

# Job Matrix User Guide

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# Chapter 1

## Job Matrix


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The designation of layer types such as drill, signal or silk screen, enables Valor NPI to perform analyses appropriate to the layer type. The Job Matrix defines layer construction, layer types and subtypes, polarity, drill intersection with board layers (for drilled via holes), and sub-panel nesting.

For example, when a silk screen check is run, NPI picks the correct layer, based on the layer classification, reads the appropriate test limit file and then performs the relevant tests.

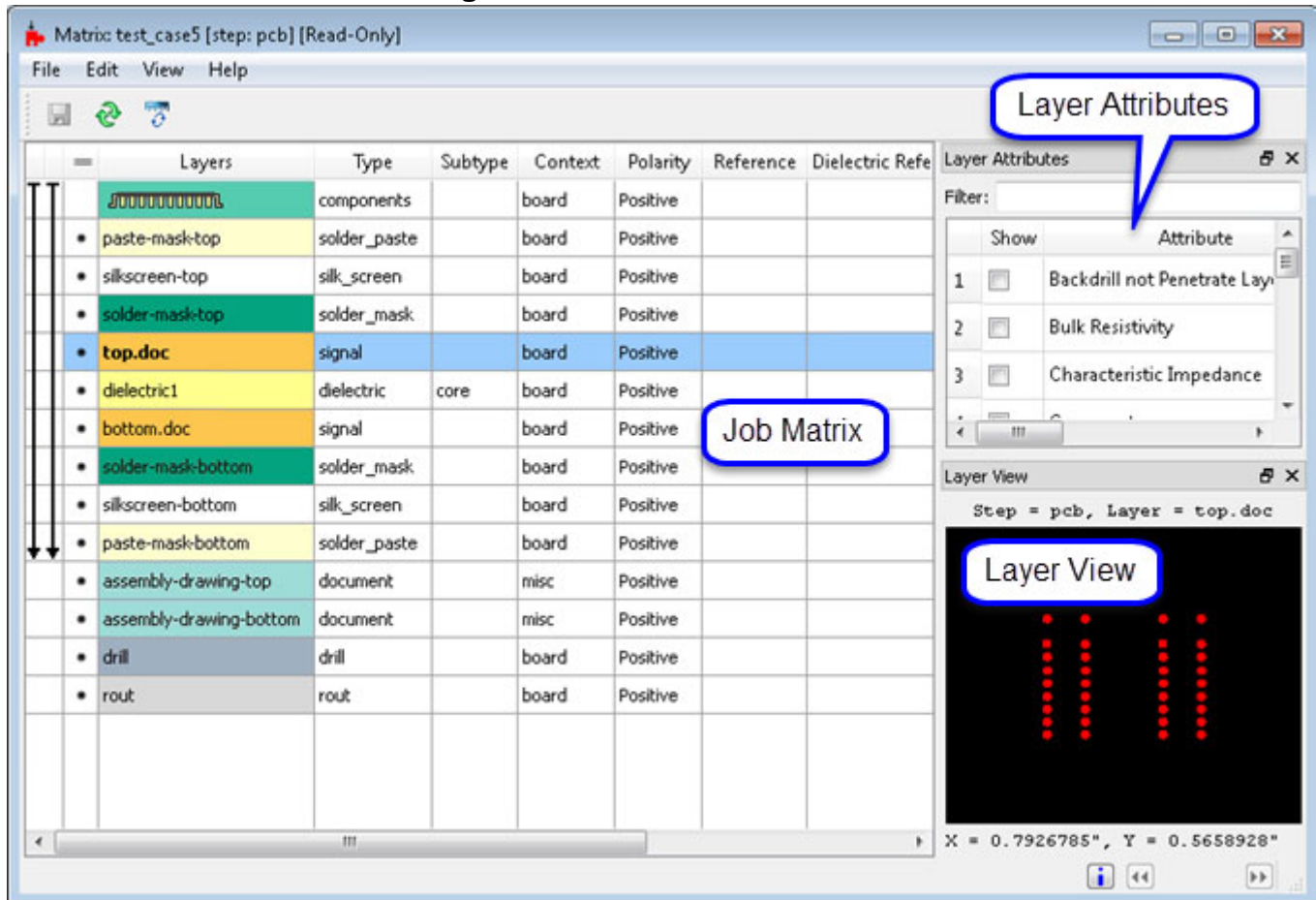
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## Read-Only Job Matrix Interface


To access: Click the **Matrix** button  on your viewer toolbar.

Use the Job Matrix interface to view the layers, their types and attributes, drill spans, and route spans. You can customize the interface by moving the windows and toggling their display. The appearance settings are remembered for future Job Matrix sessions.

**Figure 1-1. Job Matrix Interface**




## Objects


Object	Description
Job Matrix	<p>The Job Matrix contains a row for each layer in the step of the product model. Layer color reflects layer type. The positioning of the layers reflects the layer stackup.</p> <p>If HDI technology layers are present in EDA data, they are displayed above or below the relevant top or bottom component layers. They cannot be edited.</p>  <p>The Job Matrix columns represent the following:</p> <ul style="list-style-type: none"> <li>• <a href="#">Layer Parameters</a> — The basic layer characteristics.</li> <li>• <a href="#">Layer Attributes in the Job Matrix</a> — Layer properties that add intelligence to the product model data.</li> <li>• Drill or rout spans — The left-most column displays a representation of drill and rout spans, with the arrows indicating the drill direction. There is a span bar for each drill and rout layer.</li> </ul> <p>The span bars appear as solid lines, except for the layers with the subtype “backdrill” whose span bars appear as dotted lines.</p> <p>See “<a href="#">Using the Read-Only Job Matrix</a>” on page 7.</p>
Layer Attributes	<p>Lists the layer attributes and their values as described in “<a href="#">Layer Attributes in the Job Matrix</a>” on page 15.</p> <p>See “<a href="#">Controlling the Display of Layer Attribute Columns</a>” on page 8.</p>
Layer View	<p>Displays a thumbnail graphic of the layer selected in the Job Matrix. See “<a href="#">Viewing Layers in the Job Matrix</a>” on page 8.</p>



## Using the Read-Only Job Matrix

You can view the Job Matrix for each step in the product model. You can configure the matrix columns.

### Procedure

1. Click the **Matrix** button  on your viewer toolbar to open the Job Matrix window.
2. Use the appropriate options:

If you want to...	Do the following:
View the Job Matrix for a specific step.	Choose <b>File &gt; Steps</b> and select the step to be displayed.
Switch between metric and imperial units.	Click <b>Toggle Units</b>  on the toolbar.

If you want to...	Do the following:
Select layers.	Click the dot next to the layer name or press Ctrl and click multiple dots to select multiple layers. Selected layers are highlighted.
View a layer.	See “ <a href="#">Viewing Layers in the Job Matrix</a> ” on page 8.
Refresh the screen display.	Click <b>Refresh</b>  on the toolbar.
Rearrange the matrix columns.	Click on a column header and drag it to the desired location.
Control the column display.	 <b>Note:</b> You cannot hide the columns that represent drill/rout spans and layer parameters. See “ <a href="#">Layer Parameters</a> ” on page 11. See “ <a href="#">Controlling the Display of Layer Attribute Columns</a> ” on page 8.

## Controlling the Display of Layer Attribute Columns

You can show or hide layer attribute columns in the Job Matrix.


### Prerequisites

The Job Matrix is opened.

### Procedure

1. If not already present, open the Layer Attributes window (**View > Layer Attributes**).
2. Using the check boxes, specify the layer attributes that you want to be included in the Job Matrix.

#### Tip

 Use the Filter at the top of the Layer Attributes window to restrict the display to the attributes containing a specific string in the name. The filter does not support wild cards.

### Results

The selected layer attributes appear as columns in the Job Matrix.

## Viewing Layers in the Job Matrix

You can view the graphic display of a layer selected in the Job Matrix. You can use key combinations to navigate and control the display in the Layer View window.



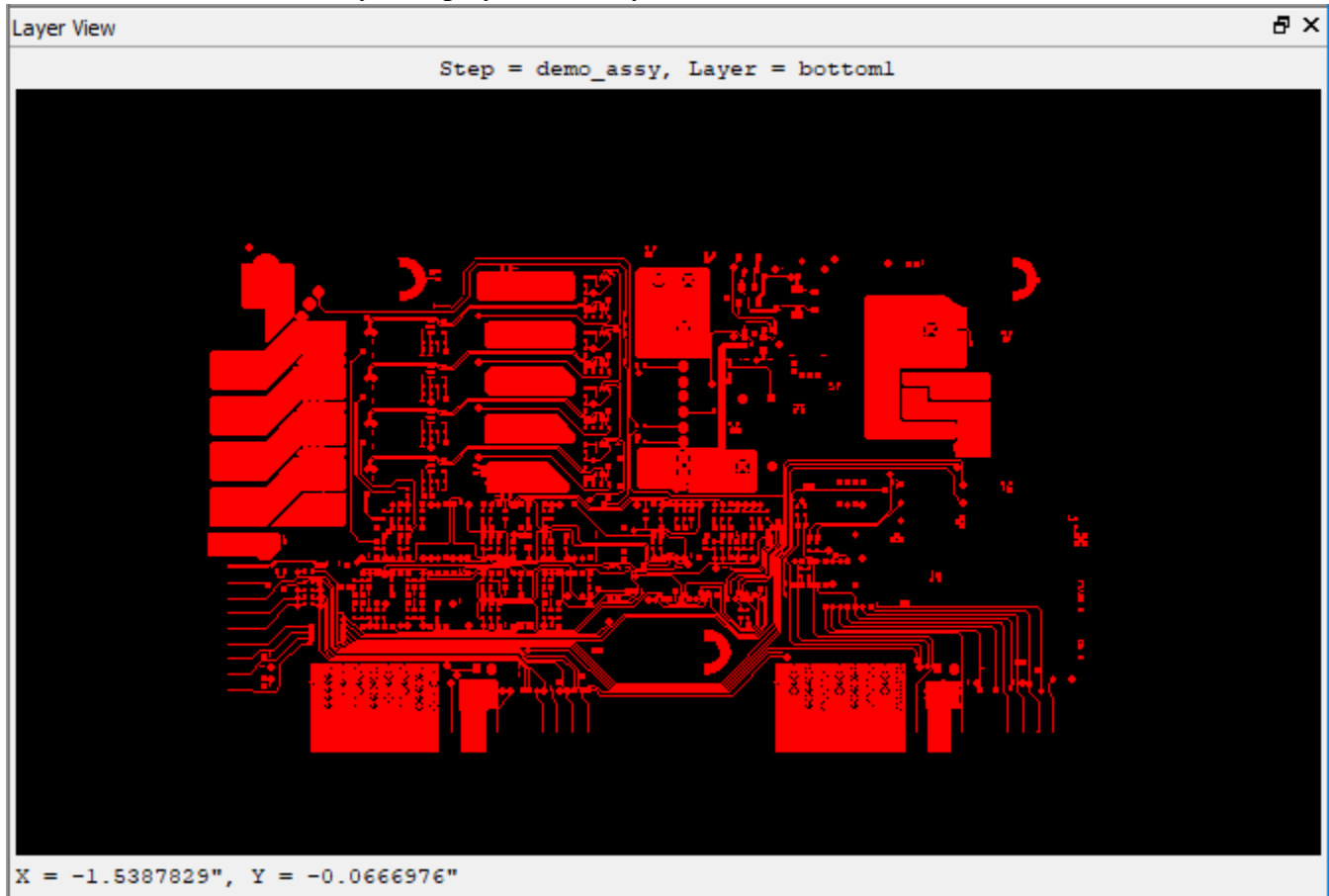
## Prerequisites

The Job Matrix is open.

## Procedure

1. If not already present, open the Layer View window (**View > Layer View**).
2. In the Job Matrix, click the dot next to the name of the layer that you want to view.

The selected layer displays in the Layer View window.



3. Use these key combinations and mouse options to navigate and control the display:

Key	Ctrl Combination	Mouse Option	Function
Home	Ctrl-H		Zoom home — display full layer up to limits
PgUp	Ctrl-I	Press the scroll button and drag the mouse to the right and down.	Zoom in — enlarge view by 90%

Key	Ctrl Combination	Mouse Option	Function
PgDn	Ctrl-O	Press the scroll button and drag the mouse to the left and up.	Zoom out — reduce view by 90%
	Ctrl-A		Zoom area — click one corner then opposite corner of rectangle to display.
	Ctrl-E		Pan center of display to cursor position
right_arrow	Ctrl-R		Pan right with 90% overlap
Shift-right_arrow	Ctrl-Shift-R		Pan right with 10% overlap
left_arrow	Ctrl-L		Pan left with 90% overlap
Shift-left_arrow	Ctrl-Shift-L		Pan left with 10% overlap
up_arrow	Ctrl-U		Pan up with 90% overlap
Shift-up_arrow	Ctrl-Shift-U		Pan up with 10% overlap
down_arrow	Ctrl-D		Pan down with 90% overlap
Shift-down_arrow	Ctrl-Shift-D		Pan down with 10% overlap

## Identification of Top and Bottom Sides of Single-sided Boards

Boards with only one copper layer are considered to be single-sided boards. These boards might have two component layers. Identifying the top and bottom sides of these boards depends on the relative order of the non-copper layer to the copper layer on the non-copper side and the copper layer side.

- Non-copper layer side — If the non-copper layer is above the copper layer, the side of the non-copper layer is Top. If the non-copper layer is below the copper layer, the side of the non-copper layer is Bottom.
- Copper layer side — The software checks for the existence of one of these layers in this order. Once it finds a layer above or below the copper layer, it determines that the copper layer is Top or Bottom: Solder mask layer, Solderpaste layer, Silkscreen layer, Component layer/s.

# Layer Parameters

In the Job Matrix, the layer parameter columns represent the basic layer characteristics: name, type, subtype, context, polarity, reference, and dielectric reference.

## Layers

Name of the layer selected in the matrix.

## Type

The type assigned to a layer is indicated by the color of the layer row in the matrix:

- signal
- power\_ground
- mixed
- solder\_mask
- silk\_screen
- solder\_paste
- drill
- rout
- document
- mask
- dielectric
- conductive\_paste

## Subtype

Layer subtype from the list of subtypes available for the assigned layer type. See “[Layer Subtypes](#)” on page 13.

## Context

Controls whether the layer is part of the physical board:

- **board** — Layers that are part of the physical board.
- **misc** — Any other layers, such as documentation and drill. These virtual layers contain information about the board, but they do not correspond to physical layers on the board.

## **Polarity**

Positive or negative layer polarity.

In negative copper layers, features represent laminate instead of copper.

## **Reference**

Layer being used as a reference layer for the selected layer. These are reference layers for non-copper feature layers such as solder mask, silk screen, or solder paste.

## **Dielectric Reference**

The position of the copper layer to which the dielectric layer relates: none, above, below, both.

Reference layers for dielectric layers are always copper layers.

## Layer Subtypes

Some layer types have subtypes that support specific cases such as drill representation, flex and flex rigid manufacturing, or embedded resistors and capacitors.

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## Standard Layer Subtypes

Standard layer subtypes available in the Job Matrix for various layer types.

### Subtypes to Support Backdrill and Dual Diameter Drill

These layer subtypes support the possible unique needs of drill representation in product models:

Layer Subtype	Base Layer Type	Description
BACKDRILL	DRILL	Represents a backdrill procedure where the plating within a hole is removed from the unused portion of the matrix using a drill hole slightly larger than the original. This removes the connection from one side of the PCB.
DUAL_DIAMETER	DRILL	Represents a condition prior to plating where a slightly larger hole is drilled part way through the matrix at the same location as an existing hole.

### Subtypes to Support Flex/Rigid Flex Manufacturing

These layer subtypes support the unique needs of Flex/Rigid Flex product models:

Layer Subtype	Base Layer Type	Description
AREA	DOCUMENT	Area definition.
BEND_AREA	MASK	For labeling areas on the PCB bent when the PCB is in use.
CARBON_MASK	CONDUCTIVE_PASTE	Defines the location where carbon ink is applied to copper layers.
COVERCOAT	SOLDER_MASK	Clearances of a covercoat layer.
COVERLAY	SOLDER_MASK	Clearances of a coverlay layer.
DRAWING	DOCUMENT	Drawing layer definition
IMMERSION_MASK	MASK	Defines which features are to be covered during immersion in the gold process.

Layer Subtype	Base Layer Type	Description
MIXED_FLEX	MIXED	Mixed copper layer—a layer containing both power/ground planes and regular signal pads or traces—on flex laminate. Used to distinguish from a Mixed copper layer on rigid laminate in a rigid-flex board.
OSP_MASK	MASK	Defines which features are to be covered with <b>OSP</b> finish.
PG_FLEX	POWER_GROUND	Power and ground (copper) layer on flex laminate. Used to distinguish from power and ground layer on rigid laminate in rigid-flex boards.
PLATING_MASK	MASK	Defines which features in the adjacent copper layer should be plated.
PSA	MASK	Shapes and locations where PSA (Pressure Sensitive Adhesive) material is placed on the PCB.
PUNCH	ROUT	Pattern to be punched by a die-cut fixture.
SIGNAL_FLEX	SIGNAL	Signal (copper) layer on flex laminate. Used to distinguish from signal on rigid laminate in rigid-flex boards.
SILVER_MASK	CONDUCTIVE_PASTE	Defines the silver mask of the adjacent copper layer.
STIFFENER	MASK	Shapes and locations where stiffener material is placed on the PCB.

## Subtypes to Support Embedded Resistors and Capacitors

These layer subtypes support the unique needs of product models containing embedded resistors and embedded capacitors:

Layer Subtype	Base Layer Type	Description
EMBEDDED_C	MASK	Feature shapes on the layer represent embedded capacitors.
EMBEDDED_R	MASK	Feature shapes on the layer represent embedded resistors.

## Custom Layer Subtypes Defined in the `lyr_types` File

The layer subtypes available for each layer type can be customized.

Layer subtypes can be read from product models containing them, even if they have not been defined. See [“How Product Models Containing Layer Subtypes are Opened”](#) in *Valor NPI Engineering Toolkit User Guide*.

In the Job Matrix window, the layer subtype of the selected layer is displayed. If layer subtypes are defined, they appear in the subtype list for the layer. If not defined, only the layer subtypes present in the product model appear in the list.

If you are working with product models known to contain layer subtypes, these subtypes can be defined in file `lyr_types`.

```
TYPES{
  NAME=micro_via
  BASIC_TYPE=DRILL
  COLOR=606090
}
TYPES{
  NAME=micro_via2
  BASIC_TYPE=DRILL
  COLOR=606091
}
```

The file can be placed at one of these locations:

- `$VALOR_EDIR/all/lyr_types` — User-defined layer subtype definitions placed in this file are overwritten during Valor NPI version update.
- `DirectAccessLibDir/lib/misc/lyr_types` — To retain user-defined layer subtypes, place them at this location.

If a layer subtype of the same name has a different value in `$VALOR_EDIR` than in the library, the library value is used.

The ODB++ job matrix file layer description can contain the parameters `ADD_TYPE` and `COLOR` to enable reading a recognized layer subtype in a site-specified color.

## Layer Attributes in the Job Matrix

In the Job Matrix, the layer attribute columns represent layer properties that add intelligence to the step data.

See [“Controlling the Display of Layer Attribute Columns”](#) on page 8.

## Backdrill not Penetrate Layer Name

Name of the layer not to be penetrated by the backdrill.

### Values

<Free text> (0 - 64 characters)

## Bulk Resistivity

The ohmic resistance of the semiconductor material.

### Values

0.0 - 10000 nano\_ohm

## Characteristic Impedance

The typical characteristic impedance (in ohms) required for a layer.

### Values

0.0 - 10000.0 ohm

### Default Value

0 ohm

## Comment

Use for general textual comments.

### Values

<Free text> (0 - 500 characters)

## Copper Thickness

The weight of copper according to its units of measure.

This layer attribute reflects the density of the copper used. Copper Weight is measured in ounces per square feet.

### Calculation

Copper Weight is calculated as <layer\_thickness> / <copper\_weight>.

- **layer\_thickness** — The value defined in EDA data for each layer. Each format may define this value using a proprietary keyword or field.



- **copper\_weight** — The layer thickness value divided by the value of the configuration parameter copper\_weight (default value = 1.35). This value reflects the density of the copper used.

#### Display in the Job Matrix

Depending on the measurement units to which the display is set, the value of the layer attribute Copper Weight stored in the ODB++ product model may differ from the value displayed in the Job Matrix window.

Measurement Units	Display Formula
Imperial	<p>The value is rounded to the nearest 0.5 oz/ft<sup>2</sup>.</p> <ul style="list-style-type: none"> <li>• If the difference between the rounded value and the actual value is less than 0.2, the rounded value is displayed as is.</li> <li>• If the difference between the rounded value and the actual value is greater than 0.2, then it is rounded to the nearest two decimal places.</li> </ul>
Metric	The value is displayed as is.

#### Examples

These examples use Cadence Allegro data with display in imperial units:

- **S!001!TOP!POSITIVE!!YES!1!341000.000000 mho/cm!1/1OZ\_PLTD\_CU\_FOIL!NO!0.0921 w/cm-degC!1.600000 mil!CONDUCTOR!0!**

In the layer TOP, LAYER\_THICKNESS = 1.6mil.

This is divided by 1.35 to obtain a Copper Weight of 1.18519 oz/ft<sup>2</sup>. This is the value stored in ODB++.

For display, this is rounded to the nearest 0.5 oz, giving a value of 1.0 oz/ft<sup>2</sup>. Since the difference between 1.18 and 1.0 is <0.2, the copper weight value displayed is 1.

- **S!011!BOTTOM!POSITIVE!!YES!1!580000.000000 mho/cm!2OZ\_COPPER!NO!0.0911 w/cm-degC!2.400000 mil!CONDUCTOR!0!**

In the layer BOTTOM, LAYER\_THICKNESS = 2.4mil.

This is divided by 1.35 to obtain a Copper Weight of 1.7777 oz/ft<sup>2</sup>. This is the value stored in ODB++.

For display, this is rounded to the nearest 0.5, giving a value of 2.0 oz/ft<sup>2</sup>. Since the difference between 1.77778 and 2 is >0.2, the copper weight value is rounded for display to two decimal points = 1.78.

## Dielectric Constant (ER)

The ratio of the field without dielectric ( $E_0$ ) to the net field ( $E$ ) with dielectric. It is unitless and has a range value of 1 for metals. Typical values are 4 and 5.

### Values

0.0 - 1000.0

### Default Value

0

## Dielectric Thickness

Applies to layers of type DIELECTRIC or SOLDERMASK in the layer matrix that contains the thickness of material according to its specified units of measure.

### Values

0.0 - 0.5

### Default Value

0

## Drill vias filled

Indicates whether the via holes created by a drill layer are filled (rather than plated). This attribute is only suitable for drill layers.

### Values

yes | no

### Default Value

no

## Embedded Passive Technology

Assigns a technology type attribute to an embedded components layer.

### Values

none | additive | subtractive

### Default Value

none

## HDI Assembly Technology

Type of HDI assembly technology identified in the product model. If None, the special layer is not created.

### Values

none | wirebond | flipchip | hybrid

### Default Value

none

## HDI Layer Type

An attribute added to a copper layer—not a dielectric layer—to distinguish buildup layers from core layers in HDI product models.

### Values

buildup | core

### Default Value

buildup

## Impedance test width

Test width of routes used for the provided impedance result.

### Values

-2147483648.0 - 2147483648.0 ml

### Default Value

0 ml

## Loss Tangent

The parameter of a dielectric material that quantifies its inherent dissipation of electromagnetic energy.

### Values

0 - 100

**Default Value**

0