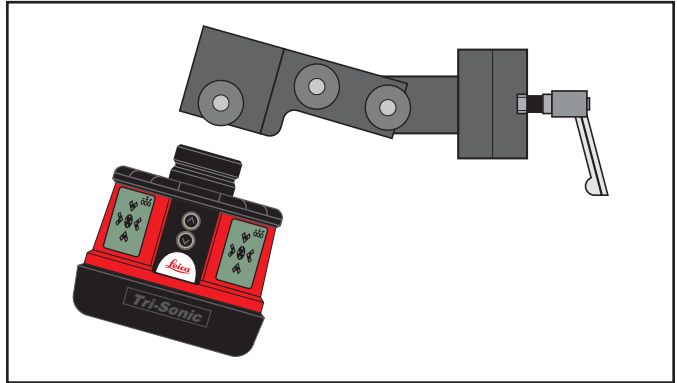


Figure 3-17. Edge Operation.

⚠ CAUTION

System Components can protrude from the machine, which could lead to bodily injury and/or product damage.

Precautions: Exercise caution in operation to avoid striking any objects or persons near the working area.

Operation with the Tri-Sonic Sensor

PowerGrade system flexibility

Multifunctional and multi task - PowerGrade system can be operated in various combinations for the most demanding job requirements.

Mount the Tri-Sonic

Mount the Tri-Sonic to the appropriate height for its maximum performance according to the reference used. The sensing range shows the minimum and maximum values possible, wherever it can be achieved to obtain the range of best performance.

Sensing range

Reference	Sensing Range	Best Performance
String	15-36 inch (38-91 cm)	24 inch (60 cm)
Edge	15-36 inch (38-91 cm)	24 inch (60 cm)
Flat ground	15-99 inch (38-250 cm)	24 inch (60 cm)

Reference ground

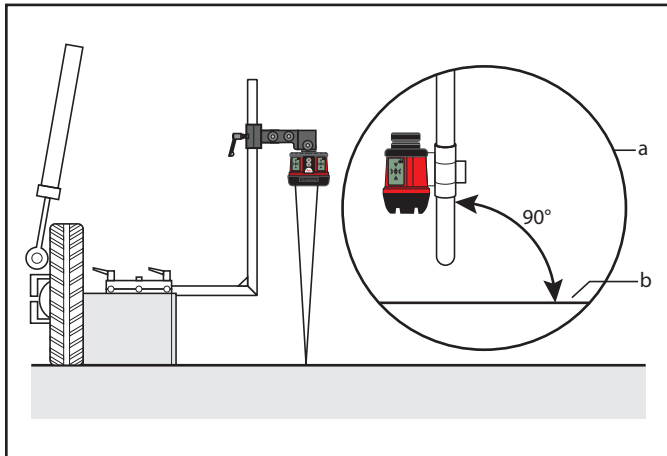


Figure 3-18. Reference Ground.

1. Side View
2. Ground

Reference stringline

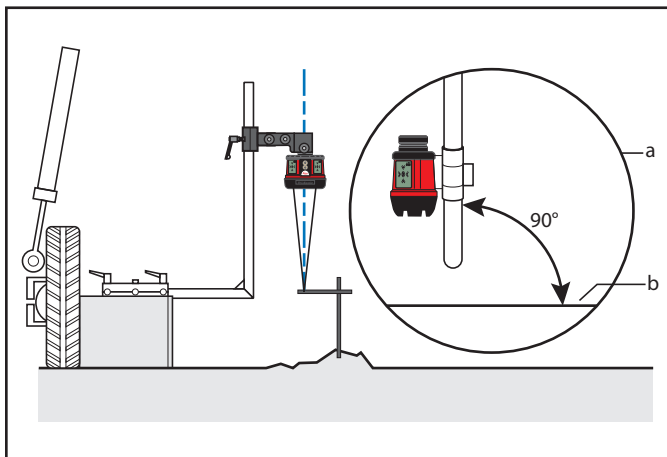


Figure 3-19. Reference Stringline.

1. Side View
2. String

Reference edge

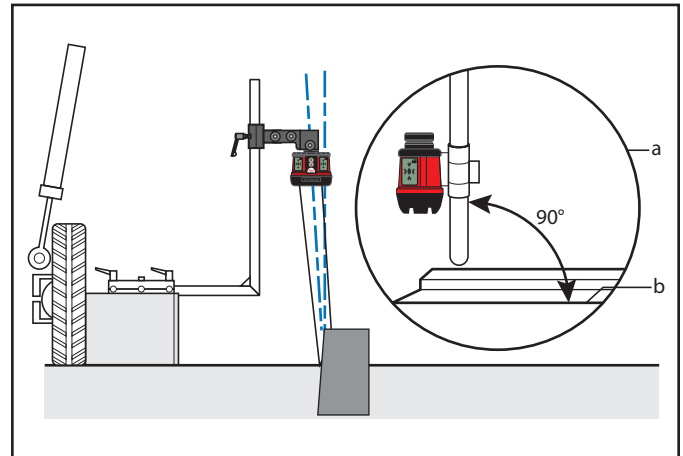


Figure 3-20. Reference Edge.

1. Side View
2. Edge

Setting up the Tri-Sonic

When setting the Tri-Sonic sensor over a reference (string, curb, or previous pass), the best performance will be achieved when the sensor is positioned square to the reference (not turned or leaning).

Setup over a curb

When setting the Tri-Sonic sensor over a curb, it is generally recommended to use the GROUND mode and use the flat surface of the gutter as the reference as shown here.

Setup over an EDGE

Use of the curb edge as a reference requires extra care be taken to ensure a proper distance and control of PowerGrade system. Unlike a string or a flat surface, a curb edge can present some special problems. It is best that this mode be used only by experienced operators.

Over any reference

It is important to rotate and roll the blade of the motorgrader to its approximate working position before setting and adjusting the Tri-Sonic sensor, the blade edge, and the reference.

Using Tri-Sonics

The Tri-Sonic can also measure the horizontal distance to a stringline or curb-edge and therefore it can be used to control moldboard side shift on a motorgrader.

To do that, complete the following steps:

1. Place the machine so that the Tri-Sonic is above ground, the edge or stringline. The sensor needs an edge or string to follow before it can control the side shift.
2. Move the blade to the working position.
3. Move the Tri-Sonic to a good working height. This is 40-70 cm above the reference.
4. Select the Tri-Sonic on the same side as where it is mounted and connected to the Junction Box on the machine.

- Ground mode (for referencing to a smooth earth or paved surface adjacent to the machine).
- Edge mode (for referencing for example a curb edge).
- Stringline (for referencing a stringline).


Press the  or  key to toggle between the modes. Once selected press the  key.

NOTE: You can also toggle between the modes by pressing left keys.

Use the right  or left  key to toggle between the following screens:



Figure 3-21. Using Tri-Sonics.

5. Enter the Tri-Sonic menu. First press the  key, then press the Adjust function key.

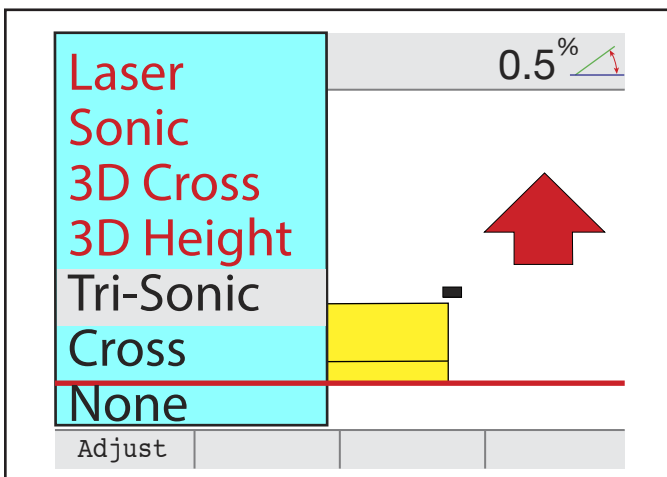


Figure 3-22. Selecting Tri-Sonic.




Select between the different modes:



Figure 3-23. Setting up Tri-Sonics.

Stringline describes the window where the Tri-Sonic will work within certain range. All readings outside of this range will be ignored.

Sideshift works only with the modes Edge and Stringline.

6. Press both  and  keys simultaneously to set the control panel in seek mode, or use the **Seek** function key.
7. Check that the height is approximately 40-70 cm.
8. Press the **Seek** function key and keep it pressed for three seconds to set the reference height.
9. Press the  key on the Tri-Sonic side to set the machine in **Auto-Mode**.
10. Press the **SS A/M** function key to enable the automatic sideshift control. The display will then indicate which channels are under Auto control as follows:

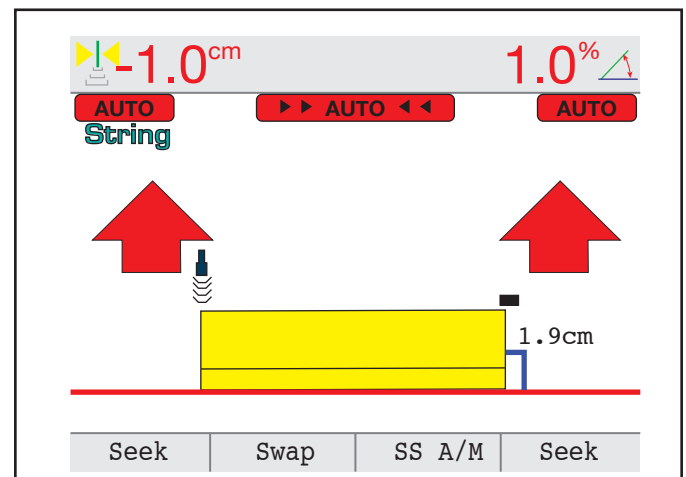


Figure 3-24. Tri-Sonic Auto Mode.

Tri-Sonic Swap Function

Set up and operation

The swap function allows the operator to quickly and easily swap sensors, turn the machine around, and grade in the opposite direction by following the previous pass.

There are two levels to the swap function available:

- **Level 1:** Swap the cross slope by inverting the actual target cross slope and swap the side of the motorgrader that is controlled by the cross slope sensor.

For example: +2,3% -> -2,3%

- **Level 2:** Swap the cross slope by inverting the actual target cross slope and swap the side of the motorgrader that is controlled by ultra-sonic.

Level 1

By pressing **F4** / **Seek** the actual target slope will be inverted.

Level 2

Requirements: Two Tri-Sonic sensors must be connected and the system must be in motorgrader mode.

1. Move the motorgrader to a flat level ground.
2. Set the moldboard level with the machine.
3. Select slope on left side and sonic on right side. Choose ground mode for the Tri-Sonic.
4. Manually set the cross slope of the blade to level.
5. Set the height for the right sonic by pressing and holding **F3** / **Seek** for 2 sec.
6. Press **F1** / **Swap** and the sensors will switch sides.
7. Set the height for the left sonic by pressing and holding **F2** / **Seek** for 2 sec.

The machine is now ready for the final grade following the previous pass.

NOTE: It is possible to have different Working Offsets and mode settings for the two Tri-Sonic sensors.

Using the Laser Receiver

LASER RECEIVER

The Laser Receiver is used to measure the elevation of the blade. This is done by measuring the distance from where the laser beam is hitting the laser and the center line on the Laser Receiver.

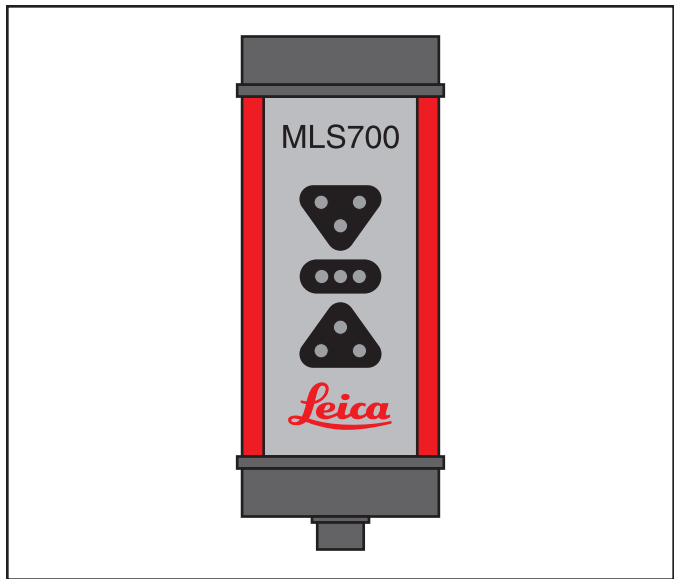


Figure 3-25. Laser Receiver.

When the Laser Receiver detects a laser beam this is indicated on the display by a red line through the laser icon.

If at some point the laser beam is lost while the control panel is set in auto mode, it will give a beep and a text message saying No laser beam will appear.

NOTE: Never adjust the Laser Receiver height while the panel is in automatic mode.






Laser Receiver and manual mast

To use the Laser Receiver with a manual mast for controlling the elevation of the blade complete the following steps:

1. Select the Laser Receiver on one of the sides.
2. Place the cutting edge of the blade at the desired height.
3. Move the mast up or down until the Laser Receiver detects the laser beam. Continue to move the mast until the indication LEDs on the Laser Receiver show a green line.
4. Press the **Auto** key to set the machine in Auto-Mode.
5. When the control panel is in Auto-Mode the machine will start to move the raise/lower hydraulic cylinders so that the laser beam always is in the center of the Laser Receiver.

Laser Receiver and power mast



To use the Laser Receiver with a power mast for controlling the elevation of the blade complete the following steps:

1. Select the Laser Receiver in one or both of the sides.
2. Place the cutting edge of the blade at the wanted height.
3. Enter seek mode by pressing the **Seek** function key.
4. Press the  or  key to tell the mast in which direction it should start to seek. The mast will move in the given direction until the Laser Receiver detects and places the laser beam in the center of the sensor.
5. Press the  key to set the machine in Auto-Mode.
6. The  and  keys can now be used to set an offset by moving the mast up or down, changing the elevation reference.

Zero the Set-Point

Press and hold for only two seconds the **Seek** function key. The set-point and offset values will be reset to 0.00.



Offset the Set-Point

Press and hold the Seek function key. At the same time, adjust the offset using the  and  keys. Once the desired offset has been reached, release the Seek function key and the offset number will be saved.

NOTE: While in Link mode (see below), both set-points will be adjusted.

Link mode when using two power masts and laser receivers

This feature will link together two Laser Receivers on power masts so that their control will match a laser reference with a predefined cross-slope.

To enable this mode, select Laser on both the right and left side and press the Link function key. The masts will retract to their lowest position and then return to their original location. Adjusting offset height with either left or right set of  and .

keys will change the height of both power masts. While in Link mode, the display will have a black line marked linked between the laser receivers.

While in Link mode, pressing the **Seek** function key will initiate a laser search on the left power mast. Once the laser beam has been located, the right power mast will move to the correct height.

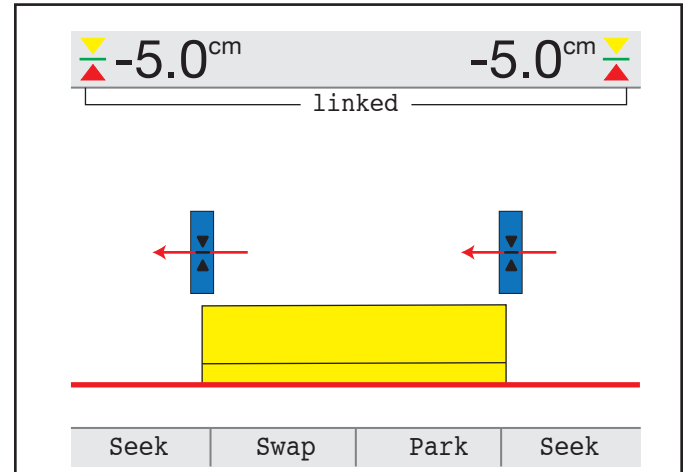


Figure 3-26. Link Mode when using two power mast.

Reset feature for the laser receiver

When using a laser receiver it is possible to relocate the laser strike set-point to the centre of the laser receiver using the **Reset** function key. The key will appear only if an MLS700 is connected.

Park feature for power masts

This feature allows for easier access to remove the laser receivers at the end of the working shift. It also affords extra protection for the masts when the machine is left unattended overnight, or during transport to another job site.

Pressing the Park function key will return the respective power mast to its lowest position.

While linked, both masts will lower and synchronization will be disabled.

3D Sensors

How to set 3D sensors

To select 3D Height, press the **left or right (sensor) key** once, and then press the Adjust function key to enter the adjust menu.

NOTE: That only the currently selected sensor in either left or right side will be adjusted.

If the 3D system is configured to indicate which sensor is currently in use, select **AUTO**.

If not, then select either **TRACKER** or **GPS** from the menu.

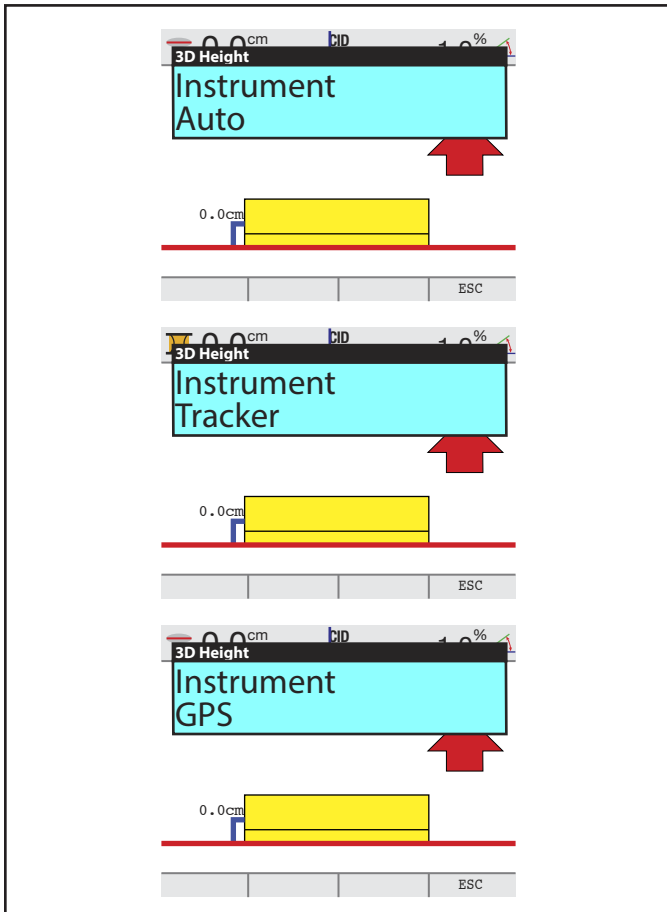


Figure 3-27. 3D Sensors.

Once **Auto / GPS / Tracker** is selected, it is required to **EXIT** from this menu for the change to take effect and then re-enter the menu to adjust gains.

Tracker and GPS 3D control modes typically give different hydraulic response/behaviour.

Gains need to be set for either GPS or Tracker depending on which sensor is used. If **AUTO** is selected, the PowerGrade will use the appropriate gains set in the Tracker and GPS settings.

Use the right arrow key to enter the gains settings.

Refer to chapter “2.6 Setting the Value for Gain and Deadband” for configuring Gains.


To select 3D Slope, press the **left or right (sensor) key** once, and then press the **Adjust** function key to enter the adjust menu.

NOTE: That only the currently selected sensor in either left or right side will be adjusted.





Setting the Value for Gain and Deadband

Adjust the gain and deadband

To adjust the gain and deadband of each of the sensors complete the following steps:

1. Press the left or right  key once, and then press the **Adjust** function key to enter the adjust menu.

NOTE: That only the currently selected sensor in either left or right side will be adjusted.

2. Use the  or left  key to scroll through the settings.
3. Use the  or  key to change the value.
4. To exit the adjust menu press the menu key.

Deadband

The deadband controls the precise motion of machine hydraulics. These values do not correspond to accuracy but only to hydraulic speeds. These values should not be confused with overall machine performance and/or precision.

Adjust the deadband for each receiver. This is done in the adjust menu for each receiver.

Below are the default values. Consult technical support prior to adjusting.

Sensor	Dozer	Grader
GPS	1.0 cm	1.0 cm
Laser	0.7 cm	0.7 cm
Cross slope	0.6 %	0.3 %
Tracker	0.5 cm	0.5 cm
Sideshift	---	2.0 cm

Gain

This is the scaling of hydraulic speeds for each of the sensors. These values should be measured at the initial calibration but can be fine tuned as needed (heavy or rough material, wet dirt, fine grading, etc.).

To enter **Gains** select the **Lower Left** or **Lower Right** buttons to open up the available sensors.

Select appropriate sensor and then the **F1** or **F4** key (depending on left or right side) to enter the **Adjust** Menu.

Adjust the gain of the hydraulic system for each sensor. This is done by pressing the **2s** button in the adjust menu for each sensor. This will control the hydraulics upwards for two seconds. Revert if necessary using the **Revert** function key.

NOTE: Please follow the on-screen instructions!

Elevation:

Press the **2s** button to adjust the value so that it corresponds to the below distances. A simple tape-measure or ruler can be used to gauge the actual blade movement (taking great care around the machine). For example, after pressing the **2s** button, the blade should move approximately 15 cm for GPS.

Sensor	Dozer	Grader
Laser/Sonics/Tri-Sonics/GPS	15 cm	13 cm
Tracker	8 cm	7 cm

Second laser for cross slope on dozer:

This should be measured 1.5 meters from the centre of the blade. Press the **2s** button to adjust the value so that it corresponds to 8 cm for a laser sensor controlling tilt on a dozer.

2D and 3D cross slope sensor:

This should be measured 1.5 meters from the centre of the blade. Press the **2s** button to adjust the value so that it corresponds to the below distances. For example, the blade should move 7 cm for 3D cross-slope.

Sensor	Dozer	Grader
2D and 3D cross-slope	7cm	14cm

Sideshift (Grader only):

Enter the Tri-Sonic or 3D height adjust menu. Press the **2s** button to adjust the value so that it corresponds to the below distances. 2D and 3D sideshift: 13 cm

Receiver Calibration Wizard

Enter the sensor calibration wizard

In order to maintain the correct calibration of the sensors, the Sensor Calibration Wizard should be run periodically due to blade wear. This should also be done when changing the blade, wear edges or changing tires on a grader, as this will change the mainfall slope.

This is done by entering the calibration wizard:

Menu -> Calibration -> Sensor Calibration and following the on-screen instructions.

Sensor calibration

1. Select Receiver calibration. Follow the on-screen instructions to calibrate each receiver. The following example is for graders, but the dozer sensor calibration is similar.

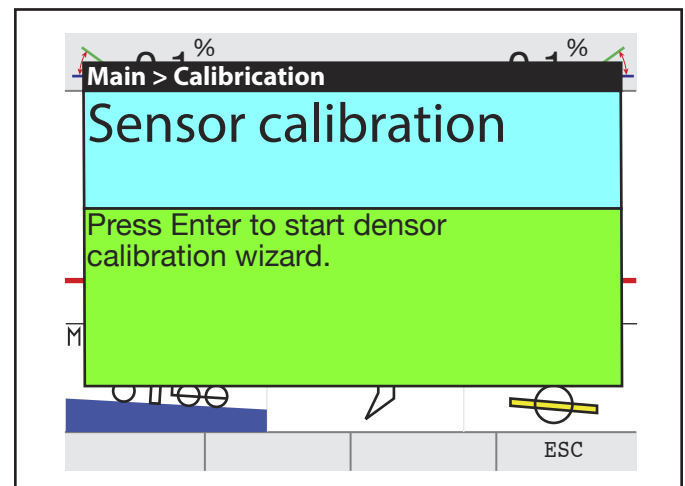


Figure 3-28. Sensor Calibration.

If any sensors are not installed or not connected, a warning screen will appear.

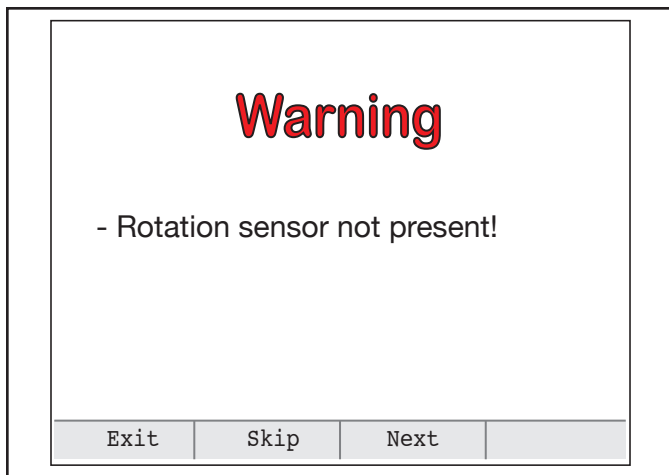


Figure 3-29. Rotation Receiver not present.

2. Park the machine on a flat, hard and level surface, preferably a paved road or similar. This will facilitate turning the machine around and facilitate proper machine alignment. If the machine is already aligned properly and is ready for calibration, skip ahead by pressing **Skip**. To start, press **Next**.

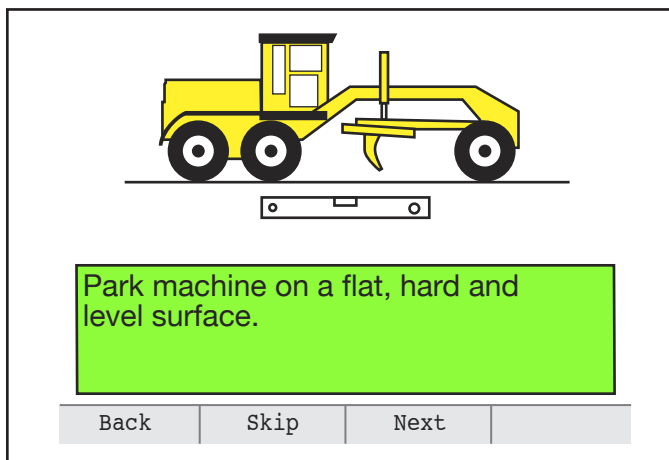


Figure 3-30. Park machine on flat surface.

3. Straighten the machine's front wheels and articulation. This ensures correct values for calibrating the main fall sensor. Press **Next** when complete.

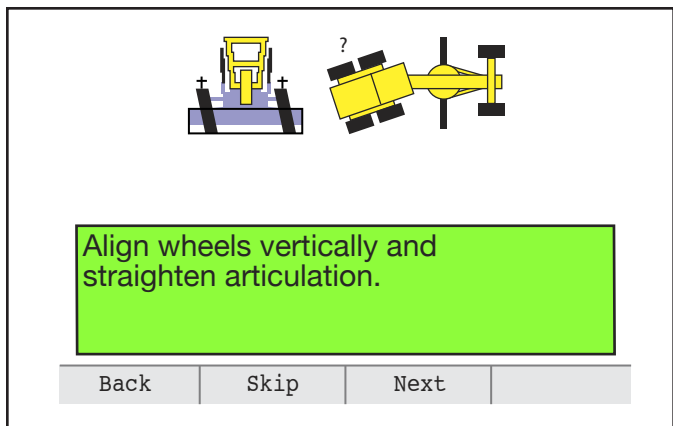


Figure 3-31. Straighten machine's front wheels.

4. Centre the machine link bar. It must be set in its centred position for proper Cross Slope calibration. Press **Next** when complete.

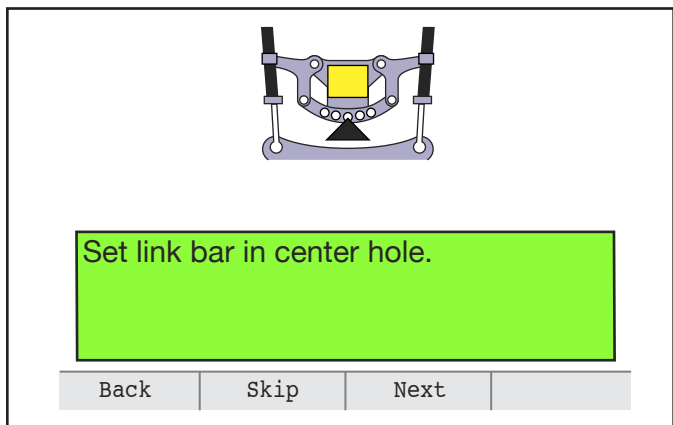


Figure 3-32. Center the machine link bar.

5. Centre the blade sideshift, ensuring that the distance from the machine base to the blade tip is the same on both sides. This is important for the measurements in the next step. Press **Next** when complete.

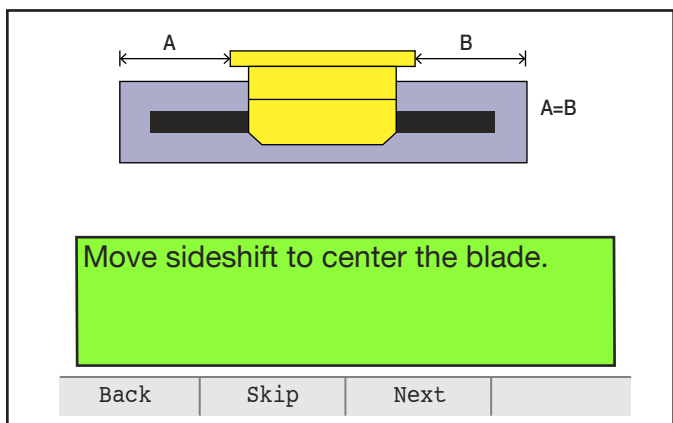


Figure 3-33. Center the blade sideshift.

- Rotate the blade so that the distance from the swivel to each blade tip is the same. This ensures that the blade is perfectly perpendicular to the axis along the machine. This is important for the correct calibration of the rotation sensor. Press **Next** when complete.

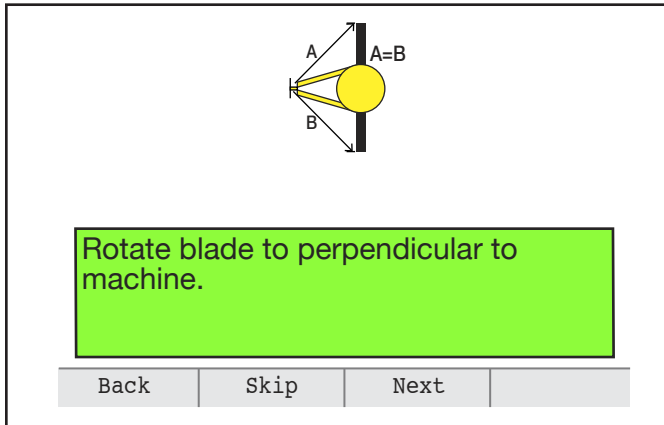


Figure 3-34. Rotate blade to perpendicular to machine.

- Mark the positions of the wheels on the ground and place the blade gently on solid blocks or other solid reference, ensure that the blade has not rotated or that sideshift has been altered. Press **Next** when complete.

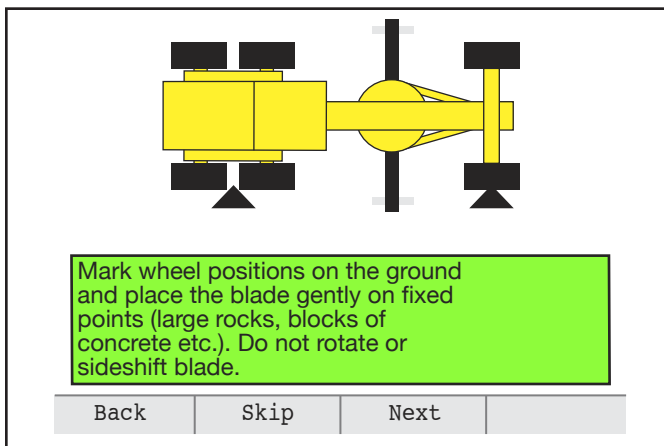


Figure 3-35. Mark positions of the wheels.

- The rotation sensor will automatically calibrate, while at the same time collecting Mainfall and Cross Slope data. Press **Next** when complete.

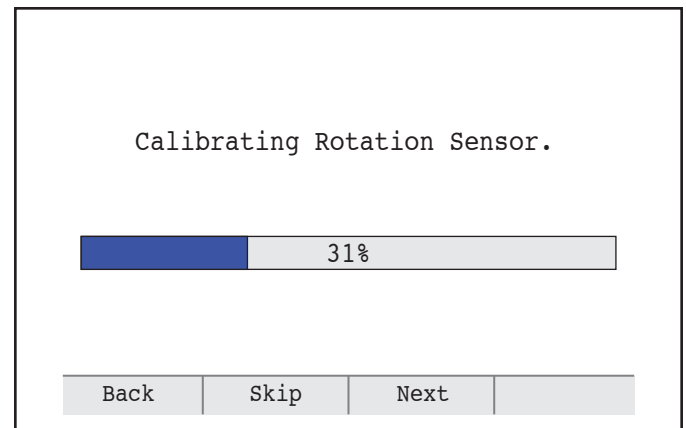


Figure 3-36. Calibrating Rotation Receiver.

- Turn the machine around and place the blade gently on the same blocks or reference as before, ensuring that the blade is not rotated or sideshift has altered. Align the wheels using the markings from step 7. This is important for the correct measurement of the Mainfall and Cross Slope values. Press **Next** when complete.

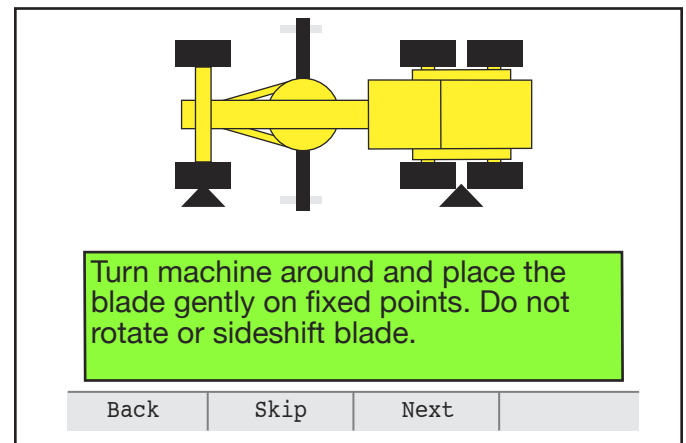


Figure 3-37. Turn the machine around and place the blade gently on the same blocks.

- The Mainfall and Cross Slope sensors will now be calibrated automatically. Press **Next** when complete.

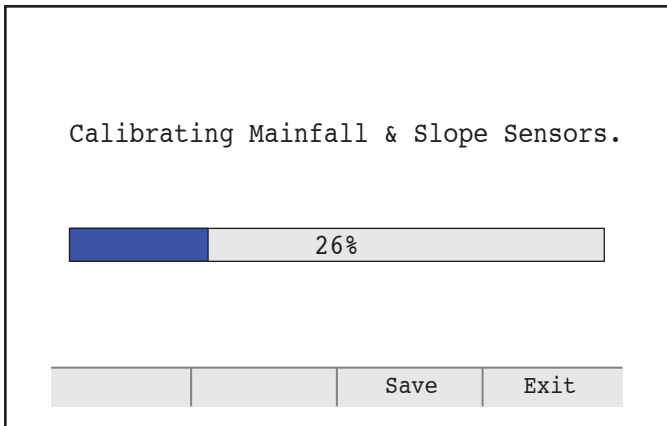


Figure 3-38. Calibrating Mainfall & Slope Receivers.

11. The calibration routine is complete. Save the calibrated values and exit the wizard by pressing **Save**. To exit the wizard without saving, press **Exit**.

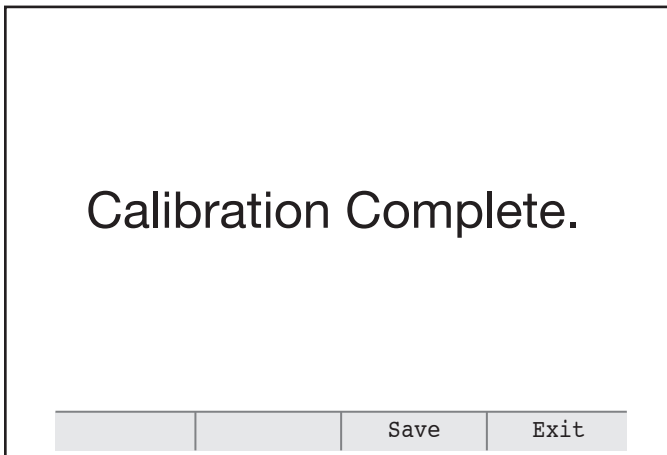


Figure 3-39. Calibration Complete

CABLES

The cables are provided to connect the various components together into a system. Each connector uses a unique number of pins to prevent the components from being connected incorrectly. At the Control Panel, each cable uses a press-and-twist style of connector. After the cable is pressed into the socket, twist the ring clockwise until tight to secure it.

⚠ CAUTION

Never force a connector into a socket.

⚠ CAUTION

All cables must be secured with adequate cable length to avoid pinching, stretching and tight bending. Do not clamp cables to pipes or hoses that may generate high heat.

Cable Configurations

Power Cable - supplies power to the system.

NOTE: The Control Panel supports both 12 and 24-volt machine systems. However, the valve is 12 volts only. Contact ATI Corporation for additional information when using a 24-volt system.

Receiver Cables (2) - power the Receiver and communicate grade information between each Laser Receiver and the Control Panel. The connector attaches to the junction block end of the receiver cable and the straight end to the Laser Receiver(s). These are coiled cables that can hang freely between the Junction Box and Laser Receiver mounted on the mast.

Solenoid Cable - communicates grade information between the Junction Box and the hydraulic valve. There is one connector for the Junction Box and four connectors for the valve. One connector goes to each valve solenoid. Labels located on the cable identify the solenoid to connect to.

NOTE: Contact your local Leica Dealer for any questions about pin locations or configurations.

CONNECTOR (2 Socket to Junction Box) CABLE 20 feet (6 meters)

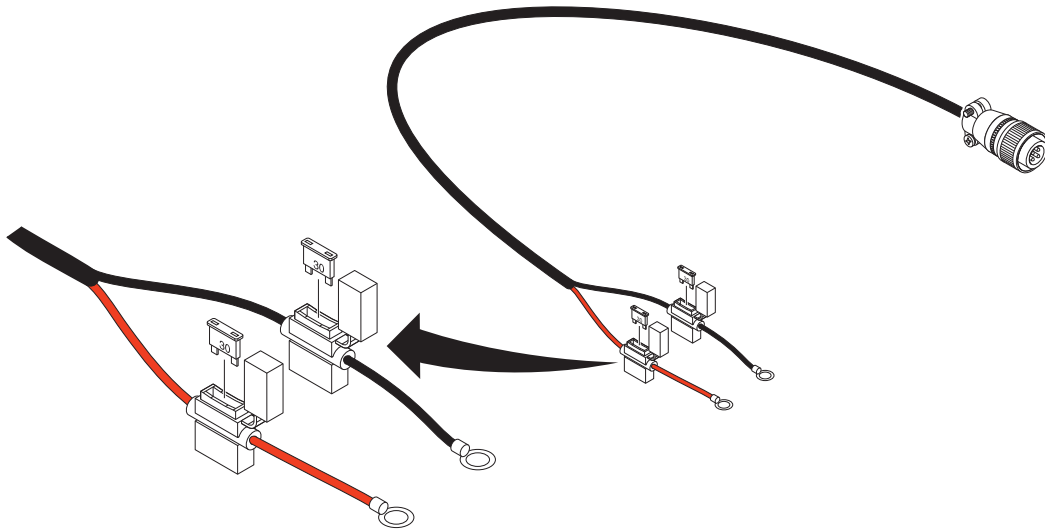


Figure 3-40. Power Cable Detail.

CONNECTOR (4 Socket to Junction Box) CONNECTOR (4 Socket to Receiver) CABLE 9 feet (2.7 meters)

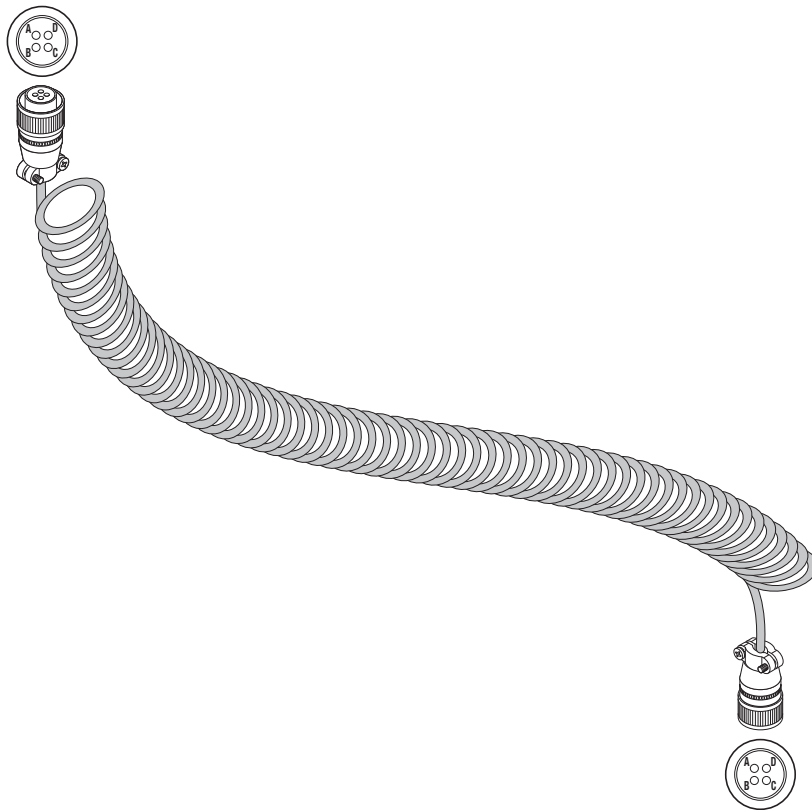


Figure 3-41. Receiver Cable Detail.

CONNECTOR (5 Pin to Junction Box) CONNECTOR (2 Socket to Valve) CABLE 12 feet (3.6 meter)

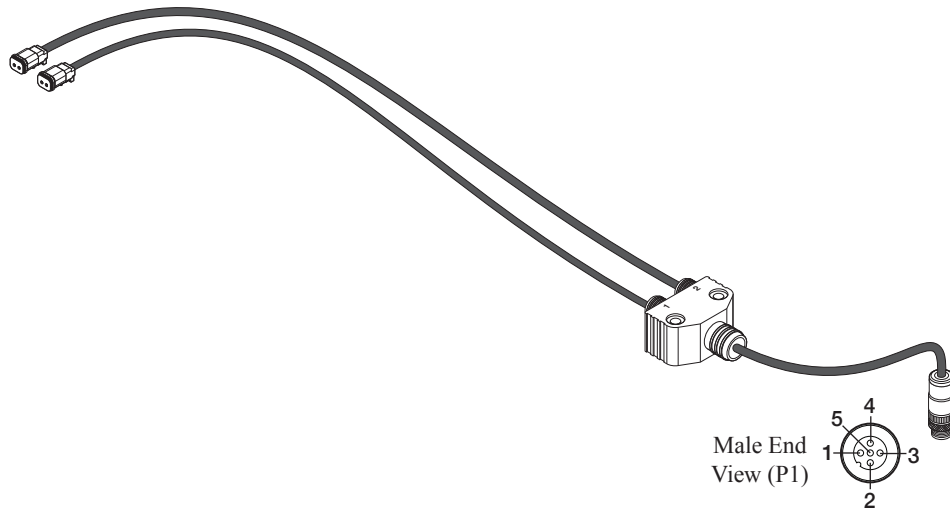


Figure 3-42. Solenoid Cable Detail.

TECHNICAL DATA

PowerGrade Technical Data

NOTE: The PowerGrade system is designed to operate from standard vehicle power systems at 24V DC - check to ensure proper connection and polarity.

System accuracy

± 3mm (Standard Deviation) Depending on sensors in use, atmospheric condition, machine condition, machined material.

Control Panel

Parameter	Specification
Voltage range	24 V DC Nominal Voltage, Range 10 V-30 V
Power consumption	< 200 mA
Graphic display	3.5" LCD colour screen
Keypad	18 keys, with backlight
Interfaces	Infrared
Dimensions	12.5 x 18.0 x 3.7 cm
Weight	0.5 kg

Cradle

Parameter	Specification
Voltage range	24 V DC Nominal Voltage, Range 10 V-30 V
Power consumption	< 2.5 A with control panel connected and no load at 12 V
Dimensions	12.4 x 15.2 x 4.4 cm
Weight	0.320 kg
Communication (Infrared)	1 Mbit
Output	2x RS232, RX, TX, 12V/2Amp, GND, 2 x MikroCAN and J1939

Junction Box

Parameter	Specification
Voltage range	24 V DC Nominal Voltage, Range 10 V-30 V
Power consumption	< 0.5 A with no sensors and valve connected
Dimensions	13.8 x 18.3 x 6.4cm
Weight	2 kg
Hydraulic Output Settings	Proportional valves, On/Off and Danfoss
Interfaces Dozer	Battery MIL Cradle M12 Valves M12 CAN A MIL CAN B MIL CAN A M12

MUS1300 Tri-Sonic

Parameter	Specification
Dimensions	17.2 x 18.3 x 14 cm
Weight	2.5 kg
Accuracy	within ± 0.125 cm @ 30.5 cm
Input voltage	11 to 30 V DC
Power Consumption	0.5 A max.

MPM700 PowerMast

Parameter	Specification
Voltage range	24 V DC Nominal Voltage, Range 10 V-30 V
Power consumption	< 2.5 A
Mast height (extended)	2.9 m
Mast height (retracted)	1.7 m
Mast travel	1.2 m
Mast travel speed	85 mm per second
Positions repeatability	± 1 mm
Weight	30 kg

Manual Mast

Parameter	Specification
Height (extended)	3.257 m
Height (retracted)	1.857 m
Travel	1.4 m
Scale	Metric/Inch
Weight	14 kg

MLS700 Laser Receiver

Parameter	Specification
Voltage range	24 V DC Nominal Voltage, Range 11 V-30 V
Power consumption	< 500 mA
Dimensions	28 x 12 x 7.2 cm (without mounting bracket)
Weight	2.5 kg (incl. clamp)
Detection angle	360°
Linear detection height	190 mm
Operating range	300 m radius
Sensor pick-up range	18.5 cm
Laser requirement	All Rotating Lasers (HeNe or Infrared Laser diodes visible and invisible)
Pulsed display	5 pulses per second

Cross Slope Sensor

Parameter	Specification
Voltage range	24 V DC Nominal Voltage, Range 10 V-30 V
Power consumption	< 0.25 A
Dimensions	15.3 x 8.7 x 3.9 cm
Weight	0.855 kg
Accuracy cross slope	±0.1 % slope at ±25°
Working range	190 mm
Operating range	±80°
Interfaces	CAN MIL

Rotation Sensor

Parameter	Specification
Voltage range	24 V DC Nominal Voltage, Range 10 V-30 V
Power consumption	< 0.25 A
Dimensions	Ø16.0 x 22.6 x 5.9 cm
Weight	1.56 kg
Working range	0-360°

Environmental Specifications

Temperature

Type	Operating temperature [°C]	Storage temperature [°C]
PowerGrade control panel	-20 to +60	-30 to +70
PowerGrade cradle	-20 to +60	-30 to +70
Junction box Grader	-20 to +60	-30 to +70
Junction box Dozer	-20 to +60	-30 to +70
MPM700 PowerMast	-20 to +60	-30 to +70
MLS700 Laser receiver	-20 to +60	-30 to +70
MUS1300 Tri-Sonic	-20 to +65	-40 to +85
Cross slope sensor	-20 to +60	-40 to +80
Rotation sensor	-20 to +60	-40 to +80

Protection against water, dust and sand

Type	Protection
PowerGrade control panel	IP67
PowerGrade cradle	IP54
Junction box Grader	IP67
Junction box Dozer	IP67
MPM700 PowerMast	IP45
MLS700 Laser receiver	IP68
MUS1300 Tri-Sonic	IP54
Cross slope sensor	IP68
Rotation sensor	IP67

Humidity

Type	Protection
PowerGrade control panel	Max 95 % non condensing. The effects of condensation are to be effectively counteracted by periodically drying out the instrument.

TROUBLESHOOTING

SYMPTOM	POTENTIAL CAUSE	REMEDY
Control Panel lamps do not light.	Control Panel not turned on.	Toggle the Power Switch upward (I i).
	Power Cable not connected to Control Panel.	Connect power cable to Control Panel.
	Power Cable not providing power to the Control Panel.	Check that the Power Cable is connected to the battery. The red wire connects to the positive (+) post and the black wire connects to the negative (-) post.
	Fuse blown.	Remove the Power Cable from the Control Panel and use a volt meter to check for 12 volts DC.
	Electrical short.	Check the fuse. Disconnect all cables except the Power Cable. If the lamps still do not cycle when the Control Panel is turned on, contact the local Apache Technologies dealer.
Laser Receiver does not display grade.	No Rotating Laser in range.	Ensure Laser Receiver is within operating range of Rotating Laser.
	Laser beam blocked.	Ensure beam is striking middle of the Laser Receiver Check and clean glass covering the Laser Receiver's photo cells.
	Laser Receiver not receiving power.	Check for obstructions keeping Laser Receiver from seeing the Rotating Laser.
	Electrical short.	Check Fuse in the Control Panel. Check Receiver Cable for damage. Use an Ohm meter to check continuity
		If LEDs do not cycle when Control Panel is turned On, contact the local Apache Technologies dealer.

TROUBLESHOOTING

SYMPTOM	POTENTIAL CAUSE	REMEDY
Laser Grading Box does not raise or lower.	Control Panel not turned on.	Toggle the Power Switch upward (I i).
	No hydraulic flow to Laser Grading Box.	<p>Ensure hydraulic control handle of tractor is in correct position.</p> <p>Ensure auxiliary hydraulics are ON or in continuous flow mode.</p>
	Cables not connected correctly.	<p>Check Solenoid Cable and directional valve for visible damage.</p> <p>Move directional valve spool manually using the overrides on the end of the directional valve.</p>
	Electrical Problems	<div style="background-color: orange; text-align: center; padding: 5px;">⚠ WARNING</div> <p>Be sure to stay clear of any moving parts of the Laser Grading Box.</p> <p>If the Laser Grading Box moves, refer to Electrical problems. If the Laser Grading Box does not move, refer to Hydraulic problems.</p>
	Hydraulic problems.	<p>Check the Solenoid Cable and directional valve for visible damage.</p> <p>Use an Ohm meter to check cable for continuity.</p> <p>Confirm hydraulic flow through the manifold and returning to the power source through the "T" hose.</p> <p>Contact ATI Corporation for help troubleshooting the hydraulic manifold.</p>
Laser Grading Box moves in opposite direction.	Hydraulic flow reversed.	<p>Confirm the pressure is going in the "P" port.</p> <p>Verify control handle is moving in desired direction.</p>

TROUBLESHOOTING

SYMPTOM	POTENTIAL CAUSE	REMEDY
Laser Grading Box does not seem to cut even across passes.	Control Panel to valve body connections are reversed.	Reverse cable connections so left-side Valve cable is connected to left-side valve body. Repeat for right side.
	Control Panel to Laser Receiver connections are reversed.	Reverse cable connections so left-side Laser Receiver is connected to the L connector on the Junction Block. Repeat for right side.
Box has trouble staying on grade.	Rotating Laser out of range.	Ensure Laser Receiver is within specified operating range of Rotating Laser.
	Laser beam being reflected.	Ensure Rotating Laser's light is not reflecting off other surfaces (windows, windshields, mirrors, etc.) causing multiple readings by the Laser Receiver.
	Multiple laser beams.	Ensure that there are no other lasers operating on the job site or nearby.
	Laser deadband set too narrow.	Ensure the On Grade Deadband is set for rough grading.
	Travel speed is too fast for grade tolerance.	Slow down.
	Hydraulic response too quick.	Decrease the Hydraulic Speed setting.
	Hydraulic flow reversed.	Confirm the pressure is going in the "P" port.

TROUBLESHOOTING

(for future use)

PARTS ILLUSTRATIONS

Parts Illustrations	5.1
Serial Number Information	5.2
Where To Get Parts and Service	5.2
How To Order Parts	5.2
List of Parts Illustrations	5.3

Serial Number Information

It is very important that the correct serial number is provided when ordering parts. The serial number plate is located on the main frame. Please mark the model and serial number of your Laser Grading Box in the space provided below in case the plate on your Laser Grading Box gets lost or damaged.

Model..... **Serial Number**

Dealer Name **Dealer Phone Number**

Where To Get Parts and Service

When replacement parts and service are required, ATI Corporation recommends returning to the dealer from which the product or optional kit was purchased. By going to the dealer, you are dealing with people that understand and know ATI products. Our dealers have the experience servicing these machines and stock the most common parts required to keep your equipment in top working condition.

How To Order Parts

Parts lists contained in this book have been prepared to help you when ordering spare and/or replacement parts. Your order will be filled promptly and accurately when the following information is provided:

1. Model and serial number of the unit. (This specifically identifies the equipment you have and permits us to verify the part numbers in your order.)
2. The parts list page number and catalog number. Include catalog revision number, if applicable.
3. The **Item** number for each part. **Item** numbers on the parts list page correspond with the numbers shown on the illustration.
4. **Part Number** as it appears in the parts list. In most cases this will be a nine-digit number; for example: 315-005-000.
5. The **Description** for the part as it appears on the parts list page.

When a complete assembly is needed, use the assembly number given in the parts list. If no assembly number is given, order by main assembly title and list only the item numbers you want. For example: "Wheel Frame Assembly per 315-509-000, Items 2 through 8, inclusive".

The part ordered may have a new part number, or the part may have been replaced by a newer design with a different part number. In these cases your acknowledgement, shipping papers and invoices will be written listing the current part number first; the old part number you referred to will follow the part description.

Our purpose in doing this is to tell you that the parts are fully interchangeable. This will avoid any unnecessary correspondence or delay in processing your order. We suggest that you add any new number to your parts lists for future use.

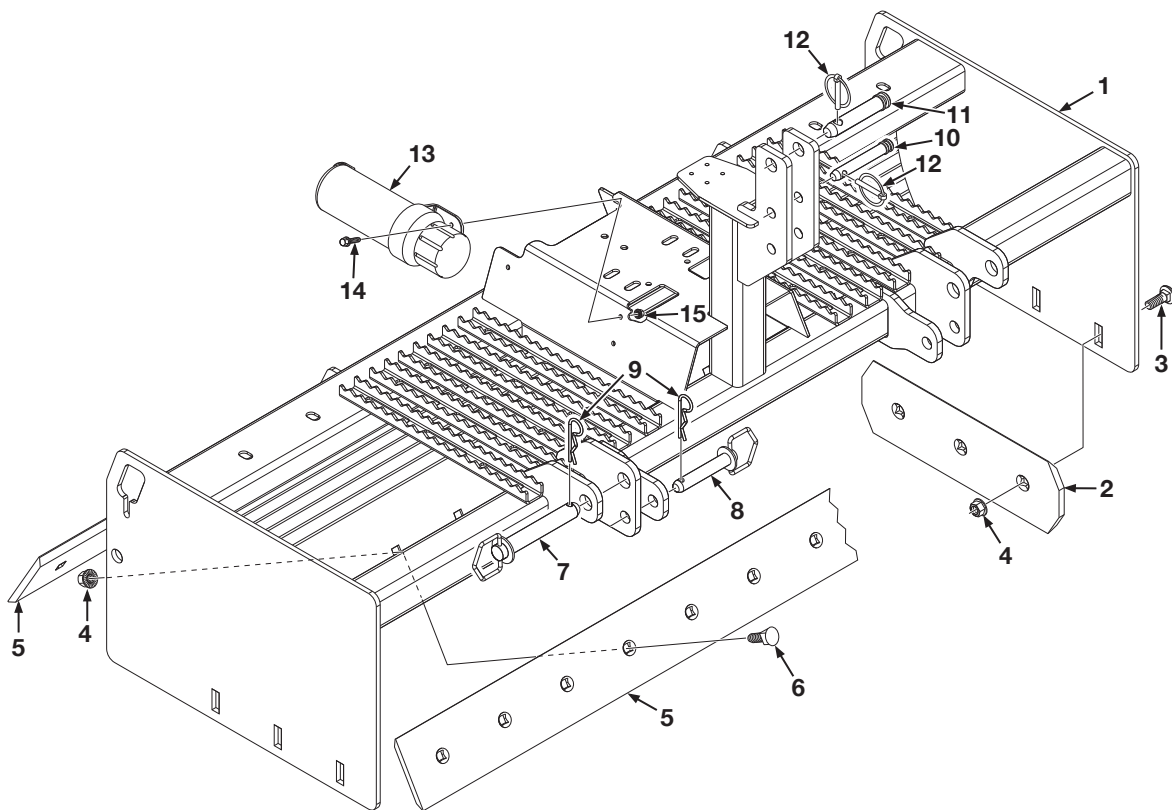
NOTE: ATI Corporation reserves the right to discontinue models at any time, change specifications, and improve design without notice and without incurring obligation on goods previously purchased and to discontinue supplying any part listed, when the demand does not warrant production.

LIST OF PARTS ILLUSTRATIONS

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PARTS ILLUSTRATIONS

Figure 5-1. Main Frame and Cutting Edges



PARTS ILLUSTRATIONS

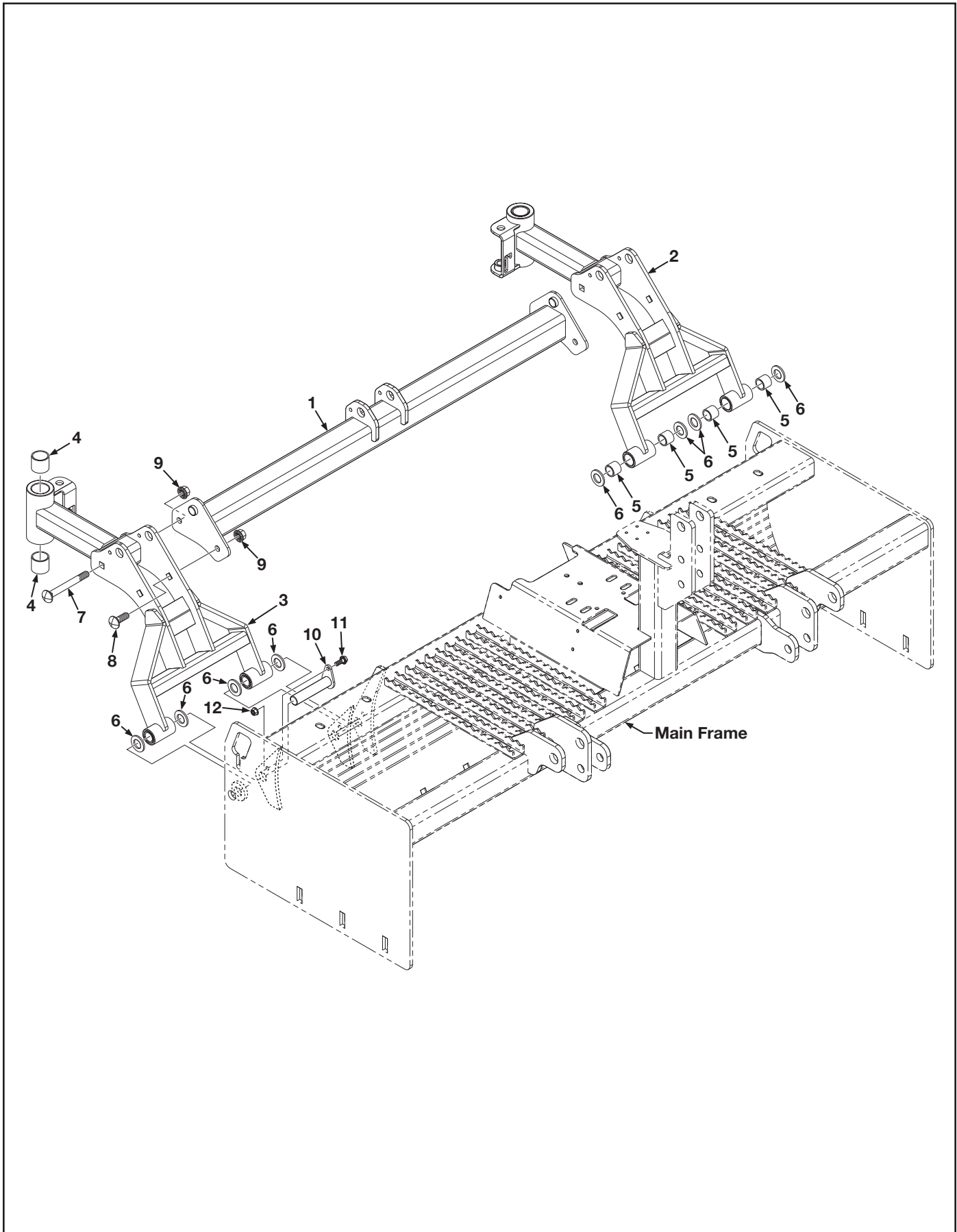
Figure 5-1. Main Frame and Cutting Edges

Item	Part No.	Qty	Description
1	315-117-000	1	Frame, Main, Tractor, 72"
	315-118-000	1	Frame, Main, Tractor, 84"
	315-119-000	1	Frame, Main, Tractor, 96"
	315-120-100	1	Frame, Main, Tractor, 108"
2	000-190-072	2	Edge, Cutting, End, DBF, 19-1/2" Long
3	000-150-256	6	Bolt, Carriage, 5/8"-11UNC x 1-1/2" Long
4	000-158-142	AR	Nut, Serrated Flange, 5/8"-11UNC
5	000-190-075	1	Edge, Cutting, DBF, 72" Long
	000-190-077	1	Edge, Cutting, DBF, 84" Long
	000-190-079	1	Edge, Cutting, DBF, 96" Long
	000-190-091	1	Edge, Cutting, DBF, 108" Long
6	000-150-258	AR	Bolt, Plow, 5/8"-11UNC x 1-3/4" Long
7	000-161-075	2	Pin, Hitch, 1-1/8" Dia. x 7" Long, Category II
8	000-161-076	2	Pin, Hitch, 7/8" Dia. x 5-1/4" Long, Category I
9	000-161-019	4	Pin, Hair, Cotter, 3/16" Dia. x 3-3/4" Long
10	000-161-081	1	Pin, Top Link, 3/4" Dia. x 5-1/2" Long, Category I
11	000-161-085	1	Pin, Top Link, 1" Dia. x 5-1/4" Long, Category II
12	000-161-028	2	Pin, Lynch, Locking, 7/16"
13	001-001-083	1	Canister, Operators Manual
14	000-150-078	3	Bolt, Serrated Flange, 5/16"-18UNC x 1" Long
15	000-158-064	3	Nut, Serrated Flange, 5/16"-18UNC

AR - As Required NSS - Not Serviced Separately ASN - After Serial No. BSN - Before Serial No. LP - Local Purchase

PARTS ILLUSTRATIONS

Figure 5-2. Wheel Frame and Related Parts



PARTS ILLUSTRATIONS

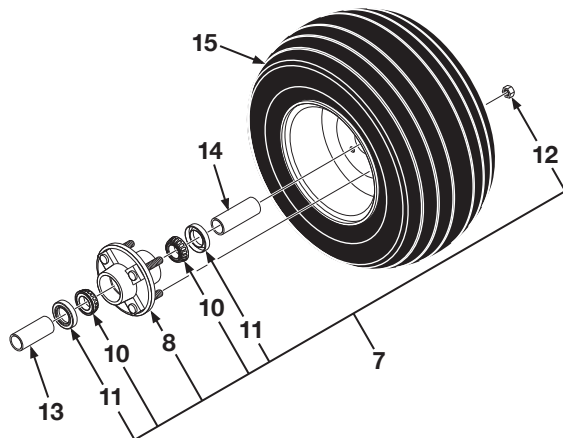
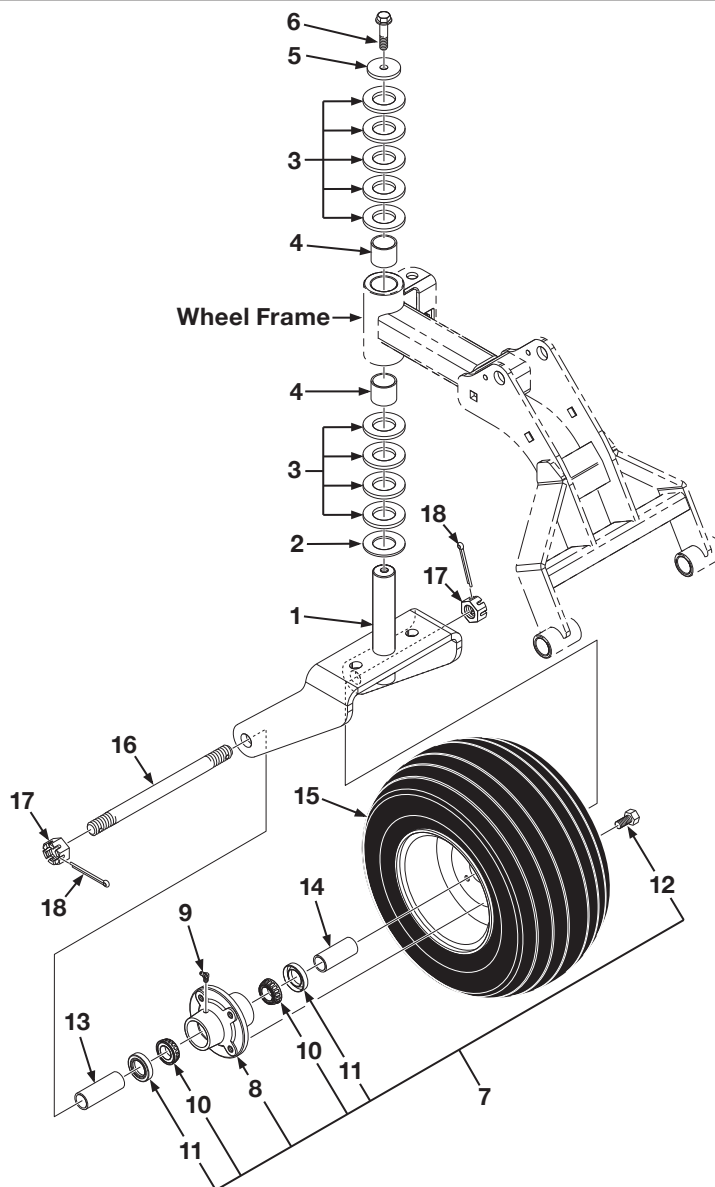
Figure 5-2. Wheel Frame and Related Parts

Item	Part No.	Qty	Description
1	315-117-310	1	Tube, Connecting, Wheel Frame, 72"
	315-118-310	1	Tube, Connecting, Wheel Frame, 84" & 96"
	315-120-310	1	Tube, Connecting, Wheel Frame, 108"
2	315-121-200	1	Frame, Wheel, Left, Includes Items 4 & 5
3	315-121-300	1	Frame, Wheel, Right, Includes Items 4 & 5
4	000-176-171	2	Bushing, Wheel Frame, 1-3/4" OD x 1-1/2" ID x 1-1/2" Long
5	000-176-174	4	Bushing, Wheel Frame, 1-1/4" OD x 1" ID x 1" Long
6	000-155-003	8	Bushing, Washer, 1-1/2" OD x 1" ID x 14 Gauge
7	000-150-288	2	Bolt, Carriage, 5/8"-11UNC x 5-1/2" Long
8	000-150-256	2	Bolt, Carriage, 5/8"-11UNC x 1-1/2" Long
9	000-158-142	4	Nut, Serrated Flange, 5/8"-11UNC
10	000-161-164	4	Pin, Pivot, Tabbed, 1" Dia. x 5" Long
11	000-150-078	4	Bolt, Serrated Flange, 5/16"-18UNC x 1" Long
12	000-158-064	4	Nut, Serrated Flange, 5/16"-18UNC

AR - As Required NSS - Not Serviced Separately ASN - After Serial No. BSN - Before Serial No. LP - Local Purchase

PARTS ILLUSTRATIONS

Figure 5-3. Caster Fork and Single Wheel - Models TD72, TD84 & TD96



Alternate Hub Assembly

PARTS ILLUSTRATIONS

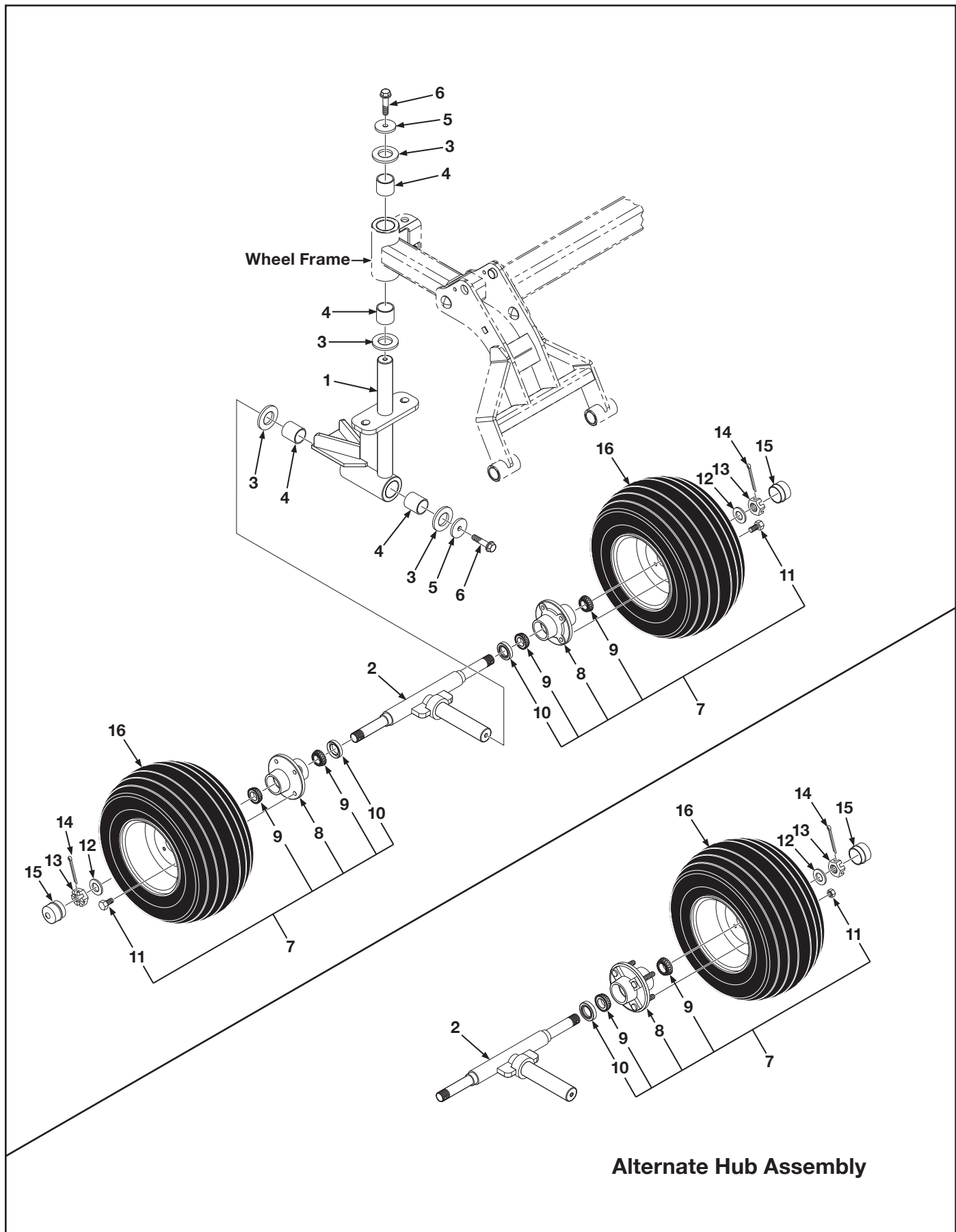
Figure 5-3. Caster Fork and Single Wheel - Models TD72, TD84 & TD96

Item	Part No.	Qty	Description
1	315-548-010	2	Fork, Caster
2	000-155-009	2	Bushing, Washer, 2-1/4" OD x 1-1/2" ID x 14 Gauge
3	000-155-002	18	Bushing, Washer, 2-1/4" OD x 1-1/2" ID x 10 Gauge
4	000-176-171	4	Bushing, Wheel Frame, 1-3/4" OD x 1-1/2" ID x 1-1/2" Long
5	000-155-004	2	Washer, Flat, 2-1/4" OD x 17/32" ID x 1/4" Thick
6	000-150-375	2	Bolt, Serrated Flange, 1/2"-13UNC x 1-1/4" Long
7	001-001-069	2	Hub Assembly, Includes Items 8 thru 12
		2	Hub Assembly, Includes Items 8 thru 12 (Alternate Hub Assembly)
8	001-001-074	1	Hub, Wheel, With Outer Race, Includes Item 9
9	NSS	1	Fitting, Grease, 65°
10	000-176-184	2	Bearing, Roller, Tapered, 1" Dia. Bore
11	000-166-457	2	Seal, 1.983" OD x 1.219" ID x .475" Thick
12	000-150-218	4	Bolt, Lug, 1/2"-20UNF x 1-1/4" Long
	000-158-120	4	Nut, Lug, Hex, 1/2"-20UNF (Alternate Hub Assembly)
13	315-598-000	2	Spacer, Wheel Hub, 1-1/4" OD x 3-5/8" Long
14	315-597-000	2	Spacer, Wheel Hub, 1-1/4" OD x 2-7/8" Long
15	001-001-057	2	Wheel/Tire, Foam-Filled, 18.5/8.50-8
16	000-150-359	2	Shaft, Axle, Bolt, Hex Head, 1"-14UNF x 12" Long
17	000-158-193	2	Nut, Castle, Jam, 1"-14UNF
18	000-161-078	2	Pin, Cotter, 1/8" Dia. x 2" Long

AR - As Required NSS - Not Serviced Separately ASN - After Serial No. BSN - Before Serial No. LP - Local Purchase

PARTS ILLUSTRATIONS

Figure 5-4. Caster Fork and Dual Wheels - Models TD96 & TD108



PARTS ILLUSTRATIONS

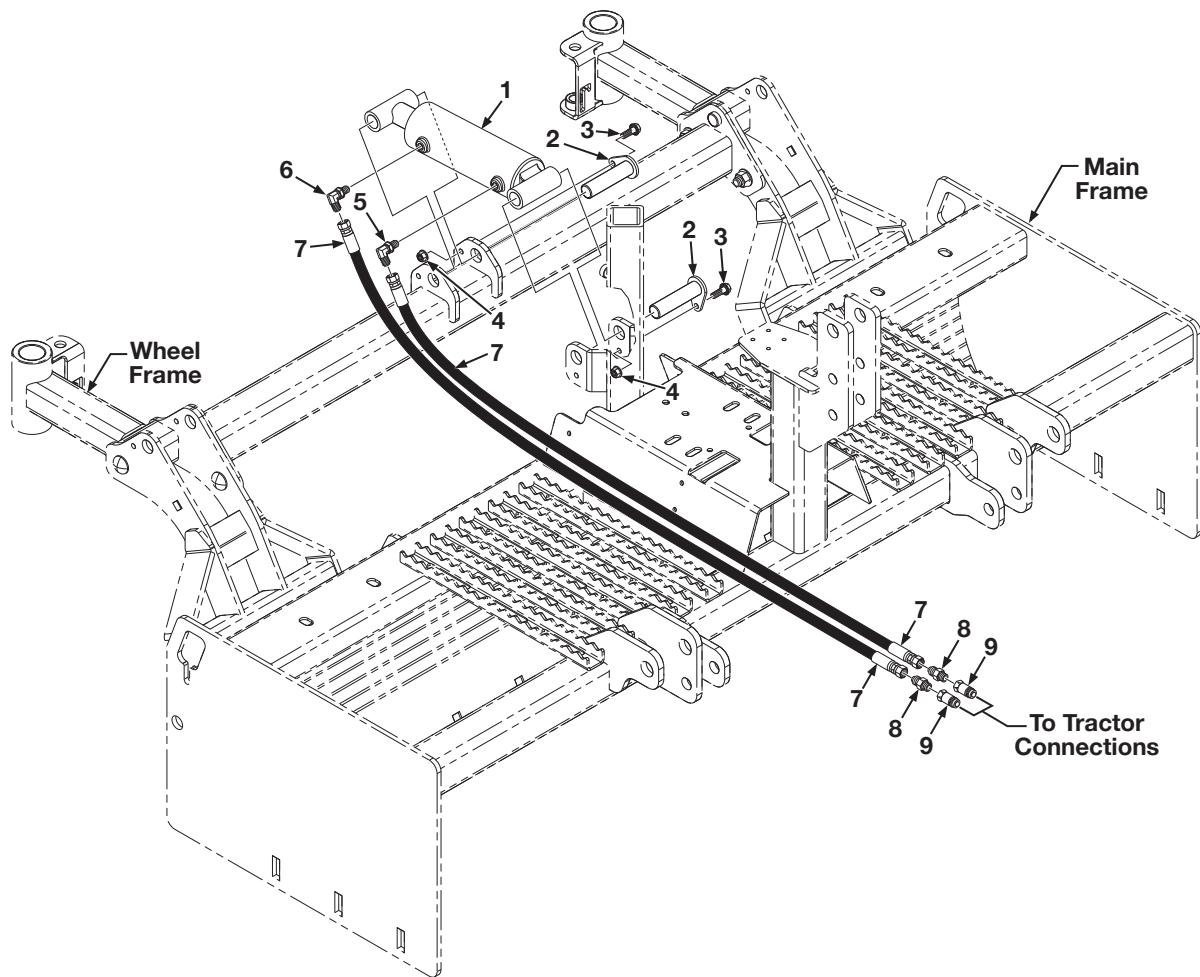
Figure 5-4. Caster Fork and Dual Wheels - Models TD96 & TD108

Item	Part No.	Qty	Description
1	315-065-310	2	Fork, Caster
2	315-065-400	2	Axle, Dual
3	000-155-002	8	Washer, Flat, 2-1/4" OD x 1-1/2" ID x 10 Gauge Thick
4	000-176-171	8	Bushing, Wheel Frame, 1-3/4" OD x 1-1/2" ID x 1-1/2" Long
5	000-155-004	4	Washer, Flat, 2-1/4" OD x 17/32" ID x 1/4" Thick
6	000-150-375	4	Bolt, Serrated Flange, 1/2"-13UNC x 1-1/4" Long
7	001-001-069	4	Hub Assembly, Includes Items 8 thru 11
		4	Hub Assembly, Includes Items 8 thru 11 (Alternate Hub Assembly)
8	001-001-074	1	Hub, Wheel, With Outer Race
9	000-176-184	2	Bearing, Roller, Tapered, 1" Dia. Bore
10	000-166-457	2	Seal, 1.983" OD x 1.219" ID x .475" Thick
11	000-150-218	4	Bolt, Lug, 1/2"-20UNF x 1-1/4" Long
	000-158-120	4	Nut, Lug, Hex, 1/2"-20UNF (Alternate Hub Assembly)
12	000-155-003	4	Washer, Flat, 1-1/2" OD x 1" ID x 14 Gauge
13	000-158-193	4	Nut, Castle, 1"-14UNF
14	000-161-078	4	Pin, Cotter, 1/8" Dia. x 2" Long
15	001-001-084	4	Cap, Dust
16	001-001-057	4	Wheel/Tire, Foam-Filled, 18.5/8.50-8

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PARTS ILLUSTRATIONS

Figure 5-5. Hydraulic Cylinder Only



PARTS ILLUSTRATIONS

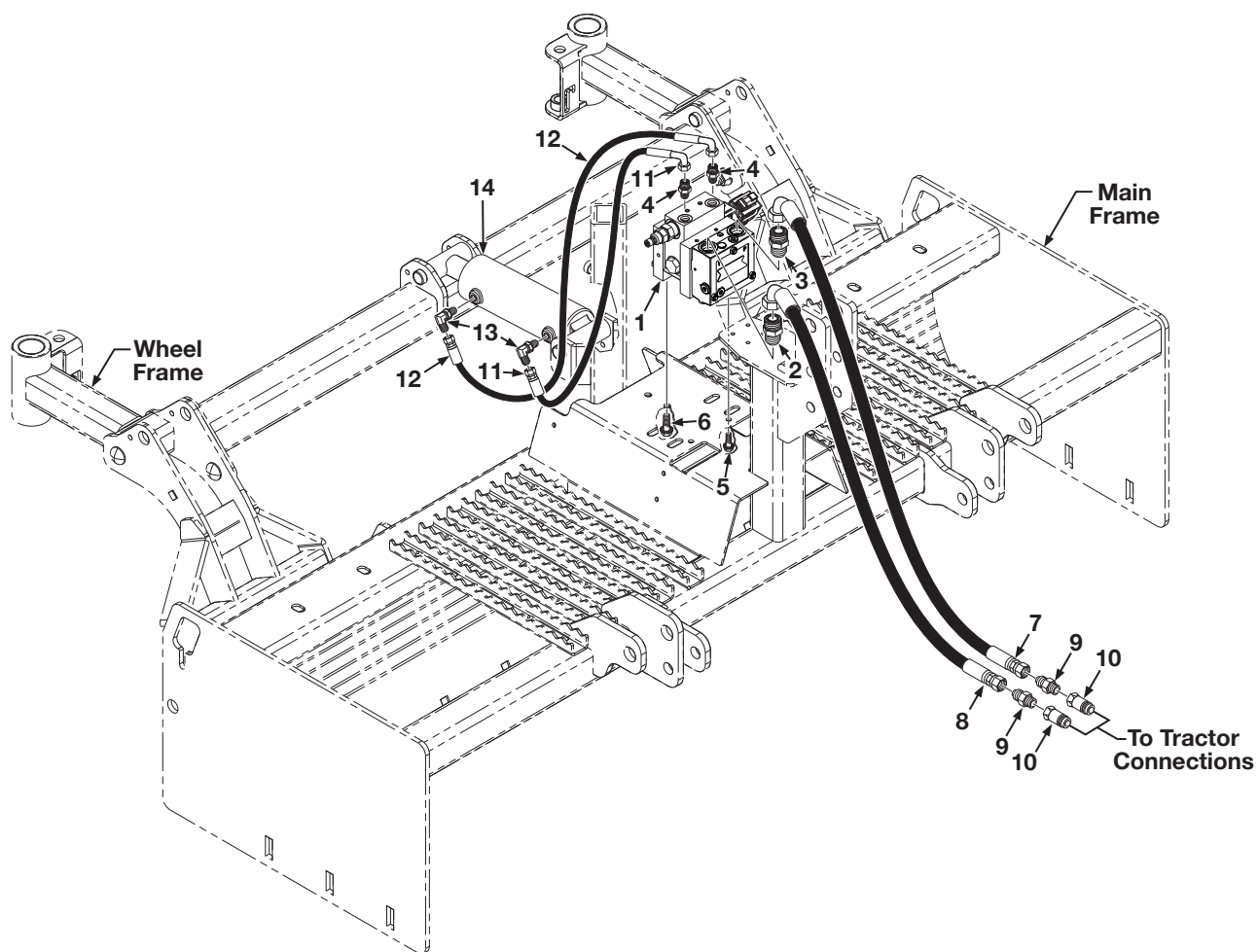
Figure 5-5. Hydraulic Cylinder Only

Item	Part No.	Qty	Description
1	000-166-689	1	Cylinder, Hydraulic, 3" Bore x 6" Stroke
2	000-161-164	2	Pin, Pivot, Tabbed, 1" Dia. x 5" Long
3	000-150-078	2	Bolt, Serrated Flange, 5/16"-18UNC x 1" Long
4	000-158-064	2	Nut, Serrated Flange, 5/16"-18UNC
5	000-166-748	1	Elbow, 90°, 6MJ x 6MB, With Orifice
6	000-166-225	1	Elbow, 90°, 6MJ x 6MB
7	000-166-453	2	Hose, 1/2" Dia. x 90" Long x 6FJX x 8FJX, 3,000 PSI
8	000-166-168	2	Adapter, Straight, 8MJ x 8MP
9	000-166-210	2	Coupler, Quick, Ag, Male, 1/2"
			BH-Bulkhead MP-Male Pipe FP-Female Pipe FPX-Female Pipe Swivel FFX- Female O-Ring Flat Face Swivel MB-Male O-Ring Boss FB-Female O-Ring Boss MJ-Male JIC FJ-Female JIC FJX-Female JIC Swivel OFS-O-Ring Face Seal OFSBH-O-Ring Face Seal Bulkhead

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PARTS ILLUSTRATIONS

Figure 5-6. Hydraulic Valve Assembly, Cylinder Assembly and Related Parts



PARTS ILLUSTRATIONS

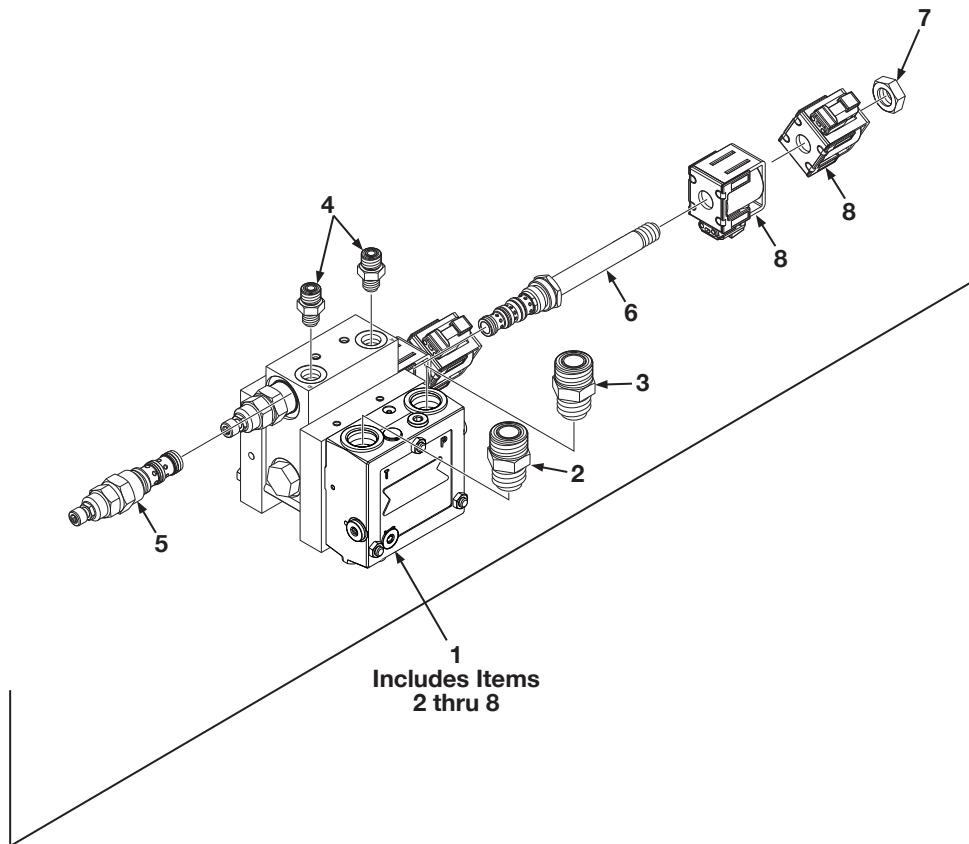
Figure 5-6. Hydraulic Valve Assembly, Cylinder Assembly and Related Parts

Item	Part No.	Qty	Description
1	000-166-874	1	Valve Assembly, Hydraulic MVB10, Includes Items 2 & 3, See Breakdown Figure 5-7
2	000-166-824	1	Valve, Check, 12OFS x 12MB, (DO NOT REMOVE FROM ITEM 1)
3	000-166-694	1	Fitting, Adapter, 12OFS x 12MB
4	000-166-685	2	Fitting, Adapter, 6OFS x 6MB
5	000-150-074	2	Bolt, Serrated Flange, 5/16"-18UNC x 3/4" Long
6	000-150-119	1	Bolt. Serrated Flange, 3/8"-16UNC x 3/4" Long
7	000-166-810	1	Hose, 5/8" Dia x 80" L x 10MORB x 12FFORX90, 4,060 PSI
8	000-166-810	1	Hose, 5/8" Dia x 80" L x 10MORB x 12FFORX90, 4,060 PSI
9	000-166-884	2	Adapter, Straight, 10FB x 8MP,
10	000-166-210	2	Coupler, Quick Disconnect, Ag, Male, 1/2"
11	000-166-896	1	Hose, 3/8" Dia. x 29" Long x 6FFX x 6FFX90, 3,000 PSI
12	000-166-896	1	Hose, 3/8" Dia. x 29" Long x 6FFX x 6FFX90, 3,000 PSI
13	000-166-697	2	Elbow, 90°, 6OFS x 6MB
14	000-166-689	1	Cylinder, Hydraulic, 3" Bore x 6" Stroke
			BH-Bulkhead MP-Male Pipe FP-Female Pipe FPX-Female Pipe Swivel FFX- Female O-Ring Flat Face Swivel MB-Male O-Ring Boss FB-Female O-Ring Boss MJ-Male JIC FJ-Female JIC FJX-Female JIC Swivel OFS-O-Ring Face Seal OFSBH-O-Ring Face Seal Bulkhead

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PARTS ILLUSTRATIONS

Figure 5-7. Hydraulic Valve Assembly



PARTS ILLUSTRATIONS

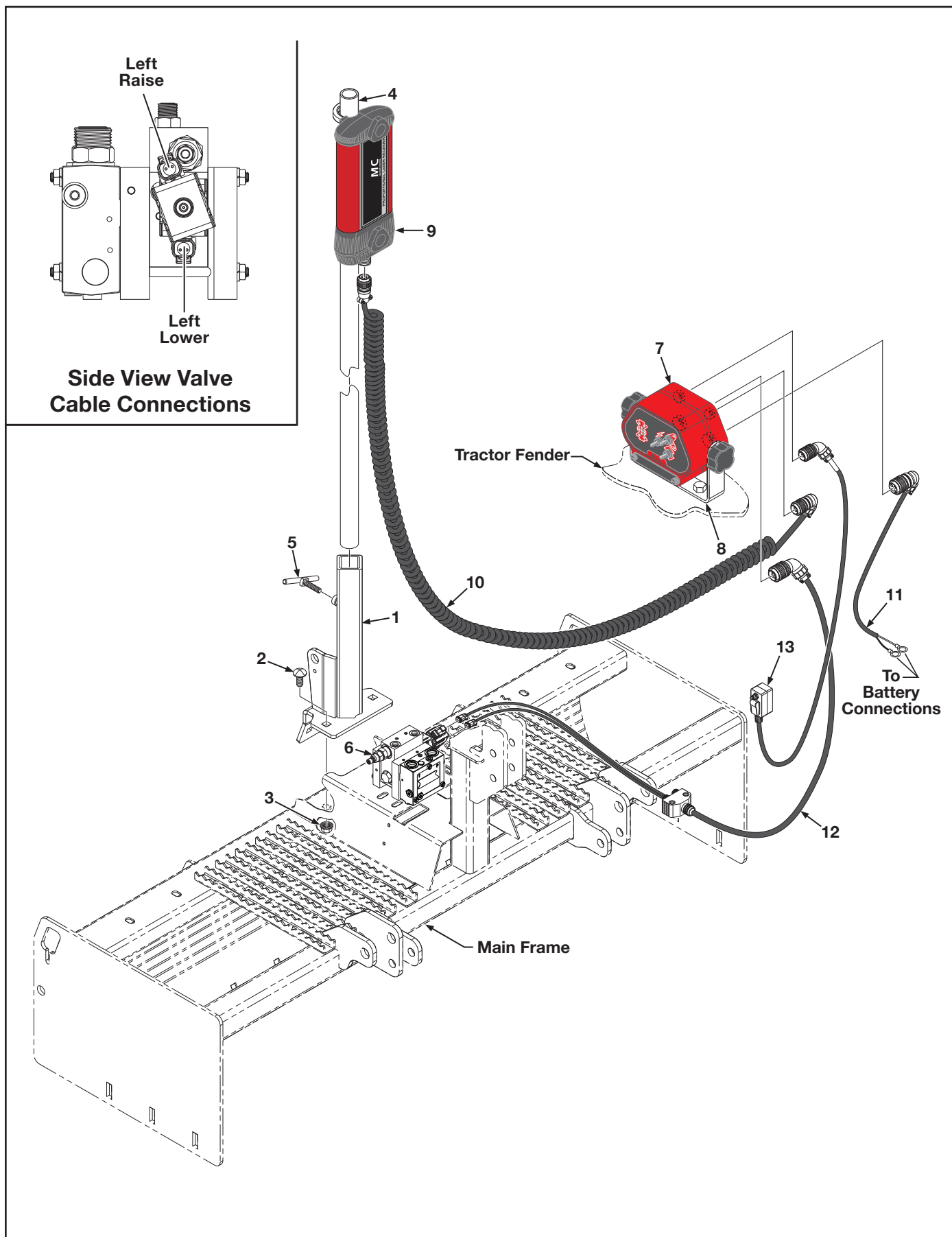
Figure 5-7. Hydraulic Valve Assembly

Item	Part No.	Qty	Description
1	000-166-874	1	Valve Assembly, Hydraulic MVB10, Includes Items 2 thru 8
2	000-166-824	1	Valve, Check, 12OFS x 12MB, (DO NOT REMOVE FROM ITEM 1)
3	000-166-694	1	Fitting, Adapter, 12OFS x 12MB
4	000-166-685	2	Fitting, Adapter, 6OFS x 6MB
5	000-166-844	2	Valve, Counter Balance
6	NSS	1	Stem, Includes Item 7
7	NSS	1	Nut
8	000-166-843	2	Coil

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Figure 5-8. Laser Controls and Related Parts - Apache CB52/Spectra CB30



PARTS ILLUSTRATIONS

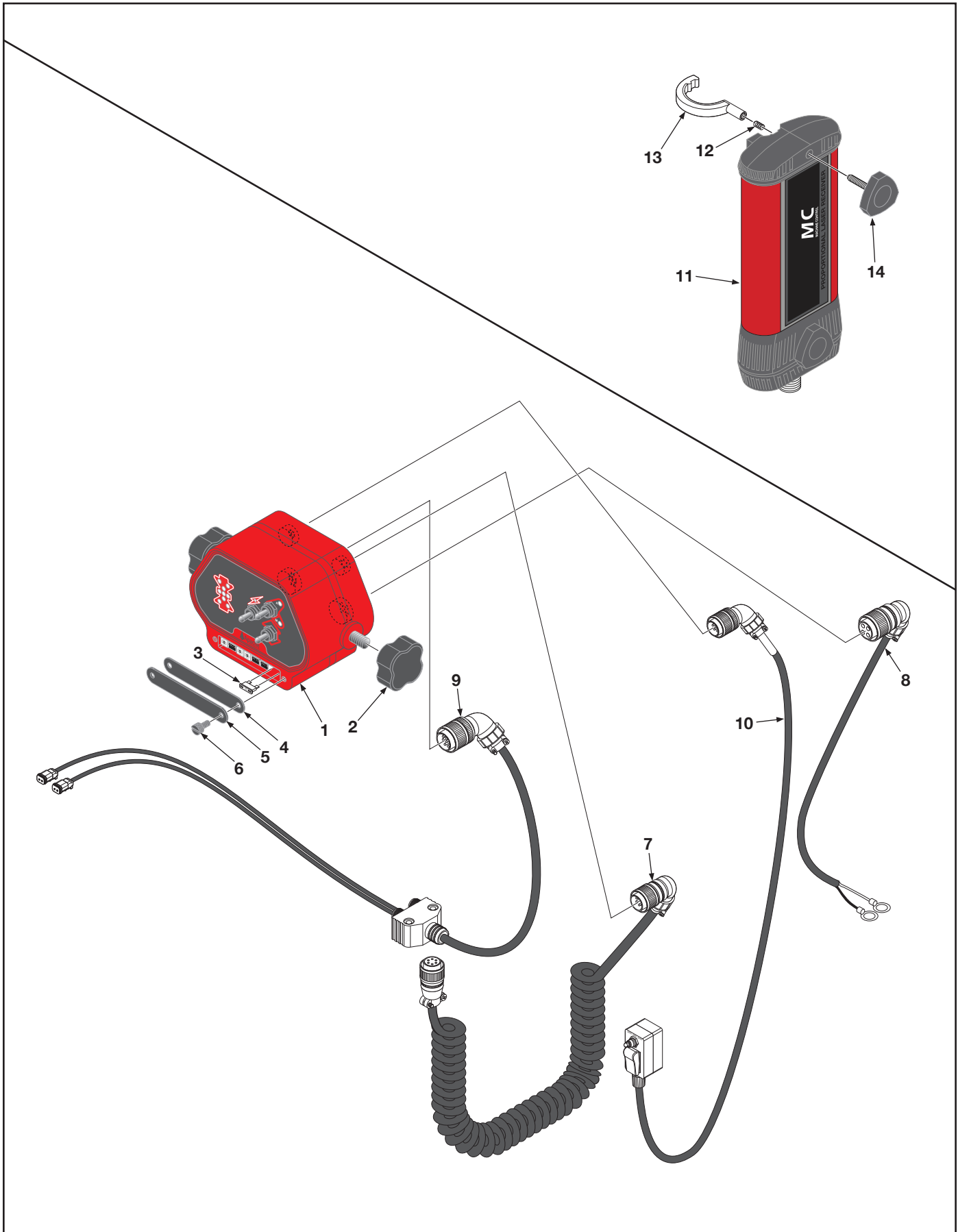
Figure 5-8. Laser Controls and Related Parts - Apache CB52/Spectra CB30

Item	Part No.	Qty	Description
1	315-117-700	1	Mount, Mast
2	000-150-256	4	Bolt, Carriage, 5/8"-11UNC x 1-1/2" Long
3	000-158-142	4	Nut, Serrated, 5/8"-11UNC
4	001-001-052	1	Pole, Mast, 1-1/2" Dia x 7' Long
5	001-001-053	1	Handle, Tee
6	000-166-874	1	Valve Assembly, Hydraulic MVB10, See Breakdown Figure 5-7
7	000-200-092	1	Panel, Control, Apache CB26, Red, See Breakdown Figure 5-9
	000-200-211	1	Panel, Control, Spectra CB25, Yellow, See Breakdown Figure 5-9
8	001-001-075	1	Bracket, Control Panel
9	000-200-093	1	Receiver, Laser 360°, Apache B5MC Red
	000-200-275	1	Receiver, Laser 360°, Spectra B5MC Yellow
10	000-200-099	1	Cable, Receiver, Coiled, 15' Long
11	000-200-097	1	Cable, Power, 2-Wire, 20' Long
12	000-200-327	1	Cable, Solenoid, 90°, 16' Long, Apache CB26/Spectra CB25
13	000-200-158	1	Switch Assembly, Remote, Auto/Manual, Raise/Lower, 10' Long

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PARTS ILLUSTRATIONS

Figure 5-9. Control Panel, Laser Receiver 360°, Cables - Apache/Spectra



PARTS ILLUSTRATIONS

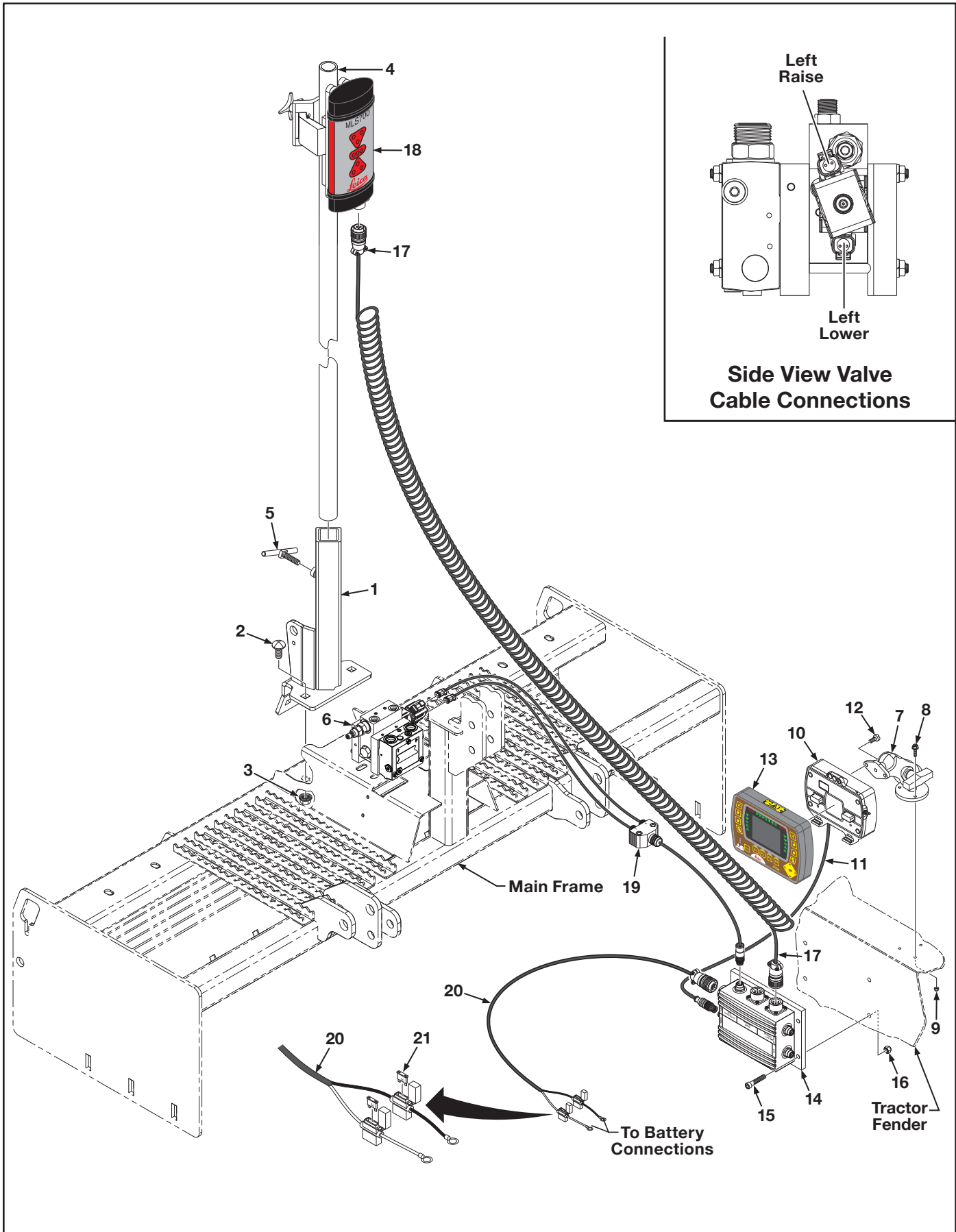
Figure 5-9. Control Panel, Laser Receiver 360°, Cables - Apache/Spectra

Item	Part No.	Qty	Description
1	000-200-092	1	Panel, Control, Apache CB26, Includes Items 2 thru 6
	000-200-211	1	Panel, Control, Spectra CB25, Includes Items 2 thru 6
2	000-200-112	2	Knob
3	LP	1	Fuse, 25 Amp
4	000-200-115	1	Gasket, Front Cover Plate
5	000-200-114	1	Plate, Front Cover
6	000-200-113	2	Screw, Thumb
7	000-200-099	1	Cable, Receiver, Coiled, 15' Long
8	000-200-097	1	Cable, Power, 2-Wire, 20' Long
9	000-200-327	1	Cable, Solenoid, 90°, 16' Long, Apache CB26/Spectra CB25
10	000-200-158	1	Switch Assembly, Remote, Auto/Manual, Raise/Lower, 10' Long
11	000-200-093	1	Receiver, Laser 360°, Apache B5MC Red, Includes Items 11 thru 13
	000-200-275	1	Receiver, Laser 360°, Spectra B5MC Yellow, Includes Items 11 thru 13
12	000-161-094	2	Spring, Clamp, Compression
13	000-200-108	2	Clamp, Universal, 2" Dia.
14	000-200-107	2	Knob, Clamp

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PARTS ILLUSTRATIONS

Figure 5-10. Laser Controls and Related Parts - Leica iCON System



PARTS ILLUSTRATIONS

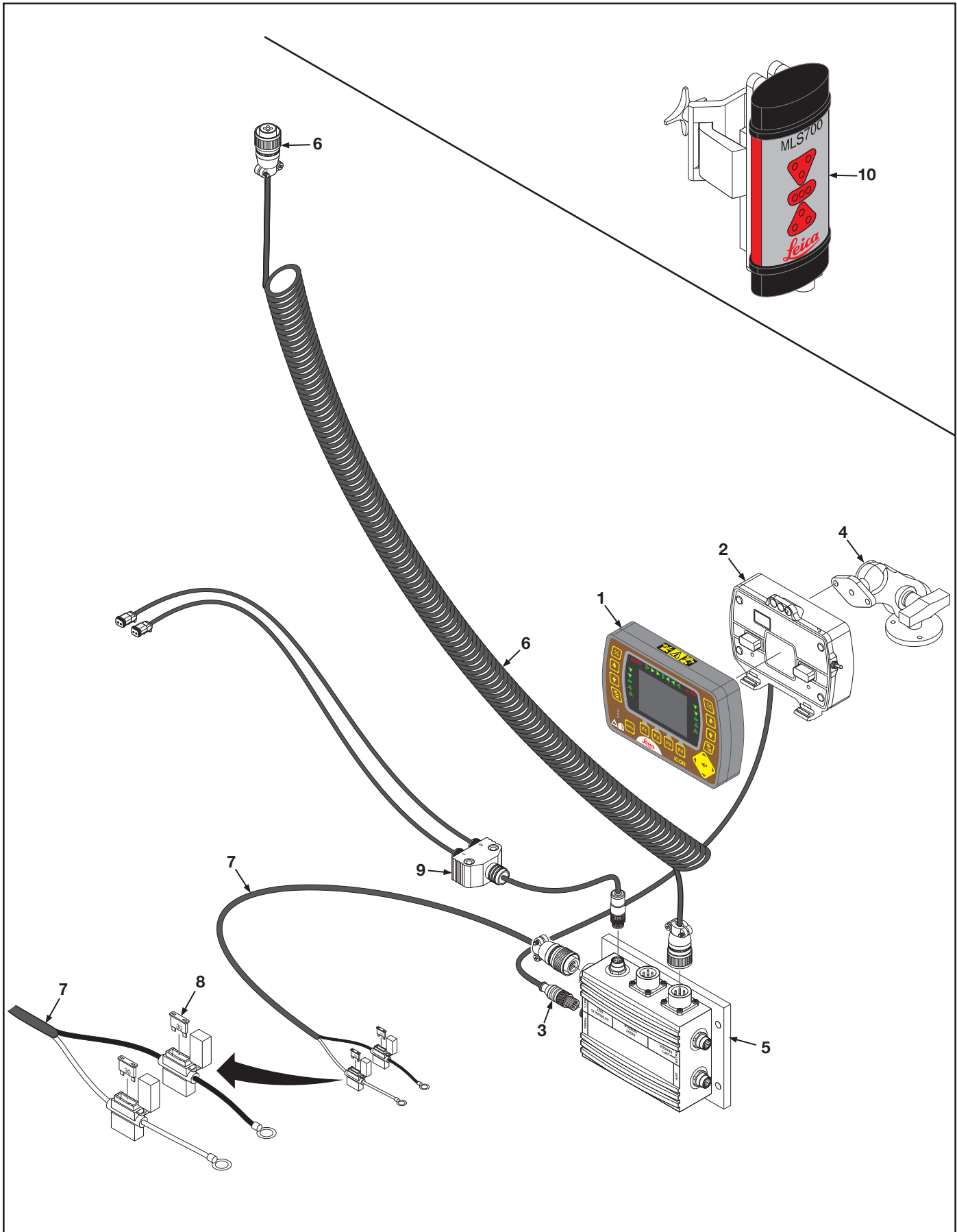
Figure 5-10. Laser Controls and Related Parts - Leica iCON System

Item	Part No.	Qty	Description
1	315-117-700	1	Mount, Mast
2	000-150-256	4	Bolt, Carriage, 5/8"-11UNC x 1-1/2" Long
3	000-158-142	4	Nut, Serrated, 5/8"-11UNC
4	001-001-052	2	Pole, Mast, 1-1/2" Dia x 7' Long
5	001-001-053	2	Handle, Tee
6	000-166-874	1	Valve Assembly, Hydraulic MVB10, See Breakdown Figure 5-7
7	000-200-261	1	Ram Ball
8	000-150-015	3	Bolt, Hex Head, SS, #10-24UNC x 3/4" Long
9	000-158-041	3	Nut, Hex Nylon Lock, SS, #10-24UNC
10	000-200-260	1	Cradle, Control Panel
11	000-200-262	1	Cable, Junction Box, Cradle
12	000-150-006	2	Screw, Slot Head
13	000-200-456	1	Control Panel, Leica iCON, See Breakdown Figure 5-11
14	000-200-263	1	Box, Junction
15	000-150-048	4	Bolt, Hex Head, SS, 1/4"-20UNC x 3/4" Long
16	000-158-050	4	Nut, Hex, Nylon Lock, SS, 1/4"-20UNC
17	000-200-463	2	Cable, Receiver/Sonic, Coiled, 1.5-6mm; Leica iCON
18	000-200-464	1	Receiver, Laser 360°
19	000-200-330	1	Cable, Solenoid, Dual, 16' L, Leica iCON
20	000-200-265	1	Cable, Power, 2-Wire, 20' Long, Includes Items 21
21	LP	2	Fuse, 30 Amp

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PARTS ILLUSTRATIONS

Figure 5-11. Control Panel, Laser Receiver 360°, Cables - Leica iCON System



PARTS ILLUSTRATIONS

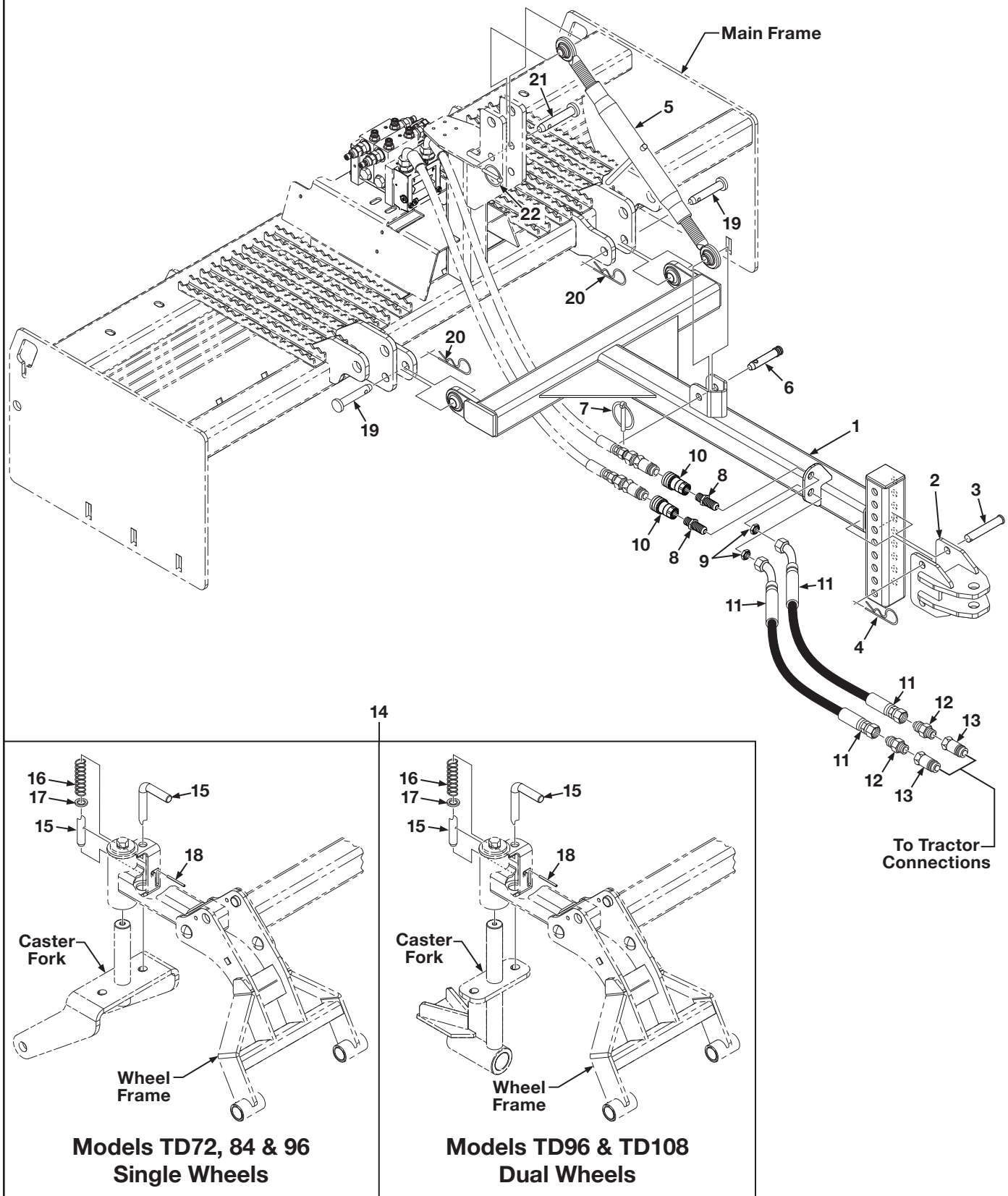
Figure 5-11. Control Panel, Laser Receiver 360°, Cables - Leica iCON System

Item	Part No.	Qty	Description
1	000-200-456	1	Control Panel, Leica iCON
2	000-200-260	1	Cradle, Control Panel
3	000-200-262	1	Cable, Junction Box, Cradle
4	000-200-261	1	Ram Ball
5	000-200-263	1	Box, Junction
6	000-200-463	1	Cable, Receiver/Sonic, Coiled, 1.5-6mm; Leica iCON
7	000-200-265	1	Cable, Power, 2-Wire, 20' Long, Includes Items 8
8	LP	2	Fuse, 30 Amp
9	000-200-330	1	Cable, Solenoid, Dual, 16' L, Leica iCON
10	000-200-464	2	Receiver, Laser 360°

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Figure 5-12. Drawbar Kit, with Wheel Locks (Optional)



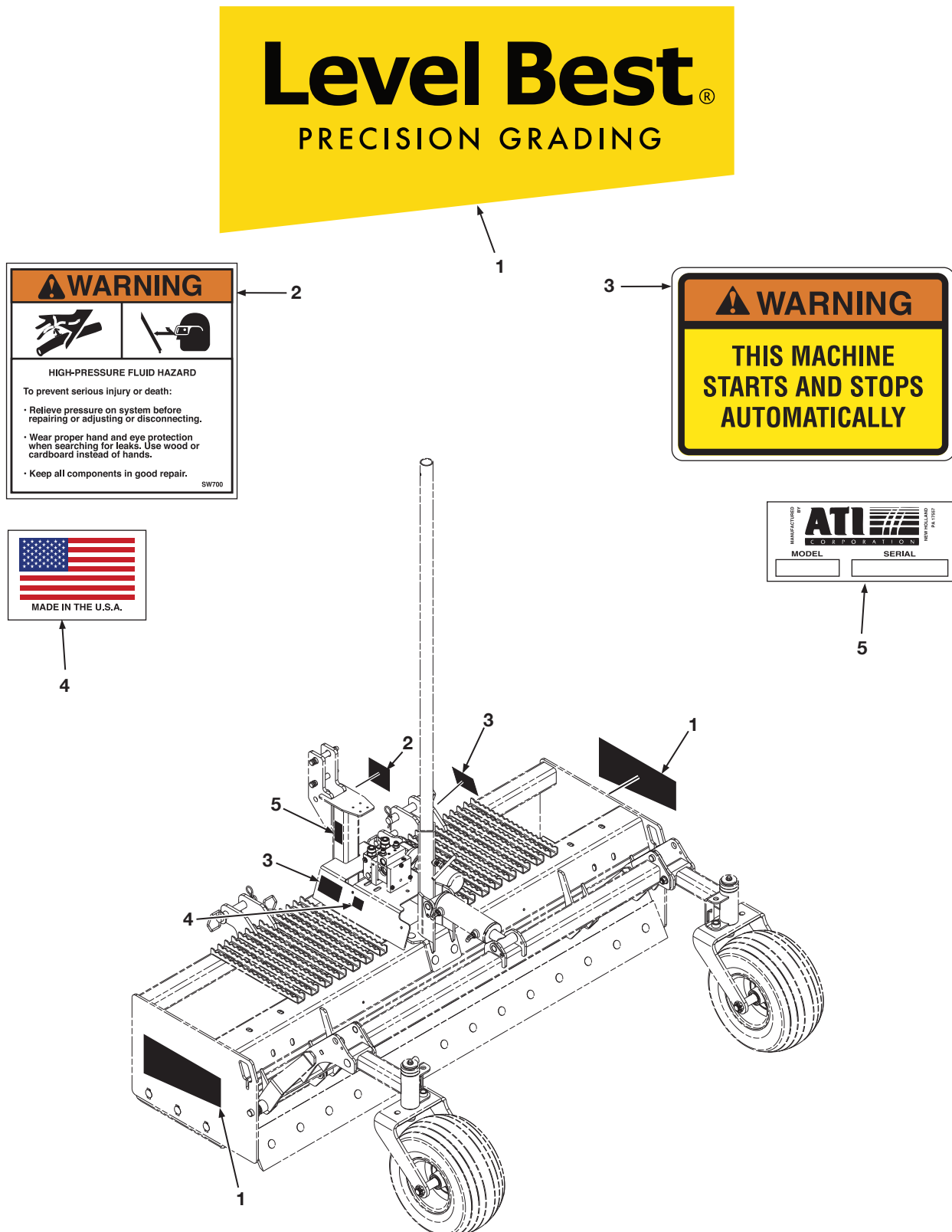
PARTS ILLUSTRATIONS

Figure 5-12. Drawbar Kit, with Wheel Locks (Optional)

Item	Part No.	Qty	Description
	315-547-000	1	Kit, Drawbar, Category I, Includes Items 1 thru 18
1	315-541-000	1	Drawbar, Category I
2	315-542-000	1	Hitch, Clevis
3	000-161-079	2	Pin, Clevis, 3/4" Dia. x 4-1/2" Long
4	000-161-071	2	Pin, Cotter, Hair, .148" Dia. x 2-11/16" Long
5	001-001-064	1	Top Link
6	000-161-080	1	Pin, Top Link, 3/4" Dia. x 4-1/2" Long
7	000-161-028	1	Pin, Lynch, Locking, 7/16"
8	000-166-447	2	Connector, Bulkhead, 8MP x 8BH, Includes Item 9
9	NSS	2	Nut, Hex, Jam Lock
10	000-166-218	2	Coupler, Quick Disconnect, Ag, Female, 1/2" x 1/2" NPT
11	000-166-616	1	Hose, 1/2" Dia. x 58" Long x 8FJX x 8FJX45, 3,000 PSI
12	000-166-168	2	Adapter, Straight, 8MJ x 8MP
13	000-166-210	2	Coupler, Quick Disconnect, Ag, Male, 1/4"
14	315-645-000	2	Kit, Wheel Lock, Caster Lock, Includes Items 15 thru 18
15	000-161-136	1	Pin, Lock, Caster Fork, 3/4" Dia. x 7" Long
16	000-161-133	1	Spring, Compression
17	000-155-096	1	Washer, Flat, 3/4" Narrow
18	000-161-119	1	Pin, Roll, 3/16" Dia. x 2-1/4" Long
19	000-161-076	2	Pin, Hitch, 7/8" Dia. x 5-1/4" Long, Category I
20	000-161-019	2	Pin, Hair, Cotter, 3/16" Dia. x 3-3/4" Long
21	000-161-081	1	Pin, Top Link, 3/4" Dia. x 5-1/2" Long, Category I
22	000-161-028	1	Pin, Lynch, Locking, 7/16"
			BH-Bulkhead MP-Male Pipe FP-Female Pipe FPX-Female Pipe Swivel MB-Male O-Ring Boss FB-Female O-Ring Boss MJ-Male JIC FJ-Female JIC FJX-Female JIC Swivel

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Figure 5-13. Decals



PARTS ILLUSTRATIONS

Figure 5-13. Decals

Item	Part No.	Qty	Description
1	000-186-045	2	Decal, Level Best Logo
2	000-186-041	1	Decal, Warning, High Pressure
3	000-186-094	2	Decal, Warning, This Machine Starts & Stops Automatically
4	000-186-092	1	Decal, Made in U.S.A.
5	000-186-035	1	Plate, Model/Serial, Adhesive Back

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(for future use)

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