



Motorgrader
System Five™
9164 Control Box
Operator's Manual





Motorgrader System Five Operator's Manual

For the 9164 Control Box

Part Number 7010-0344

Rev. E

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Preface

This manual has been developed to provide the grader operator with information necessary to operate and maintain the TOPCON System Five. Proper service and use is important to the reliable operation of the equipment. The procedures described herein are effective methods for performing service and operation of this system.

The sections provided in this manual include information necessary for the correct operation, care and trouble- shooting of your TOPCON System Five. Also contained in this manual is a selection of WARNINGS, CAUTIONS, and NOTICES you should become familiar with to safely operate the system.

Each symbol represents a particular level of danger:



WARNING

Represents a procedure or operation that, if not strictly followed, can cause serious damage to the equipment, and/or serious injury or death to the person performing the operation.



CAUTION

Represents a procedure or operation that, if not followed correctly, can result in serious damage to the equipment or personal injury.



NOTICE

Represents a procedure that, if not performed correctly, can adversely effect the performance of the equipment.

Please study this manual carefully. The benefits this product provides can be greatly influenced by your applications knowledge. All information, illustrations, and applications contained herein are based on the latest available information at the time of publication. TOPCON reserves the right to make product changes at any time without notice. Comments, suggestions, and questions about TOPCON products are welcomed. Contact your local TOPCON representative or a representative at our corporate facility.

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System Overview

Your TOPCON Grader Control System Five™ is a versatile tool that combines Elevation and Cross Slope Control into a package powerful enough for your most demanding jobs, yet convenient enough to use everyday. In fact, System Five is so easy to learn that your benefits will start immediately:

- **Increase Production**

Make faster and fewer cuts. No extra passes to check grade.

- **Control Material**

Consistent grade along the entire job, not just at the hubs, means no filling grade variations with costly base or paving materials.

- **Save Engineering Costs**

Reduced hubs and staking, waiting on bluetops, and inspection time.

Your System Five includes a Control Box, one/two Sonic Trackers II's, a Slope, Rotation, and Mainfall Sensor, and a Hydraulic Manifold Assembly. Smart Knobs, cables and mounting hardware are also included. Optional Trackerjack Systems may be added to System Five.

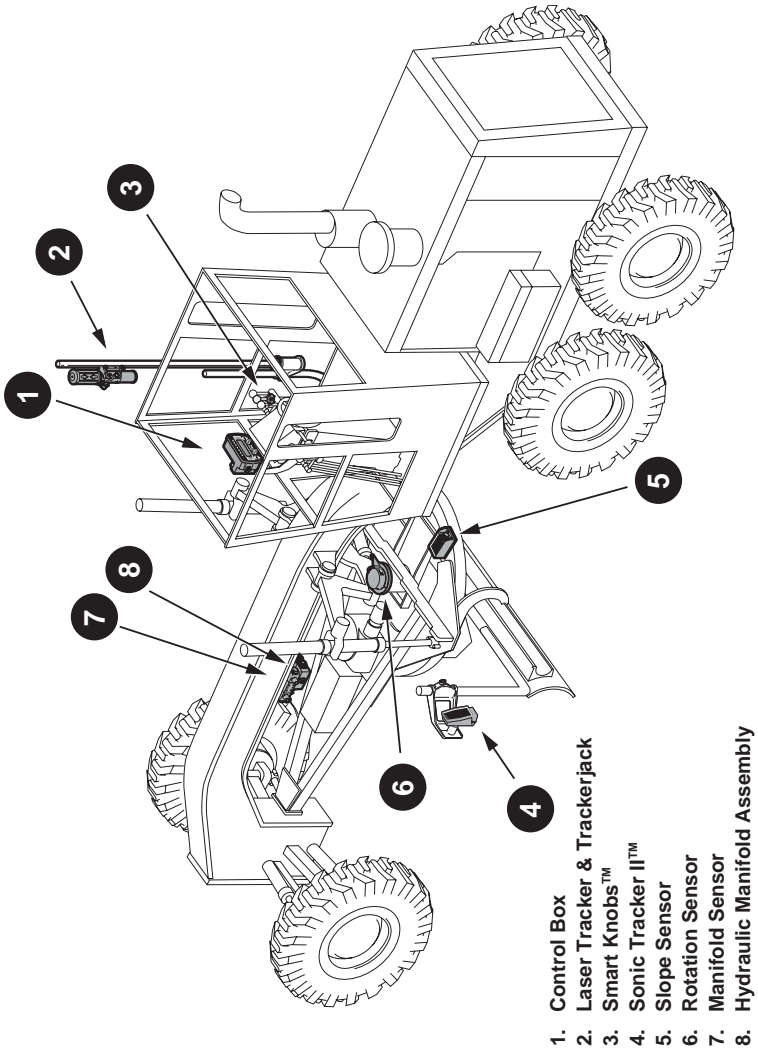


Figure 1-1.

Control Box

The Control Box is the operator's interface to System Five. It easily attaches to its mounting bracket with one clamp, and at the end of the day can be quickly removed for storage. The control box connects to the Remote "Smart" Knobs™ and the machine power system with one small connector, and connects to the other system components with one large connector.

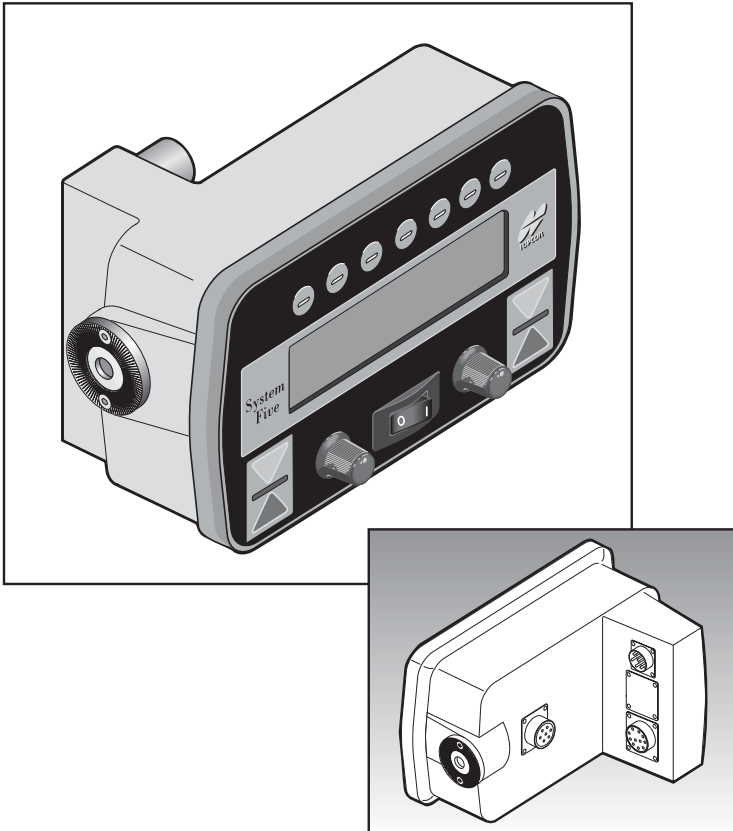


Figure 1-2.

Remote “Smart” Knobs

The Remote “Smart” Knobs™ mount on the grader’s control levers for easy access. The knobs allow the operator to perform several Control Box functions while keeping his hands where they belong - on the levers.

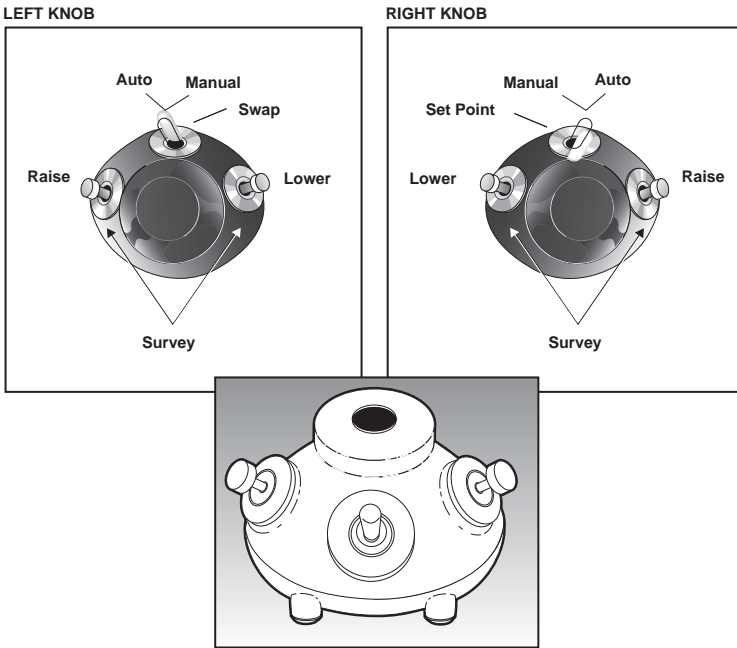


Figure 1-3.

Sonic Tracker II

The Sonic Tracker II measures and controls the elevations of the moldboard. A transducer, located in the bottom of the Sonic Tracker II™, generates sound pulses like a speaker and listens for returned echoes like a microphone. The Tracker measures the distance, and controls grade from a physical grade reference, such as a curb, stringline, or existing road surface.

The Sonic Tracker II attaches to the system through one quick connect cable and attaches to the machine with a single bolt. At the end of the day, Sonic Tracker II should be removed for proper storage in the carrying case.

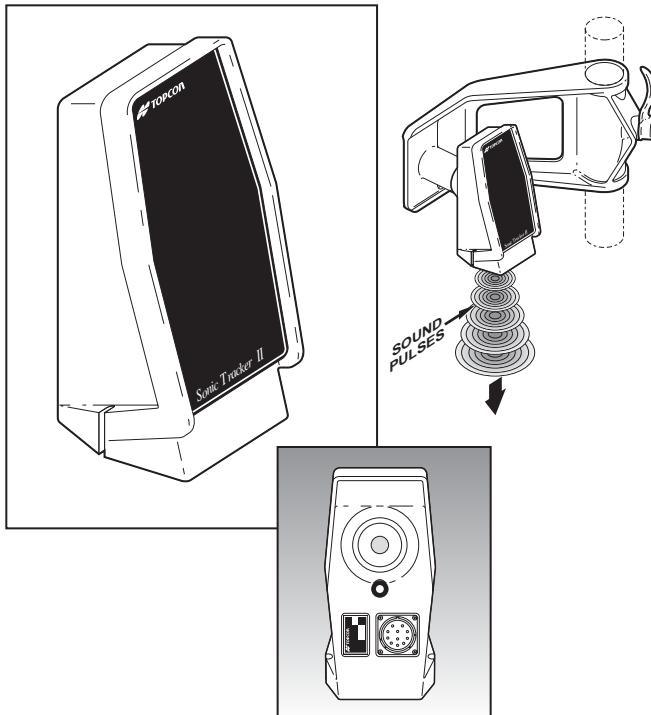


Figure 1-4.

Laser Tracker and Trackerjack

The Laser Tracker works by receiving a signal from a rotating laser and sends that signal to the Control Box. Use the same coil cord from the Sonic Tracker II to power up the Laser Tracker.

The Trackerjack attaches to the laser receiver and then mounts onto a vibration pole. Use the coil cord from the Sonic Tracker II to power up the Laser Tracker/Trackerjack System.

The Laser Trackerjack should be removed at the end of each day and stored in its carrying case. A vibration pole storage bracket can be attached to the back of the grader for use when the Trackerjack system is not needed.

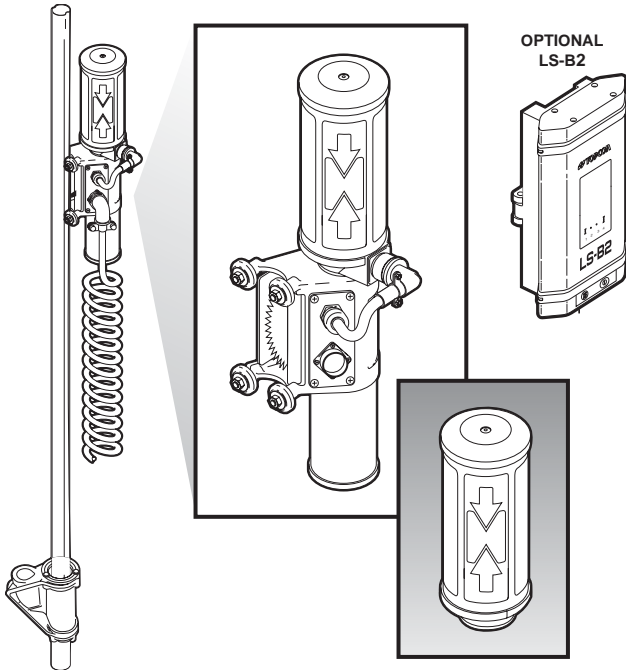


Figure 1-5.

Blade Slope Sensor

The Blade Slope Sensor measures the slope of the cutting edge. It has a precision electronic level sensor within it that functions like a carpenter's level. It then relays that information to the Control Box.

The Blade Slope Sensor will measure slopes from +20% to -20%. There is an option for a steep slope sensor that will measure up to +/- 100% slope.

The Blade Slope Sensor is sealed and once attached to the motorgrader should not be removed.

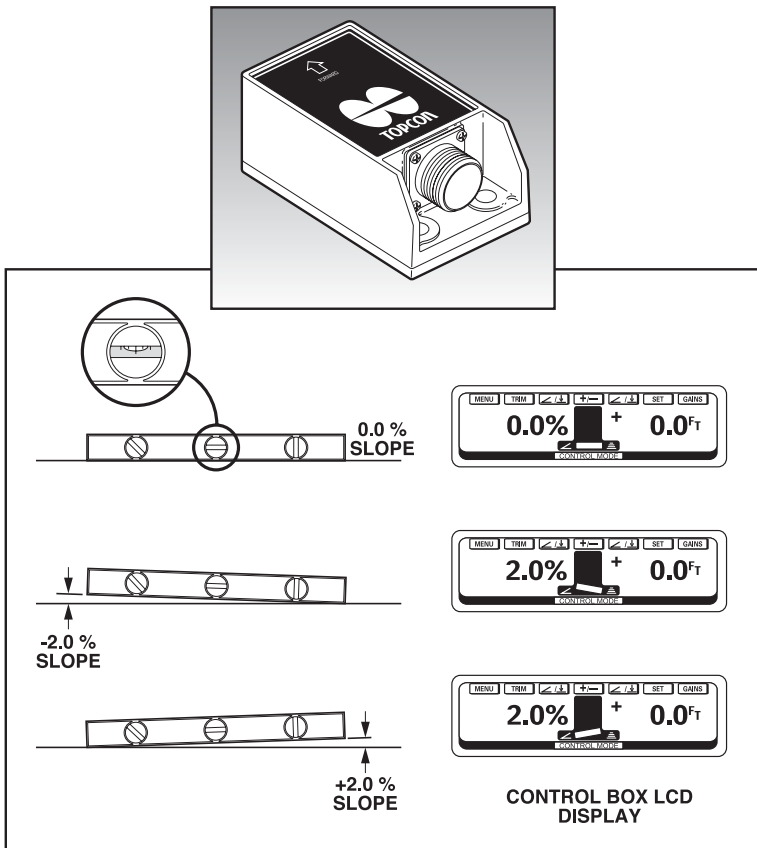


Figure 1-6.

Rotation Sensor

The Rotation Sensor continuously monitors the rotation angle of the blade. This enables the operator to rotate the blade at any time, and System Five will continue to maintain the desired cross slope.

The Rotation Sensor is a sealed unit and contains no adjustments. Once attached to the machine it should not be removed, other than for periodic maintenance (refer to Maintenance Section of this manual).

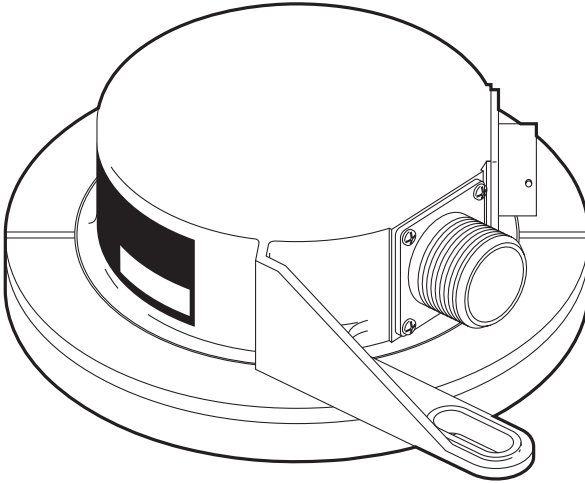


Figure 1-7.

Mainfall Sensor

The Mainfall Sensor uses the same type of precision electronic device that is used by the Blade Slope Sensor. It mounts under the Hydraulic Manifold Assembly and measures the slope of the machine in the direction of machine travel.

The Mainfall Sensor is a sealed unit and contains no manual adjustments. Once attached to the machine, it should not be removed.

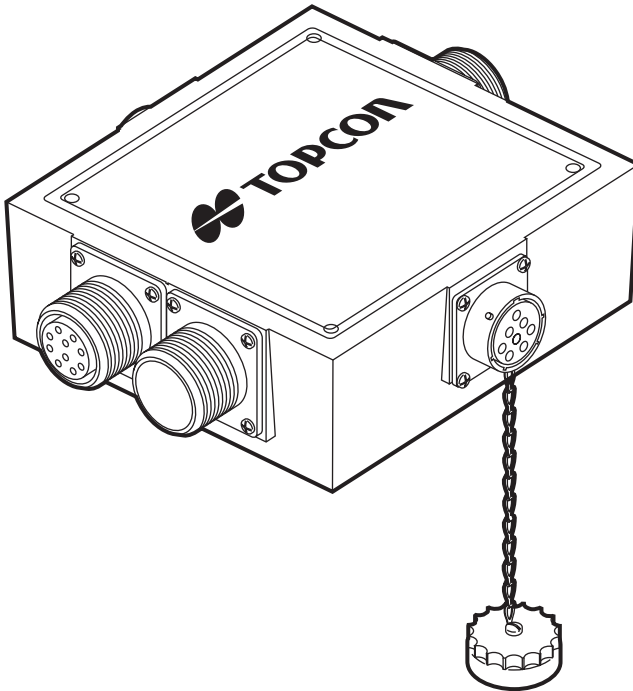


Figure 1-8.

Hydraulic Manifold Assembly

The Hydraulic Manifold Assembly is connected into the grader blade lift cylinders. It acts like the manual valves the operator controls by hand, automatically raising or lowering the blade to produce desired grade.

The Hydraulic Manifold Assembly is a sealed unit and contains no adjustments. Once attached to the machine, it should not be removed.

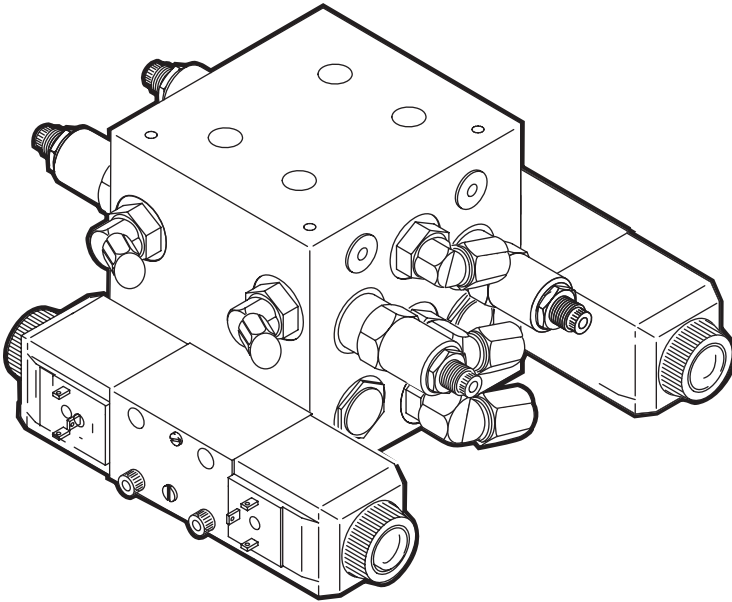


Figure 1-9.

Carrying Case

A Carrying Case is provided with each System Five. The Carrying Case is lined and includes pre-cut sections for each Sonic Tracker II and the Control Box. A cut-out section is also provided for storing coil cords.

At the end of the day, always wipe down each of the components and place them and the coil cords in the appropriate sections for storage. This will ensure the continued integrity of these components and will protect them from vandalism or theft.

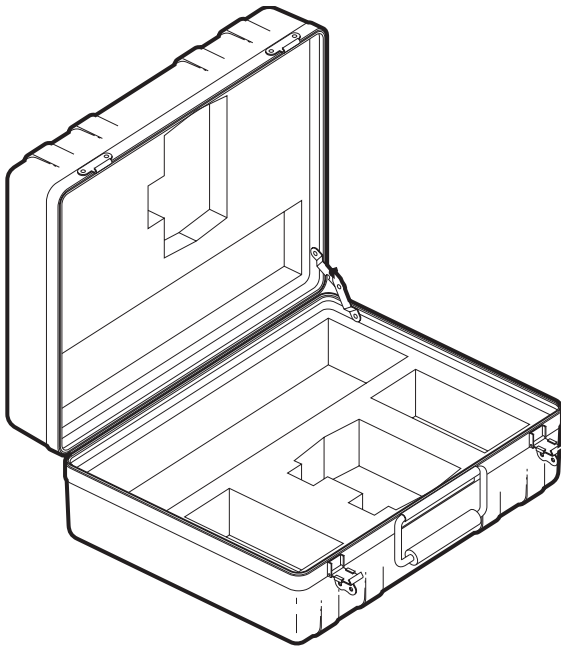


Figure 1-10.



NOTICE

Keep the Carrying Case dry and store in a dry location. Never let the interior of the Carrying Case become wet. If the case does become wet, remove the components and dry it out.

Operation

This chapter reviews System Five's components and explains the function of each.

 **NOTICE**

When operating in rainy weather or in wet conditions, the Control Box, Sonic Tracker II's, and cables must be thoroughly dried BEFORE placing them in the Carrying Case at the end of the day.

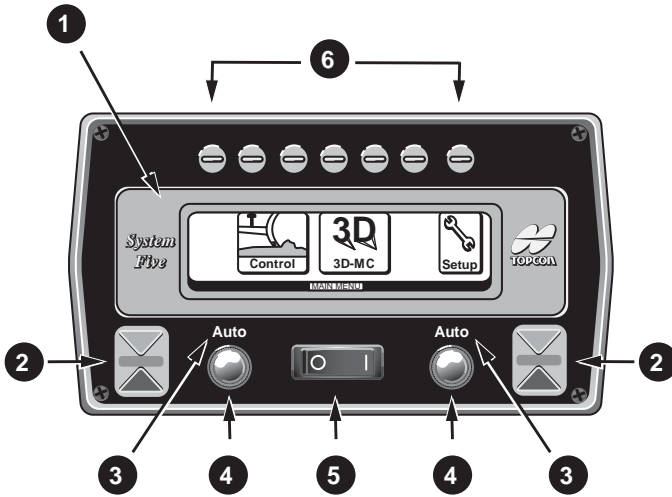
Any moisture left on the Control Box, Sonic Tracker II's and/or cables when being put into the Carrying Case can cause condensation on the inside of the components which may severely affect accurate operation during the next grading session.

Control Box

The Control Box is the main operator control interface for System Five. It has several purposes. One is to inform the operator of the system's performance. It also receives information from the sensors, processes the information, and sends out correction signals to the grader's hydraulic system when required.

Control Box Front Panel Switches and Controls

The operator can control and monitor grading using the switches and displays located on the front panel of the Control Box. The function of each is as follows:



1. LCD Display
2. Left and Right Grade Adjustment LED's
3. Left and Right Automatic Operation Indicators
4. Left and Right Grade Adjustment Knob
5. Power Switch
6. Function Buttons

Figure 2-1.

The LCD (Liquid Crystal Display)

The LCD allows the operator to view text and graphic symbols that represent elevation or slope settings that System Five is currently maintaining for the left and right sides of the motorgrader.

- System Five in Control Mode during operation.

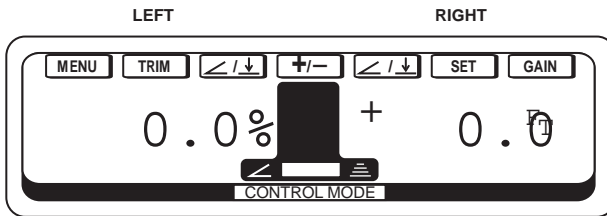


Figure 2-2.

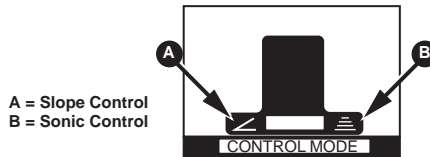


Figure 2-3.

- 2.0% cross slope has been selected for the left side. The blade symbol shows that the 2.0% slope is going down.
- The Sonic Tracker symbol indicates that Sonic Control has been selected for the right side.

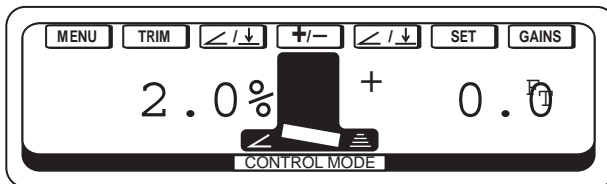


Figure 2-4.

Left and Right Grade Adjustment LEDs











ELEVATION/SLOPE CONTROL		
LED - ACTION	ELEVATION (SONIC & LASER TRACKER)	SLOPE
 Slow blinking, yellow down arrow	 Out of range, beyond .2' above grade	Beyond 2% above grade
Solid yellow down arrow	 Above grade, between .05' & .2'	Above grade, between 1% & 2%
Blinking, yellow down arrow	 Above grade, between .02' & .05'	Above grade, between .2% & 1%
Blinking yellow down arrow/green bar	 Within .02' of grade	Within .2% of grade
Blinking green bar	 On grade	On grade
Blinking red up arrow/green bar	 Within .02' of grade	Within .2% of grade
Blinking red up arrow	 Below grade, between .02' & .05'	Below grade, between .2% & 1%
Solid red up arrow	 Below grade, between .05' & .2'	Below grade, between 1% & 2%
Slow blinking, red up arrow	 Out of range, beyond .2' below grade	Beyond 2% below grade

Figure 2-5.

Left and Right Automatic Operation Indicators

These LED's illuminate with the word "Auto" when the Right and/or Left Auto/Manual switch Smart Knobs are used to switch System Five to Automatic Operation.

Left and Right Grade Adjustment Knobs

These knobs are used to make measured adjustments to the cross slope or elevation settings.

- Adjusts the grade height when Elevation Control is selected. Turning the knob clockwise increases the depth of cut, or lowers the cutting edge.

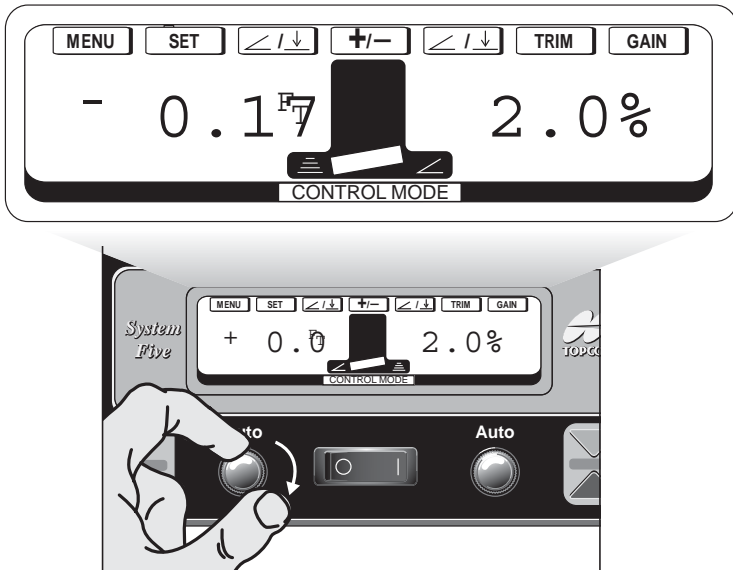


Figure 2-6.

- Adjusts the percentage of slope when cross slope control is selected.

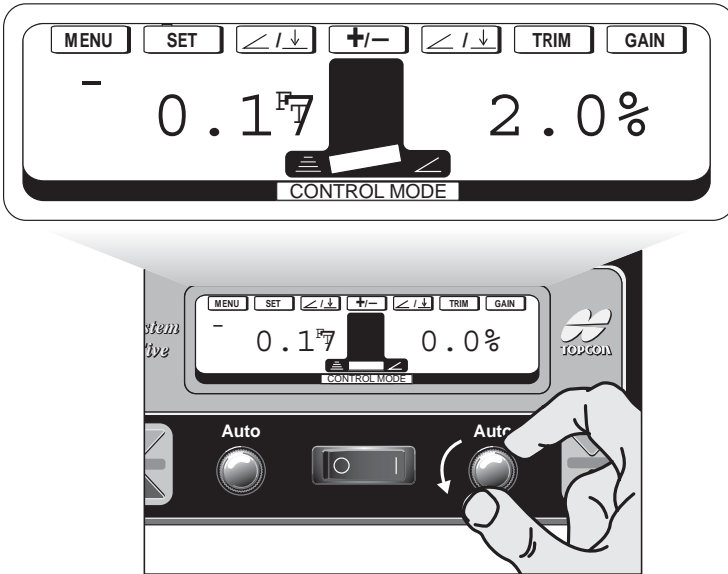


Figure 2-7.

Grade Adjustment Direction Arrows

These red arrows light up around the Grade Adjustment Knob to indicate the direction the knob should be rotated to reach On Grade.

- Rotate the knob counter-clockwise to reach grade.
- Rotate the knob clock wise to reach grade.

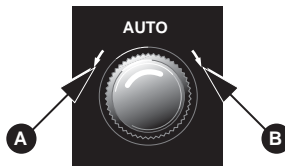


Figure 2-8.

Power Switch

Push the switch to turn the box on or off.

Function Buttons

When pushed these buttons activate the function shown on the screen directly below.

Control Box Operation

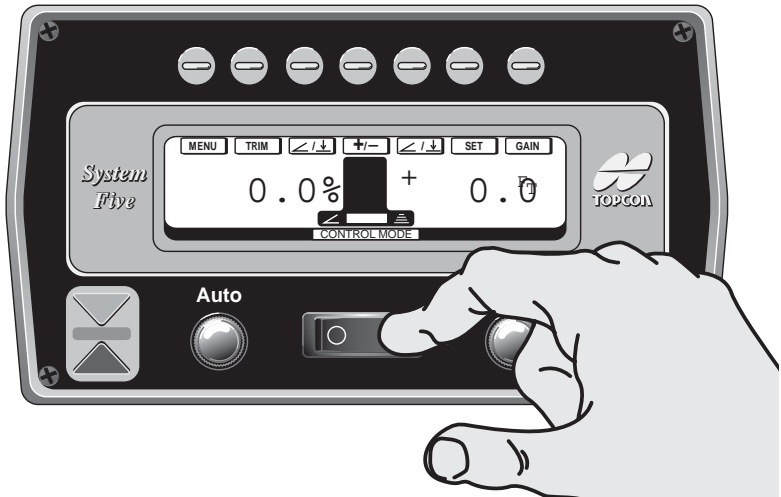


Figure 2-9.

Basic Operation

Turn the Control Box on by pressing the "On/Off" switch. It will always power up in the Control Mode. The adjustments and settings will appear just as they were left the last time the box was shut off. In order to work in the 3DMC or Setup Mode press the function button directly above the Menu display.

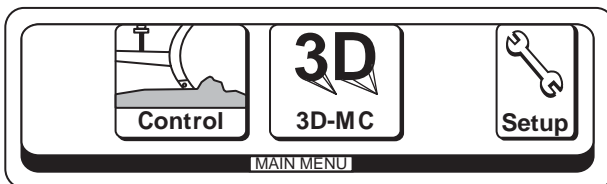


Figure 2-10.

Control Mode

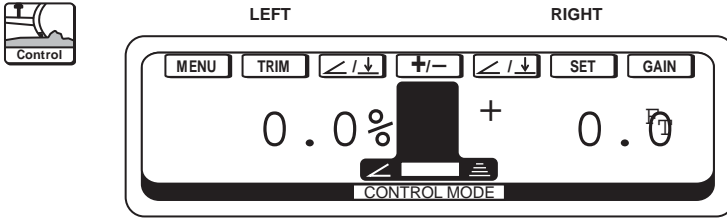


Figure 2-11.

- **Menu** MENU

Pressing the Menu button will allow the operator to go to the Main Menu. This enables the operator to choose between Control, 3DMC, and Setup Modes.

- **Elevation/Slope Setting** △/↓

Pressing the Elevation/Slope button will change the left or right sides of the LCD from Elevation Mode to Slope Mode and vice versa.

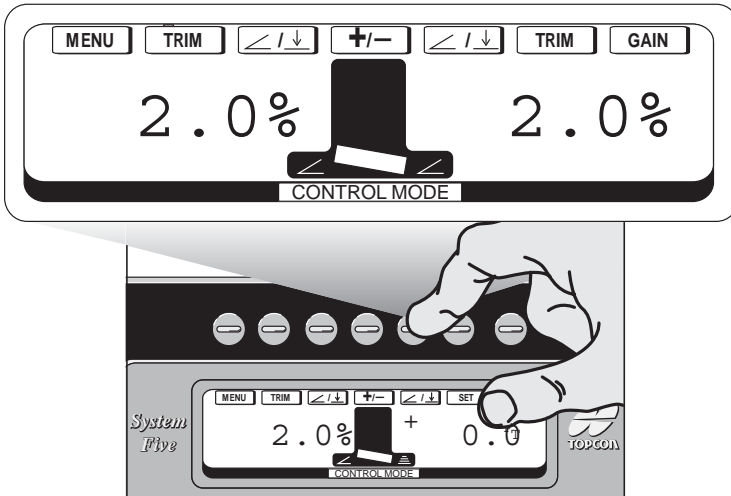


Figure 2-12.

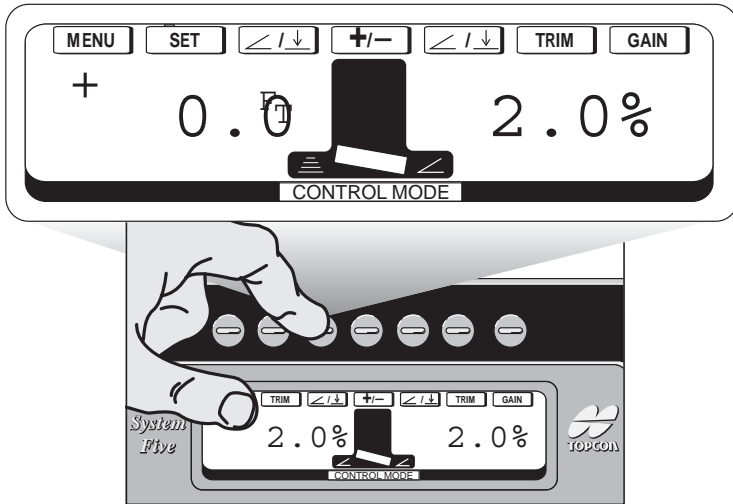


Figure 2-13.

- **Slope Direction** +/-

Pressing the Slope Direction button will change the direction of the slope, regardless of what side slope is being used. The blade indicator shows the direction of slope.

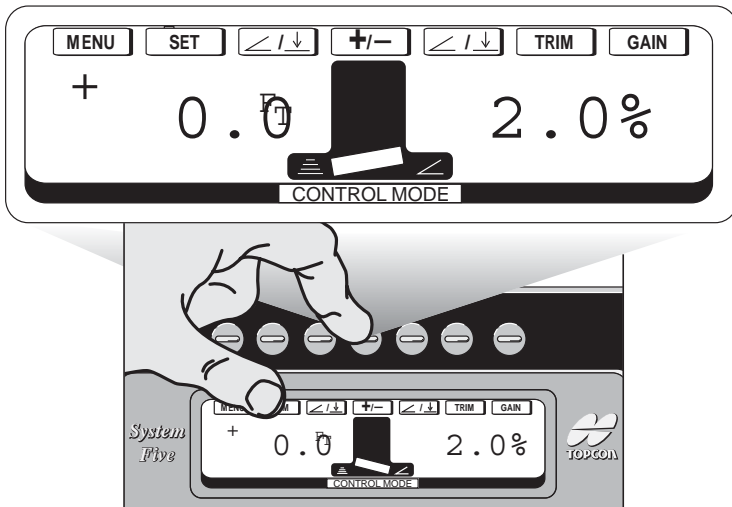


Figure 2-14.

• **Trim (Slope Control Only)** TRIM

Pressing the Trim button will allow the operator to adjust or "trim" the Blade Slope Sensor Calibration in order to compensate for the blade's cutting edge wear. This adjustment can be done "on the fly" in automatic cross slope operation. This calibration should be performed as the cutting edge wears. When operating in harsh material conditions, the slope calibration should be checked more often. (Refer to the Trim Calibration section within this manual).

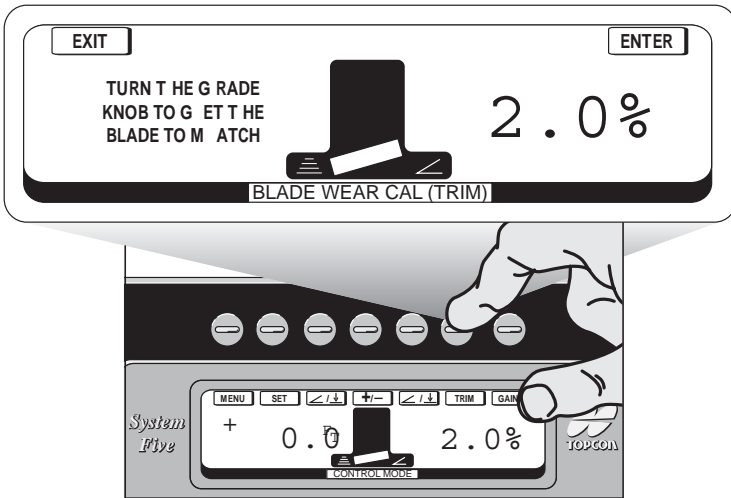


Figure 2-15.

- **Set (Elevation Control Only)**

Pressing the Set button will allow the operator to set the elevation grade reference number to any value desired. This does not change the elevation, it only changes the reference number displayed on the Control Box. (Refer to Setting Reference Number section within this manual).

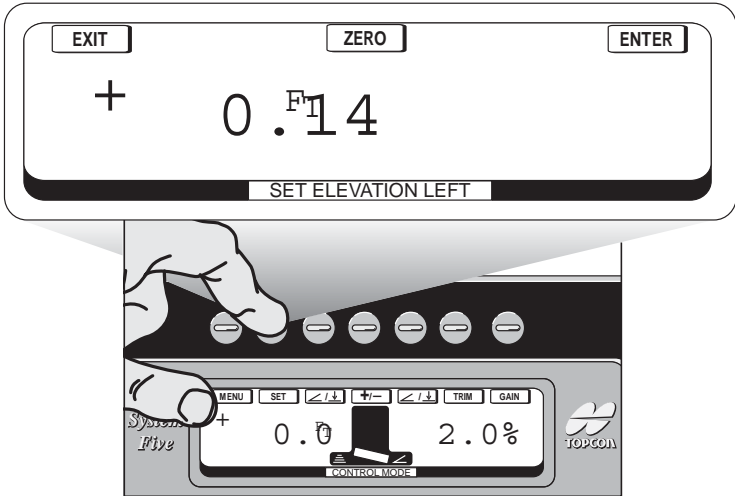


Figure 2-16.

• **Gain** GAIN

Pressing the Gain button will allow the operator to speed up or slow down the hydraulic response, or gain, of System Five. Gain adjustments can be made "on the fly" in Automatic Control.

- If the blade seems to be moving too slow and the lights take too long to reach grade, increase the Gain Setting Number, which will cause the hydraulics to respond quicker.
- If the blade is moving too fast and the lights are skipping through On Grade, decrease the gain.

There is a separate adjustment setting for Elevation Mode and Slope Mode. Making an adjustment for Elevation Mode or Slope Mode on the left side also changes the adjustment for that mode on the right side.

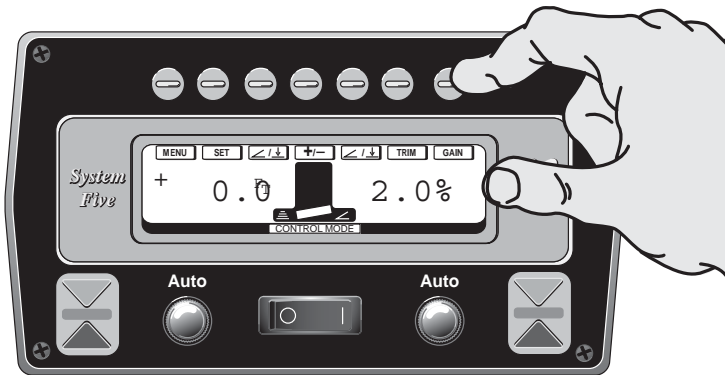


Figure 2-17.

Once Gain adjustments have been complete, push "ENTER".

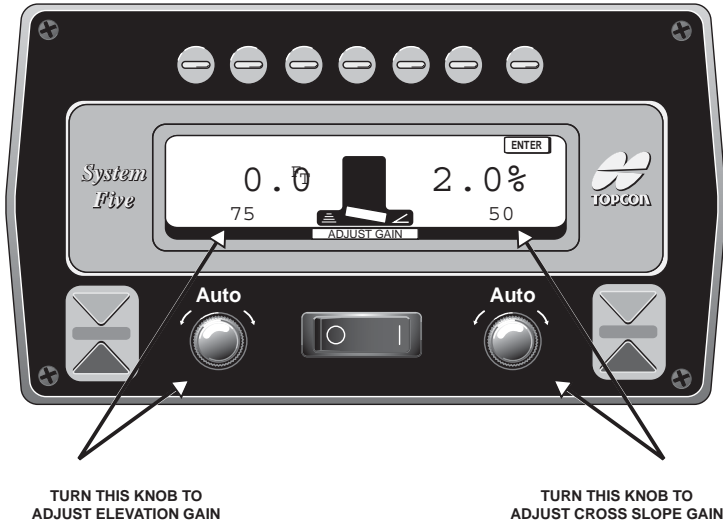


Figure 2-18.

Remote "Smart" Knobs

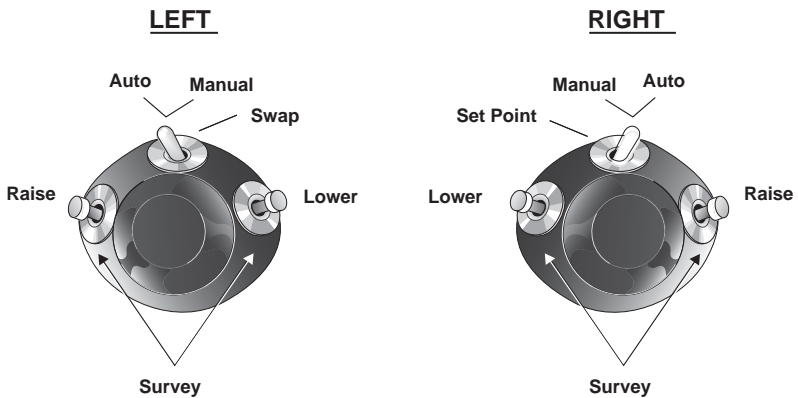


Figure 2-19.

- **Raise and Lower**

These buttons will make measured adjustments to the slope or elevation setting. Each time one of the buttons is pressed, the slope/elevation will change by one step. The outside button will

raise the moldboard and the inside button will lower the moldboard. They perform the same function as the Grade Adjustment Knobs located on the face of the Control Box, and allow the operator's hands to never leave the blade levers.

- **Survey**

Survey is used to quickly lock on grade. The Sonic Sensor will lock on the stringline, curb, or any other physical reference. The Laser Trackerjack will search up and down and lock on the laser beam. The Slope Control System will lock on to and display the slope the moldboard is setting on.

To activate Survey Mode, hold both the Raise and Lower Buttons for one second until a double beep is heard.

The Slope Control System can also be set to Indicate Mode. In this mode, the operator manually cuts grade, and the Control Box continuously displays the % slope he is cutting. It also shows the readings of the Blade Slope Sensor, Mainfall Sensor, and Rotation Sensor. This screen enables the operator to quickly check that all the sensors are functioning.

To activate the Slope Indicate Mode, first switch Slope Control to Manual. Then, hold both the Raise and Lower Smart Knob buttons for three seconds until a second double beep is heard. To switch back out of Indicate Mode, push either the Raise or Lower button, or just switch to Automatic Control.

- **Auto/Manual**

Allows operator to switch the blade between Automatic and Manual. Push the switch outward for Automatic Control. If both sides of the motorgrader are in slope mode then only one "Auto" indicator LED will illuminate consistently when System Five is switched to Automatic Operation. The other LED will flash; this indicates that side is NOT in Auto Mode. Do not leave switch in Automatic when not in use.²

- **Swap (Left Knob Only)**

Swap performs two functions at once, it reverses the sensor functions being used from one side of the machine to the other.

- Slope Sensor: the direction of fall is reversed.

- Sonic Tracker: switches the side of the machine controlling elevation.

This is commonly used when turning the machine around at the end of a pass.

Hold switch in for 1 second and swap occurs. A single beep tone is heard when swap occurs.

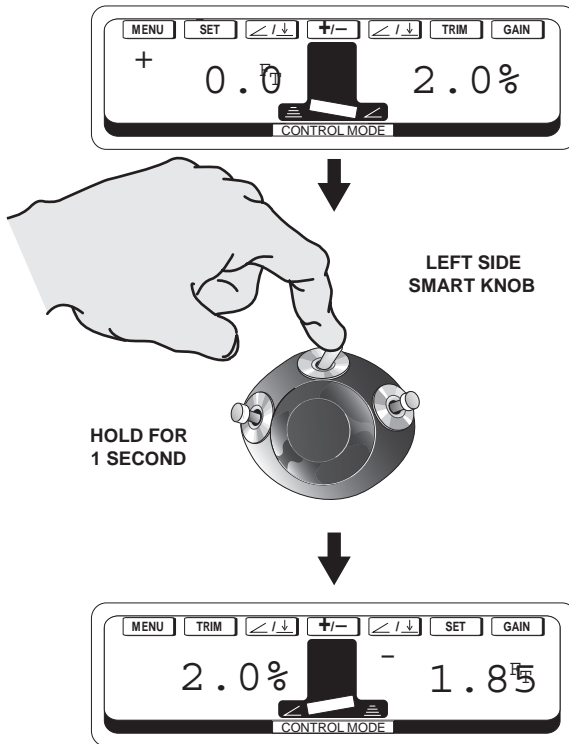


Figure 2-20.

NOTICE NOTICE

Although swap will switch elevation & slope from left to right side, it does not change the elevation grade setting used previously on that side. If the current elevation setting on the left side is 0.0 FT, pressing Swap will NOT change the right elevation setting to 0.0 FT.

- **Set Points (Right Knob Only)**

Set Points will allow the operator to preset up to 3 different elevation and slope settings. This is most commonly used when the job application requires multiple settings from one pass to another.

Each time the Set Point Switch is toggled, the Control Box will switch to the next Set Point. The Control Box will automatically remember the settings just as you left them before you switched to the next set point. (Refer to the Set Points section within this manual).

3DMC Mode



3DMC stands for 3 Dimensional Machine Control. 3D-MC is a revolutionary new automated machine control system that allows a contractor to guide an earthmoving machine directly from the digital data supplied by engineering firms. For the first time ever, a grading contractor can perform site grading work directly from design information. This system greatly reduces the need for costly stakeout work. Understanding of this system grows with experience. More experience and understanding makes judging how much survey staking to eliminate from a project easier, while still providing professional, accurate grading.

Setup Mode

Setup Mode is used for Calibration, System Setup, and advanced features of System Five.

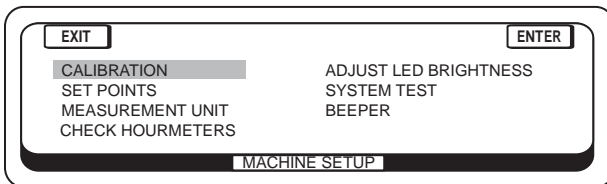


Figure 2-21.

- **Calibration**

Why do you need to calibrate?

Although System Five does not usually require maintenance or adjustment, the grader it is attached to does. All the moving parts on your grader wear at different rates. In order for System Five to work correctly, it has to be "told" what changes have occurred on your grader. (To perform Calibration Settings refer to the Calibration Chapter in this manual).

- **Set Points**

Allows operator to decide how many sets of preset values will be stored in the box—1, 2, or 3. (See Set Points Section of Manual).

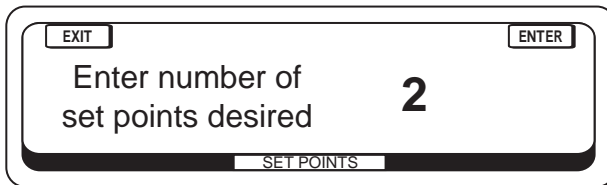


Figure 2-22.

- **Measurement Unit**

1. Using the right hand knob either select "FEET" or "METERS".
2. Press the "ENTER" button.

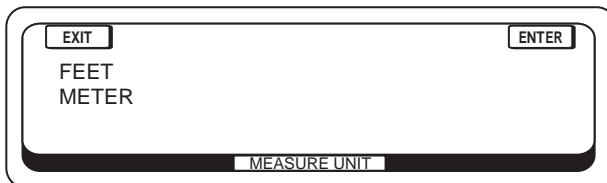


Figure 2-23.

• **Check Hourmeters**

This screen informs how many hours the box has been on and how many hours that it has been operating in the Automatic Mode. There are also user resettable hour meters. These can be reset to 0.0 by pressing the RESET button. When finished, press the "EXIT" button.

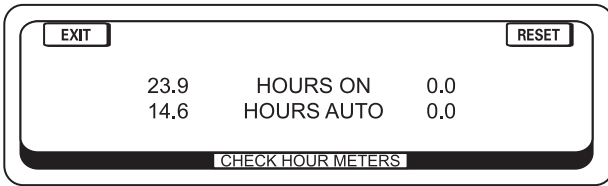


Figure 2-24.

• **Adjust LED Brightness**

1. Press button above "BACKLIGHT BRIGHT" to brighten up the backlight of the display.
2. Press button above "BACKLIGHT DIM" to dim the backlight of the display.
3. Turn the right hand knob to increase/decrease the brightness of LED's on the faceplate of the box.
4. Press the "ENTER" button to save the settings.

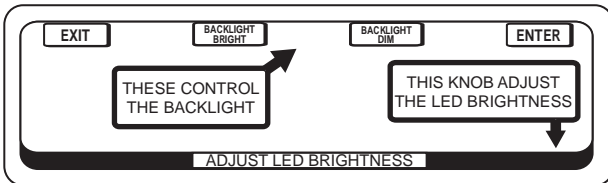


Figure 2-25.

- **System Test**

This is a diagnostic test for all of the components that make up the system. The Control Box will indicate if the device is in use and if it is properly working (Refer to Troubleshooting section).

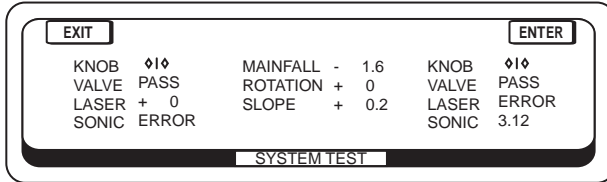


Figure 2-26.

- **Beeper**

Press the "ENTER" button to toggle between the beeper being "ON" or "OFF". When the beeper is turned on, a short beep will sound when System Five gets an out-of-range signal from the Sonic or Laser Sensor.

Sonic Tracker II

The Sonic Tracker II measures and controls the elevations of the moldboard. A transducer, located in the bottom of the Tracker, generates sound pulses like a speaker and listens for returned echoes like a microphone. The Tracker measures the distance, and controls grade from a physical grade reference, such as a curb, stringline, or existing road surface.

The Sonic Tracker II attaches to the system through one quick connect cable and attaches to the machine with a single bolt. At the end of the day, Tracker should be removed for proper storage in the carrying case.

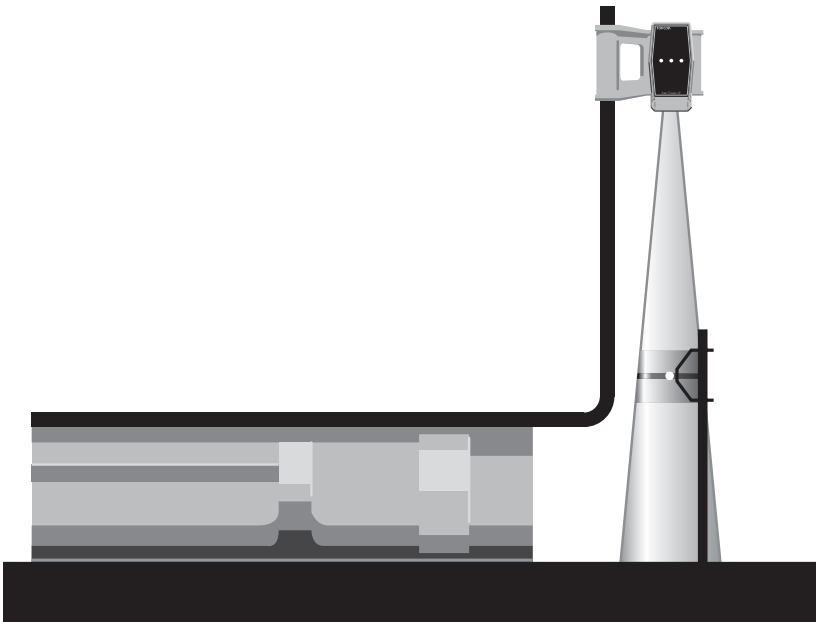


Figure 2-27.

The Sonic Tracker II measures the distance to a physical grade reference by sending out sound pulses 39 times per second. As soon as the Tracker sends out a sound wave it starts a stop watch. The sound waves go down, bounce off of any physical reference, and are reflected back to the Tracker. The Tracker measures the time it takes for the sound wave to return to the Tracker. Knowing the speed of sound, the Tracker accurately calculates the exact distance to the grade reference. The Tracker can use any physical grade reference, such as a stringline, curb, or existing surface.

STOPWATCH

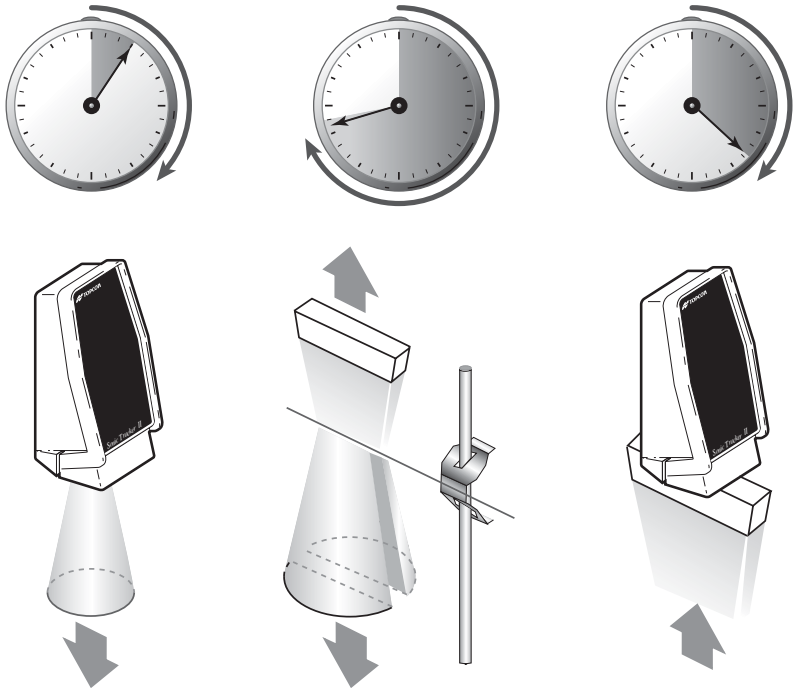


Figure 2-28.

Working Window

Since the Sonic Tracker II is mounted to the mold board, as it raises or lowers, the tracker measures exactly how far above or below the desired grade reference it is. Built into the Tracker is an operational zone, or Working Window, .2 feet above and below the grade reference. The grade lights on the Sonic Tracker and Control Box continuously display this grade information to the operator.

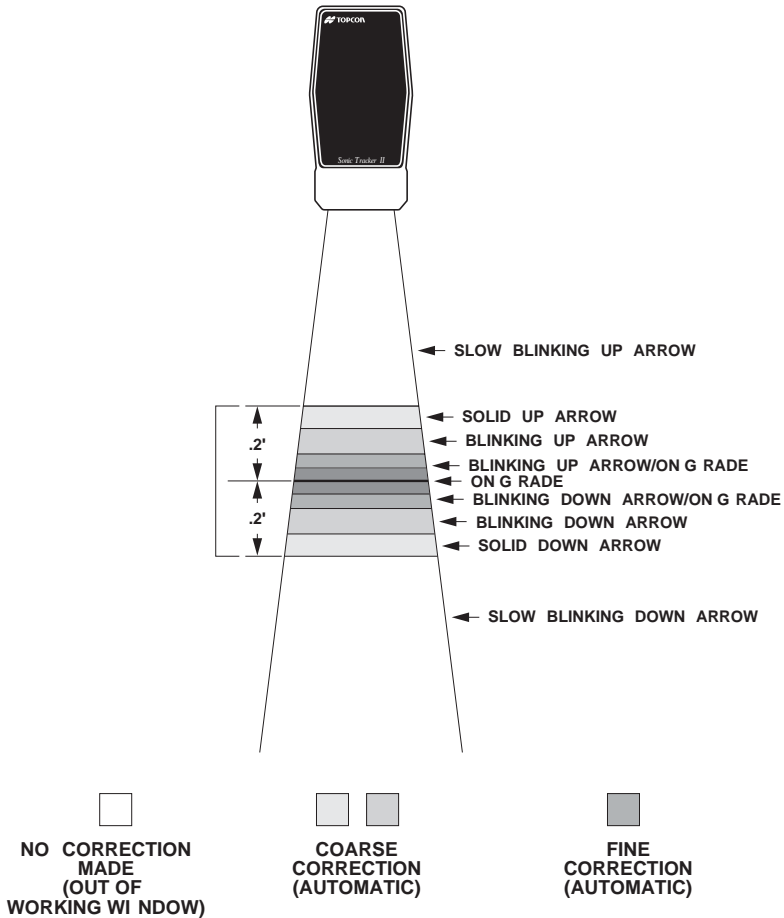


Figure 2-29.

On the grader the Sonic Tracker II will be positioned above the grade reference. Its job is to maintain the exact distance from the tracker to the grade reference, keeping the Tracker On Grade. If the Tracker is On Grade, the cutting edge will be at the desired grade.

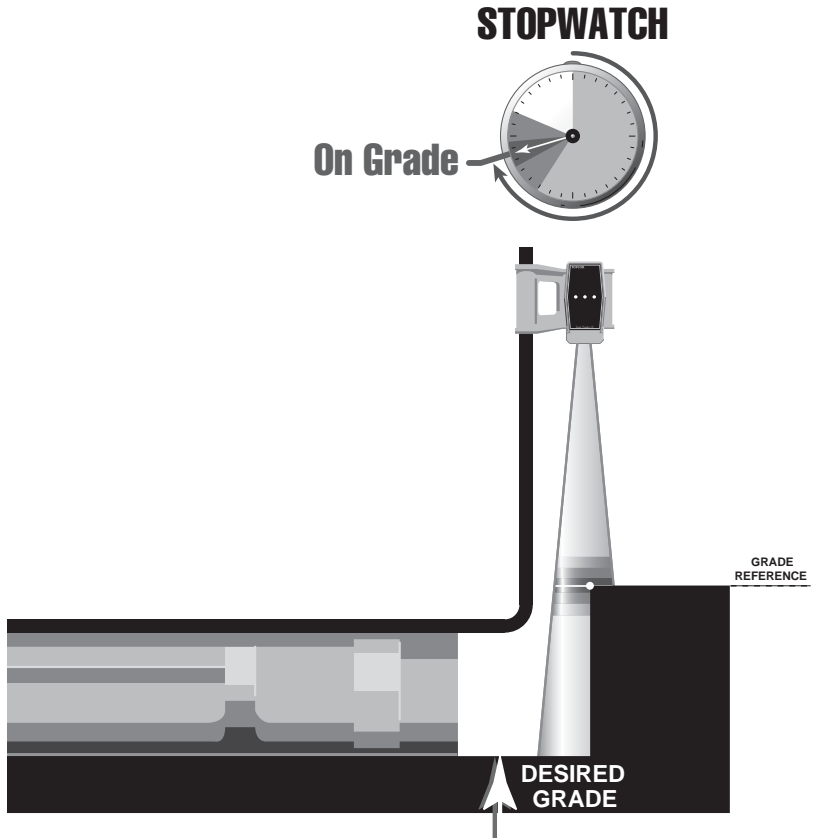


Figure 2-30.

If the moldboard and the Tracker II start to raise, the stop watch will be stopped at a longer time. The Tracker and Control Box will indicate a down correction arrow, and lower hydraulic valve corrections will be applied to bring the Tracker back to On Grade.

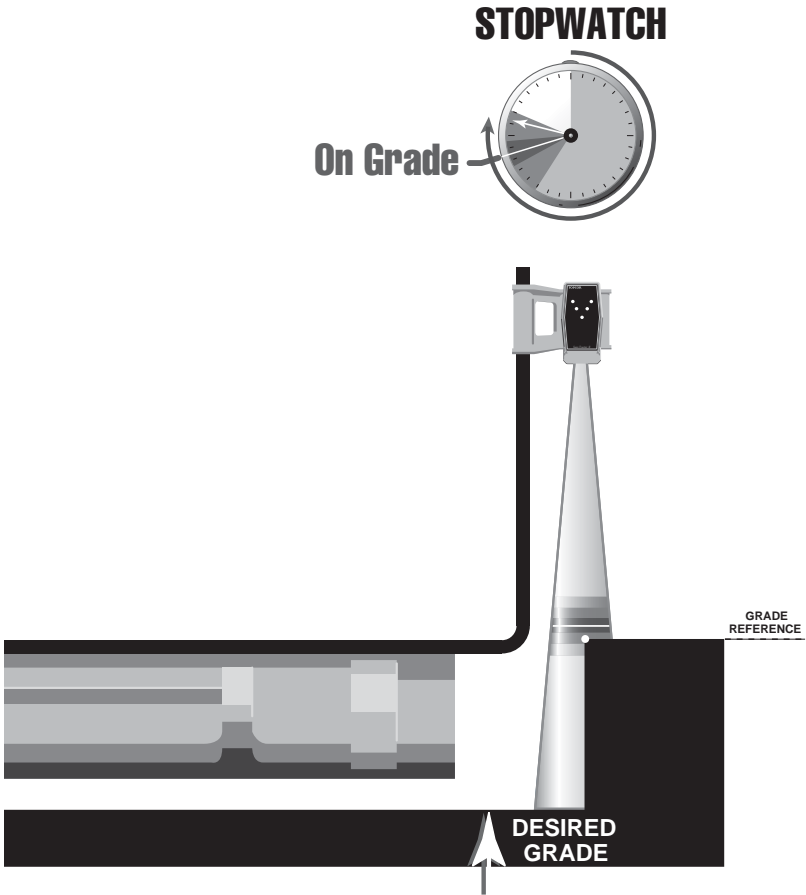


Figure 2-31.

If the moldboard and Tracker are lowered the stop watch will be stopped at a shorter time. The Tracker and Control Box will indicate a raise correction arrow, and raise hydraulic valve corrections will be applied to bring the Tracker back to On Grade.

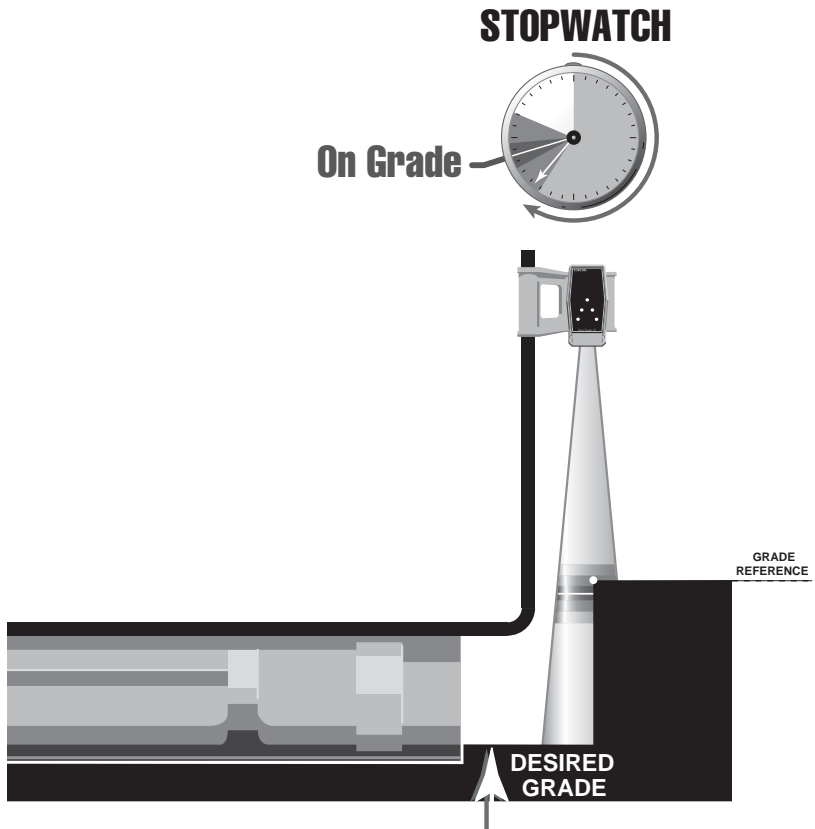


Figure 2-32.

If the Tracker is side shifted off a stringline, the Tracker's stopwatch indicates a long time for the sound waves to come back. The Tracker is out of the Working Window, and no On Grade correction signals will be applied.

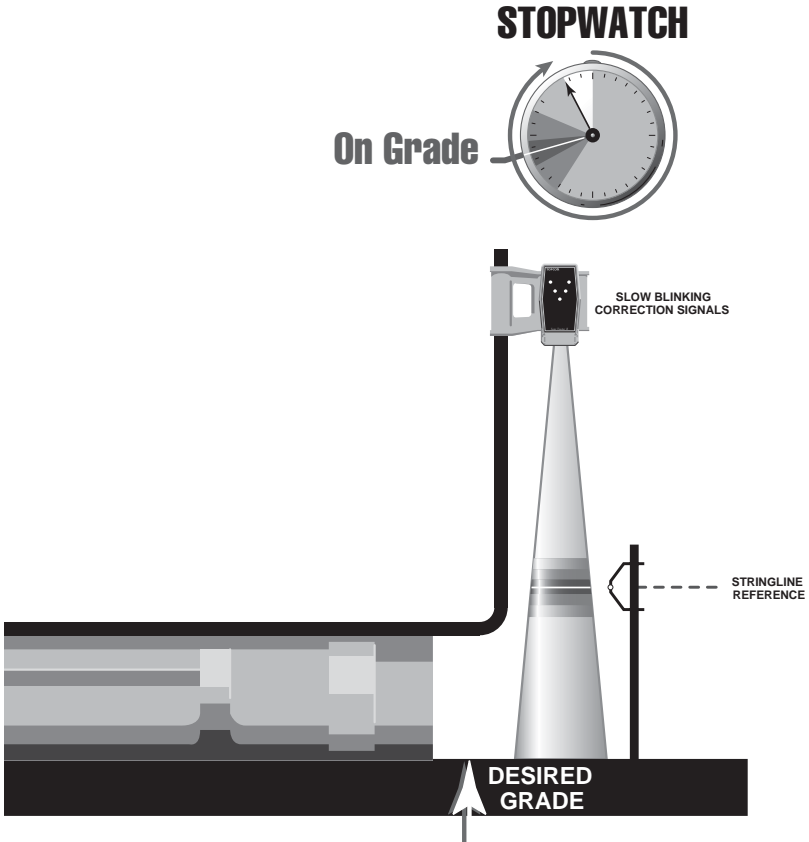


Figure 2-33.

If the Tracker sees an obstruction closer than the reference signal, such as a grade pin, the sound waves do not take as long to come back and the stop watch is stopped much sooner. The Tracker is out of the Working Window, and no On Grade correction signals will be applied.

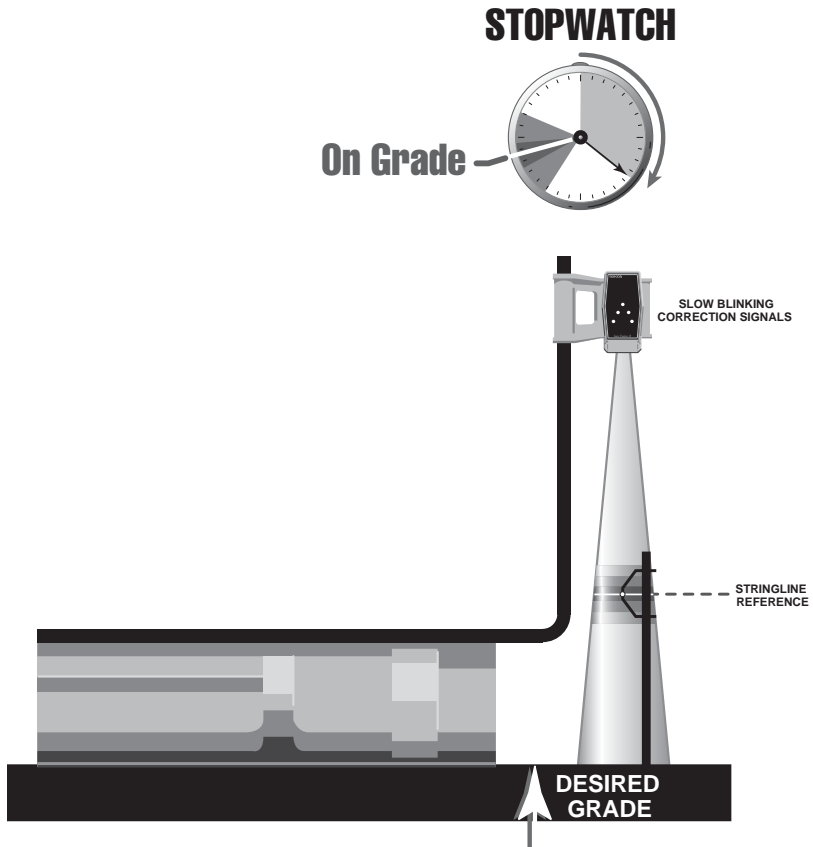


Figure 2-34.

When setting up the Tracker over a grade reference, the size of the Sonic Cone or the "footprint" needs to be considered. As an example, at about 2 feet from the tracker, you will have a footprint or cone of about 6 inches. As the Tracker is positioned closer to the grade reference the working footprint decreases in size. As the Tracker is moving farther away from the grade reference the sonic footprint or cone will increase in size.

SONIC "FOOTPRINT"

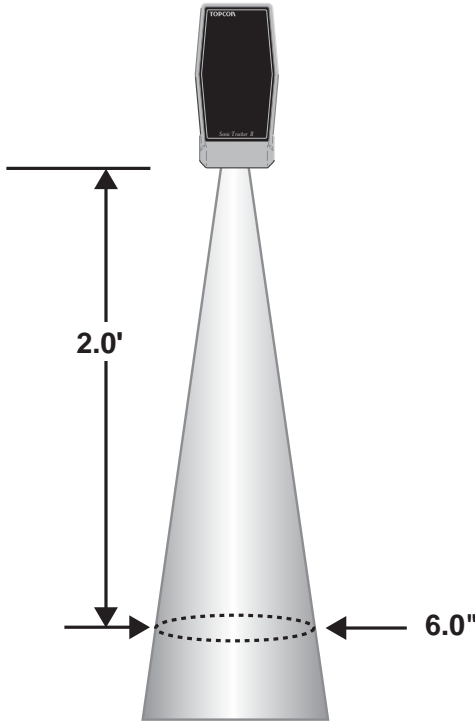


Figure 2-35.

The Tracker has a total working range of 14 inches to 55 inches—41 inches of adjustment! This allows the Tracker to be set over a stringline or choker on one pass, then match grade on the next pass without moving the tracker. The Tracker is not more accurate when set closer to the grade reference. The job application should determine the position of the Tracker. For example, as a "rule of thumb", when using a stringline reference, keep the Tracker about 2 feet above the string. This will give the operator about 6 inches of lateral movement to keep the Tracker over the string. When tracking a curb, you may want to lower the Tracker to keep it over the lip of the curb, and avoid the Tracker from "seeing" the top or face of the curb.

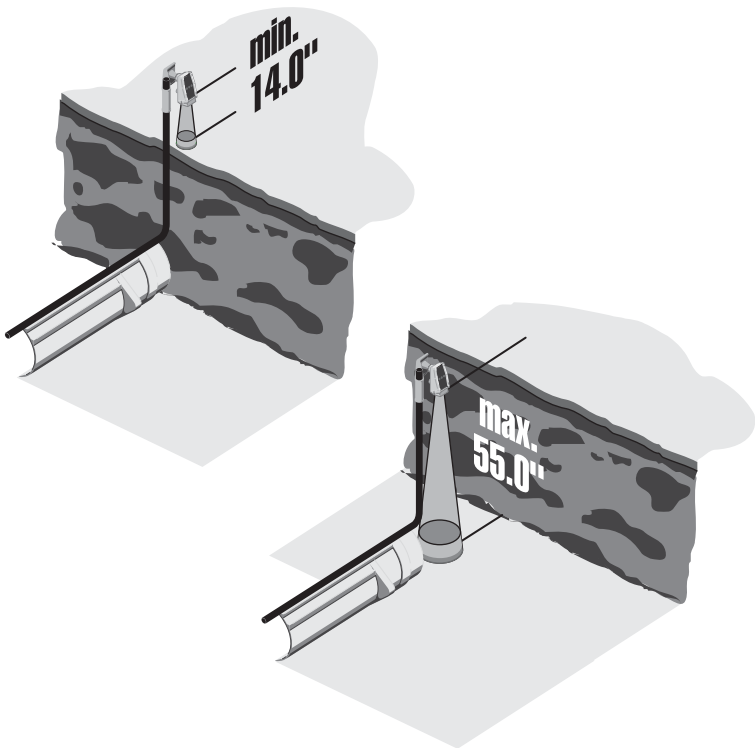


Figure 2-36.

Laser Control

For Laser Control a laser transmitter is used to produce a plane of light which becomes the grade control reference for the job site. The laser receiver will control the blade to cut grade parallel to the laser beam reference.

When the laser beam is in the center of the receiver, it indicates an On Grade signal.

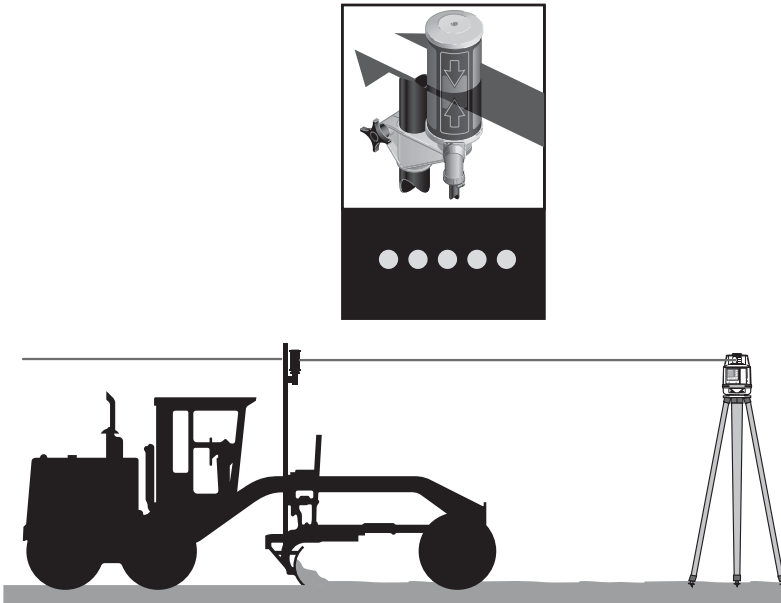


Figure 2-37.

As the blade is raised, the beam of light hits the Laser Receiver below the center and a lower signal is indicated.

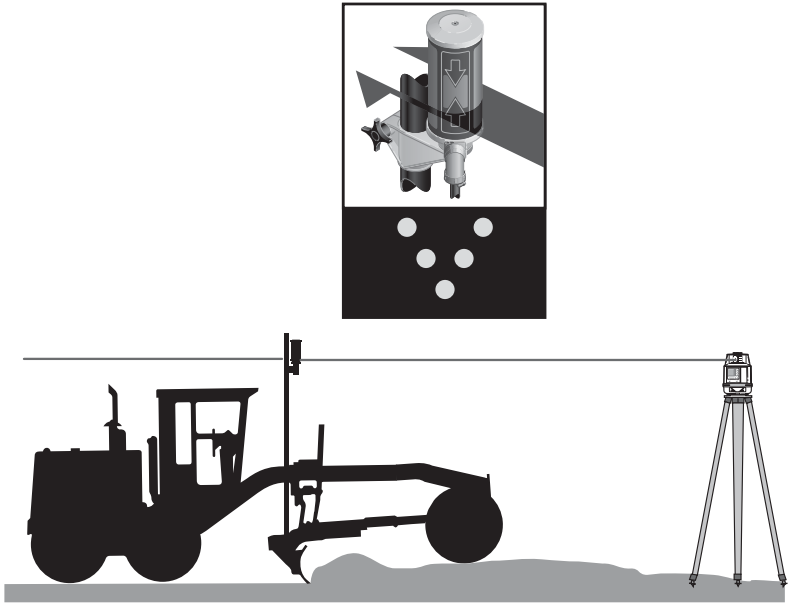


Figure 2-38.

As the blade is lowered the beam of light hits the Laser Receiver above the center a raise signal is indicated.

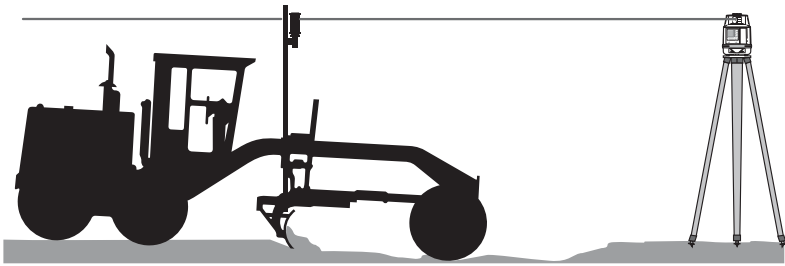
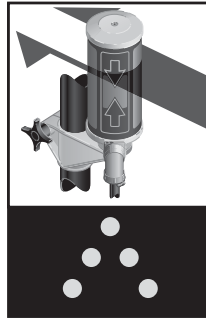


Figure 2-39.

Slope Control

System Five uses 3 sensors to measure and cut the desired slope perpendicular to the edge of the road.

- **Blade Slope Sensor**

A blade slope sensor is mounted to the back of the circle. It contains an electronic level vial, which acts as a precision carpenter's level. As the blade is raised or lowered, the Blade Slope Sensor continuously measures the slope of the cutting edge and sends the slope information to the Control Box.

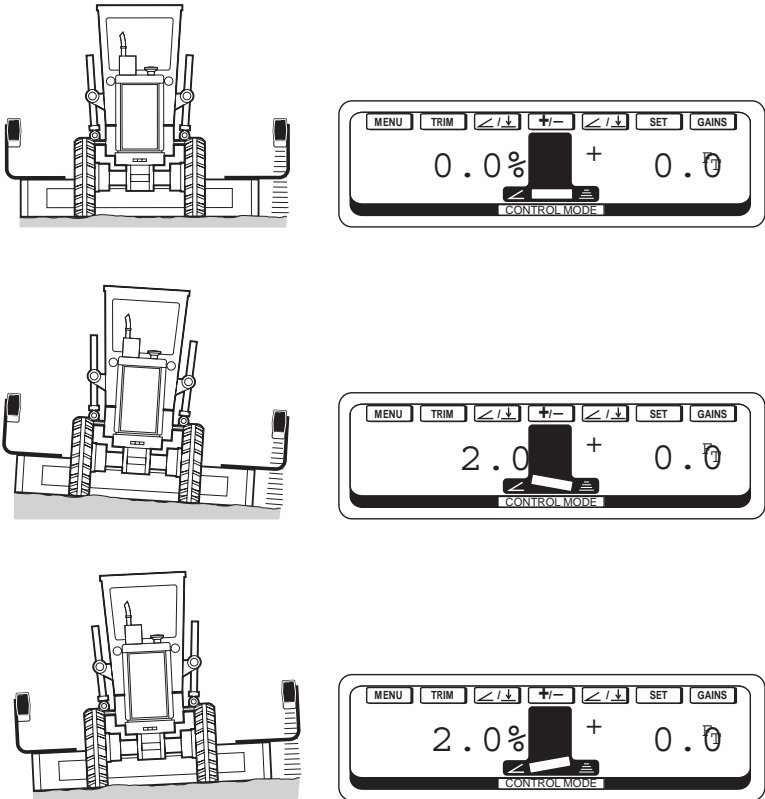


Figure 2-40.

- **Rotation Sensor**

A Rotation Sensor is mounted on the hydraulic swivel in the center of the circle.

It measures the rotation angle of the moldboard. Since the desired slope is perpendicular to the edge of the road, the rotation sensor measures the blade rotation angle to compensate to get the correct cross slope.

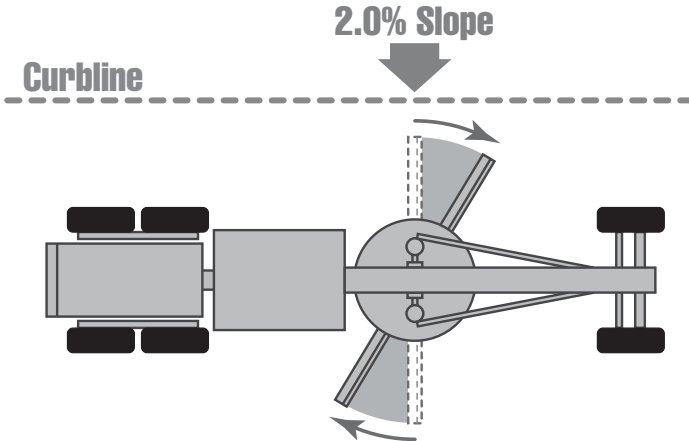


Figure 2-41.

- **Mainfall Sensor**

Mounted to the frame of the machine is the Mainfall Sensor. It has an electronic level vial just like the Blade Slope Sensor. The Mainfall Sensor measures the slope of the machine going up-hill or down. When the blade is rotated, the mainfall prevents the leading edge from undercutting when going uphill and the trailing edge from undercutting when going downhill.

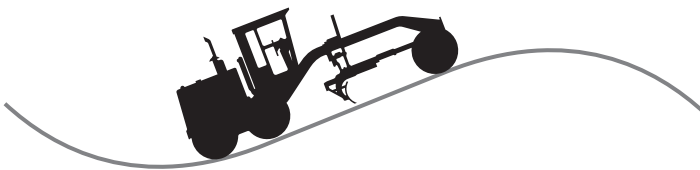


Figure 2-42.

The operator just dials in the desired slope of the project, and the system will cut the desired slope perpendicular to the edge of the road, regardless of the blade angle or going up or down hills. The operator can rotate the blade on the fly, and System Five will automatically compensate to cut the correct cross slope.

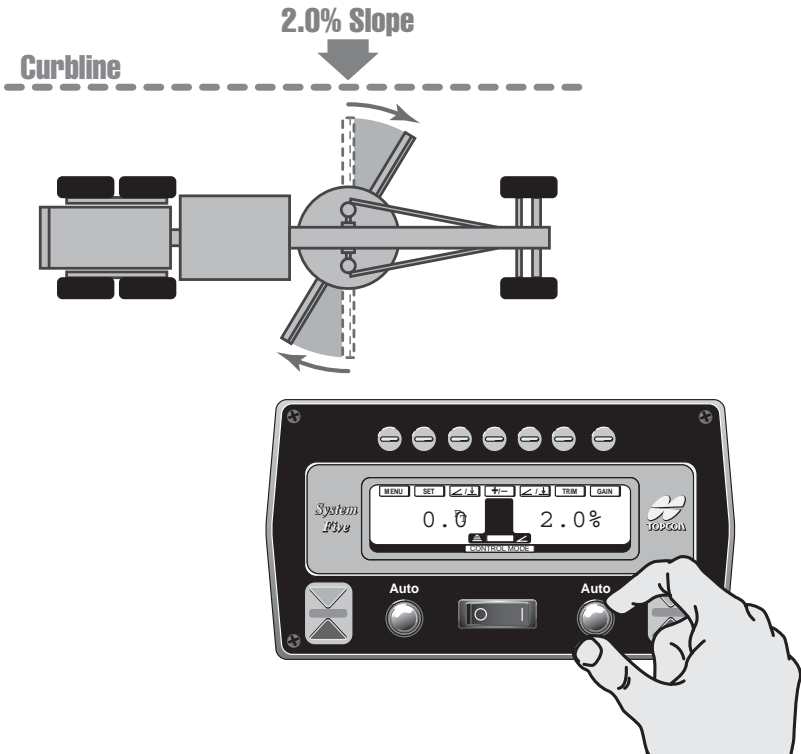


Figure 2-43.

Notes:

Calibration

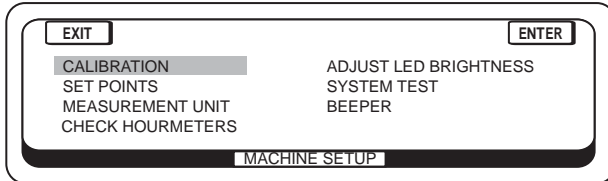


Figure 3-1.

Why do you need to calibrate?

Although System Five does not usually require maintenance or adjustment, the grader it is attached to does. All the moving parts on your grader wear at different rates. In order for System Five to work correctly, it has to be "told" what changes have occurred on your grader. All the Calibration Settings are stored in the Control Box memory. The Control Box will not "loose" the Calibration Settings when turned off or stored for long periods.

There are 6 calibration selections: Rotation Sensor, Mainfall Sensor, Blade Slope Sensor, Blade Wear (trim), Adjust Valve Offsets, External Switch.

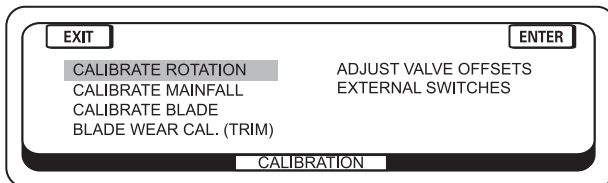


Figure 3-2.

Calibrate Rotation

The Cross Slope System cuts the desired slope perpendicular to the draw bar, or "A"-frame assembly. The Rotation Sensor, which measures the blade angle of rotation, must be calibrated so it knows when the blade is perpendicular, or at 0 degrees, to the "A"-frame assembly. Wear or damage to the machine's hose tray or guide rods are the reason for occasional Rotation Sensor Calibration.

To perform the Rotation Sensor Calibration:

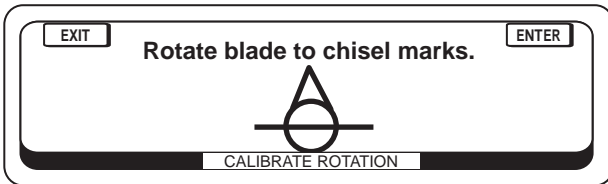


Figure 3-3.

1. Rotate the blade to the chisel marks on the "A"-frame assembly provided by installer.
2. Push the "ENTER" button and the Rotation Sensor Calibration is completed.

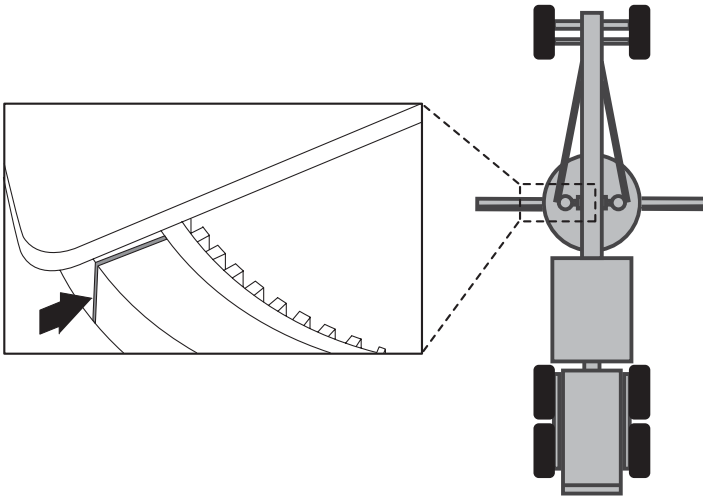


Figure 3-4.

Calibrate Mainfall

The Main Slope (Mainfall) Sensor bolted to the frame of the machine measures the slope of machine travel, up hill and down. Tire wear is the primary reason for occasional Mainfall Sensor Calibration.

To perform the Mainfall Sensor Calibration:

1. Raise the moldboard so that both sides are a few inches above the ground, position the machine on a smooth, even surface and mark the front tire locations.
Push the "NEXT" button.
2. Wait 5 seconds until you hear a single beep.

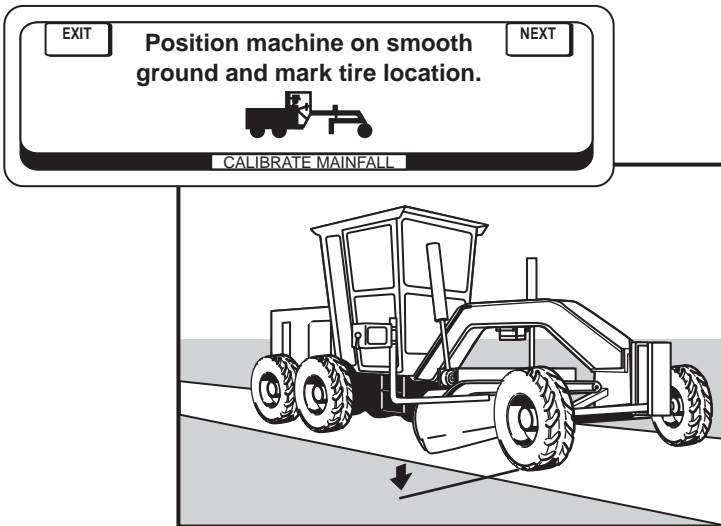


Figure 3-5.

3. Turn the machine around 180 degrees and line up the center of rear tires on previous tire mark. Push the "ENTER" button.
4. Wait 5 seconds until you hear a double beep, and the calibration is complete.

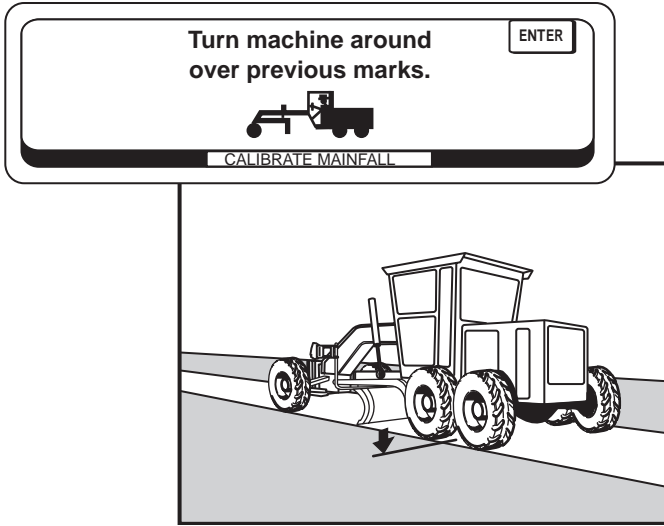


Figure 3-6.

Calibrate Blade

The Blade Slope Sensor, bolted to the back of the machine's circle assembly, measures the slope of the cutting edge. Cutting edge wear is the reason for Blade Sensor Calibration.

To perform the Blade Slope Sensor Calibration:

1. Place the cutting edge of the blade firmly on the ground and mark the location. This is position #1.
Push the "NEXT" button.
2. Wait 5 seconds until you hear a single beep.

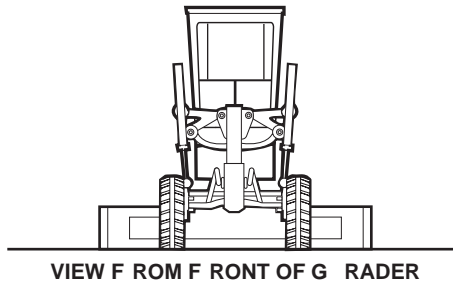
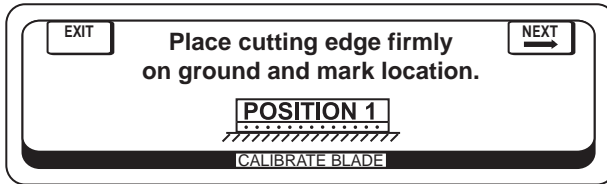
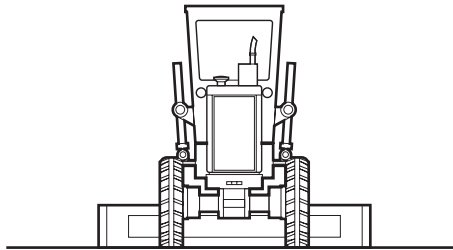
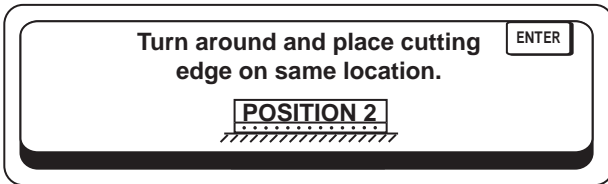


Figure 3-7.

3. Turn the machine around 180 degrees and line up the blade on the previous mark (The blade can be rotated or side shifted to make cutting edge match). This is position #2.

Push the "ENTER" button.

4. Wait 5 seconds until you hear a double beep, and the calibration is complete.



VIEW F ROM BEHIND G RADER

Figure 3-8.

NOTICE NOTICE

This is a "rough" Blade Sensor Calibration and only needs to be performed when the system is installed or if the Slope Sensor has been removed. After this calibration has been completed, always perform the Blade Wear (Trim) Calibration as your are cutting grade to make a fine calibration adjustment.

Blade Wear Calibration (Trim)

The Blade Wear Calibration allows the operator to make an adjustment for cutting edge wear. This calibration adjustment is performed while cutting grade right on the job, and can be completed in less than 5 minutes. This will insure a perfect calibration and verifies System Five is cutting exactly the way it is supposed to.

To perform the Blade Wear Calibration:

1. Switch either left side or right side to Automatic Control, and grade a smooth finish pass at least 50 feet long. The % of slope dialed in does not matter, but it is best to dial in a slope that will closely match the area being graded. If the ground is fairly rough, back up and grade 2 or 3 passes until a smooth finish pass is cut. Press the "NEXT" button.

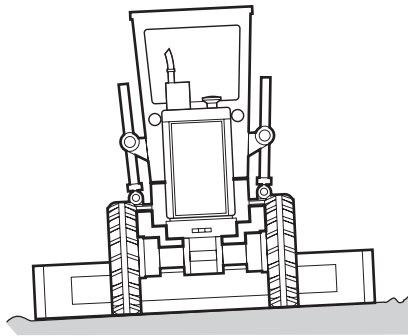
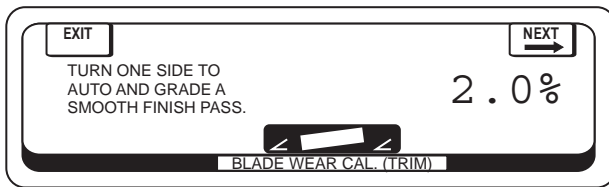


Figure 3-9.

2. Turn machine around 180 degrees and position blade over previous pass. With one side in automatic, slowly lower the blade and observe to see if the cutting edge matches the previous pass. Press the "NEXT" button.

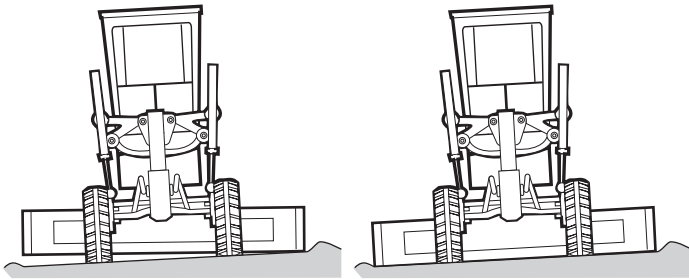
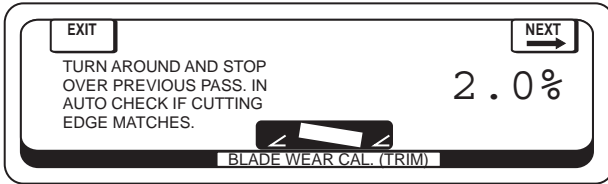


Figure 3-10.

3. If the cutting edge matches, no adjustment is needed. Press the "ENTER" button. If the cutting edge does not match, turn the right grade adjustment knob to get it to match. Press the "ENTER" button, and the Blade Trim Calibration is complete.

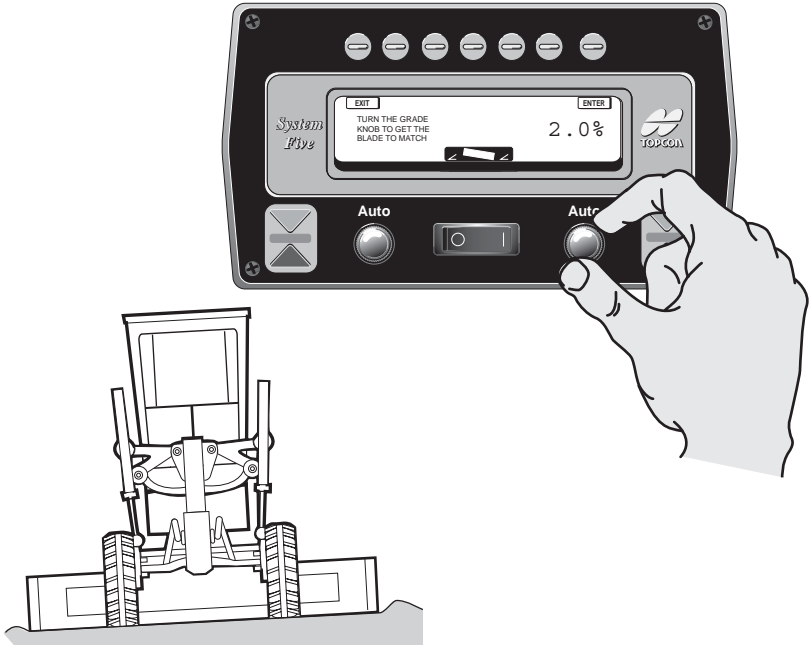


Figure 3-11.

NOTICE NOTICE

After pushing the "ENTER" button, the cutting edge will raise or lower half the distance you just dialed in to get it to match.

Adjust Valve Offsets

Allows the operator to adjust the hydraulic valve offsets automatically or manually. Valve Offsets set the minimum hydraulic correction needed to return to grade. This is not a speed adjustment.

Automatic Adjustment

1. Raise the moldboard so that both sides are a few inches above the ground.
2. Push the "Auto Offsets" button. System Five will automatically perform the Valve Calibration, first with left hand raise and then lower, then repeating with the right hand side.
3. Once all four adjustments are completed, press the "ENTER" button and the values will be saved.

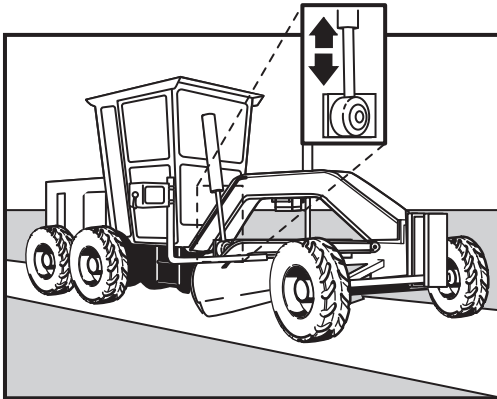
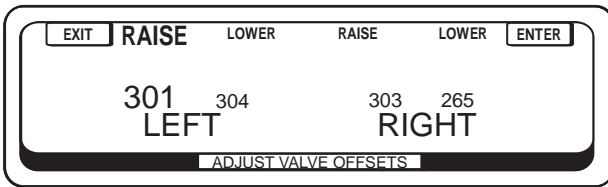


Figure 3-12.

Manual Adjustment

If the operator wants to make an adjustment or just verify that the Valve Offset Values are correct, a "Manual" Valve Offset Calibration can be performed.

1. Press the "Raise" button on the left hand side. Rotate left hand knob, raising or lowering the Raise Offsets.
2. Press the "Lower" button on the left hand side. Rotate left hand knob, raising or lowering the Lower Offsets until the left hand side of the blade raises slowly.
3. Repeat on the right hand side for both the Raise and Lower Offsets.
4. Press the "ENTER" button and the values will be saved.



NOTICE

Pressing "EXIT" does not save values.

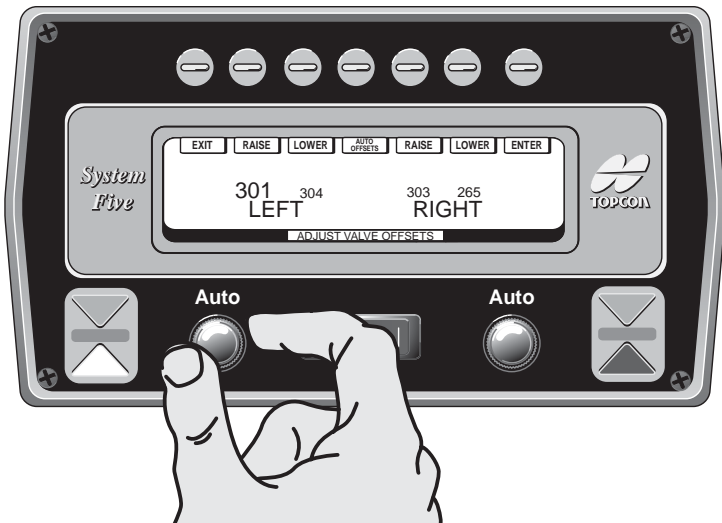


Figure 3-13.

External Switches

The External Switch Menu allows the operator to use their Remote Switch OR SmartKnobs.

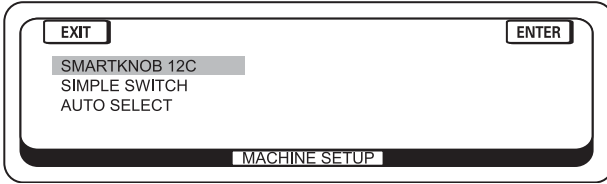


Figure 3-14.

- **SmartKnob**
Selects program to operate the SmartKnob.
- **Simple Switch**
Selects program to operate the Simple Switch (System Four Type Switches).
- **Auto Select**
Automatically determines which device (SmartKnob or Simple Switch) is connect to System Five System. The appropriate program is then selected to operate the device.

Getting Ready to Grade

Control Box Setup

To prevent theft or vandalism, the Control Box has been designed for quick removal at the end of the day. To install the Control Box, just bolt it on with the hand knob and connect the two quick-disconnect electrical connectors.

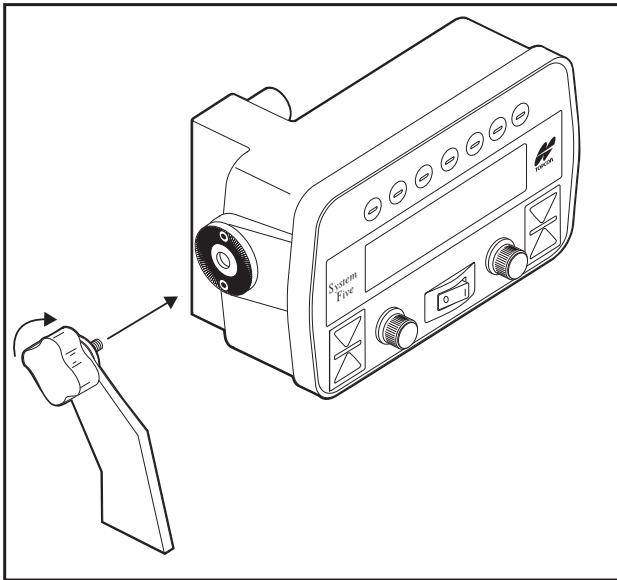


Figure 4-1.

When you power up System Five, it will automatically come on to Control Mode with the settings just as you had them the last time the box was used. The Slope Calibration and Elevation Reference Setting are stored in the Control Box. Except for possible cutting edge wear and changes in Sonic Tracker or Laser Trackerjack set up, you may not need to make any calibration or adjustments for many weeks or months. In most cases, you can turn on the box and begin grading.

Checking Cross Slope (Trim Calibration)

Before using the Cross Slope System; check to make sure there has not been excessive cutting edge wear from previous use. This takes less than 5 minutes and is completed right on the jobsite.

1. Switch the Cross Slope to either the left or right side and grade a smooth finish pass at about 50 feet long in Automatic Control. The % slope you dial in does not matter for calibration, but it is best to dial in a slope that will closely match the area you are grading so you will not have to cut too much. If the ground is fairly rough, you may need to back up and grade 2 or 3 passes until you cut a smooth finish pass.
2. Turn the machine around, push the switch to reverse the slope, and begin to grade slowly over the previous pass with either side in Automatic. Slowly lower the blade and observe to see if the cutting edge matches the previous pass. If the cutting edge matches, no adjustment is needed.

If the cutting edge does not match:

Push the Trim button, then turn the Grade Adjustment Knob to get it to match. Push "ENTER" and the Blade Trim Calibration is complete. You are now ready to begin grading with the Cross Slope System.

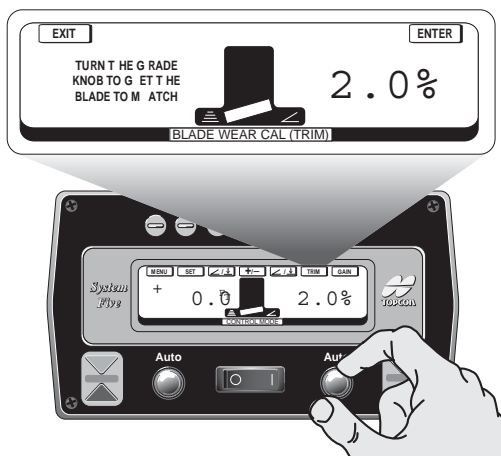


Figure 4-2.

Sonic Tracker Setup

When installing and positioning the Sonic Tracker II, first, connect the coil cord to the Tracker. Bolt the Tracker to the bracket, and visually check to get the "L"-Bar and Tracker plumb.

Make one wrap of the coil cord around the "L"- Bar. This will act as a strain relief for the connector on the Tracker. Be sure the coil cord snap hook is in place and secure.

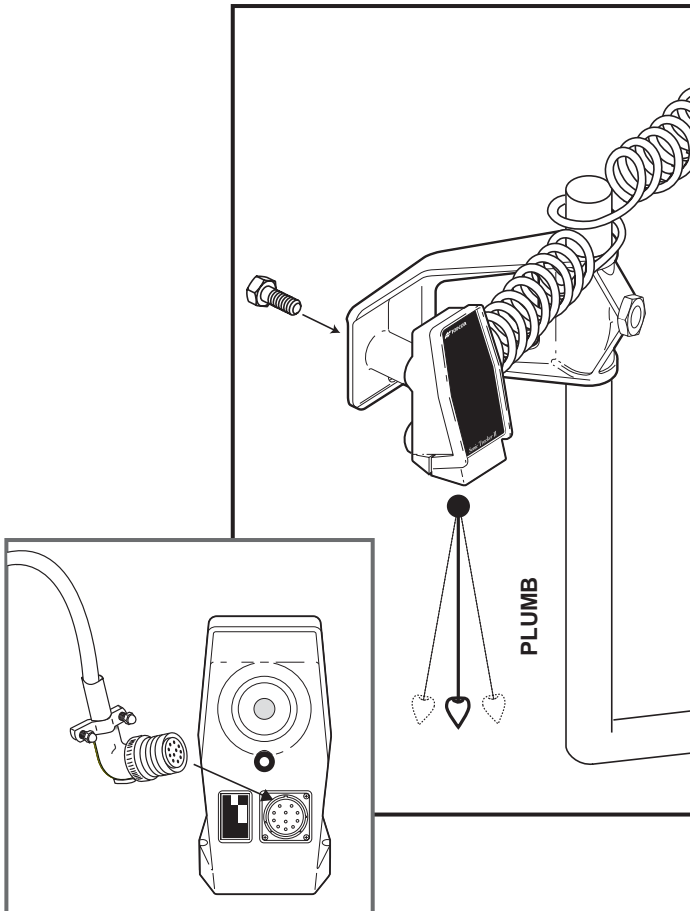


Figure 4-3.

Position the "L"-Bar horizontally so the Tracker will be over the reference for the jobsite. For example, when tracking a stringline that is offset from the edge of the road, set the end of the moldboard at the edge of the road and slide the "L"-Bar so the Tracker is over the stringline. When tracking a curb, keep the "L"-Bar in close to keep the Tracker over the lip of the curb.

Raise or lower the Tracker bracket to position it at a proper height above the grade reference. Although the Tracker can be set as close as 14 inches and as far as 55 inches from the grade reference, consider the job application for the best set up. When tracking multiple references, for example, elevated string on one pass then matching grade on the next pass, consider the Tracker position so it works for both applications without having to move the Tracker.

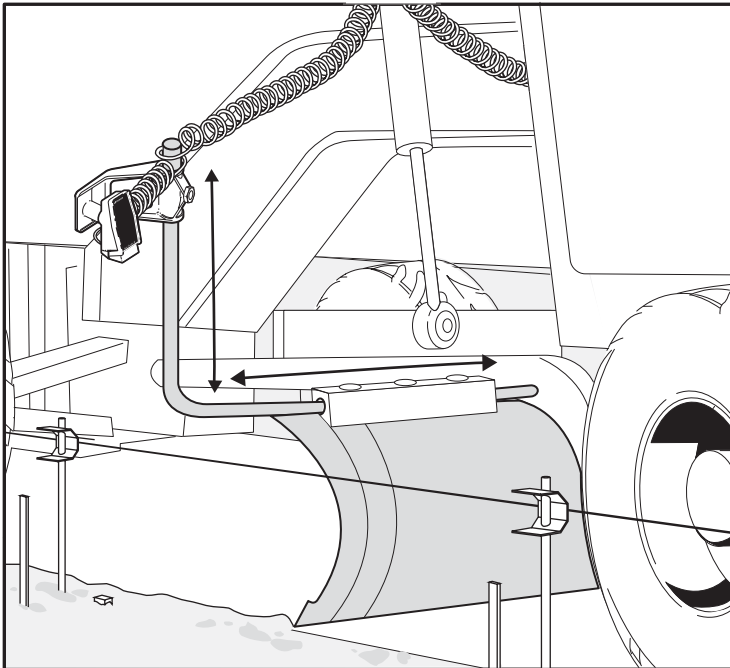


Figure 4-4.

The closest the Tracker can be set to the grade reference is 14 inches.

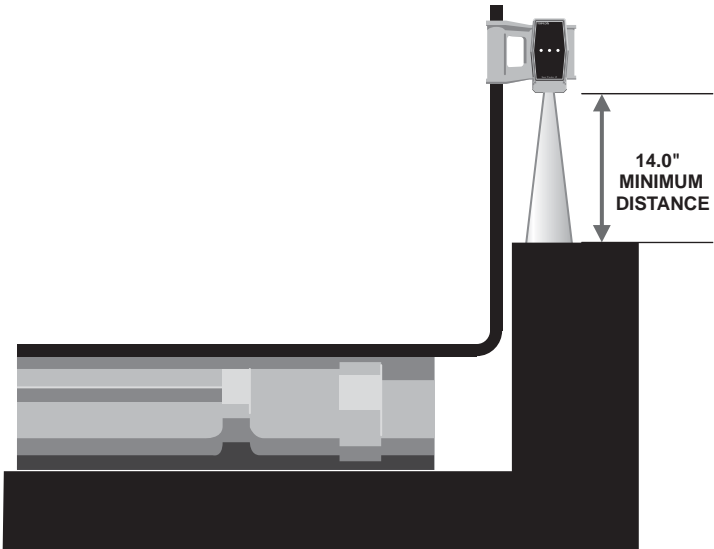


Figure 4-5.

The farthest the Tracker can be set from the grade reference is 55 inches.

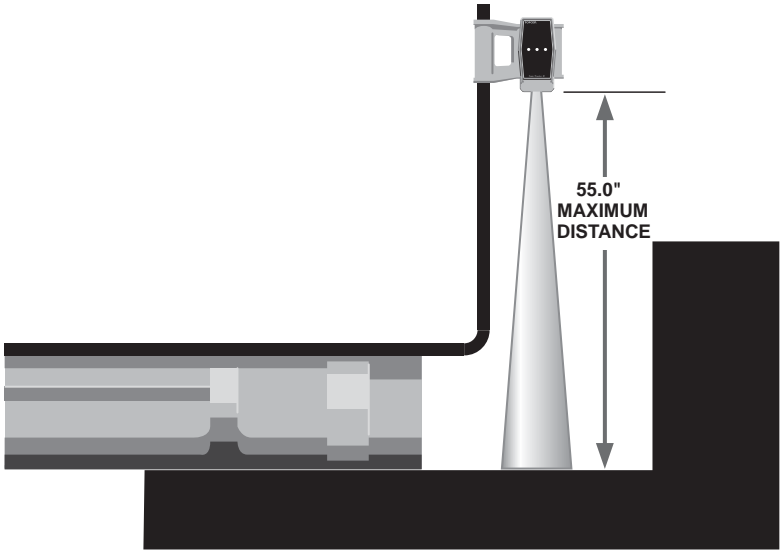


Figure 4-6.

When tracking a stringline, keep the Tracker about 24 inches above the string. At 24 inches the Sonic Footprint is about 6 inches in diameter so keeping the Tracker over the string is easy. Just keep the moldboard at the edge of the road where it should be, and the Tracker should be over the stringline.

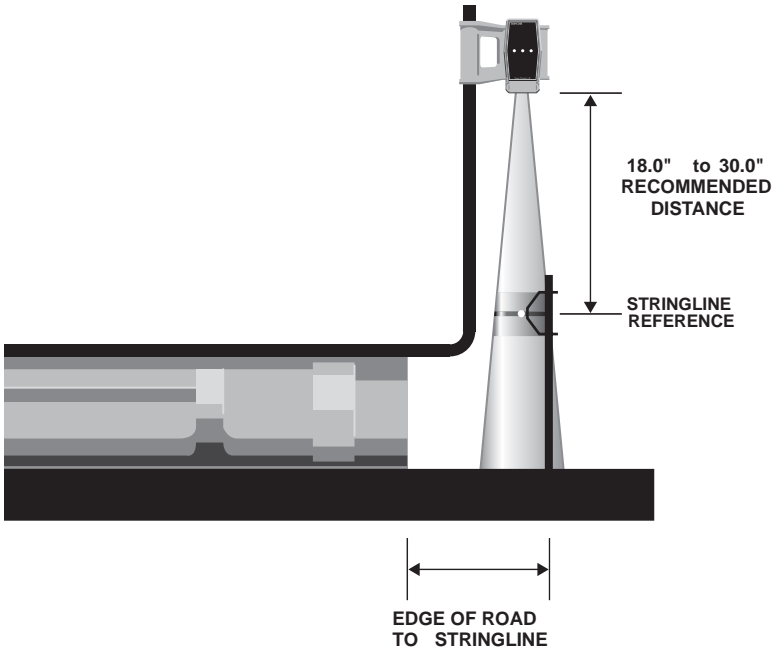


Figure 4-7.

When tracking an existing road, position the Tracker 14 - 30 inches. This will leave enough distance to adjust the Working Window to On Grade when the blade is moved over to match the first pass.

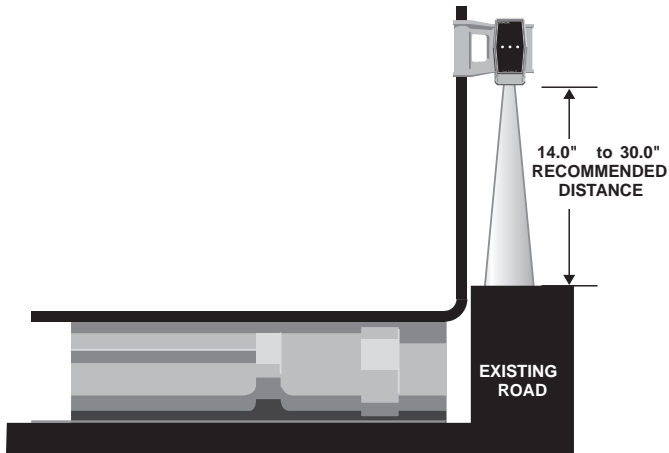


Figure 4-8.

When tracking next to a barrier wall, lower the Tracker to reduce the size of the Sonic Footprint. Position the Tracker so it just picks up the edge of the road, and does not hit the side of the barrier wall. The concrete is porous enough to reflect sound waves and give a false reading even though it is vertical.

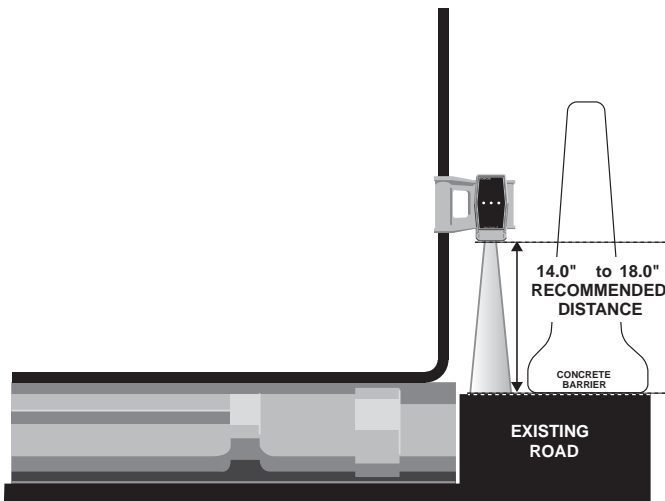


Figure 4-9.

When tracking a curb, lower the tracker so it is just picking up the lip of the curb. This will keep it from picking up the top of curb or obstructions in the gutter.

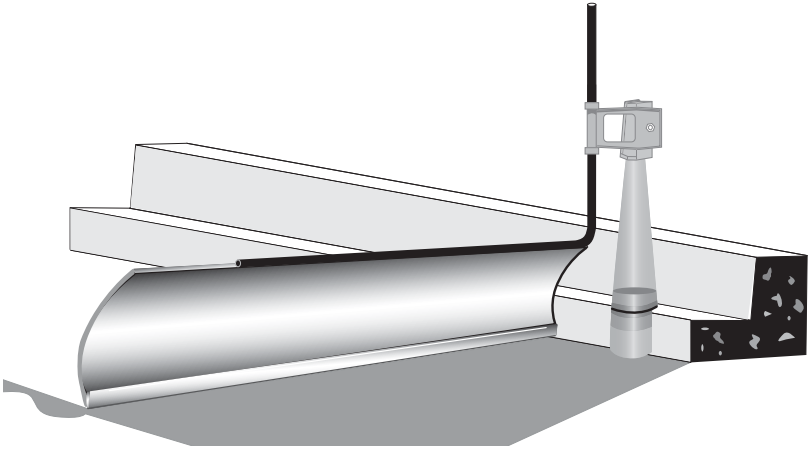


Figure 4-10.

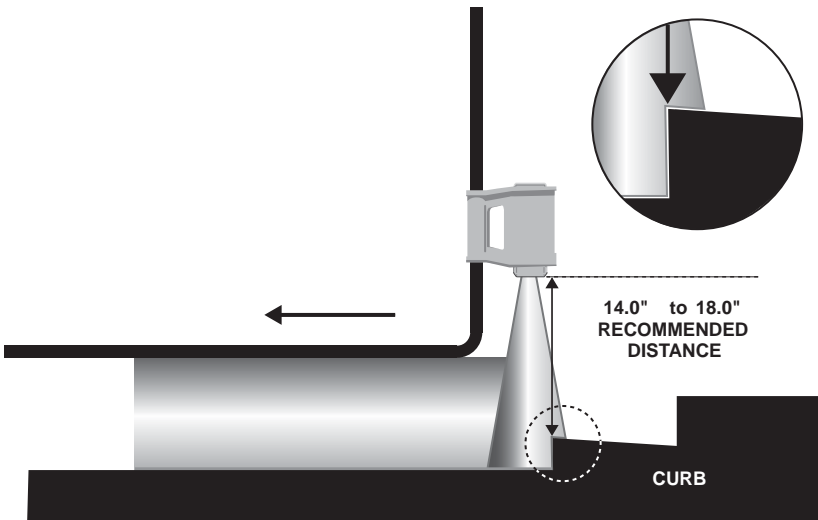


Figure 4-11.

Setting the Reference Number

For most Sonic Tracker applications, it is best to set the reference number so when the cutting edge is matching a pass, the number reads 0.00. In this case, the blade is not cutting or filling, so it makes sense that the number reads 0.00. To set the reference number:

1. Manually place the blade so the cutting edge is just resting on smooth ground.

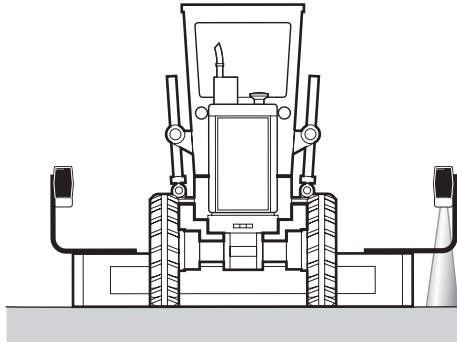


Figure 4-12.

2. Press both red buttons on the Smart Knob to lock the Tracker On Grade.

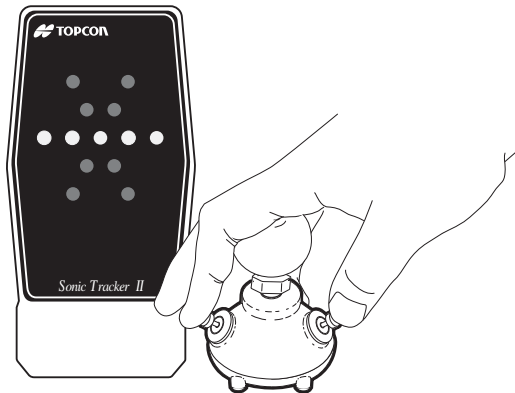


Figure 4-13.

3. Press the Set button.

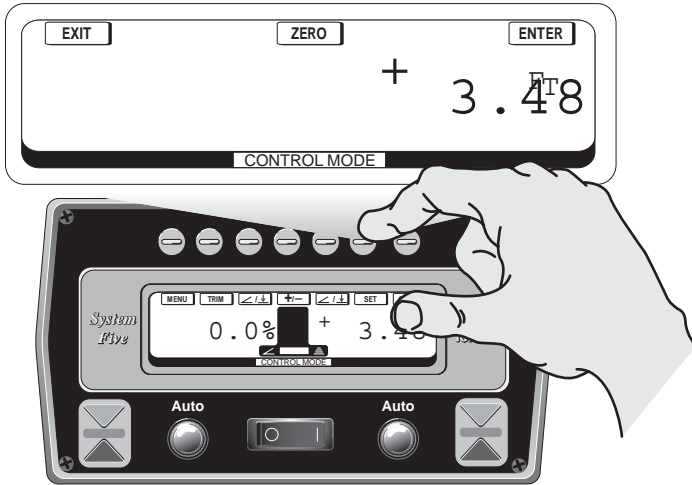


Figure 4-14.

4. Press the Zero button. The Control Box will set the reference number to zero, beep twice, and then return to the Control Mode. Repeat these steps for the Sonic Tracker on the other side.

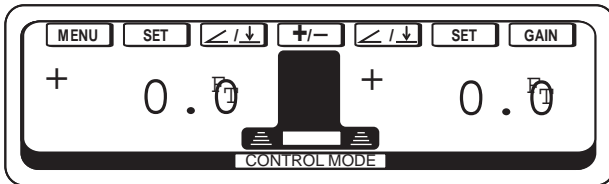


Figure 4-15.

When setting the Tracker reference number, be aware of cutting edge wear common at the edges of the blade. Setting to 0.00, with the tip of the blade on the ground, would cause the blade to undercut farther in from the edge. For best results, switch to Automatic and grade a short pass. Look about 18 inches in from the end of the blade to verify whether the cutting edge is matching. Make grade adjustments as needed to get the cutting edge to match perfectly, and then reset the number to 0.00. It is usually better to set the blade to .01 foot or .02 foot high.

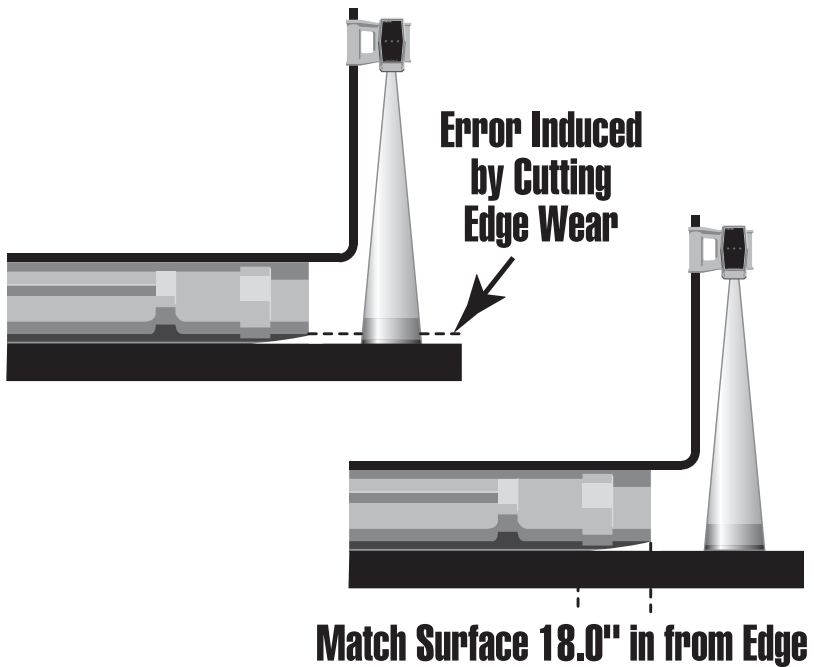


Figure 4-16.

Laser Receiver Setup

Trackerjack and Vibration Pole installation and positioning

Bolt the vibration pole to the "L"-Bar and visually check to get the "L"-Bar and vibration pole plumb.

To attach the Trackerjack, turn on the Control Box and attach the coil cord to the Trackerjack.

Place the Trackerjack on the vibration pole so the four wheels slide into the slots at the bottom of the pole.

Push the manual raise button on the Trackerjack to raise it up the pole.

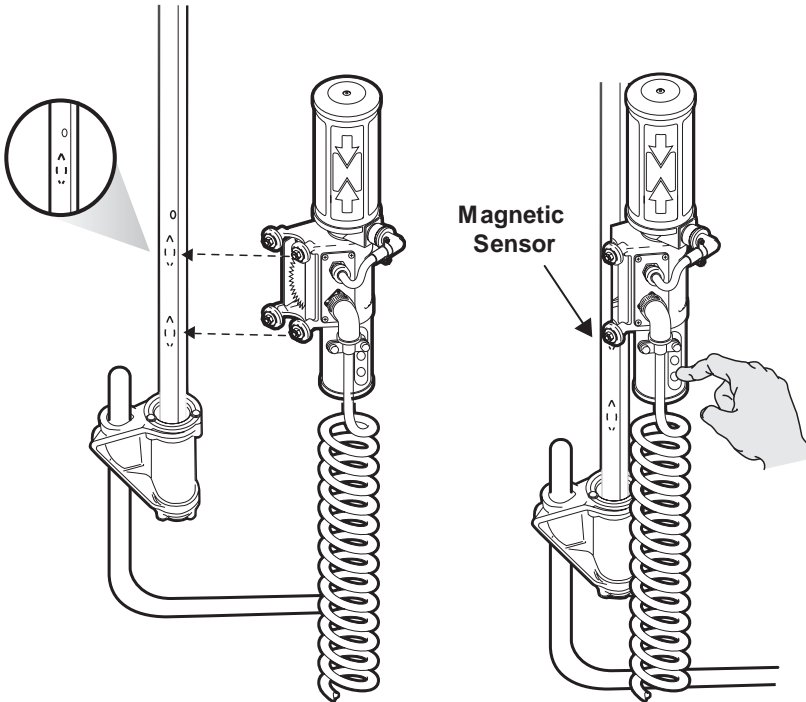


Figure 4-17.

Raise the Trackerjack so that its magnetic pickup sensor is above the magnet on the bottom of the vibration pole. Once the sensor is above the magnet, the operator can not accidentally lower the Trackerjack off the pole using the grade adjustment knob on the Control Box. Another magnet at the top of the vibration pole acts as an upper limit, keeping the Trackerjack from climbing off the top of the pole.

Position the "L"-Bar horizontally so that the Laser Trackerjack is near the end of the moldboard. Position the vibration pole vertically so the Trackerjack is at an optimum height for the job application. It is always best to keep the Laser Transmitter and Trackerjack as low as possible. For most jobs, position the vibration pole so the receiver is just above the machine frame when the Trackerjack is at the lowest position.

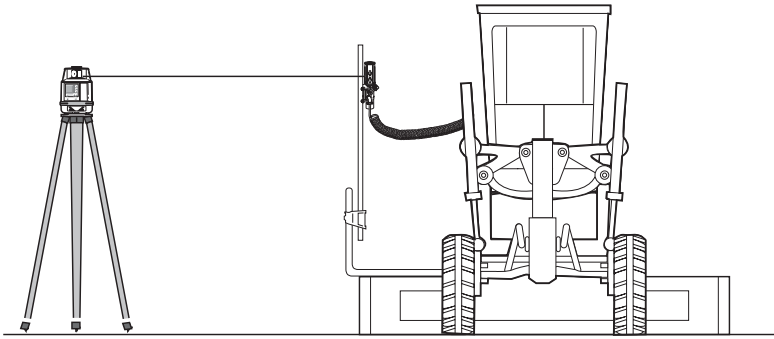


Figure 4-18.

For jobs with multiple elevations, the vibration pole and Trackerjack can be adjusted as needed, providing over 9 feet of elevation adjustment.

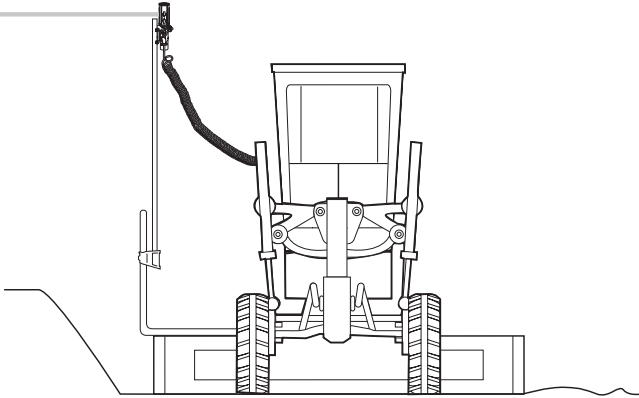


Figure 4-19.

For Laser Trackerjack application, it is best to set the reference number so that when the cutting edge is at Finished Grade, the reference number is either set to a known elevation or set to 0.00.

To set the reference number, first set up the Laser Transmitter for the job application. Then place the grade rod on the reference hub and move the detector up or down to lock on the laser beam. Adjust the rod for cut/fill or known elevation of the reference hub.

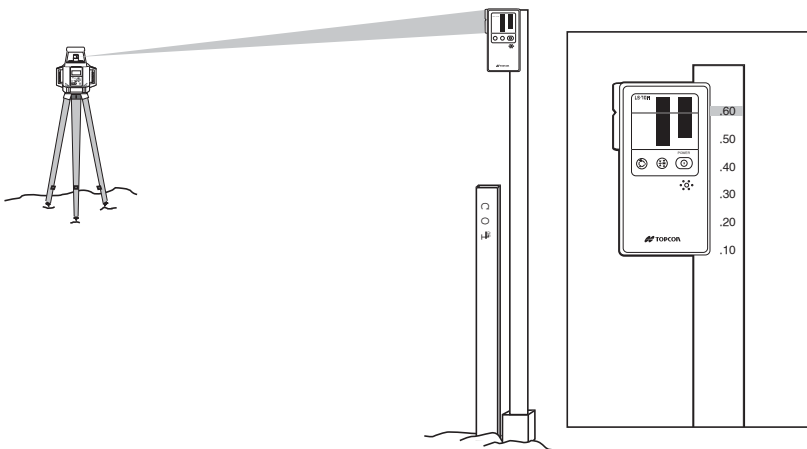


Figure 4-20.

Set both sides of the cutting edge on the ground, and raise or lower the receiver to get an On-Grade signal. This can be done by just pushing the two red buttons on the Smart Knobs, and the Trackerjack will search up and down the vibration pole and lock onto the laser beam.

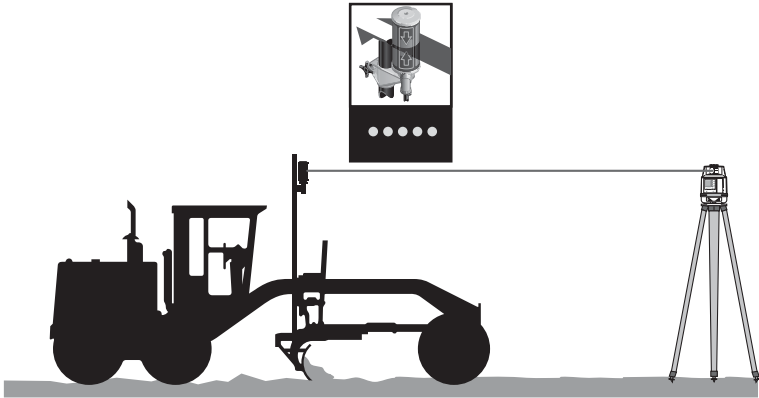


Figure 4-21.

Switch to Automatic, and grade a short pass.

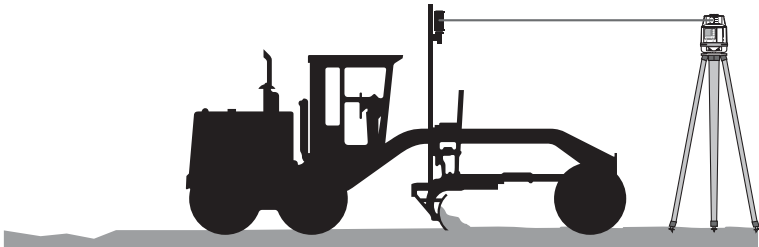


Figure 4-22.

Using the grade rod with detector, check the grade. Cut behind the machine.

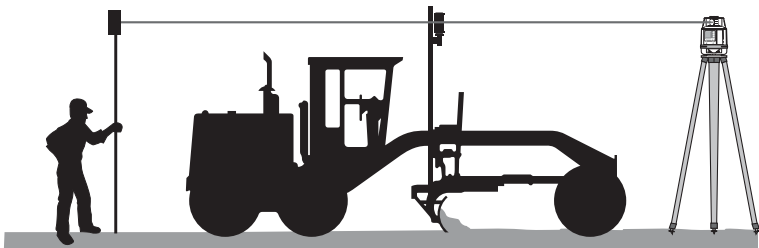


Figure 4-23.

1. **Setting the reference number to a known elevation:**

This is typically used for jobs with flat, or dead level surfaces. For example, if the cutting edge is at a known sea level elevation of 325.65 feet for example, then set the display to read 5.65 feet. In this case, the operator can just dial in a desired elevation. This is great when cutting multiple pads at different elevations.

Push the "SET" button, turn the knob to read 5.65 feet, the push "ENTER".

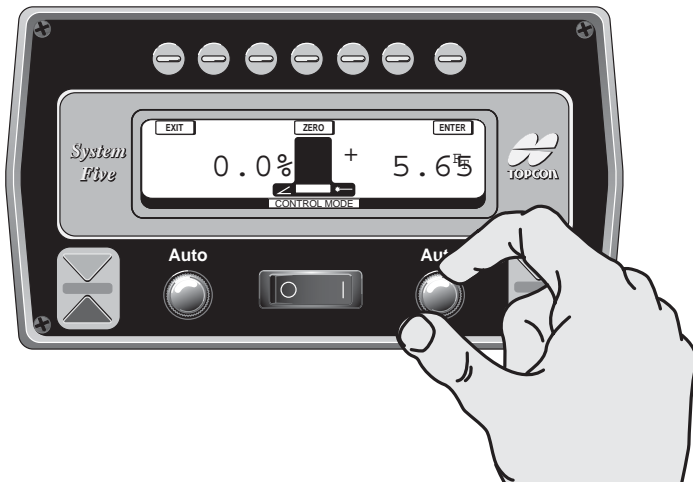


Figure 4-24.

2. Setting the reference number to 0.00:

This is typically used for jobs with slope although it can be used on flat pads as well. If the cutting edge is .15 feet above finish grade, then set the display to read .15 feet. The operator can then dial in a desired height above grade while roughing in, then dial down to 0.00 for finish grade.

Push the "SET" button, turn the knob to read 0.15 feet, the push "ENTER".

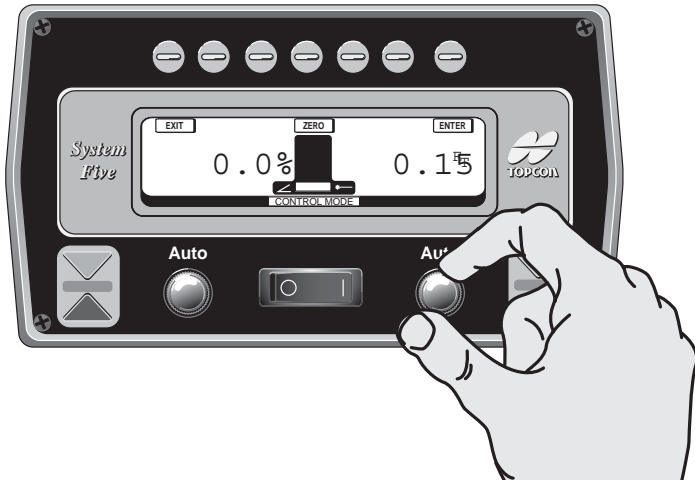


Figure 4-25.

Using Set Points

Set Points will allow the operator to preset up to 3 different elevation and slope settings. This is most commonly used when the job application requires multiple settings from one pass to another.

Each time the Set Point Switch is toggled, the Control Box will switch to the next Set Point. The Control Box will automatically remember the settings just as you left them before you switched. (Refer to the Set Points section within this manual).

To set up System Five to use Set Points, go to the Set Up Mode and select Set Points. Push "ENTER" to access Set Points.

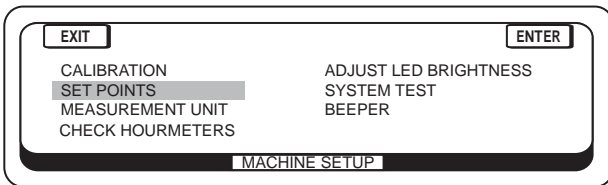


Figure 4-26.

Turn the right Control Box knob to enter the number of set points desired for your job application.

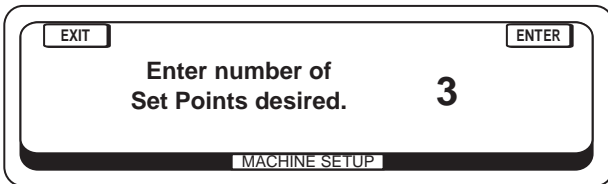


Figure 4-27.

After returning to Control Mode, the center of the LCD will display the number of Set Points entered and which one is currently being used.

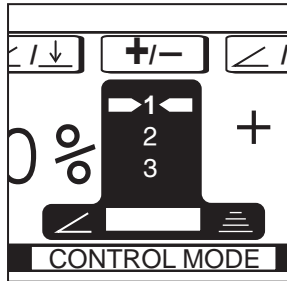


Figure 4-28.

To switch to a different Set Point, push the Set Point switch on the right hand Smart Knob inward for one second a beep is heard. System Five will now display and operate on these new settings.

As an example of how Set Points might be used, let's look at a simple job application using two Set Points.

For this pass, the right side is set to Sonic Tracker Control to cut 1.90' below the stringline. The left side is set for a 2.0% slope going up to the centerline.

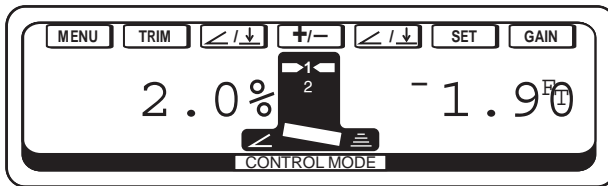
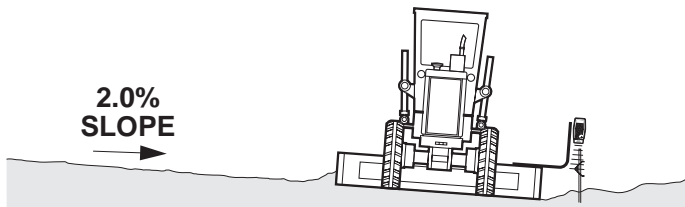
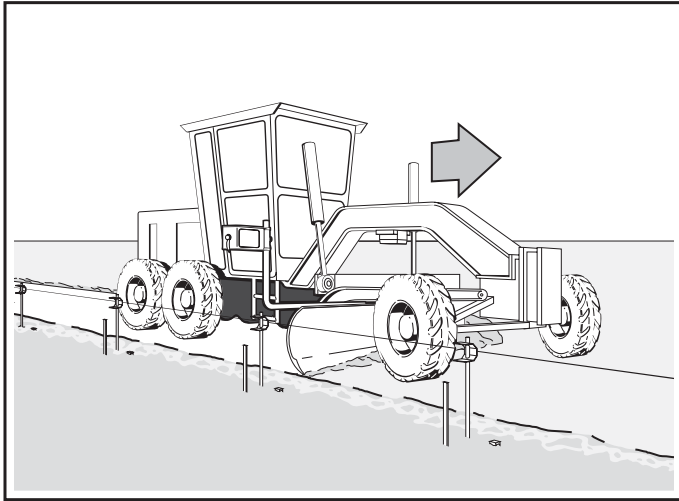


Figure 4-29.

**CUT GRADE 1.90' BELOW
THE SONIC STRINGLINE**



VIEW FROM BEHIND GRADER

Figure 4-30.

For the next pass, the right side needs to be set to match the previous pass. Push the Set Point switch, and then dial the Sonic Tracker II to 0.00, while keeping the cross slope at and the cross slope to 2.0%.

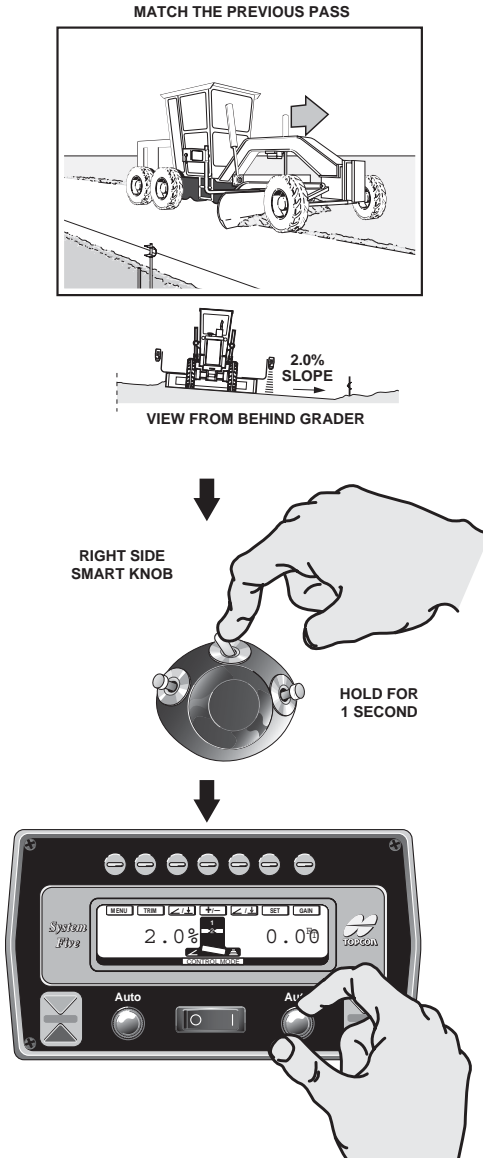


Figure 4-31.

Once set, each time the Set Points switch is toggled, the Control Box will return to the last values entered on that screen.

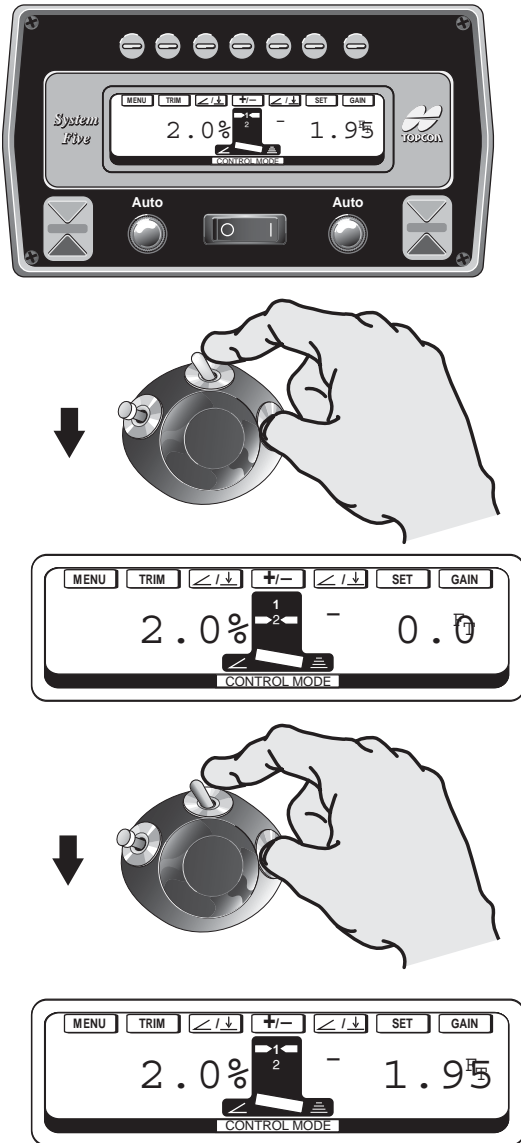


Figure 4-32.

Grading Applications

Sonic Stringline

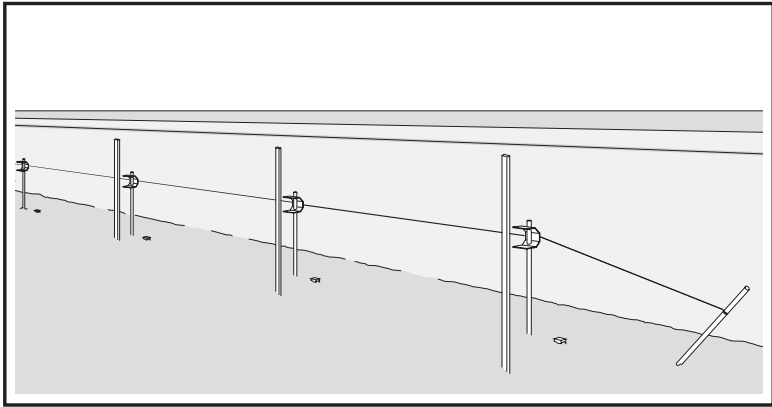


Figure 5-1.

Setting Up a Sonic Stringline

On a typical project, hubs or laths, offset from the edge of the road, provide the grade information for the operator. This information needs to be transferred from the ground to the operator. This is commonly done by a grade setter using a hand level, a 4 man crew pulling a string across the road and marking cuts, placing "blue tops" or hubs at finished grade, or some other similar method. In any of these methods, the operator has grade information at the stakes - every 25 or 50 feet.

Sonic Stringline provides an inexpensive, easy to set up, continuous reference that takes the best advantage of the non-contacting feature of the Sonic Tracker II. By taking a few minutes to set up a stringline the Tracker can transfer grade to the operator 39 times per second! And not just at the stakes, but along the entire road section. The stringline also becomes a great visual reference for the job. Any mistakes in a hub elevation can be quickly spotted by just sighting down the string.

Available From Your Topcon Dealer:	
TOPCON Part #	Description
7020-0101	Sonic Stringline, 1000' Roll
7020-0121	Sonic Grade Clips, Box of 100
7000-1026	Cut/Fill Offset Tape (Feet Tenths)
7000-1027	Cut/Fill Offset Tape (Metric)
9210-1013	Stringline Laser Bracket



NOTICE

Although Topcon's Sonic Tracker will work with many sizes and types of stringline, for best results we recommend 1/8 inch diameter nylon stringline. If the Tracker will track the ground, but will not track a 1/8 inch diameter stringline, clean or replace the transducer.

1. Place the Sonic Grade Clips on stakes and drive the stakes approximately 6 to 8 inches away from, but in line with, the hubs (Do Not disturb the hubs).

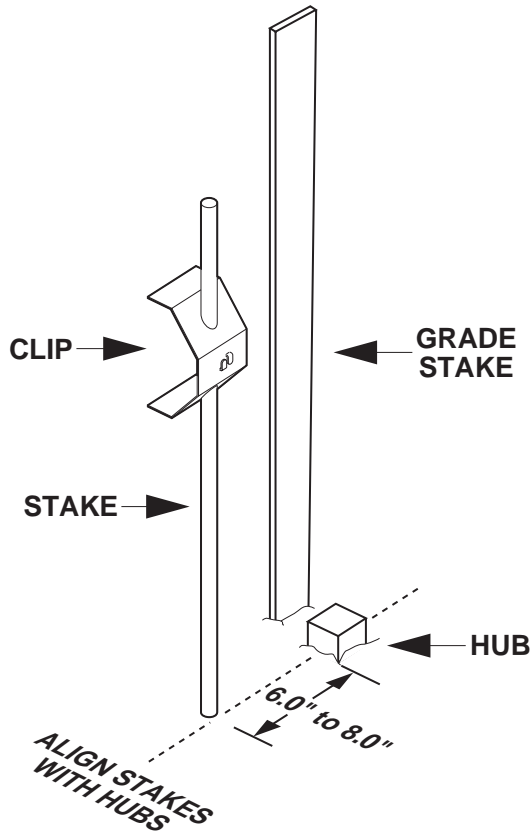


Figure 5-2.

- Using an anchor pin at each end, roll out the Sonic Stringline the length of the working area and pull the stringline tight.
- After the stringline has been pulled tight, place it into the “fingers” of each Sonic Grade Clip.

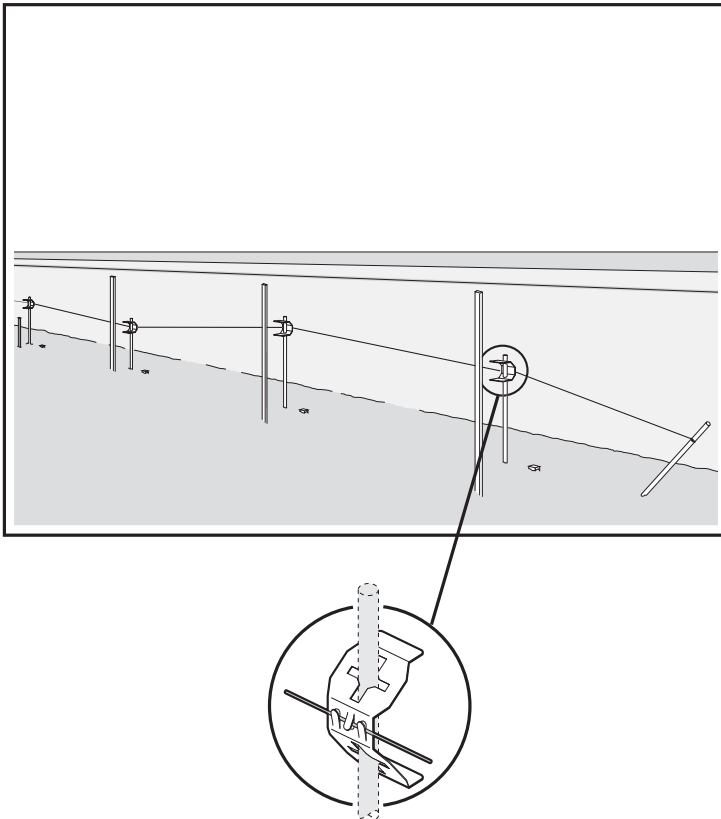


Figure 5-3.

- Decide what the Sonic Stringline hike-up (the distance from Finished Grade to the Sonic Stringline) should be: in this case, 2 feet.

Make a cut/fill lath using a lath and a Topcon Cut/Fill Decal.

Measure, from the bottom of the lath, the desired hike-up and make a mark at that point. Place the Cut/Fill Decal on the lath with "0" on the point you marked.

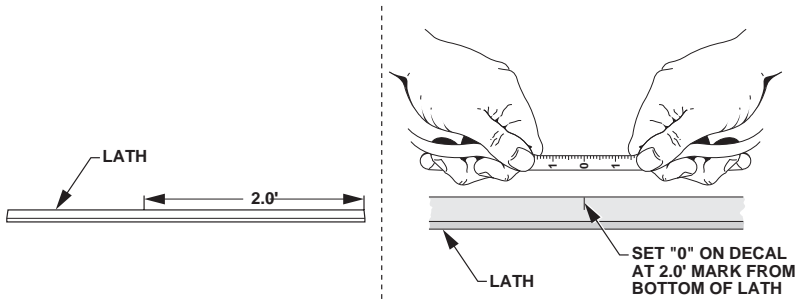


Figure 5-4.

- Next, set the cut/fill lath on the hub and read the cut or fill from the grade stake next to the hub. Adjust the clip up or down until the stringline crosses the cut/fill lath at that point.

A cut of .25 feet

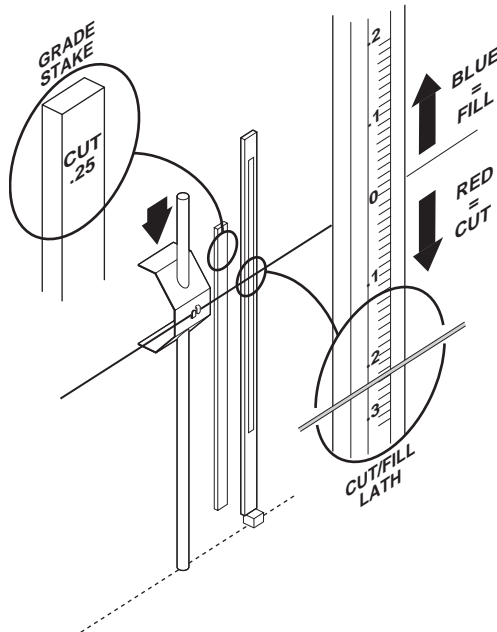


Figure 5-5.

- The stringline is now set to 2 feet above finished grade.

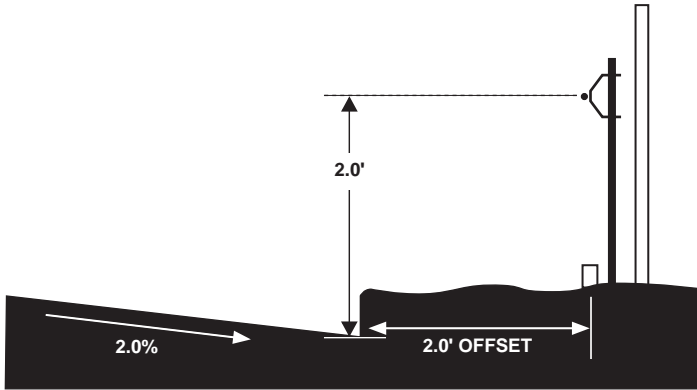


Figure 5-6.

- Repeat this process at each station before starting to grade.

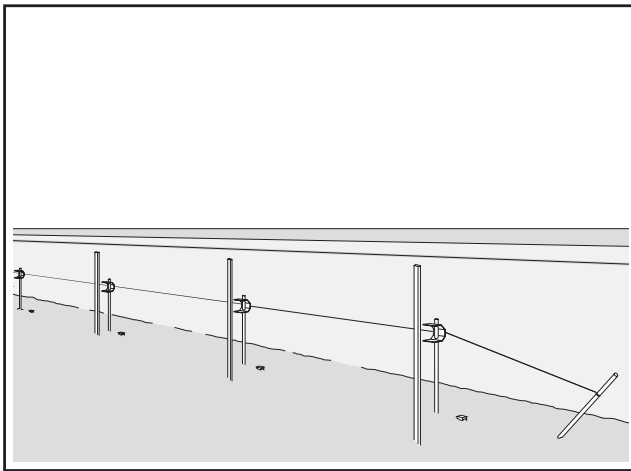


Figure 5-7.

Setting Stringline to Projected Slope

Jobs with slope transitions or super-elevations must have the stringline set to the "projected slope". Failure to do this will produce an elevation error at the edge of the road as the slope is changed. To set the stringline to the projected slope, first set up the string at the desired hike up as shown in the previous pages. Next, raise or lower the stringline to compensate for the % slope and the distance from edge of the road to the stringline. [RISE = (RUN)(%)]. If the road is rising away from the stringline, the stringline will need to be lowered. If the road is sloping down from the stringline, the stringline will need to be raised. This adjustment is needed at each station.

- Example: 2.0% Cross Slope with 2 feet offset.

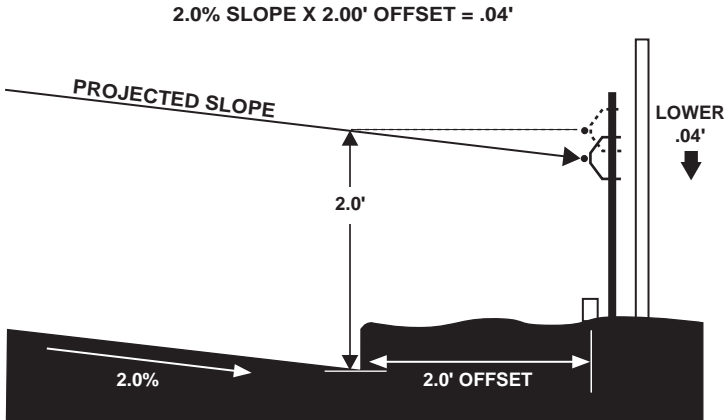


Figure 5-8.

- Example: 3.0% Cross Slope with 2 feet offset.

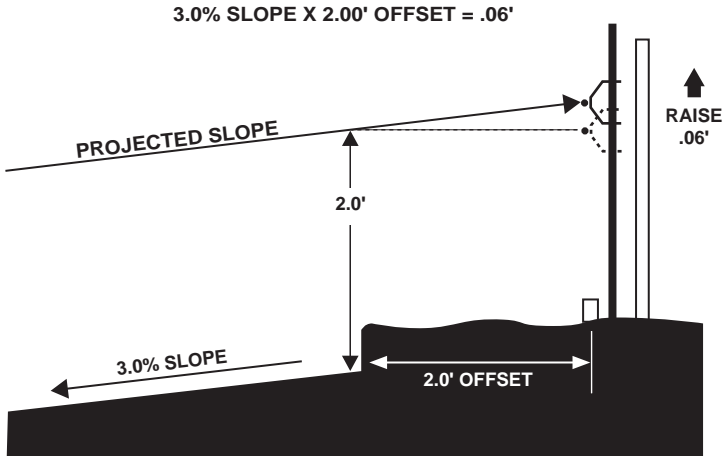


Figure 5-9.

On some jobs, it may be more practical to secure the stringline directly to the grade stake next to the hub. First, mark the lath with a 2 or 3 feet "hike up" or boot" above grade, just as you would to check grade with an eye level or pulling a string across the street.

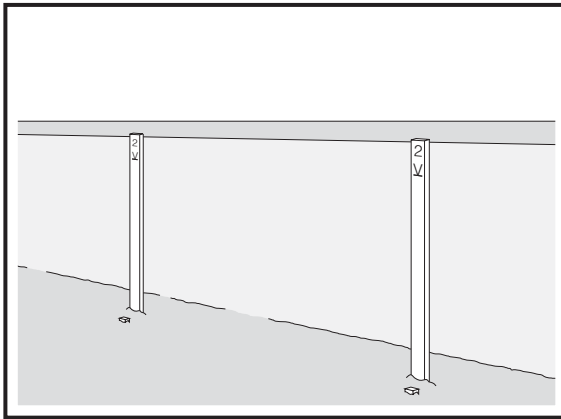


Figure 5-10.

Secure an anchor pin at each end of the stringline and pull the stringline tight. At each station, staple or ty-rap the stringline directly to the witness lath so the stringline is at the desired hike-up.

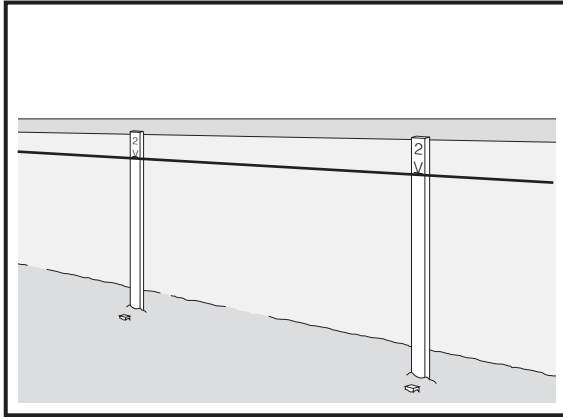


Figure 5-11.

Due to the height of some stakes the Tracker may need to be raised or the tops of those stakes may need to be cut off. Once finished, grade can be cut.

Making a Grade Verification Lath

Verifying grade requires measuring depth of cut from the Sonic Stringline. Because the hubs are offset from the edge of road and the Sonic Stringline is a predetermined "hike-up" above Finished Grade, a simple tool called a "Grade Checking Lath" can be constructed. This can be easily done using lath, a level bubble and simple hand tools.

In this example assume that the hub offset from the edge of road is 1.5 feet and that the "hike-up" is 2.0 feet. Construct a Grade Checking Lath as shown below.

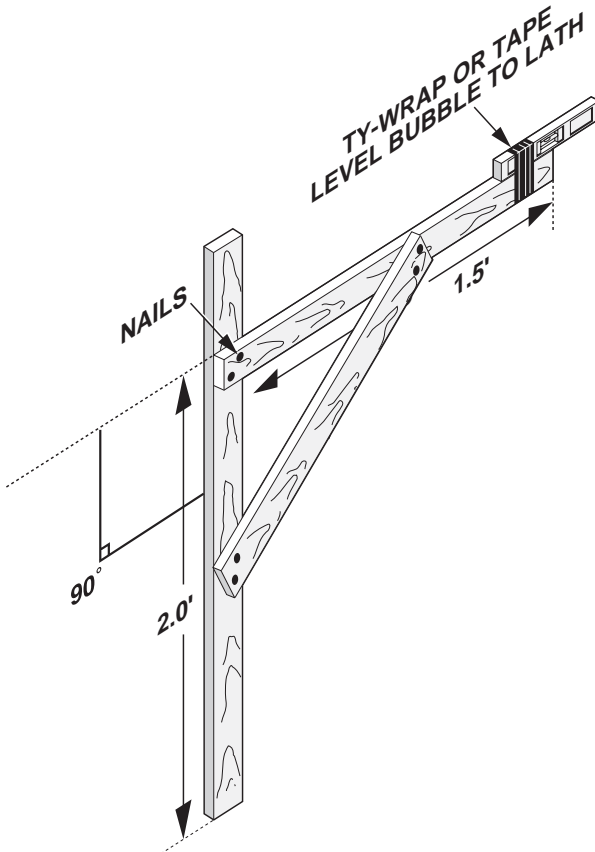


Figure 5-12.

Verifying Grade

To verify grade, set the Grade Checking Lath on the edge of the graded area so that the level bubble extends over the Sonic Stringline shown below.

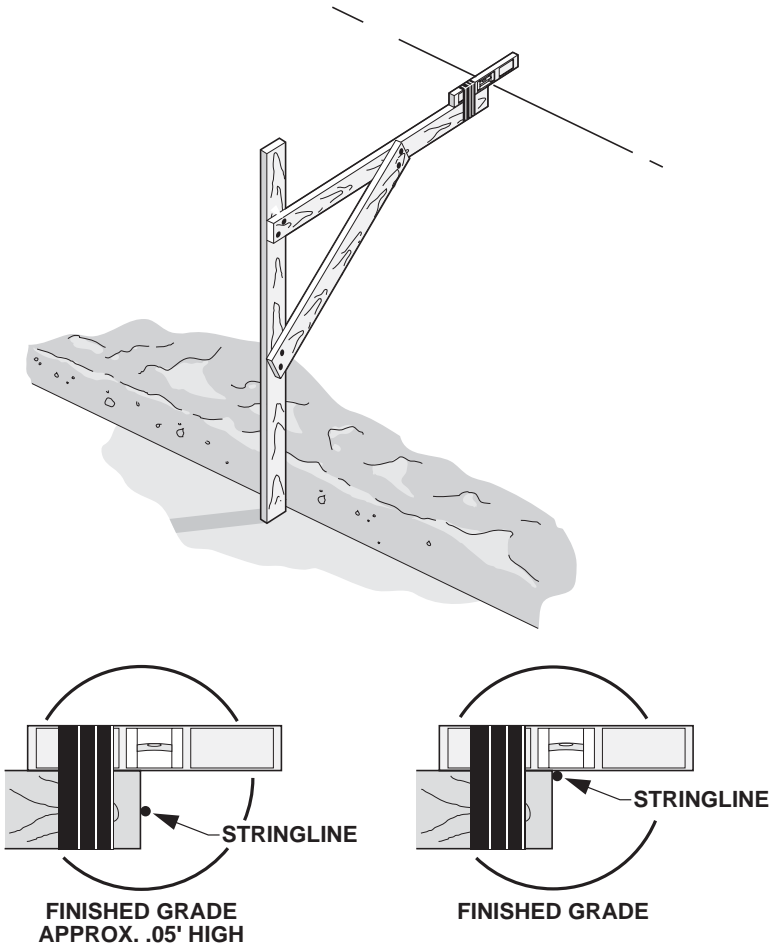


Figure 5-13.

Tilt the Grade Checking Lath until the level bubble is centered. Finished Grade is correct when the level just touches the Sonic Stringline.

Laser Grade Checking System

Once the Sonic Stringline has been set, the operator can dial in the desired cross slope and depth of cut and begin grading. As he begins grading, the grade must be immediately inspected to verify the cut is correct. The grade setters job is now to inspect the grade behind the grader and make adjustments if necessary.

Although this can be done by various methods, the Laser Grade Checking System is a quick, accurate, one person grade checking tool. It allows grade to be inspected not just at the edge of the road, but all the way across the section at any desired distance.

Set the laser on the Stringline Laser Bracket and place the bracket on the Sonic Grade Clip. The automatic leveling laser will produce a "stringline" of laser light across the road at the same height as the stringline.

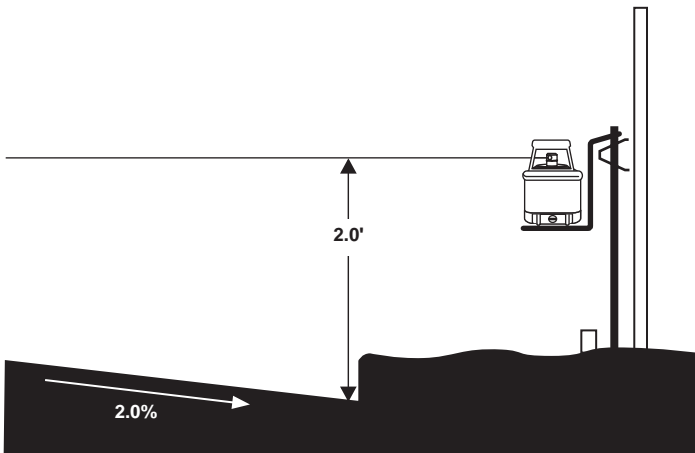


Figure 5-14.

To inspect grade, use the laser detector and the cut/fill lath or folding rule. At the edge of the road, finished grade is the same as the stringline hike-up. Any cuts or fills are immediately measured on the lath or folding rule.

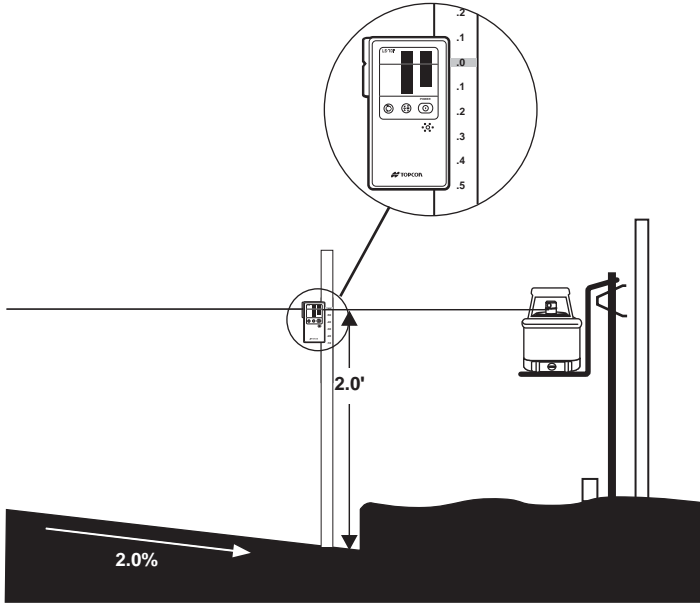


Figure 5-15.

Grade can be inspected at the 1/4 crown, centerline, or any desired distance. Just measure the distance from the edge of the road, and calculate the desired finished grade using the formula $[RISE = (\%)(RISE)]$.

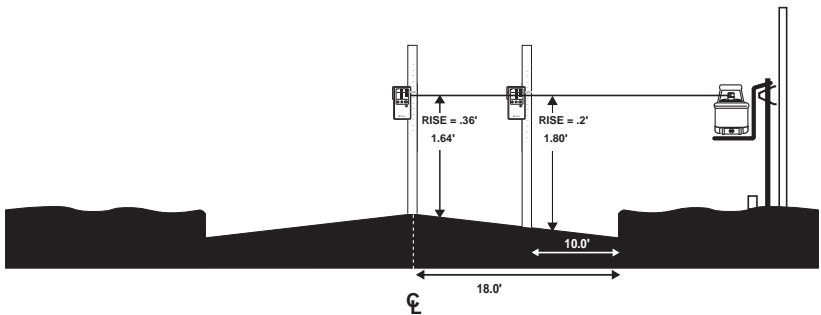


Figure 5-16.

The Laser Grade Checking System can be used to check grade on the opposite side of the road and to even verify that the hub or stringline on the opposite side is correct.

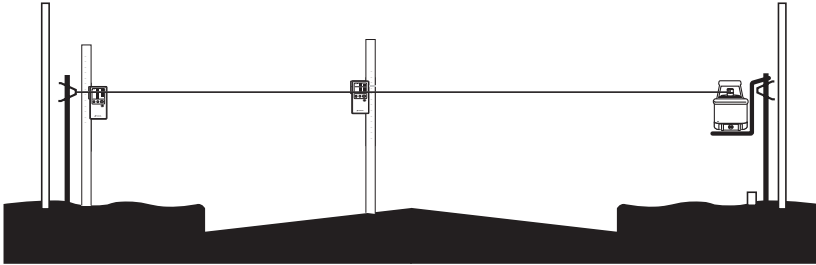


Figure 5-17.

To check grade at additional stations, just pick up the laser and move it. Because of the consistent grade cut by System Five, you will find you do not need to inspect grade at every station, but you should "spot check" grade at several stations.

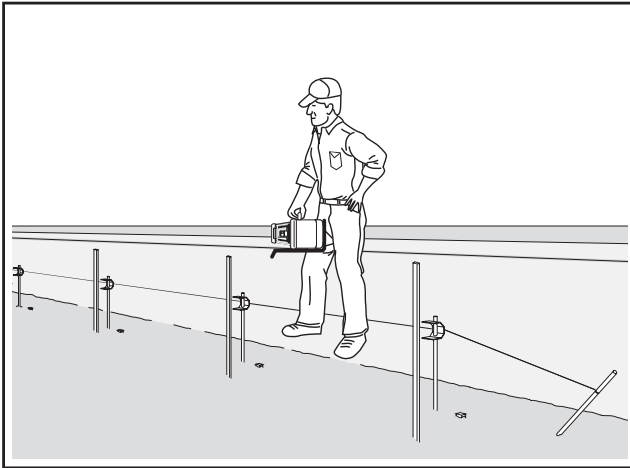


Figure 5-18.

Grading a Road Using a Stringline

In this example, a Sonic Stringline has been set 2.0' above the desired finished sub-grade. Desired cross slope is 2.0%.

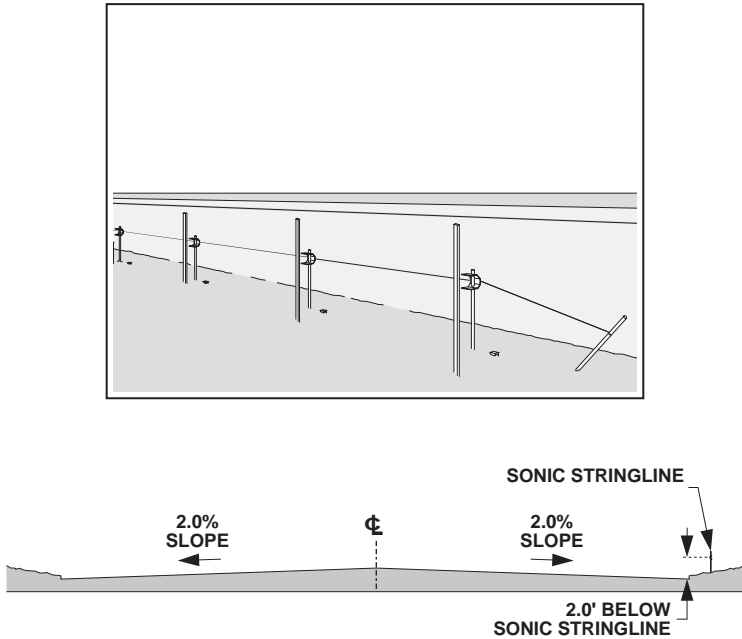


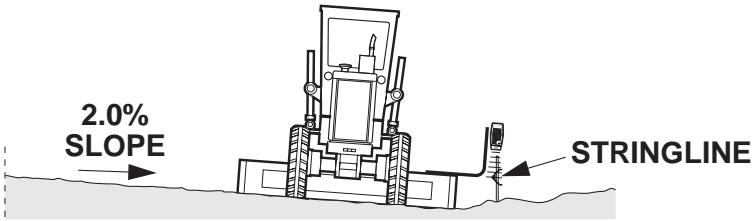
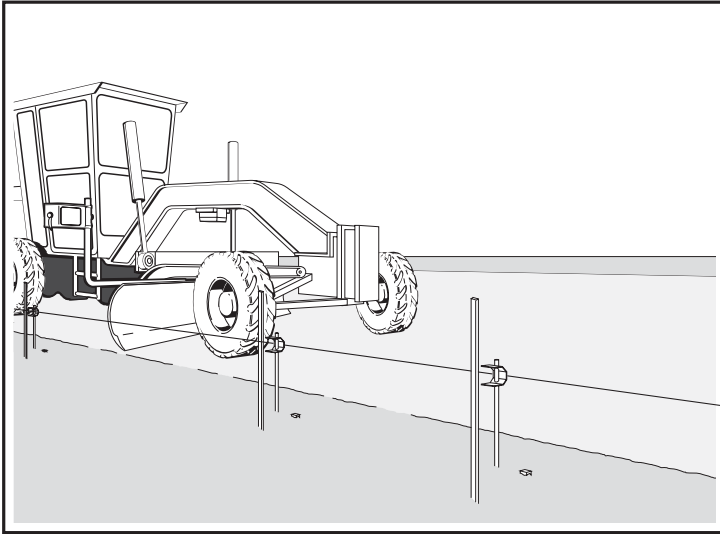
Figure 5-19.



NOTICE

Before grading, always make sure the Cross Slope System is calibrated and the Tracker reference number has been "zeroed out". (See Chapter Getting Ready to Grade).

When beginning to cut grade, it is likely that the rough subgrade is several inches above grade. To start, set the cutting edge down on the existing grade with the Tracker positioned over the stringline.



VIEW F ROM BEHIND G RADER

Figure 5-20.

Press both red buttons on the Smart Knob to set the Tracker to On-Grade. The Control Box will then read the depth of cut below the stringline at that location. In this example, the display indicates that the cutting edge is 1.65 feet below the stringline. Since the desired depth is 2.00 feet, the grade is .35 feet high at this location.

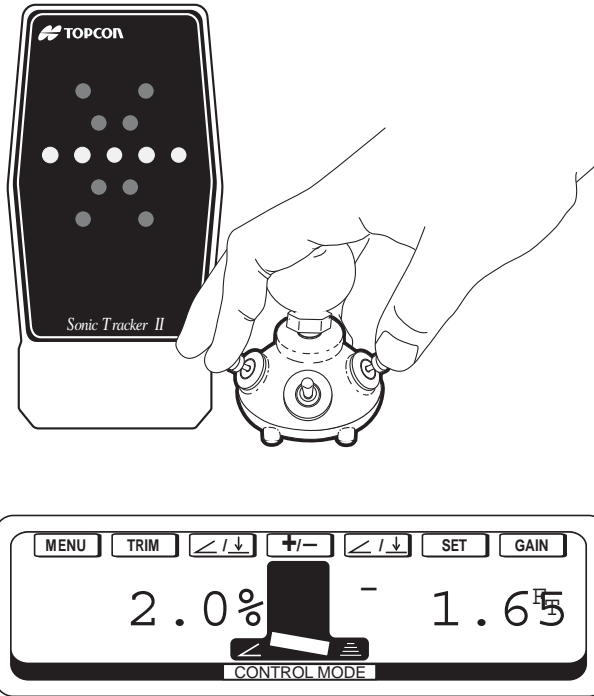
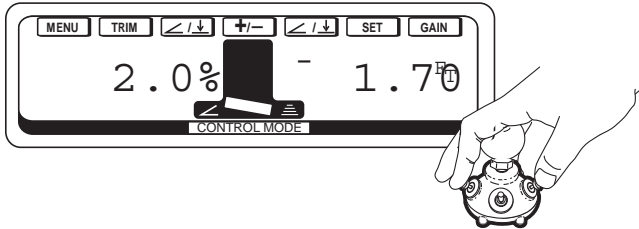
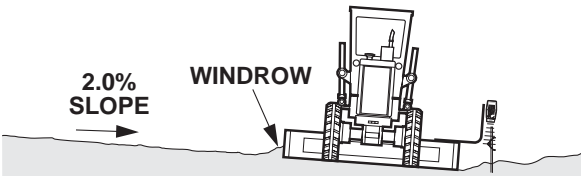
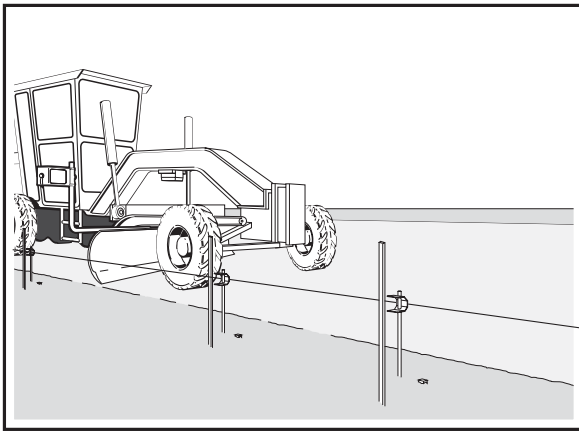


Figure 5-21.

Begin grading, then immediately switch to automatic control. You can make grade adjustments using the Smart Knob, which will keep your hands on the controls. You may want to dial in a small amount of cut as you make this first "pioneering" pass. Depending upon the material conditions and amount of cut along the road.



**CUT GRADE 1.70' BELOW
THE SONIC STRINGLINE**



VIEW FROM BEHIND GRADER

Figure 5-22.

Be sure to check the grade several times in the first 50 feet. Depending on how accurate the Tracker and the stringline offset from the edge of the road were "zeroed out", the grade may not be exactly 1.70 feet below the stringline. However, the grade will be consistently a few hundredths high or low. By checking the grade and knowing how high or low the grade is being cut, adjustments can be made to get the desired grade.

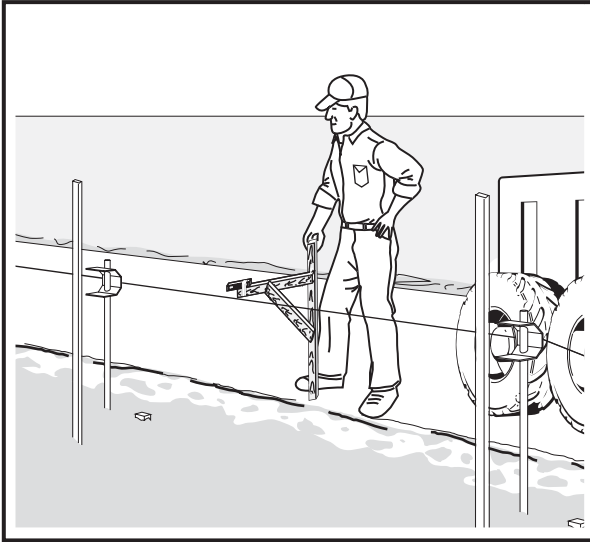


Figure 5-23.

After grading the first pass along the edge of the road, make a pass to move the material away. Just dial the Tracker to 0.00 to match the previous pass, and the cross slope system will continue to cut the slope up toward the centerline.

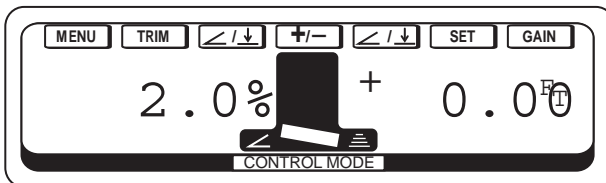


Figure 5-24.

VIEW FROM BEHIND GRADER

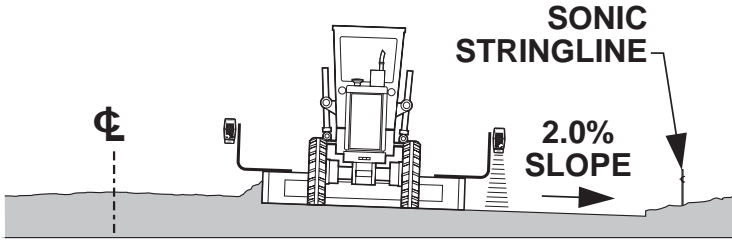


Figure 5-25.



NOTICE

For the examples in this manual the right Tracker is always used. On the job, the blade can be rotated and the Tracker or slope can be used on either side, depending on what is best for that particular job. This avoids backing up to use the Tracker only on one side.

CUT GRADE TO MATCH THE PREVIOUS PASS

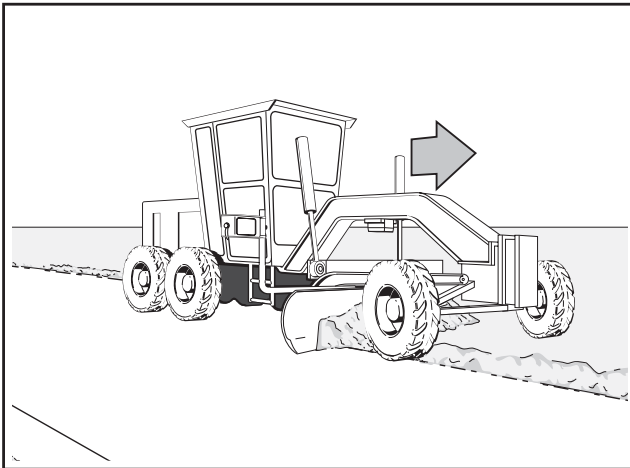
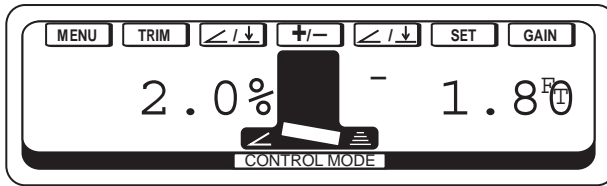


Figure 5-26.

Now go back to the stringline and make another pass, dialing in an additional cut. Since the last pass was cut at 1.70 feet, dialing to -1.80 would produce a .10 foot cut. With the cross slope system maintaining a 2.0% slope, the ENTIRE moldboard will be cutting .10 foot. Machine and material conditions will determine how much cut is made in each pass.



VIEW FROM BEHIND GRADER

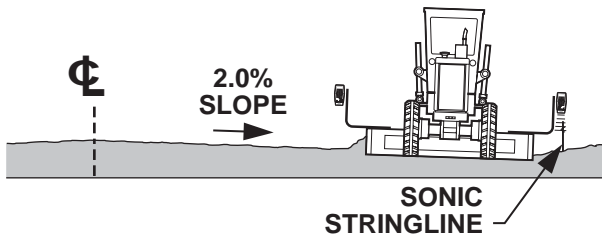
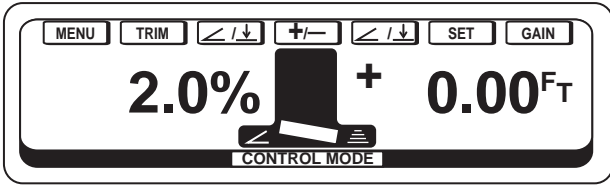
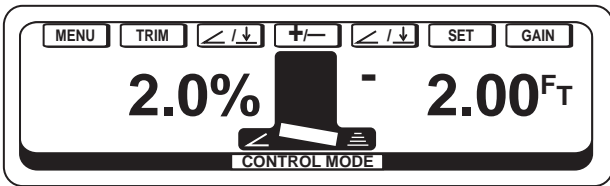
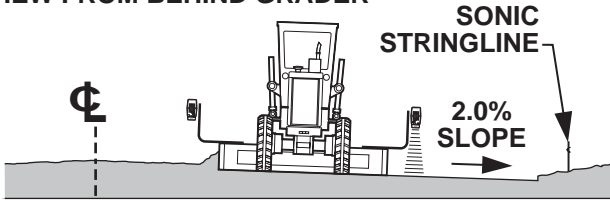


Figure 5-27.

Continue to make additional passes until you reach desired grade.



VIEW FROM BEHIND GRADER



VIEW FROM BEHIND GRADER

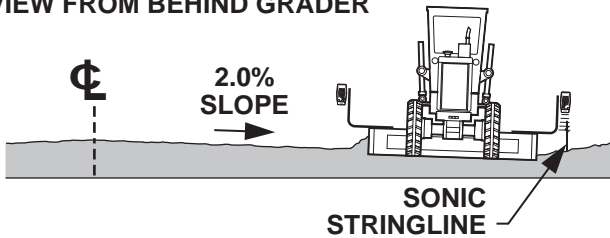
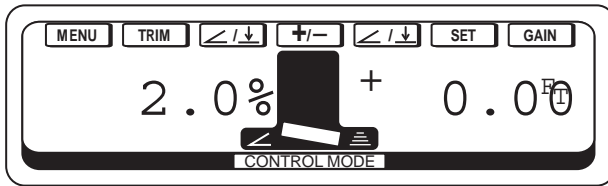


Figure 5-28.



VIEW FROM BEHIND GRADER

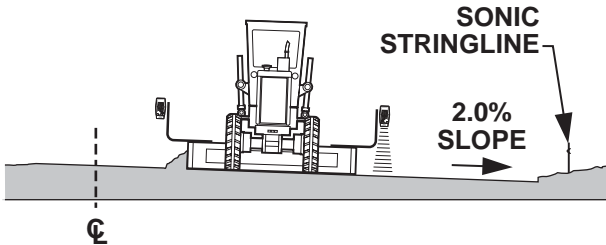
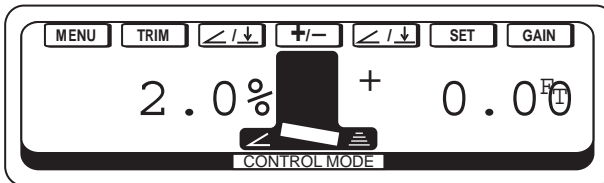


Figure 5-29.

Once to grade, carry the material on this side of the road at least 1 1/2-2 feet past the centerline.



VIEW FROM BEHIND GRADER

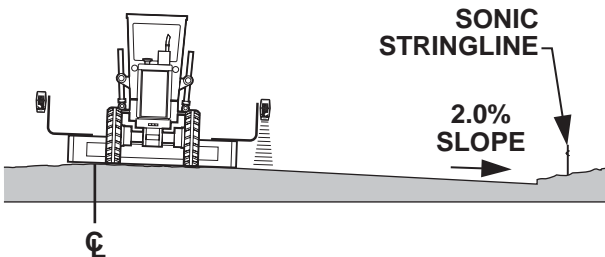


Figure 5-30.

Once grade has been cut and verified at the centerline, mark the centerline with spray paint to make it visible for the operator.

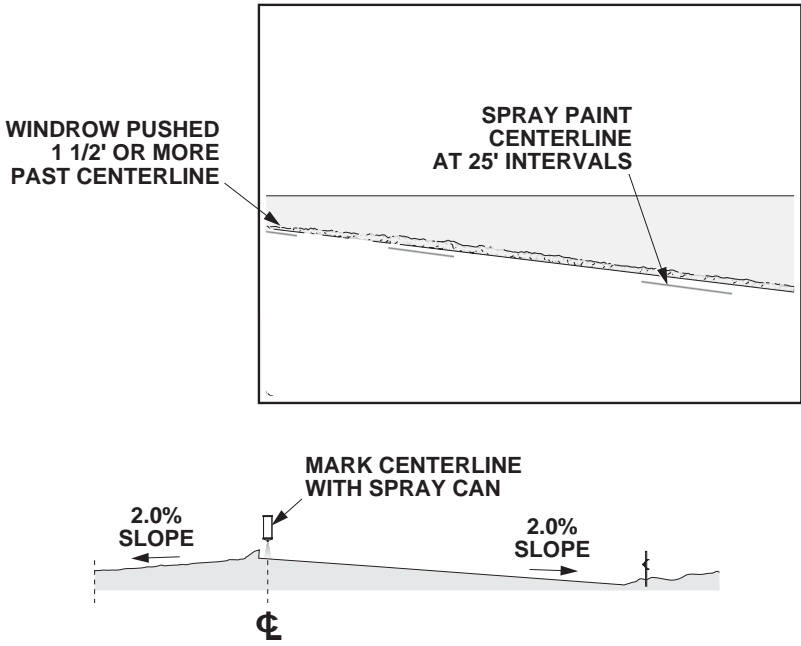


Figure 5-31.

Finished grade can be carried over the centerline by tracking the pass on the opposite side.

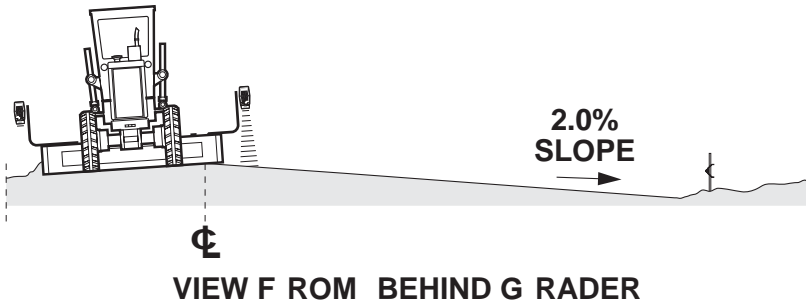


Figure 5-32.

Position the grade to make the pass by setting the edge of the moldboard so it is about 1 1/2-2 feet past the centerline. To keep the material from spilling out from the leading edge, rotate the moldboard to a fairly steep angle.

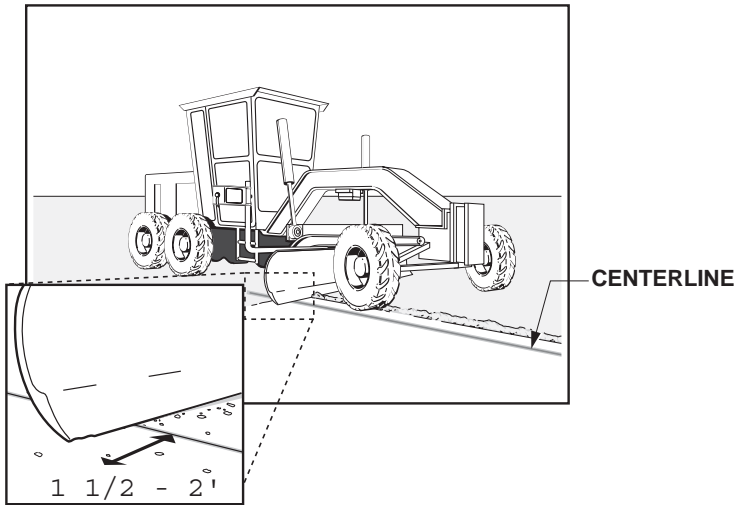


Figure 5-33.

Change the direction of the cross slope and switch the cross slope to Automatic Control. Then manually lower the leading edge until the cutting edge just touches the finished grade at the centerline.

VIEW FROM BEHIND GRADER

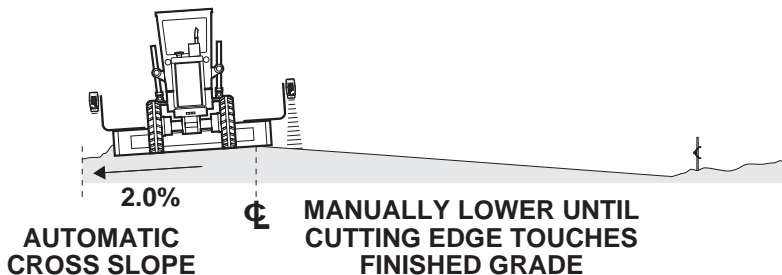


Figure 5-34.

Press the red buttons on the Smart Knobs to get the Sonic Tracker to On-Grade.

Since the Tracker is tracking the ground sloping down the opposite side, the reference number will not be 0.00.

Switch to Automatic Control and continue grading. Verify the grade and make small adjustments as necessary.

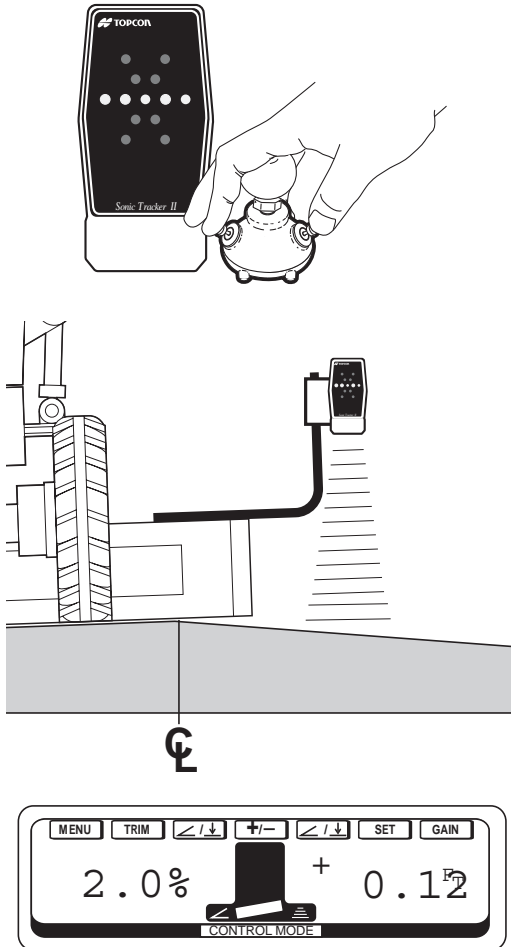


Figure 5-35.

While grading, it is important to drive straight to keep the Tracker positioned over the same "path" on the opposite slope. Steering left or right will cause the Tracker to "ride up" or "ride down" the slope, causing an elevation error at the centerline. Keep the front tire at the same position referencing the centerline paint marks.

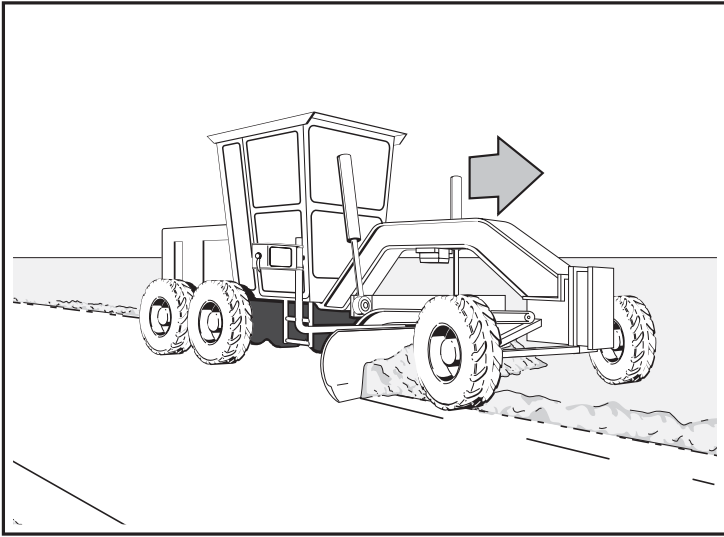


Figure 5-36.

Once centerline has been cut, carry the slope toward the edge at the road.

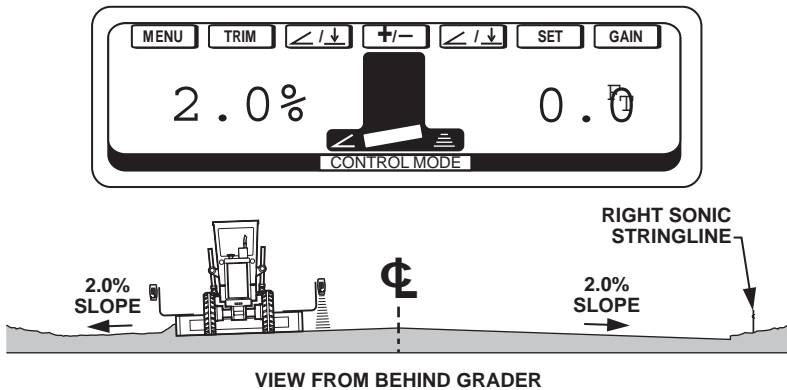


Figure 5-37.

If a Sonic Stringline has been set on the opposite side, cut the road just as you did on the first side.

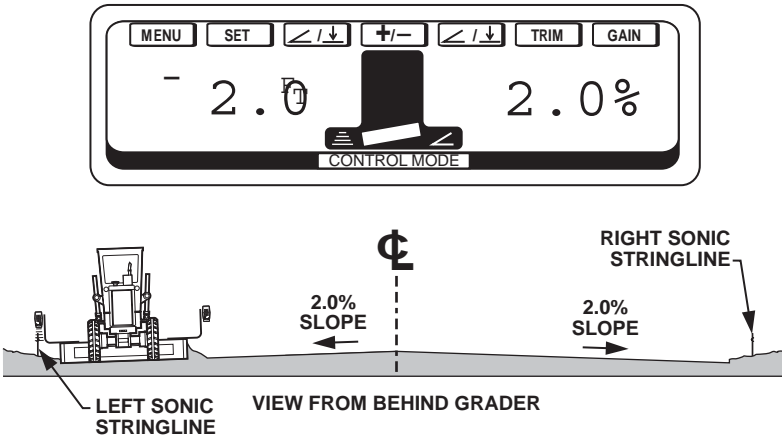


Figure 5-38.

If there is no stringline on the opposite side, the grade previously cut by System Five can be used as a reference for the Tracker. In this case, rotate the blade so that the cross slope is controlling the leading edge of the blade at the edge of the road, and the tracker is controlling grade on the trailing edge.

TOP VIEW OF GRADER

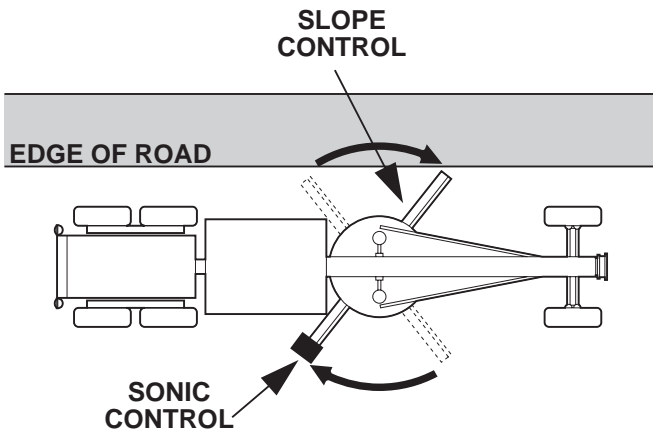


Figure 5-39.

To accomplish this, the Tracker will need to be repositioned so the sound waves will not pick up the windrow at the end of the blade.

Set the blade on a smooth, previously graded pass so that the cutting edge is just touching the ground.

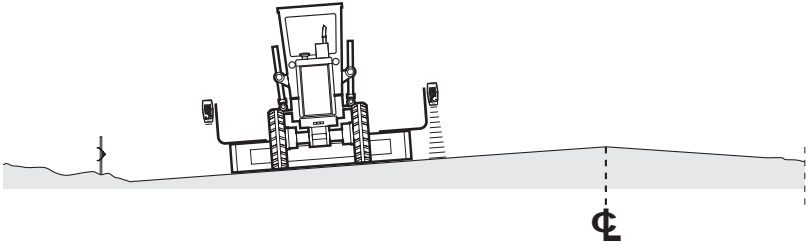


Figure 5-40.

Slide the "L"-bar out, and rotate it forward to a position where the Tracker will not "pick up" the windrow. Be sure to swivel the Tracker bracket so the Tracker is plumb. The Tracker may end up only 18 inches or so off the ground, which is OK for this application.

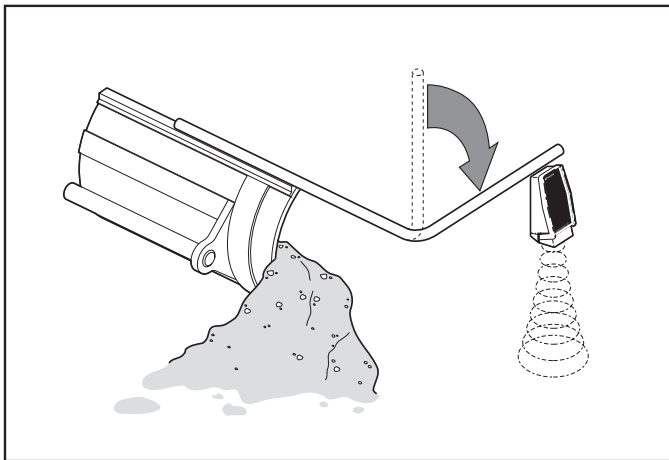


Figure 5-41.

Set the Tracker to on-grade, and grade the pass along the edge of the road.

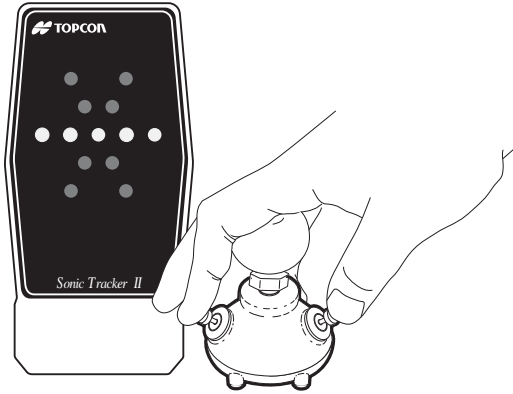
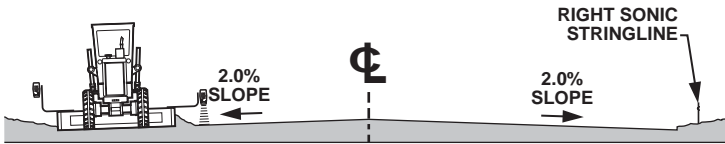
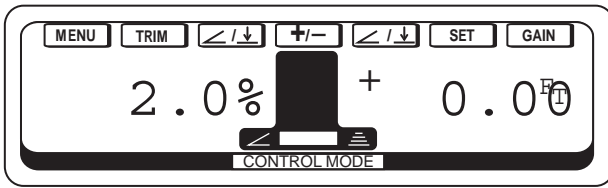


Figure 5-42.



VIEW FROM BEHIND GRADER

Figure 5-43.

After the windrow is picked up, Sonic Control on both sides may be used to make a final "clean up" pass after the scraper or loader.

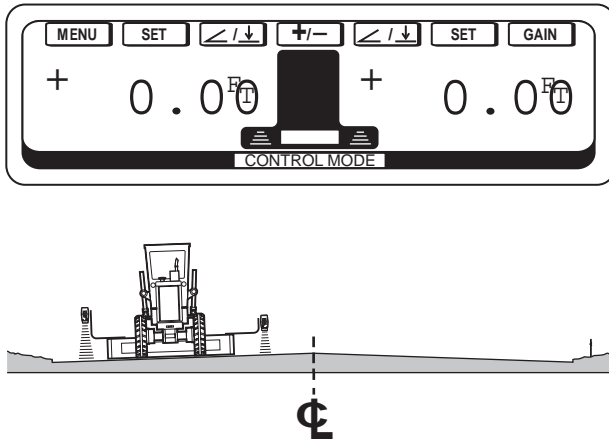


Figure 5-44.

Grading a City Street

This section reviews how to cut sidewalk, curb, and street grade, as well as cutting a crowned street from existing curb. Street design varies greatly, so use this as an example and make adjustments for your job.

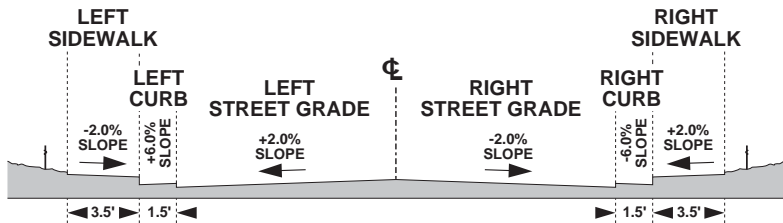


Figure 5-45.

For best results, set Sonic Stringline to use as a reference for the sidewalk grade. Using Sonic Tracker and Slope Control, dial in the desired grade and slope. Be sure the grade checker verifies the grade

being cut in the first 25-50 feet. Remember, it is always best to start with the grade high, then "trim" down on the next pass.

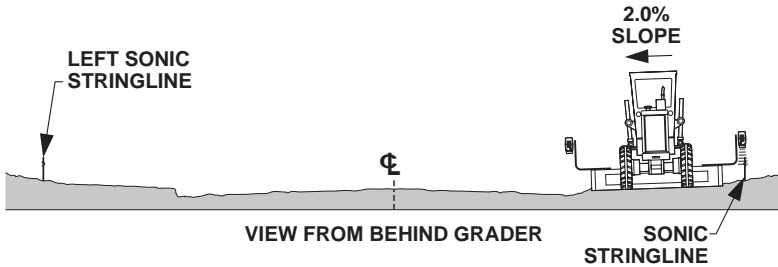
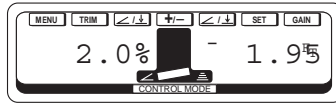


Figure 5-46.

Once the sidewalk grade has been cut and verified, mark the edge of the sidewalk with spray paint to make it visible for the operator.

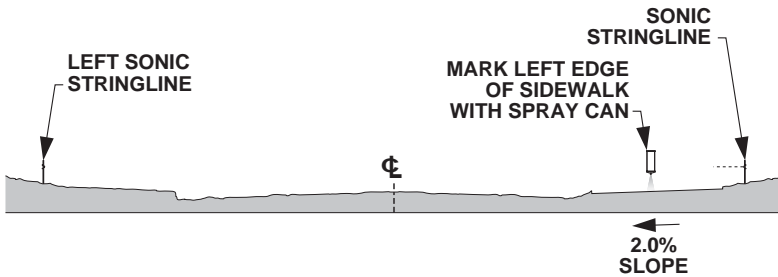


Figure 5-47.

Next use the sidewalk grade as a reference to cut the curb grade. Dial in the desired grade and slope.

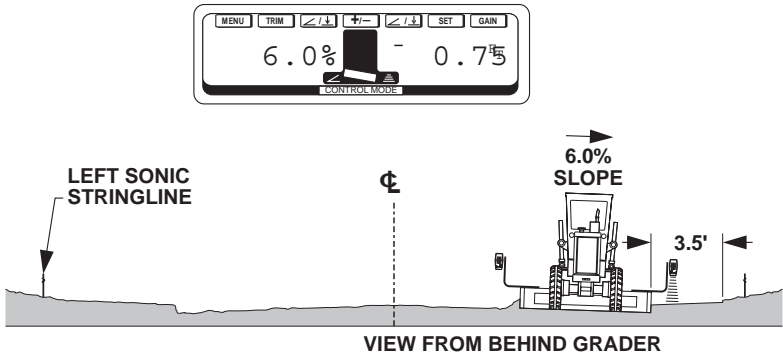


Figure 5-48.

For best results, stay about 6 inches in from the paint marks on the “rough in” passes to avoid material spilling onto the sidewalk grade.

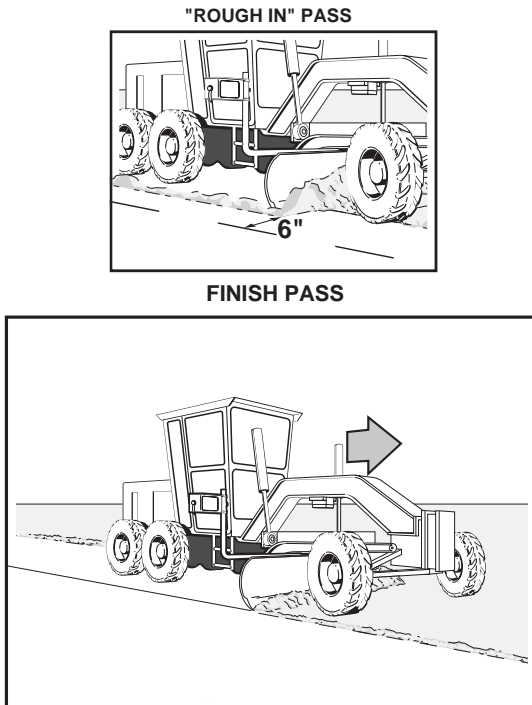


Figure 5-49.

Once the curb grade has been cut and verified, mark the edge of street with spray paint to make it visible for the operator.

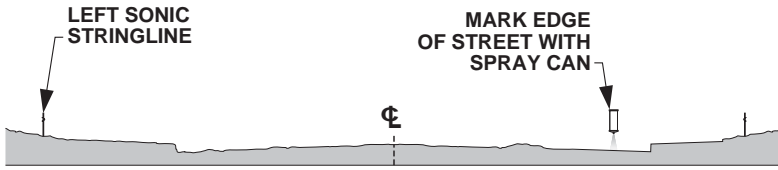
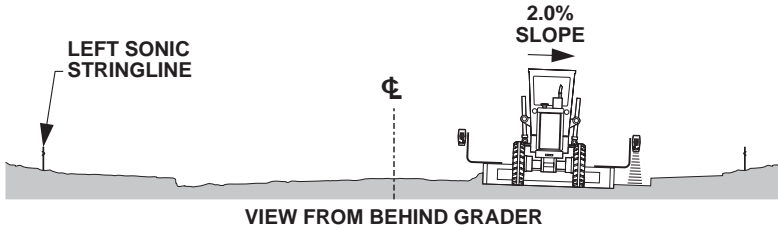
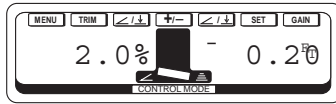


Figure 5-50.

Use the curb grade as a reference to cut the street grade. Dial in the desired grade and slope.



VIEW FROM BEHIND GRADER

Figure 5-51.

For best results, stay about 6 inches in from the paint marks on the “rough in” passes to avoid material spilling onto the curb grade.

Continue to grade the street across the centerline. Grade the opposite sidewalk curb, and street section and the project is complete.

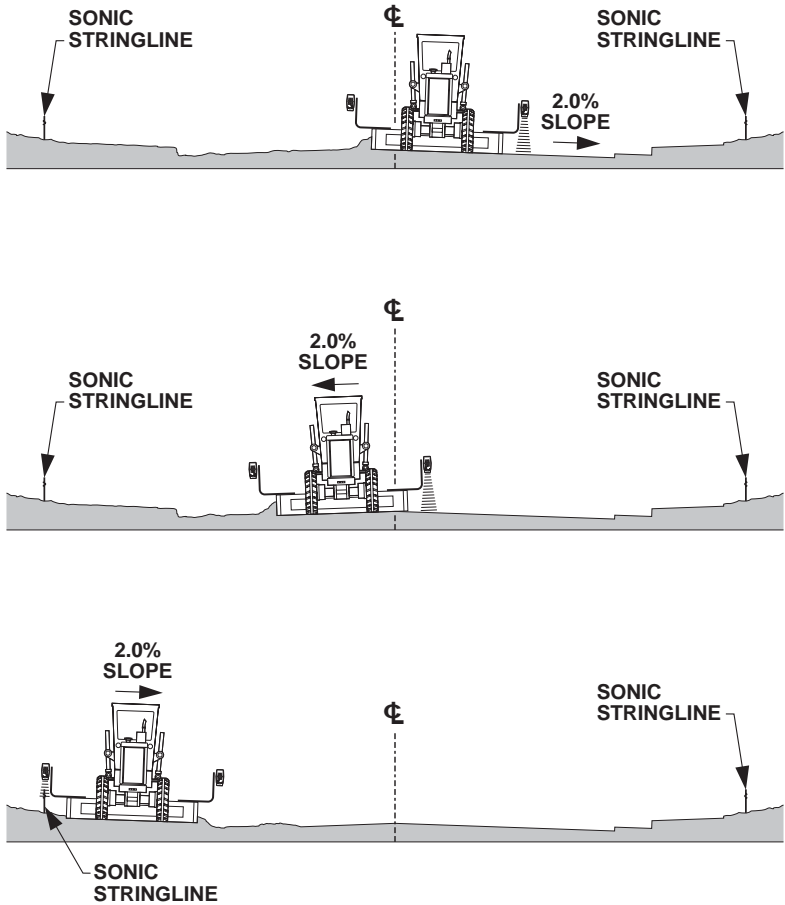


Figure 5-52.

Grading from Curbs

When grading a street from curbs, work the material across the street in the same manner as shown in the previous section.

The Completed Objective

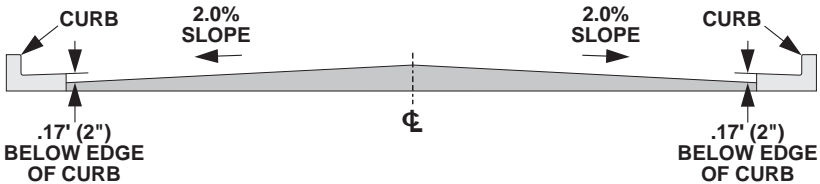


Figure 5-53.

Refer to the chapter "Getting Ready to Grade", and position the Tracker to cut from a curb. Dial in the % slope and desired depth of cut, and begin grading from the curb. Be sure the grade checker verifies the grade the first 25-50 feet. Remember, it is always best to start with the grade high, then "trim" down on the next pass.

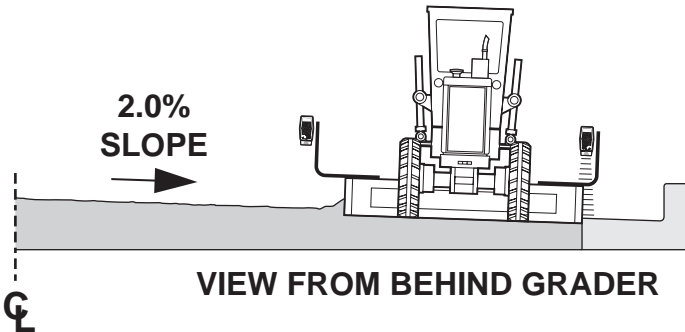
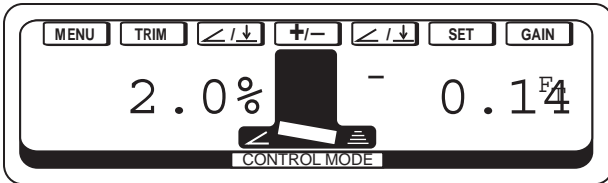


Figure 5-54.

Carry the material across the centerline, and then cut the opposite side of the street.

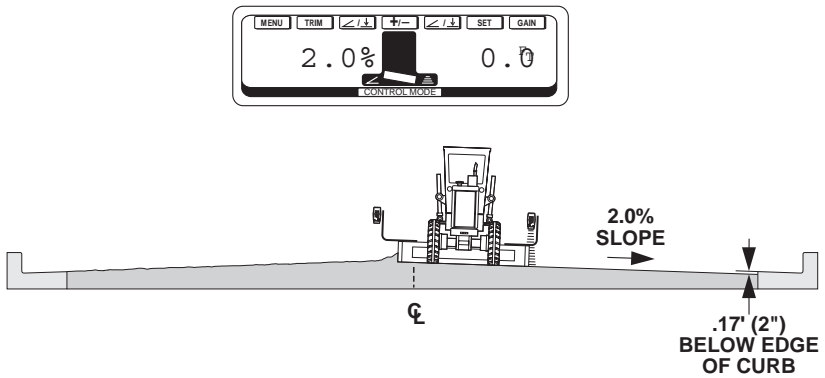


Figure 5-55.

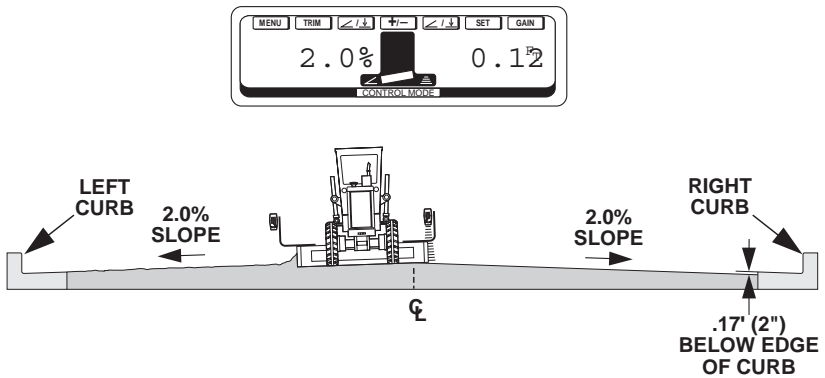


Figure 5-56.

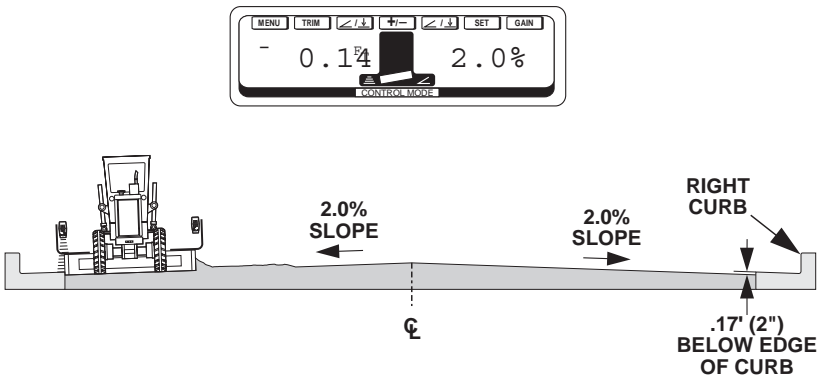


Figure 5-57.

After the windrow has been picked up, make a final "clean up" pass using a Sonic Tracker on each side to complete the project.

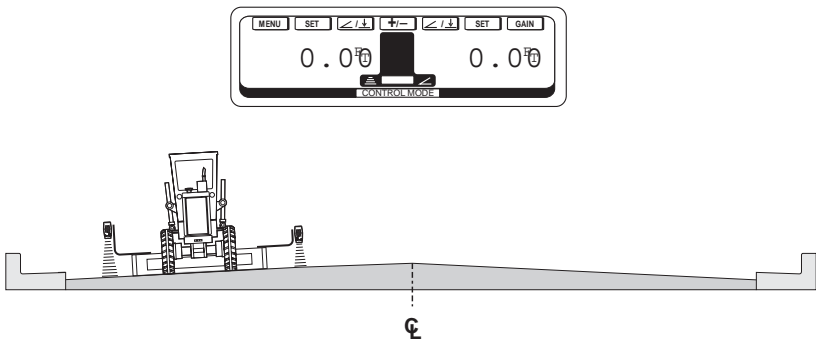


Figure 5-58.

Grading From Curbs Placed at Different Elevations

In some cases the curbs may be poured at different elevations across the street. Even though the curb was poured out of tolerance, it may have passed inspection and the grading needs to be cut from the incorrect curbs. If the curbs are at different elevations, it is impossible to grade a typical design slope on both sides of the street. Depending upon the severity of the error in the curbs, standard grading practices if System Five may have to be adjusted to meet the job requirement.

A cross section design of a 36 feet wide street a 2.0% slope will produce a .36 feet rise at centerline.

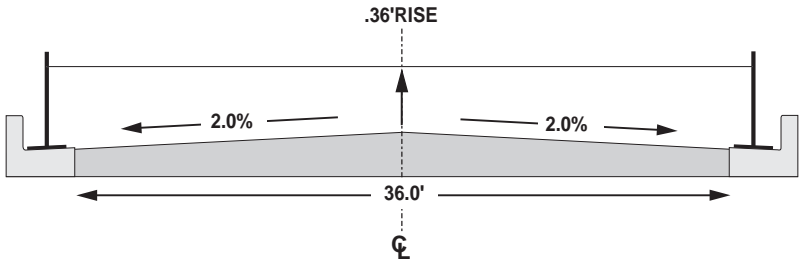


Figure 5-59.

If the curbs are at different elevations, a .36 feet rise at centerline will produce incorrect slopes.

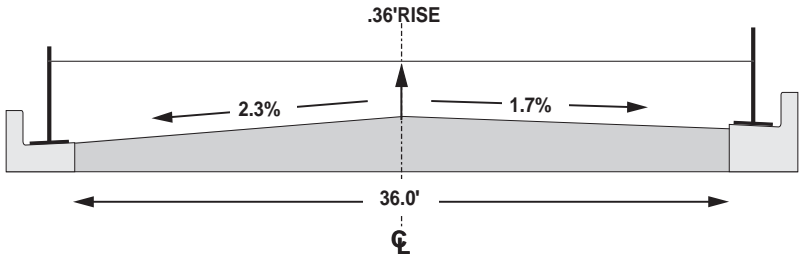


Figure 5-60.

When System Five is used to cut a true 2.0% slope, the crown of the street will not be at the centerline.

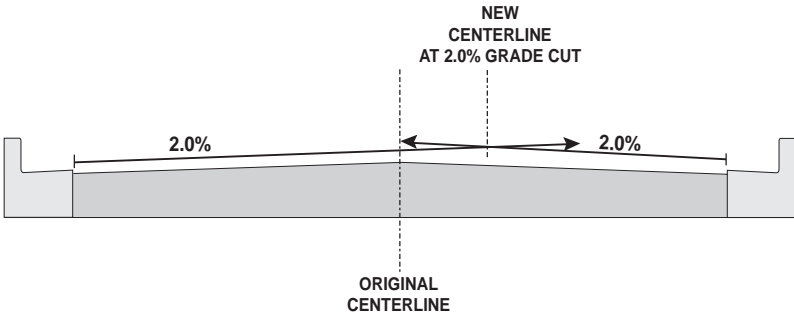


Figure 5-61.

The curb elevations can be easily spot checked using a fast leveling RL-HB rotating laser. Set the laser at the lip of one curb, then use the detector and a folding rule to take a reading on the he other curb. Spot check every 25-50 feet by just moving the laser.

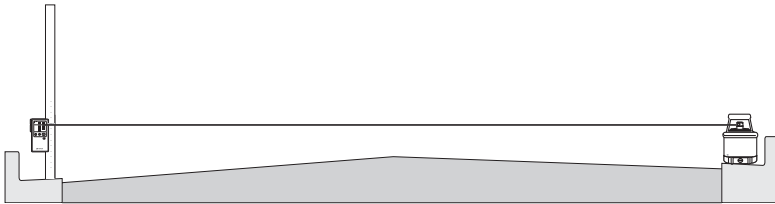


Figure 5-62.

To cut grade from uneven curbs there are two suggested methods.

Method 1

Using Sonic Tracker and Cross Slope, cut grade from one curb (highest curb if known) and carry grade past centerline.

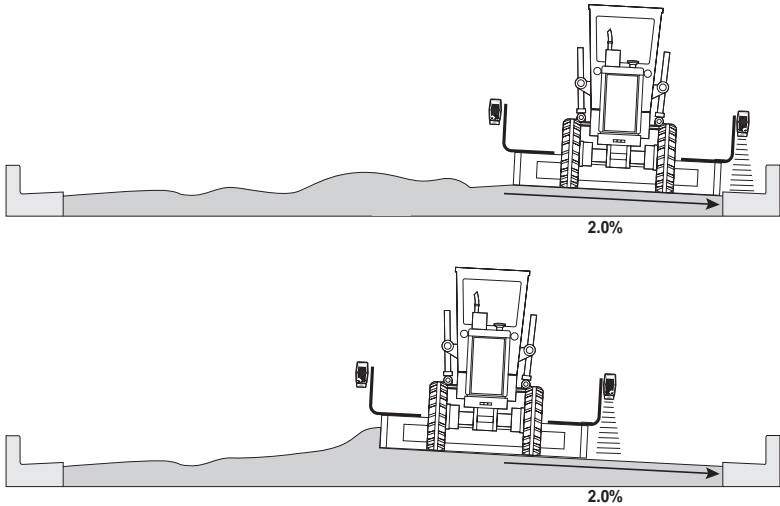


Figure 5-63.

Use Sonic Tracker and Cross Slope to match the centerline grade.

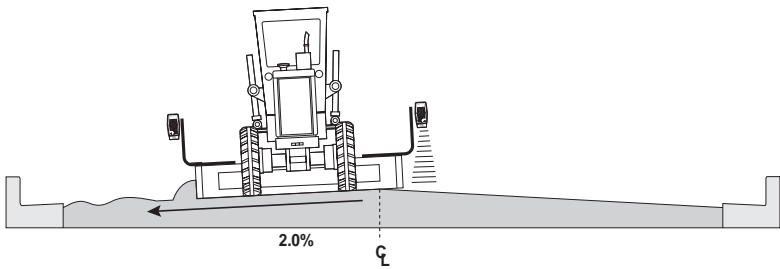


Figure 5-64.

Use Sonic Tracker and Cross Slope to cut grade from the opposite curb.

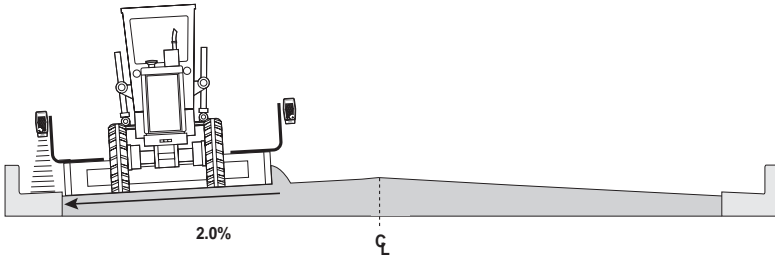


Figure 5-65.

Use Sonic Tracker and Sonic Tracker to match grade and finish the street.

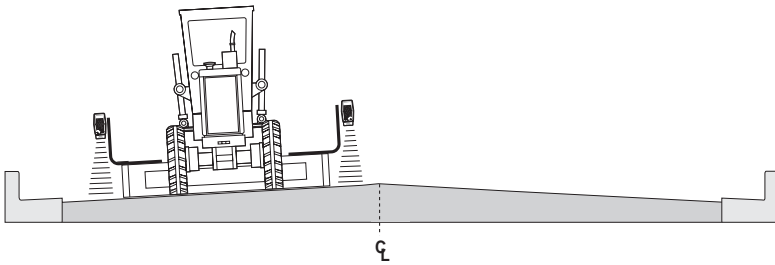


Figure 5-66.

Method 2

For this method, blue tops will need to be set at the centerline of the street.

Using Sonic Tracker and Cross Slope, cut grade from one curb.

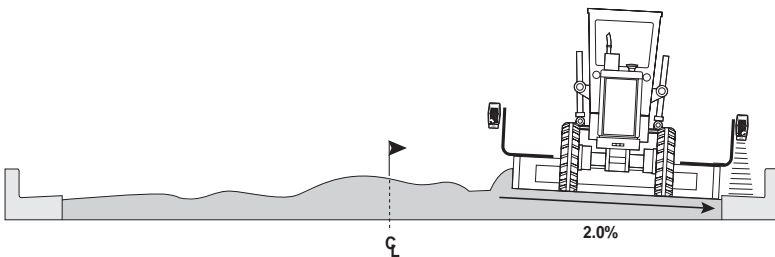


Figure 5-67.

Manually cut centerline grade from the blue tops, and use cross slope on the trailing edge leaving the windrow on this side of the street.

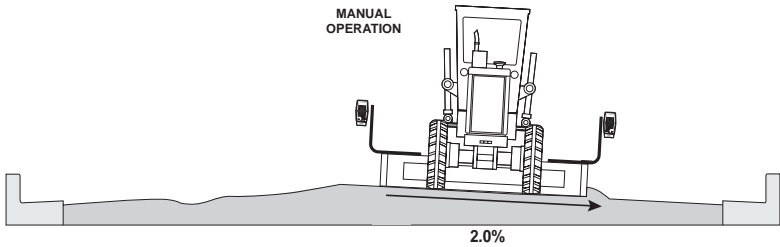


Figure 5-68.

Use Sonic Tracker and Cross Slope to match the centerline grade.

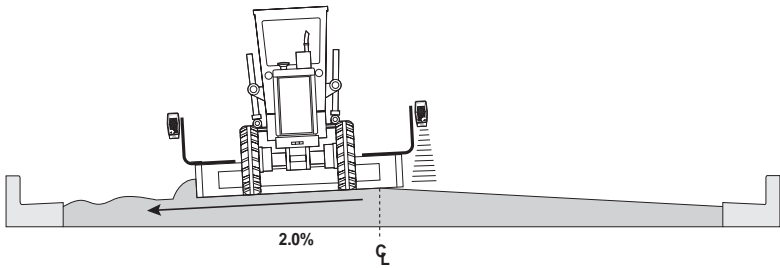


Figure 5-69.

Use Sonic Tracker and Cross Slope to cut grade from the opposite curb.

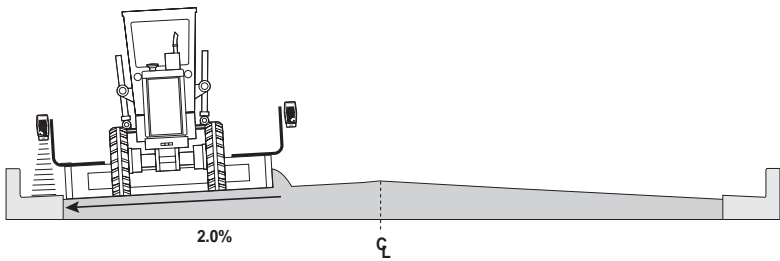


Figure 5-70.

Use Sonic Tracker and Sonic Tracker to match grade and finish the street.

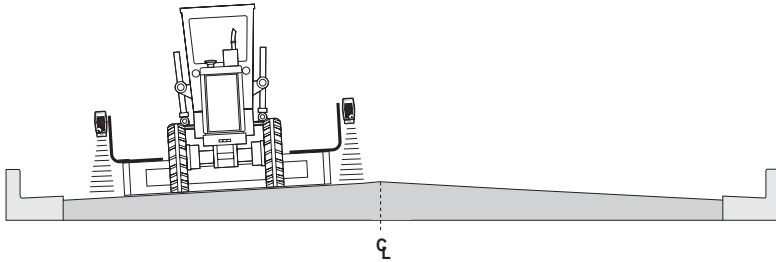


Figure 5-71.

Road Widening and Shoulders

The Sonic Tracker and Cross Slope System can be used to cut grade from an existing road surface for lane extensions or shoulders.

If a barrier wall is being used, make sure the base of the barrier is at least 2-3 inches from the edge. The Sonic Tracker needs to be positioned so it is just picking up the edge of the road, but be sure it will not pick up the base of the barrier well. (See Tracker set up in Chapter: Getting Ready to Grade)

Using Sonic Tracker and cross slope, dial in the desired depth and slope.

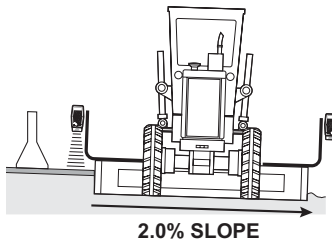
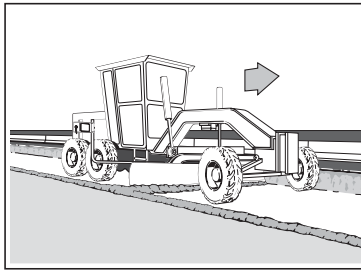
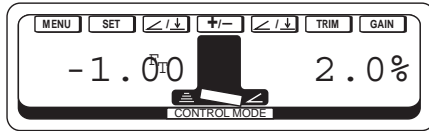


Figure 5-72.

If the barrier wall is placed so close to the edge at the road that the existing surface can not be tracked, set up a Sonic Stringline.

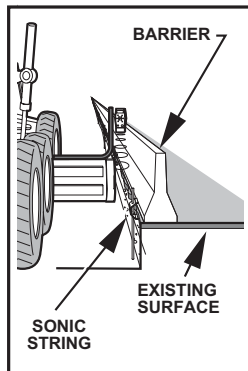


Figure 5-73.

In some cases, the existing surface may not be usable as the grade reference. Set up a Sonic String as shown above, or use short pins welded to a plate to set the stringline.

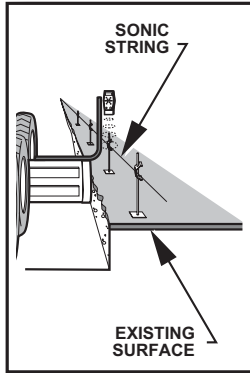


Figure 5-74.

Grading On Curves

The Cross Slope System always cuts the desired slope perpendicular to the graders draw bar assembly of the "A"-frame.

When grading corners or curves, articulate the grader to keep the draw bar assembly perpendicular to the direction of slope.

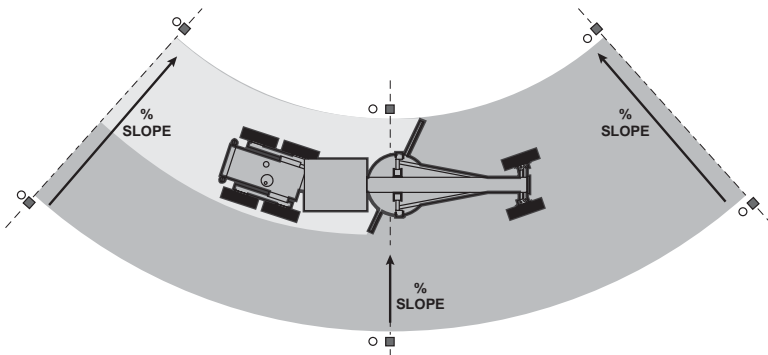


Figure 5-75.

When articulating the grader for special applications, side shift the circle assembly so the draw bar assembly is perpendicular to the direction of slope. Because the Mainfall Sensor is not measuring in the direction of travel, there may be a small error in the slope cut. After roughing in, straighten the grader to make a correct finish pass, or just adjust the slope dialed in until the correct slope is being cut.

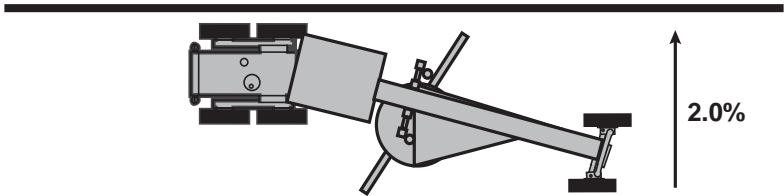


Figure 5-76.

Grading Slope Transitions

Jobs with varying slopes are easily accomplished by dialing the desired slope into the Control Box as you are grading. With the Smart Knob switches, this can be done while keeping your hands on the control levers.

The key to making this job easy is to mark the stations with the Cross Slope so the operator can see the slope at least one station ahead. Making the slope on a plastic coated paper plate and stapling the plate to the witness lath is one simple solution. Each time you press the Smart Knob button, the slope changes by 0.1%. This will produce a smooth transitions as you are grading.

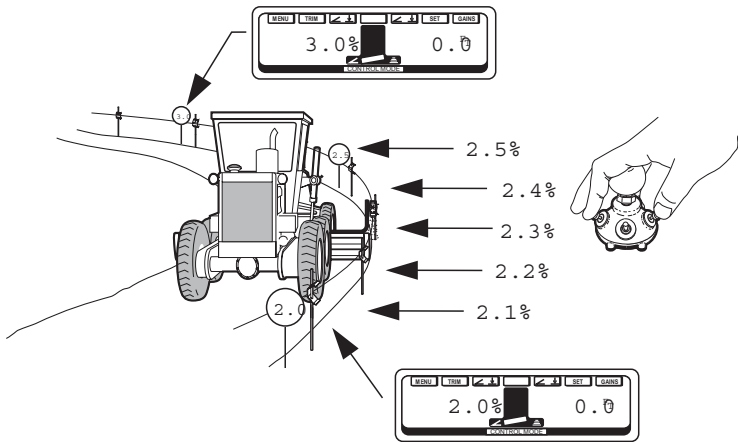


Figure 5-77.

Maintenance

This section contains information regarding preventative maintenance and daily care of System Five. Also included are:

1. Cleaning procedures for the Sonic Tracker II Transducer.
2. Replacement procedures for the Sonic Tracker II Transducer.

Preventative Maintenance & Daily Care

A good preventative maintenance and daily care routine will prevent many problems before they occur. The most important part of daily care for System Five is to clean it and keep it free of debris, and to thoroughly dry removable components (Sonic Tracker II, the Control Box, and cables) before storing them in the Carrying Case. In addition, the following procedures will ensure trouble free operation:

1. Keep the Carrying Case clean and dry. Do not leave it open and exposed to the elements. Clean and dry all components prior to placing them into the Carrying Case.
2. Be sure protective connector caps, provided on the Mainfall Sensor, are in place when the cables are not in use. Water accumulating on the connectors can cause electrical shorts.
3. Do not use high pressure spray water steam cleaner hoses directly on cables and components. The components can be used in the rain or light spraying.
4. Check the Sonic Tracker II Transducer daily to make sure the Filter Foam and Transducer are clean and free of debris. If the Filter Foam is clogged with dirt, replace it. If the Transducer appears to be covered with debris and performance is being affected (see Sonic Tracker II in Chapter 2: Operation) clean or

replace Sonic Tracker II Transducer using the steps listed later in this chapter.

Transducer Cleaning (Sonic Tracker II)



NOTICE

This procedure is not meant to be a regular maintenance procedure. Cleaning of the Transducer should only be performed when Transducer contamination is suspected or evident.

Over cleaning of the transducer will result in shortened Transducer life and/or water damage to the Sonic Tracker.

1. Hold the Sonic Tracker II in an UPRIGHT position (this will prevent moisture from inadvertently entering the Sonic Tracker).
2. Mix a mild detergent with water and place the mixture in a spray bottle (use Simple Green® where available.)
3. With the Sonic Tracker II upright, thoroughly spray the Transducer with the detergent solution.
4. Once the Transducer has been sprayed with the detergent, fill the spray bottle with clean water and rinse any residual detergent off of the Transducer.
5. Allow to thoroughly dry.

If the ability of the Sonic Tracker II to "see" a sonic stringline continues to be impaired, the transducer may be damaged and needs replaced.

Transducer Replacement Procedure (Sonic Tracker II)

NOTICE NOTICE

If the Sonic Tracker II is experiencing erratic or inconsistent readings, Transducer contamination should be considered first before assuming any other type of failure.

The most common sign of Transducer contamination is the ability of the Sonic Tracker II to "see" the ground, but not a Sonic Stringline.

Sonic Tracker II Transducer Replacement

1. Remove and discard the Filter Foam (a new Filter Foam is provided in the Transducer Replacement Kit).

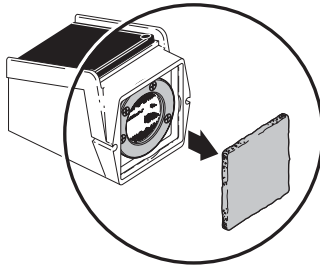


Figure 6-1.

2. Remove the four screws and the black Retaining Ring. There are four replacement screws supplied in the Transducer Replacement Kit, but it is advisable to use the original screws and keep the four supplied in the kit for replacements in the event one or more are lost). Remove and discard the "O"-Ring (a new "O"-Ring is supplied with the Transducer Replacement kit).

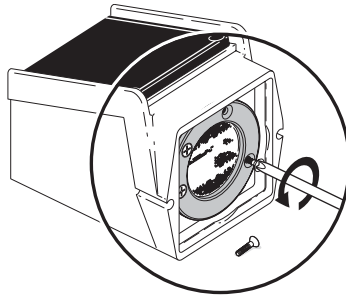


Figure 6-2.

NOTICE NOTICE

Always remove and discard used "O"-Rings. Used "O"-Rings will be distorted and may lose their elasticity due to weather or exposure to diesel fumes.

3. The Transducer can now be gently pulled out. Use a SMALL pair of dikes to gently cut the Ty-Wrap then remove the small wire connectors from their tabs.

NOTICE NOTICE

When cutting the Ty-Wrap, be careful not to cut or damage the wires.

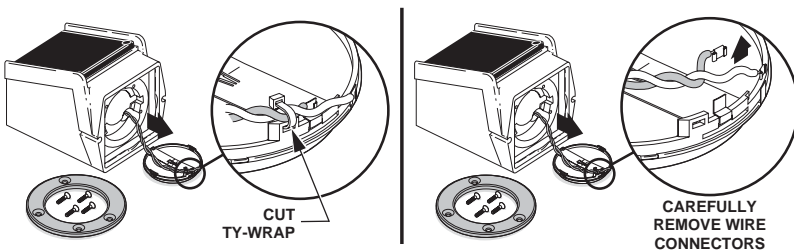


Figure 6-3.

- Place the wire connectors of the new Transducer firmly on their tabs (the gray wire connector is placed on the elevated tab). Place the Ty-Wrap in the slot next to the elevated (gray wire) tab, tighten and trim. DO NOT pinch the wires.

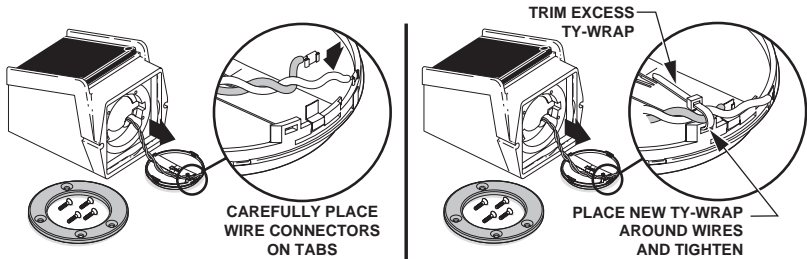


Figure 6-4.

- "Feed" the wires back up into the Sonic Tracker II and seat the Transducer into place (the two wire tabs have to sit down into the extra deep area of the recess). Place the new "O"-ring around the Transducer and seat firmly between the Transducer and the Sonic Tracker II Transducer recess.

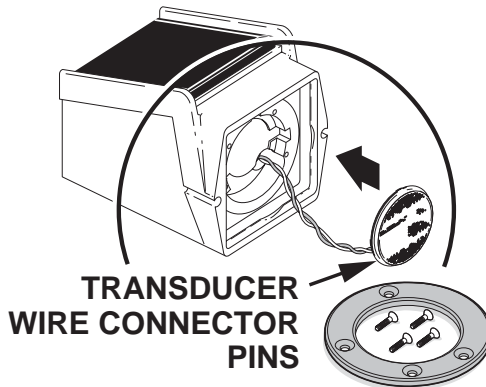


Figure 6-5.

- Place the black Retaining Ring over the Transducer assembly with the beveled edges out and the flat surface against the Sonic Tracker II base. Line up the holes for the mounting screws (the mounting screw holes are set to an irregular pattern. This ensures the retaining ring will only lineup with the mounting holes one way).

7. Start the mounting screws into the holes and tighten each until firm. **DO NOT OVER TIGHTEN.** Use a cross (X) pattern to tighten screws.

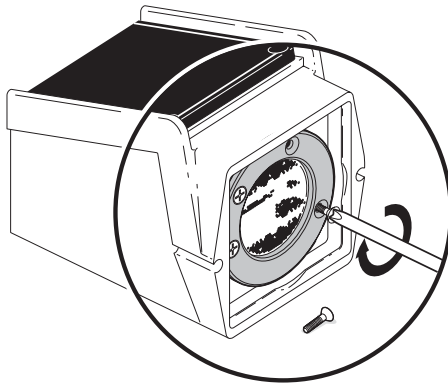


Figure 6-6.

NOTICE NOTICE

Over tightening may distort the Transducer metallic material and may crack the Retaining Ring. Use of the "O"-Ring assures tightness while preventing vibration from loosening the Mounting Screws.

NOTICE NOTICE

DO NOT use Loctite® on the mounting screws. Loctite® will attack the plastic retaining ring.

8. Make sure there are no visible wrinkles in the metallic surface inside the Transducer. If distortion is evident, repeat Steps 5 through 8.
9. Place a NEW Filter Foam over the Transducer. The Sonic Tracker II is now ready to return to operation.

Rotation Sensor Cleaning and Lubrication

The Rotation Sensor baseplate should occasionally be cleaned and greased. Although the sensor does not need lubrication, the grease will keep contaminants from accumulating in the baseplate and binding the sensor.

NOTICE NOTICE

Cleaning and lubrication of the Rotation Sensor may need to be more frequent if operating in excessively dusty or gritty materials.

Cleaning the Rotation Sensor

The following procedures detail the disassembly of the rotation sensor for cleaning.

1. Place the moldboard perpendicular to the frame of the grader and lower the cutting edge to the ground.
2. Remove the four screws securing the two halves of the retaining ring and remove the retaining rings.

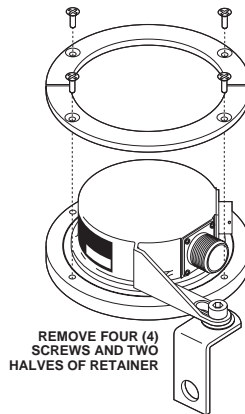


Figure 6-7.

- Now remove the shoulder screw, washer, and jam nut from the Rotation Sensor arm.

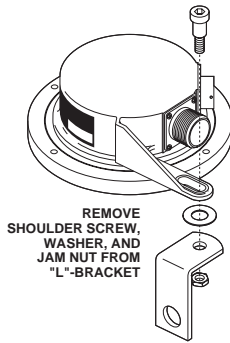


Figure 6-8.

- Carefully lift the Rotation Sensor from its base plate.

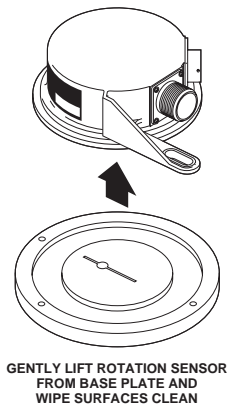


Figure 6-9.

NOTICE NOTICE

DO NOT force or pry the Rotation Sensor from the base plate. The Rotation Sensor pin may bend or break.

- Use a clean rag and thoroughly clean the base plate and bottom of the Rotation Sensor.

Lubricating the Rotation Sensor

1. Pack the base plate reservoir and pin cavity with fresh grease.

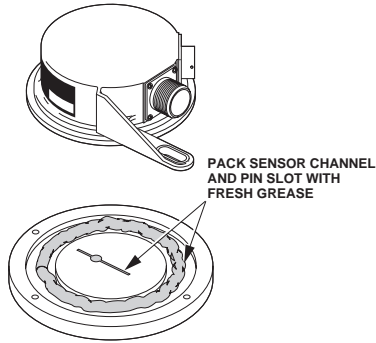


Figure 6-10.

2. Place the Rotation Sensor back on the base plate. Make sure the rotation pin seats firmly in the pin cavity (it will only seat correctly one way).

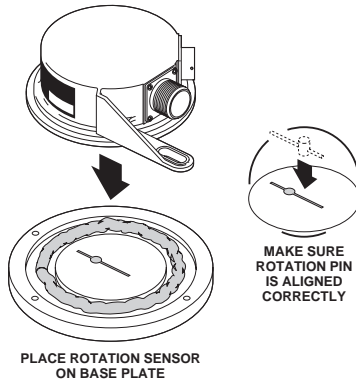
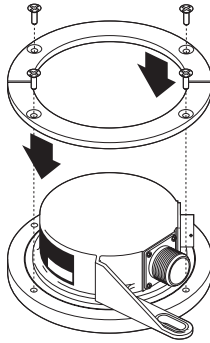


Figure 6-11.

3. Place the two halves of the retaining rings on the base plate with the screw holes aligned and replace the four screws. Tighten until firm.



PLACE BOTH HALVES OF RETAINER RING
ON ROTATION SENSOR BASE
AND RE-INSTALL SCREWS

Figure 6-12.

4. Realign the Rotation Sensor arm with the "L" bracket and replace the shoulder screw, washer, and jam nut. Tighten until firm.

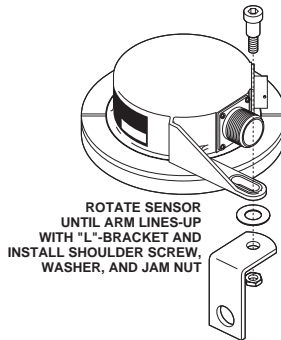


Figure 6-13.

Before returning the Rotation Sensor to work, the Rotation Sensor must be re-calibrated. Follow the procedures in the "Calibration Rotation" section of this manual.

Troubleshooting

System Test Mode

The "System Test" is a troubleshooting guide built into System Five that provides you with a method for detecting and isolating a problem with a cable or system component.

The following sections will explain how to use the System Test features in order to locate where a problem exists while in the field.



NOTICE

Before assuming sensor failure, check that all cables are firmly attached to their sensors. Also, check that the connectors are clean and free of debris that might interrupt signal communications between sensors.

Accessing the System Test

1. Press "Setup" from Main Menu.
2. Use the grade knob to select "System Test".
3. Press the button above "ENTER".

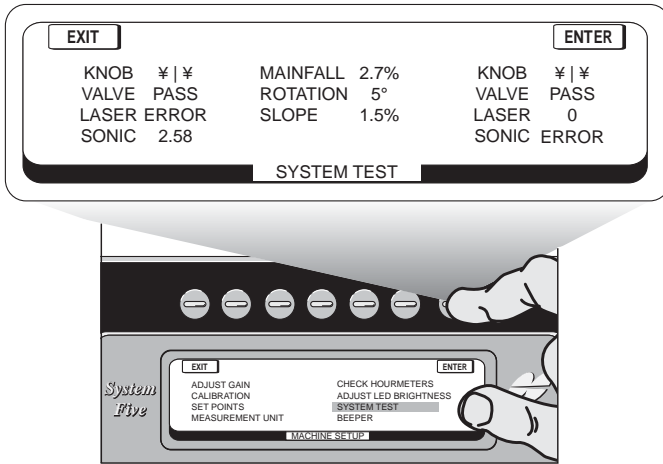


Figure 7-1.

In System Test Mode, the LCD will display System Five's component readings. The readings on the left side of the display are for the components on the left side of the grader. The reading on the right side of the display are for components on the right side of the grader. The Cross Slope System Sensor readings are displayed in the center of the LCD.

Each component should have a number or indicator next to it showing that it is communicating to the Control Box. If a component has "ERROR" displayed, that indicates it is not communicating to the Control Box. This problem could be a defective component or a defective cable attached to the component.

Slope Sensor Test

The slope reading in the center of the screen is the calibrated value of the Blade Slope Sensor.

To check if the sensor is working properly:

1. Slowly raise the right side of the blade. The slope value should increase smoothly and continuously.

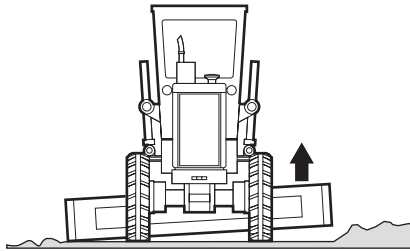
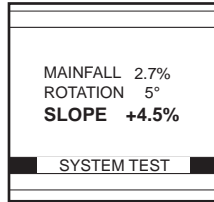


Figure 7-2.

2. Slowly lower the right side of the blade. The slope value should decrease smoothly and continuously. If your slope sensor is responding this way, proceed to next step.

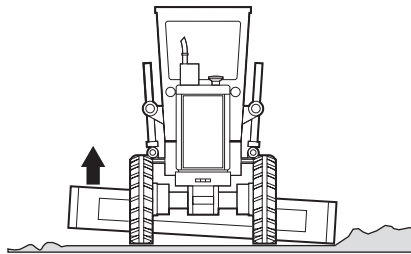
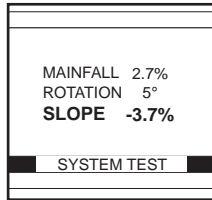


Figure 7-3.

Your Slope Sensor is not working properly if:

- The numbers increase or decrease erratically as the blade is smoothly raised and lowered.
- The number displayed continues to change even though you have stopped moving the blade.

If your Slope Sensor is responding this way, contact your local Topcon dealer.

To check if Slope Sensor is measuring accurately:

1. Using a laser, smart Level or Auto Level, calculate the slope of the ground. If you do not have an instrument to calculate slope, proceed to step #6.

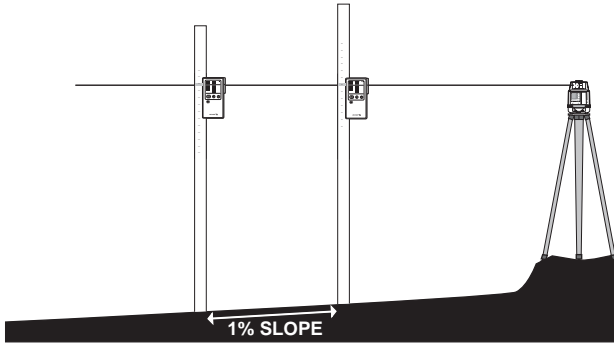


Figure 7-4.

2. Place the cutting edge lightly on the ground in the same direction you measured the slope. The value displayed on the screen should be within .2% of the calculated slope.

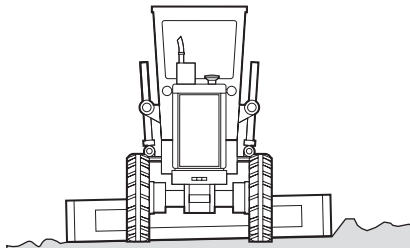
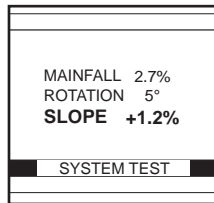


Figure 7-5.

If you cannot calculate slope:

1. Place cutting edge lightly on the ground and read the slope value on the screen.

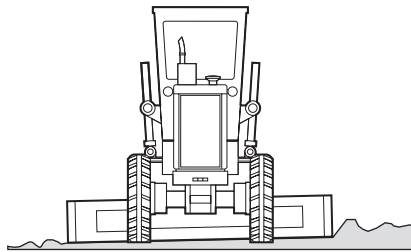
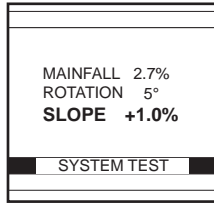


Figure 7-6.

2. Turn machine around and lightly place cutting edge in the exact same place. The slope value should be in the opposite direction and within .2% of the previous number.

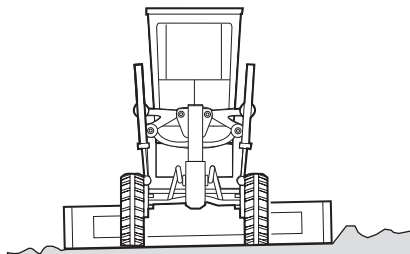
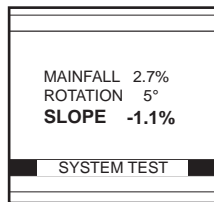


Figure 7-7.

NOTICE NOTICE

It is important to set the blade on the ground with the same amount of pressure in both directions.

Troubleshooting

When "ERROR" is displayed, the Blade Slope Sensor information is not communicating with the Control Box. This does not necessarily mean that the sensor is defective. A damaged cable may be disrupting the information. The following procedure will help you locate the problem. If the Mainfall Sensor also reads "ERROR", go to the Mainfall Troubleshooting first.

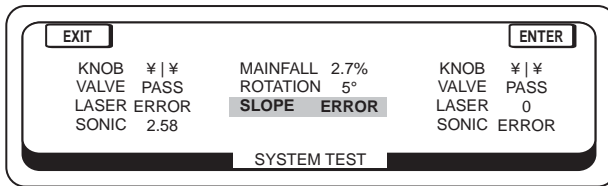


Figure 7-8.

1. Turn the Control Box off.
2. At the Mainfall Sensor, disconnect the cable from the Control Box.
3. Connect the Control Box cable directly into the Blade Slope Sensor. You will need to unbolt the Blade Sensor and hold it near the Mainfall Sensor to get the cable to reach.
4. Turn the Control Box "On" and enter the System Test Mode.

If "ERROR" continues to be displayed, your Blade Slope Sensor may have failed.

If "ERROR" is no longer displayed, the Blade Slope Sensor is not damaged, and there is a cable failure. Continue with the rest of the tests to locate the damaged cable.

5. Turn the Control Box "Off", and reconnect the cable to the Mainfall Sensor.

- At the Rotation Sensor, disconnect the cable from the Mainfall Sensor and connect it to the Blade Slope Sensor (by passing the Rotation Sensor).
- Turn the Control Box "On" again and enter the System Test Mode.

If "ERROR" is displayed, the Mainfall to Rotation Sensor Cable is damaged. If "ERROR" is NOT displayed, then the failure is located in the Rotation to Blade Slope Sensor Cable.

If a Blade Slope Sensor or cable failure has occurred, contact your Topcon Dealer or Topcon's Service Department.

Mainfall Sensor Test

The Mainfall reading in the center of the screen is the calibrated value of the Mainfall Sensor. To check if sensor is working properly:

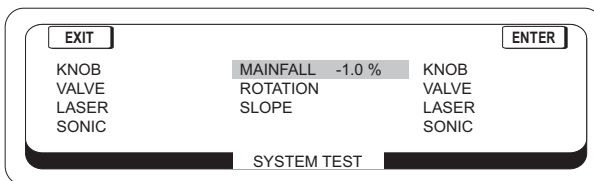
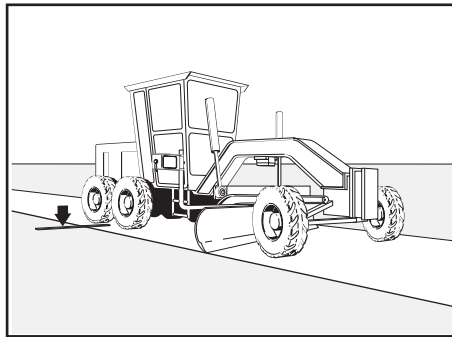


Figure 7-9.

1. Mark the midpoint between the two rear tires.
2. Note the slope displayed for the Mainfall.
3. Turn the grader around placing the front tires directly over the previous rear tire midpoint marking.
4. The LCD should display the same slope as in step 1, but in the opposite direction.

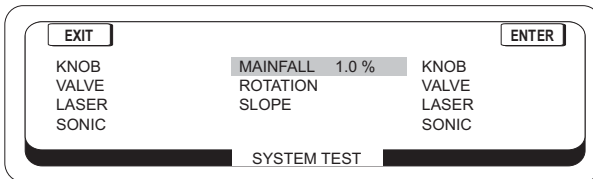
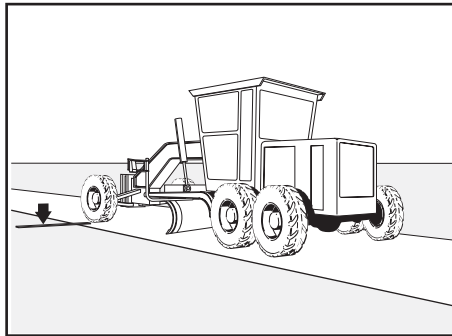


Figure 7-10.

If two different slopes are displayed...

If the second slope displayed is different from the first, recalibrate the Mainfall Sensor and perform the test one more time. If the slopes displayed continue to be different, your Mainfall Sensor is not working properly.

If the "Error" symbol is displayed...

If the Mainfall shows "ERROR" but the Slope shows a value, the Mainfall is not functioning.

If both Mainfall and Slope show "ERROR", the problem is in the Control Box, or the Control Box to the Mainfall Cable.

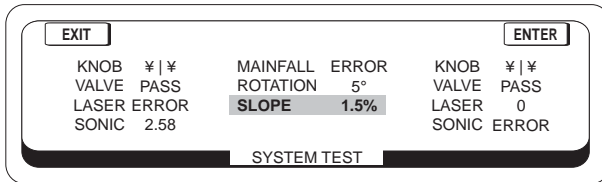


Figure 7-11.

Rotation Sensor Test

Unlike the two previous sensor test procedures, the Rotation Sensor Test displays in degrees of rotation rather than percentage of slope.

NOTICE NOTICE

The Rotation Sensor information is communicated to the Control Box from the Slope Sensor. If the Slope Sensor or Slope Sensor Cable is defective, the Rotation Sensor will also indicate "ERROR". If both are indicating error, proceed to slope sensor test before conducting Rotation Sensor Test.

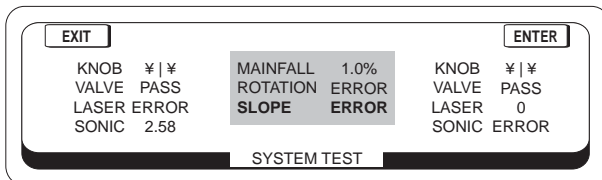


Figure 7-12.

To check if the sensor is working properly:

1. Manually rotate the circle counterclockwise approximately 1 foot.
2. Slowly rotate the circle back until the chisel mark is in line with the "A"-frame and stop.

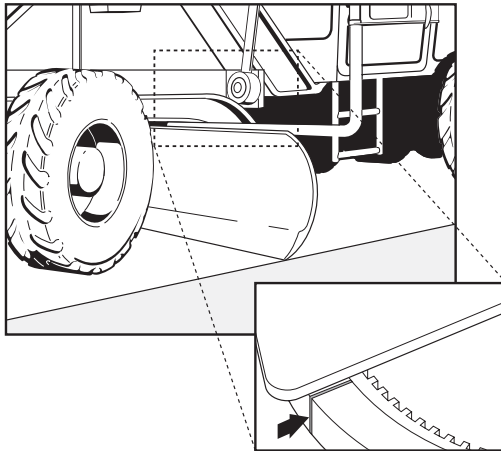
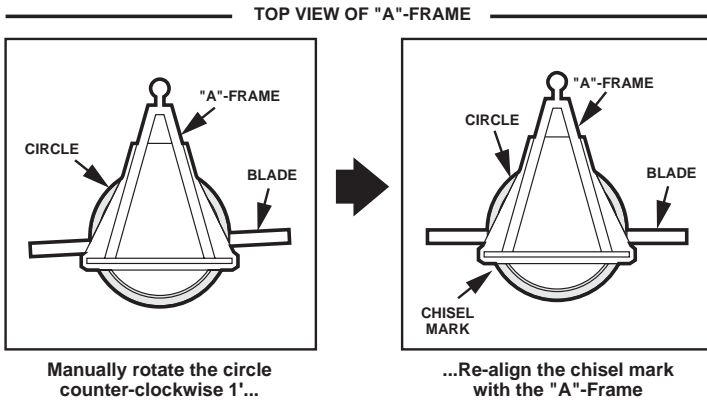


Figure 7-13.

NOTICE NOTICE

If you go past the chisel mark, repeat the procedure beginning with the circle rotated 1 foot beyond the chisel mark.

- The value next to rotation should display 0 degrees. If it does not read 0 degrees, recalibrate the Rotation Sensor in its current position and re-enter the System Test Mode.

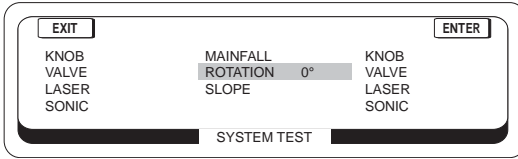
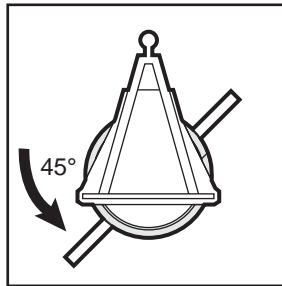


Figure 7-14.

- Proceed by rotating the circle counterclockwise continuously and smoothly to about a 45 degree angle (the right side of the blade should be approximately 1 foot from the front tire.)

The value next to "Rotation" should display the increase from 0 degrees to 45 degrees in a smooth transition:

- If the numbers jump erratically as the circle is being rotated, then the Rotation Sensor is not working properly.
- If the numbers do not change, as the circle is being rotated, remove the Rotation Sensor and check to make sure the pin has not fallen out.



ROTATE BLADE 45°...

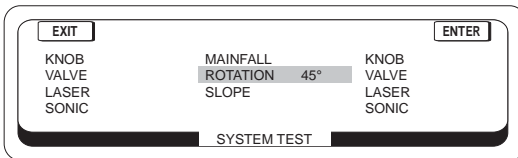


Figure 7-15.

- Rotate the circle back clockwise continuously and smoothly to a 45 degree angle.

The values next to rotation should decrease from 45 degrees to a -45 degrees angle in a smooth transition. If they do not, refer to the procedures, in step 4.

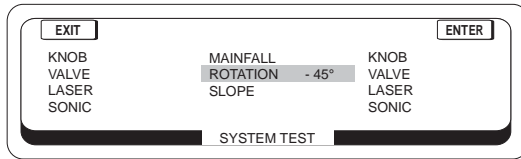
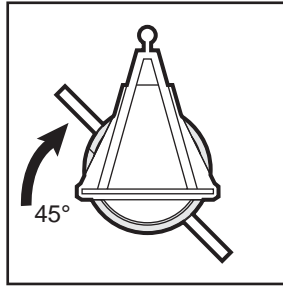
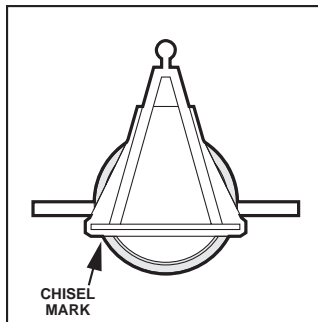


Figure 7-16.

- The Rotation Sensor Test can also be used to indicate whether servicing of the circle, hose tray or guide rods is required. Rotate the circle counterclockwise until chisel mark on the circle lines up with the "A"-frame.



...then Re-align the chisel mark with the "A"-Frame...

Figure 7-17.

NOTICE NOTICE

If you go past the chisel mark, repeat the procedure beginning with the blade rotated 1 foot clockwise beyond the chisel mark.

If the value is within 1 or 2 degrees of 0, then rotation is accurately compensated and no repairs are needed!

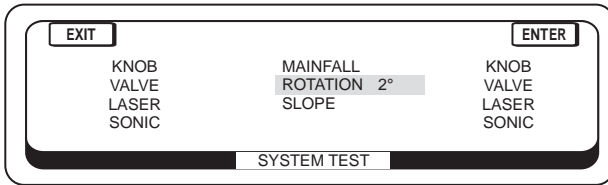


Figure 7-18.

If the value is more than beyond 2 degrees, then the problem is one or more of the following:

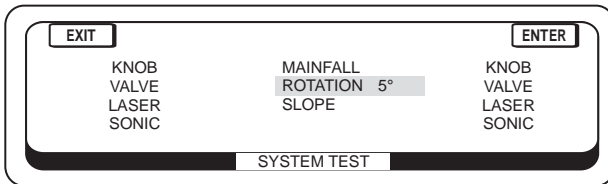


Figure 7-19.

- Excess "slop" in the pin between the grader's hydraulic swivel and the hose tray.
- Hose tray is bent and the guide rods are no longer attached to the circle.
- The hole where guide rod is attached to circle is worn so the guide rod is no longer held tight.
- Guide rods are weak and have too much flex.

These are physical wear areas that must be repaired for System Five to cut accurate cross slope.

Safety Information

It is your responsibility to be completely familiar with the cautions described in this System Five Manual. These messages advise against the use of specific methods or procedures which can result in personal injury, damage to the equipment, or unsafe operating conditions. Remember, most accidents are caused by failure to observe basic safety precautions.

General Precautions

1. Read and become familiar with the grader manufacturer's operations manual, including safety information before installing or using your TOPCON System Five.
2. Use extreme caution on the jobsite. Working around heavy construction equipment can be dangerous.
3. **DO NOT** attach System FiveD brackets or hose connections while the grader is running.
4. **DO NOT** allow any System Five component to limit the visibility of the operator.
5. Use Ty-wraps, supplied with System Five, to keep hoses and wires secured and away from possible wear or pinch points.
6. Use eye protection when welding, cutting or grinding is being done on the machine.
7. Protect yourself at all times, and wear protective clothing, when working on or near hydraulic lines. Hydraulic lines can be under extreme pressure, even when the machine is turned off.



WARNING

Relieve all pressure in the hydraulic lines before disconnecting or removing any lines, fittings or related components. If injury does occur, seek medical assistance immediately.

8. Avoid direct exposure to your eyes when using laser control.



CAUTION

DO NOT stare into the laser beam or view the beam directly with optical equipment.

9. Use appropriate welding precautions and practices when welding. After welding, all affected areas should be painted with a rust inhibitor.



NOTICE

Disconnect all Topcon system electrical cables prior to welding on the machine.



WARNING

DO NOT weld near hydraulic lines or on any equipment when in operation.



NOTICE

All mounting bracket welds must be secure and strong to prevent the sensor equipment from vibrating excessively or from becoming detached at the weld during operation.

**NOTICE**

Keep the Carrying Case dry at all times. DO NOT allow moisture to get inside the case. Moisture trapped in the case can adversely affect components.

If moisture does enter the Carrying Case, leave it open and allow it to thoroughly dry before storing any components.

10. To prevent vandalism or theft, do not leave removable Topcon components (Control Boxes, Sonic Tracket IIs and cables) on the machine at night. Remove the components each evening and store appropriately in the Carrying Case.

Limited Warranty

Electronic and Mechanical Components

TOPCON warrants that the electronic components manufactured by TOPCON shall be free of defects in materials and workmanship for a period of one year from the original date of shipment to the dealer. TOPCON warrants that all valves, hoses, cables and mechanical parts manufactured by TOPCON shall be free of defects in materials and workmanship for a period of 90 days from the date of installation.

Return and Repair

During the respective warranty periods, any of the above items found defective may be shipped to TOPCON for repair. TOPCON will promptly repair the defective item at no charge, and ship it back to you. Calibration of components, labor and travel expenses incurred for in-field removal and replacement of components are not covered under this warranty policy. Damage to components due to negligence, abuse or improper use is NOT covered under this warranty.

Warranty Disclaimer

The above warranties are in lieu of all other warranties, whether expressed or implied, including all warranties or merchantability, or fitness for a particular purpose. In no event will Topcon Laser Systems, Inc. or its Representative be liable for lost profits or other consequential damages arising from the purchase or use of TOPCON's components or any performance hereunder or any claims

of negligence, even if TOPCON has been advised of the possibility of such damages.

Service Information

Service assistance can be provided by contacting your local TOPCON dealer or by calling the Corporate Service Center.

Phone: (800) 443-4567
8 a.m. to 5 p.m. Pacific Time
Monday through Friday
FAX: (925) 460-1329

Travel charges will be applied for any on-site service whether warranty or non-warranty in nature.



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