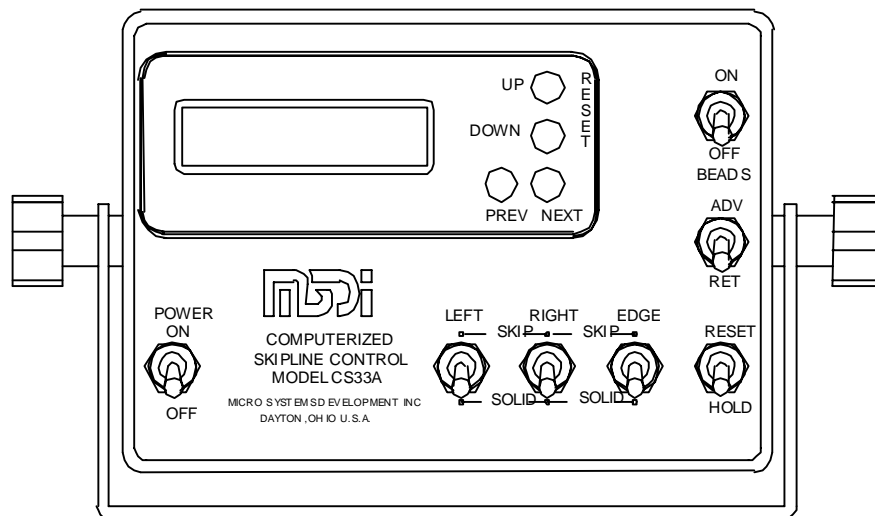


Instruction Manual...

MODEL CS33A SKIPLINE CONTROLLER Version 2.3



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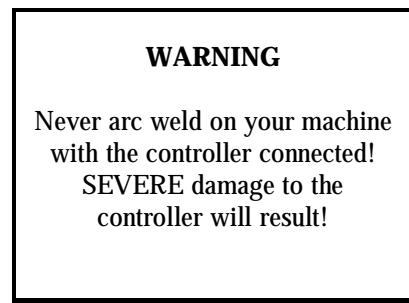
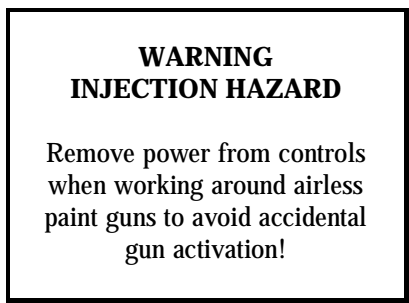
CONGRATULATIONS!

You have purchased the most advanced skipline controller available for pallet striping machines.

INTRODUCTION

Take time to read through the installation and operation guides before you begin installing your system. By doing this, you will find the installation is easier, neater, and more convenient. Because every striping machine is different, you may have to modify and adapt these instructions to fit your particular machine.

You will be installing a Control Unit, one or more solenoid operated air valves, a footage sender unit, and perhaps a battery.



INSTALLATION

PRELIMINARY STEPS

Look over your machine to determine the best location for the controller. If you have guns on both the left and right sides of the machine, you may want to consider installing a double connector cable and another mounting yoke so that the controller can be moved to the active side of the truck. The controller can, of course, be cab mounted for one man machines.

Check the location of the paint guns and bead guns or dispensers. The solenoid valve for each gun should be located on the same side of the machine as the gun to keep the air hoses short. If your machine permits the gun carriage to be moved from one side to the other, the solenoids should perhaps be mounted centrally, so that the same hoses will reach the guns on either side. Verify that the control box cable will reach from the control box to the solenoids.

Check the documentation for your painting machine to determine the maximum allowable control pressure to the guns. The standard valves for the CS33A controllers require a minimum of 50 PSI to operate dependably. If this pressure exceeds the allowable control pressure for your guns, you should use the B901022A valves instead. These valves require only 30 PSI. If your control pressures are over 150 PSI, you must install a regulator to reduce the pressure to something below 150 PSI. Be sure that your regulator can supply a sufficient volume of air to operate the valves quickly. Uneven line starts can usually be traced to insufficient air flow to the solenoid valves.

The sender assembly (the sender, pickup wheel and bearing) should be located so that the pickup wheel rides on the top tread surface of one of the large tires. Don't mount the sender on the front caster tire as it occasionally loses contact with the pavement.

CONTROL UNIT INSTALLATION

The Control Unit is supplied with a mounting yoke that mounts conveniently to any part of your machine. Be sure that the mounting is sturdy enough to hold the controller in place while you operate the switches. SEE THE BOX ON PAGE 3 REGARDING WELDING!

The controller cables come from the rear panel of the controller. Allow enough clearance so you can adjust the controller for a comfortable mounting angle and also get to the connector to remove and replace it.

SOLENOID VALVE INSTALLATION

The Solenoid Valves should be mounted to a metal plate or to individual mounting clamps (Appleton clamps) in the vicinity of the guns. Assuming you will have two centerlines and one edgeline, you will mount four valves near the left carriage and two valves near the right carriage.

SENDER INSTALLATION

The footage sender installation is the most critical part of installing the CS33A system. A poor mounting method will result in inaccurate and inconsistent line and cycle lengths.

The footage sender assembly must be mounted so that it rides firmly on the tread surface of one of the tires. The sender assembly should be mounted from a movable arm and held against the tire with a small air cylinder and retracted by a spring. Be sure to provide a method of disengaging the drive wheel so that the sender is not in contact with the tire while you are driving to the job. Speeds in excess of 30 MPH will damage the sender. When locating the sender wheel against the tire, avoid letting the wheel fall into a groove in the tread. It must consistently ride on the outer surface of the tread. See Fig. 5 for two mounting suggestions.

PLUMBING

Connect the air output port on each solenoid valve to the control input port on each gun using appropriate high pressure rubber hose. When connecting the paint guns to the valves, make sure that the hoses are exactly the same length and as short as possible. Use thread compound or tape on all connections. Connect all of the solenoid valve input ports to the main pressure line on your machine. This plumbing may be done with 1/4 inch copper tubing and flare fittings. Because of the vibration common to these machines, allow plenty of slack in the tubing in the form of U's and loops. You should also provide a master valve in this line to allow the control air to be shut off. The valves provided by MSDI do not require any filtering or lubrication of the air so no additional components will be needed. Do not obstruct the exhaust ports on the valves or install mufflers. The air in the guns must be free to exhaust quickly to assure uniform line lengths.

WIRING

Refer to the wiring diagram in this manual for color codes.

Install the controller cable using the supplied tie-wraps. When installing the cable, make sure that you provide enough slack for adjustment of the controller unit and enough slack elsewhere so that none of the cables or wires are placed under any tension or strain. Don't connect the cable connector to the controller unit just yet. Route the cables so that they will not contact the engine, engine muffler or the compressor, or be in the direct path of the hot exhaust gasses from the engine.

Connect the solenoid wires from the 5-conductor and 3-conductor branches of the cable to the solenoid terminals according to the wiring diagram. The common wire (red) can connect to either solenoid terminal, and the signal wire (green, white, brown or black) will then connect to the other terminal.

Connect the sender wires to the 4-conductor branch of the cable. If you are using the zero-speed sender, connect three wires, the red sender wire to the red cable wire, the white sender wire to green cable wire and the black sender wire to both the black and the white cable wires joined together. Use crimp-on butt splice connectors or fully insulated push-on tab terminals to join the sender wires to the cable wires. If you are using the near-zero-speed sender, connect the two wires from the sender to the green and white wires in the cable. It doesn't matter which sender wire you connect to the green or white cable wires, just be sure to use only the green and white wires from the cable. Individually insulate the unused red and black wires from the cable. If they touch each other or the machine frame, the fuse in the Control Unit will blow. If you are using a different type of sender, connect it according to the wiring diagram supplied.

Connect the battery cable to the vehicle electrical system. It is a good idea to provide a master power switch in the vehicle to remove power from all of the controller wiring.

Check the instruction manual for your striper to determine the best place to obtain 12 volts from the electrical system. Appropriate 0.250 inch tab terminals may be procured locally to connect to the striper's electrical system. Be sure that the polarity of the wires is correct, red is positive, black is negative (grounded).

THE CS33A CONTROL PANEL

Now is a good time to examine the control panel to see what the various switches do.

The panel has seven toggle switches that are ordinarily used to operate the CS33A, four pushbuttons that are used primarily for setting up the skipline and matching the controller to your machine.

The POWER switch controls the battery power to the controller and to the gun solenoids.

The LEFT, RIGHT and EDGE switches control the paint guns. These switches are OFF in the center position. When pushed upward, the gun(s) will paint a skipline with the cycle and paint lengths displayed on the LCD screen. When pushed downward, the gun(s) will paint a solid line.

The RESET/HOLD switch permits easy control of the guns for centerline painting. When the switch is placed in the HOLD position, all guns will stop painting, regardless of the positions of the LEFT, RIGHT and EDGE switches. If you are painting a double line, moving this switch to the center (RUN) position will start both lines at exactly the same time, in perfect alignment. The internal cycle counter will also restart at the same time. When this switch is moved to the RESET position, the internal cycle counter is reset and the skipping gun(s) are turned off. The solid guns will continue to paint. This switch is useful for aligning a retrace on an old skip line, while continuing to paint a solid line with the other gun.

The ADVance/RETard switch shifts the position of the skip cycle about one foot for each second that it is held. ADVance will make the paint and/or cycle longer, RETard will make them shorter.

The BEADS switch controls the bead guns. These guns will come on only if the corresponding LEFT, RIGHT or EDGE paint switch is turned on. If the machine is standing still, the bead delays are disabled to allow testing the guns.

The MENU BUTTONS, labeled PREV, NEXT, UP and DOWN allow you to access all of the setup, calibration and stored values in the CS33A. Their use will be discussed later.

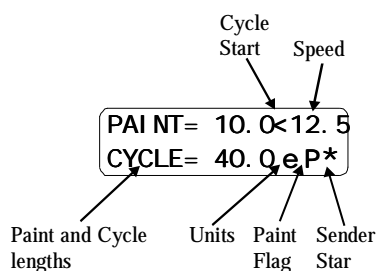
TESTING THE INSTALLATION

Now that the system is wired and plumbed and you are familiar with the controls, we will check out the controller wiring and also get some practice with the switches and the display on the Control Unit. Don't start the engine yet.

Make sure that the POWER switch on the Control Unit panel is turned OFF. Attach the circular cable connector to the Control Unit. Be sure that the connector is firmly seated in the receptacle on the back of the Control Unit. Set the SKIP-SOLID switches to OFF (center position), set the RESET-HOLD switch to OFF (center position) and set the BEADS switch to OFF.

Turn the POWER switch ON. The display will "sign-on" with the manufacturer's name, then the model number of the controller, and the version number. After a few seconds, the display will switch over to the "MAIN DISPLAY". If you don't see the "sign-on", carefully recheck the battery connections. Make sure the battery leads are not reversed. Check the fuse in the CS33A. If it is blown, make sure that none of the red cable wires are touching the machine frame. Also, make sure that the battery is charged.

The contrast of the display can be adjusted by pressing the UP or DOWN buttons to the right of the display. The contrast can be adjusted only if the main display is showing and the RESET/HOLD switch is in HOLD position. There are eight levels of contrast, one of them is sure to be "just right." The appearance of the display is affected by the viewing angle, so position the controller as it will be while you are using the machine. Adjust the contrast now for the clearest display from your normal operating position. The contrast setting will be saved and recalled the next time you turn the controller on.



At the left side of the display you will see the current PAINT and CYCLE lengths. In the upper right corner you will see the current speed. It will read 0.0 unless the striper is moving. In the lower right corner you will see a star (asterisk). This star will blink on and off as sender pulses are received. This star is also a battery low indicator. If the battery begins to run down, the star will change to a "B". This is a warning that the battery needs to be charged soon. Immediately to the left of the star is a "P". This "P" appears when the Control Unit is in the Paint portion of the cycle, and disappears while in the Skip portion of the cycle. The Cycle Start arrow points to paint if you have chosen to begin your cycle with paint, and points to cycle if you will begin with a skip. The Units indicator will be 'e' for English units (feet and miles per hour) or 'm' for metric (meters and kilometers per hour).

Turn the sender wheel a few revolutions forward or backward. You should see the Sender Star blink on and off as the sender wheel turns. If the star doesn't blink, carefully check the wiring and terminals where the sender connects to the Control Unit cable. Make sure all connections are tight and that the color codes are correct. Make sure that the drive tang (a small square shaft) is installed in the bearing assembly to couple the

rotation of the wheel to the sender shaft.

When power is first turned on, the CS33A puts itself in HOLD mode to prevent accidental release of paint in case the SKIP/SOLID switches were left on. Move the RESET-HOLD toggle switch to RESET position, then release it. This takes the CS33A out of HOLD mode and puts it in RUN mode.

Put your ear close to the left paint solenoid valve and turn on the LEFT SOLID switch. You should hear the valve click. Now listen to the left bead solenoid as you turn on the BEADS switch. You should hear this valve click. Turn the BEADS switch off and listen for another click from the left bead solenoid, then turn the LEFT SOLID switch off and listen for a another click from the left paint solenoid. Repeat this test, using the RIGHT SOLID switch and listening to the right paint and beads solenoids and then repeat yet again for the edgeline solenoids. Of course, if you are not using all six solenoid valves, you won't be able to test the valves that are not installed. Later on, during the Setup Procedure, we will turn off any unused valves so the CS33A automatic circuit checker will not continually "complain" about open circuits.

If you didn't hear the clicks from all of the solenoids, repeat the above solenoid test, but this time watch the display on the controller. If any circuit is open or shorted, the display will tell you. Short circuits will be indicated as you turn the SKIP-SOLID switch to SOLID. Open circuits will be indicated as you turn the SKIP-SOLID switches off (center position). Any solenoids that are not installed will always show as open circuits. If the display indicates a problem with a solenoid that you have installed, recheck the connections to that solenoid. If the problem is an open circuit, especially check that the push-on terminals are properly crimped to the cable wires. If a short is indicated, look for pinched or abraded wires shorting to each other or to the machine frame. If ALL of the guns indicate open circuit, the problem may be in the red common supply wire to the solenoids.

This completes the preliminary tests. The next step is to set up the guns, calibrate the sender to your machine, and set the delays.

SETUP AND CALIBRATION

In this section, we will be using the CS33A menu system to configure the CS33A to match your painting machine. All of the settings you make here will be saved in a non-volatile memory in the Control Unit and will not have to be re-entered again unless you change the configuration of your machine (such as to add a gun, etc.) Refer to the two MENU CHARTS later in this manual to see how the menus are organized and to see how to get from one menu to another.

UNUSED GUNS

The CS33A includes special circuits that monitor the current drawn by the gun solenoids. Since it doesn't make any sense to monitor solenoids that are not installed, there is a menu that allows you to "tell" the CS33A which solenoids you have installed. The system is shipped with all solenoids enabled, so if you installed all six solenoid valves the CS33A is already set up properly and you may skip over this section.

Turn the PAINT and BEADS switches OFF. Press the PREV button once so the display reads "SETUP MACHINE?". Then press UP to indicate yes. Then press the NEXT button several times so that the display reads "SET GUNS?". Press UP to indicate yes. For each gun in turn, the display will ask if the gun is installed. If it is installed, press UP for yes and if it isn't, press DOWN for no. Then press NEXT to select the next gun and repeat. After all six guns have been set, press NEXT and the display will switch to the "SET DELAYS?" menu. Just allow the display to "time-out" and return to the Main Menu again. The guns that have been "turned off" by this procedure will never be turned on, nor will they be tested for shorted or open circuits.

If, at a later time, you decide to install gun solenoids that have been turned off, you will need to repeat this procedure to turn on the new guns.

SENDER CALIBRATION

The Model CS33A incorporates an automatic calibration feature which allows accurate operation with anything from about 0.08 to 15 sender pulses per foot. This makes it unnecessary to perform difficult and time consuming sender position adjustments to achieve good accuracy. The Sender Calibration procedure adjusts the CS33A to your sender, pickup wheel and tire size or to your vehicle speedometer system if you are using the transmission signals.

You will need to tape off an exact distance of 100 feet in your parking lot, driveway or other suitable place. Measure this distance carefully, as an error here will be reproduced in every skipline you paint. If you prefer to calibrate in meters, set the controller to metric and measure off a distance of 30.5 meters. Substitute this distance for 100 feet in the following instructions. **No recalibration is necessary when changing from English to metric units.** Calibrating in English automatically calibrates metric and vice versa.

Roll your machine to one end of the marked 100 foot path. Carefully line up some part of the machine with the mark indicating the beginning of the 100 feet. A good point to line up on is the center of the tread "footprint" of the tire that drives the sender if applicable or the rear tire nearest the left paint carriage.

Press NEXT repeatedly until you see "SETUP MACHINE?". Press UP for yes. The display will show "SET SENDER RATIO?". Press UP for yes. The display will show "SENDER PULSES XX" with the current setting instead of 'XX'. The value set here will determine how the CS33A reads the signals from the sender. Start with this value set to 'X1' so that the CS33A will read only one count for each pulse. When you do the rolling calibration next, if you don't get enough pulses, come back to this menu and set the value to a higher value, then repeat the rolling calibration.

Press NEXT and the display will show "CALIBRATE SENDER?". Press UP for yes. The display will ask "ADJUST VALUE?". Press DOWN for no. The display will say "PUSH ADV, ROLL 100 FEET."

Recheck that you are lined up on the mark, then momentarily press the ADV switch. Roll the machine to the other mark at the end of the 100 foot path, stopping carefully on the mark. Don't let the machine roll backwards. Then press ADV again. The display will show the actual number of counts from the sender. Write this number down. The display will then say "ADJUST VALUE?". Press DOWN for no, then press NEXT to store the new count value. If the count was between 510 and 5000, the CS33A is now calibrated. If you didn't get between 510 and 5000 pulses, you will need to increase the Sender Ratio. Calculate the new Sender Ratio by dividing 1000 by the number of pulses, and set the Sender Ratio to the closest number. For instance, if you got 33 pulses, divide 1000 by 33. The answer is 30.303. The closest Sender Ratio is 32, so set the sender ratio display to SENDER PULSES X32. Now, repeat the rolling calibration and your pulses should be between 750 and 1500 pulses. You may want to set the Sender Ratio one step higher if you got under 750 pulses.

For even greater accuracy, repeat the 100 foot roll several times, writing down the count values each time. The count values should all be very close to each other, not more than one or two counts off. Now, average the count values. To do this, add up the count values, then divide the result by the number of values that you added. Write down the result of this division, this is the average of all the count values. Enter the SETUP MACHINE menu and go to "CALIBRATE SENDER" and then to the "ADJUST VALUE?" display. This time, press UP for yes. The current count value will be displayed. Using the UP and DOWN buttons, adjust the value shown to the average count value you got from your calculation above. When you are finished, press NEXT and the new value you entered will be stored in the CS33A.

To check your calibration, roll the machine to the end of the 100 foot path. Line up the machine with the mark. Display the TOTAL FOOTAGE counter and reset it to zero by pressing UP and DOWN simultaneously. Roll the machine to the other end of the path and then read the counter. The counter should read 100.0 feet. If it doesn't, repeat the calibration or manually adjust the Calibration Value.

If you get the message “CALIBRATION BAD...CALIBRATION CANCELED”, it indicates that the CS33A either received too many or not enough pulses. The actual pulses received will be indicated on the display. Read this number, and if it is over 5000 go back to the SENDER RATIO menu and set it to a lower number. If it's already at X1, you will have to modify your sender to reduce the pulse rate. If the pulse count is under 510, go back to the SENDER RATIO menu and set it to a higher number. If the Sender Ratio is already at X64, you will have to modify your sender to increase the pulse rate. In either case, you will have to repeat the rolling calibration after you change the sender ratio. As a goal, try to calibrate for 750 to 1500 pulses. This provides the best mix of accuracy and speed.

If you are calibrating with a Sender Ratio of X4 or higher, try to do the rolling calibration while travelling at your normal striping speed to get the best accuracy.

SETTING DELAY TIMERS

The delay timers are used to compensate for the time it takes for the air pressure to build and exhaust in the control lines and the guns, the response time of the solenoids and guns, and the time for the paint and beads to reach the roadway. An additional distance delay is provided to align the beads dispensers or guns with the paint line. Proper alignment of the beads can save 10 percent or more in beads consumption.

Setting the timers involves first setting the bead gun distance, then painting and carefully measuring some test lines. You may want to do your first trials with water in the system, but for best accuracy, the final test should be performed with paint.

BEADS DISTANCE DELAY

Measure the distance between the point at which paint strikes the pavement to the point at which the beads hit the pavement. (This is NOT necessarily the same as the spacing between the gun nozzles.) Go to the “SET DELAYS” menu and select “BEAD GUN DIST”. Using the UP and DOWN buttons, adjust the value to the distance you just measured. Press NEXT to store the value.

PAINT DELAY TIMER

Re-enter the “SET DELAYS” menu and make sure that all four timers are set to zero (don't change the “BEAD GUN DIST”.)

Go to the “SETUP SKIPLINE” menu and set the PAINT for 10 feet and the CYCLE for 20 feet. Set the HOLD/RESET switch to HOLD, the BEADS switch to OFF and either RIGHT or LEFT gun switch to SKIP.

Start the compressor and set all the pressures to their normal values.

Switch the HOLD switch to RUN (center) position and paint three paint/skip cycles at your normal painting speed. While you are painting, take note of the speed on the speedometer.

Measure the length of the second paint/skip cycle from the beginning of the second paint line to the beginning of the third paint line. This distance must be 20 feet. If it isn't, recheck the Sender Calibration as described above. If the Sender Calibration checks out OK, you should check your paint gun to make sure that the mechanism is not sticking or operating sluggishly, that the orifice is clean, and that any regulator that you may have in the control air line is large enough to activate the valves quickly. If the valves and guns are OK, manually adjust the calibration to **This is a critical value as an error here will cause errors in the footage counters and all of your other settings. Be sure that this calibration is accurate! Get this value right before continuing.**

Now measure the length of the second paint line. The goal here is to make the paint line exactly 10 feet long. If

the line is too long, you will have to insert some paint-on delay, and if the line is too short, you will have to insert some paint-off delay.

Look at Table 1. This table will convert a length error into a timer value to be inserted into a timer. Read down the left column for the speed you were moving. Then look across the top for the distance error in inches. From this distance, drop down to the line with your speed and read the delay time to be inserted.

For instance, suppose that your paint line came out to ten feet six inches (10'6") and you drove your machine at 8.1 MPH. Since the paint line should have been exactly ten feet, the error is 10'6" — 10' = 6". Look down the left column of TABLE 1 for 8.1 MPH, then look across the top row of the table for the distance error, which is six inches. Now look down the six inch column until you get to the row of numbers to the right of 8.1 MPH. The number at that intersection is 0.042 seconds. Since the paint line was too long, you must enter a 0.042 second delay into the Paint-On Delay timer.

In summary, calculate your distance error and look up the timer value that is needed to correct the error. Lines that are too long will need some On Delay. Lines that are too short will need some Off Delay.

Use the pushbuttons to enter the "SETUP MACHINE" menu. If your line was too long, go to the "PAINT ON DELAY" screen, but if your line was too short, go to the "PAINT OFF DELAY" screen. Use the UP and DOWN buttons to set your timer value on the display. Then press NEXT to save the value in memory.

Check your new timer value by painting another three cycle pattern and measuring the paint length. It should be very close to 10 feet. If you want, you may try adjusting the timer up or down a little to "fine tune" the timer and get a more exact line length.

BEADS DELAY TIMER

The BEADS timer can be adjusted now to align the beads precisely with the paint. Because the CS33A controller includes a beads distance delay, the beads timing and alignment will be accurate at any speed.

The first thing to do is to get the beads line adjusted to ten feet long. Then we will align the paint and the beads lines. If you are using blow-off nozzles, turn them off for now.

Turn the BEADS switch ON and paint another 3 cycle pattern as before. This time, look at the second paint line and measure the length of the bead pattern. Don't worry about alignment with the paint line yet. If the bead line is over ten feet long, look up the error in Table 1 as you did for the paint line. Then set the time from the table into the BEADS ON DELAY timer. If the bead line is too short, set the time from the table into the BEADS OFF DELAY timer. Don't forget to press NEXT to save the values.

Now paint another set of lines as before and measure the distance between the point where the paint line starts and the point where the bead line starts. Look up the timer value needed in Table 1 where the speed row crosses the distance error column, just as you did before. Write this number down.

If the paint line starts first, we must delay the paint to align with the beads. By adding the same delay to both the Paint-On Delay timer and the Paint-Off Delay timer, the paint line length will not change, but the line will shift. To insert the delays, read the current value in the Paint-On Delay timer. Add the value from the table to the current timer value and change the timer to this new value. Go to the Paint-Off Delay timer, read the current value. Add the value you just got from the table to the current value of the Paint-Off Delay timer and enter the new value into this timer. Be sure to press NEXT or PREV after each new value is entered to save it.

If the bead line starts before the paint line, we must delay both the Beads-On and Beads-Off times to delay the bead line without changing its length. Read the current BEADS ON DELAY value, add the number you got

from the table, and enter this new value into the timer. Repeat for the BEADS OFF DELAY. Be sure to press either PREV or NEXT after entering the values to save the new values.

This completes the setup and calibration of the CS33A Skipline Controller.

OPERATION

CONTROLS

This section will add some additional detail on the panel controls to the Front Panel section earlier in this manual.

The CS33A has four pushbuttons and seven toggle switches on the panel. The pushbuttons are used mostly for setting up the controller, and the toggle switches are used for normal everyday operation.

The pushbuttons are used to select menu items and to change the values that are stored in the CS33A. You are probably already familiar with the pushbuttons from the Setup Procedure above.

The toggle switches will be used much more often than the pushbuttons. They are:

POWER

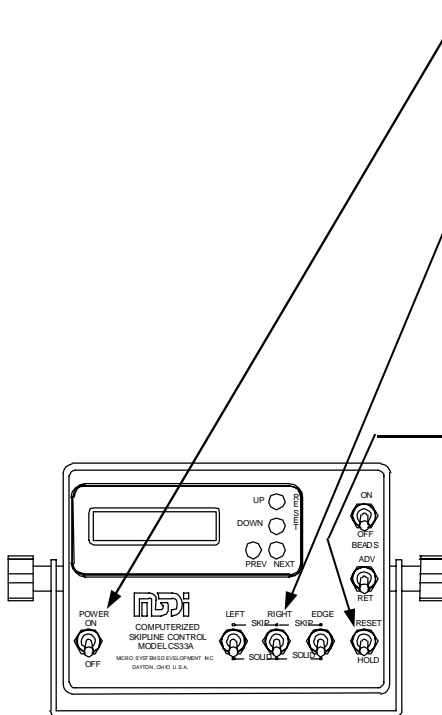
This switch turns the controller and solenoids on and off. The guns are locked off after power is first turned on to prevent unwanted painting. The lock is released by momentarily pushing the RESET/HOLD switch to RESET.

PAINT

These three switches are marked LEFT, RIGHT and EDGE. Each switch has three positions. The Center position is OFF, no paint or beads will be applied. The upper position is SKIP, and the paint gun(s) will paint a skipping line according to the PAINT and CYCLE values. The lower position is SOLID and the paint gun(s) will paint a continuous line.

RESET/HOLD

This is a three position switch. The Center position is RUN, and all selected guns will paint normally. The HOLD position stops all guns and resets the cycle counter. When the HOLD switch is returned to the RUN (center) position, the cycle counter will start at the beginning of a cycle, and all guns set to SOLID will begin painting immediately. The guns set to SKIP will also begin painting if the BEGIN PAINT ON HOLD RELEASE in the SETUP SKIPLINE menu is set. If the BEGIN SKIP ON HOLD RELEASE is set, the guns set to SKIP will not paint, but will skip until the skip length has been measured off and will then begin painting. The RESET position of this switch is identical to hold, except that it does not affect guns painting SOLID lines. The guns painting SKIP lines will be stopped while the switch is held in RESET position, and will start a new cycle when the switch is released.



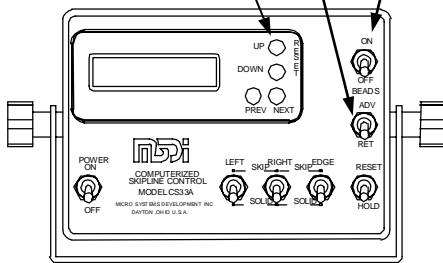
ADV/RET

This switch adjusts the skipline position to match a previously painted line. Pressing the switch to the ADV position moves the skipline farther out in front of you, while RET brings it in closer. If CYCLE-TRACK is turned on, the ADV and RET operation will also adjust the SKIP and CYCLE values stored in the controller. See CYCLE-TRACK below for more details.

BEADS

The BEADS switch turns the bead guns or dispensers on. The bead guns will be delayed according to the SETUP DELAYS menu to assure accurate alignment of the beads with the paint line. If the machine is not moving, however, the bead delays are disabled and the bead guns will work without delay. This is to allow for testing the bead guns without manually turning the sender wheel.

Menu Buttons



SETTING ENGLISH OR METRIC

The units of measure are chosen in the SETUP SKIPLINE menu. Units can be changed at any time, even while painting. The controller will convert between units to the nearest equivalent. When set to English, all distances are in feet, and the speedometer reads in miles per hour. When set to metric, all distances are in meters, and the speedometer reads in kilometers per hour.

To change units, press NEXT to get to the SETUP SKIPLINE menu and press UP to enter the menu. The display will indicate the current units. Press UP or DOWN to change to your choice, then press NEXT or PREV to exit the menu.

SETTING THE SKIPLINE PATTERN

To set the pattern, press NEXT to get to the SETUP SKIPLINE menu and press UP to enter the menu. Press NEXT to skip over the units setting, then use the UP and DOWN buttons to adjust the Paint Length. Then press NEXT to set the Cycle Length in the same way. When you are finished, press NEXT again to save the values.

SKIPLINE FAST ADJUST

When actually painting and the Main Display is showing, the UP and DOWN buttons lengthen and shorten the Cycle Length by 0.1 feet (0.03 meter) for each press. If the controller is on HOLD or RESET or a menu is displayed, these buttons either change contrast or menu values.

SETTING THE REPAINT FEATURES

The CS33A provides three features, AUTO SKIP RESET, CYCLE-TRACK and CYCLE-LOCK, that are especially useful for repainting old roadway lines.

USING AUTO SKIP RESET

The AUTO SKIP RESET function automatically resets the skipclock whenever a new skipline is started. This makes it simpler to repaint an old line since you don't have to use the RESET switch to restart the clock. If your job requires that you maintain a constant spacing even through intersections, this feature can be turned off.

If one line is painting a skip and a second skip is turned on, the cycle will not reset. The second line will follow the pattern for the first line.

To enable AUTO SKIP RESET, go to the SETUP SKIPLINE menu, select AUTO SKIP RESET, and use UP or DOWN to turn it on or off. It will remain the way you set it until you change it.

USING CYCLE-TRACK

The CYCLE-TRACK system will automatically adjust the cycle length to adjust the CS33A to old prepainted lines. The cycle length will shorten 0.1 feet (0.03 meter) whenever you operate the RETARD switch three times without operating the ADVANCE switch. Likewise, if you operate the ADVANCE switch, the cycle length will be lengthened. Depending on how often you operate the ADVANCE or RETARD switch, these effects can take place over several cycles. With some practice, you will be able to judge exactly how many times to operate the switch to correct the line perfectly. **Paint length is never changed.**

To enable or disable CYCLE-TRACK, go to the SETUP SKIPLINE menu, select the CYCLE-TRACK submenu, and use UP or DOWN to turn it on or off. It will remain the way you set it until you change it.

USING CYCLE-LOCK

The CYCLE-LOCK feature allows your painting machine to measure old skiplines 'on-the-fly' so you can repaint an old line without measuring it first.

To enable the CYCLE-LOCK system, go the SETUP SKIPLINE menu, select the CYCLE-LOCK submenu, and use UP or DOWN to turn it on. Unlike CYCLE-TRACK, CYCLE-LOCK turns itself off after each use.

The ADV switch changes function when the CYCLE-LOCK is enabled. It is used to start and stop the measurements.

If you have chosen BEGIN PAINT ON HOLD RELEASE in the SETUP MACHINE menu, you will start your CYCLE-LOCK measurement at the beginning of a paint line. If you have chosen BEGIN SKIP ON HOLD RELEASE, you will start your CYCLE-LOCK measurement on a skip, at the trailing end of a paint line.

To use CYCLE-LOCK, first enable it as described above. Roll the machine to the beginning of a paint line or the beginning of a skip depending on your set up described above.

If you want to paint the line as you measure it, turn the appropriate gun switches to SKIP position. If you want to measure only, leave the gun switches OFF (center position).

Press the ADV switch to begin measuring and start rolling the machine along the line. The CS33A will measure the distance the machine moves.

When you come to the end of the current paint line (or skip), press ADV again, and continue rolling the Machine. When you come the end of the skip (or line) press ADV a third time. The display will now indicate the actual paint and cycle lengths that the machine measured, the CYCLE-LOCK system will turn itself off, and the ADV switch will return to its normal function. If you are painting, you can continue to paint with the new cycle and paint lengths that you just measured. Of course, you can use the CYCLE-TRACK to make adjustments as necessary and the display will always show you the actual lengths of the paint line and the cycle.

The measurements made with the CYCLE-LOCK system replace the previous paint and cycle lengths stored in the CS33A and will remain until you change them, either manually through the SETUP SKIPLINE menu, or automatically by using CYCLE-LOCK again.

If you make a mistake while using CYCLE-LOCK, press the RETARD switch. This will instantly cancel CYCLE-LOCK and will restore the old PAINT and CYCLE lengths. If you are painting, paint will instantly stop.

PAINTING NEW LINES - PREMARKING

The premark system allows for convenient pre-marking of the roadway center and edgelines, and can be used without paint for surveys.

SETTING UP THE PREMARK SYSTEM

Before using the Premark System roadway layout, you must set the Paint and Cycle values to the measurements of the lines to be painted. These values are always the same as the regular Paint and Cycle lengths.

To use Premark, press NEXT until the display reads "SETUP PREMARK". Press up to select. Then press UP or DOWN to turn the layout mode on, then press NEXT. Now, use the UP and DOWN buttons to set the pip width to the desired value. This will be the actual length of the premark stripe. Some experimentation may be required to get the right pip time for your guns. Generally, you will want the pip time to be as short as possible while still making a recognizable spot on the pavement. Solid lines do not generate pips, only the skipping lines. Note that the pip at the end of the line starts one pip length early, so that it will not 'hang out' of the final painted line. The "P" paintflag will be replaced by "M" for mark and "S" for space while in Premark Mode.

The Footage counters will count the length of the lines as if real lines were being painted.

ELECTRICAL PRECAUTIONS

1. Be sure to turn the CS33A Controller Power Switch OFF before connecting a battery charger to your battery. The protective circuits in the CS33A will usually prevent damage to the controller, but may cause the controller fuse to blow.
2. It is good practice to turn the CS33A OFF when starting the engine. The drop in battery voltage during cranking may incorrectly trip the low battery indicator in the CS33A and may interfere with proper updates of the non-volatile memory.
3. **NEVER** ARC WELD on your machine while the controller is connected. Always completely remove the controller connector before arc welding.

BUILT-IN TEST PROGRAM

The CS33A has a built-in test program to check the front panel switches for proper operation and to allow resetting the stored time and distance data to the factory default values. To start this program, hold down both the UP and DOWN buttons and switch on the POWER switch. Alternatively, you may press both the PREV and NEXT buttons to start the diagnostics. After the sign-on message appears, you can release the buttons. The display will ask "RESET DEFAULTS?" Press DOWN for NO unless you wish to reset all of the calibration and delay values to factory default values. After pressing DOWN, the display will say "SWITCH PANEL DIAGNOSTIC". The display will show three letter abbreviations for each switch on the panel that is turned on.

You may test all of the switches to assure that they are working properly. When you are finished, turn the power off, then back on to restore normal operation.

If the diagnostics routine does not start as above when you switch on the power, try using the PREV and NEXT buttons. It could be that either the UP or the DOWN button is bad.

TROUBLESHOOTING

The following hints may help if you are having trouble with your system:

No data on display	Is battery connected? Is the polarity correct? Is battery charged? Check or replace the fuse. Check for a short on solenoid and sender red wires.
Gun reads Open Circuit	Is the solenoid connected? Check solenoid for continuity. If solenoid is OK, check cable for cuts or abrasions. If the gun is not installed, go to the SET GUNS menu and turn it off.
All guns read Open Circuit	Look for a break or bad connection in the common red wire that feeds 12 volts to all of the solenoids.
Gun reads Short Circuit	Check solenoid for internal short. If OK, check cable for cuts or abrasions. Some intermittent duty solenoids draw enough current to trip the overload circuitry in the CS33A. Use only recommended continuous duty solenoids.
Solids paint, Skips don't	Look for the blinking star in the lower right corner of the display. If the star isn't blinking, check the sender to make sure that it is turning. Check the drive tang that couples the sender shaft to the bearing shaft - this small part is sometimes forgotten. Check sender wiring. Try another sender if possible.
Paint lines don't start together air	Are the gun patterns mechanically lined up with each other? Be sure that control hoses are the same length, as short as possible, and that the gun needle springs have equal tension. Make sure that you have enough control air pressure. If you have a regulator on the control lines, be sure it is large enough to supply enough air fast enough. Generally, the regulator should be at least a ½" size for 2 or 3 guns.
Paint lines don't stop together	Look for an obstruction in the exhaust port of the solenoid valve. Avoid the use of mufflers or filters on the exhaust ports.
Painting suddenly stops	If you were scanning through the menus, you perhaps selected Cycle-Lock or Calibration. These are the only two menu items that can stop all painting action.

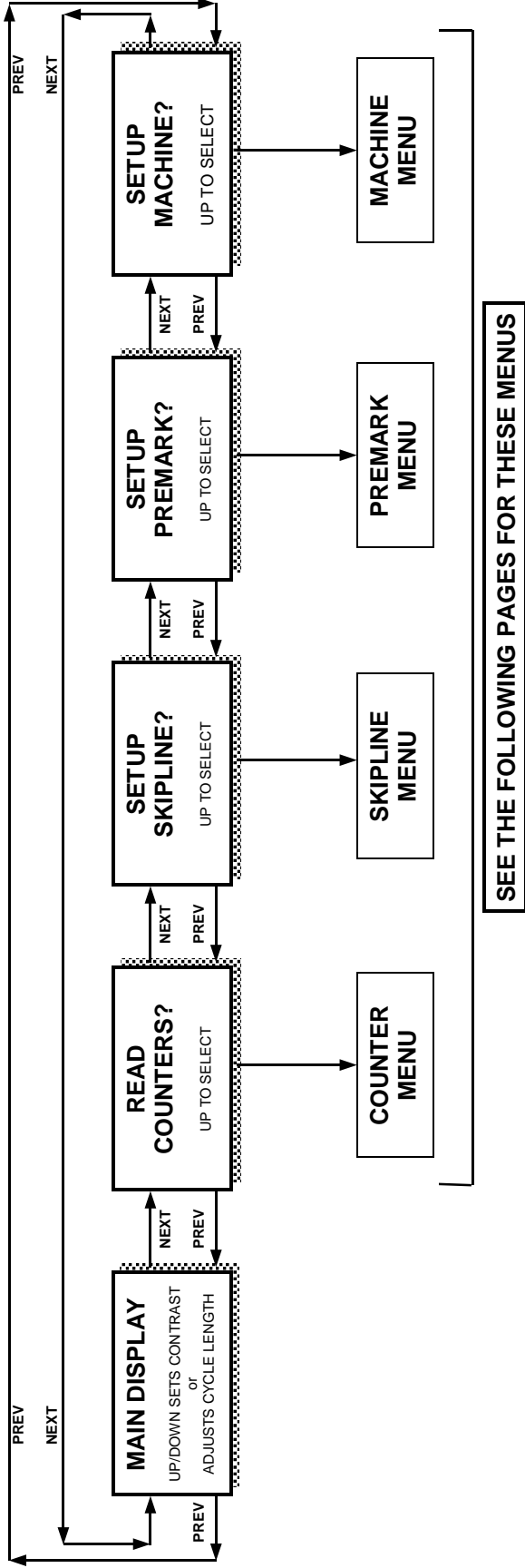
MODEL CS33A TIMER SETTING TABLE

		-----LENGTH ERROR INCHES-----									
		1	2	3	4	5	6	7	8	9	10
SPEED											
		1.0	0.056	0.114	0.170	0.228	0.284	0.340	0.398	0.454	-
	1.2	0.048	0.094	0.142	0.190	0.236	0.284	0.332	0.378	0.426	0.474
	1.4	0.040	0.082	0.122	0.162	0.202	0.244	0.284	0.324	0.366	0.406
	1.6	0.036	0.072	0.106	0.142	0.178	0.214	0.248	0.284	0.320	0.356
	1.8	0.032	0.064	0.094	0.126	0.158	0.190	0.220	0.252	0.284	0.316
	2.0	0.028	0.056	0.086	0.114	0.142	0.170	0.198	0.228	0.256	0.284
M	2.2	0.026	0.052	0.078	0.104	0.130	0.154	0.180	0.206	0.232	0.258
	2.4	0.024	0.048	0.072	0.094	0.118	0.142	0.166	0.190	0.214	0.236
I	2.6	0.022	0.044	0.066	0.088	0.110	0.132	0.152	0.174	0.196	0.218
	2.8	0.020	0.040	0.060	0.082	0.102	0.122	0.142	0.162	0.182	0.202
L											
	3.0	0.018	0.038	0.056	0.076	0.094	0.114	0.132	0.152	0.170	0.190
E	3.2	0.018	0.036	0.054	0.072	0.088	0.106	0.124	0.142	0.160	0.178
	3.4	0.016	0.034	0.050	0.066	0.084	0.100	0.116	0.134	0.150	0.168
S	3.6	0.016	0.032	0.048	0.064	0.078	0.094	0.110	0.126	0.142	0.158
	3.8	0.014	0.030	0.044	0.060	0.074	0.090	0.104	0.120	0.134	0.150
	4.0	0.014	0.028	0.042	0.056	0.072	0.086	0.100	0.114	0.128	0.142
	4.2	0.014	0.028	0.040	0.054	0.068	0.082	0.094	0.108	0.122	0.136
P	4.4	0.012	0.026	0.038	0.052	0.064	0.078	0.090	0.104	0.116	0.130
	4.6	0.012	0.024	0.038	0.050	0.062	0.074	0.086	0.098	0.112	0.124
E	4.8	0.012	0.024	0.036	0.048	0.060	0.072	0.082	0.094	0.106	0.118
R	5.0	0.012	0.022	0.034	0.046	0.056	0.068	0.080	0.090	0.102	0.114
	5.2	0.010	0.022	0.032	0.044	0.054	0.066	0.076	0.088	0.098	0.110
	5.4	0.010	0.022	0.032	0.042	0.052	0.064	0.074	0.084	0.094	0.106
	5.6	0.010	0.020	0.030	0.040	0.050	0.060	0.072	0.082	0.092	0.102
	5.8	0.010	0.020	0.030	0.040	0.048	0.058	0.068	0.078	0.088	0.098
H	6.0	0.010	0.018	0.028	0.038	0.048	0.056	0.066	0.076	0.086	0.094
	6.2	0.010	0.018	0.028	0.036	0.046	0.054	0.064	0.074	0.082	0.092
O	6.4	0.008	0.018	0.026	0.036	0.044	0.054	0.062	0.072	0.080	0.088
	6.6	0.008	0.018	0.026	0.034	0.044	0.052	0.060	0.068	0.078	0.086
U	6.8	0.008	0.016	0.026	0.034	0.042	0.050	0.058	0.066	0.076	0.084
R	7.0	0.008	0.016	0.024	0.032	0.040	0.048	0.056	0.064	0.074	0.082
	7.2	0.008	0.016	0.024	0.032	0.040	0.048	0.056	0.064	0.072	0.078
	7.4	0.008	0.016	0.024	0.030	0.038	0.046	0.054	0.062	0.070	0.076
	7.6	0.008	0.014	0.022	0.030	0.038	0.044	0.052	0.060	0.068	0.074
	7.8	0.008	0.014	0.022	0.030	0.036	0.044	0.050	0.058	0.066	0.072
	8.0	0.008	0.014	0.022	0.028	0.036	0.042	0.050	0.056	0.064	0.072
	8.2	0.006	0.014	0.020	0.028	0.034	0.042	0.048	0.056	0.062	0.070
	8.4	0.006	0.014	0.020	0.028	0.034	0.040	0.048	0.054	0.060	0.068
	8.6	0.006	0.014	0.020	0.026	0.034	0.040	0.046	0.052	0.060	0.066
	8.8	0.006	0.012	0.020	0.026	0.032	0.038	0.046	0.052	0.058	0.064
	9.0	0.006	0.012	0.018	0.026	0.032	0.038	0.044	0.050	0.056	0.064
	9.2	0.006	0.012	0.018	0.024	0.030	0.038	0.044	0.050	0.056	0.062
	9.4	0.006	0.012	0.018	0.024	0.030	0.036	0.042	0.048	0.054	0.060
	9.6	0.006	0.012	0.018	0.024	0.030	0.036	0.042	0.048	0.054	0.060
	9.8	0.006	0.012	0.018	0.024	0.028	0.034	0.040	0.046	0.052	0.058
	10.0	0.006	0.012	0.018	0.022	0.028	0.034	0.040	0.046	0.052	0.056
	10.2	0.006	0.012	0.016	0.022	0.028	0.034	0.038	0.044	0.050	0.056
	10.4	0.006	0.010	0.016	0.022	0.028	0.032	0.038	0.044	0.050	0.054
	10.6	0.006	0.010	0.016	0.022	0.026	0.032	0.038	0.042	0.048	0.054
	10.8	0.006	0.010	0.016	0.022	0.026	0.032	0.036	0.042	0.048	0.052

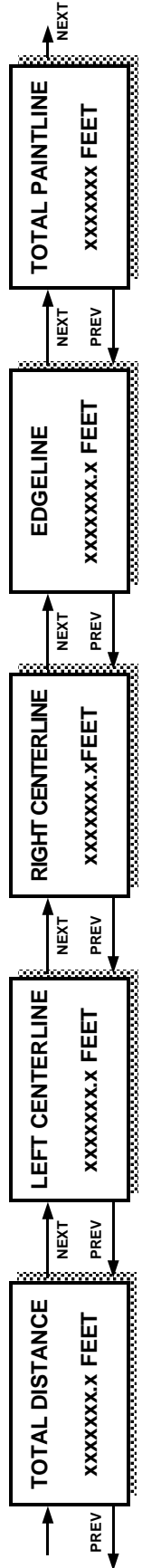
MODEL CS33A TIMER SETTING TABLE

		-----LENGTH ERROR CENTIMETERS-----										
		2	4	6	8	10	12	14	16	18	20	
SPEED	1.0	0.072	0.144	0.216	0.288	0.360	0.432	-	-	-	-	
	1.2	0.060	0.120	0.180	0.240	0.300	0.360	0.420	0.480	-	-	
	1.4	0.052	0.102	0.154	0.206	0.258	0.308	0.360	0.412	0.462	-	
	1.6	0.046	0.090	0.136	0.180	0.226	0.270	0.316	0.360	0.406	0.450	
	1.8	0.040	0.080	0.120	0.160	0.200	0.240	0.280	0.320	0.360	0.400	
	2.0	0.036	0.072	0.108	0.144	0.180	0.216	0.252	0.288	0.324	0.360	
	K	2.2	0.032	0.066	0.098	0.130	0.164	0.196	0.230	0.262	0.294	0.328
		2.4	0.030	0.060	0.090	0.120	0.150	0.180	0.210	0.240	0.270	0.300
	I	2.6	0.028	0.056	0.084	0.110	0.138	0.166	0.194	0.222	0.250	0.276
		2.8	0.026	0.052	0.078	0.102	0.128	0.154	0.180	0.206	0.232	0.258
L	3.0	0.024	0.048	0.072	0.096	0.120	0.144	0.168	0.192	0.216	0.240	
O	3.2	0.022	0.046	0.068	0.090	0.112	0.136	0.158	0.180	0.202	0.226	
	3.4	0.022	0.042	0.064	0.084	0.106	0.128	0.148	0.170	0.190	0.212	
M	3.6	0.020	0.040	0.060	0.080	0.100	0.120	0.140	0.160	0.180	0.200	
	3.8	0.018	0.038	0.056	0.076	0.094	0.114	0.132	0.152	0.170	0.190	
E	4.0	0.018	0.036	0.054	0.072	0.090	0.108	0.126	0.144	0.162	0.180	
	4.2	0.018	0.034	0.052	0.068	0.086	0.102	0.120	0.138	0.154	0.172	
T	4.4	0.016	0.032	0.050	0.066	0.082	0.098	0.114	0.130	0.148	0.164	
	4.6	0.016	0.032	0.046	0.062	0.078	0.094	0.110	0.126	0.140	0.156	
E	4.8	0.016	0.030	0.046	0.060	0.076	0.090	0.106	0.120	0.136	0.150	
R	5.0	0.014	0.028	0.044	0.058	0.072	0.086	0.100	0.116	0.130	0.144	
	5.2	0.014	0.028	0.042	0.056	0.070	0.084	0.096	0.110	0.124	0.138	
S	5.4	0.014	0.026	0.040	0.054	0.066	0.080	0.094	0.106	0.120	0.134	
	5.6	0.012	0.026	0.038	0.052	0.064	0.078	0.090	0.102	0.116	0.128	
	5.8	0.012	0.024	0.038	0.050	0.062	0.074	0.086	0.100	0.112	0.124	
	6.0	0.012	0.024	0.036	0.048	0.060	0.072	0.084	0.096	0.108	0.120	
	6.2	0.012	0.024	0.034	0.046	0.058	0.070	0.082	0.092	0.104	0.116	
P	6.4	0.012	0.022	0.034	0.046	0.056	0.068	0.078	0.090	0.102	0.112	
	6.6	0.010	0.022	0.032	0.044	0.054	0.066	0.076	0.088	0.098	0.110	
E	6.8	0.010	0.022	0.032	0.042	0.052	0.064	0.074	0.084	0.096	0.106	
R	7.0	0.010	0.020	0.030	0.042	0.052	0.062	0.072	0.082	0.092	0.102	
	7.2	0.010	0.020	0.030	0.040	0.050	0.060	0.070	0.080	0.090	0.100	
	7.4	0.010	0.020	0.030	0.038	0.048	0.058	0.068	0.078	0.088	0.098	
	7.6	0.010	0.018	0.028	0.038	0.048	0.056	0.066	0.076	0.086	0.094	
	7.8	0.010	0.018	0.028	0.036	0.046	0.056	0.064	0.074	0.084	0.092	
H	8.0	0.010	0.018	0.028	0.036	0.046	0.054	0.064	0.072	0.082	0.090	
	8.2	0.008	0.018	0.026	0.036	0.044	0.052	0.062	0.070	0.080	0.088	
O	8.4	0.008	0.018	0.026	0.034	0.042	0.052	0.060	0.068	0.078	0.086	
	8.6	0.008	0.016	0.026	0.034	0.042	0.050	0.058	0.066	0.076	0.084	
U	8.8	0.008	0.016	0.024	0.032	0.040	0.050	0.058	0.066	0.074	0.082	
	9.0	0.008	0.016	0.024	0.032	0.040	0.048	0.056	0.064	0.072	0.080	
R	9.2	0.008	0.016	0.024	0.032	0.040	0.046	0.054	0.062	0.070	0.078	
	9.4	0.008	0.016	0.022	0.030	0.038	0.046	0.054	0.062	0.068	0.076	
	9.6	0.008	0.016	0.022	0.030	0.038	0.046	0.052	0.060	0.068	0.076	
	9.8	0.008	0.014	0.022	0.030	0.036	0.044	0.052	0.058	0.066	0.074	
	10.0	0.008	0.014	0.022	0.028	0.036	0.044	0.050	0.058	0.064	0.072	
	10.2	0.008	0.014	0.022	0.028	0.036	0.042	0.050	0.056	0.064	0.070	
	10.4	0.006	0.014	0.020	0.028	0.034	0.042	0.048	0.056	0.062	0.070	
	10.6	0.006	0.014	0.020	0.028	0.034	0.040	0.048	0.054	0.062	0.068	
	10.8	0.006	0.014	0.020	0.026	0.034	0.040	0.046	0.054	0.060	0.066	

CS333A BASE MENU



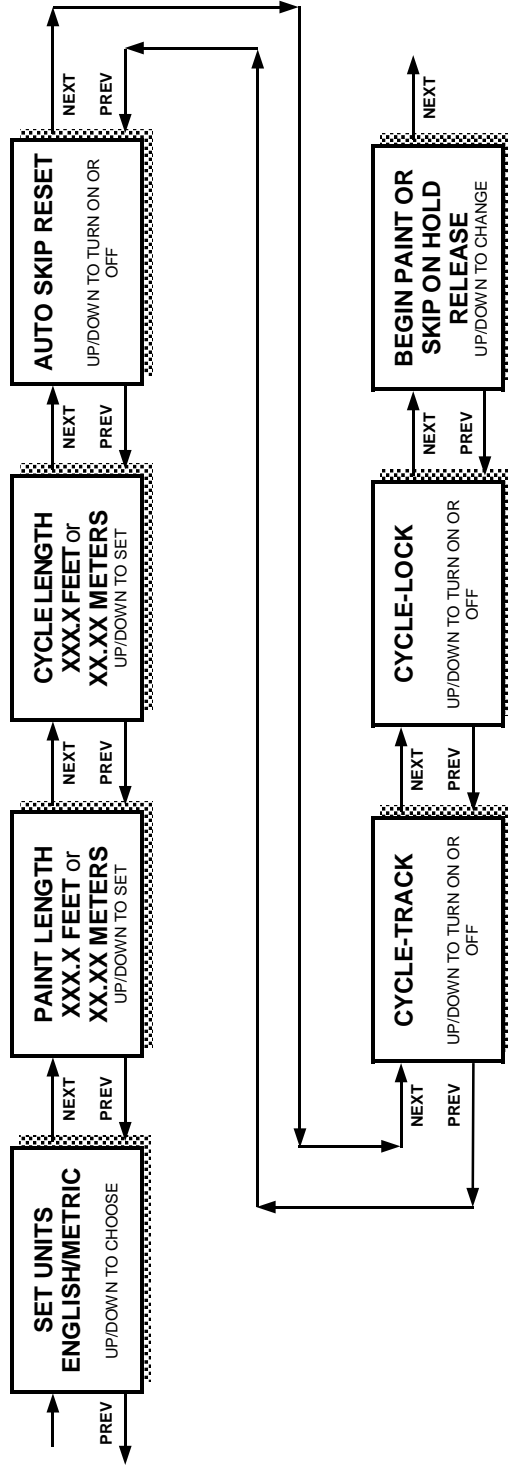
CS33A FOOTAGE COUNTERS



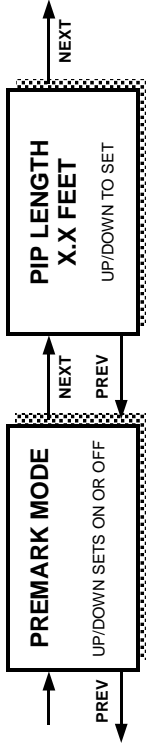
PRESSING BOTH THE UP AND THE DOWN BUTTONS SIMULTANEOUSLY WILL RESET THE DISPLAYED COUNTER.



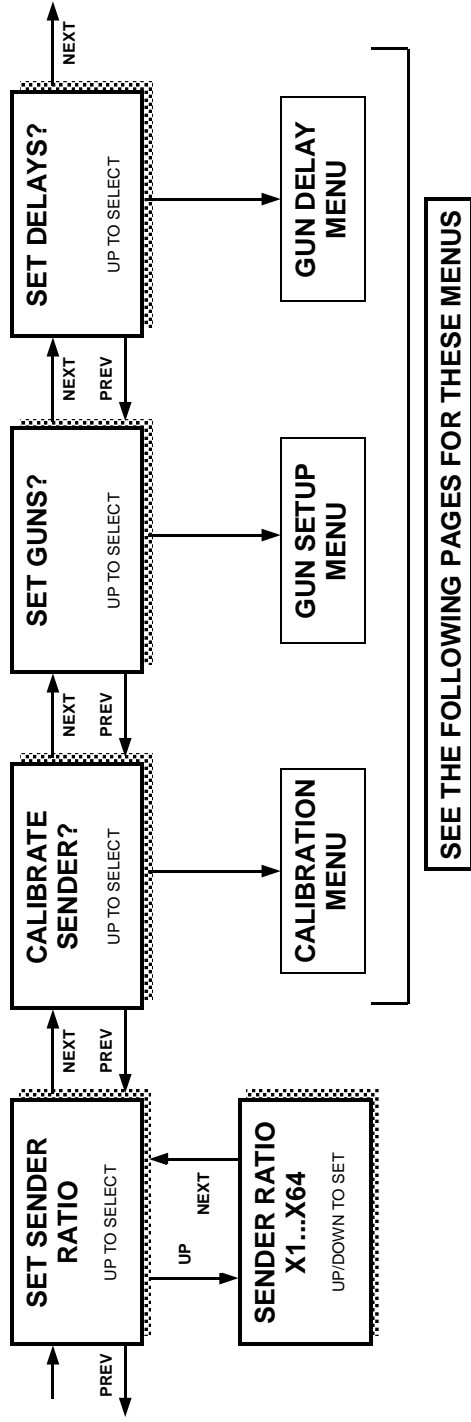
CS33A SETUP SKIPLINE MENU



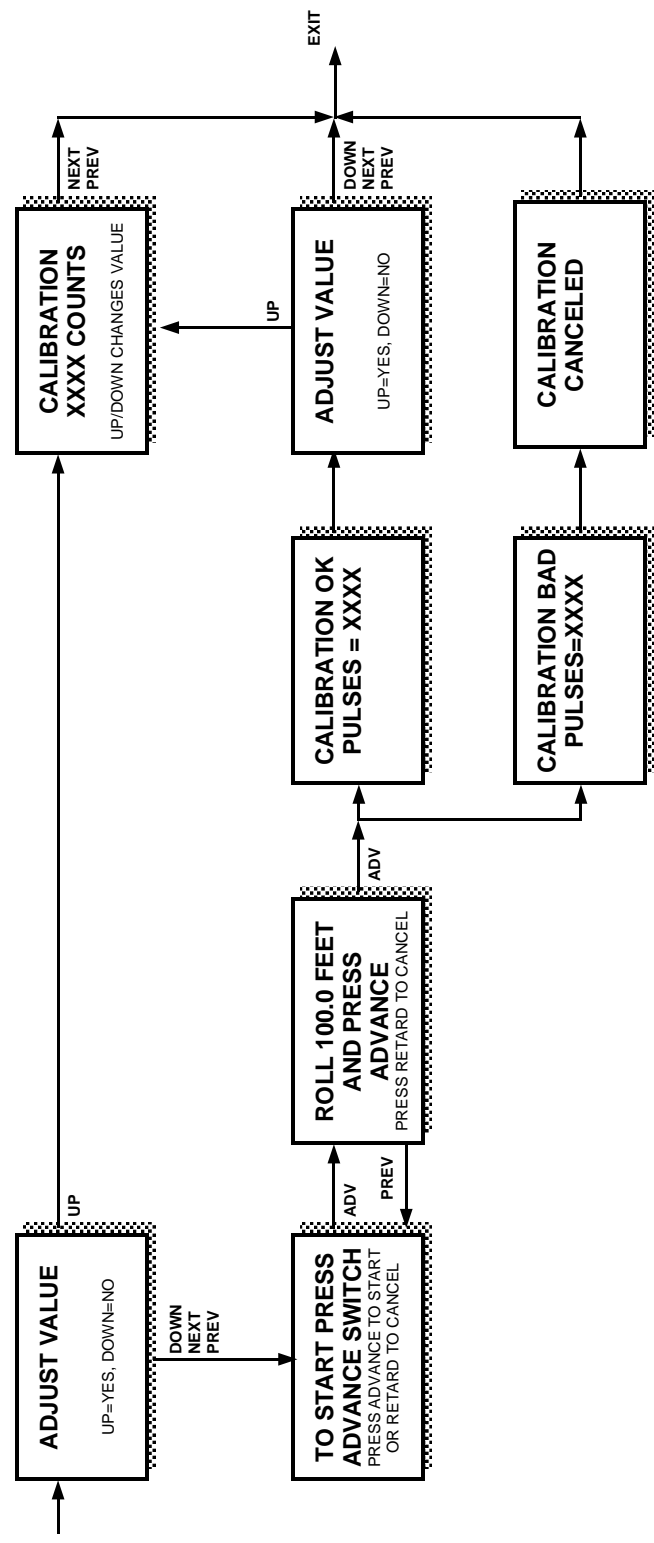
CS333A PREMARK MENU



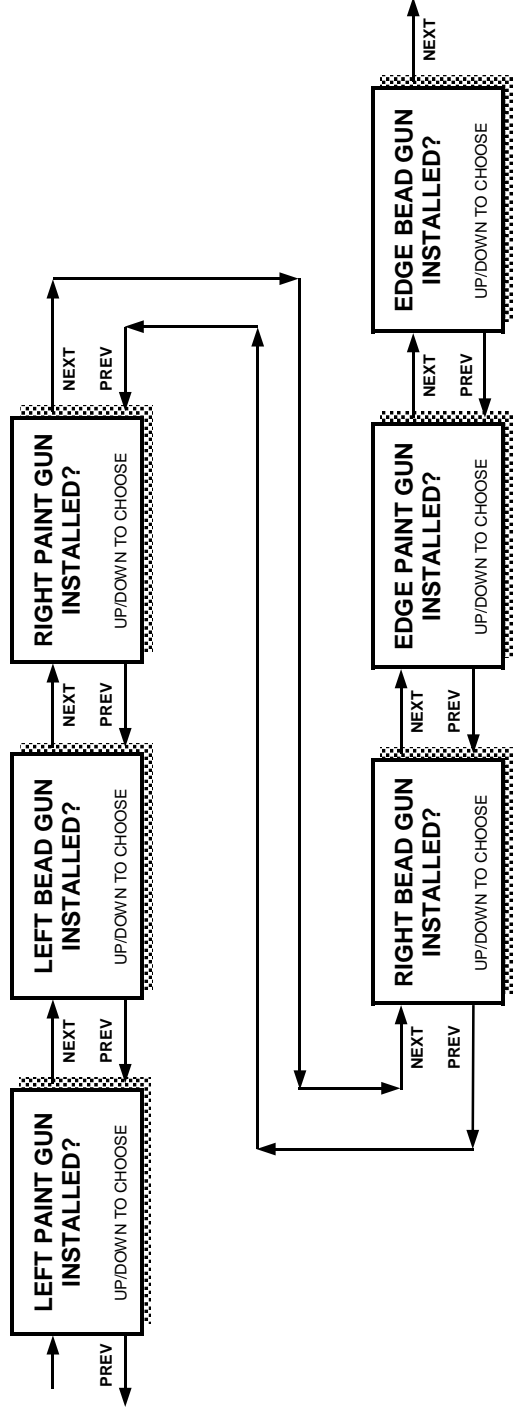
CS33A MACHINE SETUP MENU



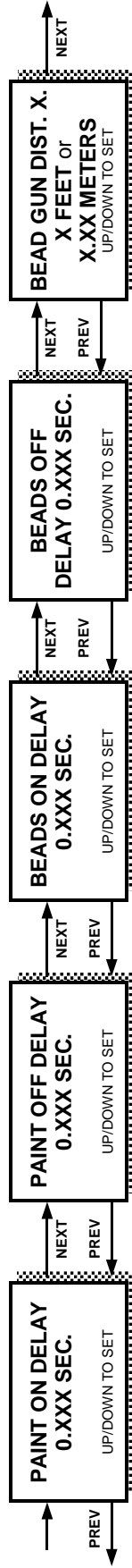
CS33A CALIBRATION MENU

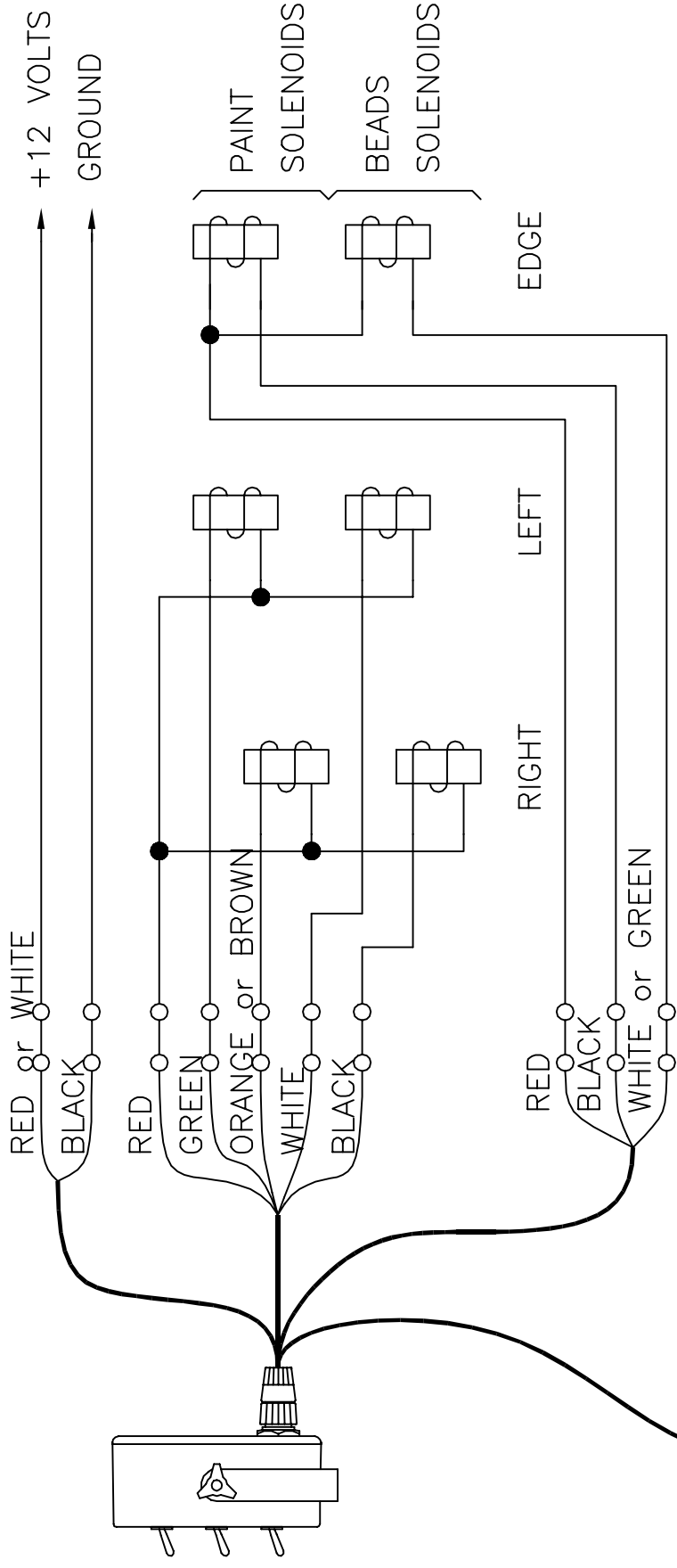


CS33A GUN SETUP MENU

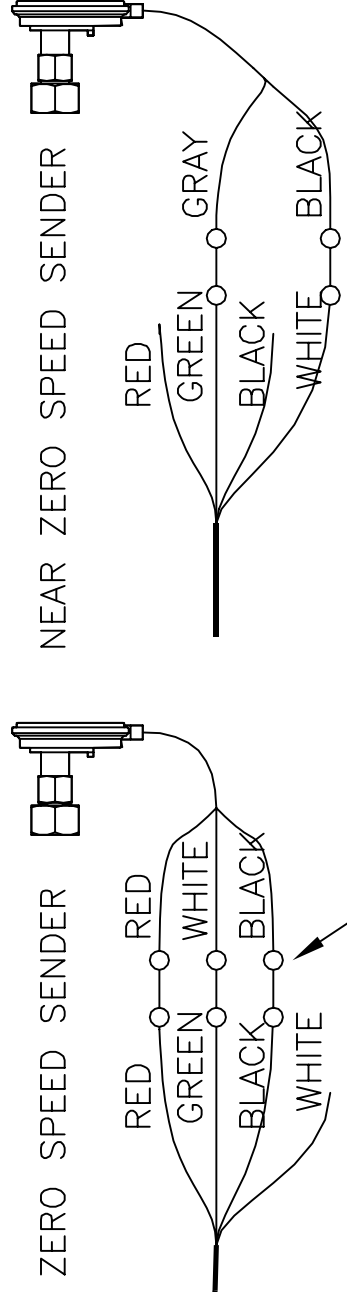


CS33A SET DELAYS MENU



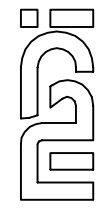


MODEL
CS33



1/17/94
Rev 2/10/95

WIRE JOINERS TAPE UNUSED WIRES



INSTALLATION DIAGRAM FOR MODEL CS33 SKIPLINE CONTROLLER



Warranty

Products manufactured by MICRO SYSTEMS DEVELOPMENT INC. (MSDI) are warranted against defects in material and workmanship for a period of ONE YEAR from date of delivery. During the warranty period, MSDI will, at its option, either repair or replace products which prove to be defective. Defective equipment must be returned prepaid. Repaired equipment will be returned to purchaser shipping charges collect. Accessories supplied by MSDI but manufactured by others are covered by their respective manufacturers' warranties.

LIMITATION OF WARRANTY

This warranty excludes normal consumables including, but not limited to, printer ribbons and paper. **Damage caused by Acts of God, improper application of the equipment, improper or reversed power supplies, or incorrect wiring is excluded from warranty coverage. Damage to R10 Sensor Heads is specifically excluded from this warranty.**

Inasmuch as the application of this equipment is beyond the control of MSDI, all warranties as to performance, merchantability, or fitness for any particular purpose, whether expressed or implied, are hereby disclaimed. The proper application of this equipment is the sole responsibility of the user.

IN NO EVENT SHALL MSDI BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES.



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