



EFILive V8 Gauge Editor

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Prerequisites

Intended Audience

EFILive Customers using the V8 Scan and Tune Tool software.

Computer Knowledge

It is expected that readers have a basic understanding of:

- The Windows operating system;
- Starting and using Windows applications.

Tuning Knowledge

It is expected that readers have a basic understanding of:

- OBDII Data logging;
- PIDs and PID selections.



Introduction

Scan Tool Dashboard

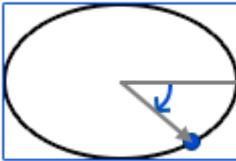
The EFILive V8 Scan Tool software displays diagnostic PID data from your vehicle's engine and/or transmission via strip charts and analog gauges. This document explains how you can create and customize the analog gauges to suit almost any data logging requirement.

Terminology

Through out this document and in the EFILive V8 software the following terms are used. Don't be concerned if some terms are not clear just yet. Each one will be explained in detail later in this document.

<p>Actions</p>	<p>Actions are the drawing primitives, such as colors, lines, rectangles, ellipses and text, that are used to create the visual appearance of a gauge.</p>
<p>Alpha</p>	<p>Colors are described using 4 channels: red, green, blue and alpha. The alpha channel describes the transparency of the color. The more transparent the color, the more objects behind it will show through. An alpha value of 0 indicates 100% transparent, an alpha value of 255 (or \$FF) indicates 100% opaque.</p> <div data-bbox="794 1200 1098 1473" data-label="Image"> </div> <p style="text-align: center;">Rectangle with an alpha channel value of 50%</p> <p>Sometimes you may be trying to figure out why a drawing primitive is not being rendered. That will happen if the alpha channel is set to 0, making it 100% transparent and therefore invisible.</p>
<p>Aspect Ratio</p>	<p>The ratio of an item's width to its height. For example, if the width of a dashboard is 1920 and its height is 1200 (which is a common screen resolution) then its aspect ratio is $1920/1200=1.6$</p>
<p>Cap</p>	<p>Defines the shape of the ends of line segments.</p> <div data-bbox="772 1872 1129 1935" data-label="Image"> </div>

<p>Dashboard</p>	<p>1. The background on which gauges are rendered. 2. A collection of gauges is often referred to as a dashboard. 3. The entire collection of:</p> <ul style="list-style-type: none"> • PID selections; • Strip charts; • Gauges; • Maps. <p>is saved in dashboard (*.dsh) files.</p>
<p>Definition</p>	<p>A named value that can be used in place of a literal value.</p>
<p>Direction</p>	<p>The horizontal or vertical direction of linear scales and linear ticks.</p>
<p>Dynamic</p>	<p>The part of a gauge that is rendered each time the gauge's value changes. All gauges have a macro called DYNAMIC which contains the actions that render the dynamic part of the gauge.</p>
<p>Font Mode</p>	<p>There are two font modes:</p> <ul style="list-style-type: none"> • Raster (fast); • Vector (slow). <p>Raster fonts are rendered faster than vector fonts but cannot be rotated. Raster fonts should be used in a gauge's dynamic part. Vector fonts can be rotated but they render more slowly. Vector fonts should only be used in a gauge's static part.</p>
<p>Gauge</p>	<p>A visual representation of a scan tool PID data value. Gauges can be circular or linear.</p>
<p>Global</p>	<p>Global macros and definitions may be shared by all gauges. See also: Local.</p>
<p>Image</p>	<p>Supported images are *.jpg, *.bmp and *.png.</p>
<p>Inside Outside</p>	<p>The numbers displayed on circular scales can face the inside of the circle or the outside of the circle.</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> Inside Outside </div>
<p>Join</p>	<p>Defines the shape of the joins between line segments.</p> <div style="text-align: center;">    </div> <div style="display: flex; justify-content: center; margin-top: 5px;"> Miter Round Bevel </div>

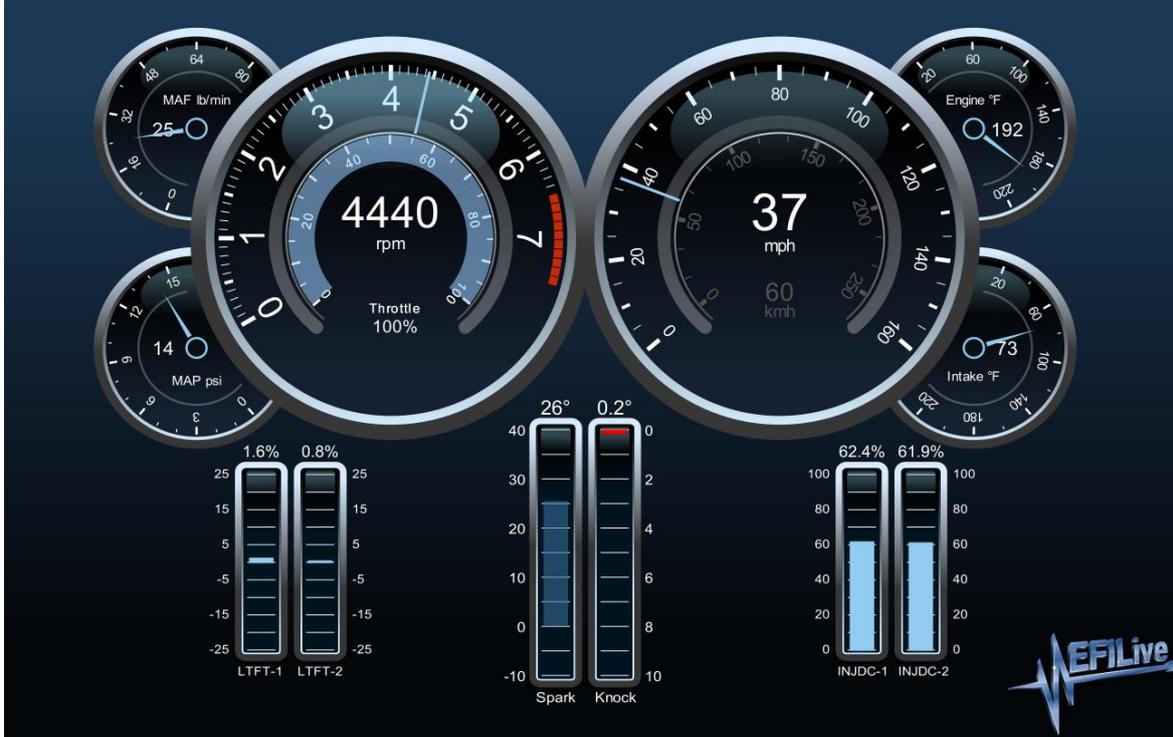
<p>Local</p>	<p>Local macros and definitions may be used only in the gauge where they are defined.</p> <p>Locally scoped items take precedence over globally scoped (i.e. shared) items with the same name. That means if a local item and a global item share the same name the local item will be used in preference to the global item.</p> <p>See also: Global.</p>
<p>Macro</p>	<p>Macros contain one or more actions that are rendered sequentially.</p>
<p>Needle</p>	<p>Needles are the animated part of a gauge that move to indicate a gauge's value.</p>
<p>Orientation</p>	<p>The needle of a linear gauge can indicate increasing values in one of four directions:</p> <ul style="list-style-type: none"> • Left to Right; • Right to Left; • Top to Bottom; • Bottom to Top.
<p>PID</p>	<p>Parameter IDentifiers represent basic units of information from the vehicle's engine and/or transmission such as:</p> <ul style="list-style-type: none"> • Engine Speed (rpm); • Spark Advance; • Engine Coolant Temperature; • Vehicle Speed; • Transmission Output Speed; • Current Gear. <p>etc.</p>
<p>Polar Coordinate</p>	<p>Polar coordinates are used to specify the individual points that make up the vertices of a needle in a circular gauge.</p> <p>Polar coordinates allow a point to be described that may rotate through 360 degrees along an arc described by an ellipse. A polar coordinate contains three values:</p> <ul style="list-style-type: none"> • Angle; • Width; • Height. <p>The width and height describe a rectangle that encloses an ellipse. The ellipse is the path along which the point moves. The angle describes the position of the point around the ellipse, starting with 0 degrees at 3 o'clock, increasing in a clockwise direction.</p> <div style="text-align: center;">  <p>Polar coordinate</p> </div>

<p>Profile</p>	<p>The amount of spread of a gradient fill. Values closer to 0 mean less spread, values closer to 1 mean more spread.</p> <p>The images below show how different profile values affect the spread of a gradient.</p>  <p style="text-align: center;"> 0.0 0.25 0.5 0.75 1.0 </p>
<p>Render</p>	<p>To cause images and/or data to be drawn on the computer's screen.</p>
<p>Scale</p>	<p>Scales are sequences of numbers. Circular and linear scales are used to label gauge value positions.</p>
<p>Static</p>	<p>The part of a gauge that is rendered only when the gauge or dashboard is resized.</p> <p>All gauges have a macro called STATIC which contains the actions that render the static part of the gauge.</p>
<p>Ticks</p>	<p>Ticks are sequences of line segments. Circular and linear ticks are used to mark gauge graduations.</p>
<p>Units</p>	<p>Units are used to scale PID values from their internal raw format to useful engineering values such as:</p> <ul style="list-style-type: none"> • mph; • psi; • °F.

Dashboards

Multiple gauges can be displayed on a dashboard. You can create many different dashboards and swap between them quickly and easily.

The two default dashboards that ship with the EFILive software show the same set of gauges but one dashboard shows metric scales, the other shows imperial scales.



Sample dashboard showing multiple gauges with imperial scales.

Gauges

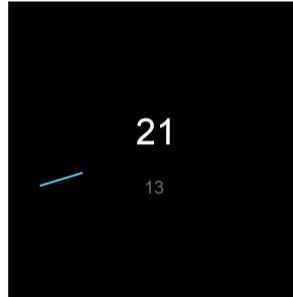
All gauges consist of two parts:

1. A STATIC part (i.e. the gauge's background) that is drawn infrequently;
2. A DYNAMIC part that is drawn frequently (i.e. each time the gauge's value changes).

When designing a gauge it is important that the dynamic part is rendered (i.e. drawn on the screen) as quickly and efficiently as possible. Appendix A contains tips that will help you optimize gauge render times.



**STATIC
Part**



**DYNAMIC
Part**



**Static and Dynamic
Parts Combined**

Notice how the dynamic part is very simple, just a small blue line and two numbers. The complex and much slower drawing is limited to the static part which is rendered infrequently.



Dashboard Properties

Editing the Dashboard Properties

To display the dashboard property editor, open the Scan Tool window [F2: Scan] and select the [F5: Gauges] tab page. Then either right-click and select “Dashboard Properties”, or press the hotkey combination Shift+F5.

The dashboard property editor window will be displayed at the right edge of the [F5: Gauges] tab page as shown below.



Toolbar



Opens a previously saved *.dash file. Use this option to replace the existing gauges with a different set of gauges without changing any PID selections, chart settings or map settings.



Saves the current gauge set to a *.dash.

*.dash files are stored in standard Windows Ini file format. Images are not saved in *.dash files so any images used by the gauge set will not be saved.

Do not confuse these open and save options with opening and saving the entire dashboard (*.dsh files) using the [Open] and [Save] buttons in the main Scan Tool window.

These open and save options are provided to allow gauge sets to be easily shared between EFILive users.



Restores all changes made to the dashboard properties.



Undoes the most recent change made to the dashboard properties.



Redoes the most recent undo made to the dashboard properties.
The restore, undo and redo options only operate on dashboard property settings. They do not operate on changes made using the gauge editor.



Docks or undocks the dashboard property editor window.

Setup

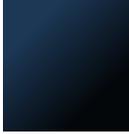
Click the [New Dashboard] button to clear the gauges and background settings.

Color

The background of a dashboard may be set to one of:

- A single color;
- A linear gradient between two colors;
- A radial gradient between two or three colors;
- A tiled image (see next section).
- A stretched image (see next section).

The “Style:” drop down list box selects the type of background color:

	None		
	Vertical		Horizontal
	Backward Diagonal		Forward Diagonal
	Radial		Radial3

Image

Only images that have previously been loaded into the gauge editor can be selected for display on the dashboard background. (See “Editing Gauges” for more information on loading images).

Images displayed on the dashboard background are not scaled when the dashboard is resized unless the “Stretched” layout is selected. If you wish to display images that automatically scale when the dashboard is resized, add the image to a gauge’s STATIC part.

The image layout can be one of:

None	No image is displayed.
Top Left	The image is displayed in the top left corner.
Top Center	The image is displayed in the horizontal center at the top.

Top Right	The image is displayed in the top right corner.
Bottom Left	The image is displayed in the bottom left corner.
Bottom Center	The image is displayed in the horizontal center at the bottom.
Bottom Right	The image is displayed in the bottom right corner.
Left Center	The image is displayed in the vertical center at the left.
Right Center	The image is displayed in the vertical center at the right.
Centered	The image is displayed at the center of the dashboard.
Percentage	The image is displayed at the Image X,Y coordinates as a percentage of the entire dashboard width or height respectively.
Pixels	The image is displayed at the Image X,Y coordinates as absolute pixels.
Tiled	The image is repeated vertically and horizontally to cover the entire dashboard.
Stretched	The image is stretched (or shrunk) to cover the entire dashboard.

The “PNG Alpha:” checkbox enables or disables the alpha channel for *.png images. The setting is ignored for *.jpg and *.bmp images.

The Image X and Y values are used to position the image when the “Layout” is set to either “Percentage” or “Pixels”, otherwise it is ignored.

Aspect Ratio

When a dashboard is displayed on different monitors with different aspect ratios the shape of the gauges may be altered, similar to the elongation that occurs when wide screen movies are displayed on relatively square television sets.



Locked Aspect Ratio
with a layout of “Centered”.



Unlocked Aspect Ratio

To prevent the dashboard distorting when it is displayed on other (different sized) monitors, select an aspect ratio that matches the monitor you are using and check the “Lock” checkbox to force the dashboard to always be displayed at that aspect ratio, regardless of which monitor is being used.

The [Set] button can be used to set the aspect ratio to the dashboard’s current aspect ratio.

The “Visible” checkbox shows the aspect ratio border as a thin red line. Keep all your gauges within the border to prevent cropping when displayed on different monitors.

The “Layout” option determines how the dashboard will be positioned on a monitor when the aspect ratio is locked. When the aspect ratio is not locked the “Layout” option is ignored.

Top Left	The dashboard will be anchored to the top and left borders.
Top Right	The dashboard will be anchored to the top and right borders.
Bottom Left	The dashboard will be anchored to the bottom and left borders.
Bottom Right	The dashboard will be anchored to the bottom and right borders.
Centered	The dashboard will be anchored to the center.
Centered Left	The dashboard will be vertically centered on the left border.
Centered Top	The dashboard will be horizontally centered on the top border.
Centered Right	The dashboard will be vertically centered on the right border.
Centered Bottom	The dashboard will be horizontally centered on the bottom border.



Creating a Simple Gauge Tutorial

Your First Gauge

Now that you have a basic understanding of setting up a dashboard background, it is time to try creating your first gauge. This tutorial will guide you step by step through the process.

Open the Dashboard Properties Window

Start the EFILive V8 Scan and Tune software, navigate to [F2: Scan]->[F5: Gauges], if you are not already there.

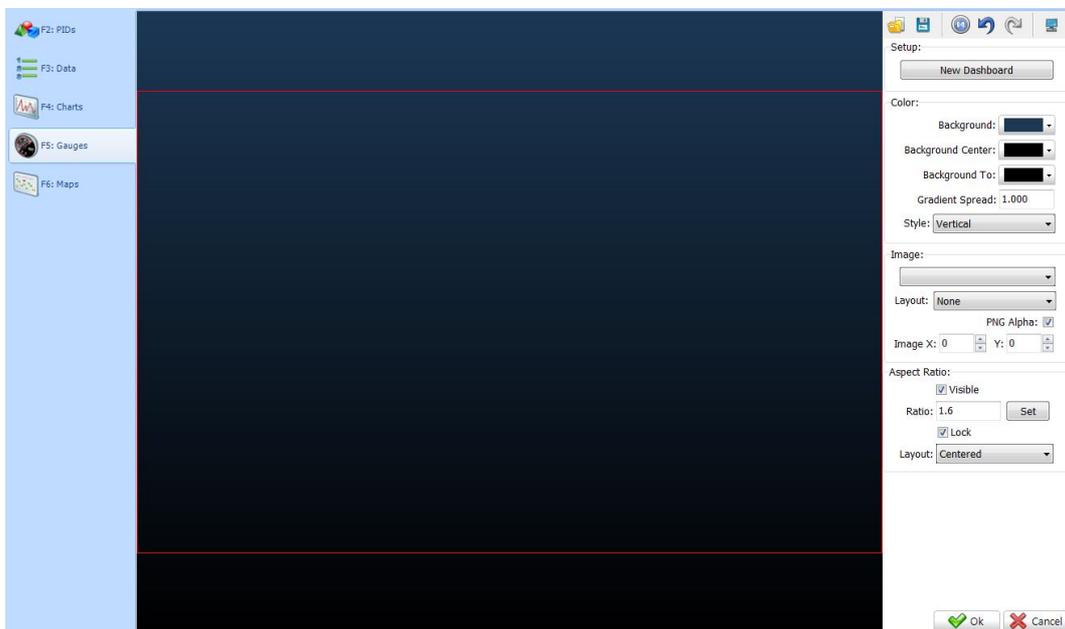
Open the dashboard properties window. To do that, right click on the dashboard display and select “Dashboard Properties”, or press the hot-key Shift+F5.

Create an Empty Dashboard

Click on the [New Dashboard] button to delete all existing gauges and reset the background settings.

Setup the Dashboard Background

Configure the dashboard background like this:



The red aspect ratio border will only be displayed while the dashboard property window is active. Click [Ok] to accept the changes.

Next, save the new dashboard with the name “Beta1.dsh”. Select the [Save Dashboard As...] option from the drop down list of the [Save] button at the bottom of the Scan Tool window. The dashboard save options are disabled when either of the property or gauge editor windows are open, you must close both of those windows before you can save the dashboard.



Dashboards cannot be saved with names that begin with **EFI_**, those names are reserved for EFILive default dashboards. That restriction prevents users accidentally overwriting the default EFILive dashboards.

Open the Gauge Editor Window

Start the EFILive V8 Scan and Tune software, navigate to [F2: Scan]->[F5: Gauges], if you are not already there.

Open the gauge editor window. To do that, right click on the dashboard display and select “Gauge Editor”, or press the hot-key Shift+Ctrl+ F5.

Create a Gauge

Select the Dashboard item at the top of the tree view and check the “Gauge Borders Visible” check box.

Select the Dashboard item again and click  to add a new gauge, or right click the Dashboard item and select New->Gauge.

Click on the gauge’s name (i.e. the name should be “New”) and press F2 to edit the gauge name (or just click on the gauge’s name again), change the name to RPM. Press Enter to finish editing the name.

Select the RPM PID that this gauge will display using the “PID:” drop down button.

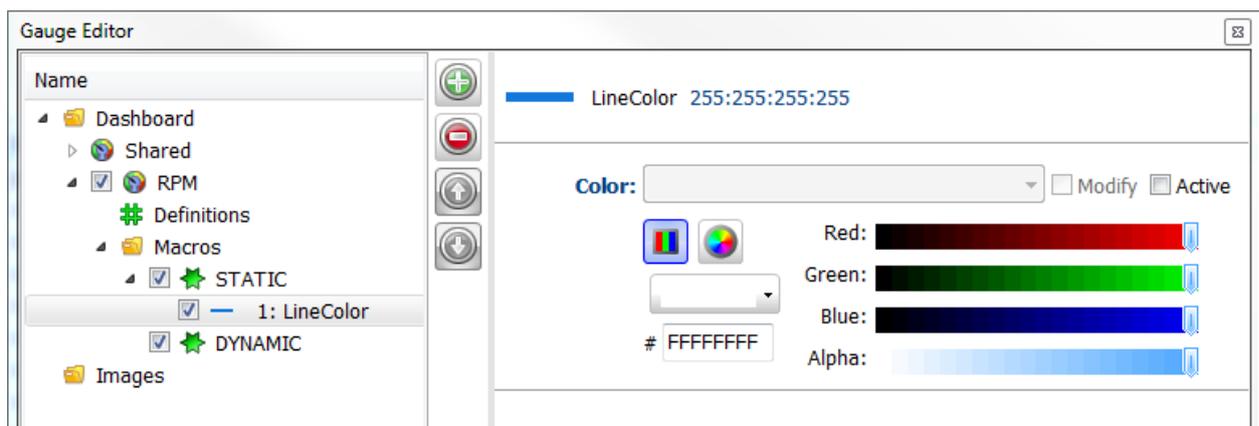


The drop down list of PIDs shows the currently selected list of PIDs. If you don’t have any PIDs selected then you won’t see any PIDs in the list. Use the [F2: PIDs] tab page to select the PIDs for your dashboard.

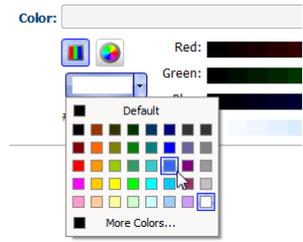
Expand the Macros item and select the STATIC macro.

Right click the STATIC macro and select: New->Line Colors->Line Color.

If everything has gone to plan so far, the gauge editor window will look like this:



There are many ways to select the color you want, for now just click on the drop down arrow on the color selection combo box and select the blue color shown in the image.

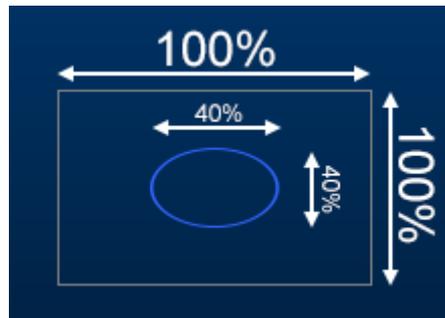


Right click on the “LineColor” item in the STATIC macro and select: New->Line Types->Line Width and set the line width to 2.

Right click on the “LineWidth” item and select: New->Shapes->Ellipse, a blue ellipse will appear in the gauge.

Positioning and Sizing a Gauge

All gauge and action dimensions and positions are percentages; 0% indicates the top or left border, 100% indicates the right or bottom border. Values less than 0% extend past the left and top borders. Values greater than 100% extend past the right or bottom borders.



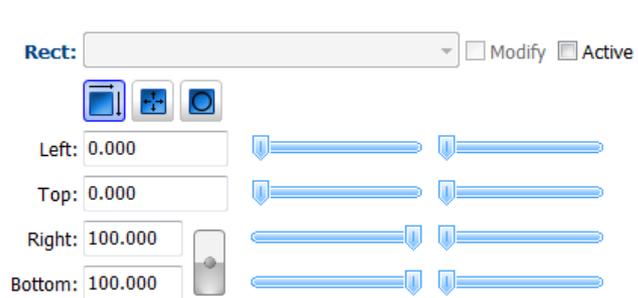
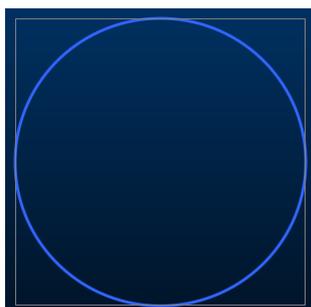
Select the gauge that was just created. Click inside the gauge’s border, it will display a double yellow border to indicate the gauge is selected. You can also click on the gauge name in the Gauge Editor window to select the gauge, which is the only way to select a gauge when is completely obscured by other gauges.

Drag the corners or edges to resize the gauge, hold down the Shift key while dragging a corner to force the gauge to be square, regardless of the dashboard’s aspect ratio.

Drag the body of the gauge to move it around on the dashboard.

After sizing and repositioning the gauge on the dashboard, click on the “Ellipse” item in the STATIC macro.

Drag the slider bars to reposition and resize the ellipse to be 100% of the gauge borders, like this:



Editing Rectangles

You can change the way a rectangle is edited by selecting the small blue icons in the rectangle editor.

	Edit a rectangle by changing its left, top, right and bottom edges.
	Edit a rectangle by changing its center, width and height. This option also supports the lock aspect ratio button which, when selected will lock the width and height together so that the rectangle can be easily resized without altering its aspect ratio.
	Reset a rectangle to be 80% of the gauge's size.

Add a Scale

Right click on the “Ellipse” item and select: New->Fill Colors->Area Color and leave the color set to white.

Right click on the “AreaColor” item and select: New->Line Colors->No Line.

Right click on the “NoLine” item and select: New->Text->Set Font, change the Mode to Vector (slow, rotatable).

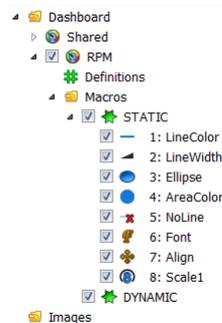
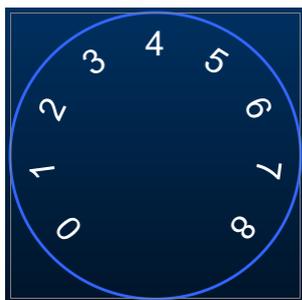
Right click on the “Font” item and select: New->Text->Alignment.

Right click on the “Align” item and select: New->Measurement->Scale Circular

Change the Scale's properties:

- Left and Top: 10, Right and Bottom: 90;
- Count: 9
- Align: Outside
- Range: 0 to 8

After adding and editing the actions in the STATIC macro, you should see this:



Add Tick Marks

Right click on the “Scale1” item and select: New->Line Colors->Line Color and leave the color set to white.

Right click on the “LineColor” item and select: New->Line Types->Line Width and set the Width to 4

Right click on the “LineWidth” item and select: New->Line Types->Line Cap and set the Cap to “Butt”.

Right click on the “LineCap” item and select: New->Measurement->Ticks Circular.

Change the Tick's properties:

- Outer: Center X, Center Y: 50, Width, Height: 95
- Inner: Center X, Center Y: 50, Width, Height: 85
- Count: 9



To edit the tick positions, change the rectangle editor to edit the width and height and lock the aspect ratio like this



Now move the scale's numbers inwards slightly so that they are not touching the newly added tick marks. To do that, select the "Scale1" item, change the Rectangle editor to "Width/Height" and activate the lock aspect ratio button. Then change the width/height so that the scale is no longer overlapping the tick marks. Setting the width and height to about 75 should be enough.

The gauge should look something like this:



Add a Needle

Right click on the DYNAMIC macro and select: New->Fill Colors->Area Color and leave the color set to white.

Right click on the AreaColor item and select: New->Line Colors->No Line.

Right click on the NoLine item and select: New->Measurement->Needle.

Change the Needle's properties:

- Range: 0 to 8000.
- Value: Value



At any time you can drag the scrollbar at the bottom of the Gauge Editor window to test all gauges in the dashboard.

Click on the [Test] button to test the render speed of the dashboard. The testing process involves redrawing the entire dashboard 1000 times and measuring the average render times. After testing, click on the [Details] button to view the render times of each gauge.

Save your work

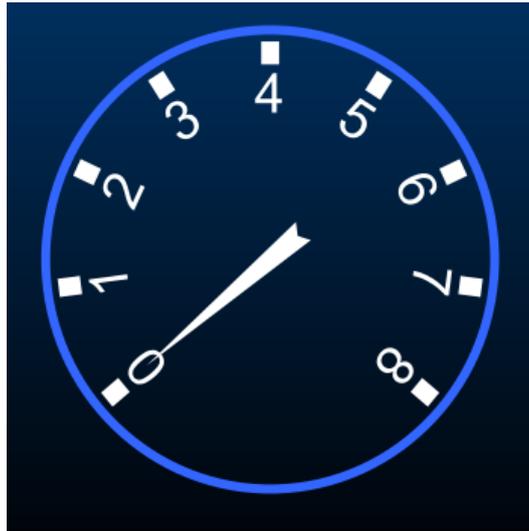
Close the Gauge Editor window by clicking [Ok] and select “Save Dashboard” from the [Save] button’s drop down list in the main Scan Tool window.

You can change between dashboards by selecting recently loaded dashboards from the drop down list in the main Scan Tool window.

Try changing the dashboard back to one of the EFILive default dashboards, then back again to the Beta1 dashboard that you have just created.

Congratulations

You’ve just created your first dashboard and gauge; it should look something like this:





Reference

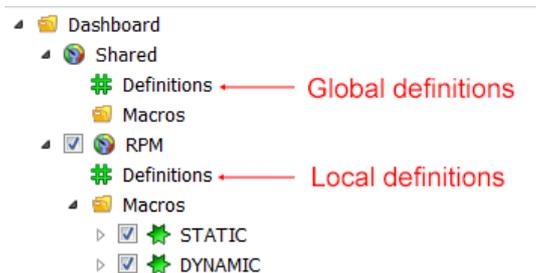
The examples and screen shots in this reference section are based on the sample RPM gauge created in the previous tutorial

Definitions

Often, multiple actions such as rectangle and colors will have identical property values. When changing the values, it is tedious to find and change each of the actions' properties. If all such values are set to a single definition then changing that single definition will change all those property values.

For example, if the scales in multiple gauges should all have the same color, create a color definition and then use that definition for each of the gauges. If the color of the scales needs to be changed then only a single definition needs to be changed and each of the gauges' properties that use that definition will be updated automatically.

Definitions can be locally or globally scoped. A locally scoped definition appears in a gauge's Definitions list, a globally scoped definition appears in the Shared definitions list.



To add a local color definition for the RPM gauge, select the RPM gauge's Definitions item.

1. Click on the  button to add a new definition.
2. Change the name to "scale_color".
3. Click in the Type column and select the "Color" type.
4. The Value will automatically be set to the default color of opaque white (255:255:255:255), leave the color white for now.

To use the definition:

1. Expand the RPM's STATIC macro.
2. Select the "AreaColor" item. Check the "Active" checkbox and select the newly created "scale_color" definition.
3. Select the "LineColor" item below the "Scale1" item. Check the "Active" checkbox and select the newly created "scale_color" definition.

If you ever need to modify the color, check the "Modify" checkbox and edit the color. All properties that use the definition will be automatically updated with the new color.

After modifying the definition's value, uncheck the "Modify" button.

Images

You can add a library of images to the Gauge Editor. Once added, those images are available for use in gauges and as a background image for the dashboard itself.

To add an image, right click on the "Images" item and select New->Image.

You can add images of the following types:

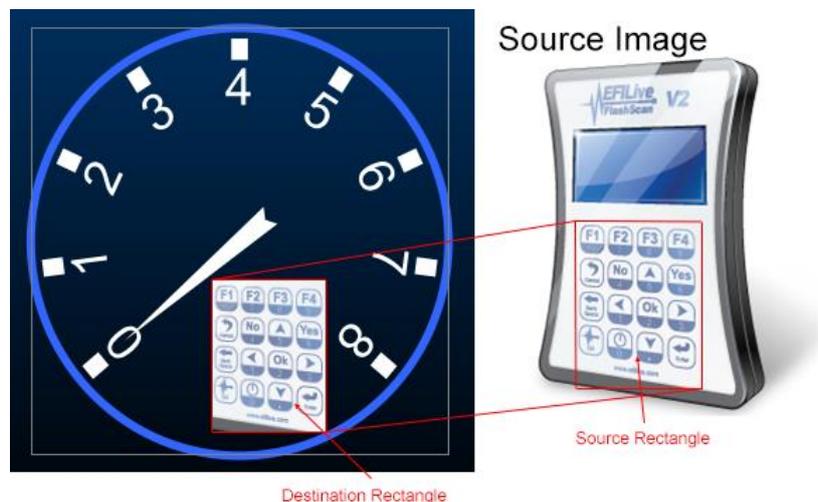
*.png	Portable Network Graphics files with alpha channel support. Use png images when you need transparency support.
*.jpg *.jpeg	Joint Photographic Experts Group. Use jpg images for photographs.
*.bmp	Bitmap files. EFILive does not recommend the use of bitmap files. Instead you should convert bitmap files to *.png or *.jpg files using a quality image editing tool (such as lrfanview) and then use those files instead.

To display an image in a gauge, add the action type "Draw Image" to the gauge.

After adding the image to a gauge, click on the "Set default size" button  in the Source and Destination rectangle editors. That will set the source rectangle to the dimensions of the image and it will resize the destination rectangle so that the image displays using the correct aspect ratio for the gauge. Any time the aspect ratio of the gauge is changed, you may use destination rectangle's "Set default size" button to recalculate the image's correct aspect ratio.

The Source rectangle defines the pixel area of the original image that is selected to be displayed in the gauge.

The Destination rectangle defines the percentage area in the gauge into which the source rectangle is copied. The final image is stretched or shrunk as necessary.



Macros

Macros simplify the repetitive nature of building gauges by encapsulating common and repetitive tasks.

Sometimes the same sequence of actions is used multiple times, either within the same gauge or across multiple gauges.

Instead of entering the same sequence of actions multiple times in multiple places, you can create macros (which are really just sequences of actions) and then call those macros whenever those sequences are needed.

EFILive also recommends using macros within gauges to encapsulate all the actions that are used to generate a single visible part of the gauge. For example, in the default dashboards that ship with EFILive, the RPM gauge contains two macros: Scale and Ticks. The Scale macro contains the actions for rendering the scale and the Ticks macro contains the actions for rendering the tick marks.

Actions

Actions are the basic building blocks of gauges. Actions are applied sequentially, each one adding to the appearance of the gauge and possibly modifying the behavior of subsequent actions. Each action has one or more parameters that control how the action behaves.

Action Parameters

Unless otherwise specified:

- Parameters for horizontal, width, x, left and right positions measure the percentage of a gauge's width.
- Parameters for vertical, height, y, top and bottom positions measure the percentage of a gauge's height.
- The top left corner of a gauge is at position 0,0, the bottom right corner of a gauge is at position 100,100.
- Angle parameters measure degrees, starting with 0 degrees at 3 o'clock, increasing in a clockwise direction and ending at 360 degrees back at 3 o'clock again.

 Line	Renders a line.
Start:	Coordinates of start of line.
Stop:	Coordinates of end of line.
Modifiers:	<ul style="list-style-type: none"> • Line Color (and Fills) • Line Width • Line Cap
 Triangle	Renders a triangle.
P1:	Coordinates of first point.

P2:	Coordinates of second point.
P3:	Coordinates of third point.
Modifiers:	<ul style="list-style-type: none"> • Area Color (and Fills) • Line Color (and Fills) • Line Width • Line Join

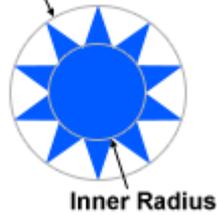
 Rectangle	Renders a rectangle with square corners.
Rect:	Rectangle dimensions.
Modifiers:	<ul style="list-style-type: none"> • Area Color (and Fills) • Line Color (and Fills) • Line Width • Line Join

 Round Rectangle	Renders a rectangle with rounded corners.
Rect:	Rectangle dimensions.
Radius:	X and Y radius of rounded corners.
Modifiers:	<ul style="list-style-type: none"> • Area Color (and Fills) • Line Color (and Fills) • Line Width

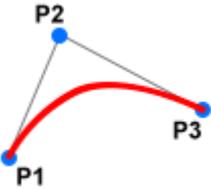
 Ellipse	Renders an ellipse.
Rect:	Enclosing rectangle dimensions.
Modifiers:	<ul style="list-style-type: none"> • Area Color (and Fills) • Line Color (and Fills) • Line Width

 Arc	Renders an arc.
Rect:	Enclosing rectangle dimensions.
Arc:	Start and stop angles.

Step:	<p>An arc is rendered by drawing many, small straight line segments. The step parameter is the number of degrees spanned by each line segment.</p> <p>A larger value will render a jagged arc but will be faster; a smaller value will render a smoother arc but will be slower.</p> <p>A value of 4 is usually a good compromise between speed and smoothness.</p>
Modifiers:	<ul style="list-style-type: none"> • Line Color (and Fills) • Line Width • Line Cap

	Star	Renders a multi-pointed star.
Center:	Coordinates of the center of the star	
Outer:	The radius of the points.	
Inner:	The radius of the internal angles	
Angle:	The starting angle of the first point.	
Rays:	The number of points.	
Notes:		
Modifiers:	<ul style="list-style-type: none"> • Area Color (and Fills) • Line Color (and Fills) • Line Width • Line Join 	

	Curve	Renders a conic Bezier curve.
P1:	Coordinates of start of curve.	
P2:	Coordinates of the curve's control point. The curve does not usually pass through this point.	
P3:	Coordinates of end of curve.	

Notes:	
Modifiers:	<ul style="list-style-type: none"> • Line Color (and Fills) • Line Width • Line Cap

	<p>No Fill Turns off shape and font filling.</p>
Notes:	<p>Shapes and fonts following a “No Fill” action will be rendered with a transparent interior fill.</p>

	<p>Area Color Sets the color for filling shapes and fonts.</p>
Color:	<p>The selected fill color.</p>

	<p>Area Fill Sets a color gradient for filling shapes and fonts.</p>
Start:	<p>Start coordinate of the gradient’s direction.</p>
Finish:	<p>End coordinate of the gradient’s direction.</p>
Color:	<p>The gradient start color.</p>
ColorTo:	<p>The gradient end color.</p>
Profile:	<p>The gradient profile. The profile determines the spread of the gradient between the start and end points.</p> <p>A value of 1 spreads the gradient completely between the start and finish points.</p> <p>A value less than 1 compresses the gradient.</p> <p>A value greater than 1 expands the gradient.</p>

Notes:



	<p>Area Radial Fill (2 Color)</p>	<p>Sets the radial (2 color) gradient for filling shapes and fonts.</p>
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<p>Center:</p>	<p>Coordinates of the center of the radial gradient.</p>
<p>Radius:</p>	<p>Size of the radial gradient's spread.</p>
<p>Inner:</p>	<p>The selected color at the center.</p>
<p>Outer:</p>	<p>The selected color at the outer edge.</p>
<p>Profile:</p>	<p>The gradient profile. (see Area Fill for details).</p>

	<p>Area Radial Fill (3 Color)</p>	<p>Sets the radial (3 color) gradient for filling shapes and fonts.</p>
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<p>Center:</p>	<p>Coordinates of the center of the radial fill.</p>
<p>Radius:</p>	<p>Size of the radial gradient's spread.</p>
<p>Inner:</p>	<p>The selected color at the center.</p>
<p>Mid:</p>	<p>The selected color halfway between the inner and outer colors.</p>
<p>Outer:</p>	<p>The selected color at the outer edge.</p>

	<p>Line Width</p>	<p>Sets the line width for drawing lines.</p>
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<p>Width:</p>	<p>The width of the line.</p>
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	<p>Line Cap</p>	<p>Sets the line cap for drawing lines.</p>
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Cap:

Can be one of:



Line Join

Sets the join type for shape vertexes.

Join:

Can be one of:



No Line

Turns off shape and font outlining.

Notes:

Shapes and fonts following a “No Line” action will be rendered with a transparent outline.



Line Color

Sets the color for rendering lines and outlining shapes and fonts.

Color:

The selected outline color.



Line Fill

Sets a color gradient for rendering lines and outlining shapes and fonts.

Start:

Start coordinate of the gradient’s direction.

Finish:

End coordinate of the gradient’s direction.

Color:

The gradient start color.

ColorTo:

The gradient end color.

Profile:

The gradient profile (see Area Fill for details).



Line Radial Fill (2 Color)

Sets the radial (2 color) gradient for rendering lines and outlining shapes and fonts.

Center:

Coordinates of the center of the radial gradient.

Radius:	Size of the radial gradient's spread.
Inner:	The selected color at the center.
Outer:	The selected color at the outer edge.
Profile:	The gradient profile. (see Area Fill for details).

 Line Radial Fill (3 Color)	Sets the radial (3 color) gradient for rendering lines and outlining shapes and fonts.
Center:	Coordinates of the center of the radial gradient.
Radius:	Size of the radial gradient's spread.
Inner:	The selected color at the center.
Mid:	The selected color halfway between the inner and outer colors.
Outer:	The selected color at the outer edge.

 Call Macro	Calls a local or global macro.
Macro:	The name of the macro to call.
Notes:	If you rename a macro, all calls to that macro are also renamed.

 Draw Image	Draws an image.
Image:	Image to draw
Source:	A rectangle that defines the source of the image. Unlike all other rectangles (which specify percentages), this rectangle specifies the actual pixel positions of the source image.
Destination:	The rectangle area of the gauge into which the source image's rectangle will be mapped.
Notes:	Before an image can be selected for drawing, at least one image must have been added to the gauge editor. See the Images section for more information.

 Set Font	Selects a font for rendering text.
Font:	<p>The name of the font face.</p> <p>To display a list of font names, the gauge editor must scan the system for all available fonts. That process can take a few seconds the first time you select the “Set Font” action.</p>
Size:	<p>The size of the font.</p> <p>Vector font sized will expand and contract smoothly when the gauge is expanded and contracted. Raster based fonts will select the best fit only.</p>
Style:	The font style: Bold, Italic or both.
Mode:	<p>Raster fonts are rendered faster than vector fonts but cannot be rotated. Raster fonts should be used in gauges’ dynamic part.</p> <p>Vector fonts can be rotated but they render more slowly. Vector fonts should only be used in gauges’ static part.</p>
 Text Alignment	Selects the text alignment.
Horizontal:	The horizontal alignment.
Vertical:	The vertical alignment.
Notes:	To ensure that the numbers displayed in circular scales are placed at the correct location, you should specify an alignment of center for both horizontal and vertical parameters.
 Draw Font	Displays text.
Position:	The coordinates of the text.
Type:	<p>The type of text to display which is one of:</p> <p>None: The Format parameter is displayed “as is”. Use this option for displaying plain text; enter the plain text into the “Format” parameter.</p> <p>Value: The current value of the gauge.</p> <p>Min: The held maximum value of the gauge.</p> <p>Max: The held minimum value of the gauge.</p>

Format:	The C-style format in which to display the selected type. For example to display a speed value of 123 as “123 kmh” use a format like “%.0f kmh”. C-style format strings are described in appendix B.
Multiplier:	Multiply the value being displayed by this value.
Offset:	Add this value to the value being displayed.
Invert:	Invert the value before applying the multiplier and offset.
Notes:	If the format string is invalid, then the format string is displayed “as is”. The multiplier, offset and invert parameters are useful for displaying the gauge’s value with alternate units. For example, you may wish to display mph and kmh in the same speedometer gauge. To do that, you would need two “Text” actions, one that displayed the VSS PID in the selected PID’s units (for example kmh) and one that converted the selected PID’s units to mph, using a Multiplier of 0.62137 and an Offset of 0 and an Invert of False.
Modifiers:	<ul style="list-style-type: none"> • Line Color (and Fills) • Line Width

	Scale1	Displays a circular scale.
Rect:	Enclosing rectangle dimensions.	
Arc:	The start and stop angles of the scale.	
Count:	The number of numbers to display.	
Align:	One of: Normal: The values are displayed as horizontal text. Outside: The values are rotated so that the bases of the numbers sit on the outside of the ellipse. Inside: The values are rotated so that the bases of the numbers sit on the inside of the ellipse	
Range:	The first and last value to be displayed	
Format:	The C-style format in which to display the scale’s values. C-style format strings are described in appendix B.	

Modifiers:	<ul style="list-style-type: none"> • Line Color (and Fills) • Line Width
 Scale3	Displays a linear scale.
Rect:	Enclosing rectangle dimensions.
Direction:	<p>One of:</p> <p>Horizontal: The values are displayed in a horizontal row.</p> <p>Vertical: The values are displayed in a vertical column.</p>
Count:	The number of numbers to display.
Range:	The first and last value to be displayed
Format:	<p>The C-style format in which to display the scale's values.</p> <p>C-style format strings are described in appendix B.</p>
Angle:	The angle of rotation for each value displayed.
Modifiers:	<ul style="list-style-type: none"> • Line Color (and Fills) • Line Width
 Ticks1	Displays a set of circular tick marks.
Outer:	Enclosing rectangle dimensions of the ellipse that defines the outer limit of the ticks.
Inner:	Enclosing rectangle dimensions of the ellipse that defines the inner limit of the ticks.
Arc:	The start and stop angles of the tick marks.
Count:	The number of ticks to display.

<p>Notes:</p>	<p>To display a set of different size ticks like this:</p>  <p>You need to render three different tick actions each with wider lines and slightly longer lengths (to obscure the previous smaller ticks) like this:</p> 
<p>Modifiers:</p>	<ul style="list-style-type: none"> • Line Color (and Fills) • Line Width • Line Cap
 <p>Ticks3</p>	<p>Displays a set of linear tick marks.</p>
<p>Rect:</p>	<p>Enclosing rectangle of the ticks.</p>
<p>Direction:</p>	<p>One of:</p> <p>Horizontal: The ticks are displayed as vertical lines in a horizontal row.</p> <p>Vertical: The ticks are displayed as horizontal lines in a vertical column.</p>
<p>Count:</p>	<p>The number of ticks to display.</p>
<p>Modifiers:</p>	<ul style="list-style-type: none"> • Line Color (and Fills) • Line Width • Line Cap
 <p>Needle1</p>	<p>Displays a pivoting needle.</p>
<p>Shape:</p>	<p>The shape of the needle is determined by four polar coordinates.</p> <p>See Appendix C for more information.</p>

Pivot:	The coordinates of the point about which the needle pivots.
Arc:	The start and stop angles of the needle's pivot.
Range:	The range of the value that the needle represents.
Value:	One of: None: Same as Value. Value: The needle represents the current value of the gauge. Min: The needle represents the held maximum value of the gauge. Max: The needle represents the held minimum value of the gauge..
Hold:	The number of milliseconds for which the min or max value will remain fixed after the actual value peaks.
Reset Step:	Once the Hold time has elapsed this is the amount by which the min or max needle will progress back towards the actual value every 50 milliseconds.
Modifiers:	<ul style="list-style-type: none"> • Area Color (and Fills) • Line Color (and Fills) • Line Width • Line Join

	Needle2	Displays a sweeping needle.
Rect:	The enclosing rectangle.	
Step:	<p>An arc is rendered by drawing many, small straight line segments. The step parameter is the number of degrees spanned by each line segment.</p> <p>A larger value will render a jagged arc but will be faster; a smaller value will render a smoother arc but will be slower.</p> <p>A value of 4 is usually a good compromise between speed and smoothness.</p>	
Arc:	The start and stop angles of the needle's sweep.	
Range:	The range of the value that the needle represents.	

Value:	<p>One of:</p> <p>None: Same as Value.</p> <p>Value: The needle represents the current value of the gauge.</p> <p>Min: The needle represents the held maximum value of the gauge.</p> <p>Max: The needle represents the held minimum value of the gauge..</p>
Hold:	The number of milliseconds for which the min or max value will remain fixed after the actual value peaks.
Reset Step:	Once the Hold time has elapsed this is the amount by which the min or max needle will progress back towards the actual value every 50 milliseconds.
Modifiers:	<ul style="list-style-type: none"> • Line Color (and Fills) • Line Width • Line Cap

	<p>Needle3</p>	<p>Displays a linear needle using a round rectangle action.</p>
Rect:	The enclosing rectangle.	
Radius:	X and Y radius of rounded corners.	
Orientation:	<p>One of:</p> <ul style="list-style-type: none"> • Left to Right • Right to Left • Top to Bottom • Bottom to Top <p>Each option causes the needle to progress in the stated direction as the value of the gauge increases.</p>	
Range:	The range of the value that the needle represents.	
Value:	<p>One of:</p> <p>None: Same as Value.</p> <p>Value: The needle represents the current value of the gauge.</p> <p>Min: The needle represents the held maximum value of the gauge.</p> <p>Max: The needle represents the held minimum value of the gauge..</p>	

Hold:	The number of milliseconds for which the min or max value will remain fixed after the actual value peaks.
Reset Step:	Once the Hold time has elapsed this is the amount by which the min or max needle will progress back towards the actual value every 50 milliseconds.
Modifiers:	<ul style="list-style-type: none">• Area Color (and Fills)• Line Color (and Fills)• Line Width

Appendix A

Optimizing Render Times

Appendix B

Format Strings

Format strings have the following form:

"%" ["-"] [width] ["." prec] type

A format string begins with a % character. After the percent sign the following elements may appear in this order:

- An optional left justification indicator, ["-"].
- An optional width specifier, [width].
- An optional precision specifier, ["." prec].
- The type character as explained below.

Type	Meaning	Description
e	Scientific	The value is converted to a string of the form "d.ddd...E+ddd". The resulting string starts with a minus sign if the number is negative. One digit always precedes the decimal point. The total number of digits in the resulting string (including the one before the decimal point) is given by the precision specifier in the format string; a default precision of 15 is assumed if no precision specifier is present. The "E" exponent character in the resulting string is always followed by a plus or minus sign and at least three digits.
f	Fixed	The value is converted to a string of the form "ddd.ddd...". The resulting string starts with a minus sign if the number is negative. The number of digits after the decimal point is given by the precision specifier in the format string—a default of 2 decimal digits is assumed if no precision specifier is present.
g	General	The value is converted to the shortest possible decimal string using fixed or scientific format. The number of significant digits in the resulting string is given by the precision specifier in the format string; a default precision of 15 is assumed if no precision specifier is present. Trailing zeros are removed from the resulting string, and a decimal point appears only if necessary. The resulting string uses the fixed point format if the number of digits to the left of the decimal point in the value is less than or equal to the specified precision, and if the value is greater than or equal to 0.00001. Otherwise the resulting string uses scientific format.
n	Number	The value is converted to a string of the form "d,ddd,ddd.ddd...". The n format corresponds to the f format, except that the resulting string contains thousand separators.

Appendix C

Polar Coordinates

The 4 vertices of the Needle1 action are defined in polar coordinates. Each of the four points (P1, P2, P3 and P4) have an angle, an X radius and a Y radius.

In the diagram below the X and Y radii are equal and so only one value is shown.

The point at 0 degrees is always the actual gauge value.

- P1 is at 0 degrees with a radius of 36% and is there for the point that indicates the gauge's value.
- P2 is at 135 degrees with a radius of 15%
- P3 is at 180 degrees with a radius of 8%
- P4 is at 225 degrees with a radius of 15%

