SCORING PRESS COMPUTER

OPERATING MANUAL

FOR

C4000 BULK BIN
LAMINATOR

CRITTENDEN
CONVERSION
CORPORATION

REVISION 2.0

INTEGRATED CONTROLS, INC.

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1.0 GENERAL DESCRIPTION

The Scoring Press produces a series of accurately positioned 'scores' to facilitate folding. It utilizes an electric servo to position the box on a set of flat belts and two hydraulically actuated rams to produce the score. A microprocessor based press control unit (PCU) controls the servo and directs the operation of the press. An operator entered program, stored in the PCU, determines the position and type of scores made.

The score cycle begins when a box breaks the photoelectric beam located between the two press platens. The servo moves the box to position for the first score then activates the specified scoring press. When the score is complete, the press retracts and the box is moved to the next score position where the process is repeated. When all the scores have been made, the box is moved off the scoring press belts and onto the folder belts.

A hand-held **Programming Terminal** (PT) is used to program, setup and monitor press operation. Part programs are entered, selected and modified using this terminal.

2.0 PROGRAMMING THE SCORING PRESS SYSTEM

The programming terminal (referred to herein as PT) is connected to the Score Press control unit (PCU) by a 6 foot long coiled cord. When power is first applied to the press controls or when the PT is first plugged in, the PT will run through a power-up test procedure which tests the display, and other components within the PT. Once the power-up test are completed, the sign-on message, illustrated below, is displayed:

```
CRITTENDEN INC.
SCORING PRESS
```

The **sign-on** message is displayed for a few seconds then is replaced by the **Opening Menu** shown below:

```
SELECT FUNCTION:
OPERATE  PROGRAM
```

The PT will not respond to any operator input while the sign-on message is displayed.

2.1 KEYPAD / DISPLAY CONVENTIONS

Certain conventions apply while using the **Programming Terminal** with the Scoring Press. Each key on the terminal keypad has two possible functions. All of the keys are labeled with a function name or character similar to a typewriter keyboard. Most keys contain a second symbol or character in a black rectangle located toward the top of the key. These are referred to as '*shifted*' symbols and include the numbers 0 through 9 along with a row of function keys labeled F1 through F5.

To access the '*shifted*' symbols, the SHIFT key located in the lower left corner of the keypad must be pressed. The SHIFT key is a toggle in that once pressed, the keypad remains '*shifted*' until the SHIFT key is pressed again or until power is removed. The PT always powers up in the '*un-shifted*' mode.

2.2 DISPLAY AND CURSOR

The PT contains a two line display near the top of the unit. A blinking cursor indicates the position where new entries will be made. The shape of the cursor indicates the shift mode of the keypad. A small square cursor indicates '*un-shifted*' operation while a larger rectangular cursor is displayed when 'shifted'. ***Function keys and numeric entry require the keypad to be in the 'shifted' mode.***

2.3 MENU ORGANIZATION

Menu Screens provide a means for selecting operation, programming or setup screens using the Terminal. Each Menu screen provides a choice of two or more additional menus or operations. Menus are organized similar to roots of a tree with the **Opening Menu** at the very top and all other menus branching out below. For instance, the **Opening Menu** provides two options, each of which are another Menu screen with two or more selections.

A **Menu Layout 'Map'** is included in the appendix of this manual to aid in navigating the menu system.

2.4 FUNCTION KEYS

Five **Function Keys** are located across the top row of the keypad. All menu selection is done with these keys. The function keys are labeled F1 through F5 and are the 'shifted' functions of keys A through E. Menu screens have 2, 3, or 5 options displayed on the lower line. These options correspond to the function keys on a position basis.

For example, when two menu options are displayed, such as on the **Opening Menu** shown below, the left option (OPERATE in this example) is selected with the F1 key. The option at the right of the display (PROGRAM) is selected using the F5 key.

```
SELECT FUNCTION:
OPERATE   PROGRAM
```

use F1 use F5

When three options are available, as illustrated below, the F1 key selects the left most option (HAND). The F3 key selects the middle option (STOP) while the F5 key selects the right option (AUTO).

```
Oper. Mode: Stop
HAND  STOP  AUTO
```

Menu screens that have five options, such as the one show below, use F1 through F5 corresponding to the selections from left to right.

```
SELECT FUNCTION:
P1 P2 P3 P5 DWL
```

2.5 ESCAPE KEY

The ESC/BKSP key is always used to leave the current menu and return to the previous Menu. For instance, selecting F5 (PROGRAM) from the **Opening Menu** will cause following Menu to be displayed.

```
SELECT FUNCTION:
PROGRAM     SETUP
```

This new Menu presents two additional options. Pressing the ESC key while this Menu is displayed will return to the **Opening Menu**. Pressing the F1 key will open the Program Edit Menu while selecting the F5 key will display the Machine Parameter menu.

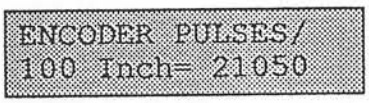
2.6 NUMERIC ENTRY

Most of the programming and setup screens require numeric entries. Numbers are entered using the embedded numeric keypad located in the right 3 columns of the keypad.

Note the keypad must be 'shifted' to allow numbers to be entered. This is indicated by the rectangular outline surrounding each number on the keypad legend.

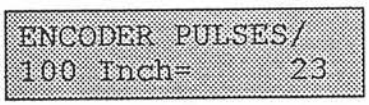
Numbers are entered without decimal points in a manner similar to a desk calculator. When the first number is entered, it appears on the right side of the numeric field on the display, replacing the number previous displayed. Additional digits are entered in the rightmost position, shifting previously entered digits left.

As an example, suppose the Encoder Constant entry screen has been selected, and the current encoder constant is 21050 pulses / 100 inches. The screen would appear as follows when first entered:



Suppose we wish to change the encoder constant to 23450 pulses / 100 inches. Make sure the keypad is 'shifted' (rectangular cursor), then press 2. The screen will appear as:

Then press 3 and the screen will appear as below:



The remaining numbers 4,5, and 0 would be entered in order, until the screen reads:

Once the new constant has been entered, press the ENTER key to store the new value into the PCU's memory.

ALL NUMERIC ENTRIES MUST BE STORED by pressing the ENTER key.

Numeric values are always entered left to right without decimal points. If additional decimal places are required, fill out the number by entering trailing zero's.

If a numeric value does not require change, press the ENTER key or ESC key to exit the entry screen without changing the value.

No delete or back space function is available with the PT. If an error is made entering a numeric value, erase the entry by entering 0's (zero's) until a zero value is displayed on the screen, then re-enter the desired value. Remember, a number is not stored in the PCU memory until the ENTER key is pressed so it is possible to exit a screen without storing a new value by pressing the ESC key before the ENTER key is pressed. This is the case even if the number has changed as long as the ENTER key had not been pressed.

3.0 MENU DESCRIPTIONS

3.1 OPERATE MENU

The Operate menu, shown below, displays the active program number and provides options to open the SELECT or OPERATE mode screens. Select the Operate menu from the **Opening Menu** by pressing the F1 key.

The Operate menu above shows program 16 has been selected as the Active Program. A valid program must be selected prior to operating the press or erratic operation will result. Press function key F1 to open the Program Select screen. Function key F5 opens the Operating mode menu.

3.1.1 PROGRAM SELECT

The Scoring Press computer is capable of storing a large number (typically 100) of programs in memory. Only one program can be *active* at any one time. The purpose of the Select screen is to select the *active* program. Programs may be select by entering the program number (typically 1 to 100), or the part number (P/N). A typical Program Select screen is shown below:

3.1.1.1 SELECT BY NUMBER

When the Program Select screen is first displayed, the selected program number and corresponding part number (P/N) is displayed. Select a new program, if necessary, using the number keys and press the ENTER key when completed. If a valid program number is entered, it becomes the active program and the P/N (if one is present) is displayed.

It is possible to scroll (browse) through the available programs while the Program Select screen is open. Function key F1 is used to scroll to the next lower program number while F5 moves to the next higher number. It is not necessary to press the ENTER key. The program number displayed at the top of the screen becomes the new selected program automatically.

Programs may contain descriptions as well as part numbers (P/N). Use function Key F2 to toggle between P/N and Description display.

If a non-existent program is entered, an error message will be displayed. If an empty program (one with no valid score positions) is selected, the message 'Empty Program' is displayed.

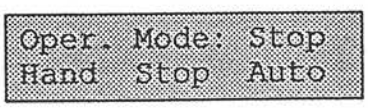
3.1.1.2 SELECT BY PART NUMBER

Programs may be selected using the part number (P/N) instead of program number. Switch to P/N mode by pressing F4. The blinking cursor will move to the P/N field to accept the *search part number*. Part numbers may be and combination of numbers or letters. The *search part number* must exactly match the P/N entered in the program for a match to be successful. When more than one program contains identical P/N's, the lowest number program that matches the P/N will be selected. If a successful match is found, the new program number become active and displayed at the top of the screen.

Switch between the P/N and Program number entry using function key F4. The position of the blinking cursor indicates the current entry field. Keep in mind numeric entry requires 'shifted' mode while many other character are only available in '*un-shifted*' operation.

3.1.2 OPERATE MODE

The operating mode of the Scoring Press may be set to one of three states: Hand, Stop, or Auto. The Operate Mode screen displays the current mode and allows a new mode to be selected. The Operate Mode screen is displayed below:



Press the appropriate function key to select the desired operating mode.

3.1.2.1 OPERATING MODE: STOP

When the mode is set STOP, the drive will stop and hold position. Select Stop mode by function key F3.

3.1.2.2 OPERATING MODE: HAND

Use function key F1 to select HAND operation. Hand operation permits manual operation of the belts without the rest of the Laminator running. In order for Hand operation to be used, the servo power supply must be powered and initialized. On most Laminators, the power up sequence is performed by the programmable controller when the Folder Belts are started. The servo power supply is put into standby (main power removed) approximately 5 minutes after the Folder belts have been stopped. Hand operation SHOULD NOT BE USED except for diagnostic or setup purposes since the normal flow control of boards through the scoring press and onto the folder belts is bypassed.

3.1.2.3 OPERATING MODE: AUTO

The scoring press should be set to AUTO operation in most cases. Select Auto operation using function key F5. In AUTO, the belts are the command of the Laminator PLC and start or stop to sequence boards through the Scoring Press and onto the Folder belts.

3.1.3 MONITOR

The Monitor menu allows the operator to check the operation of the servo incremental encoder, leading eye photocell circuit, check the mode, and press position values as the press operates. Several monitor screens are available and are selected with the function keys F1 through F5.

Function key F1 displays the current target and servo encoder values. The encoder value should be incrementing rapidly if the score press belts are running. The target value will change as a box progresses through the press.

Function key F3 displays the current program mode (different from the Operate Mode) and the state of the leading edge photocell located between the two press platens. If the photocell is blocked by a box, the LE Eye should indicate BLOCKED. If no box is present, it should indicate OPEN.

The program mode will be one of several different messages depending on the current state of the PCU. Some of the messages and corresponding modes are shown below:

Halt: Belts should be stopped and locked in position.

Idle: Belts are running waiting for a new box.

Seek: Belts are moving to a new score position.

Press 1: Scoring Press #1 is cycling

Press 2: Scoring Press #2 is cycling

Press 3: Double Score cycle in progress

Function key F5 selects a diagnostic screen that contains information used to verify program operation and is not generally useful to plant personnel.

4.0 PROGRAM MENU

Select function key F5 from the **Opening Menu** to enter and edit Scoring Programs or to setup Machine Setup Parameters. The **Program Menu** is shown below:

```
SELECT FUNCTION:
PROGRAM     SETUP
```

Function key F1 is used to edit Scoring Programs. Press function key F5 to make or change Machine Setup Parameters.

4.0.1 PASSWORD PROTECTION

Password protection is available to limit access to the program and setup menu's screen. Passwords are numeric and may be different for Machine Setup and Program Editing functions.

If a Password is in effect, selecting the menu will cause the Password Entry screen to appear as shown:

```
 PASSWORD Key
Required!
```

Be sure the keypad is in the 'shifted' mode (cursor is a rectangle as opposed to a square) then enter the proper password followed by the ENTER key. When the correct

password is entered, the requested menu screen appears. If the correct password is not, the previous menu re-appears.

Passwords are a machine parameter (accessible via the Setup menu) so if a password is specified for Setup, be sure not to forget what the password is because you will not be able to access the machine setup screens to check or change passwords.

4.1 SCORING PROGRAMS

The Scoring Press contains up to 100 individual programs. A program is identified by a program number (1 to 100) and optional part number (P/N) and description. Each program contains 1 to 16 individual scores specifying the move distance and the press which will operate once the move is completed.

Programs are entered or changed by selecting the PROGRAM menu and then PROGRAM (F1). The Program edit menu will be displayed showing the currently active program number illustrated below:

Change the program number, if necessary, by entering the desired program number followed by the ENTER key. Menu items at the bottom of the screen provide options to enter or edit the part number (P/N), description, or individual line items. Press F1 to edit the optional P/N. Function key F3 is used to enter or change the optional description while F5 is used to access the program lines which contain the score position and press number information..

4.1.1 PART NUMBERS

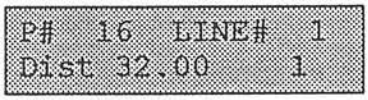
Part numbers (P/N) are optional and may be any combination of letters or numbers up to a total of 10 characters. Numbers must be entered with the keypad in the *'shifted'* mode. Use *'un-shifted'* mode to enter letters. Once the part number has been entered, press the ENTER key.

4.1.2 DESCRIPTIONS

Descriptions may be any combination of letters and numbers, up to a total of 16 characters. Enter the description using the procedure described above for part numbers.

4.1.3 PROGRAM LINES

Program lines specify the distance between the front edge of the box and the first score, or between consecutive score positions. In addition, program lines specify the press which will be activated once the move to a new score position is complete. The screen below contains a typical program line:



This screen indicates line 1 of program 16 is being edited. The program line has a move distance of 32.00 inches and will utilize press platen 1 once the move is complete. The cursor (not illustrated) will indicate which item is being edited.

This screen is an entry screen rather than a menu screen so there are no prompts visible on the lower line of the display. There are however, a number of functions available. Use function key F5 to move to the next program line. F1 changes to the previous program line. The ESC key exits the program line editor and returns to the program edit menu. Function key F4 will delete the current line while key F2 inserts a new line before the current line pushing the current line and all the lines above it line up one line number. Inserting a line causes the last line (typically line 16) to be lost as it is replaced by the line below it.

When a box is being scored by the press, the program ends when a line containing a zero distance is encountered or when all the program lines have been used. When the end of the program is found, no further scores will be made and the box is run out of the score press and onto the Folder belts.

4.1.3.1 SCORE POSITION

Each line of the program contains a distance value used to determine how far to move the box prior to making the score. Distances are incremental in that each move begins at the position of the most recent score. The first move of any program starts at the leading edge of the box. Subsequent moves are from the previous score position. Enter or change the score distance then press the ENTER key to continue. Press Enter without changing the score distance if no change is necessary. Once the ENTER key is pressed, the cursor moves to the score bar selection value.

4.1.3.2 SCORE BAR SELECTION

Select the scoring bar by pressing 1 or 2 followed by the ENTER key. On most machines, score bar 1 is closest to the Double Compression section. The choice of score bar is affected by the profile desired (if different profiles are installed) or by the score

position. Score positions must permit the box to slow down while moving forward to position. If the first score on a box is very close to the leading edge, score bar 2 would probably be used because the score may have passed score bar 1 before the leading edge breaks the photocell beam.

If score bar 0 is specified, the box will move to position then pause for a moment before continuing but no score will be made.

4.1.3.2.A DOUBLE SCORE OPTION

Some systems are supplied with the score bars a specific distance apart, corresponding to a commonly used score spacing. These machines may be equipped with a *double score* option where both presses cycle once the box is in position. Specify *double score* by pressing 3 followed by the ENTER key.

When *double score* are used, the first score (the one closest to the leading edge of the box as it passes through the score press) must be positioned under the downstream score bar (the one closest to the folder deck), typically score bar 2. The distance between the two scores is determined by the score bar spacing. The move to the next score pattern is based on the distance from the score closest to the front of the box and must include the distance between the two double scores.

4.2.0 PRESS SYSTEM SETUP MENUS

The setup menus are used to enter and change operating parameters for the system. These parameters include any value used to compute position moves and tuning parameters for the servo positioning system. Setup parameters are accessed by menu screens identical to other programming functions. Refer to the menu screen map at the end of the manual for details in menu layout.

The machine setup parameters have a profound effect of the operation of the machine. It is extremely important that these values not be changed without a thorough understanding of the effect. It is very important that an up-to-date record be kept so that parameter values may be reset in the case of computer failure or inadvertent changes to the values.

The following section lists the setup parameters and provides a summary of their purpose including a typical value or range of values. Keep in mind that the values expressed are *typical* and will not be the exact value necessary for proper operation of a particular machine.

4.2.1 Encoder Constant

The press control uses an incremental encoder to measure the movement of the belt. The *Encoder Constant* parameter specifies the number of encoder pulses received for

every 100 inch of belt movement. Typically the constant is between 20000 and 24000 pulses per 100 inches of belt travel.

The encoder constant determines the calibration for a particular machine and is probably the singularly most important parameter value. If it becomes necessary to modify the encoder constant, use the following method to compute the new constant based on the performance of the current constant.

Suppose the distance between two scores is programmed to be 48 inches but the actual scores on a the box are spaced at 46.5 inches. In addition, say the current encoder constant is 21050 pulses/100 inches. Use the formula:

$$\text{New Constant} = \frac{\text{Programmed Score Distance}}{\text{Actual Score Distance}} \times \text{Old Constant}$$

In this example, the new constant would be 48 divided by 46.5 times 21050 or 21729.03. Round to the nearest whole number and enter 21729 as the new encoder constant.

Be sure to keep a record of the current encoder constant. It will save a lot of grief if the value becomes inadvertently changed.

4.2.2 Target Window

The target window value determines how close the feedworks must be to the target position before the press will activate. This value is specified in encoder counts rather than inches. It is important to note the window does not directly affect the accuracy of the score press because the servo system will always position the box as close as possible to the computed target position. The only effect the target window has is to determine how close to the target the box must be before the score cycle can begin. Since the press takes some time to reach the box once the cycle has begun, it allows faster operation if the press can begin to move while the box is moving the last few fractions of an inch into position.

For instance, if the encoder constant for a particular machine is 20,000 counts per 100 inches, the system resolution is 200 counts per inch or 0.005 inch per encoder count. If the window is set at 2 encoder counts, the box must be within 0.010 inches of final position before the press will cycle. If the window were set to 10 the press could start to cycle when the box was 0.05 inches from final position.

A typical window value is 5 but it is normally safe to operate with values between 2 and 10. Settings as high as 50 are often possible and provide faster operation because the press starts sooner in the positioning process.

The larger the window setting, the faster the feedworks will get to position, however, it is possible to set the window so large as to cause the press to cycle while the box is still moving to position.

Setting the window too small may cause long delays while the final positioning is made. Setting the window at zero may cause large delays or even prevent the press from cycling.

4.2.3 ACCELERATION

The ACCEL value determines how fast the belts will accelerate from one score position to another. ACCEL values range from 0 to 255, with the higher numbers corresponding to faster acceleration rates. The servo drive system has sufficient torque to accelerate the belts at any ACCEL setting, however, it is possible to accelerate fast enough to cause the box to slip on the belts resulting in erratic score positions. Typical ACCEL values range from 200 to 250 although care must be taken with the faster rates to assure the hold-down rolls securely hold the box during positioning.

4.2.4 GAIN SHIFT

The Gain Shift parameter sets the point where the *alternate gain* values are activated. In general, *primary gain* values are used to bring the load to a low speed near the target position, then *alternate gains* provide the final positioning and provide stiffness at the target position. The gain shift point is specified in encoder counts.

If the Gain Shift value is greater than zero, the alternate proportional gain MUST have a value greater than the primary proportional gain. Unpredictable results will occur if this rule is not observed. Typical gain shift values are from 25 to 150. Setting the Gain Shift value at zero disables the alternate gains causing only the primary gains to be used.

4.2.5 IDLE SPEED

The *Idle Speed* setting determines the speed the belts run while the press is waiting for a box to break the leading edge photocell. Speed values are set from 0 to 127 with higher numbers indicating the faster speed. Setting the idle speed to 0 should cause the belts to stop although a small amount of creep is normal (1 to 2 inches per minute). Typical *Idle Speed* values range from 75 to 90 and vary depending on the requirement of a particular installation.

4.2.6 SEEK SPEED

The *Seek Speed* parameter determines the maximum speed of the belts while moving from one score to the next. *Seek Speed* values range from 0 to 127 with higher

numbers indicating faster speeds. Normally, *Idle Speed* and *Seek Speed* are set the same however, it is allowable to set them at different values. If the seek speed is set higher than the idle speed, the belts will speed up when the leading edge eye is broken. Setting the *Seek Speed* lower than the *Idle Speed* will cause the belts to slow down when the leading eye is broken.

Typical *Seek Speed* values range from 75 to 90 but are frequently set to 120 or higher if long score distances are used. Settings vary depending on the requirements of a particular installation and may vary from job to job.

4.2.7 PRESS #1 and #2 to EYE DISTANCE

The *Press #1* and *Press #2 to Eye Distance* values are used to compute the position of the platens relative to the leading edge eye and to each other. All distances are positive numbers, and the sum of the two distances must equal the distance between the two press platens. It may be necessary to adjust these values to correct for errors in the first score on a board.

On most presses, the box passes under platen #1 as it enters the scoring press, then it breaks the photoelectric beam. Since the box is only allowed to position in the forward direction, it is impossible for a make a score using score bar 1 closer to the end of the box than the Press #1 to photocell distance. In fact, once the photocell has broken, the box must have enough distance to slow to a stop before it reaches the first score position regardless which press platen is to be used. This places some restrictions on how close to the end of a box a score can be made, and also may determine which press platen may be used or how fast the belts can be run.

The distance between the platens is used to compute how far the box must move when different platens are used on a single board. For instance, if the first score uses platen #1 and the second score uses platen #2 then the box has to move the distance between the platens plus the distance between the scores.

In cases where a score is made using platen #2 followed by a score from platen #1, the minimum score spacing is determined by the distance between the two platens.

Systems that have *Double Score* capability, key the *double score* to the position of the #2 (down-stream) platen. The score must be programmed so that the score closest to the leading edge of the box is positioned under the #2 platen. The second score is determined by the platen spacing.

4.2.8 PRESS TIMES and DWELL TIME

4.2.8.1 SINGLE SCORE OPERATION

Three timers control the operation of the two press platens. *#1 Press Time* sets the amount of time the hydraulic cylinder on press #1 is energized to press into the board. *#2 Press Time* sets the down time for the second platen.

Dwell time is the time allowed for the press cylinder to retract from the box before the board will be accelerated for the move to the next score position.

Timers are set in 0.1 second intervals and settings will vary from machine to machine. Typical Press times range from 0.5 to 1.0 seconds while Dwell times are typically 0.5 seconds or slightly longer. If the *Dwell time* is too short, the box will drag on the platen as it is retracting and cause subsequent scores to be out of position.

4.2.8.2 DOUBLE SCORE OPERATION

Systems that have Double Score capability have three additional timers. The *Double Score time* sets the time for both press platens to make the press down cycle and is normally set somewhat longer than the press time for single score operation.

The *Double Score Dwell* time value sets the interval allowed for the platens to retract from the box and is also somewhat longer than the normal Dwell time because the cylinders retract about half as fast with both cylinders moving.

The *Stagger time* value sets the delay for Platen #1 to start moving after Platen #2 has started it's cycle. The *Double Score timer* does not start running until after the *Stagger time* has elapsed.

Double Score timers are very dependent on the individual machine, particularly the hydraulic supply. Timer setting will range from 0.7 second to 1.5 seconds or longer.

4.2.9 SERVO PARAMETERS

The press control servo positioning is based on a 3 mode PID control algorithm. The Servo Setup Parameters are the control values or gain coefficients for the three control loop element. Result of the three functions are summed to produce the command signal to the servo motor controller. The functions are called Proportional, Integral, and Derivative, hence PID. Two independent sets of gain coefficients are used. The *primary gains* are used when the load is relatively large distances away from the final target position. As the position becomes closer, as set by the GAIN SHIFT value, the *alternate gains* take over to provide final positioning and high holding forces.

4.2.9.1 PROPORTIONAL GAIN (PG)

The output of the *proportional* function varies 'proportional' to the difference between the target and the actual positions, referred to as *position error*. As the load gets closer to the target position, the position error decreases reducing the output proportionately. The lower the *proportional gain*, the more gradually the output changes as the load approaches the target position. The *proportional* function results in a deceleration that attempts to bring the load to a stop at the target position.

Large *proportional gain* values result in rapid deceleration and may attempt to stop the belts faster than the machine is capable of stopping. This results in over-shoot requiring the box to back up to reach the target position. *Proportional gain* values that are very low result in sluggish operation and slower than necessary operation. The ideal PG setting results in a smooth and rapid deceleration to stop with no over-shoot or oscillation.

Once the load has slowed and is near to the target position, the *alternate PG* is used. Since the load is moving much slower, it is possible to use higher gains without danger of over-shoot. The higher gains cause the system to pull into position faster and with greater accuracy. Typical values for *primary PG* are 7 through 9 while *alternate PG* values may range up to 20.

REMEMBER: If the gain shift value is greater than zero, the alternate PG MUST be GREATER than the primary PG.

4.2.9.2 INTEGRAL GAIN (IG)

The *integral* function produces an output proportion to the time integral of the position error. In other words, the longer an error exists, the higher the output it will produce. Integral output is used to overcome friction and null shift changes which might otherwise prevent the target position from ever being reached. Integral gain values that are set too high will result in a 'see-saw' movement of the belts. Typical integral gains IG range from 0 to 3.

4.2.9.3 DERIVATIVE GAIN (DG)

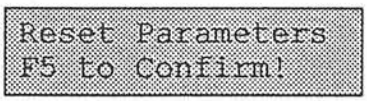
The *derivative* function produces an output inversely proportional to the rate of change of the position error. In other words, the faster the error is decreasing (or increasing), the more it slows down (or speeds up). Derivative control is used to provide dampening to the control loop. DG values that are too high will result in the stuttering as the drive comes to position. Typical DG values range from 0 to 20.

4.2.10 FACTORY RESET

The Factory Reset function is used to initialize all the setup parameters when the

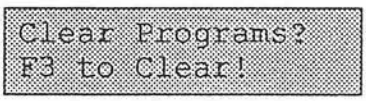
computer is first commissioned or in the event all of the setup parameters have been lost. Access to the Factory Setup option by pressing function key F3 while the Servo Parameter Setup menu shown below is open:

The Factory Reset function loads typical parameters that are seldom the specific values required for proper operation of a particular machine. For this reason, the computer asks the operator to confirm the operation. Selecting F5 from the above screen produces the first of the confirmation screens shown below:



Press F5 to continue with the reset process. Any other key will exit to the Servo Parameter menu without performing the reset.

Once the reset is completed, the computter asks if the 'user programs' are to be cleared (see below).



Press function key F3 to clear all of the user programs. Any other key will leave any user programs in memory.

5. TROUBLESHOOTING

5.1 SERVO LOOP NULL ADJUSTMENT

The servo that positions the box in the Score Press is a hybrid of analog and digital circuits. The PCU calculates target positions based on the selected user program and monitors the motion of the belts using encoder signals fed back from the servo drive. The computer produces a DC voltage corresponding to motor speed and direction (velocity command) necessary to position the servo at the target position. The velocity command is fed to a digital servo drive amplifier. The velocity command varies between -10vdc to +10vdc where -10vdc calls for full speed forward.A velocity command of 0 volts dc should bring the motor to a stop. In reality, small errors or offsets in the system, either in the PCU or the servo amplifier cause the motor to turn slowly or creep when it should be stopped.

The system is capable of compensating for a substantial voltage offset but under some conditions, it may become necessary to recalibrate the system. The following steps detail the process. It is not normally necessary to perform the 'zeroing' process so if it becomes required on a regular basis there is probably something else wrong with the system.

Perform a quick test of the zero adjustment by changing the Idle speed to 0 while the belts are running and no boxes running through the machine. The belts should come to a *near stop*, creeping less than 2 inches per minute. If the belt creep is significantly greater than 2 inches per minute, measure the dc voltage at terminals 1 and 2 at X13 on the Indramat DDS2.1 servo amplifier in the left side of the main control cabinet. Make the measurement using a digital voltmeter set on a low scale, such as 2.0 volt DC.

DANGER: HIGH VOLTAGE IS PRESENT IN THE CABINET

If the voltage measured above is less than 0.01 volt the output of the computer is within spec's and need not be adjusted. Continue with the *Indramat DDS Null Adjustment* procedure below. If the measured voltage is above 0.01 volt, skip the following section and proceed to the *SBC Servo Channel Adjustment* section.

5.1.1 INDRAMAT DDS NULL ADJUSTMENT

Perform the null adjustment procedure with the belts running and the Idle speed set at 0. This should result in a dc voltage reading of less than 0.01 volt at terminals 1 and 2 on terminal strip X13 on the digital servo drive.

Locate the *Offset* adjustment above terminal strip X13 located on the analog interface module in the DDS amplifier. Using a small screwdriver, slowly turn the adjustment screw till the belts move at the slowest possible speed. Normally the belts will stop and after a period of time, start to slowly creep again. The objective is to get the belts to move as slow as possible, accepting the fact that they will probably not stop and stay stopped. Take care accessing the adjustment screw since it is fragile and it is possible to cause mechanical damage to the amplifier.

After the adjustment is complete, reset the Idle speed to the original setting and continue operation.

5.1.2 SBC SERVO CHANNEL ADJUSTMENT

If it becomes necessary to adjust the servo channel output on the SBC (single-board computer), stop the belts using the normal operator controls, then switch the main disconnect to the main control panel to the OFF position. Open the left side of the main control cabinet and open the breaker feeding the Indramat servo system. In the right side of the main panel, remove the 5 retaining screws and cover from the SBC located in the upper right corner of the cabinet. Set the screws and cover aside then locate the Servo

channel ZERO and GAIN adjustment screws near the middle and towards the right side of the circuit board. Turn the main disconnect back on.

Using the hand-held programming terminal (**PT**), set the operating mode to HAND then access the *Servo Speed setup* menu and set the *Idle speed* to 0 (zero). Using a digital voltmeter set for a low DC voltage range (2.0 volt DC is good), measure the voltage between terminals 10 and 11 on terminal strip T2 located near the center of the right side of the circuit board. Terminal 12 is the top terminal near the T2 legend on the circuit board. Terminals 10 and 11 are the two terminals directol below terminal 12. Carefully adjust the ZERO adjustment screw until the meter reads less than 0.01 volt.

Once the Zero setting is made, set the *Idle speed* value to 127 using the **PT**. Adjust the GAIN adjustment for a reading of 10 VDC plus or minus 0.1 volt. This adjustment is very sensitive but is not critical so long as it is between 9.90 and 10.1 volts. Set the Idle speed back to 0 and check the ZERO setting once more. Adjust if necessary.

Once the settings have been completed, restore the *Idle speed* to the original setting. Return the *Operating Mode* to *AUTO*. Turn off the main disconnect and replace the cover on the computer board. Turn on the breaker for the Indramat servo. Close the enclosure doors and restore power.

APPENDIX A

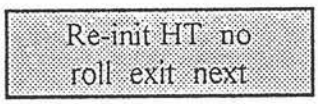
A.1 ST-32A Hand Held Terminal Setup Guide

The ST-32A hand-held terminal serves as the operator interface for certain applications. The setup parameters in the ST-32A must match those of the controller for the terminal to operate properly. Terminals supplied by ICI have these parameters preset but may require re-programming if the terminal displays nonsense characters or does not respond to key strokes.

The following directions apply to ST-32A terminals that display **FW379E** during self-test (self-test occurs when the terminal is first plugged in). Terminals with different software versions will be similar but the number and order of parameters may change.

A.1.1 SETUP MODE:

Enter the *setup* mode by pressing, then releasing the **Shift**, **Z**, **Space** keys in that order. These keys are all located in the bottom row of keys on the from of the terminal. The terminal should enter the setup mode, displaying the menu screen shown below:



A.1.2 RE-BOOT:

If the terminal does not enter the *setup menu*, it may be necessary to *reboot* the terminal. To *reboot*, unplug the power cord from the bottom of the terminal by pressing down on the plastic clip and remove the plug from the terminal. Wait a second or two then re-insert the power cord while holding down the **Z** key and the **Enter** key. Hold the keys down until the self-test is complete. The terminal should enter the *setup menu*. If the menu does not appear, repeat the boot process taking care to hold the keys down firmly through the entire self-test.

A.1.3 SETTING:

The first screen (shown above) is used to reset the terminal to the default (factory) settings. The factory default settings <u>ARE NOT</u> the settings required for proper operation

with the SBC single board computer. Advance to the next menu item by pressing the '*next*'(**F5**) key.

A.1.4 SETUP MENUS:

The *setup menu* consists of a number of menu screens. Each screen sets a particular parameter. The current setting for each parameter is displayed on the screen. Use the '*roll*' key (**F1**) to scroll through the possible settings for each parameter. You may exit from the Setup process at any time by pressing the '*exit*' key (**F3**). Advance to the next parameter screen using the '*next*' key (**F5**). There is no provision for backing up to the previous screen. Advance through all of the menu screens setting the options as follows:

A.1.5 SETTINGS FOR ST32A VERSION 'FW379E' TERMINALS:

Baud	= **9600**
Comm bits	= **8,1,N**
Parity error	= **on**
Key beep	= **off**
Key repeat	= **off**
Echo	= **off**
Shift Keys	= **yes**
Ctl Chars	= **procs**
Scroll on	= **33rd**
Cursor	= **on**
CRLF for CR	= **off**
Self test	= **fast**
Menu mode	= **long**

Pressing **F5** after the last menu item returns the terminal to self-test, then to normal operation.

APPENDIX B

B.1 PASSWORD PROGRAMMING

Password protection is available to limit access to the Programming and Setup menu's. Different passwords apply for the two menu options. Passwords are accessed by pressing function key F4 from the main *Setup* menu shown below:

```
  MACHINE SETUP
SERVO TIMER DIST
```

There is no prompt for the Password screen visible on this menu. Function key F4 accesses the Password setup screen below:

```
Prog. Key=    0
Setup Key=    0
```

The value labeled *Prog. Key* determines the password for the Programming menu's. Access to the Setup menu is controlled by the *Setup Key*. Passwords may by any number between 0 and 65535 and are entered the same as any other number. Setting the password equal to 0 (zero) disables the password and allows free access the corresponding menu.

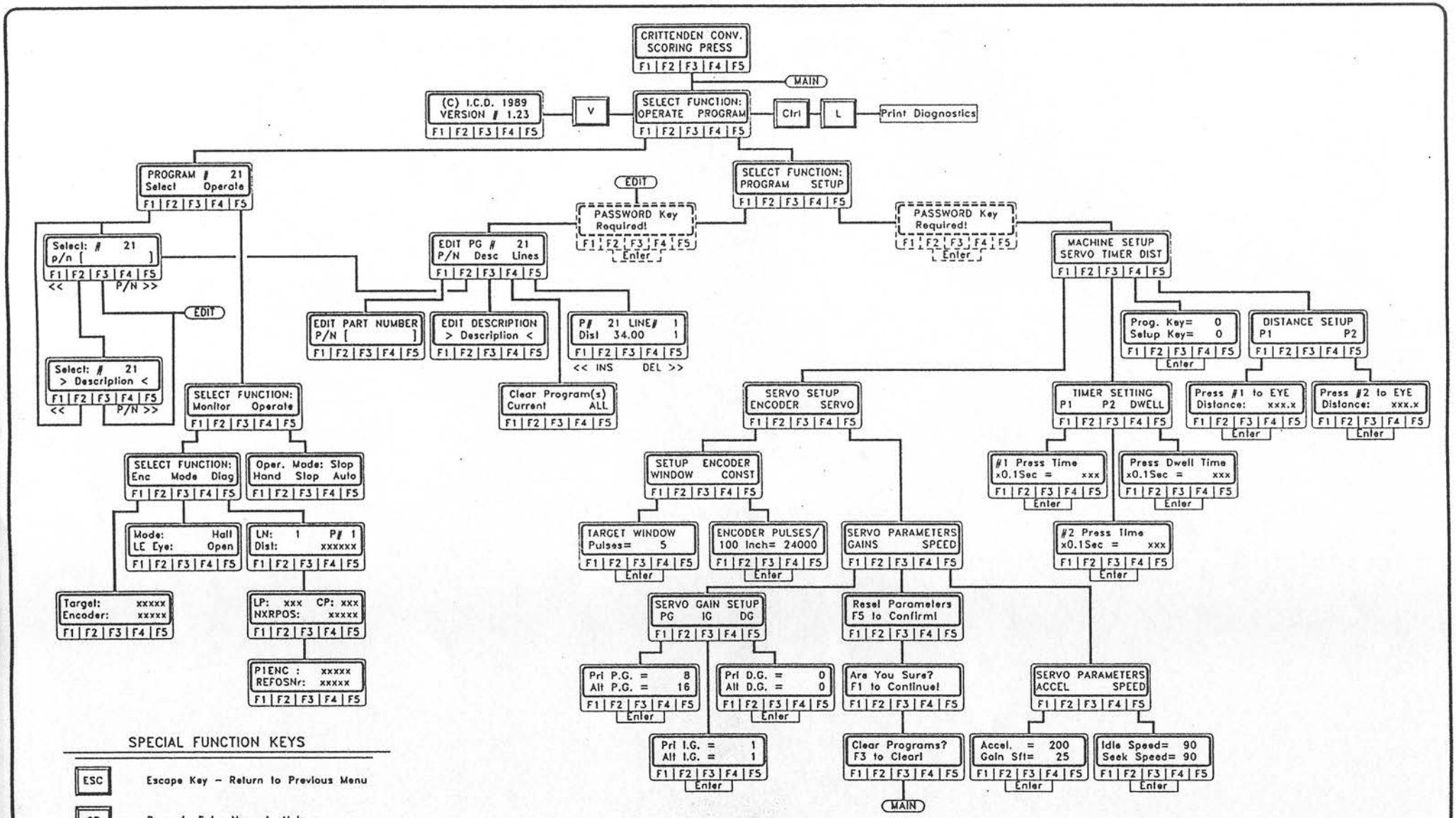
When the *Setup key* is set to a value greater than zero, access to the *Setup* menu is limited. Since the *Password Setup* screen must be accessed through the *Setup* menu, it is important not to forget the password. If the password is misplaced, the computer will accept a special '*over-ride*' password of 11748. This special password will allow access to either the Programming or Setup menu's.

APPENDIX C

C.1 MENU MAP

ICD Drawing B-1386-01 for Single Score Press Controls

ICD Drawing B-1386-02 for Double Score Press Controls



Software Version v1.23 – 6/26/95

REV	Description	DATE	BY	REV	Description	DATE	BY

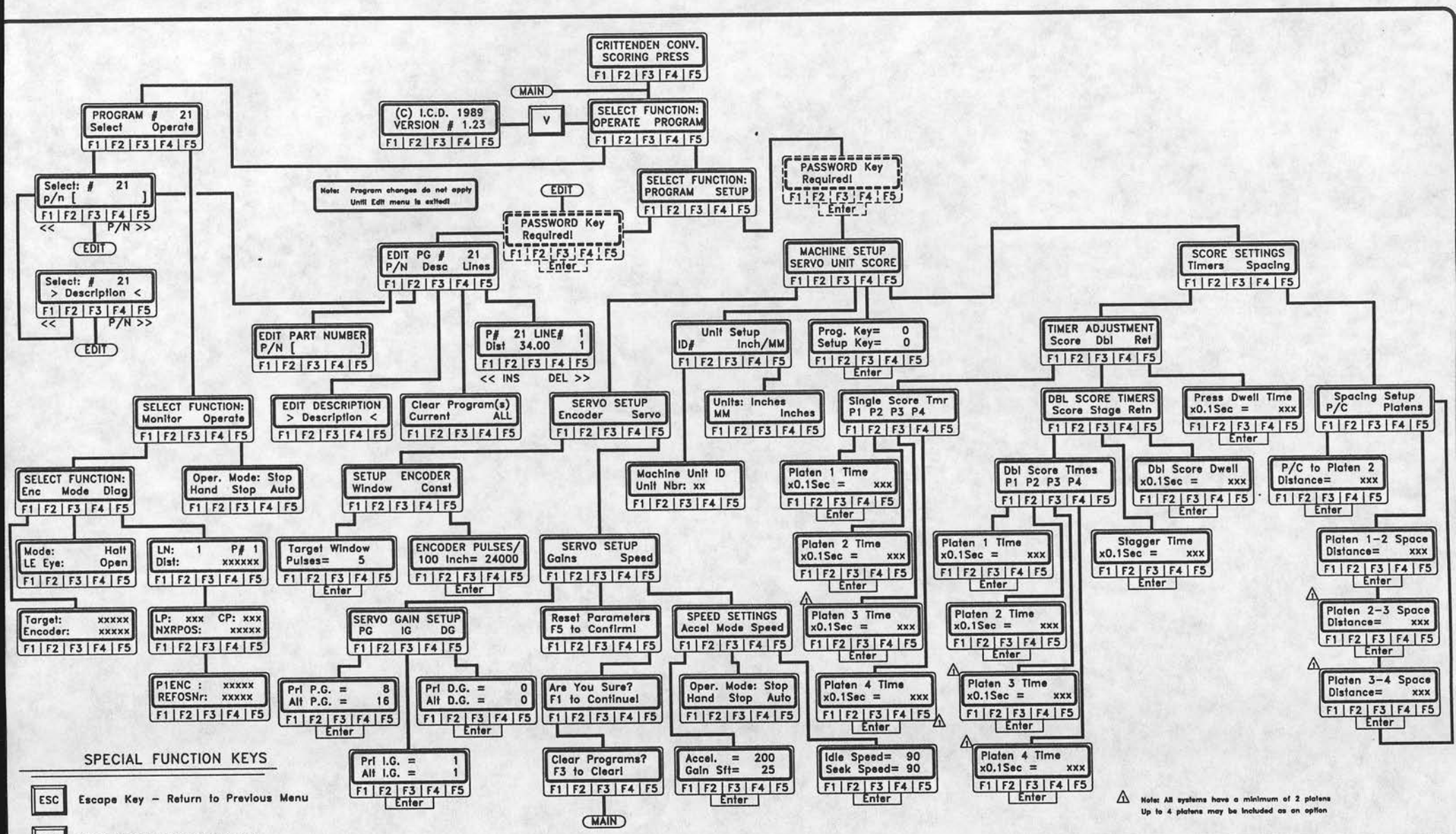
☒ PRELIMINARY DRAWING
☐ SUPERSEDES PREVIOUS DWG.
☐ APPROVAL DRAWING
☐ AS BUILT / INSTALLATION DWG.

CUSTOMER:
CRITTENDEN CONVERSIONS, INC
BULK BIN LAMINATOR

DATE: 06/24/96 DRAWN BY: MARSH
SCALE: N/A SHEET: 1 OF 1
B- 1386-01 REV:

TITLE:
SCORING PRESS
MENU MAP
SINGLE SCORE

INTEGRATED CONTROLS DESIGN
INDUSTRIAL CONTROL SYSTEMS



Software Version v3.03 – 10/11/00

REV	Description	DATE	BY	REV	Description	DATE	BY
A	V1.28 Update						

☒ PRELIMINARY DRAWING
☐ SUPERSEDES PREVIOUS DWG
☐ APPROVAL DRAWING
☐ AS BUILT / INSTALLATION DWG

CUSTOMER:
CRITTENDEN CONVERSIONS, INC
BULK BIN LAMINATOR

DATE: 10/11/00 | DRAWN BY: MARSH
SCALE: N/A | SHEET: 1 OF 1
B-1386-03 REV:

TITLE:
SCORING PRESS MENU MAP REV 3.XX

INTEGRATED CONTROLS DESIGN
INDUSTRIAL CONTROL SYSTEMS