

PROCUREMENT SPECIFICATIONS

for the

MSDI SC88B SOLID STATE SKIPLINE CONTROLLER

Date: 02-14-95

GENERAL:

0.1 The Skip Line Control System shall be the Model SC88B Skipline Control as manufactured by Micro Systems Development Inc., 46 Marco Lane, Dayton, Ohio 45458.

MECHANICAL:

1.1 The skip line controller shall consist of three units, one being the Centerline Control Panel Unit, one being the Solenoid Power Unit, and one being the Edgeline Control Panel Unit. The Centerline Control Panel Unit and the Power Unit shall be interconnected by a cable of no more than ten (10) conductors. The Edgeline Control Panel Unit and the Power Unit shall be interconnected by a cable of no more than ten (10) conductors.

1.2 The Control Panels shall be mounted by means of two supplied handwheel knobs to a customer supplied mounting yoke.

1.3 The Power Unit shall be mounted by means of four (4) bolts to any convenient electrically grounded surface in the vicinity of the paint control solenoid valves. Low side connections to the solenoid valves shall be enclosed within the Power Unit, high side (+12 volt) connections shall be external to the Power Unit.

1.4 The cabinets of all units shall be steel or cast aluminum with aluminum or steel panels, coated with weather-resistant baked epoxy enamel. The Control Panel Unit panel markings shall be protected by a non-glare polycarbonate plastic overlay which is resistant to water and normal paint thinning solvents.

1.5 The controller shall generate the required output patterns without the use of electromechanical relays, gears, cams, clutches or pulleys. Except for operator activated switches, there shall be no moving parts in the controller.

1.6 All operator activated toggle switches on the Control Panels shall be heavy duty

sealed MIL-S-83731 type switches with internal silicone rubber seals to prevent entry of contaminants and silver-to-silver contacts. The Preselected Pattern Switch shall be of the interlocking pushbutton type with indicator flags for positive identification of the currently depressed button.

1.7 The Centerline Control Panel shall be comprised of several sub-panels, any of which can be changed individually to re-configure the controller for different gun configurations or types of materials to be applied.

1.8 The Right Edgeline Control Panel shall control the edgeline gun(s) to allow the selection of skip or solid lines, independent advance and retard, instant hold and reset, and selection of two different skip/paint dimensions. This panel shall be specified as either a 1-line panel or a 2-line panel.

CONFIGURATION:

2.1 The skip line controller shall be an all solid-state microprocessor based control unit utilizing the Zilog or Hitachi Z80 series microprocessor.

2.2 The Centerline Control Panel shall be equipped with a liquid crystal display (LCD) panel of at least 16 characters by two lines. The LCD shall display the CYCLE and PAINT length settings. In addition, the LCD shall indicate the current vehicle speed and the current skipline status. The LCD shall also have an indicator to show that pulses are being received from the vehicle motion sensor. There shall be provisions for the operator to adjust the display contrast for easiest reading. The LCD display shall be illuminated from the rear by light emitting diodes.

2.3 Calibration and configuration of the controller shall be programmable from the Centerline Control Panel by means of panel mounted pushbuttons, using the LCD display to indicate the parameters being adjusted and their current values. The parameters shall be selected through simple menu selections. It shall not be necessary to disassemble the controller to perform calibration or adjustments.

2.4 All calibration and configuration parameters shall be stored in a non-volatile memory when power is turned off and shall be automatically recalled when power is turned on. This memory shall retain the stored data even if main power is removed or if the controller is removed from the vehicle. This memory shall not use a battery to retain data.

2.5 The controller shall have two independently settable skip clocks to permit the simultaneous application of two different paint/cycle dimensions, such as 10ft/40ft for the centerline and 3ft/15ft for the edgeline.

2.6 The controller shall be programmable to either English or metric units of measure.

For metric programming, substitute "meters" for "feet" in all specifications in this document.

2.7 The Centerline Control Panel Toggle Switches used to control the lines painted shall be programmable by the user to allow any switch to apply any two lines at one time, either solid lines or skipping lines on either the main skipclock or the alternate skipclock.

2.8 The controller Power Unit shall be equipped with modular solenoid output circuits, allowing fast field replacement should it be necessary. Each Module shall control two solenoids painting on the same paintline.

2.9 Each Solenoid Output Module shall have a set of switches which determine the line to be painted by that Module, and what set of materials are to be applied by the connected guns. These switches are set once upon installation and are not subsequently changed unless a Module is replaced or the guns are reconfigured.

2.10 When configured as a four line controller, the controller shall be capable of controlling up to sixteen (16) guns on four paintlines. The four guns on each line shall be Paint, Secondary Tandem Paint, Black Interpaint, and Glass Beads. The controller shall work correctly with any number of guns up to sixteen. Only the one-line Edgeline control box is supported in this configuration.

2.11 When configured as a six-line controller, the controller shall be capable of controlling up to twelve (12) guns on six painlines. The two guns on each line shall be Paint and Glass Beads. Tandem and Black paint are not supported in six-line configuration. Both the one-line and two-line Edgeline control boxes are supported in this configuration.

ELECTRICAL

3.1 The controller shall operate entirely on 12 volts DC, negative ground, with acceptable power input range of from 10 to 18 volts. Current draw to be less than 1 ampere exclusive of solenoids.

3.2 The controller shall provide filtering as necessary to prevent improper operation due to strobes, arrowboards, flashers, 2-way radio equipment, overhead power lines, etc.

3.3 The controller shall provide 12 volt operating power as necessary to the vehicle motion sensor. External power to this sensor shall not be necessary.

3.4 The controller shall operate with any of: fifth wheel encoder (any of optical, Hall-device magnetic or self-generating magnetic), drive shaft or U-joint magnetic wrapper pickup, or transmission mounted encoder provided that the pickup provides pulses of at

least 2 volts amplitude at a rate of from 2.7 pulses per foot of travel to 15 pulses per foot of travel.

3.5 Calibration of the controller to the actual pulse rate of the pickup shall be easily performed by driving the vehicle over a measured course and pressing a switch. All necessary calculations shall be performed internally within the controller. It shall not be necessary to refer to charts or solve equations to set the calibration.

3.6 The Solenoid Output Modules shall provide a switched path to ground for the solenoid valves. The maximum current is 2 amperes per gun. The modules shall have automatically resetting overcurrent protection which will remove power from a shorted solenoid before any damage occurs either to the controller or to the external controller wiring. Shorted gun circuits shall be displayed on the LCD panel by name for operator's information. Open gun circuits shall likewise be indicated on the LCD panel. Power (+12V) for the solenoids shall be supplied externally. Suppressors shall be provided for each solenoid to absorb inductive kick from the solenoid.

3.7 The controller shall provide settable gun timing parameters to provide accurate line lengths and line registration. The timing shall include compensation for the relative physical spacing of the guns (distance offset) as well as for the response speed of the guns (timing offset). These parameters shall be stored in the non-volatile memory for automatic recall.

3.8 Gun timers shall be adjustable from 0 to .5 seconds in .002 second increments. There shall be separate timers for the beginning and end of the skip line. Separate timers shall be provided for paint and beads. Timers shall be fully effective from both the internal skipclocks and from the panel switches.

3.9 Gun spacing delays shall be adjustable from 0 to 4.0 feet in 0.1 foot increments. The gun spacing delays shall be the same for both leading and trailing ends of each line.

PERFORMANCE

4.1 The controller shall have the following panel switches:

- a. Paint gun Skip-Off-Solid switches (4),
- b. Master switches for Paint and Beads (2),
- c. Reset-Run-Hold switch for intersections and pattern matching (1),
- d. Advance/Retard switch for pattern matching (1),
- e. Preselected Pattern Pushbutton Switch (1),
- f. Menu selection pushbuttons (4).

4.2 The controller shall be capable of painting patterns from 1.0 feet to 999.9 feet, adjustable in 0.1 foot increments.

4.3 The controller shall provide a separate pattern setting for the edgeline, permitting the edgeline gun(s) to simultaneously paint entirely different paint and cycle lengths than the centerline. The edgeline may be linked to the centerline if desired, under operator control.

4.4 Setting of the electronic calibration shall be automatic, by driving the vehicle over a measured course of a specified length. A means of manually overriding or "fine-tuning" the calibration shall be provided.

4.5 The system shall provide footage indicators to indicate the length of paint painted on each line, and a footage indicator for the total travel. These indicators shall appear on the LCD display upon operator command and shall be resettable to zero. These indicators shall be stored in the non-volatile memory so that the values will not be lost when the controller is turned off.

4.6 The controller shall be accurate to 0.1 feet at speeds of up to 40 MPH with a sender providing 10 pulses per foot.

4.7 There shall be provision for advance/retard to allow matching of previous lines. Such advance/retard shall operate at either of two operator selectable rates. Slow rate shall be one foot per second regardless of the vehicle speed. Fast rate shall be double-speed or stop. The advance and retard functions for the two skipclocks shall be separate with the Centerline Control Panel Advance/Retard Switch controlling the main skipclock and the Edgeline Control Panel Advance/Retard Switch controlling the alternate skipclock.

4.8 There shall be a provision to allow repeated advances or retards to modify the cycle and/or paint length to automatically adjust the controller to match previously painted lines. This system may be enabled or disabled by the operator at any time. This function shall operate independently on the center and edgelines.

4.9 There shall be a provision to allow the controller to measure the paint and cycle lengths of a previously painted skipline while actually repainting the old skipline (on-the-fly measurement).

4.10 There shall be a provision for instant reset of the skip cycle to begin a full length paint line. There shall be a provision, under operator control, for the instant reset to begin a full length skip rather than a full length paint line.

4.11 There shall be a provision for "instant off", stopping all paint and beads guns.

4.12 The Preselected Pattern Switch shall have eight buttons, providing seven preselected painting patterns and off. There shall be at least three groups of seven patterns available to the operator, one for States with two-centerline specifications, one for States with three-centerline specifications, and one set of patterns that are user programmable. These user programmable patterns shall be stored in non-volatile memory so that they are not lost when power is removed.

4.13 The Preselected Pattern Switch shall be electronically buffered so that there are no unintended interruptions in solid lines when switching from one pattern to another.

4.14 In the four-line configuration, the controller shall provide control of tandem paint guns for high-speed striping. The tandem guns shall be controlled automatically by the speed of the vehicle. The On Speed and Off Speed shall be independently adjustable from 0 to 40 MPH. The registration of the tandem guns shall be included in the timing and spacing parameters in paragraphs 3.6 to 3.8, with an independent distance delay to compensate for the position of the tandem guns behind the main paint guns.

4.15 In the four-line configuration, the controller shall provide control of black interpaint guns. This pattern shall be programmable to highlight both the beginning and end of the paint stripe, or the beginning only, or the end only, or centered within the skip portion of the line. The length of the black stripe shall be operator programmable from 0 to 30.0 feet. The edgeline gun shall have independent settings for all black interpaint values. The registration of the black interpaint guns shall be included in the timing and spacing parameters in paragraphs 3.6 to 3.8, with an independent distance delay to compensate for the position of the black paint guns behind the main paint guns.

4.16 The controller shall provide control of glass beads guns or dispensers. These guns shall have a full set of timing and spacing parameters independent of the paint guns due to the different response speed of these guns. The registration of these guns shall be included in the timing and spacing parameters in paragraphs 3.6 to 3.8.