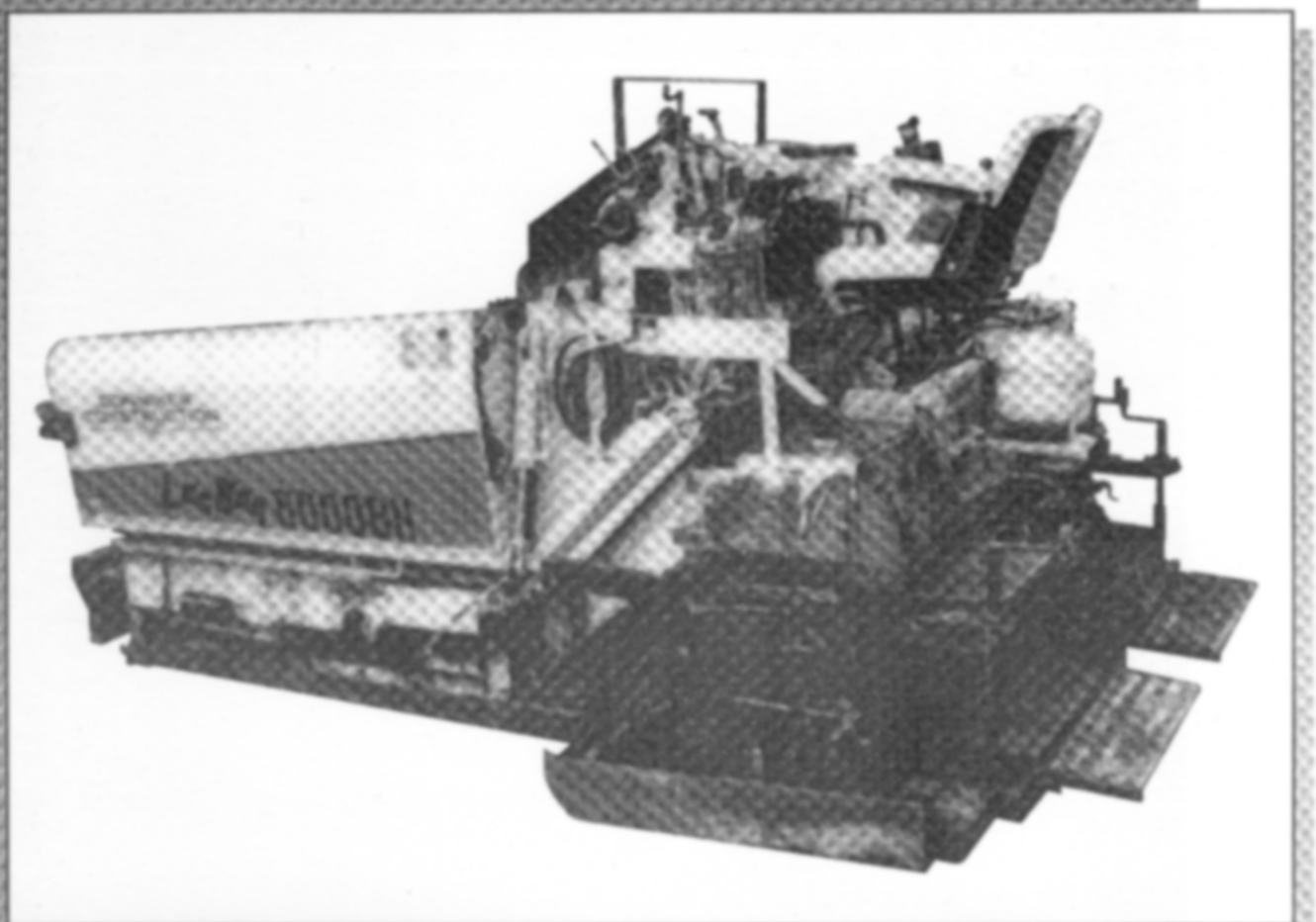
TOPCON

PAVER CONTROL SYSTEM FOUR



Lee Boy Asphalt Paver

Operation and Installation Manual

TOPCON Laser Systems, Inc.

Foreword

TOPCON Laser Systems, Inc. produces productivity enhancement tools engineered and manufactured by professionals from the construction industry. The efficient design and advanced technology of System Four allows you to increase production, effectively control materials, and reduce time spent setting and checking grade.

This manual has been developed to provide the LeeBoy® paver operator with information necessary to operate and maintain System Four. Proper service and use is important to the reliable operation of the sensing 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 installation, operation, care and troubleshooting of your System Four. Also contained in this manual are 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 Laser Systems, Inc. reserves the right to make product changes at any time without notice.

Comments, suggestions and questions about Advanced Grade Technology products are welcomed. Contact your local Advanced Grade Technology representative, or a representative at our corporate facility.

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Safety Information

Before performing any of the following installation procedures, it is your responsibility to be completely familiar with the cautions described in this installation 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 Cautions

1. Read and become familiar with the paver manufacturer's operations manual, including safety information before installing or using your System Four.
2. Working around heavy construction equipment can be dangerous; always use extreme caution on the job site.
3. System Four is externally mounted on the paver. DO NOT install System Four or reattach components while the machine is running.
4. DO NOT allow any component of System Four to protrude into traffic or to in any way limit the visibility of the operator.
5. Keep all body parts and clothing away from moving parts of the machine when adjusting the screed. Use wood blocks or other devices to set the initial screed height.
6. Use eye protection when welding, cutting, or grinding is being done on the machine.
7. Hydraulic lines can be under extreme pressure, even when the machine is turned off. When working on or near hydraulic lines, protect yourself at all times and wear protective clothing.

WARNING

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

8. When using laser control, protect your eyes.

CAUTION

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

9. When welding, always use appropriate welding precautions and practices. After welding, all affected areas should be painted with a rust inhibitor.

NOTICE

NOTICE

Disconnect all System Four electrical cables prior to welding on the machine.

WARNING

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

NOTICE

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

NOTICE

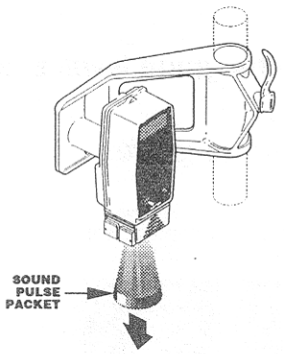
Keep the Carrying Case dry at all times. DO NOT allow moisture to get inside the case. Moisture trapped in the case can adversly affect components.

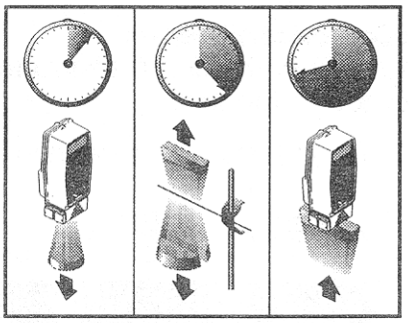
10. To prevent vandalism or theft, do not leave the removable System Four components (Control Box, Sonic Trackers, or cables) on the machine at night. Remove the components each evening and store appropriately in the Carrying Case.

System Overview

Sonic Tracker

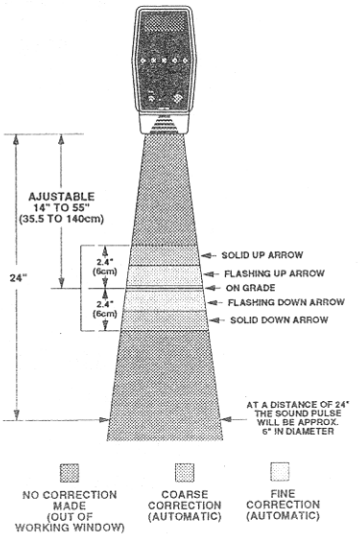
The Sonic Tracker uses sound waves to measure distance. A Transducer, located at the bottom of the Sonic Tracker sends out sound pulses at a rate of 40 pulses per second (refer to Figure 1.01). These sound waves, or pulses, bounce off a physical control reference, such as Existing Surface, Stringline, Surface String or Curb and produce echoes as they return to the Transducer. The Transducer detects the returning echo and measures the time it took for the sound wave, once emitted, to bounce off the physical reference and return. The Tracker, knowing the speed of sound, then calculates, very accurately the distance to the reference. It then determines if a correction is required, how much that correction should be and in which direction (refer to Figure 1.02).





Working Window

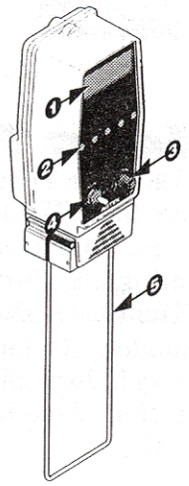
As the sound waves leave the Transducer they spread into a cone shaped pattern. Within this pattern is the working window. The working window is the region approximately 2.4" above and 2.4" below On Grade (see figure 1.03). Grade correction is made automatically (when System Four is in Automatic Operation) by System Four for any deviation within the working window above or below On Grade. This is shown on the Tracker by the flashing or solid illumination of the Grade Correction LEDs. If the reference (Stringline, Surface String, Existing Surface, etc...) is above or below the working window the LEDs on the Tracker will go out. System Four automatically switches from Automatic to Manual Control until the reference is again within the working window.



Adjusting the Working Window

The Sonic Tracker is unique because it has an adjustable working window. The working window can be adjusted (moved up or down) on the Sonic Tracker by turning the Grade Adjustment Knob.

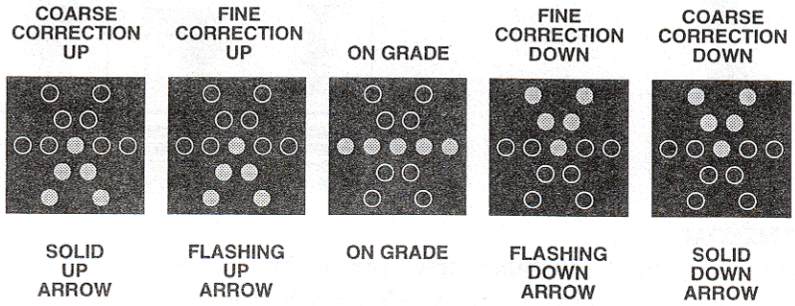
Sonic Tracker Control Panel



The Sonic Tracker Control Panel has an LCD that displays elevation and cross slope symbols as well as numeric values. It also has a Run/Set Switch, a Grade Adjustment Knob and a Grade Correction Display. These controls are used to make minor adjustments to elevation or cross slope.

1. **LCD Digital/Symbol Display**
   This display lets you view the numbers and symbols of the various function settings.
   - Numbers on the display indicate the reference elevation. Elevation measurements can appear in units of either feet or inches or centimeters.
   - Temperature Bail active.

2. **Grade Correction Display**
   The grade correction display queues you when the grade level is too high, on grade or too low.
   - LEDs indicate the correction required to return to grade.



The Tracker also displays cues which indicate what area of the Working Window the reference correctly resides in.

LEDs Flashing
Fine correction, within .6 inch (1.5 cm) of the on grade zone.

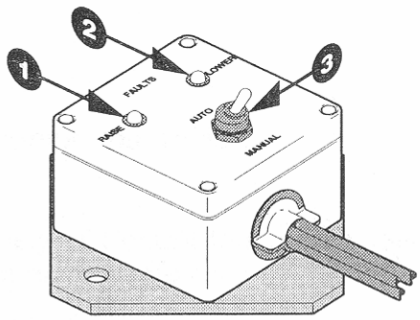
LEDs Solid
Correction more than .6 inch (1.5 cm) but less than 2.4 inches (6.10 cm).

LEDs Off
Reference is out of working window.

3. **Grade adjustment Knob**
   This knob is used to make minor adjustments to the elevation control setting.
   - Adjusts the percentage slope when cross slope control is selected.
   - Adjusts the grade height for the Sonic Tracker when elevation control is selected.
4. **Run/Set Switch**
   This switch is disabled. Leave switch in the SET position.
5. **Temperature Bail Retrofit Kit (Included w/Tracker)**
   The Temperature Bail is used to compensate for rapid air temperature changes that can occur while paving. Sound travels through cool air slower, and warm air faster. The temperature bail gives the Tracker a "known" constant distance to refer too to compensate for air temperature changes.

Auto/Manual Switch Box

The Auto/Manual Switch Box, located on the right or left cable guard (see the Installation section of this manual), controls the automatic and manual operation of your Sonic Tracker or Laser Tracker.



Auto/Manual Switch Box Controls

The following is an explanation of the function and operation of the switch and indicator lights located on the face of the Auto/Manual Switch Box.

1. **Raise Fault Indicator**
   The Raise Fault Indicator lets the operator know that the screed motor for that side of the machine is at its stops (the screed cannot be raised further). The Indicator will be "ON" when System Four is in Automatic operation only.
2. **Lower Fault Indicator**
   The Lower Fault Indicator lets the operator know that the screed motor for that side of the machine is at its stops (the screed cannot be lowered further). The Indicator will be "ON" when System Four is in Automatic operation only.
3. **Auto/Manual Switch**
   The Auto/Manual Switch allows the operator to set System Four to Automatically control the screed (Auto Setting), or control the screed using the LeeBoy controls (Manual Setting).

   When System Four is in "AUTO", the screed height (mat thickness) is controlled by turning the Grade Adjustment Knob on the Sonic Tracker. The pavers controls will be disabled.

   When System Four is in "MANUAL", the screed height (mat thickness) is controlled by the pavers screed controls, and System Four remains passive. The Grade Adjustment Knob on the Sonic Tracker will not be active.

Common Applications

Since the screed floats on the paving material and is not directly controlled, the machine must move forward in order to make an elevation correction. With automatic controls on a LeeBoy, the corrections are made by the tow point motors moving the front end of the screed arm forward or backward. This changes the angle of attack of the screed, which changes the depth of the mat as the machine moves.

The length that the machine has to travel in order to make the screed correction is affected by the location of the Tracker. Moving the Tracker back shortens the effective length of the screed arm. Moving the Tracker forward does the opposite.

NOTICE

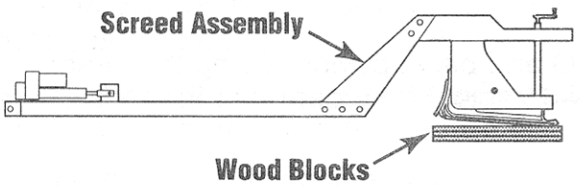
NOTICE

Never locate the Sonic Tracker ahead of the tow point or behind the screed.

Getting Started

This section will explain how to apply System Four using a variety of Control References. See the other side of this page for specific distances from the Tracker to your reference.

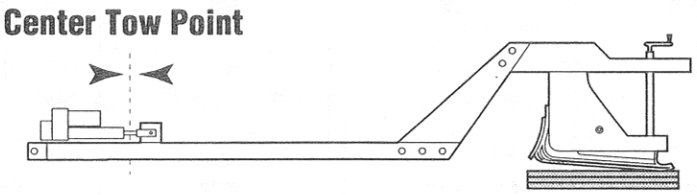
1. Set screed to proper mat thickness by resting it on wood blocks.



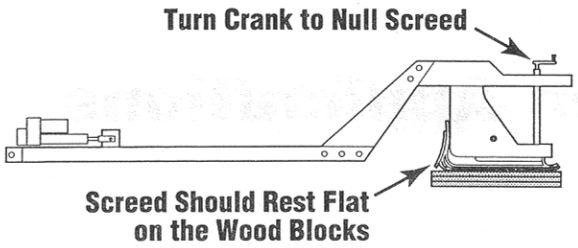
General Rule for Blocking Screed at Start of Paving Session

Approx. 1.25" of Wood Block for Every 1" of Compacted Mat

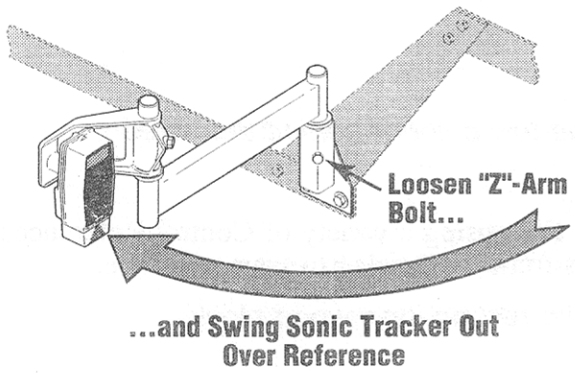
2. Make sure the Auto/Manual Switch is in MANUAL.
3. Using the pavers Screed Raise/Lower Switch, adjust the left or right tow point cylinder so that it's centered front to back.

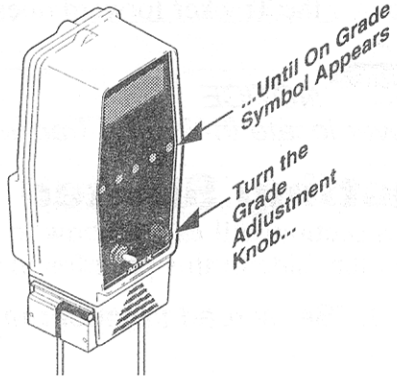


4. Using the mat thickness control screws, null the screed. When nulled properly, the screed should rest flatly on the surface it's resting on.



5. Loosen the "Z"-Arm bolt, and swing the "Z"- Arm out beyond the end gate.
6. Position the Tracker so that it is 14 inches (35.5 cm) to 30 inches (76.2 cm) above the Reference to be used.
7. Using the Grade Adjustment Knob on the Sonic Tracker, set the LED's to an On Grade Bar.

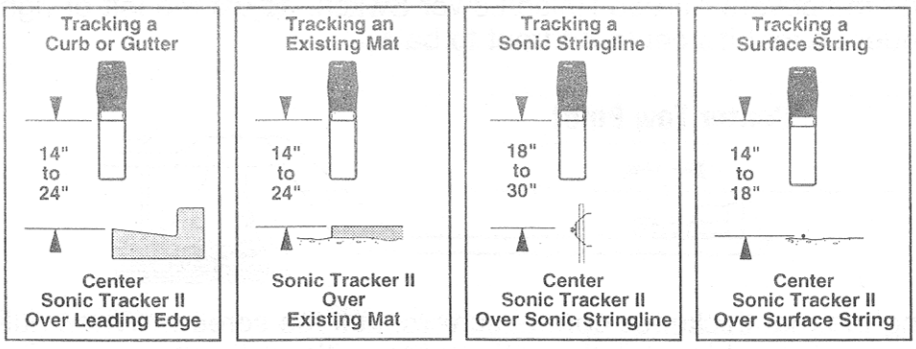




8. Set the Auto/Manual Switch to AUTO and begin paving. Using the Grade Adjustment Knob on the Sonic Tracker, adjust for proper mat thickness.

NOTICE *NOTICE*

Be sure to let the machine travel ahead at least one paver length between adjustments.



* All Distances Shown are Optimum for that Control Reference

Maintenance and Parts

This section contains information regarding preventative care and maintenance for your Paver Control System Four. Also included are replacement procedures for the Sonic Tracker Transducer and an illustrated parts guide.

Daily Maintenance

A good daily care and maintenance routine will prevent many problems before they occur. The most important part of daily care for your Paver Control System Four is to keep it clean and free of debris.

1. The components can be used in the rain or light spraying but are not submergible. Do not spray water or use high pressure steam cleaner hoses directly on cables and components.
2. Check the Sonic Transducer daily to make sure the screen is clean and free of debris. If necessary, carefully clean the Transducer with a mild detergent.

Transducer Cleaning

NOTICE

NOTICE

This is not meant to be a weekly 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 in an UPRIGHT position (this will prevent moisture from inadvertently entering the Sonic Tracker case).
2. Mix a mild detergent with water and place the mixture in a spray bottle (Simple Green® or Formula 409® where available).
3. With the Sonic Tracker 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. Use compressed air to blow-dry the Transducer. Allow to thoroughly dry for an hour or more.

Before using the Sonic Tracker, visually inspect the transducer for any residual moisture or debris and remove with compressed air if present.

If the ability of the Sonic Tracker to "see" a sonic stringline continues to be impaired, the µtransducer may be damaged. The transducer in the Sonic Tracker may be replaced as follows:

Transducer Replacement Procedure

NOTICE

NOTICE

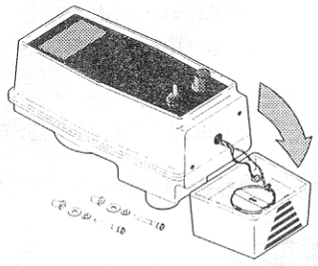
If the Sonic Tracker is experiencing erratic or inconsistent readings, Transducer contamination should be considered first before assuming any other type of failure.

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

Sonic Tracker Transducer Replacement

The only tools needed are a 5/32 Allen Wrench, a Philips Screwdriver, and a small pair of cutters plus a tube of clear silicone. Replace the transducer as follows:

1. At the bottom of the Sonic Tracker, use the 5/32 Allen Wrench to remove the two (2) mounting studs and pull the lower Sonic Tracker away from the upper Sonic Tracker exposing the wires and transducer.

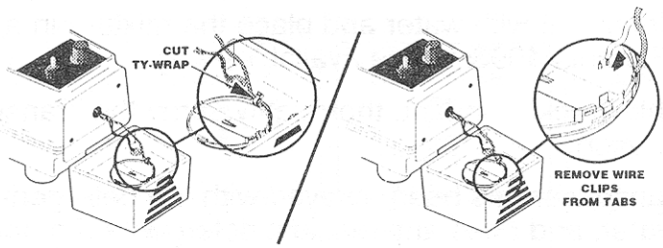


NOTICE

NOTICE

When separating the lower and upper sections of the Sonic Tracker, be careful not to damage the rubber seal where the two sections meet.

2. Use a small pair of cutters and carefully cut the ty-wrap that is securing the wires to the transducer. Now remove the wire clips from their tabs on the transducer (the clips are secured to the tabs with silicone that can be easily removed by gently scraping the clips and tabs with a sharp knife).

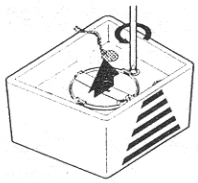


NOTICE

NOTICE

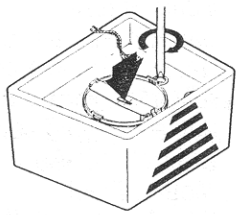
Before removing the old transducer, make a mental note of its position so that the new transducer is installed in the same position.

3. Use a Philips screwdriver to remove the two screws and washers securing the transducer and remove the transducer.



REMOVE TRANSDUCER MOUNTING SCREWS AND TRANSDUCER

4. Place the new transducer into position with the elevated wire tab facing the front of the Sonic Tracker, re-install the two washers and mounting screws and tighten (alternate between the two mounting screws when tightening to avoid distorting the face of the transducer).



INSTALL THE NEW TRANSDUCER AND REPLACE MOUNTING SCREWS

NOTICE

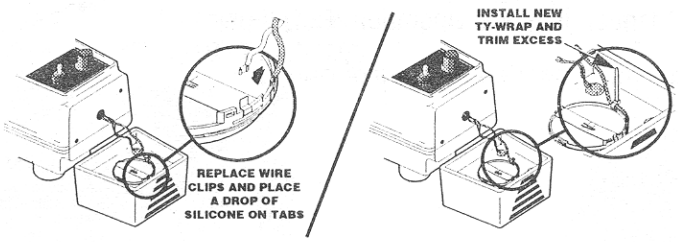
NOTICE

Make sure to alternate between the two mounting screws when securing the new transducer to avoid distorting the transducer.

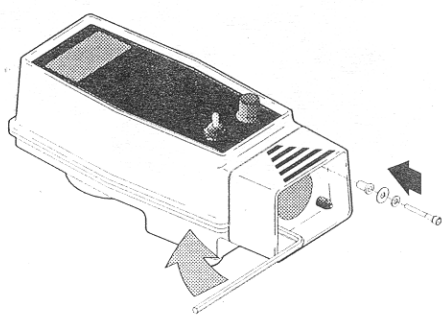
When the mounting screws are firmly tightened, take a look at the front (gold surface) of the transducer to verify there are no wrinkles on the gold transducer membrane.

If any wrinkles are present, simply loosen the mounting screws and re-tighten.

5. Place the wire clips back on there tabs (the clear wire attaches to the elevated transducer tab and the black wire attaches to the short transducer tab) and place a SMALL drop of silicone on the clips and tabs to secure them. Place the new ty-wrap around the wires and secure to the transducer. Trim off the excess ty-wrap.



6. Make sure the area inside the transducer cavity is free of dirt and debris, and place the lower Sonic Tracker flush against the upper Sonic Tracker with the mounting holes lined up.



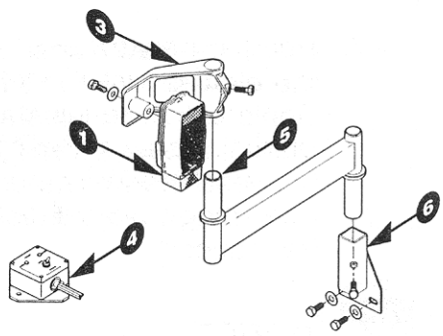
7. Place the mounting studs with their lockwashers, washers, and plastic sleeves in the mounting holes and tighten firmly. The Sonic Tracker is now ready to return to operation.

Illustrated Parts Guide

Using the listing below, match the item number of the part located on the illustration with to the item numbers listed on the chart below.

Sonic Tracker System (P/N: 4942)

Item	Part #	Part Description	Qty
1	9140-0000	Sonic Tracker	1
2	9140-1043	Bail Kit, Sonic Tracker (Not Shown)	1
3	9060-1168	Bracket, Sonic Tracker	1
4	9411-1001	A/M Module & Cable Assy w/Baseplate	1
5	9090-1125	Bracket, "Z"-Arm	1
6	9090-1128	Mount, Pivot	1
7	9060-1271	Kit, Mounting Bolt	1
8	7010-0136	Manual, Install & Operation (Not Shown)	1

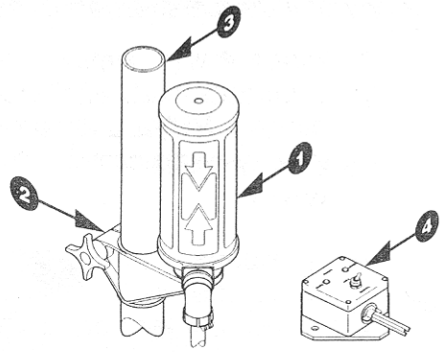


Quantities reflect all parts needed to control one side of the screed.

Installation Not Included.

Laser Tracker System (P/N: 4943)

Item	Part #	Part Description	Qty
1	9130-0000	Laser Tracker	1
2	9130-1018	Bracket, Laser Tracker	1
3	9090-1129	Assy, Laser Pole	1
4	9411-1001	A/M Module & Cable Assy w/Baseplate	1
5	7010-0136	Manual, Install & Operation (Not Shown)	1



Quantities reflect all parts needed to control one side of the screed.

Installation Not Included.

Mounting

Auto/Manual Box Mounting

The Auto/Manual Box mounts to the 45° cable protector on either side of the machine.

NOTICE

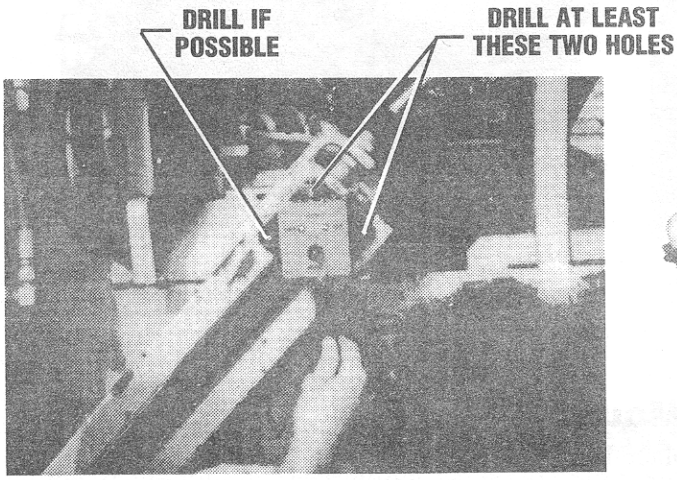
NOTICE

Before alignment and drilling, you should decide if the System Four you purchased is a single side (Sonic Tracker only system). If so, which side of the paver would you most likely use it on (or will you need to switch it from side to side as dictated by jobs).

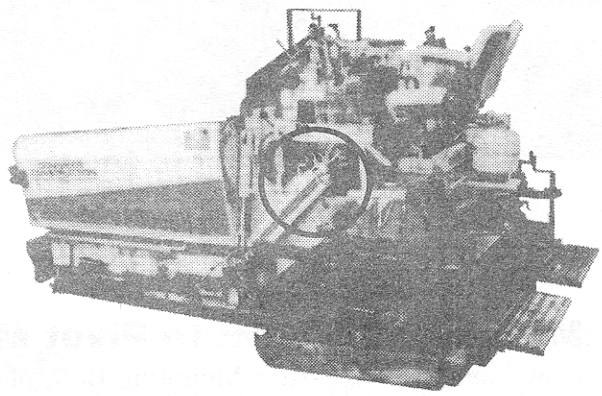
If you have purchased a Slope and Sonic Tracker System, then it would be to your advantage to prepare both sides of the paver so that System Four components can be switched from one side to the other to allow control of either side of the paver.

Line the Auto/Manual Box Mounting Plate up on the 45° cable protector and use a scribe to mark were the mounting holes are. Make sure the Auto/Manual Box is position straight.

Use a 5/16" drill bit and drill at least 2 holes of the three available (you may or may not wish to use third hole because of its inaccesability).



Hold Auto/Manual Box in place, use scribe to mark, and drill 5/16" holes.



Sonic Tracker Bracket Mounting

The Sonic Tracker Bracket consists of three pieces: a **Pivot Mount** that is secured to the tow arm with two (2) existing bolts, a **"Z"-Arm** (Swing Arm), and a **Sonic Tracker Mounting Bracket**.

Mounting Pivot Mount to Tow Arm

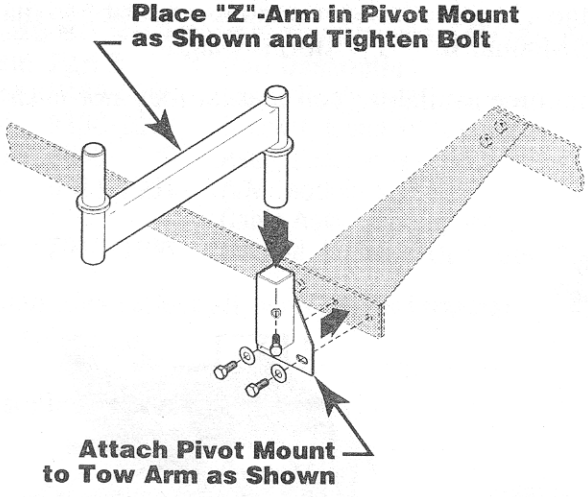
The Pivot Mount is attached using two (2) existing bolts on the the tow arm where the rear verticle tow arm plate is bolted to the lower horizontal tow arm plate.

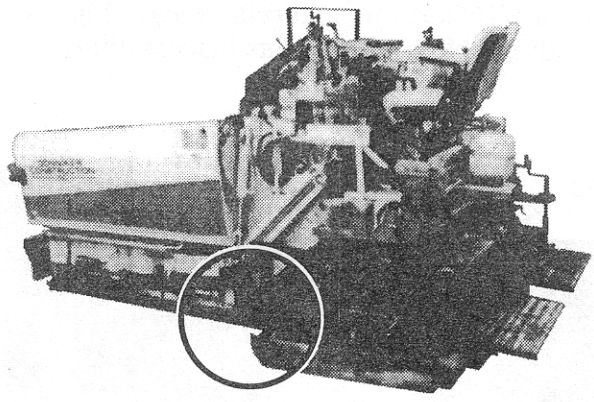
Simply remove the two (2) rear most bolts from the tow arm plates, place the Pivot Mount with its holes aligned with the bolt holes on the tow arm plates and replace the bolts.

NOTICE

NOTICE

Make sure that bolts are securely tightened after mounting the Pivot Mount. Machine vibration during operation may cause the bolts to fall out resulting in an undesirable mat, damage to the machine, or damage to your System Four.





Mounting "Z"-Arm to Pivot Mount

Now loosen the "Z"-Arm Mounting Bolt, place the "Z"-Arm shaft in the Pivote Mount as shown, and re-tighten the Bolt.

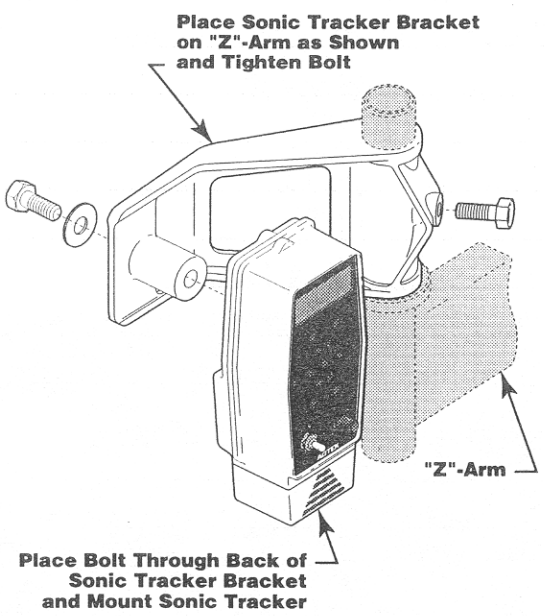
Sonic Tracker Mounting

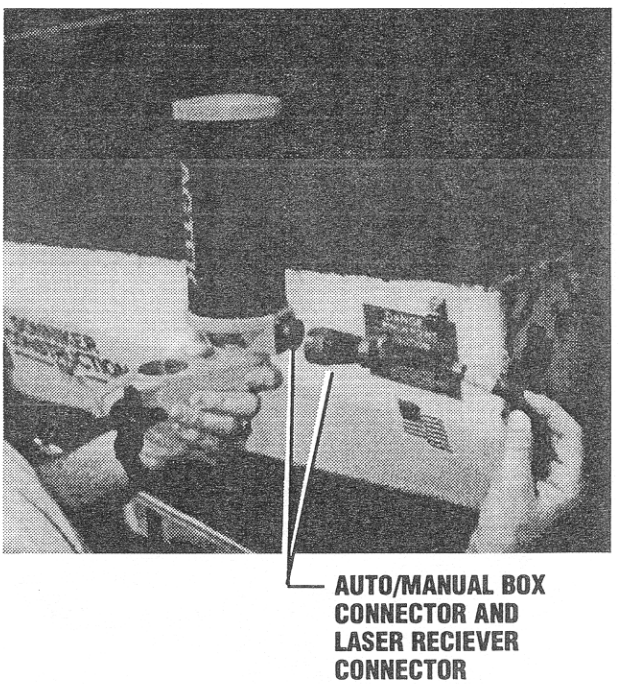
The Sonic Tracker Bracket is secured on the "Z"-Arm shaft by tightening the Sonic Tracker Bracket bolt. The Sonic Tracker is then bolted to the Sonic Tracker Bracket. By Loosening the "Z"-Arm bolt, the operator can now "swing" the Sonic Tracker into the most advantageous position for that particular application.

Mounting the Sonic Tracker

Place the Sonic Tracker Bracket on the "Z"-Arm shaft and Tighten the bolt securely. Then line up the Sonic Tracker mounting access (on the back of the Sonic Tracker) with the mounting hole provided on the Sonic Tracker Bracket. Place the mounting bolt (supplied) through the back of the bracket, and tighten firmly to hold the Sonic Tracker securely during operation.

Once the Sonic Tracker is mounted, attach the connector from the Auto/Manual Box over the connector socket on the back of the Sonic Tracker (it will only fit correctly one way) and twist until locked. The Sonic Tracker is now ready for operation.





Laser Receiver Connection

Follow the mounting instructions supplied with your Laser Receiver mast. After securely mounted, place the Laser Receiver on the mast and connect to System Four as follows.

The Laser Receiver is connected to System Four via the connector that is used on the Sonic Tracker. Simply place the connector from the Auto/Manual Box over the connector on the Laser Receiver (it will only fit correctly one way), and twist until firmly locked into place.

Electrical Installation

Electrical Connections

Before starting any electrical work on the paver, make sure the ignition is in the "OFF" position. If need be, remove the terminals from the batteries to ensure no current is being supplied to the machine.

Screed Positioning Motor Wiring

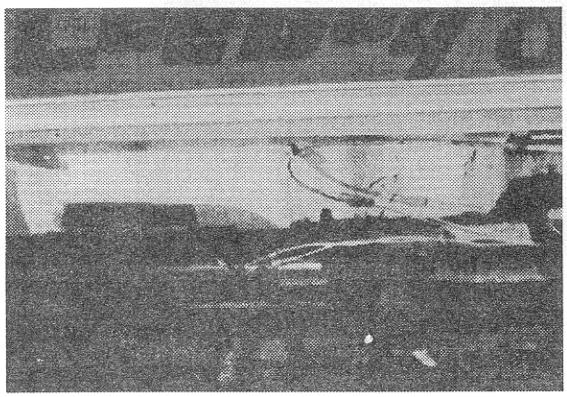
Begin by pulling apart the wire connectors just ahead of the Screed Positioning Motors.

Locate the cable coming from the Auto/Manual Box with the four wires and connectors (two long wires: Red and Orange, and two short wires: Blue and Black). Feed the cable with the wires down through the existing 45° cable protector, then through the lower cable protector (locations shown on photo).

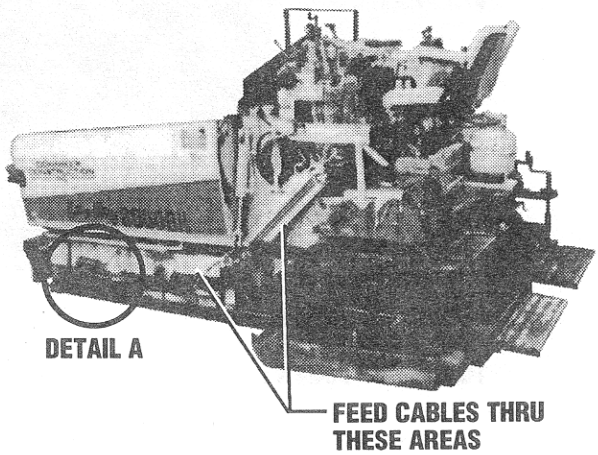
Plug the wires together as shown in the following table:

Paver Wire		Auto/Manual Box Wire
Red	to	Red
Yellow	to	Orange
Black	to	Black
White	to	Light Blue

DETAIL A



Unplug wires and plug System Four wires in as listed in the table above.



If you plan to: 1. Use System Four to control the other side of the machine, or :2. Have purchased a System Four for both sides of the machine (dual Sonic Tracker or Sonic and Slope), then repeat this procedure on the right side of the paver.

Connecting System Four to Power

The power required by System Four is supplied from the fuse panel directly behind the operators gauge panel.

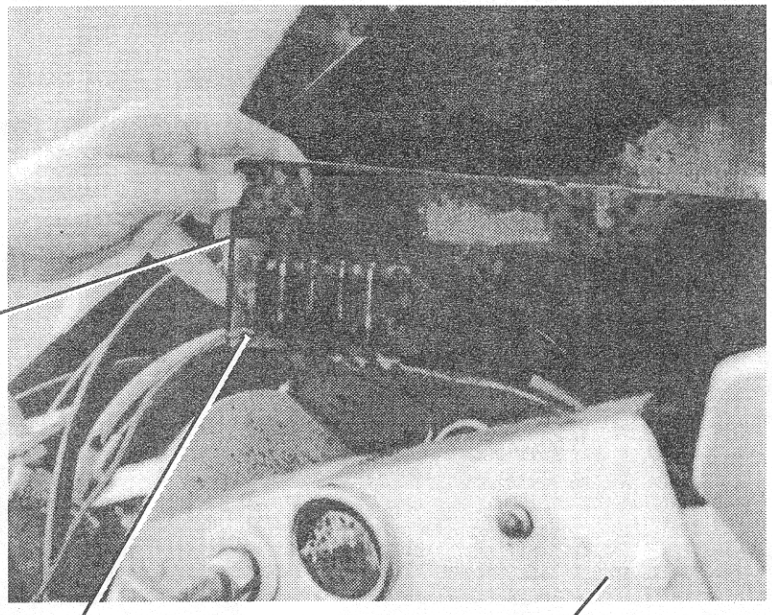
Power Hook-Up

Begin by locating the cable coming from the Auto/Manual Box containing a Red Wire and Black Wire. The Red Wire is the wire supplying power to System Four.

Remove the screws securing the cover behind the operators gauge panel. Once removed, turn the panel over. Five fuses and there holders are mounted directly to the underside of the panel. Use the fuse farthest to the left (fuse #1).

Remove the small screw at the base of fuse #1. Route the power and ground cable for System Four along,, and secure it to, the hydraulic lines running to the operator's hand controls. Place the eyelet of the red power wire over the hole and replace the screw into the fuse #1 fuse holder. Make sure the screw is firmly tightened.

Replace the panel and tighten screws firmly. Power hook-up is now complete.



Connecting System Four to Ground

Grounding System Four can be accomplished by locating a suitable metal (paint free) surface. The location shown here is simply a suggestion and demonstration of a suitable grounding area.

Grounding System Four

Use the Black Wire from the power and ground cable. Find a suitable bolt located in an area away from possible contact with other electrical components from the paver.

Remove the bolt. In this case, we show a bolt located on the forward hydraulic cooler mounting bracket. Once the bolt is removed, use sand paper or scrape the area with a sharp object to expose a fresh metal surface suitable for grounding.

Place the eyelet on the bolt, then replace the bolt and tighten firmly.