ProbeMaster
User's Guide

Introduction to ProbeMaster
How to Process a Job in ProbeMaster
ProbeMaster Menus, Toolbars, Key Commands

This manual provides information about ProbeMaster Version 7.5 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.

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Chapter 1
Getting Started with ProbeMaster

About ProbeMaster

ProbeMaster is a graphical editor for generating tester download files for moving probe testers. ProbeMaster allows you to automate most functions for maximum efficiency.

Importing PCB Data

ProbeMaster imports files in several formats:

- Import Lavenir Format 4 netlists and IPC-D-356 netlists.

- Import IPC356A.

- Import supplemental Gerber data such as silkscreen, soldermask, and board outline data for the purpose of determining the accessibility of test points.

- Import FixMaster job files. This feature allows you to split nets out of a netlist in FixMaster, generate a fixture for some of the nets in FixMaster, and set up the dense parts in ProbeMaster for testing on a moving probe tester.

Editing PCB and Test Point Data

Once PCB data has been imported, you can edit a graphic representation of pads and test points. 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:

- 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.

- Inspect and correct head collision errors.

- Check net adjacency.

Exporting Data

ProbeMaster exports files for testing PCBs on moving probe testers. ProbeMaster exports the following file types:

Exporting Tester Download Files

ProbeMaster exports tester download files for the following testers.

- MicroCraft MP-440 and Emma testers

- Probot/Mania

- Hummingbird

- AFT or ATG

- Probotech

ProbeMaster also exports IPC356A, which contains test information used by some testers and repair stations.

Exporting Computer Aided Repair Files

ProbeMaster also exports CAR files for use in fault verification on some repair stations.

Saving ProbeMaster Job Files

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

.JOB files can be used as boilerplate 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 ProbeMaster 7.5 for Windows

Lavenir has added some new features to ProbeMaster 7.5 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. Exports fiducial locations and coded step and repeats.

- **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 ProbeMaster will help us to improve features of the software.

- Please e-mail your comments and suggestions regarding ProbeMaster 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 8 AM and 5 PM Pacific Time.

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

Download ProbeMaster Updates

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

To Download ProbeMaster 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 **PROBEMASTER SETUP.EXE** update file to your system.

7. Double-click on the downloaded **PROBEMASTER 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 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 Process a Job Using ProbeMaster

This chapter includes a general outline for beginning-to-end job processing in ProbeMaster. It also lists some commonly used features that do not belong in the step-by-step outline and some special features that are unique to some test methods or testers.

Processing a Job Step-by-Step

This is a general outline for beginning-to-end job processing in ProbeMaster. Very few real-life jobs will follow this outline exactly. Once you have used ProbeMaster for a while, most jobs will skip the configuration setups and begin with opening a boilerplate .JOB file, then importing the PCB data. Use this outline as a guide to the steps in a typical job and as a way to find more detailed information.

To Process a Job Using ProbeMaster:

1. If you have previously saved tester and operation configurations, **open the boilerplate job**. See *Opening a ProbeMaster Job File* on page 139.

2. Set the **tester configuration settings**. See *Setting up the Tester Configuration* on page 47.

3. **Import the PCB data**. See *Importing PCB Files into the Job* on page 145.

4. **Position the PCB** data. See *Positioning the PCB* on page 51.

5. Identify the **power and ground nets**. See *Identifying Power and Ground Plane Nets* on page 63.

6. **Map the D Codes to Probe Codes**. See *Mapping D Codes to Probe Codes* on page 65.

7. **Generate test points**. See *Adding Test Points* on page 71.

8. Inspect possibly probeable, **possibly covered points** not given test points. See *Possibly Probeable, Possibly Covered Test Points* on page 80.

9. **Stagger test points**. See *Staggering Test Points* on page 93.

10. Inspect and correct **collision errors**. See *Checking for Collision Errors* on page 105.

11. Inspect nets one at a time and edit test points in **Netlist Inspection mode**. See *Netlist Inspection Mode* on page 109.

12. Generate **adjacency data** and **inspect adjacent nets**. See *Net Adjacency* on page 123.

13. Tag and inspect **fiducials**. See *Fiducial Points* on page 129.

14. **Export the Files**. See *Exporting Tester Download Files* on page 152 and the other export procedure in *File Handling in ProbeMaster* on page 137.

Additional Features Used in Most Jobs

In addition to those steps in the outline that are typically performed in a step-by-step order, this manual covers additional features that are often used but don't have a particular place in the outline:

- **Viewing Data**. See *Viewing Data in ProbeMaster* on page 15.

- **Editing PCB data**. See *Editing PCB Data* on page 163.

- **Printing**. See *Printing in ProbeMaster* on page 175.

- **Automation**. See *Automatic Job Processing Features* on page 179.

Special Features Unique to Some Test Methods

This manual also covers some special features that are unique to certain types of testers or test methods and are not included in the general outline:

- **Renumber Nets**. See *Renumbering Nets with Unique Net Numbers* on page 183

- **Soft Landing**. See *Soft Landing for MicroCraft Testers* on page 184.

- The **SMD Both** Command. See *SMD Both Command* on page 185.

- **Mark nets for separate export** with the **Selective Netlist** command. See *Marking Nets for Separate Export* on page 186.

Chapter 3
ProbeMaster Interface Overview

ProbeMaster has a point-and-click Windows interface with most functions available on command menus and command toolbars. Many 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
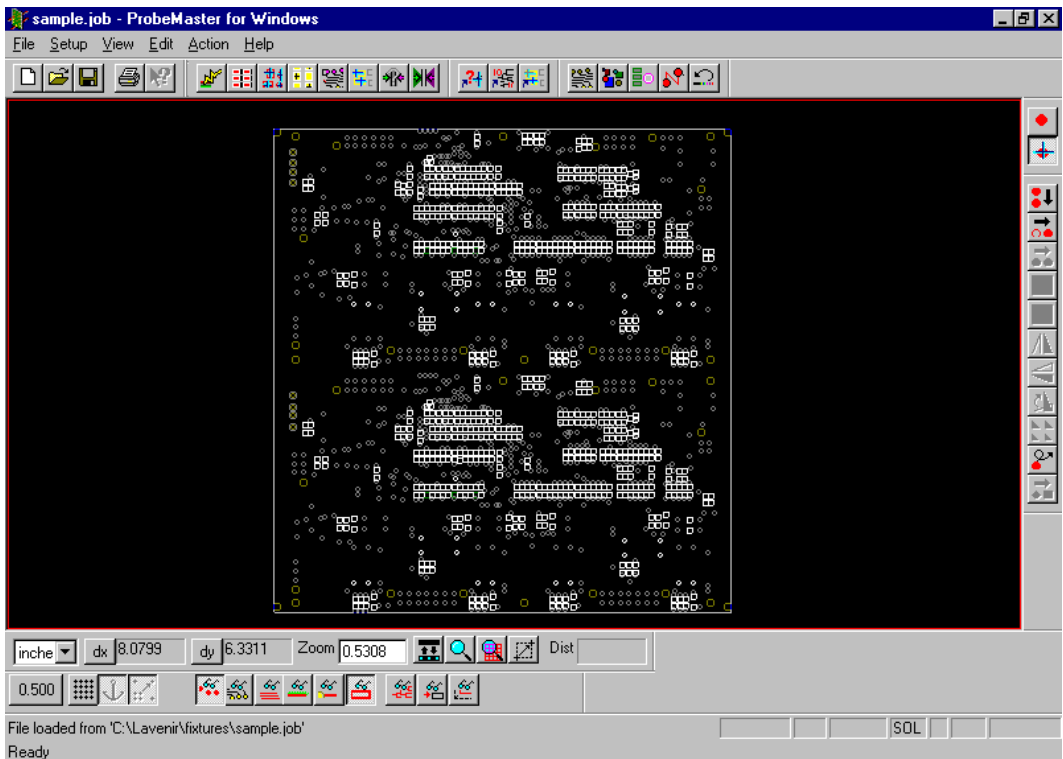
ProbeMaster Application Window

The ProbeMaster 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 ProbeMaster 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 **PCB Data-Transcode-D Code**.

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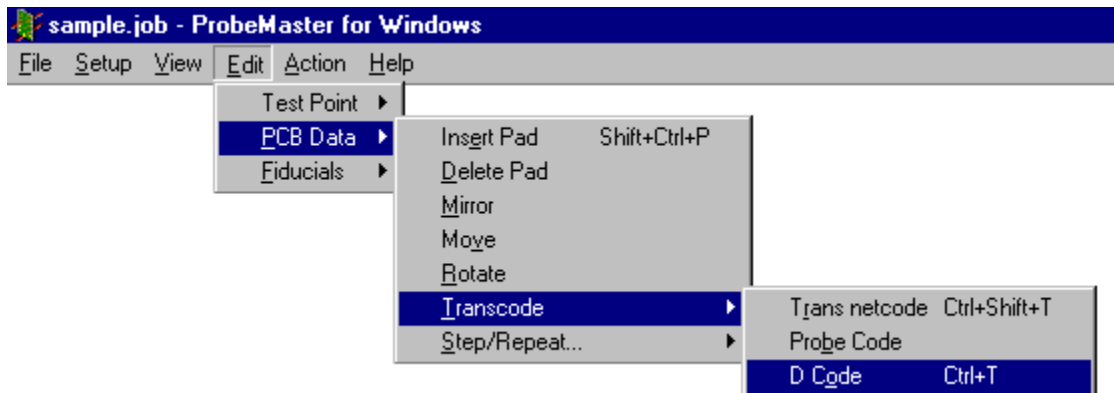
Command Menu Example

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 **P**.

   The **PCB Data** cascade menu drops down.

3. Press **T**.

   The **Transcode** cascade menu drops down.

4. Press **O**.

   The **D Code** 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 **Ctrl**+**T**. There are also shortcut keys for commands that are not on the menus. For more about shortcut key commands see *Key Commands* on page 14. For a listing of all shortcut key commands in ProbeMaster, see *Key Commands Summary* on page 189.

Command Toolbars

Many commands in ProbeMaster 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
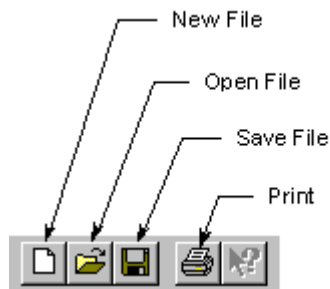
Main Toolbar

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.

Action Toolbar

The **Action** toolbar has the high-level commands for automatic features, configuration dialogs and entering **Netlist Inspection** and **Adjacency Inspection** modes.
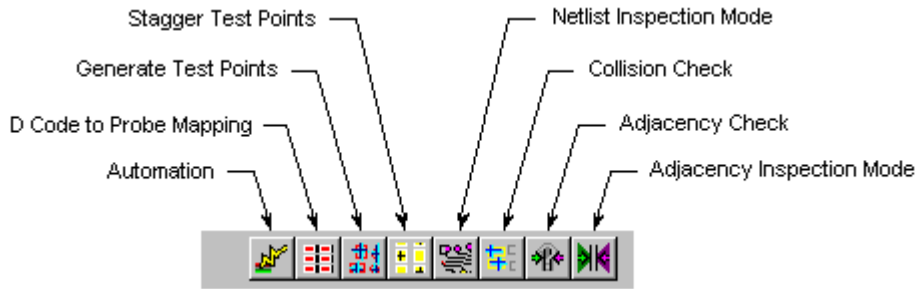
Action Toolbar

Editing Toolbar
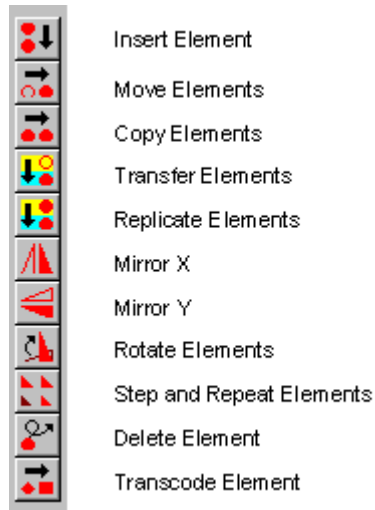
Editing Toolbar

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 or test point) 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
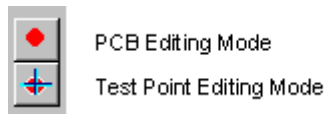
Editing Mode Toolbar

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 PCB data using the **Editing** toolbar, first click the **Pad Editing Mode** ● button on the **Editing Mode** toolbar.

The PCB Data Editing Mode is selected and now the **Editing** toolbar buttons represent commands that affect PCB data only. For instance the **Insert** button on the **Editing** toolbar inserts **pads**.

➤ 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.*

Goto Toolbar
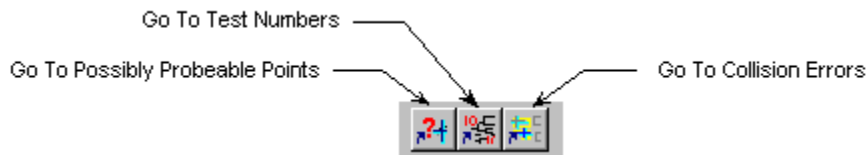
Goto Toolbar

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

HiLite Toolbar
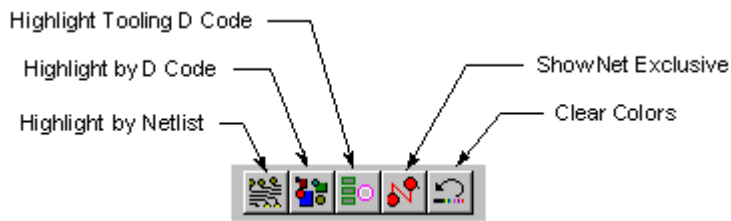
HiLite Toolbar

The **HiLite** toolbar has commands for highlighting specific types of elements.

Screen Toolbar
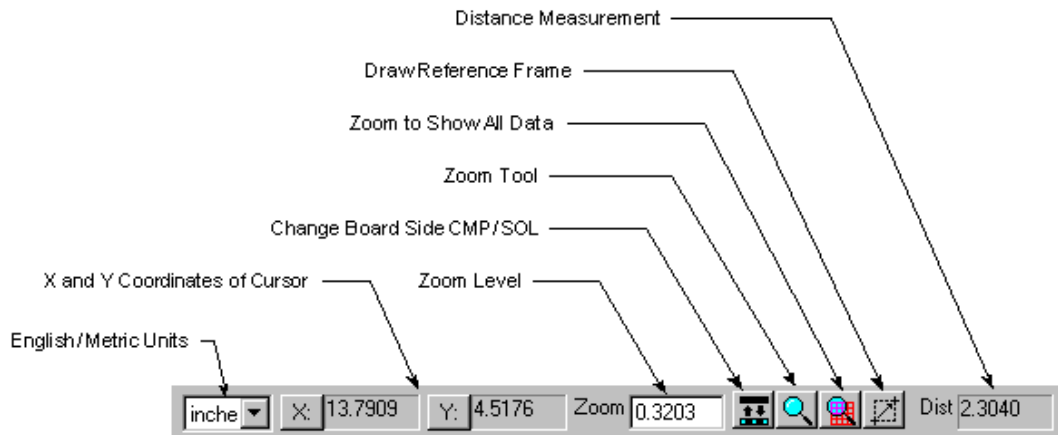
Screen Toolbar

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
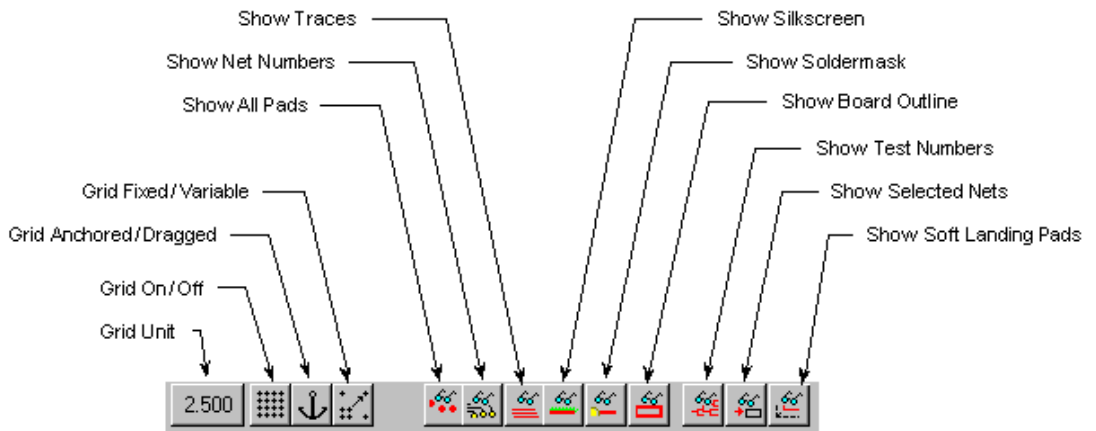
Visibility Toolbar

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

Status Bar
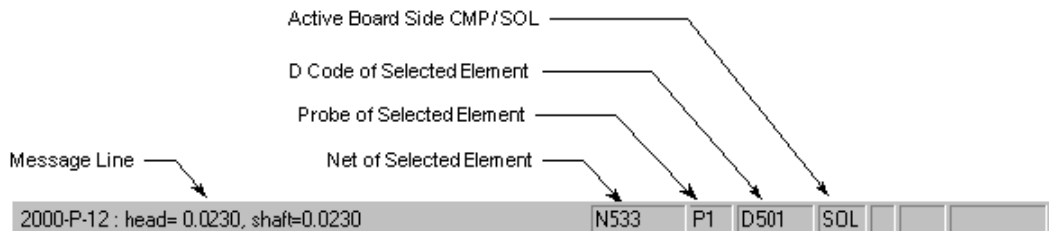
Status Bar

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 ProbeMaster can be accessed through the keyboard using the key commands. For a complete list of all shortcut keys in ProbeMaster, see *Key Commands Summary* on page 189.

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 ProbeMaster

ProbeMaster 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

ProbeMaster 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** has **no 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: *None*

   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 **all pads** are being displayed.

   - If **All** has **no 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*

Displaying "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** has **no 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*

Displaying Only "Accessed" Side for IPC-D-356 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** has **no 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

ProbeMaster 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** has **no 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 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**.
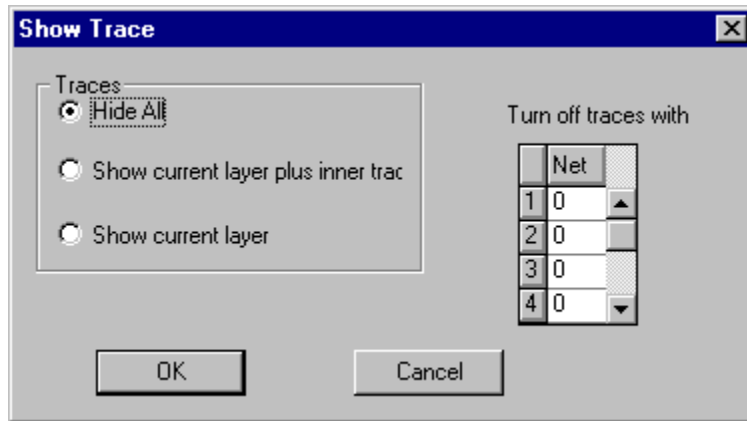
2. In the **Traces** group box, select an option for which traces to display, if any:

   - **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 that displays traces.

4. Click **OK**.

   Menu: *View-Data Elements-Trace*

   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.

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 *Importing Supplemental Gerber Files into the Job* on page 150.

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** has **no 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 *Importing Supplemental Gerber Files into the Job* on page 150.

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** has **no 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 *Importing Supplemental Gerber Files into the Job* on page 150.

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** has **no 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*

Displaying Test Point Numbers

Each test point is assigned a unique test point number when the test files are exported. Most moving probe testers report faults between test point numbers (i.e., a short between test points 14 and 25). ProbeMaster can display the test point number of each pad next to each pad. ProbeMaster also has a command that allows you to go to a specific test point number. See *Going to a Test Point Number* on page 35.

To Display Test Point Numbers:

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

   - If **Test Number** has a **checkmark** next to it, then the test point numbers are **being displayed**.

   - If **Test Number** has **no checkmark** next to it, then the test point numbers are **not being displayed**.

2. Click **Test Number** to switch between displaying or not displaying the test point numbers.

   Note: *If all the test point numbers appear to be zero, it is because the test files have not been exported yet. The test point numbers are generated when the data is exported.*

   Menu: *View-Data Elements-Test Number*

   Button:

   Key: *None*

Displaying Fiducials

ProbeMaster has a command for displaying fiducials. For information on tagging fiducial locations, see *Fiducial Points* on page 129.

To Display Fiducials:

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

   ProbeMaster displays the same **Fiducials** table that is displayed when you set up fiducials; however, on this dialog you do not have the option to tag the fiducials manually.
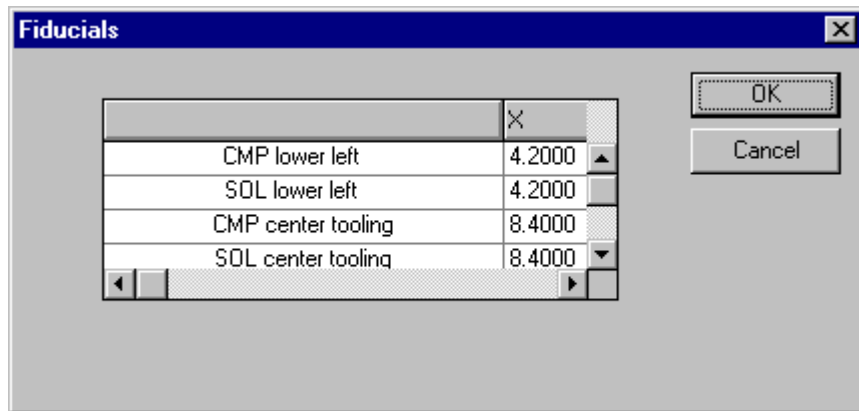
Fiducials Dialog

2. If the fiducial locations are correct, click **OK**. If they are not correct, enter the new locations and click **OK**.

   Each fiducial is displayed as a large magenta X.

   Menu: View-Data Elements-Fiducials

   Button: None

   Key: None

Highlighting Data on Screen

ProbeMaster 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, ProbeMaster also has a command for inspecting each highlighted element in sequence. See *Going to the Next Highlighted Element* on page 34.

Showing Everything in Gray Except for the Highlighted Elements

ProbeMaster 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**.

   ProbeMaster prompts for a net number.
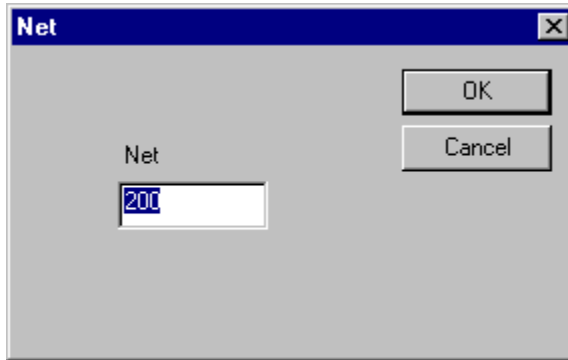
Highlight Net

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

   ProbeMaster displays the net highlighted in magenta.

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

   Button:

   Key: *Shift+F*

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.

    ProbeMaster 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**.

    ProbeMaster prompts for a D Code number.
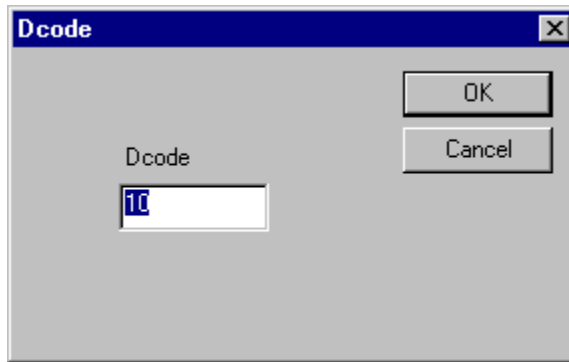
Highlight D Code

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

    ProbeMaster 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

ProbeMaster has a command to highlight PCB data that has a D Code designated as representing tooling holes in ProbeMaster. Tooling hole D Codes are not generally used in ProbeMaster, only in FixMaster. Tooling hole D Codes are used in FixMaster to indicate D Codes in the PCB that are to be transferred to the fixture and included in the drill output files. For more information on setting up D Code types, including tooling holes, see *Mapping D Codes to Probe Codes* on page 65.

To Highlight Tooling Holes:

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

ProbeMaster 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*

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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**.

   ProbeMaster prompts for a Probe Code number.
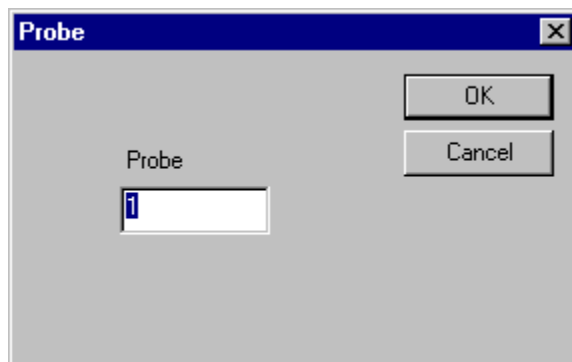
Highlight Probe Code

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

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

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

   Button: *None*

   Key: *Shift+B*

Highlighting Nets Marked with the Selective Nets Command

You can highlight all the nets that have been marked with the **Selective Nets** command. The **Selective Nets** command allows you to mark special nets and export test files for those nets separate from the rest of the loaded PCB data. For instance you could use **Selective Nets** to mark and test a ground plane. For more information on marking nets with the **Selective Nets** command, see *Marking Nets for Separate Export* on page 186. For information on exporting test files for the nets marked with the **Selective Nets** command, see *Exporting Tester Download Files* on page 152.

To Highlight Marked Nets:

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

   - If **Selective** has a **checkmark** next to it, then nets marked with the **Selective Nets** command are shown **highlighted** in magenta.

   - If **Selective** has **no checkmark** next to it, then nets marked with the **Selective Nets** command are **not highlighted** and are shown in their normal color.

2. Click **Selective** to switch between showing selective nets highlighted and not highlighted.

   Menu: *View-Data Elements-Selective*

   Button:

   Key: *None*

Highlighting Soft Landing Pads

You can highlight all pads that have been designated as soft landing pads. For more information on Soft Landing pads, see *Soft Landing for MicroCraft Testers* on page 184.

To Highlight Soft Landing Pads:

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

   - If **Soft Landing** has a **checkmark** next to it, then pads that have been designated as soft landing pads are shown **highlighted** in magenta.

   - If **Soft Landing** has **no checkmark** next to it, then soft landing pads are **not highlighted** and are shown in their normal color.

2. Click **Soft Landing** to switch between showing soft landing pads highlighted and not highlighted.

   Menu: *View-Data Elements-Soft Landing*

   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**.

ProbeMaster 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

ProbeMaster 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**.

ProbeMaster 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**.

ProbeMaster 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**.

ProbeMaster zooms on the Reference Frame.

Menu: *View-Zoom-Zoom on Frame*

Button: *None*

Key: *W*

Automatic Zoom-on-Frame Feature

You can set ProbeMaster to automatically zoom on the Reference Frame whenever a new Frame is drawn. Or you can turn the feature off so that ProbeMaster 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 ProbeMaster **will automatically zoom** on the Reference Frame whenever a new Frame is drawn.

   • If **Zoom On** has **no checkmark** next to it, then ProbeMaster **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*

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**.

    ProbeMaster prompts for a zoom level.
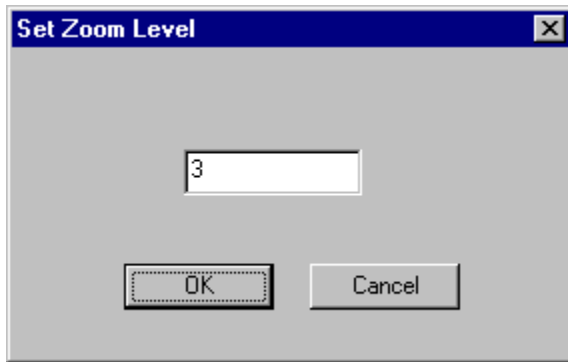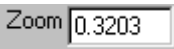
Set Zoom Level

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

    ProbeMaster 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*

Going to Specific Locations on Screen

ProbeMaster 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**.

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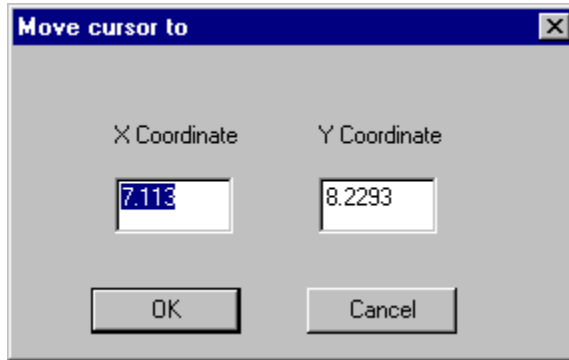
Move Cursor To dialog

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

   ProbeMaster 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: *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. 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, ProbeMaster 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*

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 22.

To Go to the Next Highlighted Element:

1. Highlight the elements.
2. Press the **N** key.

Menu: *None*

Button: *None*

Key: *N*

Going to a Test Point Number

Each test point is assigned a unique test point number when the test files are exported. Most moving probe testers report faults between test point numbers (i.e., a short between test points 14 and 25). You can go a specific test point number. ProbeMaster also has a command that allows you to display the test point number of each pad next to each pad. See *Displaying Test Point Numbers* on page 20.

To Go to a Test Number:

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

    ProbeMaster prompts for a test point number.
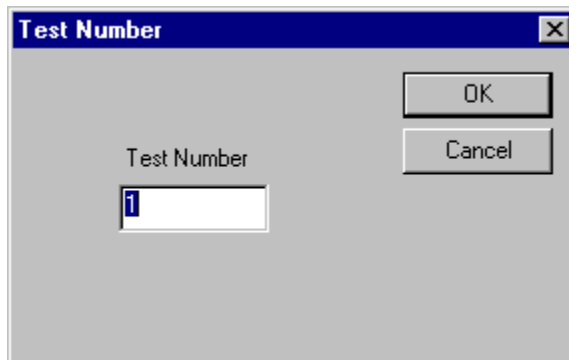
Go to Test Number Dialog

2. On the **Test Number** dialog, enter a test point number and click **OK**.

    ProbeMaster moves the cursor to the test point number.

    Note: *If all the test point numbers appear to be zero, it is because the test files have not been exported yet. The test point numbers are generated when the data is exported.*

Menu: *View-Go To-Test Number*

Button:

Key: *None*

Going to Collision Errors

You can go to each collision error. For more about collision errors, see *Checking for Collision Errors* on page 105.

To Go to Collision Errors:

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

   The **Go To Collision Error** tool is selected.

2. Click the mouse in the viewing area.

   The cursor hops to the next sequential collision error. The **Go To Collision Error** tool remains selected until you select another tool or press the **Escape** key, so you can go to one collision error after another by clicking the mouse.

   Menu: *View-Go To-Collide*

   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 80.

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 pad not given a test point. The **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 pad 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** has **no 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*
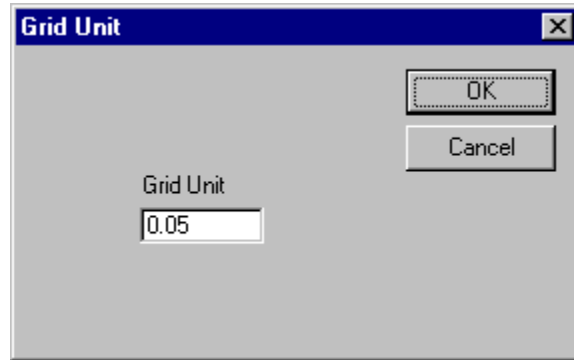   *Key:*   *Ctrl+G*

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**.

    ProbeMaster prompts you to set the grid unit.

Grid Unit Dialog

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

    ProbeMaster displays the grid based on the new grid unit.

    Menu: *View-Screen Grid-Units.*

    Button: 2.500

    Key: *None*

Displaying Statistical Information

ProbeMaster has two commands for displaying statistical information. One shows data strictly related to the imported PCB data: the pad and trace counts for each net in the currently loaded PCB data. And the other shows job statistics related to the processing of the job: the size of the PCB; the counts of surface mounts, through holes and traces; the number of errors, number of probeable and unprobeable nets; net adjacency information; and other information.
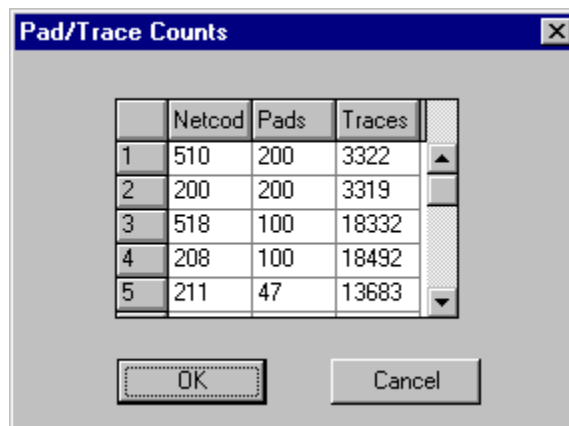
Showing the Pad and Trace Counts for each Net

ProbeMaster can display a dialog that shows the pad and trace counts for each net in the currently loaded PCB data.

Note: *This information can be useful for finding the power and ground plane nets that are required for the setting up the Plane Nets table. See **Identifying Power and Ground Plane Nets** on page 63.*

To Show the Pad and Trace Counts for each Net:

➢ On the **View** menu, click **Data Elements-Net/Pad/Trace Counts**.

Pad/Trace Counts

	Netcod	Pads	Traces	
1	510	200	3322	
2	200	200	3319	
3	518	100	18332	
4	208	100	18492	
5	211	47	13683	

OK   Cancel

Pad and Trace Counts per Net

Menu: *View-Data Elements-Net/Pad/Trace Counts*
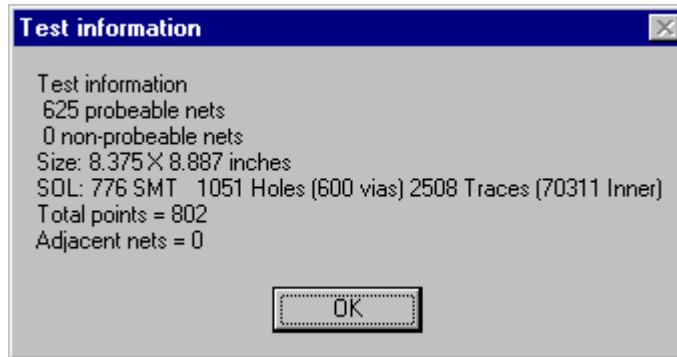*Button:* *None*
Key: *None*

Showing the Job Statistics

ProbeMaster 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

ProbeMaster 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.
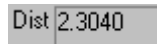
Using Distance Measurement Mode

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.

   ProbeMaster 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.

   Dist 2.3040

   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. ProbeMaster 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.

    ProbeMaster 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.

    X: 13.7909   Y: 4.5176

    Absolute Origin Mode

    dx 0.1344   dy -0.5877

    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. ProbeMaster remains in **Relative Origin** mode until you press **R** again.

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

Metric or English Units

ProbeMaster 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**.

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

2. Click **Yes**.

    ProbeMaster converts the database to the new units.

    Menu: *None*

    Button: inche ▼

    Key: *None*

Using the Reference Frame

ProbeMaster features a Reference Frame, which is used by many commands to select elements for an operation. You can automatically insert a Reference Frame around all data, or you can draw a new frame at a new location or a new size using a mouse-operated **Frame-drawing** tool. You can also set ProbeMaster to automatically zoom on the Reference Frame whenever a new Frame is drawn. Or you can turn the feature off so that ProbeMaster does not automatically zoom on a new Reference Frame. For more information on the automatic Zoom-on-Frame feature, see *Automatic Zoom-on-Frame Feature* on page 30.

Inserting a Reference Frame around All Data

You can automatically insert a Reference Frame around all data.

To Insert a Reference Frame around All Data:

➢ Press Ctrl+W.

ProbeMaster inserts a Reference Frame around all data.

Menu: *None*

Button: *None*

Key: *Ctrl+W*

Drawing a New Reference Frame

You can draw a new frame at a new location or a new size 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
Setting up the Tester Configuration

Before processing the job, set up the tester configuration.

Using Boilerplate Jobs

All tester configuration and operation 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 settings.

Selecting the Tester Type

The tester you will be using affects the operation of several ProbeMaster functions, such as tagging fiducials. It also affects the format of tester download files. So before anything else, you should select the type of tester you will be using.

To Select the Tester Type:

1. On the **Setup** menu, click **Tester**.
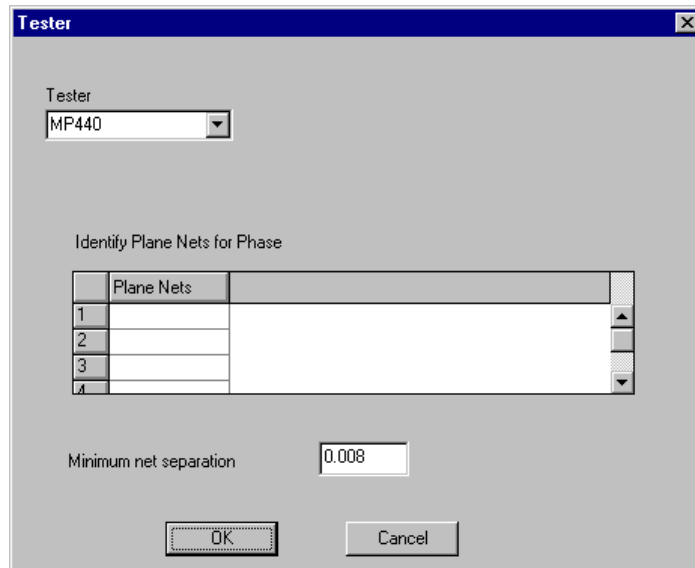
Tester Dialog

2. On the **Tester** dialog, select the tester you are using from the **Tester** drop down list.

The other settings on the **Tester** dialog are not specifically related to setting up the tester, although what is displayed in those settings does depend on the tester selected.

- **Identify Plane Nets for Phase:** In this table you identify the plane nets in the given job, and that information is used when doing capacitance testing (phase difference or impedance). How this table is displayed depends on the tester selected; however the information is entered on a job-by-job basis and is not part of the tester setup. For information on setting up this table, see *Identifying Power and Ground Plane Nets* on page 63.

- **Minimum Net Separation:** ProbeMaster uses this entry when generating the adjacency data. For information on generating adjacency data and setting up this field, see *Net Adjacency* on page 123.

3. Click **OK**.

Menu: *Setup-Tester*

Button: *None*

Key: *None*

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.

Head diameters, air gaps, and stagger margins are used when running collision checks and staggering test points.

Note: *The issues involved when setting these parameters in ProbeMaster are simpler than in FixMaster where many types of probes may be used. Generally, moving probe testers will only have one kind of probe in use at a time; however, you may still need to define the parameters a little differently for probing different types of pads. For instance, you may want different stagger margins for different types of pads. In that case, you can set up two Probe Codes for identical probes with different stagger margins and map them to different D Codes. This is the reason for more than one probe in the probe table.*

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 testing and one for solder-side testing. If you are setting up probes for both sides, set up one set for the currently active side, then come back and set up the other side. Generally the two sides are set up with the same probe parameters.

2. On the **Setup** menu, click **Probe Table**.

Probe Setup Table

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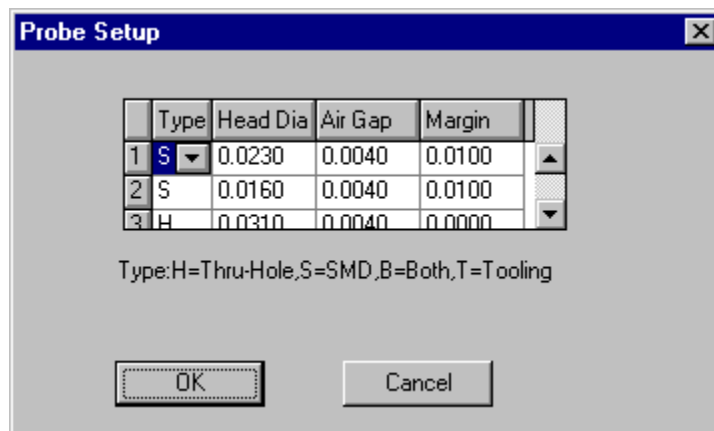
3. In the **Type** column of the **Probe Setup** dialog, set the **Probe Types**.

You need to tell ProbeMaster what type of pads can be probed with each Probe Code. If you want to set up the parameters a little differently for through holes than for surface mounts, this setting tells ProbeMaster which Probe Code is appropriate for each use. In the **Probe Setup** dialog, enter the type of each probe in the **Type** field. Later, 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. For information on mapping D Codes to Probes, see *Mapping D Codes to Probe Codes* on page 65.

- 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**.

- Type **T** is for **Tooling Holes**, and it is not generally used in ProbeMaster, only in FixMaster. A type T probe isn't actually a probe. Type T probes are used in FixMaster to indicate the diameter of tooling holes in the drill output files.

4. In the **Head Dia** column, enter the head diameter of each probe.

The Head Diameter of the probe is used for collision checking. For information on collision errors, see *Checking for Collision Errors* on page 105.

5. In the **Air Gap** column, enter an air gap for each probe.

The Head Diameter of each probe is swelled by its Air Gap when checking for collisions. For information on collision errors, see *Checking for Collision Errors* on page 105.

6. In the **Margin** column, enter a stagger margin for each probe.

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 *Staggering Test Points* on page 93.

Note: *Setting up different stagger margins for different types of pads is one of the main reasons for setting up different types of probes in ProbeMaster.*

7. Click **OK**.

Menu: *Setup-Probe Table*

Button: *None*

Key: *None*

Chapter 6
Positioning the PCB

After you import the PCB data, you must position the PCB data within the test area. ProbeMaster has several commands for mirroring, moving, rotating and stepping and repeating the PCB data.

Mirroring the PCB

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

Note: *Be sure that you leave the data oriented properly when you use the **Mirror** command. The data need to be oriented in the same way that the board will be loaded into the tester.*

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**.
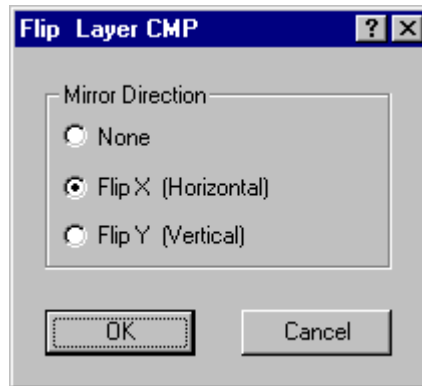
4.   Select the direction to flip the data.

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.

To Move the PCB:

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

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

   ProbeMaster prompts for a reference location.

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

4. **Click** the mouse or press **Enter**.

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

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

6. **Click** the mouse or press **Enter**.

   ProbeMaster 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

ProbeMaster transcodes the asymmetrical pads to existing D Codes of the correct size or to new D Codes defined to match the rotated pads.

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 mouse or press **Enter**.

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

   - Select to **Rotate Around Cursor**.

   - Click **OK**.
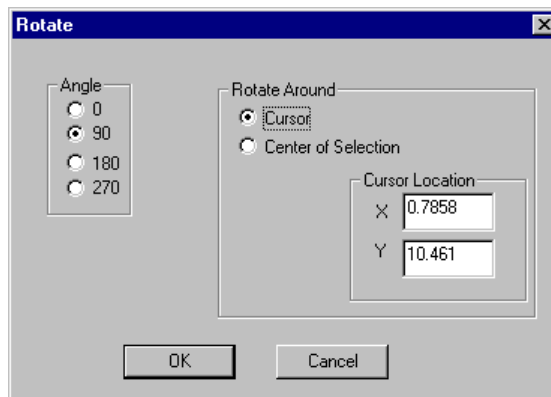
Rotate Around Cursor

If you want to rotate the PCB data around the center of the selection:

- **Click** the mouse or press **Enter**.
- On the **Rotate** dialog, enter the **Angle** of rotation.
- Select to **Rotate Around Center of Selection**.
- Click **OK**.
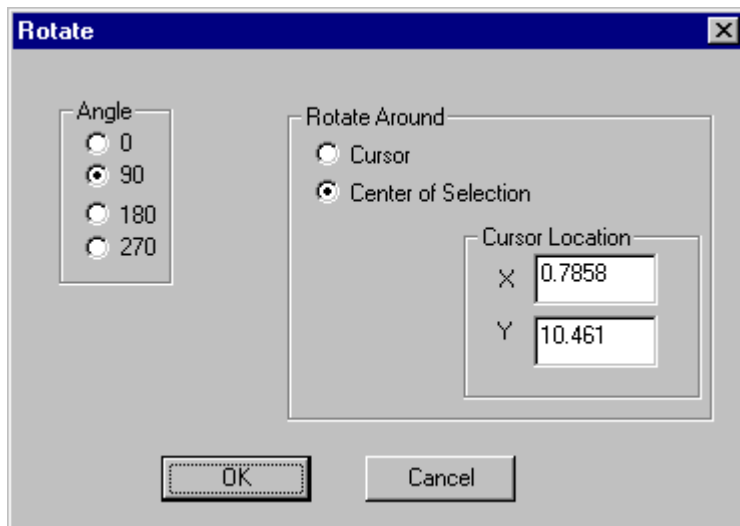
Rotate Around Center

ProbeMaster rotates the data within the Frame around the designated pivot point. ProbeMaster 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*

Stepping and Repeating the PCB

The **Step/Repeat** commands step and repeat PCB data for both board sides. Some types of testers support coded step and repeat, which makes use of codes in the data file that tell the tester to create and position copies of the image. Other testers do not support coded step and repeat, and instead you must use the non-coded step and repeat in which ProbeMaster makes copies of the data and positions each copy as you specify.

Non-Coded Step and Repeat

In a non-coded step and repeat, the ProbeMaster copies the PCB data and each copy is placed in an offset location. This method does not make use of step and repeat codes, so it is supported by all formats of testers. This method makes a larger data file than the coded step and repeat because each image of the data is a copy of the original.

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.

To Perform a Non-Coded Step and Repeat of 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-Non Coded**.

Step and Repeat Dialog

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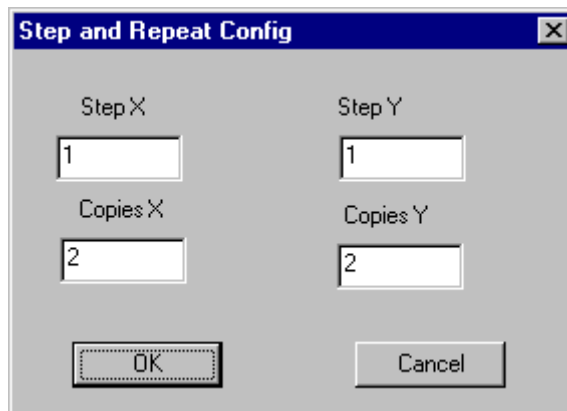
3. On the **Step and Repeat** dialog, enter the following:

- **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**.

ProbeMaster 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-Non Coded

Button: *then*

Key: None

Coded Step and Repeat

In coded step and repeat ProbeMaster adds codes to the data file that tell the tester to create and position copies of the image. ProbeMaster does not display the entire stepped and repeated array, only the original image. This method makes a smaller data file than the non-coded step and repeat because instead of creating a full copy of all the original data for each image in the step and repeat pattern, ProbeMaster inserts an instruction code telling the tester to generate the images. Because different testers use different types of step and repeat codes, not all tester types have a supported coded step and repeat function in ProbeMaster. Also, depending on the tester, there are different dialogs for setting up the coded step and repeat. If your tester does not have a supported coded step and repeat function in ProbeMaster, then you will have to do a non-coded step and repeat. See *Non-Coded Step and Repeat* on page 55.

MP-440 Format 1 Coded Step and Repeat

Format 1 coded step and repeat for the MP-440 tester is a simple, non-nested coded step and repeat. You set it up the same way you would set up the normal non-coded step and repeat.

To Perform a Format 1 Coded Step and Repeat for MP-440:

1. On the **Edit** menu, click **PCB Data-Step/Repeat-Coded-Format 1**.
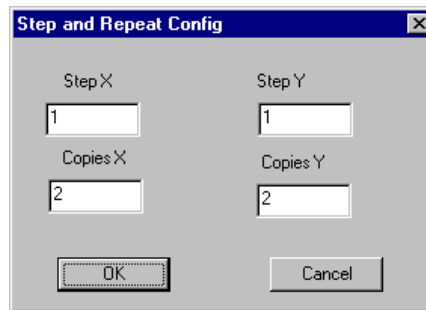
Coded Step and Repeat for MP440 Format 1

2. 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.

3. Click **OK**.

    ProbeMaster generates the step and repeat codes that will tell the tester how to generate and position the stepped and repeated images.

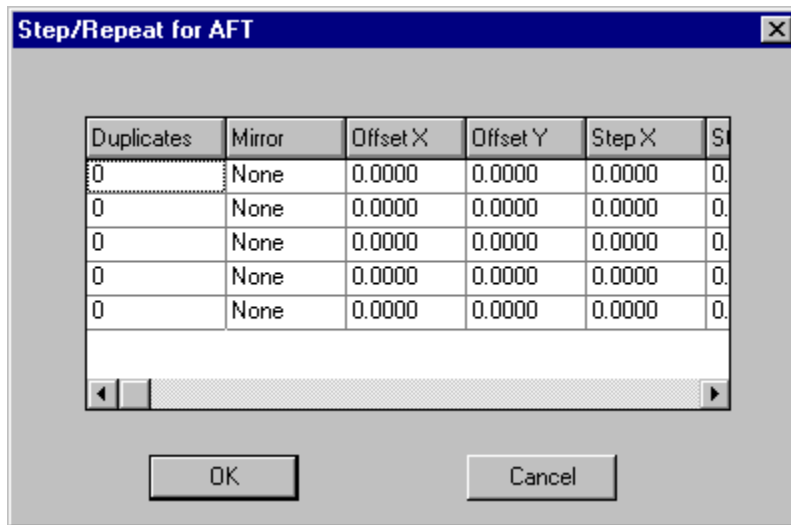   *Menu:* *Edit-PCB Data-Step/Repeat-Coded-Format 1*
    Button: *None*
    Key: *None*

MP-440 Format 2 Coded Step and Repeat

Format 2 coded step and repeat for the MP-440 tester is no longer used by MicroCraft.
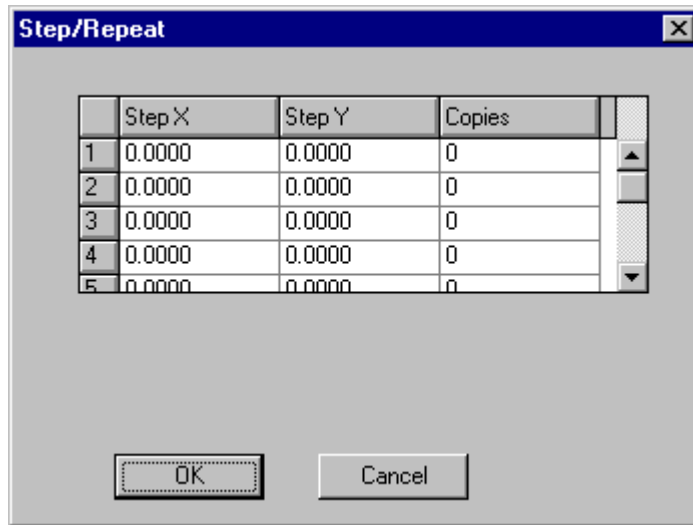
Coded Step and Repeat for MP440 Format 2

MP-440 Format 3 Coded Step and Repeat

Format 3 coded step and repeat for the MP-440 tester is exported using the same data format as the IPC format described in *MP-440 Format 4 Coded Step and Repeat* on page 61; however format 3 has a setup dialog that is easier to set up than format 4. The format 3 setup dialog uses a nested step and repeat technique in which each new line in the dialog applies to the whole image generated in the previous line.

To Perform a Format 3 Coded Step and Repeat for MP-440:

1. On the **Edit** menu, click **PCB Data-Step/Repeat-Coded-Format 3**.
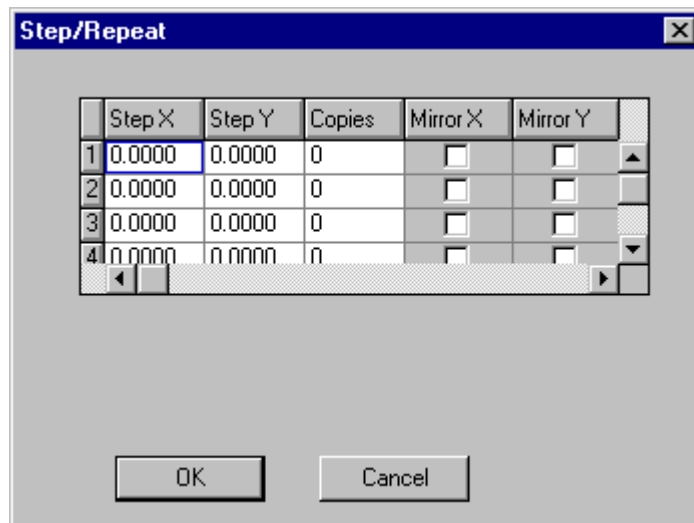
Coded Step and Repeat for MP440 Format 3

The format 3 setup dialog uses a nested step and repeat technique in which each new line in the dialog applies to the whole image generated in the previous line.

2. In the first line enter the following:

- **Step X or Step Y:** This is the distance from the lower left corner of one image to the lower left corner of the next image. Enter the distance to step the image in either the X or the Y directions. Don't enter a value for both X and Y. Instead step the image in one direction in one line of the table, and then step the resulting image in the other direction in the next line.

- **Copies:** Enter the number of copies you want stepped for this line.

- **Mirror X Mirror Y:** If you want the images mirrored, enter a checkmark.

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3. If you now want to step the image created by the first line, enter the **Step X/Y**, **Copies** and **Mirror X/Y** values in line 2, and so on. For instance, if you wanted a 4 by 6 array, you could enter 4 copies in line 1 and 6 copies in line 2.

4. When you have entered all the lines you need in the table, click **OK**.

    ProbeMaster generates the step and repeat codes that will tell the tester how to generate and position the stepped and repeated images.

    Menu: *Edit-PCB Data-Step/Repeat-Coded-Format 3*

    Button: *None*

    Key: *None*

MP-440 Format 4 Coded Step and Repeat

Format 4 coded step and repeat for the MP-440 tester is a IPC specified format. Each line in the format 4 setup table specifies the position and orientation of one image of the original. For instance, a six-up image is formed by the original image and five entries in the table. This format allows the greatest control because each image is individually positioned, but it can take a long time to set up the table if there are very many images in the step and repeat pattern. The format 3 coded step and repeat described in *MP-440 Format 3 Coded Step and Repeat* on page 59 is exported using the same IPC format used in format 4, but the format 3 dialog is easier to set up.

To Perform a Format 4 Coded Step and Repeat for MP-440:

1. On the **Edit** menu, click **PCB Data-Step/Repeat-Coded-Format 4**.
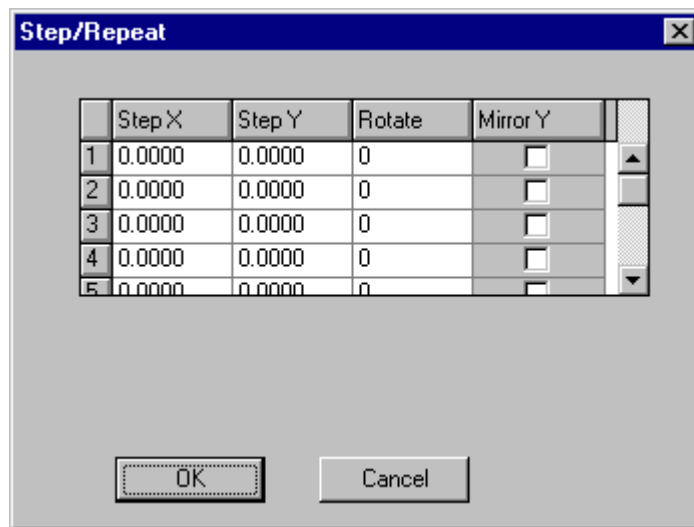
Coded Step and Repeat for MP440 Format 4

2. In the first line enter the following values to specify the position and location of the first copy of the image:

   - **Step X and Step Y:** Enter the position of the lower left corner of the image relative to the origin.

   - **Rotate:** Enter the number of degrees, if any, to rotate this copy of the image.

   - **Mirror Y:** If you want the images mirrored, enter a checkmark.

3. In the second line enter the **Step X/Y**, **Rotate** and **Mirror Y** values to specify the position and location of the next copy of the image and so on until all the images have been specified.

4. If there are not enough lines in the table to specify all the images, press the **Insert** key to insert more lines.

5. When you have entered all the lines you need in the table, click **OK**.

ProbeMaster generates the step and repeat codes that will tell the tester how to generate and position the stepped and repeated images.

Menu: *Edit-PCB Data-Step/Repeat-Coded-Format 4*

Button: *None*

Key: *None*

AFT Coded Step and Repeat

Duplicates	Mirror	Offset X	Offset Y	Step X	S
0	None	0.0000	0.0000	0.0000	0.
0	None	0.0000	0.0000	0.0000	0.
0	None	0.0000	0.0000	0.0000	0.
0	None	0.0000	0.0000	0.0000	0.
0	None	0.0000	0.0000	0.0000	0.

Step/Repeat for AFT

OK   Cancel

Coded Step and Repeat for AFT

Chapter 7
Identifying Power and Ground Plane Nets

Testers that do capacitance testing (phase difference or impedance) need power and ground plane nets to be identified in the tester download files. Each net to be tested needs to be identified with a corresponding plane net that is above the net to be tested or below it in the PCB design. Because the net to be tested and the plane net are above or below each other and separated by a layer of substrate, their capacitance can be tested using an impedance or phase difference method. And if the capacitance is within certain tolerances, the net being tested is considered to be continuous and isolated. This method is a lot faster than testing every point of a net.

Lavenir Format 2 and Format 4 netlists (.F02 and .F04) that are extracted by the Lavenir CAMMaster and ViewMaster PRO netlist extraction routines contain data that identify the power and ground nets, and ProbeMaster uses this data to fill in the plane net table automatically. If you want to verify, add to, or delete from the list of power and ground nets, or if you need to identify power and ground nets for netlists that were not extracted using the Lavenir netlist extraction routines, ProbeMaster allows you to edit the plane net table manually.

Note: *If you need to set up the power and ground planes manually, knowing the pad and trace counts for each net can help you determine which nets are planes. See **Showing the Pad and Trace Counts for each Net** on page 41.*

To Identify Power and Ground Nets Manually:

1. On the **Setup** menu, click **Tester**.

2. On the **Tester** dialog, go to the **Identify Plane Nets for Phase** table. The numbers on the far left of the table refer to the net numbers of nets to be tested, and the column to the right of that contains the net numbers for the power and ground plane nets that correspond to each net to be tested. The **Identify Plane Nets for Phase** table changes depending on the type of tester selected in the **Tester** drop down list, and for some testers there is an additional column for the layer of the plane net. Images of the **Identify Plane Nets for Phase** table for each type of tester follow.

3. For each net number on the left enter a corresponding plane net (or nets, separated by commas) in the Plane Nets column. If called for, you may also enter the layer of the plane net.

4. If there are not enough net numbers in the table, press the **Insert** key to add more nets to the table.
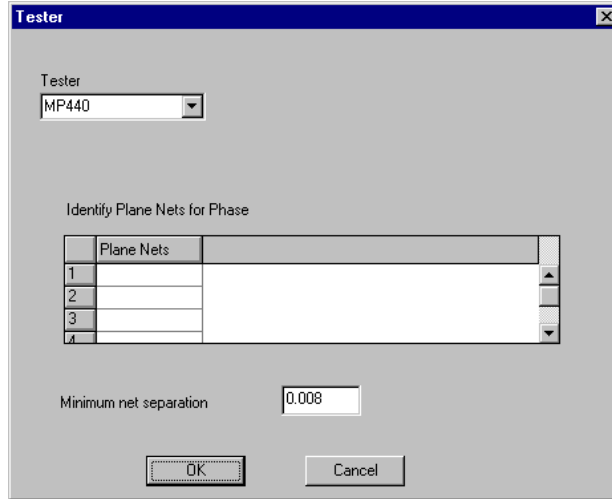
Plane Nets Table for the MP440
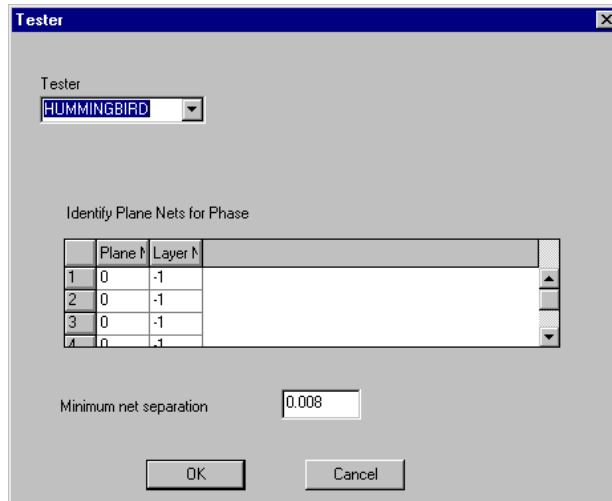
*The Plane Nets Table for Probot, Hummingbird, AFT and Probotech
are all the same and have a Layer Number column*

Menu: *Setup-Tester*
Button: *None*
Key: *None*

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Chapter 8
Mapping D Codes to Probe Codes

Note: *The issues involved when mapping D Codes to Probes in ProbeMaster are simpler than in FixMaster where many types of probes may be used. Generally, moving probe testers will only have one kind of probe in use at a time; however, you may still need to use different Probe Codes for probing different types of pads. For instance, you may want different stagger margins for different types of pads. In that case, you can set up two Probe Codes for identical probes with different stagger margins and map them to different D Codes. Also, the procedure allows you to exclude certain D Codes, such as non-plated through holes from test.*

After the PCB data has been imported, you tell ProbeMaster how to handle each D Code by mapping D Codes to Probe Codes. 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**.

Note: *There is also a setting to designate a D Code as a PCB **tooling hole**, but it is not generally used in ProbeMaster, only in FixMaster. Tooling hole D Codes are used in FixMaster to indicate D Codes in the PCB that are to be transferred to the fixture and included in the drill output files.*

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.

* Pads that are **not** going to be **probed** do not need any further processing.

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

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 ProbeMaster. The procedure that follows describes 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.

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 49. Here you select a Probe for each pad that is appropriate to the D Code **Type**, **Shape** and **Size**. The procedure that follows shows how you can manually map the D Codes to Probe Codes.

Manually Mapping 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 tester configuration procedures by going to the **Setup** menu, and clicking **Probe Table**. 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. See *Setting up the Probes* on page 49.

3. On the **Action** menu, click **D Code to Probe**.

Dcode/Tool to Probe Map

	Dcode	Count	X Size	Y Size	Shape	Type	Probe	
	12	0	0.1180	0.0630	R	1	1	
	13	0	0.0850	0.0420	R	1	1	
	14	0	0.0420	0.0850	R	1	1	
	15	616	0.0600	0.0600	S	1	1	
	16	0	0.0700	0.1250	R	1	1	
	17	0	0.1200	0.1100	R	1	1	
	18	0	0.1180	0.0500	R	1	1	
	19	40	0.0750	0.0800	R	1	1	
	20	40	0.0600	0.1000	R	1	1	

Type: 0=Ignore 1= Probe 2=Tooling Hole

[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.

    Type-1 D Code: Probed pad. Test points will be generated for type-1 pads.

    Type-2 D Code: Tooling hole, not probed. No test points will be generated for type-2 pads. Type-2 pads are not generally used in ProbeMaster, only in FixMaster. Tooling hole D Codes are used in FixMaster to indicate D Codes in the PCB that are to be transferred to the fixture and included in the drill output files.

5. For each type-1 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: Type-2 pads are not generally used in ProbeMaster, only in FixMaster. Tooling hole D Codes are used in FixMaster to indicate D Codes in the PCB that are to be transferred to the fixture and included in the drill output files.

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 9
Adding Test Points

A test point is a location in the PCB data that is to be probed during the test. In ProbeMaster a test point is defined by its X and Y location, the component it is in, and the Probe Code it is mapped to. This chapter describes how to automatically generate test points and to edit test points in ProbeMaster.

Generating Test Points

ProbeMaster 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 *Mapping D Codes to Probe Codes* on page 65.

3. Go to the **Setup** menu and click **Test Point-Generate**.
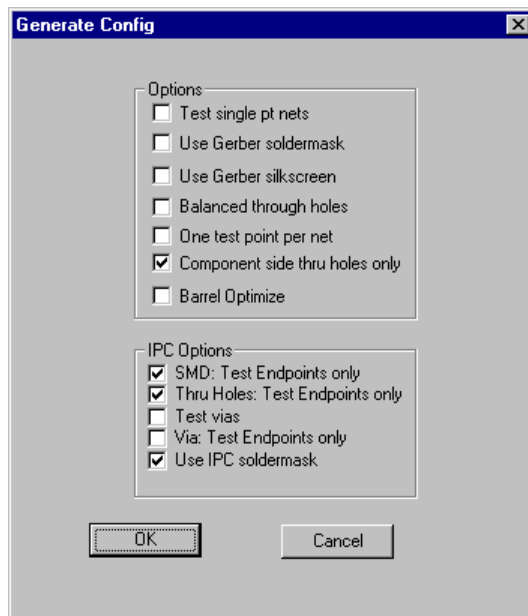
Set Up Test Point Generation

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 73.
   - **Use Gerber Soldermask:** See *No Test Points Covered by Gerber Soldermask* on page 77.
   - **Use Gerber Silkscreen:** See *No Test Points Covered by Gerber Silkscreen* on page 77.
   - **Balanced Through-Holes:** See *Equal Number of Through-Hole Test Points Per Board Side* on page 74.
   - **One Test Point Per Net:** See *One Test Point Per Net* on page 74.
   - **Component Side Through-Hole Only:** See *All Through-Hole Test Points on One Board Side* on page 75.
   - **Barrel Optimize:** See *Through-Hole Test Points on Opposite Board Side from Incoming Trace* on page 76

   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 78.
   - **Through-Holes: Test Endpoints Only:** See *Through-Hole Pads: Test Points for Endpoints Only* on page 79.
   - **Test Vias:** See *Test Points for Vias* on page 79.
   - **Vias: Test Endpoints Only:** See *Vias: Test Points for Endpoints Only* on page 79.
   - **Use IPC Soldermask:** See *No Test Points for Pads with IPC Soldermask Flags* on page 79.

   When you have set the options you want, click **OK**.

5. On the **Edit** menu, click **Test Point-Insert-All Test Points**.

   ProbeMaster generates the test points for the current board side as you specified.

   Test points are represented by blue crosshairs.

   ProbeMaster 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*

Setting up Test Point Generation Options
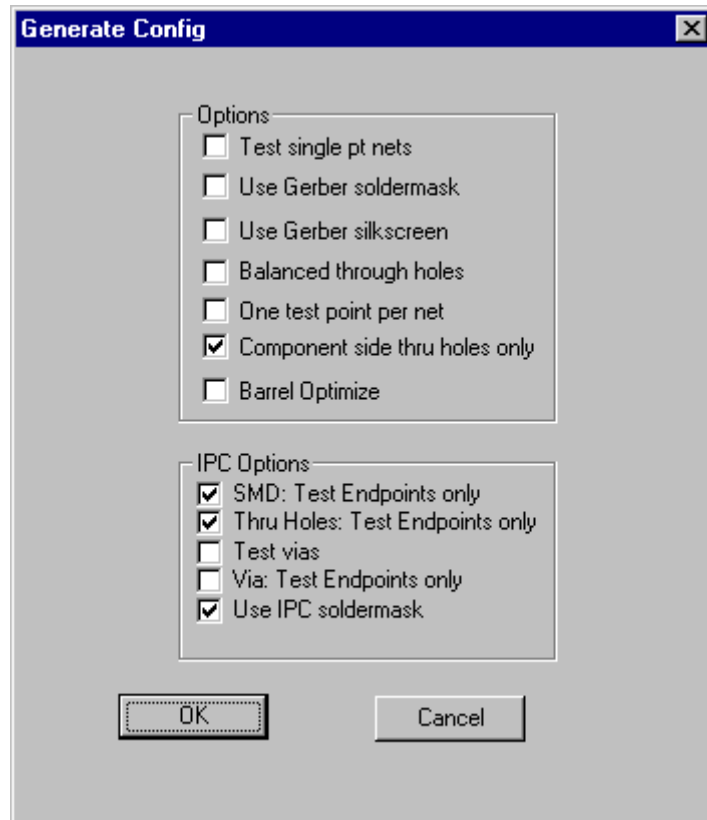
Set Up Test Point Generation

You may select any of the following options when generating test points for netlist data of any format.

Test Points for Single-Point Nets

ProbeMaster can either generate test points for single-point nets or ignore single-point nets when generating test points.

ProbeMaster 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 has **no 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 has **no checkmark**.

Note: *This option cannot be selected if any of the through-hole options are selected.*

Equal Number of Through-Hole Test Points Per Board Side

ProbeMaster 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 for 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 has **no 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 a time, and they cannot 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

ProbeMaster 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. ProbeMaster 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, ProbeMaster 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 has **no 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 a time, and they cannot 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

ProbeMaster 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, ProbeMaster 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 ProbeMaster 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 has **no 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 a time, and they cannot 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. ProbeMaster 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 *Importing Supplemental Gerber Files into the Job* on page 150.

- 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**.

  When this option is selected, ProbeMaster 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 80.

- 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 has **no 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 79.

No Test Points Covered by Gerber Silkscreen

To avoid having a probe hit silkscreen instead of a pad, you may want to generate test points only for pads that are completely cleared of silkscreen. ProbeMaster 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 *Importing Supplemental Gerber Files into the Job* on page 150.

- 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**.

  When this option is selected, ProbeMaster 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 80.

- 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 has **no checkmark**.

IPC Options Group Box
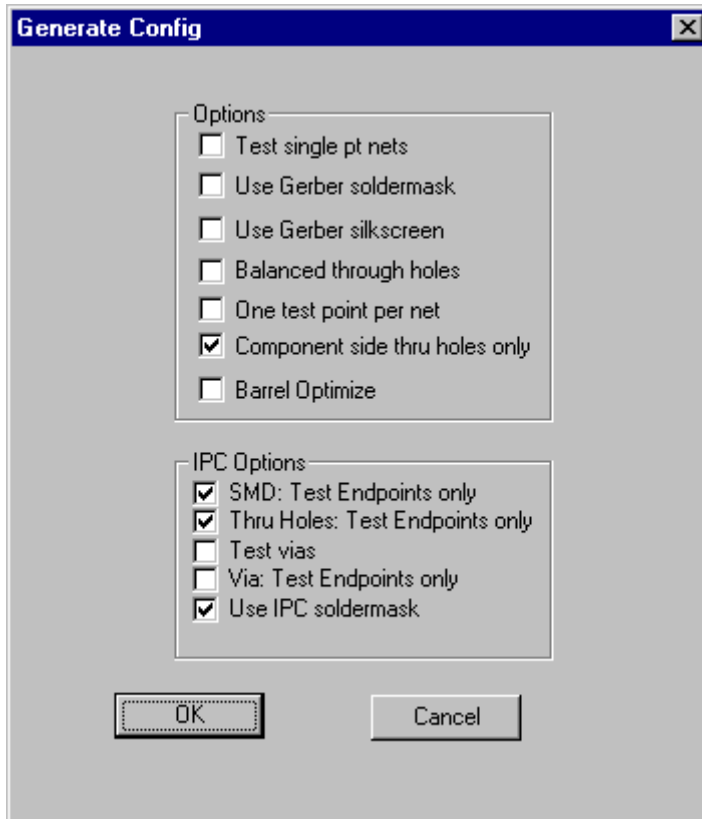
Set Up Test Point Generation

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 test points, you may want to test only endpoints of a netlist. For IPC format netlists with midpoint records (including Lavenir formats .F02 and .F04), ProbeMaster 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 has **no checkmark**.

Through-Hole Pads: Test Points for Endpoints Only

In order to reduce the number of test points, you may want to test only endpoints of a netlist. For IPC format netlists with midpoint records (including Lavenir formats .F02 and .F04), ProbeMaster 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 has **no checkmark**.

Vias: Test Points for Endpoints Only

In order to reduce the number of test points, you may want to test only endpoints of a netlist. For IPC format netlists with midpoint records (including Lavenir formats .F02 and .F04), ProbeMaster 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 has **no checkmark**.

Test Points for Vias

In IPC format netlists with via records (including Lavenir formats .F02 and .F04), ProbeMaster 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 has **no checkmark**.

No Test Points for Pads with IPC Soldermask Flags

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. ProbeMaster 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.

- 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**. When this option is selected, ProbeMaster does not generate test points for pads that are flagged in the IPC data as covered by soldermask.

- 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 has **no 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 77.

Possibly Probeable, Possibly Covered Test Points

When you have ProbeMaster generate test points using the options that look at soldermask or silkscreen data, ProbeMaster 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, ProbeMaster does not give them a test point and highlights them in magenta.

ProbeMaster 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. Look at the supplemental Gerber soldermask or silkscreen data to see if the pad is covered. 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 *Importing Supplemental Gerber Files into the Job* on page 150.

For information on using the soldermask and silkscreen data when generating test points, see *No Test Points Covered by Gerber Soldermask* on page 77, *No Test Points Covered by Gerber Silkscreen* on page 77 and *No Test Points for Pads with IPC Soldermask Flags* on page 79.

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 *Inserting Test Points* on page 81.

   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*

Editing Test Points Manually

The following commands allow you to edit test points in ProbeMaster.

Inserting Test Points

ProbeMaster 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 ProbeMaster 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**.

    ProbeMaster 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)**.
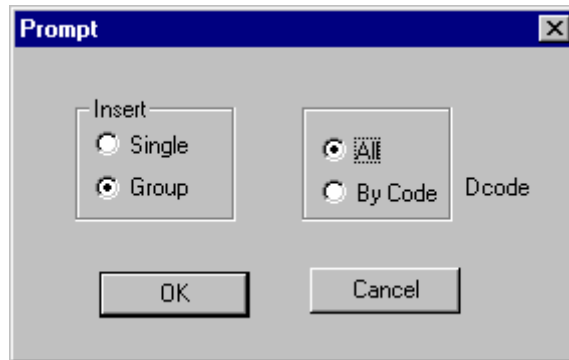
Insert Test Points in all Pads in Frame

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.

    ProbeMaster 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)**.
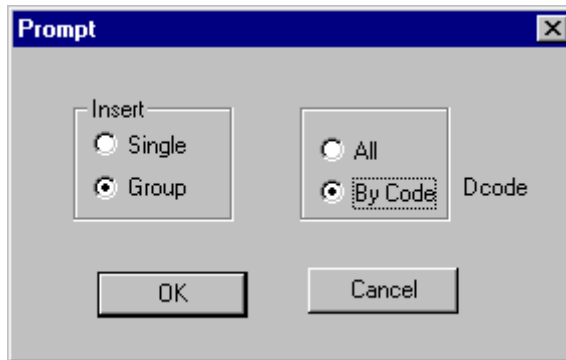
Insert Test Points in Pads of Current D Code in Frame

3. On the **Insert Test Point** dialog, select **Group** and select **D Code**.

4. Click **OK**.

   The **Insert Test Point** tool is selected, and ProbeMaster 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 the pad becomes the current D Code shown in the **Status Bar**.

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

   ProbeMaster 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)**.
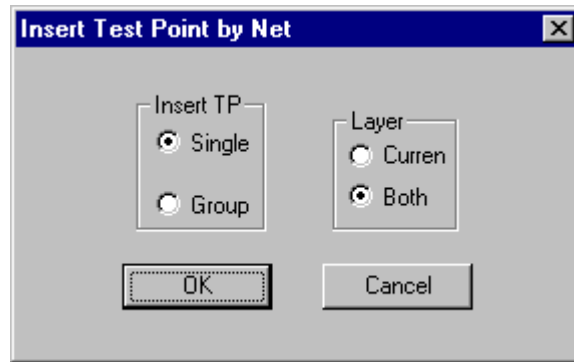
Insert Test Points in a Single Net

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 ProbeMaster prompts you to select an element.

4. Position the cursor in a pad of the net to which you want to insert test points.

5. **Click** the mouse or press **Enter**.

    The cursor hops to the center of the pad, and the Net Number of the pad becomes the current Net Number shown in the **Status Bar**.

6. **Click** the mouse or press **Enter**.

    ProbeMaster 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)**.
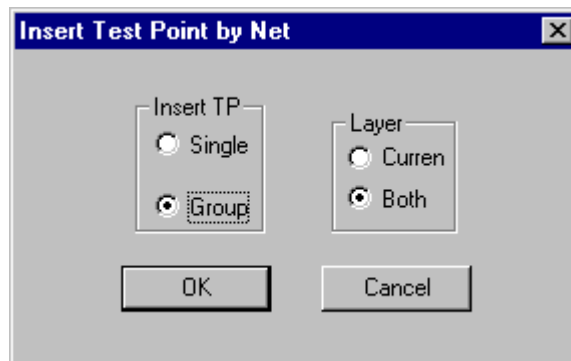
Insert Test Points in a Group of Nets in the Frame

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**.

    ProbeMaster 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*

Deleting Test Points

ProbeMaster 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 ProbeMaster 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**.

   ProbeMaster 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)**.
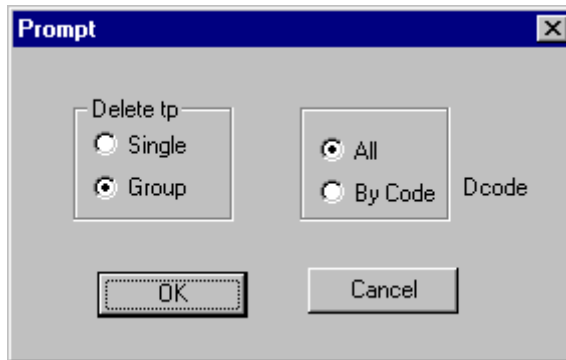
Delete Test Points from all Pads in Frame

3. On the **Delete Test Point** dialog, select **Group** and select **All**.
4. Click **OK**.
5. When the dialog disappears, click the mouse.

   ProbeMaster deletes test points from all the pads within the Frame.

   Menu: Edit-Test Point-Delete-Delete Test Point (D Code)

   Button: *then*

   Key: None

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)**.
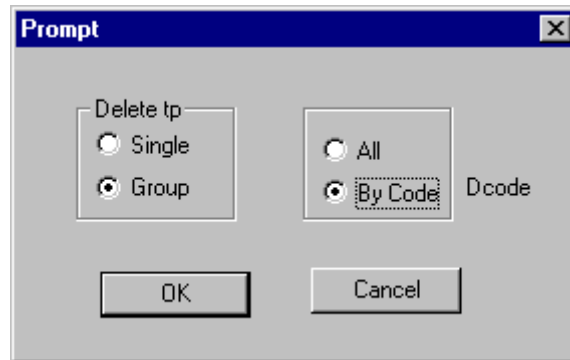
Delete Test Points from Pads of Current D Code in Frame

3. On the **Delete Test Point** dialog, select **Group** and select **D Code**.

4. Click **OK**.

   The **Delete Test Point** tool is selected, and ProbeMaster 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 the pad becomes the current D Code shown in the **Status Bar**.

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

   ProbeMaster 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*

   Key: *None*

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To Delete Test Points from Pads of a Single Net inside the 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 (Net)**.
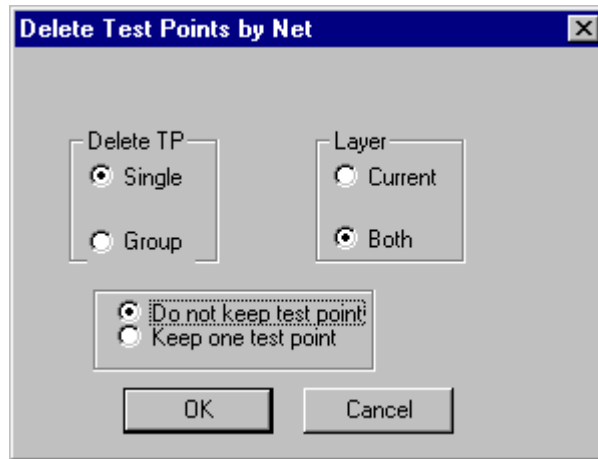
Delete Test Points from a Single Net

3. On the **Delete Test Point by Net** dialog, select **Single** 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**.

    The **Delete Test Point** tool is selected, and ProbeMaster prompts you to select an element.

6. Position the cursor in a pad of the net from which you want to delete test points.
7. **Click** the mouse or press **Enter**.

    The cursor hops to the center of the pad, and the Net Number of the pad becomes the current Net Number shown in the **Status Bar**.

8. **Click** the mouse or press **Enter**.

    ProbeMaster deletes test points in all pads inside the Frame 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)**.
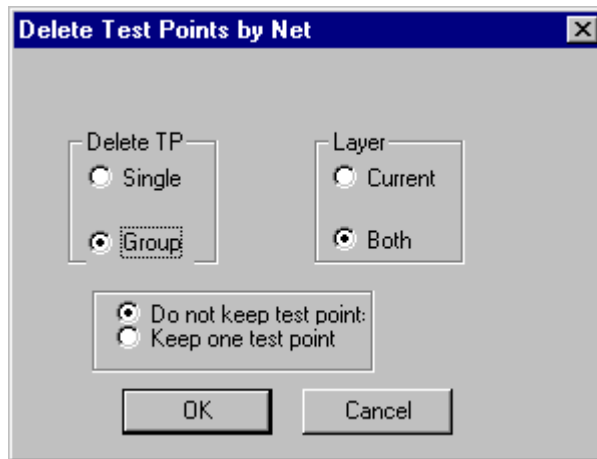
Delete Test Points from a Group of Nets in the Frame

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**.

   ProbeMaster 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*

Transferring Test Points to other Side of Board

ProbeMaster 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-Xfer Thru Hole Test Point**.
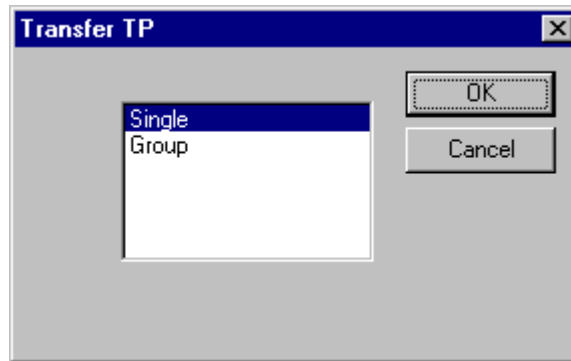
Transfer a Single Through-Hole Test Point to the Opposite Side

2. On the **Transfer Test Point** dialog, select **Single**.
3. Click **OK**.

    The **Transfer Test Point** tool is selected, and ProbeMaster 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-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-Xfer Thru Hole Test Point**.
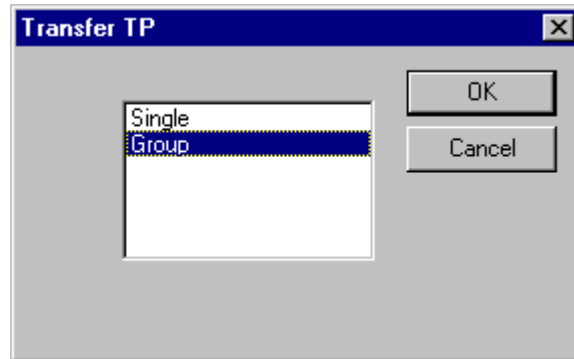
Transfer All Through-Hole Test Points in the Frame to the Opposite Side

3. On the **Transfer Test Point** dialog, select **Group**.

4. Click **OK**.

5. **Click** the mouse or press **Enter**.

   ProbeMaster 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-Xfer Thru Hole Test Point

   Button: None

   Key: None

Staggering Test Points

ProbeMaster 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; however, this feature is more useful for fixture-based testers than for moving probe testers. The feature is more commonly used in FixMaster than in ProbeMaster.

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 49.

To Set up the Probe Stagger Margin:

1. Set the Current Board Side.

2. Click **Setup-Probe Table**.

	Type	Head Dia	Air Gap	Margin	
1	S	0.0230	0.0040	0.0100	
2	S	0.0160	0.0040	0.0100	
3	H	0.0310	0.0040	0.0000	

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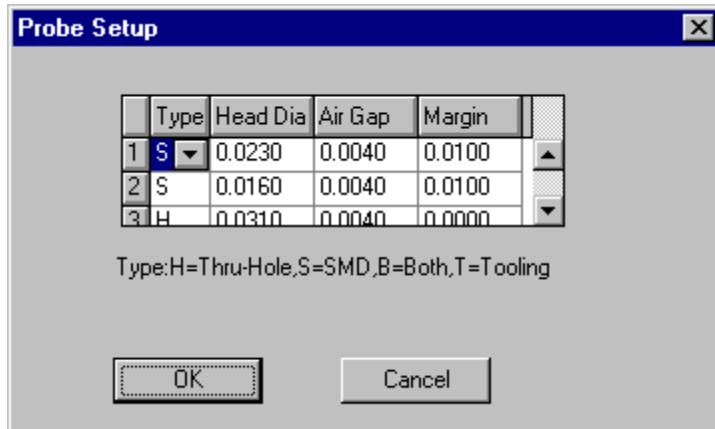
Probe Setup Table

3. On the Probe Setup Table, 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.
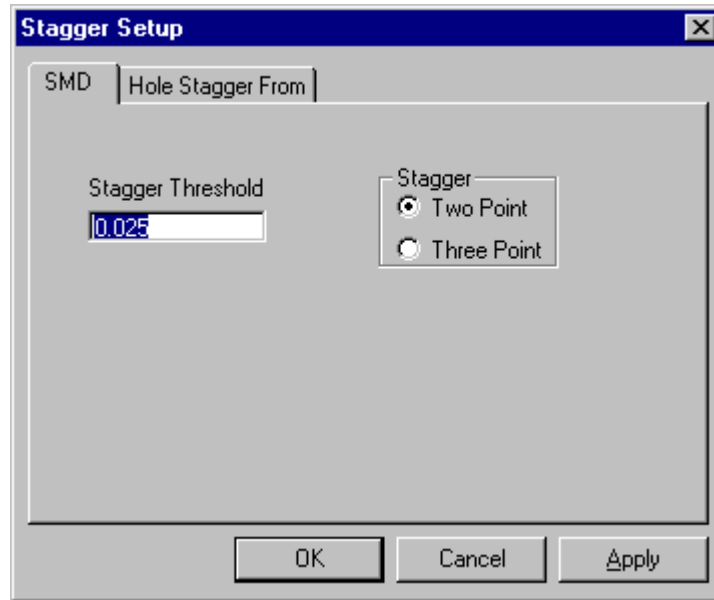
Stagger Setup SMD Tab

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.
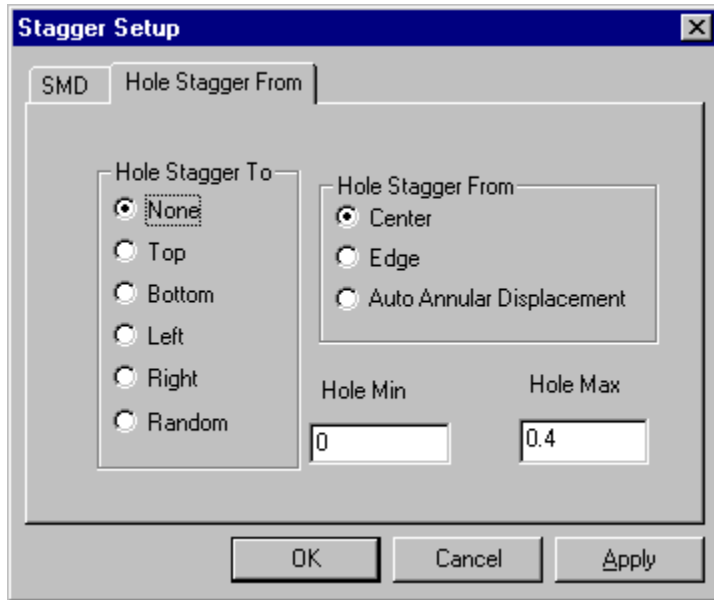
Stagger Setup Dialog, Hole Stagger From Tab

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

ProbeMaster can stagger all surface-mount and through-hole test points on the current board side automatically.

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 tester configuration procedures.

    If not, click **Setup-Probe Table** and set up the **Margin** for each probe. See *Distance a Test Point is Staggered* on page 94.

    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**.

   ProbeMaster 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

ProbeMaster allows you to manually stagger individual surface-mount test points on the current board side.

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 tester configuration procedures.

    If not, click **Setup-Probe Table** 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.

    ProbeMaster 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

ProbeMaster can stagger all surface-mount and through-hole test points on the current board side inside 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 tester configuration procedures.

   If not, click **Setup-Probe Table** 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**.

ProbeMaster 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

ProbeMaster can swap the stagger position of staggered test points for surface mount pads on the current board side 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**.

ProbeMaster 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 101. For information about setting the **Margin** value on the **Probe Setup** dialog, see *Setting up the Probes* on page 49.

To Stagger Test Points in the Frame:

1. Set the Current Board Side.

2. Position the Frame around the test points that you want to stagger.

3. On the **Edit** menu, click **Test Point-Stagger-Window Stagger with Margin**.
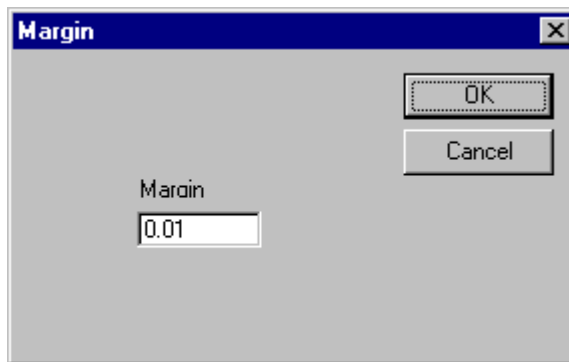
Stagger Margin

4. In the **Margin** dialog, enter the new **Margin**.

   The distance a test point is staggered is equal to the **Margin**.

   - **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.

5. Click **OK**.

   ProbeMaster staggers the test points inside the Frame as you specified.

   Menu: Edit-Test Point-Stagger-Window Stagger with Margin

   Button: None

   Key: None

Chapter 10
Checking for Collision Errors

ProbeMaster has the ability to check the job for probe collisions. These errors depend on the probe head diameters and air gaps set up in the Probe Table. See *Setting up the Probes* on page 49. On screen, collisions are displayed in yellow.

Collision errors in ProbeMaster are similar to head butts and crossed pins in FixMaster. However, in fixture-based testing, all the probes are mounted in the fixture and are in contact with the board simultaneously, so in FixMaster head butts and crossed pins indicate errors that are very likely to cause a problem with the fixture. In moving probe testing the probes do not touch all the test points simultaneously, so collision errors in ProbeMaster indicate errors that *may* cause problems if the two points in error are actually going to be probed at the same time. Most testers run their own routines to avoid collisions, so the ProbeMaster collision checking routine is used primarily to identify stacked pads and double hits. It is also a tool to help visualize the size of the probe tips in relation to the pads.

ProbeMaster automatically runs a collision check when you stagger test points. See *Staggering Test Points* on page 93. In addition you can run a collision check at any time.

Running a Collision Check

You can run a collision check on the whole PCB.

To Run a Collision Check on the Whole PCB:

1. Set the Current Board Side

2. On the **Action** menu, click **Collision Check**.

    ProbeMaster checks for collisions and reports the number of collision errors found. On screen, collisions are displayed in yellow.

    Menu: *Action-Collision Check*

    Button:

    Key: *None*

Inspecting Collision Errors
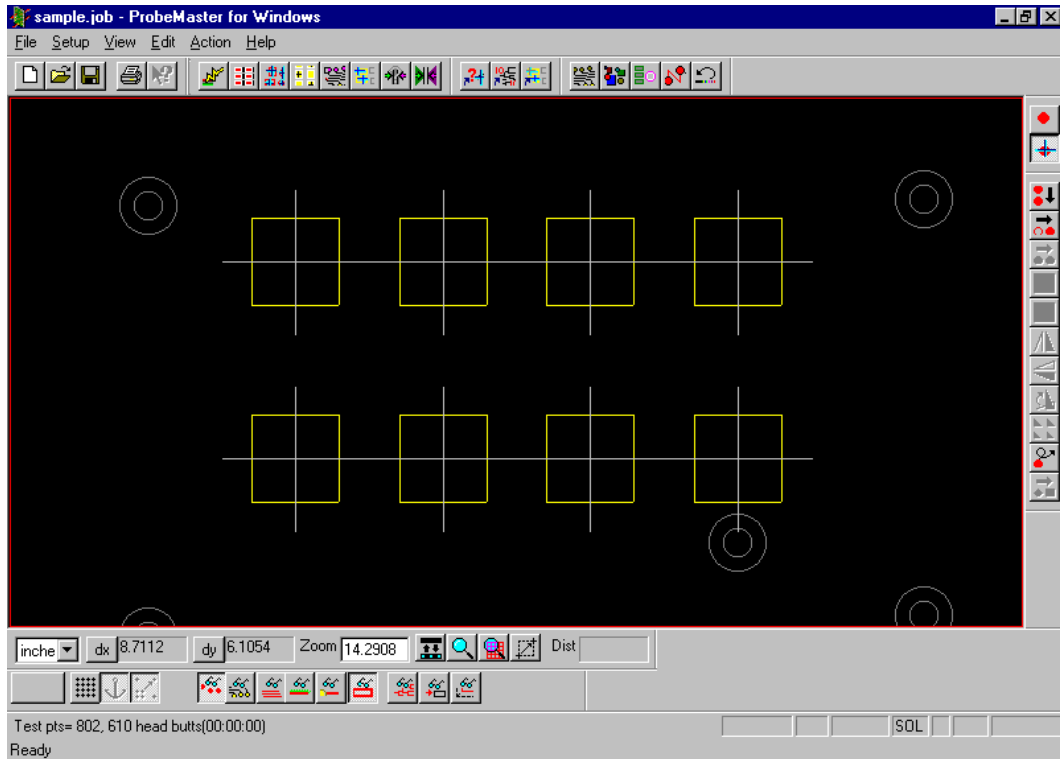
Collision Errors

ProbeMaster has a feature that allows you to go to each sequential collision error.

To Inspect Collision Errors:

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

    The **Go To Collision Error** tool is selected.

2. **Click** the mouse.

    The cursor hops to the next collision error. The test point is marked with a green cross, indicating it is selected. Pads with collision errors are displayed in yellow.

    The **Go To Collision Error** tool remains selected until you select another tool or press the **Escape** key, so you can find one collision error after another by clicking the mouse.

    Menu: View-Go To-Collide

    Button:

    Key: None

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Correcting Collision Errors

There are several manual and automatic techniques for correcting collision errors.

Remove Padstacks to Correct Collisions

Many collision errors are due to stacked pads. Removing stacked pads helps to eliminate stacked test points that can cause collision errors. See *Removing Padstacks* on page 174.

Stagger Test Points to Correct Collision Errors

In FixMaster, staggering test points can help to correct crossed pins and head butts, which are similar to collision errors in ProbeMaster. Sometimes staggering test points in ProbeMaster may prevent collisions in cases where very close pads are going to be probed simultaneously.

- **Stagger Test Points in the Frame:** See *Staggering Test Points in the Frame* on page 101.
- **Manually Stagger Individual Test Points:** See *Manually Staggering Individual Test Points* on page 100.

Chapter 11
Netlist Inspection 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, **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
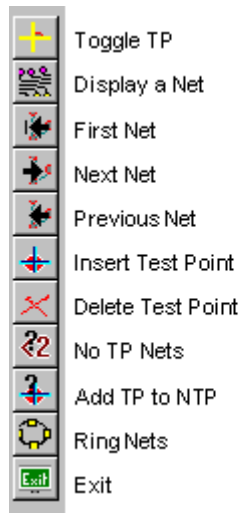
Netlist Inspection Toolbar

Color System in Netlist Inspection Mode

To aid in the netlist inspection process, ProbeMaster 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
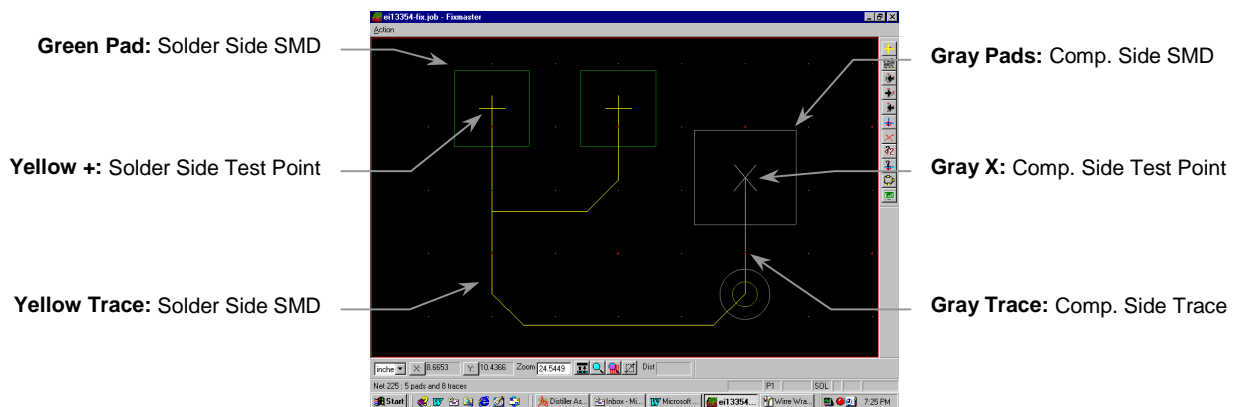
Netlist Inspection Mode Color System

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 icon] button.
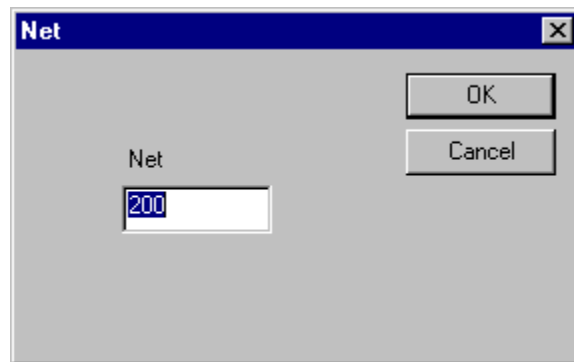
    ProbeMaster prompts you for a net number.

Display a Specific Net

2. Type the **net number** of the net you want to inspect and click **OK**.

    ProbeMaster displays the selected net and adjusts the zoom level so that the selected net fills the screen. In the message area of the **Status Bar**, ProbeMaster displays the net number and the number of pads in the net, for the current board side.

    Menu: *None*
    Button: ![button icon]
    Key: *None*

Displaying the First, Next or Previous Net in the File

ProbeMaster 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 ProbeMaster displays the selected net, the program adjusts the zoom level so that the net fills the screen. In the message area of the **Status Bar**, ProbeMaster 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 cannot be tested for shorts to other nets. ProbeMaster 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, ProbeMaster 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**, ProbeMaster displays the net number and the number of pads in the net, for the current board side. When the net is displayed, you can decide whether to add a test point.

ProbeMaster 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 121. If you identify a large number of these nets, then rather than manually adding test points, you may want to have ProbeMaster 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**.
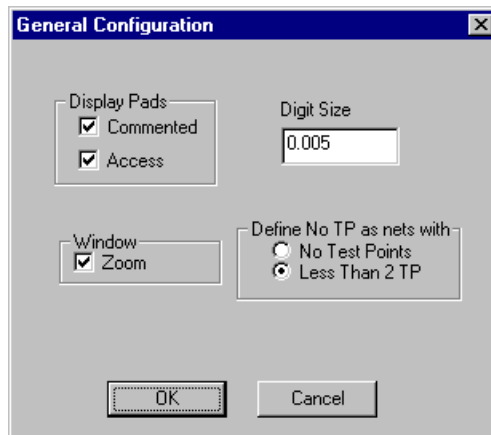
General Configuration Dialog

3. On the **General Configuration** dialog, 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.

    ProbeMaster 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**, ProbeMaster displays the net number and the number of pads in the net, for the current board side. ProbeMaster also displays the total number of nets with less than the specified number of test points.

6. To display the next sequential net with less than the designated number of test points click the **No TP Nets** button again.

Menu: *None*

Button:

Key: *None*

Options for How to Display Nets

Displaying Test Points with a Large X

ProbeMaster 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*
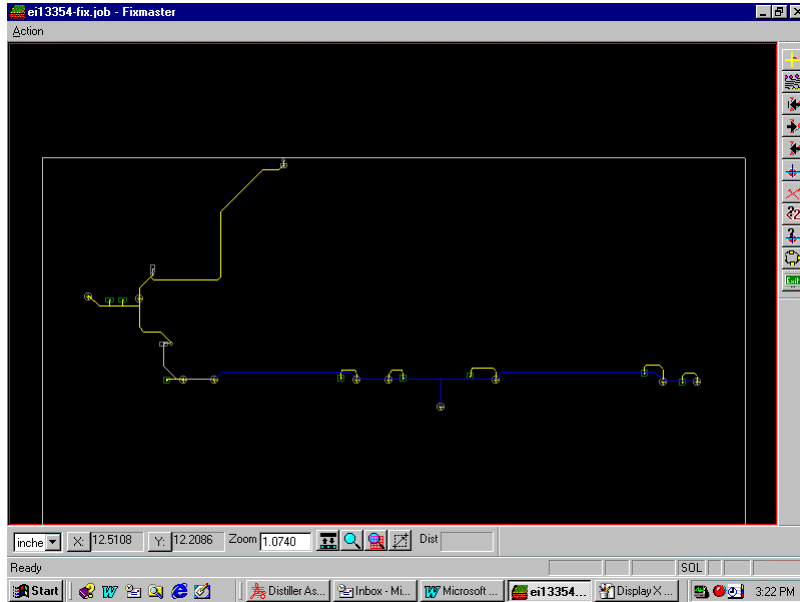
Test Points Shown with the Large X Turned Off
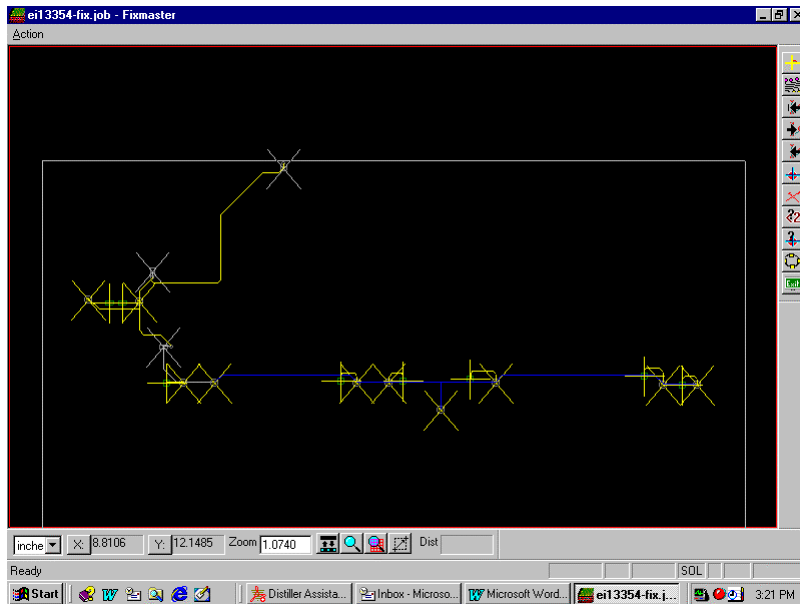
Test Points Shown with the Large X Turned On

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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. ProbeMaster gives you two ways to display ring nets for inspection.

Checking 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 114. 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

ProbeMaster 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** button on the **Netlist Inspection** toolbar.

2. In the regular editing mode, go to the **Action** menu and click **Ring Net**.
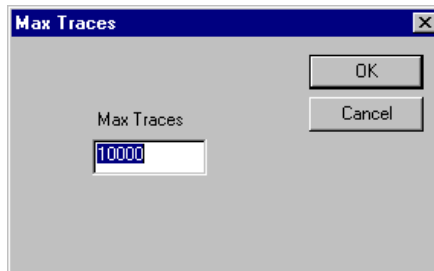
Max Traces Dialog

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.

4. Click **OK**.

    ProbeMaster identifies all of the ring nets in the loaded data. This can take a little while.

5. Enter **Netlist Inspection** mode by going to the **Action** menu and clicking **Inspect Netlist**.

6. On the **Netlist Inspection** toolbar, click the **Ring** button.

    ProbeMaster 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**, ProbeMaster displays the net number and the number of pads in the ring net, for the current board side.

7. To display the next sequential ring net, click the **Ring** button again.

    Menu: *None*

    Button:

    Key: *None*

Editing Test Points in Netlist Inspection Mode

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.

Switching the Active Board Side in Netlist Inspection Mode

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 in Netlist Inspection Mode

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 in Netlist Inspection Mode

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 *Inserting Test Points* on page 81.

Menu: *None*

Button:

Key: *None*

Deleting Test Points in Netlist Inspection Mode

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** button. See *Deleting Test Points* on page 86.

Menu: *None*

Button:

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 ProbeMaster 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** button.

Menu: *None*

Button:

Key: *None*

Chapter 12
Net Adjacency

Some moving probe testers use net adjacency data for more efficient testing. The adjacency information tells the tester which nets are "next to" each other, and the tester does not need to test for faults between nets that are not adjacent.

If you generated the netlist data using Lavenir's CAMMaster, and you selected the adjacency option, then the netlist already contains the adjacency information. Also, the IPC-356-A format may contain adjacency information, so if you import an IPC-356-A file from a netlist generation system that calculates adjacency, your file may also contain adjacency information.

If your tester uses adjacency information and it is not already contained in the netlist file, then you may generate the adjacency information in ProbeMaster.

Checking Nets for Adjacency

ProbeMaster can automatically check for net adjacency and compile a file of adjacent nets. Each element of each net is checked. If two nets have elements that are closer than the adjacency threshold that you set, then those nets will be included in the adjacency file.

To Run the Net Adjacency Check:

1. On the **Setup** menu, click **Tester**.
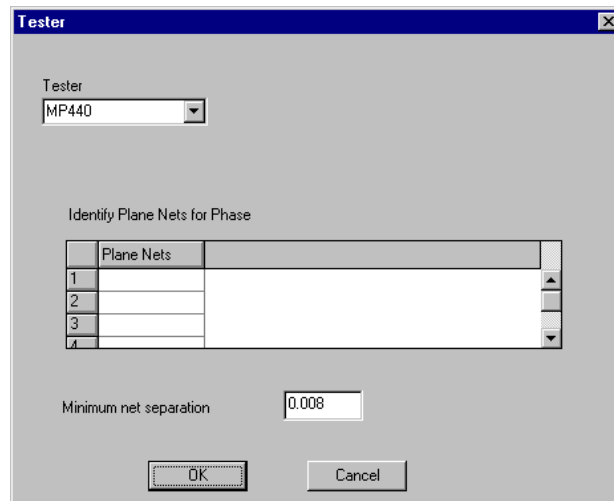
Tester Setup Dialog

2. In the **Minimum Net Separation** field, enter the adjacency threshold. Two nets that have elements closer than this distance are considered to be adjacent.

3. On the **Action** menu, click **Adjacency Nets-Find Nets**.

4. ProbeMaster prompts whether you want to export the test files at the same time that the net adjacency information is generated.

    - If you want to export the test files at the same time the adjacency data is generated, click **Yes**, and set up the test file export options. For information on how to set up the export options, see *Exporting Tester Download Files* on page 152.

    - If you do not want to export the test files, click **No**.

    ProbeMaster checks the nets for adjacency. The process can take a few minutes. ProbeMaster indicates that the adjacency check is done with a message in the **Status Bar**.

    Menu: *Action-Adjacency Nets-Find Nets*

    Button:

    Key: *None*

Adjacency Inspection Mode

ProbeMaster allows you to visually inspect adjacent nets in **Adjacency Inspection** mode. In **Adjacency Inspection** mode, ProbeMaster displays any net that you select. And if there are any nets adjacent to the selected net, ProbeMaster displays the primary net and the first adjacent net and marks the adjacent elements with a magenta crosshair. In the message area of the **Status Bar**, ProbeMaster displays the net numbers of the two nets. ProbeMaster also shows the positions of two adjacent elements in the units of the database and the distance between the two elements in the units of the export file. When there are more than one net adjacent to the selected net, you can view each adjacent pair sequentially.

The normal command menus are not available in **Adjacency Inspection** mode. You use the commands on the **Adjacency Inspection** toolbar and some special keyboard commands. **Adjacency Inspection** mode has some unique commands for locating and displaying specific nets.

Adjacency Inspection Toolbar

Adjacency Inspection Toolbar

Entering and Exiting Adjacency Inspection Mode

Adjacency Inspection mode is a separate inspection mode from the normal editing mode.

To Enter Adjacency Inspection Mode:

1. Before entering **Adjacency Inspection** mode, **run the adjacency check**. See *Checking Nets for Adjacency* on page 123.

2. On the **Action** menu, click **Adjacency Nets-Inspect Nets**.

    Menu: *Action-Adjacency Nets-Inspect Nets*

    Button:

    Key: *None*

To Exit Adjacency Inspection Mode and Return to Normal Editing:

➤ On the **Adjacency Inspection** toolbar, click the **Exit** button.

Or

➤ On the **Adjacency Inspection** mode **Action** menu, click **Quit**.

Menu: *Action-Quit*

Button:

Key: *None*

Displaying a Specific Adjacency

You can select a specific net for inspection. ProbeMaster will display the selected net and the first adjacent net if any.

To Display a Specific Net and its Adjacent Net if Any:

1. On the **Adjacency Inspection** toolbar, click the **Net Adjacencies** button.

    ProbeMaster prompts you for a net number.
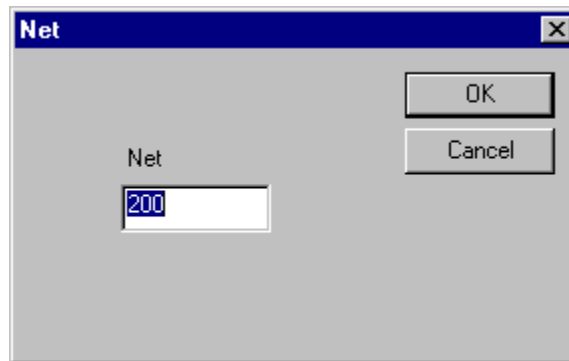
Display a Specific Net

2. Type the **net number** of the net you want to inspect and click **OK**.

    ProbeMaster displays the selected net and the first adjacent net if any. ProbeMaster adjusts the zoom level so that both nets fill the screen. In the message area of the **Status Bar**, ProbeMaster displays the net numbers of the two nets. ProbeMaster also shows the positions of two adjacent elements in the units of the database and the distance between the two elements in the units of the output file. If there is no adjacent net, ProbeMaster shows information for the selected net.

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

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Displaying the First, Next or Previous Adjacency in the File

ProbeMaster has commands to display adjacencies in numerical order according to the net numbers of the nets involved. You can display the first, next or previous adjacency in the file. Some nets are not adjacent to any other nets, and some nets are adjacent to more than one. So the adjacency sequence begins with the first net number in the file. That first net is the selected net and the system shows that net and the first net (if any) adjacent to that net. If there are more that one net adjacent to the selected net, then the next adjacency is the next net adjacent to the selected net, and so on. Once the last net adjacent to the selected net has been shown, the sequence moves on to the next net number in the file and the first net (if any) adjacent to that net. By going through this sequence each net and each adjacent pair can be seen.

To Display the First, Next or Previous Adjacency in the File:

➢ On the **Adjacency Inspection** toolbar, click the **First Adjacency** , the **Next Adjacency** or the **Previous Adjacency** button.

Menu: *None*

Button: *or* *or*

Key: *Shift+F or Shift+N. or Shift+B*

Switching the Active Board Side in Adjacency Inspection Mode

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 **Adjacency Inspection** mode; however, elements of the active side are shown in front of elements of the other 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*

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Chapter 13
Fiducial Points

Most moving probe testers use fiducial points on the board to align the probes. The tester detects the fiducials on the board, and uses the fiducial locations to calculate the test point locations, correcting for offset and rotation. So that the fiducial information can be included in the tester download files, you tag the fiducial points in ProbeMaster before outputting the files. You can tag circuit elements in the PCB database, or you can enter the locations into a table.

Elements to Use as Fiducials

Different testers can detect different types of fiducials. In general, for testers that use circuit elements that can be viewed in ProbeMaster, mid-sized plated through holes that do not have any incoming traces are a good choice. Large non-plated through holes are not as good. Through holes are good for testers that need fiducials tagged for both sides of the board, because through holes have the same locations on both sides of the board. ProbeMaster automatically makes the fiducials the same locations on both sides of the board.

Try to select fiducials that are near the outside edges of the board, but which won't be obscured by the clamps. Also be sure to mark the fiducials after stepping and repeating, and pick points at the edges of the panel, not the edges of the one-up image.

For the MP-440, the center-tooling fiducial must be to the right of the lower-left fiducial and to the left of the upper-right fiducial.

In some cases you may want to use fiducial points that are not included as elements in the loaded data. In that case you must enter the fiducial points by typing them into the table rather than by tagging elements.

Tagging the Fiducials

To Automatically Tag the Fiducials:

➢ On the **Edit** menu, click **Fiducials-Automatic**.

ProbeMaster looks for non-connected, plated through holes at the extents of the panel and tags them as fiducials.

Menu: Edit-Fiducials-Automatic

Button: None

Key: None

To Manually Tag the Fiducials with the Mouse:

1. On the **Edit** menu, click **Fiducials-Manual**.
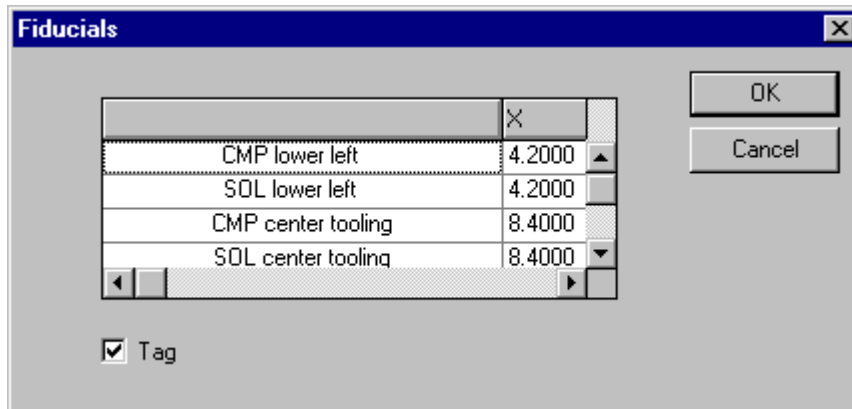
Fiducials Dialog for MP440

ProbeMaster displays the **Fiducials** dialog where you tag fiducials in the loaded PCB data for the currently active board side, CMP or SOL. Because different testers require different numbers of fiducials, the fiducials table displayed in the dialog depends on the type of tester you set up earlier. For information on selecting the type of tester, see *Selecting the Tester Type* on page 47.

2. To manually tag all the fiducials using the mouse, click the **Tag** checkbox so that it has a **checkmark**, and then click **OK**.

3. Follow the prompts in the **Status Bar**, which will tell you when to click on each fiducial. Be sure to tag the fiducials in the proper order as indicated by the prompts. ProbeMaster automatically makes the fiducials the same locations on both sides of the board.

Menu: Edit-Fiducials-Manual

Button: None

Key: None

To Manually Type the Fiducial Locations into the Table:

1. On the **Edit** menu, click **Fiducials-Manual**.
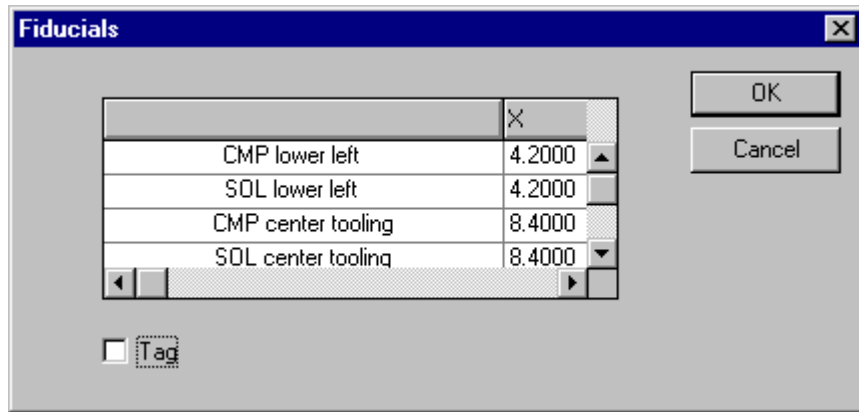
Fiducials Dialog

ProbeMaster displays the **Fiducials** dialog where you set up fiducials for the currently active board side, CMP or SOL. Because different testers require different numbers of fiducials, the fiducials table displayed in the dialog depends on the type of tester you set up earlier. For information on selecting the type of tester, see *Selecting the Tester Type* on page 47.

2. Type in all the fiducial locations in the table.

3. Be sure to click the **Tag** checkbox so that it has **no checkmark**. If the **Tag** checkbox has a checkmark when the dialog is closed, ProbeMaster will prompt you to manually tag the fiducials with the mouse.

4. Click **OK**.

Menu: *Edit-Fiducials-Manual*
Button: *None*
Key: *None*

Displaying the Fiducials

After you have tagged the fiducials, you can have ProbeMaster display them for your inspection.

To Display the Fiducials:

1. On the **View** menu, click **Data Elements-Fiducials**.
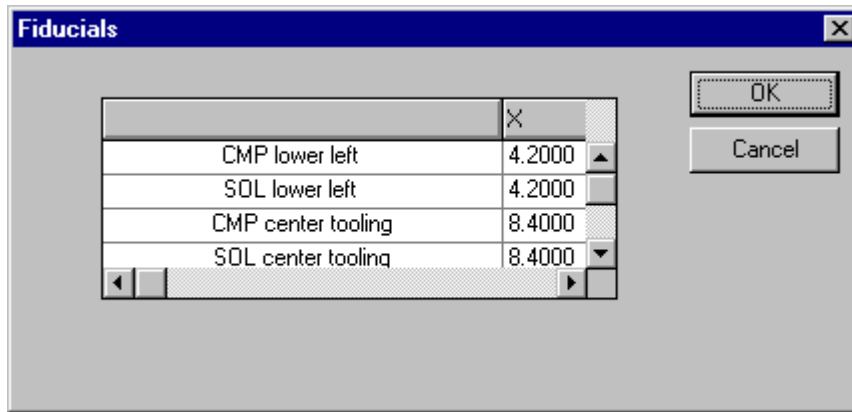
Display the Fiducials

ProbeMaster displays the same fiducial table you see when you set up the fiducials; however, this dialog does not give you the option to tag the fiducials manually.

2. Click **OK**.

   ProbeMaster displays a magenta X at all the fiducial points.

3. Click the mouse to go to each fiducial point in sequence.

   ProbeMaster identifies each fiducial and displays its location in the message area of the **Status Bar**.

   Menu: *View-Data Elements-Fiducials*

   Button: *None*

   Key: *None*

Chapter 14
Testing Dense Components Separately

There is a feature in 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. Generally this is used when a dense part is going to be tested on a moving probe tester and the rest of the board is going to be tested separately on a universal tester. This feature allows you to prepare part of the board in ProbeMaster and part of the board in FixMaster. Also this feature is included in both ProbeMaster and FixMaster, so you can begin in either program.

In jobs where the Isolated Component Test feature can be useful, 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 inside the densely packed area are tested using a moving probe. While all the test points that are outside the densely packed area are tested separately on a fixture-based tester. 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 like those in FixMaster because ProbeMaster 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**.
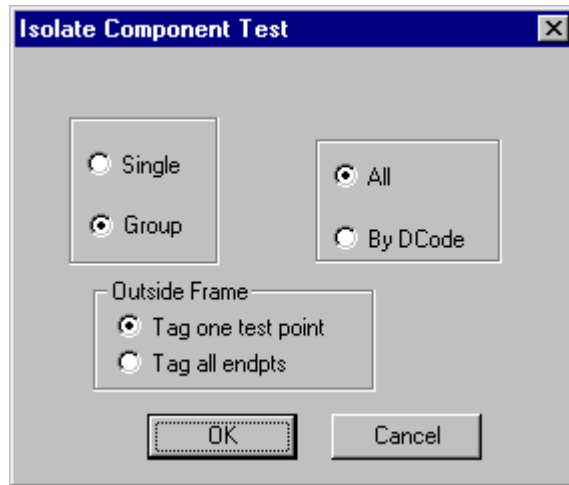
Isolate Component Test Dialog

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. *This is the recommended option.*

    *   **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**.

    ProbeMaster 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.

    ProbeMaster inserts test points in the pads of the selected net that are inside the Frame. And if the net has pads outside the Frame, ProbeMaster also inserts a test point in one (or all endpoints) outside the Frame.

    Menu: *Action-Iso Component Generate*

    Button: *None*

    Key: *None*

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**.
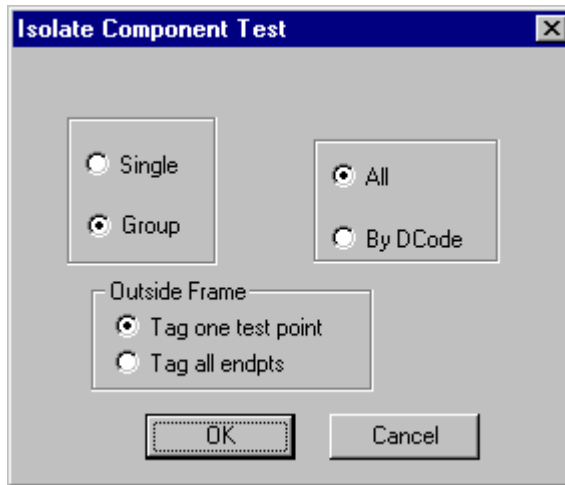
Isolate Component Test Dialog

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). *This is the recommended option.*

    *   **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.

    ProbeMaster inserts test points in all the pads inside the Frame. And if the nets of the component have pads outside the Frame, then for each net ProbeMaster also inserts a test point in one pad (or all endpoints) outside the Frame.

    Menu: *Action-Iso Component Generate*

    Button: *None*

    Key: *None*

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**.
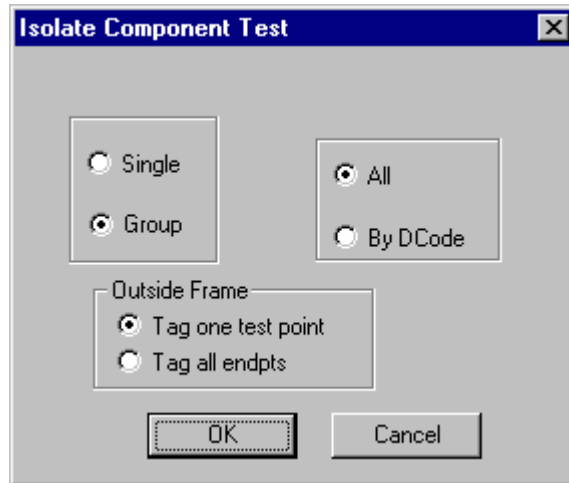
Isolate Component Test Dialog

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). *This is recommended.*

   - **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.

   The cursor hops to the pad and it's D Code becomes the current D Code shown in the **Status Bar**.

7. Click again.

   ProbeMaster inserts test points in all the pads inside the Frame that have the selected D Code. And if the nets of the component have pads outside the Frame, then for each net ProbeMaster also inserts a test point in one pad (or all endpoints) outside the Frame.

   Menu: *Action-Iso Component Generate*
   Button: None
   Key: *None*

Chapter 15
File Handling in ProbeMaster

The ProbeMaster Job File (.JOB) is the native file format for ProbeMaster 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.

ProbeMaster Job File (.JOB) Overview

The Job File (.JOB) is the native file format for ProbeMaster and contains all information regarding the current state of the database and operation settings:

Tester Configuration:

- Tester Type
- Probe Diameters
- Probe Air Gaps
- Probe Margins

Operation Variables:

- D Code and Probe Mapping
- Test Point Generation Options
- Stagger Options
- Adjacency Options

PCB database:

- Pads, Traces, Netlist Data
- Test Points
- Fiducials

Boilerplate Job Files

.JOB files can be used as boilerplate test configuration files that can be saved and reopened when you have similarly configured jobs. A boilerplate .JOB file is saved with the tester configuration and operation variables, before the PCB database is loaded.

FixMaster and Verify Job Files

ProbeMaster .JOB files can also be opened in the Lavenir product Verify. And ProbeMaster can open .JOB files saved in the Lavenir product FixMaster.

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 the *Spit Net* chapter in the *FixMaster User's Guide*.

ProbeMaster and FixMaster .JOB files of completed jobs can be opened in Verify for fault verification.

Starting a New ProbeMaster 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 ProbeMaster Job:

1. On the **File** menu, click **New**.

   ProbeMaster 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
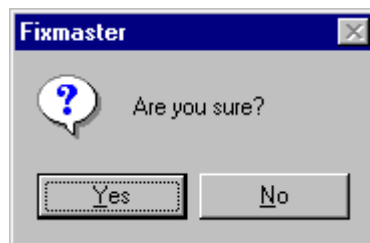
New File Prompt

2. Click **Yes**.

   The newly created ProbeMaster .JOB file has nothing in it.

   Menu: *File-New*

   Button:

   Key: *Ctrl+N*

Opening a ProbeMaster 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 ProbeMaster Job:

1. On the **File** menu, click **Open**.
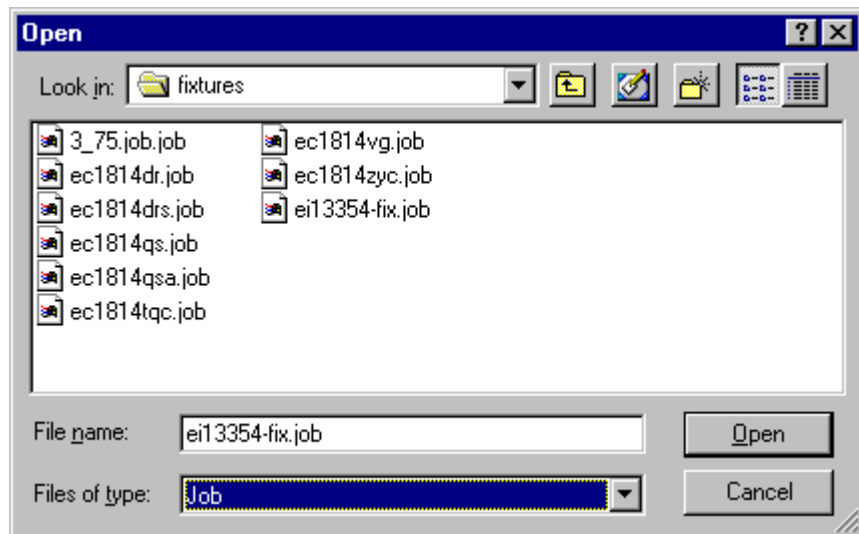
Open File Dialog

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**.

ProbeMaster 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.
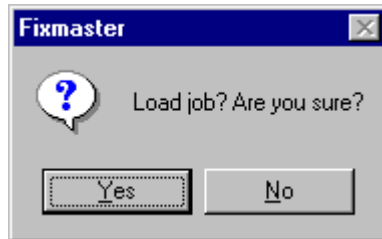
Open File Prompt

5. Click **Yes**.

Menu: File-Open

Button:

Key: Ctrl+O

Closing a ProbeMaster 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. ProbeMaster may prompt, "Are you sure?" This gives you an opportunity to save the .JOB file before closing it.
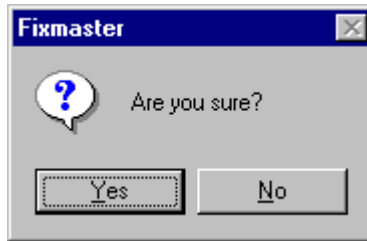
Close File Prompt

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*

Saving a Job File

There are several ways to save a .JOB file.

To Save a New, Unnamed ProbeMaster Job File:

1. On the **File** menu, click **Save**.
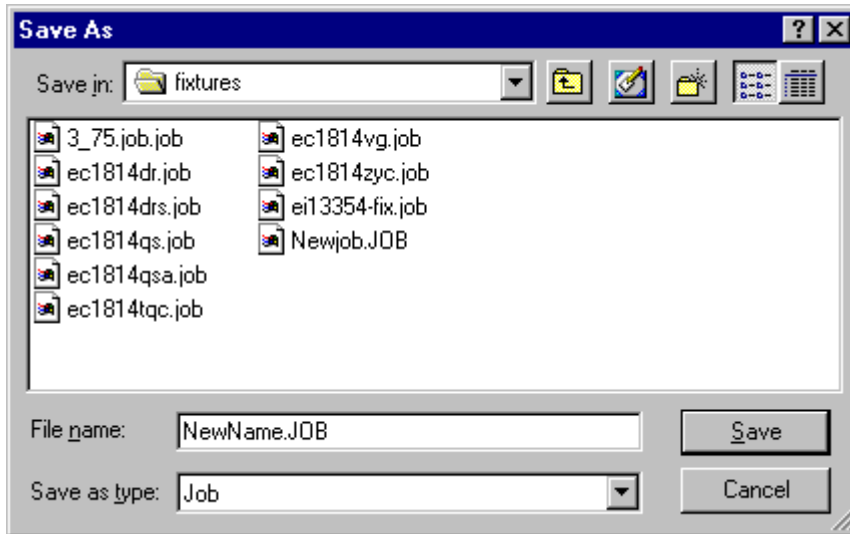
Save As Dialog

2. To save the ProbeMaster .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 ProbeMaster .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**.
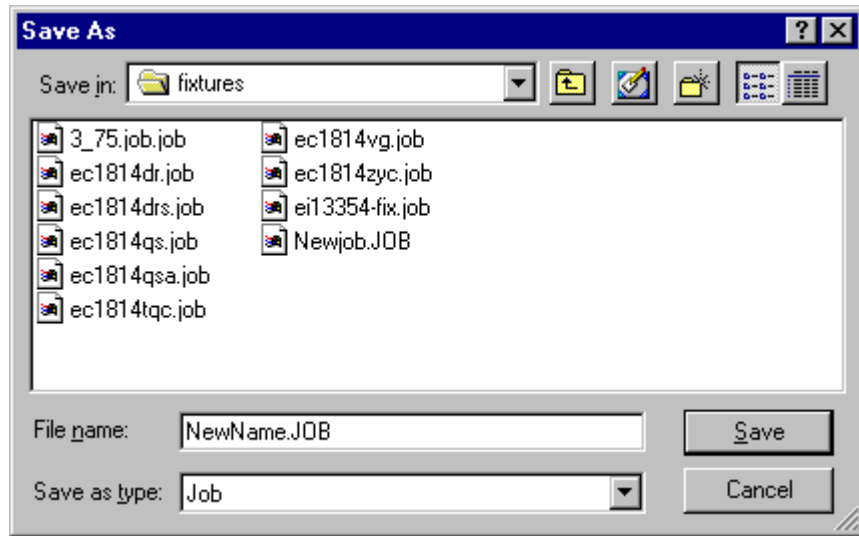
Save As Dialog

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**.

    ProbeMaster prompts for whether you want to overwrite the existing file.
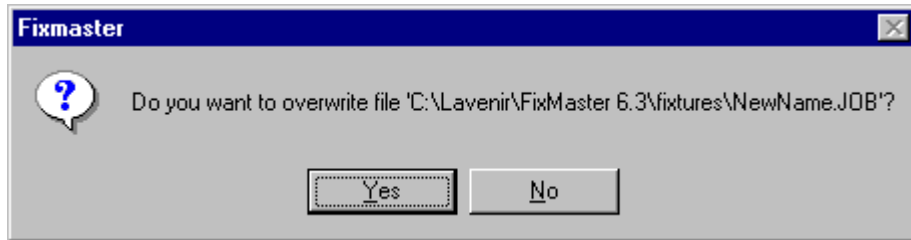
Save File Prompt

2. Click **OK**.

    Menu: *File-Save*

    Button:

    Key: *Ctrl+S*

Importing PCB Files into the Job

The program imports several formats of PCB data, including several netlist formats and supplemental Gerber files.

Importing IPC-D-356 Formatted Netlist Files into the Job

ProbeMaster 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 *Converting Netlist Files to Lavenir Format* on page 148.

To Import IPC-D-356 Formatted Netlist Files into the Job:

1. On the **File** 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.
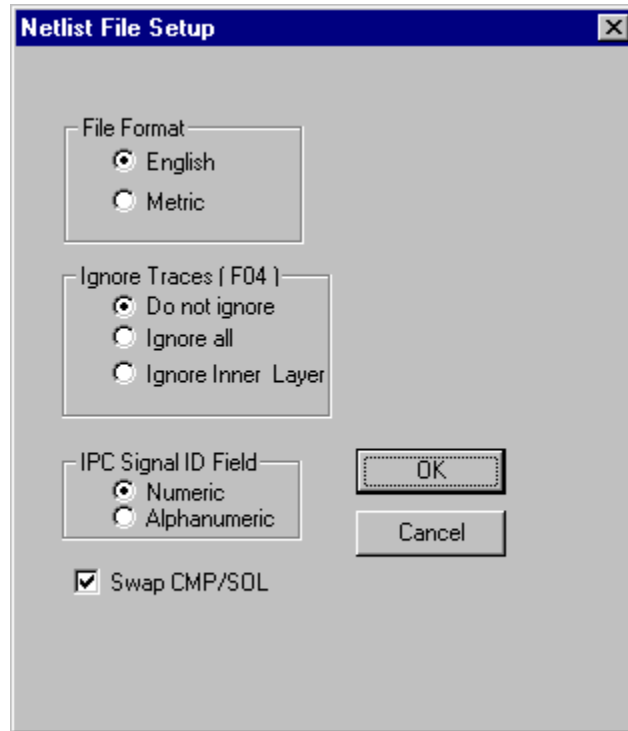
Netlist File Setup Dialog

6. Select whether the incoming data is in **English** or **Metric** units.

7. 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.

8. Select whether the incoming data has **Numeric** or **Alphanumeric** IPC Signal ID.

9. Select whether to swap the component-side and solder-side data.

    - Clicking this option so that there is a **checkmark** means ProbeMaster **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 sides are switched.

    - Clicking this option so that there is **no checkmark** means ProbeMaster **does not** swap the data. The sides are read in as is.

10. Click **OK**.

    ProbeMaster imports the netlist file, orients the data as you specified, and displays the data on the screen.

    Menu: *File-Import Netlist*
    Button: *None*
    Key: *None*

Converting 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 **Action** Menu, click **Convert Netlist File**.
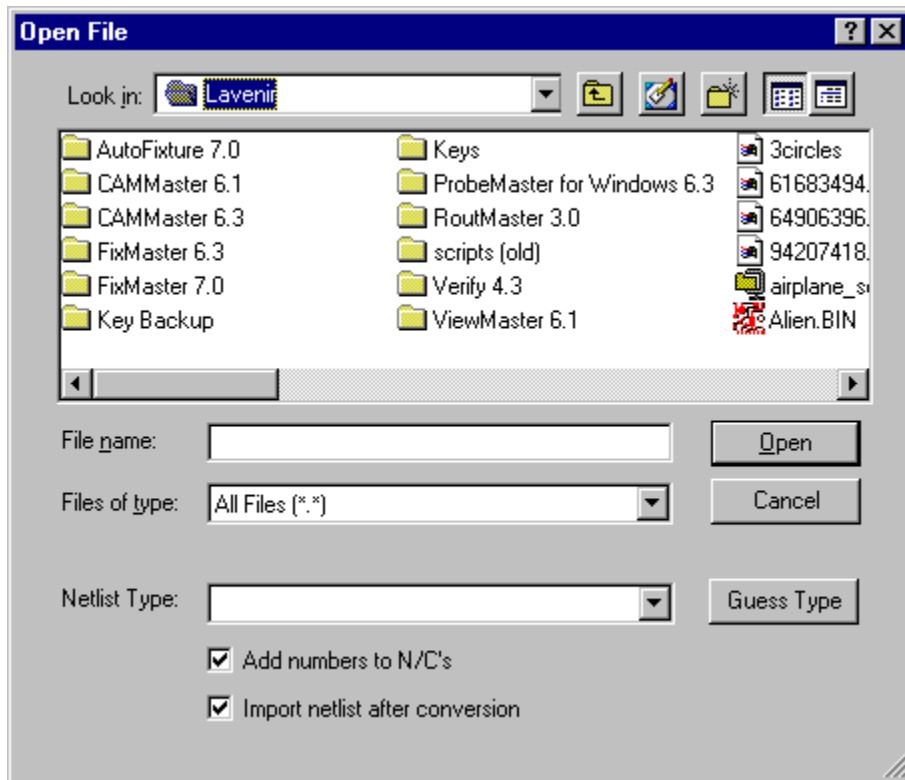
Convert Netlist Dialog

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**.

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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**.

   Menu: *Action-Convert Netlist File*

   Button: *None*

   Key: *None*

Importing Supplemental Gerber Files into the Job

ProbeMaster can import 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 that 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.

To Import Supplemental Gerber Files into the Job:

1. On the **File** Menu, click **Import-Misc Gerber**.
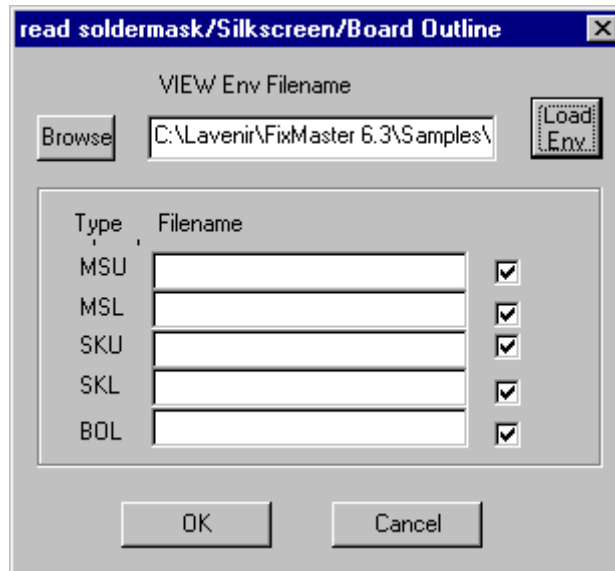
Import Supplemental Gerber Dialog

2. Click the **Browse** button.
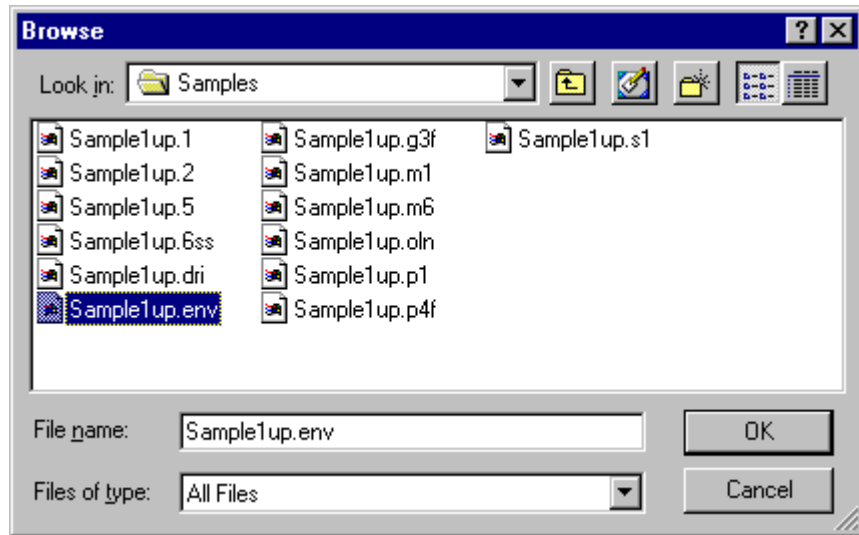
Browse for .ENV File

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.

   ProbeMaster 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 has no checkmark.

9. Click **OK**.

   ProbeMaster imports the supplemental Gerber files.

   Menu: *File-Import Misc Gerber*

   Button: None

   Key: *None*

Exporting Tester Download Files

Export options vary depending on what type of tester is selected.

Exporting MicroCraft MP-440 and Emma Test Files

To Export MicroCraft MP-440 and Emma Test Files:

1. On the **File** menu, click **Export-Test**.

2. ProbeMaster displays the **Output Test Files** dialog for MicroCraft MP-440 and Emma test files.
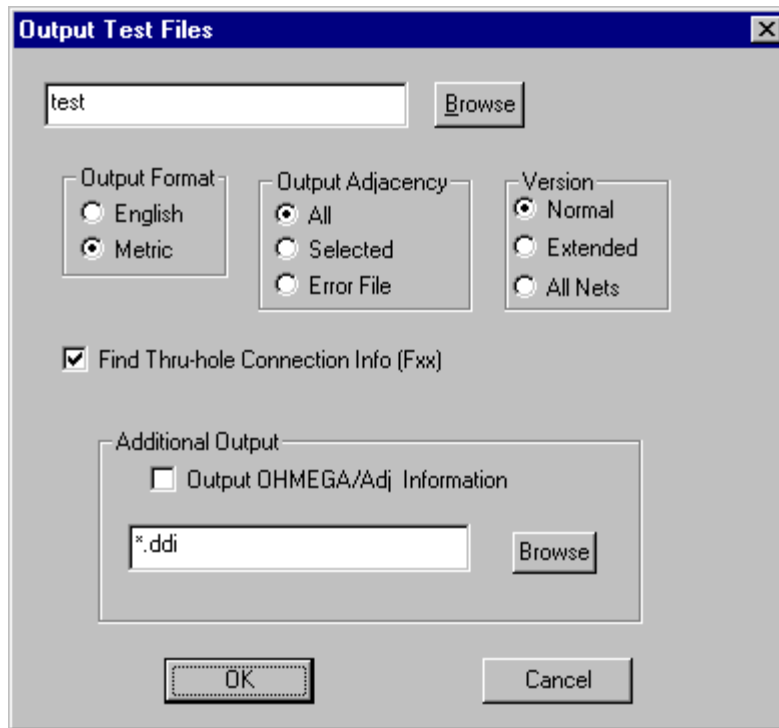
Export MP440 Test File

3. Click the **Browse** button.

4. In the **Browse** dialog, browse for the **file location** to which you want to export the file.

5. In the **File Name** field, enter the **name of the file** you want to export.

6. On the **Browse** dialog, click **OK**.

7. In the **Output Format** group box, select whether the exported data is to be in **English** or **Metric** units.

8. In the **Output Adjacency** group box, select what type of adjacency data to export.

    *   **All:** Outputs all adjacency data.

    *   **Selected:** Outputs adjacency for nets marked with the **Selective Nets** command. See *Marking Nets for Separate Export* on page 186.

    *   **Error File:** Exports a test file with no adjacency data.

9. In the **Version** group box, select what version of MP-440 or EMMA test file to export.

    *   **Normal:** This is the recommended version and is the version most commonly used.

    *   **Extended:** The extended version is the same as the normal version except that it also includes adjacency information.

    *   **All Nets:** This version is only for special uses. Instead of using the adjacency data calculated by the adjacency check, this option causes adjacency data to be exported in such a way that each net is considered to be adjacent to every other net.

10. In the **Find Thru-Hole Connection Info** checkbox, select whether to include information about the direction of traces that intersect through holes.

    *   If this option has a **checkmark**, ProbeMaster will include information about the direction of traces that intersect through holes.

    *   If this option has **no checkmark**, ProbeMaster will not include information about the direction of traces that intersect through holes. *This is the recommended option.*

    *Note: The **Thru-Hole Connection Info** option was used by earlier, less accurate machines, but it is not generally necessary for newer, more accurate machines.*

11. In the **Additional Output** group box, select whether to incorporate an external buried resistor file into the export file. In order for this to work, you must supply a buried resistor .DDI file for the loaded netlist.

    *   If you want to incorporate an external buried resistor file into the export file, then click the **Output OHMEGA/Adj Information** option so that it has a **checkmark**. Then click the **Browse** button and browse for the .DDI file that contains the buried resistor information for the loaded netlist. ProbeMaster will read the .DDI file, match it to the netlist information, and export the buried resistor information in the tester file.

    *   If you do not want to incorporate an external buried resistor file into the export file, then click the **Output OHMEGA/Adj Information** option so that it has **no checkmark**.

12. On the **Output Test Files** dialog, click **OK**.

    Menu: File-Export Test

    Button: None

    Key: None

Exporting Probot Test Files

To Export Probot Test Files:

1. On the **File** menu, click **Export-Test**.

2. ProbeMaster displays the **Output Test Files** dialog for Probot test files.

Export Probot Test File

3. Click the **Browse** button.

4. In the **Browse** dialog, browse for the **file location** to which you want to export the file.

5. In the **File Name** field, enter the **name of the file** you want to export.

6. On the **Browse** dialog, click **OK**.

7. In the **Output Format** group box, select whether the exported data is to be in **English** or **Metric** units.

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8. In the **Output Adjacency** group box, select what type of adjacency data to export.

    - **All:** Outputs all adjacency data.

    - **Selected:** Outputs adjacency for nets marked with the **Selective Nets** command. See *Marking Nets for Separate Export* on page 186.

    - **Error File:** Exports a test file with no adjacency data.

9. In the **Version** group box, select what version of Probot test file to export.

    - **Version 1:** Includes plane nets in adjacency file.

    - **Version 2:** Does not include plane nets in adjacency file.

10. On the **Output Test Files** dialog, click **OK**.

    Menu: *File-Export Test*
    Button: *None*
    Key: *None*

Exporting Hummingbird Test Files

To Export Hummingbird Test Files:

1. On the **File** menu, click **Export-Test**.

2. ProbeMaster displays the **Output Test Files** dialog for Hummingbird test files.

Export Hummingbird Test File

3. Click the **Browse** button.

4. In the **Browse** dialog, browse for the **file location** to which you want to export the file.

5. In the **File Name** field, enter the **name of the file** you want to export.

6. On the **Browse** dialog, click **OK**.

7. In the **Output Format** group box, select whether the exported data is to be in **English** or **Metric** units.

8. The Hummingbird export operation exports test points in an IPC format netlist that contains access flags indicating which side a hole should be accessed from. In the **Drill Access** group box, select which board side to use for the access flag in the file.

    -   **Both:** Indicates access from both sides.
    -   **CMP:** Indicates access from component side.
    -   **SOL:** Indicates access from solder side.

9. On the **Output Test Files** dialog, click **OK**.

    Menu: *File-Export Test*

    Button: *None*

    Key: *None*

Exporting AFT Test Files

To Export AFT Test Files:

1. On the **File** menu, click **Export-Test**.
2. ProbeMaster displays the **Output Test Files** dialog for AFT test files.
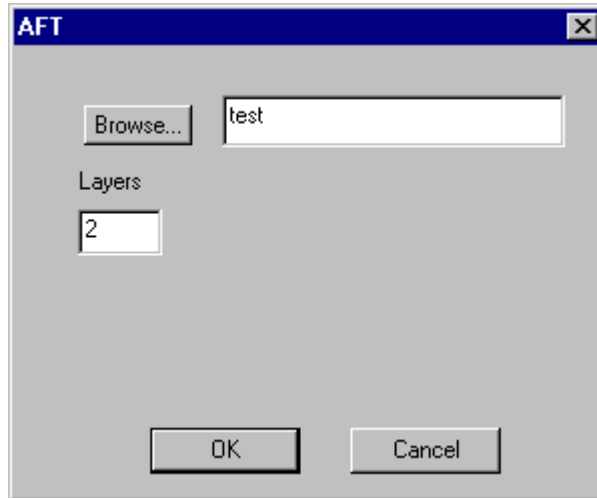
Export AFT Test File

3. Click the **Browse** button.
4. In the **Browse** dialog, browse for the **file location** to which you want to export the file.
5. In the **File Name** field, enter the **name of the file** you want to export.
6. On the **Browse** dialog, click **OK**.
7. In the **Layers** field, enter the number of layers in the PCB data.
8. On the **Output Test Files** dialog, click **OK**.

Menu: *File-Export Test*

Button: *None*

Key: *None*

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Exporting Probotech Test Files

To Export Probotech Test Files:

1. On the **File** menu, click **Export-Test**.

2. ProbeMaster displays the **Output Test Files** dialog for Probotech test files.
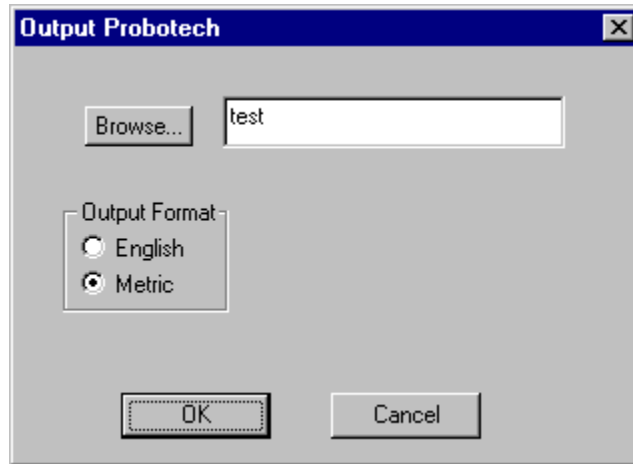
Export Probotech Test File

3. Click the **Browse** button.

4. In the **Browse** dialog, browse for the **file location** to which you want to export the file.

5. In the **File Name** field, enter the **name of the file** you want to export.

6. On the **Browse** dialog, click **OK**.

7. In the **Output Format** group box, select whether the exported data is to be in **English** or **Metric** units.

8. On the **Output Test Files** dialog, click **OK**.

Menu: File-Export Test

Button: None

Key: None

Exporting CAR Files

The **Export CAR** command exports a generic CAR (Computer Aided Repair) file for EPC workstations. The file will need to be processed by the EPC PreCAR software before being used on the workstation.

To Export CAR Files:

1. On the **File** menu, click **Export-CAR**.
2. In the **Browse** dialog, browse for the **file location** to which you want to export the CAR file.
3. In the **File Name** field, enter the **name of the file** you want to export.
4. On the **Browse** dialog, click **OK**.

Menu: *File-Export CAR*
Button: *None*
Key: *None*

Exporting IPC356A Files

ProbeMaster can export a subset of IPC356A.

To Export IPC356A:

1. On the **File** menu, click **Export-IPC356A**.
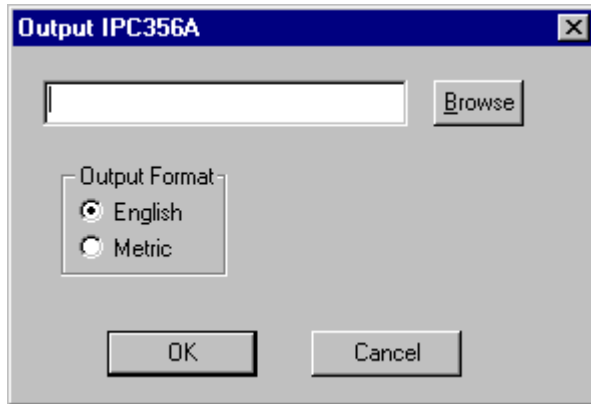
Export IPC356A

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 **Output Format** group box, select whether the exported data is to be in **English** or **Metric** units.
6. On the **Export IPC356A** dialog, click **OK**.

Menu: *File-Export IPC356A*

Button: *None*

Key: *None*

Chapter 16
Editing PCB Data

ProbeMaster 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 ProbeMaster.

ProbeMaster also has commands for changing the position of the entire PCB design. Those commands are discussed in *Positioning the PCB* on page 51.

Inserting Pads

You can insert a pad into the loaded PCB database. Because the pad that is inserted has the same D Code and Net Number as the pad selected as the "model," you may need to transcode the D Code or the Net Number of the inserted pad. See *Transcoding Net Numbers* on page 165 and *Transcoding D Codes* on page 171.

To Insert a Pad:

1. On the **Edit** menu, click **PCB Data-Insert Pad**.

    The **Insert Pad** tool is selected, and ProbeMaster 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

Deleting 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**.

   ProbeMaster prompts whether you want to delete all pads inside the Frame.

3. Click **OK**.

   Menu: *Edit-PCB Data-Delete Pad*

   Button: *then*

   Key: *None*

Transcoding 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.

Note: *This command can be useful if you have inserted a pad. See **Inserting Pads** on page 163. Because the pad that is inserted has the same Net Number as the pad selected as the "model," you may need to transcode the Net Number of the inserted pad.*

To Transcode the Net Number of a Single Element:

1. On the **Edit** menu, click **PCB Data-Transcode-Trans Netcode**.
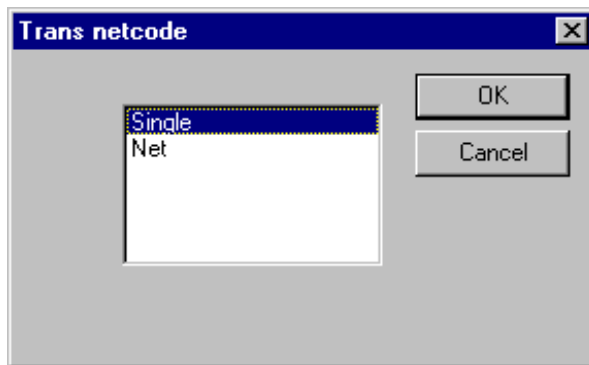
Transcode Net Number of Single Element

2. On the **Trans Netcode** dialog, select **Single** and click **OK**.

    The **Transcode Net Number** tool is selected, and ProbeMaster 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**.
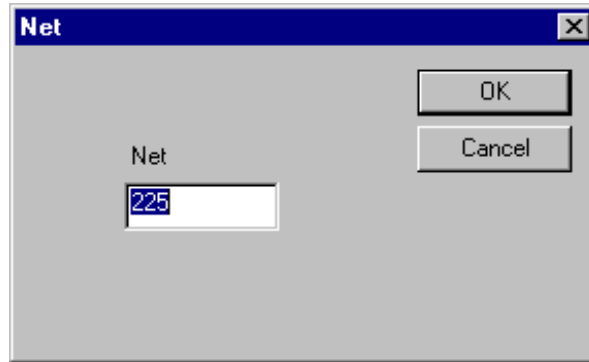
New Net Number

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**.
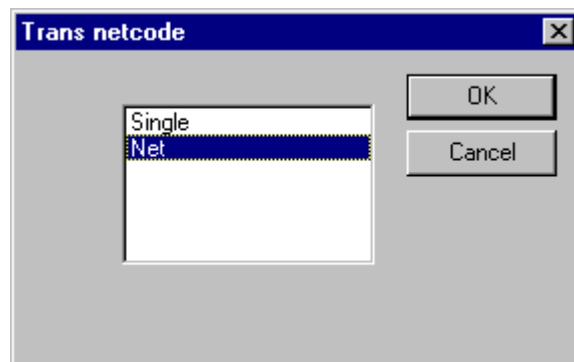
Transcode Net Number of Entire Net

2. On the **Trans Netcode** dialog, select **Net**, and click **OK**.

   The **Transcode Net Number** tool is selected, and ProbeMaster 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.

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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 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

Transcoding 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 *Mapping D Codes to Probe Codes* on page 65. 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**.
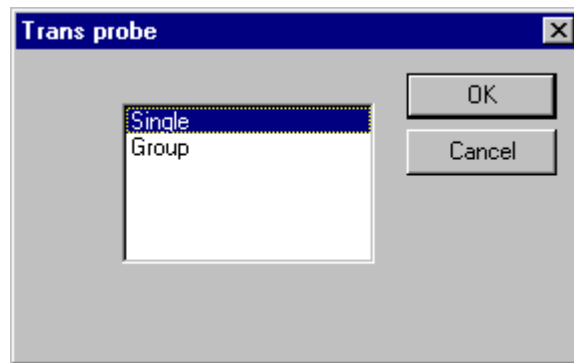
Transcode Single Probe

2. On the **Trans Probe** dialog, select **Single** and click **OK**.

    The **Transcode Probe Code** tool is selected, and ProbeMaster 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**.
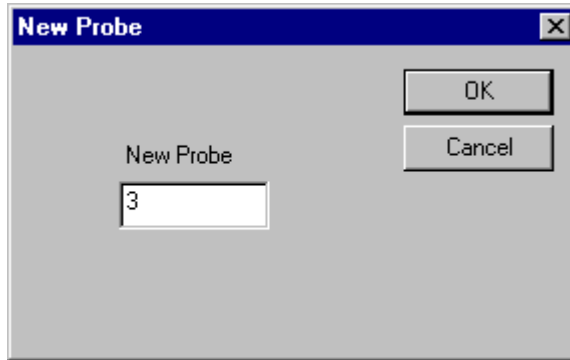
New Probe Code

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**.
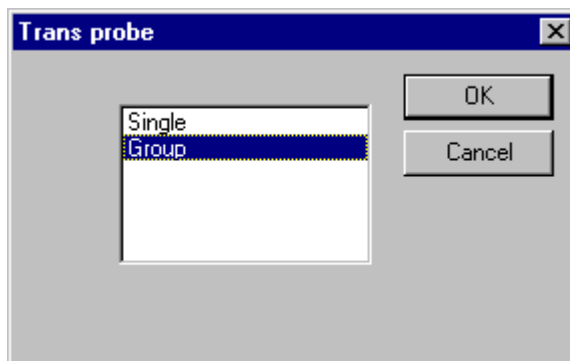
Transcode a Group of Probes

3. On the **Trans Probe** dialog, select **Group** and click **OK**.

    The **Transcode Probe Code** tool is selected, and ProbeMaster prompts you to select an element.

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4. Position the cursor near a pad that has the Probe Code you want to change.

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**.
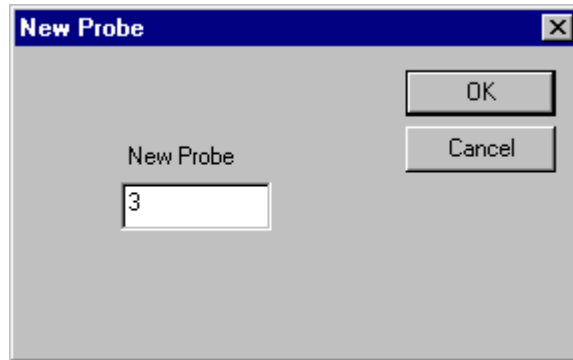
New Probe Code

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

Transcoding 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.

Note: *This command can be useful if you have inserted a pad. See **Inserting Pads** on page 163. Because the pad that is inserted has the same D Code as the pad selected as the "model," you may need to transcode the D Code of the inserted pad.*

To Transcode the D Code of a Single Pad:

1. On the **Edit** menu, click **PCB Data-Transcode-D Code**.
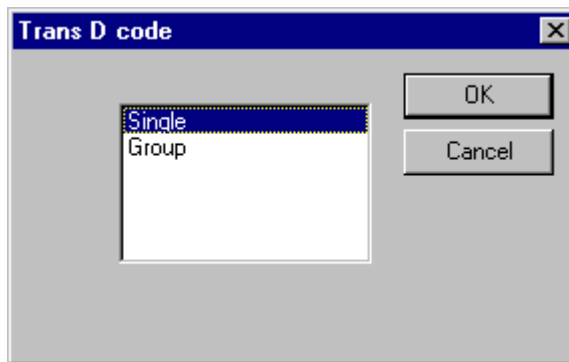
Transcode D Code of a Single Pad

2. On the **Trans D Code** dialog, select **Single** and click **OK**.

    The **Transcode D Code** tool is selected, and ProbeMaster 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**.
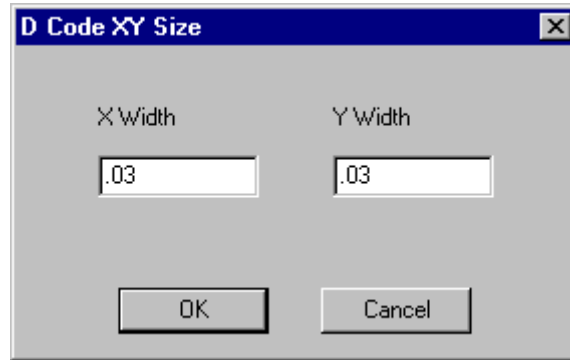
New D Code Size

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**.
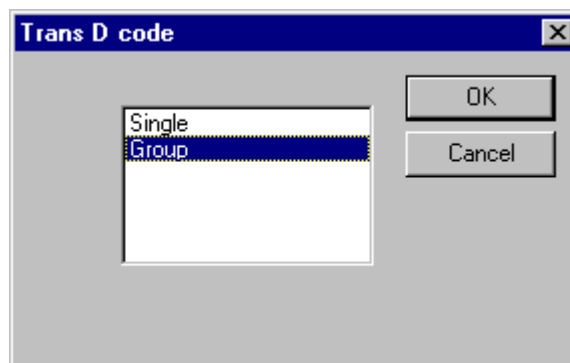
Transcode D Code of a Group of Pads

3. On the **Trans D Code** dialog, select **Group** and click **OK**.

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The **Transcode D Code** tool is selected, and ProbeMaster 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**.
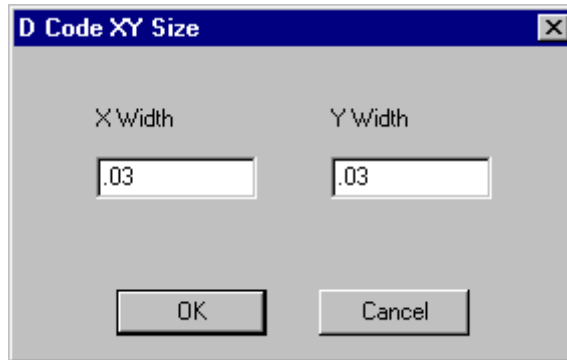
New D Code Size

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

Removing Padstacks

ProbeMaster 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 collision errors. For more about collision errors, see *Checking for Collision Errors* on page 105.

To Remove Padstacks:

➢ On the **Action** menu, click **Remove Padstacks**.

Chapter 17
Printing in ProbeMaster

ProbeMaster can print the data displayed in the Viewing Area. You can preview the print job before printing, and you can set up the paper size and orientation.

Printing the Contents of the Viewing Area

To Print the Contents of the Viewing Area:

1. Adjust the view of the data so that what you want to print is shown in the viewing area. You can set the **zoom level** and the **visibility settings** to control what is printed.

2. On the **File** menu, click **Print**.
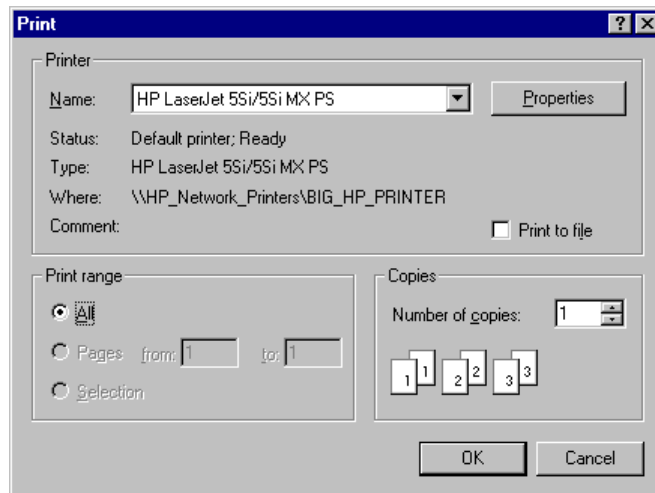
Print Dialog

3. In the **Printer** group box, you can set **options specific to your printer**.

4. In the **Print Range** group box, the only available option is **All**. What is shown in the viewing area will be printed on one page.

5. In the **Copies** group box, select how many **copies** to print.

6. Click **OK**.

Menu: *File-Print*

Button: 🖨

Key: *Ctrl+P*

Previewing a Print Job

To Preview a Print Job:

1. Adjust the view of the data so that what you want to print is shown in the viewing area. You can set the **zoom level** and the **visibility settings** to control what is printed.

2. On the **File** menu, click **Print Preview**.
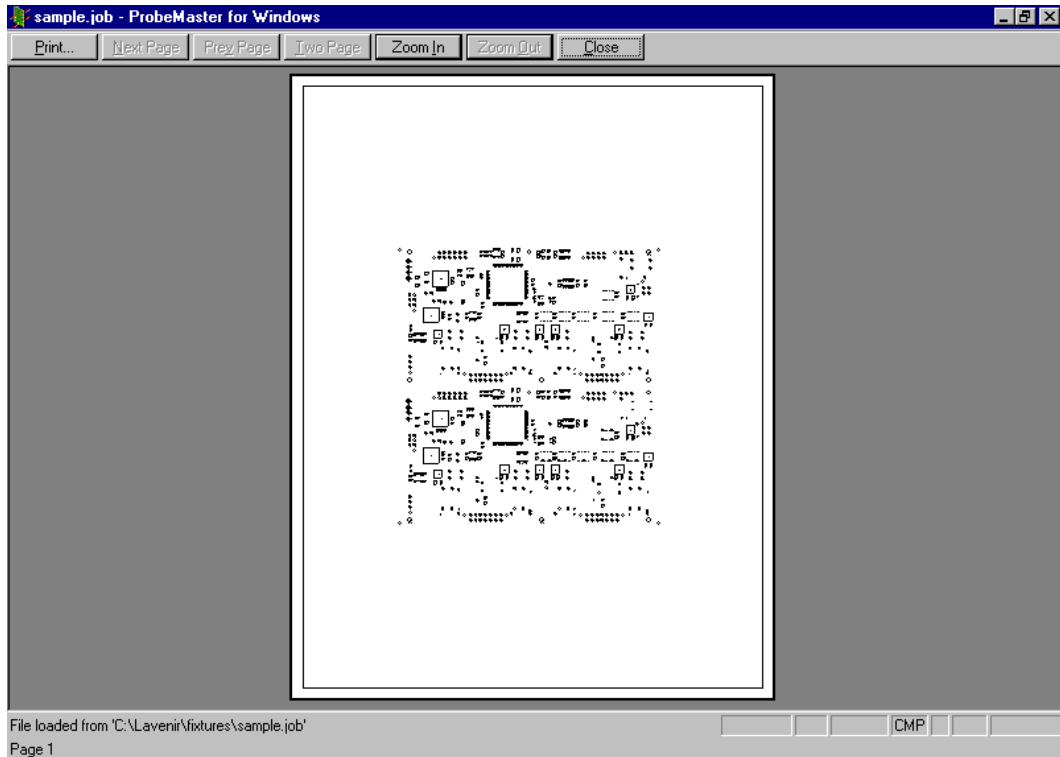
Print Preview

3. If the **Print Preview** does not show what you want to print, click the **Close** button and readjust the view and/or the Print Setup. See *Setting up Paper Size and Orientation* on page 178.
    If the **Print Preview** shows what you want to print, click the **Print** button.
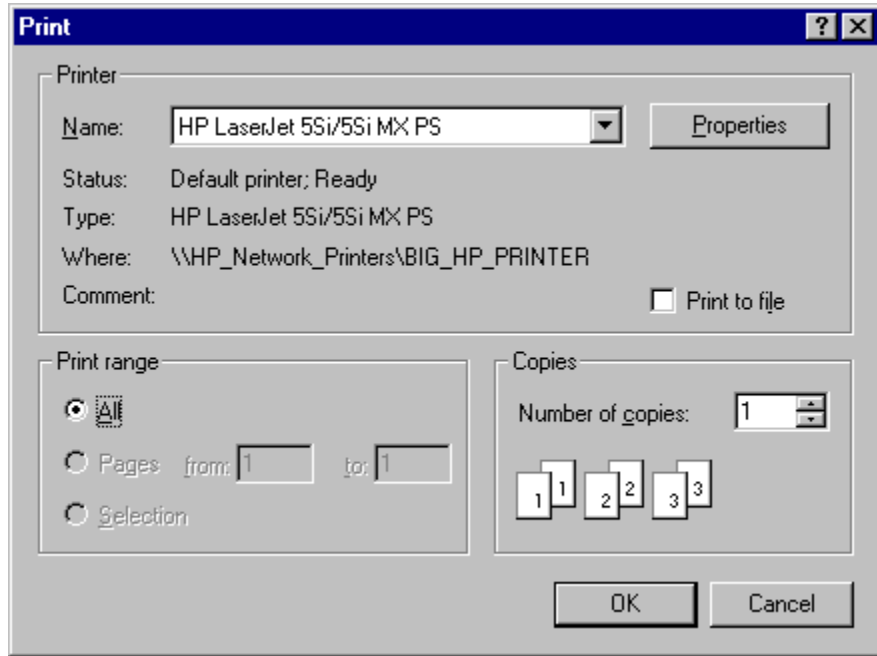
Print Dialog

4. In the **Printer** group box, you can set **options specific to your printer**.
5. In the **Print Range** group box, the only available option is **All**. What is shown in the viewing area will be printed on one page.
6. In the **Copies** group box, select how many **copies** to print.
7. Click **OK**.

    Menu: File-Print Preview
    Button: None
    Key: None

Setting up Paper Size and Orientation

To Set up Paper Size and Orientation:

1. On the **File** menu, click **Print Setup**.
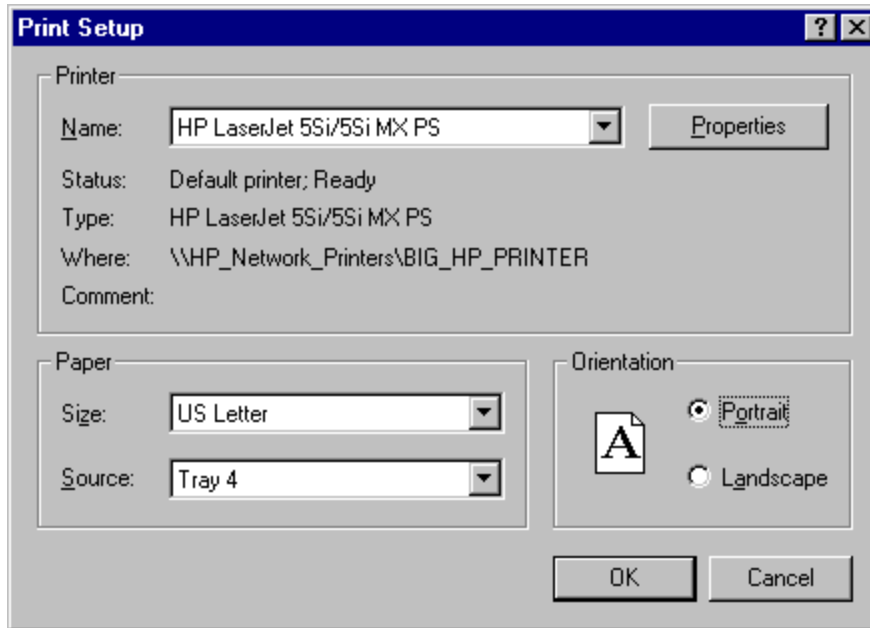
Print Setup Dialog

2. In the **Printer** group box, you can set **options specific to your printer**.
3. In the **Paper** group box, select the **paper size** and **source** to use from those available on your printer.
4. In the **Orientation** group box select either **Portrait** or **Landscape**.
5. Click **OK**.

   Menu: File-Print Setup
   Button: None
   Key: None

Chapter 18
Automatic Job Processing Features

The ProbeMaster/FixMaster product family has several features for automating the processing of jobs.

The AutoGen feature is an automatic processing feature within ProbeMaster (and also in FixMaster) that automatically removes padstacks, generates test points, staggers test points, step and repeats the PCB data, tags fiducials, exports the test files, and saves the new .JOB file. With AutoGen, you manually load the boilerplate .JOB file, import the netlist data and start AutoGen, and if AutoGen runs into a problem during the processing, you can intervene to fix it.

AutoFixture is the other automation feature and it is different from AutoGen. 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.

AutoGen is discussed in depth in this chapter, while AutoFixture is summarized here and discussed in depth in the *Automatic Job Processing Features* chapter of the *FixMaster User's Guide*. For the summary description of AutoFixture, see *AutoFixture Summary* on page 182.

AutoGen

Once you have mastered the procedures for preparing jobs in ProbeMaster, you may be ready to automate standard jobs using the ProbeMaster 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 ProbeMaster could become as simple as loading a boilerplate .JOB file, import the new PCB data for the new job, mapping D Codes to probes for the new job, checking the AutoGen setup options, and clicking **OK**. AutoGen automatically removes padstacks, generates test points, staggers test points, step and repeats the PCB data, tags fiducials, exports the test files, and saves the new .JOB file. If AutoGen runs into a problem during the processing, you can intervene to fix it.

To Process a Job Using AutoGen:

1. **Open a boilerplate .JOB file**. See *Opening a ProbeMaster Job File* on page 139.
2. **Import the PCB data**. See *Importing PCB Files into the Job* on page 145.
3. **Map the D Codes to Probes** by going to the **Action** menu and clicking **D Code to Probe Map**. See *Mapping D Codes to Probe Codes* on page 65.
4. On the **Action** menu click **AutoGen**.

   ProbeMaster displays the **AutoGen Automated Features** dialog. You can activate each operation on the dialog by clicking the option so that it has a **checkmark**.
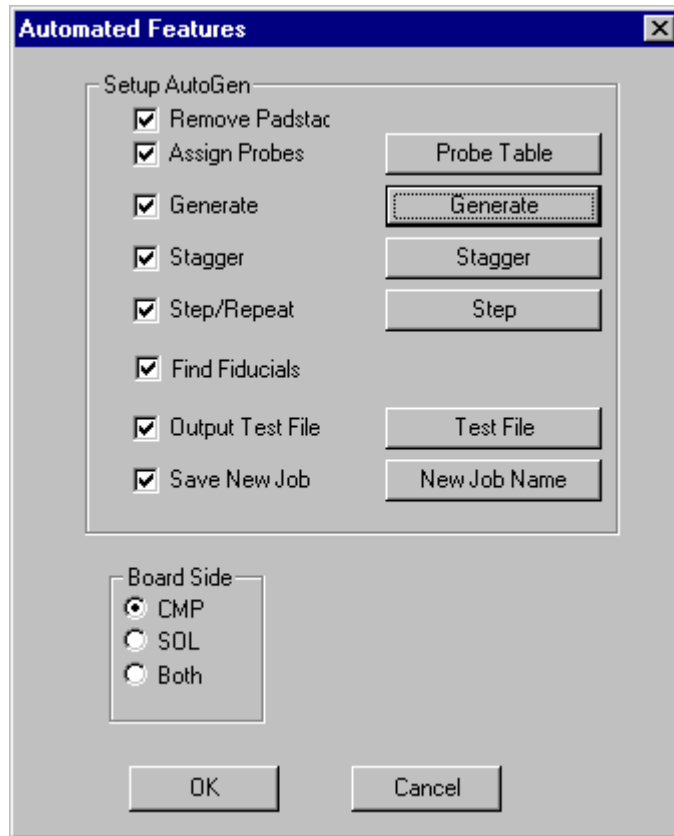
AutoGen Automated Features Dialog

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 ProbeMaster to automatically remove padstacks, click the **Remove Padstacks** option so that it has a **checkmark**. For information on removing padstacks, see *Removing Padstacks* on page 174.

6. The **Assign Probes** function is disabled in ProbeMaster, so do not check this option.

7. If you want ProbeMaster 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 *Setting up Test Point Generation Options* on page 73.

8. If you want ProbeMaster to automatically **stagger test points**:

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- 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 *Staggering Test Points* on page 93.

9. If you want ProbeMaster 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 *Stepping and Repeating the PCB* on page 55.

10. If you want ProbeMaster to automatically **tag fiducials**, click the **Find Fiducials** option so that it has a **checkmark**.

11. If you want ProbeMaster to automatically **export the test files**:

- Click the **Output Test File** option so that it has a **checkmark**.
- Click the **Test File** button.
- On the **Output Test Files** dialog, make sure the settings are what you want. See *Exporting Tester Download Files* on page 152.

12. If you want ProbeMaster 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.

13. In the **Layer** field, select the PCB side that you want processed by AutoGen, **Component** only, **Solder** only or **Both**.

14. Click **OK**.

ProbeMaster begins to process the job using the settings you specified. If the program encounters a problem (such as collision errors or a bad file name) it stops and prompts for input.

Menu: *Action-AutoGen*

Button:

Key: *None*

AutoFixture Summary

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. 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 has the capability of splitting out nets to another fixture or to a moving probe tester. Or it can save a .JOB file to be completed by you later. When finished with one job, AutoFixture moves on to the next netlist or .JOB file. 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. While AutoFixture is primarily a fixturing product, it does also have the capability of splitting nets for testing on moving probe testers and processing those split nets to completion. For more information on AutoFixture, see *AutoFixture "Lights Out" Processing* in the *FixMaster User's Guide*.

Chapter 19
Special Processing

There are some features in ProbeMaster which provide special processing unique to the needs of certain types of testers or certain test methods.

Renumbering Nets with Unique Net Numbers

The **Renumber Nets** command gives new net numbers to all nets in the loaded netlist database. This command is usually used to give unique net numbers to non-connected points. Non-connected points often are designated by an N/C rather than a net number, or they may all have the net number 0. Some systems (such as Probot) want all nets, including non-connected points, to have unique net number, and the **Renumber Nets** command is what you use to give those non-connected points a unique net number.

To Renumber Nets:

➢ On the **Action** menu, click **Renumber Nets**.

All nets are renumbered and given unique net numbers.

Menu: *Action-Renumber Nets*

Button: *None*

Key: *None*

Soft Landing for MicroCraft Testers

MicroCraft testers support a feature called "soft landing" in which the tester's probes contact pads with less force than usual. The feature is designed to prevent small pads from being damaged by the probes. The ProbeMaster **Soft Landing** feature allows you to set a size range within which pads will be tagged as soft landing pads. The soft landing tags are included in the MicroCraft test files and the MicroCraft testers can be set to probe those pads with less force. Once pads have been tagged as soft landing pads, you can highlight them for inspection. For more information about highlighting soft landing pads, see *Highlighting Soft Landing Pads* on page 27.

To Set up the Soft Landing Size Range:

1. On the **Setup** menu, click **Soft Landing**.
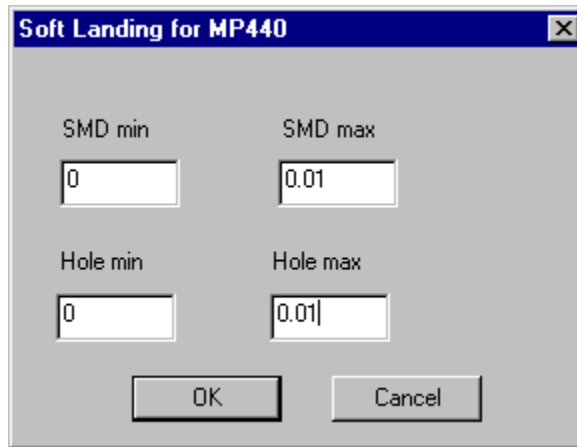
Soft Landing Dialog

2. In the **SMD Min** and **Max** fields, enter the minimum and maximum size range you want to use for tagging surface mount pads as soft landing pads.

3. In the **Hole Min** and **Max** fields, enter the minimum and maximum size range you want to use for tagging through hole pads as soft landing pads.

4. Click **OK**.

Menu: *Setup-Soft Landing*

Button: *None*

Key: *None*

SMD Both Command

The **SMD Both** command is generally used when you are doing combination testing with a moving probe tester and a single-sided universal tester. In this type of testing, nets that have all surface mount endpoints on one side of the board can be tested on the universal tester. And the only nets that need to be tested on the moving probe are those that have surface mount endpoints on both sides of the board. This command assures that nets with surface mount endpoints on both sides of the board have test points on all surface mount endpoints. And the command can also be used to eliminate all other test points.

To Use the SMD Both Command:

1. On the **Action** menu, click **SMD Both**.
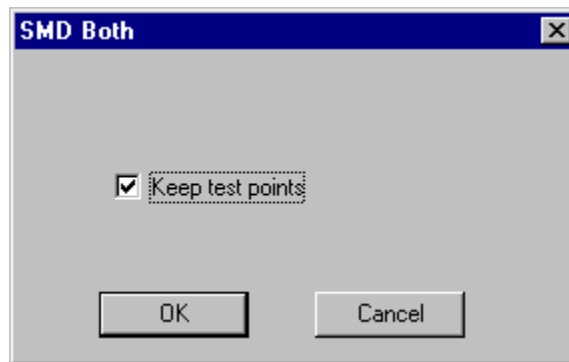
SMD Both Dialog

2. On the **SMD Both** dialog, select whether to keep existing test points or to eliminate test points that are not surface mount endpoints for nets with surface mount endpoints on both sides of the board.

   - If **Keep Test Points** has a **checkmark**, then all **existing test points will be left alone** as ProbeMaster adds test points to surface mount endpoints for nets with surface mount endpoints on both sides of the board.

   - If **Keep Test Points** has **no checkmark**, then ProbeMaster will add test points to surface mount endpoints for nets with surface mount endpoints on both sides of the board. And ProbeMaster **will eliminate all other test points**.

3. Click **OK**.

   Menu: *Action-SMD Both*
   Button: *None*
   Key: *None*

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Marking Nets for Separate Export

The **Selective Nets** command allows you to mark special nets and export test files for those nets separate from the rest of the loaded PCB data. For instance you could use **Selective Nets** to mark and test a ground plane. ProbeMaster also has a highlighting command that allows you to highlight all the nets that have been marked with the **Selective Nets** command. For more information on highlighting marked nets, see *Highlighting Nets Marked with the Selective Nets Command* on page 27. For information on exporting test files for the nets marked with the **Selective Nets** command, see *Exporting Tester Download Files* on page 152.

To Mark a Single Net:

1. On the **Action** menu, click **Selective Netlist-Mark-Single**.

   ProbeMaster prompts you to select an element.

2. **Click on an element** in the net that you want to mark.

   The cursor hops to the selected element, and the net is highlighted in magenta to indicate that it has been marked.

   The **Net-Marking** tool remains selected until you select another tool or press the **Escape** key, so you can mark one net after another by clicking on new elements.

   Menu: *Action-Selective Netlist-Mark-Single*

   Button: *None*

   Key: *None*

To Mark a Group of Nets:

1. On the **Action** menu, click **Selective Netlist-Mark-Group**.

   ProbeMaster prompts you to draw a frame.

2. **Click and drag** the mouse across elements in the nets that you want to mark so that you draw a frame around those elements. Then release the mouse.

3. If the frame is positioned correctly, click the mouse or press **Enter**.

   All nets with elements inside the frame are highlighted in magenta to indicate that they have been marked.

   The **Net-Marking** tool remains selected until you select another tool or press the **Escape** key, so you can mark one group of nets after another by drawing more frames.

   Menu: *Action-Selective Netlist-Mark-Group*

   Button: *None*

   Key: *None*

To Unmark a Single Net:

1. On the **Action** menu, click **Selective Netlist-Unmark-Single**.

   ProbeMaster prompts you to select an element.

2. **Click on an element** in a net that has already been and that you want to unmark.

   The cursor hops to the selected element, and the magenta highlighting is removed from the net to indicate that it is no longer marked.

   The **Net-Unmarking** tool remains selected until you select another tool or press the **Escape** key, so you can unmark one net after another by clicking on new elements.

   Menu: *Action-Selective Netlist-Unmark-Single*

   Button: *None*

   Key: *None*

To Unmark a Group of Nets:

1. On the **Action** menu, click **Selective Netlist-Unmark-Group**.

   ProbeMaster prompts you to draw a frame.

2. **Click and drag** the mouse across elements in the marked nets that you want to unmark so that you draw a frame around those elements. Then release the mouse.

3. If the frame is positioned correctly, click the mouse or press **Enter**.

   The magenta highlighting is removed from all nets with elements inside the frame to indicate that they are now unmarked.

   The **Net-Unmarking** tool remains selected until you select another tool or press the **Escape** key, so you can unmark one group of nets after another by drawing more frames.

   Menu: *Action-Selective Netlist-Unmark-Group*

   Button: *None*

   Key: *None*

Chapter 20
Key Commands Summary

In ProbeMaster, 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 ProbeMaster Job	Ctrl+N
Open a ProbeMaster Job	Ctrl+O
Save a ProbeMaster 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 Traces (Dialog)	T
Display Traces (Toggle)	Shift+T
Display Silkscreen Data	K
Display Board Outline Data	O
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
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
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
Insert Reference Frame Around All Data	Ctrl+W

Mapping D Codes to Probes

Map D Codes to Probe	F5

Inserting Test Points

Insert Single Test Point	Shift+I

Staggering 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

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

Editing PCB Data

Insert Pad	Ctrl+Shift+P
Transcode Net Numbers	Ctrl+Shift+T
Transcode D Codes	Ctrl+T

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