# MAULDIN®

## PAVING PRODUCTS

# SCREED AUTOMATION OPERATIONS MANUAL

# GRAD-LINE SYSTEM

# Rev 1.0

Paver Serial Number _____

Paver Specification Number _____

Engine Serial Number _____

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# SYMPHONY™ SCREED AUTOMATION SYSTEM – *OPTIONAL EQUIPMENT*



Screed Automation is available for your symphony screed. This automation system uses the latest technologies which can combine elevation control and slope control in one package. This automated system can correct for slight elevation changes better than the human eye can by using high frequency sound pulses much like a SONAR system to calculate elevation changes and then automatically adjust the screed so you get a perfect mat. The system requires no major tools for installation such as welding equipment. All you need is a 5/16$^{th}$ Allen wrench and the materials provided to you in the package.

This system can be run in different capacities:

1. First would be Single Grading, where one side of the screed is controlled by one grade sensor.
2. Dual Grading would include two grade sensors controlling grade for both sides of the screed.
3. The Single Grade with Slope system includes one grade sensor controlling one side of the screed and a slope sensor controlling the other side for slope control.
4. The Dual Grade control with Slope monitoring system would include two grading sensors controlling both sides of the screed while the slope sensor monitors slope.

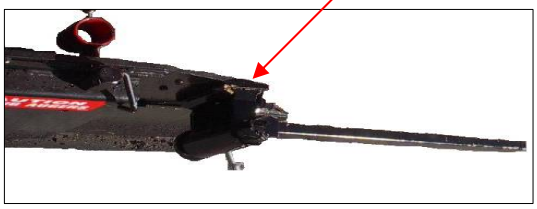
Because there are only two, tow point cylinders controlling the screed, only two sensors can be actively positioning the screed, the third would be in monitor only mode. By following the instructions below you can quickly begin using the automated screed system.

The base system comprises of one grade sensor, one connecting cable, one hand set, all the required brackets for installation, and a protective carrying case. A single grade system eliminates the need for manual adjustment of the thickness handle on whichever side it is installed.

**System set up as follows:**

1. Place the handset into the cradle at the operator's station. Route cable over the resting bolt.
2. Plug into the paver receptacle labeled HAND HELD on the side of the operator station.


3. Mount brackets to the *outside* of the screed end gate by screwing in the bracket with a 5/16th Allen wrench.

4. Next slide the arm into the bracket, this arm is capable of swinging 180° so the mounting system may be used on either side of the paver. Tighten two wing bolts to secure and then rotate the arm to face forward. Tighten the wing bolt to keep the arm from swinging.


5. Connect the vertical post to the horizontal arm by sliding rectangular opening down the rectangular tube with the wing bolt facing out. Tighten the wing bolt to secure it.

6. Then attach the Grade Sensor to the mounting bracket by sliding it down the upper part of the arm and tighten the wing bolt. Make sure the sensor has the wire “bail” attached.

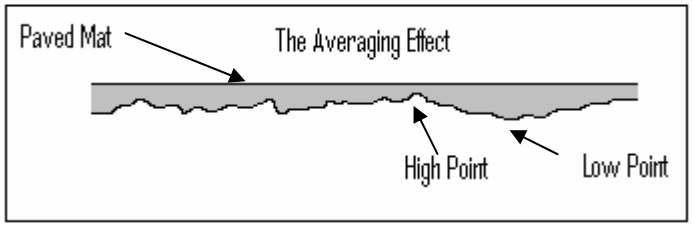
**WARNING:** DO NOT PLUG IN THE SENSOR WHILE THE KEY IS IN THE ‘ON’ POSITION. Plugging in the sensor while the paver key switch is in the ‘on’ position may cause blown the tow point cylinder 10 amp fuse located in the main panel of the paver. ALWAYS connect cables with the key switch in the ‘off’ position.

7. Plug one end of cable into Grade Sensor, the other end into the paver receptacle labeled Grade Sensor. Make sure the sensors are within the working range of 17” to 19” (450-500mm) from the reference target or 8” to 10” from the bottom of the reference bail to the target.


At this point the system should be powered up and ready to go. If you have made any mistakes the handset will display the word “**S.O.S.**

**Mounting Tips:** There are two basic ways to mount the sensor. The first would be mounting the sensor for "Rideability" which basically makes the pavement as smooth as possible. The other way to mount the sensor is for "Joint Matching" also known as "Paving for Profile". In joint matching, elevation changes are quickly made allowing two surfaces to match up perfectly but there is sometimes a resulting degradation to overall mat smoothness. It is therefore necessary to decide if it is more important to have a very smooth surface or a perfectly matched joint.


Rideability: Paving for rideability requires that the sensor be mounted forward on the bracket arm. To do this slide the vertical arm toward the front of the bracket arm (away from the screed). The sensor corrects for any changes slowly resulting in an averaging effect of elevation changes over a greater area allowing for a smoother surface and thus a better ride.
**NOTE:** In this position the deadband setting will need to be set at 0.080 or 0.120 (2mm or 3mm) to prevent the system from "hunting" or jumping up and down.



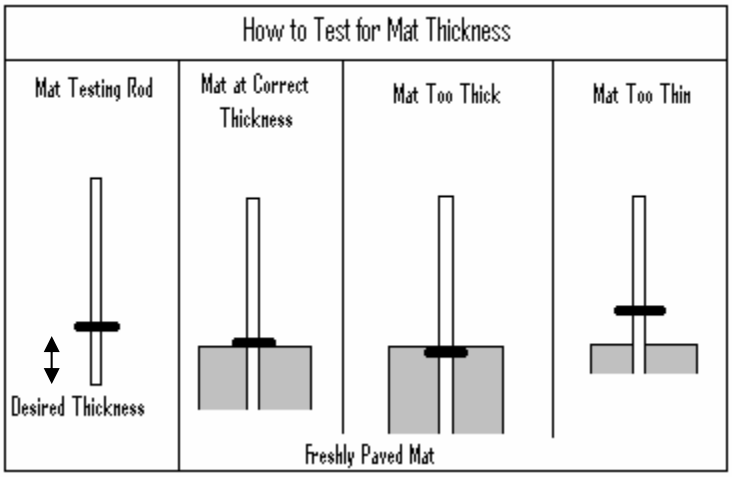


Joint Matching: In order to perfectly match the changes in elevation of an existing curb or mat the screed must quickly change in response to elevation changes. Mounting the sensor close to the screed will cause the system to react quickly to any changes in elevation. In this position the system will achieve accuracy by doing less averaging. To do this, slide the vertical arm back very close to the screed so it is possible to very accurately match the edges.
**NOTE:** The deadband setting should be run at 0.04 or 0.08 (1mm or 2mm) for best results.

**How to operate:**

1. Pulling off an asphalt pad or wood boards. Screed must be at desired thickness level.
    i. Lower screed to paving position on pad or boards.
    ii. Adjust the Tow Point cylinders to their mid points. The tow point cylinders are controlled by toggle switches at the operator's station, extend or retract cylinders until 5 inches of cylinder rod is exposed, do this on both sides of paver.
    iii. Adjust mounting brackets so that the sensor is properly positioned. Grade Sensor mounted 24" back from the tow point will produce the best smoothness results; use this setting whenever you are not matching a joint. As you position the sensor closer to the screed, reaction time will increase; just in front of the augers is a better position for joint matching.
    iv. Ensure that the path the sensor will travel over is free of large debris; ideally it should be following some form of finished grade, curb, or adjacent asphalt mat.
    v. Null the thickness screw. *(See screed settings if unsure of this procedure).*
    vi. Rotate thickness screw one full rotation, (in the thicker direction).

vii. Lock thickness screw into position with travel locks.
viii. Press [CAL] key on the Handset.
ix. Press [AUTO] key on the Handset.
x. Check the thickness of the asphalt mat with a probe. Adjust the up ⬆ or the down ⬇ on the handset as required until screed is paving required depth.




**How to cancel & resume:**

2. Cancel Automatic operation – Be sure to do this before you lift the screed at the end of a pass.
   i. Press [MAN] at any time to stop the automation.

3. Resume Automatic Operation – with out changing any settings, ***[typical for truck change]***
   i. Press [AUTO] key on handset

4. Resume Automatic Operation – with a change in settings, ***[typical for a new pass]***
   i. Lower screed to paving position on pad or boards.
   ii. Null the thickness screw. *(See screed settings if unsure of this procedure).*
   iii. Rotate thickness screw one full rotation, (in the thicker direction).
   iv. Lock thickness screw into position with travel locks.
   v. Press [CAL] key on the Handset.
   vi. Press [AUTO] key on the Handset.
   vii. Check thickness of asphalt mat with probe. Adjust the up ⬆ or the down ⬇ as required until screed is paving required depth.

**NOTE:** Many factors can effect changes in mat thickness. For best results:

- **ALWAYS** use the full Automatic material feed system.
- **ALWAYS** keep the paver moving at the same speed, (use Pave/Resume to maintain perfect speed).
- **NEVER** let the screed run out of asphalt.

- **ALWAYS** keep the path of the sensor clear. Any asphalt spills that the sensor travels over will cause an erroneous reaction. Crew working with shovels around the sensor can also cause erroneous reactions.

**Daily Operation Procedures:**

1) Connect the cables to all sensors and check the power
2) Check to make sure that the sensors are within the working range.
3) Select Sensor. (See sensor switch)
4) Set level (Zero): Press the [CAL] key, ‘ CAL ‘ will then flash in the upper display.
5) The system is now ready, press the [AUTO] key to start.

6) During work it is possible to change the height/slope with the [↑], [↓] keys.

**Key Functions for the Mini-Line ® Handset HS 300** (Manual Mode)


1. **Minimum Pulse:** ( [MODE] + [MAN] )The minimum pulse setting is used to control the duration of an electronic signal sent to the valve from the control box. If the pulse setting is too low, a clicking sound can be heard but the cylinder will not move in both directions. If the setting is too high, the valve will open too long causing the cylinder to overcorrect.

*To set the minimum pulse*: press the [MAN] and the [MODE] keys at the same time. You will then see a number in the top display of the handset and ' P.U.L. ' in the lower display. Press the arrow keys up [↑] or down [↓] to change the value in the top display. Set the value at the lowest number that still gives motion in *both* directions. When the desired setting is reached, press the [MODE] key to store the changes. This change may only be done in manual mode.

**NOTE:** This setting must be done with hydraulic oil up to operational temperatures and the engine running between 1700 and 2200 RPM.

***Factory Suggested Value** of either 3 or 4.


2. **Working Window:** ( [MODE] + [CAL] ) The working window is used to assure that the paver does not change too drastically if a sudden change in elevation is discovered. This could occur when using a Stringline and the paver comes to a Stringline clip on a stake (used to keep the string taught and at the correct height).The clip extends above the string and this could cause the sensor to read an elevation change and cause the system to raise the screed undesirably.

In order to correct for sudden elevation changes the Working Window is set to a certain value. A change in elevation greater than the set value, such as an elevation raise of more than one inch, would cause the sensor to go into standby mode and not register the change until the value comes back inside of the Working Window. This setting should be set so that it is wide enough to allow for normal elevation changes yet not too wide to cause undesirable changes in screed height.

*To set the working window*: press the [Mode] and the [CAL] keys at the same time. You should then see a number in the top display and ' [ ] ' in the bottom display. Set the number using the arrow keys so that it is not too small or too large for your needs. Use the [MODE] key to store the changes. This value may only be changed in manual mode.

***Factory Suggested Value** of 1".


3. **Deadband:** ( [MAN] + [CAL] ) The sensor deadband is the portion of the working window which is On Grade. This means that while the reference is within that set value, the paver valves will remain idle. The wider the deadband, the more the reference may move up or down without any corrections being made by the sensor. *However, the deadband value should be selected so that it is **not** so small that the screed is constantly moving up and down*. This setting is especially important when the screed vibrator is used.

*To set the deadband:* press the [MAN] and the [CAL] keys at the same time. You should then see a number in the top display and ' .d.b. ' in the lower display. Use the arrow keys to raise or lower this value. When the desired value is reached, press the [MODE] key to store the changes. This setting may only be changed in manual mode.

**NOTE:** This value should be set with the screed on asphalt and ***not*** on a hard surface such as concrete.

***Factory Suggested Value** of between 0.04 and 0.12 (1mm or 3mm). This is a highly dependant value on what you are intending to do. For joint matching with the sensor close to the base of the arm 0.04 (1mm) will work well. When paving for smoothness with the sensor toward the end of the arm, the value will need to be increased to 0.12 (3mm) to minimize the effect of vibration.


4. **Sensitivity:** ( [MODE] ) Sensitivity refers to how quickly the automation system causes the tow point cylinders to adjust to a change in elevation. The sensitivity setting allows the paver operator to set the system to allow the valve to open a pre-determined amount letting the screed react to elevation changes faster or slower depending on how open the valve is allowed to be. The sensitivity should be set low enough so that the screed reacts quickly to elevation changes but not so low as the screed reacts too quickly and overshoots the new elevation.

*To set the sensitivity*: press the [MODE] key. You should then see a number in the top display and ' S.E.n. ' in the lower display. Use the arrow keys to change the value in the top display and press the [MODE] key to store the changes. This setting may be changed in either manual or automatic modes.

***Factory Suggested Value:** This value should be set by measuring the amount of time it takes the tow point cylinder to go from the absolute top to bottom extensions. If the total travel time takes 6 seconds or less, use a setting of 0-2. If the total travel time takes 10 seconds or more use a setting of 5-6.

5 **Changing from Metric to English Measurements:** To change from metric (mm) to English (inches) measurements follow these steps:

1) Press and hold the [CAL] key while the power is turned on.
2) After approx. 3 seconds the lower display will show "RES"
3) Release [CAL] key and press the UP [↑] arrow IMMEDIATELY (After a few seconds you can no longer make the changes and must start all over again).
4) "101" will now show in the top display
5) Use the UP [↑] ARROW quickly to change the value to "111"
6) Press [CAL] to store

6. **Automatic Mode:** To enter automatic mode after all settings have been input, press the [AUTO] key.

**Special functions for mechanical and ultrasound sensors:**

[AUTO]+[MAN]>>3 sec: Switches between showing the actual height and zero for the sensor in the top display. This works only with upper display.

**Special key functions for slope:**

Zeroing: ( [AUTO]+[MAN]>>3 sec ): The slope sensor is much like a precise carpenters level using lasers and computing power to calculate the exact slope that the sensor is on. In order for the slope sensor to accurately measure slope, it must be first zeroed to a flat surface.

*To set the default value to zero* for the slope sensor, set the screed on the desired thickness and slope using the asphalt pad or wooden blocks. When at the correct thickness and slope press the [AUTO] and [MAN] keys at the same time and hold them for 3 seconds. Zero should then appear in the upper display. This then stores this zero value for reference during the paving. This works only for the upper display.

[MODE] >> 3 sec.: Pressing this key and holding it for three seconds tells the system that it is controlling the left side of the screeds slope and it will then only affect the left tow point cylinder. When accessed ' [= ' is shown in the display.

[CAL] >> 3 sec.: Pressing this key and holding it for three seconds tells the system that it is controlling the right side of the screeds slope and it will then only affect the right tow point cylinder. When accessed ' =] ' is shown in the display.

**Key Settings For Automatic Mode:**

[MODE] : Sets the sensitivity as in the Sensitivity section above.

[CAL] : Changes the displayed value in the upper display. Use the [↑] and [↓] keys on the handset to change the values.

**Error Codes:**

Er1: Sensor is out of range. Set sensor to correct height (between 450-500mm from reference) and press the [CAL] key.

Er2: Ultrasound error: there is no reference target. Make sure the wire "bail" is attached. If there is still a problem make sure the sensor is free from debris as that will adversely affect sensor performance. During hot or windy days, error 2 may appear from time to time, this is normal if the error leaves the screen after a few seconds.

Er4: The sensor is defective, disconnect the power by taking the connector out and then redo the daily operations on the device. If the problem persists, send the sensor for the device in to be serviced.

S.O.S. : The sensor is not communicating, check cables to make sure they are fully and correctly connected and check the power supply to make sure that they are adequately powered.

[][][]: Sensor is out of its working window range. Increase Working Window using the working window calibration described above.

**NOTE:** To restore the handset to factory settings: Disconnect the power by taking the connector out. Hold the [CAL] key and reconnect the power. After 3 seconds the handset is reset to factory settings.

**SLOPE ONLY - System set up as follows:**


1. Install Slope mounting beam with brackets provided to the two operator control stand bases.

2. Place the handset into the cradle at the operator's station. Route cable over the resting bolt. Plug into the into the paver receptacle labeled hand held on side of operator's consoles.

3. Mount slope sensor to mounting beam with the two bolts provided.

4. Plug the connecting cable into the paver receptacle labeled slope sensor on the side of operator's consoles. Plug other end into the slope sensor. Use RH plug to match RH operator's station, vice versa for LH control.

At this point the system should be powered up and ready to go. If you have made any mistakes the handset will display the word "**S.O.S.**".

**How to operate – SLOPE ONLY OPERATION:**

1. Pulling off an asphalt pad or wood boards. Screed must be at desired thickness **& slope** levels.
   i. Adjust the Tow Point cylinders to their mid points. The tow point cylinders are controlled by toggle switches at the operator's station, extend or retract cylinders until 5 inches of cylinder rod is exposed, do this on both sides of paver.
   ii. Ensure that the slope sensor is positioned level on the slope beam.
   iii. Lower screed onto a level surface with **ZERO %** slope.
   iv. At the same time press and hold for 3 seconds [MAN] & [AUTO]. This will reset the slope sensor to the default/zero position.
   v. Lower screed to paving position on pad or boards. This screed should be resting in a position that has the screed at both the desired thickness as well as the desired slope.
   vi. Null the thickness screw. *(See screed settings if unsure of this procedure).*
   vii. Rotate thickness screw two full rotations, (in the thicker direction).
   viii. Lock thickness screw into position with travel locks.
   ix. Press [CAL] key on the Handset. At this point the slope sensor will be reading out the actual slope percentage the screed is resting at. If at the desired slope % you may continue. Otherwise, return to step "v." and correct your asphalt pad.
   x. Press [AUTO] key on the Handset. The word AUTO will become illuminated.
   xi. Check the slope of asphalt mat with a measuring device. Adjust the up ⬆ or the down ⬇ on the handset as required until screed is paving required slope.

**How to cancel & resume:**

2. Cancel Automatic operation – Be sure to do this before you lift the screed at the end of a pass.
   viii. Press [MAN] at any time to stop the automation.
3. Resume Automatic Operation – with out changing any settings, ***[typical for truck change]***
   ix. Press the [AUTO] key on handset

4. Resume Automatic Operation – with a change in settings, ***[typical for a new pass]***
    x. Lower screed to paving position on pad or boards.
    xi. Null the thickness screw. *(See screed settings if unsure of this procedure).*
    xii. Rotate thickness screw one full rotation, (in the thicker direction).
    xiii. Lock thickness screw into position with travel locks.
    xiv. Press [CAL] key on the Handset.
    xv. Press [AUTO] key on the Handset.
    xvi. Check the slope of asphalt mat with a measuring device. Adjust the up ⬆ or the down ⬇ on the handset as required until screed is paving required slope.

**How to operate – GRADE & SLOPE OPERATION:**

When running grade & slope, you must first decide which side of the screed is to control grade, (or thickness), and which side of screed is to maintain a certain slope, given the grade maintained on the opposite side. The following procedure assumes that grade is maintained on the RH side of the screed and slope is maintained on the LH side of the screed.

1. Pulling off an asphalt pad or wood boards. Screed must be resting at desired mat thickness on the RH side, from there the mat should taper, (up or down), to the desired slope percentage on the LH side.
    i. Adjust the Tow Point cylinders to their mid points. The tow point cylinders are controlled by toggle switches at the operator's station, extend or retract cylinders until 5 inches of cylinder rod is exposed, do this on both sides of paver.
    ii. Ensure that the slope sensor is positioned level on the slope beam, and equally spaced into the centerline of paving.
    iii. Lower screed onto a level surface with **ZERO %** slope.
    iv. At the LH station use the hand held remote and at the same time press and hold for 3 seconds [MAN] & [AUTO]. This will reset the slope sensor to the default/zero position.
    v. With the grade sensor installed on the RH side, adjust mounting brackets so that the sensor is properly positioned. Grade Sensor mounted 24" back from the tow point will produce the best smoothness results; use this setting whenever you are not matching a joint. As you position the sensor closer to the screed, reaction time will increase; just in front of the augers is a better position for joint matching.
    vi. Ensure that the path the sensor will travel over is free of large debris; ideally it should be following some form of finished grade, curb, or adjacent asphalt mat.
    vii. Lower screed to paving position on pad or boards. This screed should be resting in a position that has the screed at both the desired thickness as well as the desired slope.
    viii. Null the thickness screw. *(See screed settings if unsure of this procedure).*
    ix. Rotate thickness screw one full rotation, (in the thicker direction).
    x. Lock thickness screw into position with travel locks.
    xi. At the RH station use the hand held remote and press [CAL] key on the Handset.
    xii. At the RH station use the hand held remote and press [AUTO] key on the Handset. The word AUTO will become illuminated. The RH station is now in Auto mode to maintain grade.
    xiii. At the LH station use the hand held remote and press [CAL] key on the Handset. At this point the slope sensor will be reading out the actual slope percentage the screed is resting at. If at the desired slope % you may continue. Otherwise, return to step "vii." and correct your asphalt pad.
    xiv. Press [AUTO] key on the Handset. The word AUTO will become illuminated. The LH station is now in Auto mode to maintain slope.
    xv. Check thickness of asphalt mat with probe. Adjust the up ⬆ or the down ⬇ as required until screed is paving required depth.
    xvi. Check the slope of asphalt mat with a measuring device. Adjust the up ⬆ or the down ⬇ on the handset as required until screed is paving required slope.

**How to cancel & resume:**

2. Cancel Automatic operation – Be sure to do this before you lift the screed at the end of a pass.
   xvii. Press [MAN] at any time to stop the automation.

3. Resume Automatic Operation – with out changing any settings, ***[typical for truck change]***
   xviii. Press the [AUTO] key on handset

4. Resume Automatic Operation – with a change in settings, ***[typical for a new pass]***
   xix. Lower the screed to paving position on pad or boards.
   xx. Null the thickness screw. *(See screed settings if unsure of this procedure).*
   xxi. Rotate thickness screw one full rotation, (in the thicker direction).
   xxii. Lock thickness screw into position with travel locks.
   xxiii. Press [CAL] key on the Handset.
   xxiv. Press [AUTO] key on the Handset.
   xxv. Check the slope of asphalt mat with a measuring device. Adjust the up ⬆ or the down ⬇ on the handset as required until screed is paving required grade or slope, depending on which remote you are using.

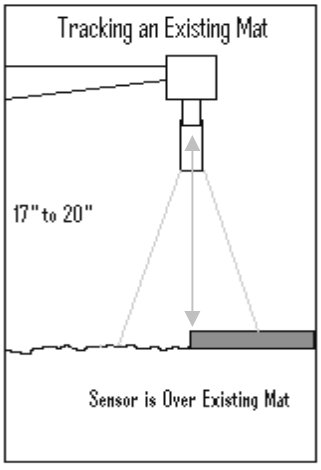
**GRADE, GRADE & SLOPE OPERATION – Same as above for the other side of screed.**

**Maintaining the Symphony™ Screed Automation System**

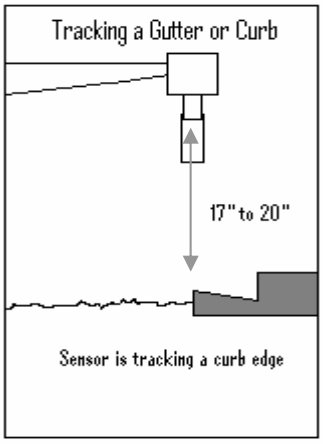
1. After each working day, unplug the sensors and then wipe down the sensor and wire bail making sure to get rid of any asphalt that may have accumulated. This asphalt could potentially build up and cause the sensor to not work properly.
2. Dry the sensor, cord and wire bail before placing in the protective carry case to assure that no moisture gets into the dry carrying case. Any moisture in the carrying case could cause condensation to occur inside the components which may adversely affect future sensor performance.
3. Remove the handset, wipe it down and place it in the protective case with the sensor. Take the case with you at the end of the day and store in a safe dry location. Do not allow the case to become wet. If the case does become wet, remove all of the components and allow the case to air dry. This assures that the system is free from damage, weather, vandalism and theft if you keep the carrying case locked away safely.
4. Do not use harsh cleansers or wash the components in excess water as they are not waterproof.
5. To clean off asphalt from the sensor use diesel fuel or kerosene, do not however soak the sensor in the diesel fuel as that may damage the sensor.

**Using Different References:**

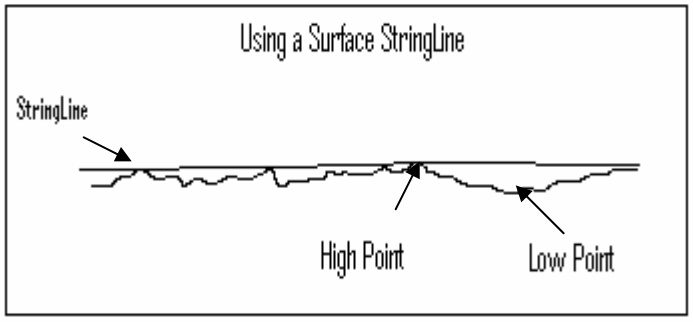
The following section illustrates a few typical reference examples and how to use them.




1. **Using an Existing mat as a reference.** This reference is often used when attempting a second pass. Simply position the sensor so that it is 17” to 20” above the existing mat and then proceed paving.




2. **Using a Curb or a Gutter as a reference.** This reference is often used on the first pass making sure that the new mat matches the curb perfectly. Position the sensor 17” to 20” above the desired curb or gutter and begin paving to use this reference type.




3. **Using a Surface Stringline.** Surface string lines are perfect when you are paving for rideability. By stretching over the high points of a surfaced to be paved and bridging the gaps of the low points, a surface stringline helps produce a very smooth surface using the averaging effect. To use a stringline, stretch the line over the length of the surface to be paved making sure it is straight and that it is taught. Next, line the sensor up so it is 14” to 18” directly above the stringline. Once that has been completed you are ready to begin paving.