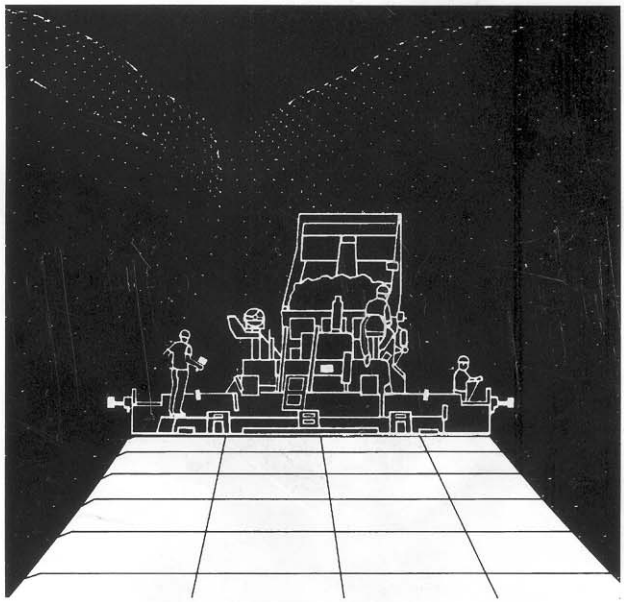
Screed-Pro®
Modular Control System
Operating Manual



Trimble

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System Components

ST2-25 CSM-30 LM-25 R-25

The Tracer-Plus Ultra Sonic Grade Controller mounts to the tow arm or screed end gate of the paver. It uses sound to measure the distance to a reference surface, such as a curb gutter, stringline, or previous pass. Once locked onto the reference surface, any change in the distance causes a correction signal to be sent to the machine's hydraulic control valve. This maintains the proposed elevation of asphalt. The Tracer Plus can be used alone as a wand type sensor replacement, or with the Universal Remote for even more convenience and features.

The Universal Remote provides an optional remote access to the Tracer Plus functions and must be used with the Slope Module or the Laser interface Module for controlling slope.

The Slope Module is mounted to the machine's transverse beam to read and automatically maintain the desired slope across the screed. Slope adjustments are made and displayed at the Universal Remote.

The Laser/Slope Interface Module is mounted to the machine's transverse beam. The Laser/Slope Interface module acts as a slope module while also interfacing to the Spectra Precision Electric Masts or Laser Receivers. Slope, or Elevation Control Mode adjustments are made and displayed at the universal remote.

System Configuration

The SCREED-PRO System's modular design allows many different system configurations. This chart indicates the components required for different applications.

Configurations	MODELS REQUIRED					
	Tracer Plus (ST2-25)	Universal Remote (R-25)	Slope Module (CSM-30)	Tracer Plus (ST2-25)	Universal Remote (R-25)	Laser/Slope Interface (LM-25)
Single Side Elevation	X					
Single Side Elevation with Remote	X	X				
Single Side Elevation, with Slope Control	X	X	X			
Slope Control		X	X			
Single Side Elevation, with Remotes and Slope Control	X	X	X		X	
Dual Side Elevation (No Remotes)	X			X		
Dual Side Elevation With Remotes	X	X		X	X	
Dual Side Elevation, with Remotes and Slope Control	X	X	X	X	X	
Dual Side Elevation (Laser), with Remotes and Slope Control		X			X	X
Dual Side Elevation (Laser and Tracer), with Remotes and Slope Control	X	X		X	X	X

Tracer-Plus™ Ultra Sonic Grade Controller: ST2-25

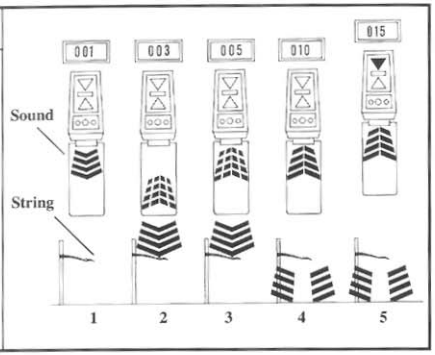
Description

The Tracer-Plus Ultra Sonic Grade Controller is a stand-alone, direct replacement for mechanical wand and joint-matching grade sensors. The Tracer-Plus features self-contained valve drivers for operating Proportional Time (P.T.) and Proportional Current (P.C.) type hydraulic control valves. The Tracer-Plus uses super bright LED indicators to display the relative correction rate and direction, as well as Automatic or Manual operation. It has switches for increasing and decreasing the relative mat thickness, resetting the Tracer- Plus to a new reference surface, and for selecting Automatic or Manual operation. A flip down reference bail is used in high wind and temperature conditions to maintain distance measuring accuracy. The Tracer- Plus operates independently or with the Universal Remote R-25 for additional convenience and features (see Universal Remote).

Theory of Operation

Clock

1. The tracer emits a the sound wave.
2. The sound wave hits the bail. The mojority of the sound wave continues towards the reference the remainder bounces off the bail as an echo.
3. The bail echo reaches the tracer.
4. The sound wave hits the reference and bounces the echo back up to the tracer.
5. The tracer corrects for any changes in elevation.

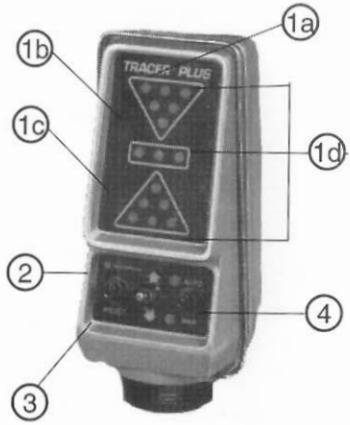


The Tracer-Plus ST2-25 uses high frequency sound "chirps" to measure the distance from the bottom of the Tracer-Plus to a reference surface. When the chirp is emitted, an internal clock is started. When the return echo is heard, the clock is stopped. This measurement of time is used to calculate and define the distance to the reference surface. Once the distance to the reference surface is known, any change in the measured distance to the reference surface will be indicated by the LED grade indicator. If the System is set for automatic, a correction signal will be sent to the hydraulic control valve. The tow arm cylinder is moved to keep the leveling edge at the set distance. The speed of sound is a relative value. Fast changes in temperature will cause the speed of sound to change, i.e., gusting wind over hot asphalt will cause distance errors if not compensated for.

Exceptional Accuracy through Temperature Compensation
The Reference Bail compensates for rapid changes in temperature by comparing the distance to the bail 20 times a second. If the measured distance to the bail changes, the Tracer-Plus will automatically compensate the distance to the reference surface.

If the bail is not in use, the thermistor (an electronic temperature measuring component) measures ambient temperature to correct for gradual temperature variations.

Features and Functions



1. **LED Grade and Diagnostic Indicators** - displays the relative grade correction. The faster the flash rate, the faster the correction rate.

   a. The top arrow indicates that a "lower" correction is required to maintain grade.

   b. The center bar indicates "on grade" and no correction is required.

   c. The bottom arrow indicates that a "raise" correction is required to maintain grade.

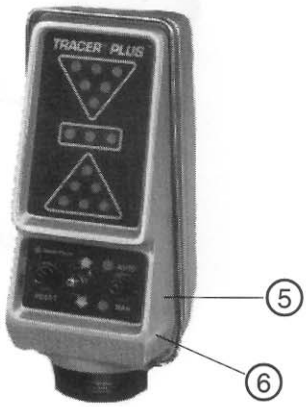
   d. All LEDs will flash when power is first applied, or when the reset button is pressed.

2. **Reset Reference switch** - locks the tracer onto the first surface under the Tracer- Plus. The Reference Bail is automatically detected if down, and used for temperature compensation.

3. **Elevation Increase/Decrease switch** - increases or decreases the distance between the Tracer and the reference surface to increase or decrease the thickness of the mat. Changes the distance by one increment per switch actuation.

4. **Automatic/Manual switch** - selects the system mode of operation. In Auto, the green LED indicator is on and grade corrections are sent to the control valve. In Manual, the red LED is on and no corrections are sent to the control valve.

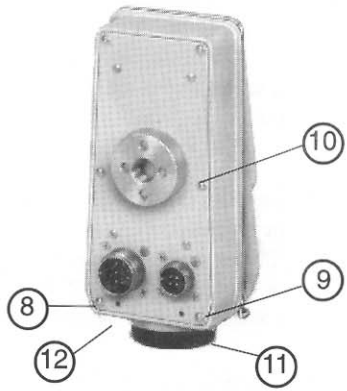
Features and Functions (cont'd)



5. **Green Automatic Indicator** - system is in automatic operating mode when on.

6. **Red Manual Indicator** - system is in manual operating mode with no control output when on or flashing.

7. **Reference Bail** - the flip down metal reference bar provides a fixed elevation reference that is used to compensate for fast changes in air temperature. These rapid changes can be caused by traffic or gusty wind conditions. The reference bail can be flipped up for storage when not in use.



8. **Ten-Pin Connector** - provides input for machine power and ground, and valve output from the Tracer Plus.

9. **Four-Socket Connector** - provides a serial interface to the optional Universal Remote.

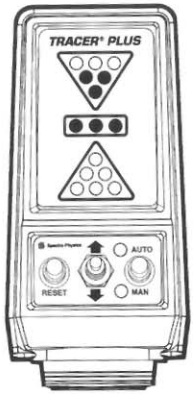
10. **Mounting Boss** - allows rotation of the Tracer-Plus for vertical alignment over the reference surface.

11. **Sonic Transducer** - emits sound wave and listens for return sound echo.

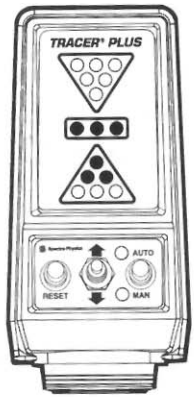
12. **Thermistor** - electronically measures ambient temperature when the reference bail is flipped up. Compensates for gradual temperature changes.

Warning Indications

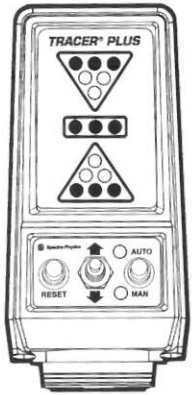
The LED grade indicators are also used for displaying certain system conditions. The LED indicators will continue to flash until the condition is corrected.



The Tracer Plus is reading an object below the reference surface or the Tracer- Plus is no longer over the reference. An example would be loss of a stringline reference.

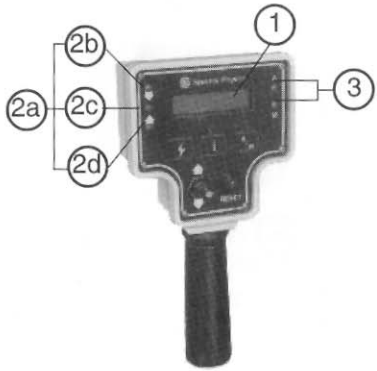


The Tracer-Plus is reading an object above the reference surface. An object is between the Tracer Plus and the reference surface.



The Tracer-Plus has lost the reference bail. The reference bail has been moved and is no longer under the Tracer. Place the bail back under the Tracer-Plus. If the bail has become bent, care should be taken in bending the bail back into shape.

Universal Remote Model R-25
Features and Functions



The Universal Remote (R-25) is designed to be used with the CSM-30 Slope Module, the LM-25 Laser/ Slope Module, or as an option with the ST2-25 Tracer-Plus. The R-25 provides flexible, mobile control of the LM-25, the ST2-25, or the CSM-30 from the back of the screed, keeping the operator out of the traffic lane while making grade changes.

1. **Liquid Crystal Display (LCD) with Backlighting**: displays the elevation or % slope and user functions on the 8-character LCD display. The backlit display allows night or low light operation.

2. **Grade Indicators**: mirrors the grade information displayed on the Tracer-Plus. When using the CSM-30 Slope Module orLM-25, it indicates the magnitude and direction of the slope correction.

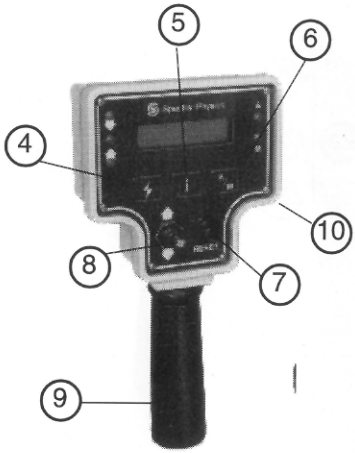
   a. The top arrow indicates that a "lower" correction is required to maintain grade.

   b. The center bar indicates "on grade" and no correction is required.

   c. The bottom arrow indicates that a "raise" correction is required to maintain grade.

   d. All LEDs will flash when power is first applied, or when the reset button is pressed.

3. **Auto/Manual LEDs**: displays the system mode of operation, either Automatic (green) or Manual (red).



4. **Power On-Off Switch**: turns the system ON or OFF (press and hold for 3 seconds to turn off).

5. **User Selectable Functions**: allows access to the user functions.

6. **Auto/Manual Switch**: switches between Automatic or Manual operation.

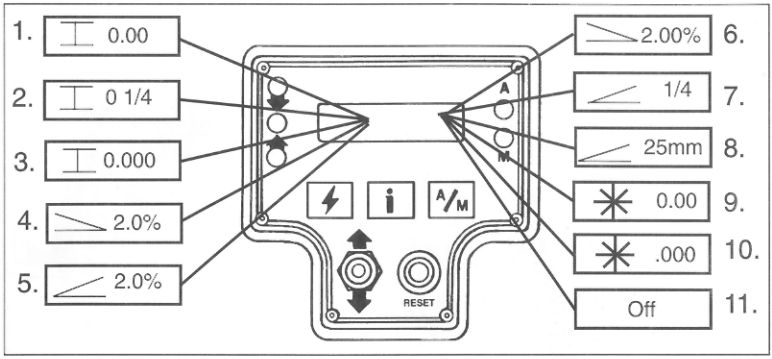
7. **Reset Switch**: resets the distance of the Tracer-Plus to a new reference surface.

8. **Elevation/Slope Increase/ Decrease Switch**: press the switch up to increase the mat thickness (elevation) or slope value. Press the switch down to decrease the mat thickness (elevation) or slope value (press and release = changes value by one unit, press and hold = changes value by multiple units).

9. **Removable Handle**: allows the remote to be mounted directly to the screed rail by using a mounting bracket (not supplied in kit).

10. **Four (4) Pin Tracer-Plus Interface Connector**: provides communication between the R-25 Universal Remote and the ST2-25 Tracer-Plus, LM-25 Laser/Slope Module or the CSM-30 Slope Module.

Display Information



Display Symbols

Elevation

Slope Direction Up to the left (-) Slope

Slope Direction Up to the right (+) Slope

Laser

Elevation - Tracer Plus Connected:

1. Tracer Mode - Feet selected as the unit of measurement.
2. Tracer Mode - Inches selected as unit of measurement.
3. Tracer Mode - Metric selected as unit of measurement.

Slope - Slope Module Connected:

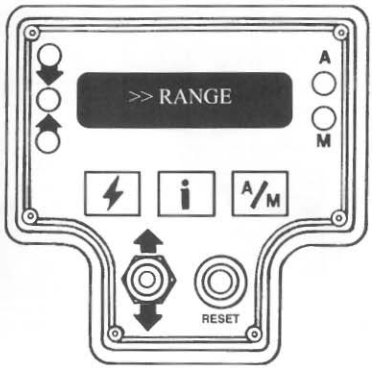
4. Slope goes up to the left 2.0% (tenths of a percent).
5. Slope up the right 2.0% (tenths of a percent).
6. Hundredths of a percent selected as the unit of slope measurement.
7. Inches/feet selected as unit of slope measurement.
8. Millimeters per Meter selected as the unit of slope measurement.

Elevation - Laser/Slope Module Connected:

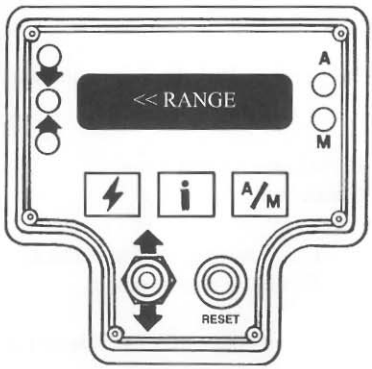
9. Laser Mode - Feet selected as the unit of measure.
10. Laser Mode - Metric selected as the unit of measure.
11. The elevation on one side of the paver will be controlled manually.

Warning Indicators

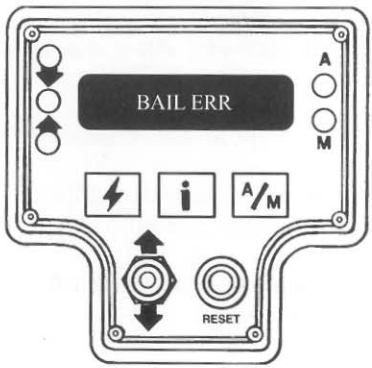
The grade indicator combinations also show system warnings. No grade correction outputs occur during system warnings. The warning will continue until the condition is corrected.



The Tracer-Plus is reading an object below the reference surface. An example would be the Tracer-Plus is no longer over stringline reference and picking up the ground below.

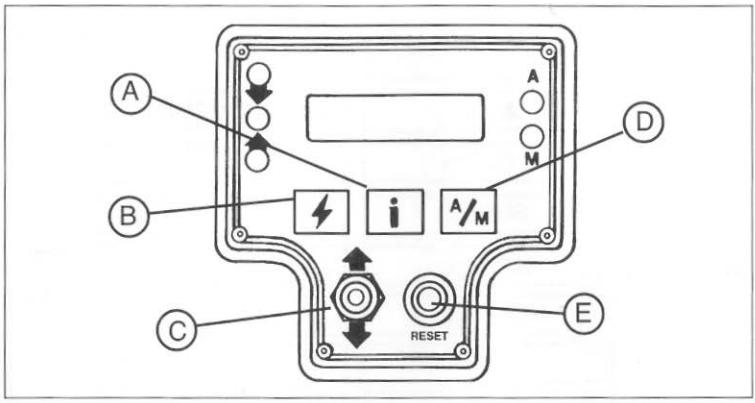


The Tracer-Plus is reading an object above the reference surface. An object is between the Tracer-Plus and the reference surface.



The Tracer-Plus has lost the reference bail. The reference bail has been moved and is no longer directly under the Tracer-Plus. Reposition to the bail so it is directly under the Tracer-Plus.

User Function Switches



These switches provide the following operations to optimize control system performance:

A. Press the [i] Information switch to enter and move through the User Options/ Functions.

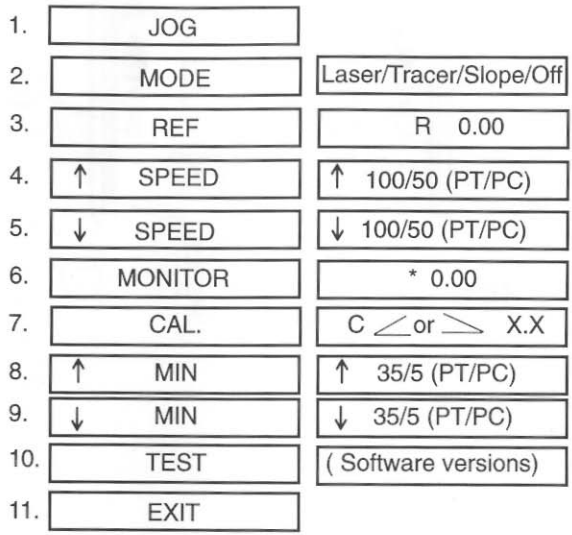
B. Press the [⚡] Power switch at any point to go back to normal operation.

C. Toggle the Mat Increase/ Decrease switch to change the displayed values.

D. Press the RESET button to restore the factory default value for the option/function being displayed.

E. Press the [A/M] switch to put the system into automatic operation while in the Speed or Monitor modes.

R-25 User Selectable Options/Functions



This MENU is available on the R-25 LCD display.

Use these options/functions to optimize system performance:

Note: Refer to previous page for switch functions.

1. **JOG**: Moves the tow arm cylinder up or down (to center the ram).

2. **MODE**†: Lets you choose between the following operating modes: Laser, Tracer, Slope, or Off. Select the operating mode that matches the device you are using.

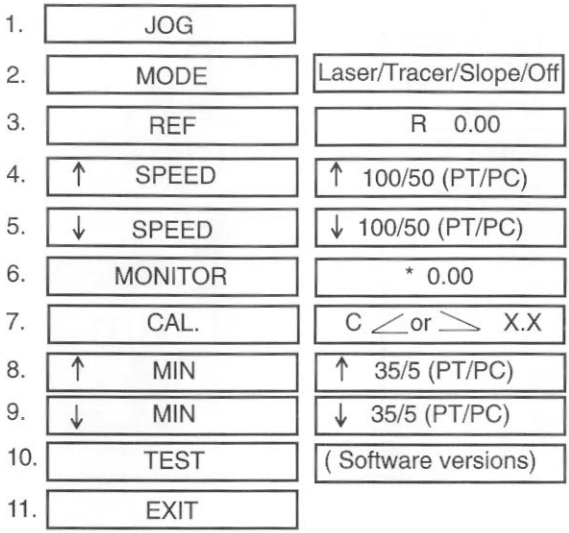
3. **REFERENCE**†: Enter an elevation reference or mat thickness value.

4. ↑ **SPEED**: Adjusts the cylinder raise speed.

5. ↓ **SPEED**: Adjusts the cylinder lower speed.

6. **MONITOR**: Displays the elevation deviation (difference) from the reference surface.

†This menu item appears only when you are using a LM-25 Laser/SlopeModule.



7. **CAL.‡**: Allows for slope sensor calibration.

8. **↑ MIN**: Adjusts the minimum raise speed of the tow arm cylinder.

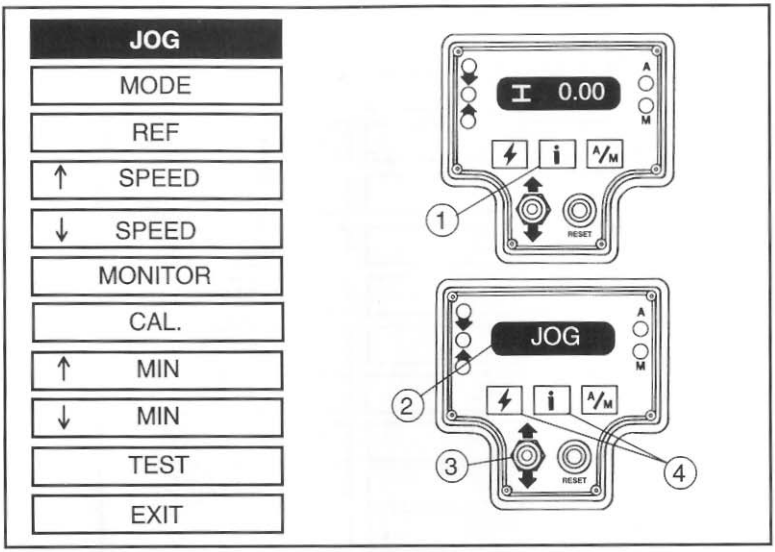
9. **↓ MIN**: Adjusts the minimum lower speed of the tow arm cylinder.

10. **TEST**: Checks the function of all LEDs and the LCD. Displays all recorded system errors and software version.

11. **EXIT**: Exits user selectable options and enters normal operating mode.

Note: Refer to the following pages for specific option/function instructions.

‡This menu item appears only when you are using a slope or laser/slope module.



Jog Function

The JOG function allows tow arm cylinder adjustment from the Screed-Pro Universal Remote.

1. Press [i] to enter the user options.

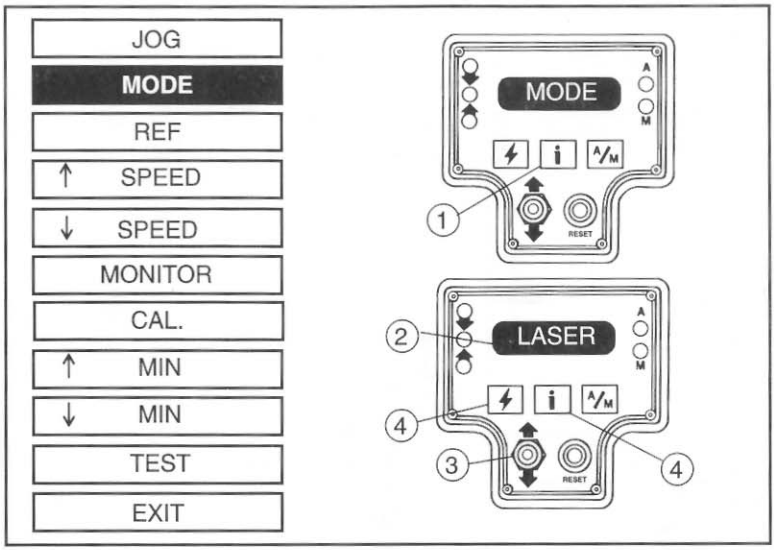
2. JOG is displayed in the window.

3. Use the Mat Increase/Decrease switch to center the tow arm cylinder.

4. Press [⚡] to return to normal operating mode.

   or

   Press [i] to go to the next user option.



Selecting the Mode:

Allows user to select set the operating mode.

1. Press the [i] switch and repeat until MODE is displayed.

   One second delay.

2. The current operating mode is listed in the window.(Laser Tracer Slope or Off)

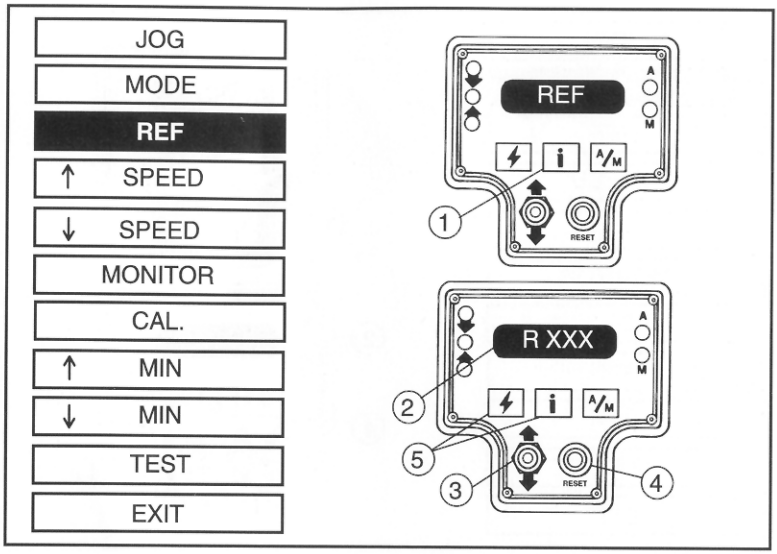
3. Press the Increase/Decrease switch to until the mode you want to use is listed in the window.

4. Press [⚡] to return to normal operating mode.

   or

   Press [i] to go to the next user option.

Note: If slope is selected on both sides, the mode on the opposite side of the paver will automatically change to the last mode selected or revert to the Off mode.



Setting Reference Elevation:

Allows user to set in a reference elevation or mat thickness value.

1. Press the [i] switch and repeat until REF is displayed.

   One second delay.

2. R is displayed in the window with a value.

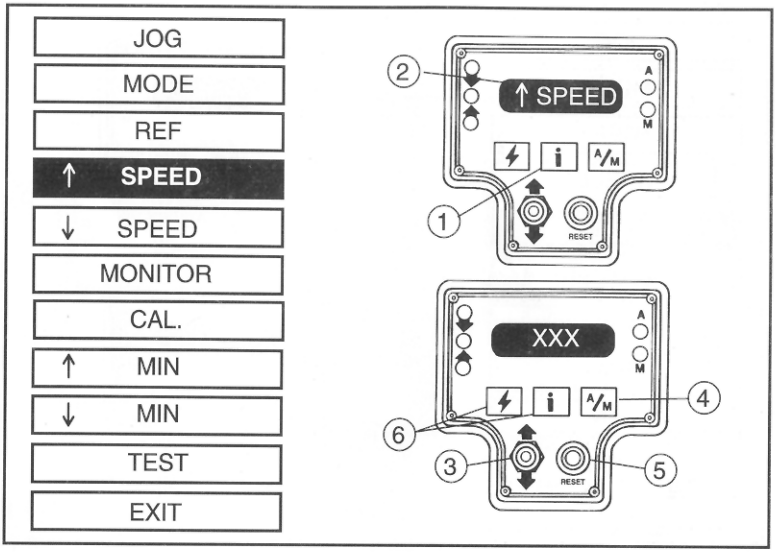
3. Use the Increase/Decrease switch to change the reference value to the material thickness or to a reference elevation.

4. To quickly zero the display, press the RESET button.

5. Press [⚡] to return to normal operating mode.

   or

   Press [i] to go to the next user option.



Adjusting Cylinder Raise Speed:

Provides user the ability to optimize performance by adjusting the cylinder speed.

1. Press the [i] switch and repeat until ↑ SPEED is displayed.

   One second delay

2. ↑ will be displayed in the window with a value.

3. Use the Increase/Decrease switch to change the Raise speed. The greater the value, the faster the cylinder will move.

4. To monitor the cylinder speed, press the [A/M] switch to change the operating mode to Automatic (green LED on). Press the [A/M] again to return to Manual (red LED on).

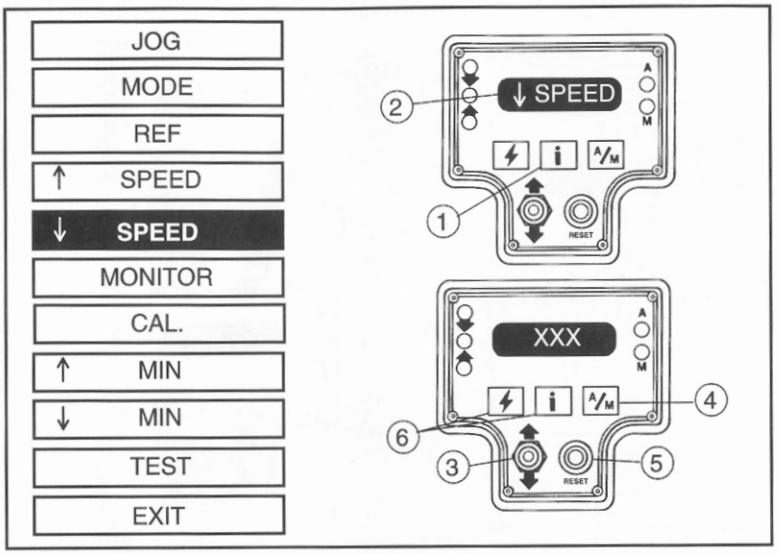
5. Pressing RESET restores the factory default value of 100 (may not be the best value for the valve being used).

6. Press [⚡] to return to normal operating mode.

   or

   Press [i] to go to the next user option.

Note: Ensure the ↑ SPEED and ↓ SPEED values are adjusted and stored for both sides of the CSM-30 and LM-25.



Adjusting Cylinder Lower Speed.

Provides user the ability to optimize performance by adjusting the cylinder speed.

1. Press the [i] switch and repeat until ↓ SPEED is displayed.

   One second delay

2. ↓ will be displayed in the window with a value.

3. Use the Increase/Decrease switch to change the Lower speed. The greater the value, the faster the cylinder will move.

4. To monitor the cylinder speed, press the [A/M] switch to change the operating mode to Automatic (green LED on). Press the [A/M] again to return to Manual (red LED on).

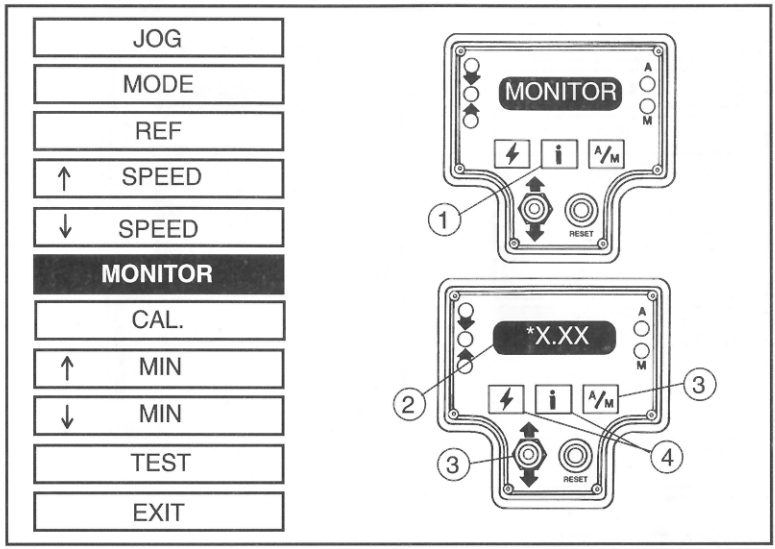
5. Pressing RESET restores the factory default value of 100 (may not be the best value for the valve being used).

6. Press [⚡] to return to normal operating mode.

   or

   Press [i] to go to the next user option.

Note: Ensure the ↑ SPEED and ↓ SPEED values are adjusted and stored for both sides of the CSM-30 and LM-25.



Monitor Function

The monitor function provides the user a way to see the measured difference in elevation from the set point during operation.

1. Press the [i] switch and repeat until MONITOR is displayed.

   One second delay.

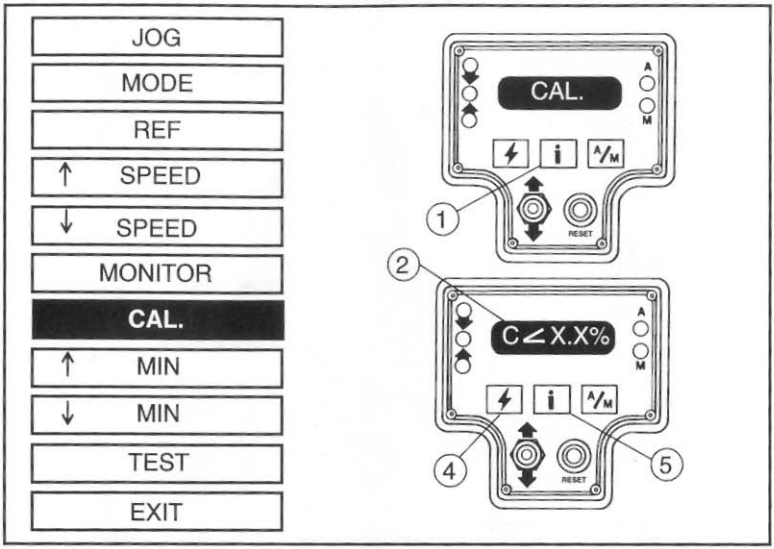
2. * will be displayed in the window with the deviation from grade value.

3. To monitor the deviation while in automatic control, press the [A/M] switch (green LED on). Press it again to return to manual (red LED on).

4. Press [⚡] to return to normal operating mode.

   or

   Press [i] to go to the next user option.



Calibration

The calibrates function allows the user to adjust the calibration of the system such that when a desired slope is entered into the Universal Remote, and the Screed-Pro is operated in AUTO under normal operation, the resultant actual slope before roll down will be the same as the desired slope.

1. Press the [i] switch and repeat until CAL. is displayed.

One second delay

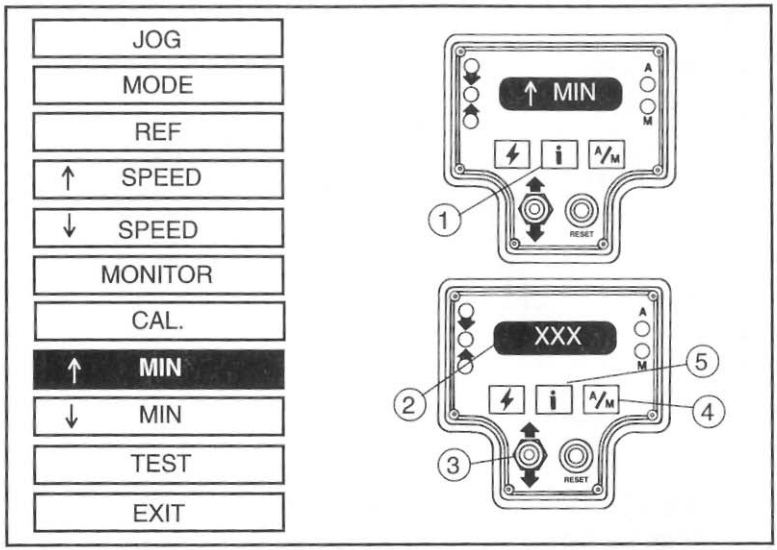
2. The window shows the direction of slope and the slope value currently measured by the slope sensor.

3. Refer to Slope Module Calibration section to perform or check calibration.

4. Press and POWER switch to return to normal operation mode.

or

5. Press [i] to go to next user option.



↑ MIN RAISE

Calibrates the control system to the response characteristics of the machine tow arm hydraulic valve. This adjustment provides optimum system performance.

↑ MIN Raise should only be adjusted at the time of initial installation or when changing from one paver to another. ↓ MIN establishes the minimum correction required to raise the tow arm cylinder.

1. Press the [i] switch and repeat until ↑ MIN is displayed.

One second delay

2. ↑ is now displayed in the window with a value.

3. Use the Increase/Decrease switch to adjust the value.

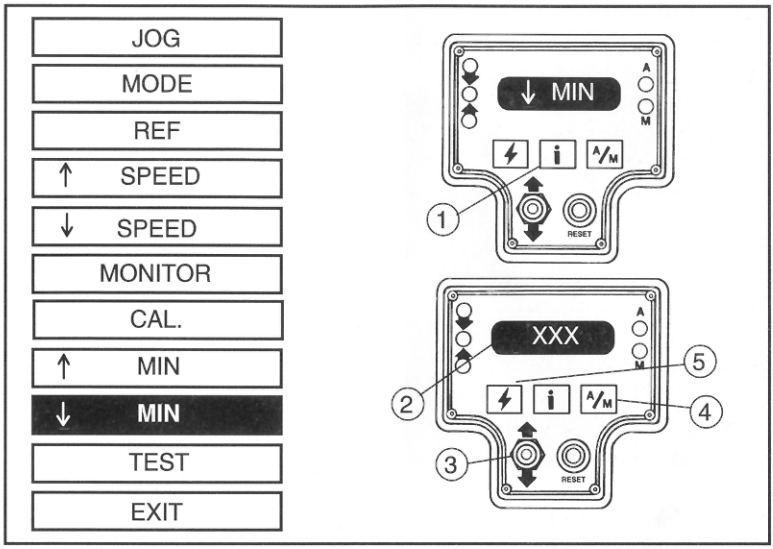
4. Press and hold the [A/M] switch to send the correction to the control valve. Adjust the value until the Tow Arm Cylinder just begins to move.

5. Press [i] to go to ↓ MIN (when ↑ MIN is adjusted, ↓ MIN typically should also be adjusted).

Note: When using dual elevation (Tracer- Plus on each side) or moving one Tracer- Plus from side to side according to the application, determine and use the highest ↑ MIN and ↓ MIN values (between left and right side). This enables the Tracer- Plus(s) to be used on either side with optimum results.

Note: Ensure the ↓ MIN and ↑ MIN values are adjusted and stored for both sides of the CSM-30 or LM-25.

Note: When using a LM-25 (Laser/ Slope Interface Module) all calibration valves are stored in the LM-25. If Tracers are to be used without the LM-25. The Min Cal. is required to be set and stored in the Tracers.



↓ MIN LOWER

Calibrates the control system to the response characteristics of the machine tow arm hydraulic valve. This adjustment provides optimum system performance.

↓ MIN Lower should only be adjusted at the time of initial installation or when changing from one paver to another.

↓ MIN establishes the minimum correction required to lower the tow arm cylinder.

1. Press the [i] switch and repeat until ↓ MIN is displayed.

One second delay

2. ↓ is now displayed in the window with a value.

3. Use the Increase/Decrease switch to adjust the value.

4. Press and hold the [A/M] switch to send the correction to the control valve. Adjust the value until the Tow Arm Cylinder just begins to move.

5. Press [⚡] to return to normal operating mode.

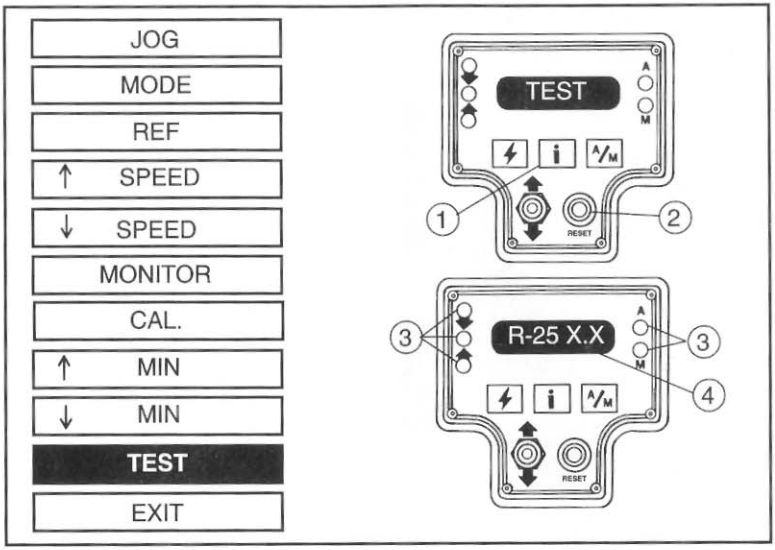
or

Press [i] to go to the next user option.

Note: When using dual elevation (Tracer- Plus on each side) or moving one Tracer- Plus from side to side according to the application, determine and use the highest ↑ MIN and ↓ MIN values (between left and right side). This enables the Tracer- Plus(s) to be used on either side with optimum results.

Note: Ensure the ↓ MIN and ↑ MIN values are adjusted and stored for both sides of the CSM-30 or LM-25.

Note: When using a LM-25 (Laser/ Slope Interface Module) all calibration valves are stored in the LM-25. If Tracers are to be used without the LM-25. The Min Cal. is required to be set and stored in the Tracers.

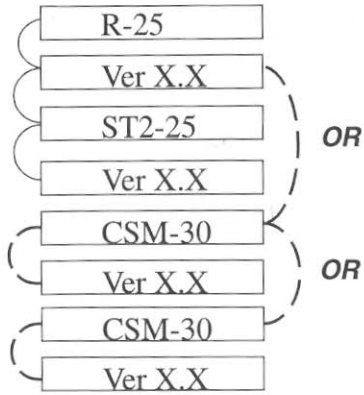


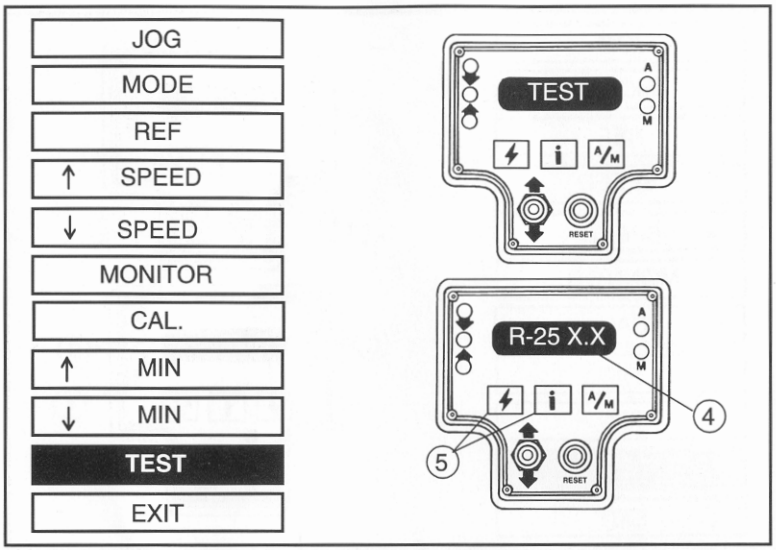
TEST Function

The TEST function allows the user to confirm operation of all indicator LEDs, software versions and view all recorded errors if any have occurred.

1. Press the [i] switch and repeat until TEST is displayed in the window.
2. To enter TEST, press the RESET button (RESET may be pressed repeatedly to see messages again).
3. All LEDs will be turned on for 5 seconds.
4. MESSAGES are displayed for 1 second each.

Software versions are shown for future updates and for verification when troubleshooting system performance.





All recorded errors will be displayed. If no errors have occurred, the error log will not be shown.

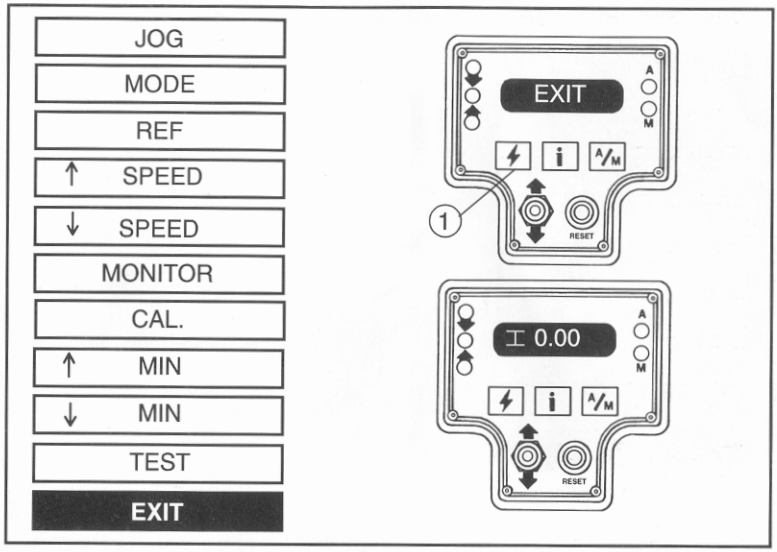
#XX=XX

Error Code — Number of Occurrences

(See error code list)

5. Press ⚡ to return to normal operating mode.

   Press i *or* to go to the next user option.



EXIT

To exit from the User Options back to normal operating mode:

1. Press the ⚡ Power switch.

or

2. Wait three seconds (the display will change to the normal operating mode).

Slope Module Model CSM-30

Description

The Slope Module is used with the R-25 Universal Remote to automatically control the slope of the screed. The CSM-30 uses a digital inclinometer to measure the slope across the screed of the paver. The CSM-30 is "plug in compatible" to the machine's existing automatic interface. The CSM-30 features self-contained valve drivers for Proportion Time (P.T.) and Proportional Current (P.C.) type valves.

Theory of Operation

The Slope Module CSM-30 and R-25 Remote allow the operator to adjust the slope of the screed from the back of the machine. The CSM-30 mounts to the transverse beam and measures the slope of the screed. If the measured slope is different from the value set at the R-25 remote, the CSM-30 sends the necessary valve correction to the tow arm cylinder to maintain the desired slope. The CSM-30 plugs into the existing machine's automatic connector to provide valve control signals and receive power for operation.

Features and Functions

1. **Right Side Control Output Connector:** Connect to the machine's right side automatic connector for controlling the slope on the right side of the machine.

2. **Remote Interface Connector:** Connect to the Universal Remote to provide the necessary serial interface between the Slope Module and the Universal Remote.

3. **Left Side Control Output Connector:** Connect to the machine's left side automatic connector for controlling the slope on the left side of the machine.

4. **Temperature Compensation:** The CSM-30 is temperature compensated to maintain consistent slope accuracy throughout the range of temperatures typical to asphalt paving.

Laser/Slope Module Model LM-25

Description

The LM-25 Laser/Slope Interface Module is used with the R-25 Universal Remotes to allow for multiple configurations of automatic control of the screed. The LM-25 uses a digital inclinometer to measure the slope across the screed of the paver. The LM-25 also allows the Screed-Pro system to interface with the Laserplane Electric Masts or Laser Receivers. The LM-25 can also be interfaced directly with the ST2-25 Tracer Plus. This ability allows the screed operator to easily change the mode of automatic operation "on the fly." The LM-25 is plug-in compatible with the machine's existing automatic interface. The LM-25 features self-contained valve drivers for Proportional Time (P.T.) and Proportional Current (P.C.) type valves.

Theory of Operation

The Laser/Slope Module LM-25 and R-25 Remote allow the operator to adjust the slope of the screed from the back of the machine. It can also control the elevation of the screed when used with a laser, or interface directly to the ST2-25 Tracer. The LM-25 mounts to the transverse beam and measures the slope of the screed. If the measured slope or elevation is different from the value set at the R-25 remote, the LM-25 sends the necessary valve correction to the tow arm cylinder to maintain the desired slope. The LM-25 plugs into the existing machine's automatic connector to provide valve control signals and receive power for operation.

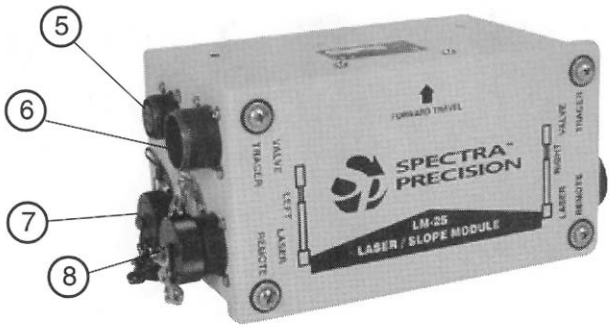
Features and Functions

1. **Right Side Control Output Connector:**
   Connect to the machine's right side automatic connector for controlling Slope or Elevation on the right side of the machine.

2. **Right Side Laser Interface Connector:**
   Connect to the Electric Mast or Laser Receiver to receive and interpret the Laser receiver signals. To also provide elevation changes to the electric mast.

3. **Right Side Tracer Interface Connector:**
   Connect to the socket connector of the ST2-25 Tracer-Plus™ to provide the necessary serial interface between the LM-25 and the Tracer-Plus™.

4. **Right Side Remote Interface Connector:**
   Connect to the R-25 Universal Remote to provide the necessary serial interface between the LM-25 and the Universal Remote.



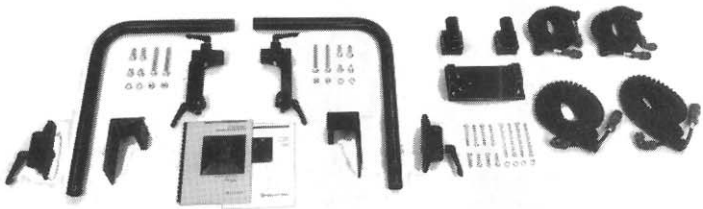
5. Left Side Control Output Connector:
Connect to the machine's left side automatic connector for controlling Slope or Elevation on the right side of the machine.

6. Left Side Laser Interface Connector:
Connect to the Electric Mast or Laser Receiver to receive and interpret the Laser receiver signals. To also provide elevation changes to the electric mast.

7. Left Side Tracer Interface Connector:
Connect to the socket connector of the ST2-25 Tracer-Plus™ to provide the necessary serial interface between the LM-25 and the Tracer-Plus™.

8. Left Side Remote Interface Connector:
Connect to the R-25 Universal Remote to provide the necessary serial interface between the LM-25 and the Universal Remote.

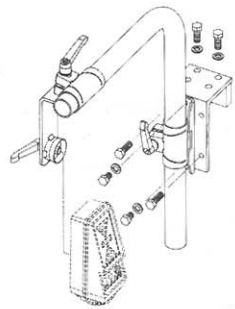
Elevation System Installation



The SCREED-PRO System can be installed in a matter of minutes with only a 3/4 inch and 9/16 inch wrench. To start the installation, remove all the components, brackets, and cables from their boxes and confirm contents.

The kit shown is a Dual Elevation with Cross Slope. Kits will vary depending on configuration ordered.

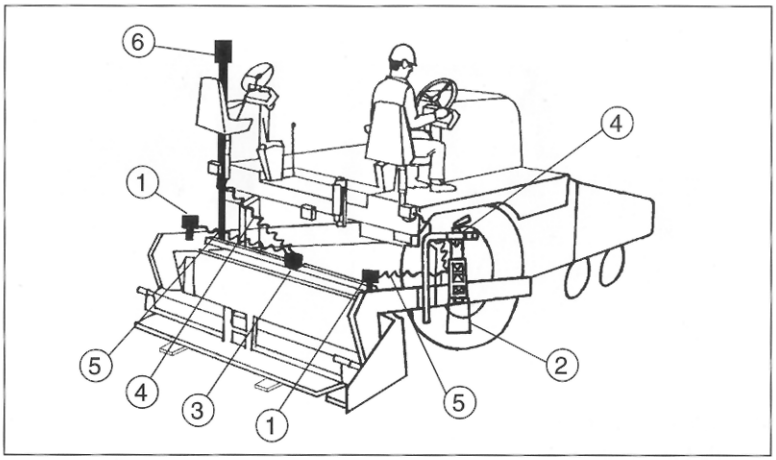
It is best to mount the Tracer-Plus at the same location as recommended by the paver manufacturer for automatic controls. For Blaw Knox, Barber Greene and Cat, use the square tubing attached to the screed wing for joint matching. If possible, mount to the tow arm when using an averaging ski. For Cedar Rapids, mount the Tracer-Plus on the tow arm using either the manufacturers supplied tow arm mount and extensions or by mounting the



Universal mount directly to the tow arm and using an optional 4 foot Tracer Tube (part number 0791-6100).

In general: the Tracer-Plus mounted to the screed provides the fastest response to corrections. When mounted to the tow arm, corrections will be smaller giving more averaged effect.

Component Placement



1. **Universal Remote R-25**
   The R-25 is designed to be held in a bracket at the screed rail for easy access.

2. **Tracer-Plus ST2-25**
   The ST2-25 must be mounted so that the reference bail is between 4 and 6 inches (10cm to 15cm) away from the reference surface for best temperature compensation.

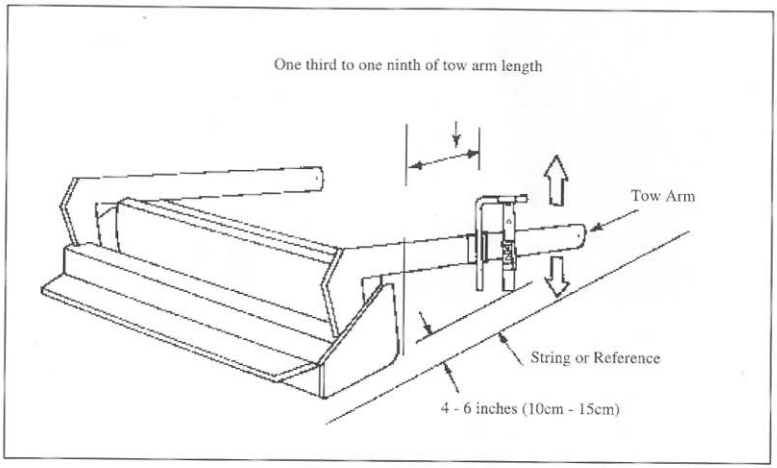
3. **Slope Module CSM-30 or LM-25**
   This module is mounted to the transverse beam that connects the right and left side tow arm.

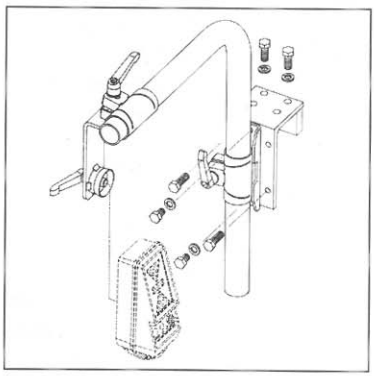
4. **Machine Interface Cable**
   Connects the ST2-25 or CSM-30 to the machine automatic control connector.

5. **Remote Interface Cable**
   Connects the R-25 Universal Remote to the ST2-25 or CSM-30.

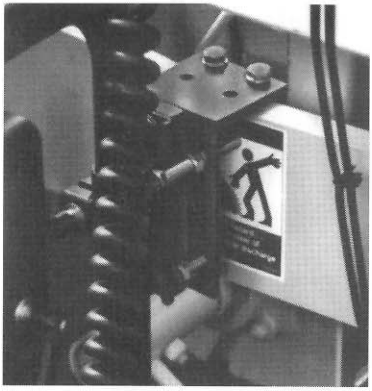
6. **Laser Receiver**
   The Laser Receiver is mounted to either the tow arm or the screed. To receive and interpret the Laser signals.

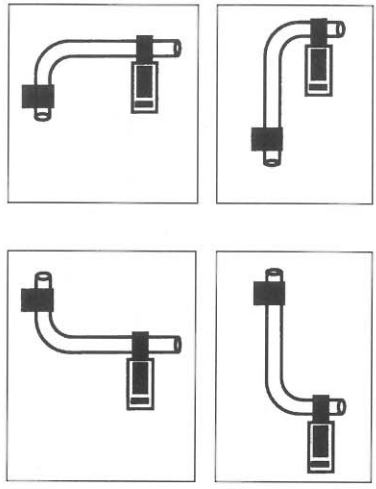
Install Brackets to Machine





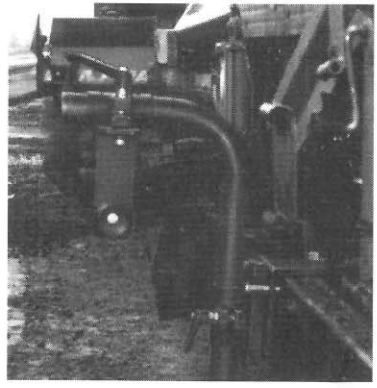
1. Attach the Tracer-Plus Tube Mount Clamp to the Universal Machine Mount using the two (2) 1/2 x 3/4 inch bolts. Position the Universal Machine Mount either to the Tow Arm for averaging or the screed extension for joint matching.
   The mounting location of the Universal Mount must allow the Tracer-Plus to be 12 inches (21cm) in front of the auger and have 4 to 6 inches (10-15cm) between the reference bail and the reference surface for optimal performance. Position the mount to minimize possible sound wave echoes from adjacent paver frame and other structures.





2. Insert the Tracer Tube into the Tracer Tube Clamp, position and tighten. Use one of the four (4) methods shown. To determine which setup will work, a minimum of 24 inches (61cm) is required from the tube to the reference surface. This allows 4 inches (10cm) from the reference bail to the reference surface.

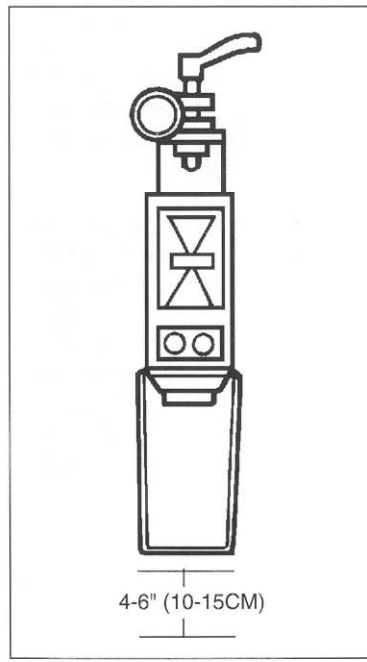
3. Slide the Tracer Arm over the Tracer Tube and position the arm over the reference. If stringline or wire is used, make sure the arm is directly over the center of the string. Maximize the distance to reflecting surfaces other than the target surface.



Attach the Tracer-Plus

1. Place the Tracer-Plus so the mounting boss fits into the hole in the arm. Thread and secure the Tracer to the Arm. Make sure the Tracer-Plus is vertically positioned over the reference.

2. Flip the Tracer-Plus reference bail down and measure the distance between the bail and the reference surface. Adjust the Tracer Tube so that 4 to 6 inches (10cm to 15cm) of clearance is measured between the bail and the reference.



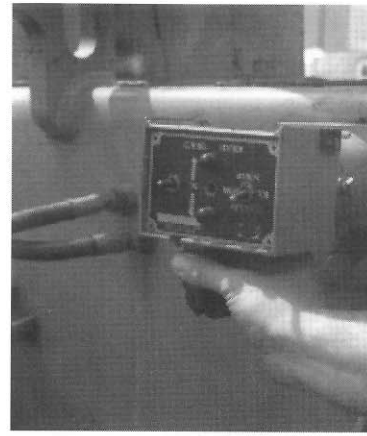
Connect the Cable(s)

1. Connect the 10 Socket 180 degree (straight) connector of the 10 or 7 conductor cable to the back of the Tracer Plus. The other end of this cable will connect to the machine automatics bulkhead.

Note: If the Universal Remote is to be used with the Tracer-Plus, connect the 4 pin 180 degree (straight) connector of the 4 conductor remote cable to the 4 socket bulkhead connector on the back of the Tracer-Plus. The other end of this cable will connect to the R-25 Universal Remote.

Note: When using the Tracer Plus in conjunction with the LM-25 connect the 4 pin 180 degree (straight) connector of the 4 conductor LM-25 interface cable to the 4 socket bulkhead on the back of the Tracer Plus. The other end of this cable will connect to the Tracer bulkhead in the LM-25 Laser/Slope interface module. The 10 socket connector on the back of the Tracer Plus **is not** used in this application

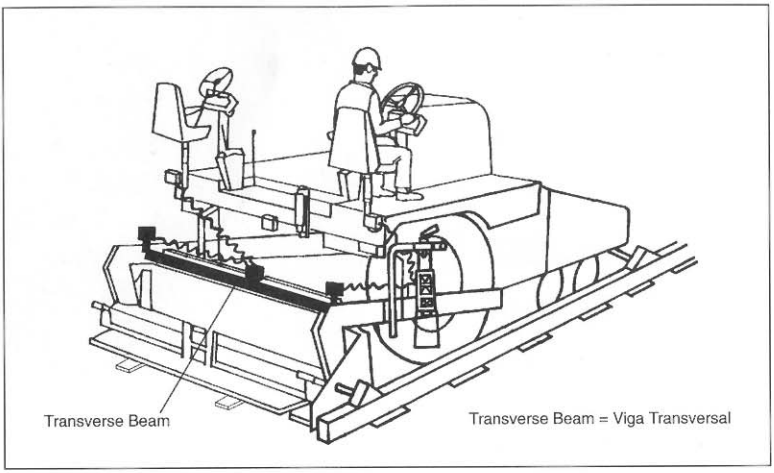
Note: Connect the cable end with the YELLOW sleeve to the ST2-25 Tracer-Plus or the CSM-30 Slope Module. This should be the 180^0 (straight) connector end.



2. Connect the 10 pin or 7 pin 90 degree connector (depending on the manufacturer of the machine) of the 10 or 7 conductor Screed-Pro cable to the machine automatics bulkhead connector. Connect to the appropriate connector, right for right side control, left for left side control. The other end of the cable connects to either the ST2-25 Tracer-Plus or the CSM-30/ LM-25 Slope Module.

Note: Connect the cable end with the YELLOW sleeve to the ST2-25 Tracer-Plus or the CSM-30 Slope Module. This should be the 180^0 (straight) connector end.

Slope Control System Installation



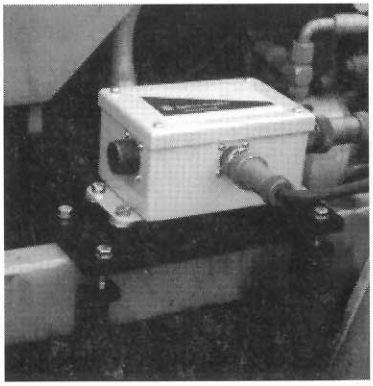
Slope Module Installation:

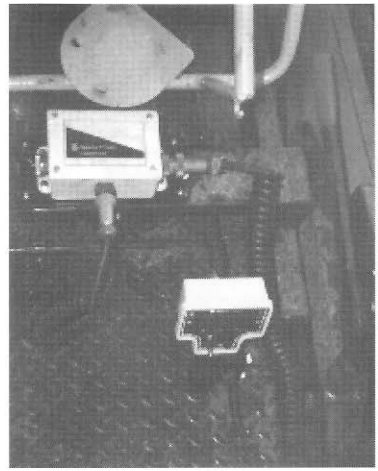
The Slope Module must be mounted to the transverse beam that connects to the right and left side tow arm. If this beam is not on the machine, contact your local paver dealer.

1. Attach the Slope Module to the mounting plate with the 1/4 inch bolts and shock mounts.

2. Fasten the mounting plate to the transverse beam with the two (2) U-Clamps and the 5/16 inch bolts.

Note: If you are installing this system to an ABG paver, you need to mount the shock mount on top of the existing paver shock mount.





Cables

1. Connect the 10-Socket, 180-degree (straight) connector of the 10 or 7 conductor cables to the CSM-30/LM-25 Slope Module. Connect to the RIGHT Connector for right side control, LEFT for the left side control. The other end of this cable will connect to the machine automatics bulkhead. Connect the 4-pin, 180-degree (straight) connector of the 4 conductor remote cable to the 4 socket bulkhead connector on the CSM-30/LM-25 Slope Module. The other end of this cable will connect to the R-25 Universal Remote.

Note: Connect the cable end with the YELLOW sleeve to the ST2-25 Tracer-Plus or the CSM-30 Slope Module. This should be the 180-degree (straight) connector end.

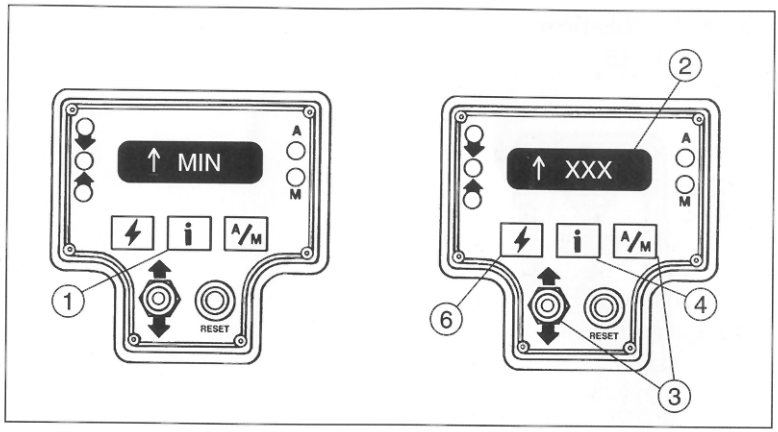
2. Connect the 10-pin or 7-pin 90-degree connector (depending on the manufacturer of the machine) of the 10 or 7 conductor Screed-Pro cable to the machine automatic bulkhead connector. Connect to the appropriate connector, right for right side control, left for left side control. The other end of the cable connects to either the ST2-25 Tracer-Plus, the LM-25 Laser/ Slope Module, or the CSM-30 Slope Module.

Note: Connect the cable end with the YELLOW sleeve to the ST2-25 Tracer-Plus or the CSM-30 Slope Module. This should be the 180 degree (straight) connector end.

System Calibration

Tracer Calibration With R-25

This function optimizes system performance by matching valve drive signals to the characteristics of the particular tow arm hydraulic valve. Calibration should be performed upon initial installation or if the equipment is to be used on a different machine. Once calibrated, the value will be stored in the Tracer-Plus. The values displayed in the MIN modes represent the minimum pulse length or current required to drive the tow arm hydraulic valve.



1. Press the [i] switch to enter the program mode and repeat Pressing [i] until ↑ MIN is displayed in the window.

2. To calibrate the raise cylinder response, wait one second and the display will change to a value.

3. Press and hold the [A/M] switch to send the displayed correction to the valve. Toggle the Increase/ Decrease switch up to increase the speed and displayed value, or down to decrease the speed and displayed value. Adjust the value until the cylinder just beings to move.

4. Once completed, press the [i] switch and ↑ MIN will appear in the window. After one second, ↓ will appear in the window with a value.

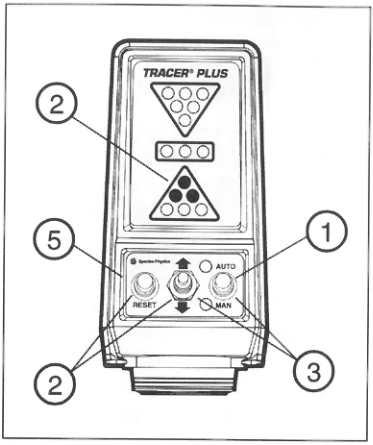
5. Follow step 3 to calibrate the lower cylinder response.

6. Press the Power switch to return to normal operation.

Note: Once ↑ MIN and ↓ MIN are set, user functions ↑ Speed and ↓ Speed should be used to adjust tow arm speed for optimum paving performance (see ↑ Speed and ↓ Speed in the User Options/Functions section).

Note: When using dual elevation (Tracer-Plus on each side) or moving one Tracer-Plus from side to side according to the application, determine and use the highest MIN and MIN values (between left and right side). This enables the Tracer-Plus(s) to be used on either side with optimum results.

Tracer Calibration
Without R-25



This function allows the user to optimize system performance by adjusting the tow arm cylinder speed. Typically, this adjustment is made at the time of installation or when changing from one paver to another (matches valve drive signals to the characteristics of the particular valve).

Setting the Lower Minimum Valve Setting

1. Place the Tracer-Plus in the Manual operation mode (red MAN LED on).

2. Toggle the Increase/Decrease switch up while pressing the RESET button. The top three LEDs in the bottom triangle will be on.

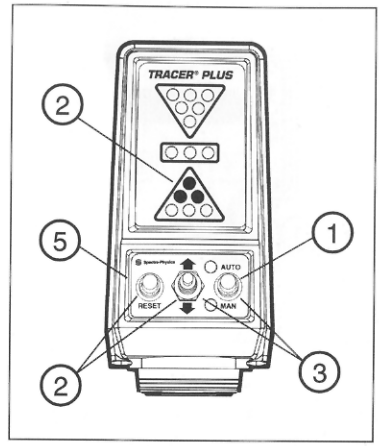
3. To increase the speed, toggle the Increase/Decrease switch up then press and hold the Auto/Man button. The green Auto indicator light will light and a correction signal will be sent to the control valve. To decrease the speed, toggle the Increase/Decrease switch down, then press and hold the Auto/Man button to send the correction signal to the valve.

4. Repeat step 3 until the cylinder moves at the desired speed.

5. Press the RESET button to return to normal operation.

Note: If MIN is set too fast, the first correction from "On Grade" may be abrupt.

Tracer Calibration
Without R-25



Setting the Raise Minimum Valve Setting

1. Place the Tracer-Plus in the Manual operation mode (red MAN LED on).

2. Toggle the Increase/Decrease switch down while pressing the RESET button. The bottom three LEDs in the top triangle will be on.

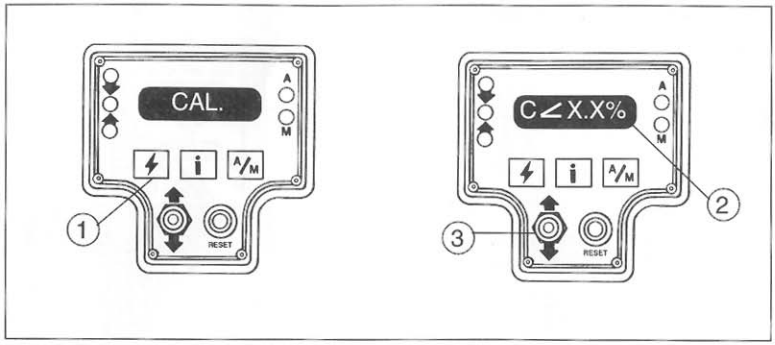
3. To increase the speed, toggle the Increase/Decrease switch up then press and hold the Auto/Man button. The green Auto indicator light will light and a correction signal will be sent to the control valve. To decrease the speed, toggle the Increase/Decrease switch down, then press and hold the Auto/Man button to send the correction signal to the valve.

4. Repeat step 3 until the cylinder moves at the desired speed.

5. Press the RESET button to return to normal operation.

Note: If MIN is set too fast, the first correction from "On Grade" may be abrupt.

System Calibration
Slope Sensor Calibration



Calibrating the CSM-30 or LM-25 Slope Module to the machine enables the operator to enter the desired slope in either PERCENT SLOPE (%) or RISE / RUN (inches/ foot or millimeters/ meter) into the R-25 Universal Remote and expect the paver to maintain that desired slope while in AUTO control.

In order to obtain a good reliable calibration, follow this easy procedure and use the slope measurement method that best suits your job accuracy requirements:

Slope Module Calibration

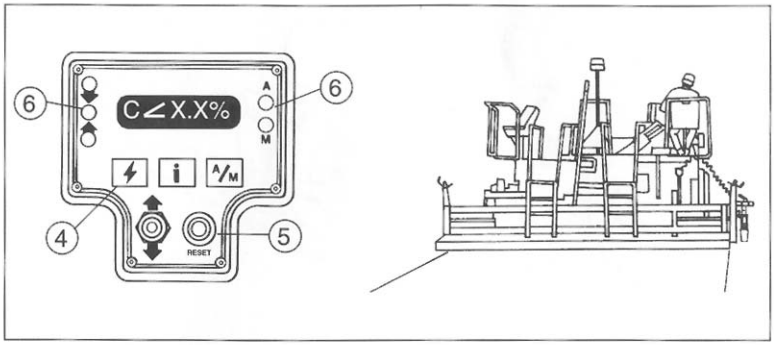
1. Press [i] and repeat until CAL. is displayed on the R-25 Universal Remote.

   One second delay.

   C and a value will be displayed.

2. Measure the actual slope of the screed using the method that best fits your job accuracy requirements (see *Slope Measurement Methods*).

3. Enter the measured slope value into the R-25 Universal Remote as the CAL. value by using the Mat Increase/Decrease switch. Confirm that the slope direction symbol matches the measured direction of slope. Example: down to the right ∠ , down to the left ∠ .



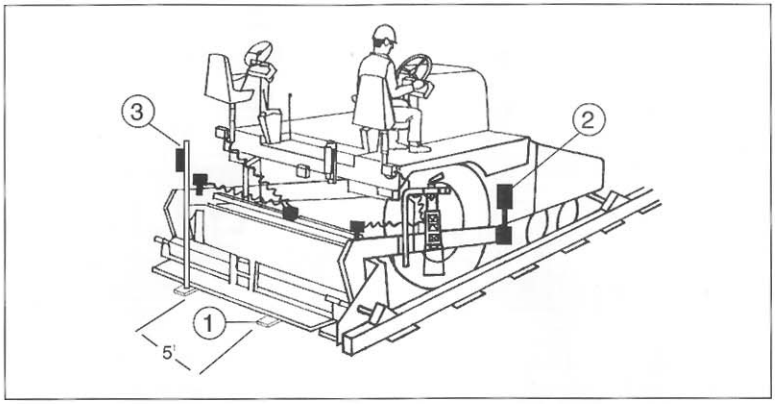
4. Press the ⚡ switch to return to the normal operating mode.

5. Press the RESET button to apply the monitored slope value to the desired slope display window.

6. Pave in AUTO until 'On Grade' is achieved for three (3) tow arm lengths in distance traveled.

7. Measure the actual slope before roll down to confirm slope accuracy.

Slope Measurement Methods



Laser Method

The laser method of slope measurement is the recommended method of measurement when a high degree of accuracy is required. (These instructions assume familiarity with proper laser setup and use.)

1. Set the screed on blocks which are 5 feet apart, centered in the width of the screed (use 2 meters between blocks if measuring in metric units). Blocks should be long enough to extend out behind the screed by at least 2 in (5 cm).

Note: If the screed is extended and a tight tolerance is required, a larger distance between the blocks and careful measurement may result in a higher accuracy.

2. Raise fully or lower fully both tow arm cylinders.

3. Measure the elevation (with a level laser) at each block. Find the difference in elevation between the two blocks. Use the appropriate table below to find the percent slope value to enter as the CAL. value.

Note: Use the table when using 5 feet or 2 meters between the blocks. When a different distance between blocks is used, follow this simple formula to determine the percent slope value:

RISE / RUN x 100 = % SLOPE
(example: 0.2ft./10 ft. x 100=2.0 %)

4. Use this as your Slope Calibration Value (see *System Calibration: Slope Module*, step 3, page 39).

Percent Slope Table 1 (5 feet between blocks...Laser Method)
(5 feet straight edge...Straight Edge with Level Method)

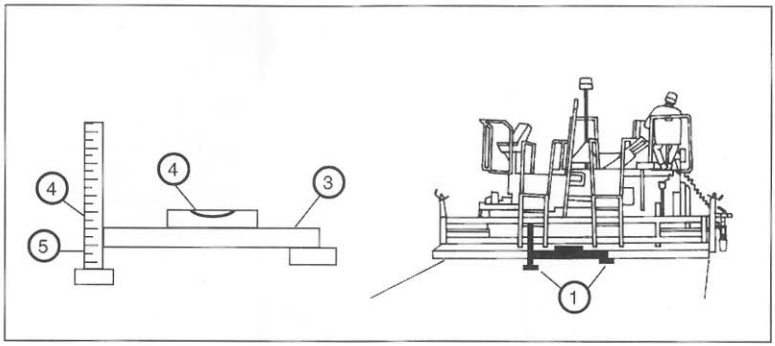
Elevation Difference																
Inches	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1
Feet	0.005	0.010	0.016	0.021	0.026	0.031	0.036	0.042	0.047	0.052	0.057	0.063	0.068	0.073	0.078	0.083
Percent Slope	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.4	1.5	1.6	1.7
Inches Per Foot (Nearest Equivalent)*	0	1/32	1/32	1/16	1/16	1/16	3/32	3/32	1/8	1/8	1/8	5/32	5/32	3/16	3/16	3/16

*Note: 1/32 inch per foot is the minimum value accectable in inch/foot

Percent Slope Table 2 (2 meter between blocks...Laser Method)
(2 meter straight edge...Straight Edge with Level Method)

Elevation Difference																
Millimeters	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	
Percent Slope	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	
Millimeters Per Meter Equivalent	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Straight Edge With Level Method



The following procedure should take place on a hard surface. This method of slope measurement is commonly used and, when care is taken, can result in measurements meeting the accuracy requirements of many jobs.

1. Set the screed on blocks which are 5 feet apart, centered in the width of the screed (use 2 meters between blocks if measuring in metric units). Blocks should be long enough to extend out behind the screed by at least 2 inches (5 cm).

2. Raise fully or lower fully both tow arm cylinders (as shown on page 46 #2).

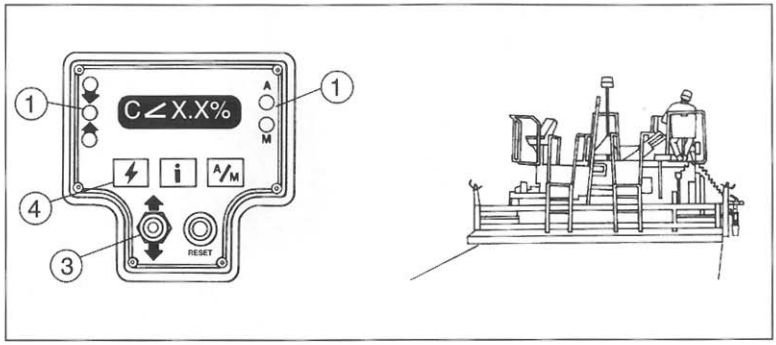
3. Place a 5 foot (2 meter) straight edge across the blocks and place a reliable level on the straight edge.

4. Raise one end of the straight edge until the bubble is in the center of the level.

5. Measure the distance from the bottom of the straight edge to the top of the block. Convert this distance to Percent Slope or Rise/ Run (inches / foot or millimeter/ meter). Refer to the appropriate slope conversion table on page 47.

6. Use this as your Slope Calibration Value (see *System Calibration: Slope Module*, step 3, page 39).

Working Slope Accuracy Check and Adjustment



This method of calibration adjustment is meant for situations where the measured slope is slightly different than desired slope while paving is in process.

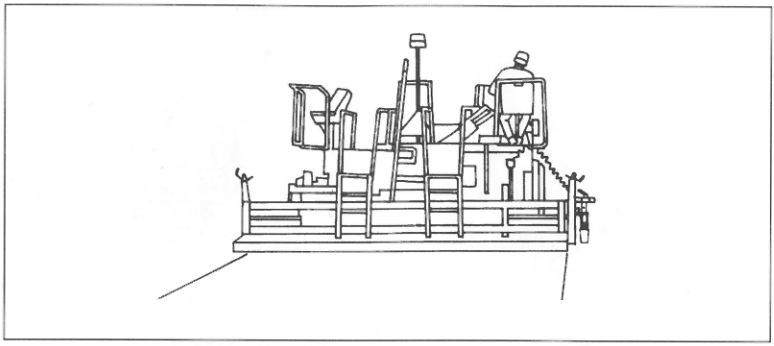
1. Pave with slope control in AUTO and with the On Grade indication for 3 tow arm lengths in distance traveled.

2. Measure the actual slope before roll down. Use a method of measurement which best suits your job accuracy requirements (see Slope Measurement Methods). The actual slope should be the same as the desired slope entered in the R-25 Universal Remote in the Normal Operating Mode. Note the direction of slope measured. (For example, down to the right ◺, down to the left ∠.)

3. If the actual slope is different than the desired slope, step to the CAL. mode of operation by repeatedly pressing the [i] switch until CAL. appears. While in MANUAL, change the CAL. Value to the measured actual slope with the Mat Increase/ Decrease switch (match the direction of slope symbol to the actual slope direction).

4. Press the [⚡] power switch to return to the Normal Operating Mode.

5. Repeat steps 1 and 2 to confirm results.



Paver Operation

In all setups, follow the same procedures that are required with your existing automatic systems.

1. Remove screed lock pins or otherwise release screed for operation.

2. Set the screed on wood blocks or material equal to the desired material depth.

3. Open the tow arm cylinder flow control valves.

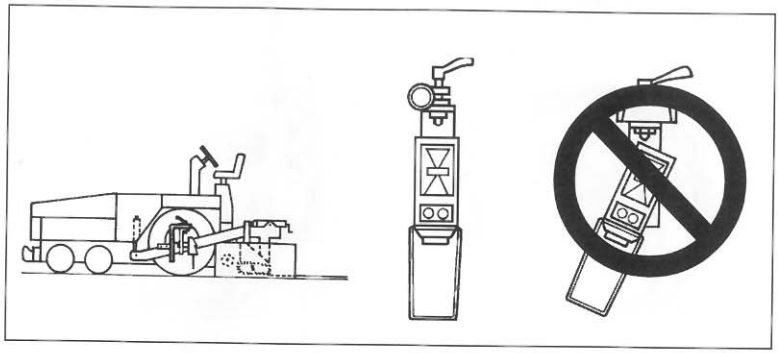
4. Center the tow arm cylinders.

5. Null the screed.

6. Adjust the angle of attack.

7. Set all switches on the paver to automatic.

Screed-Pro
Tracer Plus Setup and Operation

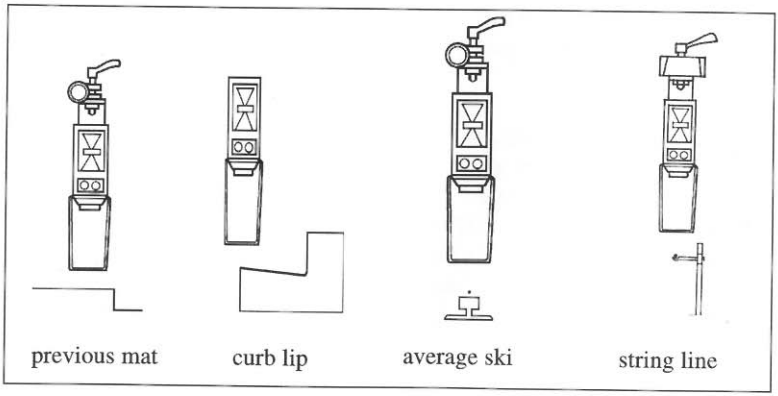


Tracer-Plus Setup

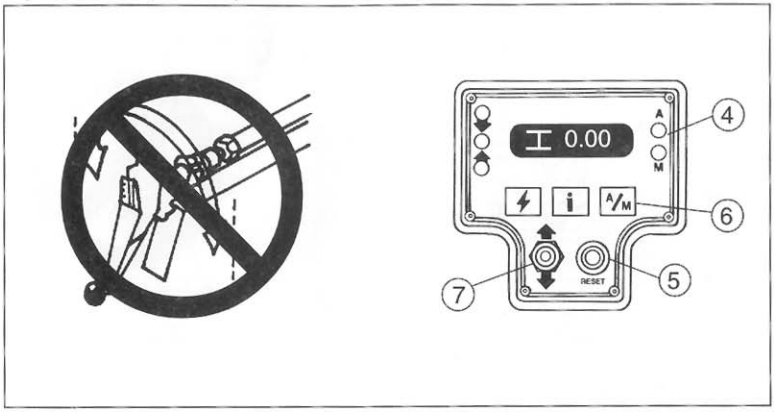
1. Position the Tracer-Plus directly over the reference surface so that the reference bail is 4 to 6 inches (10-15cm) away from the reference surface.

2. Plumb the Tracer-Plus.

3. Center the Tracer-Plus over the reference.



Screed-Pro
Tracer Plus Setup and Operation (cont'd)



4. With the SCREED-PRO in the manual operating mode, pull forward and adjust the screed attack angle until the material depth is correct.

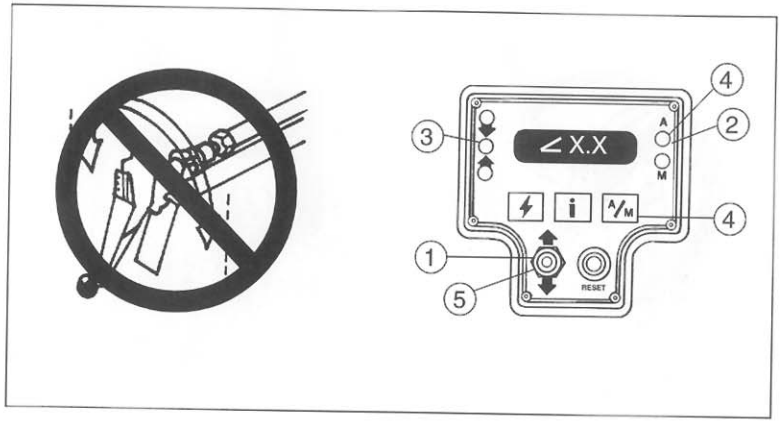
5. Press the RESET button to lock on to the reference.

6. Press the A/M switch for automatic control. The green LED will now be on.

7. Check the material depth. If corrections are required, make small changes with the Mat Increase/Decrease switch. Always wait several tow arm lengths (in distance traveled) before making additional changes.

Note: **DO NOT** use the screed hand cranks while the Screed-Pro is in AUTOMATIC.

Slope Control
Setup and Operation



1. Enter the desired slope into the Universal Remote with the Mat Increase/Decrease switch (note the slope symbol direction).

2. With the SCREED-PRO in the manual operating mode, pull forward and adjust the screed attack angle until the material slope before roll down is correct. Always wait several tow arm lengths (in distance traveled) before making additional changes.

3. Confirm an "On Grade" condition on the Universal Remote.

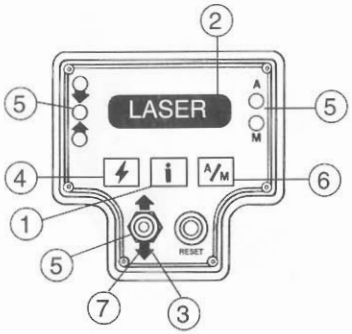
4. Press the A/M switch for automatic control. The green LED will now be on.

5. Check the material slope before roll down. If corrections are required, make small changes with the Mat Increase/Decrease switch. Always wait several tow arm lengths (in distance traveled) before making additional changes.

Note: **DO NOT** use the screed hand cranks while the Screed-Pro is in AUTOMATIC.

Note: When using the LM-25 this procedure assumes slope has already been selectedas the operating mode.

Screed-Pro Laser Control
Setup and Operation



1. With the universal remote connected to the LM-25 Laser/ Slope Interface Module press the [i] switch until MODE is displayed

   One Second delay

2. The current operating mode is now displayed in the window.

3. Use the increase/decrease switch to select LASER.

4. Press [⚡] to return to normal operating mode.

5. With the Screed-Pro in the manual operating mode, adjust the height of the Laser Receiver until a green "On Grade" condition appears on the universal remote. (When using an electric mast the increase/ decrease switch can be used to adjust the elevation of the Laser Receiver).

6. Press the [A/M] switch for automatic control. The green LED will now be on.
   Begin Paving.

7. Check the material elevation before roll down. If corrections are required make small changes with the increase/decrease switch (if using an electric mast) if not manually adjust the elevation of the laser receiver. Always wait several tow arm lengths (in distance traveled) before making additional changes.

Note: This description assumes correct setup of the laser transmitter. (see the laser operating instructions for this procedures).

***Note*: Do Not** use the screed hand cranks while the Screed-Pro is in AUTOMATIC.

Error Code List

This list will assist in troubleshooting problems which may occur with the Screed-Pro Control System.

Error Code	Meaning/Action
01 02	Communication Error between the Universal Remote and ST2-25 Tracer Plus or CSM-30/LM-25 Slope Module /Check cables and connections (clean and tight)
11	Bail Error/Check that the bail is directly under the ST2-25 Tracer Plus (bend back into shape)
12 13	Echo Error/Check for dirt or other material on the transducer

ST2-25 Tracer Plus Transducer Replacement Procedure

If the Tracer Plus is experiencing erratic or inconsistent readings, or displaying Error 12 or 13 on the Universal Remote, the Tracer Transducer may be contaminated or have dirt or material on it. Transducer failure should be considered before assuming any other types of failure.
The Transducer (P/N 5501-0151) is designed to be field replaceable. The following steps should be followed for the removal and replacement of the Transducer.

Removal.

Step 1: Remove the Warranty Label from the transducer clamp ring and remove ring.

Step 2: Lift the transducer up from the housing and remove the two (2) connectors from the tabs.

Replacement:

Step 1: Inspect the transducer of wrinkles in the foil, bent screen, dirt, or a sticker on the back. Remove any stickers on the transducer.

Step 2: Lightly lubricate both O-rings with vacuum grease. Install the larger O-ring onto the Tracer housing and the smaller O-ring on the face of the transducer.

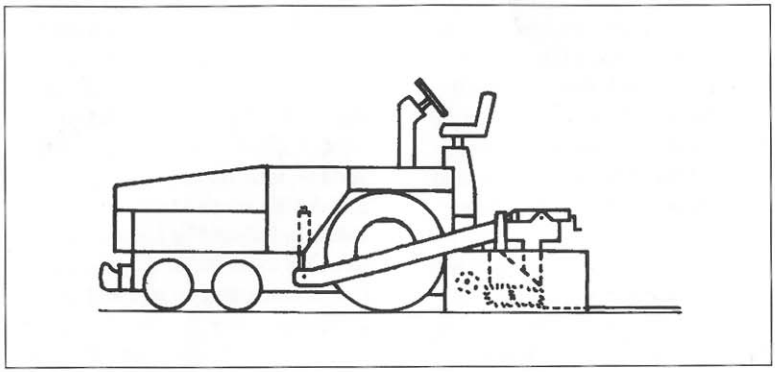
Step 3: Attach the wire connectors to the transducer. The wire with the red stripe goes to the copper colored terminal (connection to back of transducer). Note: The flat side of the connector goes toward the inside of the transducer.

Step 4: Seat the transducer into the housing while taking any slack out of the wires. The connectors fit into the larger machined area of the housing. Ensure the rim of the transducer fits flush with the housing.

Step 5: Screw the transducer ring onto the housing until the ring is fully seated. Check to see that the transducer is not wrinkled from over-tightening. Install new warranty label.

Appendix A

This chapter explains Basic Paver Operating Principles and Terms.



General Description

All asphalt pavers consist of two basic units, the tractor and the screed. The primary functions of the tractor are to receive, deliver and spread the asphalt material in front of the screed, and to tow the screed. The primary functions of the screed are to level and smooth the asphalt surface.

Material Flow

Material flow is controlled by two independent feeder systems, each consisting of a conveyor and auger. The conveyor delivers the asphalt through the flow gate to the auger. The auger then distributes the asphalt evenly in front of the screed.

Free-Floating Screed

All asphalt pavers use the free-floating screed principle. The screed floats on the asphalt surface the same way a boat floats on water. As the screed is towed into the head of material, it will either rise or fall until the screed is traveling in a plane parallel to the direction of travel. Mat thickness is controlled by this rise and fall of the screed.

The screed's tow arms are attached to the tractor in two locations (tow points) so the screed is free to float and level itself on the asphalt surface. As paving continues, the free-floating action of the screed will compensate for any changes in the base surface over which paving is to be performed.

There are two hydraulic cylinders used to lift the screed into the travel position. When the screed is lowered into the paving position, the cylinders have no affect on the screed in the paving position. Ridability and surface texture of the fresh mat are influenced by several variable factors. Temperature and mix design are two of these variables, and should be controlled if the screed is to do its job of producing a mat of consistent texture and thickness.

Since the screed is supported by asphalt beneath it during the paving operation, it is very important that the asphalt have a uniform consistency and temperature. This will ensure best results.

Machine Levelability

Machine Levelability is the ability of the paver to enhance the leveling action of the free-floating screed by compensating for changes in the base surface over which the unit is paving.

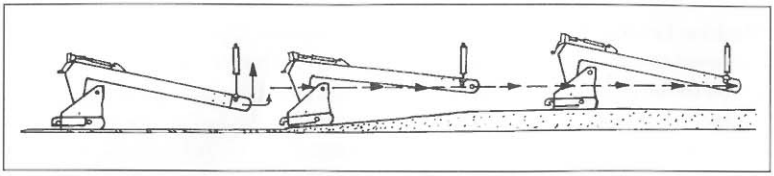
The degree of machine levelability is determined by the length of the screed tow arms and the location of the screed tow points in relation to the wheel base of the tractor.

Machine levelability is the result of maintaining a constant vertical positioning of the tow points. A relatively high ratio of vertical tow point movement to screed reaction is maintained in making a correction in mat thickness.

The reaction time required to accomplish these corrections is proportioned gradually over a distance of approximately 4 to 5 times the length of the tow arm. This travel distance is the same whether the mat thickness is being controlled manually or with automatic screed controls. Controlling the vertical position of the free-floating screed over the surface being paved is the primary factor in producing a level of smooth mat.

Factors such as paving speed, head of material, mix consistency and screed angle of attack will affect the vertical position of the screed. If any of these factors are changed during the paving operation, a change in mat thickness will happen. Understanding the relationship of these factors and controlling them are essential in producing a high quality mat.

Angle of Attack



The angle of attack is the angle that exists between the screed and the surface over which paving is being performed. This angle is a primary factor in regulating the amount of asphalt that will pass under the screed (very important in controlling mat thickness).

If the angle of attack is increased, more asphalt is allowed to pass under the screed causing it to rise to a plane parallel to the surface over which paving is being performed. The screed will continue in this plane as long as all factors remain constant. Decreasing the angle of attack will reduce the amount of asphalt allowed under the screed, causing the screed to drop to a plane parallel to the grade surface.

The angle of attack can be controlled manually by using the depth cranks or automatically by controlling the tow points. **The depth cranks should not be used after initial machine setup on the job when automatics are being used.** Any variations in the angle of attack will affect the smooth ridability of the finished asphalt surface.

Problems to look for related to Angle of Attack:

A. Over correcting with the depth cranks will produce waves in the mat. Allow paver to travel the proper distance after a correction before making another one.

B. Worn bearings in the depth cranks will allow the screed to pivot back and forth or "chatter." This constant changing angle of attack will cause ripples in the finished surface.

C. Oversensitive automatic screed controls will cause a searching condition. This condition will cause changes in the angle of attack, producing ripples or waves in the mat surface.

D. Too many people are adjusting the angle of attack. This adjustments should only be done by the screed person.

Head of Material

The head of material or the amount of asphalt determines the ease by which it flows under the screed and is transformed into a quality mat.

While paving, if the amount of material in front of the screed is varied, you will notice a change in mat thickness. With this variation acting on the screed, the self-leveling screed will move in either direction (up or down) trying to establish its original angle of attack.

The proper amount of material in front of the screed should be at a level so that the auger shaft is just covered. If the head of material is too high, the resistance to forward travel is increased. The screed will rise in an attempt to overcome the increased pressure resulting in a condition which could cause ripples, long waves, increased depth and less density being produced in the finished surface.

If the head of material is too low, the resistance to forward travel is decreased. Then the screed will gradually fall due to the decreased pressure. This condition results in reduced mat thickness and possible voids in the mat. Also, a fluctuating head of material will result in a combination of the previously mentioned mat problems. Any changes in the consistency of the paving material, such as moisture, blend of aggregate or temperature will affect the flow of material under the screed, resulting in mat change. Even the most technically correct operating procedures will not compensate for inconsistencies in the asphalt.

Maintaining a constant head of material in front of the screed is accomplished by controlling the relationship between the flow gates, speed of the two independent conveyors and augers and paving speed.

Paving Speed

The speed of any paving operation should be determined by the rate of asphalt delivery to the paver. The optimum speed for paving is such that the paver is in a continuous operation. Continuous forward travel at constant speed is important in producing a smooth riding finished surface. The fewer the stops or changes in paving speed, the smoother the surface will be, assuming that all of the other variables remain constant.

When the paver is stopped, the screed will tend to settle in the fresh mat. When paving continues, the screed will climb back to its original elevation, which produces a dip in the mat that does not roll out completely. Changes in paving speeds affect the head of material and the angle of attack. Increasing paving speed will decrease mat thickness, while decreasing paving speed will increase mat thickness.

Examples of the most common mistakes that affect the ridability of the finished surface:

A. Variations in paving speeds affect the ridability of the finished surface.

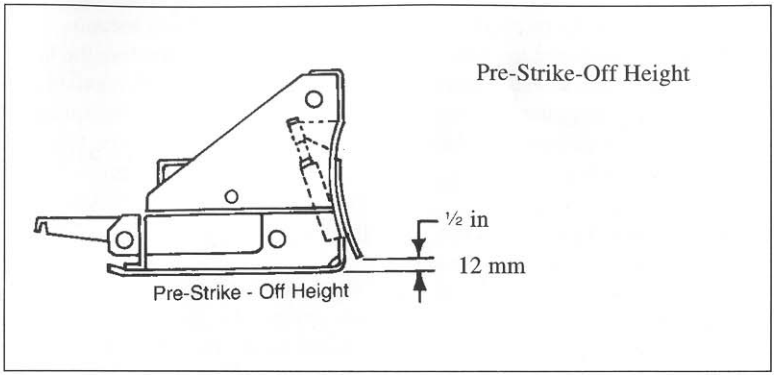
B. Trucks with brakes applied will reduce paving speeds causing an increase in mat depth.

C. Trucks bumping paver can cause marks and ridges in the finished mat.

D. Running the augers empty between loads can cause a dip in the mat.

E. Unequal inflation of drive tires can cause them to slip or break traction resulting in rough or uneven mat.

Pre-Strike Off Shield



The pre-strike off shield controls the amount of asphalt reaching the nose of the screed. The depth and texture of a fresh mat are affected by the elevation of the shield in relation to the screed. If the shield is too high, the excessive amount of material that reaches the screed will cause the screed to rise. In an effort to keep the screed down, the angle of attack will have to be decreased to a position where the screed rides on its nose. The screed will sink into the mat when the paver is stopped; producing a dip in the mat. This position will also cause excessive wear on the screed.

If the pre-strike off shield is too low, the mat depth will decrease due to do enough supporting material. To try and maintain proper depth, the angle of attack will have to be increased. This position will also cause a dip in the mat, because all the weight is now at the rear of the screed. Proper adjustment of the shield is required to give a consistent texture across the mat.

Automatic Screed Controls

The purpose of automatic screed control is to assist the paver in producing a smooth and level riding surface. Automatic screed controls do this by controlling the elevation of the screed tow pointing in relation to a reference surface.

Hydraulic cylinders located at the forward end of each tow arm raise, lower or maintain the elevation of each tow point. These cylinders are activated by hydraulic valves which receive electronic signals from a sensing unit.

The screed responds by rising, falling or staying level in relation to the grade. By keeping the tow arm tow points at a fixed elevation in relation to a grade reference, the screed is able to produce a smooth and level asphalt surface, even though the paver is traveling over an irregular base.

When using automatic screed controls, the mounting locations of grade and slope sensors are an important consideration in obtaining the best performance.

In selecting their location in relation to the screed, you must remember that errors are introduced at the tow points (as the tractor moves over a rough surface) and at the screed itself (speed changes, material variations, etc.). Therefore, the sensor locations must be at positions where both types of errors can be sensed. The mounting location must also take into consideration the lag time inherent to the self-regulating screed. There are three mounting locations to consider: at the tow point, at the screed, or somewhere between the screed and the tow points.

When you position the sensors at the tow points, you get maximum sensitivity of vertical movements of the tractor and the tow points. However, this location cannot sense vertical movements at the screed caused by variations in paver speed, mix temperature, material density, etc.

Positioning the sensor at the screed also has some drawbacks. Even though this location accurately senses what has just been done to the mat, it provides no anticipation of what effect the next external disturbance will have. The problem with sensing at this point is one of making a stable system. Remember, from the description of the self-leveling floating screed, there is no vertical displacement of the screed until after the paver has traveled at the proper distance forward. While an error sensed in grade or slope would result in a correction in the hydraulic system, balancing of the sensor would result only when the screed reached the new elevation, causing over-displacement of the

sensing mechanism. Under conditions of forward travel, the system would be in constant oscillation.

It is logical that grade and slope control sensors be located somewhere between the screed and tow points. For the best accuracy of the finished mat, the sensors should be located close to the screed. For the best anticipation of changes and stability of the screed, the sensors should be located close to the two points.

Therefore, the best location of the grade and slope sensors should be located at a point one-third to one-ninth the tow arm length, forward of the screed. For example, if the tow arms are nine feed long, the sensors should be located from one to three feet ahead of the leading edge of the screed. With the sensors placed within this zone, the best utilization of the proportional response self-leveling system can be made.