FixMaster User's Guide

Introduction to FixMaster
How To Build a Fixture In FixMaster
FixMaster Menus, Toolbars, Key Commands
AutoFixture Automation

This manual provides information about FixMaster Version 7.0 and AutoFixture 7.0 for the Windows operating system. Every effort has been made to make it as complete and accurate as possible, however the information contained in it is subject to change without notice and does not represent a commitment on the part of Lavenir. No part of this document may be reproduced by any means without the prior written consent of Lavenir, 2440 Estand Way, Pleasant Hill, CA 94523.

Version 7.0, February 28, 2001

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Part Number: DOU-0443A

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Chapter 1
Getting Started with FixMaster

About FixMaster

FixMaster is a graphical editor for building test fixtures and generating tester download files.

Importing PCB Data

FixMaster imports files in several formats:

- Import Gerber PCB data and supplemental Gerber Layers.

- Import Lavenir Format 4 netlists, IPC-D-356, and several proprietary formats such as ATF, CATE, and TIF.

- Import NC Drill files in Excellon and Sieb & Meyer.

You specify which data is read in or excluded, map D Codes to Probe Codes, define the Probe Codes, and decide whether or not to flip the data.

Editing PCB and Test Point Data

Once PCB data has been imported, you can edit a graphic representation of pads, test points, drills, and probes. Use the Reference Frame to include or exclude portions of the data for automatic group editing operations. Inspect and edit netlist data all at once or one net at a time. You can automatically or manually perform many functions:

- Place, move, rotate, and mirror PCB data.

- Specify the D Code size range and all other parameters for automatically generating test points.

- Select a two-point or three-point stagger and D Code size range for automatically staggering test points.

- Manually add, delete, move and stagger test points.

- Specify the maximum allowed pin deflection and other design rules for automatically assigning test points to the fixture grid.

- Manually reassign test points to the fixture grid.

- Inspect and correct unmatched test points and crossed pins with a click of the mouse.

Fixture Building

FixMaster allows you to design multiple-plate fixtures. You can set up two fixtures for a tower tester, one for the component side of the board and one for the solder side. You specify the thickness and material of each plate, the spaces between plates, the fixture grid, and the maximum pin deflection. Insert, delete, move, copy, transfer, and replicate drills for outside tooling. Create panelized drill files. Add spacers.

FixMaster automatically generates the data for the fixture plate probe drills when you define the fixture parameters and assign test points to grid points. FixMaster determines drill position based on PCB position, test point parameters, fixture configuration, and pin deflection. You can manually assign drill sizes for each probe in each plate at a range of deflections, or you can have FixMaster automatically calculate drill size based on oversize parameters and probe diameters.

You specify shaft and head diameters, air gap, stagger margin, and pad size range for different types of probes used to test through holes, surface-mount pads, or both.

You can also designate D Codes on the PCB to be transferred as tooling holes to the fixture. These locations can be output in the fixture drill files and used to mount alignment pins that will match the D Code locations on the PCB.

Exporting Data

FixMaster exports files for use in building fixtures and testing PCBs. Export data in NC Drill and a variety of tester formats. You can save the fixture tooling and configuration for reuse. FixMaster exports the following file types:

Exporting NC Drill Files for Manufacturing Fixtures

FixMaster outputs fixture tooling and probe drills in NC format. The output consists of as many files as there are plates in the fixture. Plates and the corresponding output file for each plate are numbered starting from the top of the fixture.

FixMaster supports Excellon and Sieb & Meyer output. You set the language and the options you want.

Exporting Tester Download Files

FixMaster outputs tester download files. Most formats allow you to output a shorts file in addition to a standard tester download file. Points are output relative to the datum point.

Saving FixMaster Job Files

FixMaster saves and opens FixMaster .JOB files which contain all configuration and environment variables for a FixMaster job: probe diameters, probe air gaps, probe margins, D Code and probe mapping, fixture grid size, and stagger and generate options. The file also contains fixture plates and tooling and the PCB database, including pads, test points, and grid points for both layers.

.JOB files can be used as boilerplate fixture files that can be saved and reloaded when you have similarly configured jobs.

.JOB files of completed jobs can be loaded into Verify for fault verification.

What's New in FixMaster 7.0 for Windows

Lavenir has added some new features to FixMaster 7.0 for Windows since the release of Version 6.3:

New Features

- **New Support for IPC-356-A:** Imports and exports a subset of IPC-356-A. Adds more support for end of copper testing.

- **Nidec/Read:** More Nidec/Read support.

- **Test Point Staggering:** Adds a "random" option for staggering test points around through holes which staggers test points randomly (up, down, left and right).

- **Densely Packed Component Isolation:** When a component is to be split out to be tested separately and multiple test points of split out nets lie outside the component, then only one test point outside the component needs to be kept with the split. The component isolation feature makes for more efficient testing of split out components.

Send Us Your Comments

Lavenir is committed to continuous improvement. Your constructive comments on FixMaster will help us to correct problems and improve features.

- Please e-mail your comments and suggestions regarding FixMaster to **feedback@lavenir.com**.

- Visit the Lavenir Web Site at **http://www.lavenir.com**.

- You can reach Lavenir Technical Support at **(925) 680-7400** between the hours of 8am and 5pm Pacific Time.

- Lavenir is located at:
  **2440 Estand Way
  Pleasant Hill, CA   94523**

Download FixMaster Updates

Lavenir will be making updated versions of FixMaster and updated Help files available to customers who have a current maintenance agreement or warranty. You can download the current FixMaster updates from the Lavenir Premier Support Web site.

To Download FixMaster Updates:

1. Have your **User Name** and **Password** ready before logging on to the Lavenir Premier Web Site. Your User Name and Password are printed on your User Password Letter. If you do not know your User Name and Password, call Lavenir at (925) 680-7400.

2. Go to the **Lavenir Web Site** at **http://www.lavenir.com.**

3. On the Site Map, click on **Premier Support**.

4. On the User Name and Password dialog, enter your **User Name** and **Password**.

5. Click on **Software Library**.

6. Follow the instructions to download the **FIXMASTER SETUP.EXE** update file to your system.

7. Double-click on the downloaded **FIXMASTER SETUP.EXE** file on your system and follow the setup instructions.

Lavenir Technical Support

You can reach Lavenir Technical Support by:

- Telephone**: (925) 680-7400** between the hours of 8 AM and 5 PM Pacific Standard Time.

- E-Mail: **support@lavenir.com**.

- Web Site: **http://www.lavenir.com**

Contact Lavenir Customer support with questions about Lavenir hardware and software or to arrange for training or maintenance.

Lavenir is located at:

2440 Estand Way
Pleasant Hill, CA   94523

Chapter 2
How to Build a Fixture Using FixMaster

This is a general outline for beginning-to-end fixture building in FixMaster. Very few real-life jobs will follow this outline exactly. Once you have used FixMaster for a while, most jobs will skip the configuration setups and begin with opening a boilerplate .JOB file, then importing the PCB data. Some jobs may be processed almost entirely automatically using AutoGen. Use this outline as a general guide to the steps in a typical job and as a resource for locating more detailed information.

To Build a Fixture Using FixMaster:

1. If you have previously saved fixture configuration, outside tooling, and operation configurations, **open the boilerplate job**. See *Open a FixMaster Job File* on page 293.

2. Set the **fixture configuration settings**. See *Set Up the Fixture Configuration* on page 51.

3. Set up **outside tooling**. See *Set Up the Fixture Outside Tooling* on page 83.

4. **Import the PCB data**. See *Import PCB Files into the Job* on page 299.

5. If you are going to test both sides of a board on one single-sided fixture, do a **flip test**. See *Set up a Flip Test* on page 117.

6. **Position the PCB** data within the fixture. See *Position the PCB* on page 119.

7. **Map the D Codes to Probe Codes**. See *Map D Codes to Probe Codes* on page 129.

8. **Generate test points**. See *Add Test Points* on page 137.

9. Inspect possibly probeable, **possibly covered points** not given test points. See *Possibly Probeable, Possibly Covered Test Points* on page 148.

10. **Stagger test points**. See *Stagger Test Points* on page 165.

11. **Assign test points to tester grid points**. See *Assign Test Points to Tester Grid Points* on page 177.

12. Inspect and correct **design-rule errors**. See *Check for Design Rule Errors* on page 195.

13. Inspect nets one at a time and edit test points in **Netlist Inspection mode**. See *Inspect Netlist Mode* on page 207.

14. If you are going to split out some nets of the netlist to be tested separately, do a **Split Net**. See *Split Nets* on page 221.

15. Do any **wire wrapping** required for this job. See *Wire Wrapping* on page 237.

16. When all the test points are assigned, and all the design rule errors are corrected, **add spacers**. See *Add Spacers* on page 281.

17. **Export the Files**. See *Export Tester Download Files* on page 316 and the other export procedure in *File Handling in FixMaster* on page 291.

Chapter 3
FixMaster Interface Overview

FixMaster has a point-and-click Windows interface with most functions available on command menus and command toolbars. Most functions can also be activated using shortcut key commands. This chapter provides a brief overview of the major elements of the interface. For more detailed descriptions of the commands represented on the individual menus and toolbar buttons, see the sections of this manual that describe the function you want to perform.

Application Window
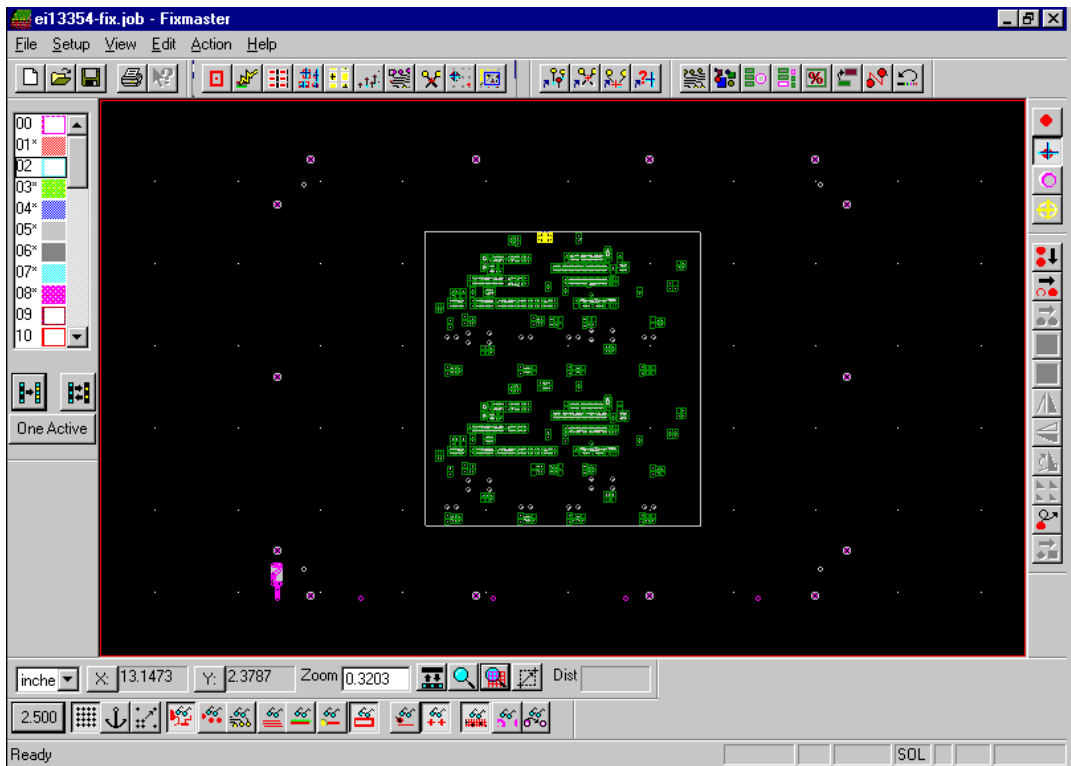
FixMaster Application Window

The FixMaster Application Window has command menus at the top, toolbars around the edges, a status bar at the bottom and the viewing area in the center.

Command Menus

Most commands in FixMaster can be accessed through the command menus. Command menus are usually accessed by clicking on the command. In this manual, command menu commands are written in **bold** and the cascade menus are separated by a dash (**-**).

Command Menu Instruction Example:

➢ On the **Edit** menu, click **Fixture-Spacers-Insert Spacer**.

The instruction in the example means to click the menu shown in the following graphic.
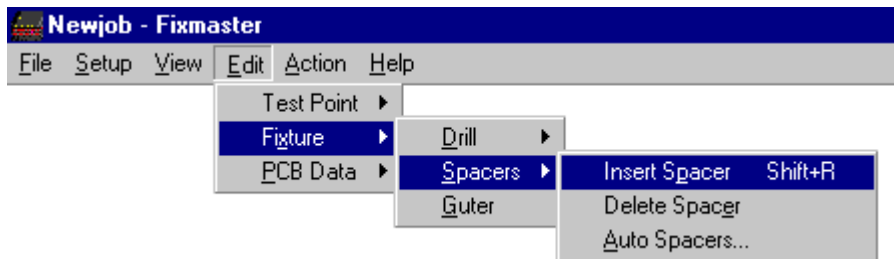
Command Menu Example

Access Keys for Menu Commands

Command menus can also be accessed from the keyboard using what are sometimes called access keys or accelerator keys. The underlined character in each menu indicates the access key for that menu selection. To use the access keys press the **Alt** key and the first access key indicated in the top-level menu. The menu drops down. Then press the other access keys indicated in each cascade menu.

Access Key Example:

1. For the example shown in the Command Menu Example graphic, press **Alt**+**E** together.

   The **Edit Menu** drops down.

2. Press **X**.

   The **Fixture** cascade menu drops down.

3. Press **S**.

   The **Spacers** cascade menu drops down.

4. Press **P**.

   The **Insert Spacer** command is selected.

Shortcut Keys for Menu Commands

Often a command on the command menus will have an even faster way to access the command by keyboard. These key commands are sometimes called shortcut keys or hotkeys. If there is an equivalent key command, it is usually indicated on the final cascade menu. In the example in the graphic, the shortcut key command is **Shift**+**R**. There are also shortcut keys for commands that are not on the menus. For more about shortcut key commands see *Key Commands* on page 16. For a listing of all shortcut key commands in FixMaster, see *Key Commands Summary* on page 391.

Command Toolbars

Many commands in FixMaster can be accessed through the command toolbars. Toolbar controls are activated by clicking on the toolbar button or control. In this manual, toolbar controls are either shown using a graphic, or the name of the button or control is written in **bold**.

To Find Out What a Toolbar Control Is:

➢ Hold the cursor over the toolbar button or control for a moment.

A ToolTip pops up next to the control. The ToolTip gives the name of the control and usually also gives the equivalent key command. The Message Line in the Status Bar gives some additional information about the control.

The following sections provide brief descriptions of each of the toolbars. For more detailed descriptions of the toolbar commands, see the sections of this manual that describe the function you want to perform.

Main Toolbar
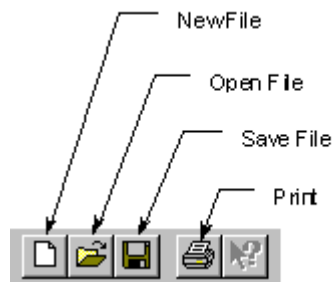
Main Toolbar

The Main toolbar has the File menu commands common to most Windows programs: New File, Open File and Save File. It also has the Print command.

Editing Toolbar

⬇	Insert Element
→	Move Elements
→	Copy Elements
⬇	Transfer Elements
⬇	Replicate Elements
⋀	Mirror X
◁	Mirror Y
↻	Rotate Elements
◤◤	Step and Repeat Elements
↗	Delete Element
→	Transcode Element
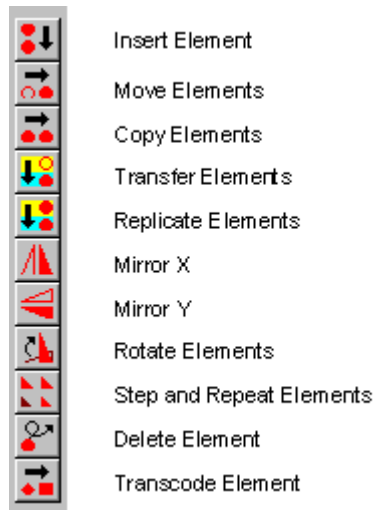
Editing Toolbar

The Editing Toolbar has commands for editing different types of elements. The Editing Toolbar and the Editing Mode Toolbar are used together. The kind of element that can be edited (pad, test point, drill, or spacer) and the type of commands available on the Editing Toolbar depend on the editing mode selected on the Editing Mode toolbar. See *Editing Mode Toolbar* on page 11.

Editing Mode Toolbar

●	PCB Editing Mode
✛	Test Point Editing Mode
◯	Drill Editing Mode
✛	Spacer Editing Mode
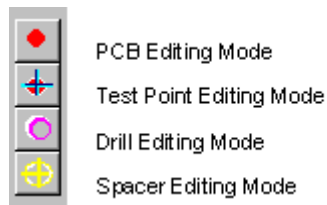
Editing Mode Toolbar

The Editing Mode Toolbar and the Editing Toolbar are used together. The Editing Mode Toolbar determines which types of elements can be edited by the commands on the Editing toolbar, and it determines which commands are available on the Editing Toolbar. See also *Editing Toolbar* on page 10.

Editing Mode Example:

➢ To edit drill data using the Editing Toolbar, first click the **Drill Editing Mode** ◯ button on the Editing Mode Toolbar.

 The Drill Editing Mode is selected and now the Editing Toolbar buttons represent commands that affect drills only. For instance the Insert button on the Editing Toolbar inserts drills.

➢ To edit test points using the Editing Toolbar, first click the **Test Point Editing Mode** ✛ button on the Editing Mode Toolbar.

 The Test Point Editing Mode is selected and now the Editing Toolbar buttons represent commands that affect test points only. For instance the Insert button on the Editing Toolbar inserts test points.

Note: *The Editing Mode Toolbar only affects the editing mode for commands on the Editing Toolbar. Editing commands that appear on the command menus do not require you to set the editing mode first.*

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Fixture Plates Toolbar
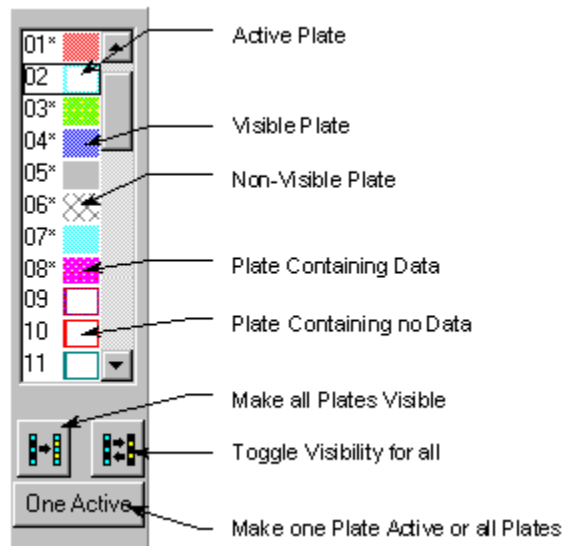
Fixture Plates Toolbar

The Fixture Plates Toolbar indicates the status of fixture plates for drill editing.

Visible Plates

Visible plates show a solid block of color on the toolbar. The color on the toolbar is the same color that represents the plate in the viewing area. Non-visible plates are indicated on the toolbar using a crosshatched pattern.

To Make a Single Plate Visible or Non-Visible:

➢ **Double-click** on the **plate number** in the toolbar.

The plate switches from visible to non-visible and vice versa.

To Make all Plates Visible:

➢ Click on the **All Visible** button in the toolbar.

The plate switches from visible to non-visible or vice versa.

To Toggle the Visibility of all Plates:

➢ Click on the **Toggle All** button in the toolbar.

All visible plates switch to non-visible and vice versa.

To Change the Plate Color:

1. **Right-click** on the **layer number**.

2. On the pop-up context menu, click **Color**.

3. On the **Choose a Color** dialog, **click the color** you want and click **OK**.

Active Plates

Editing commands only work on active, visible plates. FixMaster can have one active plate or all plates can be active. When the active plate button at the bottom of the toolbar says **All Active**, then all plates are active and editing commands can affect all plates. When the active plate button at the bottom of the toolbar says **One Active**, then only the plate that has the black box around it in the toolbar is active, and editing commands can only affect that one plate.

To Make all Plates Active:

➢ Click the button at the bottom of the Fixture Plates Toolbar so that it says **All Active**

    All Active.

To Make one Plate Active:

1. Click the button at the bottom of the Fixture Plates Toolbar so that it says **One Active**

    One Active.

2. Then click the plate that you want to be the active plate so that the **black box** is around that plate.

Plates with Data

The Fixture Plates Toolbar indicates which plates have drills and which plates don't. Plates with data have a solid block of color, while plates that don't have data have only an outline of color. Also plates with data have an asterisk next to the plate number, while plates that don't have data also don't have the asterisk.

Goto Toolbar
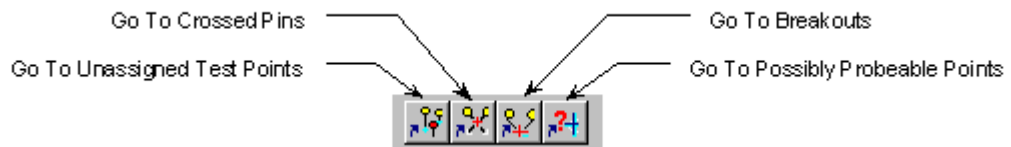
Goto Toolbar

The Goto Toolbar has commands for going to specific types of elements and test point errors.

HiLite Toolbar
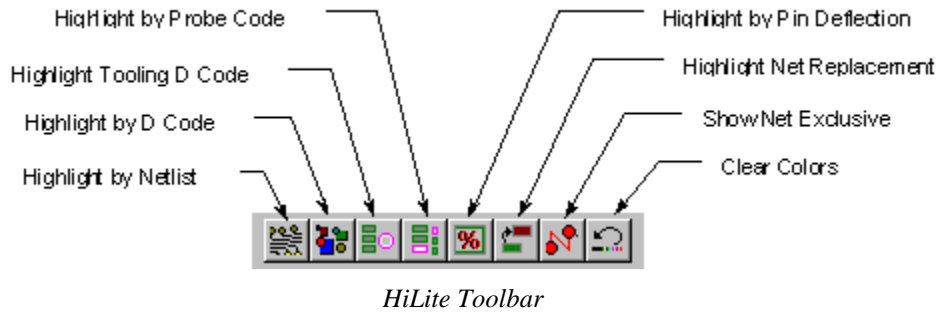
HiLite Toolbar

The HiLite Toolbar has commands for highlighting specific types of elements.

Screen Toolbar
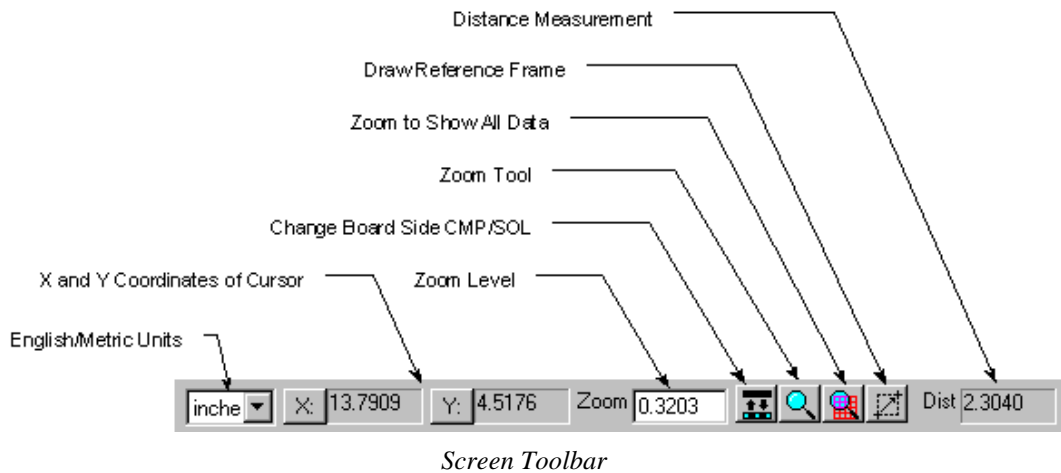
Screen Toolbar

The Screen Toolbar has controls for changing the view of the Viewing Area and changing how the cursor coordinates and distance are shown.

Visibility Toolbar
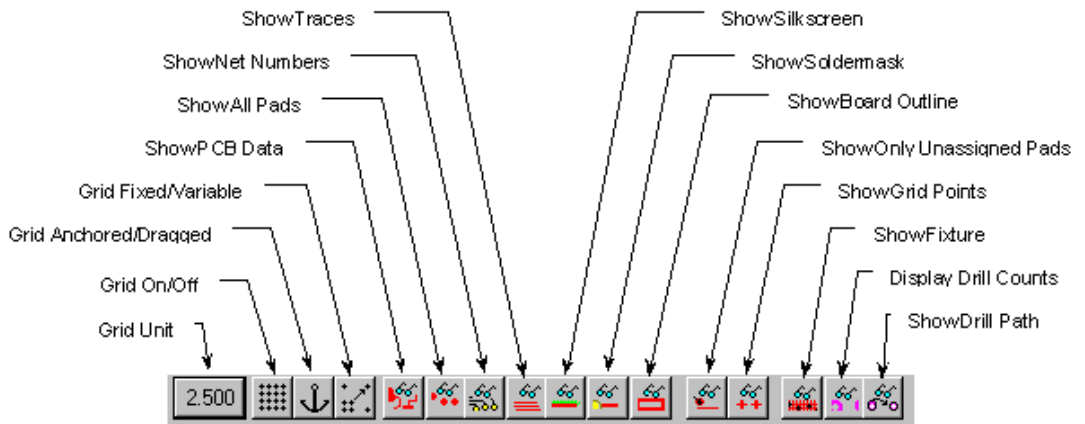
Visibility Toolbar

The Visibility Toolbar has buttons that control what is shown on screen.

Status Bar
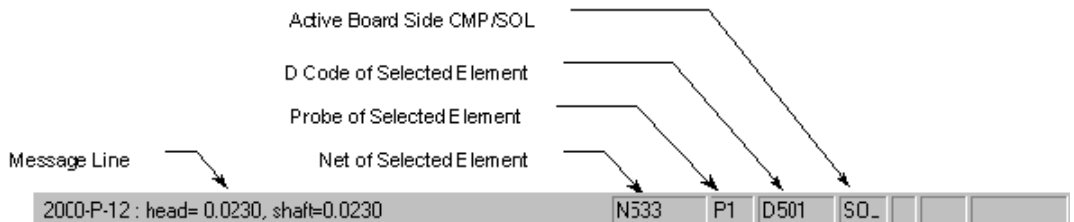
Status Bar

The Status Bar provides information about the selected elements and displays messages from the system, such as prompts for commands.

Key Commands

Many commands in FixMaster can be accessed through the keyboard using the key commands. For a complete list of all shortcut keys in FixMaster, see *Key Commands Summary* on page 391.

Shortcut Key Commands

Shortcut keys are the fastest way to activate commands. Shortcut keys are usually a single keyboard key (such as **R** or **D**), or they can use the **Shift** or **Ctrl** keys modifiers (such as **Shift**+**R** or **Ctrl**+**R**).

To Find the Shortcut Key for a Menu Command:

➢ Go to the menu command that you want to use.

If there is a shortcut key for that command, it will be indicated on the final cascade menu.

To Find the Shortcut Key for a Toolbar Control:

➢ Hold the cursor over the toolbar button or control for a moment.

A ToolTip pops up next to the control. If there is a shortcut key for that command, it will be indicated on the ToolTip.

Access Key Commands

Access keys are just an alternative way to activate a menu command. The underlined character in each menu indicates the access key for that menu selection. To use the access keys press the **Alt** key and the first access key indicated in the top-level menu, and then press the other access key indicated in each cascade menu. For more about access keys, see *Access Keys for Menu Commands* on page 8.

Chapter 4
Viewing Data in FixMaster

FixMaster has many options for viewing data. You can choose what data to display on screen, highlight certain types of data, zoom up and down, go to specific locations or types of data, use an on-screen positioning grid, measure distance and display job statistics.

Choosing What Data to Display

FixMaster has many commands that allow you to control what data is displayed on screen.

Displaying Component Side or Solder Side Data

You can choose which side of the board to display, either the component side or the solder side. Many commands only work on the active board side. The currently active side is shown in the Status Bar, either CMP or SOL.

To Display Component Side or Solder Side Data:

1. On the **View** menu, go to **Active Side** and look at **Component Side** and **Solder Side**.

    - If **Component Side** has a checkmark next to it, then the **Component Side** data is being displayed.

    - If **Solder Side** has a checkmark next to it, then the **Solder Side** data is being displayed.

2. Click the either **Component Side** or **Solder Side** to select that side for display.

Menu: *View-Active Side-Component Side or Solder Side*

Button:

Key: *Shift+O*

Displaying the PCB Data

You can choose to display or not to display the imported PCB data.

To Display the PCB Data:

1. On the **View** menu, go to **Data Elements** and look at **PCB**.

    - If **PCB** has a checkmark next to it, then the PCB data is being displayed.

    - If **PCB** does not have a checkmark next to it, then the PCB data is not being displayed.

2. Click **PCB** to switch between displaying or not displaying the PCB data.

Menu: *View-Data Elements-PCB*

Button:

Key: *B*

Displaying All Pads or Only Pads with Test Points

When the PCB data is being displayed you can choose to display all pads or only pads that have test points on them.

To Display All Pads or Only Pads with Test Points:

1. On the **View** menu, go to **Data Elements-Pads** and look at **All**.

    -   If **All** has a checkmark next to it, then the All pads are being displayed.

    -   If **All** does not have a checkmark next to it, then only the pads with test points are being displayed.

2. Click **All** to switch between displaying all pads or only pads with test points.

Menu: *View-Data Elements-Pads-All*

Button:

Key: *Shift+P*

Display "Commented" Pads in IPC-D-356 Data

This command displays the "commented" pads in IPC-D-356 data. These are elements in which a letter C has been inserted into the data to indicate that the element is "commented out."

To Display "Commented" Pads in IPC-D-356 Data:

1. On the **View** menu, go to **Data Elements-Pads** and look at **Commented**.

    -   If **Commented** has a checkmark next to it, then the "commented" pads in IPC-D-356 data are being displayed.

    -   If **Commented** does not have a checkmark next to it, then the "commented" pads in IPC-D-356 data are not being displayed.

2. Click **Commented** to switch between displaying and not displaying the "commented" pads in IPC-D-356 data.

Menu: *View-Data Elements-Pads-Commented*

Button: *None*

Key: *None*

Display Only the Accessed Side for IPC-D-356 Pads with Access Data

Some IPC-D-356 files contain access data indicating which board side a given pad is to be accessed from.

To Display Only the Accessed Side for IPC-D-356 Pads with Access Data:

1. On the **View** menu, go to **Data Elements-Pads** and look at **Access**.

    - If **Access** has a checkmark next to it, then pads in IPC-D-356 data that have access information are displayed only for the board side where they can be accessed.

    - If **Access** does not have a checkmark next to it, then even pads in IPC-D-356 data that have access information are displayed for both board sides, even if they can only be accessed from one side.

2. Click **Access** to switch between displaying pads that have access information only on the accessed board side and displaying those pads on both board sides.

Menu: *View-Data Elements-Pads-Access*

Button: *None*

Key: *None*

Displaying Net Numbers

FixMaster can display the net number of each pad next to each pad.

To Display Net Numbers:

1. On the **View** menu, go to **Data Elements** and look at **Net Numbers**.

    - If **Net Numbers** has a checkmark next to it, then the net numbers are being displayed.

    - If **Net Numbers** does not have a checkmark next to it, then the net numbers are not being displayed.

2. Click **Net Numbers** to switch between displaying or not displaying the net numbers.

Menu: *View-Data Elements-Net Numbers*

Button:

Key: *F*

Displaying All Pads or Only Pads with Unassigned Test Points

When the PCB data is being displayed you can choose to display all pads or only pads that have unassigned test points on them.

To Display Only Unassigned Test Points:

1. On the **View** menu, go to **Data Elements** and look at **Unassigned TP Only**.

   - If **Unassigned TP Only** has a checkmark next to it, then only pads that have unassigned test points are being displayed.

   - If **Unassigned TP Only** does not have a checkmark next to it, then all pads are being displayed.

2. Click **Unassigned TP Only** to switch between displaying all pads or only pads with unassigned test points.

Menu: *View-Data Elements-Unassigned TP Only*

Button:

Key: *U*

Displaying Traces

When the PCB data is being displayed, you have several options for how to display traces, and you have the option to not display them at all. Traces must be present in the imported PCB data in order to be displayed.

To Display Traces:

1. On the **View** menu, click **Data Elements-Trace**.
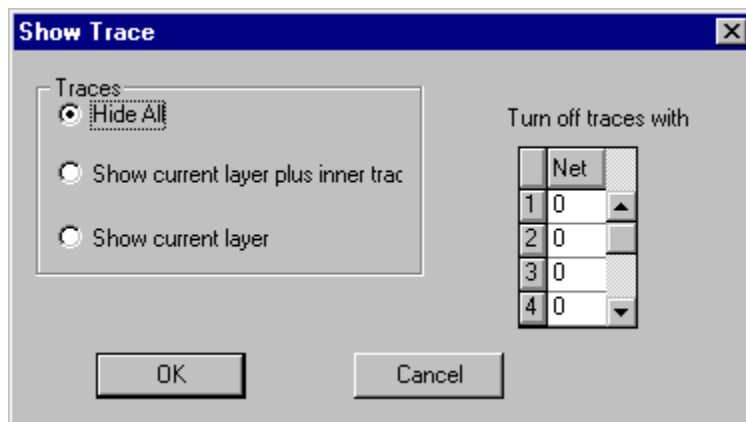
2. In the **Traces** group box, select an option for which traces to display, if any:

    - **Hide All:** When this option is selected, no traces are displayed.

    - **Show Current Layer Plus Inner:** When this option is selected, the traces for the active board side, component or solder, are displayed, and the traces for the inner layers are also displayed.

    - **Show Current Layer:** When this option is selected, the traces for the active board side, component or solder, are displayed.

3. In the **Turn Off Traces with Net** table, enter any net numbers for which you want to turn off the display of traces. This option only has meaning if you have selected an option which displays traces.

4. Click **OK**.

Menu: *View-Data Elements-Trace*

Button: ![button] *This button is a shortcut that switches between showing no traces and showing the traces in the active board side, CMP or SOL.*

Key: *T: This key displays the Show Trace dialog.*
Shift+T: This key is a shortcut that switches between showing no traces and showing the traces in the active board side, CMP or SOL.

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Displaying Fixture Grid Points

You can choose to display or not to display the fixture grid points. The grid points appear on screen as small red crosses.

To Display Fixture Grid Points:

1. On the **View** menu, go to **Data Elements** and look at **Grid Probes**.

   - If **Grid Probes** has a checkmark next to it, then grid points are being displayed.

   - If **Grid Probes** does not have a checkmark next to it, then grid points are not being displayed.

2. Click **Grid Probes** to switch between displaying or not displaying grid points.

Menu: *View-Data Elements-Grid Probes*

Button:

Key: *None*

Displaying Silkscreen Data

If you have imported a silkscreen data file, you can choose to display or not to display the silkscreen data. For information on importing silkscreen data, see *Import Supplemental Gerber Files into the Job* on page 312.

To Display Silkscreen Data:

1. On the **View** menu, go to **Data Elements** and look at **Silkscreen**.

   - If **Silkscreen** has a checkmark next to it, then silkscreen data is being displayed.

   - If **Silkscreen** does not have a checkmark next to it, then silkscreen data is not being displayed.

2. Click **Silkscreen** to switch between displaying or not displaying silkscreen data.

Menu: *View-Data Elements-Silkscreen*

Button:

Key: *K*

Displaying Soldermask Data

If you have imported a soldermask data file, you can choose to display or not to display the soldermask data. For information on importing soldermask data, see *Import Supplemental Gerber Files into the Job* on page 312.

To Display Soldermask Data:

1. On the **View** menu, go to **Data Elements** and look at **Soldermask**.

   - If **Soldermask** has a checkmark next to it, then soldermask data is being displayed.

   - If **Soldermask** does not have a checkmark next to it, then soldermask data is not being displayed.

2. Click **Soldermask** to switch between displaying or not displaying soldermask data.

Menu: *View-Data Elements-Soldermask*

Button:

Key: *None*

Displaying Board Outline Data

If you have imported a board outline data file, you can choose to display or not to display the board outline data. For information on importing board outline data, see *Import Supplemental Gerber Files into the Job* on page 312.

To Display Board Outline Data:

1. On the **View** menu, go to **Data Elements** and look at **Board Outline**.

   - If **Board Outline** has a checkmark next to it, then board outline data is being displayed.

   - If **Board Outline** does not have a checkmark next to it, then board outline data is not being displayed.

2. Click **Board Outline** to switch between displaying or not displaying board outline data.

Menu: *View-Data Elements-Board Outline*

Button:

Key: *O*

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Displaying the Fixture Drills

You can choose to display or not to display the fixture drills. This option allows you to display the outside tooling and other drills that you add manually, not the probe drills that FixMaster creates.

To Display the Fixture Drills:

1. On the **View** menu, go to **Data Elements** and look at **Fixture**.

    - If **Fixture** has a checkmark next to it, then the fixture drills are being displayed.

    - If **Fixture** does not have a checkmark next to it, then the fixture drills are not being displayed.

2. Click **Fixture** to switch between displaying or not displaying the fixture drills.

Menu: *View-Data Elements-Fixture*

Button:

Key: *L*

Displaying the Drill Path for the Fixture Drills

When the fixture drills are displayed, you can also choose to display or not to display the drill path for the fixture drills. This option allows you to display the drill path for the outside tooling and other drills that you add manually, not the drill path for the probe drills that FixMaster creates.

To Display the Drill Path for the Fixture Drills:

1. On the **View** menu, go to **Data Elements** and look at **Drill Path**.

    - If **Drill Path** has a checkmark next to it, then the drill path for the fixture drills is being displayed.

    - If **Drill Path** does not have a checkmark next to it, then the drill path for the fixture drills is not being displayed.

2. Click **Drill Path** to switch between displaying or not displaying the drill path for the fixture drills.

Menu: *View-Data Elements-Drill Path*

Button:

Key: *None*

Show the Drill Count

FixMaster can display a dialog that shows the number of drills for each Tool Code.

To Show the Drill Count:

➢ On the **View** menu, click **Data Elements-Drill Count**.

Pattern	Count
0	0
1	37
2	0
3	40
4	40
5	37

Number of Spacers 0

OK   Cancel
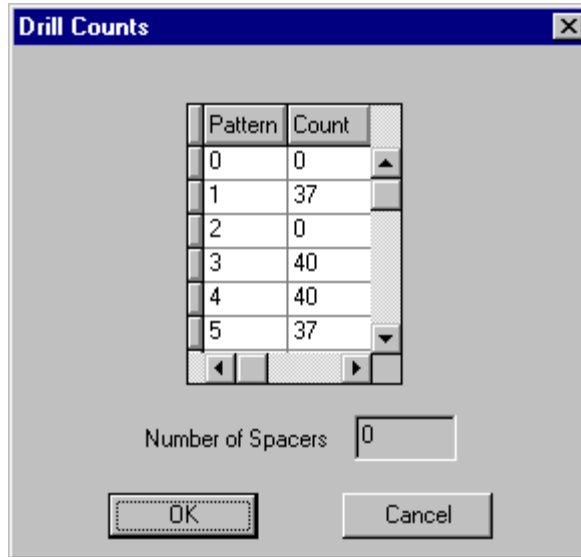
Drill Counts Dialog

Menu:	*View-Data Elements-Drill Count*
Button:	
Key:	*Shift+F5*

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Highlighting Data On Screen

FixMaster has several highlighting commands to help you find certain types of data elements on screen. These commands cause the particular type of data element to be displayed in magenta on screen. Once data is highlighted, FixMaster also has a command for inspecting each highlighted element in sequence. See *Going to the Next Highlighted Element* on page 38.

Show Everything in Gray Except for the Highlighted Elements

FixMaster can make it easier to inspect the highlighted data by displaying everything in gray except for the highlighted data.

To Show Everything in Gray Except for the Highlighted Elements:

1. On the **View** menu, click **Data Elements-Net Exclusive**.

   All data elements on screen turn gray.

2. Activate the highlighting command you want to use.

   The highlighted elements are shown in magenta and all other elements remain gray.

3. To restore the elements to normal color, go back to the **View** menu and click **Data Elements-Net Exclusive** again.

Menu: *View-Data Elements-Net Exclusive*

Button: *None*

Key: *None*

Highlighting a Specific Net

You can highlight a specific net.

To Highlight a Specific Net:

1. On the **View** menu, click **Hi Lite Image-By Netlist**.

   FixMaster prompts for a net number.
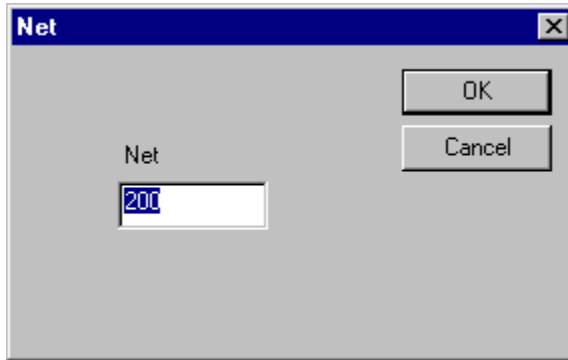
Highlight Net

2. On the Net dialog, enter the number of the net you want to highlight and click **OK**.

   FixMaster displays the net highlighted in magenta.

Menu: *View-Hi Lite Image-By Netlist*

Button:

Key: *Shift+F*

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Highlighting the Net of a Selected Element

You can highlight the net of a selected element.

To Highlight the Net of a Selected Element:

1. On the **HiLite** Toolbar, click the **Show Netlists** button .

2. Click on the element in the net that you want to highlight.

    The cursor snaps to the element and marks it with an X.

3. Click again.

    FixMaster displays the net highlighted in magenta.

    The Highlight Net of Element tool remains selected until you select another tool or press the **Escape** key, so you can highlight one net after another by clicking on more elements.

Menu: *None*

Button:

Key: *None*

Highlighting Data by D Code

You can highlight all the elements that have a selected D Code.

To Highlight Data by D Code:

1. On the **View** menu, click **Hi Lite Image-By D Code**.

   FixMaster prompts for a D Code number.
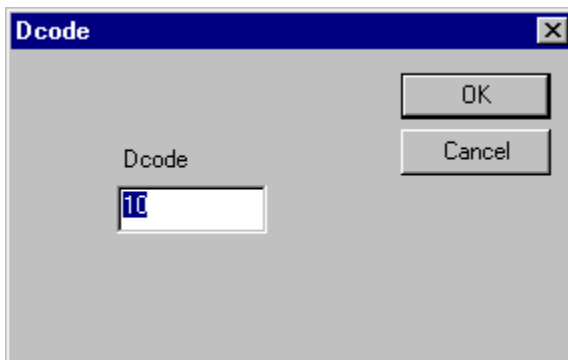
Highlight D Code

2. On the D Code dialog, enter the D Code you want to highlight and click **OK**.

   FixMaster displays the all elements of the selected D Code highlighted in magenta.

Menu: *View-Hi Lite Image-By D Code*

Button:

Key: *Ctrl+D*

Highlighting Tooling Holes

FixMaster has a command to highlight PCB data that has a D Code designated as representing tooling holes in FixMaster. For more information on tooling holes, see *PCB Tooling Holes and Fixture Alignment Pins* on page 385.

To Highlight Tooling Holes:

➢ On the **View** menu, click **Hi Lite Image-By Tooling D Code**.

   FixMaster displays all data having a D Code mapped as a tooling hole highlighted in magenta.

Menu: *View-Hi Lite Image-By Tooling D Code*

Button:

Key: *Shift+E*

Highlighting Data by Probe Code

You can highlight all the pads mapped to a selected Probe Code.

To Highlight Data by Probe Code:

1. On the **View** menu, click **Hi Lite Image-By Probe Code**.

   FixMaster prompts for a Probe Code number.
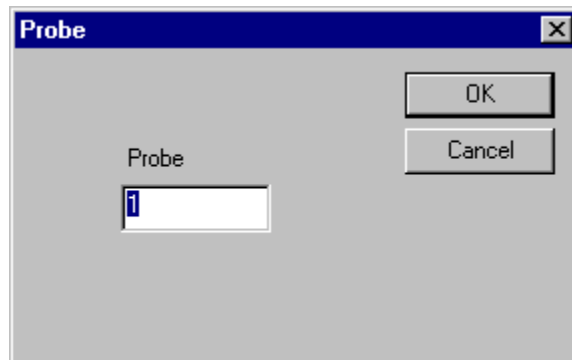
Highlight Probe Code

2. On the Probe dialog, enter the **Probe Code** you want to highlight and click **OK**.

   FixMaster displays the all elements mapped to the Probe Code highlighted in magenta.

Menu: *View-Hi Lite Image-By Probe Code*

Button:

Key: *Shift+B*

Highlighting Data by Pin Deflection

FixMaster has a command that highlights elements that are assigned to grid points within a specified pin deflection range. You select the pin deflection range and FixMaster highlights those elements in magenta.

To Highlight Data by Pin Deflection:

1. On the **View** menu, click **Hi Lite Image-By Pin Deflection**.

   FixMaster prompts for a pin deflection range.
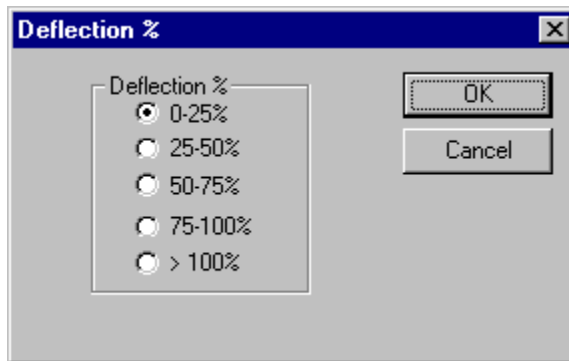
Highlight by Pin Deflection

2. On the Deflection % dialog, select the pin deflection range you want to highlight and click **OK**.

   FixMaster displays the all elements that have test points assigned to grid within the selected pin deflection range highlighted in magenta.

Menu: *View-Hi Lite Image-By Pin Deflection*

Button:

Key: *Shift+5*

Highlighting the Data Changed by a Net Replace Operation

The Net Replace operation can change the netlist connectivity data behind a PCB design that has already been imported into FixMaster. FixMaster has a command to highlight the elements that have changed due to a Net Replace operation.

To Highlight Data Changed by a Net Replace Operation:

➢ On the **View** menu, click **Hi Lite Image-By Net Replace**.

FixMaster displays the elements that have changed due to a Net Replace operation highlighted in magenta.

Menu: *View-Hi Lite Image-By Net Replace*

Button:

Key: *None*

Removing Highlighting from the Screen

You can remove the highlighting from the screen and return all elements to their normal color.

To Remove Highlighting from the Screen:

➢ On the **View** menu, click **Hi Lite Image-Remove Hi Lite**.

FixMaster removes the magenta highlighting from any elements that are currently highlighted and displays all elements in their normal colors.

Menu: *View-Hi Lite Image-Remove Hi Lite*

Button:

Key: *Shift+H*

Zooming on Data

FixMaster has several commands for zooming up and down on the viewing area and zooming on specific areas of the screen.

Zooming Up or Down in Steps

You can zoom up or down by a fixed amount.

To Zoom Up or Down:

➢ On the **View** menu, click **Zoom-Zoom Up** or **Zoom Down**.

FixMaster zooms the viewing area up or down, centered on the cursor position.

Note: *It is usually preferable to run this command from the keyboard rather than the command menus because you have more control over the cursor position when the command is activated. This allows you to control the exact position to zoom on.*

Menu: *View-Zoom-Zoom Up or Zoom Down*

Button: *Click the button, then click in the viewing area to Zoom Up.*
No button for Zoom Down.

Key: *Page Up key or Page Down key*

Zooming to Show All Data

You can zoom so that all data fits in the screen.

To Zoom so that All Data is Shown on Screen:

➢ On the **View** menu, click **Zoom-Zoom to Show All**.

FixMaster zooms up or down so that all data on screen fits inside the viewing area.

Menu: *View-Zoom-Zoom to Show All*

Button:

Key: *Home key*

Zooming on the Reference Frame

You can zoom on the Reference Frame.

To Zoom on the Reference Frame:

➢ On the **View** menu, click **Zoom-Zoom On Frame**.

FixMaster zooms on the Reference Frame.

Menu: *View-Zoom-Zoom on Frame*

Button: *None*

Key: *W*

Automatic Zoom-on-Frame Feature

You can set FixMaster to automatically zoom on the Reference Frame whenever a new Frame is drawn. Or you can turn the feature off so that FixMaster does not automatically zoom on a new Reference Frame.

To Select to Automatically Zoom when a New Frame is Drawn:

1. On the **View** menu, go to **Zoom** and look at **Zoom On**.

   - If **Zoom On** has a checkmark next to it, then FixMaster will automatically zoom on the Reference Frame whenever a new Frame is drawn.

   - If **Zoom On** does not have a checkmark next to it, then FixMaster will not automatically zoom on a new Reference Frame.

2. Click **Zoom On** to switch between automatically zooming on a new Frame and not automatically zooming on a new Frame.

Menu: *View-Zoom-Zoom On*

Button: *None*

Key: *None*

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Zooming to a Specific Zoom Level

You can set an exact zoom level.

To Zoom to a Specific Zoom Level:

1. On the **View** menu, click **Zoom-Set Zoom Level**.

   FixMaster prompts for a zoom level.
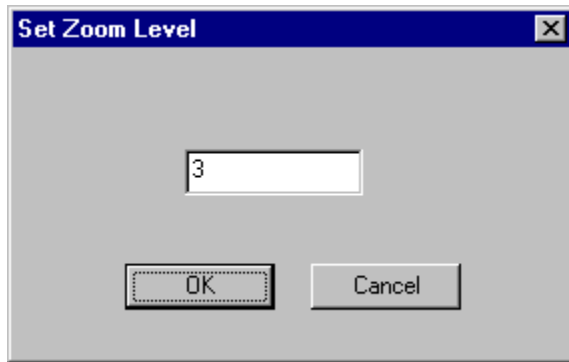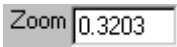
Set Zoom Level

2. On the **Set Zoom Level** dialog, enter the zoom level and click **OK**.

   FixMaster zooms to the zoom level you selected.

Menu: *View-Zoom-Set Zoom Level*

Button: Zoom 0.3203   *Type the zoom level into the control and then move the mouse into the viewing area.*

Key: *Z*

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Going To Specific Locations on Screen

FixMaster has many commands for going to specific location or specific types of data on screen.

Moving the Cursor Manually

You can manually move the cursor around on the viewing area using the mouse or the arrow keys.

Using the Mouse

Moving the mouse moves the cursor around the screen. You can use the mouse to move the cursor outside the viewing area to click on menus and buttons, which is something you cannot do using the arrow keys. When the screen grid is turned on, moving the cursor with the mouse allows you to position the cursor off of the grid points, which is also something you cannot do using the arrow keys.

Using the Arrow Keys

Pressing the **arrow keys** moves the cursor up, down, left or right on the viewing area. When the screen grid is turned on, pressing the **arrow keys** causes the cursor to hop from one grid point to the next. The **arrow keys** cannot be used to move the cursor outside the viewing area to click on menus and buttons.

Going To Specific X, Y Coordinates

You can go a specific X, Y coordinate.

To Go To Specific X, Y Coordinates:

1. On the **View** menu, click **Go To-Coordinates**.

    FixMaster prompts for X and Y coordinates.
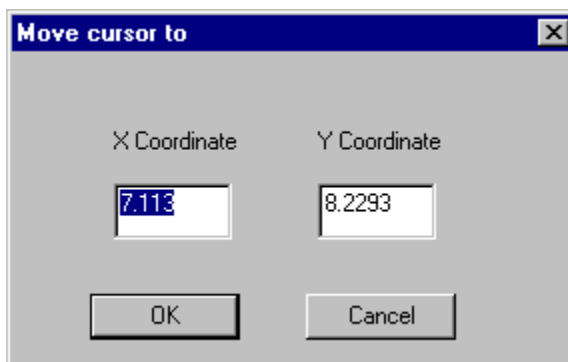
Move Cursor To dialog

2. On the **Move Cursor To** dialog, enter new X and Y coordinates and press the **Enter** key.

    FixMaster moves the cursor to the X and Y coordinates.

    Note: *It is usually preferable to close the dialog using the **Enter** key instead of clicking **OK**.*
    *Clicking **OK** can sometimes cause you to jiggle the mouse and move the cursor off of the*
    coordinates you set.

Menu: *View-Go To-Coordinates*

Button: $\boxed{\text{X: } 13.7909}$ $\boxed{\text{Y: } 4.5176}$ *Click the X or Y buttons.*

Key: *X key or Y key*

Selecting a Test Point or Pad

Selecting an element causes the cursor to hop to the nearest element, and the D Code, net number and probe number of the selected element is displayed on the Status Bar.

To Select a Pad or Test Point:

➢ Position the cursor next to the test point or pad and press the **S** key.

Menu: *None*

Button: *None*

Key: *S*

Going to the Last Selected Test Point

Pressing **Ctrl+H** moves the cursor to the last selected test point. If the selected test point is off the screen, FixMaster redraws the screen at the current zoom level with the selected test point in the center. A green cross marks the selected test point.

To Go to the Last Selected Test Point:

➢   Press **Ctrl+H**.

Menu: *None*

Button: *None*

Key: *Ctrl+H*

Moving between a Test Point and its Grid Point

Pressing the **E** key moves the cursor from a selected test point to its assigned fixture grid point. Pressing **E** again moves the cursor back to the selected test point. A green cross marks the selected test point.

To Move between a Test Point and its Grid Point:

➢   Press the **E** key.

Menu: *None*

Button: *None*

Key: *E*

Going to the Next Highlighted Element

Pressing the **N** key moves the cursor sequentially to the next highlighted element. Use this command to find every highlighted element in sequence. For the highlighting commands, see *Highlighting Data On Screen* on page 26.

To Go to the Next Highlighted Element:

1.   Highlight the elements.

2.   Press the **N** key.

Menu: *None*

Button: *None*

Key: *N*

Going To the Datum Point

You can move the cursor to the datum point. For information on setting the datum point, see *Setting the Datum Point* on page 340.

To Go To the Datum Point:

➢ On the **View** menu, click **Go To-Datum Point**.

The cursor goes to the datum point.

Menu: *View-Go To-Datum Point*

Button: *None*

Key: *None*

Going To Unassigned Test Points

You can go to each unassigned test point. For more about unassigned test points, see *Check for Design Rule Errors* on page 195.

To Go To Unassigned Test Points:

1. On the **View** menu, click **Go To-Unassigned TP**.

   The Go To Unassigned Test Point tool is selected.

2. Click the mouse in the viewing area.

   The cursor hops to the next sequential unassigned test point. The Go To Unassigned Test Point tool remains selected until you select another tool or press the **Escape** key, so you can go to one unassigned test point after another by clicking the mouse.

Menu: *View-Go To-Unassigned TP*

Button:

Key: *None*

Going To Crossed Pins

You can go to each instance of crossed pins. For more about crossed pins, see *Check for Design Rule Errors* on page 195.

To Go To Crossed Pins:

1. On the **View** menu, click **Go To-Crossed Pins**.

    The Go To Crossed Pins tool is selected.

2. Click the mouse in the viewing area.

    The cursor hops to the next sequential instance of crossed pins. The Go To Crossed Pins tool remains selected until you select another tool or press the **Escape** key, so you can go to one instance of crossed pins after another by clicking the mouse.

Menu: *View-Go To-Crossed Pins*

Button:

Key: *None*

Going To Breakouts

You can go to each instance of breakout errors. For more about breakouts, see *Check for Design Rule Errors* on page 195.

To Go To Breakouts:

1. On the **View** menu, click **Go To-Breakouts**.

    The Go To Breakouts tool is selected.

2. Click the mouse in the viewing area.

    The cursor hops to the next sequential instance of breakouts. The Go To Breakouts tool remains selected until you select another tool or press the **Escape** key, so you can go to one instance of breakouts after another by clicking the mouse.

Menu: *View-Go To-Breakouts*

Button:

Key: *None*

Going To Possibly Probeable Pads not Given Test Points

You can go to each instance of pads possibly covered by soldermask or silkscreen. For more about pads that may be covered by silkscreen or soldermask, see *Possibly Probeable, Possibly Covered Test Points* on page 148.

To Go To Possibly Probeable Pads not Given Test Points:

1. On the **View** menu, click **Go To-Probeable TP**.

   The Go To Possibly Probeable Pads tool is selected.

2. Click the mouse in the viewing area.

   The cursor hops to the next sequential possibly probeable pads not given a test point. Go To Possibly Probeable Pads tool remains selected until you select another tool or press the **Escape** key, so you can go to one possibly probeable ad after another by clicking the mouse.

Menu: *View-Go To-Probeable TP*

Button:

Key: *None*

Using the Screen Grid

The program has a screen grid that can be used for precisely positioning the cursor. The grid can be turned on and off as needed.

When the grid is on:

- The cursor moves only on the grid points when moved with the arrow keys.
- The cursor snaps to the closest grid point when you activate an editing command such as insert, copy or move.
- The cursor can be moved off the grid using the mouse or by aligning to an element.

Some settings affect the behavior of the grid:

- The **grid unit** determines the spacing of grid points.
- The space between grid points can be **fixed** at one interval or can be set to be **variable** depending on the zoom level.
- The grid can be **anchored** so that it does not move, or it can be **dragged** by the cursor.

Turning the Screen Grid On or Off

You can turn the display of the screen grid on and off.

To Turn the Screen Grid On or Off:

1. On the **View** Menu, go to **Screen Grid** and look at **Display Grid**.
   - If **Display Grid** has a checkmark, the grid is **On**.
   - If **Display Grid** does not have a checkmark, the grid is **Off**.
2. Click **Display Grid** to turn the grid on or off.

Menu: *View-Screen Grid-Display Grid*

Button: *Up = Off, Down = On*

Key: *G*

Anchored or Dragged Grid

The grid can be **Anchored** in place so that it does not move. When the grid is set to **Anchored** mode and the cursor is moved, the cursor hops from one grid point to the next.

Or the grid can be **Dragged** so that it is moveable. When the grid is set to **Dragged** mode and the cursor is moved, the cursor drags the grid to a new position.

Generally the grid is left in **Anchored** mode and is only put in **Dragged** mode when it needs to be repositioned.

To Switch between an Anchored Grid and One that can be Dragged:

1. On the **View** Menu, go to **Screen Grid** and look at **Anchored** and **Dragged**. The position of the bullet indicates the status of the grid:

   - If there is a bullet on **Anchored**, the grid is stationary, and the cursor hops from one grid point to the next.

   - If there is a bullet on **Dragged**, the grid is moveable, and the cursor drags the grid.

2. To switch between the two states, click **Anchored** or **Dragged**.

Menu: *View-Screen Grid-Anchored or Dragged*

Button: *Up = Dragged, Down = Anchored*

Key: *Shift+G*

Fixed or Variable Grid

The grid can be set to **Variable** or **Fixed** mode. The difference between these two modes is the interval displayed between grid dots.

- **Variable Mode:** The program changes the displayed grid interval so that a comfortable number of grid dots appears on screen at any zoom level. The displayed grid interval will be equal to a multiple of the grid unit. The possible grid intervals are grid unit times a power of ten or any such value divided by two.

  As you increase the zoom level, the grid interval becomes smaller to the point of the finest resolution until it reaches the grid unit. It will never be smaller than the grid unit.

- **Fixed Grid:** The interval displayed between grid dots is always equal to the grid unit, at any zoom level. The grid interval does not change until the screen is almost filled with grid dots. When there are too many dots to display, the grid becomes invisible, but it is still on.

To Switch between a Fixed Interval Grid and One that is Variable with Zoom:

1. On the **View** menu, go to **Screen Grid** and look at **Variable** and **Fixed**. The position of the bullet indicates the status of the grid:

   - If there is a bullet on **Variable**, the grid interval is variable depending on zoom level.

   - If there is a bullet on **Fixed**, the grid interval is fixed regardless of zoom level.

2. To switch between the two states, click **Variable** or **Fixed**.

Menu: *View-Screen Grid-Variable or Fixed.*

Button: *Up = Fixed, Down = Variable*

Key: *Ctrl+G*

Grid Units

The grid unit is the basis of the grid interval, the space between grid points.

To Set the Grid Unit:

1. On the **View** menu, click **Screen Grid-Units**.

    FixMaster prompts you to set the grid unit.
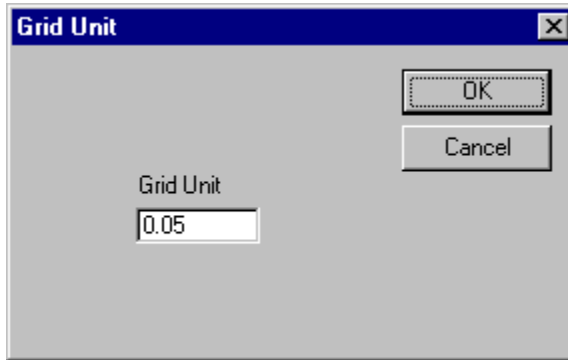
Grid Unit Dialog

2. On the **Grid Unit** dialog, enter the new grid unit and click **OK**.

    FixMaster displays the grid based on the new grid unit.

Menu:	*View-Screen Grid-Units.*
Button:	2.500
Key:	*None*

Showing the Job Statistics

FixMaster can display a dialog that shows statistics for the current job.

To Show the Job Statistics:

➢ On the **View** menu, click **Statistics**.
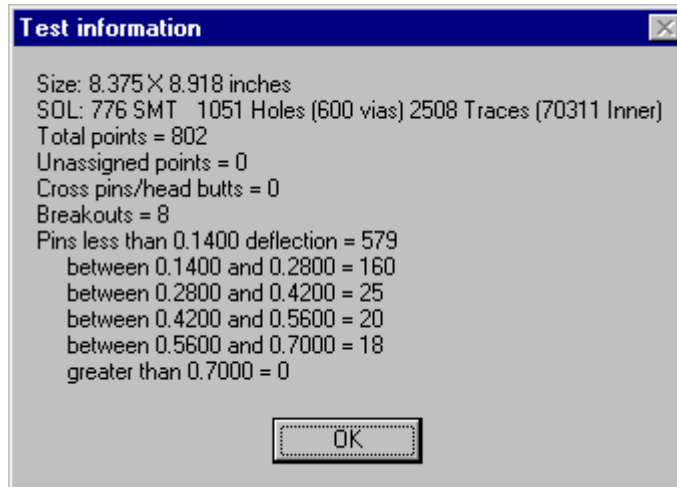
Test Information Statistics Dialog

Menu: *View-Statistics*

Button: *None*

Key: *F6*

Measuring Distance

FixMaster allows you to measure distance in the viewing area in two different ways. You can measure the straight-line distance between two points in Distance Measurement Mode. Or you can use a relative origin, which gives you the X and Y distances from one point to the other.
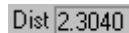
Using Distance Measurement Mode

When Distance Measurement Mode is on, the Status Bar shows distance between the current cursor position and the point on screen where the cursor was when Distance Measurement Mode was turned on.

To Measure Distance with Distance Measure Mode:

1. Position the cursor at the point on screen where you want to measure distance from.

2. Press the **D** key.

    FixMaster marks the starting point on screen with a yellow X and goes into Distance Measure Mode. The Status Bar begins displaying the distance between the starting point on screen and the cursor position.

Distance Displayed in Status Bar

3. Move the cursor to the point on screen where you want to measure distance to.

    The Status Bar displays the distance between the starting point on screen and the cursor position. FixMaster remains in Distance Measurement mode until you press **D** again.

Menu: *None*

Button: *None*

Key: *D*

Using the Relative Origin

Ordinarily the Screen Toolbar shows the cursor's X and Y coordinate position relative to the absolute origin, X=0, Y=0. When the Relative Origin is turned on, the Screen Toolbar shows cursor's dx and dy position relative to the Relative Origin, dx=0, dy=0. The Relative Origin, dx=0, dy=0, is the point on screen where the cursor was when the Relative Origin was turned on.

To Measure Distance with the Relative Origin:

1. Position the cursor at the point on screen where you want to measure distance from.

2. Press the **R** key.

    FixMaster switches to Relative Origin Mode. Instead of the normal X, Y coordinates, the Screen Toolbar begins displaying the cursor position as the dx and dy coordinates relative to the position on screen where Relative Origin Mode was turned on.

Absolute Origin Mode

Relative Origin Mode

3. Move the cursor to the point on screen where you want to measure distance to.

    The Screen Toolbar displays the dx and dy distance between the Relative Origin and the cursor position. FixMaster remains in Relative Origin mode until you press **R** again.

Menu: *None*

Button: *None*

Key: *R*

Metric or English Units

FixMaster can convert units of measurement for the current job between English and metric units.

To Select Metric or English Units:

1. On the Screen Toolbar, click the **Coordinate Units drop down** inche ▼ and select either **Inches** or **mm**.

    FixMaster prompts, "Convert all data and parameters to metric/English?"

2. Click **Yes**.

    FixMaster converts the database to the new units.

Menu: *None*

Button: inche ▼

Key: *None*

Using the Reference Frame

FixMaster features a Reference Frame, which is used by many commands to select elements for an operation. You can reposition and resize the Frame using a mouse-operated Frame-drawing tool.

To Draw a New Reference Frame:

1. On the **Screen** toolbar, click the **New Window** button.

    The New Window button stays down and the Frame-drawing tool is selected.

2. Position the cursor where you want one corner of the Frame to be to be. Then click the mouse and drag the cursor to where you want the opposite corner.

    The Frame-drawing tool remains selected until you select another tool or press the **Escape** key.

Menu: *None*

Button:

Key: *Shift+W*

Chapter 5
Set Up the Fixture Configuration

Fixture Configuration is defined by:

- **Fixture Plates:** Plate size and spacing, plate materials and material characteristics

- **Fixture Grid:** Grid type and spacing

- **Fixture Design Rules:** Maximum allowed Pin Deflection, and Breakout Gap

- **Fixture Probes:** Probe characteristics and rules for how the plates will be drilled to accommodate the probes

About Dual-Sided Testing

FixMaster supports dual-sided testing, including tower testers that have a fixture for each side of the board. When you set up the fixture parameters, you set them up for the currently active board side, CMP or SOL. Be sure the correct board side, shown in the Status Bar, is active before you set up the fixture plates, grids, probes, and tooling.

Using Boilerplate Jobs

All fixture configuration settings can be saved in a .JOB file. If you typically have similar jobs, you can open a previously saved boilerplate .JOB file, import the new PCB data, and begin processing without having to reset all of the fixture configuration settings.

Lavenir Technical support has many sample fixture files available for download from the Lavenir FTP site. For more information on how to get boilerplate fixture files to use as starting points for your own fixture designs, contact Lavenir Technical support. See *Lavenir Technical Support* on page 4.

Setting up the Fixture Plates

Plate size and spacing, plate materials and material characteristics are part of the fixture setup.

To Set up the Fixture Plates:

1. On the **View** Menu, click **Active Side**, and select the **Active Board Side** for which you want to configure the fixture.

    There are two fixture configuration tables, one for component-side fixtures and one for solder-side fixtures. If you are setting up the two fixtures of a tower tester, set up one set for the currently active side, then come back and set up the other side.

2. On the **Setup** Menu, click **Fixture-Fixture Table**.

3. On the **Fixture Setup** dialog, click the **Fixture Plates** tab.

4. Set the plate settings described below for each plate and space.

Fixture Plates Tab

Item Number

There are two Fixture Plates tables, one for each board side. Each Fixture Plates table has 49 items. The items are numbered sequentially from the top of the fixture.

To get the plate numbers referred to in the Plates Toolbar and elsewhere, plates are numbered sequentially beginning with the top plate. Spaces and unused items are not counted.

Note: *If you are using* **headless probes,** *begin the Fixture Plates table with the* **top plate.** *If you are using* **probes with heads,** *begin the table with a* **space above the top plate.** *This space represents the head lengths of your probes. Enter an S in the Type field for the space above the fixture and enter the head length in the Thickness field.*

Type

Each item can be a plate (P), a space (S), or an unused item (U). Enter an S or P for each sequential space and plate in your fixture and leave the remaining Type fields marked U, for unused.

Thickness

For each plate or space in your fixture enter a value for the plate thickness or space height in the Thickness field.

Drill Oversize

If you are going to have FixMaster automatically calculate drill sizes for probe drills by adding an oversize factor to the probe Shaft Diameter on the Probe Setup tab of the Probe Setup dialog, enter a value into the Drill Oversize field for each plate.

If you are going to manually assign drill sizes, or have FixMaster automatically assign hole sizes from the drill bit table, the Drill Oversize value on this table has no meaning.

For information on different ways to set the drill size for probe drills, see *Set up Drill Size for Probe Drills* on page 73.

Tooling

When the drill files are exported, you have the option to export tooling holes imported in the PCB data as drills in fixture plates. This feature is used to mount alignment pins on the fixture that match holes drilled into the PCB. Tooling holes must be properly set up in the D Code Probe Map and the Probe Table in order to be output correctly.

If you want to output tooling holes for a particular plate, enter a checkmark for the Tooling option, otherwise leave the Tooling field blank for that particular plate.

For complete information on setting up Tooling Holes, see *PCB Tooling Holes and Fixture Alignment Pins* on page 385.

Material

You can assign each plate a material with unique feed and spindle rates for different tool sizes. These rates will be output in the drill files. If you want to output feed and spindle rates for each plate, enter a material number (1-5) in the Material field and click the Materials Tab to set up the Material Table. See *Setting up Fixture Plate Materials* on page 55.

Breakout

FixMaster can check for breakouts between probe drills in each plate. If the edges of drills in a plate are closer than the Breakout Gap set on the Cross Check Options dialog, FixMaster will flag the breakout errors. For some plates, such as stiffener plates, you may not care about breakouts.

If you want to check a plate for breakouts, enter a **checkmark** in the Breakouts field for that plate and set the Breakout Gap by going to the **Setup** menu and clicking **Fixture-Cross Check**. Otherwise leave the Breakouts field for that plate blank.

For more information on setting the breakout gap, see *Fixture Plate Breakout Gap* on page 60. For information on checking a job for breakout errors, see *Check for Design Rule Errors* on page 195.

Base Plate Holes

The locations for base plate hole drills can be calculated in three ways:

- **On Grid:** Base plate holes can be drilled exactly at the grid point locations, in which case drill locations for the other plates are calculated as though the probe were going to end at the top of the base plate. This option is usually used if you are using a base plate that has been pre-drilled on the grid interval.

- **Off Grid:** Another way to calculate the position of the base plate holes is to consider the pins to hang down beyond the base plate to contact the grid. In this case, the length of the pin hang is used when calculating the drill locations for all plates, including the base plate, and the drill is placed where the pin would go through the center of the plate. The pin hang is the space below the bottom plate. To calculate the base plate hole positions using this method, select Off Grid for the Base Plate Holes option. Then enter an S in the Type field for the space below the fixture and enter the pin hang in the Thickness field.

- **New Off Grid:** Another way to calculate the position of the base plate holes is to consider the pins to stop at the bottom of the base plate and not to hang down below the plate. In this case, the length of the pin hang is not used when calculating the drill locations and the drill is placed where the pin would go through the center of the plate. To calculate the base plate hole positions using this method, select New Off Grid for the Base Plate Holes option.

Height

FixMaster calculates and displays the height of your fixture, including all plates and space in use, in the Height field.

Setting up Fixture Plate Materials

You can assign each plate a material with unique feed and spindle rates for different tool sizes. These rates will be output in the drill files. If you want to output feed and spindle rates for each plate, enter a material number (1-5) in the **Material** field of the **Fixture Plates** tab on the **Fixture Setup** dialog, and then set up the Material Table. For information on the Fixture Plates tab, see *Setting up the Fixture Plates* on page 52.

To Set up the Material Table:

1. On the **Setup** Menu, click **Fixture-Fixture Table**.
2. On the **Fixture Setup** dialog, click the **Material Table** tab.
3. Set the material settings described below for each material.

Fixture Setup Materials Tab

Material Number

The material number identifies the material that you are currently setting up on the Material Table. This is also the number used to identify the material used for each plate in the Fixture Plates Table. FixMaster allows you to configure as many as 5 materials per job. Change the material with which you are currently working by clicking the Next Material or Previous Material buttons.

Material Name

You may assign each material a unique name for your own use in the Material Name Field. The material name is not output in the drill files.

Minimum and Maximum Size Range

In the Minimum and Maximum fields, enter the minimum and maximum drill diameters which you want to assign to a particular feed and spindle rate for this material.

Feed Rate

In the Feed field, enter the feed rates assigned to the drill size range for this material.

For Excellon, the feed rate is in ipm

For Sieb & Meyer, the feed rate is in 0.1m/min.

Spindle Rate

In the Spindle field, enter the spindle rates assigned to the drill size range for this material.

Spindle speed is in 1000 rpm for both Excellon and Sieb & Meyer.

Setting up the Fixture Pin Loading Plate

FixMaster can automatically generate drill files for Fixture Pin Loading Plates when exporting the drill files for the fixture drills. The system generates one file for each probe used in the fixture, and extends the file name with the letter B followed by the probe number.

To Set up the Fixture Pin Loading Plate:

1. On the **Setup** Menu, click **Fixture-Fixture Table**.

2. On the **Fixture Setup** dialog, click the **Fixture Loading Plate** tab.

3. Set the Fixture Loading Plate settings described below.
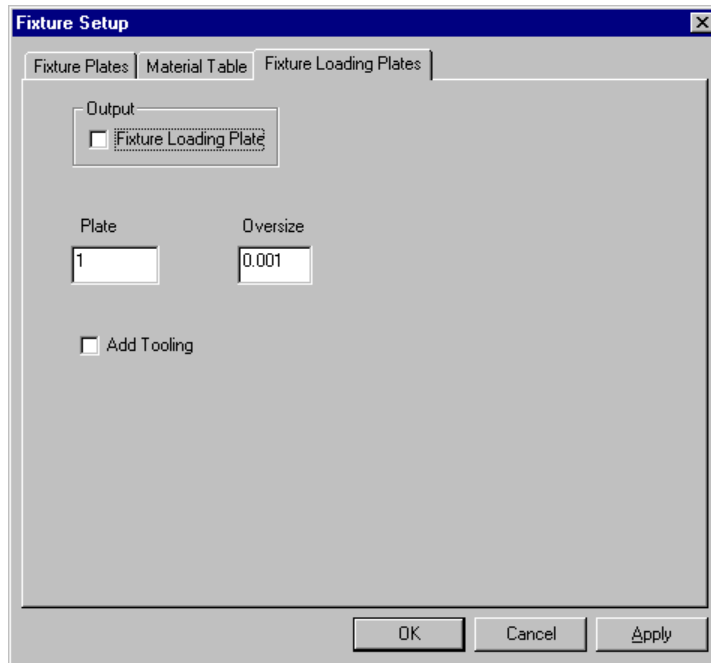
Fixture Loading Plates Tab

Output Fixture Loading Plates

To generate Fixture Pin Loading Plates when exporting the drill files, enter a checkmark for the Output Fixture Loading Plates option.

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Plate Number

Enter the Plate Number of the plate that you want to set up as the Fixture Loading Plate. The Plate Number corresponds to the Plate Number as it would appear on the on the Plates toolbar, not the Item Number on the Fixture Plates tab.

To get the plate numbers referred to in the Plates Toolbar and elsewhere, plates are numbered sequentially beginning with the top plate on the Plates tab. Spaces and unused items are not counted, only plates.

Drill Oversize

When automatically calculating drill sizes, FixMaster adds the Drill Oversize value to the probe shaft diameter.

Add Tooling

When the drill files are exported, you have the option to export tooling holes imported in the PCB data as drills in Fixture Loading plates. If you want to output tooling holes for the Fixture Loading plates, enter a checkmark for the Tooling option, otherwise leave the Tooling field blank. For more information on tooling holes in FixMaster, see *PCB Tooling Holes and Fixture Alignment Pins* on page 385.

Setting up the Fixture Design Rules

FixMaster allows you to set up certain design rules to use when the program calculates the position of the fixture probes. You can set a maximum allowable pin deflection for each side of the board and a minimum allowable breakout gap between probe holes in a plate.

To Set up the Fixture Design Rules:

1. On the **Setup** menu, click **Fixture-Cross Check**.

2. On the **Cross Check Options** dialog, set the following design rules settings:
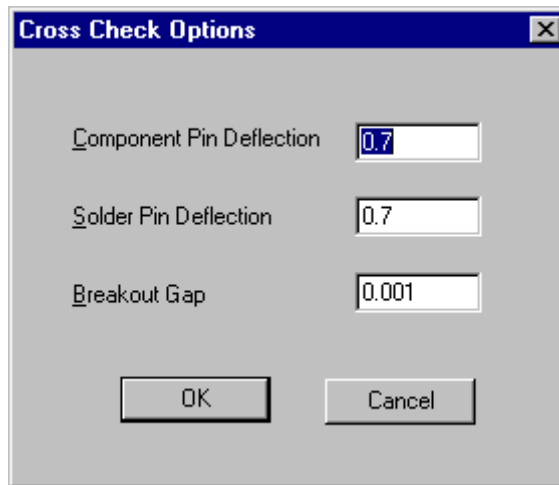
Cross Check Options

Fixture Pin Deflection

Set the maximum allowable pin deflection for both sides of the board, CMP and SOL. A typical maximum pin deflection is about 10% of the pin length.

In an operation called dropping pins, FixMaster calculates how to position probes in order to assign test points to fixture grid points. The program assigns test points to the closest available grid point, achieving the lowest possible pin deflection. As board density increases, FixMaster may have to increase the pin deflection to find grid points for all test points.

If the only available grid points for a particular test point exceed the maximum allowed pin deflection, FixMaster will not automatically assign that test point to the grid. You can correct this problem later with the error checking and error correction procedures. See *Check for Design Rule Errors* on page 195. The maximum allowable pin deflection is also used when you are setting up drill sizes manually. See *Set up Drill Size for Probe Drills* on page 73.

Fixture Plate Breakout Gap

Set the breakout gap distance allowed between neighboring drills.

When FixMaster assigns test points to grid points, the program determines the location and size of the probe drills. Breakouts can occur in fixture plates if the distance between two drills is too small. You can set the breakout gap distance allowed between two neighboring drills. Breakout errors occur when the distance between the edges of drills is smaller than the breakout gap distance you set. Breakout errors can be found and corrected using the error checking and correction procedures. For information on checking a job for breakout errors, see *Check for Design Rule Errors* on page 195.

For some plates, such as stiffener plates, you may not care about breakouts, so FixMaster gives you the option to check for breakouts on a plate-by-plate basis.

To Check a Plate for Breakouts:

1. Enter a **Breakout Gap** distance here.

2. Then go to the **Setup** menu and click **Fixture-Fixture Table**.

3. On the **Fixture Plates** tab, click the **Breakout** column so that each plate you want to check has a **checkmark**. Leave the Breakout field blank for plates that you do not want to check (such as stiffener plates).

Setting up the Fixture Grids

FixMaster allows you to set up tester grids for both sides of the board. The procedure for setting up the grid depends on the type of grid you want to set up:

- Single-Density Grid
- Dual-Density Grid
- Quad-Density Grid
- Dedicated Fixture
- TTI 1400TG Shared Grid

Note: Setting up the Fixture Grid does not affect the Screen Grid.

Single-Density Grids

Single-density grids have the same grid interval over the entire grid field, generally .100 inches.

To Set up a Single-Density Grid:

1.   On the **Setup** menu, click **Fixture-Grid**.
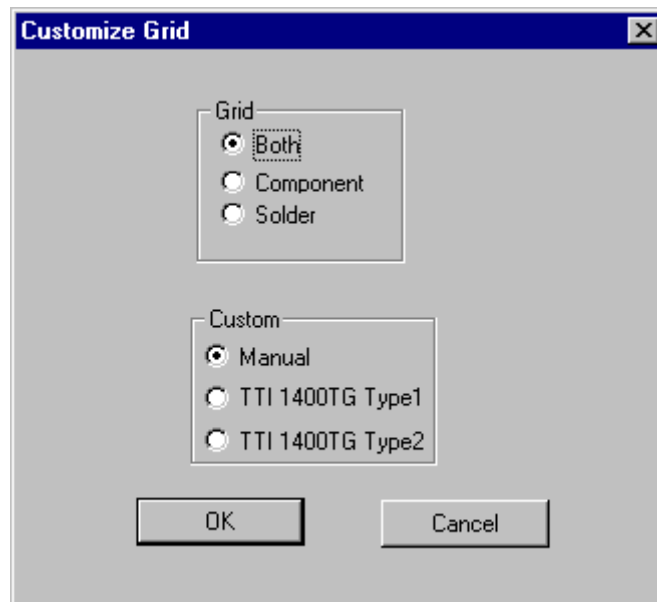
Customize Fixture Grid

2.   On the Customize Grid dialog, **select the side of the board** to be tested on this grid.

There are two sets of grids that you can set up. One is for testing the component side of the PCB and one for the solder side. You can set them up separately, or if they have the same parameters,

you can set them up simultaneously. Select **Component**, **Solder**, or **Both**. Later, when the data is written out, you map the component-side and solder-side to the top and bottom grids of the tester.

3. Select **Manual** and click **OK**.

	Start X	Start Y	End X	End Y	Grid X	Grid Y	On	
1	3.2000	0.0000	22.4000	13.9000	0.1000	0.1000	☒	
2	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
3	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
4	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
5	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
6	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
7	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
8	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
9	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
1|	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	

Build both grids

☑ Move PCB when dropping pin:

OK

Cancel
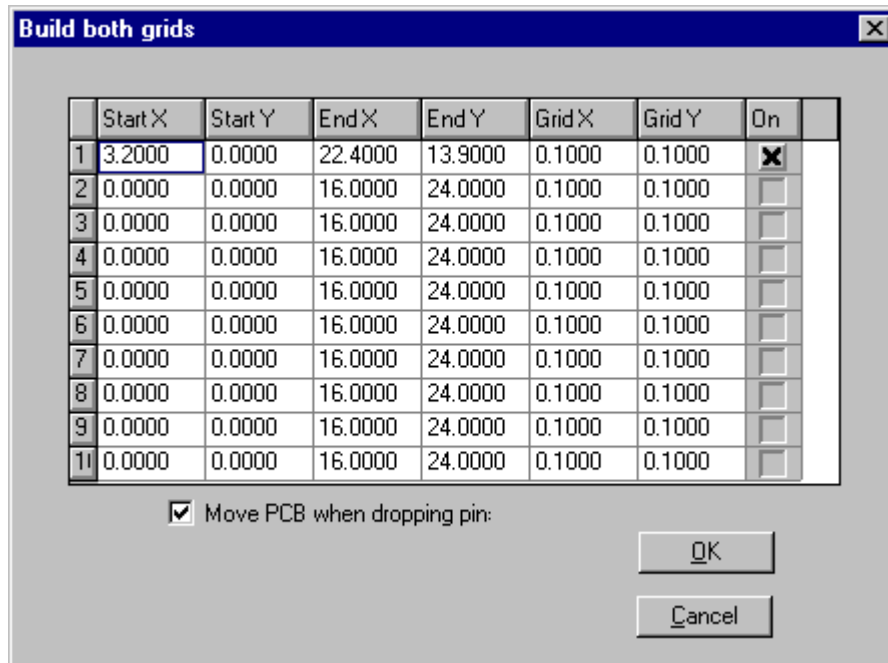
Change Grid Dialog

4. On the **Change Grid** dialog, set up the single-density grid field and intervals.

   FixMaster allows you to define up to 10 fixture grid fields and intervals for component-side and solder-side fixture grids. For a single-density grid you will only need to set up one grid field per side.

5. For a given Grid Field, enter the X and Y intervals between grid points in the **Grid X** and **Grid Y** fields.

6. Define the dimensions of the grid field by entering the grid starting coordinates relative to the absolute origin in the **Start X, Y** fields and the ending coordinates in the **End X, Y** fields.

   The grid size must be an exact multiple of the grid interval. Be sure to enter the Grid X and Y intervals first. Next enter the Start X, Y coordinates, and then the End X, Y coordinates. FixMaster will recalculate the grid ending coordinates to exactly match the grid interval.

7. Turn the grid field on by clicking in the **On** field so that there is a checkmark. For all the other grid fields that are not used for a single-density grid, click so that there is no checkmark.

8. If you want FixMaster to reposition the PCB when you drop pins, click in the **Move PCB When Dropping Pins** field so that there is a checkmark. Otherwise, click so that there is no checkmark.

   FixMaster can move the PCB when dropping pins so that the maximum number of through-hole test points are directly above a grid point. This way the most through-hole test points can be assigned to grid points with zero deflection.

   At most this operation will move the PCB by one grid interval, so you should still use one of the positioning routines to put the PCB approximately where you want it. If you position the PCB exactly where you want it, and do not want it to move by even one grid interval, do not use this option. For information on positioning the PCB data, see *Position the PCB* on page 119.

9. Click **OK**.

Dual-Density Grids

Dual-density grids are like two single-density grids, with the same X and Y intervals, offset from each other by half their X and Y intervals. This yields a grid with twice as many grid points as a single-density grid. The interval is the distance from one grid point to the next grid point directly on the X and Y axes. The closest grid point to any other grid point is on the diagonal.

For example, a typical dual-density grid would be set up as two single-density grids with .100-inch X and Y intervals. The second grid would be offset from the first by .050 inches in both the X and Y directions. Grid points would be separated by .070 inches on the diagonal.

Some testers do not have a dual-density grid over the entire grid field — they are single density for much of the field and have a smaller region of dual density.

To Set up a Dual-Density Grid:

1. On the **Setup** menu, click **Fixture-Grid**.

Customize Fixture Grid

2. On the Customize Grid dialog, select the **side of the board** to be tested on this grid.

   There are two sets of grids that you can set up. One is for testing the component side of the PCB and one for the solder side. You can set them up separately, or if they have the same parameters, you can set them up simultaneously. Select **Component**, **Solder**, or **Both**. Later, when the data is written out, you map the component-side and solder-side to the top and bottom grids of the tester.

3. Select **Manual** and click **OK**.

Build both grids

	Start X	Start Y	End X	End Y	Grid X	Grid Y	On
1	3.2000	0.0000	22.4000	13.9000	0.1000	0.1000	☒
2	3.2500	0.0500	22.3500	13.8500	0.1000	0.1000	☒
3	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐
4	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐
5	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐
6	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐
7	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐
8	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐
9	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐
1ı	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐

☑ Move PCB when dropping pin:

[OK]

[Cancel]

Change Grid Dialog

4. On the Change Grid dialog, set up the grid fields and intervals.

   FixMaster allows you to define up to 10 fixture grid fields and intervals for component-side and solder-side fixture grids. For a dual-density grid you will need to set up two grid fields.

5. For the first Grid Field, enter the X and Y intervals between grid points in the **Grid X** and **Grid Y** fields.

6. Define the dimensions of the grid field by entering the grid starting coordinates relative to the absolute origin in the **Start X, Y** fields and the ending coordinates in the **End X, Y** fields.

   The grid size must be an exact multiple of the grid interval. Be sure to enter the Grid X and Y intervals first. Next enter the Start X, Y coordinates, and then the End X, Y coordinates. FixMaster will recalculate the grid ending coordinates to exactly match the grid interval.

7. Turn the grid field on by clicking in the **On** field so that there is a checkmark.

8. For the next grid field in the same board-side table, enter the **Grid X, Y** intervals for the dual-density portion of grid. This interval will be the same as the previous grid's interval.

9. Enter the **Start X, Y** coordinates and the **End X, Y** coordinates for the dual-density portion of grid.

    - If the entire grid field is dual density, the starting and ending coordinates will be offset from the first grid by half the grid interval.

    - If only part of the grid field is dual density, the starting and ending coordinates will be offset from the first grid by the larger offset for the dual-density region plus half the grid interval.

    - The grid size must be an exact multiple of the grid interval.

10. Turn the second grid field on by clicking in the **On** field so that there is a checkmark. For all the other grid fields that are not used for a dual-density grid, click so that there is no checkmark.

11. If you want FixMaster to reposition the PCB when you drop pins, click in the **Move PCB When Dropping Pins** field so that there is a checkmark. Otherwise, click so that there is no checkmark.

    FixMaster can move the PCB when dropping pins so that the maximum number of through-hole test points are directly above a grid point. This way the most through-hole test points can be assigned to grid points with zero deflection.

    At most this operation will move the PCB by one grid interval, so you should still use one of the positioning routines to put the PCB approximately where you want it. If you position the PCB exactly where you want it, and do not want it to move by even one grid interval, do not use this option. For information on positioning the PCB data, see *Position the PCB* on page 119.

12. Click **OK**.
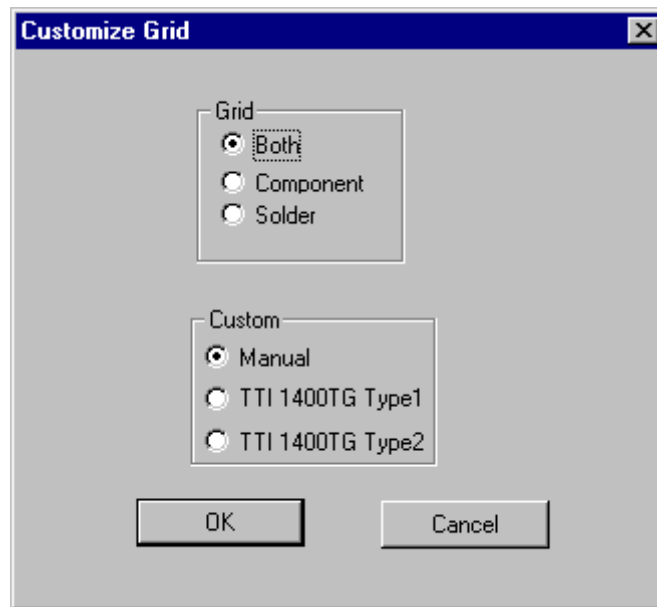
Quad-Density Grids

Quad-density grids have an interval that is half the interval of a single-density grid, in both the X and Y directions, generally .050 inches. This yields a grid with four times the grid points of a single-density grid.

To set up a quad-density grid over the entire field, set it up as one single-density grid with the tighter X and Y intervals.

Some testers do not have a quad-density grid over the entire grid field. They are single density for much of the field and have a smaller region of quad density.
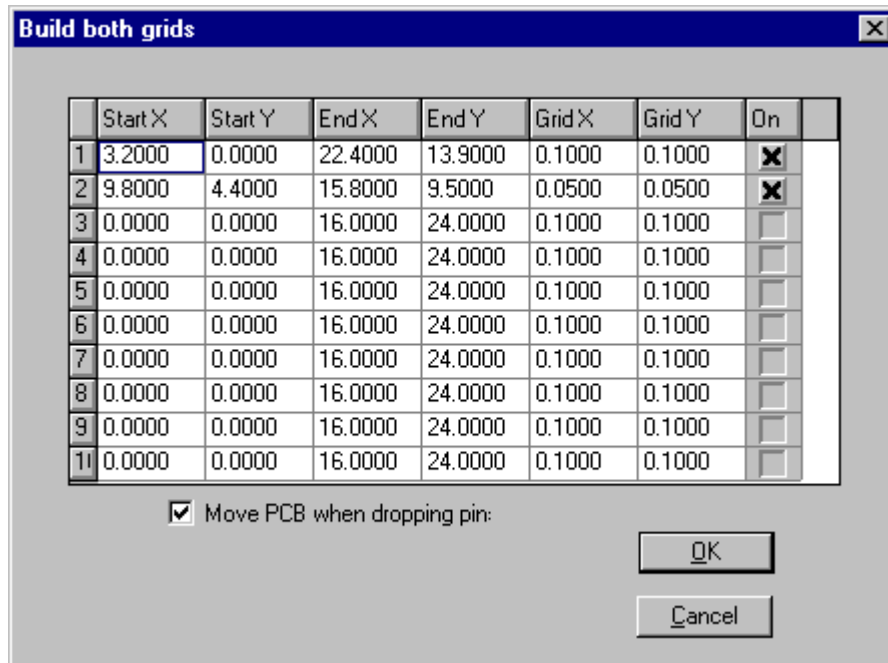
To Set up a Quad-Density Grid over a Portion of the Grid Field:

1. On the **Setup** menu, click **Fixture-Grid**.

Customize Fixture Grid

2. On the Customize Grid dialog, select the **side of the board** to be tested on this grid.

    There are two sets of grids that you can set up. One is for testing the component side of the PCB and one for the solder side. You can set them up separately, or if they have the same parameters, you can set them up simultaneously. Select **Component**, **Solder**, or **Both**. Later, when the data is written out, you map the component-side and solder-side to the top and bottom grids of the tester.

3. Select **Manual** and click **OK**.

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		Start X	Start Y	End X	End Y	Grid X	Grid Y	On	
	1	3.2000	0.0000	22.4000	13.9000	0.1000	0.1000	☒	
	2	9.8000	4.4000	15.8000	9.5000	0.0500	0.0500	☒	
	3	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
	4	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
	5	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
	6	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
	7	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
	8	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
	9	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
	11	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	

Build both grids

☑ Move PCB when dropping pin:

[OK] [Cancel]

Change Grid Dialog

4. On the Change Grid dialog, set up the grid fields and intervals.

    FixMaster allows you to define up to 10 fixture grid fields and intervals for component-side and solder-side fixture grids. For a quad-density grid you will need to set up two grid fields, the larger single-density field and the smaller quad density portion.

5. In the first Grid Field, enter the **Grid X** and **Grid Y** intervals between grid points for the larger single-density grid field.

6. Define the dimensions of the larger single-density grid field by entering the grid starting coordinates relative to the absolute origin in the **Start X, Y** fields and the ending coordinates in the **End X, Y** fields.

    The grid size must be an exact multiple of the grid interval. Be sure to enter the Grid X and Y intervals first. Next enter the Start X, Y coordinates, and then the End X, Y coordinates. FixMaster will recalculate the grid ending coordinates to exactly match the grid interval.

7. Turn the larger single-density grid field on by clicking in the **On** field so that there is a checkmark.

8. For the next grid field in the same board-side table, enter the **Grid X, Y** intervals for the quad-density portion of grid. This interval will be half the larger single-density grid's interval in each direction.

9. Enter the **Start X, Y** coordinates and the **End X, Y** coordinates for the quad-density portion of grid. Both the starting and ending coordinates need to be exact multiples of the grid interval so that the quad-density portion will overlay the larger single-density portion

10. Turn the quad-density grid field on by clicking in the **On** field so that there is a checkmark. For all the other grid fields that are not used for a quad-density grid, click so that there is no checkmark.

    The second grid will overlay the first. Grid points from the two grids that have exactly the same coordinates are treated as one grid point, so that FixMaster sees a field of grid points at single density with a portion at quad density.

11. If you want FixMaster to reposition the PCB when you drop pins, click in the **Move PCB When Dropping Pins** field so that there is a checkmark. Otherwise, click so that there is no checkmark.

    FixMaster can move the PCB when dropping pins so that the maximum number of through-hole test points are directly above a grid point. This way the most through-hole test points can be assigned to grid points with zero deflection.

    At most this operation will move the PCB by one grid interval, so you should still use one of the positioning routines to put the PCB approximately where you want it. If you position the PCB exactly where you want it, and do not want it to move by even one grid interval, do not use this option. For information on positioning the PCB data, see *Position the PCB* on page 119.

12. Click **OK**.

Dedicated Fixtures

Dedicated fixtures are fixtures that sit on top of a grid of one interval and translate it into a grid of a smaller interval. This creates a denser fixture grid and allows for testing denser parts.

The test fixture sits on top of the dedicated fixture and needs to be designed for the smaller grid interval. The tester download files need to be generated for the larger grid interval. If you use dedicated fixtures, call Lavenir Technical Support at (925) 680-7400 between the hours of 8 AM and 5 PM, Pacific Standard Time, for a case-by-case analysis of your requirements.

TTI 1400TG Shared Grid

The TTI Model 1400TG Tester has a shared grid that is supported by FixMaster.

The two options, TTI 1400TG Type 1 and Type 2, are for this tester's shared grid.

For these testers set the component side Start X and the Start Y values at (0,0), and set up the size of the grid field and the intervals as you would for a single density grid. The solder side grid will automatically be offset (.8, .8) from the component side grid.

Setting up the Probes

Using the Probe Setup dialog, you define the parameters for the probes that will be used to test pads on the currently active side of the board. This table is also used to set up tooling holes read in from the PCB data.
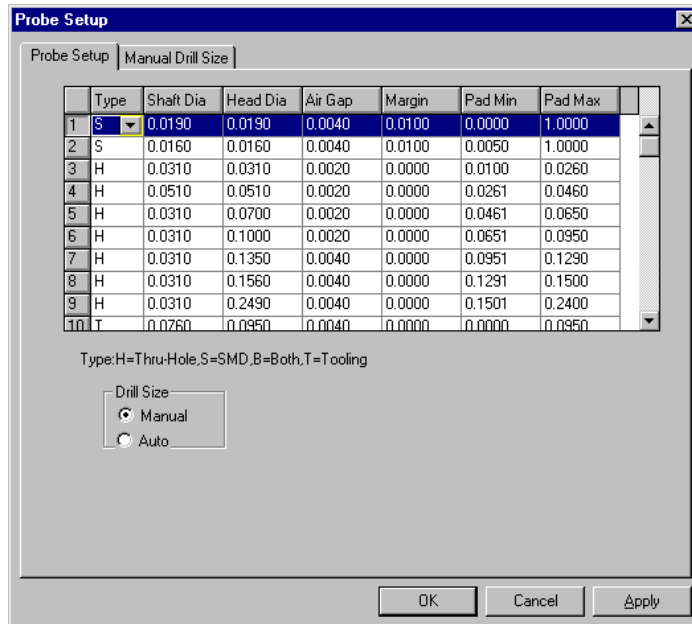
Shaft and head diameters, air gaps, and stagger margins are used when running fixture-design rule checks, staggering test points, and calculating drill sizes. These parameters must be defined before staggering test points or dropping pins.

To Set up the Probes:

1. On the **View** Menu, click **Active Side**, and select the **Active Board Side** for which you want to set up probes.

   There are two Probe Setup tables, one for component-side fixtures and one for solder-side fixtures. If you are setting up probes for the two fixtures of a tower tester, set up one set for the currently active side, then come back and set up the other side.

2. On the **Setup** Menu, click **Fixture-Probe**.

3. On the **Probe Setup** tab of **Probe Setup** dialog, set the following settings.

	Type	Shaft Dia	Head Dia	Air Gap	Margin	Pad Min	Pad Max
1	S	0.0190	0.0190	0.0040	0.0100	0.0000	1.0000
2	S	0.0160	0.0160	0.0040	0.0100	0.0050	1.0000
3	H	0.0310	0.0310	0.0020	0.0000	0.0100	0.0260
4	H	0.0510	0.0510	0.0020	0.0000	0.0261	0.0460
5	H	0.0310	0.0700	0.0020	0.0000	0.0461	0.0650
6	H	0.0310	0.1000	0.0020	0.0000	0.0651	0.0950
7	H	0.0310	0.1350	0.0040	0.0000	0.0951	0.1290
8	H	0.0310	0.1560	0.0040	0.0000	0.1291	0.1500
9	H	0.0310	0.2490	0.0040	0.0000	0.1501	0.2400
10	T	0.0760	0.0950	0.0040	0.0000	0.0000	0.0950

Type:H=Thru-Hole,S=SMD,B=Both,T=Tooling

Drill Size
- Manual
- Auto

Probe Setup Tab

Probe Types

Each probe you set up may be appropriate to probe one kind of pad, but not another. Each D Code to be tested will be mapped to a Probe Code, meaning that a probe having that Probe Code will be used to test pads of that D Code.

FixMaster can map the PCB D Codes to the Probe Codes in this table automatically or you can map them manually. For information on mapping D Codes to Probes, see *Map D Codes to Probe Codes* on page 129.

If you are going to have FixMaster **automatically** map D Codes to Probe Codes, you must set up the probe Types and Pad Min and Max size ranges. These settings are not important if you are **manually** mapping D Codes to Probe Codes.

When FixMaster is mapping D Codes to Probe Codes automatically, the program takes each D Code and looks for Probe Codes of the correct Type and then checks whether the Pad Min and Max size range matches the D Code size. The first Probe Code in the list that matches the Type and Pad Min and Max size criteria is mapped to the D Code.

- For probes for **through-hole drills**, enter **H**.

- For probes for **surface-mount pads (SMD)**, enter **S**.

- For probes for **both** through-hole drills and surface-mount pads, enter **B**.

- For **Tooling Holes**, enter **T**.

> *Note:* *In addition to setting up Probes, the **Probe Setup** tab of the **Probe Setup** dialog is also used to set up diameters for Tooling Holes read in from the PCB data. For a complete discussion of tooling holes, see **PCB Tooling Holes and Fixture Alignment Pins** on page 385.*
> *For Tooling Holes, enter T in the Type field. A type-T probe isn't actually a probe. FixMaster uses the diameter of the type-T probe as the Tooling Hole size. This will be the size of the Tool Code in the drill output files.*
> *Enter the size you want the tooling hole to be drilled to in the Shaft Dia field. The Drill Oversize parameter on the Fixture Plates tab of the Fixture Setup dialog is not added to this size.*

Shaft Diameter

Enter the shaft diameter of each probe in the **Shaft Dia** field. The Shaft Diameter of the probe is used to check for Pin Crossing and for automatically calculating probe drill sizes.

There are several ways to calculate the sizes of the probe drills and these are all explained in *Set up Drill Size for Probe Drills* on page 73. When you select the option to have FixMaster automatically calculates drill sizes for probes the program uses this Shaft Diameter. The Shaft Diameter and the Drill Oversize parameter on the Fixture Plates tab of the Fixture Setup dialog are both used when calculating the tool size needed to drill these holes.

Head Diameter

Enter the head diameter of each probe in the **Head Dia** field. The Head Diameter of the probe is used for Head Butt error checking. If the probe is headless, make the head diameter equal to its shaft diameter. For information on Head Butt errors, see *Check for Design Rule Errors* on page 195.

Air Gap

Enter an air gap for each probe in the **Air Gap** field. The Shaft Diameter and Head Diameter of each probe is swelled by its Air Gap when checking for Crossed Pins and Head Butts. For information on Crossed Pins and Head Butt errors, see *Check for Design Rule Errors* on page 195.

Margin

Enter a stagger margin for each probe in the **Margin** field. The Margin is used when staggering test points. For surface-mount pads, the margin is how much to set back the test point from the pad edge. For through-hole pads, the margin is either the amount to stagger the test point inward from the hole edge or the amount to stagger the test point outward from the hole center point. You can also enter a negative margin and stagger the test point outward from the hole edge to probe the covering pad. The option to measure from the edge or from the center point is set on **Setup-Test Point-Stagger**, along with the option to stagger the test point toward the top, bottom, right or left of the pad. For more information about staggering test points, see *Stagger Test Points* on page 165.

Pad Min and Max

If you are going to have FixMaster **automatically** map D Codes to Probe Codes, you must set up the probe Types and Pad Min and Max size ranges. These settings are not important if you are **manually** mapping D Codes to Probe Codes. For information on mapping D Codes to Probes, see *Map D Codes to Probe Codes* on page 129.

Enter the smallest pad size that can be probed by each probe in the **Pad Min** field, and the largest in **Pad Max**.

Set up Drill Size for Probe Drills

One of the most important fixture-design features of FixMaster is its ability to generate drill files for making the fixture plates. When test points are assigned to grid points, the program automatically determines the locations of the drills needed in each plate to accommodate the probes. FixMaster gives you several options for determining the drill sizes for each probe drill:

- **Drill Bit Table:** Automatically pick the best hole size from a Drill Bit table based on a formula for pin deflection. ***This is the recommended procedure.*** See *Automatically Pick Best Fit to Drill Bit Table* on page 74.

- **Manual Setup:** Manually set up a plate-by-plate, probe-by-probe hole size table for a range of pin deflections. ***This is an accurate, but time-consuming, method.*** See *Manually Set Up Probe Hole Size Table* on page 78.

- **Plate-by-Plate Oversize Factor:** Automatically calculate hole size based on probe diameter plus plate-by-plate oversize factor. ***This is convenient and quick, but not as accurate as the other methods.*** See *Automatically Calculate Hole Size Based on Plate Oversize* on page 81.

Automatically Pick Best Fit to Drill Bit Table

FixMaster can automatically pick the best probe hole size from a Drill Bit table based on a formula for pin deflection. To do this, FixMaster calculates the exact hole size needed to accommodate a probe of the given diameter in a plate of the given thickness at a deflection of the given range. Then it adds a Drill Oversize factor, if you specify. Then it searches the Drill Bit Table for the smallest drill bit that is large enough to accommodate the hole.

To Automatically Pick Best Fit to Drill Bit Table:

1. If you want FixMaster to automatically pick the best probe hole size from a Drill Bit table based on a formula for pin deflection, then you must first **set up the Drill Bit table**.

2. If you are in the **Probe Setup** dialog, click **OK** to exit the dialog for now.

3. On the **Setup** menu, click **Fixture-Drill Bit Table**.
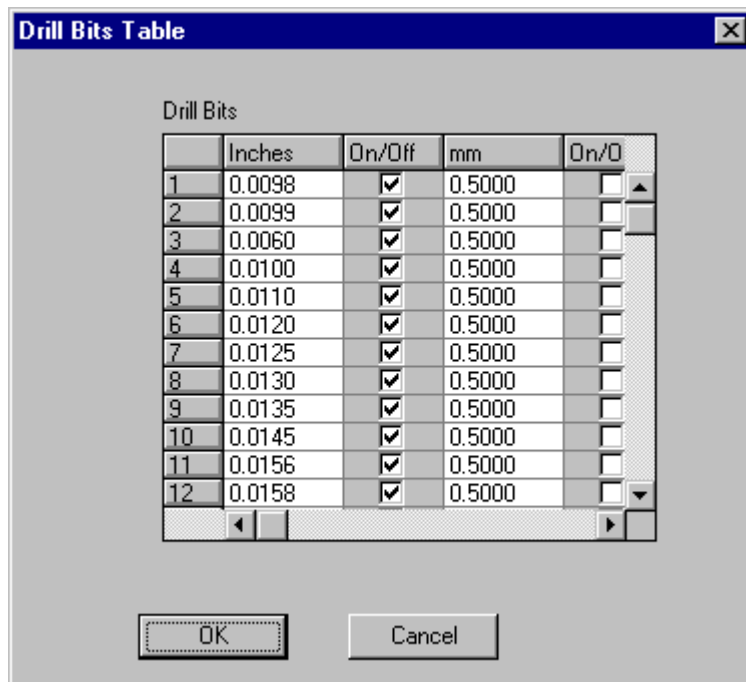
Drill Bit Table

4. On the **Drill Bit** table, enter **Drill Bit Sizes** that you want to have available for drilling probe holes in fixture plates.

5. Click the **On/Off** check boxes so that the sizes you want to use for a given job are on and the others are off. A checkmark indicates that a given drill bit is available. No checkmark means a given drill bit will not be used.

6. Click **Ok**.

7. On the **Setup** Menu, click **Fixture-Probe**.

8. On the **Probe Setup** tab of the **Probe Setup** dialog, click the **Manual Drill Size** option.

	Type	Shaft Dia	Head Dia	Air Gap	Margin	Pad Min	Pad Max	
1	S	0.0190	0.0190	0.0040	0.0100	0.0000	1.0000	
2	S	0.0160	0.0160	0.0040	0.0100	0.0050	1.0000	
3	H	0.0310	0.0310	0.0020	0.0000	0.0100	0.0260	
4	H	0.0510	0.0510	0.0020	0.0000	0.0261	0.0460	
5	H	0.0310	0.0700	0.0020	0.0000	0.0461	0.0650	
6	H	0.0310	0.1000	0.0020	0.0000	0.0651	0.0950	
7	H	0.0310	0.1350	0.0040	0.0000	0.0951	0.1290	
8	H	0.0310	0.1560	0.0040	0.0000	0.1291	0.1500	
9	H	0.0310	0.2490	0.0040	0.0000	0.1501	0.2400	
10	T	0.0760	0.0950	0.0040	0.0000	0.0000	0.0950	

Type:H=Thru-Hole,S=SMD,B=Both,T=Tooling

Drill Size
⊙ Manual
○ Auto

Probe Setup Tab

9. Click on the **Manual Drill Size** tab of the **Probe Setup** dialog.

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Manual Drill Size Tab

The numbers in the plate column represent the plates of the fixture, which you set up on the Fixture Plates tab of the Fixture Setup dialog. Plates are numbered sequentially beginning with the top plate. For more information on the Fixture Plates tab, see *Setting up the Fixture Plates* on page 52.

The percentages in the top row correspond to a percentage of the Maximum Pin Deflection, which you set on the Cross Check Options dialog. See *Fixture Pin Deflection* on page 59.

The numbers in the body of the table are the hole sizes for the selected probe in each plate at each deflection range.

10. On the **Manual Drill Size** tab, select the **Probe Number** you want to set up.

The Probe Number is the Probe Code with which you are currently working. You can select a different Probe Code by clicking the Next Probe or Previous Probe buttons.

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11. On the **Manual Drill Size** tab, you may set a **Probe Name** for the probe you are working with.

    You may assign each probe a unique name for your own reference or accept the default name. The probe name does not affect the output files, but if you would like to use probe names for your own reference, enter them in the Probe Name field.

12. On the **Manual Drill Size** tab, you may set a **Drill Oversize**.

    If you want FixMaster to enlarge the hole size that it calculates for the probe, enter a value for the **Drill Oversize**.

    The other two options for calculating probe holes sizes do not use this Drill Oversize value.

    - If you are going to manually assign drill sizes, the Drill Oversize value has no meaning. See *Manually Set Up Probe Hole Size Table* on page 78.

    - If you are going to have FixMaster automatically calculate drill sizes for probe drills by adding an oversize factor to the probe Shaft Diameter on the Probe Setup dialog, then do not use this Drill Oversize setting. Instead, set up the Drill Oversize field for each plate on the Fixture Plates table. For information on the Fixture Plates table, see *Setting up the Fixture Plates* on page 52. For information on automatically calculating drill sizes for probe drills, see *Automatically Calculate Hole Size Based on Plate Oversize* on page 81.

13. On the **Drill Size Based on Pin Deflection Table**, select a range of plates and pin deflections for which you want to have FixMaster calculate hole sizes. *Typically you would drag the cursor to select all the plates in the fixture at all the deflection ranges.*

14. Click on **Find Drill Size**.

    FixMaster calculates the exact hole size needed to accommodate a probe of the given diameter in a plate of the given thickness at a deflection of the given range. Then it adds the Drill Oversize, if any. Then it searches the Drill Bit Table for smallest drill bit that is large enough to accommodate the hole.

15. On the **Manual Drill Size** tab, select the next **Probe Number** you want to set up and repeat the process.

16. When you are done setting up drill sizes for Probes, click **Ok**.

Manually Set Up Probe Hole Size Table

You can manually set up the drill sizes for probe drills.

To Manually Set Up Probe Hole Size Table:

1. On the **Setup** Menu, click **Fixture-Probe**.

Probe Setup

Probe Setup | Manual Drill Size

	Type	Shaft Dia	Head Dia	Air Gap	Margin	Pad Min	Pad Max
1	S	0.0190	0.0190	0.0040	0.0100	0.0000	1.0000
2	S	0.0160	0.0160	0.0040	0.0100	0.0050	1.0000
3	H	0.0310	0.0310	0.0020	0.0000	0.0100	0.0260
4	H	0.0510	0.0510	0.0020	0.0000	0.0261	0.0460
5	H	0.0310	0.0700	0.0020	0.0000	0.0461	0.0650
6	H	0.0310	0.1000	0.0020	0.0000	0.0651	0.0950
7	H	0.0310	0.1350	0.0040	0.0000	0.0951	0.1290
8	H	0.0310	0.1560	0.0040	0.0000	0.1291	0.1500
9	H	0.0310	0.2490	0.0040	0.0000	0.1501	0.2400
10	T	0.0760	0.0950	0.0040	0.0000	0.0000	0.0950

Type:H=Thru-Hole,S=SMD,B=Both,T=Tooling

Drill Size
- ● Manual
- ○ Auto

[OK] [Cancel] [Apply]

Probe Setup Tab

2. On the **Probe Setup** tab of **Probe Setup** dialog, click the **Manual Drill Size** option.
3. Click on the **Manual Drill Size** tab.
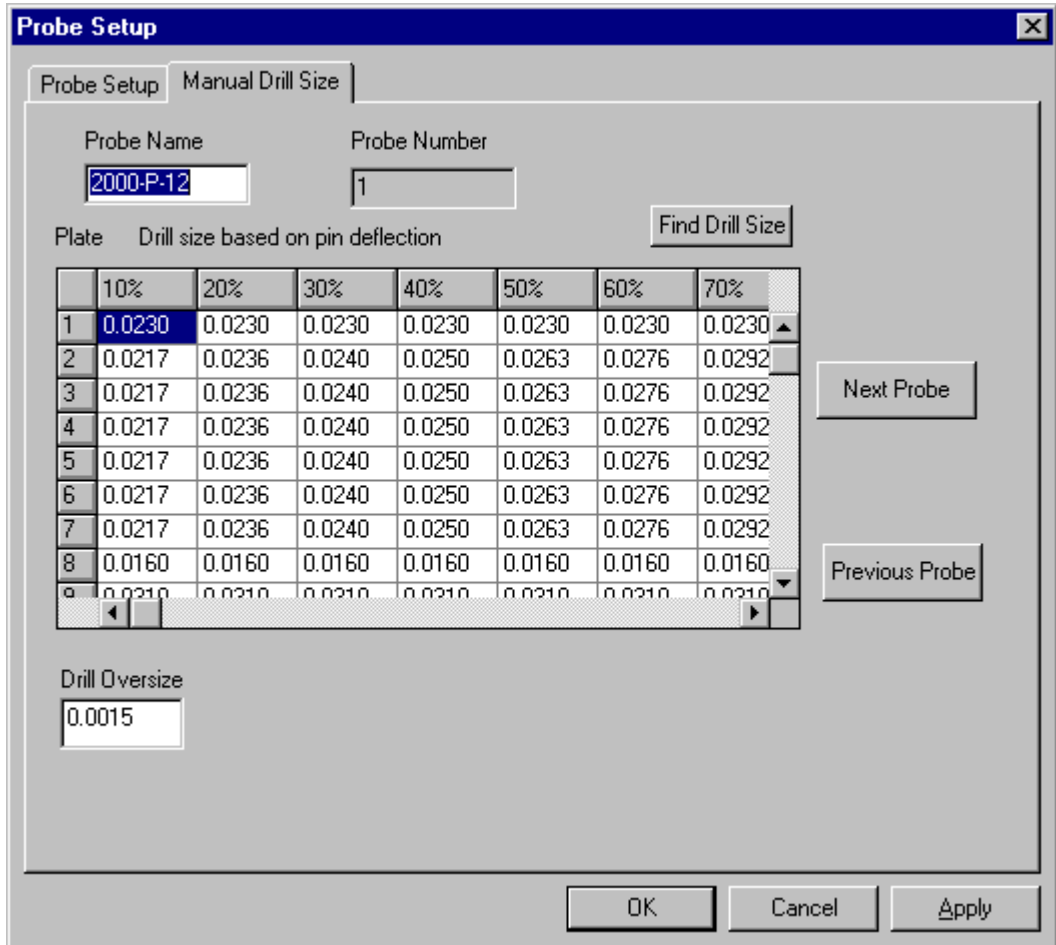
Manual Drill Size Tab

4. On the **Manual Drill Size** tab, select the **Probe Number** you want to set up.

   The Probe Number is the Probe Code with which you are currently working. You can set parameters for a different Probe Code by clicking the **Next Probe** or **Previous Probe** buttons.

5. On the **Manual Drill Size** tab, you may set a **Probe Name** for the probe you are working with.

   You may assign each probe a unique name for your own reference or accept the default name. The probe name does not affect the output files, but if you would like to use probe names for your own reference, enter them in the Probe Name field.

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6. On the **Drill Size Based on Pin Deflection Table**, enter the drill sizes to be used for the current probe for each deflection range in each plate.

    The numbers in the plate column represent the plates of the fixture, which you set up on the Fixture Plates tab of the Fixture Setup dialog. Plates are numbered sequentially beginning with the top plate. For more information on the Fixture Plates tab, see *Setting up the Fixture Plates* on page 52.

    The percentages in the top row correspond to a percentage of the Maximum Pin Deflection, which you will set on the Cross Check Options dialog. See *Fixture Pin Deflection* on page 59.

7. *Do not* set the **Drill Oversize**.

8. *Do not* click on **Find Drill Size**.

9. On the **Manual Drill Size** tab, select the next **Probe Number** you want to set up and repeat the process.

10. When you are done setting up drill sizes for Probes, click **Ok**.

Automatically Calculate Hole Size Based on Plate Oversize

To Automatically Calculate Hole Size Based on Plate Oversize:

If you are going to have FixMaster automatically calculate the hole size by adding the Drill Oversize factor for each plate to the Shaft Diameter of each probe, then you will have already set up the Drill Oversize factor for each plate on the Fixture Plates dialog. See *Setting up the Fixture Plates* on page 52. And you will have set up the Shaft Diameter for each probe on the Probe Setup tab of the Probe Setup dialog. See *Setting up the Probes* on page 70.

1. On the **Setup** Menu, click **Fixture-Probe**.

	Type	Shaft Dia	Head Dia	Air Gap	Margin	Pad Min	Pad Max	
1	S	0.0190	0.0190	0.0040	0.0100	0.0000	1.0000	
2	S	0.0160	0.0160	0.0040	0.0100	0.0050	1.0000	
3	H	0.0310	0.0310	0.0020	0.0000	0.0100	0.0260	
4	H	0.0510	0.0510	0.0020	0.0000	0.0261	0.0460	
5	H	0.0310	0.0700	0.0020	0.0000	0.0461	0.0650	
6	H	0.0310	0.1000	0.0020	0.0000	0.0651	0.0950	
7	H	0.0310	0.1350	0.0040	0.0000	0.0951	0.1290	
8	H	0.0310	0.1560	0.0040	0.0000	0.1291	0.1500	
9	H	0.0310	0.2490	0.0040	0.0000	0.1501	0.2400	
10	T	0.0760	0.0950	0.0040	0.0000	0.0000	0.0950	

Type:H=Thru-Hole,S=SMD,B=Both,T=Tooling

Drill Size
- Manual
- Auto

OK   Cancel   Apply

Probe Setup Tab, with Auto Drill Size Option

2. On the **Probe Setup** tab of **Probe Setup** dialog, click on the **Auto Drill Size** option.

3. You do not need to set up anything on the **Manual Drill Size** tab of the **Probe Setup** dialog.

4. Click **Ok**.

Chapter 6
Set Up the Fixture Outside Tooling

FixMaster has features to help you set up the fixture outside tooling. You can import drill files, set up Tool Codes, and edit drills in fixture plates.

Tool Codes

Each drill in the fixture is identified by its Tool Code. Tool Codes for fixture outside tooling are set up in the Fixture Tool Table.

Setting up the Tool Codes for Outside Tooling

Set up the Tool Codes for outside tooling on the Fixture Tool Table.

To Set up the Tool Codes for Outside Tooling:

1. On the **Setup** menu, click **Fixture-Tool Table**.
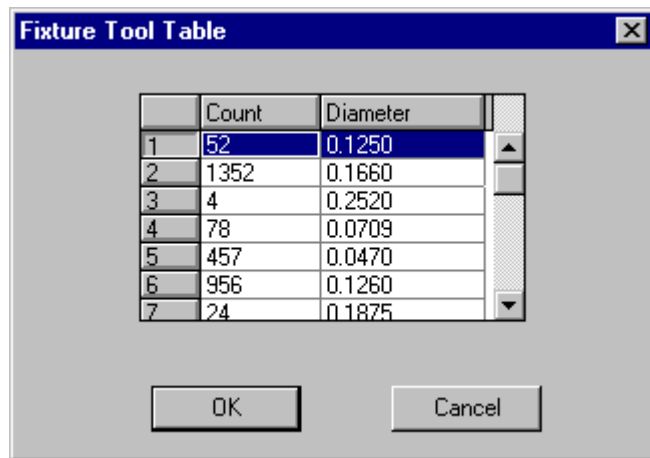
Fixture Tool Table

2. On the Fixture Tool Table, for each Tool Code you intend to use, enter a diameter.

Menu: Setup-Fixture-Tool Table

Button: None

Key: None

The Fixture Tool Table displays the following information.

Tool Code

The number at the left of the table is the Tool Code used to identify the particular tool.

Counts of Tool Codes

The Counts column of the Fixture Tool Table indicates how many times the Tool Code is used for outside tooling in the fixture drills of the current .JOB file.

Tool Diameters

The diameter column of the Fixture Tool Table indicates the diameter of the hole drilled by the given Tool Code.

Diameters are in inches or millimeters as indicated in the Units control on the Status Bar

If you change the diameter of a Tool Code that has been used already, FixMaster displays drills of that Tool Code at the new size.

Tool Codes for Probe Drills

When you assign test points to grid points, FixMaster calculates the sizes and locations of the drills needed to accommodate the probes in the fixture, but FixMaster does not map Tool Codes to the probe drills until drill data is exported. When the drill files are exported, FixMaster assigns drills to existing Tool Codes of the correct size. If there are no existing Tool Codes of the correct size, FixMaster assigns drills to unused Tool Codes and makes them the correct size. This procedure is used regardless of whether the drill sizes are calculated automatically or are entered manually.

Current Tool Code

Many commands, such as Insert Drill, refer to the Current Tool Code.

The Current Tool Code and its diameter are displayed in the Status Bar at the bottom of the FixMaster application window.

You can set the Current Tool Code in several ways:

To Set the Current Tool Code on the Fixture Tool Table:

1. On the **Setup** menu, click **Fixture-Tool Table**.
2. On the Fixture Tool Table, click on the **Tool Code** you want.
3. Click **OK**.

Menu: *Setup-Fixture-Tool Table*

Button: *None*

Key: *None*

To Set the Current Tool Code from the Command Menus:

1. On the **Edit** menu, click **Fixture-Drill-Change Tool**.
2. Enter the **Tool Code** you want.
3. Click **OK**.

Menu: *Edit-Fixture-Drill-Change Tool*

Button: *None*

Key: *None*

Plate Toolbar

Only Active, Visible Plates are available for drill editing.

The Plate Toolbar indicates which plates are visible and which are active for drill editing.
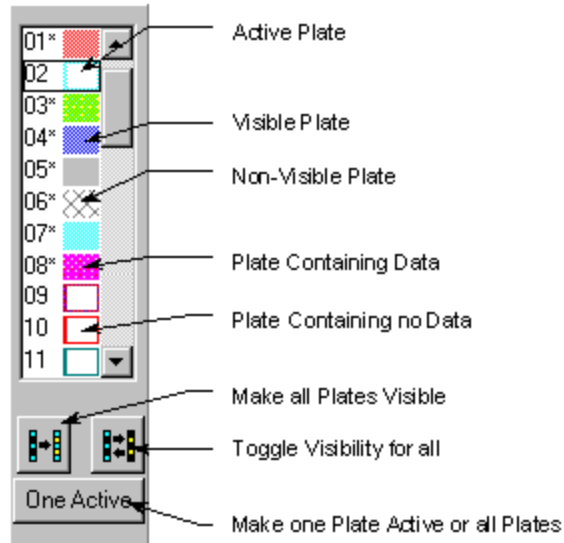
Plate Toolbar

Plate Numbers

The Plate Toolbar has a row of plate numbers that indicate which plates are active and visible for editing. Plates are numbered starting from the top of the fixture.

Plate 0

Plate 0 is a special global plate. Drills that go through all the fixture plates at the same size and location should be put in Plate 0.

Plates 1-39

These are the individual fixture plates numbered starting from the top of the fixture. You can edit drills in individual plates. Some fixture types require certain holes, such as alignment holes, to be on only specific plates, and this option allows you to accomplish this.

Active Plate

You can set a single active plate or have multiple active plates.

Single Active Plate

The plate number of the single active plate is outlined with a black rectangle.

To Make a Single Plate Active:

1. Click the button at the bottom of the Plate Toolbar so that it says **One Active**.
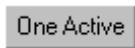
One Active

One Active Plate

2. Click on the **Plate Number** in the Plate Toolbar.

Menu: *None*

Button: One Active

Key: *None*

Multiple Active Plates

If the button at the bottom of the Plate Toolbar says All Active, then all visible plates are active and available for drill editing.

Note: *When the Insert Drill command is activated with all visible plates active, drills are only inserted into plates that already have drills.*

To Make Multiple Plates Active:

1. Click the button at the bottom of the Plate Toolbar to so that it says **All Active**.

All Active
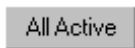
All Visible Plates Active

2. **Double-click** on the **Plate Numbers** in the Plate Toolbar so that only the plates you want to be active are visible.

Menu: *None*

Button: All Active

Key: *None*

Plate Visibility

Only visible plates may be edited. Next to each Plate Number in the Plate Toolbar is a colored rectangle which indicates if the plate is visible.

Visible Plates

If the rectangle is shown in solid color, the plate is visible, and drills in that plate are shown in that plate color on screen.

Plates Not Visible

If the rectangle is shown in a crosshatched pattern, the plate is not visible, and drills in that plate are not shown on screen.

Change Plate Visibility

To Change the Visibility of a Single Plate:

➢ **Double-click** on that **plate** in the Plate Toolbar.

To Toggle the Visibility of All Plates:

➢ Click the **Toggle Visibility** button.

Menu:	*None*
Button:	
Key:	*None*

To Make All Plates Visible:

➢ Click on the **Make All Visible** button.

Menu:	*None*
Button:	
Key:	*None*

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Plate Color

The color of the rectangle next to the Plate Number in the Plate Toolbar indicates the color in which FixMaster displays each visible plate.

To Change the Plate Color:

1. **Right-click** the **Plate Number** in the Plate Toolbar.
2. On the Context Menu, click **Color**.
3. On the Choose Color dialog, **click the color** you want for that plate.
4. Click **OK**.

Import Drill Data

If you have drill files for your outside tooling, you can import them into FixMaster. See *Import Drill Data* on page 314.

Drill Editing

Inserting Drills

You can insert drills into the fixture.

To Insert Drills:

1. Set the active, visible plates.

   Note: *This command also works with the All Visible Plates Active option, indicated when the button at the bottom of the Plate Toolbar says All Active. However, the operation is limited in that drills will only be added to active, visible plates that already have at least one drill.*

2. Set the Current Tool Code.
3. On the **Edit** menu, click **Fixture-Drill-Insert Drill**.
4. **Position the cursor** at the desired insertion point.
5. **Click** the mouse or press **Enter**.

   FixMaster inserts a drill of the Current Tool Code in the active, visible plate at the cursor position.

   The Insert Drill tool remains selected until you select another tool or press the **Escape** key, so you can insert one drill after another.

Menu: *Edit-Fixture-Drill-Insert Drill*

Button: *then*

Key: *Shift+L*

Deleting Drills

The Delete command deletes drills from the active, visible plates.

To Delete a Single Drill:

1. Set the active, visible plates.

2. On the **Edit** menu, click **Fixture-Drill-Delete Drill**.
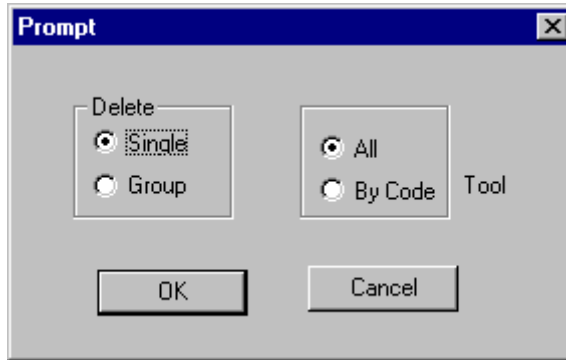
Delete Single Drill

3. On the Delete Drill dialog, click **Single**.

4. Click **OK**

   The Delete Drill tool is selected, and FixMaster prompts you to select an element.

5. **Position the cursor** near a drill you want to delete and **click** the left mouse button.

   The cursor hops to the drill.

6. **Click** the left mouse button a second time.

   FixMaster deletes the marked drill.

   The Delete Drill tool remains selected until you select another tool or press the **Escape** key, so you can delete one drill after another.

Menu: *Edit-Fixture-Drill-Delete Drill*

*Button:*   *then*

Key: *None*

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To Delete a Group of Drills in the Frame:

1. Set the active, visible plates.

2. Position the Frame around a group of drills you want to delete.

3. On the **Edit** menu, click **Fixture-Drill-Delete Drill**.

4. On the Delete Drill dialog, click **Group**, and click **All**.
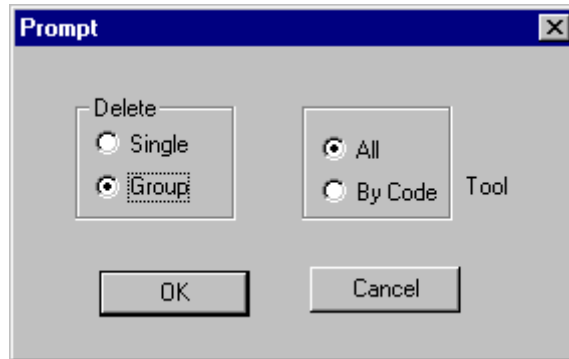
Delete a Group of Drills

5. Click **OK**

   FixMaster prompts you to click the mouse to delete the drills.

6. **Click** in the viewing area.

   FixMaster deletes all drills in the active, visible plates inside the Frame.

Menu: Edit-Fixture-Drill-Delete Drill

Button: *then*

Key: None

To Delete a Group of Drills of the Current Tool Code in the Frame:

1. Set the active, visible plates.

2. Position the Frame around a group of drills you want to delete.

3. On the **Edit** menu, click **Fixture-Drill-Delete Drill**.

4. On the Delete Drill dialog, click **Group**, and click **Tool Code**.
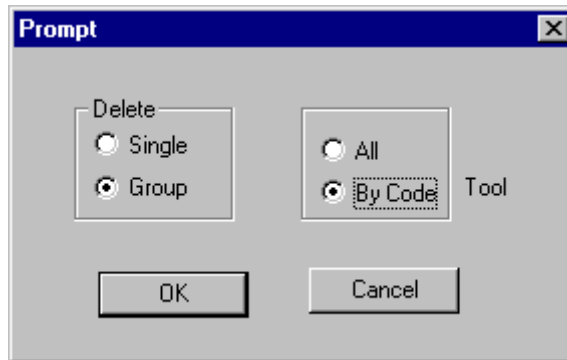
Delete by D Code

5. Click **OK**

   FixMaster prompts you to select an element.

6. **Position the cursor** near a drill that has the same Tool Code as the drills you want to delete.

7. **Click** the left mouse button.

   The cursor hops to the drill.

   The Tool Code of the marked drill becomes the Current Tool Code.

   FixMaster prompts you to click the mouse to delete the drills.

8. **Click** in the viewing area.

   FixMaster deletes all drills in the active, visible plates inside the Frame that have the current Tool Code.

   The Delete Drill tool is selected until you select another tool or press the **Escape** key, so you can delete drills inside the Frame of one Tool Code after another.

Menu: *Edit-Fixture-Drill-Delete Drill*

Button: *then*

Key: *None*

Copying Drills

Copy commands copy drills in the active, visible plate to another location in the same plate. The original drills remain at their original location. Copies are positioned relative to the originals.

To Copy a Single Drill:

1. Set the active, visible plates.

2. On the **Edit** menu, click **Fixture-Drill-Copy Drills**.

3. Click **Single**.
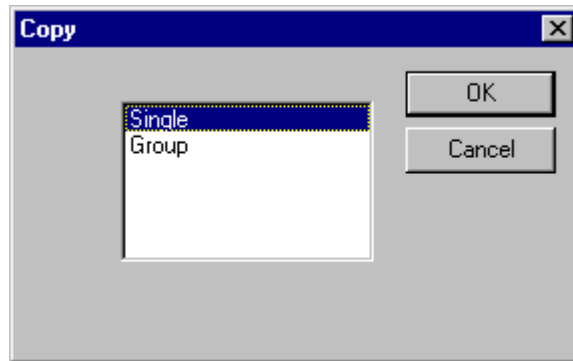
Copy a Single Drill

4. Click **OK**.

    The Copy Drill tool is selected, and FixMaster prompts you to select an element.

5. **Position the cursor** near a drill you want to copy and **click** the left mouse button.

    The cursor hops to the drill.

    FixMaster prompts for a destination position.

6. **Position the cursor** at the destination position.

7. **Click** the left mouse button or press **Enter**.

    The original drill remains in its original location, and FixMaster copies the drill to the new position.

    The Copy Drill tool remains selected until you select another tool or press the **Escape** key, so you can copy one drill after another.

Menu: *Edit-Fixture-Drill-Copy Drill*

Button: *then*

*Key:*   *None*

To Copy a Group of Drills in the Frame:

1. Set the active, visible plates.

2. Position the Frame around the drills you want to copy.

3. On the **Edit** menu, click **Fixture-Drill-Copy Drills**.

4. Click **Group**.
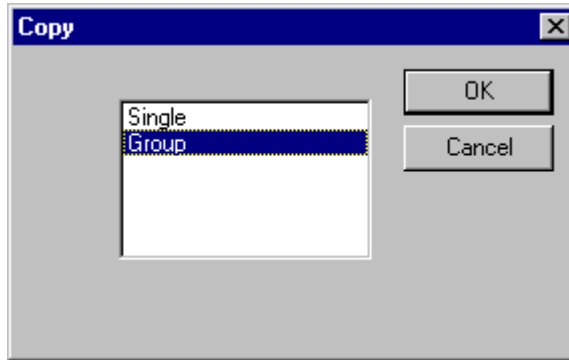
Copy a Group of Drills

5. Click **OK**.

   FixMaster prompts for a reference position.

6. **Position the cursor** at the reference position.

7. **Click** the left mouse button or press **Enter**.

   FixMaster marks the reference position with a yellow crosshair and prompts for a destination position.

8. **Position the cursor** at the destination position.

9. **Click** the left mouse button or press **Enter**.

   The original drills within the Frame remain at their original location, and FixMaster copies them to the new position.

Menu: *Edit-Fixture-Drill-Copy Drill*

Button: *then*

Key: *None*

Moving Drills

The Move command repositions drills in the active, visible plate to a new position in the same plate.

To Move a Single Drill:

1. Set the active, visible plates.

2. On the **Edit** menu, click **Fixture-Drill-Move Drills**.

3. Click **Single**.
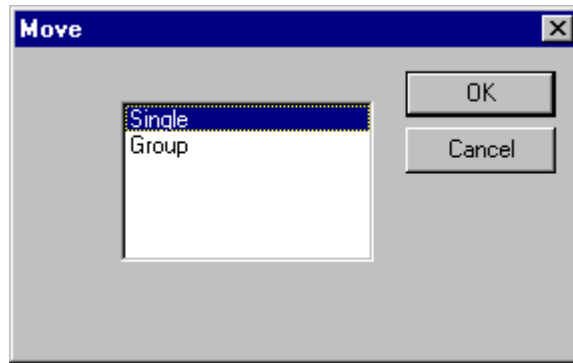
Move a Single Drill

4. Click **OK**.

   The Move Drill tool is selected, and FixMaster prompts you to select an element.

5. **Position the cursor** near a drill you want to move and **click** the left mouse button.

   The cursor hops to the drill.

   FixMaster prompts for a destination position.

6. **Position the cursor** at the destination position.

7. **Click** the left mouse button or press **Enter**.

   FixMaster moves the drill to the new position.

   The Move Drill tool remains selected until you select another tool or press the **Escape** key, so you can move one drill after another.

Menu: *Edit-Fixture-Drill-Move Drill*

Button: *then*

Key: *None*

To Move a Group of Drills in the Frame:

1. Set the active, visible plates.

2. Position the Frame around the drills you want to move.

3. On the **Edit** menu, click **Fixture-Drill-Move Drills**.

4. Click **Group**.
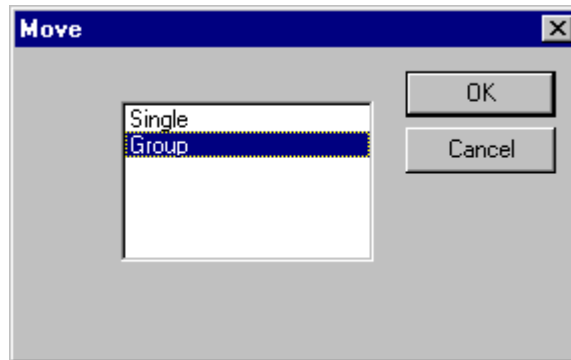
Move a Group of Drills

5. Click **OK**.

   FixMaster prompts for a reference position.

6. **Position the cursor** at the reference position.

7. **Click** the left mouse button or press **Enter**.

   FixMaster marks the reference position with a yellow crosshair and prompts for a destination position.

8. **Position the cursor** at the destination position.

9. **Click** the left mouse button or press **Enter**.

   FixMaster moves the drills inside the Frame to the new position.

Menu: Edit-Fixture-Drill-Move Drill

Button: *then*

Key: None

Mirroring Drills

The Mirror commands mirror a single drill or a group of drills within the Frame in the active, visible plates.

The Mirror X command flips the selected drills in the X direction so that left becomes right.

The Mirror Y command flips the selected drills in the Y direction so that up becomes down.

Note: *These commands can be used to simulate different drill language versions. For instance Excellon Version 1 and Version 4 measure drill coordinates as though they were mirrored versions of each other. The mirror commands allow you to insert drills using one coordinate system, then automatically change them to a different version.*

To Mirror a Single Drill:

1. Set the active, visible plates.

2. On the **Edit** menu, click **Fixture-Drill-Mirror X** or **Mirror Y**.

3. Click **Single**.
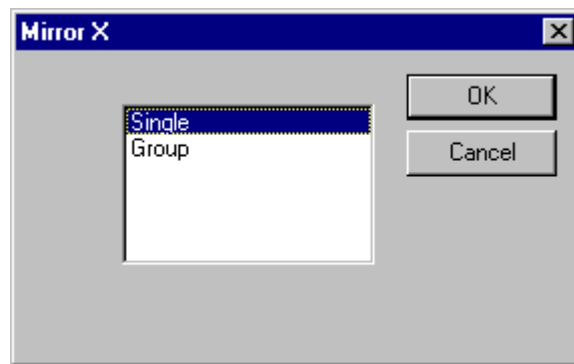
Mirror a Single Drill

4. Click **OK**.

   FixMaster prompts you to select an element.

5. **Position the cursor** near a drill you want to mirror and **click** the left mouse button.

   The cursor hops to the drill.

   FixMaster displays a yellow line that follows the cursor.
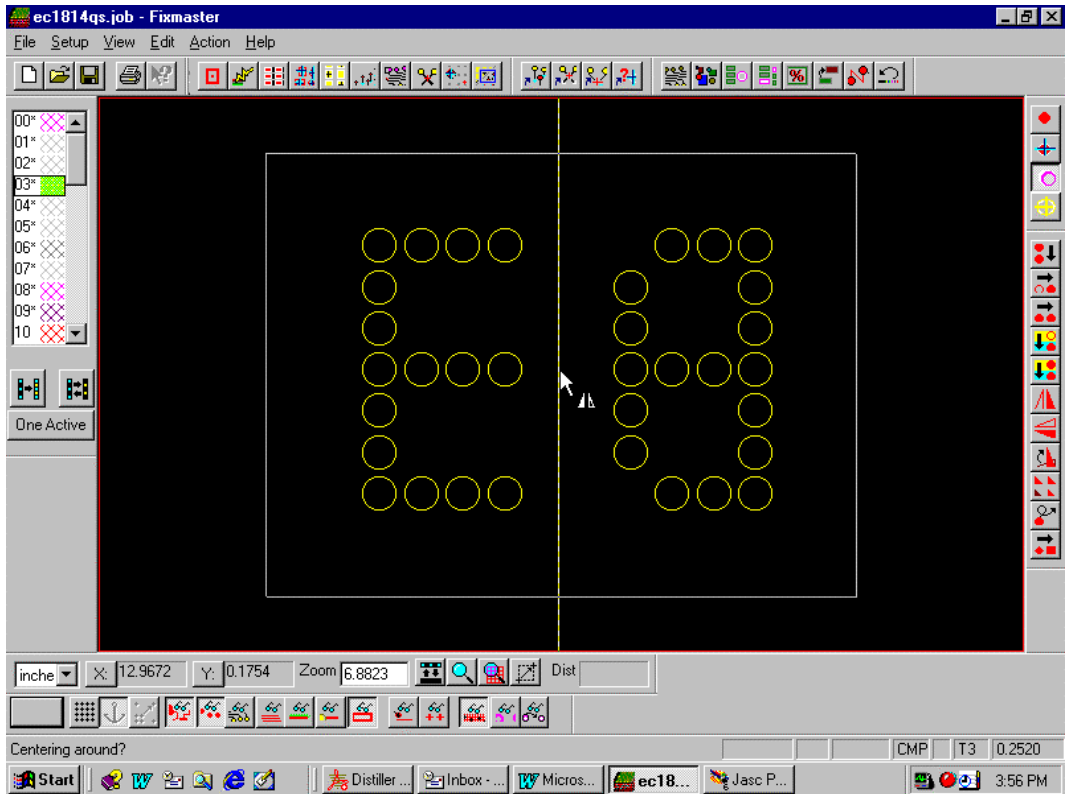
Mirror Axis Line

6. **Place the yellow line** at a position around which you want to mirror the drill.

7. **Click** the left mouse button.

   FixMaster flips the selected drill to the opposite side of the yellow line at an equal distance.

Menu: *Edit-Fixture-Drill-Mirror X or Mirror Y*

Button: ⬛ *then* ⬛ *or* ⬛

Key: *None*

To Mirror a Group of Drills in the Frame:

1. Set the active, visible plates.

2. Position the Frame around the drills you want to Mirror.

3. On the **Edit** menu, click **Fixture-Drill-Mirror X or Mirror Y**.

4. Click **Group**.
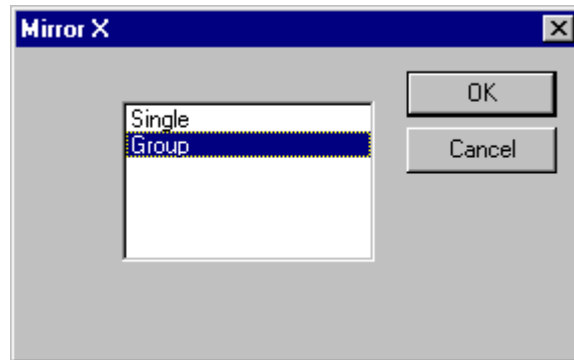
Mirror a Group of Drills

5. Click **OK**.

6. **Click** the mouse.

   FixMaster displays a yellow line that follows the cursor.
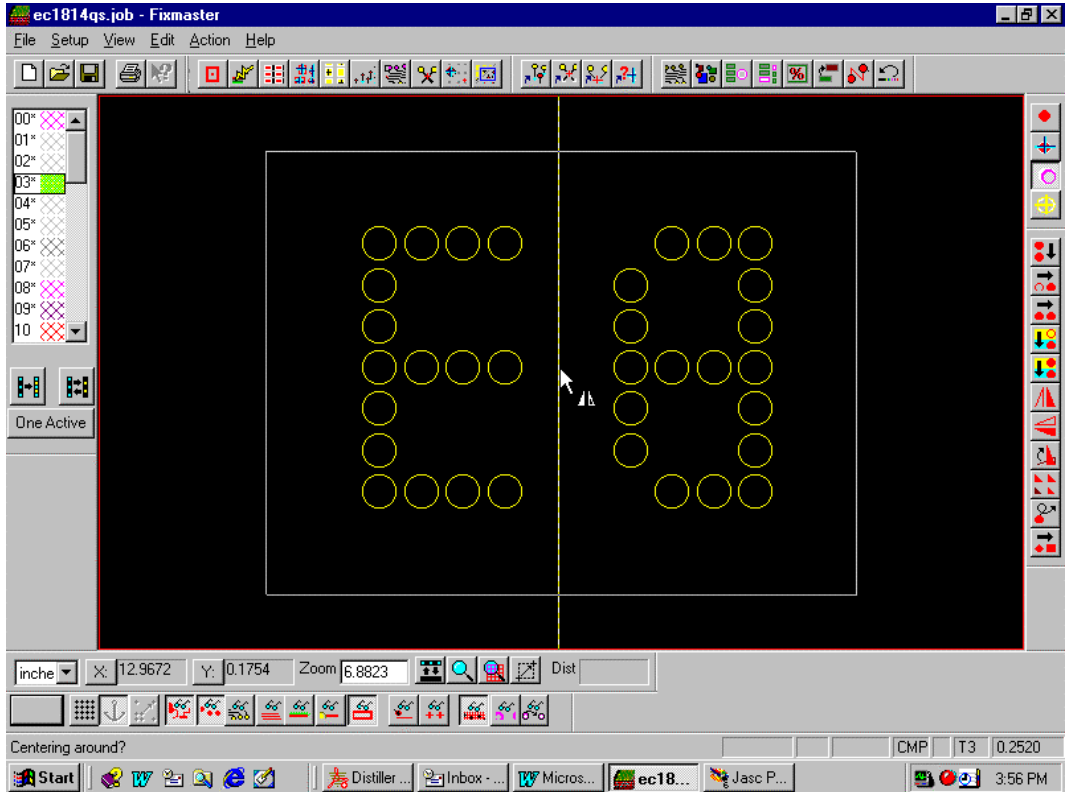
Mirror Axis Line

7. **Place the yellow line** at a position around which you want to mirror the drills.

8. **Click** the left mouse button.

   FixMaster flips the selected drills to the opposite side of the yellow line at an equal distance.

Menu: *Edit-Fixture-Drill-Mirror X or Mirror Y*

Button: ⬤ *then* /▯\ *or* ◀

Key: *None*

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Rotating Drills

The Rotation command rotates drill data in the active, visible plates. Rotation is clockwise in multiples of 90 degrees.

To Rotate a Single Drill:

1. Set the active, visible plates.

2. On the **Edit** menu, click **Fixture-Drill-Rotate Drills**.

3. Click **Single**.
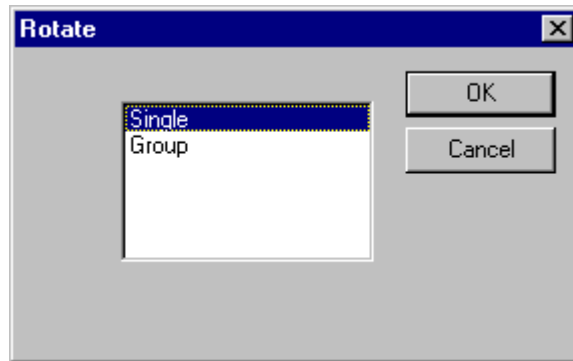
Rotate a Single Drill

4. Click **OK**.

   FixMaster prompts you to select an element.

5. **Position the cursor** near a drill you want to rotate and **click** the left mouse button.

   The cursor hops to the drill.

6. **Position the cursor** at the center of rotation.

7. **Click** the left mouse button or press **Enter**.
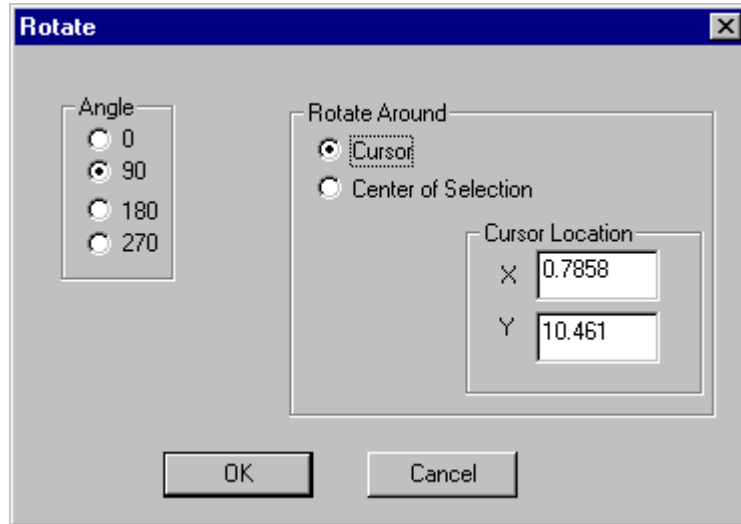
Rotate around Cursor

8. On the Rotate dialog, enter the **Angle** of rotation.

9. Select to **Rotate Around Cursor**. The other option, Rotate Around Center of Selection, does not really have any meaning for a single selected drill and is for rotating a group of drills.

10. Click **Ok**.

Menu: *Edit-Fixture-Drill-Rotate*

Button: [icon] *then* [icon]

Key: *None*

To Rotate a Group of Drills in the Frame:

1. Set the active, visible plates.
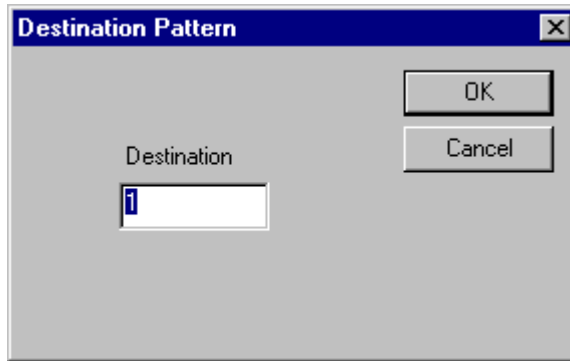
2. Position the Frame around the drills you want to rotate.

3. On the **Edit** menu, click **Fixture-Drill-Rotate Drills**.

4. Click **Group**.
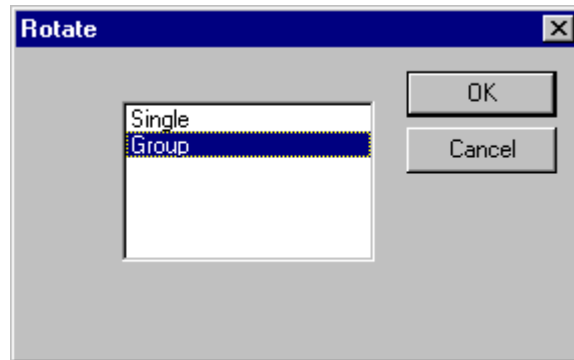
Rotate a Group of Drills

5. Click **OK**.

6. If you want to rotate the drills around a specific cursor location:
   - **Position the cursor** at the center of rotation.
   - **Click** the left mouse button or press **Enter**.
   - On the Rotate dialog, enter the **Angle** of rotation.
   - Select to **Rotate Around Cursor**.
   - Click **Ok**
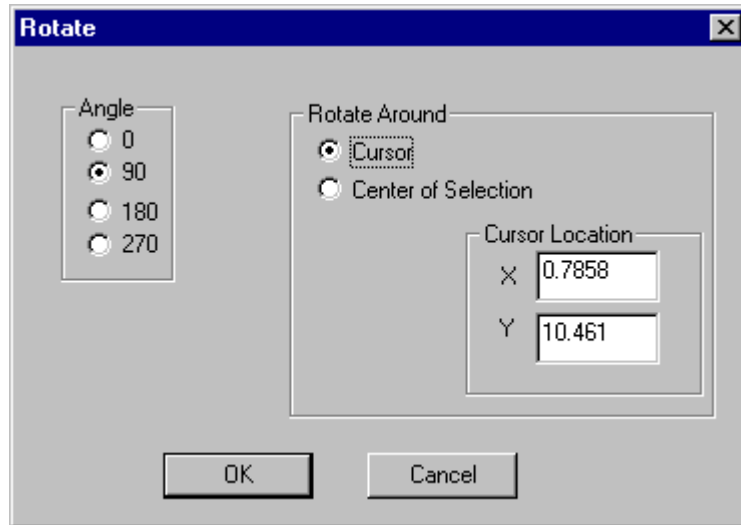
Rotate around Cursor

If you want to rotate the drills around the center of the selection:

- **Click** the left mouse button or press **Enter**.

- On the Rotate dialog, enter the **Angle** of rotation.

- Select to **Rotate Around Center of Selection**.

- Click **Ok**
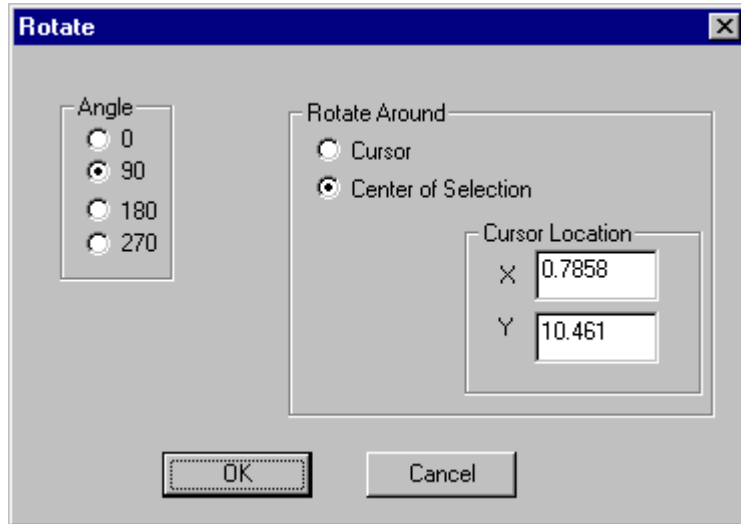
Rotate around Center of Selection

Menu: *Edit-Fixture-Drill-Rotate*

Button: *then*

Key: *None*

Stepping and Repeating Drills

FixMaster allows you to step and repeat a group of drills selected by the Frame. This operation makes multiple copies of the drills within the Frame, in all active, visible plates, and positions the copies at the step intervals you specify.

To Step and Repeat Drills:

1. Set the active, visible plates.

2. Position the Frame around the drills you want to step and repeat.

3. On the **Edit** menu, click **Fixture-Drill-Step/Repeat**.
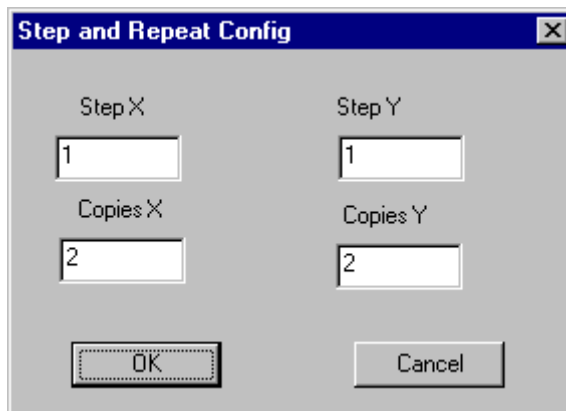
Step and Repeat

4. On the Step and Repeat Config dialog, enter the following step and repeat parameters:

   - **Step X and Step Y:** Enter the distance to step each copied drill in the X and Y directions.

   - **Copies X and Copies Y:** Enter how many copies of the selected drills to make in the X and Y directions.

5. Click **OK**.

Menu: *Edit-Fixture-Drill-Step/Repeat*

Button: *then*

Key: *None*

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Replicating Drills

Replicate commands copy and transfer drills to a destination plate at a new position. The original drills remain at their original position in the original plate. FixMaster replicates copies of the selected drills at the new position in the destination plate.

To Replicate a Single Drill:

1. Set the active, visible plates.

    Note: The active, visible plate determines the plate from which the replicated drills will be ***selected****, not the plate to which they will be* ***replicated****.*

2. On the **Edit** menu, click **Fixture-Drill-Replicate Drills**.

3. Click **Single**.
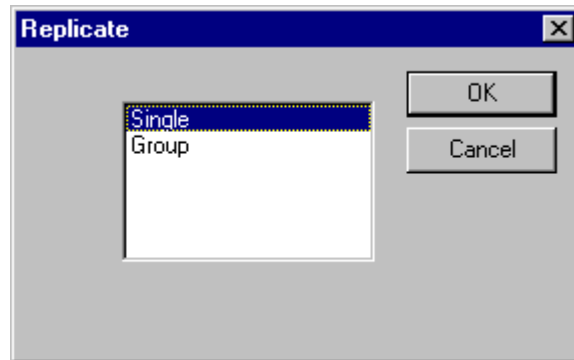
Replicate a Single Drill

4. Click **OK**.

   The Replicate Drill tool is selected, and FixMaster prompts you to select an element.

5. **Position the cursor** near a drill you want to replicate and **click** the left mouse button.

    The cursor hops to the drill.

    FixMaster prompts for a destination position.

6. **Position the cursor** at the destination position.

7. **Click** the left mouse button or press **Enter**.

FixMaster prompts for a destination plate.
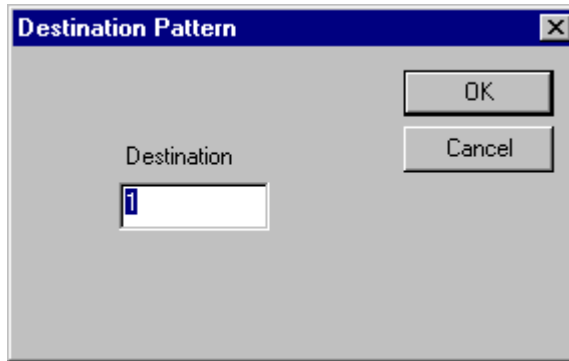
Destination Plate

8. Type the **plate number** you want to replicate the drill to.

9. Click **OK**.

The original drill remains in its original plate at its original location, and FixMaster replicates the drill to the destination plate at the new position.

The Replicate Drill tool remains selected until you select another tool or press the **Escape** key, so you can replicate one drill after another.

Menu: Edit-Fixture-Drill-Replicate Drill

Button: *then*

Key: *None*

To Replicate a Group of Drills in the Frame:

1. Set the active, visible plates.

    Note: *The active, visible plate determines the plate from which the replicated drills will be **selected**, not the plate to which they will be **replicated**. Regardless of how many plates drills are selected from, **all drills are transferred to the single destination plate.***

2. Position the Frame around the drills you want to replicate.

3. On the **Edit** menu, click **Fixture-Drill-Replicate Drills**.

4. Click **Group**.
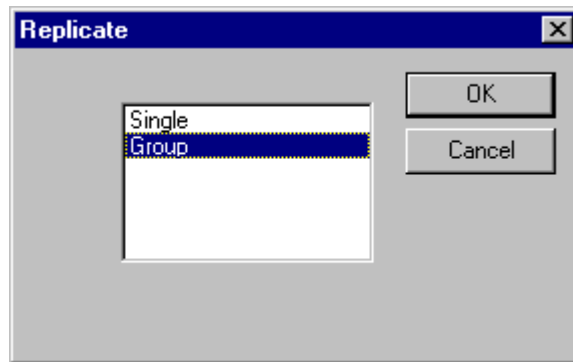
Replicate Group

5. Click **OK**.

    FixMaster prompts for a reference position.

6. **Position the cursor** at the reference position.

7. **Click** the left mouse button or press **Enter**.

    FixMaster marks the reference position with a yellow crosshair and prompts for a destination position.

8. **Position the cursor** at the destination position.

9. **Click** the left mouse button or press **Enter**.

FixMaster prompts for a destination plate.
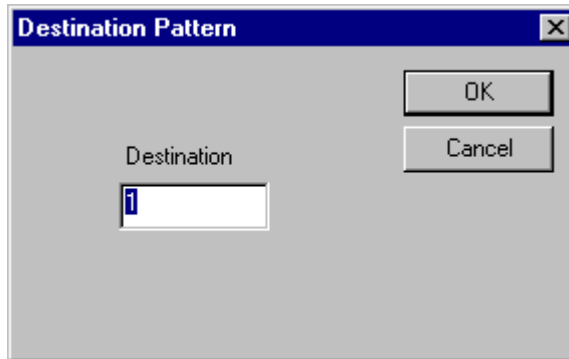
Destination Plate

10. Type the **plate number** you want to replicate the drills to.

11. Click **OK**.

    The original drills within the Frame remain in their original plates at their original location, and FixMaster replicates them to the destination plate at the new position.

Menu: *Edit-Fixture-Drill-Replicate Drill*

Button: *then*

Key: *None*

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Transferring Drills

Transfer commands remove drills in the active, visible plate and insert them into a destination plate at the same X and Y position.

To Transfer a Single Drill:

1. Set the active, visible plates.

    Note: *The active, visible plate determines the plate from which the transferred drills will be* ***selected****, not the plate to which they will be* ***transferred****.*

2. On the **Edit** menu, click **Fixture-Drill-Transfer Drills**.

3. Click **Single**.
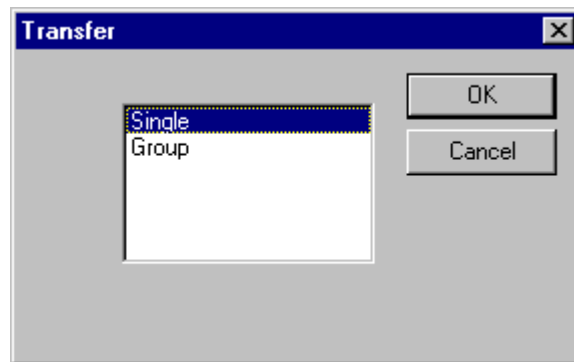
Transfer a Single Drill

4. Click **OK**.

    The Transfer Drill tool is selected, and FixMaster prompts you to select an element.

5. **Position the cursor** near a drill you want to transfer and **click** the left mouse button.

    The cursor hops to the drill.

6. **Click** the mouse again.

FixMaster prompts for a destination plate.
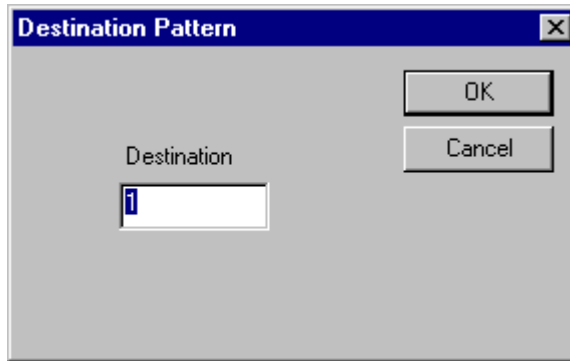
Destination Plate

7. Type the **plate number** you want to transfer the drill to.

8. Click **OK**.

    FixMaster transfers the drill to the destination plate at the same position.

    The Transfer Drill tool remains selected until you select another tool or press the **Escape** key, so you can transfer one drill after another.

Menu: *Edit-Fixture-Drill-Transfer Drill*

Button: *then*

Key: *None*

To Transfer a Group of Drills in the Frame:

1. Set the active, visible plates.

    Note: *The active, visible plate determines the plate from which the transferred drills are **selected**, not the plate to which they are **transferred**. Regardless of how many plates drills are selected from, **all drills are transferred to the single destination plate.***

2. Position the Frame around the drills you want to transfer.

3. On the **Edit** menu, click **Fixture-Drill-Transfer Drills**.

4. Click **Group**.
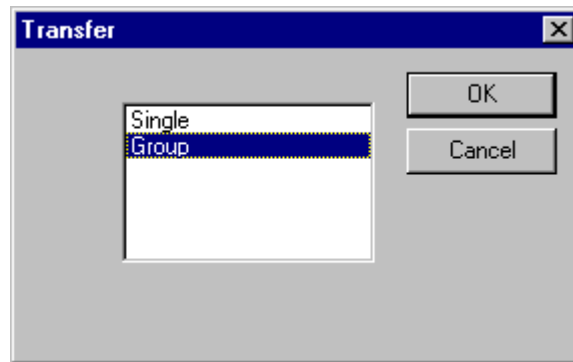
Transcode a Group of Drills

5. Click **OK**.

FixMaster prompts for a destination plate.

Destination Plate

6. Type the **plate number** you want to transfer the drills to.

7. Click **OK**.

FixMaster transfers the drill inside the Frame to the destination plate at the same position.

Menu: *Edit-Fixture-Drill-Transfer Drill*

Button: *then*

Key: *None*

Transcoding Drill Tool Codes

The Transcode command changes the Tool Code of drills in the active, visible plates.

To Transcode the Tool Code of a Single Drill:

1. Set the active, visible plates.

2. On the **Edit** menu, click **Fixture-Drill-Transcode**.

3. Click **Single**.
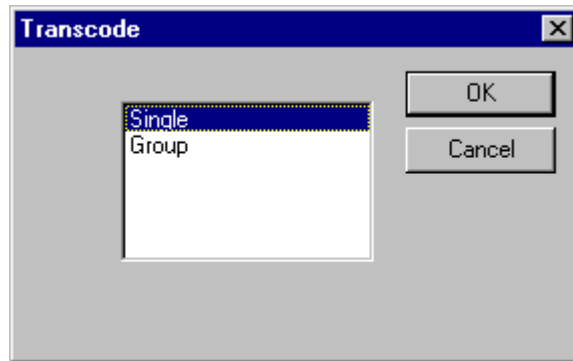
Transcode a Single Drill

4. Click **OK**.

   The Transcode Tool is selected and FixMaster prompts you to select an element.

5. **Position the cursor** near a drill you want to transcode and click the left mouse button.

   The cursor hops to the drill.

6. **Click** the left mouse button again.
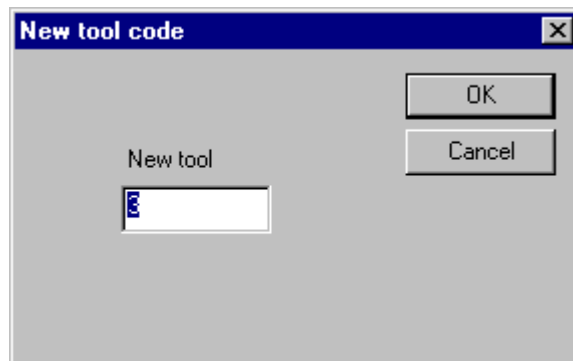
New Tool Code

7. On the Transcode dialog, enter the new **Tool Code**.

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8. Click **OK**

FixMaster transcodes the Tool Code of the selected drill and shows the drill at the size of the new Tool Code.

The Transcode Tool remains selected until you select a new tool or press the **Escape** key, so you can transcode the Tool Code of one drill after another.

Menu: *Edit-Fixture-Drill-Transcode Drill*

Button: *then*

Key: *None*

To Transcode the Tool Code of a Group of Drills in the Frame:

1. Set the active, visible plates.
2. Position the Frame around the drills you want to transcode.
3. On the **Edit** menu, click **Fixture-Drill-Transcode**.
4. Click **Group**.
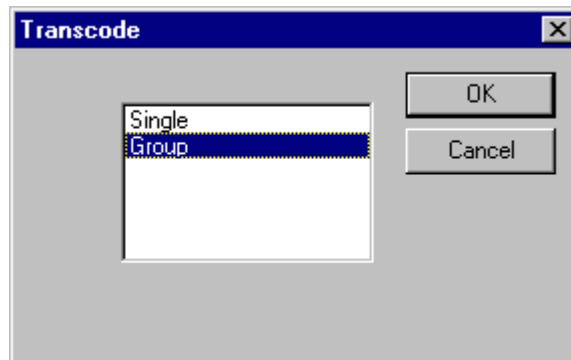
Transcode a Group of Drills

5. Click **OK**.

   The Transcode Tool is selected and FixMaster prompts you to select an element.

6. **Position the cursor** near a drill that has the Tool Code you want to transcode and **click** the left mouse button.

   The cursor hops to the drill.

   The Tool Code of the selected drill becomes the current Tool Code in the Status Bar.

7. **Click** the left mouse button again.
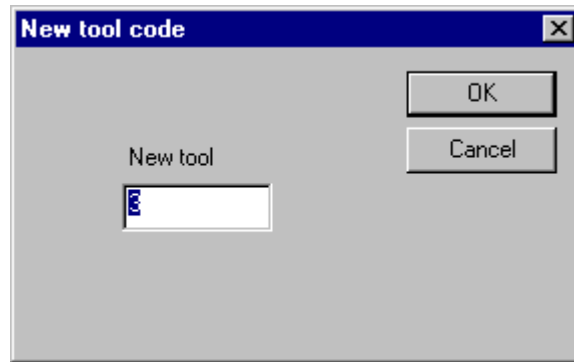
New Tool Code

8. On the Transcode dialog, enter the new **Tool Code**.

9. Click **OK**

   FixMaster transcodes all the drills in the Frame that have the same Tool Code as the selected drill and shows the transcoded drills at the size of the new Tool Code.

   The Transcode Tool remains selected until you select a new tool or press the **Escape** key, so you can transcode drills of one Tool Code after another.

Menu: *Edit-Fixture-Drill-Transcode Drill*

Button: *then*

Key: *None*

Chapter 7
Set up a Flip Test

A flip test is a test in which the two sides of the board, CMP and SOL, are tested separately. When you run the Flip Test operation, FixMaster finds a common via between sides for each net, saves the test points assigned to the via and any surface mounts, and deletes other test points. This minimizes the number of test points for common vias between sides and maintains a high level of testing with the fewest number of test points.

Note: *No method of testing only one board side at a time can assure that nets that go from one side to the other are continuous. This is because the continuity of the vias between layers cannot be tested by only testing one side at a time. The Flip Test assures a high level of test by testing those types of nets for continuity to a common via on both board sides, but this does not test the continuity of the via itself.*

If you are going to do a flip test, you should use the Flip Test command before panelizing, deleting, rotating, moving or mirroring the PCB.

There are two types of flip tests.

One-Fixture Flip Test

The two sides can be tested on a single fixture in a one-fixture flip test. In this case one side is tested, and then the board is flipped over and the other side is tested on another offset portion of the same fixture.

For a one-fixture flip test, FixMaster copies the non-current side data to the current side, CMP or SOL, and offsets the copied data. The data will be tested on the current side grid. FixMaster does not actually flip the data that is offset for a one-fixture flip test, so you need to either import one side of the data in a flipped orientation or mirror it after import.

Two-Fixture Flip Test

Another kind of flip test is the two-fixture flip test in which one side of the board is tested on one fixture, and the other side is tested on another fixture.

In the two-fixture flip test, the data is not copied from one side to another or offset. You process the job just as you would for any two-sided job, processing each side separately. The advantage of doing the Flip Test operation in this case is that the operation still reduces the number of test points for common vias between sides and maintains a high level of testing with the fewest number of test points.

Running the Flip Test Operation

To Run the Flip Test Operation:

1. After the PCB data have been imported and the test points are generated, but before you mirror, move, rotate or step/repeat the PCB, go to the **Action** menu and click **Flip Test**.
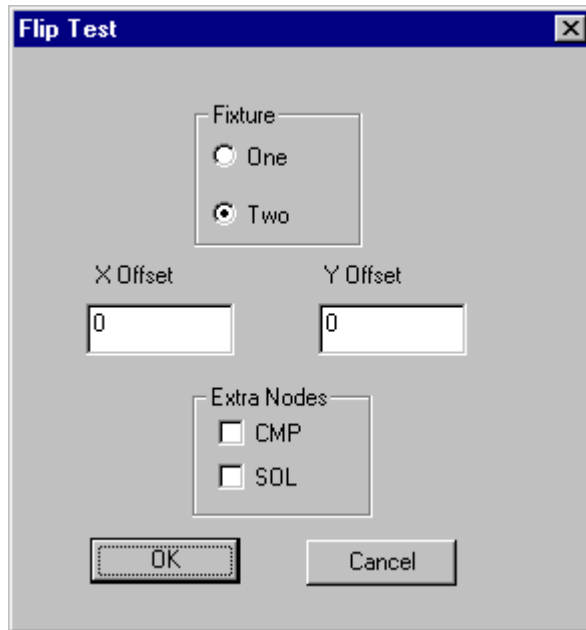
Flip Test Dialog

2. Select whether to do a **one-fixture** flip test or a **two-fixture** flip test.

3. If you selected a one-fixture flip test, enter the distance to offset corresponding points on the two sides in the **X and Y Offset**.

4. Select whether you want **Extra Single Nodes** on the component or solder side. This option assures that all netlists have at least one test point on each board side after the test point reduction. This is to ensure a complete test for shorts.

5. Click **OK**.

Chapter 8
Position the PCB

After you import the PCB data, you must position the PCB data within the fixture. FixMaster has a feature for automatically centering the PCB in the fixture tooling and several commands for mirroring, moving, rotating and stepping and repeating the PCB data.

Before you position the PCB data you should also consider whether you want to automatically move the PCB when dropping pins, or if you want to wait to position the PCB until after dropping pins.

Automatically Moving the PCB when Dropping Pins

You have the option to automatically move the PCB when dropping pins so that the maximum number of pins are directly over fixture grid points. At most this option will move the PCB by one fixture grid interval, so you should still use one of the positioning commands to put the PCB approximately where you want it. If you position the PCB exactly where you want it and don't want it to move by even one fixture grid interval, do not use the option.

To Automatically Move the PCB when Dropping Pins:

1. On the **Setup** menu, click **Fixture-Grid**.

2. On the Customize Grid dialog select the type of fixture grid you have and click **OK**.

3. If you want FixMaster to reposition the PCB when you drop pins, then on the Change Grid dialog, click the **Move PCB When Dropping Pins** option so that there is a checkmark. Otherwise, click so that there is no checkmark.

	Start X	Start Y	End X	End Y	Grid X	Grid Y	On	
1	3.2000	0.0000	22.4000	13.9000	0.1000	0.1000	✖	
2	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
3	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
4	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
5	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
6	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
7	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
8	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
9	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	
1	0.0000	0.0000	16.0000	24.0000	0.1000	0.1000	☐	

☑ Move PCB when dropping pin:

Change Grid Dialog, with Move PCB Option Selected

For more information on setting the other fixture grid options, see *Setting up the Fixture Grids* on page 61.

Waiting to Position the PCB until After Dropping Pins

If you wait to position the PCB until after dropping pins and use the positioning commands on a part that already has pin assignments, FixMaster attempts to keep the pin assignments. In order for this to work, the new part position must be similar relative to the fixture grid points:

- If you step and repeat or move PCB data with pin assignments, the distance must be a multiple of the fixture grid interval.

- If you rotate PCB data with pin assignments, the pivot point must be on a fixture grid point.

- If you mirror PCB data with pin assignments, the flip axis must be on a fixture grid point.

The only advantage to waiting to position the PCB is if you plan to step and repeat a complex part. If you are going to do a lot of manual test point assignments, it makes sense to do it only once and then panelize the part with the pin assignments intact. However, even if you plan to step and repeat after dropping pins, you should position the original part. Position the original image where you want the lower left corner of the step and repeat pattern.

Automatically Centering the PCB in the Fixture Tooling

You can automatically center all PCB data, both the component-side and solder-side layers, within the fixture tooling or the tester grid.

To Center the PCB:

1. Go to the **Edit** menu and click **PCB Data-Center PCB**.
2. In the Place PCB dialog, select whether to center within the **Fixture** or the **Grid**.
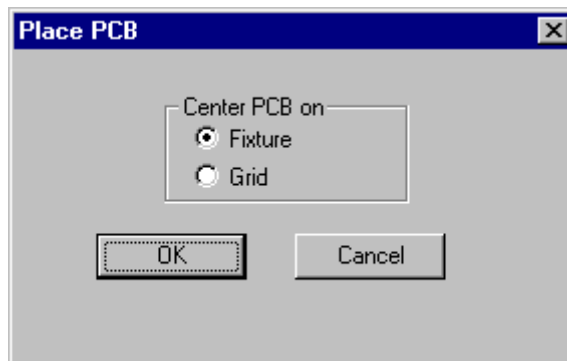
Place PCB Dialog

Menu: *Edit-PCB Data-Center PCB*

Button:

Key: *Ctrl+B*

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Mirroring the PCB

The Mirror command flips PCB data for the current board side in either the X or Y directions.

Note: *You typically orient the data to the tester grid when you import the PCB data, so be sure that you leave the data oriented properly when you use the Mirror command. For information on orienting the data on import, see* **Import PCB Files into the Job** *on page 299.*

Pin Assignments

If pins have **not** yet been assigned to the fixture grid before mirroring, the flip axis is the center of the selected data.

If pins **have** been assigned to the fixture grid before mirroring, the flip axis is the fixture grid point closest to the center of the selected data. This allows pin assignments to be preserved.

To Mirror the PCB:

1. Set the current Board Side.

2. Position the Frame around the data you want to mirror.

3. On the **Edit** menu, click **PCB Data-Mirror**.
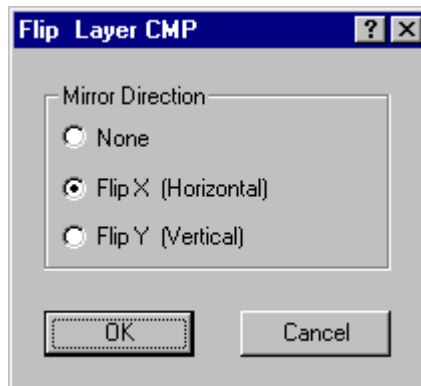
4. Select the direction to flip the data.

   None: The data is not flipped.

   Flip X: The data is flipped horizontally, along the X axis, so that left becomes right.

   Flip Y: The data is flipped, vertically, along the Y axis, so that up becomes down.

5. Click **OK**.

Menu: *Edit-PCB Data-Mirror*

Button: *then* *or*

Key: *None*

Moving the PCB

The Move command moves PCB data for both board sides.

One use of this feature is for optimizing pin drops. If you position the board so that the part with the highest density is between fixture grid coordinates, you will have equal deflection for pins assigned to the highest-density test points.

Pin Assignments

If you move a part that already has pin assignments, FixMaster attempts to keep the pin assignments. In order for this to work, the distance moved must be a multiple of the fixture grid interval.

To Move the PCB:

1. Position the Frame around the data you want to move.

2. On the **Edit** menu, click **PCB Data-Move**.

   FixMaster prompts for a reference location.

3. **Position the cursor** at the reference location.

4. **Click** or press **Enter**.

   FixMaster marks the reference position with a yellow crosshair and prompts for a destination position.

5. **Position the cursor** at the destination location.

6. **Click** or press **Enter**.

   FixMaster moves the data in the Frame as a group so that the reference location moves to the destination location.

Menu: *Edit-PCB Data-Move*

Button: *then*

Key: *None*

Rotating the PCB

The Rotate command rotates PCB data for both board sides.

Direction

Rotation is clockwise in multiples of 90 degrees.

D Codes

FixMaster transcodes the asymmetrical pads to existing D Codes of the correct size or to new D Codes defined to match the rotated pads.

Pin Assignments

If you rotate a part that already has pin assignments, FixMaster attempts to keep the pin assignments. In order for this to work, the pivot point must be on a fixture grid point.

To Rotate the PCB:

1. Position the Frame around the PCB data you want to rotate.

2. Go to the **Edit** menu and click **PCB Data-Rotate**.

3. If you want to rotate the PCB data around a specific cursor location:

   - **Position the cursor** at the center of rotation.

   - **Click** the left mouse button or press **Enter**.

   - On the Rotate dialog, enter the **Angle** of rotation.

   - Select to **Rotate Around Cursor**.
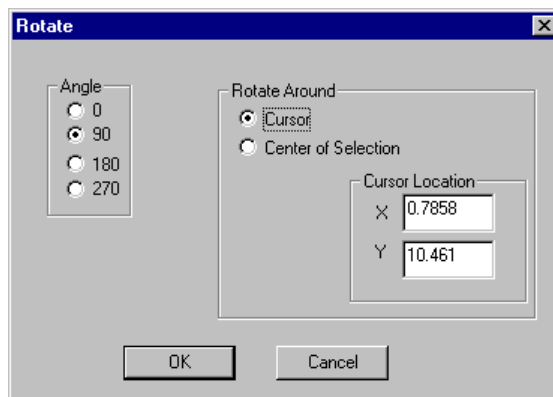
   - Click **Ok**

Rotate Around Cursor

If you want to rotate the PCB data around the center of the selection:

- **Click** the left mouse button or press **Enter**.
- On the Rotate dialog, enter the **Angle** of rotation.
- Select to **Rotate Around Center of Selection**.
- Click **Ok**
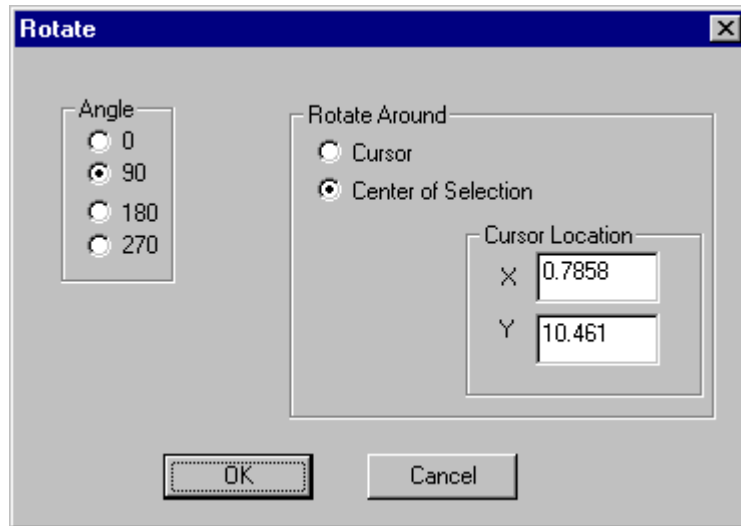
Rotate Around Center

FixMaster rotates the data within the Frame around the designated pivot point. FixMaster transcodes the asymmetrical pads to existing D Codes of the correct size or to new D Codes defined to match the pads.

Menu: *Edit-PCB Data-Rotate*

Button: *then*

Key: *None*

Step and Repeat the PCB

The Step/Repeat command steps and repeats PCB data for both board sides.

Direction of Step and Repeat

The original image is the lower left copy in the pattern and the new copies are stepped up to the right and above the original.

Net Numbers after Step and Repeat

Each net in the original PCB data is assigned a unique new net number in each new copy of the data.

Pin Assignments after Step and Repeat

If you step and repeat a part that already has pin assignments, FixMaster attempts to keep the pin assignments in the repeated images. In order for this to work, the step distances must be a multiple of the fixture grid interval. This technique can save a lot of work in jobs that require a lot of manual pin assignments. See *Waiting to Position the PCB until After Dropping Pins* on page 120.

To Step and Repeat the PCB:

1. Position the Frame around the data you want to step and repeat.

2. On the **Edit** menu, click **PCB Data-Step/Repeat**.
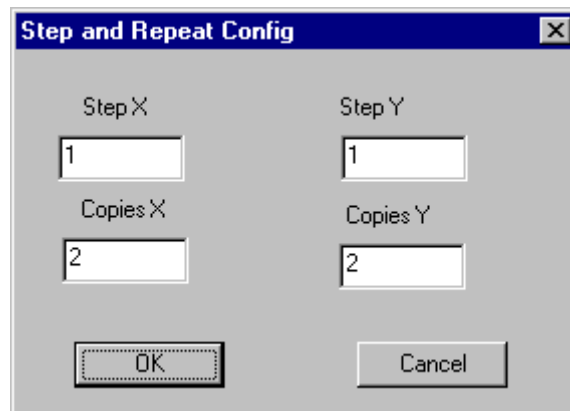
Step and Repeat Dialog

3. On the Step and Repeat dialog, enter the following:

   - **Copies X, Y:** Enter the number of copies you want in the X and Y directions.

   - **Step X, Y:** Enter the distance to step the image in the X and Y directions. This is the distance from the lower left corner of one image to the lower left corner of the next image.

4. Click **OK**.

FixMaster makes multiple copies of the data in the Frame and positions them to the right and above the original by the distances you specified. Each net in the original PCB data is assigned a unique new net number in each new copy of the data.

Menu: *Edit-PCB Data-Step/Repeat*

Button: *then*

Key: *None*

Chapter 9
Map D Codes to Probe Codes

D Code to Probe Mapping Table

The D Code to Probe Mapping Table is where you map D Codes in the imported PCB data to Probe Codes that you have set up in the Probe Table.
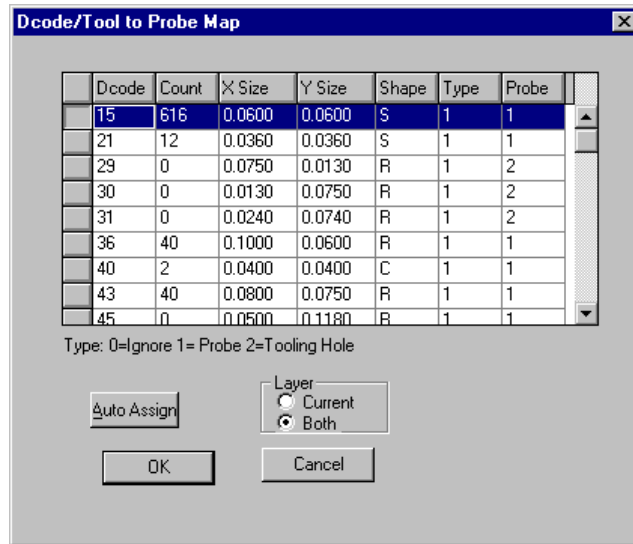
D Code to Probe Map Table

You tell FixMaster how to handle pads of each D Code in the PCB data. Each D Code can be set to represent one of the following types of pad:

- A pad that is going to be **probed**.

- A pad that is **not** going to be **probed**.

- A PCB **tooling hole** to be transferred to the fixture. For a complete discussion of tooling holes, see *PCB Tooling Holes and Fixture Alignment Pins* on page 385.

After each pad is given a type:

- Each pad that is to be **probed** must be mapped to a specific Probe Code. The Probe Code identifies the probe used to test that pad and contains the drill diameter information for that probe.

- Pads that are **not** going to be **probed** do not need any further processing.

- Each PCB **tooling hole** transferred to the fixture needs to be assigned to a specific Probe Code. The tooling hole Probe Code identifies the tooling hole diameter for that pad. For a

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complete discussion of tooling holes, see *PCB Tooling Holes and Fixture Alignment Pins* on page 385.

The D Code to Probe Mapping Table contains the following information.

D Code

The D Code column contains all the D Codes found in the imported PCB data.

Count

The Count column shows how many pads of each D Code are in the imported PCB data.

X/Y Size

The X and Y Sizes show the dimensions of the each D Code in the imported PCB data.

Shape

The Shape column shows the shape of the each D Code in the imported PCB data. The letters that identify each shape are consistent with those used in the Lavenir CAM software (CAMMaster, ViewMaster PRO, And ViewMaster). Elements that were obrounds or rounded rectangles in the original file are imported as circles, squares or rectangles and are shown as surface mounts.

Type

The Type column identifies how the particular D Code is to be handled in FixMaster. The procedures that follow describe how to enter these values. You may already know how each D Code is to be handled, or you may be able to determine this from the Size and Shape values.

Type-0 D Code: Unprobed pad.

- No test points will be generated for type-0 pads.
- No drill data will be generated when the drill files are generated.

Type-1 D Code: Probed pad.

- Test points will be generated for type-1 pads.
- Drill data will be generated for the probe drills. The Probe Code parameters for the Probe Codes mapped to type-1 D Codes will be used to generate the Tool Codes when drill files are generated.

Type-2 D Code: Tooling hole, not probed.

- No test points will be generated for type-2 pads.
- Drill data will be generated for these tooling holes. The shaft diameter of the type-T Probe Codes mapped to the type-2 D Codes will be used as the tooling hole diameter and will be used as the Tool Code size when drill files are generated. For a complete discussion of tooling holes, see *PCB Tooling Holes and Fixture Alignment Pins* on page 385.

Probe

The Probe column identifies the Probe Code that is mapped to the corresponding D Code. Probe Code Values are set up in the Probe Table. For information on the Probe Table, see *Setting up the Probes* on page 70. Here you select a Probe for each pad that is appropriate to the D Code Type, shape and size.

Type-0 D Code: Don't map a Probe Code for type-0 pads. These are unprobed pads.

Type-1 D Codes: Map each type-1 D Code to an appropriate Probe Code from the Probe Setup table. A probe having that Probe Code will be used to test pads of that D Code.

• For surface-mount pads, use a type-S or type-B Probe Code.

• For through-hole pads, use a type-H or type-B Probe Code.

Type-2 D Codes: Map each type-2 D Code to an appropriate type-T Probe Code from the Probe Setup Table. The type-T Probe Code isn't actually a probe. FixMaster uses the shaft diameter of the type-T probe as the tooling hole size. For a complete discussion of tooling holes, see *PCB Tooling Holes and Fixture Alignment Pins* on page 385.

The procedures that follow show how you can have FixMaster automatically map the D Codes to Probe Codes, or how you can do this manually.

Automatically Mapping D Codes to Probe Codes

FixMaster can automatically map D Codes to Probes based on type and size.

To Automatically Map D Codes to Probe Codes:

1. Set the current board side.

2. You may have already set up the Probe Code parameters in the fixture configuration procedure. If not, go to the **Setup** menu, click **Fixture-Probe**, and set the following settings:

   - Type
   - Pad Min and Max

   See *Setting up the Probes* on page 70.

   The other settings on the Probe Setup Table are not *required* for mapping the D Codes to Probe Codes, but it may help guide your choices for Probe Codes later in the procedure and will be necessary for generating test points and exporting probe drill files.

3. On the **Action** menu, click **D Code to Probe**.

Dcode	Count	X Size	Y Size	Shape	Type	Probe
15	616	0.0600	0.0600	S	1	1
21	12	0.0360	0.0360	S	1	1
29	0	0.0750	0.0130	R	1	2
30	0	0.0130	0.0750	R	1	2
31	0	0.0240	0.0740	R	1	2
36	40	0.1000	0.0600	R	1	1
40	2	0.0400	0.0400	C	1	1
43	40	0.0800	0.0750	R	1	1
45	0	0.0500	0.1180	R	1	1

Type: 0=Ignore 1= Probe 2=Tooling Hole

D Code to Probe Map Table

4. For each D Code, enter a **Type**.

    Type-0 D Code: Unprobed pad.

    - No test points will be generated for type-0 pads.

    - No drill data will be generated when the drill files are generated.

    Type-1 D Code: Probed pad.

    - Test points will be generated for type-1 pads.

    - Drill data will be generated for the probe drills. The Probe Code parameters for the Probe Codes mapped to type-1 D Codes will be used to generate the Tool Codes when drill files are generated.

    Type-2 D Code: Tooling hole, not probed. For a complete discussion of tooling holes, see *PCB Tooling Holes and Fixture Alignment Pins* on page 385.

    - No test points will be generated for type-2 pads.

    - Drill data will be generated for these tooling holes. The shaft diameter of the type-T Probe Codes mapped to the type-2 D Codes will be used as the tooling hole diameter and will be used as the Tool Code size when drill files are generated.

5. In the Layer group box, select whether you want to map D Codes to Probe Codes for **Both** the component board side and solder board side or just the **Current** board side.

6. Click the **Auto Assign** button.

    FixMaster automatically maps D Codes to Probe Codes for type-1 and type-2 D Codes.

    Type-0 D Codes: The program skips the type-1 D Codes because they are unprobed pads.

    Type-1 D Codes:

    - For each type-1 D Code, FixMaster looks for Probe Codes of the correct type in the Probe Setup table.
      For surface-mount pads, FixMaster looks for a type-S or type-B Probe Code.
      For through-hole pads, FixMaster looks for a type-H or type-B Probe Code.

    - When FixMaster finds a probe of the correct type, the program then checks whether the pad-size range for the Probe Code matches the D Code size. The first Probe Code in the Probe Setup Table that matches the type and pad minimum and maximum size criteria is mapped to the D Code.

    - A probe having that Probe Code will be used to test pads of that D Code.

    Type-2 D Codes: For a complete discussion of tooling holes, see *PCB Tooling Holes and Fixture Alignment Pins* on page 385.

    - For each type-2 D Code, FixMaster looks for a type-T Probe Code in the Probe Setup Table.

    - When FixMaster finds a type-T Probe Code, the program then checks whether the pad-size range for the Probe Code matches the D Code size. The first type-T Probe Code in

the Probe Setup Table that matches the pad minimum and maximum size criteria is mapped to the D Code.

- The type-T Probe Code isn't actually a probe. FixMaster uses the shaft diameter of the type-T probe as the tooling hole size.

7. Check the automatic assignments to make sure everything is correct. You can manually change any D Code to Probe Code assignment using the Manually Map D Codes to Probes procedure. See *Manually Map D Codes to Probe Codes* on page 135.

8. When all D Codes are mapped to Types and Probe Codes, click **OK**.

9. If you have mapped D Codes to Probe Codes for one board side and need to map them for the other side you can go back and do it now.

Menu: *Action-D Code to Probe*

Button:

Key: *F5*

Manually Map D Codes to Probe Codes

You can manually map D Codes to Probes.

To Manually Map D Codes to Probe Codes:

1. Set the current board side.

2. You may have already set up the Probe Code parameters in the fixture configuration procedures by going to the **Setup** menu, and clicking **Fixture-Probe**. This step is not *required* for mapping the D Codes to Probe Codes, but it may help guide your choices for Probe Codes later in the procedure and will be necessary for generating test points and exporting probe drill files. See *Setting up the Probes* on page 70.

3. On the **Action** menu, click **D Code to Probe**.

Dcode/Tool to Probe Map

	Dcode	Count	X Size	Y Size	Shape	Type	Probe	
	15	616	0.0600	0.0600	S	1	1	
	21	12	0.0360	0.0360	S	1	1	
	29	0	0.0750	0.0130	R	1	2	
	30	0	0.0130	0.0750	R	1	2	
	31	0	0.0240	0.0740	R	1	2	
	36	40	0.1000	0.0600	R	1	1	
	40	2	0.0400	0.0400	C	1	1	
	43	40	0.0800	0.0750	R	1	1	
	45	0	0.0500	0.1180	R	1	1	

Type: 0=Ignore 1= Probe 2=Tooling Hole

Auto Assign

Layer
○ Current
⊙ Both

OK   Cancel

D Code to Probe Map Table

4. For each D Code, enter a **Type**.

   Type-0 D Code: Unprobed pad.

   - No test points will be generated for type-0 pads.

   - No drill data will be generated when the drill files are generated.

Type-1 D Code: Probed pad.

- Test points will be generated for type-1 pads.

- Drill data will be generated for the probe drills. The Probe Code parameters for the Probe Codes mapped to type-1 D Codes will be used to generate the Tool Codes when drill files are generated.

Type-2 D Code: Tooling hole, not probed. For a complete discussion of tooling holes, see *PCB Tooling Holes and Fixture Alignment Pins* on page 385.

- No test points will be generated for type-2 pads.

- Drill data will be generated for these tooling holes. The shaft diameter of the type-T Probe Codes mapped to the type-2 D Codes will be used as the tooling hole diameter and will be used as the Tool Code size when drill files are generated.

5. For each type-1 or type-2 D Code, enter a **Probe Code**.

Type-0 D Code: Don't map a Probe Code for type-0 pads. These are unprobed pads.

Type-1 D Codes: Map each type-1 D Code to an appropriate Probe Code from the Probe Setup table. A probe having that Probe Code will be used to test pads of that D Code.

- For surface-mount pads, use a type-S or type-B Probe Code.

- For through-hole pads, use a type-H or type-B Probe Code.

Type-2 D Codes: Map each type-2 D Code to an appropriate type-T Probe Code from the Probe Setup Table. The type-T Probe Code isn't actually a probe. FixMaster uses the shaft diameter of the type-T probe as the tooling hole size. For a complete discussion of tooling holes, see *PCB Tooling Holes and Fixture Alignment Pins* on page 385.

6. When all D Codes are mapped to Types and Probe Codes, click **OK**.

7. If you have mapped D Codes to Probe Codes for one board side and need to map them for the other side, you can go back and do it now.

Menu: *Action-D Code to Probe*

Button:

Key: *F5*

Chapter 10
Add Test Points

A test point is a location in the PCB data that is to be probed during the test. In FixMaster a test point is defined by its X and Y location, the component it is in, the grid point it is assigned to, and the Probe Code it is mapped to. This chapter describes how to automatically generate test points and to edit test points in FixMaster.

Generating Test Points

FixMaster can automatically generate test points for Gerber and netlist data.

Generating Test Points for Gerber Data

FixMaster generates test points for all pads mapped as probeable (Type-1 D Codes) in the D Code to Probe map.

To Generate Test Points for Gerber Data:

1. Set the Current Board Side.

2. To determine which pads are probeable and what types of probes can be used for each pad, map D Codes to Probe Codes. See *Map D Codes to Probe Codes* on page 129.

3. On the **Edit** Menu, click **Test Point-Insert-All Test Points**.

   FixMaster generates the test points for the current board side as you specified.

   Test points are represented by blue crosshairs.

   FixMaster highlights pads for which test points have been generated.

4. If you need to generate test points for the opposite board side, **repeat** the procedure.

Menu: *Edit-Test Point-Insert-All Test Points*

Button:

Key: *None*

Generating Test Points for Netlist Data

FixMaster can generate test points for all pads mapped as probeable (Type-1 D Codes) in the D Code to Probe map, or for only selected probeable pads limited by the options you set.

To Generate Test Points for Netlist Data:

1. Set the Current Board Side.

2. To determine which pads are probeable and what types of probes can be used for each pad, map D Codes to Probe Codes. See *Map D Codes to Probe Codes* on page 129.

3. Go to the **Setup** menu and click **Test Point-Generate**.
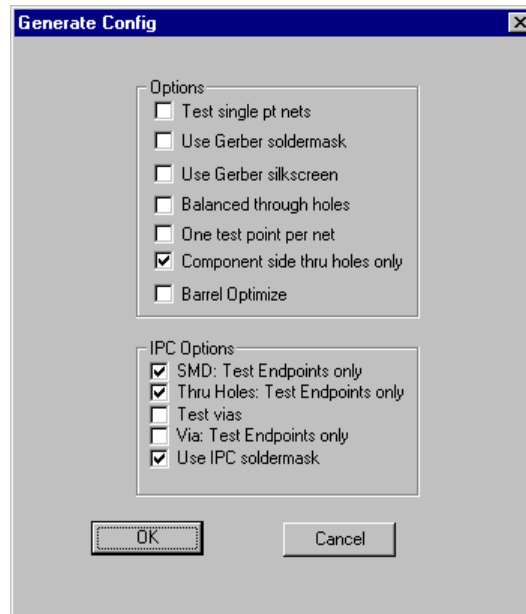
Set Up Test Point Generation

4. On the Generate Config dialog, set up the additional options for generating test points for netlists. These options are described in detail in the sections that follow this procedure.

   Options Group Box: You may select any of these options when generating test points for netlist data of any format. Not all options are compatible with other options.

   - **Test Single pt Nets:** See *Test Points for Single-Point Nets* on page 140.

   - **Use Gerber Soldermask:** See *No Test Points Covered by Gerber Soldermask* on page 143.

   - **Use Gerber Silkscreen:** See *No Test Points Covered by Gerber Silkscreen* on page 144.

   - **Balanced Through-Holes:** See *Equal Number of Through-Hole Test Points Per Board Side* on page 141.

- **One Test Point Per Net:** See *One Test Point Per Net* on page 141.
- **Component Side Through-Hole Only:** See *All Through-Hole Test Points on One Board Side* on page 142.
- **Barrel Optimize:** See *Through-Hole Test Points on Opposite Board Side from Incoming Trace* on page 143

IPC Options Group Box: You may select any of these options when generating test points for IPC format netlists with the appropriate records (including Lavenir formats .F02 and .F04). Not all options are compatible with other options.

- **SMD: Test Endpoints Only:** See *Surface-Mount Pads: Test Points for Endpoints Only* on page 145.
- **Through-Holes: Test Endpoints Only:** See *Through-Hole Pads: Test Points for Endpoints Only* on page 146.
- **Test Vias:** See *Test Points for Vias* on page 146.
- **Vias: Test Endpoints Only:** See *Vias: Test Points for Endpoints Only* on page 146.
- **Use IPC Soldermask:** See *No Test Points for Pads with IPC Soldermask Flags* on page 147.

When you have set the options you want, click **OK**.

5. On the **Edit** Menu, click **Test Point-Insert-All Test Points**.

   FixMaster generates the test points for the current board side as you specified.

   Test points are represented by blue crosshairs.

   FixMaster highlights pads for which test points have been generated.

6. If you need to generate test points for the opposite board side, **repeat** the procedure.

Menu: *Setup-Test Point-Generate*

Button: *None*

Key: *None*

Set Up Test Point Generation Options for Netlists
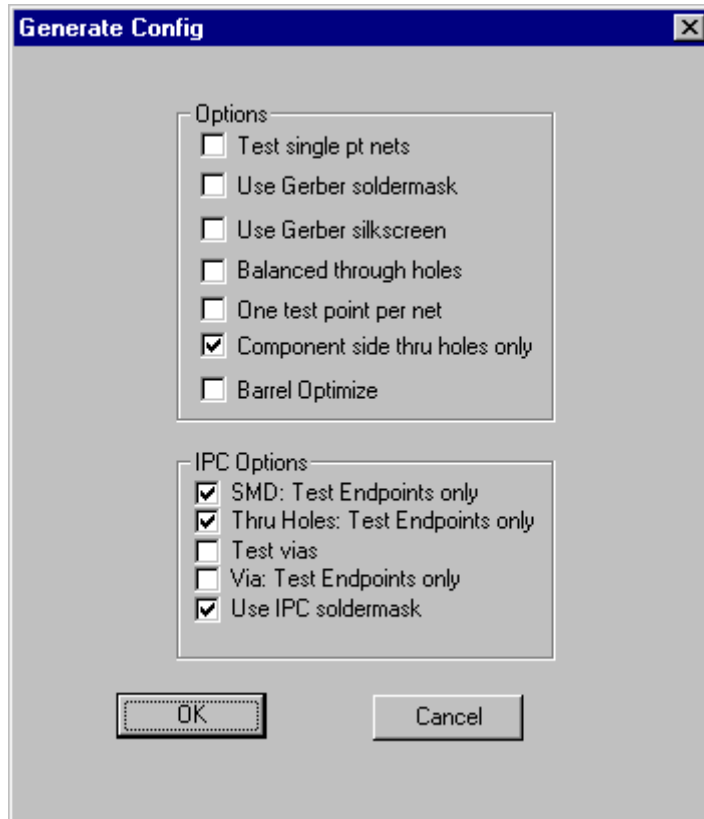
Set Up Test Point Generation

You may select any of the following options when generating test points for netlist data of any format.

Test Points for Single-Point Nets

FixMaster can either generate test points for single-point nets or ignore single-point nets when generating test points.

FixMaster looks at the net designation in the netlist data to determine if a net is a single-point net, and does not actually count the number of nodes in each net. Nets that have a net number of zero or are designated with an N/C are considered to be pads with no connections. If your netlist format does not designate non-connected pads this way, the option will not work.

- To generate test points for single-point nets, click the **Test Single Pt Nets** option so that it has a checkmark.

- To ignore single-point nets when generating test points for netlists, click this option so that it does not have a checkmark.

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One Test Point Per Net

If you are only testing for shorts between nets, and not testing for continuity, then you need only one test point per net.

- To generate a test point for only one node of each net, click the **One Test Point Per Net** option so that it has a checkmark.

- To generate test points for more than one node per net, click this option so that it does not have a checkmark.

Note: *This option can not be selected if any of the through-hole options are selected.*

Equal Number of Through-Hole Test Points Per Board Side

FixMaster can balance the number of test points generated for through holes on each side of the board.

- To generate an equal number of test points through holes on each side of the board, click on the **Balanced Through Holes** option so that it has a checkmark.

- If you want to use one of the other through-hole options or if you want through-hole test points to be generated for the current side each time you generate, click on the **Balanced Through Holes** option so that it does not have a checkmark.

Note: *This is one of the three options for generating test points for through holes when both sides of the board are going to be tested. Only one of these through-hole options can be selected at time, and they can not be used if the One Test Point Per Net option is selected. If none of these options are selected, then through-hole test points will be generated for the current board side. This means that you will have test points for both sides of each through hole if you generate test points for both sides of the board.*

All Through-Hole Test Points on One Board Side

FixMaster has an option that can be used to force through-hole test points to one side of the board. Generally if you are using this option, you want the through-hole test points on the component side, so this option is called Component Side Through-Holes Only. This option generates test points for through-holes on the current side only for through-holes that do not already have test points on the other side.

- If you want to use this option, click on the **Component Side Through-Holes Only** option so that it has a checkmark, and generate test points for the side that you want to have the through-hole test points. FixMaster puts test points everywhere that it can, including all probeable through-holes on the current side. Then when you generate test points for the other board side, FixMaster will not put a test point on the through-holes that received test points on the first board side.

- If you want to use one of the other through-hole options or if you want through-hole test points to be generated for the current side each time you generate, click on the **Component Side Through-Holes Only** option so that it does not have a checkmark.

Note: *This is one of the three options for generating test points for through holes when both sides of the board are going to be tested. Only one of these through-hole options can be selected at time, and they can not be used if the One Test Point Per Net option is selected. If none of these options are selected, then through-hole test points will be generated for the current board side. This means that you will have test points for both sides of each through hole if you generate test points for both sides of the board.*

Through-Hole Test Points on Opposite Board Side from Incoming Trace

FixMaster can place test points generated for through-holes on the opposite side of the board from an incoming trace. This allows the integrity of the through-hole to be tested.

Note: *This option is for dual-sided testers.*

- To generate through holes on the opposite side of the board from the incoming trace, click the **Barrel Optimize** option so that it has a checkmark.

   If you have turned on both the Barrel Optimize option and the Test Single Point Nets option, then when you generate test points, FixMaster will prompt for extra information regarding where to test single-point nets that are also through holes. A single-point through hole has no incoming trace, so you need to tell FixMaster where to place the test point. To place all test points for through-hole pads that are single-point nets on one side of the board, select either **CMP** for the component side or **SOL** for the solder side. To divide the number of test points for these pads equally between the two sides, select **BAL** for balance.

- If you want to use one of the other through-hole options or if you want through-hole test points to be generated for the current side each time you generate, click on the **Barrel Optimize** option so that it does not have a checkmark.

Note: *This is one of the three options for generating test points for through holes when both sides of the board are going to be tested. Only one of these through-hole options can be selected at time, and they can not be used if the One Test Point Per Net option is selected. If none of these options are selected, then through-hole test points will be generated for the current board side. This means that you will have test points for both sides of each through hole if you generate test points for both sides of the board.*

No Test Points Covered by Gerber Soldermask

To avoid having a probe hit soldermask instead of a pad, you may want to generate test points only for pads that are completely cleared of soldermask. FixMaster can compare PCB data to imported Gerber soldermask layers (MSU and MSL) to determine if PCB pads are completely cleared of soldermask. To import Gerber soldermask layers, see *Import Supplemental Gerber Files into the Job* on page 312.

- To generate test points only for pads that are completely cleared of Gerber soldermask, click the **Use Gerber Soldermask** option so that it has a checkmark.

   FixMaster does not generate test points for pads that are touched at all by soldermask and marks such pads as possibly probable, possibly covered pads. You can inspect the possibly covered pads manually and decide whether or not to add test points for these pads. See *Possibly Probeable, Possibly Covered Test Points* on page 148.

- To ignore the Gerber soldermask data when generating test points and to generate test points even for pads that may be touched by soldermask, click the **Use Gerber Soldermask** option so that it does not have a checkmark.

Another option for using soldermask data when generating test points is to use the soldermask flag in IPC format netlists with soldermask records (including Lavenir formats .F02 and .F04). See *No Test Points for Pads with IPC Soldermask Flags* on page 147.

No Test Points Covered by Gerber Silkscreen

To avoid having a probe hit silkscreen instead of a pad, you may want generate test points only for pads that are completely cleared of silkscreen. FixMaster can compare PCB data to imported Gerber silkscreen layers (SKU and SKL) to determine if PCB pads are completely cleared of silkscreen. For information on importing Gerber silkscreen layers, see *Import Supplemental Gerber Files into the Job* on page 312.

- To generate test points only for pads that are completely cleared of Gerber silkscreen, click the **Use Gerber Silkscreen** option so that it has a checkmark.

  FixMaster does not generate test points for pads that are touched at all by silkscreen and marks such pads as possibly probable, possibly covered pads. You can inspect the possibly covered pads manually and decide whether or not to add test points for these pads. See *Possibly Probeable, Possibly Covered Test Points* on page 148.

- To ignore the Gerber silkscreen data when generating test points and to generate test points even for pads that may be touched by silkscreen, click the **Use Gerber Silkscreen** option so that it does not have a checkmark.

IPC Options Group Box
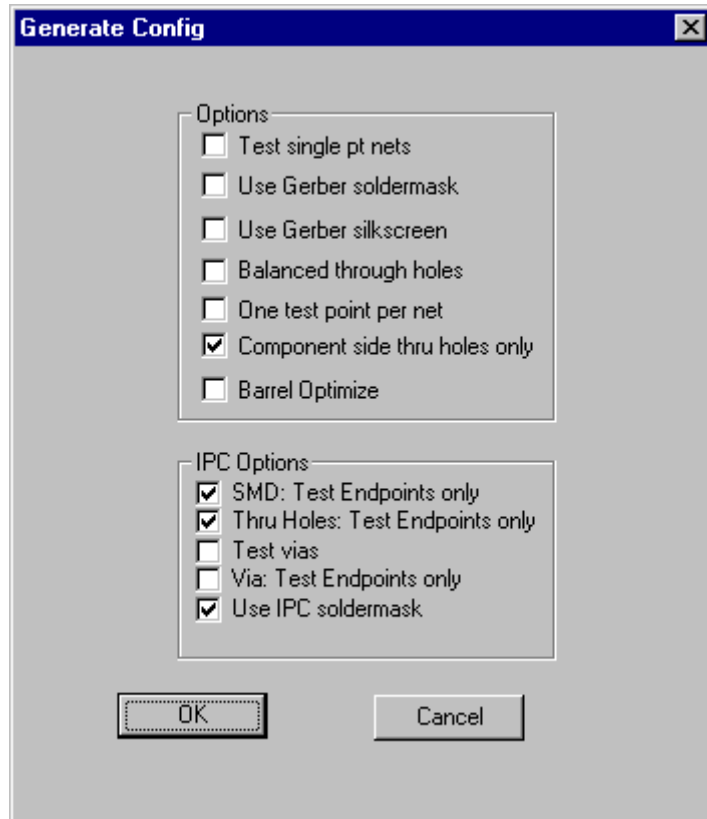
Set Up Test Point Generation

You may select any of these options when generating test points for IPC format netlists with the appropriate records (including Lavenir formats .F02 and .F04).

Surface-Mount Pads: Test Points for Endpoints Only

In order to reduce the number of probes, you may want to test only endpoints of a netlist. For IPC format netlists with midpoint records (including Lavenir formats .F02 and .F04), FixMaster allows you to limit test point generation for surface-mount pads to endpoints only or to generate test points for all surface-mount pads.

- For surface-mount pads, to generate test points only for netlist endpoints, click the **SMD: Test Endpoints Only** option so that it has a checkmark.

- To generate test points for all surface-mount pads, click the **SMD: Test Endpoints Only** option so that it does not have a checkmark.

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Through-Hole Pads: Test Points for Endpoints Only

In order to reduce the number of probes, you may want to test only endpoints of a netlist. For IPC format netlists with midpoint records (including Lavenir formats .F02 and .F04), FixMaster allows you to limit test point generation for through-hole pads to endpoints only or to generate test points for all through-hole pads.

- For through-hole pads, to generate test points only for netlist endpoints, click the **Through-Holes: Test Endpoints Only** option so that it has a checkmark.

- To generate test points for all through-hole pads, click the **Through-Holes: Test Endpoints Only** option so that it does not have a checkmark.

Vias: Test Points for Endpoints Only

In order to reduce the number of probes, you may want to test only endpoints of a netlist. For IPC format netlists with midpoint records (including Lavenir formats .F02 and .F04), FixMaster allows you to limit test point generation for vias to endpoints only or to generate test points for all vias.

- For vias, to generate test points only for netlist endpoints, click the **Vias: Test Endpoints Only** option so that it has a checkmark.

- To generate test points for all vias, click the **Vias: Test Endpoints Only** option so that it does not have a checkmark.

Test Points for Vias

In IPC format netlists with via records (including Lavenir formats .F02 and .F04), FixMaster allows you to control test point generation for vias.

- To generate test points for elements that are labeled as vias in the netlist data, click the **Test Vias** option so that it has a checkmark.

- If you do not want to generate test points for elements that are labeled as vias in the netlist data, click the **Test Vias** option so that it does not have a checkmark.

No Test Points for Pads with IPC Soldermask Flags

To avoid having a probe hit soldermask instead of a pad, you may want generate test points only for pads that are completely cleared of soldermask. FixMaster can use the soldermask flag in IPC format netlists with soldermask records (including Lavenir formats .F02 and .F04) to generate test points for pads that are not flagged as covered by soldermask.

FixMaster can compare PCB data to imported Gerber soldermask layers (MSU and MSL) to determine if PCB pads are completely cleared of soldermask.

- To generate test points only for pads that are not flagged in the IPC data as covered by soldermask, click the **Use IPC Soldermask** option so that it has a checkmark.

  FixMaster does not generate test points for pads that are flagged in the IPC data as covered by soldermask and marks such pads as possibly probable, possibly covered pads. You can inspect the possibly covered pads manually and decide whether or not to add test points for these pads. See *Possibly Probeable, Possibly Covered Test Points* on page 148.

- To ignore the IPC soldermask records when generating test points and to generate test points even for pads that may be covered by soldermask, click the **Use IPC Soldermask** option so that it does not have a checkmark.

Another option for using soldermask data when generating test points is to use imported Gerber soldermask layers (MSU and MSL) to determine if PCB pads are completely cleared of soldermask. See *No Test Points Covered by Gerber Soldermask* on page 143.

Possibly Probeable, Possibly Covered Test Points

When you have FixMaster generate test points using the options that look at soldermask or silkscreen data, FixMaster will identify pads that are partially covered by silkscreen or are not fully cleared of soldermask. Because these pads might be covered in such a way that makes them unprobeable, FixMaster does not give them a test point and highlights them in magenta.

FixMaster has a command that allows you to find each pad that may be probeable but was not automatically assigned test points.

After you activate the command and go to the possibly probeable pad, you decide if the pad should have a test point. If you are viewing Gerber soldermask or silkscreen data you can see if the pad is covered. If you are using an IPC-D-356 netlist, the soldermask data is a digital switch in the file that indicates the pad is covered or clear, and you will not be able to see the soldermask. If you determine the pad is probeable, you can insert a test point; otherwise, leave it unprobed.

For information on importing Gerber soldermask and silkscreen data, see *Import Supplemental Gerber Files into the Job* on page 312.

For information on using the soldermask and silkscreen data when generating test points, see *No Test Points Covered by Gerber Soldermask* on page 143, *No Test Points Covered by Gerber Silkscreen* on page 144 and *No Test Points for Pads with IPC Soldermask Flags* on page 147.

To Highlight Possibly Probeable, Possibly Covered Test Points:

➢ If the magenta highlighting for possibly probeable, possibly covered test points is not being displayed, go to the **Action** menu and click **Soldermask**.

To Go to Each Possibly Probeable, Possibly Covered Test Points:

1. On the **View** menu, click **Go To-Probeable TP**.

   The Probeable Test Point Tool is selected.

2. **Click** the mouse.

   The cursor hops to the next possibly probeable, possibly covered element. The element is marked with a green cross, indicating it is selected. Pads that are possibly probeable, but possibly covered are displayed in magenta.

3. If you determine the pad should be probed, use one of the commands for inserting test points. See *Insert Test Points* on page 149.

   The Probeable Test Point Tool remains selected until you select another tool or press the **Escape** key, so you can find one possibly probeable, possibly covered element after another by clicking the mouse.

Menu: *View-Go To-Probeable TP*

Button:

Key: *None*

Edit Test Points Manually

The following commands allow you to edit test points in FixMaster.

Insert Test Points

FixMaster has several commands for inserting test points manually.

To Insert Test Points Individually:

1. On the **Edit** Menu, click **Test Point-Insert-Insert Single Test Point**.

   The Insert Test Point tool is selected, and FixMaster prompts you to select an element.

2. Position the cursor inside a pad exactly where you want to insert the test point.

Tip:	*To place the test point at an exact location, you can use the Select Pad command, S, to put the test point in the center of the pad, or use the mouse or the cursor positioning commands, X and Y, then press Enter.*

3. With the cursor positioned where you want the test point, **click** the mouse or press **Enter**.

   FixMaster inserts a test point at the cursor position.

   The Insert Test Point tool remains selected until you select another tool or press the **Escape** key, so you can insert one test point after another before quitting the operation.

Menu: *Edit-Test Point-Insert-Insert Single Test Point*

Button: *then*

Key: *Shift+I*

To Insert Test Points in Pads in the Frame:

1. Position the Frame around a group of pads into which you want to insert test points.

2. On the **Edit** Menu, click **Test Point-Insert-Insert Test Point (D Code)**.
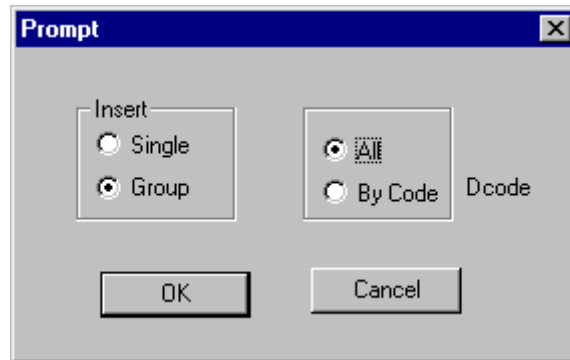
Insert Test Points in all Pads in Frame

3. On the Insert Test Point dialog, select **Group** and select **All**.

4. Click **OK**.

5. After the dialog disappears, click the mouse in the viewing area.

    FixMaster inserts test points in all the pads within the Frame.

Menu: *Edit-Test Point-Insert-Insert Test Point (D Code)*

Button: *None*

Key: *None*

To Insert Test Points in Pads of Current D Code in Frame:

1. Position the Frame around a group of pads into which you want to insert test points.

2. On the **Edit** Menu, click **Test Point-Insert-Insert Test Point (D Code)**.
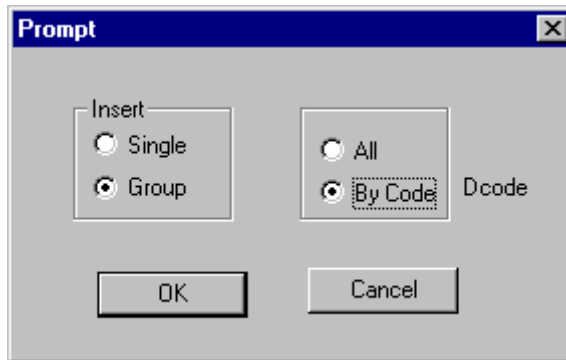
Insert Test Points in Pads of Current D Code in Frame

3. On the Insert Test Point dialog, select **Group** and select **D Code**.

4. Click **OK**.

   The Insert Test Point tool is selected, and FixMaster prompts you to select an element.

5. Position the cursor in a pad that has the D Code to which you want to insert test points.

6. **Click** the mouse or press **Enter**.

   The cursor hops to the center of the pad, and the D Code of pad becomes the current D Code shown in the Status Bar.

7. **Click** the mouse or press **Enter**.

   FixMaster inserts test points in all the pads within the Frame that have the current D Code.

   The Insert Test Point tool remains selected until you select another tool or press the **Escape** key, so you can insert test points in pads of one D Code after another before quitting the operation.

Menu: *Edit-Test Point-Insert-Insert Test Point (D Code)*

Button: *None*

Key: *None*

To Insert Test Points in a Single Net:

1. On the **Edit** Menu, click **Test Point-Insert-Insert Test Point (Net)**.
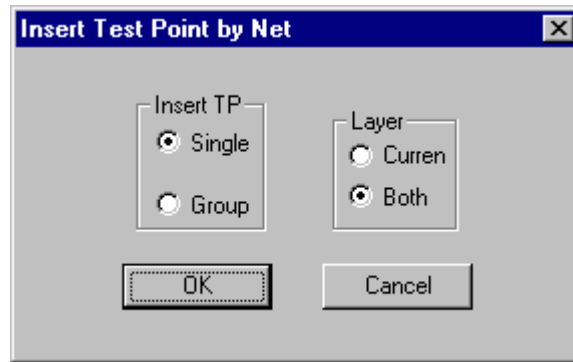
Insert Test Points in a Single Net

2. On the Insert Test Point by Net dialog, select **Single**, and select whether to insert on only the **Current** board side or **Both** sides.

3. Click **OK**.

   The Insert Test Point tool is selected, and FixMaster prompts you to select an element.

4. Position the cursor in a pad of the net to which you want to insert test points.

   The cursor hops to the center of the pad, and the Net Number of pad becomes the current Net Number shown in the Status Bar.

5. **Click** the mouse or press **Enter**.

   FixMaster inserts test points in all pads that have the current Net Number .

   The Insert Test Point tool remains selected until you select another tool or press the **Escape** key, so you can insert test points in one net after another before quitting the operation.

Menu: *Edit-Test Point-Insert-Insert Test Point (Net)*

Button: *None*

Key: *None*

To Insert Test Points in a Group of Nets in the Frame:

1. Position the Frame around a group of pads that all belong to the nets into which you want to insert test points.

    Note: *The Frame establishes which nets will have test points inserted, not which pads. Every net that has a pad inside the Frame will have test points inserted in pads that are both inside and outside the Frame.*

2. On the **Edit** Menu, click **Test Point-Insert-Insert Test Point (Net)**.
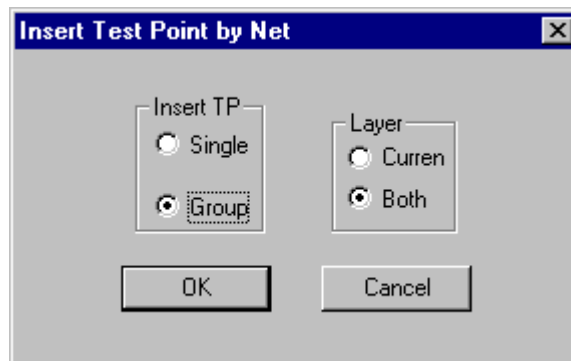
Insert Test Points in a Group of Nets in the Frame

3. On the Insert Test Point by Net dialog, select **Group**, and select whether to insert on only the **Current** board side or **Both** sides.

4. Click **OK**.

5. When the dialog disappears, **click** the mouse or press **Enter**.

    FixMaster inserts test points in all pads that have the same Net Number as the pads inside the Frame.

Menu: *Edit-Test Point-Insert-Insert Test Point (Net)*

Button: *None*

Key: *None*

Delete Test Points

FixMaster has several commands for deleting test points.

To Delete Test Points Individually:

1. On the **Edit** Menu, click **Test Point-Delete-Delete Single Test Point**.

    The Delete Test Point tool is selected, and FixMaster prompts you to select an element.

2. Position the cursor near a test point you want to delete.

3. **Click** the mouse or press **Enter**.

    The cursor hops to the test point and marks it with a yellow cross.

4. **Click** the mouse or press **Enter**.

    FixMaster deletes the marked test point.

    The Delete Test Point tool remains selected until you select another tool or press the **Escape** key, so you can delete one test point after another before quitting the operation.

Menu: *Edit-Test Point-Delete-Delete Single Test Point*

Button: *then* *then select Single on the dialog.*

Key: *None*

To Delete Test Points in Frame:

1. Position the Frame around a group of pads from which you want to delete test points.

2. On the **Edit** Menu, click **Test Point-Delete-Delete Test Point (D Code)**.
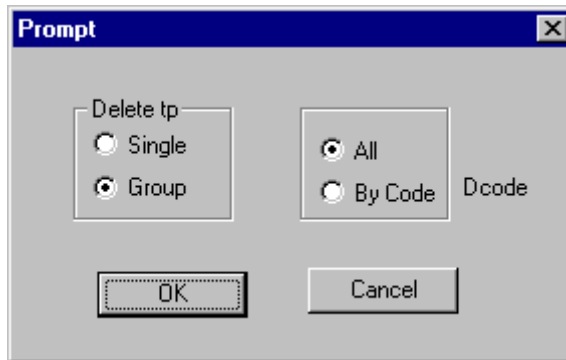
Delete Test Points from all Pads in Frame

3. On the Delete Test Point dialog, select **Group** and select **All**.

4. Click **OK**.

5. When the dialog disappears, click the mouse.

    FixMaster deletes test points from all the pads within the Frame.

Menu: Edit-Test Point-Delete-Delete Test Point (D Code)

Button: *then*

Key: None

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To Delete Test Points from Pads of Current D Code in Frame:

1. Position the Frame around a group of pads from which you want to delete test points.

2. On the **Edit** Menu, click **Test Point-Delete-Delete Test Point (D Code)**.
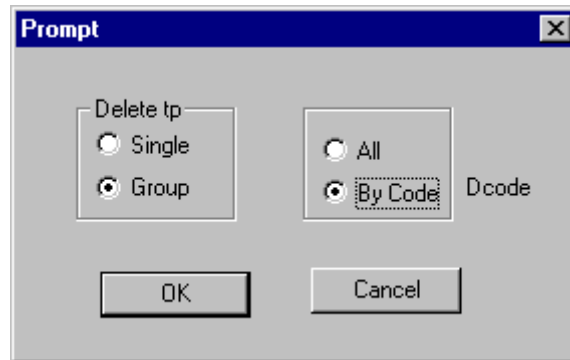
Delete Test Points from Pads of Current D Code in Frame

3. On the Delete Test Point dialog, select **Group** and select **D Code**.

4. Click **OK**.

    The Delete Test Point tool is selected, and FixMaster prompts you to select an element.

5. Position the cursor in a pad that has the D Code from which you want to delete test points.

6. **Click** the mouse or press **Enter**.

    The cursor hops to the test point in the pad, and the test point is marked with a green cross. The D Code of pad becomes the current D Code shown in the Status Bar.

7. **Click** the mouse or press **Enter**.

    FixMaster deletes test points from all the pads within the Frame that have the current D Code.

    The Delete Test Point tool remains selected until you select another tool or press the **Escape** key, so you can delete test points from pads of one D Code after another before quitting the operation.

Menu: Edit-Test Point-Delete-Delete Test Point (D Code)

Button: ![+] *then* ![cursor]

Key: None

To Delete Test Points from a Single Net:

1. On the **Edit** Menu, click **Test Point-Delete-Delete Test Point (Net)**.
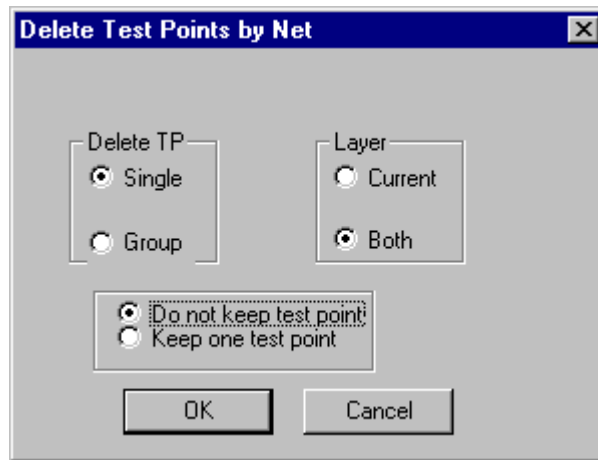
Delete Test Points from a Single Net

2. On the Delete Test Point by Net dialog, select **Single** and select whether to delete on only the **Current** board side or **Both** sides.

3. Select whether to **keep one test point** in each net for which you delete test points, or to **delete all test points in each net**.

4. Click **OK**.

   The Delete Test Point tool is selected, and FixMaster prompts you to select an element.

5. Position the cursor in a pad of the net from which you want to delete test points.

   The cursor hops to the center of the pad, and the Net Number of pad becomes the current Net Number shown in the Status Bar.

6. **Click** the mouse or press **Enter**.

   FixMaster deletes test points in all pads that have the current Net Number .

   The Delete Test Point tool remains selected until you select another tool or press the **Escape** key, so you can delete test points from one net after another before quitting the operation.

Menu: *Edit-Test Point-Delete-Delete Test Point (Net)*

Button: *None*

Key: *None*

To Delete Test Points from a Group of Nets in the Frame:

1. Position the Frame around a group of pads that all belong to the nets from which you want to delete test points.

Note: *The Frame establishes which **nets** will have test points deleted, not which **pads**. Every net that has a pad inside the Frame will have test points deleted from pads that are both inside and outside the Frame.*

2. On the **Edit** Menu, click **Test Point-Delete-Delete Test Point (Net)**.
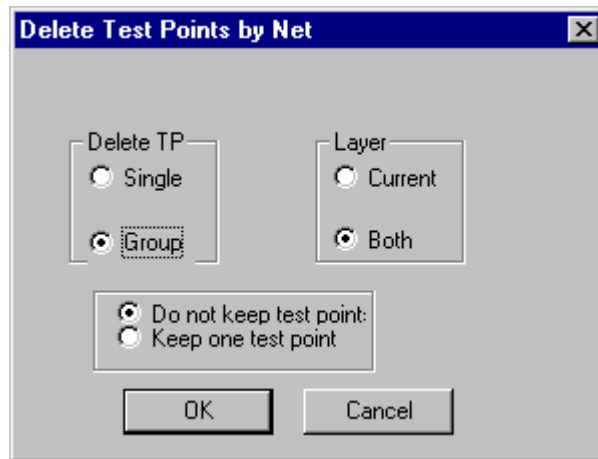
Delete Test Points from a Group of Nets in the Frame

3. On the Delete Test Point by Net dialog, select **Group** and select whether to delete on only the **Current** board side or **Both** sides.

4. Select whether to keep one test point in each net for which you delete test points, or to delete all test points in each net.

5. Click **OK**.

6. **Click** the mouse or press **Enter**.

   FixMaster deletes test points from all pads that have the same Net Number as the pads inside the Frame.

Menu: *Edit-Test Point-Delete-Delete Test Point (Net)*

Button: *None*

Key: *None*

Move Test Points

You can move an assigned test point within its pad.

To Move an Assigned Test Point:

1. On the **Edit** Menu, click **Test Point-Move-Assigned Test Point**.

2. Position the cursor near a test point that has been assigned to a point on the tester grid.

3. **Click** the mouse or press **Enter**.

    The cursor hops to the test point and marks it with a green cross.

4. Position the cursor where you want to move the test point to.

5. **Click** the mouse or press **Enter**.

    If the new test point position will not cause problems, the test point is moved to the new position and remains assigned to the same fixture grid point.

    If the new test point position will create crossed pins or breakouts or exceed the maximum pin deflection, FixMaster displays a dialog describing the problem and prompts whether to proceed.

    This Test Point Moving Tool remains selected until you select another tool or press the **Escape** key, so you can move one test point after another before quitting the operation.

Menu: *Edit-Test Point-Move-Assigned Test Point*

Button: *None*

Key: *None*

To Move a Single Unassigned Test Point:

1. On the **Edit** Menu, click **Test Point-Move-Unassigned Test Point**.
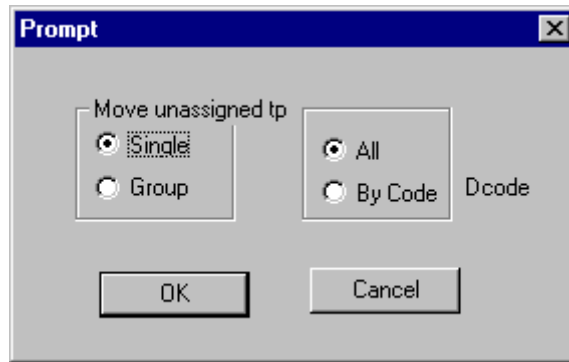
Move a Single Unassigned Test Point

2. On the Move Unassigned Test Point dialog, select **Single**.

3. Click **OK**.

    The Move Unassigned Test Point tool is selected, and FixMaster prompts you to select an element.

4. Position the cursor near a test point that has not been assigned to a point on the tester grid.

5. **Click** the mouse or press **Enter**.

    The cursor hops to the test point and marks it with a green cross.

6. Position the cursor where you want to move the test point to.

7. **Click** the mouse or press **Enter**.

    The test point moves to the new position.

    The Move Unassigned Test Point tool remains selected until you select another tool or press the **Escape** key, so you can move one test point after another before quitting the operation.

Menu: *Edit-Test Point-Move-Unassigned Test Point*

Button: ⊞ *then* ⧉

Key: *None*

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To Move Unassigned Test Points in the Frame:

1. Position the Frame around a group of unassigned test points that you want to move.
2. On the **Edit** Menu, click **Test Point-Move-Unassigned Test Point**.

Move Unassigned Test Points in the Frame

3. On the Move Unassigned Test Point dialog, select **Group** and select **All**.
4. Click **OK**.
5. Position the cursor near one of the test points you want to move.
6. **Click** the mouse or press **Enter**.

    The cursor hops to the test point and marks it with a green cross.

7. Position the cursor where you want the marked test point to move to.
8. **Click** the mouse or press **Enter**.

    All the unassigned test points in the Frame move as a group so that the marked test point moves to the new position.

    The Move Unassigned Test Point tool does not remain selected.

Menu: *Edit-Test Point-Move-Unassigned Test Point*

Button: *then*

Key: *None*

To Move Unassigned Test Points in Pads of Current D Code in Frame:

1. Position the Frame around a group of unassigned test points that you want to move.

2. On the **Edit** Menu, click **Test Point-Move-Unassigned Test Point**.
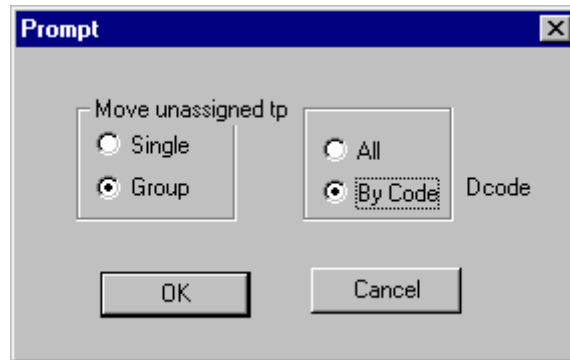
Move Unassigned Test Points in Pads of Current D Code

3. On the Move Unassigned Test Point dialog, select **Group** and select **D Code**.

4. Click **OK**.

   The Move Unassigned Test Point tool is selected, and FixMaster prompts you to select an element.

5. Position the cursor near a test point in a pad that has the D Code for which you want to move test points.

6. **Click** the mouse or press **Enter**.

   The cursor hops to the test point in the pad, and the test point is marked with a green cross. The D Code of pad becomes the current D Code shown in the Status Bar.

7. Position the cursor where you want the marked test point to move to.

8. **Click** the mouse or press **Enter**.

   All the unassigned test points in the Frame that have the same D Code move as a group so that the marked test point moves to the new position.

   The Move Unassigned Test Point tool remains selected until you select another tool or press the **Escape** key, so you can move test points in pads of one D Code after another before quitting the operation.

Menu: *Edit-Test Point-Move-Unassigned Test Point*

Button: *then*

Key: *None*

Transfer Test Point to other Side of Board

FixMaster allows you to transfer a single through-hole test point or a group of through-hole test points selected by the Frame to the other side of the board. If you are doing a dual sided test, this can help to alleviate density problems by moving a test point from the denser side to the less dense side.

To Transfer a Single Through-Hole Test Point to the Opposite Side:

1. On the **Edit** Menu, click **Test Point-Move-Xfer Thru Hole Test Point**.
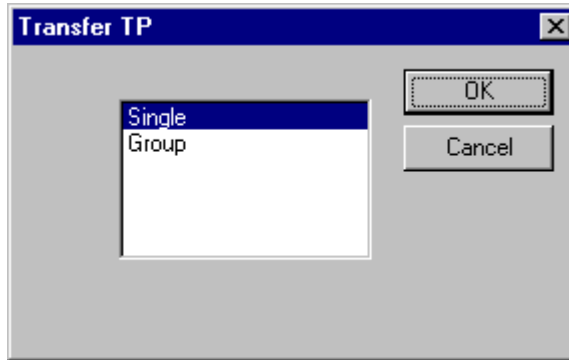
Transfer a Single Through-Hole Test Point to the Opposite Side

2. On the Transfer Test Point dialog, select **Single**.

3. Click **OK**.

   The Transfer Test Point tool is selected, and FixMaster prompts you to select an element.

4. Position the cursor near a through hole test point that you want to transfer to the other side of the board.

5. **Click** the mouse or press **Enter**.

   The cursor hops to the test point and marks it with a green cross.

6. **Click** the mouse or press **Enter**.

   The test point transfers to the other side of the board.

   The Transfer Test Point tool remains selected until you select another tool or press the **Escape** key, so you can transfer one test point after another before quitting the operation.

Menu: *Edit-Test Point-Move-Xfer Thru Hole Test Point*

Button: *None*

Key: *None*

To Transfer All Through-Hole Test Points in the Frame to the Opposite Side:

1. Position the Frame around the through-hole test points you want to transfer to the other side of the board.

2. On the **Edit** Menu, click **Test Point-Move-Xfer Thru Hole Test Point**.
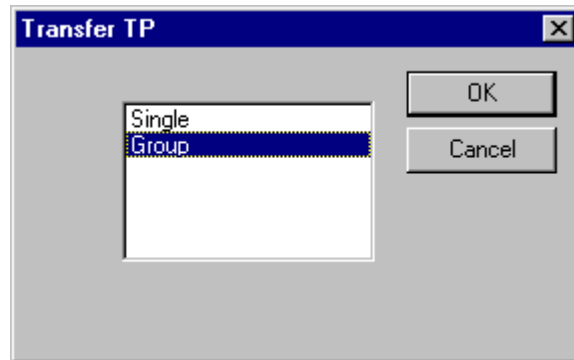
Transfer All Through-Hole Test Points in the Frame to the Opposite Side

3. On the Transfer Test Point dialog, select **Group**.

4. Click **OK**.

5. **Click** the mouse or press **Enter**.

   FixMaster transfers all through-hole test points within the Frame to the other side of the board.

   The Transfer Test Point tool does not remain selected.

Menu: *Edit-Test Point-Move-Xfer Thru Hole Test Point*

Button: *None*

Key: *None*

Stagger Test Points

FixMaster can stagger test points for rectangular surface-mount pads and for through-hole pads. There are automatic features for staggering groups of test points, or you can stagger individual test points manually.

Why Stagger Surface-Mount Pads?

By staggering test points for rectangular surface-mount pads, you can relieve some of the problems of testing dense boards, such as head butts.

Why Stagger Through-Hole Pads?

By staggering test points for through-hole pads, you can have the probe hit the pad instead of the hole.

Distance a Test Point is Staggered

The distance a test point is staggered depends on the probe that is associated with that test point. Each Probe Code has a Margin value that determines the distance that test points associated with that Probe Code will be staggered. For information on the other entries on the Probe Setup dialog, see *Setting up the Probes* on page 70.

Set up the Probe Stagger Margin:

1. Set the Current Board Side.

2. Click **Setup-Fixture-Probe**.
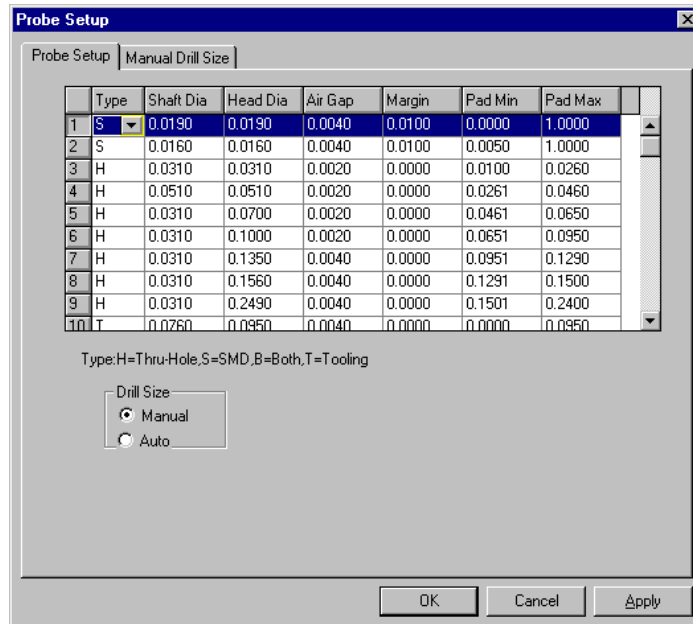
Probe Setup Tab

3. On the Probe Setup Tab, enter a **Margin** for each probe.

Margin for Surface-Mount Pads

For surface-mount pads, the Margin is measured from the end of the pad. So a staggered test point will be positioned at a distance from the end of the pad that is equal to the Margin.

Margin for Through-Holes

For through-hole pads, the Margin is measured outward from the hole center or inward from the hole edge, as selected on the Stagger dialog. In order to stagger a test point beyond the edge of the hole and probe the covering pad, the Margin factor should be negative, and the distance should be measured from the edge of the hole.

Surface-Mount Pads Stagger Options

Options for how to stagger test points for surface-mount pads are set on the SMD tab of the Stagger Setup dialog. This dialog can be displayed by clicking **Setup-Test Point-Stagger**, but it is also displayed in many of the procedures for staggering described in the sections that follow.
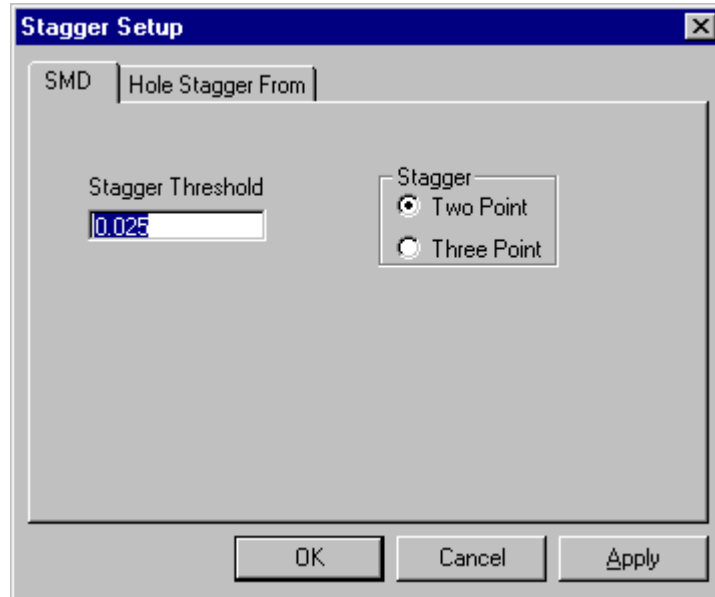
Stagger Setup SMD Tab

Stagger Threshold

Enter a minimum pad size to determine which rectangular surface-mount pads will have staggered test points. Any rectangular SMD pad with a side less than or equal to the Stagger Threshold value will have its test point staggered.

Two/Three-Point Stagger

Select the option for either a two-point or three-point stagger. A two-point stagger puts a test point at either of the two extremes of the pad. A three-point stagger puts a test point at either of the two extremes of the component or in the middle of the component.

Through Hole Stagger Options

Options for staggering test points for through-hole pads are set on the Hole Stagger From tab of the Stagger Setup dialog. This dialog can be displayed by clicking **Setup-Test Point-Stagger**, but it is also displayed in many of the procedures for staggering described in the sections that follow.
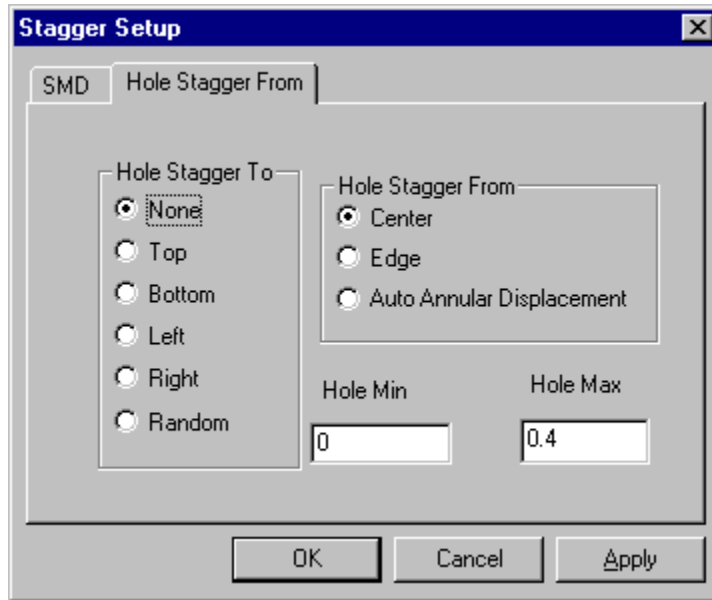
Stagger Setup Dialog, Hole Stagger From Tab

Hole Stagger To

Select the direction to stagger through-hole test points toward.

- **None:** Do not stagger through-hole test points.
- **Top:** Stagger through-hole test points toward the top of the pad.
- **Bottom:** Stagger through-hole test points toward the bottom of the pad.
- **Left:** Stagger through-hole test points toward the left of the pad.
- **Right:** Stagger through-hole test points toward the right of the pad.
- **Random:** Randomly staggers test points to the top, bottom, left and right.

Hole Stagger From

Select where to measure the stagger distance from.

- **Center:** Stagger by a distance measured from the hole center point.

- **Edge:** Stagger by a distance measured from the hole edge.

- **Auto Annular Displacement:** For netlists that also contain covering pad data for through holes in addition to the hole size, test points for through holes can also be automatically staggered to a point midway between the hole edge and the covering pad edge.

Hole Min and Max

Set the **minimum** and **maximum size through-hole pads** for which you want to stagger test points. Through-holes smaller than the minimum or larger than the maximum will not have test points staggered.

Staggering All Test Points Automatically

FixMaster can stagger all surface-mount and through-hole test points on the current board side automatically.

Note: *This operation unassigns all staggered test points.*

To Stagger All Test Points Automatically:

1. Set the Current Board Side.

2. You may have already set up the Probe Code parameters in the fixture configuration procedures.

   If not, click **Setup-Fixture-Probe** and set up the **Margin** for each probe. See *Distance a Test Point is Staggered* on page 166.

   The distance a test point is staggered is equal to the Margin for the Probe Code mapped to the staggered test point.

   - **Surface-Mount Pads:** The Margin is measured from the end of the pad.

   - **Through-Holes:** The Margin is measured outward from the hole center or inward from the hole edge, as selected on the Stagger dialog. In order to stagger a test point beyond the edge of the hole and probe the covering pad, the Margin factor should be negative, and the distance should be measured from the edge of the hole.

3. On the **Edit** Menu, click **Test Point-Stagger-All**.

4. On the SMD tab of the Stagger dialog, set options for staggering test points for **surface-mount pads**:

   Stagger Threshold: Enter a **pad size minimum** to determine which rectangular surface-mount pads will have staggered test points. Any rectangular SMD pad with a side less than or equal to the Stagger Threshold value will have its test point staggered.

   Stagger: Select the option for either a **two-point** or **three-point** stagger. A two-point stagger puts a test point at either of the two extremes of the pad. A three-point stagger puts a test point at either of the two extremes of the component or in the middle of the component.

5. On the Hole Stagger From tab of the Stagger dialog, set options for staggering test points for **through-hole pads**:

   Hole Stagger To: Select the direction to stagger through-hole test points toward.

   - **None:** Do not stagger through-hole test points.

   - **Top:** Stagger through-hole test points toward the top of the pad.

   - **Bottom:** Stagger through-hole test points toward the bottom of the pad.

   - **Left:** Stagger through-hole test points toward the left of the pad.

   - **Right:** Stagger through-hole test points toward the right of the pad.

   - **Random:** Randomly staggers test points to the top, bottom, left and right.

Hole Stagger From: Select where to measure the stagger distance from.

- **Center:** Stagger by a distance measured from the hole center point.

- **Edge:** Stagger by a distance measured from the hole edge.

- **Auto Annular Displacement:** For netlists that also contain covering pad data for through holes in addition to the hole size, test points for through holes can also be automatically staggered to a point midway between the hole edge and the covering pad edge.

Hole Min and Max: Set the **minimum** and **maximum size through-hole pads** for which you want to stagger test points. Through-holes smaller than the minimum or larger than the maximum will not have test points staggered.

6. Click **OK**.

   FixMaster automatically staggers the test points as you specified.

7. If you need to stagger test points for the opposite side of the board, repeat the procedure.

Menu: *Edit-Test Point-Stagger-All*

Button:

Key: *Ctrl+Shift+F9*

Manually Staggering Individual Test Points

FixMaster allows you to manually stagger individual surface-mount test points on the current board side.

Note: *This operation does not unassign staggered test points the way that automatically staggering all test points and staggering test points in the Frame does.*

To Manually Stagger Individual Test Points:

1. Set the Current Board Side.

2. You may have already set up the Probe Code parameters in the fixture configuration procedures.

    If not, click **Setup-Fixture-Probe** and set up the **Margin** for each probe.

    The distance a test point is staggered is equal to the Margin for the Probe Code mapped to the staggered test point.

    - **Surface-Mount Pads:** The Margin is measured from the end of the pad.

    - **Through-Holes:** The single stagger operation does not stagger test points for through holes.

3. On the **Setup** Menu, click **Test Point-Stagger**.

4. On the SMD tab of the Stagger dialog, set options for staggering test points for **surface-mount pads**:

    Stagger Threshold: Enter a **pad size minimum** to determine which rectangular surface-mount pads will have staggered test points. Any rectangular SMD pad with a side less than or equal to the Stagger Threshold value will have its test point staggered.

    Stagger: Select the option for either a **two-point** or **three-point** stagger. A two-point stagger puts a test point at either of the two extremes of the pad. A three-point stagger puts a test point at either of the two extremes of the component or in the middle of the component.

5. The single stagger operation does not stagger test points for through holes, so the settings on the Hole Stagger From tab of the Stagger dialog are unimportant.

6. Click **OK**.

7. On the **Edit** Menu, click **Test Point-Stagger-Single**.

8. Click on the **Test Point** you want to stagger.

9. Click on the **stagger position** that you want to move the test point to, at either of the two extremes of the component or in the middle of the component.

    FixMaster staggers the test point to the position you specified.

Menu: *Edit-Test Point-Stagger-Single*

Button: *None*

Key: *Shift+F9*

Staggering Test Points in the Frame

FixMaster can stagger all surface-mount and through-hole test points on the current board side inside the Frame.

Note: *This operation unassigns all staggered test points in the Frame.*

To Stagger Test Points in the Frame:

1. Set the Current Board Side.

2. You may have already set up the Probe Code parameters in the fixture configuration procedure.

    If not, click **Setup-Fixture-Probe** and set up the **Margin** for each probe.

    The distance a test point is staggered is equal to the Margin for the Probe Code mapped to the staggered test point.

    -   **Surface-Mount Pads:** The Margin is measured from the end of the pad.

    -   **Through-Holes:** The Margin is measured outward from the hole center or inward from the hole edge, as selected on the Stagger dialog. In order to stagger a test point beyond the edge of the hole and probe the covering pad, the Margin factor should be negative, and the distance should be measured from the edge of the hole.

3. Position the Frame around the test points that you want to stagger.

4. On the **Edit** Menu, click **Test Point-Stagger-Window**.

5. On the SMD tab of the Stagger dialog, set options for staggering test points for **surface-mount pads**:

    Stagger Threshold: Enter a **pad size minimum** to determine which rectangular surface-mount pads will have staggered test points. Any rectangular SMD pad with a side less than or equal to the Stagger Threshold value will have its test point staggered.

    Stagger: Select the option for either a **two-point** or **three-point** stagger. A two-point stagger puts a test point at either of the two extremes of the pad. A three-point stagger puts a test point at either of the two extremes of the component or in the middle of the component.

6. On the Hole Stagger From tab of the Stagger dialog, set options for staggering test points for **through-hole pads**:

    Hole Stagger To: Select the direction to stagger through-hole test points toward.

    -   **None:** Do not stagger through-hole test points.

    -   **Top:** Stagger through-hole test points toward the top of the pad.

    -   **Bottom:** Stagger through-hole test points toward the bottom of the pad.

    -   **Left:** Stagger through-hole test points toward the left of the pad.

    -   **Right:** Stagger through-hole test points toward the right of the pad.

    -   **Random:** Randomly staggers test points to the top, bottom, left and right.

Hole Stagger From: Select where to measure the stagger distance from.

- **Center:** Stagger by a distance measured from the hole center point.

- **Edge:** Stagger by a distance measured from the hole edge.

- **Auto Annular Displacement:** For netlists that also contain covering pad data for through holes in addition to the hole size, test points for through holes can also be automatically staggered to a point midway between the hole edge and the covering pad edge.

Hole Min and Max: Set the **minimum** and **maximum size through-hole pads** for which you want to stagger test points. Through-holes smaller than the minimum or larger than the maximum will not have test points staggered.

7. Click **OK**.

   FixMaster staggers the test points inside the Frame as you specified.

Menu: *Edit-Test Point-Stagger-Window*

Button: *None*

Key: *None*

Swapping the Stagger Position of Staggered Points in the Frame

FixMaster can swap the stagger position of staggered test points for surface mount pads on the current board side in the Frame.

Note: *This operation unassigns all staggered test points in the Frame.*

To Swap the Stagger Position of Staggered Test Points in the Frame:

1. Set the Current Board Side.

2. Position the Frame around the staggered test points for which you want to swap stagger positions.

3. On the **Edit** Menu, click **Test Point-Stagger-Swap Stagger**.

   FixMaster swaps the stagger position of all staggered test points for surface mount pads inside the Frame. Staggered test points that were at one end of the pad are staggered to the other end. Test points in the center of the pad remain there.

Menu: *Edit-Test Point-Stagger-Swap Stagger*

Button: *None*

Key: *Ctrl+F9*

Window Stagger with Margin

This command staggers a group of test points inside the Frame using a new Margin value, without resetting the margin in the Probe Setup dialog. For information about staggering a group of test points in the Frame without setting a unique margin value, see *Staggering Test Points in the Frame* on page 173. For information about setting the Margin value on the probe Setup dialog, see *Setting up the Probes* on page 70.
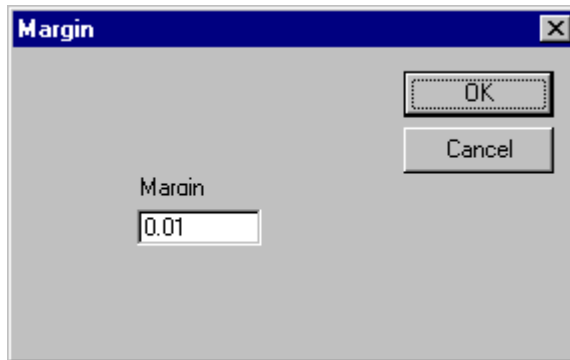
Stagger Margin

Menu: *Edit-Test Point-Stagger-Window Stagger with Margin*

Button: *None*

Key: *None*

Microstagger for Luther Maelzer Testers

The microstagger feature is unique to Luther Maelzer testers. When the microstagger feature is used, every other SMD test point is moved by the selected amount in a random up, down, left, or right direction. The movement of those test points is saved in the Luther Maelzer export files. The Luther Maelzer machine can use the information to check for false opens by moving the test plate.

To Microstagger the Test Points for Luther Maelzer Testers:

1. On the **Edit** menu, click **Test Point-Stagger-Microstagger**.
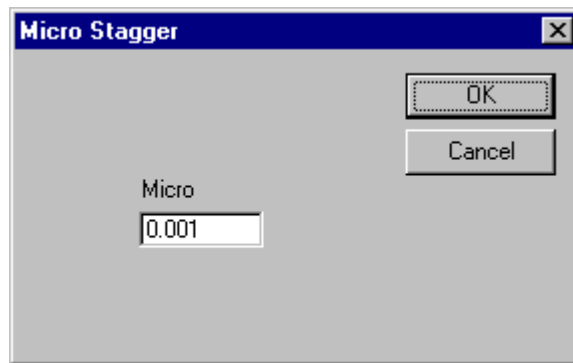
Microstagger

2. On the Micro Stagger dialog, enter the **distance** to microstagger the test points.

3. Click **OK**.

   FixMaster indicates the microstagger by showing a small blue arrow next to the test points that have been microstaggered.

4. When you export the files, select the **QSA** option to include the microstagger information in the export. See *Export Luther & Maelzer Test Files* on page 330.

Menu: *Edit-Test Point-Stagger-Mocrostagger*

Button: *None*

Key: *None*

Chapter 11
Assign Test Points to Tester Grid Points

In a fixture, probes connect test points on the board to tester grid points. The primary function of FixMaster is to assign test points to tester grid points. Once this is done, the program can then export drill files for making the fixture and output tester download files for testing the boards.

FixMaster has features that automatically assign test points to tester grid points. When automatically assigning test points to grid, FixMaster can give priority to certain areas of the board or to certain types of probes. In addition to the automatic features, FixMaster has features for manually editing test point assignments.

Assigning All Test Points to Tester Grid Points

FixMaster has a feature that attempts to automatically assign all test points on the current board side to tester grid points. The operation uses the grid configuration and pin deflection settings set up in the fixture configuration procedure. See *Set Up the Fixture Configuration* on page 51. Within those rules, FixMaster attempts to assign as many test points as possible to grid points.

Note: *This command un-assigns any previously assigned test points before beginning. So, if you have test point assignments that you want to keep, use one of the other test point-assignment routines, such as Assign Test Points in the Frame to Tester Grid Points. See **Assigning Test Points in the Frame to Tester Grid Points** on page 179.*

To Assign All Test Points to Tester Grid Points:

1. Set the current board side.

2. On the **Edit** menu, click **Test Points-Assign to Grid-All (Drop Pins).**

   FixMaster assigns as many test points as possible to grid points.

   In the viewing area, probes (shown as blue lines) connect tester grid points (shown as red crosshairs) to test points (shown as blue crosshairs).

   FixMaster automatically runs a fixture design rule check and reports:

   - Number of Unassigned Test Points. See *Unassigned Test Points* on page 197.

   - Number of Crossed Pins. See *Crossed Pins and Head Butts* on page 199.

   - Number of Breakouts. See *Breakouts* on page 201.

   For information on the design rule checks, see *Check for Design Rule Errors* on page 195.

Menu: *Edit-Test Point-Assign to Grid-All (Drop Pins)*

Button:

Key: *Ctrl+Shift+J*

Assigning All Test Points to Tester Grid Points Based on Density

FixMaster has a feature that calculates dense areas of the board and attempts to automatically assign all test points on the current board side to tester grid points, starting with the densest regions. The operation uses the grid configuration and pin deflection settings set up in the fixture configuration procedure. See *Set Up the Fixture Configuration* on page 51. Within those rules, and starting with the densest areas first, FixMaster attempts to assign as many test points as possible to grid points.

To Assign All Test Points to Tester Grid Points Based on Density:

1. Set the current board side.

2. On the **Edit** menu, click **Test Points-Assign to Grid-Density Drop**.

   FixMaster calculates the densest areas of the board, then assigns as many test points as possible to grid points, starting with the densest areas.

   In the viewing area, probes (shown as blue lines) connect tester grid points (shown as red crosshairs) to test points (shown as blue crosshairs).

   FixMaster automatically runs a fixture design rule check and reports:

   - Number of Unassigned Test Points. See *Unassigned Test Points* on page 197.

   - Number of Crossed Pins. See *Crossed Pins and Head Butts* on page 199.

   - Number of Breakouts. See *Breakouts* on page 201.

   For information on the design rule checks, see *Check for Design Rule Errors* on page 195.

Menu: *Edit-Test Point-Assign to Grid-Density Drop*

Button: *None*

Key: *None*

Assigning Test Points in the Frame to Tester Grid Points

FixMaster has a feature that attempts to automatically assign all test points within the Frame and on the current board side to tester grid points. The operation uses the grid configuration and pin deflection settings set up in the fixture configuration procedure. See *Set Up the Fixture Configuration* on page 51. Within those rules, FixMaster attempts to assign as many test points as possible to grid points.

Note: *This operation can be useful for correcting the fixture design rule errors automatically. For information on the design rule checks, see* **Check for Design Rule Errors** *on page 195.*

To Assign Test Points in the Frame to Tester Grid Points:

1. Set the current board side.

2. Position the Frame around the test points you want to assign. Be sure to enclose both the test points you want to assign and the tester grid points you want available.

3. On the **Setup** menu, click **Configuration**.
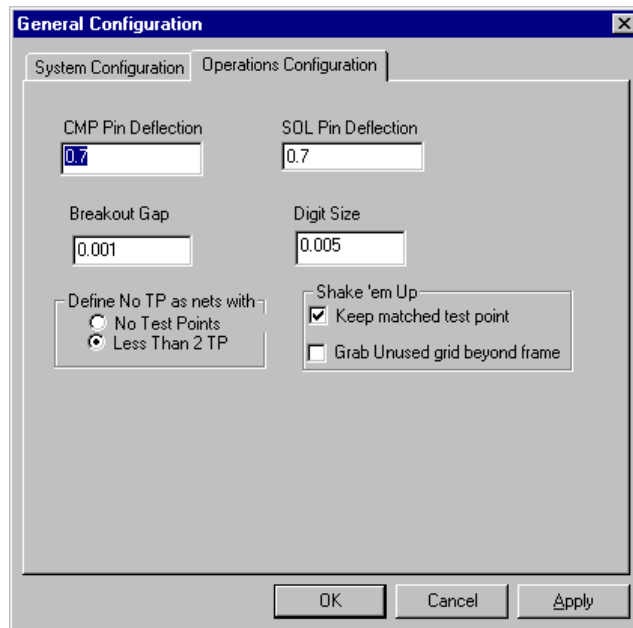
Shake 'em Up Options on Operations Configuration Tab

4. On the Operations Configuration tab, set the **Shake 'em Up** settings:

Keep Matched Test Point: Determines whether the operation keeps or reassigns previously assigned test points.

- **To keep**, and not reassign, previously assigned test points within the Frame, click this option so that it has a **checkmark**.

- **To un-assign and reassign** previously assigned test points within the Frame, click this option so that it **does not have a checkmark**.

Grab Unused Test Point Beyond Frame: Determines whether the operation includes tester grid points beyond the edge of the Frame or only grid points inside the Frame.

- To use the closest available tester grid points including those outside the Frame when assigning test points within the Frame, click this option so that it has a checkmark.

- To use only tester grid points inside the Frame when assigning test points within the Frame, click this option so that it does not have a checkmark.

5. On the **Edit** menu, click **Test Points-Assign to Grid-By Window (Shake 'Em Up)**.

FixMaster assigns as many test points in the Frame as possible to grid points.

In the viewing area, probes (shown as blue lines) connect tester grid points (shown as red crosshairs) to test points (shown as blue crosshairs).

FixMaster automatically runs a fixture design rule check on the Frame area and reports:

- Number of Unassigned Test Points. See *Unassigned Test Points* on page 197.

- Number of Crossed Pins. See *Crossed Pins and Head Butts* on page 199.

- Number of Breakouts. See *Breakouts* on page 201.

For information on the design rule checks, see *Check for Design Rule Errors* on page 195.

Menu: *Edit-Test Point-Assign to Grid-By Window (Shake 'Em Up)*

Button:

Key: *None*

Assigning Test Points in a Priority Region to Tester Grid Points

FixMaster can give priority to designated regions of the PCB when automatically assigning test points to grid points.

By assigning high-density regions of the board to the tester grid before assigning the rest of the test points, you increase the chance of having the entire high-density region assigned on the first try. Use this technique to assign ball grid arrays and other high-density regions.

Note: *This operation does not unassign any assigned test points before making the new test point assignments.*

To Assign Test Points in a Priority Region to Tester Grid Points:

1. Set the current board side.

2. On the **Edit** menu, click **Test Points-Assign to Grid-Priority Drop**.

3. On the Priority Drop dialog, select **By Region** and click **OK**.
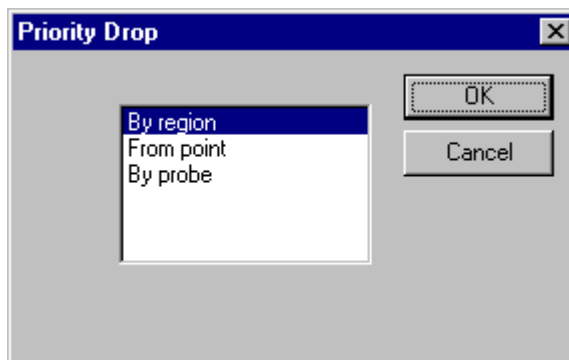
Priority Drop by Region

4. Click and **drag the mouse** to select the area for priority drop the same way you would make a Frame selection.

    FixMaster shows the priority region with a green box.

5. The region selection function remains active so that you can designate more than one priority region by dragging the mouse over as many priority areas as you want.

6. After you have designated all of the priority regions, **double-click** the mouse button to start the operation.

    FixMaster assigns the priority regions first, and then assigns as many of the rest of the test points as possible.

    In the viewing area, probes (shown as blue lines) connect tester grid points (shown as red crosshairs) to test points (shown as blue crosshairs).

    FixMaster automatically runs a fixture design rule check and reports:

    - Number of Unassigned Test Points. See *Unassigned Test Points* on page 197.

    - Number of Crossed Pins. See *Crossed Pins and Head Butts* on page 199.

    - Number of Breakouts. See *Breakouts* on page 201.

    For information on the design rule checks, see *Check for Design Rule Errors* on page 195.

Menu: *Edit-Test Point-Assign to Grid-Priority Drop*

Button: *None*

Key: *Ctrl+J*

Assigning Test Points from a Priority Centerpoint

FixMaster can give priority to a designated centerpoint of the PCB when automatically assigning test points to grid points. The operation assigns the test points sequentially depending on how close they are to the centerpoint, beginning with the points closest to the centerpoint and working outward.

By assigning high-density regions of the board to the tester grid before assigning the rest of the test points, you increase the chance of having the entire high-density region assigned on the first try. Use this technique to assign ball grid arrays and other high-density regions.

Note: *This operation does not unassign any assigned test points before making the new test point assignments.*

To Assign Test Points from a Priority Centerpoint Outward:

1. Set the current board side.
2. On the **Edit** menu, click **Test Point-Assign to Grid-Priority Drop**.
3. On the Priority Drop dialog, select **From Point** and click **OK**.
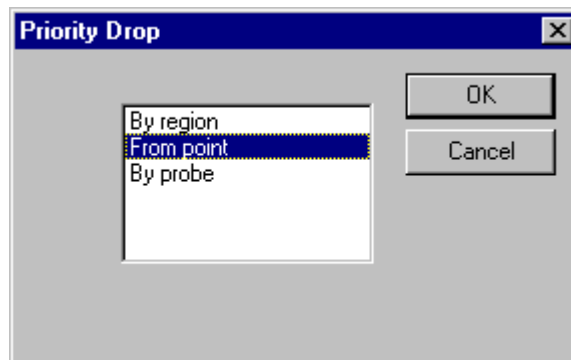
Priority Drop from Point

4. **Position the cursor** at the priority centerpoint and **click** the mouse button to start the operation.

FixMaster assigns test points, working outward from the centerpoint.

In the viewing area, probes (shown as blue lines) connect tester grid points (shown as red crosshairs) to test points (shown as blue crosshairs).

FixMaster automatically runs a fixture design rule check and reports:

- Number of Unassigned Test Points. See *Unassigned Test Points* on page 197.

- Number of Crossed Pins. See *Crossed Pins and Head Butts* on page 199.

- Number of Breakouts. See *Breakouts* on page 201.

For information on the design rule checks, see *Check for Design Rule Errors* on page 195.

Menu: *Edit-Test Point-Assign to Grid-Priority Drop*

Button: *None*

Key: *Ctrl+J*

Assigning Test Points for a Priority Probe Code to Tester Grid Points

FixMaster can automatically assign test points of a single Probe Code to tester grid points.

By selecting a specific probe to be assigned to the tester grid before assigning the rest of the probes, you ensure that the priority probe has the smallest possible pin deflection.

To Assign Test Points for a Priority Probe Code to Tester Grid Points:

1. Set the current board side.
2. On the **Edit** menu, click **Test Point-Assign to Grid-Priority Drop**.
3. On the Priority Drop dialog, select **By Probe** and click **OK**.
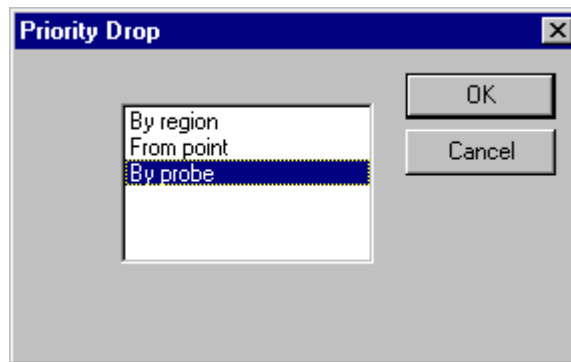
Priority Drop by Probe

4. In the Probe dialog, enter the **Probe Code** for which you want to assign test points to tester grid points and click **OK**.
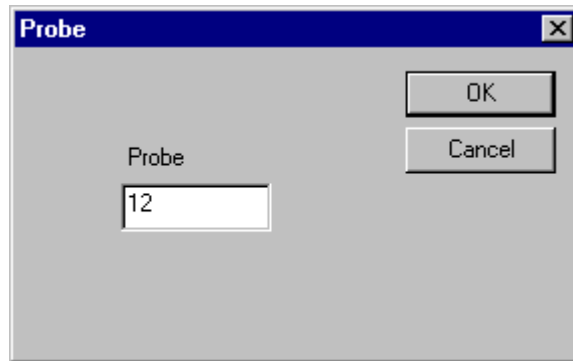
Select Probe Code

FixMaster assigns as many test points of the selected Probe Code as possible to tester grid points.

In the viewing area, probes (shown as blue lines) connect tester grid points (shown as red crosshairs) to test points (shown as blue crosshairs).

FixMaster automatically runs a fixture design rule check and reports:

- Number of Unassigned Test Points. See *Unassigned Test Points* on page 197.

- Number of Crossed Pins. See *Crossed Pins and Head Butts* on page 199.

- Number of Breakouts. See *Breakouts* on page 201.

For information on the design rule checks, see *Check for Design Rule Errors* on page 195.

Note: *FixMaster does not go on to assign any other test points that do not have the selected probe code and does not un-assign any existing test point assignments. So you can repeat the process for another probe and still maintain the order of priority.*
*After you have assigned test points for all of the priority probes, you can assign the rest of the test points using the Assign Test Points in the Frame to Tester Grid Points procedure, selecting the **Keep Matched Test Point** option. See **Assigning Test Points in the Frame to Tester Grid Points** on page 179.*
Do not use the Assign All Test Points to Tester Grid Points procedure, because this will disconnect the priority assignments.

Menu: *Edit-Test Point-Assign to Grid-Priority Drop*

Button: *None*

Key: *Ctrl+J*

Automatically Transcode to Smaller Probes to Assign Test Points

FixMaster has a feature that will automatically try transcoding to smaller probes if larger probes prevent test points from being assigned due to crossed pins. This Jiggle Pins feature allows FixMaster to try the larger pins first and transcode to smaller ones as needed.

To Automatically Transcode to Smaller Probes to Assign Test Points:

1. Set up the Probe Table with two or more surface mount probes that have the same D Code size range. Start with the largest diameter probe first, and put the smaller probes in descending size order. FixMaster will go down the list, trying the probes in order. For information on how to set up the Probe Table, see *Setting up the Probes* on page 70.

2. On the **Edit** menu, click **Test Point-Assign to Grid-Jiggle Pins**.
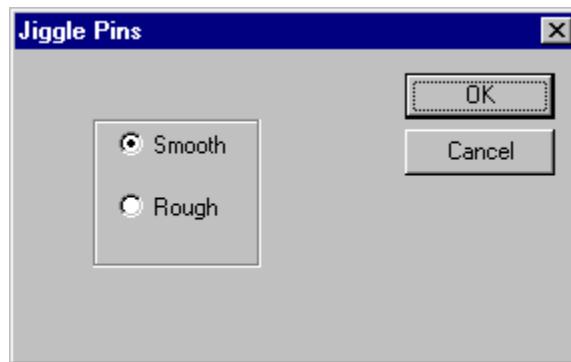
Jiggle Pins

3. On the Jiggle Pins dialog, select **Smooth** or **Rough**.

   - **Smooth:** Transcodes all crossed pins to a smaller probe code to attempt to assign test points to grid.

   - **Rough:** Transcodes *every other* crossed pin to a smaller probe code. Fewer test points are transcoded this way.

4. Click **OK**.

   FixMaster begins to assigns test points to grid. As it finds crossed pins, the program transcodes those test points to smaller probe codes in an attempt to eliminate the crossed pins.

Manually Assigning Individual Test Points to Tester Grid Points

FixMaster allows you to manually assign test points to tester grid points. By manually assigning test points to grid points, you can often fix problem areas of the board that have un-assigned test points, crossed pins or breakouts which the program is unable to solve.

Assignment Aid

FixMaster has an optional Assignment Aid to assist you when you are manually assigning test points to tester grid points.
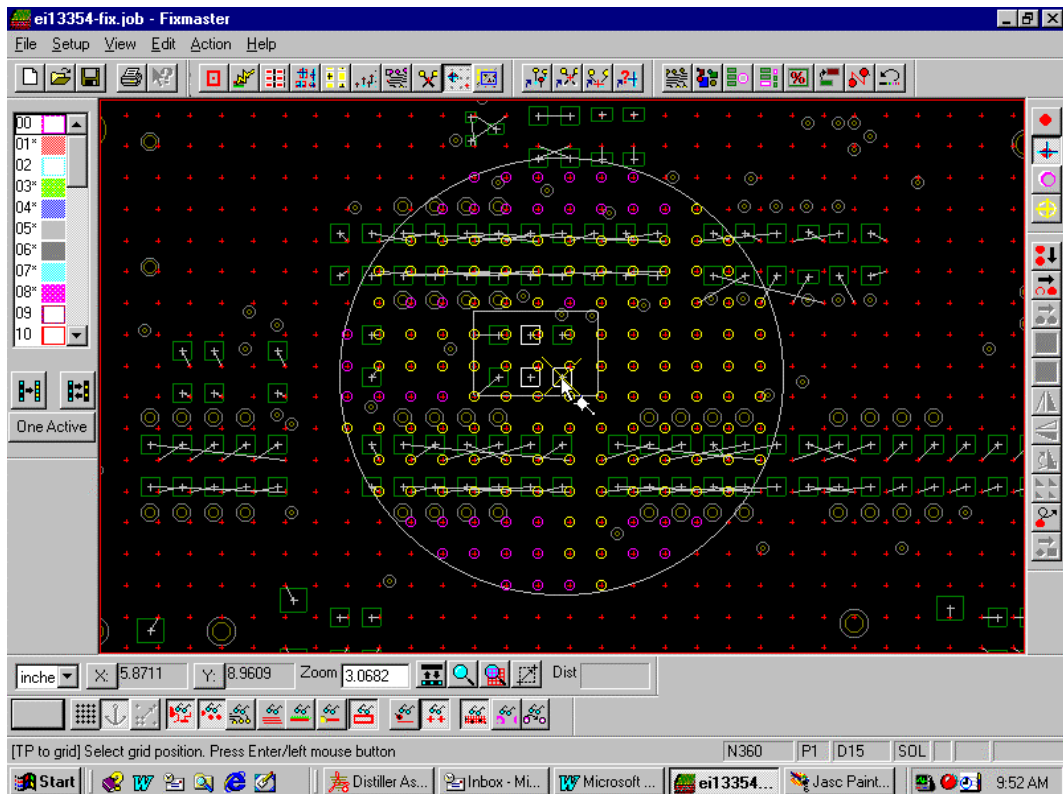
When you select a test point to assign to grid, the Assignment Aid shows you the following information.

Points within Allowable Deflection

A circle around the selected test point indicates which tester grid points are within the allowable deflection. FixMaster prompts you before allowing you to select a point outside the circle.

Previously Assigned Points

Tester grid points within the circle that are already assigned to other test points are shown in yellow. You may assign a test point to a tester grid point that is already assigned to another test point. This disconnects the other test point.

Points in Error

Tester grid points within the circle that would cause a design rule violation, such as crossed pins, or a breakout, are shown in magenta. FixMaster will prompt you before allowing you to select a tester grid point that would cause a design rule violation.

Available Points

Tester grid points within the circle that are available with no restrictions are colored green.

To Manually Assign Individual Test Points to Tester Grid Points:

1. Set the current board side.

2. To use the optional Assignment Aid, go to the **Setup** menu, click **Configuration**, and on the System Configuration tab, click **Assign Aid On** so that the option has a **checkmark**.

    If you do not want to use the Assignment Aid, click the option so that it has no checkmark.

    The Assignment Aid shows you:

    - Points within Allowable Deflection
    - Previously Assigned Points
    - Points in Error
    - Available Points
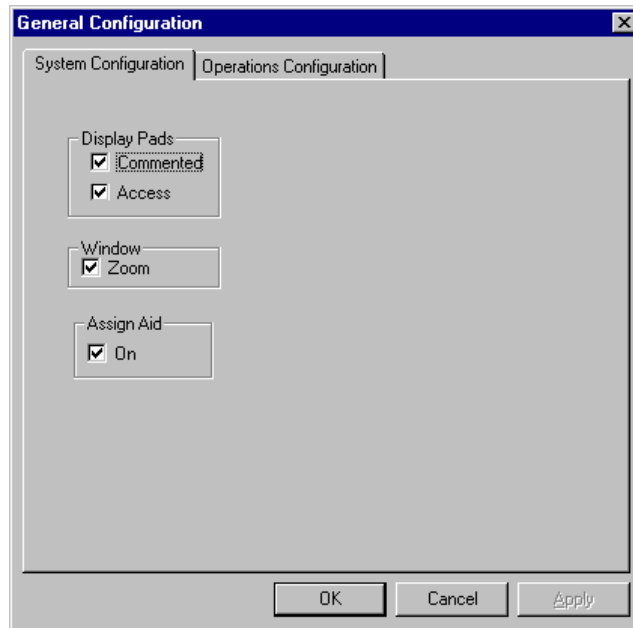
Assignment Aid Option On

3. On the **Edit** menu, click **Test Point-Assign to Grid-Single.**

    The test point assigning tool is selected.

4. **Click** close to the test point you want to assign to a grid point.

    FixMaster marks the test point to be assigned with a green cross.

    If the Assignment Aid function is on, FixMaster indicates which points are within the allowable deflection, which tester grid points are already assigned, which tester grid points would cause errors, and available tester grid points.

5. **Click** on the tester grid point you want to assign the selected test point to.

If the new test point assignment will not cause problems, the test point is assigned to that tester grid point. This is shown as a light blue line joining the two points.

If the new test point assignment will create crossed pins or breakouts or exceed the maximum pin deflection, FixMaster displays a dialog describing the problem and prompts whether to proceed.

The test point assignment tool remains selected until you select a new tool or press the **Escape** key, so you can assign one test point after another.

Menu: *Edit-Test Point-Assign to Grid-Single*

Button:

Key: *Shift+J*

Manually Un-Assigning Individual Test Points from Tester Grid Points

You can manually un-assign individual test points from grid points.

To Manually Un-Assigning Individual Test Points from Tester Grid Points:

1. Set the current board side.

2. On the **Edit** menu, click **Test Point-Unassign**.
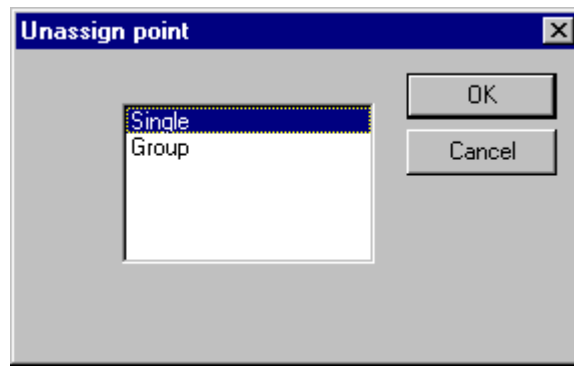
Un-assign Single Test Point

3. On the Unassign dialog, select: **Single** and click **OK**.

    The Un-assign tool is selected.

4. **Click** on the assigned test point you want to un-assign from the tester grid.

    A green cross marks the test point to be un-assigned.

5. **Click** the mouse button again.

    FixMaster un-assigns the selected test point from the tester grid point. The blue line connecting the points is removed, and the pad is shown in white to indicate it is unassigned.

    The Un-assign tool remains selected until you select another tool or press the **Escape** key, so you can un-assign one test point after another before quitting the operation.

Menu: *Edit-Test Point-Unassign*

Button: *None*

Key: *None*

Un-Assigning Test Points in the Frame from Tester Grid Points

You can un-assign a group of test points inside the Frame from grid points.

To Un-Assigning Test Points in the Frame from Tester Grid Points:

1. Set the current board side.

2. Position the Frame around the test points you want to un-assign from the tester grid.

3. On the **Edit** menu, click **Test Point-Unassign**.
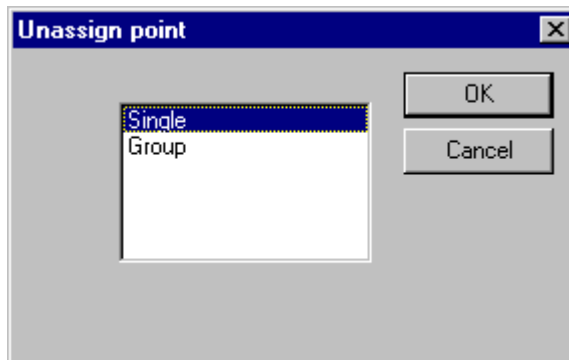
Un-assign a Group of Test Points

4. On the Unassign dialog, select **Group** and click **OK**.

5. **Click** the left mouse button.

   FixMaster un-assigns all test points within the Frame from the tester grid points. The blue lines connecting the points are removed, and the pads are shown in white to indicate they are unassigned.

Menu: *Edit-Test Point-Unassign*

Button: *None*

Key: *None*

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Chapter 12
Check for Design Rule Errors

FixMaster automatically runs a design rule check when you assign test points to tester grid points. See *Assign Test Points to Tester Grid Points* on page 177. In addition you can run a design rule check at any time.

Running a Design Rule Check

Running a Design Rule Check on the Whole PCB

You can run a design rule check on the whole PCB.

To Run a Design Rule Check on the Whole PCB:

1. Set the Current Board Side

2. On the **Action** menu, click **Cross Check-All**.

    FixMaster checks the design rules and reports:

    - Number of Unassigned Test Points. See *Unassigned Test Points* on page 197.

    - Number of Crossed Pins. See *Crossed Pins and Head Butts* on page 199.

    - Number of Breakouts. See *Breakouts* on page 201.

Menu: *Action-Cross Check-All*

Button:

Key: *Ctrl+C*

Running a Design Rule Check Inside the Frame

You can run a design rule check on only a part of the PCB by using the Reference Frame.

To Run a Design Rule Check Inside the Frame:

1. Set the Current Board Side.

2. Position the Frame around the area you want to check for design rules.

3. On the **Action** menu, click **Cross Check-Window**.

   FixMaster checks the design rules inside the Frame and reports:

   - Number of Unassigned Test Points. See *Unassigned Test Points* on page 197.

   - Number of Crossed Pins. See *Crossed Pins and Head Butts* on page 199.

   - Number of Breakouts. See *Breakouts* on page 201.

Menu: *Action-Cross Check-Window*

Button: *None*

Key: *Non*

Unassigned Test Points

Unassigned test points are test points that are not assigned to tester grid points. On screen, pads with unassigned points are displayed in white.
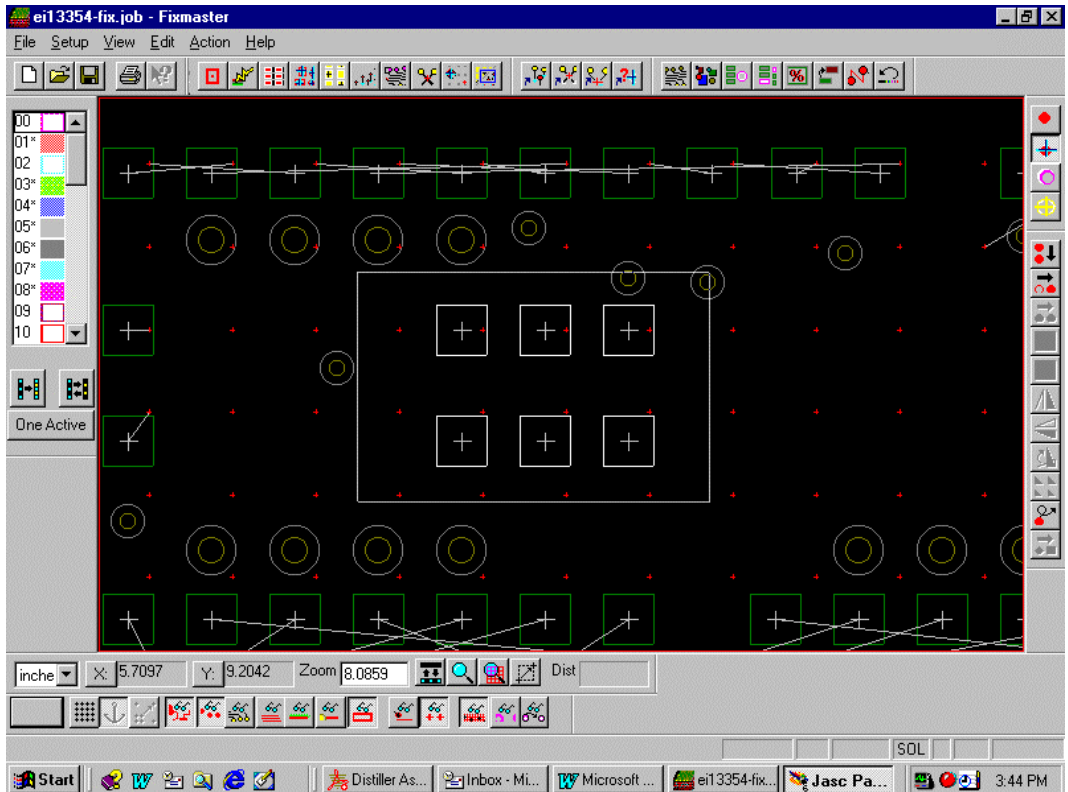
Unassigned Test Points

FixMaster has a feature that allows you to go to each sequential unassigned test point.

To Inspect Unassigned Test Points:

1.   On the **View** menu, click **Go To-Unassigned TP**.

     The Unassigned Test Point Tool is selected.

2.   **Click** the mouse.

     The cursor hops to the next unassigned test point. The test point is marked with a green cross, indicating it is selected. Pads with unassigned test points are displayed in white.

3.   To correct the error, use one of the commands for assigning test points to tester grid points. See *Assign Test Points to Tester Grid Points* on page 177.

     The Unassigned Test Point Tool remains selected until you select another tool or press the **Escape** key, so you can find one unassigned test point after another by clicking the mouse.

Menu: *View-Go To-Unassigned TP*

Button:

Key: *None*

Crossed Pins and Head Butts

Crossed pins and head butt errors represent probes that would probably be in contact with each other. Crossed pins occur when the way that test points are assigned to tester grid points brings two probes so close together that the probes are likely to be in contact. Head butts are a little different in that they occur when the test points are so close together that the heads of the probes are likely to be in contact; so, for head butts, the test point-to-grid point assignments are not important.

FixMaster finds crossed pins and head butt errors by checking the arrangement of the probes that results from the Assign Test Point to Tester Grid Points procedures. FixMaster calculates the distance between the probes then checks the probe diameters, head diameters and air gaps set in the Probe Table. See *Setting up the Probes* on page 70.

On screen, pads with crossed pins or head butts are displayed in yellow.
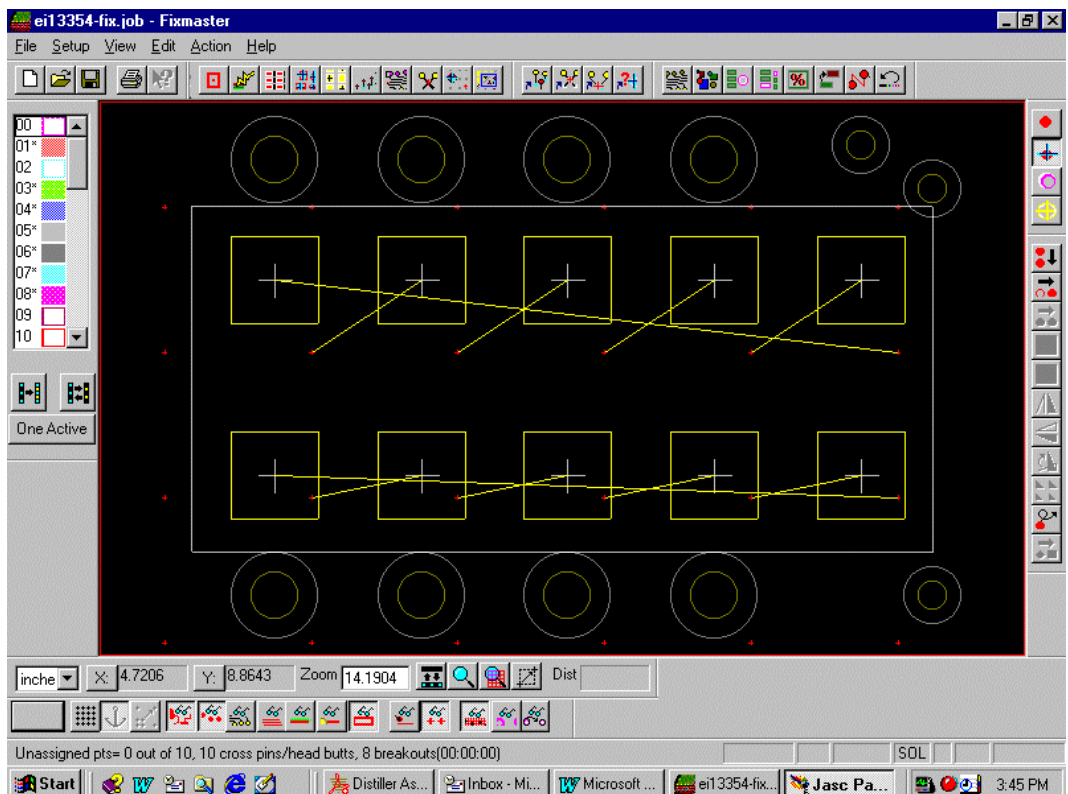
Crossed Pins

FixMaster has a feature that allows you to go to each sequential crossed pin error and head butt.

To Inspect Crossed Pins and Head Butts:

1. On the **View** menu, click **Go To-Cross Pins**.

   The Crossed Pin Tool is selected.

2. **Click** the mouse.

   The cursor hops to the next crossed pin or head butt. The test point is marked with a green cross, indicating it is selected. Pads with crossed pins or head butts are displayed in yellow.

   The Crossed Pin Tool remains selected until you select another tool or press the **Escape** key, so you can find one crossed pin or head butt after another by clicking the mouse.

Menu: *View-Go To-Crossed Pins*

Button:

Key: *None*

Breakouts

Breakout errors represent probe drills in fixture plates that are close enough that they are likely to break through to each other.

FixMaster finds breakouts in fixture plates by checking the locations of the probe drills that result from the Assign Test Point to Tester Grid Points procedures. FixMaster calculates the distance between the probe drills and compares it to the breakout gap parameter set in the Fixture Configuration procedure. See *Setting up the Fixture Design Rules* on page 59. You control which plates are checked for breakouts when you set up the fixture plates. See the description of the **Breakout** field in *Setting up the Fixture Plates* on page 52.

On screen, pads with breakouts are displayed in green.
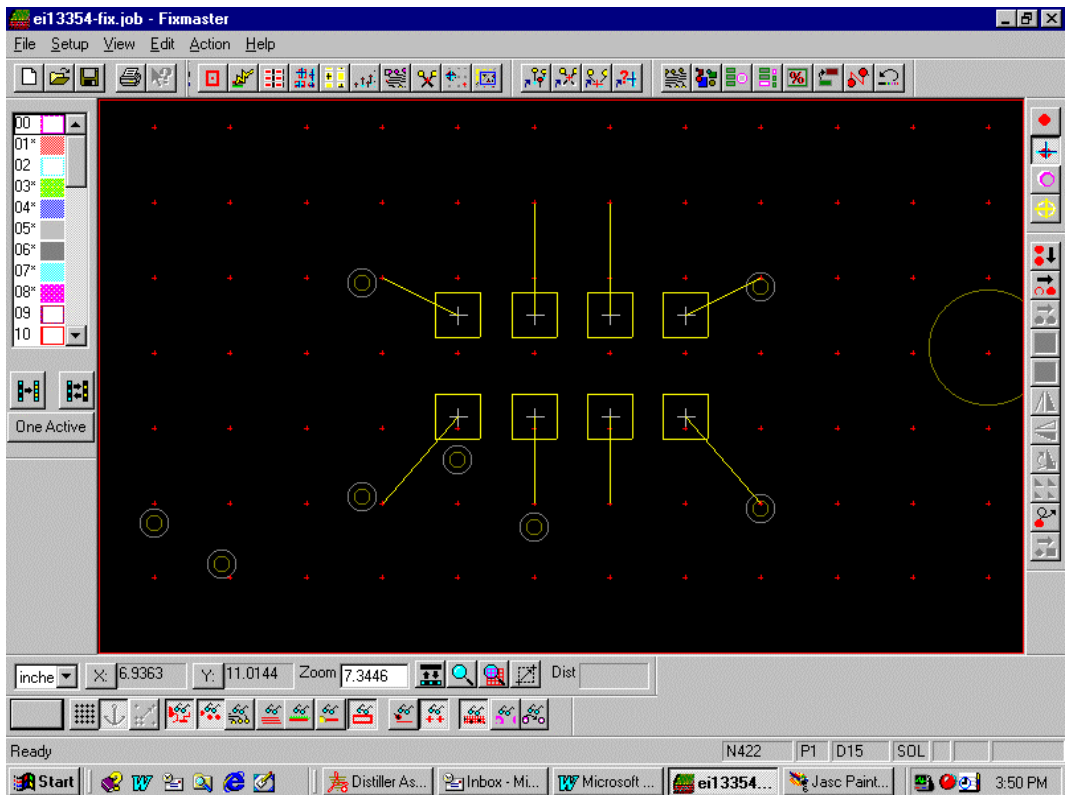
Breakouts

FixMaster has a feature that allows you to go to each breakout error.

To Inspect Breakouts:

1. On the **View** menu, click **Go To-Break Outs**.

   The Breakout Tool is selected.

2. **Click** the mouse.

   The cursor hops to the next breakout error. The test point is marked with a green cross, indicating it is selected. Pads with breakouts are displayed in green.

   The Breakout Tool remains selected until you select another tool or press the **Escape** key, so you can find one breakout error after another by clicking the mouse.

Menu: *View-Go To-Breakouts*

Button:

Key: *None*

Correcting Design Rule Errors

There are several manual and automatic techniques for correcting design rule errors.

Manually Change Test Point Assignments for Test Points with Errors

Most Unassigned Test Points, Crossed Pins and Breakouts can be corrected by changing the test point-to-grid point assignments.

The Assignment Aid is a valuable feature for manually correcting errors. The assignment aid shows you which tester grid points are within the allowable pin deflection of the selected test point, which tester grid points are already assigned, which tester grid points would cause errors, and available tester grid points.

This technique is not useful for correcting Head Butts.

To Manually Change Test Point Assignments for Errors:

1. Go to the errors.

   - Inspect Unassigned Test Points. See *Unassigned Test Points* on page 197.

   - Inspect Crossed Pins. See *Crossed Pins and Head Butts* on page 199.

   - Inspect Breakouts. See *Breakouts* on page 201.

2. Manually assign individual test points to tester grid points using the Assignment Aid. See *Manually Assigning Individual Test Points to Tester Grid Points* on page 188.

Automatically Correcting Design Rule Errors

FixMaster also has some commands that can automatically correct some types of errors.

Automatically Assign Test Points inside the Frame to Grid Points

Often, instead of manually inspecting and reassigning test points that have Unassigned Test Points, Crossed Pins or Breakouts, you can automatically assign test points inside the Frame to correct the errors automatically.

This technique is not useful for correcting Head Butts.

To Correct Errors by Automatically Assigning Test Points inside the Frame to Grid Points:

1. Look for locations on the board with groups of errors.

2. Position the Frame around the test points that are in error. Be sure to enclose both the test points you want to re-assign and the tester grid points you want available.

3. On the **Setup** menu, click **Configuration**.

4. On the Operations Configuration tab, set the **Shake 'em Up** settings to the following:

    *   Click **Keep Matched Test Point** so that *does not have a checkmark*.

    *   Click **Grab Unused Grid Point Outside Frame** so that it *has a checkmark*.

5. On the **Edit** menu, click **Test Points-Assign to Grid-By Window (Shake 'Em Up)**.

    FixMaster assigns as many test points in the Frame as possible to grid points and automatically runs a fixture design rule check on the Frame area and reports:

    *   Number of Unassigned Test Points. See *Unassigned Test Points* on page 197.

    *   Number of Crossed Pins. See *Crossed Pins and Head Butts* on page 199.

    *   Number of Breakouts. See *Breakouts* on page 201.

6. If FixMaster does not correct all of the errors automatically, position the Frame a little differently and try again, or try one of the other error-correction techniques.

Stagger Test Points to Correct all Types of Errors

Sometimes staggering test points can correct all types of errors, including Head Butts.

*   **Stagger Test Points in the Frame:** See *Staggering Test Points in the Frame* on page 173.

*   **Swap the Stagger Position of Staggered Test Points in the Frame:** See *Swapping the Stagger Position of Staggered Points in the Frame* on page 174.

*   **Manually Stagger Individual Test Points:** See *Manually Staggering Individual Test Points* on page 172.

Remove Padstacks to Correct Head Butts

Head Butts that appear to have two tester grid points assigned to a single test point are due to stacked pads. Removing stacked pads helps to eliminate stacked test points that can cause Head Butt errors. See *Remove Padstacks* on page 368.

Transcode Probe Codes to Correct Head Butts

Head butts, and sometimes other types of errors, can be corrected by transcoding probe codes to smaller-diameter probes. The smaller diameter probes are less likely to contact each other in dense area of the board. See *Transcode Probe Codes* on page 362.

Chapter 13
Inspect Netlist Mode

There may be times when you want to view individual nets and edit test points one net at a time. While the automatic test point generating command and manual test point editing commands allow you to edit test points with a view of the entire board and fixture, Netlist Inspection mode allows you to view individual nets and edit test points for a single displayed net. This is useful for assuring that each net is tested properly, and for dealing with special situations such as ring nets.

The normal command menus are not available in Netlist Inspection mode. You use the commands on the Netlist Inspection toolbar and some special keyboard commands. Netlist Inspection mode has some unique commands for locating and displaying specific nets. Many of the Netlist Inspection mode commands for editing test points are the same as the test point editing commands in the normal editing mode; however, there are some unique commands also.

Netlist Inspection Toolbar

┼	Toggle TP
≋	Display a Net
⏮	First Net
➡	Next Net
⏪	Previous Net
⊕	Insert Test Point
✕	Delete Test Point
?2	No TP Nets
⊕	Add TP to NTP
⟳	Ring Nets
Exit	Exit
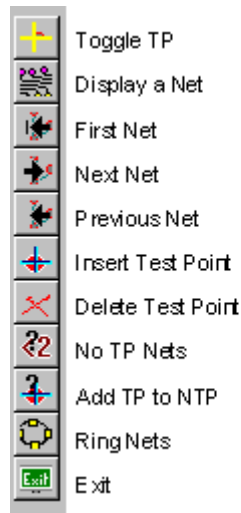
Netlist Inspection Toolbar

Color System in Netlist Inspection Mode

To aid in the netlist inspection process, FixMaster uses the following color system to identify specific elements in Netlist Inspection mode.

- **Green Pads:** Solder Side SMD
- **Gray Pads:** Component Side SMD
- **Yellow Traces:** Solder Side Traces
- **Gray Traces:** Component Side Traces
- **Blue Traces:** Internal Traces
- **Yellow +:** Solder Side Test Point
- **Gray X:** Component Side Test Point
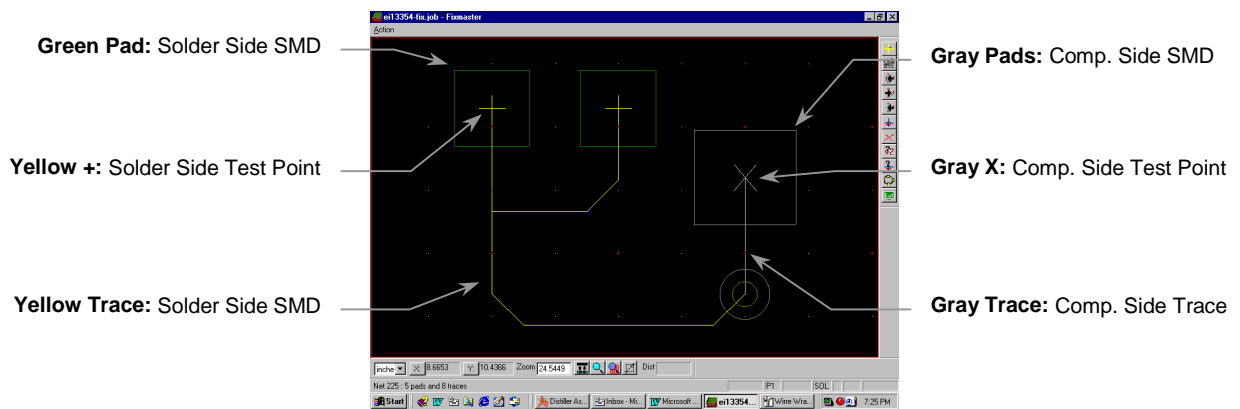
Netlist Inspection Mode Color System

Entering and Exiting Netlist Inspection Mode

Netlist Inspection Mode is a separate editing mode from the normal editing mode.

To Enter Netlist Inspection Mode:

➢ On the **Action** menu, click **Inspect Netlist**.

Menu: *Action-Inspect Netlist*

Button:

Key: *None*

To Exit Netlist Inspection Mode and Return to Normal Editing:

➢ On the Netlist Inspection toolbar, click the **Exit** button.

Or

➢ On the Netlist Inspection mode **Action** menu, click **Quit**.

Menu: *Action-Quit*

Button:

Key: *None*

Displaying Nets

Netlist Inspection Mode has several options for displaying nets.

Displaying a Specific Net

You can select a specific net to display.

To Display a Specific Net:

1. On the **Netlist Inspection** toolbar, click the **Display a Net** button.

    FixMaster prompts you for a net number.
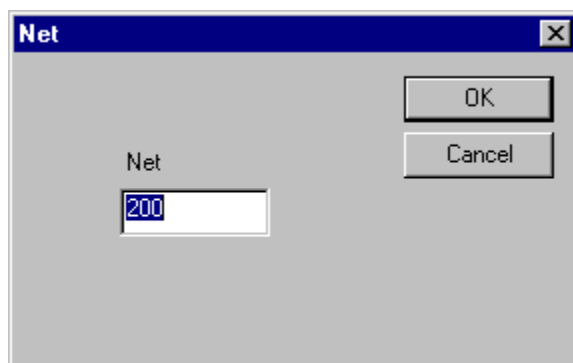
Display a Specific Net

2. Type the **net number** of the net you want to inspect and click **OK**.

    FixMaster displays the selected net and adjusts the zoom level so that the selected net fills the screen. In the Message Line, FixMaster displays the net number and the number of pads in the net, for the current layer.

Menu:	*None*
Button:	
Key:	*None*

Displaying the First, Next or Previous Net in the File

FixMaster has commands to display nets in numerical order according to their net numbers in the file. You can display the first net in the file or the next or previous net. When FixMaster displays the selected net, the program adjusts the zoom level so that the net fills the screen. In the Message Line, FixMaster displays the net number and the number of pads in the net, for the current board side.

To Display the First, Next or Previous Net in the File:

➢ On the Netlist Inspection toolbar, click the **First Net** , the **Next Net** or the **Previous Net** button.

Menu:	*None*
Button:	*or* *or*
Key:	*Shift+F or Shift+N. or Shift+B*

Displaying Nets that Do Not Have Enough Test Points

Multi-point nets can sometimes end up with only one test point because of the options selected when automatically generating test points. For instance, the pads on ring nets which are connected by traces that form a closed loop or pads on filled areas which are intersected by many fill traces may not receive test points if you are only generating test points for endpoints. Such nets cannot be tested properly for continuity. In some cases a net may not have any test points. Such nets can not be tested for shorts to other nets. FixMaster has a command that allows you to identify nets that have less than one or two test points.

You select whether to find nets that do not have at least one test point or to find nets that do not have at least two test points. When the command is activated, FixMaster displays the next net that has less than the designated number of test points and adjusts the zoom level so that the selected net fills the screen. In the message area of the Status Bar, FixMaster displays the net number and the number of pads in the net, for the current layer. When the net is displayed, you can decide whether to add a test point.

FixMaster also has a command for automatically generating test points for some of these nets. See *Adding Test Points to Nets that Do Not Have Enough Test Points* on page 219. If you identify a large number of these nets, then rather than manually adding test points, you may want to have FixMaster try to generate test points for them. Then you can manually correct any remaining nets with too few test points.

To Displaying Nets that Do Not Have Enough Test Points:

1. To set up the operation you need to be in the regular editing mode, so if you are already in Netlist Inspection Mode, exit by clicking the **Exit** button on the Netlist Inspection toolbar.

2. In the regular editing mode, go to the **Setup** menu and click **Configuration**.
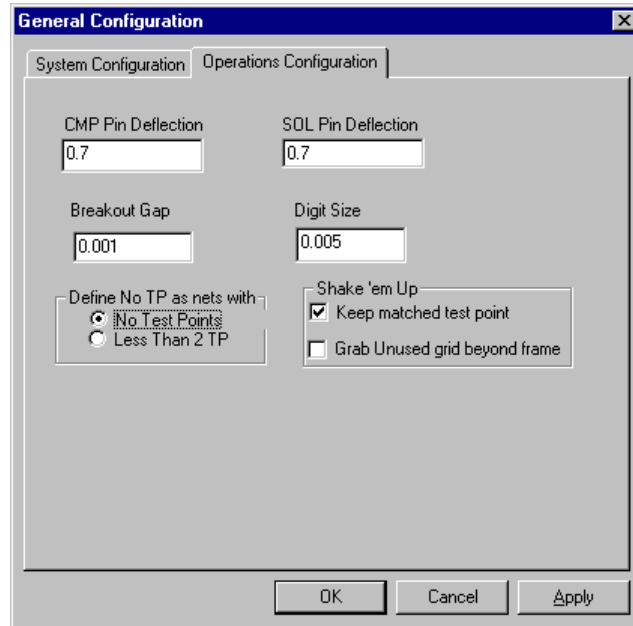
3. On the **Operations Configuration** tab, go to the group box labeled **Define No TP Nets as Nets With**, and set the number of test points to look for in each net:

- **No Test Points:** If this option is selected, the No TP Nets command will display only nets that do not have at least one test point.

- **Less Than 2 TP:** If this option is selected, the No TP Nets command will display nets that do not have at least two test points.

4. Enter Netlist Inspection mode by going to the **Action** menu and clicking **Inspect Netlist**.

5. On the **Netlist Inspection** toolbar, click the **No TP Nets** button button.

   FixMaster displays the first sequential net with less than the designated number of test points and adjusts the zoom level so that the selected net fills the screen. In the message area of the Status Bar, FixMaster displays the net number and the number of pads in the net, for the current layer. FixMaster also displays the total number of nets with less than the specified number of test points.

6. To display the next sequential nets with less than the designated number of test points click

   the **No TP Nets** button button again.

Menu: *None*

Button: button

Key: *None*

Options for How to Display Nets

Display Test Points with a Large X

FixMaster has a command to display a large X mark at each test point, making test points easier to spot. This feature can be turned off by activating the command a second time.

To Toggle the Display of a Large X at Each Test Point:

➢ On the **Netlist Inspection** toolbar, click the **Toggles TP** button.

Menu: *None*

Button:

Key: *None*
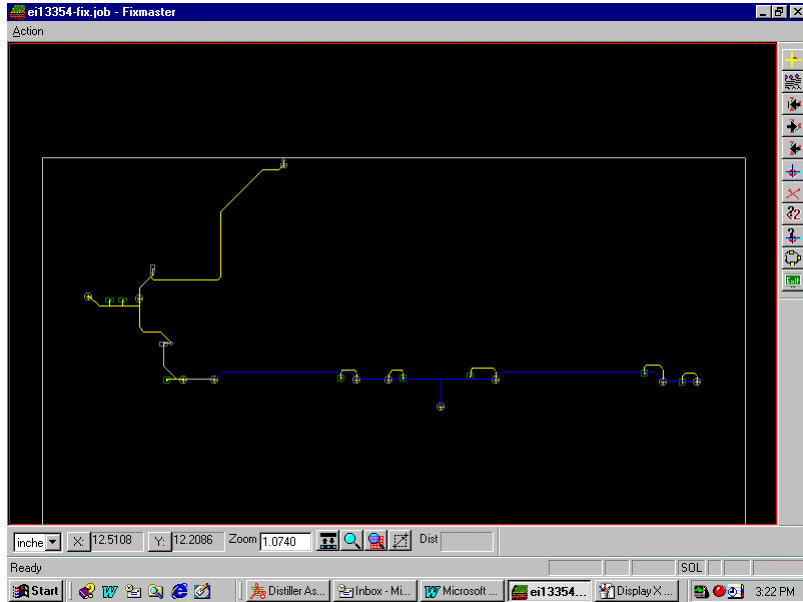
Test Points Shown with the Large X Turned Off
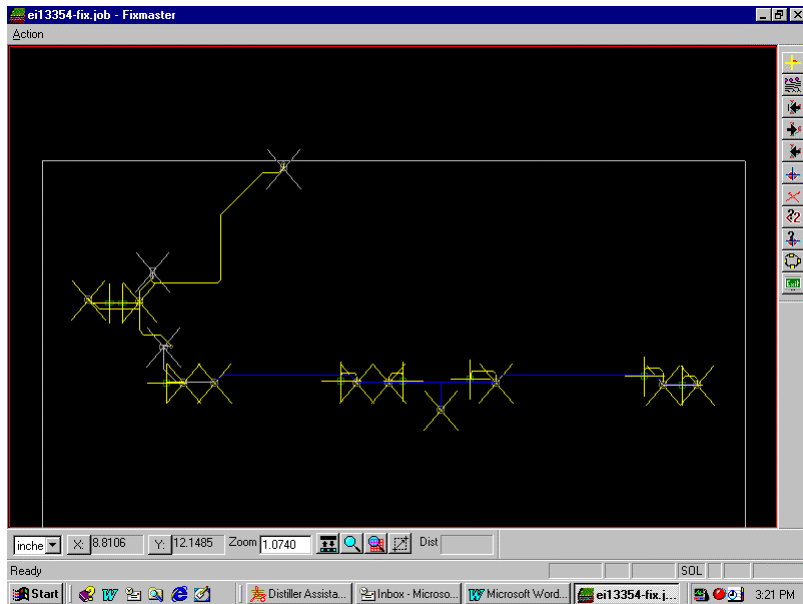
Test Points Shown with the Large X Turned On

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Inspecting Ring Nets

Ring nets are nets in which traces form closed loops. Filled areas generally form ring nets. Pads on the ring portion of the net may be designated as midpoints during netlist extraction. If you generate test points for endpoints only, then you will not be testing the ring portion of the net for continuity. FixMaster gives you two ways to display ring nets for inspection.

Check Nets With Less Than One or Two Test Points to Find Rings

You can sequentially inspect all nets that have less than one or two test points, as explained earlier. See *Displaying Nets that Do Not Have Enough Test Points* on page 212. This command will display many ring nets, along with other nets that are not rings. The advantage to this method is that it does not require any time-consuming preprocessing to identify ring nets. The disadvantage is that it shows you some nets that are not ring nets, and it will not show you nets that have many endpoints but also have a ring portion. Still, this is generally the method that most people prefer.

Display Ring Net Command

FixMaster has a command that displays the next sequential ring net. The advantage to this method is that it will show you all ring nets, even those that do have a few endpoints, and it does not show you any nets that are not ring nets. The disadvantage is that before using this feature you must first run an operation to identify all of the ring nets in the loaded data, and that operation can take some time. Most people generally prefer the other method.

To Display Ring Nets:

1. To run the operation that identifies the ring nets, you need to be in the regular editing mode,

    so if you are already in Netlist Inspection Mode, exit by clicking the **Exit** ![Exit button] button on the Netlist Inspection toolbar.

2. In the regular editing mode, go to the **Action** menu and click **Ring Net**.

3. On the **Max Traces** dialog, enter the **largest size net** you want to check for ring nets. Nets that have more traces than the Max Traces value are not checked.
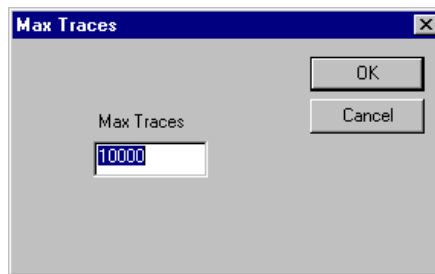
Max Traces Dialog

FixMaster identifies all of the ring nets in the loaded data. This can take a little while.

4. Enter Netlist Inspection mode by going to the **Action** menu and clicking **Inspect Netlist**.

5. On the **Netlist Inspection** toolbar, click the **Ring** ![Ring button] button.

    FixMaster displays the first sequential ring net and adjusts the zoom level so that the selected ring net fills the screen. In the message area of the Status Bar, FixMaster displays the net number and the number of pads in the ring net, for the current layer.

6. To display the next sequential ring net, click the **Ring** ![Ring button] button again.

Menu:	*None*
Button:	![Ring button]
Key:	*None*

Edit Test Points

Many of the Netlist Inspection mode commands for editing test points are the same as the test point editing commands in the normal editing mode; however, there are some unique commands also.

Switch the Active Board Side

You can switch the active board side between the component side and the solder side. The active side is shown in the Status Bar, CMP and SOL. Unlike in the normal editing mode, both sides of the board are shown in Netlist Inspection mode; however, commands for selecting or editing pads or test points still operate only on elements in the active board side.

To Switch the Active Side between Component Side and Solder Side:

➢ In the Status Bar, click the **Active Side** button.

Menu: *None*

Button:

Key: *None*

Selecting a Test Point or Pad

Selecting an element causes the cursor to hop to the nearest element, and the D Code, net number and probe number of the selected element is displayed on the Status Bar.

To Select a Pad or Test Point:

➢ Position the cursor next to the test point or pad and press the **S** key.

Menu: *None*

Button: *None*

Key: *S*

Inserting Test Points

You can insert individual test points for single pads, groups of test points for all pads within the Frame, or groups for pads of a selected D Code within the Frame. These commands are operated just as in the normal editing mode except that they are activated from the Netlist Inspection toolbar by clicking the

Insert TP button. See *Insert Test Points* on page 149.

Menu: *None*

Button:

Key: *None*

Deleting Test Points

You can delete individual test points one at a time, delete groups of all test points within the Frame, or delete groups of test points from pads of a selected D Code within the Frame. These commands are operated just as in the normal editing mode except that they are activated from the Netlist Inspection toolbar by clicking the **Del TP** ![icon] button. See *Delete Test Points* on page 154.

Menu: *None*

Button: ![icon]

Key: *None*

Adding Test Points to Nets that Do Not Have Enough Test Points

Netlist Inspection mode has a unique command that can be used to correct ring nets and other nets that do not have enough test points to test for continuity.

This command overrides the test point generation options set on the Generate Config dialog when you are automatically generating test points, and it allows FixMaster to add test points to nets that have less than two test points.

This command also has a unique feature that determines if a net endpoint is covered by soldermask, and if so, it searches the net for an open test point.

The command is a global command that affects some of the nets that you could eventually inspect by clicking the **No TP Nets** command. It does not affect only the one net that can be displayed in Netlist Inspection mode.

To Add Test Points to Nets that Do Not Have Enough Test Points:

➢ On the Netlist Inspection toolbar, click the **Add TP to NTP** ![icon] button.

Menu: *None*

Button: ![icon]

Key: *None*

Chapter 14
Split Nets

Some parts are too dense to test all nets simultaneously on fixtures of a given grid density or given fixture height. In this case, you can split out some nets to be tested at an offset location on the same fixture. You can also split nets to a separate job that is to be tested on a separate fixture or processed in ProbeMaster and tested on a moving probe tester.

Split nets are shown highlighted in red. As the nets are split out, one test point from each of the split nets is copied and left on the board with the unsplit nets. This allows you to test the unsplit nets for shorts to the split nets.

You split nets after generating test points and dropping pins.

The operation is carried out in two steps:

1. Setting up where you want the split nets to be moved to (either to an offset location or to a separate .JOB file). See *Set Up Split Net Options* on page 222.

2. Selecting the nets to be split out. See *Split the Nets* on page 225.

In addition, you may want to:

- Copy tooling hole information to the offset split nets. See *Tooling Holes and Split Nets* on page 230.

- Copy and split one node from each unsplit net. See *Test for Shorts between Split and Unsplit Nets* on page 231.

- Test densely packed components separately. See *Testing Densely Packed Components Separately* on page 232. This procedure is not technically a Split Net operation, but it does allow for testing different parts of a board separately.

Set Up Split Net Options

The first part of the Split Net procedure is to configure the options for splitting nets:

Splitting Nets to an Offset Location on the Same Fixture

If you are going to test the split nets on the same fixture, split the nets to an offset location.

Note: *Do not use this procedure or change the following options if you have already split out any nets in this job.*

To Split Nets to an Offset Location on the Same Fixture:

1. After generating test points and dropping pins, go to the **Setup** menu and click **Split Net**.

   FixMaster displays the Split Net Configuration dialog.
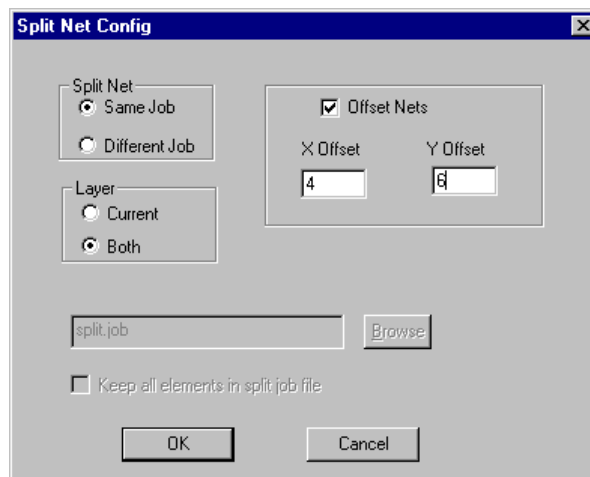
Split Nets to the Same Job

2. In the **Split Net** group box, select **Same Job**.
3. Click the **Offset** option so that it has a **checkmark**.
4. In the **X and Y offset fields**, enter the **distance to offset** the split nets from the unsplit nets.
5. In the **Layer** group box, select whether you want to split nets for only the **Current** board side or for **Both** board sides.
6. Click **OK**.
7. Split the nets. See *Split the Nets* on page 225.

   Note: *Because you are offsetting split nets on the same fixture, after you split out the nets, you should also Offset Tooling Holes. See **Tooling Holes and Split Nets** on page 230.*

Splitting Nets to a Different FixMaster Job or ProbeMaster Job

If you are going to test the split nets on a separate fixture or on a moving probe tester, split the nets to a separate job.

Note: *Do not use this procedure or change the following options if you have already split out any nets in this job.*

To Split Nets to a Different Job file for Testing on a Different Fixture or for Processing in ProbeMaster:

1. After generating test points and dropping pins, go to the **Setup** menu and click **Split Net**.

    FixMaster displays the **Split Net Configuration** dialog.
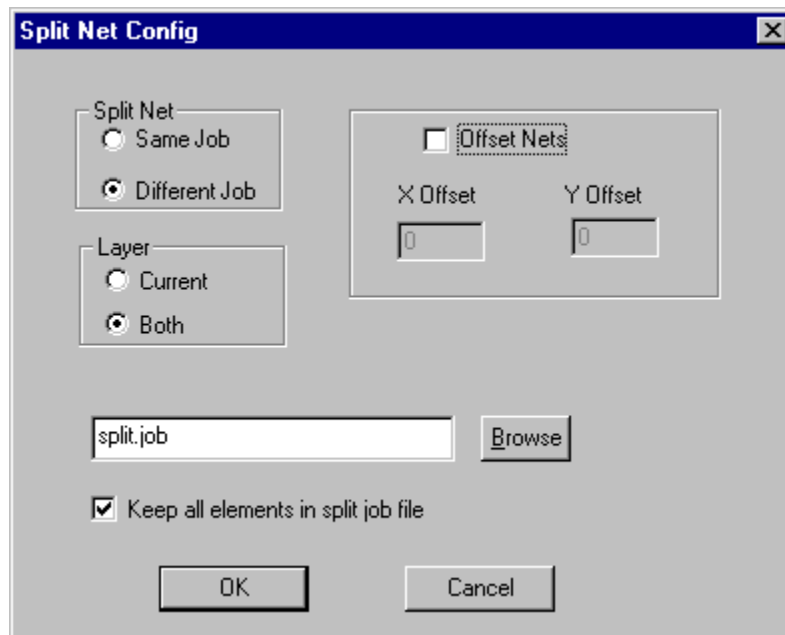
Split Nets to a Different Job

2. In the **Split Net** group box, select **Different Job**.

3. In the **New Job File** field, enter the **name of the new job file** that will contain the split nets.

    Specifying the New Job name and closing this dialog does not save the .JOB file. When you are done actually splitting the nets, then save a .JOB file. FixMaster will save two .JOB files, one for the current job and one for the split nets. See *Save a Job File* on page 296.

4. It is not necessary to offset split nets saved in a different .JOB file the way it is with nets split to the same job, and generally you would not offset the nets, but it is an option.

   If you *do not* want to offset nets, click the **Offset** option so that it has **no checkmark**.

   To offset nets:

   - Click the **Offset** option so that it has a **checkmark**.

   - In **the X and Y offset** fields, enter the **distance to offset** the split nets from the unsplit nets.

5. In the **Layer** group box, select whether you want to split nets for only the **Current** board side or for **Both** board sides.

6. In the **Keep All Elements in Split Net File** checkbox, select whether you want to copy all the elements of the file to the split job. Later, when you actually split out the nets, you select specific types of nets to split to the new job. See *Split the Nets* on page 225. This option allows you to copy the rest of the elements that you did not specifically select to the split job.

   - If **Keep All Elements in Split Net File** has a checkmark, then all elements will be copied to the split job. This is recommended.

   - If **Keep All Elements in Split Net File** does not have a checkmark, then only the elements of the split nets will be copied to the split job. The other elements will not be copied.

7. Click **OK**.

8. Split the nets. See *Split the Nets* on page 225.

Split the Nets

Now that you have set up the options for the split-net operation, the second part of the procedure is to actually split out the nets that you want to test separately. There are several ways to go about splitting the nets, and each is outlined below.

Splitting Single Nets One at a Time

You can manually split nets one at a time.

To Split Single Nets One at a Time:

1. After the Split Net Options are set, go to the **Action** menu and click **Split Net**.
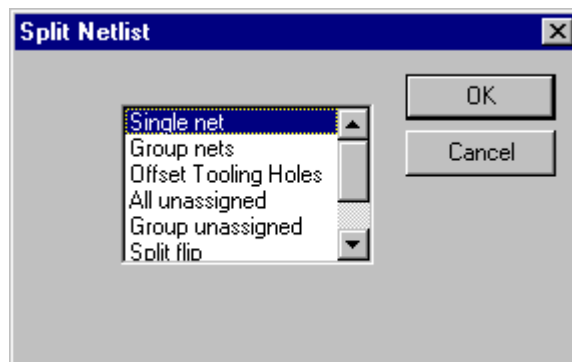
Split Single Nets

2. On the **Split Netlist** dialog, select **Single Net** and click **OK**.

   The Net Splitting tool is selected, and FixMaster prompts you to select an element.

3. Position the cursor near a pad that is in a net you want to split.

4. **Click** the mouse or press **Enter**.

   The net containing the selected pad is split. The split net is highlighted in red.

   The Net Splitting tool remains selected until you select another tool or press the **Escape** key, so you can split or unsplit one net after another. To unsplit a split net, click on the red, highlighted net with the Net Splitting tool.

Splitting a Group of Nets that Have Pads in the Frame

You can split a group of nets that have pads inside the Reference Frame.

To Split a Group of Nets that Have Pads in the Frame:

1. After the Split Net Options are set, position the Frame around a group of pads that belong to the nets you want to split.

2. On the **Action** menu, click **Split Net**.
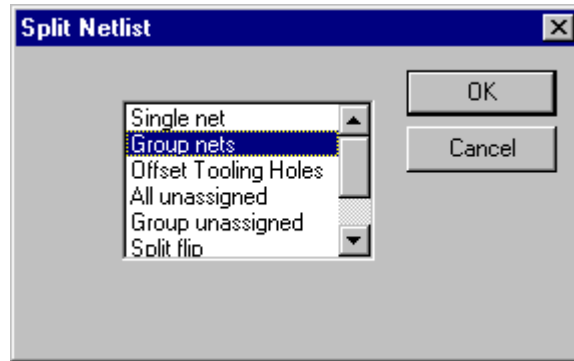
Split a Group of Nets

3. On the **Split Netlist** dialog, select **Group Nets** and click **OK**.

    Every net that has a pad inside the Frame is split. The split nets are highlighted in red.

    The Net Splitting tool becomes selected, so you can split or unsplit single nets one at a time by clicking on pads of the desired net. The Net Splitting tool remains selected until you select another tool or press the **Escape** key, so you can split or unsplit one net after another.

Splitting All Nets with Unassigned Test Points

Note: *This is the most common form of net splitting.*

This feature allows you to make your best effort to get all test points in the PCB assigned to the tester grid, and have FixMaster automatically split out the nets of the remaining test points.

To Split All Nets with Unassigned Test Points:

1.   On the **Action** menu, click **Split Net**.
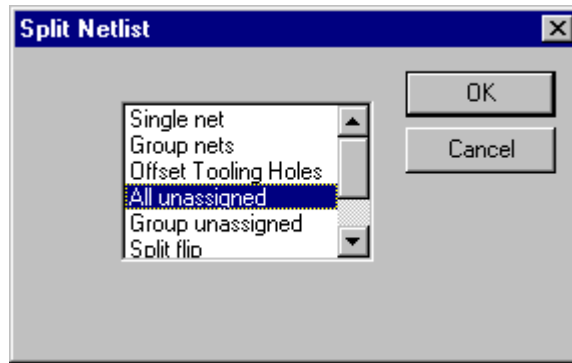
Split All Nets with Unassigned Points

2.   On the **Split Netlist** dialog, select **All Unassigned** and click **OK**.

Every net that has a pad with an unassigned test point is split. The split nets are highlighted in red.

Splitting Nets with Unassigned Test Points in the Frame

This feature allows you to make your best effort to get all test points in a dense area assigned to the tester grid, and have FixMaster automatically split out the nets of the remaining test points.

To Split Nets with Unassigned Test Points in the Frame:

1. Position the Frame around the pads with unassigned test points that are in the nets that you want to split.

2. On the **Action** menu, click **Split Net**.
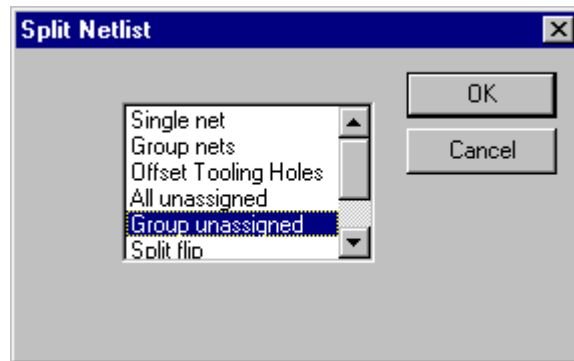
Split a Group of Nets with Unassigned Points

3. On the **Split Netlist** dialog, select **Group Unassigned** and click **OK**.

   Every net that has a pad with an unassigned test point inside the Frame is split. The split nets are highlighted in red.

Split Flip

This feature allows you to split out unassigned test points, but instead of copying the entire net containing the unassigned point, it copies the unassigned point and only one other point of that net.

To Do a Split Flip:

1. On the **Action** menu, click **Split Net**.
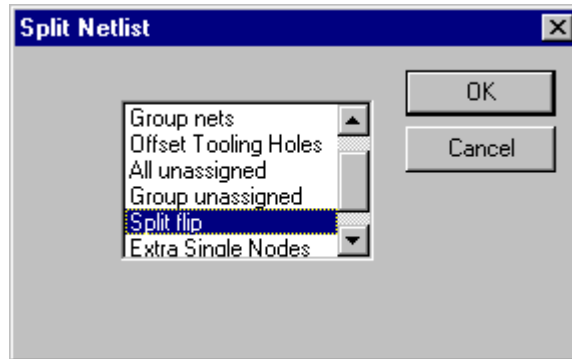
Split Flip

2. On the **Split Netlist** dialog, select **Split Flip** and click **OK**.

Tooling Holes and Split Nets

D Codes mapped as tooling holes are automatically saved with nets that are split out to a different .JOB file. But when you split nets to an offset position on the same fixture, you also need to have FixMaster copy and offset the D Codes mapped as tooling holes. For more information about Tooling Holes, see *PCB Tooling Holes and Fixture Alignment Pins* on page 385.

Copy and Offset Tooling Holes for Split Nets:

1. After splitting nets, go to the **Action** menu, and click **Split Net**.
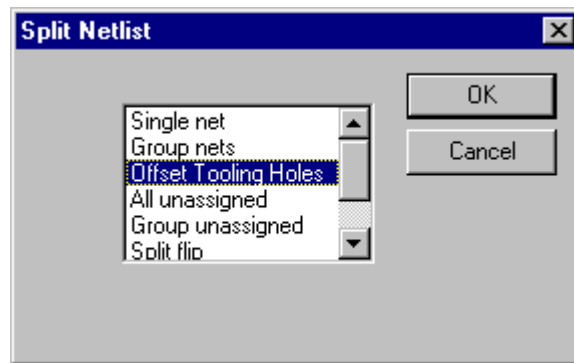
Offset Tooling Holes

2. On the **Split Net** dialog, select **Offset Tooling Holes** and click **OK**.

FixMaster automatically copies and offsets the D Codes mapped as tooling holes to the same offset as the split nets.

Test for Shorts between Split and Unsplit Nets

As nets are split out, one test point from each of the split nets is copied and left on the PCB with the unsplit nets. This allows you to test the unsplit nets for shorts to the split nets. In order to do a redundant test for shorts the other way, you can copy and split one node from each unsplit net.

Copy and Split One Node from each Unsplit Net:

1. After splitting nets, go to the **Action** menu, and click **Split Net**.
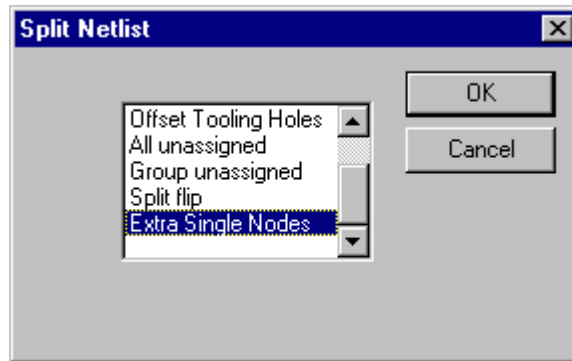
Split Extra Single Nodes

2. On the **Split Net** dialog, select **Extra Single Nodes** and click **OK**.

    FixMaster copies and splits one node from each unsplit net.

Testing Densely Packed Components Separately

In addition to splitting nets, there is another option in FixMaster and ProbeMaster for testing densely packed components separate from the rest of a PCB. The Isolated Component Test feature allows for an efficient way to completely test the nets associated with a densely packed component in two different jobs.

In this case test points inside the densely packed component belong to nets that also have test points in less densely packed areas. All the test points that are outside the densely packed area are tested as usual along with the rest of the PCB. The test points that are inside the densely packed area are tested separately using a test methodology that can handle the high density (a denser grid or a flying probe). For every net that has a test point inside the densely packed area, one test point in that net that is outside the densely packed area is also tested. That test point is the "bridge" between the two jobs because it is tested with the densely packed region, and it is also tested along with the rest of the PCB. The Isolated Component Test feature generates the "bridge" test points for the densely packed component.

Note: *The Isolated Component Test feature is not a Split Net operation because FixMaster does not generate the two split jobs. You must save the two jobs separately. In one job you generate test points for all but the densely packed component, and in the other job you generate test points for the component and then use the Isolated Component Test feature to generate the "bridge" test points outside the component.*

To Insert "Bridge" Test Points for a Single Net in a Densely Packed Component:

1. Position the Frame around the densely packed component.

2. On the **Action** Menu, click **Iso Component Generate**.
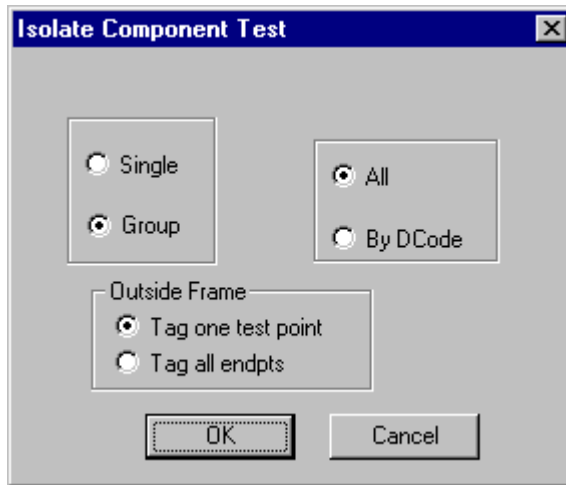
Isolate Component Test Dialog

3. On the Isolate Component Test Dialog, select **Single**.

4. In the Outside Frame group box, select whether to generate **only one test point** outside the Frame, or to generate **test points for all endpoints** of the selected net.

    *   **Tag One Test Point:** If this option has a checkmark, then the command will generate only one test point outside the Frame for the selected net.

    *   **Tag All Endpoints:** If this option has a checkmark, then the command will generate test points for all endpoints of the selected net.

5. Click **OK**.

    FixMaster prompts you to select an element.

6. Click inside a pad of the component that belongs to the net that you want to generate a "bridge" test point for.

    FixMaster inserts test points in the pads of the selected net that are inside the Frame. And if the net has test points outside the Frame, FixMaster also inserts a test point in one (or all endpoints) outside the Frame.

To Insert "Bridge" Test Points for All Nets in a Densely Packed Component:

1. Position the Frame around the densely packed component.

2. On the **Action** Menu, click **Iso Component Generate**.
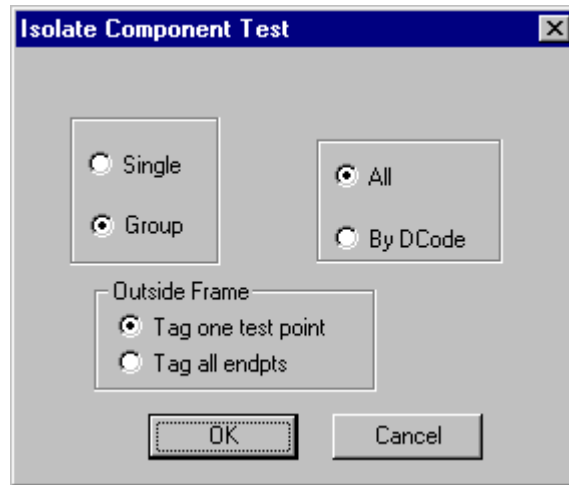
Isolate Component Test Dialog

3. On the Isolate Component Test Dialog, select **Group** and select **All.**

4. In the Outside Frame group box, select whether to generate **only one test point** outside the Frame, or to generate **test points for all endpoints** of the selected net(s).

   - **Tag One Test Point:** If this option has a checkmark, then the command will generate only one test point outside the Frame for the selected net(s).

   - **Tag All Endpoints:** If this option has a checkmark, then the command will generate test points for all endpoints of the selected net(s).

5. Click **OK**.

6. Click inside the Frame.

   FixMaster inserts test points in all the pads inside the Frame. And if the nets of the component have test points outside the Frame, then for each net FixMaster also inserts a test point in one pad (or all endpoints) outside the Frame.

To Insert "Bridge" Test Points for Nets with a Specific D Code in a Densely Packed Component:

1. Position the Frame around the densely packed component.

2. On the **Action** Menu, click **Iso Component Generate**.
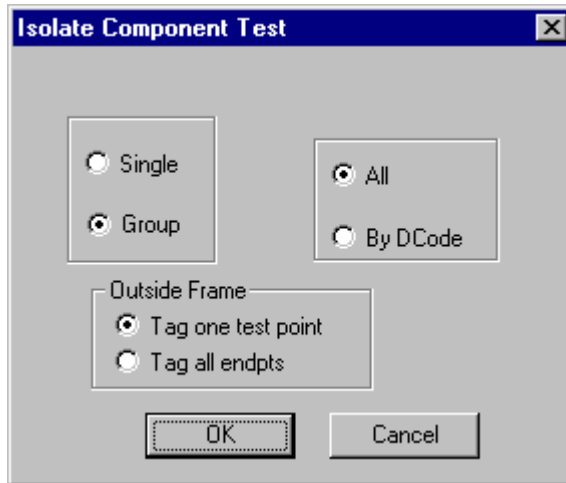
Isolate Component Test Dialog

3. On the Isolate Component Test Dialog, select **Group** and select **D Code.**

4. In the Outside Frame group box, select whether to generate **only one test point** outside the Frame, or to generate **test points for all endpoints** of the selected net(s).

   - **Tag One Test Point:** If this option has a checkmark, then the command will generate only one test point outside the Frame for the selected net(s).

   - **Tag All Endpoints:** If this option has a checkmark, then the command will generate test points for all endpoints of the selected net(s).

5. Click **OK**.

6. Click a pad inside the Frame that has the D Code you want to select.

7. Click again.

   FixMaster inserts test points in all the pads inside the Frame that have the selected D Code. And if the nets of the component have test points outside the Frame, then for each net FixMaster also inserts a test point in one pad (or all endpoints) outside the Frame.

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Chapter 15
Wire Wrapping

In FixMaster wire wrapping is used to set up testing for several types of testers that do not rely exclusively on conventional test fixtures. In some cases, such as clamshell testers, test points are wire wrapped to pins on the fixture that then contact the test grid. In other cases, such as dedicated testers, test points are wire wrapped directly to the tester without going through the grid. In both cases the concept and the procedure is the same in FixMaster.

Wire Wrapping Outline:

1. First you **set up a block of drills and tag them as a translation block.** The drills of the translation block represent the locations to which the test points will be wire wrapped. FixMaster also has some preloaded translation blocks for specific testers. See *Translation Blocks* below.

2. After the translation block is created, you automatically or manually **assign each test point to a translation block location**. See *Wire Wrap Test Points* on page 243.

3. Before writing out the files, **edit the road map** for clarity. See *Edit the Appearance of the Wire Wrap Road Map* on page 257.

4. Along with the other test and fixture files, **export the wire wrap road map**. See *Export a Gerber Road Map for Wire Wrapping* on page 350.

Translation Blocks

The first step to wire wrapping is to create and tag the translation blocks. FixMaster will give an error message if you attempt to go into Wire Wrap Mode without first creating a translation block. A translation block is a block of drills that represent the locations to which the test points will be wire wrapped. Each translation block is highlighted in a separate color, and the same color will be used to represent the wire wrap path for test points wrapped to that block.

If you are using one of the testers for which FixMaster has pre-loaded translation blocks, you can use the Custom Block command to automatically generate translation blocks for your tester.

If you are not using one of the testers for which FixMaster has pre-loaded translation blocks, you must create a block of drills and use the Tag command to tag them as translation holes. You can also untag a block by using the Untag command.

Using Pre-Loaded Translation Blocks

FixMaster has pre-loaded translation blocks for some Everett Charles testers, for the TTI model 1400 and for some Utron testers. If you are using these testers you can use the pre-loaded translation blocks.

To Use Pre-Loaded Translation Blocks:

Note: *Do not set up the pre-loaded translation blocks if you are not going to be using one of the testers listed on the dialog box. This setup affects the format of the drill files and the tester download files. If you open this dialog and are planning to use a different type of tester, select **None** for the tester type.*

1. On the **Action** menu, click **Wire Wrapping-Custom Block**.

   FixMaster displays the Custom Block Dialog.
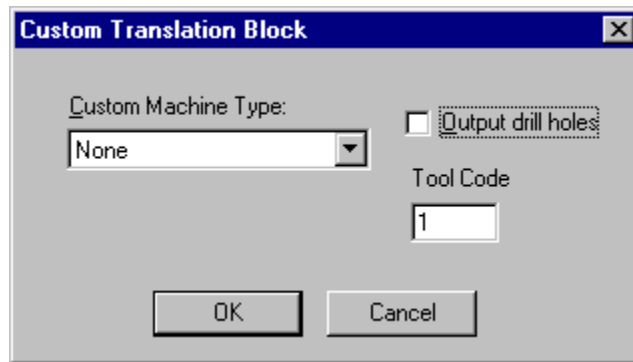
Custom Block Dialog

2. In the Custom Machine Type drop down list, select the tester you are using:

   - **ECT4K:** Generates new translation blocks for Everett Charles tester with 4096 test points and deletes previously built translation blocks.

   - **ECT8K:** Generates new translation blocks for Everett Charles tester with 8192 test points and deletes previously built translation blocks.

   - **ECT10K:** Generates new translation blocks for Everett Charles tester with 10240 test points and deletes previously built translation blocks.

   - **TTI1400:** Generates translation blocks for the TTI model 1400 tester. FixMaster uses Unicated Translation Type 14 for addressing the top side fixture via the rear connectors.

   - **ECT4KBOTH:** Generates new translation blocks for Everett Charles tester with 4096 test points and deletes previously built translation blocks. Displays and wraps data for both sides of the part.

   - **ECT8KBOTH:** Generates new translation blocks for Everett Charles tester with 8192 test points and deletes previously built translation blocks. Displays and wraps data for both sides of the part.

- **UTRON/READ/KYOEI:** Generates new translation blocks for Utron, Read and Kyoei testers and deletes previously built translation blocks.

- **UTRONBOTH/KYOEIBOTH:** Generates new translation blocks for Utron, Read and Kyoei testers and deletes previously built translation blocks. Displays and wraps data for both sides of the part.

3. In the Tool Code field, enter the Tool Code to be used for the translation block drills.

4. In the Output Drill Holes checkbox, select whether the holes for the translation blocks are to be exported in the drill files. Some testers wire wrap directly to the tester, not the fixture, so translation holes do not need to be exported and drilled.

   - To export all wired translation holes when writing drill files, click the **Output Drill Holes** checkbox so that it has a checkmark.

   - To select not to export translation holes when writing drill files, click the **Output Drill Holes** checkbox so that it does not have a checkmark.

5. Click **OK**.

   FixMaster prompts, "Existing translation blocks will be deleted. Continue?"

6. Click **Yes**.

7. If you are creating a TTI1400 custom block, you must enter the number of the first sequential drill in the translation block. Subsequent drills are counted starting from this number.

   FixMaster deletes any existing translation blocks and generates the new pre-loaded custom translation blocks.

Menu: *Action-Wire Wrap-Custom Block*

Button: *None*

Key: *None*

Creating Translation Blocks for Wire Wrapping

If you are not using one of the preloaded translation blocks for specific testers, you will have to create your translation blocks manually.

To Create Translation Blocks for Wire Wrapping:

1. Make plate 0 the active, visible plate. Translation holes must be in plate 0.

2. On the **Edit** menu, click **Drill-Fixture-Change Tool** and select the Tool Code you want to use for the translation block drills.

3. On the **Edit** menu, click **Drill-Fixture-Insert Drill**.

4. Position the cursor where you want the lower left corner of the translation block and align with the fixture grid.

5. Insert a drill by pressing the **Enter** key.

6. Position the Reference Frame around the drill.

7. On the **Edit** menu, click **Fixture-Drill-Step/Repeat**.

   FixMaster displays the step and repeat input box.

8. In the Copies X and Y fields, enter the number of drills you want in the translation block in X and Y directions.

9. In the Step X and Y fields, enter the interval between drills in the X and Y directions. The interval of the translation block must match the interval of the fixture grid.

10. On the Step/Repeat dialog, click **OK**.

    FixMaster steps and repeats the drill as you specified.

11. Position the Reference Frame around the stepped-and-repeated pattern.

12. On the **Action** menu, click **Wire Wrap-Tag**.

    FixMaster displays the translation block Sort Setup dialog.
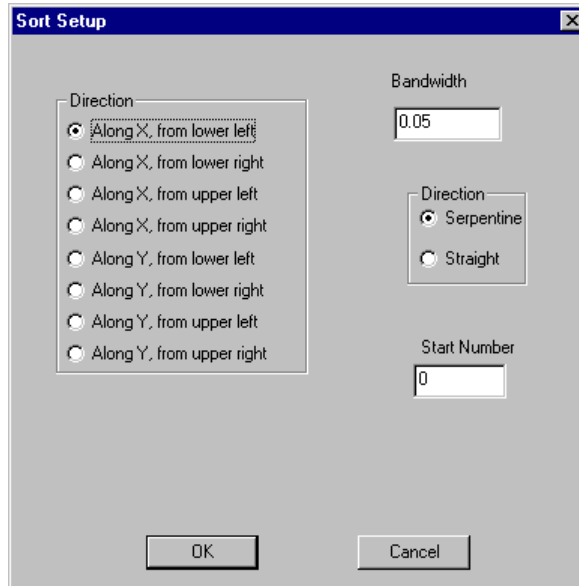
Translation Block Sort Setup

13. In the Direction group box, select a starting point and direction for your hole sort.

14. Select either a Serpentine or Straight sort.

    Serpentine: Sorts translation holes in a forward and backward motion. When FixMaster reaches the end of the row, it moves over by one band width, and sorts in the opposite direction. Not as commonly used as the straight sort.

    Straight: Sorts translation holes only in one direction. When FixMaster reaches the end of the row, it returns to the beginning of the row, moves over by one band width, and sorts again in the same direction. The straight sort is recommended over the serpentine sort

15. Set the Band Width to a number less than the interval you specified in the Step and Repeat operation. The Band Width is the width of the channel used in the sorting process.

16. In the Start Num field, set the number of the first sequential drill in the translation block. Subsequent drills are counted starting from this number.

17. Click **OK**

    FixMaster sorts the translation holes and tags the pattern as a translation block.

    The translation block is shown in a unique color, and the wire wrap path for test points wrapped to this translation block will have the same color.

    Once the translation blocks are set up, you are ready to wire wrap.

Menu: *Action-Wire Wrap-Tag (Block)*

Button: *None*

Key: *None*

Untagging a Translation Block

You can "untag" a group of drills that have been tagged as a translation block.

To Untag a Translation Block:

1. Position the Reference Frame around the tagged translation block.

2. On the **Action** menu, click **Wire Wrap-Untag**.

   The colored highlighting is removed from the drills as they are untagged.

Menu: *Action-Wire Wrap-Untag (Block)*

Button: *None*

Key: *None*

Wire Wrap Test Points

After you have tagged the translation blocks, it is time to wire wrap the test points to the translation holes. You have the option of having FixMaster automatically wire wrap test points to translation holes or of wire wrapping manually in Manual Wire Wrapping mode.

Wire Wrap All Test Points Automatically

In order to wire wrap test points automatically, you first set some parameters for how to sort the test points. It is not necessary to enter Wire Wrapping mode to start the automatic wire wrapping function; however, you may later have to manually add or delete some points or edit the wire wrap road map.

To Wire Wrap All Test Points Automatically:

1. On the **Setup** menu, click **Wire Wrap**.

   FixMaster displays the Auto Wire Wrap Config dialog where you set the parameters for sorting the test points. The direction of this sort is automatically matched to the sort direction of the translation holes, which you have already set when creating the translation blocks. See *Translation Blocks* on page 237.

2. Select whether you want FixMaster to sort test points using a closest neighbor sort or a band sort.

   Closest Neighbor: The next closest test point will be the next test point wrapped.

   Band Width: The next test point in the sort row will be the next test point wrapped.

3. If you select a Band Width sort, then you must also enter a Band Width to define the width of the sort row.

4. On the **Auto Wire Wrap Config** dialog, click **OK**.

5. On the **Action** menu, click **Wire Wrap-Auto**.

   FixMaster automatically maps each test point to a translation hole. Translation blocks at the top of the PCB are used first, then the blocks to the bottom, the right and finally the left side.

   Each sequential wire wrapped test point is shown connected to the next by a line. The line represents the wire wrap path and is shown in the same color as the translation block.

Menu: *Action-Wire Wrap-Auto*

Button: *None*

Key: *None*

Wire Wrap Test Points Manually

All manual wire wrapping is carried out in Wire Wrap mode. In this mode you can edit an existing wire wrap job that you generated using the automatic wire wrapping feature, or you can set up an entire wire wrap job by hand.

Entering and Exiting Wire Wrapping Mode

To Enter Wire Wrap Mode:

➢ In the **Action** menu, click **Wire Wrap-Manual**.

The normal editing toolbars and menus disappear and are replaced by the Wire Wrapping Toolbar.

Menu: *Action-Wire Wrap-Manual*

Button: *None*

Key: *None*

To Exit Wire Wrap Mode and Return to Normal Editing:

➢ In the **Action** menu, click **Quit**.

Or

➢ Click the **Exit** button on the Wire Wrapping Toolbar.

Menu: *Action-Quit*

Button:

Key: *None*

Wire Wrap Toolbar

In Wire Wrapping mode, the normal editing toolbars and menus disappear and are replaced by the Wire Wrapping Toolbar. There are also unique keyboard commands in Wire Wrapping mode that are different than the key commands in the normal editing mode.

	WnWrap
	Unwrap
	Translation Block
	Smooth Region
	Swap Points
	Copy Block
	Setup
	Offset Text
	Elbows
	Rotate Number
	Add Number
	Delete Number
	Change Number Size
	Optimize Path
	New Path
	Add Path
	Hide Number
	Unhide Number
	New Number
	Exit

Wire Wrap Toolbar

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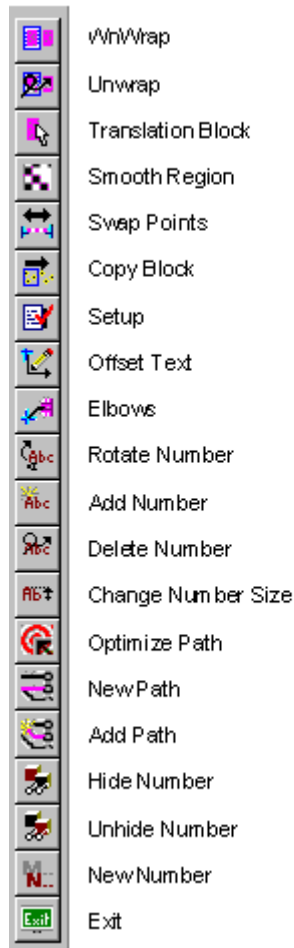
Select Translation Block

Because most wire wrapping commands add or remove wire wrapping to test points for only the selected block, the most important step for most manual wire wrapping commands is to select the translation block you want to work with. All test points wire wrapped to a translation block are shown on a wire wrap path of the same color as the translation block.

To Select Translation Block:

1. In the **Wire Wrapping** Toolbar, click the **Select Translation Block** button.

2. **Click near the translation block** you want to use.

   In the Message Line, FixMaster displays which translation block is selected, the number of holes available in that block for wire wrapping, and the total number of holes in that block. You may now wire wrap test points to the selected translation block.

Menu: *None*

Button:

Key: *None*

Wire Wrapping Test Points One at a Time

You can manually wire wrap test points one at a time.

To Wire Wrap Test Points One at a Time:

1. Select a translation block.

2. If you are using another wire wrapping tool, disengage it by pressing the **Escape** key or by **right-clicking** and selecting **Abort** from the context menu.

3. Position the cursor near the test point you want to wire wrap and press the **Spacebar**.

   A green cross marks the test point, and a line the color of the selected translation block connects it to the previously wrapped test point, indicating the wire wrap path.

Menu: *None*

Button: *None*

Key: *Spacebar*

Wire Wrapping a Group of Test Points onto the End of the Sequence

You can wire wrap a whole group of test points onto the end of the wire wrap sequence.

To Wire Wrap a Group of Test Points onto the End of the Sequence:

1. Select a translation block.

2. On the **Wire Wrap** toolbar, click the **WinWrap** button.

3. Click where you want the first corner of the Frame and drag to the other corner so that the points you want to wire wrap are inside the Frame.

   FixMaster displays options for how to sort the test points in the Frame.
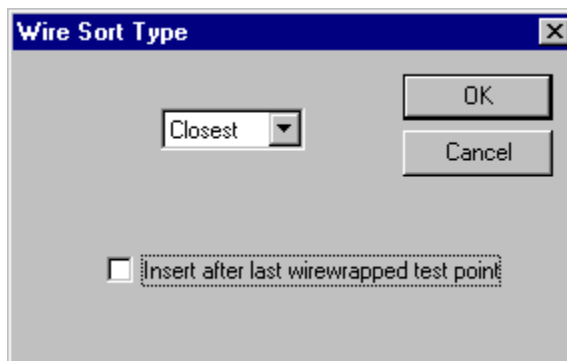
Wire Sort Type Dialog

4. Select whether to sort test points in the Frame using a closest neighbor or a band sort.

   Closest: The sort path will go from the last wrapped point to the next closest point in the Frame.

   Up, Down, Left, and Right Arrows: The sort path will go from the last wrapped point to the next point in the selected direction.

5. To add points to the end of the existing wire wrap sequence, click the **Insert After Last Wire Wrapped Test Point** option so that the option has a checkmark.

   FixMaster prompts you to select the first test point to wrap

6. Click near the test point inside the Frame with which you want to start.

   FixMaster wire wraps all the test points in the Frame, starting with the one you selected.

   This tools remains selected until you select another tool or press the **Escape** key. You can wrap one Frame region after another.

Menu: *None*

Button:

Key: *None*

Wire Wrapping a Group of Test Points into the Middle of the Sequence

You can wire wrap a whole group of test points into the middle of the wire wrap sequence.

To Wire Wrap a Group of Test Points into the Middle of the Sequence:

1. Select a translation block.

2. On the **Wire Wrap** toolbar, click the **WinWrap** button.

3. Click where you want the first corner of the Frame and drag to the other corner so that the points you want to wire wrap are inside the Frame.

   FixMaster displays options for how to sort the test points in the Frame.
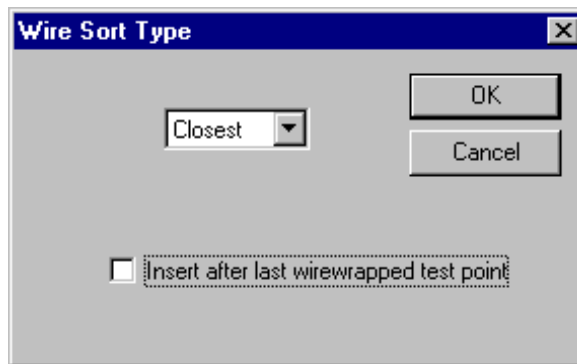
Wire Sort Type Dialog

4. Select whether you want FixMaster to sort test points in the Frame using a closest neighbor sort or a band sort.

   Closest: The sort path will go from the last wrapped point to the next closest point in the Frame.

   Up, Down, Left, and Right Arrows: The sort path will go from the last wrapped point to the next point in the selected direction.

5. To add points to the middle of the existing wire wrap sequence, click the **Insert After Last Wire Wrapped Test Point** option so that the option **does not** have a checkmark.

   In the message line FixMaster prompts you to pick the existing wire wrapped test point after which to insert the new wire wrapped points.

6. Click the left mouse button near the wire-wrapped test point that you want to be before the new points you want to add.

   The cursor snaps to the selected point. FixMaster will break the sequence after the point you selected. Then, after you have wrapped the new points, FixMaster will resume the sequence after the point where it was broken.

   FixMaster prompts you to select the first test point to wrap

7. Click near the test point inside the Frame with which you want to start.

   FixMaster automatically wire wraps all the test points within the Frame, starting with the test point you selected.

   This tools remains selected until you select another tool or press the **Escape** key. You can wrap one Frame region after another.

Menu: *None*

Button:

Key: *None*

Unwrapping the Last Test Point in the Wire Wrap Sequence

You can undo the wire wrapping for the last point in the wire wrap sequence.

To Undo Wire Wrapping for Last Wire Wrapped Test Point:

1. Select a translation block.
2. Press the **Backspace** key.

   The last wrapped test point of the selected translation block is now unwrapped. The green cross moves to the previously wrapped test point. The wire wrap path line is removed from the unwrapped test point.

   You can sequentially unwrap one test point after another by simply activating the command repeatedly.

   You can also designate another translation block and sequentially unwrap test points from it.

Menu: *None*

Button: *None*

Key: *Backspace*

Unwrapping a Single Test Point Anywhere in the Sequence

FixMaster has a tool that allows you to undo wire-wrapped test points one at a time for the selected translation block. Once the feature is activated, you click on the points you want to unwrap. This feature allows you to break into a sequence of wire-wrapped test points, and remove wire-wrapped points from the middle of the sequence.

To Undo Wire Wrapping for a Group of Test Points:

1. Select a translation block for which you want to undo wire-wrapped test points.

2. On the **Wire Wrap** toolbar, click the **Unwrap** button.

3. On the **Unwrap** dialog, click **Single** and click **OK**.

4. Click on the test point you want to unwrap. The selected test points can be anywhere in the wire-wrap sequence, not just at the end.

    The cursor snaps to the test point.

5. Click again.

    FixMaster undoes the wire wrapping for the test point. If the test point was in the middle of the wire-wrap sequence, the sequence now skips from the wire-wrapped point before the removed point to the wire-wrapped point after it.

    This tool remains selected until you select another tool or press the **Escape** key, so you can unwrap one test point after another.

Menu: *None*

Button:

Key: *None*

Unwrapping a Group of Test Points

FixMaster has a tool that allows you to undo the wire-wrapped test points within an area for the selected translation block. Once the feature is activated, you create a Reference Frame around the points you want to unwrap. This feature allows you to break into a sequence of wire-wrapped test points, and remove wire-wrapped points from the middle of the sequence.

To Undo Wire Wrapping for a Group of Test Points:

1. Select a translation block for which you want to undo wire-wrapped test points.

2. On the **Wire Wrap** toolbar, click the **Unwrap** button.

3. On the **Unwrap** dialog, click **Group** and click **OK**.

4. Click where you want the first corner of the Frame and drag to the other corner so that the points you want to unwrap are inside the Frame. The selected test points can be anywhere in the wire-wrap sequence.

5. When the Reference Frame is positioned, click again.

    FixMaster automatically undoes the wire wrapping for all the test points within the Frame and wire wrapped to the selected translation block. If the test points were in the middle of the wire-wrap sequence, the sequence now skips from the wire-wrapped point before the removed points to the wire-wrapped point after them.

    This tool remains selected until you select another tool or press the **Escape** key, so you can unwrap one group of test points after another.

Menu: *None*

Button:

Key: *None*

Smooth Region

FixMaster has a command that attempts to automatically reorder the wire wrap path to remove areas where the path crosses over itself. This makes the wire wrap path easier to read.

To Automatically Smooth Areas where the Wire Wrap Path Crosses Itself:

1. Select a translation block for which you want to smooth the wire wrap path.

2. On the **Wire Wrap** toolbar, click the **Smooth Region** button.

3. Click where you want the first corner of the Frame and drag to the other corner so that the points you want to smooth are inside the Frame. The selected test points can be anywhere in the wire-wrap sequence.

4. When the Reference Frame is positioned, click again.

    FixMaster automatically reorders the wire wrap path to remove areas where the path crosses over itself.

    This tool remains selected until you select another tool or press the **Escape** key, so you can smooth one region after another.

Menu: *None*

Button:

Key: *None*
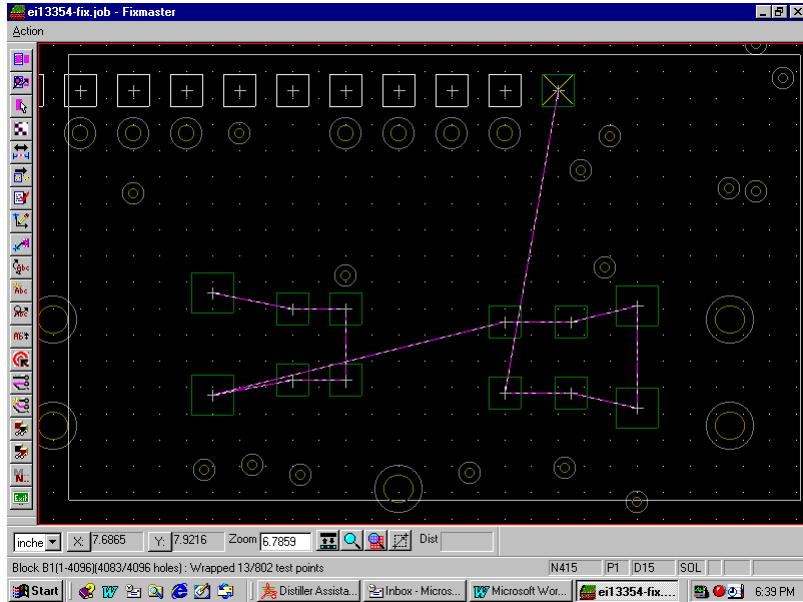
Before the Smooth Region Operation the Path Crosses Over Itself
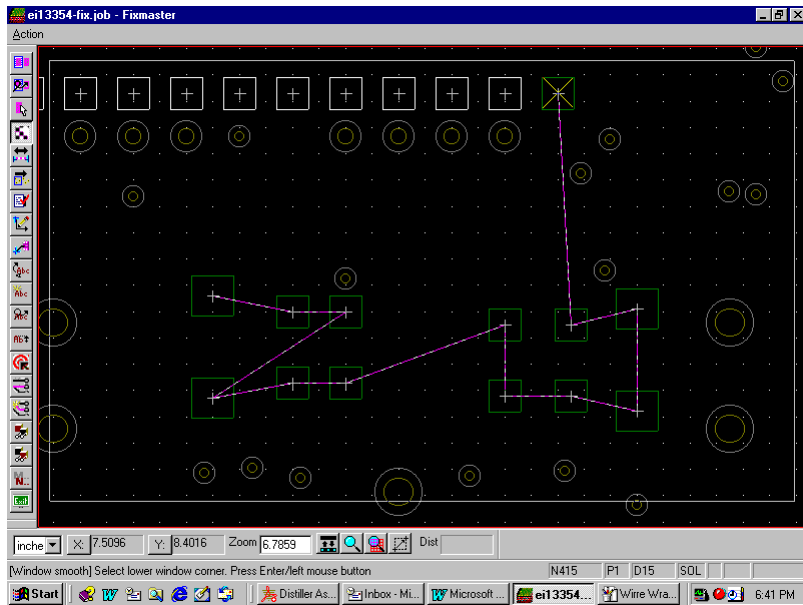
After the Smooth Region Operation the Path Does Not Cross Over Itself

Copy Block

This command copies a segment of the wire wrap path to another identical block of test points. For instance, if a part is wrapped in a particular way, and that part appears elsewhere on the same board, the Copy Block command allows you to wrap the second block in exactly the same way that the first was wrapped.

Menu: *None*

Button:

Key: *None*

Swap Test Points

FixMaster has a command to swap the order of two points in the wire wrap path.

To Swap the Order of Two Points in the Wire Wrap Path:

1. Select a translation block for which you want to swap points in the wire wrap path.

2. On the **Wire Wrap** toolbar, click the **Swap Test Points** button.

3. Click near one of the points you wan to swap.

4. Click near the other point you wan to swap.

   FixMaster reorders the wire wrap path so that the two points trade position in the path.

Menu: *None*

Button:

Key: *None*
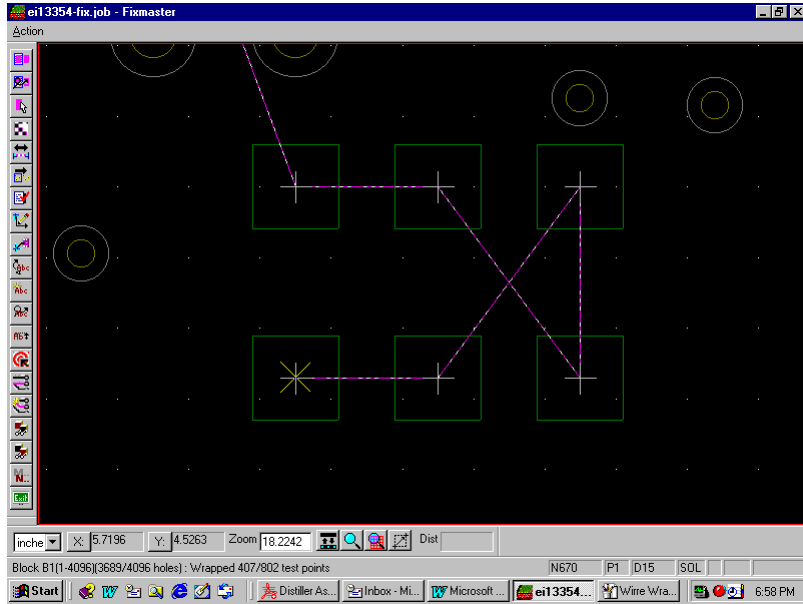
Before the Swap Points Command
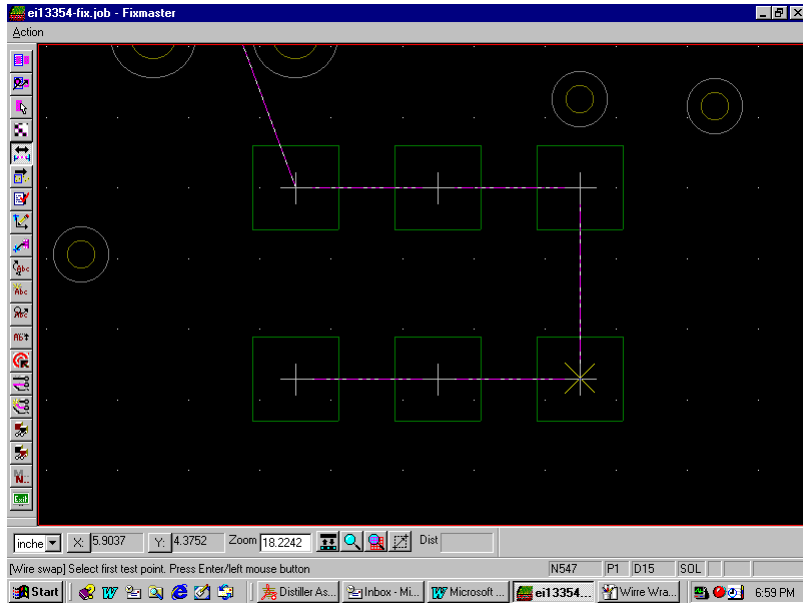
After the Swap Points Command

Go To First, Next, or Previous Wrapped Test Point

FixMaster has commands to move the cursor to the first, next, or previous wrapped test point of the selected translation block respectively. If the indicated test point is on the screen, the cursor hops to it and marks it with a green cross. If it is not on the screen, FixMaster redraws the data at the present zoom level with the test point placed at screen center and marks it with a green cross.

The sequence is the same as that indicated by the colored wire wrap path. Use these commands together to find every wrapped test point of the selected translation block in sequence.

To Go To the First, Next, or Previous Wrapped Test Point:

1. Select a translation block.
2. Press the **F**, **N**, or **B** keys.

Menu: *None*

Button: *None*

Key: *F, N or B keys*

Edit the Appearance of the Wire Wrap Road Map

The wire wrap road map aids in the actual physical wire wrapping of test points to translation blocks. In FixMaster the road map is represented on screen by test points, test point numbers, the colored wire wrap path, and colored translation blocks. The colored wire wrap path indicates the sequence of the wire wrapped points for each translation block. The test point numbers appear periodically on the wire wrap path to help keep track of the sequence. The road map can be output from FixMaster in Gerber format and later plotted for hard copy.

In order to be a helpful tool during the actual wire wrapping, the road map must be clear and easy to read. The manual wire wrapping mode has commands for editing the representation of test point numbers and the wire wrap path to make easy-to-read road maps.

Set up Test Point Number Parameters

Each wire wrapped test point is linked to a specific numbered hole in the translation block. You can display the test point numbers that correspond to the numbered translation block points. There are several options for how to display the test point numbers on the road map.

To Set up Test Point Number Parameters:

1. On the **Wire Wrap** toolbar, click the **Setup** button.

    FixMaster displays the Wire Wrap text setup dialog where you set the parameters for displaying the road map test point numbers.
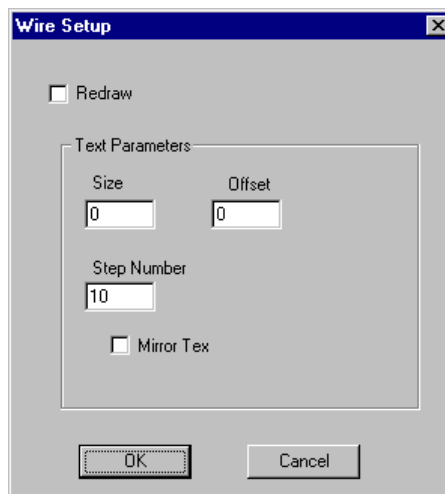
Wire Wrap Road Map Text Setup Dialog

2. In the **Size** field, enter the size of the digits to be used for test point numbers.

3. In the **Offset** field, enter the distance the test point numbers will be offset from the test point. The offset allows the number to be set away from the wire wrap path.

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4. In the **Step Number** field, enter how often you want a test point number to be displayed on the wire wrap path.

   All test points are counted in the number sequence, but the number does not need to be displayed for every test point. For example, entering 1 would display every test point number, while entering 10 would display numbers for every tenth test point.

5. In the **Mirror Text** checkbox, select whether to mirror the text of the test point numbers or to show the test point numbers in the normal orientation.

   - To display the digits in **reverse**, as if in a mirror, click the **Mirror Text** option so that it has a checkmark. This is useful if the road map is going to be output to film and used in the reverse orientation.

   - To display the digits in the **normal orientation**, click the **Mirror Text** option so that it does not have a checkmark.

6. If you want the system to redraw the wire wrap path as you add new test points, select the **Redraw** option. If this option is not checked, the system may not immediately display the new test point numbers as you add new test points to the path, but the numbers will be displayed as soon as the screen is redrawn by zooming or panning. If this option is selected, the numbers will be displayed as soon as you add new test points to the path.

7. Click **OK**.

Menu:	*None*
Button:	
Key:	*None*

Adding a Test Point Number

The test point parameters include a setting for how frequently FixMaster will automatically display a test point number on the wire wrap path. However, you may want to add numbers to test points that are important reference points but which were not automatically numbered. FixMaster allows you to display the number of a test point whose number was not previously shown.

To Add a Test Point Number:

1. On the **Wire Wrap** toolbar, click the **Add Number** ![Abc] button.

2. Click on the test point for which you want to add the number.

   The test point is marked with a green cross and the number is displayed. A white line that represents the number offset connects the cursor to the test point.
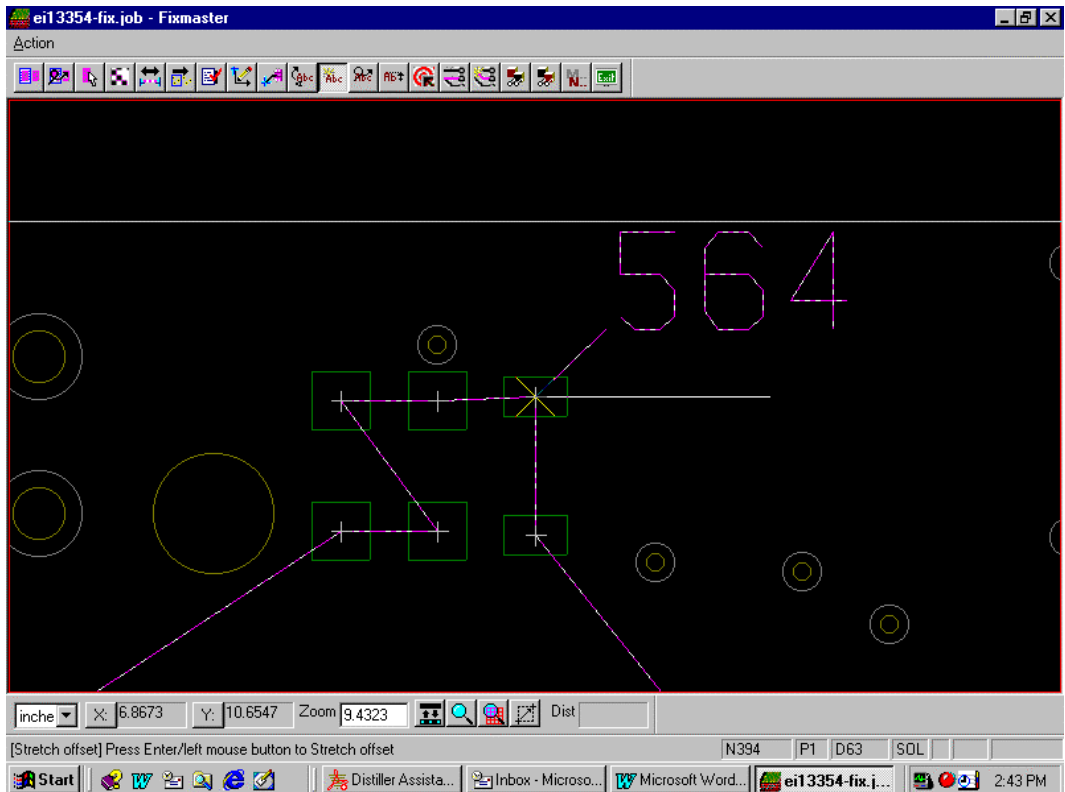
Added Number at Initial Position

3. Move the cursor to where you want the number to be positioned and click the left mouse button again.

The test point number moves to the cursor location.
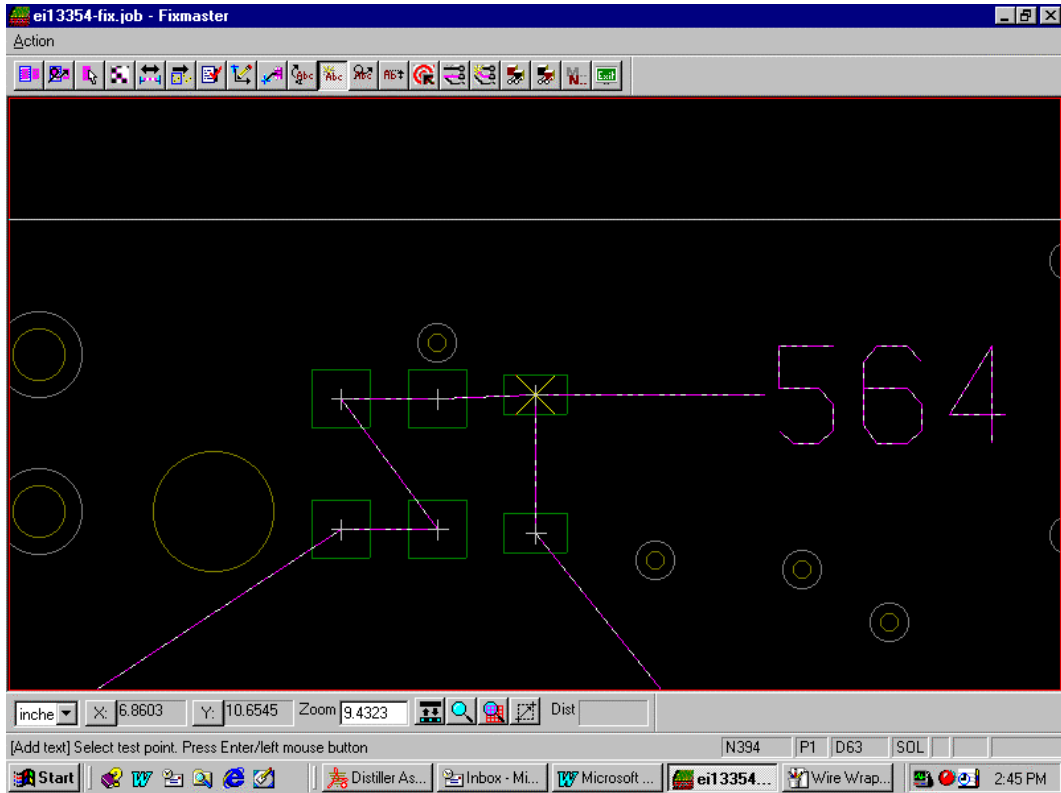
Added Number at Final Position

The Add Number tool remains selected until you select another tool or press the **Escape** key, so you can add one test point number after another.

Menu:	*None*
Button:	
Key:	*None*

Deleting a Single Test Point Number

You can delete a test point number from the wire wrap Road Map.

To Delete a Test Point Number:

1. On the **Wire Wrap** Toolbar, click the **Delete** button.
2. On the Delete Text dialog, click **Single** and click **OK**.
3. Click on the test point for which you want to delete a test point number.

   The cursor snaps to the test point.
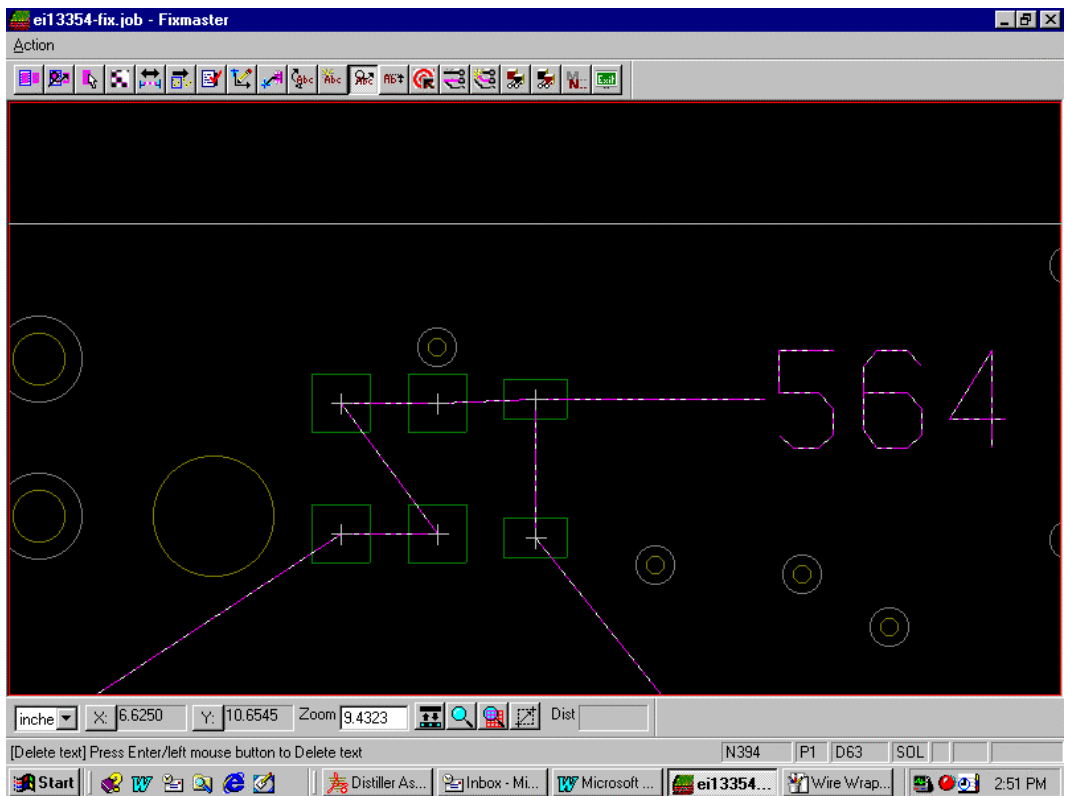
Before Deleting Number

4. Click again.

The test point number is deleted
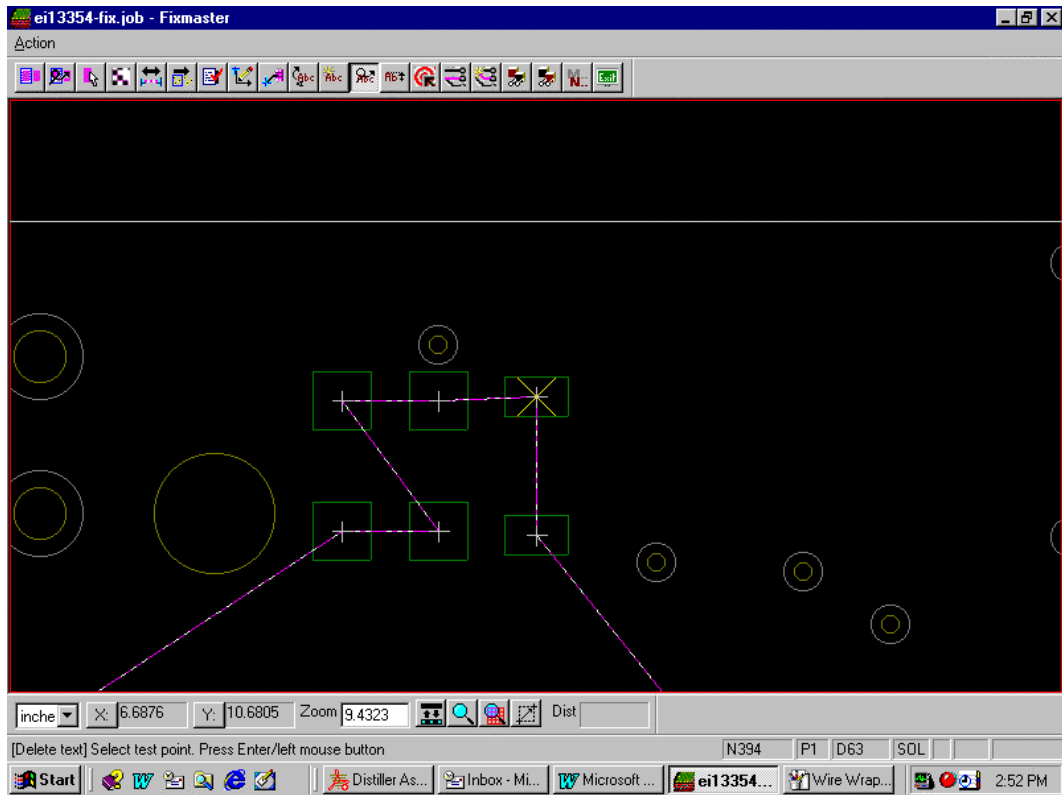
After Deleting Number

The Delete Number tool remains selected until you select another tool or you press the **Escape** key, so you can delete more than one test point number.

Menu: *None*

Button: [button icon]

Key: *None*

Deleting a Group of Test Point Numbers

You can delete a group of test point numbers from the wire wrap Road Map.

To Delete a Group of Test Point Numbers:

1. On the **Wire Wrap** Toolbar, click the **Delete** button.

2. On the **Delete Text** dialog, click **Group** and click **OK**.

3. Click where you want one corner of the Frame and then drag the Frame across all the test points for which you want to delete numbers.
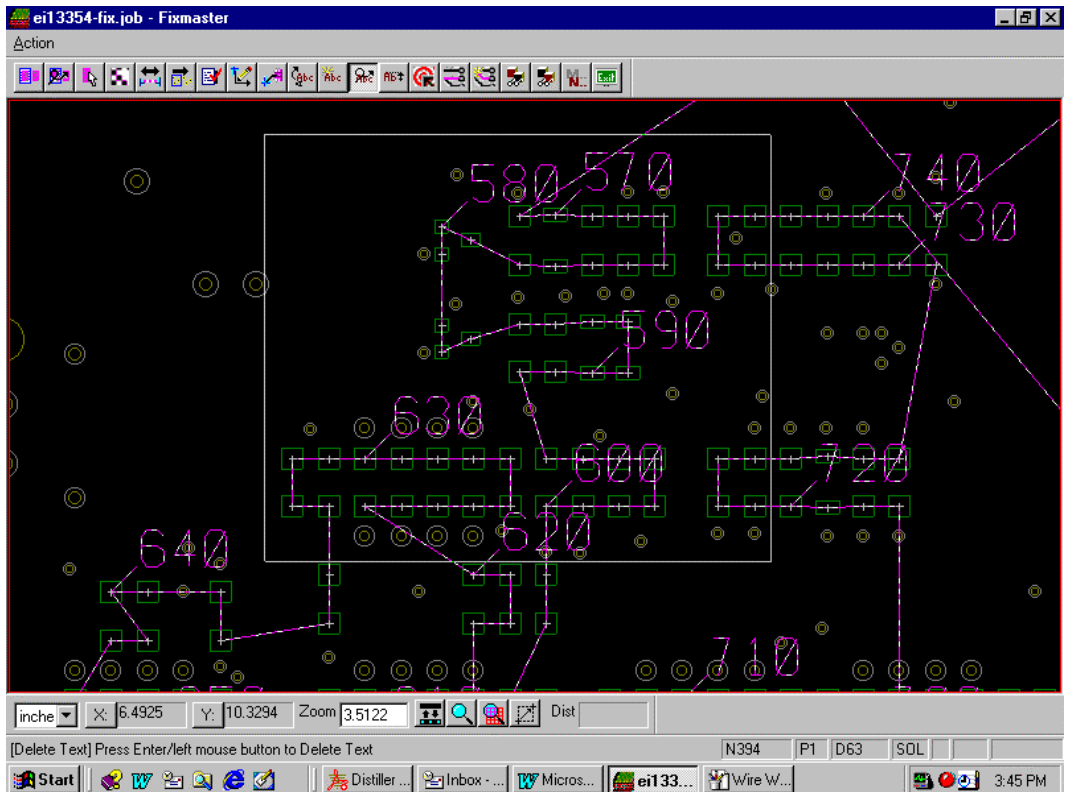
Frame Positioned to Delete Numbers

4. Click again.

The test point numbers inside the Reference Frame are deleted.
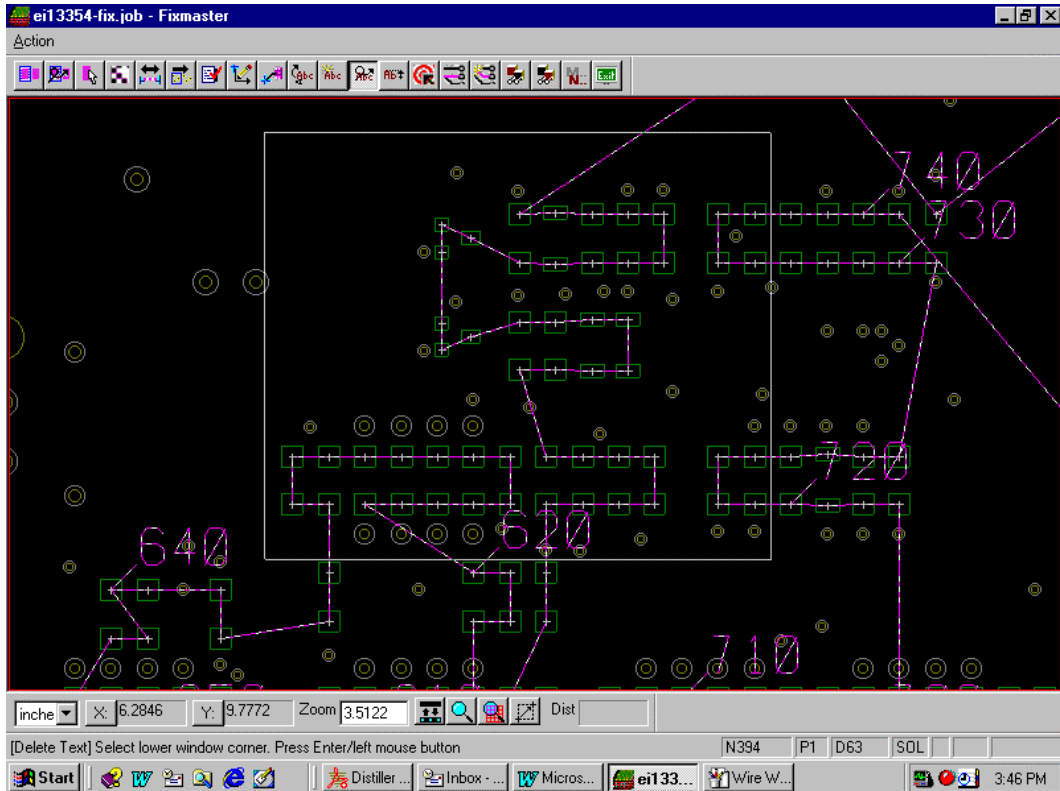
After Numbers are Deleted for Test Points Inside Frame

The Delete Number tool remains selected until you select another tool or you press the **Escape** key, so you can delete more than one group of test point numbers.

Menu: *None*

Button:

Key: *None*

Change Test Point Number Offset

The test point parameters include a setting for how far FixMaster will automatically offset a test point number from the wire wrap path. However, you can manually change the offset in order to move the numbers out of the way of the wire path.

To Change Test Point Number Offset:

1. On the **Wire Wrapping** toolbar, click the **Offset Text** button.

2. Click on the test point for which you want to offset the number.

   The test point is marked with a green cross and a white line representing the new offset connects the test point to the cursor.
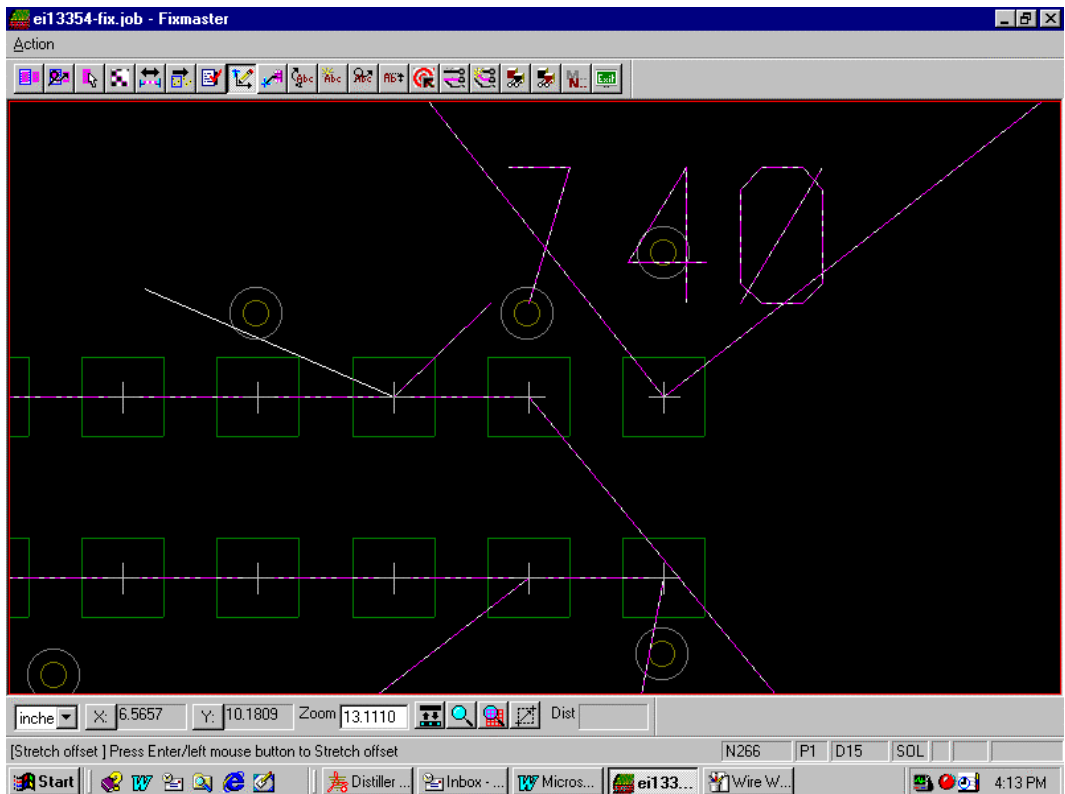
The Test Point is Selected and the White Line Represents a New Offset

3. Move the cursor to the new offset.

4. Click the left mouse button.

The numbers moves to the new offset position.
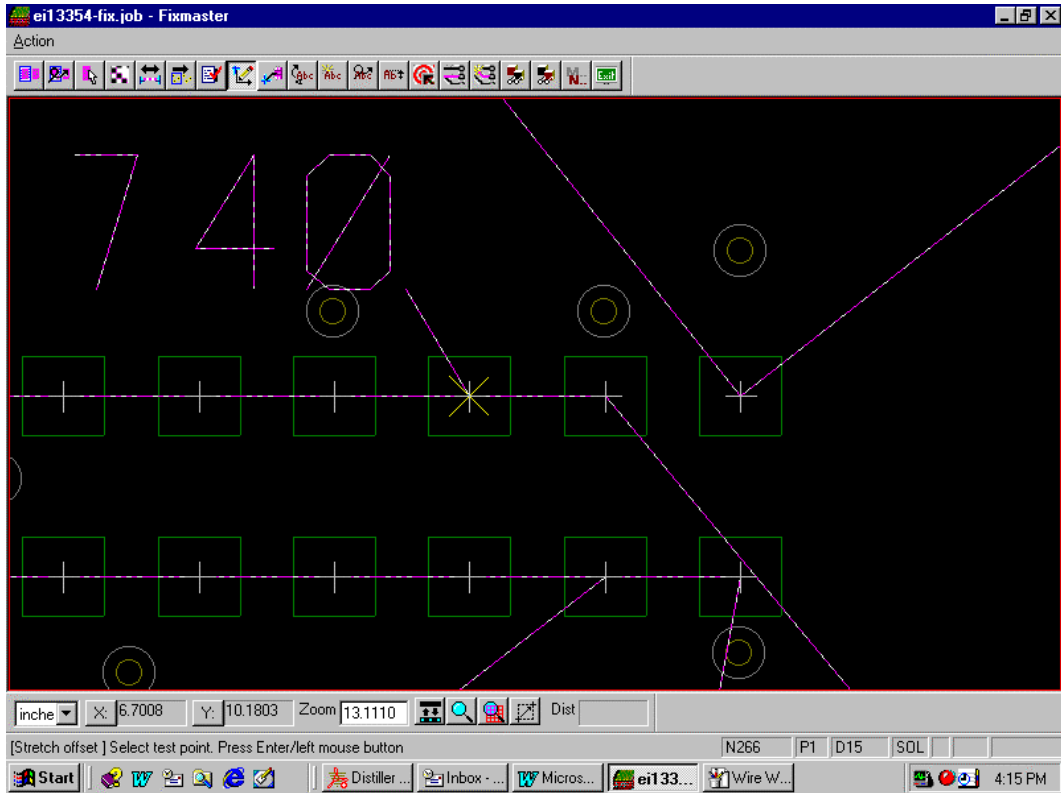
The Number Moves to the New Offset

The Change Offset tool remains selected until you select another tool or press the **Escape** key, so you can change the offset of more than one test point number.

Menu: *None*

Button:

Key: *None*

Rotating the Text of Test Point Numbers to New Orientations

The text of the test point numbers can be displayed at different orientations. Each orientation is a multiple of a 90-degree angle. You may want to change the orientation of a test point number in order to move the number out of the way of the wire-wrap path.

To Rotate the Text of a Test Point Number to New Orientation:

1. On the **Wire Wrapping** toolbar, click the **Rotate Number** ![button icon] button.

2. Click near the test point that has a number you want to rotate.

   The cursor hops to the test point.
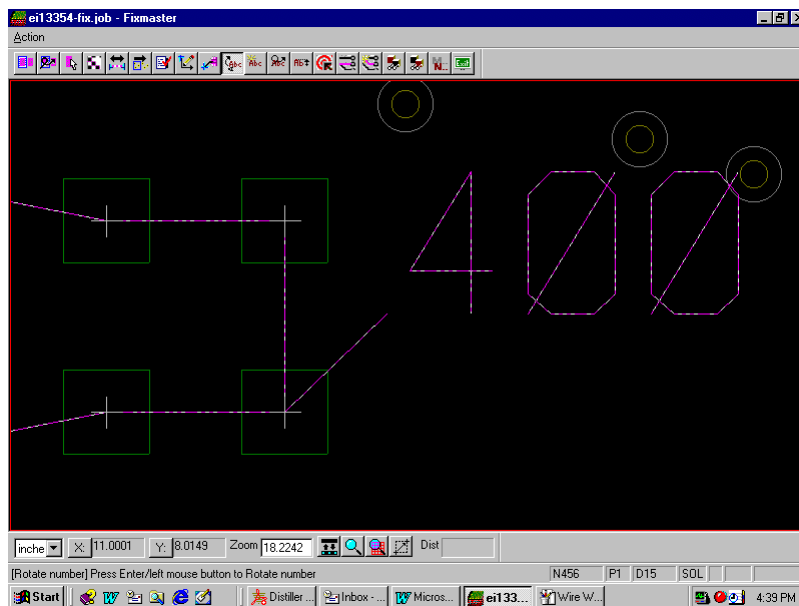
The Selected Test Point Number Before Rotation

3. Click again.

FixMaster displays the Rotate Number dialog.
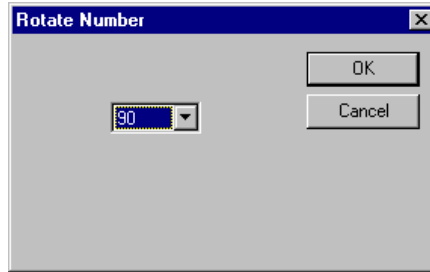
Rotate Number Dialog

4. Select the **Rotation Angle** and click **OK**.

FixMaster rotates the text of the test point number to the new orientation.
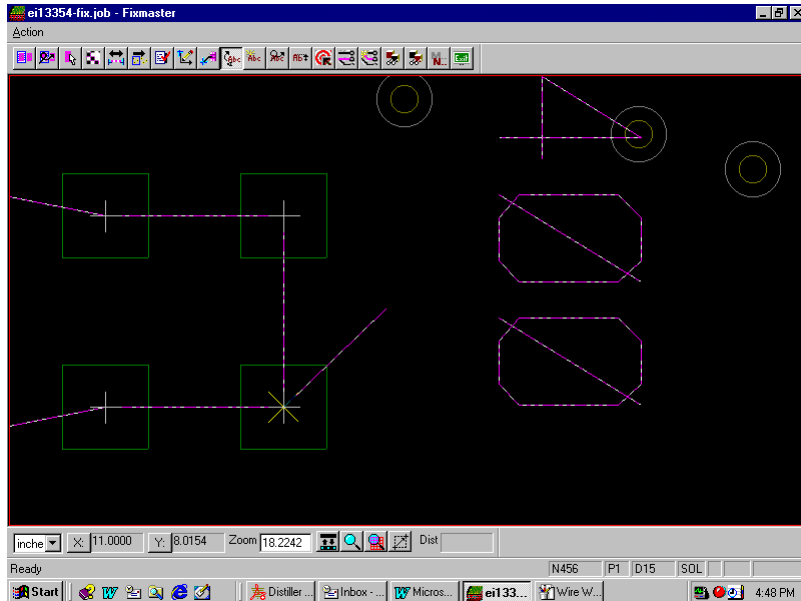
The Number is Rotated

The Rotate Number tool remains selected until you select another tool or press the **Escape** key, so you can rotate the text of one number after another.

Menu:	*None*
Button:	
Key:	*None*

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Optimizing Test Point Number Offset

FixMaster has a feature that attempts to position all test point numbers away from the wire wrap path. This operation does not change the length of the offset, just the angle. Double-check the test point numbers after you use this command to make sure they are positioned the way that you want them.

To Optimize Test Point Number Offset:

➢ On the **Wire Wrap** toolbar, click the **Optimize Path** button.

Menu:	*None*
Button:	
Key:	*None*

Changing the Size of the Test Point Number Text

You can change the size of the text used to display the test point numbers.

To Change the Size of the Test Point Number Text:

1. On the **Wire Wrap** toolbar, click the **Change Number Size** ![button] button.

2. Select **Single** and click **OK**.

3. Click near the test point for which you want to change the size of the number text.

   The cursor hops to the test point.
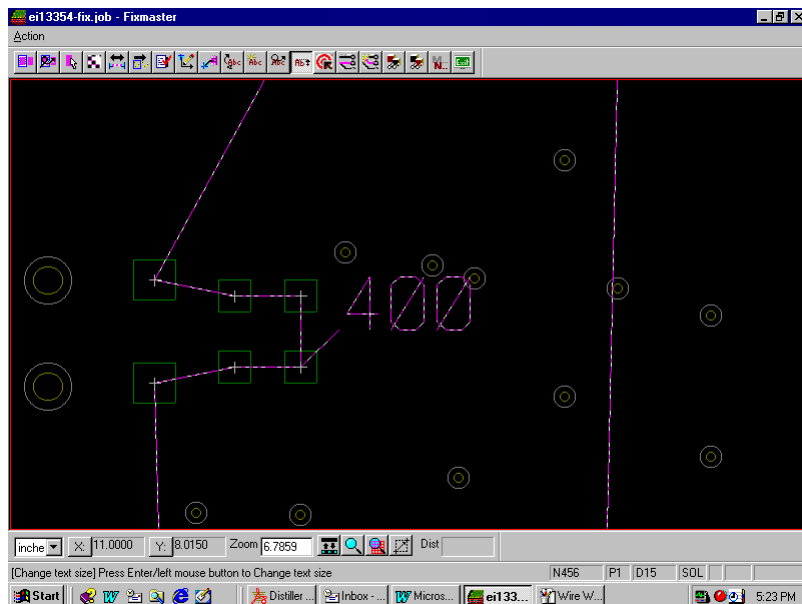
Before the Number's Size has Changed

4. Click again.
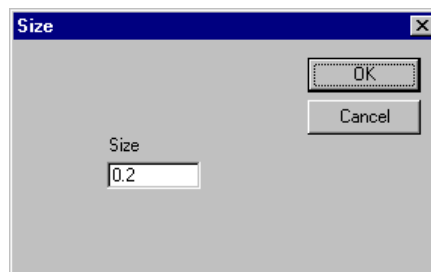
5. On the **Size** dialog, **enter the size** that you want the number to be and click **OK**.

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The text of the test point number changes to the new size.
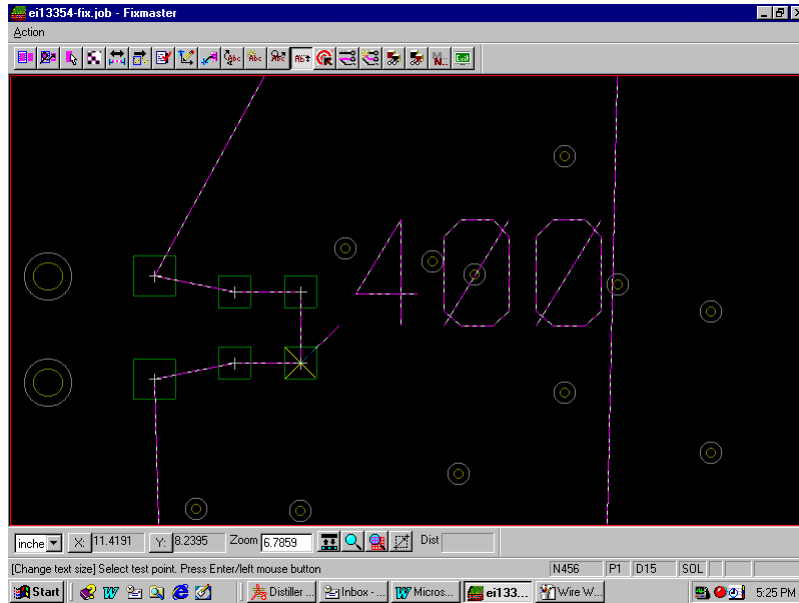
The Number Changes to the New Size

The Change Size tool remains selected until you select a new tool or press the **Escape** key, so you can change the size of more than one number.

Menu:	*None*
Button:	
Key:	*None*

Edit the Route of the Wire Wrap Path

By default FixMaster shows the wire wrap path as straight-line segments between consecutive wire wrapped points. FixMaster allows you to put an elbow in a segment of the path and make it into two segments. With this feature you can reroute the path so that it is not as cluttered.

Adding an Elbow to a Segment of Wire-Wrap Path

You can add an elbow to the wire wrap path so that the straight-line segment does not pass directly over other elements.

To Add an Elbow to a Segment of Wire-Wrap Path:

1. On the **Wire Wrap** toolbar, click the **Add Path** button.
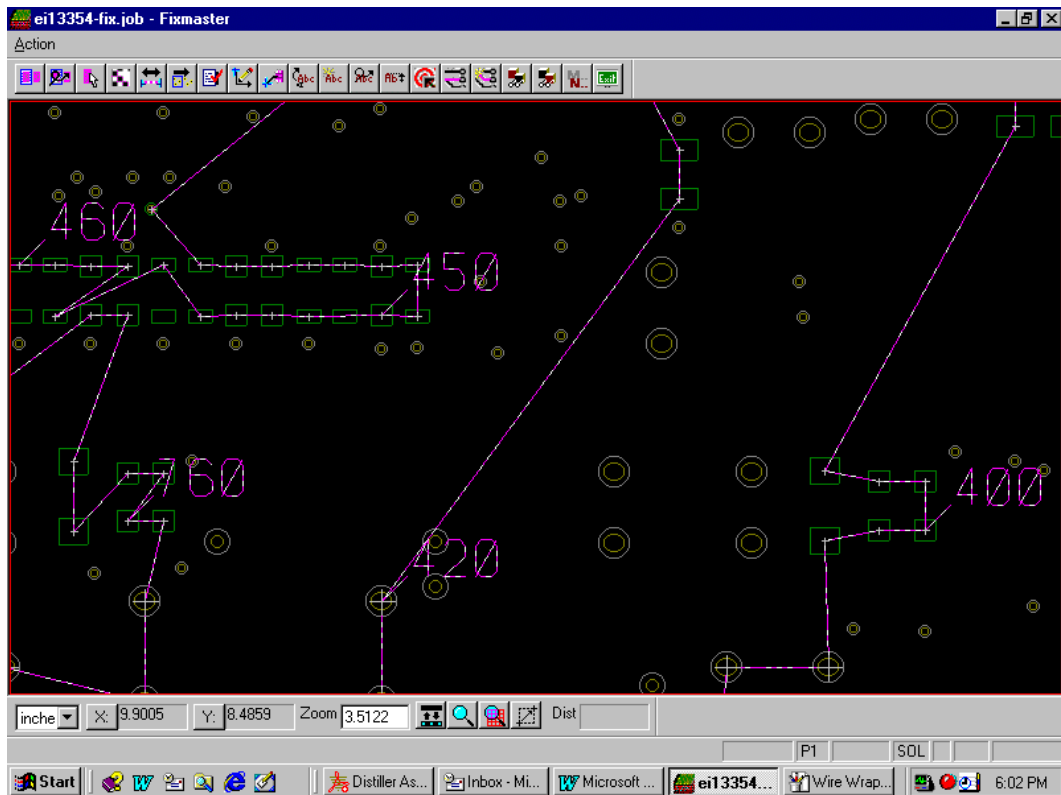
Wire Wrap Path Before the Elbow is Inserted

2. Click near the path segment you want to change.

The path segment is broken into two segments and the elbow is selected.
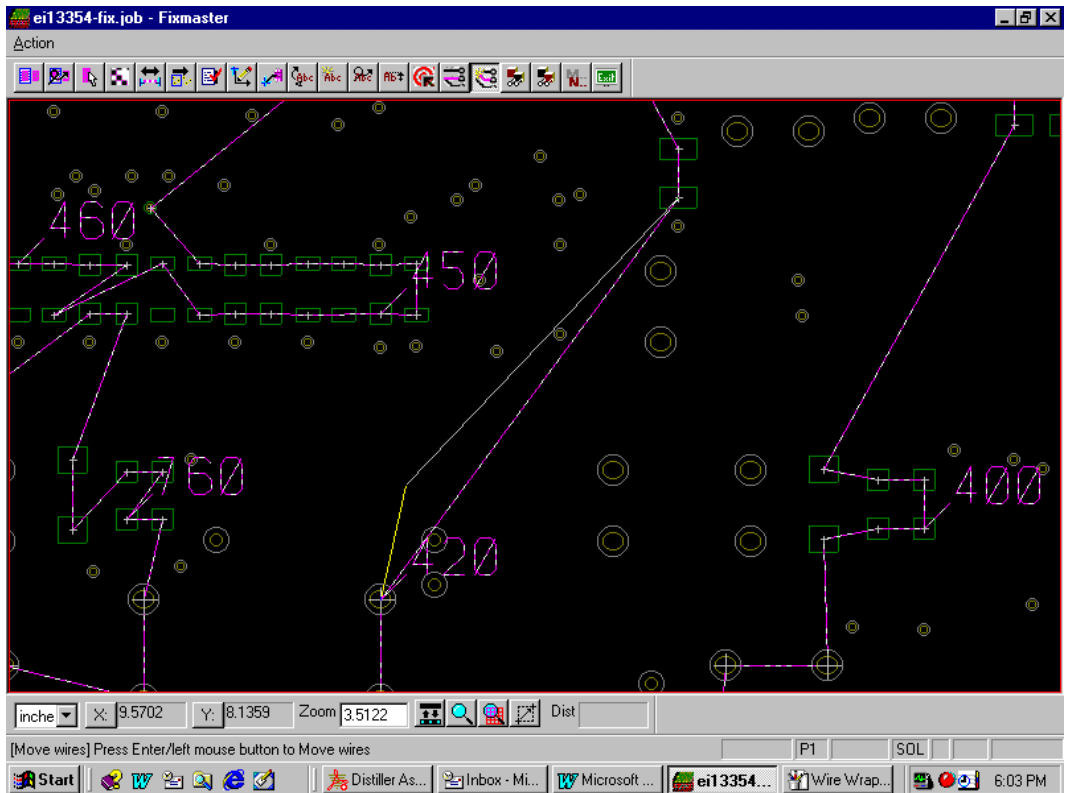
The Elbow is Selected

3. Position the elbow where you want it and click the left mouse button again.

The path segment is replaced by the two segments that meet in an elbow.
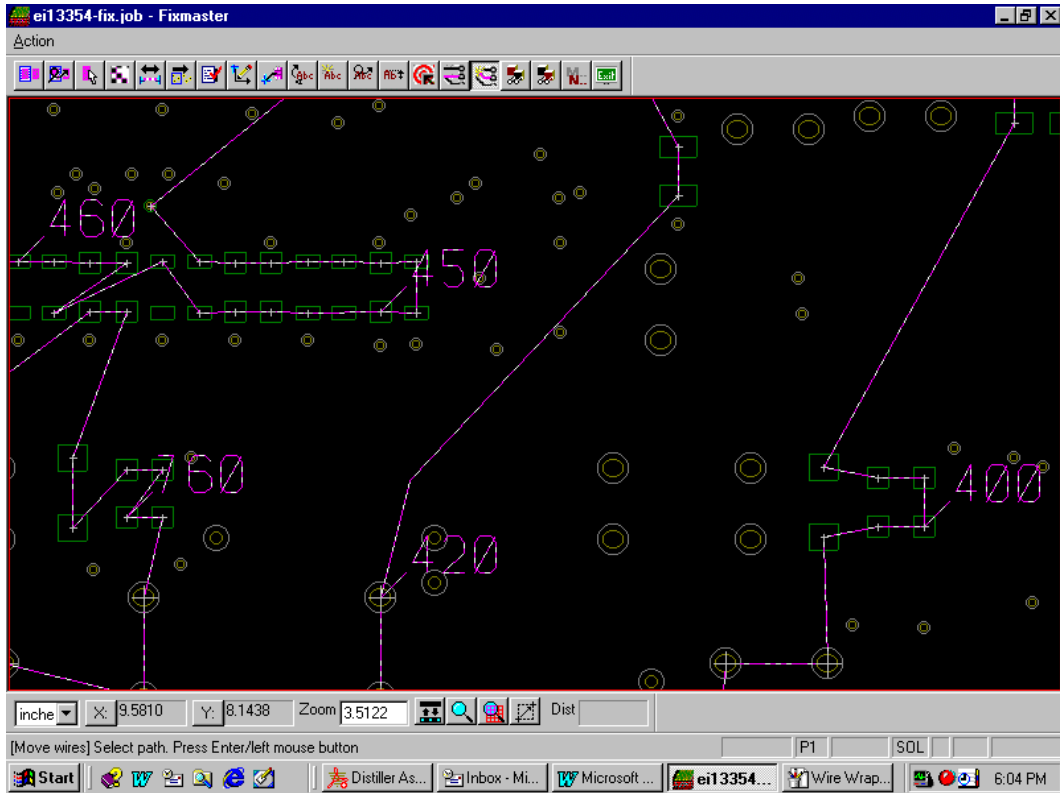
The Wire Wrap Path is Rerouted

The Add Path tool remains selected until you select a new tool or press the **Escape** key, so you can edit other path segments.

After you have rerouted a path segment using the Add Path command, you can restore the original straight-line path segment or add a new elbow. See *Restoring the Original Straight-Line Segment* on page 275.

Menu: *None*

Button:

Key: *None*

Restoring the Original Straight-Line Segment

To Restore the Original Straight-Line Segment:

1. On the **Wire Wrap** toolbar, click the **New Path** button.

2. Click near an endpoint of the path segment you want to restore.

   The straight-line path segment that was broken into multiple segments is restored. At the same time, the path segment is broken into two new segments and the elbow is selected.

3. If you want to leave the restored straight-line path segment connecting the two test points as it is, press the **Escape** key.
   Or
   If you want to reposition the elbow, move it to where you want it and click.

   The path segment is replaced by the two segments that meet in an elbow. And the Add Path tool that allows you to break path segments two segments that meet in an elbow is now selected. This tool remains selected until you select a new tool or press the **Escape** key, so you can edit other path segments.

Menu: *None*

Button:

Key: *None*

Hide a Segment of the Wire Wrap Path

FixMaster allows you to hide segments of the wire wrap path so that they are not shown on screen or exported in the Gerber road map. FixMaster automatically displays the test point numbers for the endpoints of the hidden segment so that the sequence will not be lost. You can use this feature to hide long segments that cut across other portions of the plot.

To Hide Wire-Wrap Path Segment:

1. On the **Wire Wrap** toolbar, click the **Hide Number** ![icon] button.

2. Click near the path segment you want to hide.

   The path segment is selected.
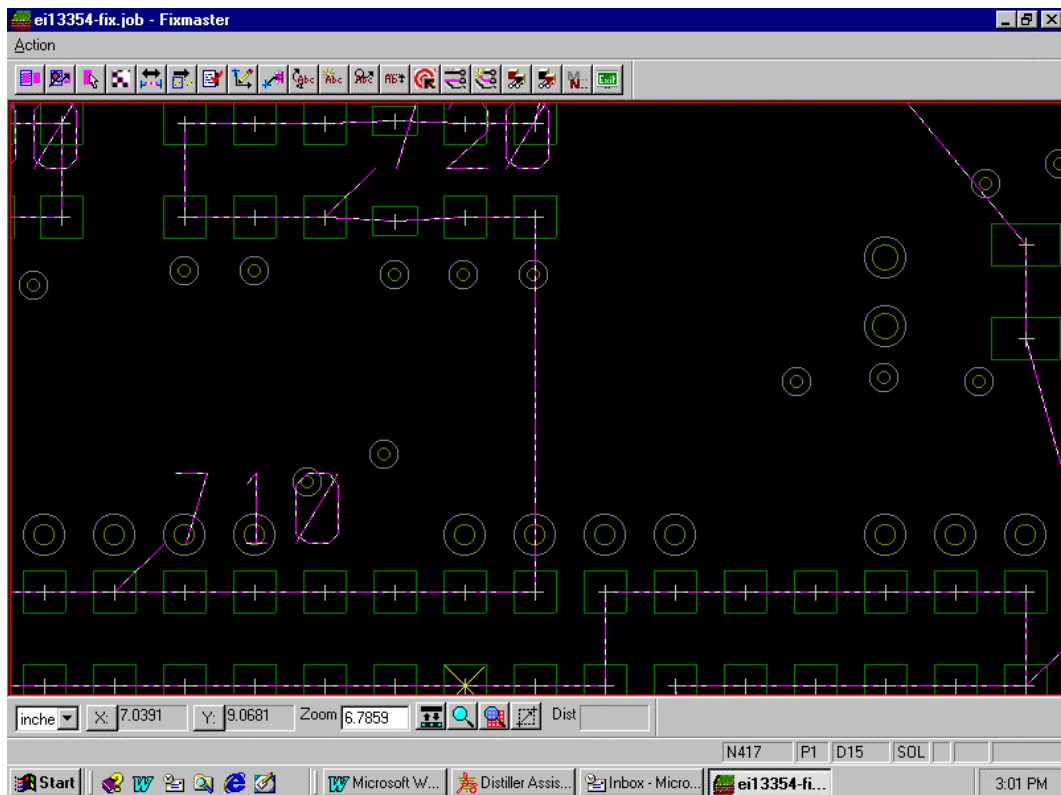
Before the Path Segment is Hidden

3. Click again.

The path segment is hidden.
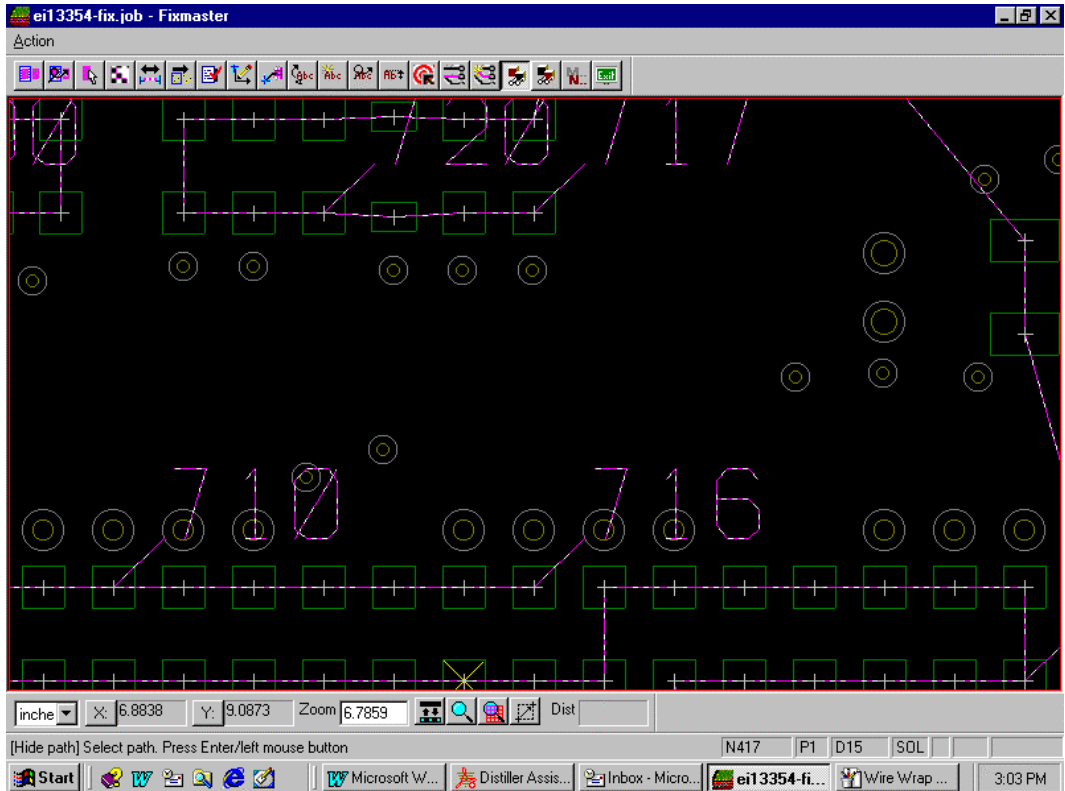
After the Path Segment from Point 716 to 717 is Hidden

The Hide Path tool remains selected until you select another tool or press the **Escape** key, so you hide one segment after another.

After you have hidden a segment of the wire wrap path with the Hide command, you can always restore its visibility using the Unhide Number button. See *Restoring Visibility to Hidden Segments of Wire-Wrap Path* on page 278.

Menu: *None*

Button:

Key: *None*

Restoring Visibility to Hidden Segments of Wire-Wrap Path

If you have hidden segments of the wire wrap path, you can restore visibility to those segments.

To Restore Visibility to Hidden Segments of Wire-Wrap Path:

1. On the **Wire Wrap** toolbar, click the **Unhide Number** button.

2. Click near the first test point of the path segment you want to restore. When the path segment was hidden, FixMaster automatically displayed the test point numbers for the endpoints of the hidden segment. You must select the first endpoint of the hidden segment.

   The cursor snaps to the test point.
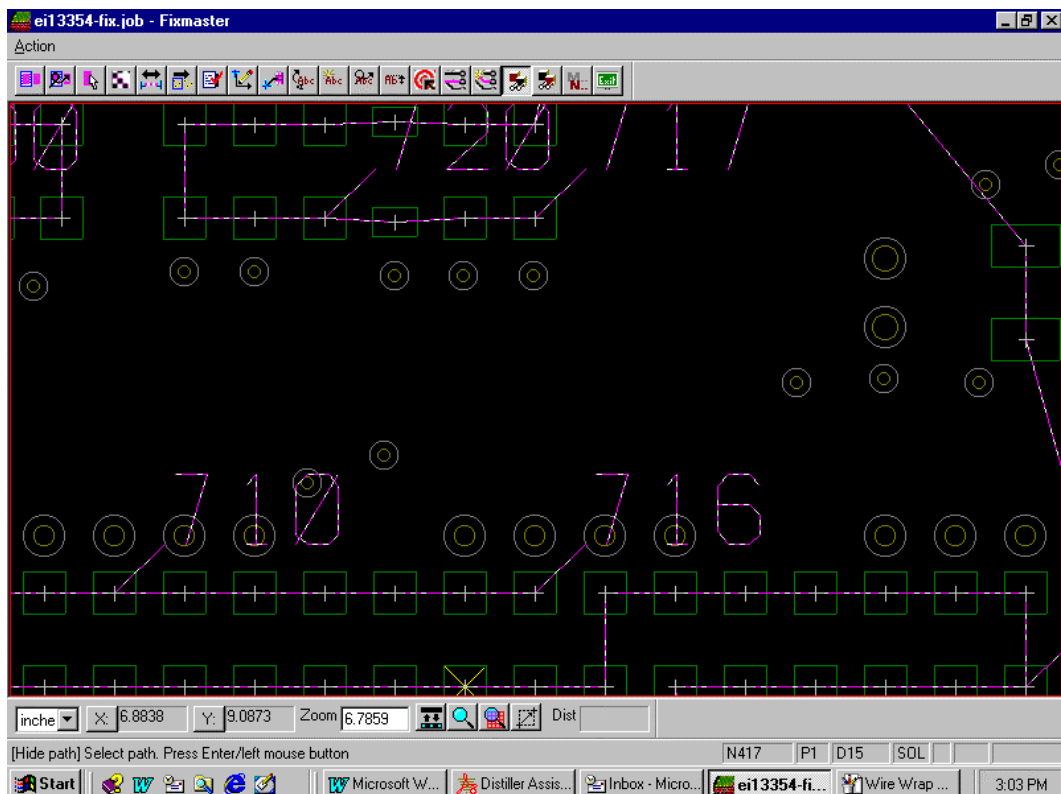
Before the Hidden Segment between Points 716 and 717 is Restored

3. Click again.

The path segment is restored.
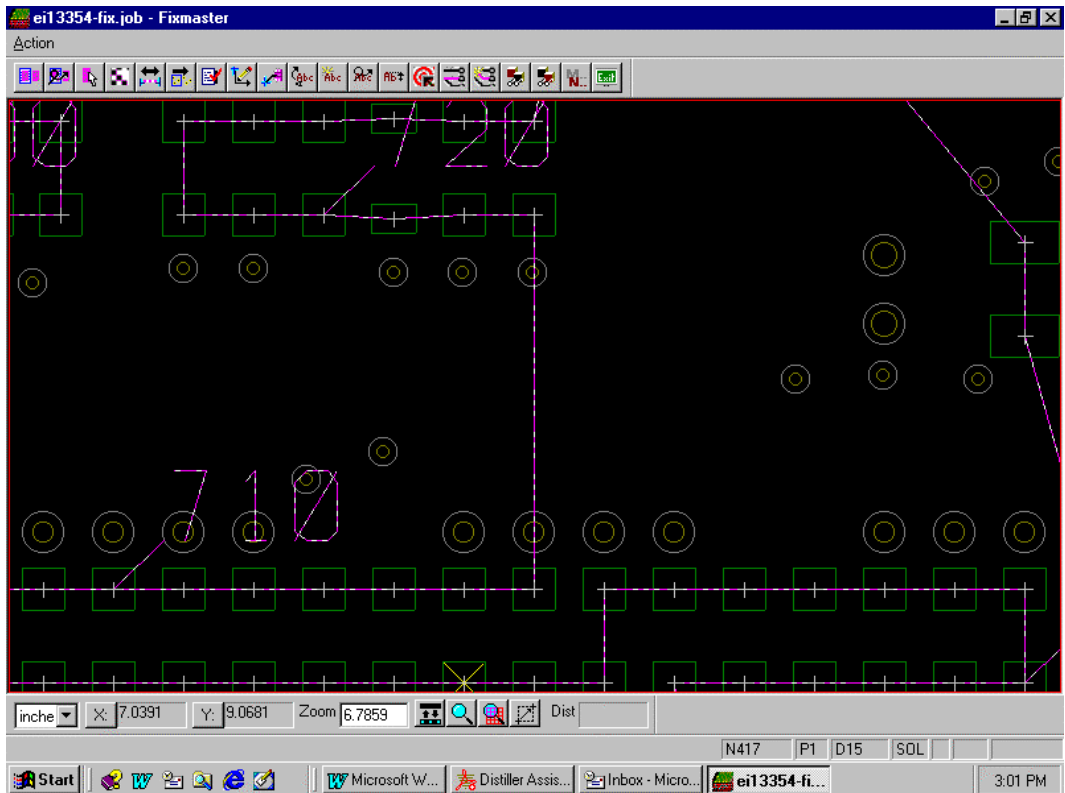
After the Segment is Restored

The Unhide Number tool remains selected until you select another tool or press the **Escape** key, so you can restore other hidden path segments.

Menu:	*None*
Button:	
Key:	*None*

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Chapter 16
Add Spacers, Air Holes and Guter Holes

When all the test points are assigned and all the design rule errors are corrected, you can add spacers air holes and Guter holes to the fixture before outputting the drill and tester files.

Spacers

When spacers are installed in a fixture, they may require different size drills for different fixture plates. Also the actual spacer will be larger than the drill used for mounting it. FixMaster has a feature that allows you to configure spacers to have different drill diameters and different spacer diameters for different plates. When you insert a spacer, FixMaster will display the largest spacer diameter so you can see if the spacer will fit. When the drill files are output, FixMaster will output the proper drill diameter for each plate.

This feature allows you to configure several types of spacers to be used for stiffening the fixture. These spacers will probably be different from those used for outside tooling. For outside tooling you can set up a stack of drills with appropriate drill sizes for each plate in Drill mode, and then copy the whole stack to each outside tooling location. See *Set Up the Fixture Outside Tooling* on page 83.
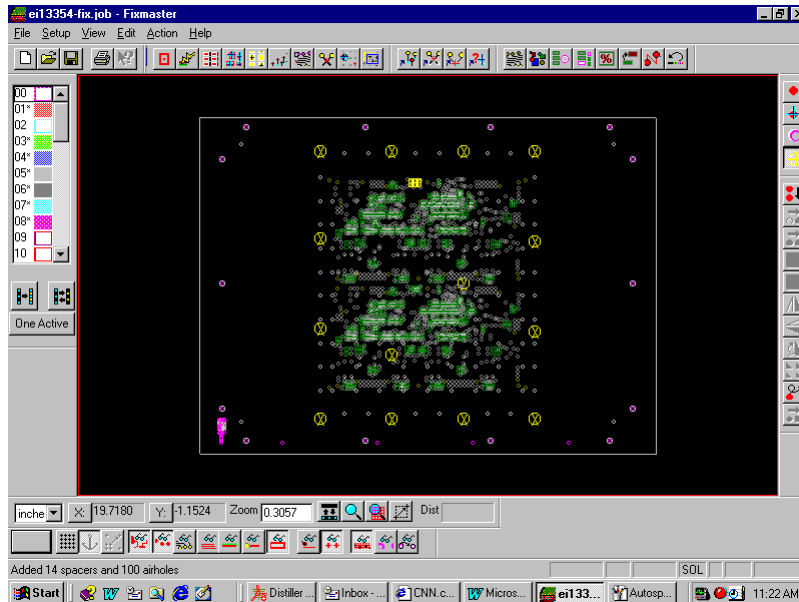
Fixture with Spacers

Set Up Spacers

Before you insert spacers, you must set up the parameters for the spacers that you want to use.

To Set Up Spacers:

1. On the **Setup** menu, click **Fixture-Spacers**.

   FixMaster displays the **Spacer/Guter Setup** dialog table. On the **Spacer Config** tab, there is a table that allows you to set up six different spacers with display diameters and drill diameters for each plate.

Guter/Spacer Dialog, Spacer Config Tab

2. For the first spacer, enter the diameter to display the actual spacer in the **Display** table.

   For a given spacer, there is only one spacer **Display** diameter, regardless of the plate. The spacer will be shown on screen at this **Display** diameter for visual inspection purposes. This way you can determine visually if the spacer is going to interfere with any other element of the fixture. To give yourself some extra margin, you can make this diameter a little larger than the size of the actual spacer.

3. For the first spacer, go to the **Plate** table and enter the diameter of the drill needed for mounting the spacer in each plate.

   The diameters in the **Plate** table will be exported for each plate in the drill files.

   That completes the setup of the first spacer. You may set up any other spacers that you want to use in the same way.

Insert Spacers

Before you insert spacers, you must set up the parameters for the spacers that you want to use. See *Set Up Spacers* on page 282.

When inserting spacers, you should display the PCB data so that you can decide where to place the spacers and you can be sure that spacers are not interfering with features of the board or the fixture.

To Display the PCB Data:

➢ On the **View** menu, click **Data Elements** and look at the menu item that says **PCB**.

- If the **PCB** menu item **has a checkmark**, then the PCB data is being displayed, and you don't need to do anything.

- If the **PCB** menu item **does not have a checkmark**, then click **PCB** so that it has a checkmark and the PCB data is displayed.

You insert and delete spacers in almost the same way that you insert and delete drills.

To Insert Spacers One at a Time:

1. On the **Edit** menu, click **Fixture-Spacers-Insert Spacer**.
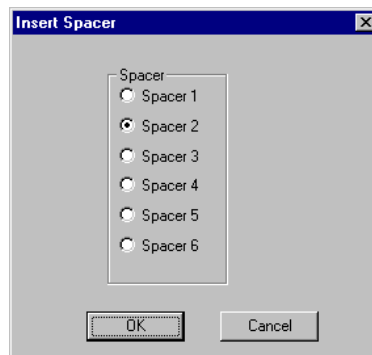
Insert Spacer Dialog

2. On the **Insert Spacer** dialog, select the spacer code for the type of spacer you wan to insert.

3. **Position the cursor** at the desired insertion point.

4. **Click** the mouse or press **Enter**.

    FixMaster inserts a spacer of the selected spacer code at the cursor position.

    The Insert Spacer tool remains selected until you select another tool or press the **Escape** key, so you can insert one spacer after another.

Menu: *Edit-Fixture-Spacers-Insert Spacer*

Button: *then*

Key: *Shift+R*

To Automatically Insert a Group of Spacers and Air Holes:

Note: *Before the Autospacer operation can be run, test points must be assigned to the grid points. See **Assign Test Points to Tester Grid Points** on page 177.*

1. On the **Setup** menu, click **Fixture-Spacers**.
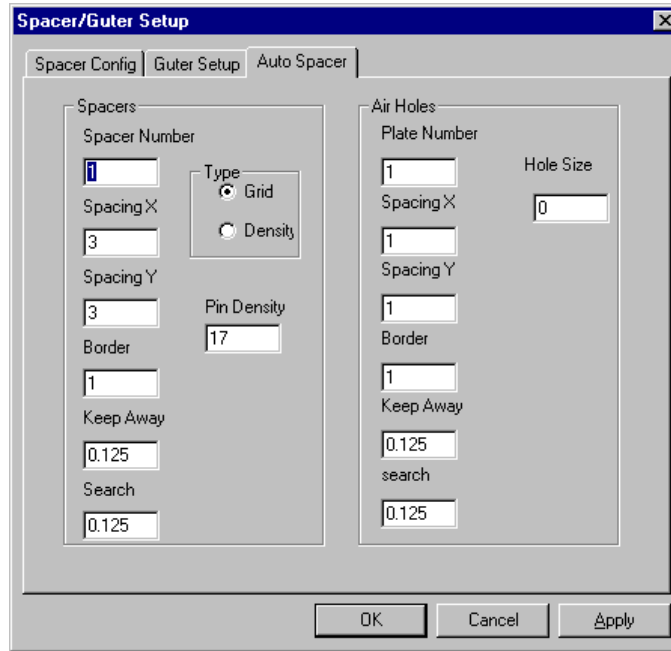
Space/Guter Setup Dialog, Auto Spacer Tab

Note: *You can automatically insert spacers and air holes simultaneously. If you want to insert only spacers, then enter zero for the Plate Number in the Air Holes group box to disable air hole insertion. Or if you want to insert only air holes, then enter zero for the Spacer Number in the Spacers group box to disable spacer insertion.*

2. To set up **spacers**, enter the following in the **Spacers** group box of the **Auto Spacer** tab:

    Spacer Number: This identifies a spacer set up on the Spacer Config Tab. Enter zero to disable spacer insertion.

Note: *To automatically insert two types of spacers simultaneously, set the Spacer Number to 2. The program will place spacer number 1 inside the part and spacer number 2 outside the part.*

Type: Select whether to add spacers in a grid fashion or by pin density.

- **Density:** The Density method determines how many pins press against the part and automatically generates spacers to distribute the load. If you select the Density method, enter values for the **Pin Density** and the **Keep Away** distance.

- **Grid:** The Grid method automatically inserts spacers in a grid fashion. If you select the Grid method, enter values for the **Spacing**, **Border**, **Keep Away** and **Search**.

Pin Density: The number of pins that require a spacer when using the Density option.

Spacing X, Y: Distance between spacers entered with the Grid option.

Border: Distance from the edge of the part. The edge is determined by looking at the extents of the data or from a Board Outline file (BOL), imported as a miscellaneous Gerber file. See *Import Supplemental Gerber Files into the Job* on page 312.

Keep Away: Distance from pins and other elements.

Search: If a spacer cannot be placed directly on a grid point due to a conflict with pins and other elements, the search value indicates the distance to look for an open spot to place the spacer.

3. To set up **air holes**, enter the following in the **Air Holes** group box of the **Auto Spacer** tab:

Plate Number: This identifies the plate where the air holes are to be inserted. Enter zero to disable air hole insertion.

Spacing X, Y: Distance between air holes.

Border: Distance from the edge of the part. The edge is determined by looking at the extents of the data or from a Board Outline file (BOL), imported as a miscellaneous Gerber file. See *Import Supplemental Gerber Files into the Job* on page 312.

Keep Away: Distance from pins and other elements.

Search: If an air hole cannot be placed directly on a grid point due to a conflict with pins and other elements, the search value indicates the distance to look for an open spot to place the air hole.

Hole Size: Size of the air holes.

4. Click **OK** on the **Space/Guter Setup** dialog.

5. On the **Edit** menu, click **Fixture-Spacers-Auto Spacer**.

The spacers and air holes are automatically inserted into the fixture.

If you repeat the automatic spacer insertion operation, the old spacers are automatically deleted before the new ones are inserted. Air holes are not automatically deleted and must be manually deleted. See *Deleting Drills* on page 89.

Menu: *Edit-Fixture-Spacers-Auto Spacer*

Button: *None*

Key: *None*
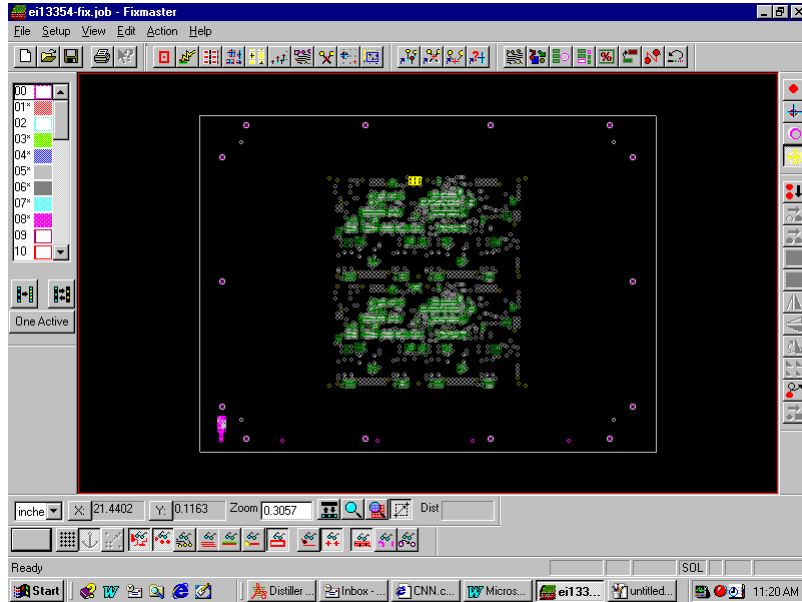
Fixture before Spacers and Air Holes are Inserted
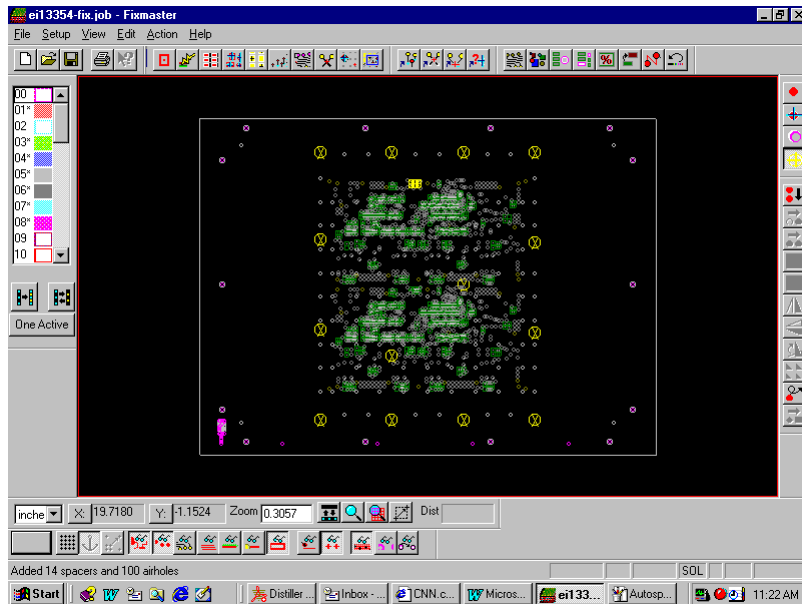
Fixture after Spacers and Air Holes are Inserted

Delete Spacers

You can delete spacers one at a time or delete a group of spacers inside the Reference Frame. When you run the operation to automatically insert spacers, the old spacers are automatically deleted before the new ones are inserted. For more information on automatically inserting spacers, see *Insert Spacers* on page 283.

To Delete Spacers One at a Time:

1. On the **Edit** menu, click **Fixture-Spacers-Delete**.
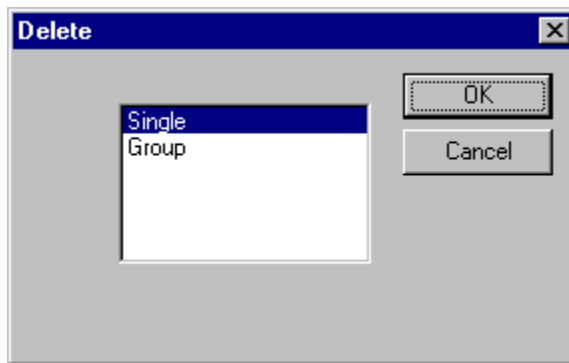
Delete a Single Spacer

2. On the **Delete Spacer** dialog, select **Single** and click **OK**.
3. Position the cursor near the spacer you want to delete.
4. **Click** the left mouse button or press the **Enter** key.

   The cursor jumps to the center of the spacer.
5. Again, **click** the left mouse button or press the **Enter** key.

   FixMaster deletes the spacer.

   The Delete Spacer tool remains selected until you select a new tool or press the **Escape** key, so you can delete one spacer after another.

Menu: *Edit-Fixture-Spacers-Delete Spacer*

Button: *then*

Key: *None*

To Delete a Group of Spacers inside the Frame:

1. Position the **Reference Frame** around the spacers you want to delete.

2. On the **Edit** menu, click **Fixture-Spacer-Delete Spacer**.
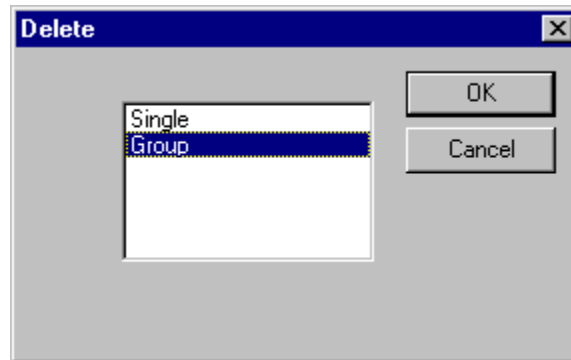
Delete a Group of Spacers

3. On the **Delete Spacer** dialog, select **Group** and click **OK**.

4. **Click** the left mouse button or press the **Enter** key.

   FixMaster deletes the spacers inside the Frame.

Menu: *Edit-Fixture-Spacers-Delete Spacer*

Button: *then*

Key: *None*

Air Holes

Air holes may be inserted as part of the process of automatically inserting spacers. See *To Automatically Insert a Group of Spacers and Air Holes:* on page 284.

Air holes may be deleted the same way any drill hole is deleted. See *Deleting Drills* on page 89.

Guter Holes

Guter Holes are specific tooling used to align a PCB to an Everett Charles universal tester. This tooling is used by an autoloader that is specific to the Everett Charles 909X series of testers.

Setting up Guter Holes

To Set up Guter Holes:

1. On the **Setup** menu, click **Fixture-Spacers**.

2. On the **Guter Setup** tab of the Spacer/Guter dialog, enter the parameters as called for in your tester specification.
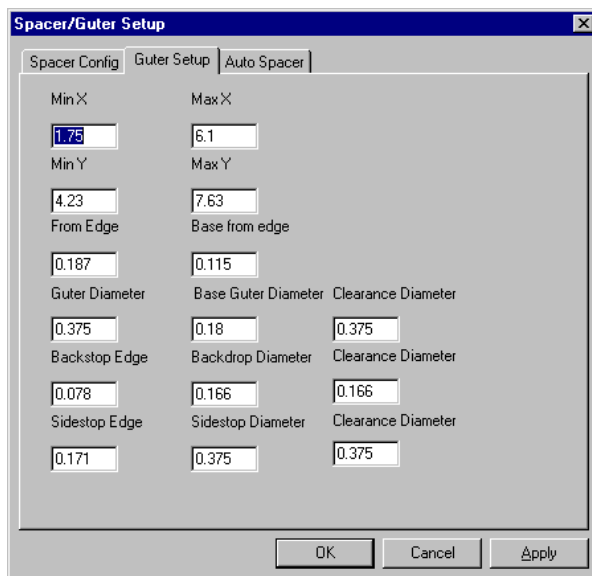
Guter Setup Tab

3. Click **OK** on the **Space/Guter Setup** dialog.

4. On the **Edit** menu, click **Fixture-Guter**.

   The Guter holes are automatically inserted into the fixture.

Chapter 17
File Handling in FixMaster

The FixMaster Job File (.JOB) is the native file format for FixMaster and contains all information regarding the current state of the database and program settings. The .JOB file is the only file type that the program Opens and Saves. However the program can Import other file types into the open .JOB file and Export other file types from the .JOB file.

FixMaster Job File (.JOB) Overview

The Job File (.JOB) is the native file format for FixMaster and contains all information regarding the current state of the database and operation settings:

Fixture Configuration:

- Fixture Plates and Tooling
- Fixture Grid Size
- Probe Diameters
- Probe Air Gaps
- Probe Margins

Operation Variables:

- D Code and Probe Mapping
- Stagger Options
- Generate Options

PCB database:

- Pads, Traces, Netlist data
- Test Points
- Test Point to Grid Point Assignment

Boilerplate Job Files

.JOB files can be used as boilerplate fixture files that can be saved and reopened when you have similarly configured jobs. A boilerplate .JOB file is saved with the fixture configuration and operation variables, before the PCB database is loaded.

Job Files for ProbeMaster and Verify

FixMaster .JOB files can also be opened in the Lavenir products ProbeMaster and Verify.

Generally the FixMaster .JOB files that are opened in ProbeMaster are those that are saved after a Split Net operation, and they contain nets that have been split out for testing on a moving probe tester. For more information on splitting nets, see *Split Nets* on page 221.

FixMaster and ProbeMaster .JOB files of completed jobs can be opened in Verify for fault verification.

Start a New FixMaster Job

The New command creates a new .JOB file that has nothing in it and is ready to have other files imported into it or to have data inserted into it. The program can only have one .JOB file open at a time; so, if a different .JOB file is already open when you start a new .JOB file, then the program prompts to give you an opportunity to save the existing .JOB file before starting the new .JOB file.

To Start a New FixMaster Job:

1. On the **File** menu, click **New**.

   FixMaster may prompt, "Are you sure?" This prompt is to warn you that you are about to close the currently opened .JOB file and open a new one. This gives you an opportunity to save the existing .JOB file before starting the new .JOB file

New File Prompt

2. Click **Yes**.

   The newly created FixMaster .JOB file has nothing in it.

Menu:　*File-New*

Button:　

Key:　*Ctrl+N*

Open a FixMaster Job File

The Open command opens a previously saved .JOB file. The program can only have one .JOB file open at a time; so, if a different .JOB file is already open when you open another .JOB file, then the program prompts to give you an opportunity to save the existing .JOB file before opening the new .JOB file.

Tip: *To open a .JOB file you've used recently, click the file name on the **Recent Files** List at the bottom of the **File** menu.*

To Open a FixMaster Job:

1. On the **File** menu, click **Open**.
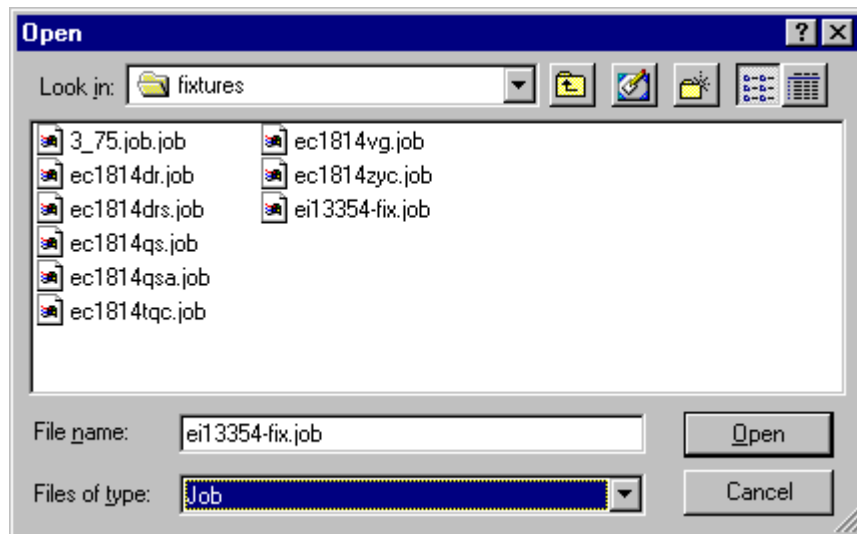
Open File Dialog

2. In the **Look in** box, click the drive, folder, or network location that contains the .JOB file.
3. In the folder list, double-click folders until you open the folder that contains the .JOB file you want.
4. Double-click the **.JOB file**.

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FixMaster may prompt, "Are you sure?" This prompt is to warn you that you are about to close the currently opened .JOB file and open a new one. This gives you an opportunity to save the existing .JOB file before opening the new .JOB file.

Open File Prompt

5. Click **Yes**.

Menu: *File-Open*

Button:

Key: *Ctrl+O*

Close a FixMaster Job File

The program can have one and only one .JOB file open at a time; so, closing the current .JOB file without opening another one is the same as exiting the program. The Open and New commands automatically close the current .JOB file; so, if a different .JOB file is already open when you open another .JOB file, then the program prompts you to save and close the existing .JOB file before opening the new .JOB file.

To Close a Job File:

1. On the **File** menu, click **Exit**.

   Closing a .JOB file does not automatically save the .JOB file. FixMaster may prompt, "Are you sure?" This gives you an opportunity to save the .JOB file before closing it.

Close File Prompt

2. Click **Yes**.

   Tip: *If you have made a bad mistake in your editing since the last time you saved and you want to go back to your saved version, close the file without saving and then open the saved version.*

Menu: *File-Exit*

Button: *None*

Key: *None*

Save a Job File

There are several ways to save a .JOB file.

To Save a New, Unnamed FixMaster Job File:

1. On the **File** menu, click **Save**.
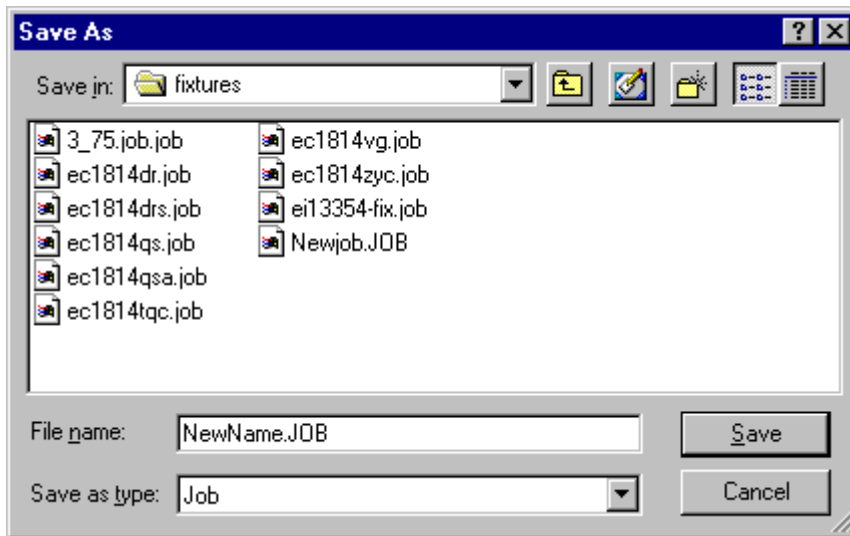
Save As Dialog

2. To save the FixMaster .JOB file in a different folder, click a different drive in the **Save in** box, or double-click a different folder in the folder list.

   To save the FixMaster .JOB file in a new folder, click **Create New Folder**.

3. In the **File name** box, type a name for the .JOB file.

Menu: *File-Save*

Button: 🖫

Key: *Ctrl+S*

To Save a Copy of a Job File:

1.   On the **File** menu, click **Save As**.
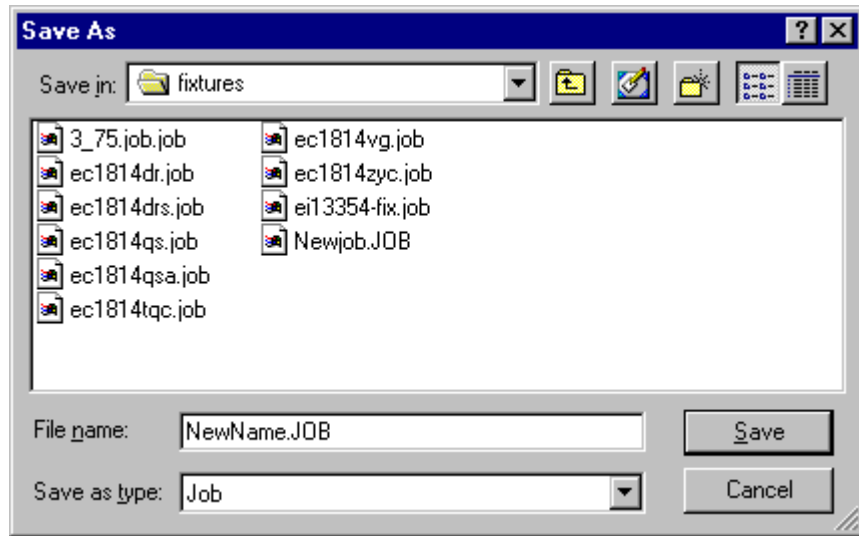
Save As Dialog

2.   To save the copy in a different folder, click a different drive in the **Save in** box, or double-click a different folder in the folder list.

To save the copy in a new folder, click **Create New Folder**.

3.   In the **File name** box, type a name for the copy.

Menu: *File-Save As*

Button: *None*

Key: *None*

To Save Work in Progress:

When you have work in progress that you want to save in case of power failure or because you need to shut down the program, you can save it under the current file name and overwrite the original .JOB file.

1. To save the open .JOB file under the current file name, go to the **File** menu, and click **Save**.

    FixMaster prompts for whether you want to overwrite the existing file.
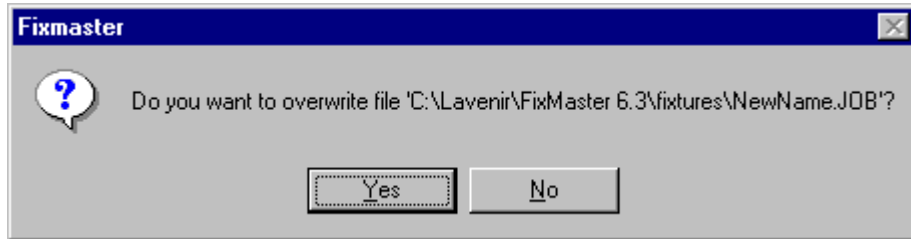
Save File Prompt

2. Click **OK**.

Menu:	*File-Save*
Button:	🖫
Key:	*Ctrl+S*

Import PCB Files into the Job

The program imports several formats of PCB data, including Gerber and several netlist formats.

Import IPC-D-356 Formatted Netlist Files into the Job

FixMaster imports IPC-D-356 formatted netlists including the Lavenir Format 4 and Format 2 netlists (.F02 and .F04 files). If you want to import another format of netlist you may be able to convert it to a Lavenir format. See *Convert Netlist Files to Lavenir Format* on page 303.

To Import IPC-D-356 Formatted Netlist Files into the Job:

1. On the **Files** Menu, click **Import-Netlist**.
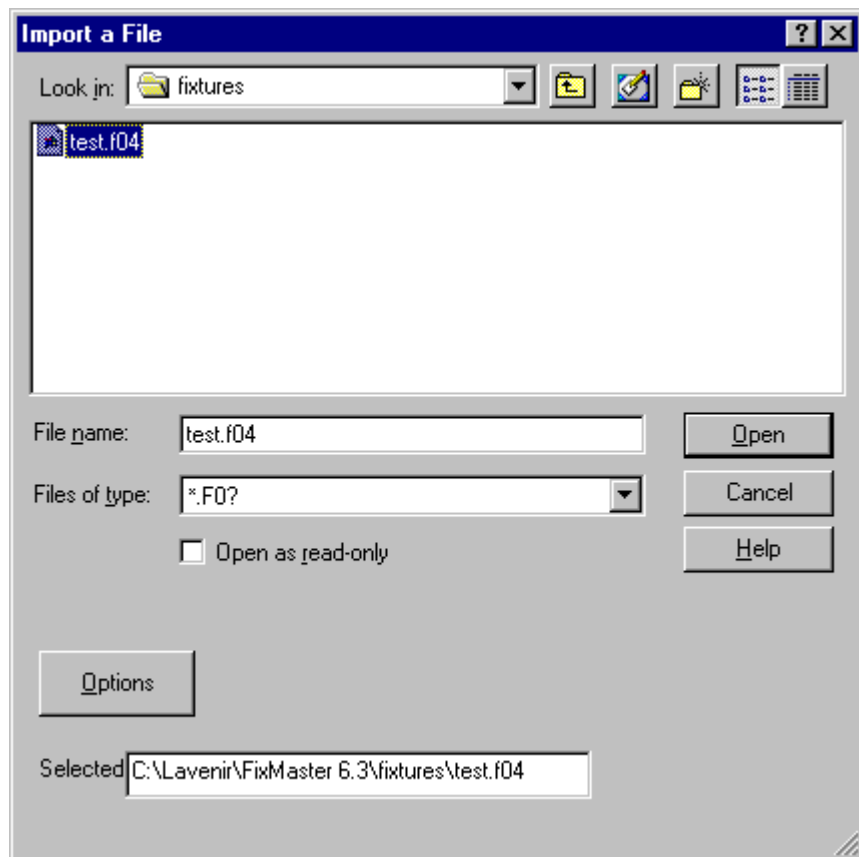
Import Netlist File Dialog

2. In the **Look in** box, click the drive, folder, or network location that contains the netlist file.

3. In the folder list, double-click folders until you open the folder that contains the netlist file you want.

4. Click on the netlist file that you want.

5. Click the **Options** button.
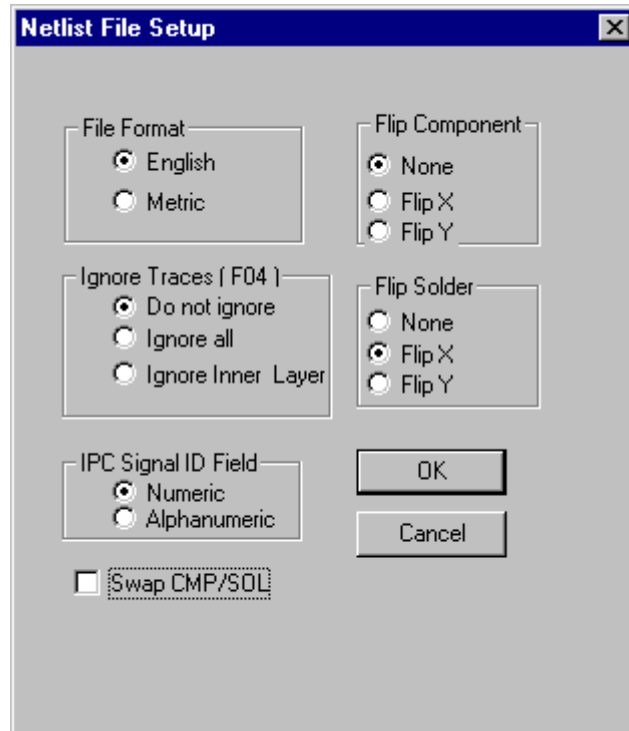
Netlist File Setup Dialog

6. Select whether the incoming data is in **English** or **Metric** units.

7. Select whether the incoming data has **Numeric** or **Alphanumeric** IPC Signal ID.

8. Format 4 netlists can contain trace data. Select whether to read in the trace data.

- **Do Not Ignore:** Reads in all traces.

- **Ignore All:** Does not read in any traces.

- **Ignore Inner:** Reads in component-side and solder-side traces, but does not read in traces on inner layers.

9. Select whether to swap the component-side and solder-side data.

   - Clicking this option so that there is a **checkmark** means FixMaster **swaps** the component-side and solder-side data. This is not the same as flipping the data. The orientation of the data remains the same, but the layers are switched.

   - Clicking this option so that there is **no checkmark** means FixMaster **does not** swap the data. The layers are read in as is.

10. Orient Board Layers to Tester Grids.

    Netlists read by FixMaster identify the component side (CMP) and solder side (SOL) of the PCB data. In order for the fixture to be designed properly and for the tester download files to be correct, you must orient the data properly when reading it in and writing it out. Generally, users want to orient the data so that the densest side of the board is tested by the densest part of the tester grid. The settings for orienting the incoming data are different depending on whether you will be doing a single-sided test, a one-fixture flip test, or a two-fixture flip test, a universal test, or a wire wrap job. The following procedures outline how to read properly oriented data for each type of test.

    Orientation for Single-Sided Test:

    Generally, if you are testing only one side of a board on a single fixture, you are testing the component side on the bottom grid of the tester.

    - If you have a board with surface mounts and a dense component side, put the component side against the bottom grid by setting **Flip Component** to **Flip X** or **Flip Y**.

    - If you have a through-hole board with no surface mounts, do not flip either side, and test the solder side, which is already oriented toward the grid. Set **Flip Solder** to **None**. It doesn't matter how you orient the component side, because you are only testing the solder side.

    Orientation Two-Fixture Flip Test:

    Generally, if you are testing each side of a board on separate fixtures, you are testing both the component side and the solder side on the bottom grid of the tester.

    - Set **Flip Component** to **Flip X** or **Flip Y**. This puts the component side against the bottom grid.

    - Set **Flip Solder** to **None**. The solder side is already oriented toward the bottom grid.

    Orientation for One-Fixture Flip Test:

    Generally, if you are testing both sides of a board on a single fixture, you are testing both the component side and the solder side on the bottom grid of the tester.

    - Set **Flip Component** to **Flip X** or **Flip Y**. This puts the component side against the bottom grid.

    - Set **Flip Solder** to **None**. The solder side is already oriented toward the bottom grid.

Orientation for Tower Tester:

Generally, if you are testing both sides of a board simultaneously in a universal tester, you are testing the component side on the bottom grid of the tester and the solder side on the top grid of the tester.

- Set **Flip Component** to **Flip X** or **Flip Y**. This puts the component side against the bottom grid.

- Set **Flip Solder** to flip exactly the same way that you set the component side. Both sides are being tested simultaneously and must be oriented the same way.

Orientation for Wire Wrap Test:

Generally, if you are testing both sides of a board simultaneously in a wire wrapped fixture, you are testing the component side on the bottom grid of the tester and testing the solder side on the wire wrapped side.

- Set **Flip Component** to **Flip X** or **Flip Y**. This puts the component side against the bottom grid.

- Set **Flip Solder** to flip exactly the same way that you set the component side. Both sides are being tested simultaneously and must be oriented the same way.

11. Click **OK**.

FixMaster imports the netlist file, orients the data as you specified, and displays the data on the screen.

Convert Netlist Files to Lavenir Format

The program can convert many formats of netlist file into Lavenir Format 2 or Format 4 netlists. When the netlist is converted into a Lavenir format netlist, you can import the netlist into the job.

To Convert a Netlist File:

1. On the **Tools** Menu, click **Netlist-Convert Netlist**.
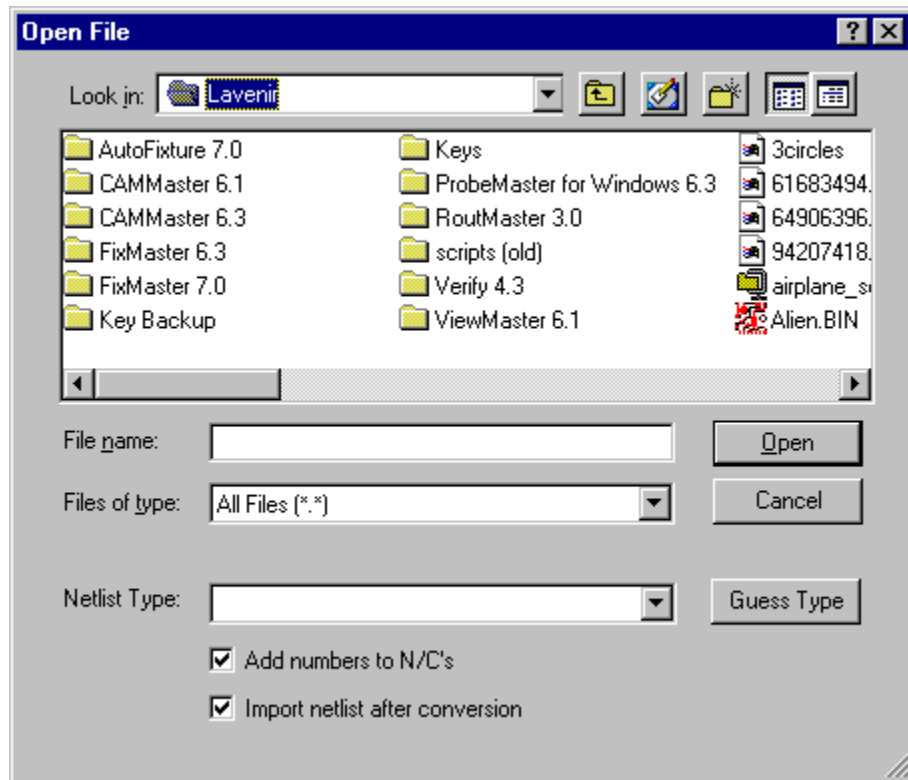
Convert Netlist Dialog

2. In the **Look in** box, click the drive, folder, or network location that contains the netlist file.

3. In the folder list, double-click folders until you open the folder that contains the netlist file you want.

4. Click on the file that you want so that it is highlighted.

5. Pick the netlist type on the **Netlist Type** drop down list, or click **Guess Type**.

6. If the file contains N/C records for non-connected points and you want those points to have unique identifiers, click on **Add Numbers to N/C's** so that the option has a checkmark. If there is no checkmark, then those points will have the N/C identifier with no unique net number.

7. If you want to automatically import the converted netlist after conversion, click on **Import Netlist After Conversion** so that the option has a checkmark. If there is no checkmark, then the netlist will be converted and saved under a name you specify later, but it will not be imported.

8. Click **Open**.

   Depending on the netlist type, the program may prompt for some additional information or files.

   The program prompts for a name for the converted netlist file.

9. If you want to accept the default name, click **Accept Default**.
   If you want to change the name or directory, click **Change Name**, and enter a new name or location for the converted netlist file. Then click **OK**.

Import ATF, CATE, TIF Formatted Netlist Files into the Job

You can import ATF, CATE and TIF formatted netlist files into the job

To Import ATF, CATE or TIF Files into the Job:

1. On the **Files** Menu, click **Import-ATF/CATE/TIF**.
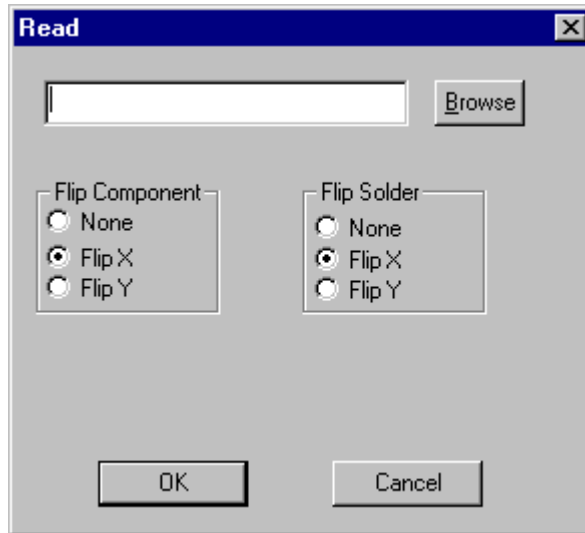
Import ATF, CATE or TIF Dialog

2. Click the **Browse** button.
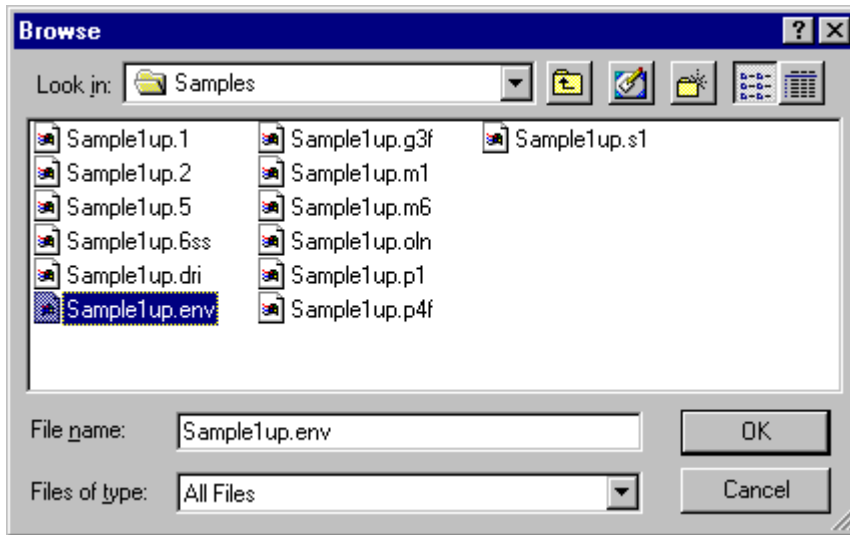
Browse for File

3. In the **Look in** box, click the drive, folder, or network location that contains the file you want.

4. In the folder list, double-click folders until you open the folder that contains the file you want.

5. Click on the file that you want.

6. Click **OK**.

7. Orient Board Layers to Tester Grids.

Netlists read by FixMaster identify the component side (CMP) and solder side (SOL) of the PCB data. In order for the fixture to be designed properly and for the tester download files to be correct, you must orient the data properly when reading it in and writing it out. Generally, users want to orient the data so that the densest side of the board is tested by the densest part of the tester grid. The settings for orienting the incoming data are different depending on whether you will be doing a single-sided test, a one-fixture flip test, or a two-fixture flip test, a universal test, or a wire wrap job. The following procedures outline how to read properly oriented data for each type of test.

Orientation for Single-Sided Test:

Generally, if you are testing only one side of a board on a single fixture, you are testing the component side on the bottom grid of the tester.

- If you have a board with surface mounts and a dense component side, put the component side against the bottom grid by setting **Flip Component** to **Flip X** or **Flip Y**.

- If you have a through-hole board with no surface mounts, do not flip either side, and test the solder side, which is already oriented toward the grid. Set **Flip Solder** to **None**. It doesn't matter how you orient the component side, because you are only testing the solder side.

Orientation Two-Fixture Flip Test:

Generally, if you are testing each side of a board on separate fixtures, you are testing both the component side and the solder side on the bottom grid of the tester.

- Set **Flip Component** to **Flip X** or **Flip Y**. This puts the component side against the bottom grid.

- Set **Flip Solder** to **None**. The solder side is already oriented toward the bottom grid.

Orientation for One-Fixture Flip Test:

Generally, if you are testing both sides of a board on a single fixture, you are testing both the component side and the solder side on the bottom grid of the tester.

- Set **Flip Component** to **Flip X** or **Flip Y**. This puts the component side against the bottom grid.

- Set **Flip Solder** to **None**. The solder side is already oriented toward the bottom grid.

Orientation for Tower Tester:

Generally, if you are testing both sides of a board simultaneously in a universal tester, you are testing the component side on the bottom grid of the tester and the solder side on the top grid of the tester.

- Set **Flip Component** to **Flip X** or **Flip Y**. This puts the component side against the bottom grid.

- Set **Flip Solder** to flip exactly the same way that you set the component side. Both sides are being tested simultaneously and must be oriented the same way.

Orientation for Wire Wrap Test:

Generally, if you are testing both sides of a board simultaneously in a wire wrapped fixture, you are testing the component side on the bottom grid of the tester and the solder side on the wire wrapped side.

- Set **Flip Component** to **Flip X** or **Flip Y**. This puts the component side against the bottom grid.

- Set **Flip Solder** to flip exactly the same way that you set the component side. Both sides are being tested simultaneously and must be oriented the same way.

8. Click **OK**.

   FixMaster imports the netlist file, orients the data as you specified, and displays the data on the screen.

Import Basic Gerber Files into the Job

You can import Basic Gerber files into the job.

To Import Basic Gerber Files into the Job:

1. On the **Files** Menu, click **Import-Gerber**.
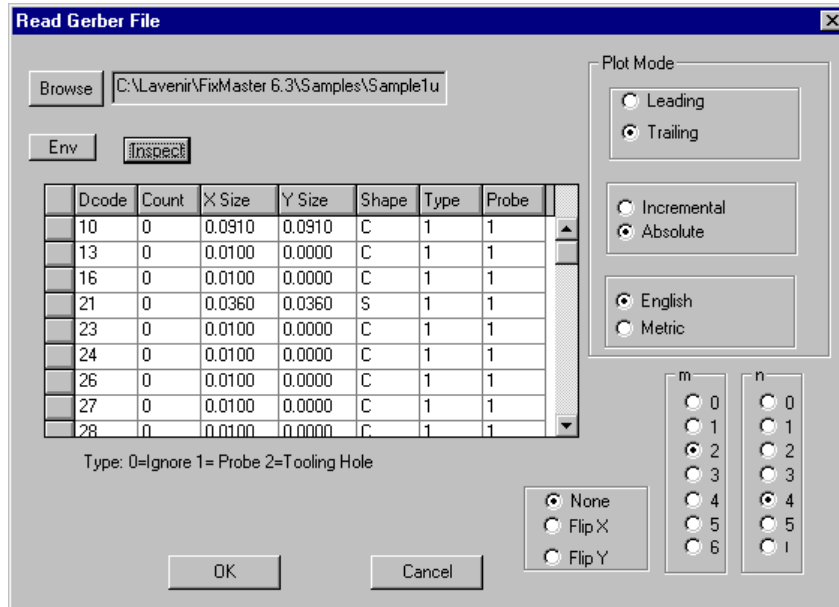
Import Gerber Dialog

2. Click the **Browse** button.
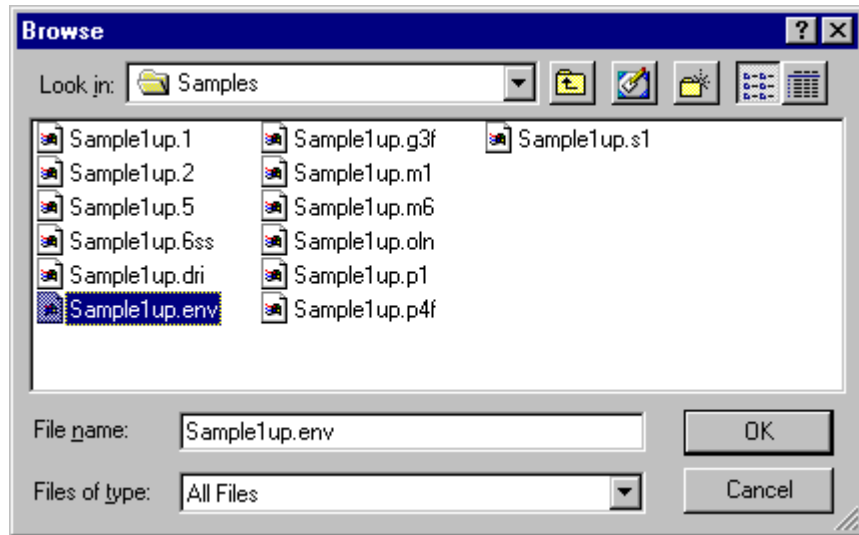
Browse for .ENV File

It's a good idea to import the Lavenir environment file (.ENV file) associated with the Gerber file before importing the Gerber.

3. In the **Look in** box, click the drive, folder, or network location that contains the .ENV file.

4. In the folder list, double-click folders until you open the folder that contains the .ENV file you want.

5. Click on the .ENV file that you want.

6. Click **OK**.

7. On the main Import Gerber dialog, click the **Env** button.

   FixMaster imports the environment file. The D Code sizes and shapes are shown in the file inspection table.

   The environment file also sets the Gerber format options for the incoming Gerber file in the Plot Mode group box and the m and n fields.

8. Click the **Browse** button again.

9. Browse for the **Gerber** file and click **OK**.

10. On the main Import Gerber dialog, click the **Inspect** button.

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FixMaster displays the file name, number of pads and traces, and PCB dimensions.

Fixmaster

'C:\Lavenir\FixMaster 6.3\Samples\Sample1up.1': 2462 traces and 2742 pads (78.450 by 54.360 inches).

OK
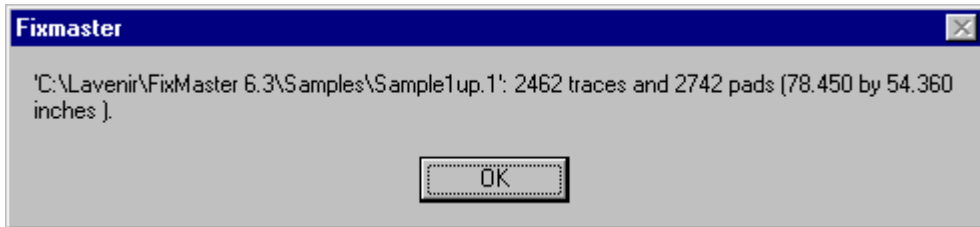
File Inspection

11. Click **OK**.

Now, in the main Import Gerber dialog, in addition to the D Codes sizes and shapes loaded in the environment file, FixMaster displays D Code counts for the named Gerber file.

12. You have the option of manually mapping incoming D Codes to Probe Codes in this table now. Or you can skip this step and do the mapping either manually or automatically later. For information on mapping D Codes to Probes later, see *Map D Codes to Probe Codes* on page 129.

If you are going to manually map D Codes to Probes now, then for each incoming D Code, enter a **Type**.

> **Type-0 D Code:** Unprobed pad.

- No test points will be generated for type-0 pads.
- No drill data will be generated when the drill files are generated.

> **Type-1 D Code:** Probed pad.

- Test points will be generated for type-1 pads.
- Drill data will be generated for the probe drills. The Probe Code parameters for the Probe Codes mapped to type-1 D Codes will be used to generate the Tool Codes when drill files are generated.

> **Type-2 D Code:** Tooling hole, not probed.

- No test points will be generated for type-2 pads.
- Drill data will be generated for these tooling holes. The shaft diameter of the type-T Probe Codes mapped to the type-2 D Codes will be used as the tooling hole diameter and will be used as the Tool Code size when drill files are generated.

For each type-1 or type-2 D Code, enter a **Probe Code**.

> **Type-0 D Code:** Don't map a Probe Code for type-0 pads. These are unprobed pads.
>
> **Type-1 D Codes:** Map each type-1 D Code to an appropriate Probe Code from the Probe Setup table. A probe having that Probe Code will be used to test pads of that D Code.
>
> - For surface-mount pads, use a type-S or type-B Probe Code.
> - For through-hole pads, use a type-H or type-B Probe Code.
>
> **Type-2 D Codes:** Map each type-2 D Code to an appropriate type-T Probe Code from the Probe Setup Table. The type-T Probe Code isn't actually a probe. FixMaster uses the shaft diameter of the type-T probe as the tooling hole size.

13. Orient the imported board layer to the tester grid.

    - If you are loading a **component-side file** (CPU in Gerber file, CMP in FixMaster) select **Flip X or Flip Y**. This puts the component-side data against the tester grid.
    - If you are loading a **solder-side** file (CPL in Gerber file, SOL in FixMaster) select **None**. This solder-side data is already oriented toward the tester grid.

14. Click **OK**.

    FixMaster loads the Gerber file and displays the data on the screen.

Import Supplemental Gerber Files into the Job

FixMaster can read in supplemental Gerber silkscreen, soldermask, and board outline PCB data. Gerber files with the Lavenir layer types SKU, SKL, MSU, MSL contain silkscreen and soldermask data which can be used to determine if pads are exposed and can be probed. Gerber files with the Lavenir layer type BOL contain board outline data.

Before importing the soldermask, silkscreen, or board outline files, you import a Lavenir environment file containing the D Code values and the layer file names. Unlike a Gerber PCB file, the elements of a soldermask, silkscreen, or board outline file are not meant to be probed. So you do not map incoming D Codes for soldermask, silkscreen, or board outline files to Probe Codes. When the soldermask, silkscreen, or board outline layers are imported, FixMaster will automatically flip the files to match the orientation of the loaded PCB file.

To Import Supplemental Gerber Files into the Job:

1. On the **Files** Menu, click **Import-Misc Gerber**.
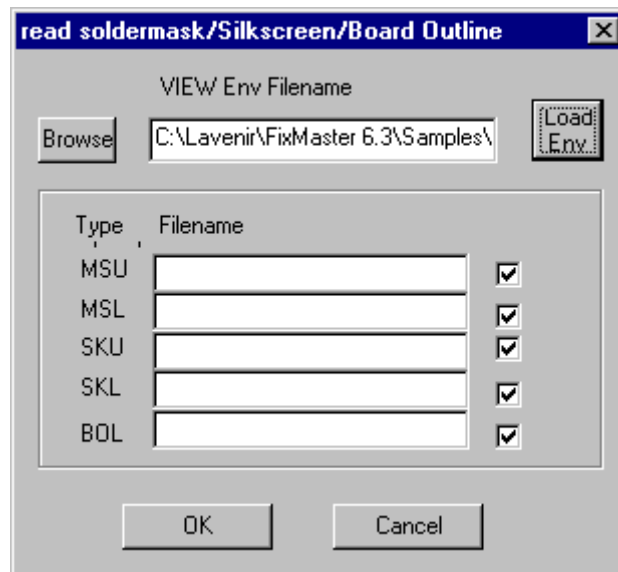
Import Supplemental Gerber Dialog

2. Click the **Browse** button.
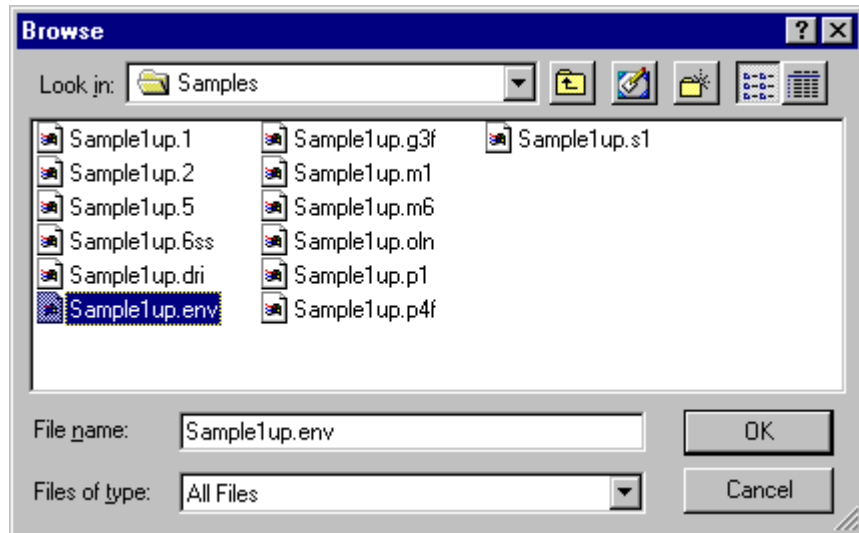
Browse for .ENV File

You must import the Lavenir environment file (.ENV file) associated with the supplemental Gerber files before importing the supplemental Gerber.

3. In the **Look in** box, click the drive, folder, or network location that contains the .ENV file.

4. In the folder list, double-click folders until you open the folder that contains the .ENV file you want.

5. Click on the .ENV file that you want.

6. Click **OK**.

7. On the main Import Supplemental Gerber dialog, click the **Load Env** button.

   FixMaster imports the environment file. The names of the supplemental Gerber files are added to the Filename fields.

8. Click in the **Load** column for each file that you do want to import so that the file has a **checkmark** next to it. If you do not want to import a particular file, make sure it does not have a checkmark.

9. Click **OK**.

   FixMaster imports the miscellaneous Gerber files.

Import Drill Data for Outside Tooling

The import drill command is used to bring in drill data for outside tooling. The drills are imported into the active plates.

To Import Drill Data into the Job:

1. Set the active, visible plates.

2. On the **Files** menu, click **Import-Drill**.
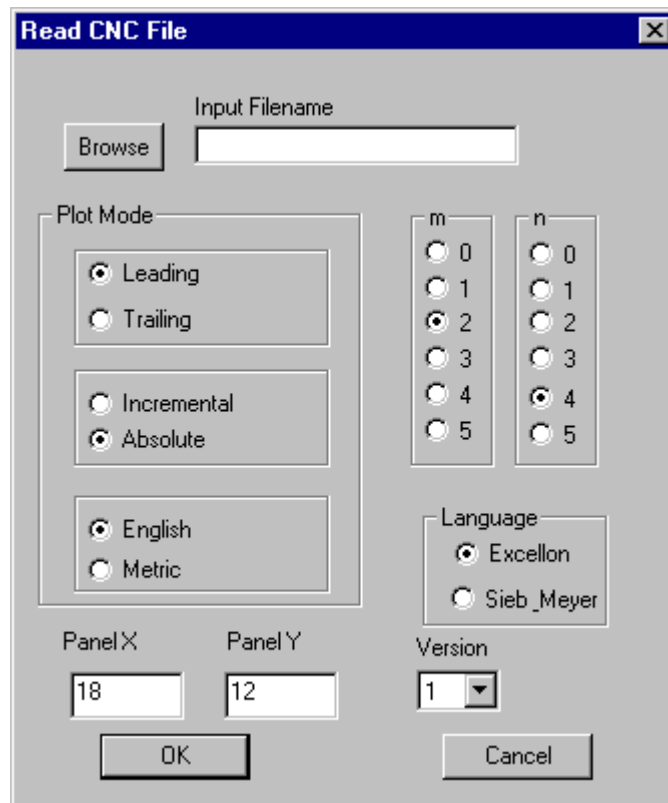
Import Drill Dialog

3. Click the **Browse** button.

4. In the **Look in** box, click the drive, folder, or network location that contains the drill file.

5. In the folder list, double-click folders until you open the folder that contains the drill file you want.

6. Click on the drill file that you want.

7. On the open file dialog, click **OK**.

8. On the Import Drill Dialog, set the **plot mode** options:

   - **Leading:** Leading zeros are omitted.
   - **Trailing:** Trailing zeros are omitted.
   - **Absolute:** Position coordinates are absolute.
   - **Incremental:** Position coordinates are incremental.
   - **English:** Units are in English units.
   - **Metric:** Units are in metric.

9. In the **m** box, set the number of digits to the left of the implied decimal point. And in the **n** box, set the number of digits to the right of the implied decimal point.

10. In the language box select **Excellon** or **Sieb and Meyer**.

11. If you selected Excellon as the language, select **Version** 1 or 2. If you selected Sieb and Meyer, you do not need to select a version.

12. If you selected Excellon Version 2, then set the **panel size**. If you selected Sieb and Meyer or Excellon Version 1, then you do not need to set a panel size.

13. Click **OK**.

    The drill data is imported into the active, visible plates.

14. To import different data into a different plate, repeat the procedure selecting the new plate and the new file.

Export Tester Download Files

When the fixture is complete, all the test points are assigned, and all the design rule errors are corrected, you may export the files to test the boards.

The tester download files tell the tester how the grid points or translation block locations are assigned to test points. Exporting the tester download files involves setting the datum point, selecting the specific tester and file options, and orienting the output data to the proper tester grid for the type of test you are doing.

Export Tester Download Files:

1. If you are exporting data for only one board side, be sure it is the active board side shown in the Status Bar.

2. Before exporting, set the datum point. See *Setting the Datum Point* on page 340.

3. On the **File** menu, click **Export-Test**.

   The Export Test File main dialog is displayed.
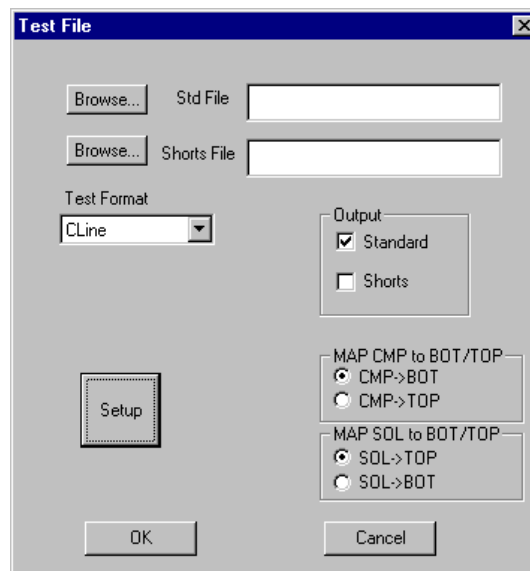
Export Test File Main Dialog

4. If you want to output a standard tester download file:

    - Click **Standard** in the Output group box so that the option has a **checkmark**.

    - Click the **Browse** button.

    - Browse for the drive, folder, or network location where you want the file to be saved and **enter a name** for the file.

    - Click **OK**.

5. If you *don't* want to output a standard tester download file, be sure the Standard option in the Output group box *does not have a checkmark*.

   In addition to standard output, most formats, except EPC and CAET, allow you to output a shorts file in which test points are output as a single continuous netlist.

6. If you want to output a shorts file:

    - Click **Shorts** in the Output group box so that the option has a **checkmark**.

    - Click the **Browse** button.

    - Browse for the drive, folder, or network location where you want the file to be saved and **enter a name** for the file.

    - Click **OK**.

7. If you *don't* want to output a shorts file, be sure the Shorts option in the Output group box *does not have a checkmark*.

8. **Orient Board Layers to Tester Grids**:

   When you imported the netlist data, you oriented the PCB data so that the fixture data can be generated properly. But telling FixMaster to flip the data does not actually tell the program which tester grid will be used to test each board side. You set this up when you write out the tester download files

   The Map to BOT/TOP options on the Export Test File dialog tell FixMaster to write the data for each board side to either the top or bottom tester grid. And the CMP/SOL Combine option, when available in a particular format, tells FixMaster whether component-side and solder-side data will be output in a single file or in separate files. The following procedures outline settings for typical scenarios. For information about importing data in the proper orientation, see *Import PCB Files into the Job* on page 299.

Orientation for Single-Sided Test:

Generally, if you are testing only one side of a board on a single fixture, you are testing the component side on the bottom grid of the tester.

- In the Map CMP to BOT/TOP group box, select **CMP to BOT**

- In the Map SOL to BOT/TOP group box, select **SOL to BOT**

Note: *Regardless of which side is actually tested, the above two steps are the same, because in a single sided test, the test data is mapped to the bottom grid.*

- Later, in the **Setup** options for the selected file format, if there is an option for **CMP/SOL Combined**, don't select that option. You are only writing out test data for the one side.

Orientation Two-Fixture Flip Test:

Generally, if you are testing each side of a board on separate fixtures, you are testing both the component side and the solder side on the bottom grid of the tester.

- In the Map CMP to BOT/TOP group box, select **CMP to BOT.** This puts the component side against the bottom grid.

- In the Map SOL to BOT/TOP group box, select **SOL to BOT.** This puts the solder side against the bottom grid.

- Later, in the **Setup** options for the selected file format, if there is an option for **CMP/SOL Combined**, don't select that option. You are writing out test data for the component side and solder side separately.

- After exporting the data for one Board Side, change the active layer shown in the Status Bar, and export the other board side with the same options as shown above.

Orientation for One-Fixture Flip Test:

Generally, if you are testing both sides of a board on a single fixture, you are testing both the component side and the solder side on the bottom grid of the tester.

- In the Map CMP to BOT/TOP group box, select **CMP to BOT.** This puts the component side against the bottom grid.

- In the Map SOL to BOT/TOP group box, select **SOL to BOT.** This puts the solder side against the bottom grid.

- Later, in the **Setup** options for the selected file format, if there is an option for **CMP/SOL Combined**, select that option. You are writing out test data for the component side and solder side combined in one file.

Orientation for Tower Tester:

Generally, if you are testing both sides of a board simultaneously in a universal tester, you are testing the component side on the bottom grid of the tester and testing the solder side on the top grid.

- If you *flipped* the component side data when you imported the PCB data, then in the Map CMP to BOT/TOP group box, select **CMP to BOT.**
  Or, if you *did not flip* the component side data when you imported the PCB data, then in the Map CMP to BOT/TOP group box, select **CMP to TOP.**

- If you *flipped* the solder side data when you imported the PCB data, then in the Map SOL to BOT/TOP group box, select **SOL to TOP.**
  Or, if you *did not flip* the solder side data when you imported the PCB data, then in the Map SOL to BOT/TOP group box, select **SOL to BOT.**

- Later, in the **Setup** options for the selected file format, if there is an option for **CMP/SOL Combined**, select that option. You are writing out test data for the component side and solder side combined in one file.

Orientation for Wire Wrap Test:

Generally, if you are testing both sides of a board simultaneously in a wire-wrapped fixture, you are testing the component side on the bottom grid of the tester and testing the solder side on the wire wrapped side.

- If you *flipped* the component side data when you imported the PCB data, then in the Map CMP to BOT/TOP group box, select **CMP to BOT.**
  Or, if you *did not flip* the component side data when you imported the PCB data, then in the Map CMP to BOT/TOP group box, select **CMP to TOP.**

- If you *flipped* the solder side data when you imported the PCB data, then in the Map SOL to BOT/TOP group box, select **SOL to TOP.**
  Or, if you *did not flip* the solder side data when you imported the PCB data, then in the Map SOL to BOT/TOP group box, select **SOL to BOT.**

- Later, in the **Setup** options for the selected file format, if there is an option for **CMP/SOL Combined**, select that option. You are writing out test data for the component side and solder side combined in one file.

9. In the **Test Format** drop down list, select the format for your tester download files.

10. Click the **Setup** button.

Each format calls up a unique setup dialog when you click the Setup button.

11. Set up the unique setup options for the selected tester format as explained in the following sections:

- *Export ATG1000 Test Files* on page 321.
- *Export ATG2000 Test Files* on page 322.
- *Export CAET Test Files* on page 323.
- *Export CircuitLine Test Files* on page 324.
- *Export EPC Test Files* on page 326.
- *Export Everett Charles Test Files* on page 327.
- *Export Fastek Test Files* on page 328.
- *Export Luther & Maelzer Test Files* on page 330.
- *Export Mania Test Files* on page 331.
- *Export PDI Test Files* on page 332.
- *Export TRACE Test Files* on page 332.
- *Export TTI Test Files* on page 333.
- *Export Viking Test Files* on page 334.
- *Export Integri Test Files* on page 335.
- *Export Utron Test Files* on page 336.
- *Export NidecRead Test Files* on page 337.
- *Export Taiyo Test Files* on page 338.
- *Export Kyoei Test Files* on page 339.

12. Click **OK**.

Export ATG1000 Test Files
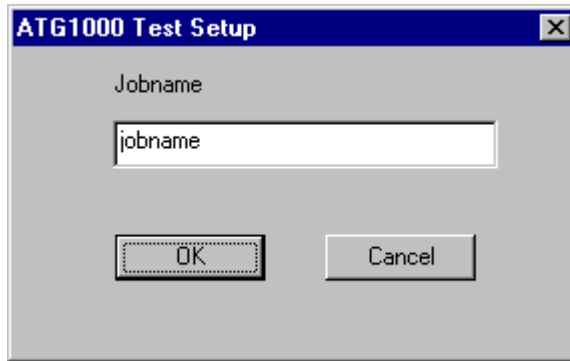
ATG1000 Export Setup Options

Jobname

Enter an internal job name for your own reference in the Jobname field.

Export ATG2000 Test Files
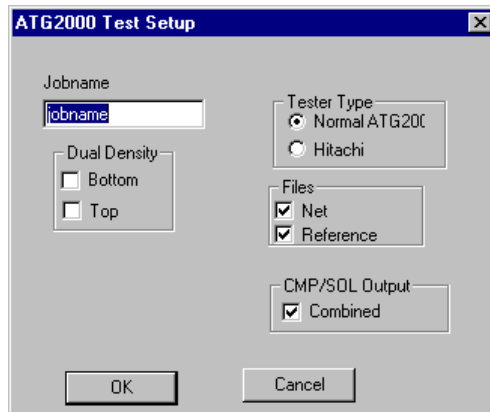
ATG2000 Export Setup Options

Jobname

Enter an internal job name for your own reference in the Jobname field.

Dual Density

The ATG2000 tester is unique in that the top and bottom grids both have dual density capability but have different offsets. The two sides are defined independently when setting up the grids. In the Dual Density box indicate whether the top and/or bottom grids are set up for dual density.

Tester Type

- Normal ATG2000: This is the normal ATG output.
- Hitachi: This is a special ATG output for Hitachi Corp.

Files Group Box

- If you want to export a file that contains only grid points, click the **Net** option so that it has a checkmark. The exported file has a .NET suffix.
- If you want to export a file that contains both grid points and test points, click the **Reference** option so that it has a checkmark. The exported file has a .REF suffix.

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.
- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Export CAET Test Files

There are no additional setup options for the CAET format.

CAET Export Setup Options

Export CircuitLine Test Files
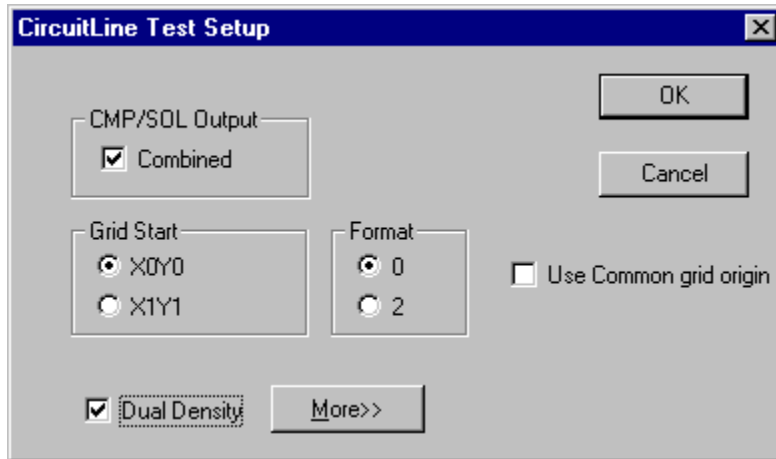
CircuitLine Export Setup with Fewer Options Displayed
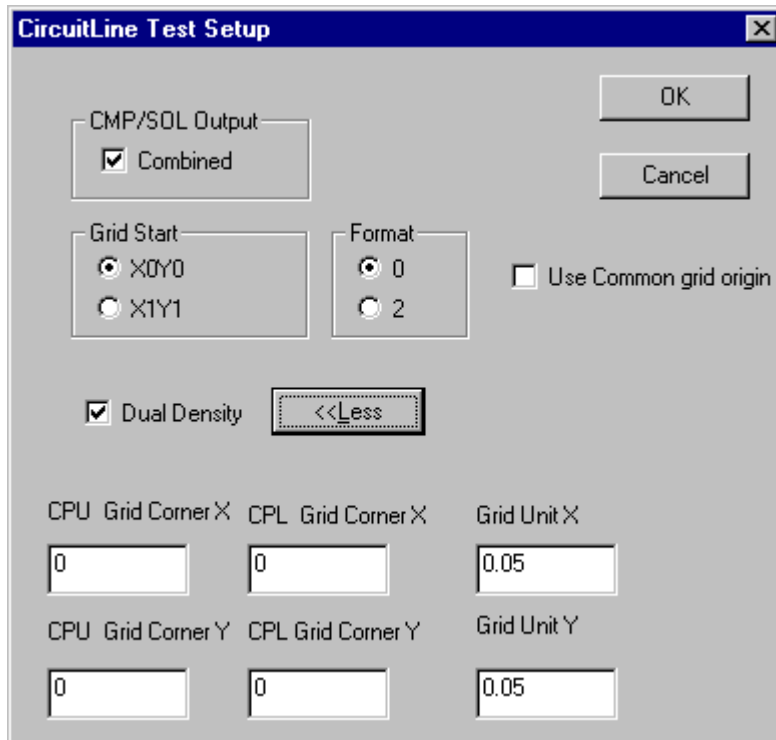
CircuitLine Export Setup with More Options Displayed

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Start Grid

Indicate whether the grid begins at (0, 0) or (1, 1).

- X0Y0
- X1Y1

Format

- 0
- 2

Use Common Grid Origin

Indicate whether the top and bottom grids have the same origin or unique origins.

CPU/CPL Grid Corner X/Y

Enter the grid corners for the CPU and CPL sides.

Grid Unit X/Y

Enter the grid units in the X and Y directions.

Export EPC Test Files
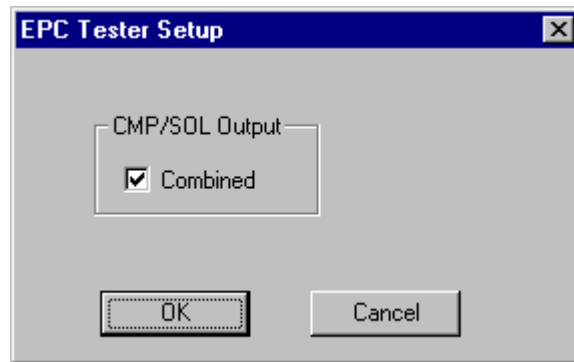
EPC Export Setup Options

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Export Everett Charles Test Files
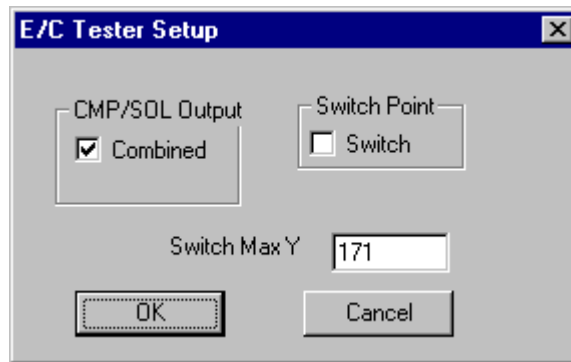
Everett Charles Export Setup Options

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Switch Point

- If you want to output a switch point file, click the **Switch** option so that it has a checkmark. Select this option if you are outputting wire wrap information for a Kryterion-type dedicated tester.

- Otherwise, do not select this option, and export the .XY file with test point locations.

Switch Max Y

The Switch Max Y parameter defines the maximum grid field (i.e., 161=16" grid, 171=17" grid, 181=18" grid, etc.)

Export Fastek Test Files
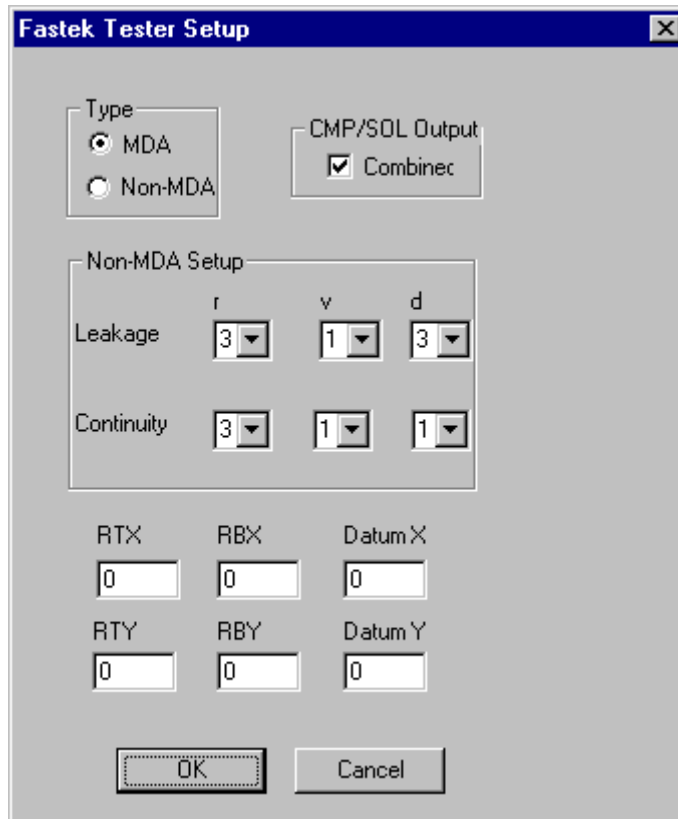
Fastek Export Setup Options

Type

For the Type setting, select MDA or Non-MDA. This indicates how the file name will be extended. If you select MDA, FixMaster will automatically extend the file name with the .MDA suffix. If you select Non-MDA, then you should enter the extension you want to use as part of the file name.

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

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Non-MDA Setup Group Box

Enter the Leakage and Continuity factors: r, v, and d.

RTX and RTY

Optional information for Fastek header.

RBX and RBY

Optional information for Fastek header.

Datum X and Datum Y

Optional information for Fastek header.

Export Luther & Maelzer Test Files

Luther Maelzer Export Setup Options

Header

- If you want to attach a header file to the export file, click the **Header** option so that it t has a checkmark. Then click the **Browse** button and browse for the file that you would like to attach to the export file.

- If you do not want to attach an additional file to the export file, be sure the **Header** option does not have a checkmark.

Use QSA

Select whether you want to export the QSA map that contains the microstagger information. For information about generating the microstagger information, see *Microstagger for Luther Maelzer Testers* on page 176.

- If you want to export the QSA map, click the **QSA** option so that it has a checkmark. Then **enter the values** in the QSA group box.

- If you do not want to export the QSA map, be sure the **QSA** option does not have a checkmark.

Output Unit

Select whether you want the output in inches or metric units.

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Export Mania Test Files
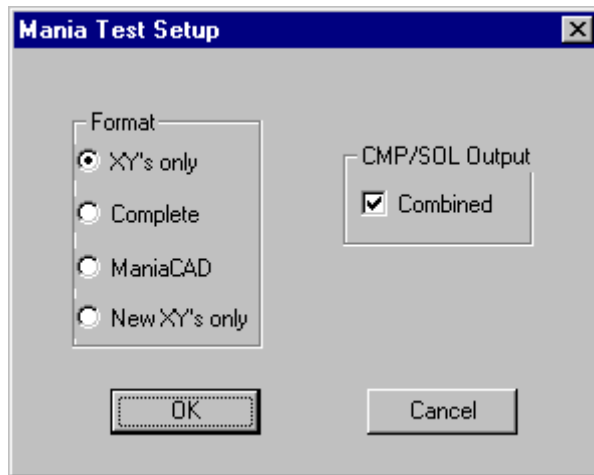
Mania Export Setup Options

Format

- **XY's Only:** If you want to output grid points only, select XY's Only.
- **Complete:** If you want to output both grid points and test points, select Complete.
- **Mania CAD:** If you want to output both grid points, test points, and a check sum value, select Mania CAD.
- **New XY's Only:** Select this option if you use this specific proprietary format. This file contains the same information as the file generated by the XY's Only option, but it has a .TES or .SMT suffix and is formatted with 3 digits and leading zeros.

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

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Export PDI Test Files
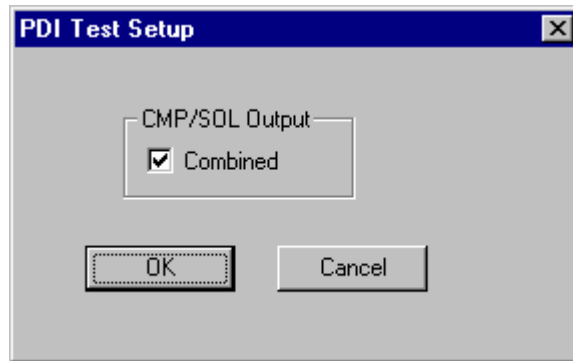
PDI Export Setup Options

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Export TRACE Test Files
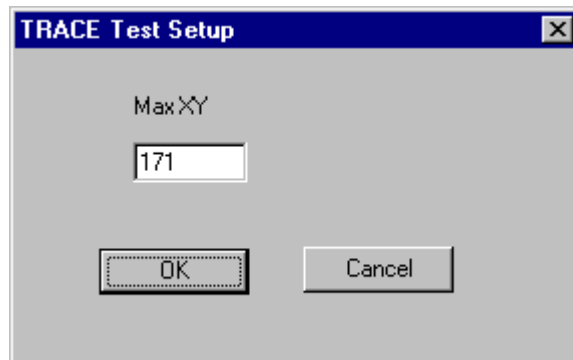
TRACE Export Setup Options

Max XY

The Max XY parameter defines the maximum grid field (i.e., 161=16" grid, 171=17" grid, 181=18" grid, etc.)

Export TTI Test Files
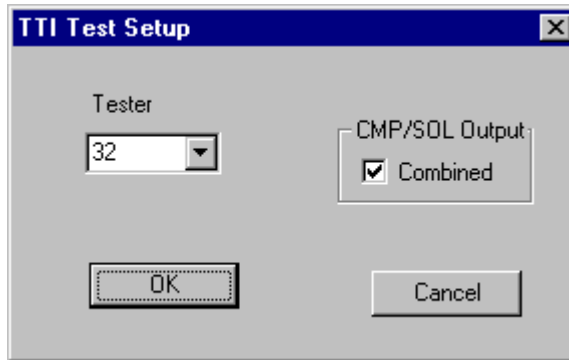
TTI Export Setup Options

Tester

Identify the tester model in the Tester field: 8, 14, 16, 36, 44, 45, 221, 222.

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Export Viking Test Files
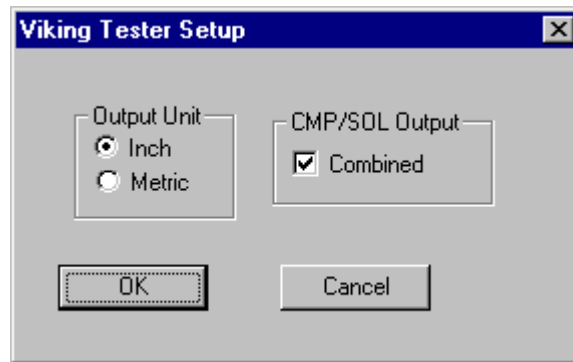
Viking Export Setup Options

Output Unit

Select inches or metric units for output.

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Export Integri Test Files
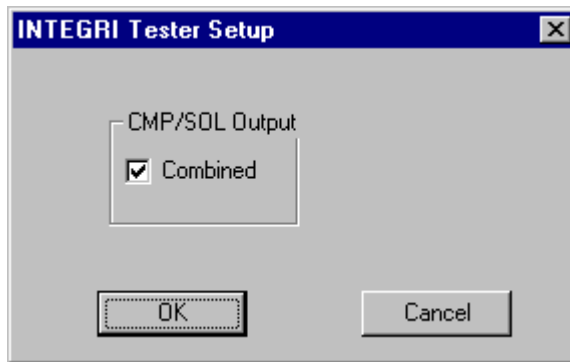
Integri Export Setup Options

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Export Utron Test Files
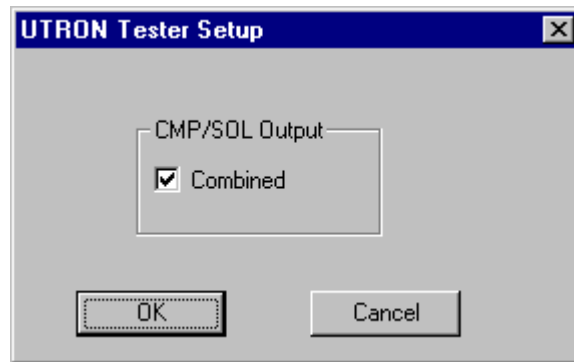
Utron Export Setup Options

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Export NidecRead Test Files
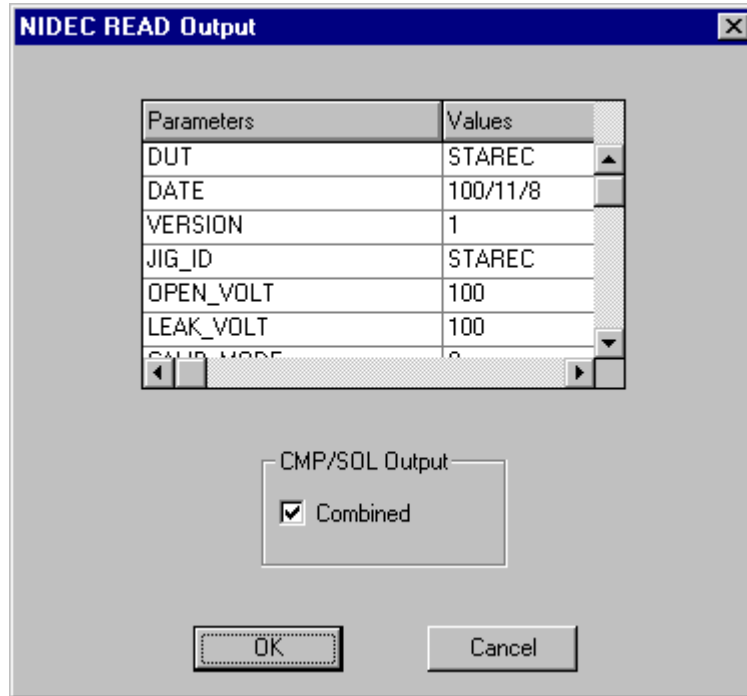
NidecRead Export Setup Options

Parameters Table

Parameters for Nidec header.

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Export Taiyo Test Files
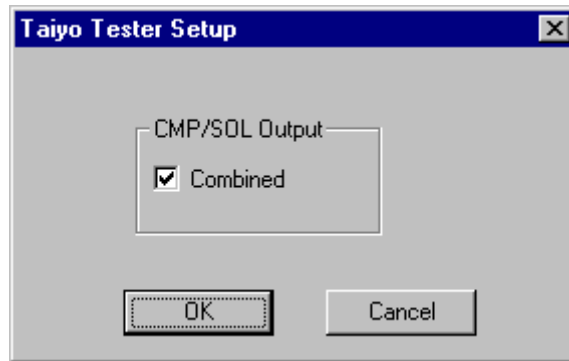
Taiyo Export Setup Options

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Export Kyoei Test Files
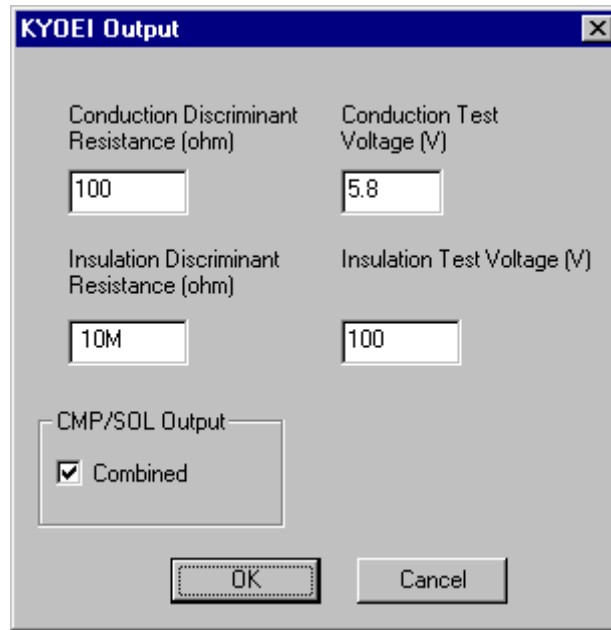
Kyoei Export Setup Options

Conduction Discriminant Resistance

Customer parameters for individual Kyoei testers.

Conduction Test Voltage

Customer parameters for individual Kyoei testers.

Insulation Discriminant Resistance

Customer parameters for individual Kyoei testers.

Insulation Test Voltage

Customer parameters for individual Kyoei testers.

CMP/SOL Output

See the information about orienting the board sides to the tester grids in step 8 on page 317.

- If you want both the component-side and solder-side data to be output in a combined file, click the **CMP/SOL Output Combined** option so that it has a checkmark.

- If you want to output tester data for only the current board side, be sure the **CMP/SOL Output Combined** option does not have a checkmark.

Setting the Datum Point

The tester and the test file output *must* share a common datum point. To ensure this, always check the datum point prior to outputting test files and change it if necessary.

To Set the Datum Point:

1. On the **View** menu, click **Go To-Datum Point**.

    FixMaster positions the cursor at the current datum point and displays the coordinates in the Status Bar.

    If the datum point is correct, then you don't need to do anything.

2. To change the datum point, go to the **Setup** menu and **Fixture-Datum Point**.

    FixMaster prompts for the new datum point.

3. Position the cursor using the **X** and **Y** key commands.

4. When the cursor positioned at the desired new datum point, press the **Enter** key.

    FixMaster puts the datum point at the cursor position and reports the coordinates on the Status Bar.

Export Fixture Drill Files

You may export drill data for the fixture outside tooling. Or when the fixture is complete, all the test points are assigned, and all the design rule errors are corrected, you may export drill files containing all drill data necessary to build the fixtures.

The complete drill files contain the data to drill for the fixture tooling, spacers and probe drills. FixMaster exports the fixture drill data for the current board side, component or solder, in one of two NC formats. Each plate of the fixture is exported in its own individual file, extended with the plate number as its suffix.

The following procedure outlines steps required regardless of whether you are exporting Excellon or Sieb and Meyer drill data. There are also additional procedures to outline the options that are specific to each of those formats.

To Export Fixture Drill Files:

1. On the **View** menu, click **Active Side** and select the board side for which you want to write out fixture drills, **Component** or **Solder**.

2. On the **File** menu, click **Export-Drill-Plates** or **Fixture**.

    - **Plates:** If you click **File-Export-Drill-Plates**, FixMaster exports all drill data for the fixture tooling, spacers and probe drills.

    - **Fixture:** If you click **File-Export-Drill-Fixture**, FixMaster exports only the drill data for the fixture tooling.

Export Drill Main Dialog

3. Click the **Browse** button.

4. Browse for the drive, folder, or network location where you want the Drill files to be saved and enter a **Prefix** for the file.

5. Click **OK**.

6. In the **Trailing/Leading** group box, select whether **trailing** or **leading** zeros are **omitted** in outgoing data.

7. In the **Incremental/Absolute** group box, select whether outgoing data contains **absolute** or **incremental** position coordinates.

8. In the **English/Metric** group box, select whether **English** or **metric** units are written out for outgoing data.

9. In the **m** and **n** group boxes, set the number of digits to the **left** and **right** of the implied decimal point for outgoing data.

10. In the **Language** field, select the either **Excellon** or **Sieb and Meyer** as the drill language for the outgoing file.

    FixMaster supports subsets of Excellon Format 1 and 2, and subsets of Sieb & Meyer Format 1000 and 3000.

11. For additional language format options, click the **Write Options** button.

    Your choice of language determines which dialog appears when you click the **Write Options** button:

    - For Excellon, see *Set Excellon Language Format Options* on page 343.

    - For Sieb and Meyer, see *Set Sieb & Meyer Language Format Options* on page 346.

Set Excellon Language Format Options

The following procedure outlines the options for when you are exporting drill data in the Excellon format.

To Set Excellon Language Format Options:

The **Excellon Write Options** dialog is displayed when you have selected **Excellon** as your drill language on the **Export Drill** main dialog and you click the **Write Options** button.
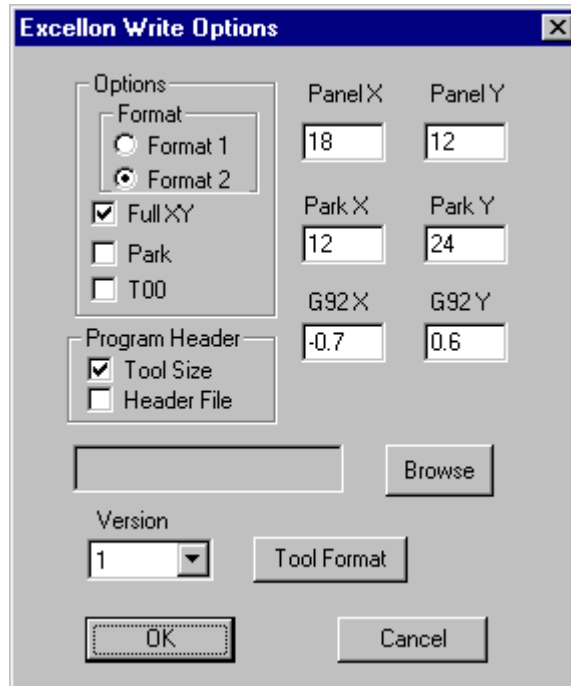
Excellon Write Options

1. In the Options group box, select either Format 1 or Format 2.

2. In the Options group box, select whether to output both X and Y coordinates for every move command (non-modal) or only the coordinate that has changed (modal).

   - For modal output, click the **Full XY** checkbox so that it doesn't have a checkmark. If there is no checkmark, FixMaster will only output the coordinate that has changed.

   - For non-modal output, click the **Full XY** checkbox so that it does have a checkmark. If there is a checkmark, FixMaster will always output both coordinates, even if only one has changed.

3. In the Options group box, select whether or not to park the drill bit after each subprogram.

- To park the bit, click **Park** in the Options group box so that the option has a checkmark, and set the park position in **Park X** and **Park Y**. If there is a checkmark, FixMaster will park the bit at the park position you specified after each subprogram.

- To not park the bit, click **Park** in the Options group box so that the option doesn't have a checkmark. If there is no checkmark, FixMaster will not park the bit after each subprogram.

4. In the Options group box, select whether or not to output a T00 at the end of the program before M30.

- To output a T00, click **T00** in the Options group box so that the option has a checkmark.

- To not output a T00, click **T00** in the Options group box so that the option doesn't have a checkmark

5. In the Version drop down list, select Version 1-8 for outgoing data. This sets the version of the Excellon File.

6. If you selected an Excellon version other than Version 1, set the panel size in Panel X and Panel Y. Ignore this setting if you are using Excellon version 1.

7. In the G92 X and G92 Y fields, set the offset coordinate for the G92 Zero Set command.

8. Select whether to generate an Excellon Header containing tool sizes for the output file.

   If you don't want to generate an Excellon Header for the Excellon file, click the **Tool Sizes** option in the Program Header group box so that the option doesn't have a checkmark.

   If you do want to generate an Excellon Header containing tool sizes, do the following:

   a. In the Program Header group box, click the **Tool Sizes** option so that the option has a checkmark.

   b. Click the **Tool Format** button.
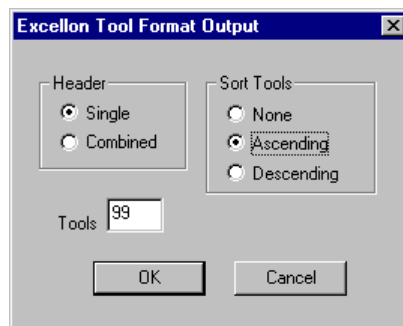
Excellon Tool Format Dialog

   c.   In the Header Group Box, select how to number tools in each individual plate's drill file:

- If you want every plate file to have a header in which tools are numbered according the drill diameters in that one plate, click **Single** so that the option has a checkmark.

- If you want all the plate files to have header files in which tools are numbered according the drill diameters for all the plates in the job, click **Combined** so that the option has a checkmark. Only the tools used for the individual plates are output in the individual headers, but the tools are numbered according to a combined tool chart.

   d.   In the Sort Tools Group Box, select how you want tools sorted:

- If you want the tools to be sorted in ascending order of tool diameter, click **Ascending** so that the option has a checkmark.

- If you want the tools to be sorted in descending order of tool diameter, click **Descending** so that the option has a checkmark.

- If you do not want the tools to be sorted, click **None** so that the option has a checkmark.

   e.   In the Tools field, enter the maximum number of tools you want output in one file. FixMaster will split files that have more than the maximum number of unique diameters so as not to exceed the maximum.

   f.   On the Excellon Tool Format Dialog, click **OK**.

9. You also have the option to attach an additional file to the Excellon file. This is not an actual Excellon header containing tool sizes. It is any file which you would like to attach to the Excellon file and can contain any information you want, job or customer information for instance. To attach an additional file to the Excellon file:

If you don't want to attach an additional file to the Excellon file, click the **Header File** option in the Program Header group box so that the option doesn't have a checkmark.

If you do want to attach an additional file to the Excellon file, do the following:

   a.   In the Program Header group box, click the **Header File** option so that the option has a checkmark.

   b.   Click the **Browse** button.

   c.   Browse for the drive, folder, or network location where the file you want to attach is located and select the file.

   d.   On the browse dialog, click **OK**.

10. On the Excellon Write Options dialog, click **OK**.

11. On the Drill Export main dialog, click **OK**.

FixMaster exports the drill files as you specified.

12. If you are doing a dual-fixture test, change the board side, CMP or SOL, and export the drill files for the other fixture.

Set Sieb & Meyer Language Format Options

The following procedure outlines the options for when you are exporting drill data in the Sieb and Meyer format.

To Set Sieb & Meyer Language Format Options:

The **Sieb & Meyer Write Options** dialog is displayed when you have selected **Sieb & Meyer** as your drill language on the **Export Drill** main dialog and you click the **Write Options** button.
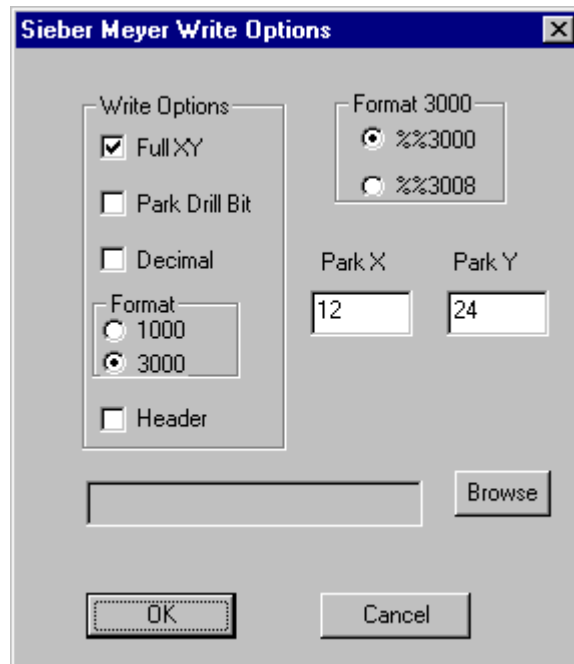
Sieb and Meyer Format Options

1. In the Options group box, select whether to output both X and Y coordinates for every move command (non-modal) or only the coordinate that has changed (modal).

   - For modal output, click the **Full XY** checkbox so that it doesn't have a checkmark. If there is no checkmark, FixMaster will only output the coordinate that has changed.

   - For non-modal output, click the **Full XY** checkbox so that it does have a checkmark. If there is a checkmark, FixMaster will always output both coordinates, even if only one has changed.

2. In the Options group box, select whether or not to park the drill bit after each subprogram.

    - To park the bit, click **Park** in the Options group box so that the option has a checkmark, and set the park position in **Park X** and **Park Y**. If there is a checkmark, FixMaster will park the bit at the park position you specified after each subprogram.

    - To not park the bit, click **Park** in the Options group box so that the option doesn't have a checkmark. If there is no checkmark, FixMaster will not park the bit after each subprogram.

3. In the Options group box, select either Format 1000 or Format 3000.

4. If you selected Format 3000, select %%3000 or %%3008.

5. Sieb & Meyer does not support an actual header file containing tool sizes like Excellon does, but with FixMaster you do have the option to attach any file you wish to the Sieb & Meyer output file. This file can contain any information you want, job or customer information for instance:

    If you don't want to attach an additional file to the Sieb & Meyer file, click the **Header File** option in the Program Header group box so that the option doesn't have a checkmark.

    If you do want to attach an additional file to the Sieb & Meyer file, do the following:

    a. In the Program Header group box, click the **Header File** option so that the option has a checkmark.

    b. Click the **Browse** button.

    c. Browse for the drive, folder, or network location where the file you want to attach is located and select the file.

    d. On the browse dialog, click **OK**.

6. On the Sieb and Meyer Write Options dialog, click **OK**.

7. On the Drill Export main dialog, click **OK**.

    FixMaster exports the drill files as you specified.

8. If you are doing a dual-fixture test, change the board side, CMP or SOL, and export the drill files for the other fixture.

Export Plate Gerber for an Interface Board

An interface board, also called a personality board, is a board that sits between the part being tested and the test fixture. The interface board translates the test point locations to grid point locations so that the fixture pins have no deflection.

FixMaster can output the Gerber and drill files for building a two-layer interface board. These files use the drill points generated by dropping pins for a three-plate fixture. The drill points on the top and bottom plates represent the locations of the test points and grid points, and they are output as pad locations for the interface board. Traces connect these pad locations. Drill points on the middle plate are output as vias to connect the two layers of the interface board.

In order for the fixture data in FixMaster to be output in Gerber, certain elements need to be assigned D Codes.

To Export Plate Gerber for an Interface Board:

1. On the **File** menu, click **Export-Plate Gerber**.
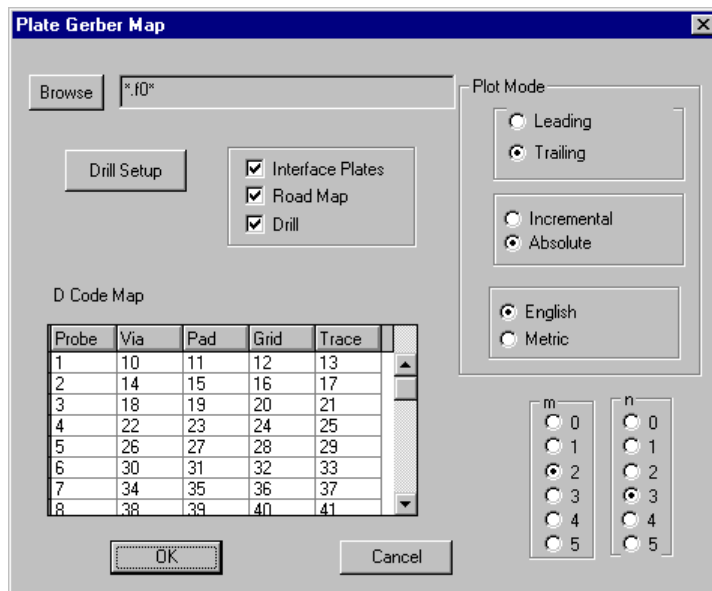
Export Plate Gerber

2. Click the **Browse** button.
3. Browse for the drive, folder, or network location where you want to save the files and enter the prefix for the files.
4. On the browse dialog, click **OK**.
5. In the **Trailing/Leading** group box, select whether **trailing** or **leading** zeros are **omitted** in outgoing data.

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6. In the **Incremental/Absolute** group box, select whether outgoing data contains **absolute** or **incremental** position coordinates.

7. In the **English/Metric** group box, select whether **English** or **metric** units are written out for outgoing data.

8. In the **m** and **n** group boxes, set the number of digits to the **left** and **right** of the implied decimal point for outgoing data.

9. To set the drill data format options, click **Drill Setup** and set these options the same way as explained in *Export Fixture Drill Files* on page 341.

10. Select the types of files you want to export:

    - **Interface Plates:** To export interface plate files, click the **Interface Plates** option so that it has a checkmark. When this option is selected with a checkmark, FixMaster exports one file with the drill points from the top and middle plates as pads connected by traces in Gerber format. In a second file FixMaster exports the drill points from the bottom and middle plates as pads connected by traces in Gerber format. These files can be used to build an interface plate board. If the option is not selected, FixMaster does not export these files.

    - **Road Map:** To export a "road map" file showing the connections between the grid points and test points, click the **Road Map** option so that it has a checkmark. If this option is selected with a checkmark, FixMaster exports the drill points from the top and bottom plates as pads connected by traces in Gerber format. If this option is not selected, FixMaster does not export this file.

    - **Drill:** To export the via drills, click the **Drill** option so that it has a checkmark. If this option is selected with a checkmark, FixMaster exports the drill points from the middle plate in NC Drill format. These will be the via drills between the two layers of the interface board. If this option is not selected, FixMaster does not export this file.

11. In the D Code Map table, for each Probe Code, assign each type of element a Gerber D Code:

    - **Via:** D Code to be mapped to drill points on the middle plate. This will be the D Code of the via covering pads.

    - **Pad:** D Code to be mapped to drill points on the top plate. This will be the D Code of the pads on the test point side of the interface board.

    - **Grid:** D Code to be mapped to drill points on the bottom plate. This will be the D Code of the pads on the grid side of the interface board.

    - **Trace:** This will be the D Code of the traces that connect the pads to the vias.

    Note: *The D Code values for these D Codes (size, shape, etc.) are not set in FixMaster. Set the D Code values in CAMMaster.*

12. On the Export Plate Gerber dialog, click **OK**.

    FixMaster outputs the Gerber and Drill files for an interface board.

Export a Gerber Road Map for Wire Wrapping

The wire wrap road map aids in the actual physical wire wrapping of test points to translation blocks. In FixMaster the road map is represented on screen by test points, test point numbers, the colored wire wrap path, and colored translation blocks. The colored wire wrap path indicates the sequence of the wire wrapped points for each translation block. The test point numbers appear periodically on the wire wrap path to help keep track of the sequence.

The road map can be output from FixMaster in Gerber format and later plotted for hard copy. In order for the road map displayed in FixMaster to be output in Gerber, the graphic elements of the road map need to be assigned D Codes.

To Export a Gerber Road Map for Wire Wrapping:

1. On the **File** menu, click **Export-Road Map**.

Export Wire Wrap Road Map

2. Click the **Browse** button.
3. Browse for the drive, folder, or network location where you want to save the files and enter the prefix for the files.

4. On the browse dialog, click **OK**.

5. In the **Trailing/Leading** group box, select whether **trailing** or **leading** zeros are **omitted** in outgoing data.

6. In the **Incremental/Absolute** group box, select whether outgoing data contains **absolute** or **incremental** position coordinates.

7. In the **English/Metric** group box, select whether **English** or **metric** units are written out for outgoing data.

8. In the **m** and **n** group boxes, set the number of digits to the **left** and **right** of the implied decimal point for outgoing data.

9. In the Output group box, select whether you want to output the road map as a wire wrap path or straight-line links.

    - **Map:** If you select Map, FixMaster exports the road map as a wire wrap path.

    - **Link:** If you select Link, FixMaster exports the road map as straight-line links between each test point and the translation hole. This can be very cluttered when there are more than a few wire-wrapped points.

10. In the D Code Map table, assign each type of graphic element in the road map to a Gerber D Code:

    - Wire wrap path

    - Test point

    - Numbered test point

    - Drill

    - Digit

    Note: *The D Code values for these D Codes (size, shape, etc.) are not set in FixMaster. Set the D Code values in CAMMaster.*

11. On the Export Wire Wrap Road Map dialog, click **OK**.

    FixMaster outputs the Gerber road map.

Export ATF

ATF is the download file format for ATG.

To Export ATF:

1. On the **File** menu, click **Export-ATF**.
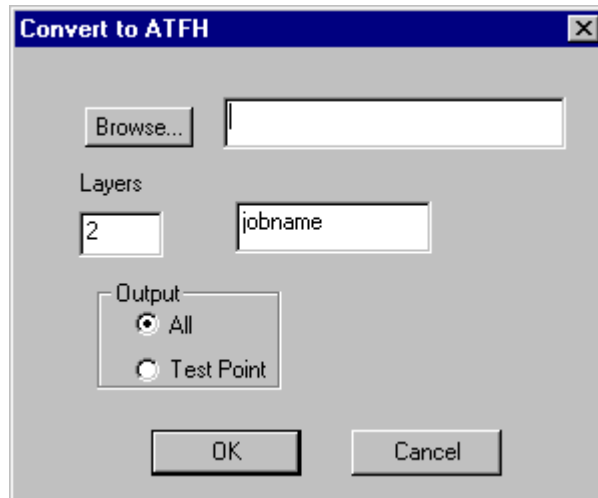
Export ATF

2. Click the **Browse** button.
3. Browse for the drive, folder, or network location where you want to save the files and enter the name for the file.
4. The following are parameters for the ATF header:
   - Layers
   - Jobname
   - Output Group Box: All/Test Point
5. On the browse dialog, click **OK**.

Export TIF

TIF is the format for UTRON.

To Export TIF:

1. On the **File** menu, click **Export-TIF**.
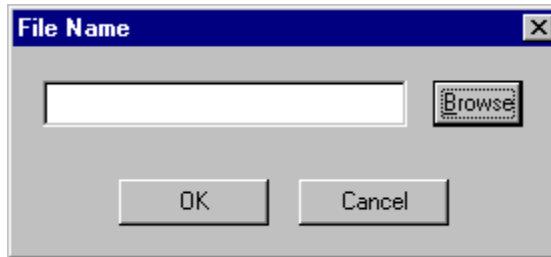
Export TIF

2. Click the **Browse** button.
3. Browse for the drive, folder, or network location where you want to save the files and enter the name for the file.
4. On the browse dialog, click **OK**.
5. On the Export TIF dialog, click **OK**.

Export IPC356A

FixMaster can export a subset of IPC356A.

To Export IPC356A:

1. On the **File** menu, click **Export-IPC356A**.
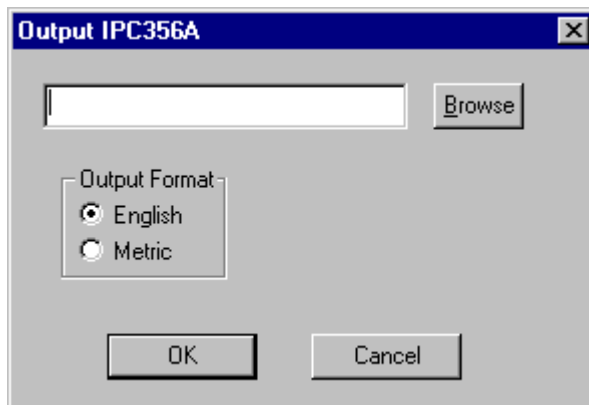
Export IPC356A

2. Click the **Browse** button.

3. Browse for the drive, folder, or network location where you want to save the files and enter the name for the file.

4. On the browse dialog, click **OK**.

5. In the **English/Metric** group box, select whether **English** or **metric** units are written out for outgoing data.

6. On the Export IPC356A dialog, click **OK**.

Export a Report File

FixMaster can export a new report file or append to the end of an existing Report File. The report file is an informational text file and cannot be read back in to FixMaster as data.

A report file contains the fixture size, grid size, PCB size, number of pads, number of assigned test points, number of crossed pins and breakout errors, and allowed pin deflection.

The report also includes a table of D Codes, pad counts, and probe information for each PCB side, as well as Tool Codes, drill sizes and counts for each fixture plate.

At the end of the report is a label table containing a time stamp, job name, units and probe information for both sides of the PCB.

You can also output an ASCII file extended with the suffix .TG that contains a list of test points, their assigned grid points, net numbers and their access directions: top or bottom.

To Export a Report File:

1. On the **File** menu, click **Export-Report File**.
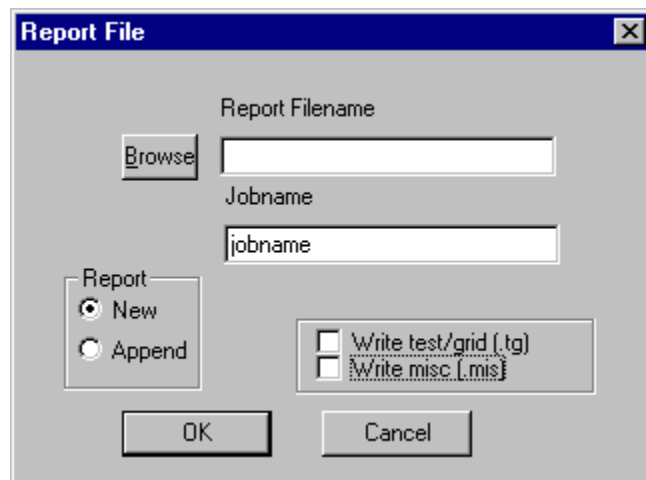
Export a Report File

2. Click the **Browse** button.

3. Browse for the drive, folder, or network location where you want to save the files and enter the name for the file.

4. On the browse dialog, click **OK**.

5. In the Jobname field, enter an internal job name for your own reference. The job name does not need to be related to Report File Name.

6. In the Report group box, select whether you want to generate a New report file or if you want to Append to an existing file of the same name.

7.   If you want to generate a text file that contains a list of test points, their assigned grid points, net numbers and their access directions, click the **Write Test/Grid** option so that is has a checkmark. This file will be extended with the suffix .TG. If you don't want to generate the additional file, be sure the option does not have a checkmark.

8.   If you want to generate a text file that contains pad coordinates for the original PCB data and corresponding pad coordinates for the mirrored, moved and/or rotated data as it is set up in the job, click the **Write Misc** option so that is has a checkmark. This file will be extended with the suffix .MIS. If you don't want to generate the additional file, be sure the option does not have a checkmark.

9.   Click **OK**.

     FixMaster generates or appends the report file as you specified.

Chapter 18
Edit PCB Data

FixMaster has several features for editing PCB data that has been imported into the job.

This chapter discusses PCB Editing topics which all involve changing the fundamental characteristics of the design, not just the position of the design as a whole. Generally the PCB data imported into the job is completely prepared in a CAM environment before importing, and this type of editing is seldom required in FixMaster.

FixMaster also has commands for changing the position of the entire PCB design. Those commands are discussed in *Position the PCB* on page 119.

Insert Pad

You can insert a pad into the loaded PCB database.

To Insert a Pad:

1. On the **Edit** Menu, click **PCB Data-Insert Pad**.

   The Insert Pad tool is selected, and FixMaster prompts you to select an element.

2. Position the cursor near an existing pad that has the same D Code and Net Number as the pad you want to insert.

3. **Click** the mouse or press **Enter**.

   The cursor hops to the existing pad and makes its D Code and Net Number the current values in the Status Bar.

4. Position the cursor where you want to insert the new pad.

5. **Click** the mouse or press **Enter**.

   A new pad with the same D Code and Net Number as the selected pad is inserted at the new location.

   The Insert Pad tool remains selected until you select another tool or press the **Escape** key, so you can insert one pad after another before quitting the operation.

Menu: *Edit-PCB Data-Insert Pad*

Button: *then*

Key: *Ctrl+Shift+P*

Delete Pads

You can delete a pad from the loaded PCB database.

To Delete Pads:

1. Position the Frame around the pads you want to delete.

2. On the **Edit** Menu, click **PCB Data-Delete Pad**.

   FixMaster prompts whether you want to delete all pads inside the Frame.

3. Click **OK**.

Menu: *Edit-PCB Data-Delete Pad*

Button: *then*

Key: *None*

Transcode Net Numbers

The net numbers of elements are included in imported netlist data. The commands for transcoding net numbers allow you to change the net number of a single element or an entire net.

To Transcode the Net Number of a Single Element:

1. On the **Edit** Menu, click **PCB Data-Transcode-Trans Netcode**.
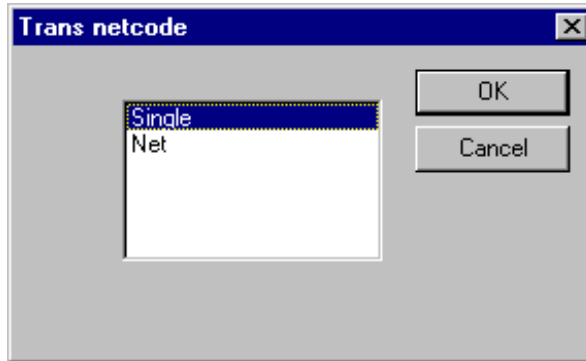
Transcode Net Number of Single Element

2. On the **Trans Netcode** dialog, select **Single** and click **OK**.

    The Transcode Net Number tool is selected, and FixMaster prompts you to select an element.

3. Position the cursor near the pad for which you want to change the Net Number.

4. **Click** the mouse or press **Enter**.

    The cursor hops to the pad.

5. **Click** the mouse or press **Enter**.
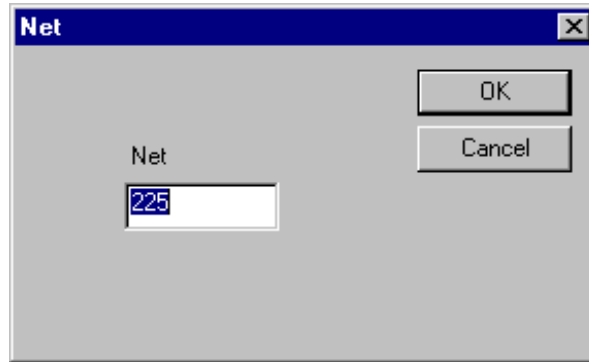
New Net Number

6. On the **Net** dialog, enter the **new net number**, and click **OK**.

    The pad is transcoded to the new Net Number and the entire net of that Net Number is highlighted.

    The Transcode Net Number tool remains selected until you select another tool or press the **Escape** key, so you can transcode the Net Number of one pad after another before quitting the operation.

Menu: Edit-PCB Data-Transcode-Trans Netcode

Button: None

Key: Ctrl+Shift+T

To Transcode the Net Number of an Entire Net:

1. On the **Edit** Menu, click **PCB Data-Transcode-Trans Netcode**.
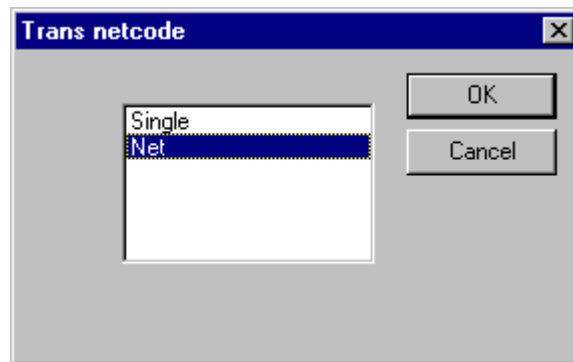
Transcode Net Number of Entire Net

2. On the **Trans Netcode** dialog, select **Net**, and click **OK**.

    The Transcode Net Number tool is selected, and FixMaster prompts you to select an element.

3. Position the cursor near a pad in the net for which you want to change the Net Number.

4. **Click** the mouse or press **Enter**.

360

The cursor hops to the pad.

5. **Click** the mouse or press **Enter**.
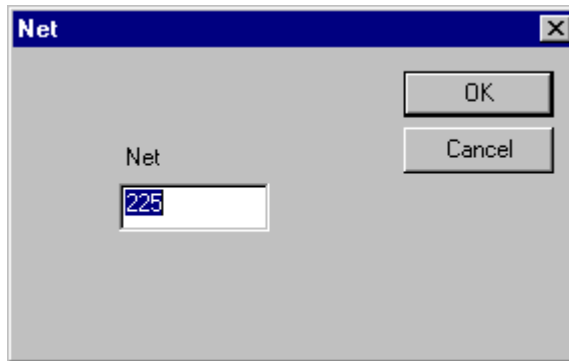
New Net Number

6. On the **Net** dialog, enter the **new net number**, and click **OK**.

The net containing the selected pad is transcoded to the new Net Number and the entire net is highlighted.

The Transcode Net Number tool remains selected until you select another tool or press the **Escape** key, so you can transcode the Net Number of one net after another before quitting the operation.

Menu: *Edit-PCB Data-Transcode-Trans Netcode*

Button: *None*

Key: *Ctrl+Shift+T*

Transcode Probe Codes

The Probe Code used to probe a given pad is automatically determined by the D Code of the pad and the D Code to Probe mapping. See *Map D Codes to Probe Codes* on page 129. However, you may decide that some pads of a given D Code may need to be probed by a different probe than the one mapped to that D Code. The commands to transcode Probe Codes allow you to do this.

To Transcode the Probe Code of a Single Pad:

1. On the **Edit** Menu, click **PCB Data-Transcode-Probe Code**.
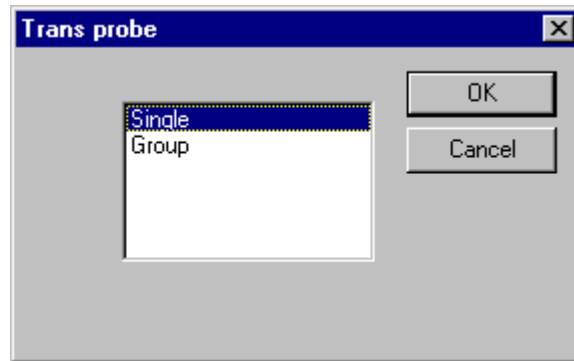
Transcode Single Probe

2. On the **Trans Probe** dialog, select **Single** and click **OK**.

   The Transcode Probe Code tool is selected, and FixMaster prompts you to select an element.

3. Position the cursor near the pad for which you want to change the Probe Code.

4. **Click** the mouse or press **Enter**.

   The cursor hops to the pad.

5. **Click** the mouse or press **Enter**.
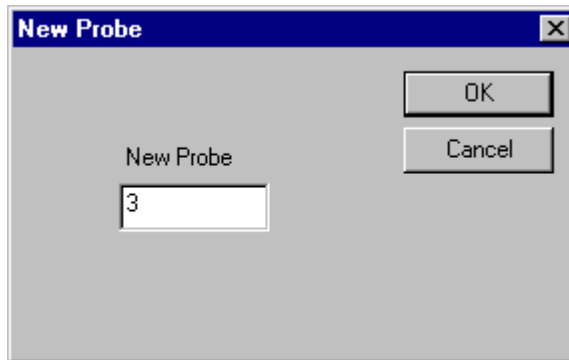
New Probe Code

6. On the **New Probe** dialog, enter the **new Probe Code** and click **OK**.

    The pad is transcoded to the new Probe Code.

    The Transcode Probe Code tool remains selected until you select another tool or press the **Escape** key, so you can transcode the Probe Code of one pad after another before quitting the operation.

Menu: *Edit-PCB Data-Transcode-Probe Code*

Button: *None*

Key: *None*

To Transcode Probe Codes of a Group of Pads in the Frame:

1. Position the Frame around the pads for which you want to change the Probe Code.
2. On the **Edit** Menu, click **PCB Data-Transcode-Probe Code**.
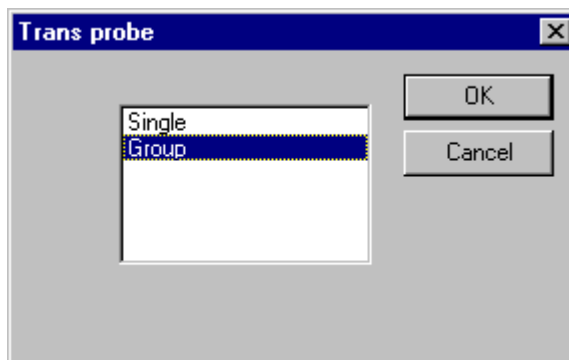
Transcode a Group of Probes

3. On the **Trans Probe** dialog, select **Group** and click **OK**.

    The Transcode Probe Code tool is selected, and FixMaster prompts you to select an element.

4. Position the cursor near a pad that has the Probe Code you want to change.

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5. **Click** the mouse or press **Enter**.

   The cursor hops to the pad and its Probe Code is displayed as the current Probe Code in the Status Bar.

6. **Click** the mouse or press **Enter**.
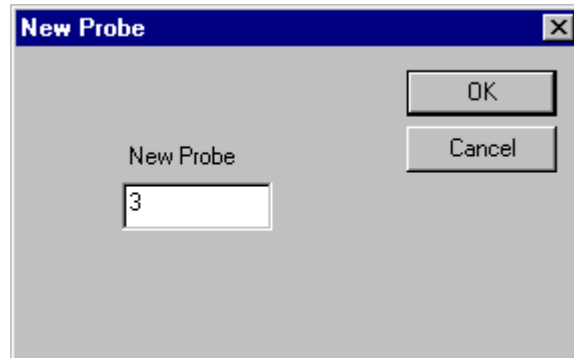
New Probe Code

7. On the **New Probe** dialog, enter the **new Probe Code** and click **OK**.

   All pads inside the Frame that have the same Probe Code as the selected pad are transcoded to the new Probe Code.

   The Transcode Probe Code tool remains selected until you select another tool or press the **Escape** key, so you can transcode the Probe Code for one group of pads in the Frame after another before quitting the operation.

Menu: *Edit-PCB Data-Transcode-Probe Code*

Button: *None*

Key: *None*

Transcode D Codes

The D Codes of pads are included in imported PCB data, and they determine the size and shape of the pads. The commands for transcoding D Codes allow you to change the size of a single pad or of a group of pads inside the Frame.

To Transcode the D Code of a Single Pad:

1. On the **Edit** Menu, click **PCB Data-Transcode-D Code**.
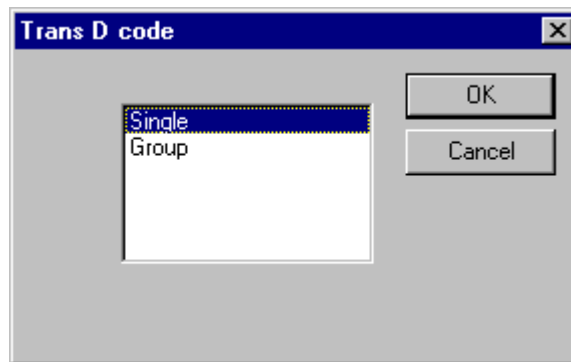
Transcode D Code of a Single Pad

2. On the **Trans D Code** dialog, select **Single** and click **OK**.

   The Transcode D Code tool is selected, and FixMaster prompts you to select an element.

3. Position the cursor near the pad for which you want to change the D Code.

4. **Click** the mouse or press **Enter**.

   The cursor hops to the pad.

5. **Click** the mouse or press **Enter**.
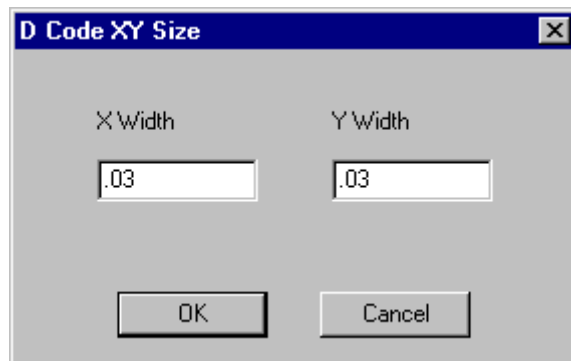
New D Code Size

6. On the **D Code XY Size** dialog, enter the **dimensions of the new D Code** and click **OK**.

   The pad is transcoded to a new D Code with the new dimensions. If a different D Code with the new dimensions already exists, that D Code is used. If a D Code with the new dimensions does not exist, a new D Code is created with the new dimensions.

   The Transcode D Code tool remains selected until you select another tool or press the **Escape** key, so you can transcode the D Code of one pad after another before quitting the operation.

Menu: *Edit-PCB Data-Transcode-D Code*

Button: *then*

Key: *Ctrl+T*

To Transcode the D Codes of a Group of Pads in the Frame:

1. Position the Frame around the pads for which you want to change the D Code.

2. On the **Edit** Menu, click **PCB Data-Transcode-D Code**.
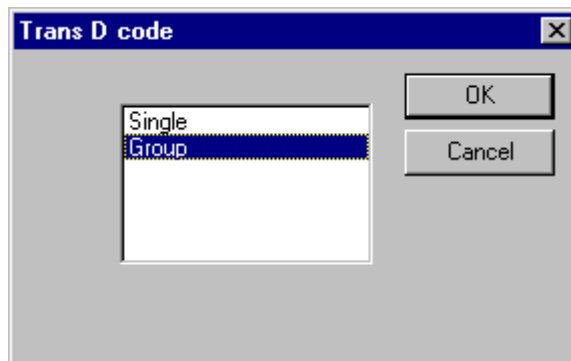
Transcode D Code of a Group of Pads

3. On the **Trans D Code** dialog, select **Group** and click **OK**.

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The Transcode D Code tool is selected, and FixMaster prompts you to select an element.

4. Position the cursor near a pad that has the D Code you want to change.

5. **Click** the mouse or press **Enter**.

    The cursor hops to the pad and its D Code is displayed as the current D Code in the Status Bar.

6. **Click** the mouse or press **Enter**.
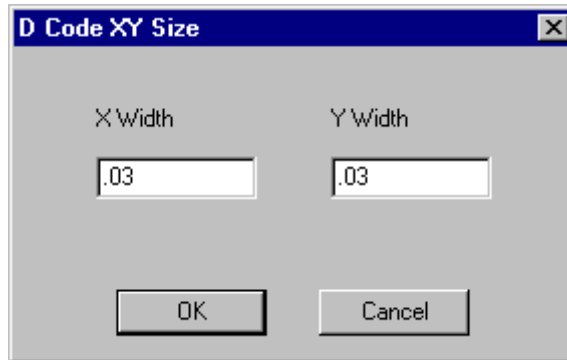
New D Code Size

7. On the **D Code XY Size** dialog, enter the **dimensions of the new D Code** and click **OK**.

    All pads inside the Frame that have the same D Code as the selected pad are transcoded to a new D Code. If a different D Code with the new dimensions already exists, that D Code is used. If a D Code with the new dimensions does not exist, a new D Code is created with the new dimensions.

    The Transcode D Code tool remains selected until you select another tool or press the **Escape** key, so you can transcode the D Code for one group of pads in the Frame after another before quitting the operation.

Menu: *Edit-PCB Data-Transcode-D Code*

Button: *then*

Key: *Ctrl+T*

Remove Padstacks

FixMaster has a command that automatically removes stacked pads in the imported PCB database. The command identifies pads that have the same centerpoint and removes all but the largest pad. The pads that are removed must be entirely covered by the larger pads in order to be removed. If the pads identified are all the same size, then only one is kept.

Removing stacked pads helps to eliminate stacked test points that can cause head butt errors. Head butt errors that appear to have two grid points assigned to the same test point are due to stacked pads, and you should remove the padstacks to solve such errors. For more about head butt errors, see *Crossed Pins and Head Butts* on page 199.

To Remove Padstacks:

➢   On the **Action** menu, click **Remove Padstacks**.

Chapter 19
Automatic Job Processing Features

The FixMaster product family has two features for automating the processing of jobs. The AutoGen feature is an automatic processing feature within FixMaster that allows for some user intervention when desirable. And the AutoFixture product is an upgraded version of FixMaster that has an automatic "lights out" feature that can process batches of jobs with no intervention.

With AutoGen, you load a boilerplate fixture file, import the new PCB data for the new job, and then AutoGen automatically assigns D Codes to Probe Codes, generates test points, staggers test points, positions the PCB data, drops pins, and saves the new .JOB file. If AutoGen runs into a problem during the processing, you can intervene to fix it.

With AutoFixture's "Lights Out" automatic processing, you start the AutoProcessing feature and point it at a folder containing netlists or .JOB files to be processed. AutoFixture processes the netlists or .JOB files in the directory automatically with no intervention. For netlists, AutoFixture finds the best fixture to use for the job, processes the job to completion, exports the tester and fixture files, and moves on to the next netlist. For .JOB files, AutoFixture uses the fixture information saved in the files and processes the job to completion. If AutoFixture cannot complete a particular job, it saves a .JOB file to be completed by you later, and moves on to the next netlist or .JOB file.

AutoGen

Once you have mastered the beginning-to-end fixture building procedures, you may be ready to automate standard jobs using the FixMaster AutoGen Feature. AutoGen combines all the setup dialogs in one place and automatically performs operations that you would ordinarily do manually one at a time. You need a thorough understanding of each of the operations and dialogs available from the AutoGen dialog to effectively use the feature.

If you frequently process similar jobs, using FixMaster could become as simple as loading a boilerplate .JOB file, reading the new PCB data, checking the AutoGen setup options, and clicking **OK**. AutoGen can automatically assign D Codes to Probe Codes, generate test points, stagger test points, position the PCB data, drop pins, and save the new .JOB file.

To Process a Job Using AutoGen:

1. **Open a boilerplate .JOB file**. See *Open a FixMaster Job File* on page 293.

2. **Import the PCB data**. See *Import PCB Files into the Job* on page 299.

3. **Map the D Codes to types** as you read in the file, or do it next by going to the **Action** menu and clicking **D Code to Probe Map**. See *Map D Codes to Probe Codes* on page 129.

4. On the **Action** menu click **AutoGen**.

   FixMaster displays the AutoGen Automated Features Dialog. You can activate each operation on the dialog by clicking the option so that it has a checkmark.
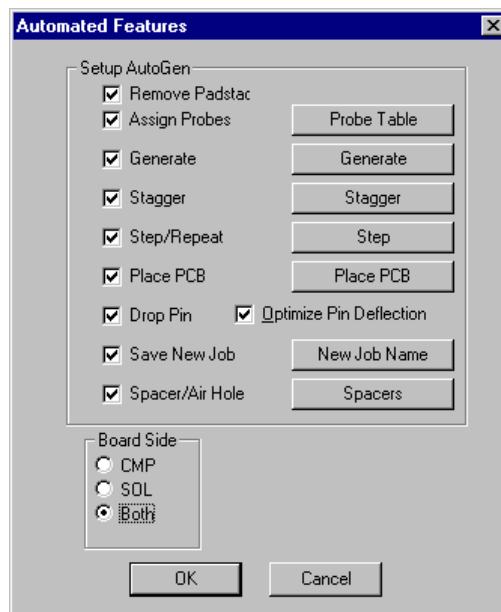
AutoGen Automated Features Dialog

Most operations have corresponding setup dialogs that must be configured before the operation can be run. To set up each operation, click on the corresponding button to display the setup dialog. Many of these settings are stored in the boilerplate .JOB file and will not need to be changed between jobs.

5. If you want FixMaster to automatically remove padstacks, click the **Remove Padstacks** option so that it has a checkmark. For information on removing padstacks, see *Remove Padstacks* on page 368.

6. If you want FixMaster to automatically **map D Codes to Probe Codes**:

   - Click the **Assign Probes** option so that it has a checkmark.

   - Click the **Probe Table** button.

   - On the Probe Table dialog, make sure the settings are what you want. See *Setting up the Probes* on page 70.

   Note: *D Codes need to be mapped to types before FixMaster can assign Probe Codes, so if you did not map them when reading in the PCB data, do it before running the AutoGen operation by going to the **Action** menu and clicking **D Code Probe**. See **Map D Codes to Probe Codes** on page 129.*

7. If you want FixMaster to automatically **generate test points**:

   - Click the **Generate** option so that it has a checkmark.

   - Click the **Generate** button.

   - On the Generate Config dialog, make sure the settings are what you want. See *Set Up Test Point Generation Options for Netlists* on page 140.

8. If you want FixMaster to automatically **stagger test points**:

   - Click the **Stagger** option so that it has a checkmark.

   - Click the **Stagger** button.

   - On the Stagger Setup dialog, make sure the settings are what you want. See *Stagger Test Points* on page 165.

9. If you want FixMaster to automatically **Step and Repeat the PCB**:

   - Click the **Step and Repeat** option so that it has a checkmark.

   - Click the **Step and Repeat** button.

   - On the Step and Repeat dialog, make sure the settings are what you want. See *Step and Repeat the PCB* on page 126.

10. If you want FixMaster to automatically **position the PCB** within the fixture tooling:

   - Click the **Place PCB** option so that it has a checkmark.

   - Click the **Place PCB** button.

   - On the Place PCB dialog, make sure the settings are what you want. See *Automatically Centering the PCB in the Fixture Tooling* on page 121.

11. If you want FixMaster to automatically **assign test points to fixture grid points**, click the **Drop Pin** option so that it has a checkmark.

12. If you want FixMaster to **optimize the pin deflection** by sequentially reducing the maximum displacement, click the **Optimize Pin Deflection** option so that it has a checkmark.

13. If you want FixMaster to automatically **save the completed job**:

    • Click the **Save New Job** option so that it has a checkmark.

    • Click the **New Job File** button.

    • On the Save File dialog, browse for the drive, folder, or network location where you want to save the file and enter the name for the file.

14. If you want FixMaster to automatically **insert spacers and/or air holes**:

    • Click the **Spacer/Air Hole** option so that it has a checkmark.

    • Click the **Spacers** button.

    • On the Spacer/Guter Setup dialog, make sure the settings are what you want. See *Add Spacers* on page 281.

15. In the **Layer** field, select the PCB layer that you want processed by AutoGen, Component only, Solder only or Both.

16. Click **OK**.

    FixMaster begins to process the job using the settings you specified. If the program encounters a problem, it stops and prompts for input. There are several potential trouble spots. The program stops if:

    • The Assign Probe operation is unable to map all D Codes to Probe Codes.

    • The Generate or Stagger operations create any head butts.

    • The Drop Pins operation creates any crossed pins, breakouts, or unassigned test points.

    • The New .JOB file has a bad file name.

Menu: *Action-AutoGen*

Button:

Key: *None*

AutoFixture "Lights Out" Processing

The AutoFixture product has an AutoProcessing feature that automatically detects Lavenir .F04 format netlists or Lavenir .JOB files as they are placed in a target directory and generates fixture drill files and tester download files for them with no user intervention. For a full "lights-out" fixture-processing routine you can use AutoFixture's automatic processing along with the NetRipper.BAS script for CAMMaster. Using the two features together, the system can take a directory full of prepared .BIN files, automatically create the netlists and then automatically generate the fixture and tester download files. This is useful for overnight processing of netlist and fixture files.

AutoFixture Overview

During the AutoProcessing setup, you make some AutoFixture template files for the types of fixtures that you usually use. You may have several fixture designs, some for one-sided, some for two-sided, some for dense boards, some for not so dense ones, some for large boards, and some for smaller ones. Then you tell AutoFixture whether each fixture template is for single-sided or double-sided boards and the maximum size of board that can be tested on each. You organize the fixture templates in order so that AutoFixture will use the most cost-effective fixtures whenever it can and only use the more complex fixtures when the board design requires it. You also tell AutoFixture where to look for input netlists or input .JOB files and where to output the finished fixture and tester files.

After you have done the one-time setup, daily fixture processing can be automated. On a daily basis, you do the normal CAM processing for your day's jobs, but save the netlist extraction and fixture processing for "lights-out" AutoProcessing by AutoFixture. Tell the CAMMaster NetRipper.BAS script where the CAMMaster .BIN files are located and where to put the netlists. Start the CAMMaster NetRipper.BAS script and the AutoFixture AutoProcessing feature.

The AutoFixture system will do the following:

- The NetRipper.BAS script extracts netlists from the jobs you prepared during the day and puts the netlists in a directory where AutoFixture can find them.

- The AutoFixture AutoProcessing feature automatically detects the completed netlists as NetRipper places them in the input directory.

- AutoFixture matches each netlist to the first fixture file template in its list that has the right number of sides (single or double) and the right size.

- AutoFixture processes each job to completion. If the system cannot completely solve a particular job using the current fixture template, it moves to the next fixture design in the list and tries again. If it can't find a fixture design that it can use to solve the job automatically, it saves the job out for manual processing, makes a log file entry, and moves on to the next job.

- Once AutoFixture has processed each job to completion, it exports all the necessary test files, drill files and report files, and it updates the log file. Then it looks for the next netlist.

When you return, you find all the files you need to generate the fixtures and test the jobs and a log file that gives you the status of all jobs processed.

Set Up AutoFixture Fixture Templates

Before you can use AutoFixture to automatically process netlists, you must set up the AutoFixture templates. Templates are not necessary if you are using AutoFixture to process .JOB files.

To Set Up AutoFixture Fixture Templates:

1. If you have a boilerplate .JOB file that you want to use as a starting point, import the job. See *Open a FixMaster Job File* on page 293.

2. On the **Setup** menu, click **AutoProcess-Build Templates**.

    The AutoProcess Templates dialog is where you will set up the configurations that define each of your templates. This dialog is able to access all the other configuration and setup dialogs that you ordinarily use to process a FixMaster job. Each of these dialogs is explained in other sections of this manual, so to set up a given configuration dialog, click on the appropriate button and refer to the corresponding section in this manual.

    After you have saved all the template files that you plan to use, there is a separate procedure in which you will organize the templates by what size of job each template should be used for and whether each template is for a single sided or double sided test. See *Set Up the AutoProcessing Options* on page 376.
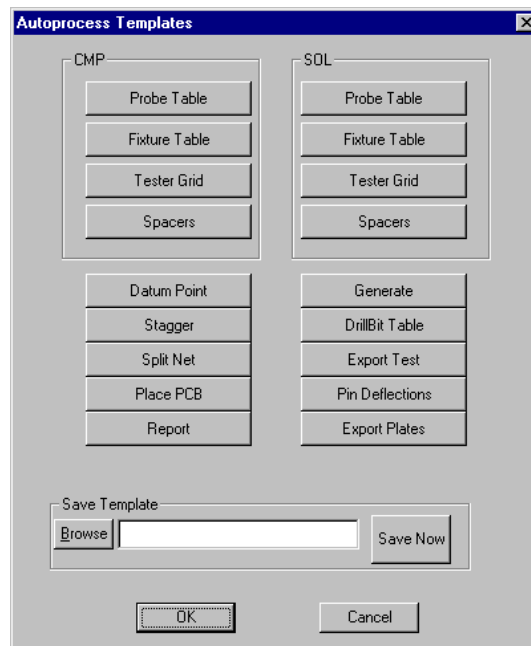
AutoProcess Templates Dialog

3. To set up the fixture probes and the D Code to probe mapping, click the **Probe Table** button. See *Setting up the Probes* on page 70.

4. To set up the fixture plates, click the **Fixture Table** button. See *Setting up the Fixture Plates* on page 52.

5. To set up the tester grid, click the **Tester Grid** button. See *Setting up the Fixture Grids* on page 61.

6. To set up the automatic spacer insertion, click the **Spacers** button. See *Add Spacers* on page 281.

Note: *Be sure to set up both the Spacer Config tab and the Auto Spacer tab.*

7. To set up the datum point, click the **Datum Point** button. See *Setting the Datum Point* on page 340.

8. To set up test point staggering, click the **Stagger** button. See *Stagger Test Points* on page 165.

9. To set up net splitting if necessary, click the **Split Net** button. See *Set Up Split Net Options* on page 222.

10. To set up automatic placement of the PCB, click the **Place PCB** button. See *Automatically Centering the PCB in the Fixture Tooling* on page 121.

11. To set up generation of a report file, click the **Report** button. See *Export a Report File* on page 355.

12. To set up test point generation, click the **Generate** button. See *Generating Test Points* on page 137.

13. To set up automatic hole-size calculation based on drill bits, click the **Drill Bit Table** button. See *Automatically Pick Best Fit to Drill Bit Table* on page 74.

14. To set up the tester download file options, click the **Export Test** button. See *Export Tester Download Files* on page 316.

15. To set up the allowable pin deflections and breakout gap, click the **Pin Deflections** button. See *Setting up the Fixture Design Rules* on page 59.

16. To set up the drill files for the fixture plates, click the **Export Plates** button. See *Export Fixture Drill Files* on page 341.

17. When all the configuration settings are set up the way you want, click the **Browse** button. Browse for the drive, folder, or network location where you want to save the file and enter the name for the file.

18. Click the **Save Now** button.

19. If you want to save other templates, you can go back and make changes on the AutoProcess Templates dialog and save the new templates under new names.

20. When you are done saving templates, click **OK** on the AutoProcess Templates dialog.

21. Go to the AutoProcessing setup procedure to prioritize your fixture templates and set up your other AutoProcessing options. See *Set Up the AutoProcessing Options* on page 376.

Menu: *Setup-AutoProcess-Build Templates*

Button: *None*

Key: *None*

Set Up the AutoProcessing Options

Before you can use AutoFixture, you must set up the AutoProcessing options.

To Set Up the AutoProcessing Options:

1. On the **Setup** menu, click **AutoProcess-AutoProcess**.
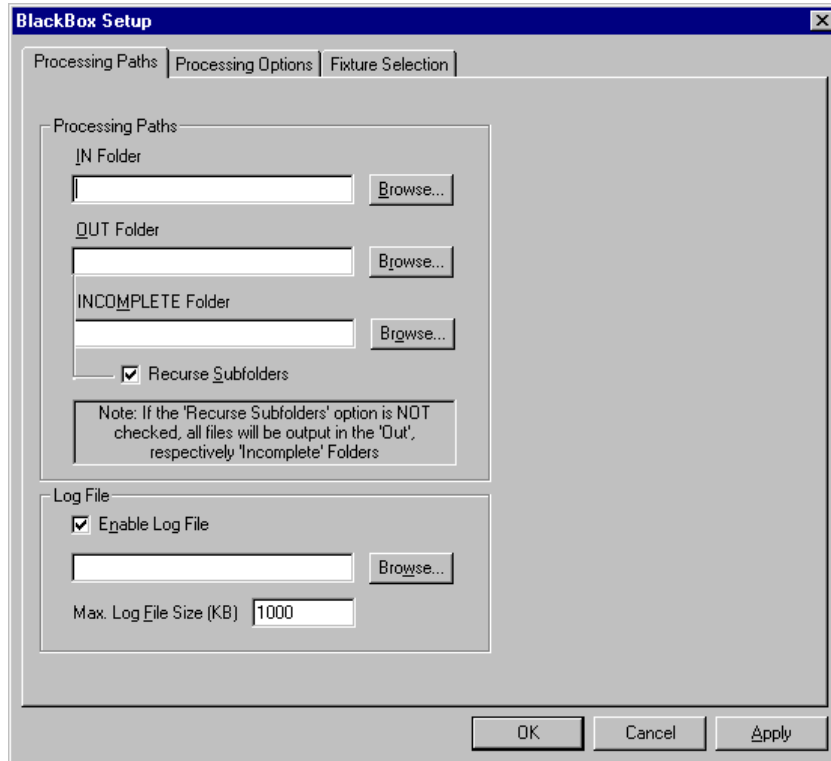
AutoProcess Processing Paths Tab

2. On the Processing Paths Tab, set the following folder locations:

   IN Folder: Next to the IN Folder field, click the **Browse** button, and browse for the folder where the netlists or .JOB files that are to be processed are located.

   OUT Folder: Next to the OUT Folder field, click the **Browse** button, and browse for the folder where you want the completed .JOB, fixture and test files to be saved.

   INCOMPLETE Folder: Next to the INCOMPLETE Folder field, click the **Browse** button, and browse for the folder where you want the .JOB files for incomplete AutoProcessing jobs to be saved.

3. When the Folder locations are set up on the Processing Paths tab, click **Apply**.
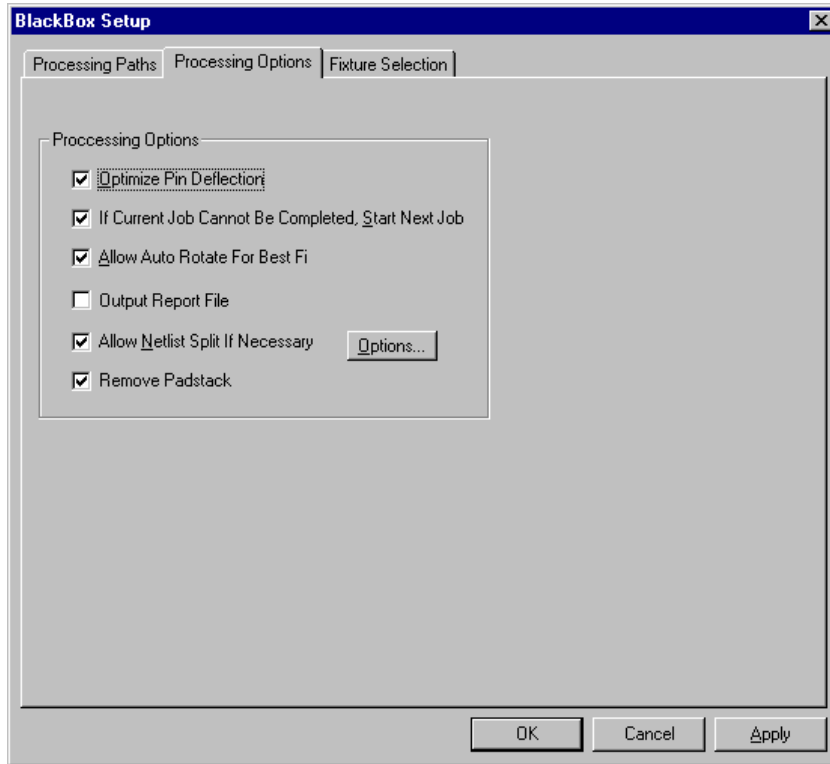
AutoProcess Processing Options Tab

4. On the Processing Options tab, set the following processing options:

    Optimize Pin Deflection: If you select this option, AutoFixture will attempt to solve the job with the original pin deflection. If the program succeeds with all test points assigned without error, it will try to solve the job with a smaller pin deflection, and so on. This process can be time-consuming, but it can achieve tighter pin deflections.

    If Current Job Cannot be Completed Start Next Job: If this option is selected, AutoFixture will move on to the next job if it cannot complete the current job.

    Allow Auto Rotate for Best Fit: If this option is selected, AutoFixture will rotate the imported netlist if the PCB will not fit within the fixture tooling. Because the rotation is only attempted if the PCB doesn't fit, this does not mean that the long side of the board will always match the long side of the fixture. If you know how you want the PCB to be oriented, you should set it up that way and not select this option.

    Output Report File: If this option is selected, AutoFixture will export a Report File for every job.

    Allow Netlist Split if Necessary: If you select the option to allow netlist splitting if necessary, there are more options to set up. For information about the options for netlist splitting during AutoProcessing, see *To Set up the AutoProcess Netlist Splitting:* on page 380.

Remove Padstacks: If this option is selected, AutoFixture will remove padstacks. For information on removing padstacks, see *Remove Padstacks* on page 368.

5. When the options are set up on the Processing Options tab, click **Apply**.
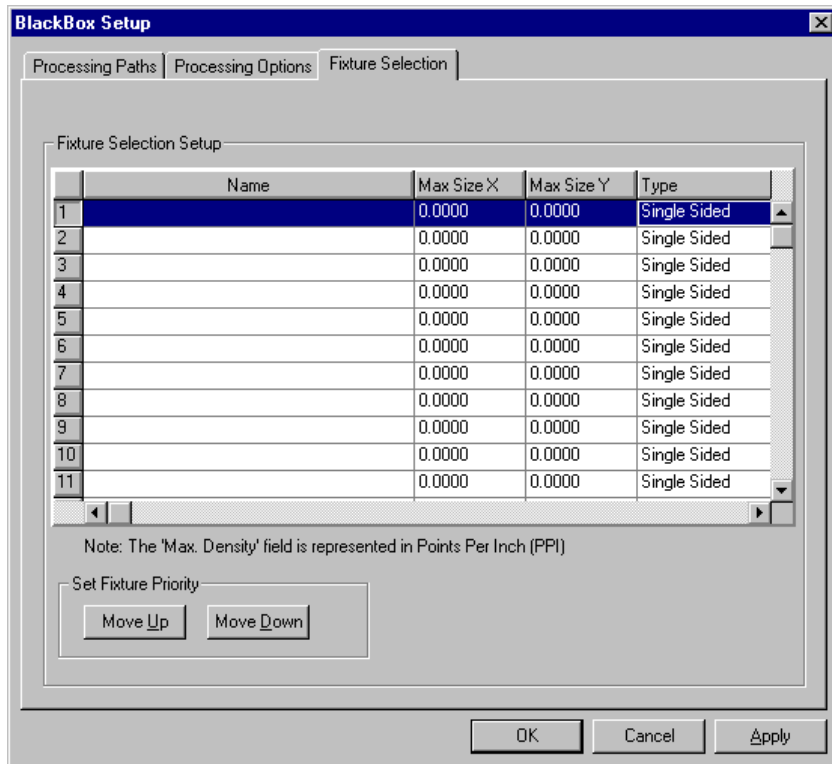
AutoProcess Fixture Selection Tab

6. On the Fixture Selection tab, prioritize the order in which you want the fixture templates to be used.

Note: *When processing .JOB files, AutoFixture does not use these fixture template files, and the order is unimportant. Instead, AutoFixture will use the fixture information saved in the .JOB file. The template selection order is only used when processing netlists.*

When the AutoProcessing feature begins to process a netlist, it starts in the beginning of this Fixture Selection Setup list and uses the first fixture it finds that is the right type (Single Sided or Double Sided), and that is for the correct size (Max X, Y dimensions). If AutoProcessing is unable to solve the job using the first fixture template, it tries to process the job with the next fixture template that is the right type and right size. By prioritizing this list you can have AutoProcessing try the most cost-effective fixtures first.

Set up the following:

Name: This field lists the file names of fixture template files that you saved earlier in the Build Templates procedure. See *Set Up AutoFixture Fixture Templates* on page 374. Move these files up or down in the list by selecting the row of the file you want to move and then clicking the **Move Up**, **Move Down** buttons.

Max Size X, Y: Enter the Maximum board dimensions that can be tested on the given fixture template.

Type: Select whether the given fixture template is appropriate for testing single or double sided jobs.

Enable: You can select whether to turn on or turn off a given fixture template file. This way you may decide not to use a particular template at a particular time, but still maintain the order of the list. To allow a given template to be used, click the **Enable** checkbox for that template file so that the template has a checkmark. To not allow a given template to be used, click the **Enable** checkbox for that template file so that the template does not have a checkmark.

Move Up, Move Down: These buttons move a selected template up or down in the list.

7. When the templates are set up on the Fixture Selection tab, click **Apply**.

8. When all the AutoProcessing options are set up, click **OK**.

Menu: *Setup-AutoProcess-AutoProcess*

Button: *None*

Key: *None*

To Set up the AutoProcess Netlist Splitting:

This procedure explains the options for netlist splitting that you may select while setting up the AutoProcessing options. For the main setup procedure for AutoProcessing, see *To Set Up the AutoProcessing Options:* on page 376.

1. On the AutoProcess Processing Options Tab, click the **Allow Netlist Split if Necessary** option so that it has a checkmark.
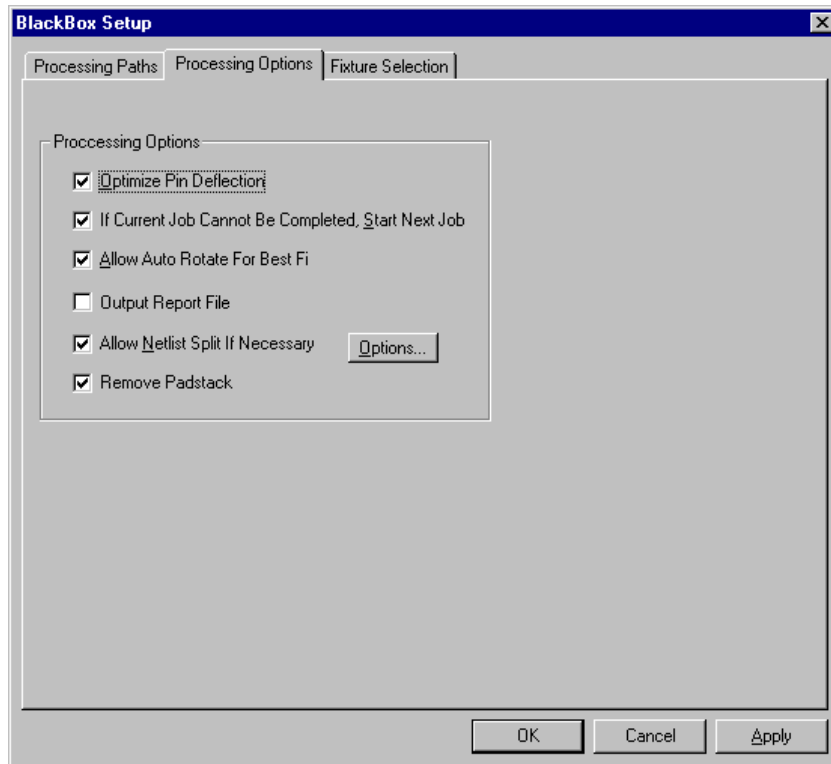
AutoProcess Processing Options Tab

2. Click the **Options** button.
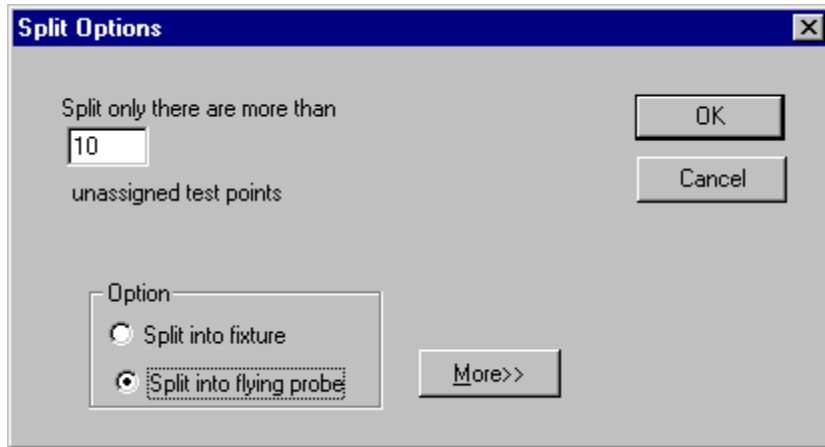
3. On the Split Options dialog, enter a **threshold number of test points**. If there are more unassigned test points than the number you enter, AutoFixture will split out the nets containing unassigned points.

4. In the Options group box select whether to split to **another fixture** or to a **flying probe tester**.

   Split into Fixture: If you select this option, AutoFixture will split nets into another FixMaster job. And then it will process the split job until the entire job is done.

   Split into Flying Probe: If you select this option, AutoFixture will split nets into a ProbeMaster job. And then it will process the split ProbeMaster job until the entire job is done.

5. If you selected to split the nets to a **Flying Probe** job, click the **More** button and set up the additional flying probe options.
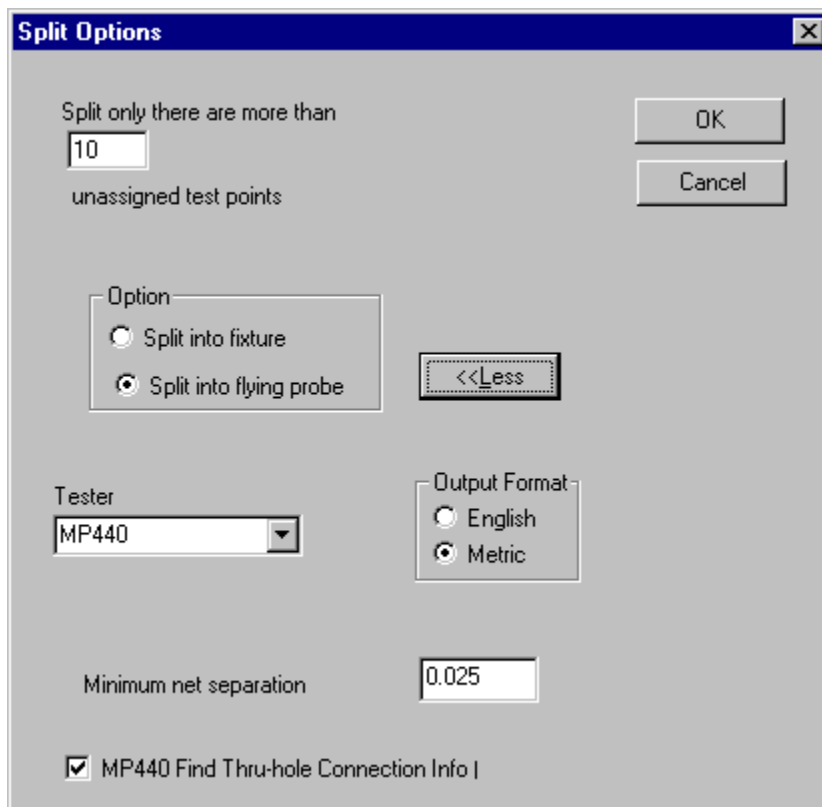
Split Options for Flying Probe

- **Tester:** Select the type of Flying Probe Tester.
- **Output Format:** Select English or Metric units.
- **Minimum Net Separation:** This is for generating adjacency data.
- **MP-440 Find Thru-Hole Connection Info:** Generates thru-hole connection data for the EMMA tester.

6. Click **OK**.

7. Return to the main setup procedure. See *To Set Up the AutoProcessing Options:* on page 376.

Start AutoProcessing

The AutoProcessing feature can be run on its own, or it can be run with the NetRipper.BAS script for CAMMaster. Regardless, the AutoProcessing feature monitors an input directory for netlist files or for .JOB files that need to be processed. AutoFixture processes any files that are in the directory when AutoProcessing is started and any files that are placed into the directory while it is running. By using the NetRipper.BAS Script, you can also automate the netlist extraction process.

To Start AutoProcessing:

1. If you are going to use the NetRipper.BAS script in CAMMaster, start it now.

2. If you have difficult jobs that you would like to be processed using a specific fixture, or if you expect that jobs will need to use split nets, import those types of jobs into FixMaster. Generate test points and save the .JOB file.

3. Place your prepared netlists or .JOB files in the AutoProcessing IN Folder directory you defined during the setup. Or start the NetRipper.BAS script in CAMMaster and make its output directory the same as the AutoProcessing IN Folder directory you defined during the setup.

4. On the **Action** Menu, click **AutoProcess**.

    The FixMaster window minimizes, and the AutoProcessing feature begins processing netlists or .JOB files in the IN Folder directory.

    If you are using the NetRipper.BAS script in CAMMaster, AutoFixture automatically detects the completed netlists as NetRipper places them in the IN Folder directory.

    AutoFixture matches each netlist to the first fixture template file in its list that is the right type (single-sided or double-sided) and the right size. For .JOB files, AutoFixture does not attempt to match to a template file; it uses the fixture saved in the .JOB.

    AutoFixture processes each job to completion. If the system cannot completely solve a particular netlist job using the current fixture template, it moves to the next fixture design in the list and tries again. If it can't find a fixture design that it can use to solve the job automatically, it saves the job out for manual processing, makes a log file entry, and moves on to the next job.

    If AutoFixture cannot completely solve a particular .JOB file job and netlist splitting is enabled, it splits the job to another FixMaster or ProbeMaster job and processes the split jobs to completion.

    Once AutoFixture has processed a job to completion, it exports all the necessary test files, drill files and report files, and it updates the log file. Then it looks for the next netlist or .JOB file.

    When you return, you find all the files you need to generate the fixtures and test the jobs and a log file that gives you the status of all jobs processed.

Menu: *Action-AutoProcess*

Button: *None*

Key: *None*

Chapter 20
PCB Tooling Holes and Fixture Alignment Pins

Some PCBs are designed with tooling holes to match alignment pins on the test fixture. Those tooling holes are represented by D Codes on the PCB design, and they can be imported into FixMaster when the PCB design is imported. Then, if you want to add drills to your fixture plate drill files so that you can mount the alignment pins, FixMaster can export drills for alignment pins in your fixture to match tooling holes on the PCB. FixMaster reads the tooling hole locations from the imported PCB data, then exports drills in the fixture plate files at the same locations.

You specify:

- Which fixture plate files will be exported with tooling holes.

- The size of the tooling holes needed to mount the alignment pins.

- Which D Codes in the PCB represent tooling holes.

Dual Fixture Issues

Just as you can map the same D Code to different probes on different sides of the board, you can handle tooling holes differently on different sides of the board. For instance, you may want to put drills for mounting alignment pins at tooling hole locations on the component-side fixture, and put a different size drill at the same location on the solder side fixture to allow the tower tester to close over the pins. If you are doing simultaneous dual-sided testing, you can set up two Fixture Plate configurations and two Probe Tables and two D Code/Tool to Probe Maps. Whenever you have one of these tables displayed, it is for the current board side, CMP or SOL.

Fixture Plates with Tooling Holes

When the drill files are exported, you have the option to export tooling holes from the PCB data as drills in fixture plates. It may be that you want to have drills for tooling holes in some plates and not in others.

To Specify which Fixture Plates will be Exported with Tooling Holes:

1. On the **Setup** menu, click **Fixture-Fixture Table**.
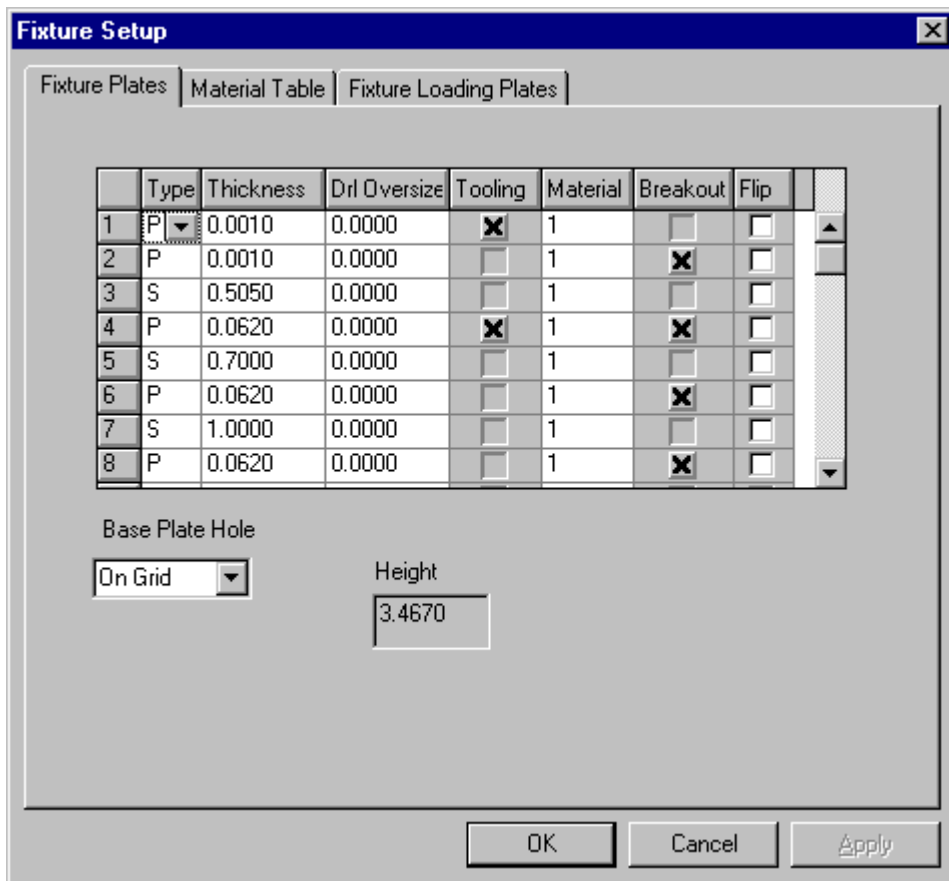
Fixture Plates Tab

2. On the **Fixture Plates** tab, if you want to export tooling holes for a particular plate, enter a **checkmark** in the **Tooling** field of that plate. Otherwise clear the checkmark for that plate.

Tooling Hole Drill Diameters

The D Codes which are imported from the PCB data as tooling holes have diameters that represent the diameter of the hole in the PCB. The diameter of the corresponding hole in the fixture will be different. The hole in the fixture needs to be drilled to the diameter needed to mount the alignment pin on the fixture. The Probe Table, where you set up the probe parameters, is also used to set up tooling hole diameters.

To Set up Tooling Hole Diameters:

1. On the **Setup** Menu, click **Fixture-Probe**.
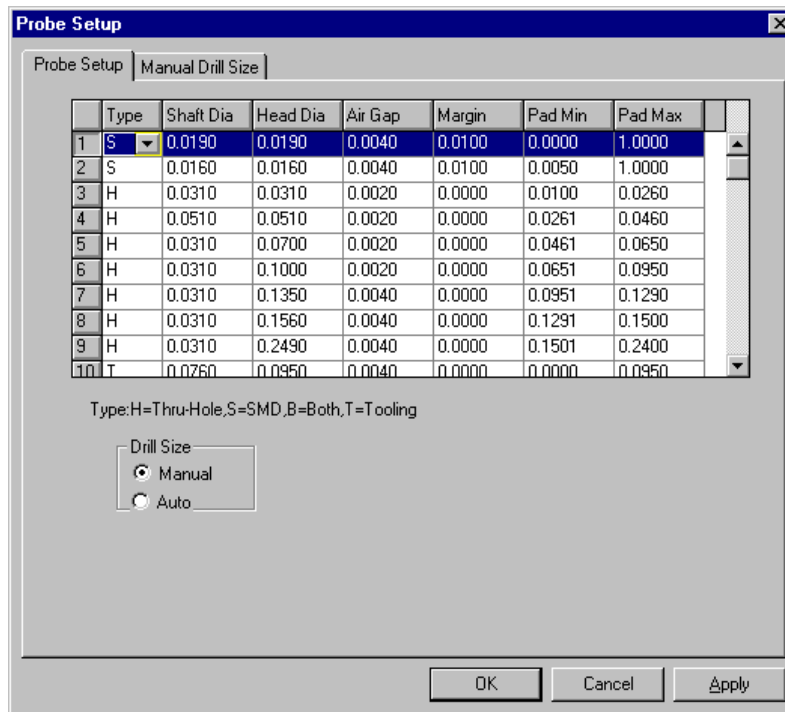
Probe Setup Tab

2. On the **Probe Setup** tab of **Probe Setup** dialog, enter T in the Type field of this table for each Tooling Hole.

    A type-T probe isn't actually a probe. FixMaster uses the diameter of the type-T probe as the tooling hole size and the size of the Tool Code in the drill export files.

3. In the **Shaft Dia** field, **enter the size** you want the tooling hole to be.

    Note: The Drill Oversize parameter in the Fixture Plates dialog is not added to this size.

4. If you are going to automatically map D Codes to Probe Codes, set up the Pad Min and Pad Max fields also. This is not necessary if you are manually mapping D Codes to Probes.

D Codes Mapped as Tooling Holes

In order for this process to work, the PCB data must contain D Codes which represent tooling holes on the PCB. After the PCB data is imported, set up the tooling holes in the D Code to Probe Map, just like you set up the D Codes for probed and unprobed pads.

To Map D Codes as Tooling Holes:

1. On the **Action** menu, click **D Code to Probe**.
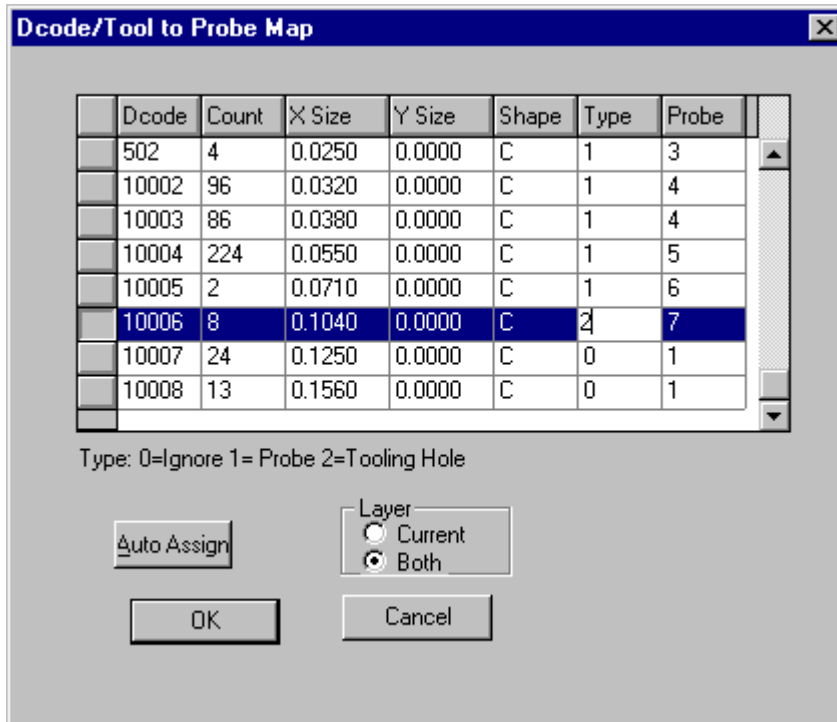
D Code to Probe Map Table

2. For each D Code that represents a tooling hole, enter **2** in the **Type** field.

    This indicates to FixMaster that the D Code is a tooling hole. No test points will be generated for type-2 pads.

3. Type-2 D Codes need to be mapped to a Tooling Hole Probe Code, even though they are not actually probed.

    - If you are **manually** mapping D Codes to Probe Codes, **map the type-2 D Codes to a type-T Probe** which you have set up earlier in the Probe Table. The shaft diameter of the type-T Probe will be used as the tooling hole diameter and will be used as the Tool Code size when drill files are generated.

    - If you use the Auto Assign feature to automatically map type-2 D Codes to Probe Codes, FixMaster looks first for the type-T Probe Code and then the correct pad-size range. The first type-T Probe Code in the list that matches pad minimum and maximum size criteria is mapped to the D Code.

View Tooling Holes

You can highlight and inspect each pad mapped as a tooling hole.

To Highlight all Tooling Holes:

➢   On the **View** Menu, click **HiLite Image-By Tooling Code**.

FixMaster highlights all elements which have D Codes mapped as tooling holes in the D Code to Probe Map.

To Go to Each Tooling Hole:

➢   After the Tolling Holes are highlighted, press **N**.

The cursor hops to the next Tooling Hole.

To Remove the Highlighting from all Tooling Holes:

➢   On the **View** Menu, click **HiLite Image-Remove HiLite**.

FixMaster removes the magenta highlighting.

Chapter 21
Key Commands Summary

In FixMaster, many menu and toolbar commands have shortcut key equivalents, and some commands are only activated by key commands. Shortcut key commands are usually the fastest way to activate commands. In addition all menu commands can be accessed using access key commands, which are an alternative way of working the command menus. See *Access Keys for Menu Commands* on page 8.

This chapter lists the shortcut key commands.

File Commands

Start a New FixMaster Job	Ctrl+N
Open a FixMaster Job	Ctrl+O
Save a FixMaster Job	Ctrl+S

Displaying Data

Display Component Side or Solder Side Data	Shift+O
Display the PCB Data	B
Display All Pads or Only Pads with Test Points	Shift+P
Display Net Numbers	F
Display Only Unassigned Test Points	U
Display Traces	T
Display Silkscreen Data	K
Display Board Outline Data	O
Display the Fixture Drills	L
Show the Drill Count	Shift+F5
Show Job Statistics	F6

Highlighting Data

Highlight a Specific Netlist	Shift+F
Highlight Data by D Code	Ctrl+D
Highlight Tooling Holes	Shift+E
Highlight Data by Probe Code	Shift+B
Highlight Data by Pin Deflection	Shift+5
Remove Highlighting from the Screen	Shift+H

Zooming

Zoom Up or Down	Page Up or Page Down
Zoom so that All Data is Shown on Screen	Home
Zoom on the Reference Frame	W
Zoom to a Specific Zoom Level	Z

Going to Locations on Screen

Move the Cursor	Arrow Keys
Go To Specific X, Y Coordinates	X or Y
Select a Pad or Test Point	S
Go to the Last Selected Test Point	Ctrl+H
Move between a Test Point and its Grid Point	E
Go to the Next Highlighted Element	N

Screen Grid

Turn the Screen Grid On or Off	G
Anchored or Dragged Grid	Shift+G
Fixed or Variable Grid	Ctrl+G

Measuring Distance

Measure Distance with Distance Measure Mode	D
Measure Distance with the Relative Origin	R

Reference Frame

Draw a New Reference Frame	Shift+W

Edit Drills

Insert Drill	Shift+L

Position PCB

Center PCB	Ctrl+B

Map D Codes to Probe

Map D Codes to Probe	F5

Insert Test Points

Insert Single Test Point	Shift+I

Stagger Test Points

Stagger All Test Points Automatically	Ctrl+Shift+F9
Manually Stagger Individual Test Points	Shift+F9
Swap the Stagger Position of Staggered Points	Ctrl+F9

Assign Test Points to Grid

Assign All Test Points to Tester Grid Points	Ctrl+Shift+J
Assign Test Points with Priority	Ctrl+J
Manually Assign Individual Test Points to Grid	Shift+J

Design Rule Checking

Run a Design Rule Check on the Whole PCB	Ctrl+C

Netlist Inspection Mode

Display the First Net	Shift+F
Display the Next Net	Shift+N
Display the Previous Net	Shift+B
Select a Pad or Test Point	S

Wire Wrap Mode

Wire Wrap Test Points One at a Time	Spacebar
Undo Wire Wrapping for Last Wire Wrapped Test Point	Backspace
Go To the First Wrapped Test Point	F
Go To the Next Wrapped Test Point	N
Go To the Previous Wrapped Test Point	B

Spacers

Insert Spacer   Shift+R

Edit PCB Data

Insert Pad   Ctrl+Shift+P

Transcode Net Numbers   Ctrl+Shift+T

Transcode D Codes   Ctrl+T

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