

2-1-99



2000 LX
FLEXIBLE SMD
PLACEMENT SYSTEM

RMENU3

2000 LX
Automatic
Pick & Place
Manual



Operations

WELCOME:

Congratulations on one of your most recent business decisions! The Multitroniks 2000 LX Automatic Pick and Place Machine will provide a more efficient production process which will ultimately stimulate your profits. We at Multitroniks would like to welcome you to the growing number of satisfied customers who have taken steps in order to maintain the competitive edge on which successful businesses thrive.

INTRODUCTION:

Multitroniks, Inc. has been manufacturing PCB assembly systems for more than a quarter of a century. We take pride in being able to offer you the state-of-the-art equipment you deserve for about half the price of the competition. The all new Multitroniks 2000 LX Automatic Pick & Place System has a clean, simplified design which provides long term reliable and diversified performance with minimal maintenance. The 2000 LX machine represents the most efficient, economical and reliable low volume PCB assembly equipment in the industry.

The following document describes the use of two new features which have been added to the 2000LX software, revision 2.20. These new features will only affect programs which have more than one offset enabled to build multiple boards.

1. Global and Panel fiducial mark recognition.

An alternate method of using fiducial marks has been developed which will allow the use of individually fixtured boards. The use of this mode requires that each board have it's own pair of fiducial marks. These mark must be the same pattern and in the same location on each board. The 2000 will then be able to find these marks and adjust for any positional or rotational mis-alignments.

This new mode has been labeled as the Panel Fiducial Mark mode. The original fiducial mark recognition process which uses only one pair of fiducial marks for an entire panel of boards is now known as the Global Fiducial Mark mode. The program creation and editing process is the same for both modes, but the particular locations chosen for the fiducial mark and for the offset points might be different for each mode.

To select which fiducial mode that is to be used for a particular board, go to the Edit Fiducial Marks section of the Edit menu. The current mode is displayed in the upper right corner of the screen. To change the mode, press ALT-T.

When programming offset points in the Panel mode, please note that offset #1 must remain at an X/Y coordinate of 0,0 which makes the offset location the same as fiducial mark #1. For each additional offset, the offset location should also be at the fiducial mark #1 for each panel.

PLEASE NOTE: The fiducial mode cannot be changed while in Assembly.

2. Serial and Parallel Assembly modes

A method of changing the assembly sequence has also been added to this version. In this new mode which is labeled as the Serial Assembly Mode, each individual board will be completely assembled before the next board in the sequence is started. The original assembly mode which assembles the first part on all boards in the sequence before moving on to the second part, is now called the Parallel Assembly mode.

The Serial Assembly mode was created for customers who have parts prepared for their feeders where all of the parts for a particular board are sequenced together. If the Serial Assembly mode is chosen for a program which uses multiple pick nozzles, The assembly time will be long due to an increase in the number of times pick nozzles are changed.

To Change the current assembly mode to either Serial or Parallel, first select Options from the Assembly menu, then select Toggle Assembly mode. The current mode is displayed in the upper right corner of the screen.

Multitroniks Inc.

2000 LX Assembly System

User's Guide And Reference

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Section 1 - Creating a New Program

The following will describe the recommended sequence that should be followed to prepare the system for programming and assembly of a new PC board.

1.1 Feeder Preparation

The first step will be to determine the type of feeder that will be required for each component. The Multitroniks 2000 LX is able to handle components in Reels, Sticks or Trays. Each feeder is then assigned to a specific numbered location on one of the 4 sides of the machine. There are several restrictions as to the locations of some types of feeders. If you are using parts that are in a JEDEC carrier tray, you must locate these trays across the back of the system. If you are using parts that are in a stick, you must locate the vibratory feeders on either the front, back, or left sides. Vibratory feeders cannot be located on the right side of the system. Tape and reel feeders can be located on all 4 sides of the machine.

Once the feeder locations have been assigned, you must fill in a table which matches the component data with a feeder number. This feeder table is a separate file stored in the computer, but is always loaded along with the assembly program. The computer software has been designed so that if you keep all or most of your feeders in the same location as a previously created assembly program, you can use that previous feeder table as a starting point so that you do not have to fill in all of the same feeder information again..

1.2 Creating an Assembly Step Sequence

After you have completed the entries for the feeder table, you will be ready to create the assembly sequence and fill in the information for each part into the assembly program. The information that is required for each step includes items such as part name, X and Y location, part rotation and feeder number. If the board you are assembling has been created on a CAD system, you can use a Multitroniks CAD conversion program to create an assembly file with most of this information already in it.

To create a feeder table and assembly sequence for a new board, use the following steps:

1. Place the board that is to be assembled on the board mounting fixture.
2. At the Main Menu, select CREATE ASSEMBLY PROGRAM, and at the prompt, type in a name for the program. This name should consist of a maximum combination of 8 numbers or letters.
3. You will next be shown a list of existing feeder table files. If this is the first program you are creating, you will only be shown the factory supplied feeder table named: DEFAULT.FDR. Use the arrow keys to highlight the desired feeder table and then press the ENTER key. You will now be presented with the EDIT menu.
4. Select EDIT FEEDERS. You will be shown the feeder editing screen, with the information for feeder #1 displayed. The system will also move the head so that the video screen will display the feeder pick point. To change the screen so that it shows the information for another feeder, use the up or down arrow key to highlight the FEEDER # field and type in the number of the feeder that you would like to edit. When you have the desired feeder displayed, use the up and down arrow keys to move to each field and fill in the information as described below.
5. Fill in each field of the feeder table with the following information:
 - Description: This is an optional 14 character text field for describing the part.
 - Type: Press the space bar to change the type to either REEL, STICK or TRAY so that it matches your feeder.
 - X/Y Coord: Move the screen cursor so that the Z coordinate field is highlighted. Then use the hand-held programmer to move the head in the X and Y directions so that the cross-hair on the video screen is centered on the pickup point for that feeder, and then press the READ button. Both the X and Y coordinates will be updated together.

- Z Coord:** Move the screen cursor so that the Z Coordinate field is highlighted. Then use the hand-held programmer to move the head in the Z direction so that the bottom of the pick-up nozzle touches the top of the component in the feeder, and then press the READ button. Since all REEL feeders pick up at the same height, you can copy this Z coordinate into all other feeders that are set to REEL type feeder by pressing the F5 key.
- Part Width:** Measure the width of the component and enter that value here. The width is the left to right dimension of the component as it is presented in the feeder, and viewed from the outside of the system looking in.
- Part Length:** Measure the length of the component and enter that value here.
- Part Height:** Measure the thickness of the component and enter that value here. This is used to find the middle of the component for the laser align process, and is also used so that during placement, the part stops moving down just as it touches the PC board. HOW
- X Offset:** Used only for TRAY type feeders. This is the distance in the X-axis from the center of one component to the center of the next component.
- Y Offset:** Used only for TRAY type feeders. This is the distance in the Y-axis from the center of one component to the center of the next component.
- Counts:** Used only for TRAY type feeders. This is the total quantity of parts in the tray.
- Pitch:** Used for REEL and TRAY feeders. For REEL feeders, this is the number of tape sprocket holes for each component. For TRAY feeders, this is the number of components in the X-axis of the tray.
- Scan Height:** The scan height for the laser centering system can be changed from the default level with this number. If this is set to zero, components less than or equal to .120 inches are scanned at the half the thickness of the part. Parts thicker than .120 inches are scanned at 2/3 of the way down from where the pick head touches the part. This value can only be a positive number and will move the scan level to the specified distance below the bottom of the pick nozzle

- Head: This is the number of the pick nozzle that should be used for this part.
- Force: The default force is 10 grams. For every increase of 10 grams, the pick head will move .001 inches further down during placement, pushing the component harder onto the board.
- Retry: When this feature is turned ON, a failure to pick a part from this particular feeder will activate the automatic retry process as described in section 3.1.4.. If this feature is turned OFF, then a failure to pick a part from this feeder will result in the step being skipped.

Melf Angle - change from 0-90-0 by hitting space bar

6. After completing the programming for all feeders, press the ESC key on the computer keyboard to return to the EDIT menu.

7. Select SAVE FEEDER CONFIGURATION to save the changes that were made to the feeder table.

8. Select MEASURING BOARD ANGLE. Select two points that are along the same line in the X-Axis (Left to Right). For the most accurate angle measurement, select two points that are as far apart as possible. Also, avoid using 2 points along the edge of the PC board since the edge might not be parallel with the printed patterns on the board.

9. Use the arrow keys on the hand-held controller to move the head in the X and Y directions so that the cross-hair on the video screen is centered on the first point. Press the READ button on the hand-held controller.

10. Use the arrow keys on the hand-held controller to move the head in the X and Y directions so that the cross-hair on the video screen is centered on the second point. Press the READ button on the hand-held controller. The system will then display and automatically store this alignment angle. If this angle is other than 0.000 degrees, then each part will be rotated by that amount before placement.

11. Press the ESC key on the computer keyboard to return to the EDIT menu.

12. Select DEFINE THE FIDUCIAL MARKS. The fiducial marks are two symbols or component pads that are used to determine the actual location of the board that is being programmed. The two marks should ideally be located near two diagonally opposite corners, for example, lower left and upper right. For the most accurate measurement, the two marks should be simple geometric patterns such as a circle, square or rectangle.

13. Move the head so that the mark that you have selected for fiducial mark #1 is centered on the crosshair of the video monitor. Press the READ XYZ button on the Hand-Held Programmer.

14. If the system cannot find any fiducial mark near the center of the screen, or if too many objects are found and identified as possible fiducial marks, the computer will indicate an error condition by displaying the message: "Fiducial Mark Not Found". To correct this condition, you may have to change the threshold level so that the symbol is recognized. The usual range of values for the threshold is 60 to 120.

15. To change the threshold level, first move the cursor to the field labeled THRESHOLD.

16. Press the SPACE BAR to activate the adjustment process. Note that the picture from the camera has changed to a binary black and white picture.

17. Use the PAGE UP/ PAGE DN key for coarse adjustment and the UP/DOWN arrow keys for fine adjustmet, and change the picture so that the symbol has a solid white appearance, and the background has a black appearance. The edges of the fiducial mark should be sharp and well defined assure the most reliable calculation of the center of the mark. After an acceptable threshold has been established, press the ENTER key to return the cursor to the fiducial mark screen.

18. You should next try to read the fiducial mark again by pressing the READ XYZ button. If you still cannot read the fiducial mark, then you may select a manual alignment. This option will simply use the coordinate located at the center of the cross-hair as the fiducial mark location. If this method is chosen, then when starting the assembly process, the system will stop and wait for the user to manually locate the cross-hair at the previously selected fiducial location.

19. Move the head so that the mark that you have selected for fiducial mark #2 is centered on the cross-hair of the video monitor. Press the READ XYZ button on the Hand-Held Programmer. If this mark is not found, follow the previously described procedure for adjusting the threshold.

20. When both marks have been found, press the ESC key to return to the EDIT MENU.

21. Select EDIT THE OFFSET POINTS from the EDIT MENU. Activate board #1 by pressing the SPACE BAR on the computer keyboard. For most programs, you will leave the X/Y coordinates at 0,0. This will make the offset point for board #1 the same location as fiducial mark #1.

(See the section on Editing the Offset Table for programming the X/Y coordinates to a different location than fiducial mark #1, as well as how to set the offset points for boards 2 - 256.)

22. Move the cursor to the field labeled B and type in the thickness of the PC Board.

23. Press the ESC key to return to the EDIT MENU.

24. Press the S key to SAVE the fiducial and offset coordinates.

25..Select ENTER THE PROGRAM STEPS and enter the information for each program step. Please refer to the SOFTWARE REFERENCE section for descriptions of how to enter program step information. When you have completed the last step press the ESC key to return to the EDIT menu and then press the S key to SAVE THE PROGRAM.

26. PLEASE NOTE: If not SAVED, then all program step information will be lost!

27. Press the ESC key to return to the MAIN MENU.

(See the section on Editing the Offset table for programming the offset point at a different location than fiducial mark #1, as well as how to set the offset points for boards 2 -256.)

Section 2 - Starting the Assembly Process

After you have completed the programming sequence, the system will be ready to begin the assembly of the PC board. From the MAIN MENU, select AUTOMATIC PCB ASSEMBLY. You will now be presented with the ASSEMBLY MENU. Before you start the assembly process you may wish to change one or more of the available options. To change options, select SET UP ASSEMBLY OPTIONS. (See the SOFTWARE REFERENCE section on Assembly Options for details.)

To begin the assembly process, select START ASSEMBLY. The 2000 LX system will then pick and place the components in the sequence that was programmed. When the assembly process has finished, the display will show the message PROGRAM COMPLETED. Pressing any key will then return you to the assembly menu.

Section 3 - Software Reference

The control software for the 2000 LX Pick and Place system has been designed to give the user as many options as possible while maintaining a user friendly menu selection system.

A block diagram of the Software Menu Structure Space is shown on the next page in Figure #1.

When the System PC controller is started, the 2000 LX MAIN MENU will be displayed (see Figure #2 below). The screen will also show the name of the assembly file that is currently loaded. When a new assembly program is created or an existing program is loaded, it will become the current program.

The sequence of the menu entries has been chosen based on the amount of use that is expected, with the most used items at the top of the menu. A menu item can be selected by using the up and down arrow keys to highlight the desired item and then pressing the [ENTER] key on the computer keyboard.

Items can also be selected by pressing the letter in the word that is highlighted in light blue. In the following list, the letter is a bold capital letter.

Main Menu

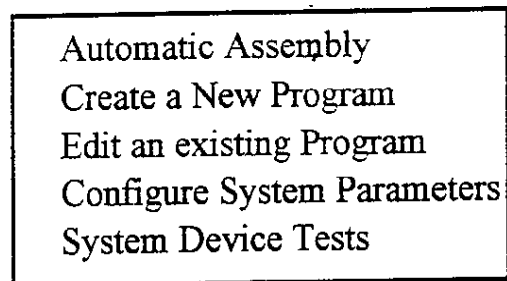


Figure #2

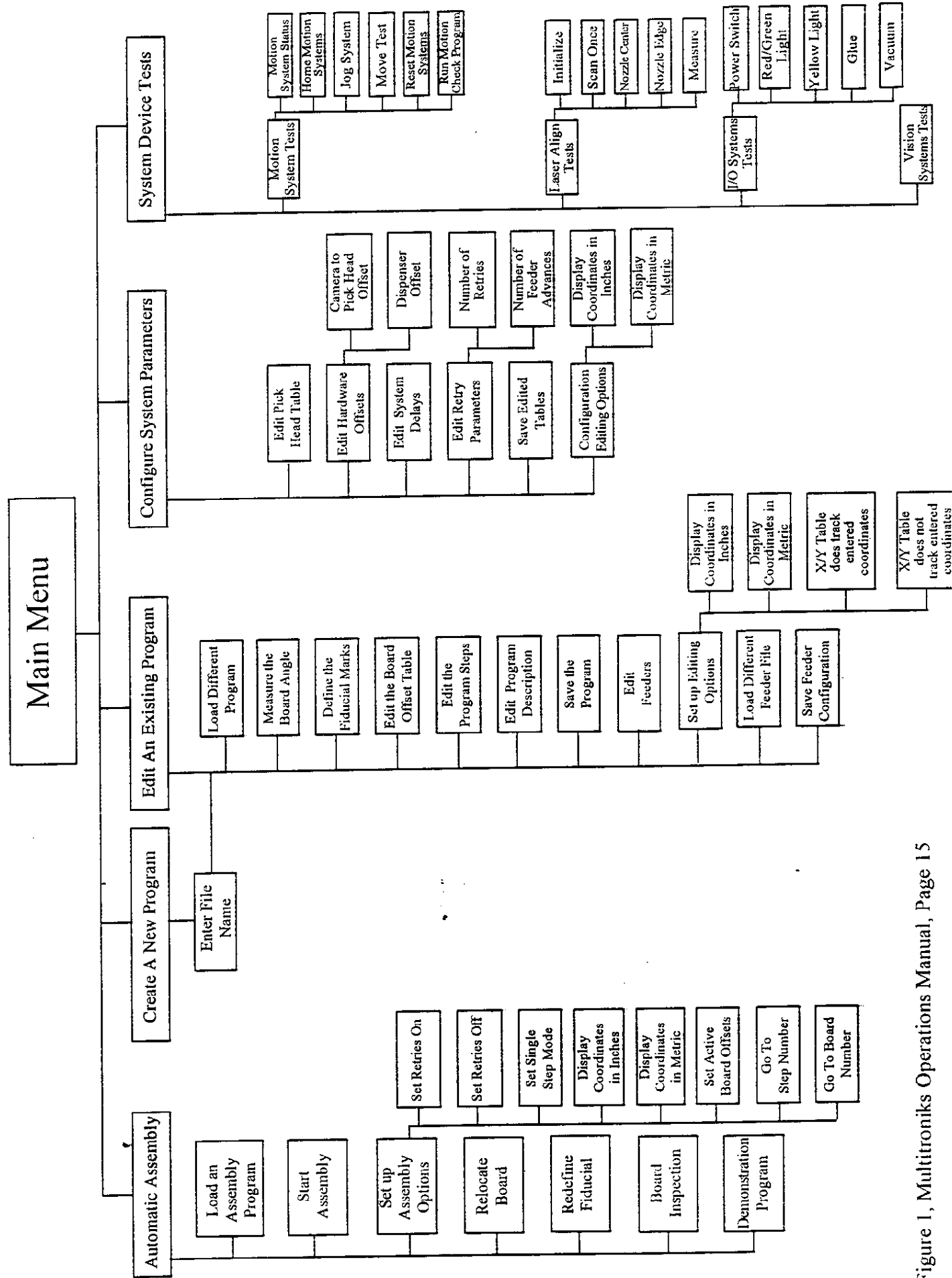


Figure 1, Multitronics Operations Manual, Page 15

3.1 Automatic PCB Assembly

This selection will allow the system to run an existing assembly program. See Figure #3 below for a list of selections on this menu. The system will use the currently loaded program unless you choose another previously saved program by selecting "LOAD AN ASSEMBLY PROGRAM". The file name of the currently loaded program is displayed above the menu box. If no program has been loaded, the name displayed is "NONE". If you have not created a program for your board, then you must first create one using either the OFF-LINE EDITING PROGRAM, or by selecting "CREATE OR EDIT ASSEMBLY PROGRAM" from the Main Menu.

Assembly Menu

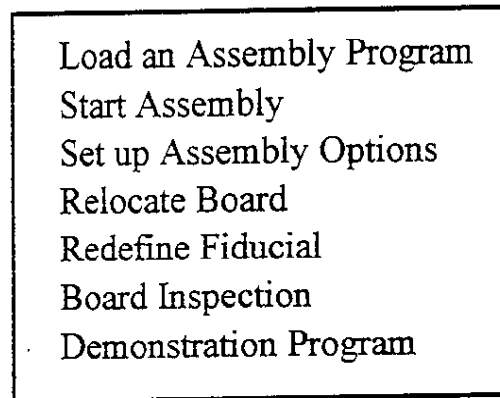


Figure #3

3.1.1 Load an Assembly Program

This option allows you to load a previously created assembly program. When you select this item, all of the assembly programs in the system will be displayed. You may make a selection by using the up and down arrow keys to highlight the desired program and then pressing the [ENTER] key on the computer keyboard.

3.1.2 Start Assembly

This option starts execution of the currently loaded assembly program. The system will first initialize the X/Y/Z/THETA mechanism. When this is completed, the assembly process will begin.

The assembly screen is displayed showing the programmed information for the step that is being performed.

For the 2000LX system with the fiducial vision option, the system will first read the fiducial marks to locate the board to be assembled. Then the pick mechanism will begin the assembly process by moving to the nozzle storage rack and selecting the appropriate nozzle. The pick mechanism will then move to the selected feeder and attempt to pick up a part.

The machine is equipped with an integrated vacuum generator/sensor system to ensure a reliable pick and place operation. The level of vacuum pressure on the nozzle is an indicator for the existence of a part on the nozzle. This pressure is monitored by the vacuum sensor. If the sensor does not trip after a pick operation, it means that the part has not been successfully picked up. If the retry option is off, the system will proceed to the next part. If the retry process is turned on, the pick mechanism will try to retrieve the same part again. If the maximum number of retries has been completed without picking up a component, the feeder will advance to the next component and try to pick up that piece. If this advance feeder and retry pick process does not result in picking a component from the feeder, the program will pause and display the following options: Retry, Skip, and Abort.

To retry (pick the same part) select Retry.

To Skip this step, select Skip.

To Abort the assembly process, select Abort.

The number of times that the pick mechanism will try to pick the same part and the number of times that the feeder will advance before the program is stopped can be set in the CONFIGURE SYSTEM PARAMETERS menu (see section 3.3).

After the part has been picked up, the part will then be scanned by the Laser Align System and adjusted for proper rotation and centering before placement.

If the laser system fails to measure a part, a beep will be heard and a message displayed on the screen with a failure code. The laser system will then scan the same part again. If it fails the second time, the system will drop the part into the scrap drawer in the front left corner, and then pick up another part from the same feeder. If three (3) parts are picked up from a feeder and all fail the laser scan, the system will stop and allow the operator to either RETRY, SKIP or ABORT.

Please Note: All failure codes that occur, are stored in a disk file, which can be used by Multitroniks technical support to determine the reason for the failure.

After the component is placed on the PC board, if more than one board has been activated in the step and repeat offset table, the same component will be placed on all active boards before the next component in the assembly sequence is selected.

The assembly process will continue until all steps have been completed, unless interrupted by the operator. Pressing the [P] key on the keyboard will temporarily pause the assembly process until any other key is pressed to resume assembly. Pressing the [O] key will also pause the assembly process and display the options menu. Changes may then be made to any of the options before returning to the assembly process. Pressing the ESC key will also stop the assembly process and return the program to the assembly menu. The system will then finish the current step and then return to the assembly menu.

Please Note: If one or more components are missed during assembly, you may restart the program and assemble only those parts. (See section 3.1.4 - Go To Step and Board)

3.1.3 Assembly Screen

The screen that is displayed during the assembly process is shown below in Figure #4, which is followed by a description of each item.

Assembling File: TEST.SMD		
Program Description: Demonstration PC Board		
Step#: 1	Board#: 1	Retry Count: 0
Retry Status: ON	Assembly Mode: Normal	
Current Function: Fetching Pick Nozzle #1		

Figure #4

Assembling File:

The filename of the program being assembled is displayed at the top of the assembly screen.

Program Description:

This box displays the description of the assembly program that was entered in when the program was created.

Step #:

This box displays the number of the currently executing program step. This number will advance each time the program completes the current step.

Board #:

This displays the number of the board offset currently being used. For each program step, the assembly software will run through each of the active board offsets, duplicating the program step for each one. Only the X and Y coordinates for

the step will change, as the offsets for the new board position are added to the basic program offsets.

Retry Count:

This field shows the number of pick retries that have occurred. The normal value is set to zero and only increases if a component pick has failed and the number of retries is set to a value greater than zero.

Retry Status:

This field will either show ON or OFF, indicating the current state of the retry process.

Assembly Mode:

This field indicates either NORMAL which means the assembly process will run continuously, or it will indicate if the single step mode has been activated.

Current Function:

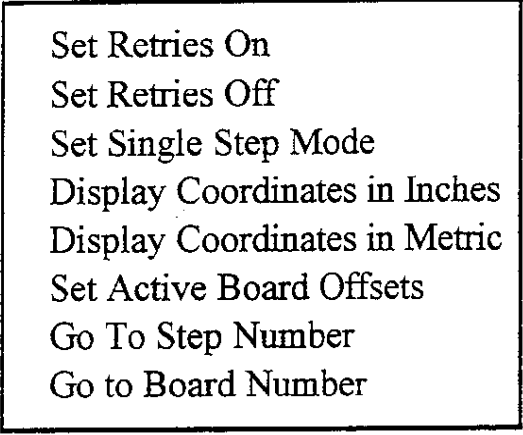
This field will show the current process that is taking place. Some examples of typical messages include:

- Picking part
- Squaring part
- Placing part

3.1.4 Set Up Assembly Options

This selection brings up the Assembly Options menu as shown in Figure #5 and described below. You may make a selection by using the up and down arrow keys to highlight the desired program and then pressing the [ENTER] key on the computer keyboard.

Assembly Options



- Set Retries On
- Set Retries Off
- Set Single Step Mode
- Display Coordinates in Inches
- Display Coordinates in Metric
- Set Active Board Offsets
- Go To Step Number
- Go to Board Number

Figure #5

Retries:

The 2000 LX is equipped with a vacuum sensing device so that the program can detect if a component has been picked up or dropped during transit. When assembly starts, the default condition has retries turned OFF. If this feature is turned ON, the system will attempt to pick up the same part again, and will retry as many times as is set in the configure system parameters menu (see section 3.3.4). If the system fails to pick up the component, then if possible, the system will advance the feeder and begin the retry process again. The number of times that the feeder will advance is also set in the configuration table. If the total number of feeder advances and pick retries has been completed and the part has still not been picked up, the system will stop and display a message box, giving you the option to retry picking the same part, skip this step or abort the assembly process.

Single Step Mode:

The assembly process will automatically advance to the next step unless a single step option is chosen. Single stepping is mostly used to observe the movement and position of the X/Y/Z mechanism, or to pause after placing the part on the board. If this option is selected, you will be able to choose between

pausing after completing each component placement, or pausing after each separate X/Y/Z motion.

Coordinate Units:

The 2000 LX can display coordinates in either English (inches) or Metric (millimeters) units.

Active Board Offsets:

When this option is chosen, the operator can activate or deactivate any of the 256 boards in the step and repeat offset table. However, The offset coordinates can not be changed with this selection. If you need to change the location of any offset coordinate, you must do so by selecting "Edit the Board Offset" table which is located in the "Edit an Existing Program" menu. (See section 3.2.4)

Go To Step And Board:

The assembly program can be directed to start the assembly at any step other than the first. The use of this will require knowledge of which step number corresponds to the part that is desired. This can be found by stepping through the program in the program edit mode. If multiple boards are being assembled, then a specific board may be selected as the assembly start point.

3.2 Create a New Program or Edit an Existing Program

These two selections from the main menu will allow you to create or change information for assembly program steps.

If you select Create a New Program, you will first be asked to enter in a new file name and to select a previously created feeder file to be used with this new program. The EDIT menu, as shown below in Figure #6, will then be displayed.

If you select Edit an Existing Program you will first be asked if you want to define the board location using the existing fiducial marks.

This is a very important step to ensure that any new X/Y locations that are created are stored with the same reference as previously programmed X/Y locations. If you choose to skip this step, any new X/Y locations might not be stored with accurate values. This step is most often skipped if changes are required to any data element other than component X/Y coordinates.

If the board has moved to a different location from when it was previously programmed, and you do want to add or change X/Y locations, you must first type Y to answer yes to this question. The camera will then fail to find the first fiducial mark and will give you the following options:

- Retry again
- Redefine fiducials
- Manual locating
- Abort the assembly

At this time you should select Redefine fiducials, which will prompt you to use the hand-held programmer to locate fiducial mark #1. The system will then automatically go and try to find the fiducial mark #2. If Mark #2 is found and is not exactly where the system expects to find it, then the software will calculate how much the board has been rotated from the original location. This will allow for accurate X/Y positions to be programmed. After this step has been completed, The EDIT menu, as shown on the following page in Figure #6, will then be displayed.

Edit Menu

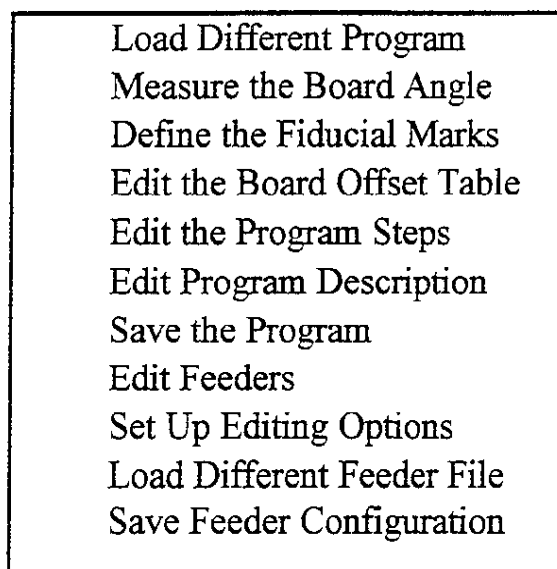


Figure #6

Each item in the Edit Menu is described below:

3.2.1 Load a different program

This option allows you to load a previously created assembly program. When you select this item, all of the assembly programs in the system will be displayed. You may make a selection by using the up and down arrow keys to highlight the desired program and then pressing the [ENTER] key on the computer keyboard.

3.2.2 Measure the Board Angle

This selection is used to determine if the X/Y axis of the board is parallel to the X/Y axis of the 2000. For this process to work correctly, you should choose two (2) points that are along the same line in the X-axis (from left to right). You will be prompted to locate the camera cross-hair on one of the points, and then press the READ XYZ key. When both have been entered, the system will then automatically calculate the alignment angle.

3.2.3 Define the Fiducial Marks

This selection is used to define two fiducial marks, component pads or other recognizable symbols on the PC board. These are used to determine the actual location of the board that is being programmed. For the most accurate measurement, the two marks should be simple geometric patterns such as a circle, square or rectangle.

For best accuracy, the marks should also be located in opposite corners. This will allow the system to compensate for slight rotational errors due to boards that are not tightly mounted in the board fixture.

To teach the fiducial marks, use the following sequence of steps:

1. Move the head so that the mark that you have selected for fiducial mark #1 is centered on the crosshair of the video monitor. Press the READ XYZ button on the Hand-Held Programmer.
2. If the system cannot find any fiducial mark near the center of the screen, or if too many objects are found and identified as possible fiducial marks, the computer will indicate an error condition by displaying the message: "Fiducial Mark Not Found". To correct this condition, you may have to change the threshold level so that the symbol is recognized. The usual range of values for the threshold is 60 to 120.
3. To change the threshold level, first move the cursor to the field labeled THRESHOLD.
4. Press the SPACE BAR to activate the adjustment process. Note that the picture from the camera has changed to a binary black and white picture.
5. Use the PAGE UP/ PAGE DN key for coarse adjustment and the UP/DOWN arrow keys for fine adjustment, and change the picture so that the symbol has a solid white appearance, and the background has a black appearance. The edges of the fiducial mark

should be sharp and well defined to assure the most reliable calculation of the center of the mark. After an acceptable threshold has been established, press the ENTER key to return the cursor to the fiducial mark screen.

6. You should next try to read the fiducial mark again by pressing the READ XYZ button. If you still cannot read the fiducial mark then you may select a manual alignment. This option will simply use the coordinate located at the center of the cross-hair as the fiducial mark location. If this method is chosen, then when starting the assembly process, the system will stop and wait for the user to manually locate the cross-hair at the previously selected fiducial location.
7. Move the head so that the mark that you have selected for fiducial mark #2 is centered on the cross-hair of the video monitor. Press the READ XYZ button on the Hand-Held Programmer. If this mark is not found, follow the previously described procedure for adjusting the threshold.
8. When both marks have been found, press the ESC key to return to the EDIT MENU.

3.2.4 Edit The Board Offset Table

The offset table is used when you want to build multiple boards (up to 256) at one time. If you are creating the assembly program by manually teaching the pick head where to place parts, we recommend using fiducial mark #1 as the offset point. When Fiducial mark #1 was programmed, it was declared as the 'anchor point' for the board and was given the X/Y coordinate of 0,0. So to use fiducial mark #1 as the offset point, you will not have to change the X/Y coordinate for board #1.

Defining a correct offset for board #1 is necessary, since all programming steps are entered relative to this point. If a valid offset

point is not programmed before entering the program step coordinates, the step and repeat function may not be useable. You must not change the X/Y offsets for board #1, once entering the programming steps has begun, or the program will not operate correctly.

When the offset point has been located on the first board, you may either proceed with the program creation or enter the offset points for up to 255 additional boards. All boards must be the same and all must be mounted parallel to each other.

Each offset table entry has several items. A status (which is either on or off) and an X and Y offset coordinate. Move between menu entries by using the arrow keys, Page Up, Page Down, Home, Tab and Shift tab keys. The ON/OFF status of the board may be changed by pressing any alphanumeric key while the cursor is in the status field of the appropriate board. The X and Y coordinates may be programmed by one of the following two ways:

1. Use the arrow keys on the computer keyboard to move the screen cursor to the appropriate X or Y coordinate field. Then type in the coordinates.
2. Use the arrow keys on the Hand-Held Programmer to move the pick head in the X and Y directions so that the offset point is at the center of the cross-hair on the video display screen. Next, press the READ XYZ button on the Hand-Held Programmer to read the coordinates.
3. Enter the board thickness in the **B:** field.

3.2.5 Edit the Program Steps

This selection allows 650 program steps to be entered. The programming sequence requires that you first teach the system the location of the two fiducial marks and the first offset reference point. If the fiducial and offset functions have not been performed, the program will automatically go to these screens before allowing the program step information to be entered.

The program step that is displayed on this screen can be changed by pressing the PAGE UP or PAGE DOWN until the desired step is on the screen. Information can then be changed for the current step by moving the cursor to that field and typing over the current entry. The INSERT and DELETE keys can be used to insert and delete program steps. If you press DELETE, the current step information is deleted and all of the steps are renumbered accordingly. If you press the INSERT key, the current step and all steps after it are moved to the next step number. A new step will then be created using the current step number and with pick head #1 in the pick head field. All other information will then have to be filled in for the step to be completed.

The following table describes the key or key sequence required for each editing function:

Move to any step:	TYPE STEP # IN STEP NUMBER-FIELD.
Move to previous/next step:	PAGE UP/PAGE DOWN.
Move to Previous/next field:	LEFT ARROW/RIGHT ARROW.
Confirm Data Entry:	ENTER.
Delete the current step:	DELETE.
Insert a new step:	INSERT.
Toggle Single/Normal Mode:	F8 (hit any key to do single step, ESC to Quit.)
Test the current step:	F10.

The program step screen will show a field for each item that may be entered and is shown below in Figure #7.

Program Step Table

Step#:	1
Laser:	on
Feeder:	93
Rotation:	90.0 deg
Part Type:	10K Resistor - 1206
Part Ref:	R135
X Coord.:	2.890"
Y Coord.:	1.045"
Disp Time:	0 ms

Figure #7

The following is a description of each program item and whether it is optional or required.

Step Number (Automatically Supplied)

This number is automatically assigned to each step as it is being created. It is required to start the assembly process at other than the current step. You may jump to another step by typing in the new step number in this field.

Laser Alignment (Optional)

This field allows activation of the optional laser alignment system. It is provided to assure a higher level of placement accuracy by determining the correct rotation angle for that specific part.

Feeder (Required)

This is the number of the feeder from which the part will be fetched.

Rotation (Optional)

This field is used to indicate the amount of component rotation after being picked up at a feeder and before placement on the board. The units of the angle are in degrees, with a 0.1 degree resolution. The rotation direction can be determined by the sign of the number, with negative numbers rotating clockwise and positive numbers rotating counter-clockwise.

Part Type (Optional)

This is an alphanumeric field of up to 19 characters and is usually used to show a description of the part that is placed on the PC board. Since this field is for display purposes only, it can be used for any information you care to present.

Part Reference # (Optional)

An alphanumeric field of up to 9 characters, this is used to indicate the reference number of the part on the PC board. Since this field is for display only, it can be used for any information you care to present.

X/Y Place Coordinates (Required)

This is the position where the part will be placed on the circuit board. To enter the X/Y coordinates for the component placement point, either type in the values, or teach the program by moving the pick head to the correct point with the arrow keys on the Hand-Held Programmer. The center of the component pads on the PC board should be located at the center of the cross-hair on the video monitor. To transfer the current X/Y coordinates to the computer screen, press the READ XYZ key on the Hand-Held Programmer. When all of the information is correct for the step, you can either exit by pressing the ESC key, or PAGE DOWN key to advance to the next step. The system will beep twice and prompt you to press PAGE DOWN again to create a new step. Any other key but PAGE DOWN will return you to the last step without creating a new one. Pressing PAGE DOWN will copy all of the parameters except the X and Y coordinates over into the new step. Once you have entered in the complete information for a step, you can execute the step by pressing the F10 key. The system will get the correct head, get the part, square and place it on the board and then replace the head and get head #1 again.

Dispense Time (Optional)

This is used when you have the optional fluid dispenser and wish to activate it for the current step. Enter the amount of time (in milliseconds) that you want the dispenser to be active. This time, along with the dispense air pressure adjustment, will determine the amount of fluid that will be dispensed for this step. Please note that when the time in this field is set to other than zero, any part that has been selected will not be picked, and a fluid drop will be placed at the X/Y coordinates.

3.2.6 Edit The Program Description

This selection allows you to enter an optional word description for the current assembly program.

3.2.7 Save the Program

This selection saves any changes that have been made to the currently loaded program. If you have not saved the program changes before you exit the CREATE/EDIT module, you are prompted with the options of saving the program before returning to the main menu, or returning without saving.

3.2.8 Edit Feeders

Each assembly program (with a .SMD extension) will create a separate feeder file (with a .FDR extension) which will store all of the information associated with each of the 255 available feeder numbers. This will allow you to have a different feeder set-up for each program. Each time you load a different assembly program, the matching feeder file is also loaded.

When you make this selection, you will be shown the feeder editing screen, with the information for feeder #1 displayed as shown in Figure #8. The system will also move the head so that the video screen will display the feeder pick point. To change the display so that it shows the information for another feeder, use the up or down arrow

key to highlight the FEEDER # field and type in the number of the feeder that you would like to edit. When you have the desired feeder displayed, use the up and down arrow keys to move to each field and fill in the information as described below.

<u>Feeder Table</u>	
Feeder #1:	1
Description:	8mm 1206
Head:	1
Type:	Reel
Pitch:	1
Part Width:	0.120"
Part Length:	0.060"
Part Height:	0.020"
Scan Height:	0.000"
X Coord:	8.867"
Y Coord:	-11.226"
Z Coord:	-1.175"
X Offset:	0.000"
Y Offset:	0.000"
Counts:	1
Force:	10 g

Figure #8

Each field of the feeder table is described below:

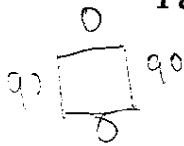
Feeder #: This number is automatically supplied. You may jump to another feeder by typing in the new feeder number in this field.

Description: This is an optional 16 character text field describing the part.

Type: Press the space bar to change the type to either REEL, STICK or TRAY so that it matches your feeder.

X/Y Coord: Use the hand-held programmer to move the head in the X and Y directions so that the cross-hair on the video screen is centered on the pick-up point for that feeder, and then press the READ button. Both the X and Y coordinates will be updated together.

Z Coord: Move the screen cursor so that the Z Coordinate field is highlighted. Then use the hand-held programmer to move the head in the Z direction so that the bottom of the pick-up nozzle touches the top of the component in the feeder, and then press the READ button. Since all REEL feeders pick up at the same height, you can copy this Z coordinate into all other feeders that are set to REEL type feeder by pressing the F5 key.



Part Width: Measure the width of the component and enter that value here. The width is the left to right dimension of the component as it is presented in the feeder, and viewed from the outside of the system looking in.

Part Length: Measure the length of the component and enter that value here.

Part Height: Measure the thickness of the component and enter that value here. This is used to find the middle of the component for the laser align process, and is also used so that during placement, the part stops moving down just as it touches the PC board.

X Offset: Used only for TRAY type feeders. This is the distance in the X-axis from the center of one component to the center of the next component.

Y Offset: Used only for TRAY type feeders. This is the distance in the Y-axis from the center of one component to the center of the next component.

Counts: Used only for TRAY type feeders. This is the total quantity of parts in the tray.

Pitch: Used for REEL and TRAY feeders. For REEL feeders, this is the number of tape sprocket holes for each component. For TRAY feeders, this is the number of components in the X-axis of the tray.

- Scan Height:** The scan height for the laser centering system can be changed from the default level with this number. If this is set to zero, components less than or equal to .120 inches are scanned at the half the thickness of the part. Parts thicker than .120 inches are scanned at 2/3 of the way down from where the pick head touches the part. This value can only be a positive number and will move the scan level to the specified distance below the bottom of the pick nozzle.
- Head:** This is the number of the pick nozzle that should be used for this part.
- Force:** The default force is 10 grams. For every increase of 10 grams, the pick head will move .001 inches further down during placement, pushing the component harder onto the board.
- Retry:** When this feature is turned ON, a failure to pick a part feeder will activate the automatic retry process as described in section 3.1.4. If this feature is turned OFF, then a failure to pick a part from this feeder will result in the step being skipped.

3.2.9 Set Up Editing Options

This selection allows for selecting the type of measurement units to be used in programming (English or Metric), and whether or not the X/Y table will move to the coordinates that are displayed on the screen.

3.2.10 Load a Different Feeder File

This selection allows you to replace the current feeder file with a feeder file that was created for another assembly program. This is usefull for when you have a board that uses many of the same parts as another program. You will reduce your set-up time for each program if you keep often-used parts in the same feeder location all of the time.

3.2.11 Save Feeder Configuration

This selection saves any changes that have been made to the currently loaded feeder file. You should save your changed feeder file before exiting the edit mode and returning to the main menu.

3.3 Configure System Parameters

This selection allows the set up of various system parameters to be set up such as, the location of pick heads, hardware offsets and system delays. This menu is shown below in Figure #9, followed by a description of each item.

Configure System Parameters Menu

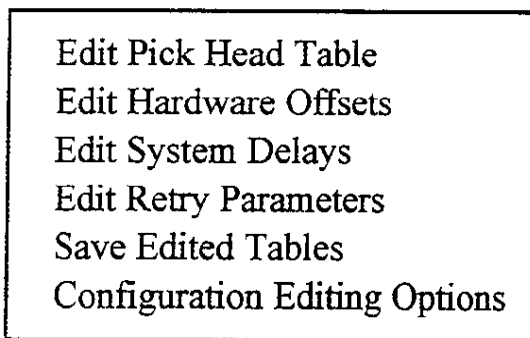


Figure #9

3.3.1 Edit The Pick Head Table

The pick head table is used to describe the locations of the pick heads. These locations are programmed at the factory, but may be changed after the system has been installed.

- To program the X/Y coordinate locations, either type in the numbers, or move the camera with the arrow keys on the 2000 LX Hand-Held Programmer. Move the camera so it points to the pick head. Use the READ XYZ button to record the XY coordinates when the cursor is not in the Z field. To transfer the current X/Y coordinates to the computer screen, make sure the cursor on the screen is either in the X or Y coordinate fields. When in position, press the READ XYZ on the Hand-Held Programmer.

To program the Z coordinate of the pick head, first move the cursor to the Z field, then lower the head by pressing the Z-DOWN key on the Hand-Held Programmer and move XY to align the Z height of the picking position. Press the READ XYZ key on the Hand-Held Programmer.

This process should be repeated for each head in the storage rack. When you have finished finding the location for all of the heads, press the ESC key to return to the System Configuration Menu.

3.3.2 Edit The Hardware Offsets

The hardware offset table has been provided to show the X and Y offsets for the VIDEO CAMERA and the FLUID DISPENSER. These locations are programmed at the factory, but may be changed after the system has been installed.

The Video Camera Offset describes the distance from the center of the video camera to the center of the pick nozzle. The Fluid Dispenser Offset describes the distance from the center of the video camera to the center of the dispenser tip.

Please refer to the Installation/Maintenance manual for instructions for setting these values.

3.3.3 Edit The Delays

The Delay Table has been provided to fine tune the performance of the system. The times in this table have been factory pre-set for average use, but may be adjusted in the field for special applications.

Pick point delays from vacuum on to z-Axis up:

Delay #1: small components (width + length < 0.4")

Delay #2: medium components (0.4" >= width + length < 1.0")

Delay #3: large components (width + length >1.0")

Place point delays from z-Axis down to vacuum off:

Delay #4: small components (width + length < 0.4")

Delay #5: medium components (0.4" >= width + length < 1.0")

Delay #6: large components (width + length >1.0")

Miscellaneous Delays:

Delay #7: Feeder delay for double pitch devices

Delay #8: Wait time for dispense head down

Delay #9: Wait time for dispense head up

3.3.4 Edit Retry Parameters

This table will allow you to set options that will be used if the retry function has been enabled and the system has failed to pick up a part at a feeder.

The first item is to select the number of times that the system will try to pick up a missed part. The second item is to select the number of feeder advance and missed part retry cycles that will occur before the system will pause and display a message indicating that a fault has occurred. This corrective action needs to be taken before continuing with assembly.

Please Note: The feeder advance will only be useful for reel type feeders, since stick and tray feeders cannot be advanced.

3.3.5 Save The Edited Tables

This selection saves any changes that have been made to the system configuration. If you have not saved your configuration changes before you exit the SYSTEM CONFIGURATION module, you will be prompted with the options of saving the program before returning to the main menu, or returning without saving.

3.3.6 Configure Editing Options

This selection is used to select the displayed coordinates in either English (inches) or Metric (millimeters) units.

3.4 System Device Tests

This selection is used to test, align and calibrate all of the electrically controlled mechanical devices on the 2000LX. To activate this mode, you should press T from the main menu to activate the test menu. The System Test Menu is shown below in Figure #10.

Systems Device Tests Menu

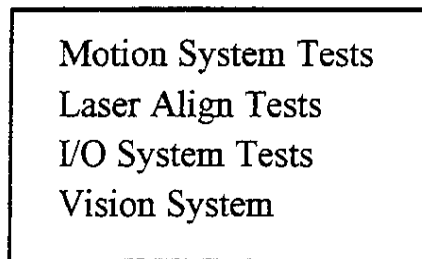
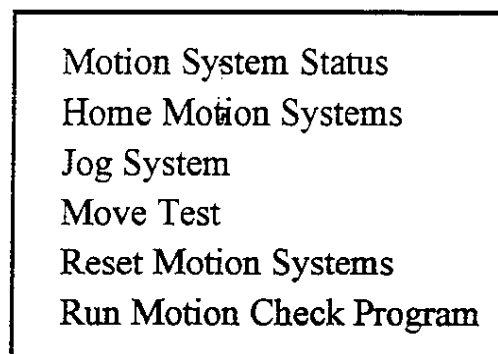


Figure #10

3.4.1 Motion System Tests

The motion test section will allow you to test for the proper operation of each of the four axes of motion, and to calibrate the z-axis height. When this heading is chosen, you will then be presented with the motion system test menu shown below in Figure #11:

Motion System Tests Menu



X = motor 2
 Y = motor 1
 Z = motor 3

Figure #11

Motion System Status

The Status test will show the present condition of the home sensors, and the amount of encoder motion away from the present position. This screen is helpful to determine the proper operation of a replacement encoder or home sensor.

Home Motion System

The Home System command will reset all 4 axes of motion and return them all to their zero position at the center of the machine.

Jog System

The Jog System test will allow you to use the hand-held controller to move the position of the X, Y and Z axes. The display will show the location in both motion steps, and in the amount of inches from the 0,0,0 point at the center of the machine.

Move Test

Selecting Move Test will start a continuous motion of all 4 axes, using a pre-programmed set of stop locations. The sequence of moves has been chosen to exercise all combinations of moves. The screen display will show the present position of the pick head, as well as the total quantity of moves that have been made since the move test has started.

Reset Motion Systems

This command will turn off the motion control circuitry so that the motors and drive shafts can be moved manually.

Run Motion Check Program

The motion check program is a test and setup tool provided by the manufacturer of our motion control systems. This is generally for use

by a Multitroniks technician or other trained personnel to tune the motion control systems for maximum performance.

WARNING! CASUAL USE OF THIS PROGRAM BY AN UNTRAINED PERSON COULD DAMAGE OR DESTROY MOTORS OR DRIVE ELECTRONICS!

Instructions for this program are found in the Installation/Maintenance manual.

3.4.2 Laser Align Test

The Laser Align test section will allow you to test for the proper operation of the laser measurement system, and to calibrate the center of the pick up nozzle. When this heading is chosen, you will then be presented with the Laser Test Menu, shown below in figure #12.

Laser Test Menu

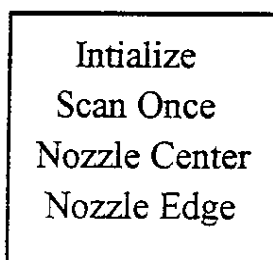


Figure #12

Initialize

The Initialize command will clear all operating parameters from the laser measurement system, and re-load initial system settings.

Scan Once

The Scan Once command will activate the laser measurement system and display the results of the scan. NOTE: The laser must be initialized before attempting to start the scan process.

Nozzle Center

The Nozzle Center alignment process is used to center the pick nozzle. Since most rotating mechanisms are not perfect, they exhibit some degree of eccentricity. This calibration process will rotate the head and take measurements throughout its rotation so that the software will be able to calculate the center location of the pick head. To perform the calibration, use the following steps:

1. If you have not already done so, select nozzle edge and perform that calibration first.
2. Remove a pick nozzle from the storage rack, and manually place it on the pick up head.
3. Press the letter C to start the nozzle centering process. The center value is automatically calculated and stored.
4. Remove the pick nozzle and return it to the storage rack.

Nozzle Edge

This calibration is usually done by a service technician during installation, but may be required if any mechanical assemblies are ever replaced. The calibration is actually a hunting process, where you are looking for the bottom edge of the pick nozzle. You do this by raising and lowering the Z-axis while looking for 2 adjacent steps, one that blocks the laser, and one that does not. You would then save the Z-axis location that does not block the laser. To perform the calibration, use the following steps:

- Use the hand-held controller to move the pick head to the front of the machine.
- Remove a pick nozzle from the storage rack, and manually place it on the pick up head.
- Use the hand-held controller to move the Z-axis down to a location of approximately -170 steps.
- Press the F1 key on the computer keyboard.
- If the laser system was not previously initialized, it will be done at this time.
- Press any key to scan the nozzle.
- Make a note of the last status. It will usually read either 1 or 64. A value of 64 indicates that the nozzle is not blocking the laser. *10/24/00
-156/-155*
- Move the Z-axis height and re-scan with the F1 key.
- Continue this process until you find one step that has a status of 1, and an adjacent step that has had a status of 64.
- When the height is at the step with a status of 64, press the F2 key to save the Z-axis height.
- Remove the pick nozzle and return it to the storage rack.

3.4.3 I/O System Tests

The Accessory test will allow the testing of all remaining electrically controlled devices. When this heading is chosen, you will then be presented with the I/O Test Screen, shown below in Figure #13.

-----Input Status-----	
Vacuum Sensor:	1
Emergency Stop Switch:	1
Door Switch:	0
-----Output Status-----	
1. Power Switch:	1
2. Red/Green Light:	0
3. Yellow Light:	0
4. Glue Cylinder:	0
5. Vacuum Generator:	0
6. Glue Dispenser:	0

Figure #13

The input status group shows the present state of the following devices:

Vacuum Sensor: 1 = no part
 0 = part detected

Estop: 1 = no Estop button is pressed.
 0 = an Estop is pressed

Door: 1 = a door is open
 0 = all doors are closed.

You can turn devices in the output status group on and off by pressing the number which preceeds each item. The status will read a "1" when the device is on and "0" when it is off.

The following numbers are used to turn their respective devices on and off:

1 = Power switch
 2 = Red/Green light (When one is on the other is off)
 3 = Yellow light
 4 = Glue cylinder
 5 = Vacuum generator
 6 = Glue dispenser

3.4.4 Vacuum Sensor Test

The 2000 LX is equipped with a Vacuum detection sensor and can be checked for proper operation with this test program.

To check the operation of the vacuum sensor, first activate the vacuum generator. Then use a finger to alternately block and then open the vacuum tip. If you do this while standing in back of the 2000, you should see the red vacuum sensor light turn on when the nozzle tip is blocked, and turn off when the nozzle tip is opened. If this does not occur, then the vacuum sensor needs to be adjusted. The adjustment will require the use of a small, flat screwdriver. Use the following steps to set the sensor to the correct setting:

1. Turn the screw fully clockwise until it stops turning. Smallest nozzle installed and open (not blocked)
2. With the vacuum tip open, turn the screw counter-clockwise until the LED indicator light is ON.
3. Turn the screw somewhere from $\frac{1}{4}$ to 1 full turn clockwise.
4. Alternately block and then open the vacuum tip. If the light does not change then make a fine adjustment until it does.

Please Note: The correct operation of the vacuum generator requires that the main air pressure feeding the vacuum generator be between 75 and 95 PSI.

3.5 Quit This Control Program

This selection exits the SMD software back to the MS-DOS operating system. The SMD software can be restarted by typing LX2000 and then pressing the ENTER key at the DOS prompt.

Section 4 - Component Loading

The 2000 LX accepts components in three different package types: Tape, Stick and Tray. The loading for each type is described below.

4.1 Tape and Reel Type Feeder

The 2000 LX must be equipped with an 8 position feeder block in order to be able to use tape feeders. The tape widths that can be used are 8, 12, 16, 24 and 32 millimeters using a maximum reel diameter of 13 inches.

The tape containing the parts must be properly prepared before you can load it into a feeder. If you have a new reel, there is usually at least 12 inches (30 centimeters) of blank pockets before the first component. If this amount of empty tape is available, then peel back 8 inches of cover tape and cut the pocket tape so that the cover tape will be 8 inches longer than the component pocket tape. (SEE FIGURE 14) If components are loaded to the end of the tape you may choose to either peel 9 inches of cover tape off and cut off the exposed component pocket tape, discarding the tape and the components, or you can extend the cover tape by attaching a length of previously used cover tape to the current end with adhesive tape.

The component tape must have a cleanly cut end for it to properly slide into the feeder. To load the tape, perform the following steps:

1. Attach the component reel support to the reel hub by pushing the hub through the center hole of the reel. The tape should feed off of the top of the reel, with the sprocket holes on the side that is closest to the metal plate which supports the reel hub. (SEE FIGURE #16)
2. Fold the cover tape around the end of the component pocket tape so that it is on the bottom of the component pocket tape. (SEE FIGURE #15)
3. Slide the tape stabilizing spring mechanism all of the way back to expose the feeder sprocket teeth.

4. Insert the end of the tape into the tape entry slot located at the rear of the feeder, near the red and green push buttons. Push the tape in until it is pushed out of the front of the feeder approximately 1 inch.
5. Pull the cover tape out from under the bottom of the component tape and then push the component tape back into the feeder so that it's end is at the front of the feeder.
6. Align the feeder sprocket teeth with the sprocket holes in the component tape and then slide the tape stabilizing spring mechanism fully forward.
7. Thread the cover tape so that it changes direction and heads toward the back of the feeder. The cover tape should feed over the top of the cover tape guide. (See View A of Figure #16)
8. Pull back the disengagement cam for the scrap tape roller to open up a space between the rubber and steel rollers. Guide the scrap tape through this space.
9. While keeping the cover tape taut, release the cam so that it pinches the tape.
10. Turn the tape winder clutch so that the slot is facing up. Wrap the cover tape around the bottom of the winder and so that it is pulled partly through the slot. If you have enough cover tape, turn the tape winder clutch one full turn so that the cover tape is securely attached to the winder, then cut off the excess. If you have insufficient cover tape to hold in in place as just was described, you can attach the cover tape to the outside surface of the tape winder clutch with adhesive tape.
11. Slide the feeder into a slot until it makes contact with the feeder base vertical manifold and push in the push-button fastener to secure it to the feeder base.

12. You can now move the tape manually using the red and green buttons located on the back of the feeder. a Brief press of the green button will advance the feeder by one sprocket hole (one pitch). Pressing the green button continuously will advance the tape until the button is released. Pressing the red button continuously will retract the tape until the button is released. You should set the tape so that the pocket that is showing is the last empty pocket before the components appear.

4.2 Vibratory Stick Feeder

To use the vibratory stick feeder, you must first turn the amplitude control on the feeder to its minimum setting. There are several vibratory bases available and each has the amplitude and frequency controls in different locations. If there is only an amplitude control available, then ignore the following notes which refer to the frequency control.

For each tube used, determine which end should be opened. Each tube should contain the same component and all should be oriented so that the printing or reference marks are in the same direction for each part.

Begin by turning the amplitude down to the minimum setting. Remove the end plug from a tube, cover the end of the tube with your finger, and slide the tube against the tube stop near the inside portion of the feeder. When all tubes have been put in place, adjust the frequency to the maximum setting. Now, Increase the amplitude to the maximum setting and begin to decrease the frequency setting until the parts in the tubes make the most noise and show the most amount of vibration. Finally, reduce the amplitude so that all of the parts exit each tube and slide into the feeder part slots.

4.3 Tray Feeder

The 2000 can accommodate standard JEDEC matrix trays which are supported in a tray holding fixture. The programming of the tray location in the feeder table consists of locating the center point of a component at one end of a row, and then indicating the X and/or Y offset distance to the adjacent components.

Section 5 - Off-line Programming

The Multitroniks 2000 LX has the ability to be programmed off-line utilizing a separate computer, a digitizing tablet and full scale artwork of the PC board. Currently, the off-line software is configured to work with the Summagraphics Summasketch digitizer. Other digitizers may be added in future revisions.

The operation of the off-line software is identical to the on-line programming sequence, with the exception that the coordinates will come from the digitizing tablet. When the programming has been completed, you must copy the program that you have just created onto a floppy disk. This disk must then be inserted into the floppy disk drive on the 2000 LX and the file copied onto the 2000 LX hard disk. The 2000 LX control software may then be re-started to load and run this program.

Section 6 - Optional Equipment

The Multitroniks 2000 LX has several optional accessories available.

Adhesive (Fluid) Dispenser

The Adhesive Dispenser option is used when adhesives or other fluids are required to be placed on the PC board assembled. This option will be activated when a dispense time of other than zero seconds has been selected. The dispense time and the dispenser air pressure will both have to be adjusted in order to obtain the correct size fluid drop. For most fluids, you should try starting with between five and ten pounds of air pressure, and 100 milliseconds. If there is too much fluid, first try reducing the air pressure before reducing the dispense time. The best control over drop size will occur when the air pressure is low and the dispense time is high. An adhesive vacuum adjustment is provided for the drawback of excess fluid after a dispense operation. Normally start with the vacuum OFF and only increase the vacuum by small amounts to stop the adhesive dispenser tip from dripping.

Please Note: Too much vacuum could draw adhesive fumes back up the air hose and possibly damage other pieces in the adhesive dispenser.

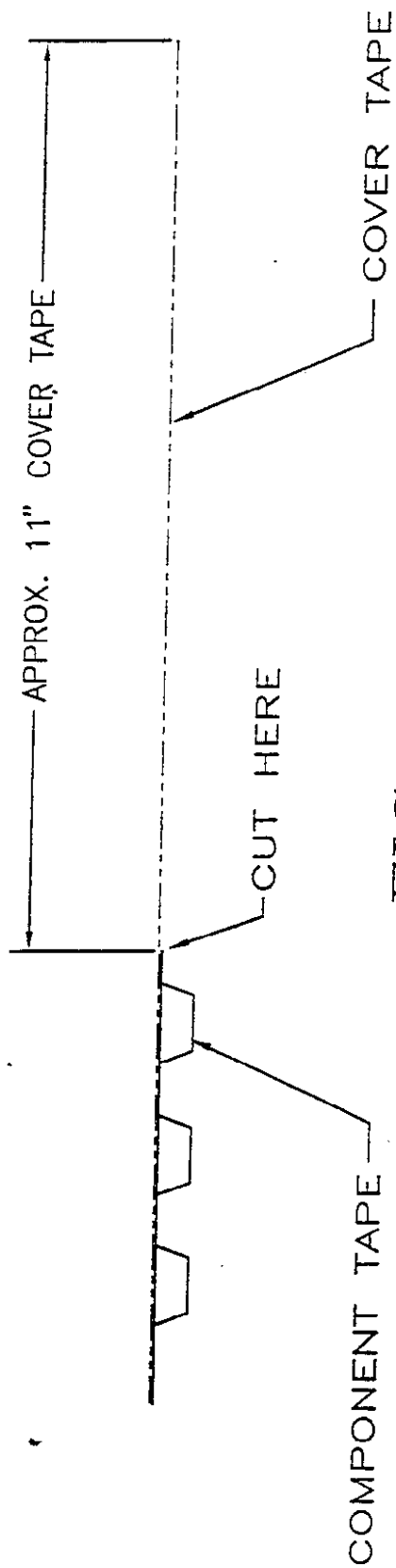


FIG. 14

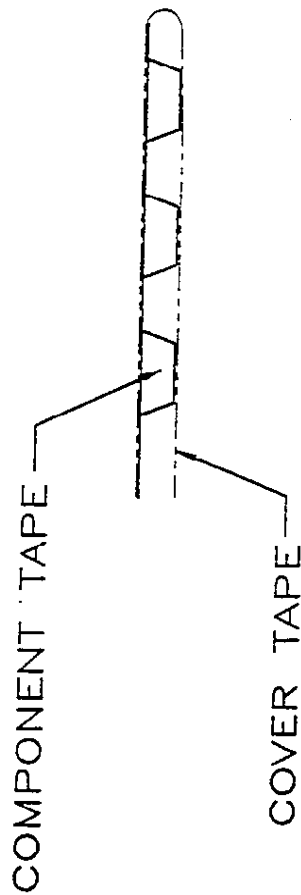
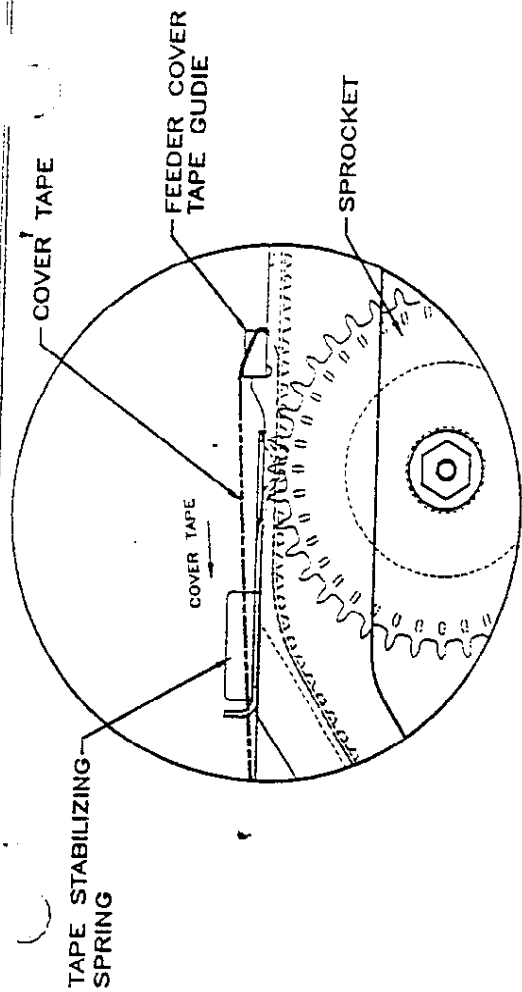


FIG. 15



VIEW A
(SCALE 2 : 1)

SEE VIEW A FOR DETAILS

SCRAP ROLLER
DISENGAGEMENT CAM

PULL BACK

SCRAP WINDER

FORWARD BUTTON
(GREEN)

REVERSE BUTTON
(RED)

COMPONENT
TAPE

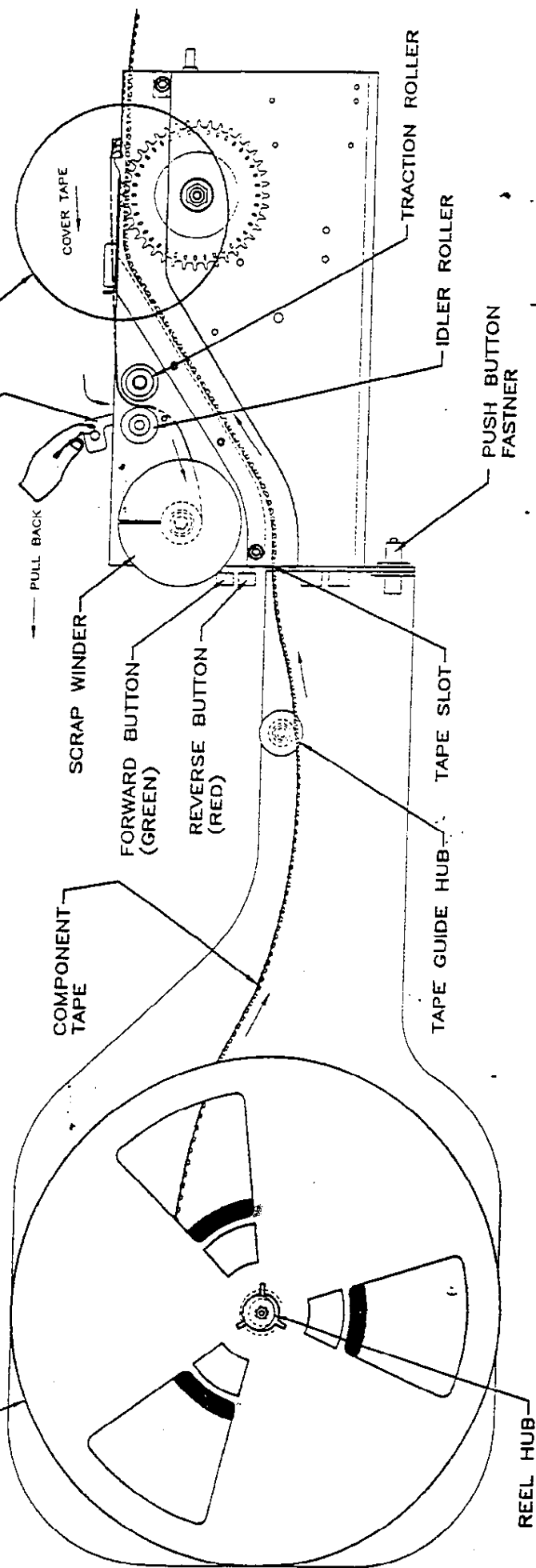
TAPE GUIDE HUB

TAPE SLOT

TRACTION ROLLER

IDLER ROLLER

PUSH BUTTON
FASTNER

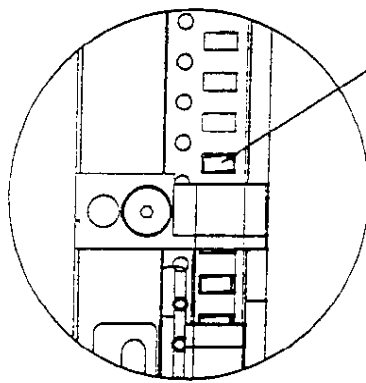


MULTITRONICS

ONE FREDERICK ROAD - WARREN, NEW JERSEY 07059

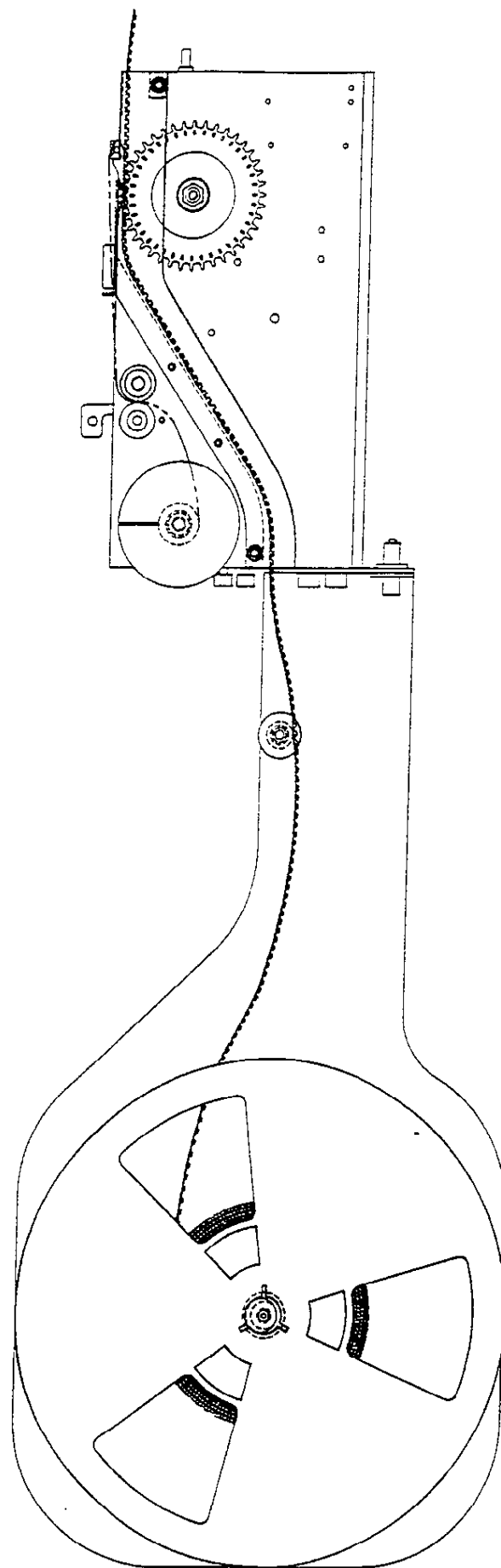
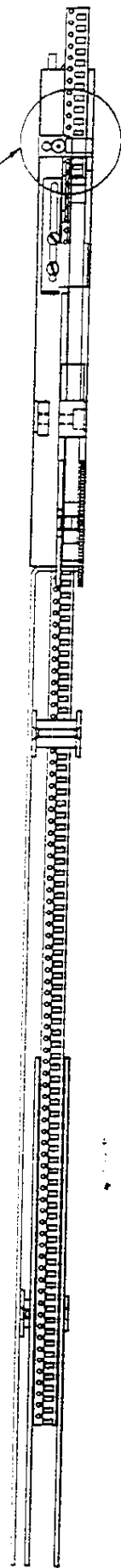
FIG 16 (REF)

TITLE, LOADING COMPONENT TAPE ONTO REEL FEEDER



VIEW A
(3 X SCALE)

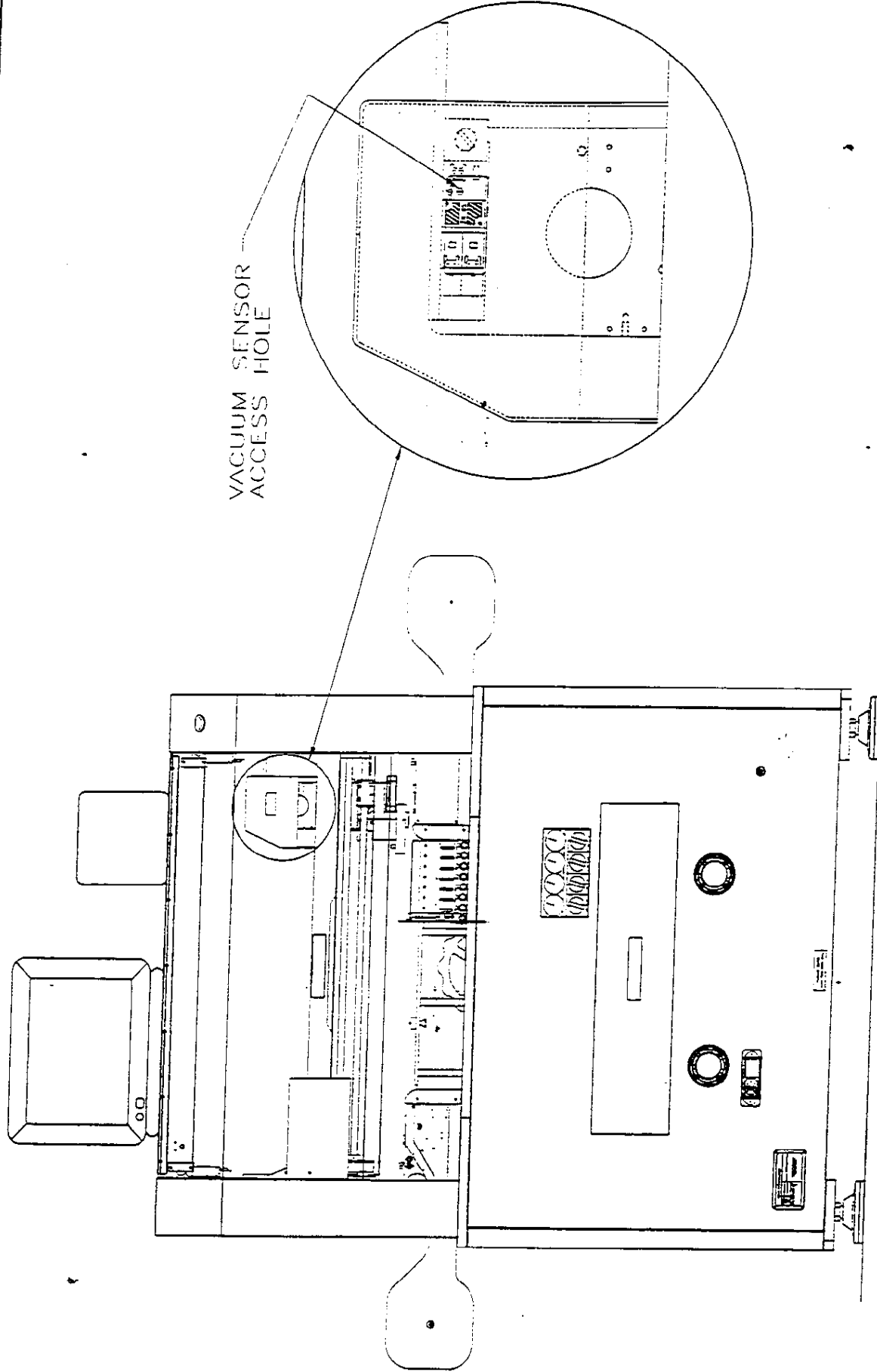
SEE VIEW A



MULTITRONICS

ONE FREDERICK ROAD -- WARREN, NEW JERSEY 07059

FIG. 1111 PICK POINT MECHANISM FOR...



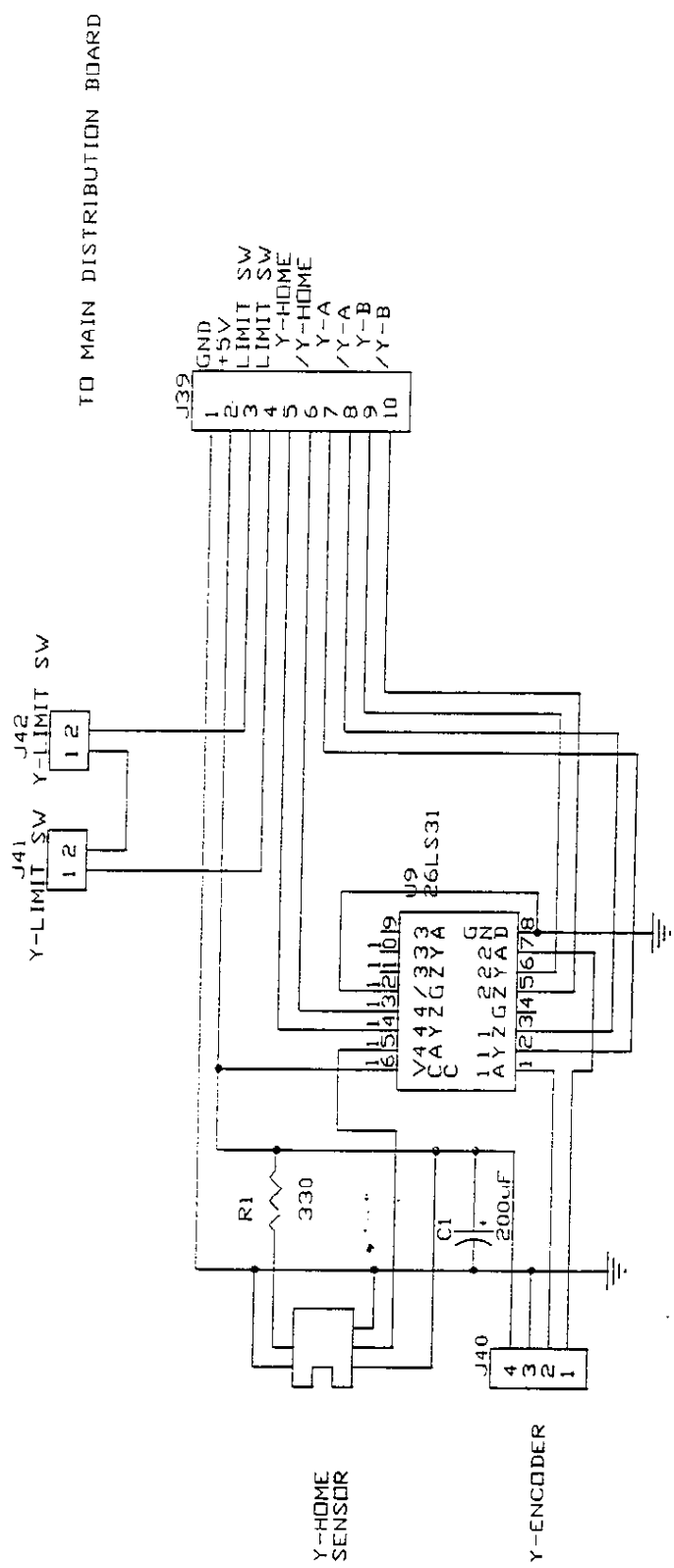
REAR OF MACHINE

MULTITRONICS

ONE FREDERICK ROAD - WARREN, NEW JERSEY 07059

FIG 12 (REF)

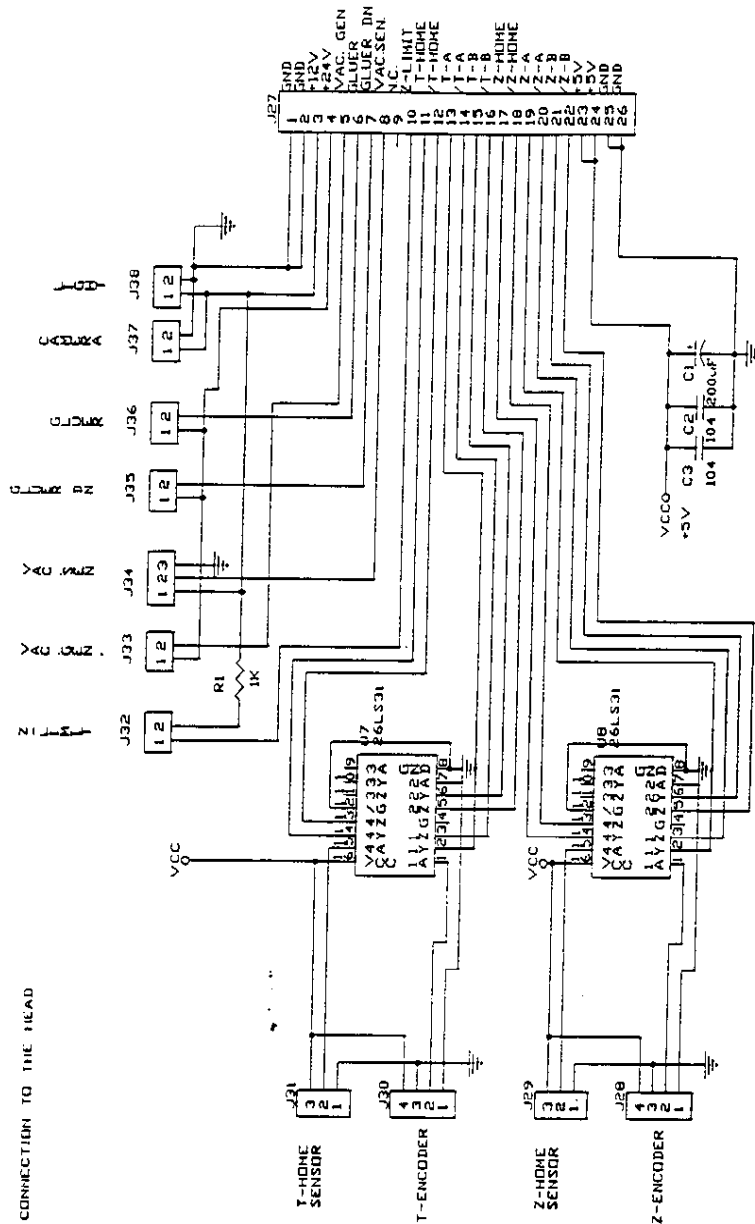
TITLE: VACUUM SENSOR



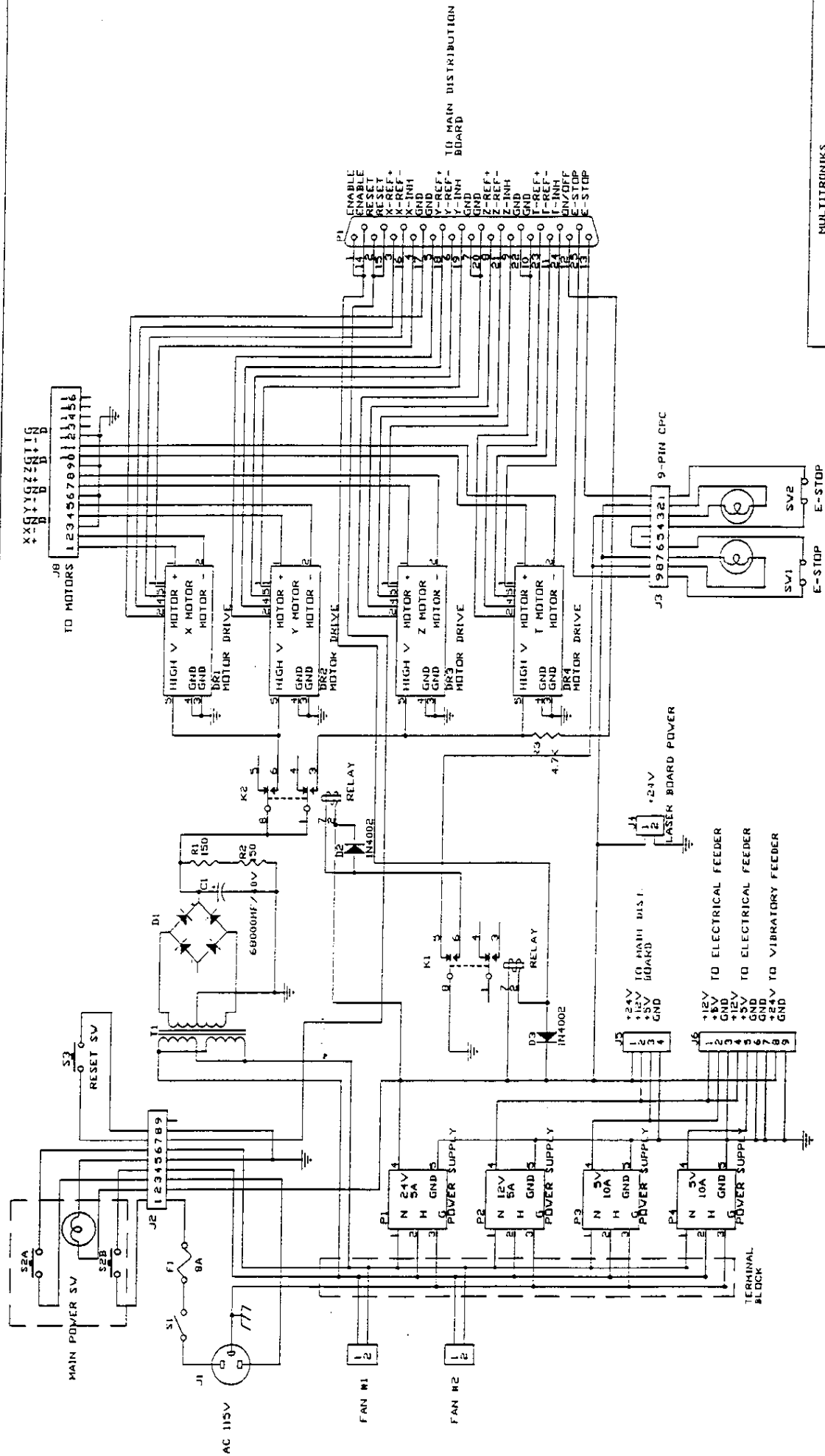
TO MAIN DISTRIBUTION BOARD

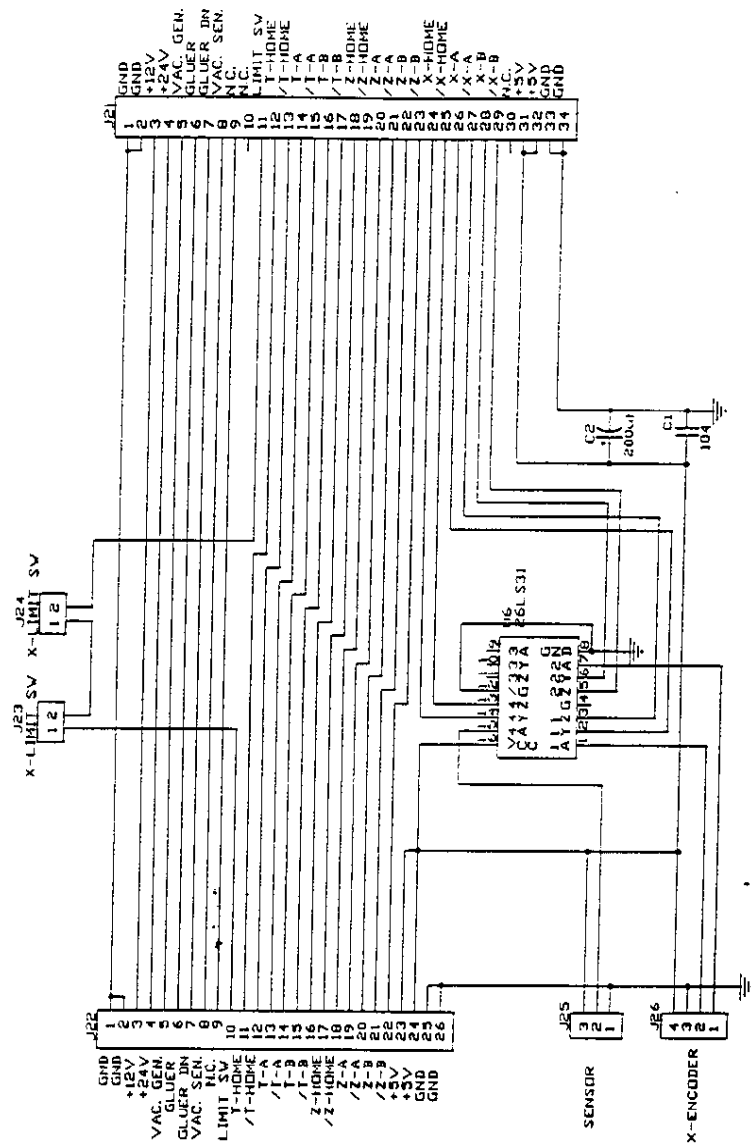
MULTITRONIKS	
1 FREDERICK ROAD	
WARREN, NJ 07059	
Title	
Size	Document Number
A	217502-1
REV	

CONNECTION TO THE HEAD

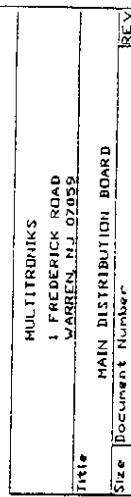


TO SENSOR INTERFACE BOARD





TO MAIN DISTRIBUTION BOARD

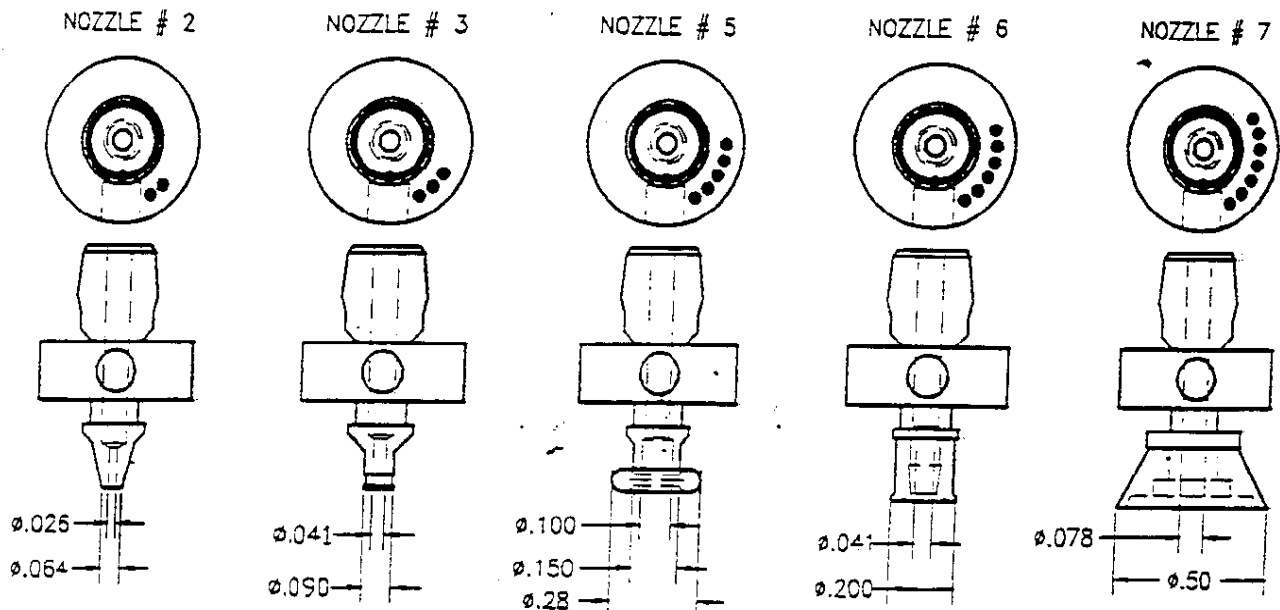


BALL DETENT NOZZLES

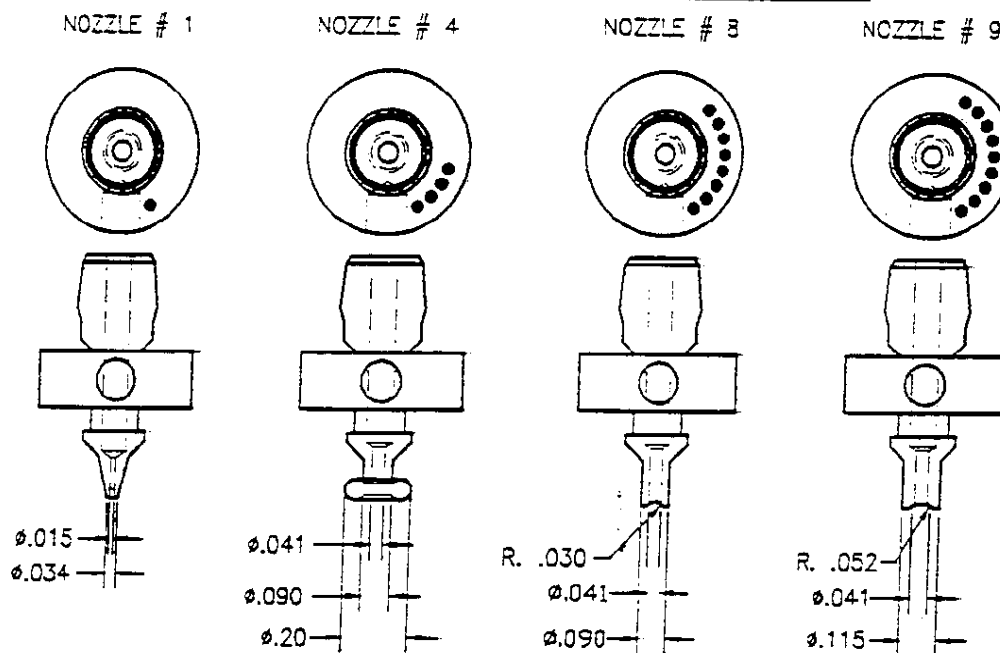
USED ON MACHINES WITH 213000-B & 213000-C HEAD ASSEMBLIES:

257000-A

5 STANDARD NOZZLES



4 SPECIAL NOZZLES



NOZZLE #	MULTITRONIKS ORDER #	MULTITRONIKS SUCTION CUP #	RECOMMENDED FOR USE WITH THESE COMPONENTS	SELLING PRICE
1	257018	NONE	0402 AVAILABLE SPECIAL	\$90.00
2	257019	NONE	0603, 0504, 0805, 1206, 1005	\$60.00
3	257016	NONE	1210, 1805, 1808, 1812, 1825, SOT23	\$60.00
4	257016-B	O-RING #40921	2218, 2220, S08 — S020 AVAILABLE SPECIAL	\$65.00
5	257017-B	O-RING #40922	S08L, S028, VS040 — VS056, PLCC18 — PLCC32	\$75.00
6	257025	SUCTION CUP #46914 (MOD.)	2218, 2220, S014 — S020, S016M, S08L — S020L, PLCC20, PLCC28	\$90.00
7	257020	QFP SUCTION CUP #EA043039	PLCC44 — PLCC84, QFP44 — QFP256	\$115.00
8	257021	NONE	MINI-MELF (RADIUS IN LINE WITH MAGNET) AVAILABLE SPECIAL	\$90.00
9	257022	NONE	MELF IN (RADIUS LINE WITH MAGNET) AVAILABLE SPECIAL	\$90.00

257000-A SET OF 5 STANDARD NOZZLES (INCLUDE: #2, #3, #5, #6, & #7)

MULTITRONIKS

2000 Series Vibratory Lanes

Multitroniks Part Number	Component Name	Escape Width "A"	Escape Length "B"	Track Width "C"	Price
46830-2	SOIC-14/16	.252	.500	.330	60.00
46830-9	SOLIC	.422	.750	.596	95.00
46830-4	PLCC-20	.400	.482	.500	60.00
46830-5	PLCC-28/32	.505	.736	.610	60.00
Blank	Blank	-	-	-	95.00
46830-3	PLCC-18	.338	.650	.422	95.00
46830-11	SOJ-20/26	.345	.920	.470	60.00
46830-7	PLCC-68	1.005	1.236	1.086	95.00
46830-14	PLCC-84	1.209	1.484	1.300	95.00
46830-10	PLCC-44	.706	.860	.790	95.00
46830-1	SOIC-8	.252	.250	.330	60.00
46830-6	PLCC-52	.810	.992	.914	95.00
46830-15	PLCC-100	1.410	1.736	1.526	95.00
46830-8	SOMC	.320	.510	.446	95.00

MX261000-1 Vibratory Feeder: \$2,195.00

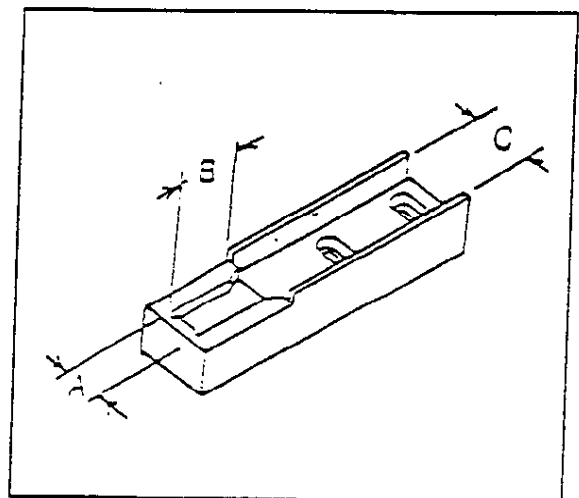
Lanes Not Listed Above Are Special Lanes.

All Special Lanes: \$225.00

★ Please Include The Following Information When Ordering :

- ✓ Width Of Component Including Leads
- ✓ Length Of Component
- ✓ Width Of Stick
- ✓ Height Of Stick

★ We Recommend Sending Samples

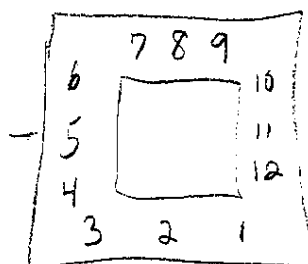


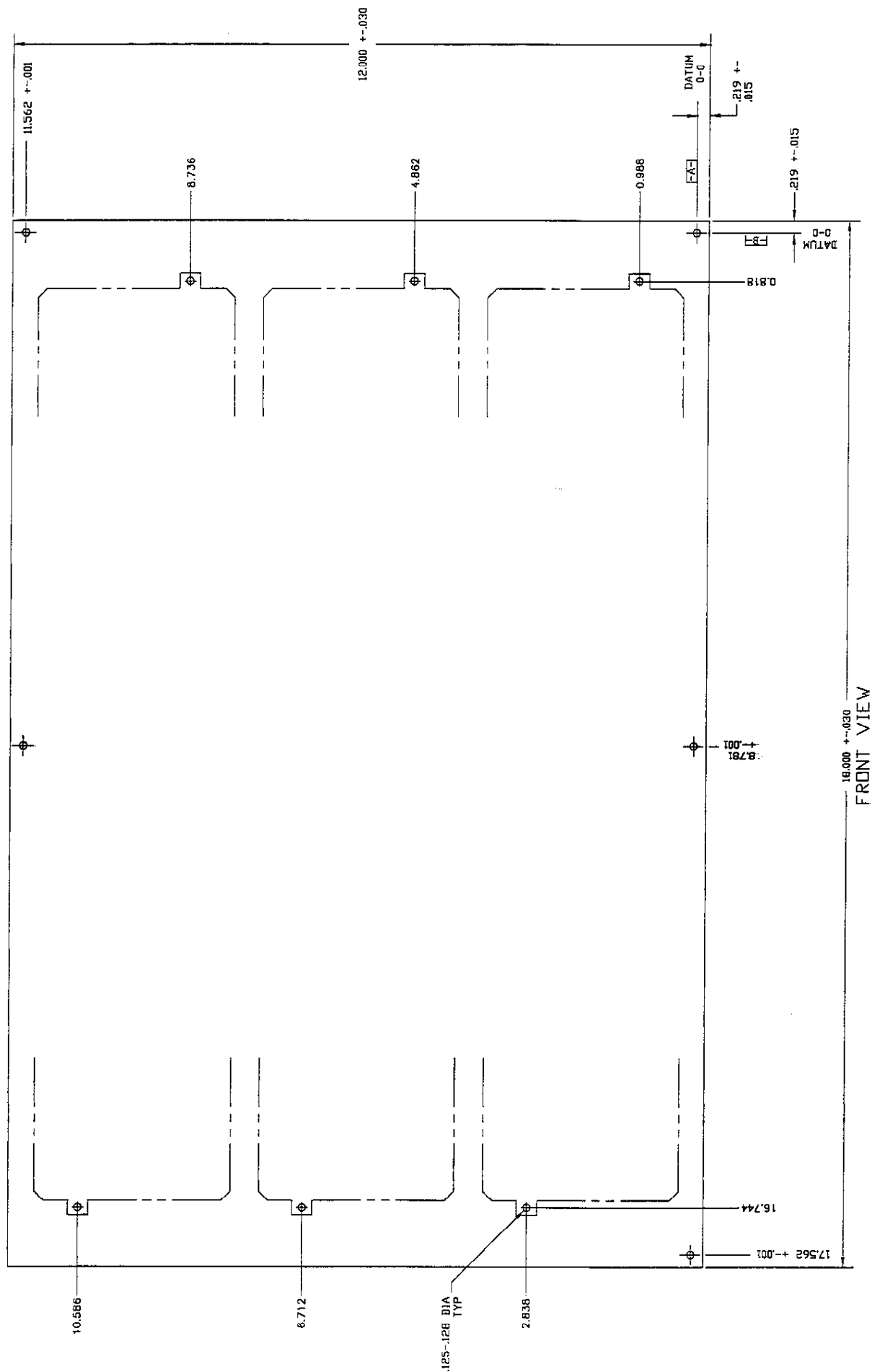
Number One Frederick Road • Warren NJ • 07059

Phone: 908-561-4200 • Fax: 908-461-1184

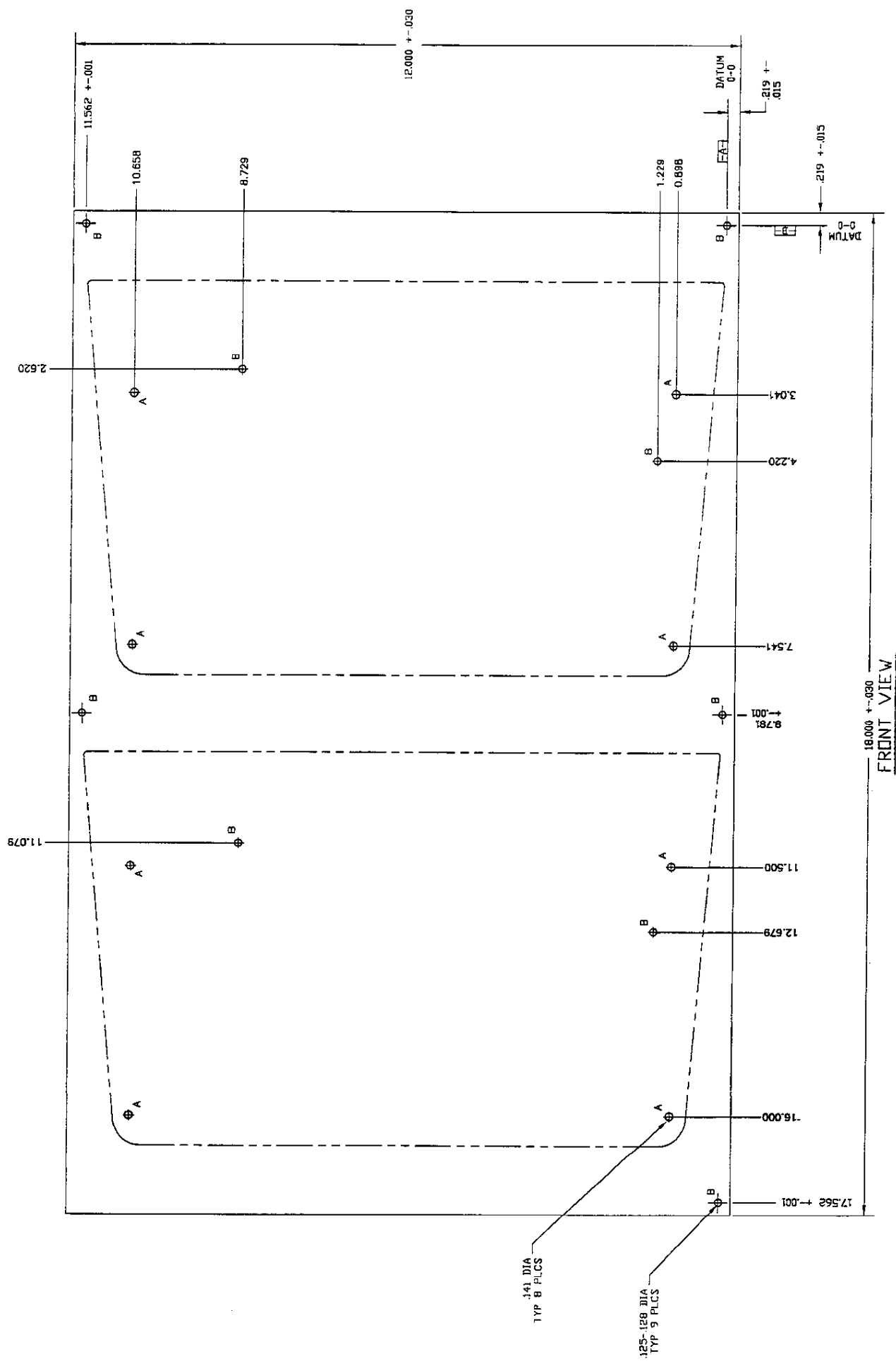
Dip Switch Setting for Electric Feeder Blocks

Station #	Sw 1	Sw 2	Sw 3	Sw 4	Sw 5	Sw 6	Sw 7	Sw 8
1	close	close	close	close	close	close	close	close
2	Open	close	close	close	close	close	close	close
3	close	Open	close	close	close	close	close	close
4	Open	Open	close	close	close	close	close	close
5	close	close	Open	close	close	close	close	close
6	Open	close	Open	close	close	close	close	close
7	close	Open	Open	close	close	close	close	close
8	Open	Open	Open	close	close	close	close	close
9	close	close	close	Open	close	close	close	close
10	Open	close	close	Open	close	close	close	close
11	close	Open	close	Open	close	close	close	close
12	Open	Open	close	Open	close	close	close	close
13	close	close	Open	Open	close	close	close	close
14	Open	close	Open	Open	close	close	close	close
15	close	Open	Open	Open	close	close	close	close
16	Open	Open	Open	Open	close	close	close	close
17	close	close	close	close	Open	close	close	close
18	Open	close	close	close	Open	close	close	close
19	close	Open	close	close	Open	close	close	close
20	Open	Open	close	close	Open	close	close	close
21	close	close	Open	close	Open	close	close	close
22	Open	close	Open	close	Open	close	close	close
23	close	Open	Open	close	Open	close	close	close
24	Open	Open	Open	close	Open	close	close	close
25	close	close	close	Open	Open	close	close	close
26	Open	close	close	Open	Open	close	close	close
27	close	Open	close	Open	Open	close	close	close
28	Open	Open	close	Open	Open	close	close	close
29	close	close	Open	Open	Open	close	close	close
30	Open	close	Open	Open	Open	close	close	close
31	close	Open	Open	Open	Open	close	close	close





FRONT VIEW



[illegible]

FRONT VIEW

01
ISSUED
MAR 3/15/98

[illegible]

PART NO.		SHEET	OF
DRAWING NO.		FULL	1
CUSTOMER'S NO.			
DATE ORDERED			
DATE RECEIVED			
DATE SHIPPED			
DATE PAID			
DATE DELIVERED			
DATE OF INSPECTION			
DATE OF ACCEPTANCE			
DATE OF CLOSURE			
DATE OF COMPLETION			
DATE OF FINAL REVIEW			
DATE OF PROJECT CLOSEOUT			
DATE OF PROJECT EVALUATION			
DATE OF PROJECT REPORT			
DATE OF PROJECT SUMMARY			
DATE OF PROJECT CONCLUSION			
DATE OF PROJECT REVISION			
DATE OF PROJECT AMENDMENT			
DATE OF PROJECT CHANGE			
DATE OF PROJECT MODIFICATION			
DATE OF PROJECT ADJUSTMENT			
DATE OF PROJECT CORRECTION			
DATE OF PROJECT IMPROVEMENT			
DATE OF PROJECT OPTIMIZATION			
DATE OF PROJECT ENHANCEMENT			
DATE OF PROJECT UPGRADE			
DATE OF PROJECT REDESIGN			
DATE OF PROJECT RECONSTRUCTION			
DATE OF PROJECT RENOVATION			
DATE OF PROJECT RESTORATION			
DATE OF PROJECT PRESERVATION			
DATE OF PROJECT MAINTENANCE			
DATE OF PROJECT OPERATION			
DATE OF PROJECT MANAGEMENT			
DATE OF PROJECT ADMINISTRATION			
DATE OF PROJECT FINANCIALS			
DATE OF PROJECT LEGAL			
DATE OF PROJECT POLITICAL			
DATE OF PROJECT SOCIAL			
DATE OF PROJECT CULTURAL			
DATE OF PROJECT ENVIRONMENTAL			
DATE OF PROJECT ECONOMIC			
DATE OF PROJECT TECHNICAL			
DATE OF PROJECT SCIENTIFIC			
DATE OF PROJECT HISTORICAL			
DATE OF PROJECT ARTISTIC			
DATE OF PROJECT LITERARY			
DATE OF PROJECT MUSICAL			
DATE OF PROJECT THEATRAL			
DATE OF PROJECT CINEMATIC			
DATE OF PROJECT TELEVISUAL			
DATE OF PROJECT AUDIOVISUAL			
DATE OF PROJECT MULTIMEDIA			
DATE OF PROJECT DIGITAL			
DATE OF PROJECT ANALYTICAL			
DATE OF PROJECT STATISTICAL			
DATE OF PROJECT MATHEMATICAL			
DATE OF PROJECT PHYSICAL			
DATE OF PROJECT CHEMICAL			
DATE OF PROJECT BIOLOGICAL			
DATE OF PROJECT MEDICAL			
DATE OF PROJECT AGRICULTURAL			
DATE OF PROJECT INDUSTRIAL			
DATE OF PROJECT COMMERCIAL			
DATE OF PROJECT EDUCATIONAL			
DATE OF PROJECT RESEARCH			
DATE OF PROJECT DEVELOPMENT			
DATE OF PROJECT INNOVATION			
DATE OF PROJECT CREATION			
DATE OF PROJECT PRODUCTION			
DATE OF PROJECT DISTRIBUTION			
DATE OF PROJECT MARKETING			
DATE OF PROJECT SALES			
DATE OF PROJECT SUPPORT			
DATE OF PROJECT SERVICE			
DATE OF PROJECT CUSTOMER RELATIONS			
DATE OF PROJECT PUBLIC AFFAIRS			
DATE OF PROJECT COMMUNICATIONS			
DATE OF PROJECT INFORMATION TECHNOLOGY			
DATE OF PROJECT SOFTWARE			
DATE OF PROJECT HARDWARE			
DATE OF PROJECT NETWORKS			
DATE OF PROJECT SECURITY			
DATE OF PROJECT RISK MANAGEMENT			
DATE OF PROJECT COMPLIANCE			
DATE OF PROJECT QUALITY ASSURANCE			
DATE OF PROJECT CONTINUOUS IMPROVEMENT			
DATE OF PROJECT LEAN MANUFACTURING			
DATE OF PROJECT SIX SIGMA			
DATE OF PROJECT TQM			
DATE OF PROJECT ISO 9000			
DATE OF PROJECT ISO 14000			
DATE OF PROJECT ISO 26000			
DATE OF PROJECT ISO 27000			
DATE OF PROJECT ISO 31000			
DATE OF PROJECT ISO 45000			
DATE OF PROJECT ISO 50000			
DATE OF PROJECT ISO 60000			
DATE OF PROJECT ISO 70000			
DATE OF PROJECT ISO 80000			
DATE OF PROJECT ISO 90000			
DATE OF PROJECT ISO 100000			
DATE OF PROJECT ISO 110000			
DATE OF PROJECT ISO 120000			
DATE OF PROJECT ISO 130000			
DATE OF PROJECT ISO 140000			
DATE OF PROJECT ISO 150000			
DATE OF PROJECT ISO 160000			
DATE OF PROJECT ISO 170000			
DATE OF PROJECT ISO 180000			
DATE OF PROJECT ISO 190000			
DATE OF PROJECT ISO 200000			
DATE OF PROJECT ISO 210000			
DATE OF PROJECT ISO 220000			
DATE OF PROJECT ISO 230000			
DATE OF PROJECT ISO 240000			
DATE OF PROJECT			

Required Feeder Cleaning

Whenever a reel of components is changed, the idler and traction rollers should be cleaned.

1. Back up the tape 10"-14" on the feeder by pressing the red reverse button. The cover tape may need to be manually rewound. If required, cut the component tape at the discharge end of the feeder.
2. Remove feeder from pick and place machine (note position for replacement).
3. Slide stabilizing spring rearward to release component tape from the sprocket.
4. Remove the old reel from feeder.
5. Remove and discard cover tape from the scrap winder.
6. Using isopropyl alcohol, clean both the idler roller (steel) and the traction roller (rubber), removing any adhesive buildup.
7. Place new reel of components onto the reel hub.
8. Feed component tape/feeder tape through tape slot and engage the feeder sprocket.
9. Slide stabilizing spring forward to lock component tape to sprocket.
10. Re-install feeder to its required location.