

# METER

This is the manual for **Meter**, the program to draw scales for analog meter movements.

Last updated 5 July 2011

Meter, this manual and the associated support files  
Copyright © 2004-2011 James L. Tonne  
All rights reserved.

## Intro

This is the manual for **Meter** is the program to make scales for analog meter movements.

After a short **How To Start** section, the manual is intended to be for reference purposes. The items listed in the Table of Contents will illustrate how to do various tasks. It is arranged in a logical manner but is not a "how to" document with the exception of the AppNotes section.

This is the first printing of this manual. Surely there will be areas that should be upgraded, corrected or changed and we will most certainly welcome comments and suggestions. E-mail us at [Support@TonneSoftware.com](mailto:Support@TonneSoftware.com) and we will respond as soon as possible.

- Jim Tonne   Tonne Software   [www.TonneSoftware.com](http://www.TonneSoftware.com)

# Table of Contents

Title	1	Scale design	43
Intro	2	Edit scale number	44
Contents	3	Scale title	45
Getting Started	4	Scale value entries	46
Toolbar	7	Bottom to title	48
Open file	8	Bottom to scale ceiling	49
Save file	9	Relative font size	50
Plate design	10	Foreground color	51
Plate width	11	Tics & labels	52
Plate height	12	Scale linearity (exponent)	54
Bottom to bearing	13	Special scales	55
Bottom to mounting	14	Arbitrary scales	57
Hole separation	15	dB / vu scales	59
Pointer deflection	16	VSWR scales	63
Actual/virtual offset	17	S-meter scales	64
Minor tic length	19	Ohmmeter scales	65
Major tic length	20	Text entry	71
Minor tic width	21	Graphic entry	75
Major tic width	22	Highlight entry	77
Font size	23	Preview	80
Label-arc spacing	24	About Meter	83
Arc width	25	Appnotes	84
Number of scales	26		
Label rotate	27		
Style	28		
Labels	30		
Arcs print	31		
Graphic entry	33		
Linearity (movement)	35		
Calibrate	36		
Background	40		
Get font	41		
Comma / komma	42		

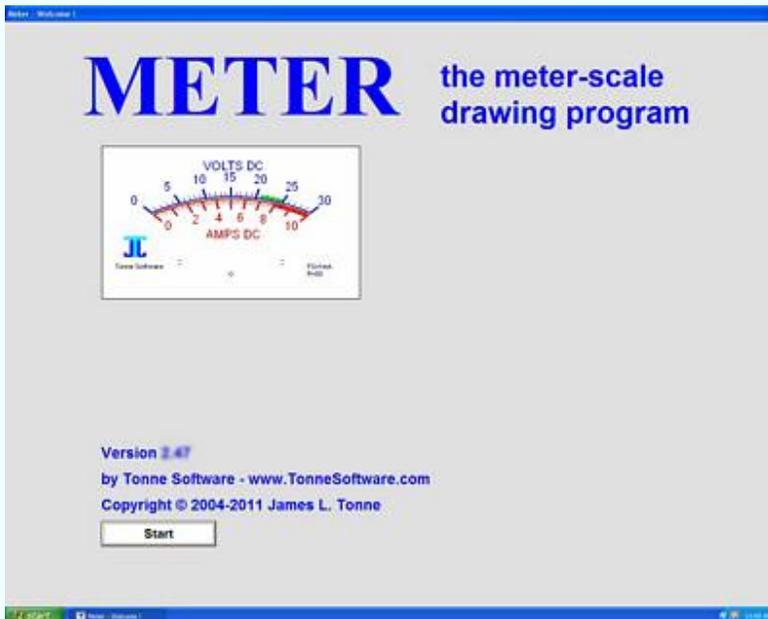
## Getting Started

**Meter** is a Windows program from Tonne Software. As downloaded it is wrapped into an executable install package with a filename of `MeterInstallxxx.exe`, where **xxx** is the revision number.

After that executable has been downloaded onto your computer, run it to perform the installation. If this is an upgrade then run it and answer Yes to the question about unloading the old version. If upgrading, your designs should remain intact unless they have the same name as one of those in the install package; the installation will overwrite those files that have the same name as any in that package. It will not overwrite the user's designs if they have unique names.

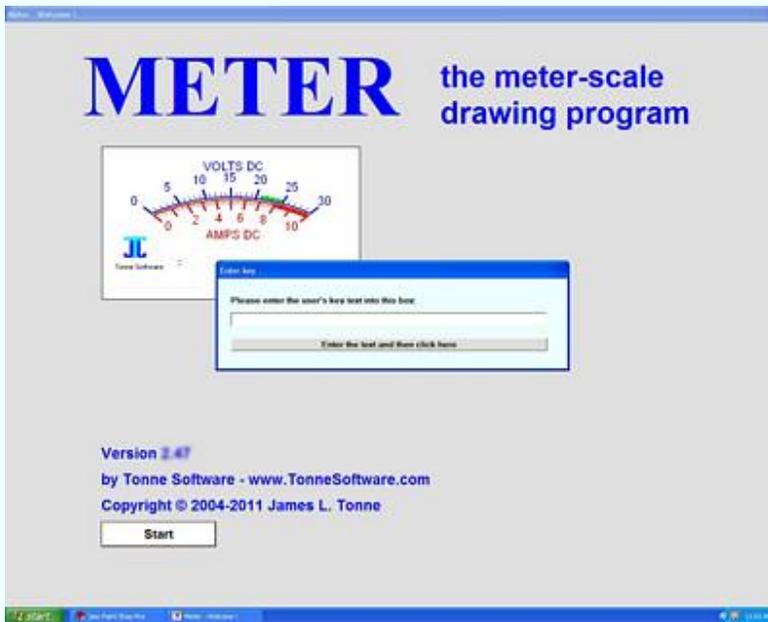


An icon is by default placed on the desktop during the installation. To start the program click on that icon. You will see the opening screen for **Meter**:



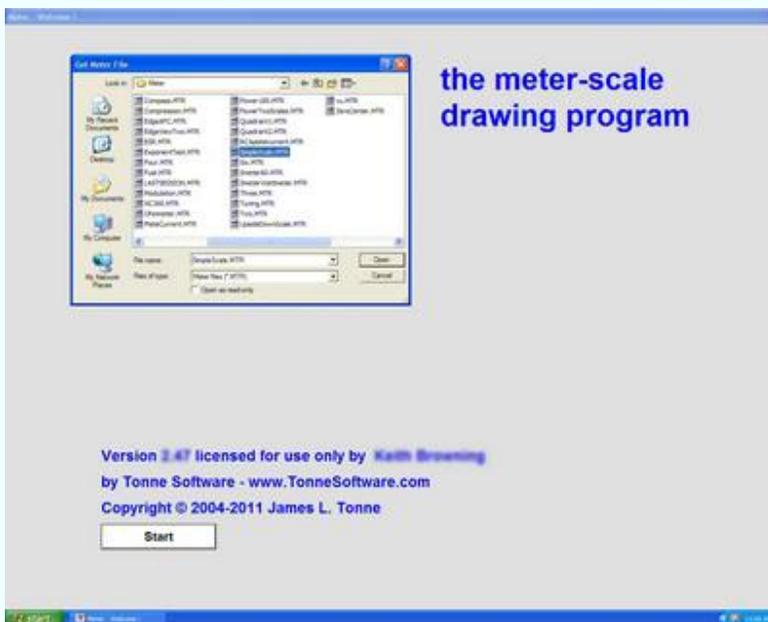
Click on the **Start** button.

If the key string has not been entered, an invitation to enter the string will appear; if a valid key has been entered previously this step will be skipped.

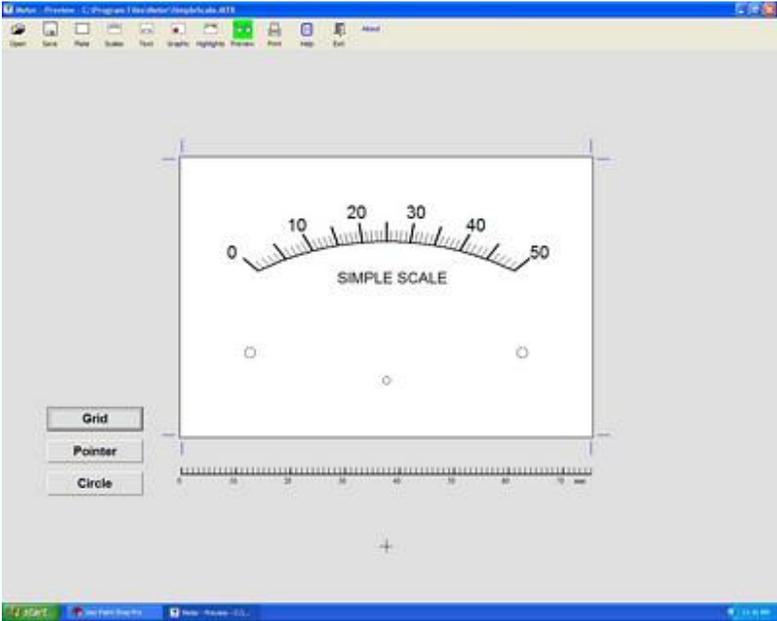


Enter the string of text and click on the **Enter** button. If the string is valid the program will now be in the normal run mode with the licensed user's name appearing on the screen.

A window will appear allowing selection of designs that are available. You may choose any of those designs. Several examples are included in the install package to illustrate various design possibilities.



For this writeup we chose "SimpleScale." As soon as the selection was made that design appeared on the screen as seen here:

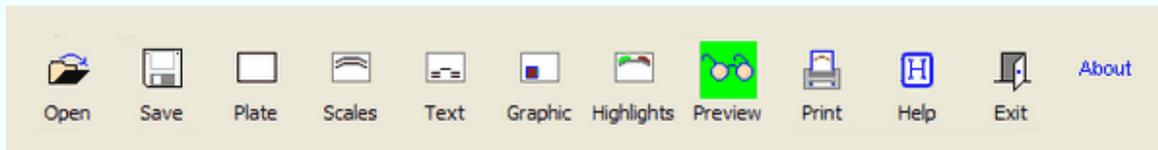


Now we can exercise the various options in Meter to edit the design as desired. To do that we need to take a look at the toolbar with its icons at the top of the screen.

## Menu toolbar

At the top of each of the major pages in Meter is a toolbar with icons. Clicking on one of those icons will enable a particular action.

Here is the toolbar:



Beneath each icon is a word describing the action.



Clicking on that first button will take you to a routine to **open** or **get** a Meter file.



Clicking on that second button takes you to a routine to **save** a Meter file.



Clicking on this button takes you to the **Plate design** page.



Clicking on this button takes you to the **Scales design** page.



Clicking on this button takes you to the **Text entry** page.



Clicking on this button takes you to the **Graphic entry** page.



Clicking on this button takes you to the **Highlights entry** page.



Clicking on this button allows you to **Preview** the meter scale you have designed.



Clicking on this button allows you to **Print** the scale as designed.



Clicking on this button calls the **Help** system.  
The exact page which is called is context-sensitive.



Clicking on this button allows you to **Exit** the program.  
The small screen called up also allows you to cancel this operation and return to the program.

About

Clicking on this button allows you to look at the **About** page.

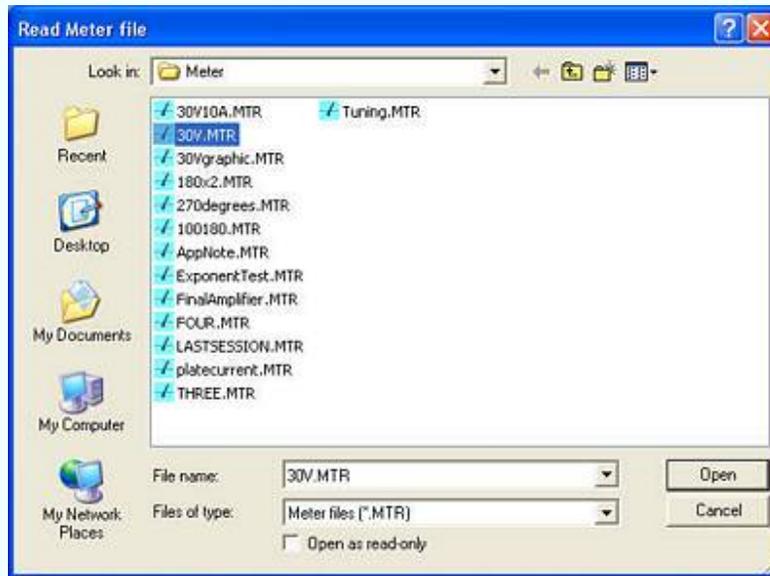
**Now we are going to look more closely at those items. The Plate icon discussion will be followed immediately by discussions of each of the options on that page. Similarly, the Scale icon discussion will be followed immediately by discussions of each of the options on that page.**

## Open File

To get a Meter file, click on the **Open file** icon.



See the usual window into which you may enter the file root name and path:



The usual file and path selection options are available to allow retrieval of a file. As soon as a file is chosen that design is presented on Meter's Preview screen.

## Save File

To save a design, click on the **Save file** icon:



See the window in which you may enter the file root name and path:



The usual file and path selection options are available to allow saving (storing) a file. If a filename is in memory that name will be placed in the filename box.

## Plate design

Clicking on the menu item **Plate** brings up the Plate Design window:

The screenshot shows the 'Plate design' window with the following settings:

Parameter	Value	Help (H)
Plate width	75	<input type="checkbox"/>
Plate height	50	<input type="checkbox"/>
Bottom to bearing	10	<input type="checkbox"/>
Bottom to mounting	15	<input type="checkbox"/>
Hole separation	50	<input type="checkbox"/>
Pointer deflection	100	<input type="checkbox"/>
Actual/virtual offset	30	<input type="checkbox"/>
Minor tic length	2	<input type="checkbox"/>
Major tic length	3.5	<input type="checkbox"/>
Minor tic width	2	<input type="checkbox"/>
Major tic width	4	<input type="checkbox"/>
Font size	8	<input type="checkbox"/>
Label-arc spacing	6	<input type="checkbox"/>
Arc width	2	<input type="checkbox"/>
Number of scales	1	
Labels	<input checked="" type="radio"/> Yes <input type="radio"/> No	
Arcs	<input checked="" type="radio"/> Yes <input type="radio"/> No	
Graphic	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Label rotate	<input checked="" type="radio"/> Horizontal <input type="radio"/> Bearing	
Style	<input checked="" type="radio"/> Standard <input type="radio"/> Quadrant	

Buttons: Linearity, Background, Calibrate, Get font

Font: Arial

All of the options regarding the mounting plate for the scale will be entered in this window.

Most of the items have a small box labelled **H** nearby. Clicking on these gives immediate **Help** for that item.

In many cases the default values remaining from a prior design can be used. If a set of meters for a project is being designed this may in fact be advisable; it will lend continuity to the task.

**The following pages in this manual will provide the details for each of the entries to be made on this page.**

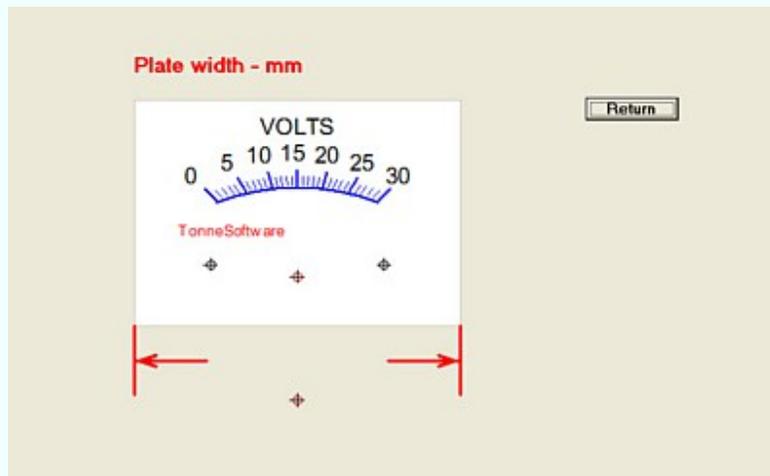
## Plate width

The plate width is entered into the program to assist in the design process. It serves primarily as a guide for showing the plate at maximum possible size on the computer screen.

To set the plate width entry go to the Plate design page and enter the plate width into the **Plate width** textbox:



Clicking on the **H** button next to the textbox brings up the Plate Width help window:



The graphic illustrates the item being entered, in this case plate width.

Entries for plate width are in millimeters, 25 minimum to 180 maximum.

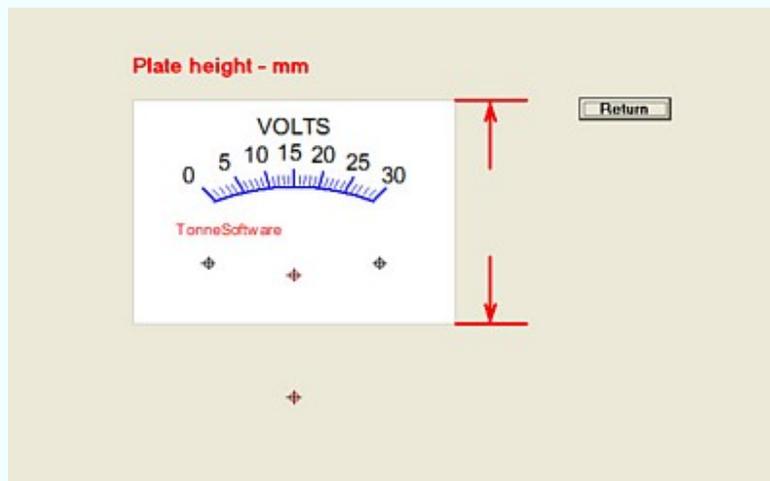
## Plate height

The plate height, like the width, is entered into the program to assist in the design process. It serves primarily as a guide for showing the plate at maximum possible size on the computer screen.

To set the plate height entry go to the Plate design page and enter the plate width into the **Plate height** textbox:



Clicking on the **H** button next to the textbox brings up the Plate Height help window:



The graphic illustrates the item being entered, in this case plate height.

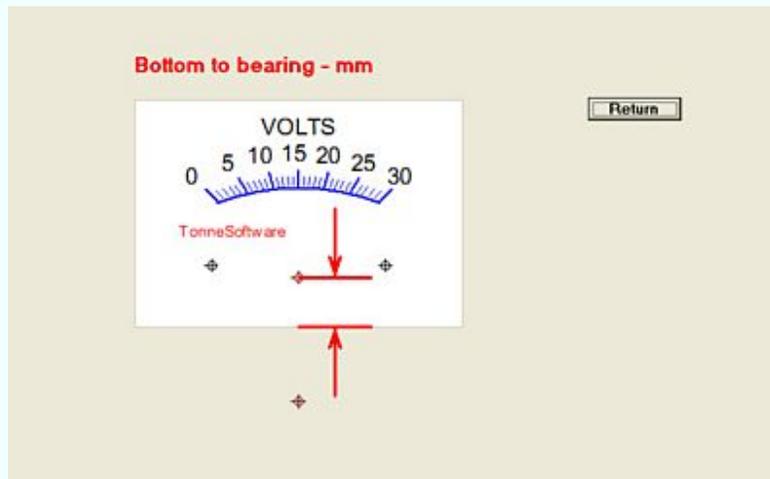
Entries for plate height are in millimeters, 25 minimum to 120 maximum.

## Bottom to bearing

To change the distance between the bottom of the plate and the pointer bearing, go to the Plate design window and enter the new value in the **Bottom to bearing** textbox:



Clicking on the **H** button next to that box will bring up the Bottom to bearing help window:



The graphic illustrates the item being entered, in this case the distance between plate bottom and the bearing.

Entries for bottom to bearing are millimeters, -100mm minimum to +200mm maximum.

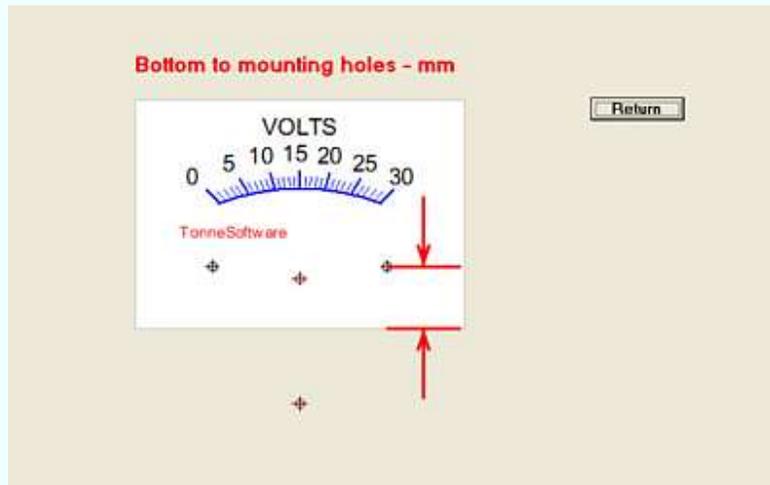
## Bottom to mounting

To change the distance from the bottom of the plate to the mounting holes, go to the Plate design page and enter the new value in the **Bottom to mounting** textbox:



A screenshot of a software interface showing a text input field labeled "Bottom to mounting" containing the number "15". To the right of the input field is a button labeled "H".

Clicking on the **H** button next to that box will bring up the Bottom to mounting graphic:



The graphic illustrates the item being entered, in this case the distance between plate bottom and the mounting holes.

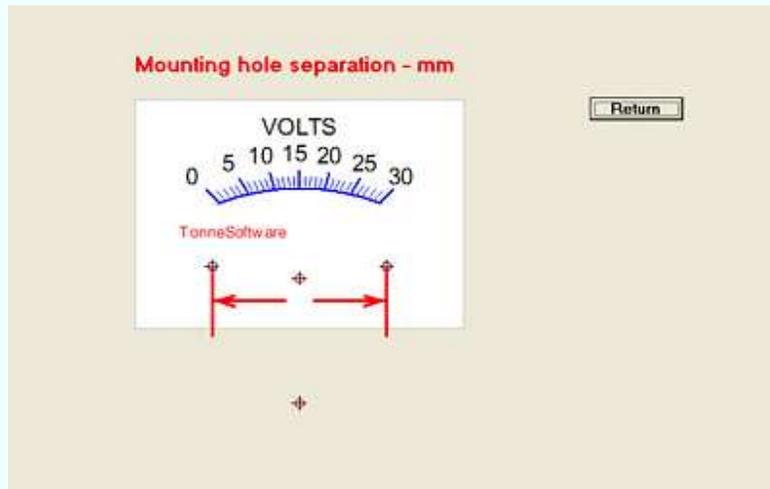
Entries for bottom to mounting holes are in millimeters, 0 mm minimum to 120 mm maximum.

## Hole separation

To change the distance between the two mounting holes, go to the Plate design window and enter the new value in the **Hole separation** textbox:



Clicking on the **H** button next to that textbox brings up the Hole separation graphic:



The graphic illustrates the item being entered, in this case the distance between the two plate mounting holes.

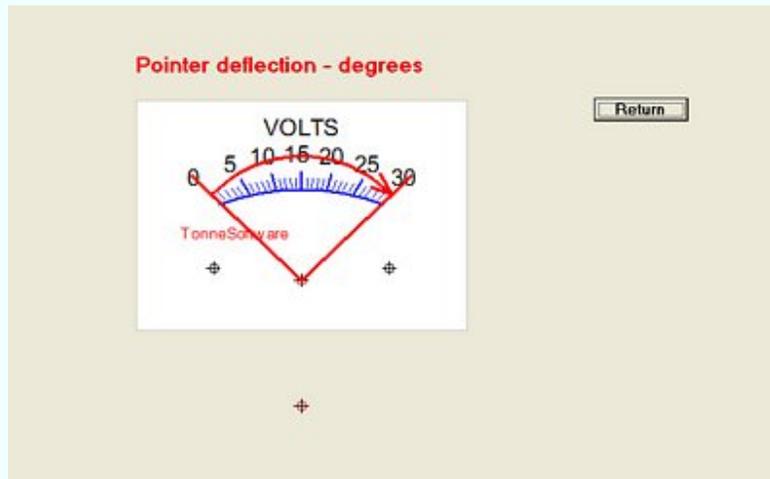
The entry for mounting hole separation is 1 mm minimum to 180 mm maximum.

## Pointer deflection

To change the pointer deflection value go to the Plate design window and enter the new value in the **Pointer deflection** textbox:



Clicking on the **H** button next to that box brings up the Pointer deflection graphic:



The graphic illustrates the item being entered, in this case the pointer deflection, none to maximum.

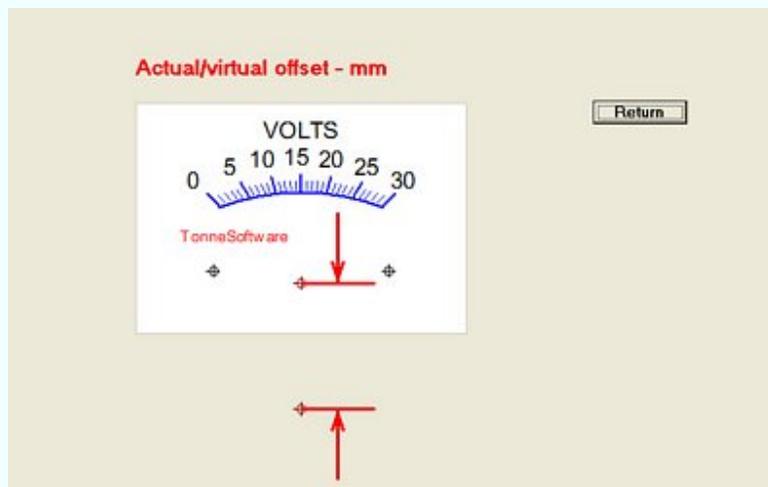
The entry for pointer deflection is 1 degree minimum to 360 degrees maximum. Typical values are 90 and 100 degrees.

## Actual/virtual offset

To design a modern-appearing scale is quite simple with Meter. We merely suppress or offset the actual pointer bearing to a point beneath that point. The spacing of this item is entered into the **Actual/virtual offset** textbox on the Plate design page:



Clicking on the **H** button next to **Actual/virtual offset** on the Plate Design window brings up the Actual/virtual graphic:

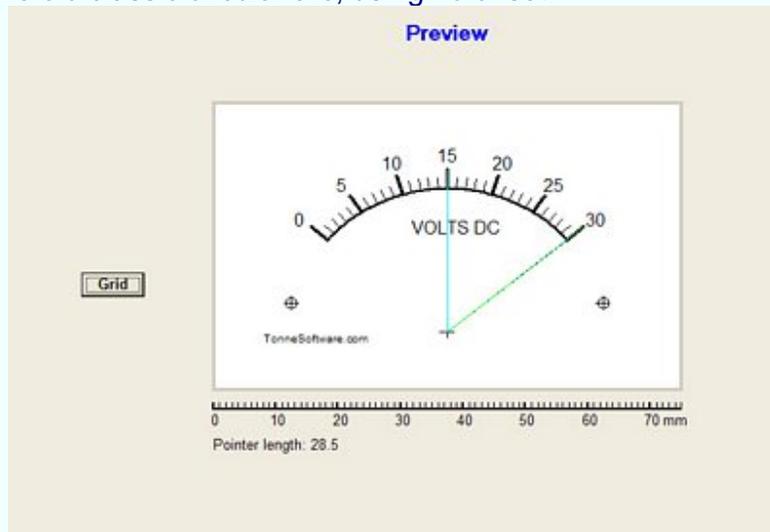


The graphic illustrates the item being entered, in this case the offset or distance between the actual pointer bearing and the virtual bearing below it. When set to zero this yields the classic circular arc. As the offset figure increases the arc becomes flattened.

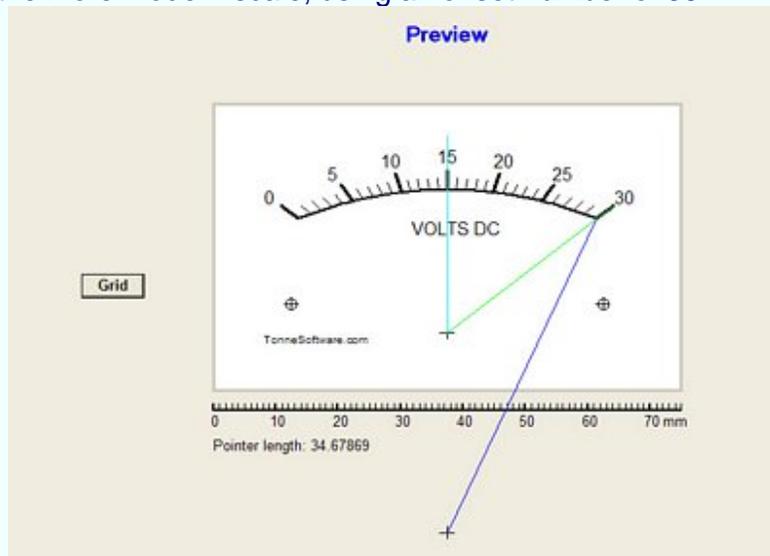
On the next page are the "old style" and the "new style" of designs adjacent to one another for comparison.

Here are the two designs for comparison.

First we see the old classic circular arc, using no offset:



Here we see the more modern scale, using an offset number of 35:



The lines illustrate the pointer position at 50% of full-scale deflection and 100% deflection. The latter shows the appearance of the actual pointer and illustrates the virtual bearing as well.

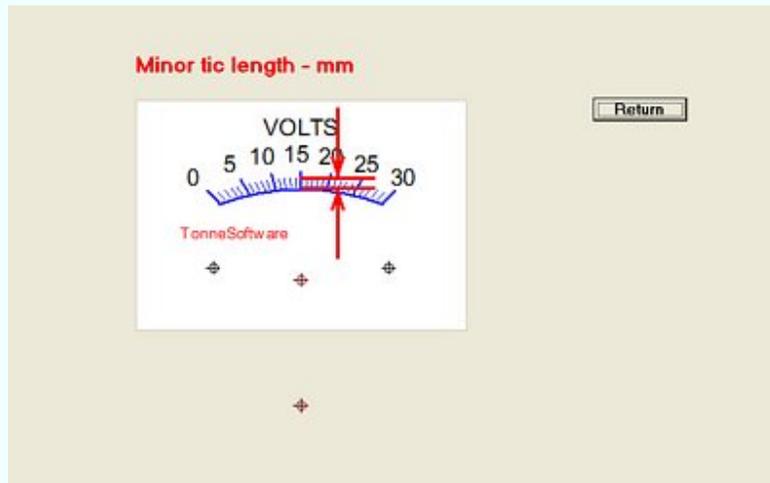
The entry for the actual/virtual offset is zero (for a circular arc) up to 1000 (to make the arc degenerate into a horizontal line). A common entry for this item will be either zero or in the vicinity of 35. If the pointer has at its end a "spade" or other pointing device this feature is of less utility.

## Minor tic length

To change the length of the minor tic marks go to the Plate design window and enter the new value in the **Minor tic length** textbox:



Clicking on the **H** button next to that box brings up the Minor tic length graphic:



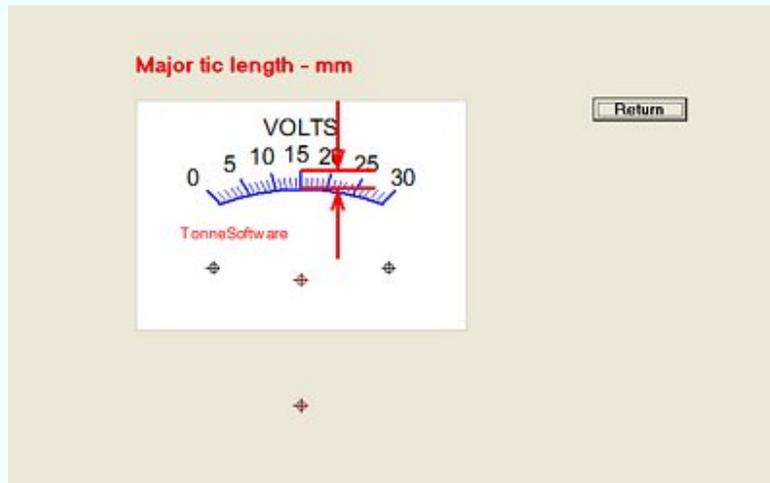
The graphic illustrates the minor tic length entry. These are usually shorter than the major tics. They are also usually narrower.

## Major tic length

To change the length of the major tic marks go to the Plate design page and enter the new value in the **Major tic length** text box:



Clicking on the **H** button next to that box brings up the Major tic length graphic:



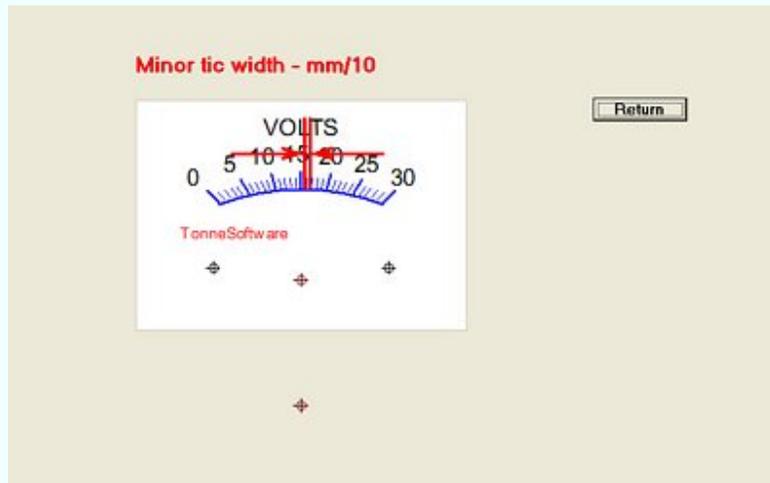
The graphic illustrates the major tic length entry. These are usually longer than the minor tics; they are also usually wider. The length is specified in millimeters; the limits are one millimeter minimum and 20 mm maximum.

## Minor tic width

To change the width of the minor tic marks go to the Plate design window and enter the new value in the **Minor tic width** textbox:



Clicking on the **H** button next to that box brings up the Minor tic width graphic:



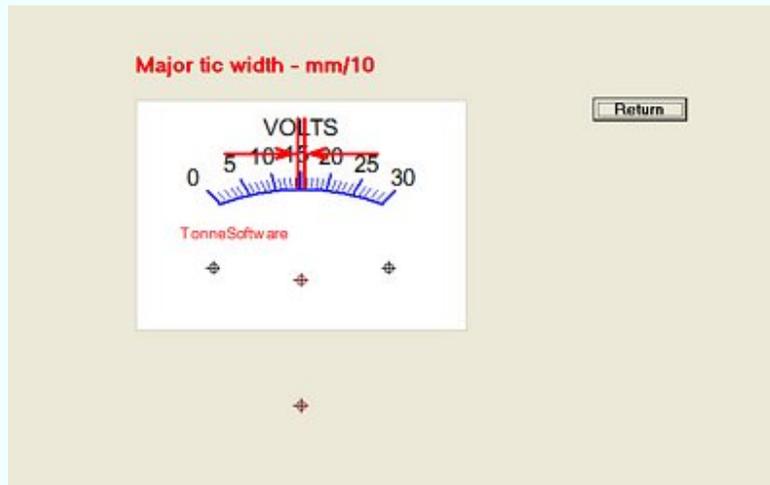
The graphic illustrates the minor tic width entry. These are usually narrower than the major tics. They are also usually shorter. The width is specified in tenths of millimeters; the limits are one (tenth) millimeter minimum and 50 (tenths) maximum.

## Major tic width

To change the width of the major tic marks, go to the Plate design page and enter the new value in the **Major tic width** textbox.



Clicking on the nearby **H** button brings up the Major tic width graphic:



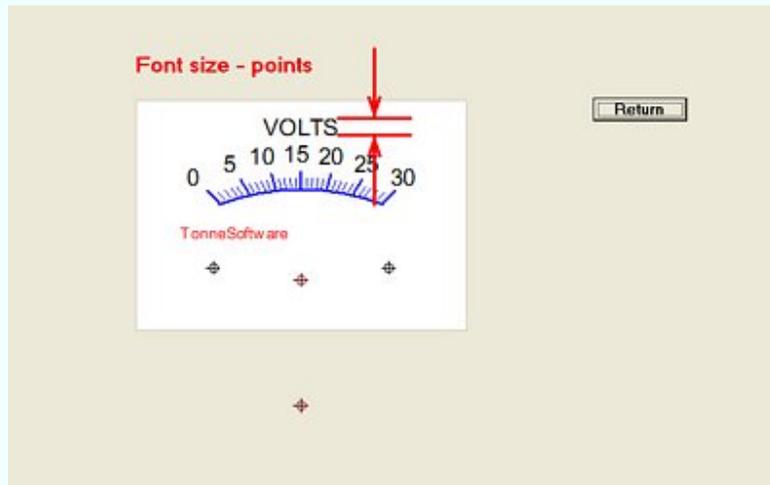
The graphic illustrates the major tic width entry. These are usually wider than the minor tics. They are also usually longer. The width is specified in tenths of millimeters; the limits are one (tenth) millimeter minimum and 50 (tenths) maximum.

## Font size

The size of the font is adjusted by going to the Plate design window and entering the desired font size into the **Font size** textbox:



Clicking on the **H** button next to that textbox brings up the Font size graphic:



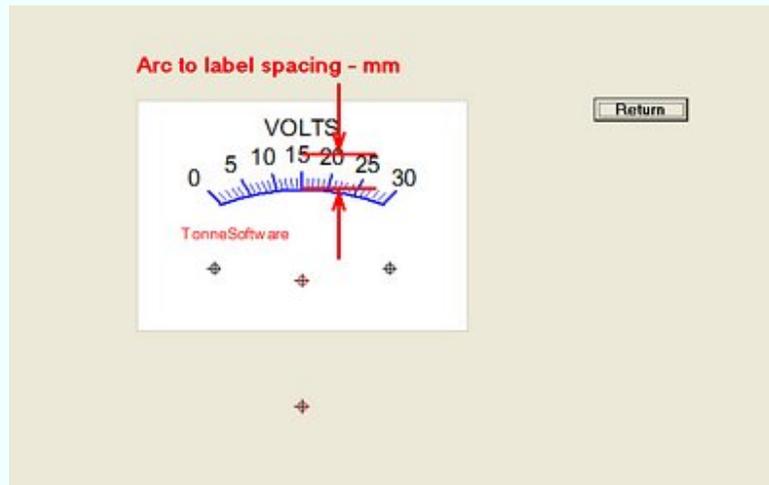
The graphic illustrates the font size entry. The program has been set to approximately agree with the fonts as printed using MS standards. A typical value is 6 to 8. The minimum is 2 and the maximum is 20.

## Label-arc spacing

The spacing between the arc and the labels for a given scale can be adjusted by going to the Plate design window and entering the value in the **Label-arc spacing** textbox:



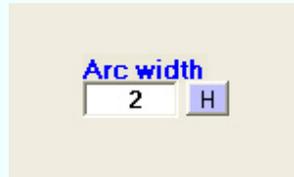
Clicking on the **H** button next to that box brings up the Label-arc graphic:



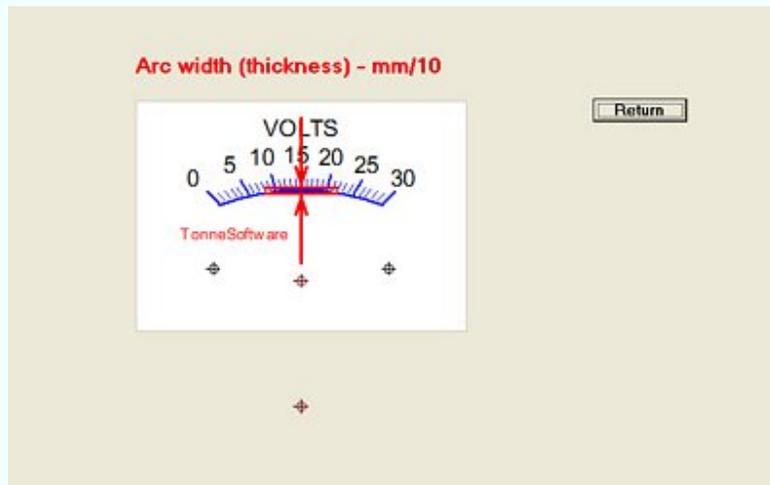
The graphic illustrates the spacing between the arc and the labels for the tickmarks. A typical value is 6 to 8. Adjust this value so that the numbers are spaced slightly away from the ends of the major ticks. The minimum is 0 and the maximum is 100. The spacing for this measurement is from the arc to the *vertical center* of the text.

## Arc width

The width (thickness) of the arc as printed can be adjusted by going to the Plate design window and entering the desired width in the **Arc width** textbox:



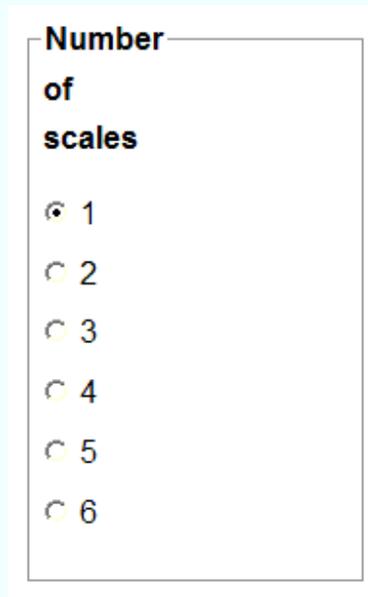
Clicking on the **H** button next that box brings up the Arc width graphic:



The graphic illustrates the width or thickness of the arc. The value is entered in tenths of a millimeter. A typical value is 5 (tenths) of a millimeter with the limits being 1 to 20.

## Number of scales

To set the number of scales on a plate, click on the appropriate button (1 to 6) in the **Scales** box on the Plate design page:



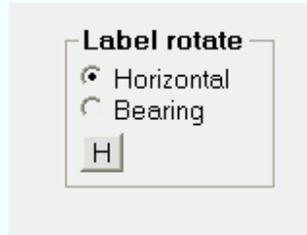
The image shows a rectangular control panel with a white background and a thin black border. At the top left, the text "Number of scales" is displayed in a bold, black, sans-serif font. Below this text, there are six vertically aligned radio button options, each consisting of a small circle followed by a number from 1 to 6. The radio button for the number 1 is filled with a dark grey color, indicating it is the selected option. The other radio buttons (2, 3, 4, 5, and 6) are empty and have a light grey outline.

On a new design this will be preset to a value of one. You may reset this to any other number. It will be found easier to add one scale at a time; increment the number upward one at a time and enter the data for the new scale.

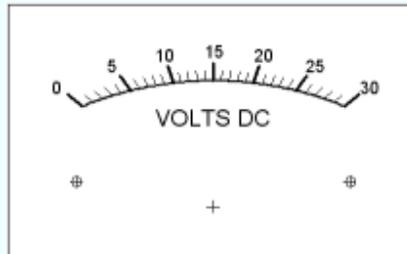
If this number is reset downward, the previously-entered data is still in the program. It may be restored by resetting the number of scales back up to a previous value. However when the file is saved the unused data will not be saved.

## Label rotate

The labels for the ticmarks can remain horizontal or they can "rotate" about the pointer bearing. The former is recommended for the modern "flattened" scale design whereas the latter is recommended for the old style scale. To choose the type, click on either **Horizontal** or **Bearing** in the Label Rotate box on the Plate design page:

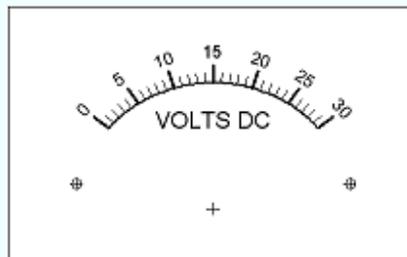


Clicking on the **Horizontal** button will select the horizontal printing mode, illustrated here:



That mode is commonly used with the "modern" style of design (as shown) taking advantage of the virtual/actual offset capability in Meter.

Clicking on the **Bearing** button will select the rotated printing mode, with the labels rotated about the bearing as shown here:



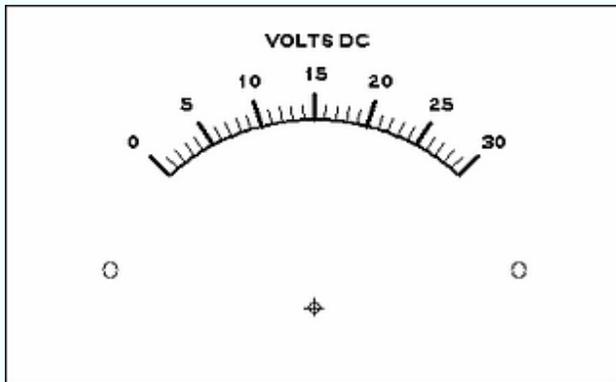
That mode is commonly used with the older style of design (as shown) where there is no virtual/actual offset.

## Style

Meter can do "Quadrant" or "Sector" plate designs. The default is the older "Standard" style but on the Plate design page is an option to switch to the Quadrant style:



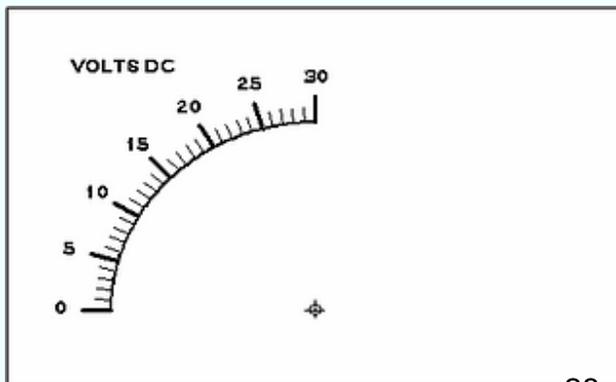
When this option is chosen the result is the Standard style:



To switch to the Quadrant style, click on the **Quadrant** option:



This changes the design to the Quadrant style:



The label for scale number one is left-justified but its vertical positioning may be altered just as is done with the Standard style. The label for scale number two is right-justified but again it may be repositioned vertically.

The normal pointer deflection for the quadrant style is 90 degrees and the use of actual/virtual offset is contraindicated.

The mounting hole printout is suppressed for the Quadrant style. This slightly complicates the placing of the printout on the underlying plate as shown in the AppNote.

## Labels

The labels for the ticmarks and also the label for a given scale can be printed as usual or this may be suppressed. To choose whether or not the labels will be printed, click on the appropriate button (yes or no) in the **Labels** box on the Plate design page:

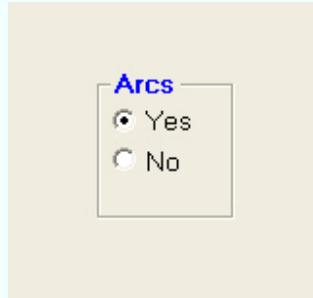


To restore the appearance to a previous state simply reset this option.

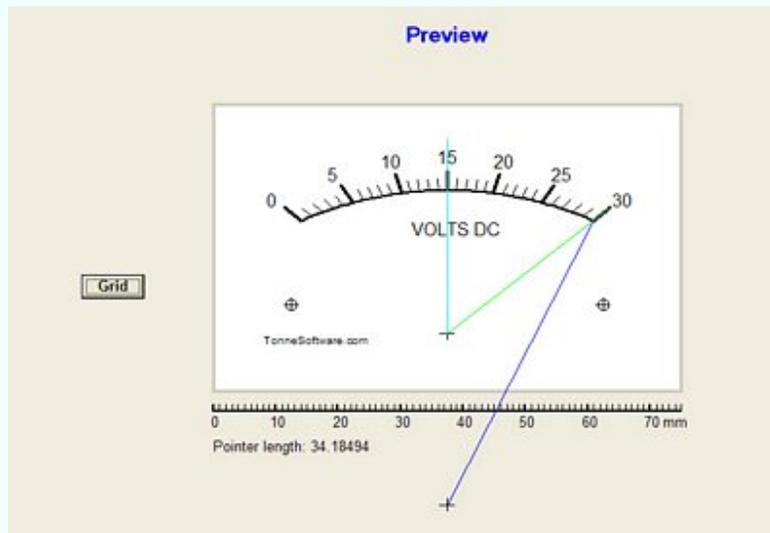
This on/off function is independent of the text items added using the Text Entry screen. To delete any of those items simply delete the text string in the appropriate textbox.

## Arcs print

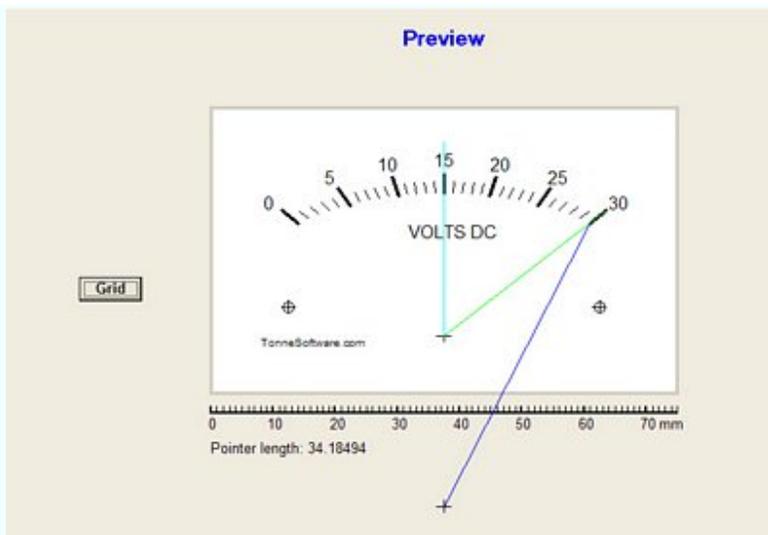
The arcs on a scale can be printed as usual or this may be suppressed. To choose whether or not the arcs will be printed, click on the appropriate button (yes or no) in the **Arcs** box on the Plate design page:



Seen here is the usual way to print a scale, with the arc being shown:



When the "no" selection is made the plate will be printed as shown here:



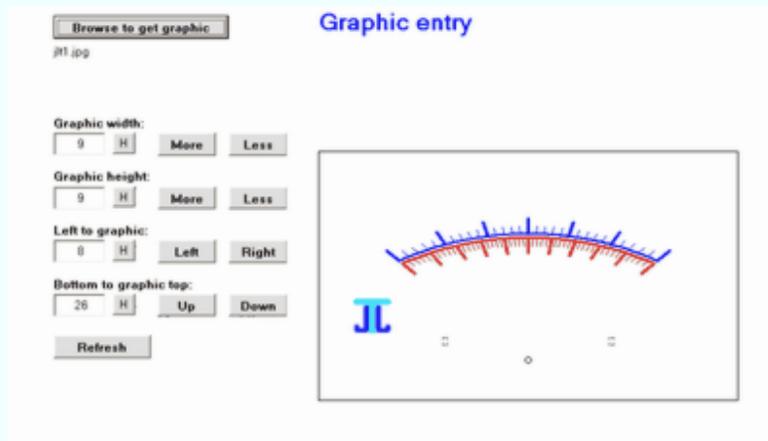
To restore the appearance to a previous state simply reset this option.

## Graphic entry

A graphic (sometimes called "logo") may be added to the meterscale. This can be positioned on the plate arbitrarily as well as resized by the program. The graphic type can be .bmp, .gif, .ico or .jpg type. A graphic does not *need* to be used.

To enter or edit a graphic, click on the menubar item **Graphic**.

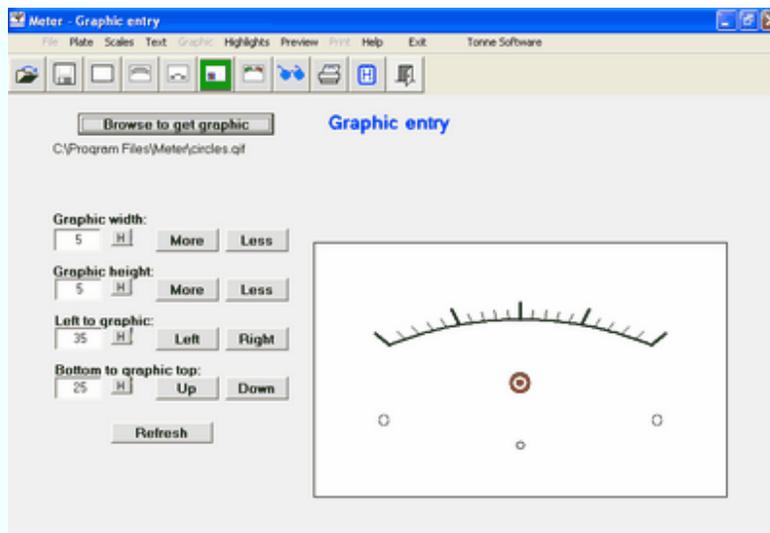
The Graphic Entry window will then show:



Click on the **Browse to get graphic** button to call up the routine to browse and retrieve a graphic. Only the allowed graphic types will show, probably about as seen here:



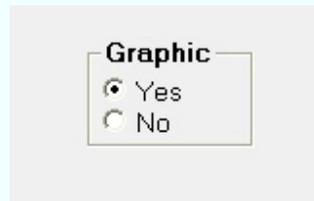
Highlight the desired graphic and click on the **Open** button.



We are now back at the Graphic Entry screen and the chosen graphic is shown in a summary of the plate so that the graphic can be seen in context with the scale.

You may position and resize the graphic using the set of buttons. You may also enter the new number(s) into the textboxes. If that is done use the **Refresh** button to enter those numbers into the system.

The graphic can be turned on or off by using the Yes/No entry on the Plate design page.

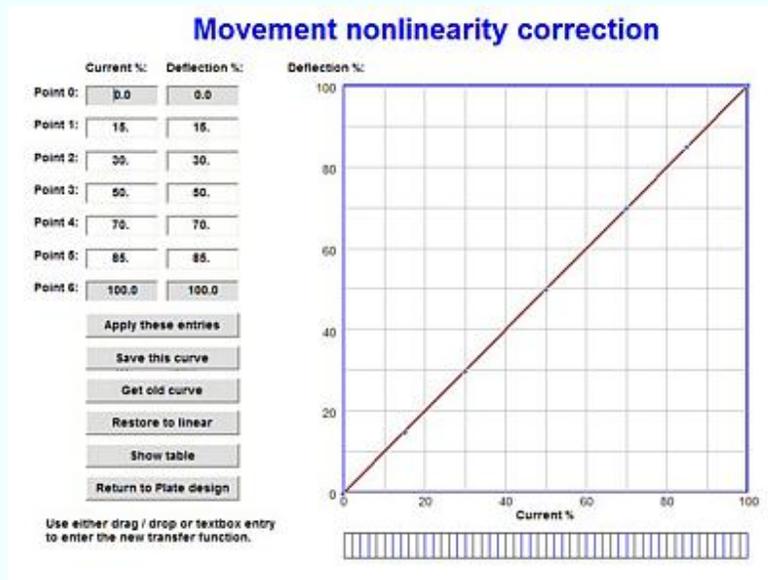


Significant resizing of a graphic, either making it wider or narrower, or taller or shorter, may result in a distorted reproduction. It is best to use an external graphics program to significantly resize a graphic.

## Linearity (movement)

Meter has the capability to compensate for meter movement nonlinearity. This procedure allows correction of the nonlinearity frequently found in less-expensive meters. This routine can also be used to advantage in creating special scales, but bear in mind that **all** scales on the plate will have the same degree of correction. If the plate has but a single scale this is of no concern.

To use the Linearity procedure, go to the Plate Design page and click on the **Linearity** button. This takes us to the Linearity routine.



A set of textboxes where currents ("x-axis") and their resulting deflections ("y-axis") can be entered is at the left side of the page. After any such entries are made press the **Accept these entries** button.

The entries can also be made by using the mouse to "drag and drop" the segment junctions in the plot. Six such segments are available to produce the correction.

The end points (at zero current and at fullscale current) cannot be changed. Entries are always checked to confirm that they are legitimate, resulting in a realizable function. The process is blocked until the last-entered point is corrected.

The resulting transfer is then shown as a graph on the right side of the page. Beneath that graph is a ruler-like presentation of the meter deflection.

Clicking on the **Save this curve** button saves the transfer data to the hard drive using a user-specified location and name.

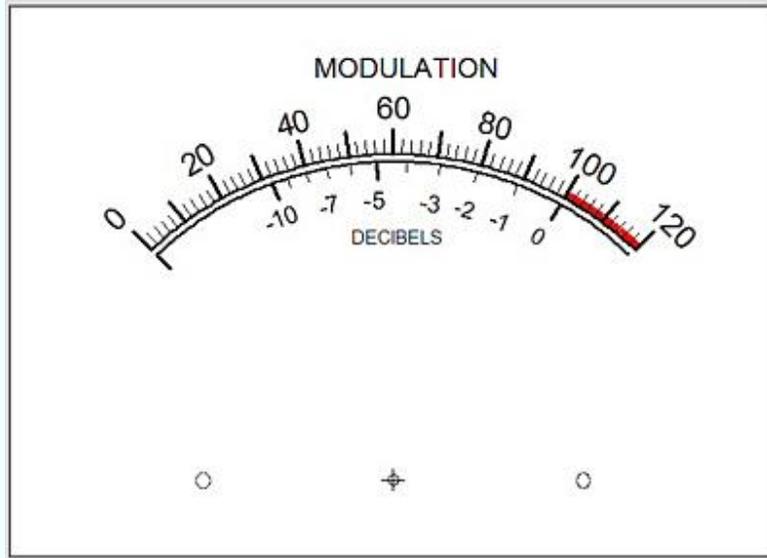
Clicking on the **Get old curve** button retrieves one of these earlier-saved curves.

At any time the curve can be restored to a linear function by clicking on the **Restore to linear** button.

Clicking on the **Show table** button shows the slopes of each of the six segments along with a 50-point table of X and Y values.

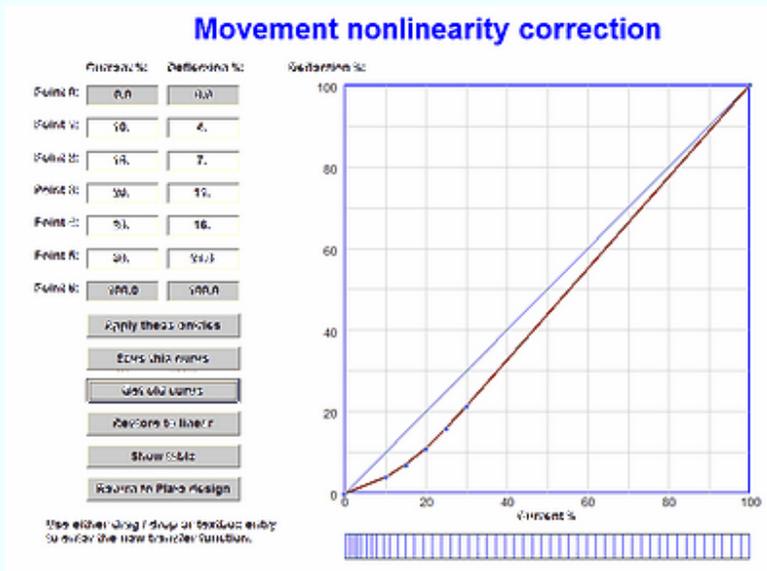
Clicking on the **Return to Plate design** button exits from this process and takes the designer to the Plate Design page. At this point the most likely thing to be done is to click on the **Preview** button to see how the linearity correction looks.

Below is a design with two scales and ideal linearity. Note that the "-10" decibel ticmark is at 31.6 percent modulation.

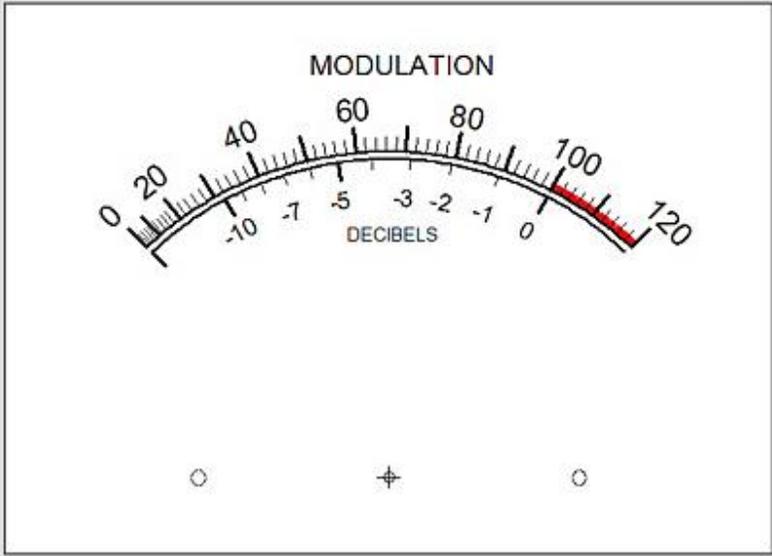


Now let us apply a correction. This might be for a nonlinear meter movement or for a nonlinear driving electronics circuit. In this case we have applied a nonlinearity in the low-current area, such as might be encountered in a semiconductor diode rectifier.

Here is the transfer used for this example:



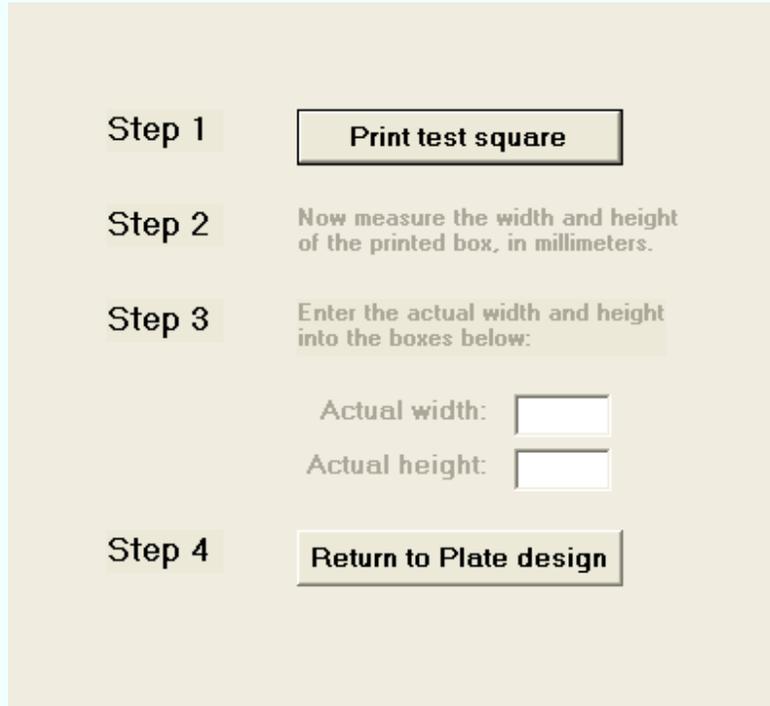
The resulting design now appears as below. Note that both scales have been changed. The decibel scale perfectly tracks the upper percentage scale; the decibel "-10" ticmark is still at 31.6 percent modulation.



## Printer calibration

The meter plate as printed by the printer is close to being correctly sized. But by following a calibration procedure the output can be adjusted to be exact.

To use the calibration procedure, go first to the Plate Design page and click on the **Calibrate** button. This takes us to the Calibrate routine.



The screenshot shows a four-step calibration routine on a light beige background. Step 1 is a button labeled 'Print test square'. Step 2 is a text instruction: 'Now measure the width and height of the printed box, in millimeters.' Step 3 is a text instruction: 'Enter the actual width and height into the boxes below:', followed by two input fields labeled 'Actual width:' and 'Actual height:'. Step 4 is a button labeled 'Return to Plate design'.

Step 1	<b>Print test square</b>
Step 2	Now measure the width and height of the printed box, in millimeters.
Step 3	Enter the actual width and height into the boxes below: Actual width: <input type="text"/> Actual height: <input type="text"/>
Step 4	<b>Return to Plate design</b>

Next we send a test pattern to the printer. To do that, click on the **Print test square** button. The printed pattern will be a square of 100 mm width and 100 mm height, with no other information.

After the printout, further instructions are enabled as shown here:

Step 1

Step 2 **Now measure the width and height of the printed box, in millimeters.**

Step 3 **Enter the actual width and height into the boxes below:**

Actual width:

Actual height:

Step 4

The printed pattern should be 100 mm by 100 mm in size. Use a ruler to measure the actual printed size. Enter the width and height into the boxes (as shown here with an example set of numbers):

Step 1

Step 2 **Now measure the width and height of the printed box, in millimeters.**

Step 3 **Enter the actual width and height into the boxes below:**

Actual width:

Actual height:

Step 4

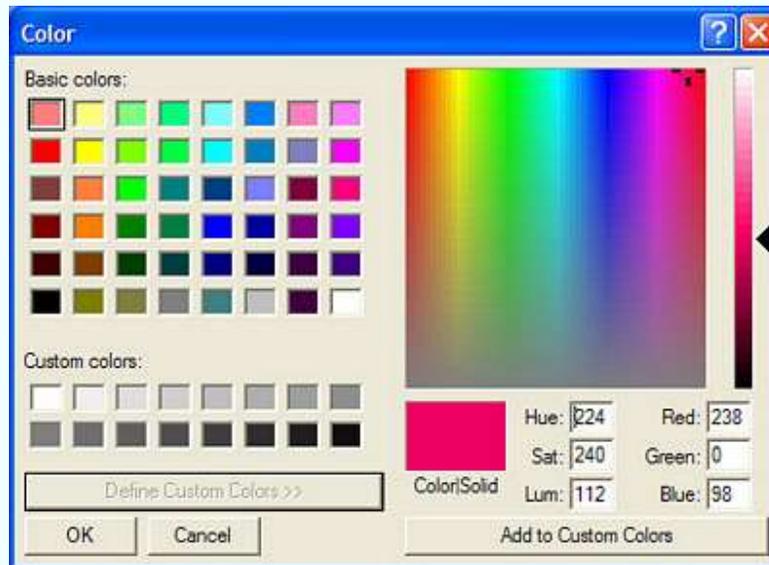
After that, click on the **Return to Plate design** button. At that time the program's internal scaling factors are updated and stored to the hard drive for recovery on program startup.

## Background color

The color of the plate - the background - is changed by going to the Plate Design window and clicking on the **Background** button:

**Background**

The color-selection box will then appear:



The background color is white by default. If a different color is desired then you can use this control to make the selection. You may select a complex color by using the custom control as shown.

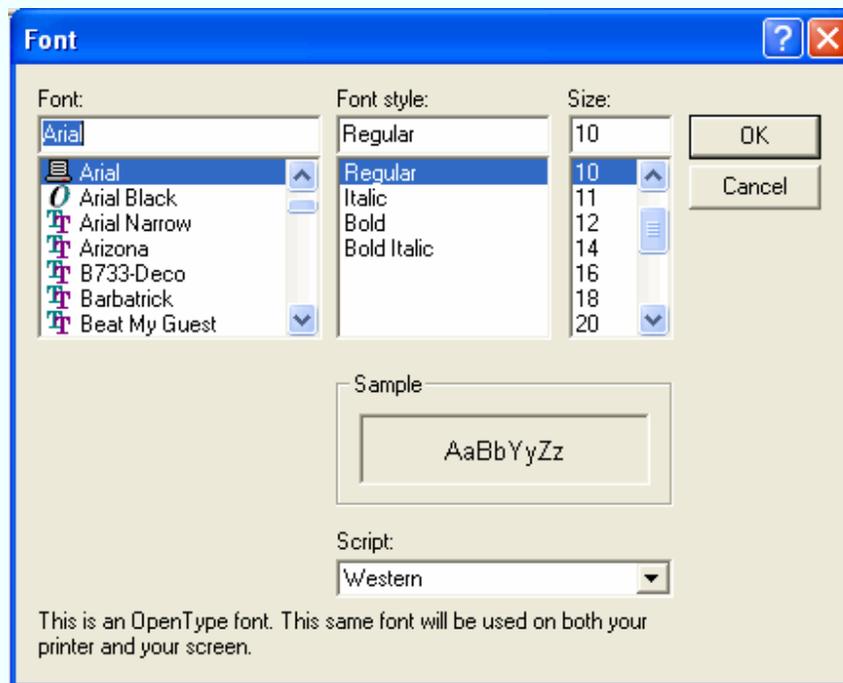
## Font

To change the font used by Meter, click on the **Get font** button on the Plate design page:



The font currently in use will be shown below the button.

Clicking on that button will bring up the font selection window:



Select the desired font and click on **OK**.

The font **size** is not necessarily that which the program will use; the user can select the various sizes and ratios in Meter and those sizes will over-ride what is seen on this menu.

## Komma/comma

On a global basis, the decimal delineator for value entry may be either "." or "," according to the computer's regional setting.

This program has been modified to use the regional setting for the decimal point. Should you have a problem with the decimal, try using the "other" kind: if you normally use a period (".") try the comma (",") and also the other way around.

The scale uses only "." for printout to the plate.

Decimal point delineation is thought to be correct. If you are having a problem with this please send us an e-mail including your regional and keyboard settings.

## Scale design

Clicking on the menu item **Scale** brings up the Scale Design window:

The screenshot shows the "Scale design" window with the following fields and controls:

- Scale #:** A vertical list of numbers 1 through 6. Number 1 is highlighted with a yellow border, while 2 through 6 are greyed out.
- Scale title:** A text box containing "SIMPLE SCALE".
- Scale left end (units):** A text box containing "0".
- Scale length (units):** A text box containing "50".
- Bottom to title:** A text box containing "30" and a small "H" button.
- Bottom to scale ceiling:** A text box containing "35" and a small "H" button.
- Relative fontsize:** A text box containing "1".
- Number of tics:** A text box containing "50".
- Major tics every how many:** A text box containing "5".
- Labels every how many:** A text box containing "10".
- Linearity exponent:** A text box containing "1" and a small "H" button.
- Print tics are:** Radio buttons for "Yes" (selected) and "No".
- Buttons:** "Foreground color", "Create or edit special scale", "Select tics", "H", and "Revert to standard scale".

All of the options regarding a specified scale will be entered here. To edit a particular scale, click on the scale number on the left side of the window. Those scales not available for editing are "greyed out." To change the number of scales, go to the Plate Design page.

Small buttons labelled **H** are near some items. Clicking on these gives immediate **H**elp for that item.

**The following pages in this manual will provide the details for each of the entries to be made on this page.**

## Edit scale number

On the Scale design page is the place where you select which scale to edit. The scale to be edited is chosen by clicking on the appropriate scale number in the **Edit scale #** box:

Scale #:

1

2

3

4

5

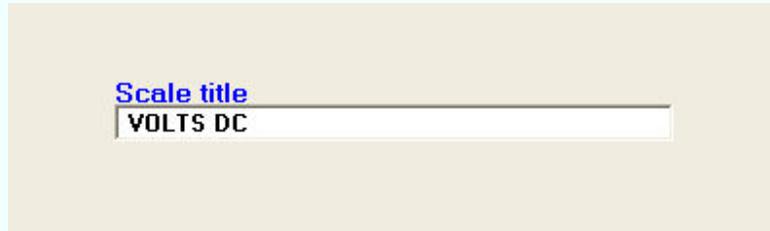
6



That illustration shows that this plate has two scales and scale number two has been selected for editing. Because there are only two scales, the remaining scales are not available for editing; this is shown by their being "greyed out."

## Scale title

The title of a given scale is changed by going to the Scale Design window and editing the entry in the **Scale title** box.



Leading and trailing blank spaces are not removed; they are left intact and can be used as an alternative method of horizontal positioning.

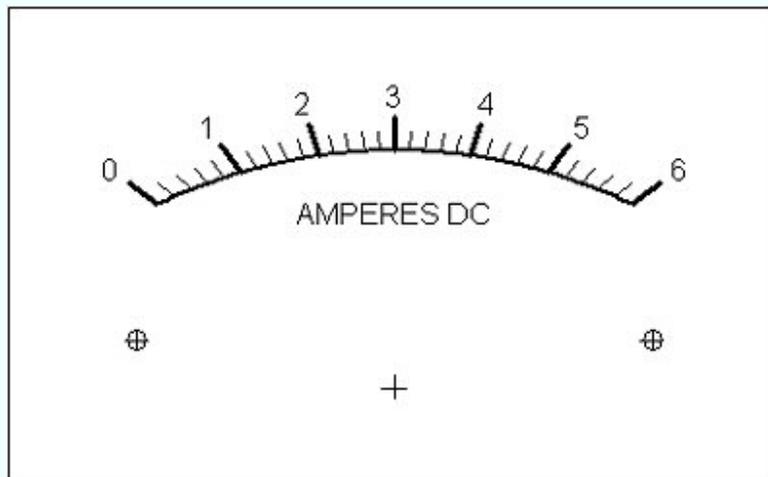
The program will use a default title if you try to leave the title blank. To have no label at all for a given scale, simply enter a blank space (by pressing the spacebar once). This tells the program that the label is not really empty and so it will not print the default name; the title will then appear blank.

## Scale value entries

The values for a given scale (volts, amperes, etc.) are changed by going to the Scale Design window and editing the items in the **Scale left end** and **Scale length** boxes.

<b>Scale left end (units)</b>
<input type="text" value="0"/>
<b>Scale length (units)</b>
<input type="text" value="6"/>

Such an entry pair will yield this scale:

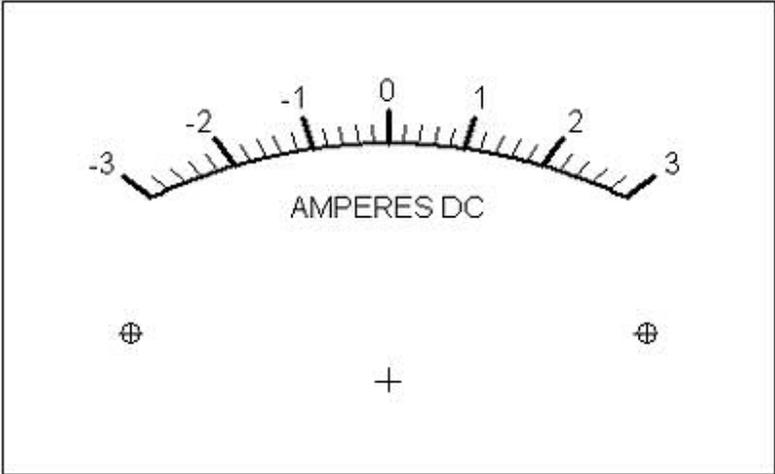


This is the most common kind of scale in that the left-end value will be zero. Scales with left-end values other than zero are easily designed.

An example of this would be a "zero-center" meter. For example let us design a scale with a left end reading of -3 and a right end reading of +3. For that design the scale left end would be -3 and the scale length would be 6. The entries would then appear as shown here:

<b>Scale left end (units)</b>
<input type="text" value="-3"/>
<b>Scale length (units)</b>
<input type="text" value="6"/>

The resulting scale would look like this:

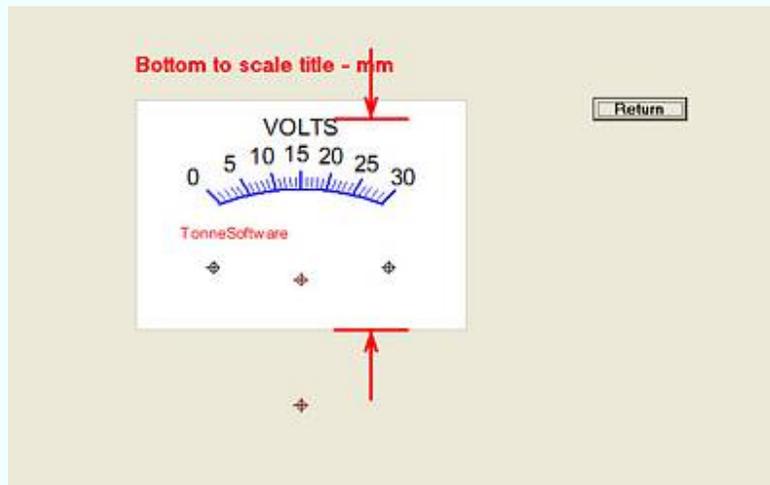


## Bottom to title

The distance from the bottom of the scale to the title for a given scale can be adjusted. This is done by going to the Scale Design page and entering the value into the **Bottom to title** text box

**Bottom to title**

Pressing the nearby **H** button would show us the help graphic

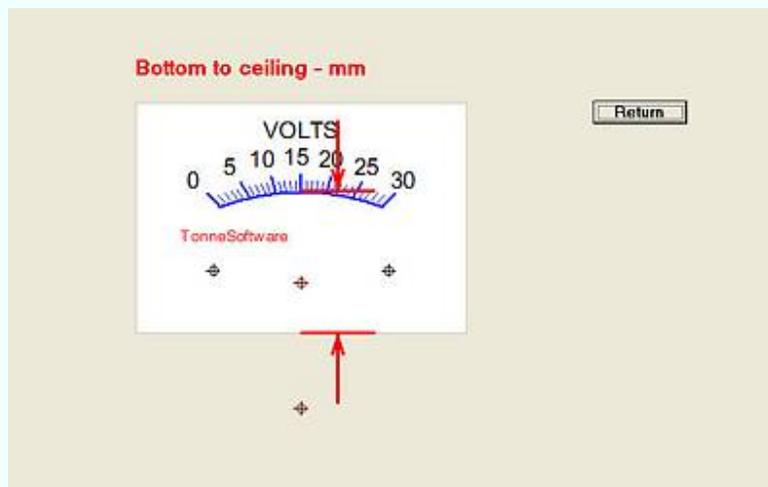


## Bottom to scale ceiling

The distance from the bottom of the scale to the top of a scale arc - the ceiling - is adjusted by going to the Scale Design page and entering the value into the **Bottom to scale ceiling** text box

**Bottom to scale ceiling**

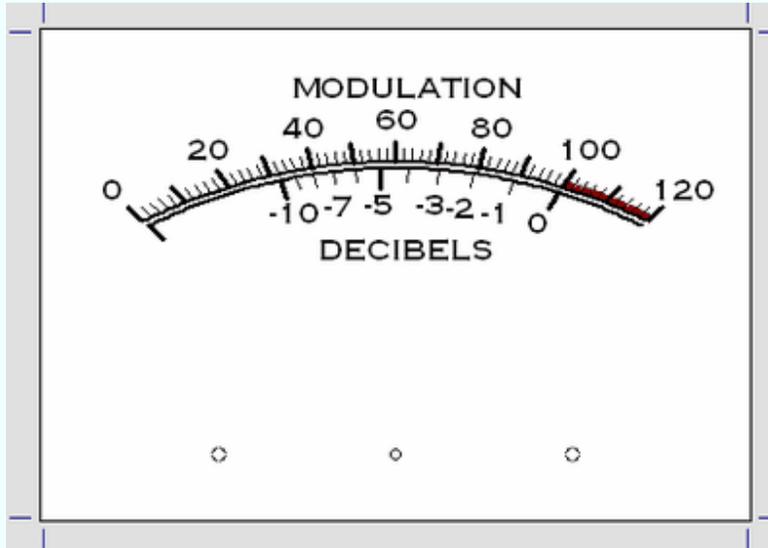
Pressing the nearby **H** button would show us the help graphic



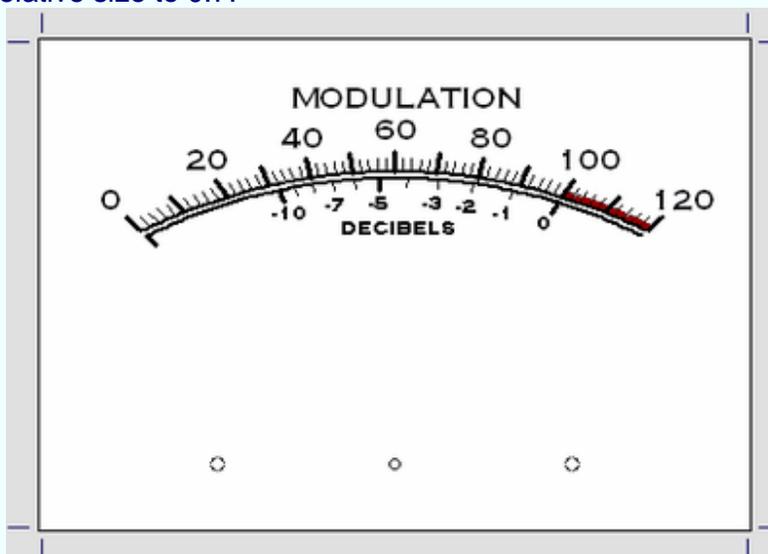
## Relative font size

On the Scale Design window, entering a value into the **Relative fontsize** textbox will change the size of the font for that scale.

Here is an example of a plate with two scales on it, with each scale having the same size font:



By going to the Scale Design page, and then clicking on **2** under Edit Scale # on that page, we can enter a number into the **Relative fontsize** textbox. In this example, we have set the relative size to 0.7.



The fontsize is rescaled according to that entry, and so are the lengths of the tickmarks for that scale and the spacings of the labels from the tickmarks.

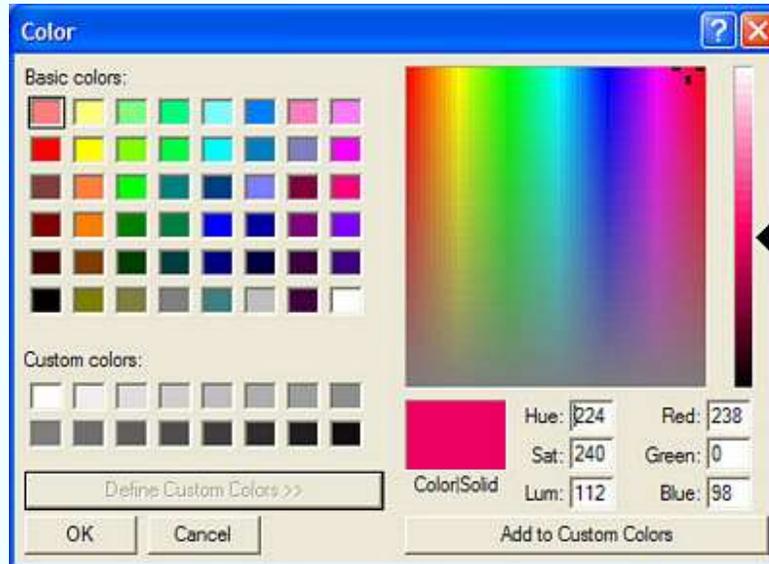
The textbox to enter a relative font size is "greyed out" (made inactive) for scale #1. For the other scales the entry must be 0.5 or greater and 1.0 or less.

## Foreground color

The color of a given scale is changed by going to the Scale Design window and clicking on the **Foreground color** button:

Foreground color

The color-selection box will then appear:



Scale colors are black by default. If a color has been chosen it will be retained if you press the Cancel button on this control. You may select a complex color by using the custom control as shown.

The color chosen will apply to that scale and its associated text.

## Tics and labels

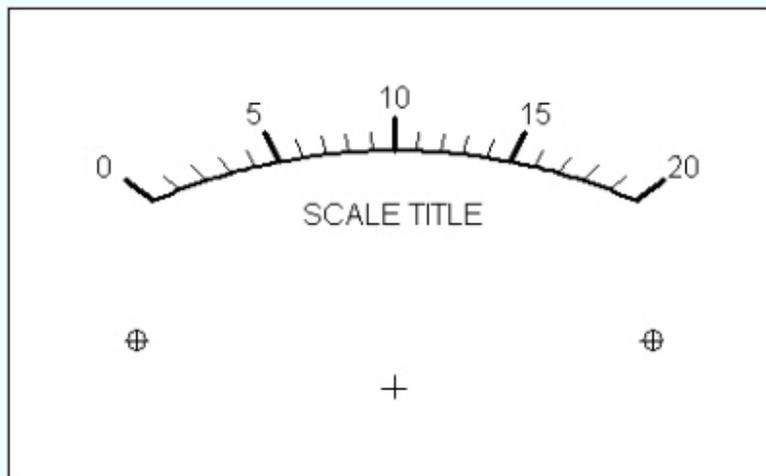
The small marks are called tics or ticmarks. Their length and width both can be adjusted. Further, we have two types: minor ticmarks (short and narrow) and major ticmarks (longer and wider).

Only the major ticmarks can be labelled. If you attempt to label a minor ticmark it will be converted to a major one.

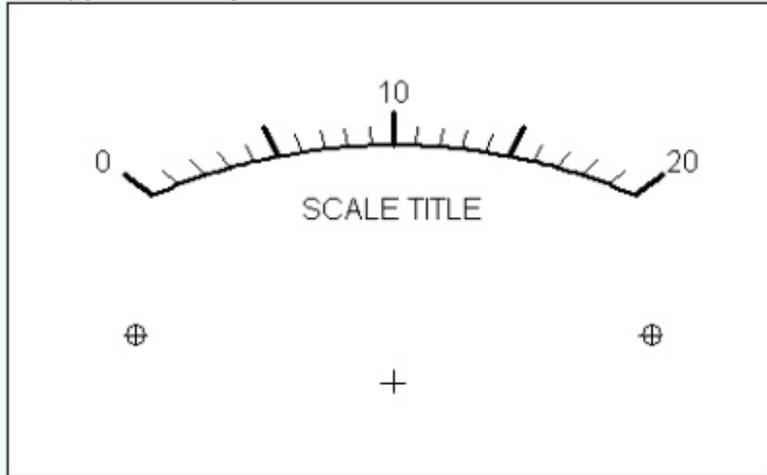
Each scale has its own set of definitions. On the Scale Design page we have this example set of entries for each scale:

<b>Number of tics</b>
<input type="text" value="20"/>
<b>Major tics every how many</b>
<input type="text" value="5"/>
<b>Labels every how many</b>
<input type="text" value="5"/>

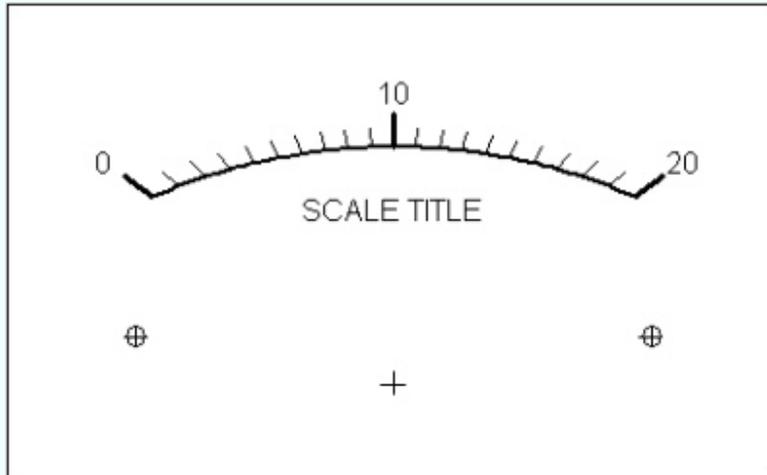
Those entries would result in this scale:



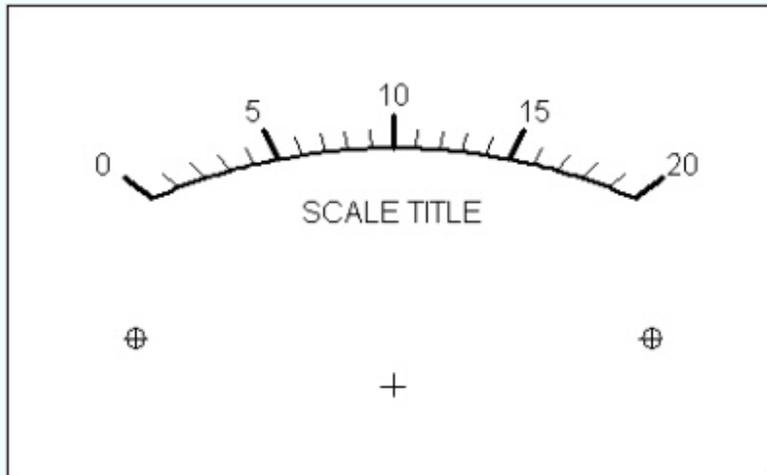
If the value for **Labels every how many** is adjusted from its original value of 5 up to 10 then the scale appears thusly:



If the value for **Major tics every how many** is adjusted from its original value of 5 up to 10 then the scale looks like this:



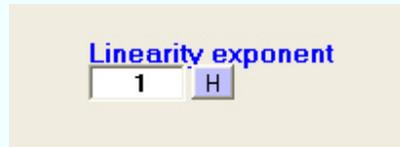
If a minor ticmark is labelled it will be forced to be a major ticmark at printing time. If we change the labels back to being every five tics, we get this result, with every fifth tic being major:



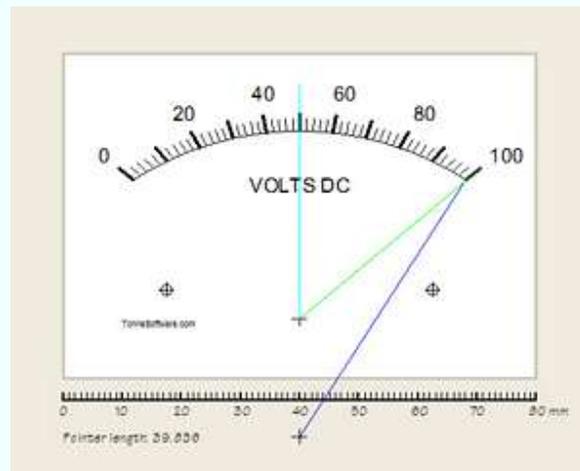
## Scale linearity (exponent)

Most meter scales are linear; the pointer deflection is directly (linearly) proportional to the value of some variable being measured. In the case of a power scale, this variable might be a voltage but the scale would be calibrated in watts. This can be accomplished by using an exponent other than unity for the meter tickmark placement.

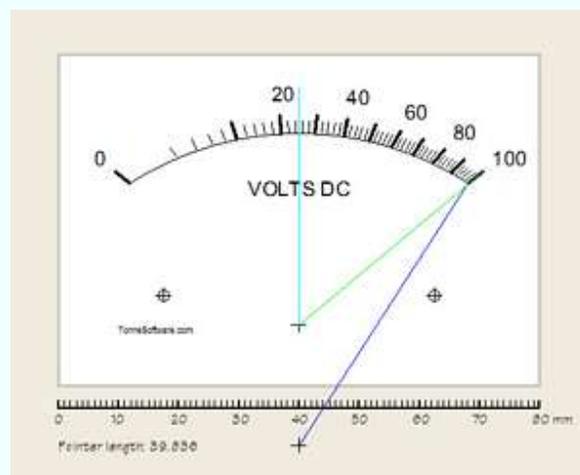
This is accomplished by going to the Scales Design page and entering the appropriate exponent in the **Linearity Exponent** textbox:



The usual scale would have its tickmarks placed uniformly as shown here:



For an idealized power scale the value of the exponent in Meter would be set to 0.5 and the resulting scale would have an appearance such as this:



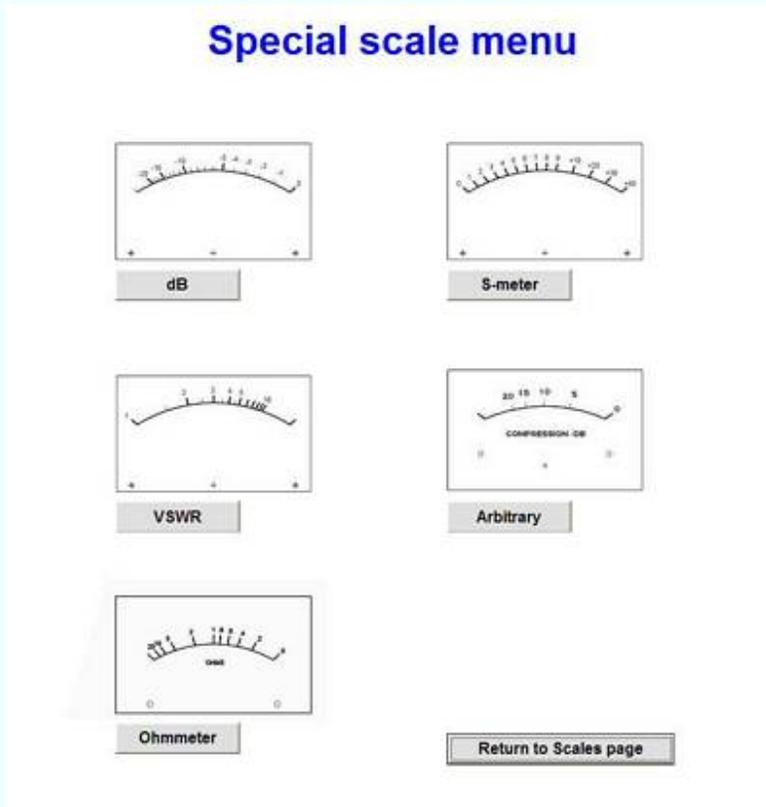
As can be seen, half-voltage yields an indication of one quarter power.

## Special scales

Clicking on the menu item **Scale** brings up the Scale Design window. In the lower-right hand corner is the **Generate special scale** button.

**Generate special scale**

Clicking on that button takes you to the special scale menu where you can choose from any of the five available types. Examples of each are shown.

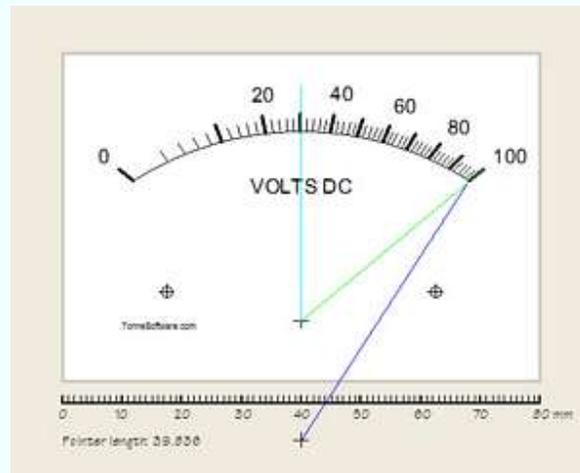


Each tic is normally printed but printing of each can be suppressed if desired. And each tic is normally made minor but can be changed to major if desired. And each tic can be labelled or the labelling can be suppressed. This degree of control over the design allows a very large variety of designs.

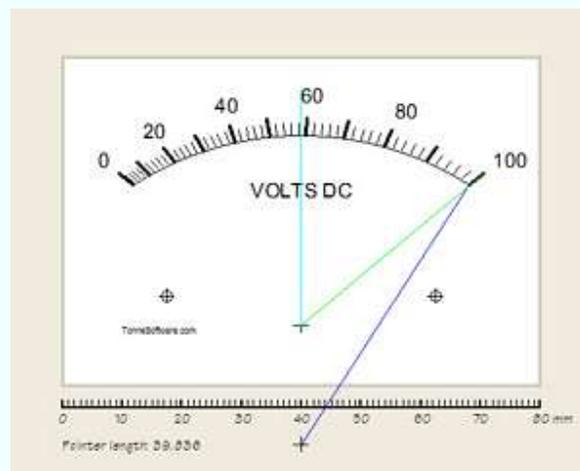
Fontsize and background (plate) color are set in the Plate design page and the Foreground color is set in the Scale design page, as usual. Further, the linearity of the scale can be warped to some degree by using the Linearity entry box. This item is initialized to unity.

The following pages illustrate the special scales that are available in Meter.

In a practical world the lower part of the scale is suppressed somewhat. An exponent of about 0.58 can make the rectifier circuit track power more closely. The exponent value can be adjusted in a given case to maximize tracking accuracy. Here is the above scale with the exponent set to 0.58:



Adjusting the exponent upward, to over 1.0, can make the scale of a rectifier-type AC voltmeter be correct. The scale below is an example of adjusting the exponent to 1.3 to simulate a noticeably nonlinear AC voltmeter scale. As in the case of the wattmeter, the value of the exponent can be adjusted to maximize accuracy in a given case.



Another tool in the Meter toolbox is the Linearity correction feature. It is quite capable of yielding totally arbitrary and even extreme correction. However it modifies the transfer of every scale on a given plate at the same time; it cannot be used to modify the transfer of one scale in a series. To invoke this method of linearity modification go to the Plate Design page and click on **Linearity**.

# Arbitrary scales

On the Special Scales menu page, clicking on the "Arbitrary" button



will bring up the Arbitrary scale design page which is nearly blank at this time.

Enter the number of ticmark intervals in the Ticmarks textbox.

**Number of ticmarks:**

When this entry is made the page configures itself to accommodate the number of ticmarks entered, as seen here:

Tic#:	Major/minor?	Label:	Deflection:
0	<input type="radio"/> Maj <input type="radio"/> Min	<input type="text"/>	<input type="text"/>
1	<input type="radio"/> Maj <input type="radio"/> Min	<input type="text"/>	<input type="text"/>
2	<input type="radio"/> Maj <input type="radio"/> Min	<input type="text"/>	<input type="text"/>
3	<input type="radio"/> Maj <input type="radio"/> Min	<input type="text"/>	<input type="text"/>
4	<input type="radio"/> Maj <input type="radio"/> Min	<input type="text"/>	<input type="text"/>
5 (top)	<input type="radio"/> Maj <input type="radio"/> Min	<input type="text"/>	<input type="text"/>

Number of ticmarks:

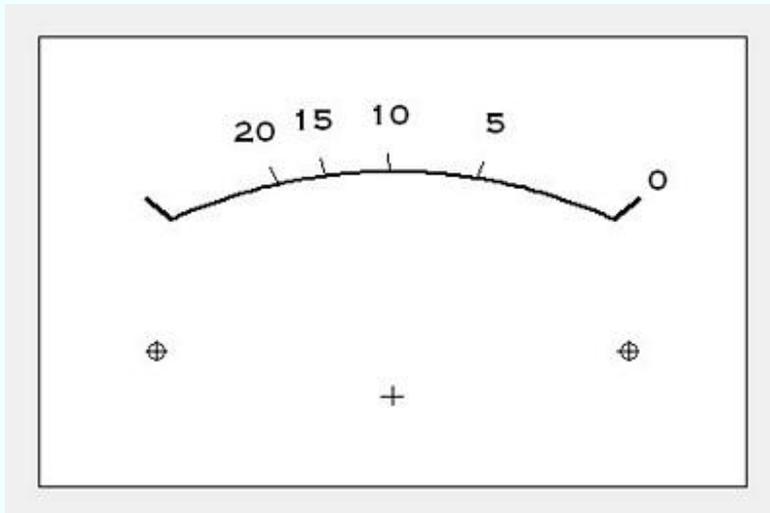
Each ticmark can be set to be major or minor, it can have a label and it needs a deflection value. Each ticmark does not *need* a label. Each ticmark does require a deflection, however. Deflection values range from 0 (no deflection) to 1.00 (fullscale deflection). Values outside those limits are forced to be within them.

After the entries are made this page might appear as here:

Tic#:	Major/minor?	Label:	Deflection:
0	<input checked="" type="radio"/> Maj <input type="radio"/> Min	<input type="text"/>	<input type="text" value="0"/>
1	<input type="radio"/> Maj <input type="radio"/> Min	<input type="text" value="20"/>	<input type="text" value=".23"/>
2	<input type="radio"/> Maj <input type="radio"/> Min	<input type="text" value="15"/>	<input type="text" value=".34"/>
3	<input type="radio"/> Maj <input type="radio"/> Min	<input type="text" value="10"/>	<input type="text" value=".49"/>
4	<input type="radio"/> Maj <input type="radio"/> Min	<input type="text" value="5"/>	<input type="text" value=".7"/>
5 (top)	<input checked="" type="radio"/> Maj <input type="radio"/> Min	<input type="text" value="0"/>	<input type="text" value="1"/>

Number of ticmarks:

Clicking on the **Preview** button shows what the scale would look like:



If you want to abandon this entire process click on the **Ignore** button to go back to the Scale design page.

**Ignore; just return to  
Scale Design page**

If you are satisfied with the design, click on the **Accept** button:

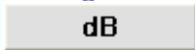
**Accept and return to  
Scale Design page**

The design will then be read into the system and you will be returned to the Scale design page.

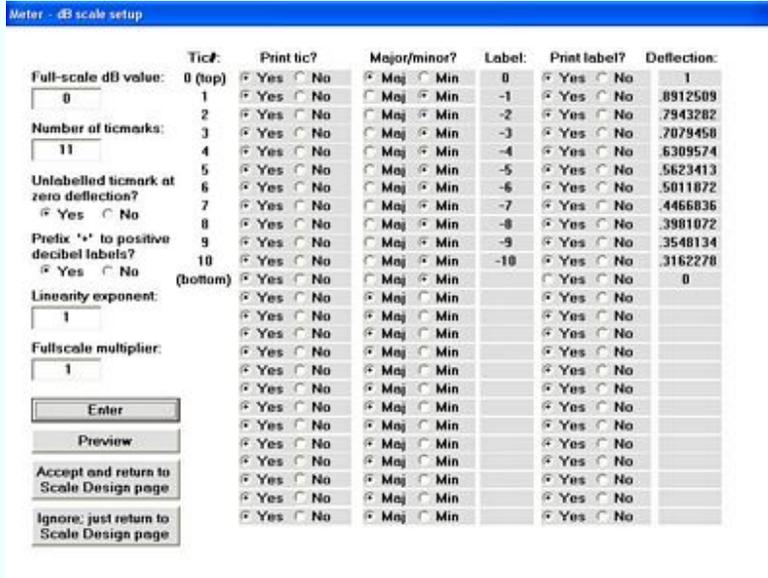
The values for the previous design (prior to conversion to one of the special scales) are still in memory until the program is exited. If you have made an error and want to restore that earlier design, go to the Scale Design page and click on the **Revert to standard scale** button.

# dB / vu scales

On the Special Scales menu page, clicking on the "dB" button



will bring up the dB design page.



The dialog box titled "Meter - dB scale setup" contains the following fields and controls:

- Full-scale dB value: 0 (top) [input: 0]
- Number of ticmarks: 11 [input: 11]
- Unlabelled ticmark at zero deflection?  Yes  No
- Prefix '+' to positive decibel labels?  Yes  No
- Linearity exponent: 1 [input: 1]
- Fullscale multiplier: 1 [input: 1]
- Buttons: Enter, Preview, Accept and return to Scale Design page, Ignore: just return to Scale Design page
- Table with columns: Tic#, Print tic?, Major/minor?, Label, Print label?, Deflection:

Tic#	Print tic?	Major/minor?	Label	Print label?	Deflection
0 (top)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maj <input type="checkbox"/> Min	0	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	1
1	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Maj <input type="checkbox"/> Min	-1	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	.8912509
2	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Maj <input type="checkbox"/> Min	-2	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	.7943282
3	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Maj <input type="checkbox"/> Min	-3	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	.7079458
4	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Maj <input type="checkbox"/> Min	-4	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	.6309574
5	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Maj <input type="checkbox"/> Min	-5	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	.5623413
6	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Maj <input type="checkbox"/> Min	-6	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	.5011072
7	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Maj <input type="checkbox"/> Min	-7	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	.4466836
8	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Maj <input type="checkbox"/> Min	-8	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	.3981072
9	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Maj <input type="checkbox"/> Min	-9	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	.3548134
10	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Maj <input type="checkbox"/> Min	-10	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	.3162278
(bottom)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Maj <input type="checkbox"/> Min		<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	0

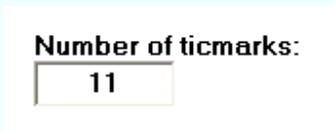
This may seem overwhelming but when broken into small blocks it will be seen to be quite logical.

In the upper-left corner is a box into which is entered the full-scale value in dB.



This defaults to zero but other values can be entered. For example a vu meter would have an entry of "3" in this box; this would set the full-scale value to +3 dB.

Below that box is another, for the number of ticmarks. This defaults to a value of 11, for a scale of 0 dB fullscale and -10 dB at the "bottom."



A vu meterscale would probably have an entry of 24 at this point (for +3 to -20).

The dB scales are designed by starting at full scale and working downward. It is apparent then that the design process never reaches down to the zero-deflection point. But it is customary to have a ticmark at zero deflection. Accordingly the program will ask if you want such a mark.

**Unlabelled ticmark at zero deflection?**  
 Yes  No

This option defaults to "Yes" but can be changed by clicking on the "No" button.

It is customary to have the "+" symbol prefixed to positive decibel values. The program asks if this should be done.

**Prefix '+' to positive decibel labels?**  
 Yes  No

This option defaults to "Yes" but can be changed by clicking on the "No" button.

As with standard scales, a nonlinearity (typically due to diode rectifier nonlinearity) can be invoked.

**Linearity exponent:**

This defaults to 1.0 but other values can be used.

By default the highest dB number is at fullscale. This can be adjusted over slight limits by using the fullscale multiplier function:

**Fullscale multiplier:**

This number defaults to unity (1.0). It can be adjusted over the range of 0.7 to 1.1 to allow the decibel scale to be in exact agreement with an associated percent modulation scale or any other voltage scales.

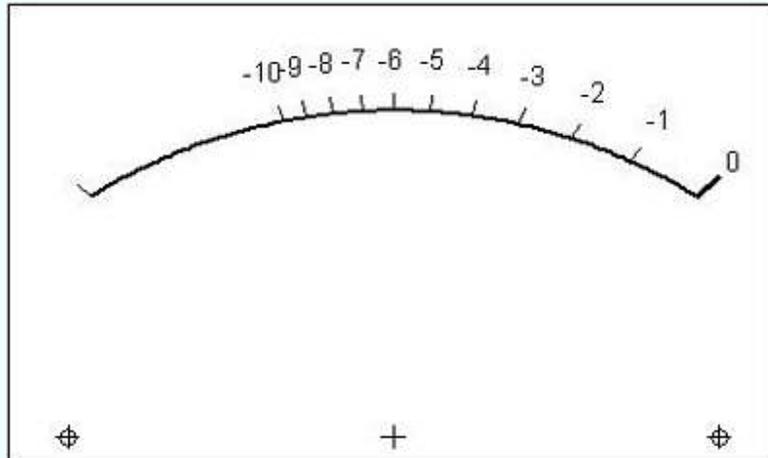
After any items are changed on this page the **Enter** button must be pressed.

**Enter**

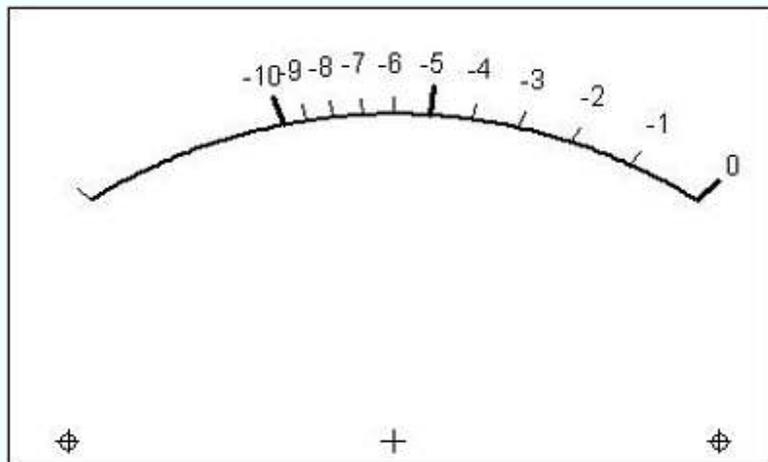
This updates the matrix of options which occupy most of the page. At that time it would be best to immediately see what the design at that point looks like. To do that, click on the **Preview** button.

**Preview**

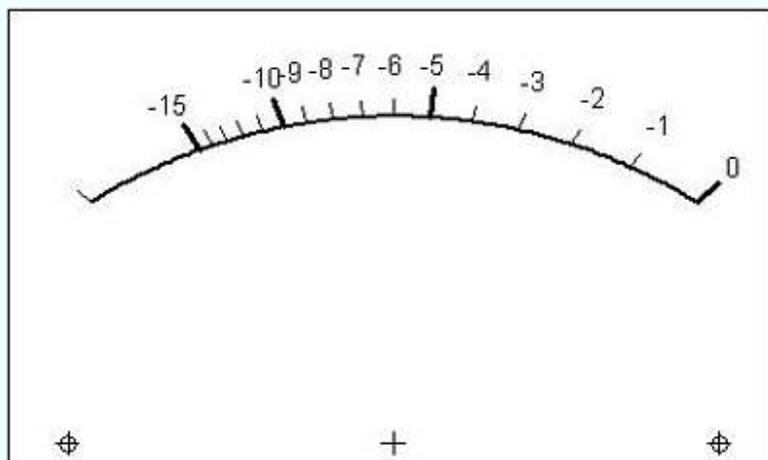
This will call up a plotting routine which reads the various entries and draws the scale. When all default values are used, this is how the drawing will appear:



Exiting from that image takes us back to the design page where we can make some changes. As an exercise, change the "-5" tickmark to be a major tick and do the same for the "-10" tickmark. Then click on **Enter** and **Preview**:



Continuing the exercise, exit back to the design page and change number of tickmarks from 11 to 16; this will add 5 tickmarks. Make the "-15" tickmark a major type. Click on the "No" for printing the labels for "-11", "-12", "-13" and "-14". Click on **Enter** and then **Preview** to see the result:



If the number of ticmarks is not correct, or if a ticmark is made to not print but you wanted it to print, or it isn't labelled but you want it labelled, simply go back to the design matrix and click on the correct "button" to make a change.

If you want to abandon this entire process click on the **Ignore** button to go back to the Scale design page.

<

**Ignore: just return to  
Scale Design page**

If you are satisfied with the design, click on the **Accept** button:

**Accept and return to  
Scale Design page**

The design will then be read into the system and you will be returned to the Scale design page.

The values for the previous design (prior to conversion to one of the special scales) are still in memory until the program is exited. If you have made an error and want to restore that earlier design, go to the Scale Design page and click on the **Revert to standard scale** button.

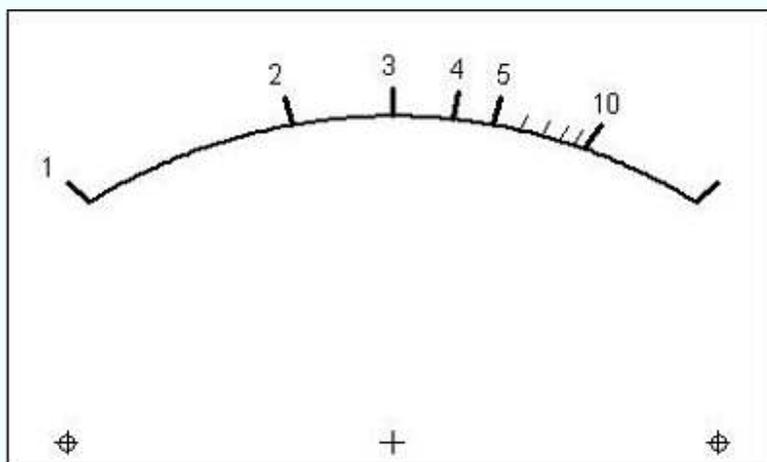
## VSWR scales

On the Special Scales menu page, clicking on the "VSWR" button

VSWR

will bring up the VSWR design page which is nearly blank at this time.

For this run-through, click on the **1.0** button. That design will be shown.



You may also click on the other designs. They differ only in the resolution of the tickmarks.

Modest system nonlinearities can be accommodated by adjusting the value entered in the Linearity box. The value of this variable defaults to unity (1.0) but can be adjusted to account for (as an example) diode nonlinearity.

If you want to abandon this entire process click on the **Ignore** button to go back to the Scale design page.

Ignore: just return to  
Scale Design page

If you are satisfied with the design, click on the **Accept** button:

Accept and return to  
Scale Design page

The design will then be read into the system and you will be returned to the Scale design page.

The values for the previous design (prior to conversion to one of the special scales) are still in memory until the program is exited. If you have made an error and want to restore that earlier design, go to the Scale Design page and click on the **Revert to standard scale** button.

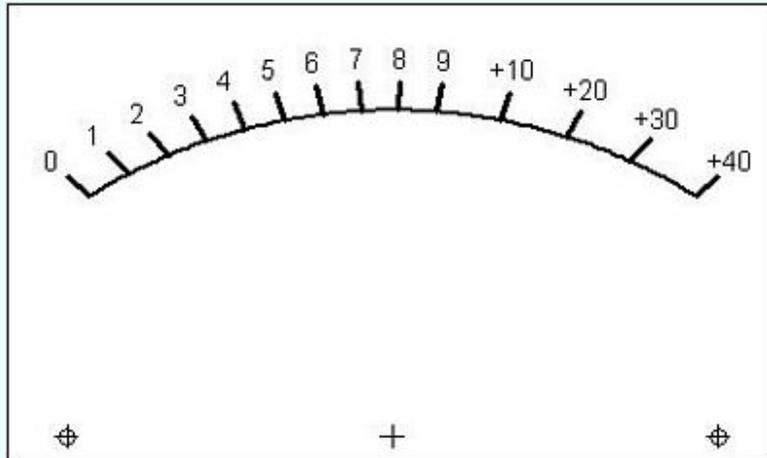
## S-meter scales

On the Special Scales menu page, clicking on the "S-meter" button

**S-meter**

will bring up the S-meter design page which is nearly blank at this time.

For this run-through, click on the **S 0-9,+40** button. That design will be shown.



You may also click on the other designs. They differ only in the number of dB over S9 at fullscale.

This plot is mathematically correct in that the S-units are 6 dB apart and the dB-over-S9 units are 10 dB apart. You can use an exponent value other than 1 to "warp" the scale somewhat.

If you want to abandon this entire process click on the **Ignore** button to go back to the Scale design page.

**Ignore; just return to  
Scale Design page**

If you are satisfied with the design, click on the **Accept** button:

**Accept and return to  
Scale Design page**

The design will then be read into the system and you will be returned to the Scale design page.

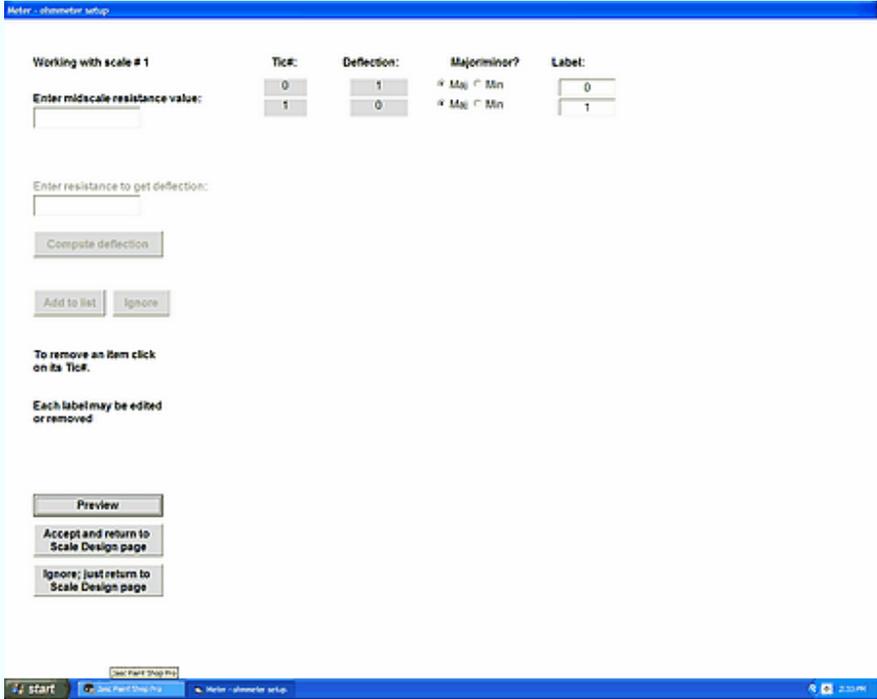
The values for the previous design (prior to conversion to one of the special scales) are still in memory until the program is exited. If you have made an error and want to restore that earlier design, go to the Scale Design page and click on the **Revert to standard scale** button.

# Ohmmeter scales

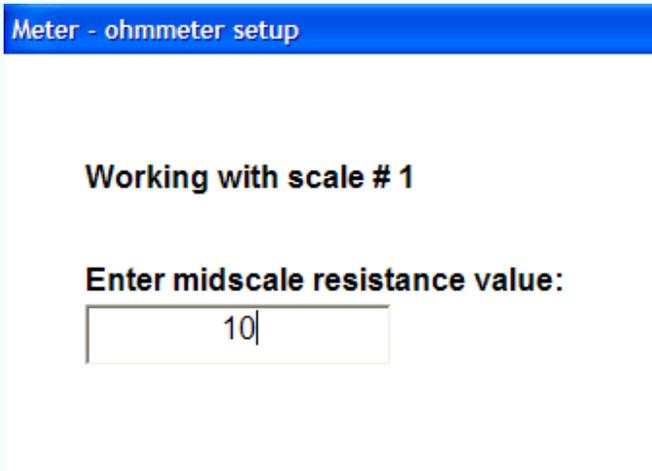
On the Special Scales menu page, clicking on the **Ohmmeter** button



will bring up the ohmmeter design page.



In the upper-left corner is a box into which is entered the mid-scale value in ohms. The page is not operative until a value has been entered into this box.



When the page opens this box is empty. Here we have entered the value '10' into the box. This would make an ohmmeter scale in which midscale deflection corresponds to 10 ohms. This value will remain a constant for the rest of the ohmmeter design phase.

Now we can enter each of the ticmarks in terms of ohms, have the program figure the deflection, and see the result. This is done ticmark by ticmark until the ticmarks have all been placed. At any point you can stop and review the design to that point.

Our first ticmark in this example will be for for one ohm. The entry box then appears like this:

**Enter resistance to get deflection:**

After that is done, click on the **Compute deflection** button:

**Compute deflection**

The fraction of full-scale deflection will be shown beneath the **Compute deflection** button.

Now we can add this ticmark to the list of tics if we decide to accept it. To do this click on the **Add to list** button:

**Enter resistance to get deflection:**

**Compute deflection**

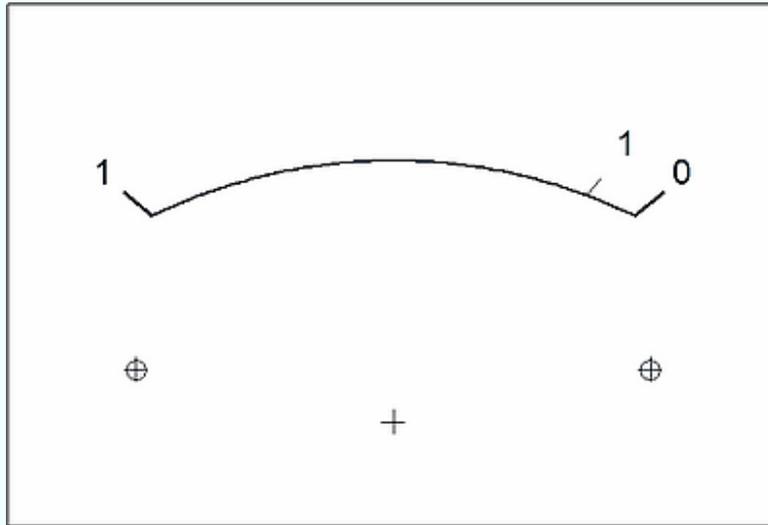
Deflection: .90909

**Add to list** **Ignore**

At any point we can preview our work so far. To do this, click on the **Preview** button:

**Preview**

We now see the design so far in the process:



Return to the design page by clicking on the **Return** button.



Now continue adding ticmarks one at a time, clicking on the **Compute deflection** and **Add to list** buttons.

You may delete a label (but leave the ticmark intact) by erasing the content in the textbox associated with a given label.

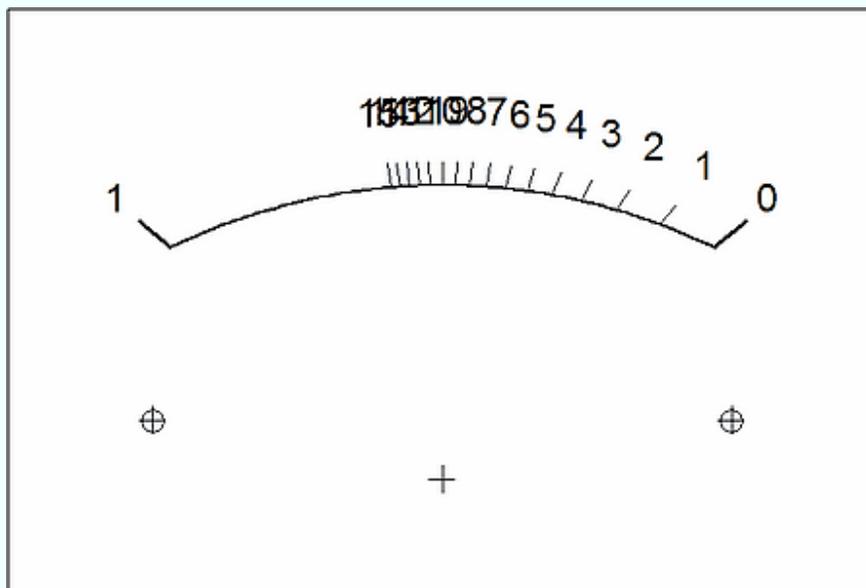
You may change a ticmark from minor to major (or go back to minor) by clicking on the options buttons for major/minor.

You may completely delete a ticmark by clicking on the ticmark number.

After 15 ticmarks have been entered we would see something like this:

Tic#:	Deflection:	Major/minor?	Label:
0	1	<input checked="" type="radio"/> Maj <input type="radio"/> Min	0
1	0	<input checked="" type="radio"/> Maj <input type="radio"/> Min	1
2	.90909	<input type="radio"/> Maj <input checked="" type="radio"/> Min	1
3	.83333	<input type="radio"/> Maj <input checked="" type="radio"/> Min	2
4	.76923	<input type="radio"/> Maj <input checked="" type="radio"/> Min	3
5	.71429	<input type="radio"/> Maj <input checked="" type="radio"/> Min	4
6	.66667	<input type="radio"/> Maj <input checked="" type="radio"/> Min	5
7	.625	<input type="radio"/> Maj <input checked="" type="radio"/> Min	6
8	.58824	<input type="radio"/> Maj <input checked="" type="radio"/> Min	7
9	.55556	<input type="radio"/> Maj <input checked="" type="radio"/> Min	8
10	.52632	<input type="radio"/> Maj <input checked="" type="radio"/> Min	9
11	.5	<input type="radio"/> Maj <input checked="" type="radio"/> Min	10
12	.47619	<input type="radio"/> Maj <input checked="" type="radio"/> Min	11
13	.45455	<input type="radio"/> Maj <input checked="" type="radio"/> Min	12
14	.43478	<input type="radio"/> Maj <input checked="" type="radio"/> Min	13
15	.41667	<input type="radio"/> Maj <input checked="" type="radio"/> Min	14
16	.4	<input type="radio"/> Maj <input checked="" type="radio"/> Min	15

Click on the **Preview** button to see what the design looks like:



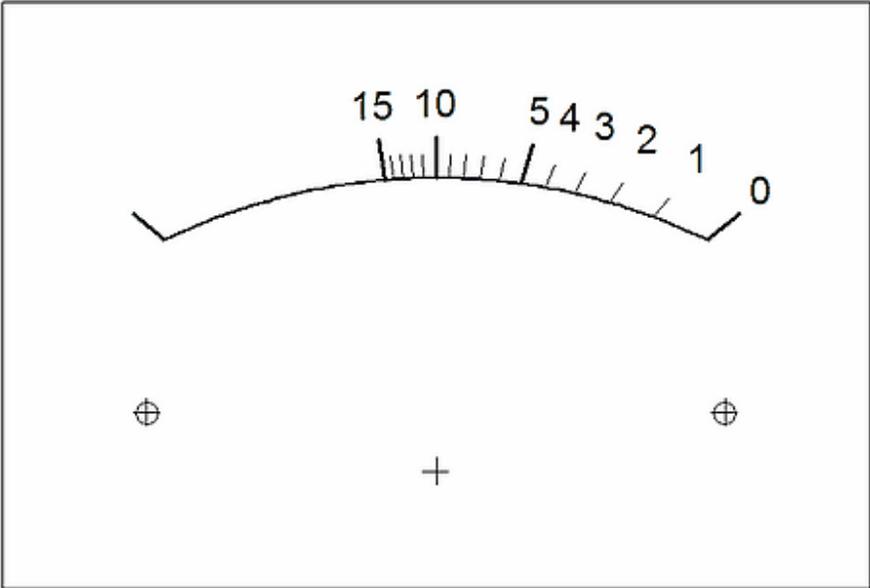
We now see what will commonly happen: the labels are overlapping; the scale is quite cluttered.

A first pass here is to delete some labels. Go to the textboxes showing the offending labels and clear them. For this example we are going to clear the labels for ticmarks representing 6, 7, 8, 9, 11, 12, 13 and 14 ohms. We are also going to delete the label for zero deflection. In addition we are going to change the ticmarks from minor to major for 5, 10 and 15 ohms.

Here is the design page after that change:

Tic#:	Deflection:	Major/minor?	Label:
0	1	<input checked="" type="radio"/> Maj <input type="radio"/> Min	0
1	0	<input checked="" type="radio"/> Maj <input type="radio"/> Min	
2	0.90909	<input type="radio"/> Maj <input checked="" type="radio"/> Min	1
3	0.83333	<input type="radio"/> Maj <input checked="" type="radio"/> Min	2
4	0.76923	<input type="radio"/> Maj <input checked="" type="radio"/> Min	3
5	0.71429	<input type="radio"/> Maj <input checked="" type="radio"/> Min	4
6	0.66667	<input checked="" type="radio"/> Maj <input type="radio"/> Min	5
7	0.625	<input type="radio"/> Maj <input checked="" type="radio"/> Min	
8	0.58824	<input type="radio"/> Maj <input checked="" type="radio"/> Min	
9	0.55556	<input type="radio"/> Maj <input checked="" type="radio"/> Min	
10	0.52632	<input type="radio"/> Maj <input checked="" type="radio"/> Min	
11	0.5	<input checked="" type="radio"/> Maj <input type="radio"/> Min	10
12	0.47619	<input type="radio"/> Maj <input checked="" type="radio"/> Min	
13	0.45455	<input type="radio"/> Maj <input checked="" type="radio"/> Min	
14	0.43478	<input type="radio"/> Maj <input checked="" type="radio"/> Min	
15	0.41667	<input type="radio"/> Maj <input checked="" type="radio"/> Min	
16	0.4	<input checked="" type="radio"/> Maj <input type="radio"/> Min	15

The resultant design now looks like this:



At this point we are going to consider this example design as finished

## Text entry

Meter allows up to eight text strings to be placed at arbitrary locations on the plate. These can be used to explain the units used for a scale, or the designer's name can be shown, or data about the meter movement can be shown. These strings of text are *in addition* to the labels used for each scale.

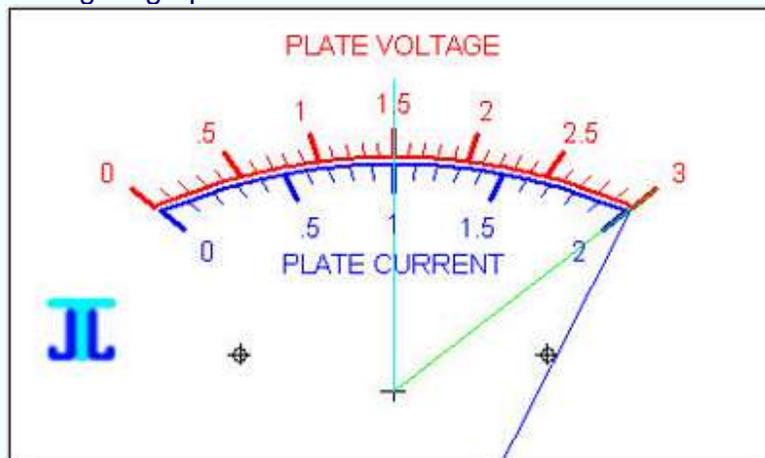
Clicking on the menubar item **Text** calls up the Text entry page. Here we see that page:

**Text entry**

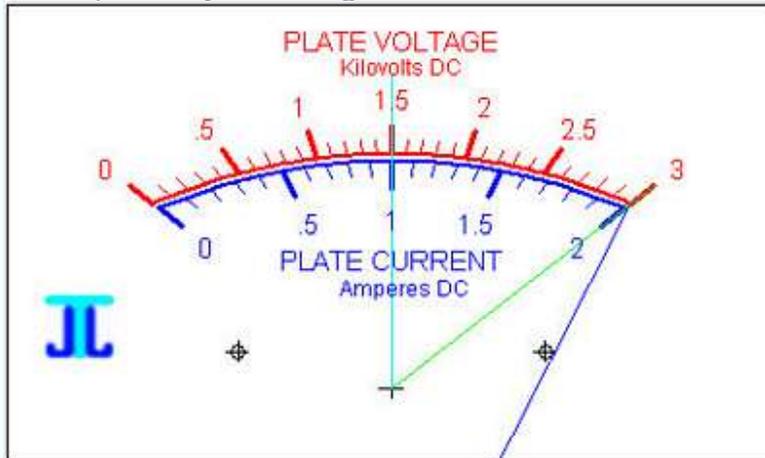
#1:	#2:	#3:	#4:	#5:	#6:	#7:	#8:
Text: AMPERES I	Text: WVENE	Text: FS=1mA	Text: R=50	Text: 	Text: 	Text: 	Text: 
Left to text: H 33	Left to text: 8	Left to text: 60	Left to text: 60	Left to text: 0	Left to text: 0	Left to text: 0	Left to text: 0
Bottom to text: H 26	Bottom to text: 17	Bottom to text: 17	Bottom to text: 15	Bottom to text: 0	Bottom to text: 0	Bottom to text: 0	Bottom to text: 0
Relative size: H .7	Relative size: .7	Relative size: .6	Relative size: .6	Relative size: 1	Relative size: 1	Relative size: 1	Relative size: 1
Example	Example	Example	Example	Example	Example	Example	Example
Color 1	Color 2	Color 3	Color 4	Color 5	Color 6	Color 7	Color 8

The text entry page allows the text to be entered, its location adjusted, its relative font size set and the color can be selected. Eight such text strings can be entered.

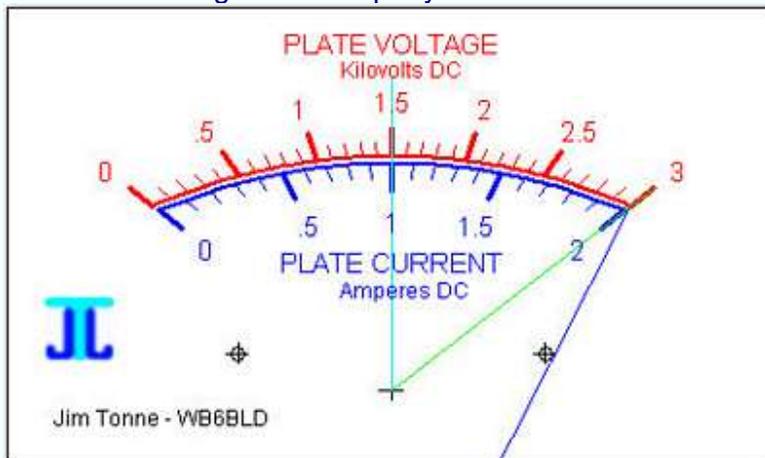
Here is an example set showing some possibilities of using the text options. This is the "plain" scale, although a graphic has been added:



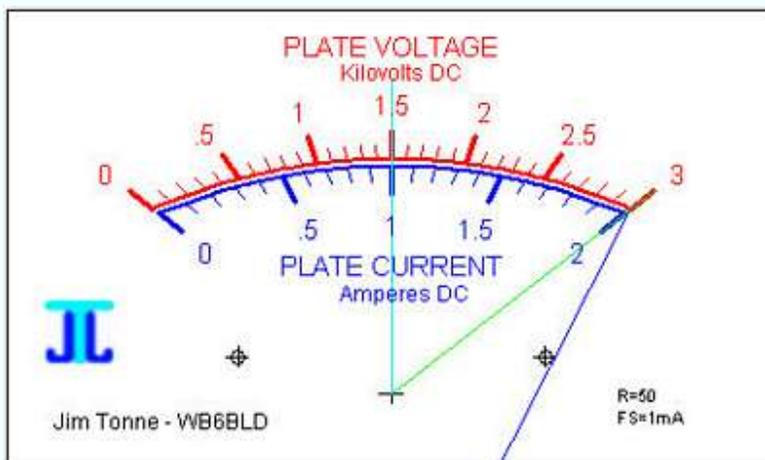
We can add some explanatory text and get this result:



Now add the name of the designer or company:

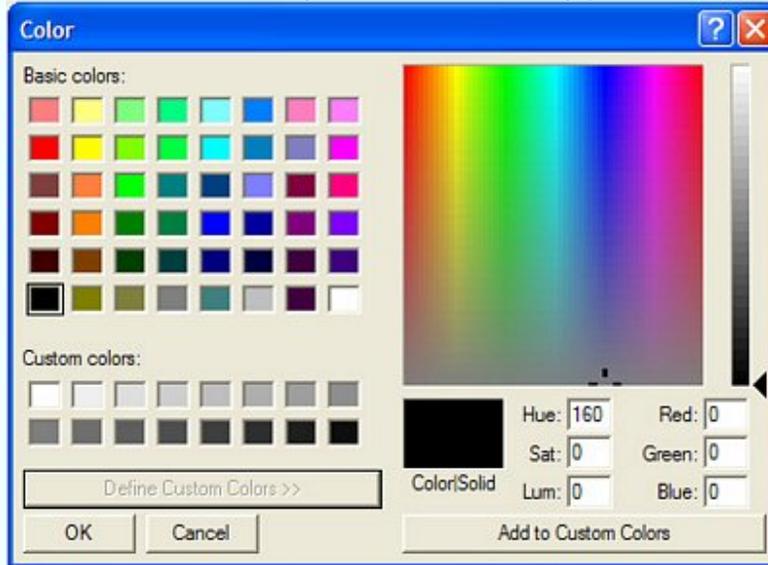


And we can add some information about the movement by using two text items in this manner:



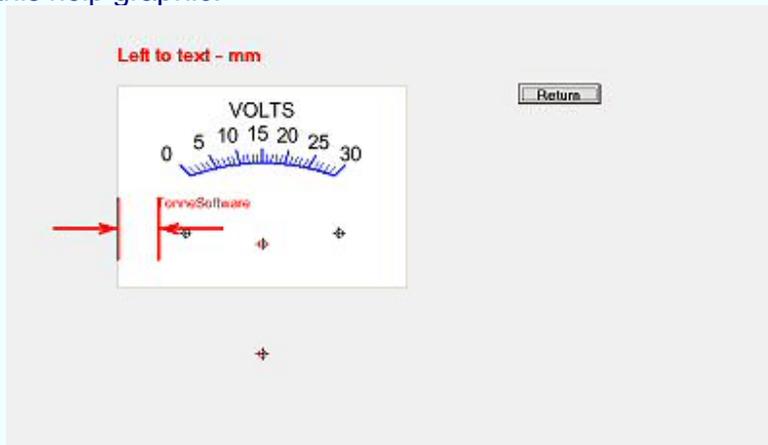
Up to eight such text items can be added. Each has its text, position, color and relative size specified independently.

Clicking on a **Color #n** button takes you to the color entry panel:



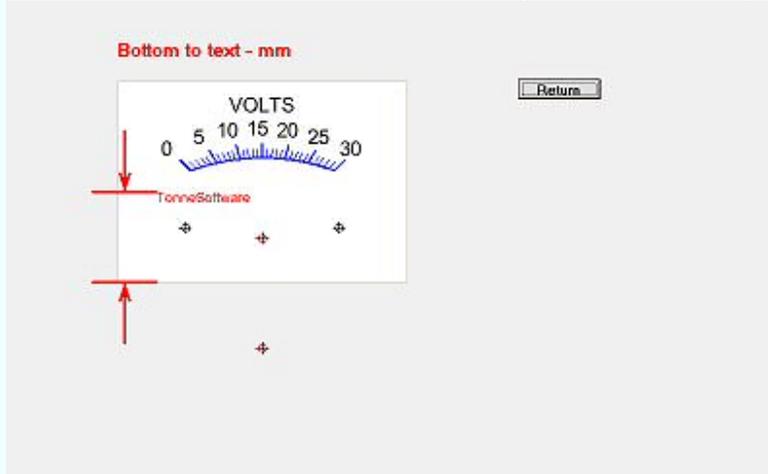
If no color is selected then the original value is used if it has been selected. If the text does not show but the remaining traits seem to be correct, go back and select a color. To insure maximum contrast when using a black-and-white printer it is advisable to select black. Colors will normally be modified by the printer or printer driver to be less than optimum when printed on a black-and-white printer.

When the Text entry page is showing, clicking on the button near the **Left to text 1** entry reveals this help graphic:



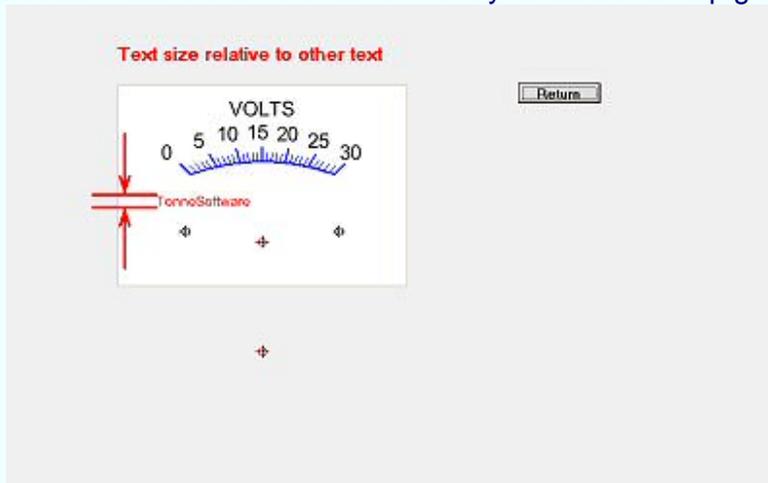
The entry is the spacing from the left side of the plate to the left side of the text, in millimeters.

Clicking on the button near the **Bottom to text 1** entry reveals this help graphic:



The entry is the spacing from the bottom of the plate to the top of the text, in millimeters.

Clicking on the button near the **Size of text 1**: entry reveals this help graphic:



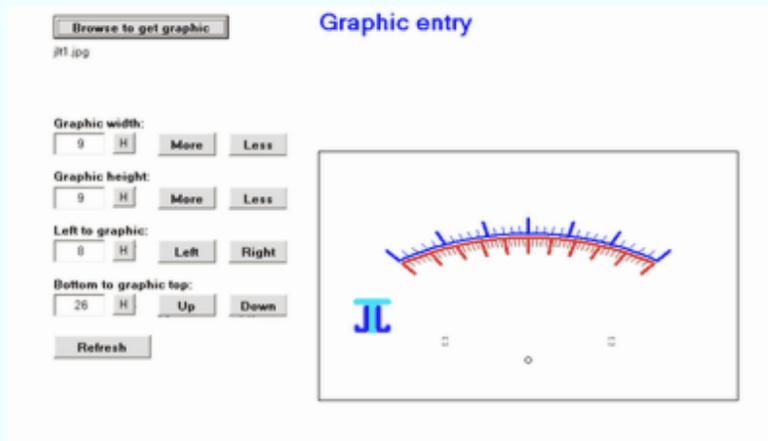
The entry is the size of the text used for the signature *relative to the size used for the remainder of the plate*. The limits are 0.1 to 3.0 times the other text size.

## Graphic entry

A graphic (sometimes called "logo") may be added to the meterscale. This can be positioned on the plate arbitrarily as well as resized by the program. The graphic type can be .bmp, .gif, .ico or .jpg type. A graphic does not *need* to be used.

To enter or edit a graphic, click on the menubar item **Graphic**.

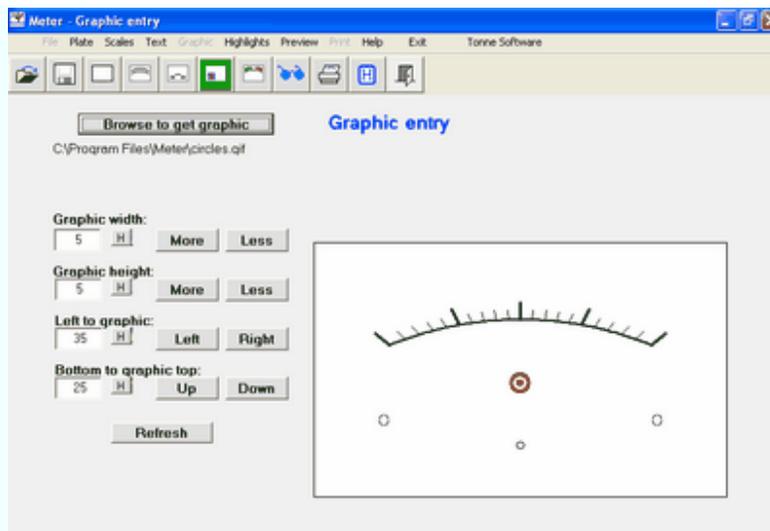
The Graphic Entry window will then show:



Click on the **Browse to get graphic** button to call up the routine to browse and retrieve a graphic. Only the allowed graphic types will show, probably about as seen here:



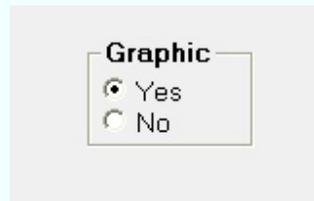
Highlight the desired graphic and click on the **Open** button.



We are now back at the Graphic Entry screen and the chosen graphic is shown in a summary of the plate so that the graphic can be seen in context with the scale.

You may position and resize the graphic using the set of buttons. You may also enter the new number(s) into the textboxes. If that is done use the **Refresh** button to enter those numbers into the system.

The graphic can be turned on or off by using the Yes/No entry on the Plate design page.



Significant resizing of a graphic, either making it wider or narrower, or taller or shorter, may result in a distorted reproduction. It is best to use an external graphics program to significantly resize a graphic.

## Highlight entry

Meter allows up to eight "highlights" to be used on each scale. These are commonly used to indicate "off limits" or "overload" areas on a given scale. To add one or more highlights, click on the menubar item **Highlights** and see the Highlight Entry screen:

### Highlight entry

	#1:	#2:	#3:	#4:	#5:	#6:	#7:	#8:
Start %:	<input type="text" value="0"/>	<input type="text" value="50"/>	<input type="text" value="83"/>	<input type="text" value="0"/>				
Stop %:	<input type="text" value="50"/>	<input type="text" value="83"/>	<input type="text" value="100"/>	<input type="text" value="0"/>				
Bottom mm:	<input type="text" value="35"/>	<input type="text" value="35"/>	<input type="text" value="35"/>	<input type="text" value="10"/>				
Height mm:	<input type="text" value="1"/>	<input type="text" value="1.5"/>	<input type="text" value="2"/>	<input type="text" value="0"/>				

Color 1	Color 2	Color 3	Color 4	Color 5	Color 6	Color 7	Color 8
---------	---------	---------	---------	---------	---------	---------	---------

To remove a given highlight, set its Start and Stop percentages both to zero

Let us examine one of the entry blocks, in this case the first one on the far left.

### #1:

Start %:

Stop %:

Bottom mm:

Height mm:



At the top we see the entry "Start %". This is a percentage from 0% to 100% of full-scale and determines where the highlight starts. In this example the highlight starts at 0% deflection.

Next we see the entry "Stop %". This is a percentage from 0% to 100% of full-scale and determines where the highlight stops. In this example the highlight stops at 50% deflection.

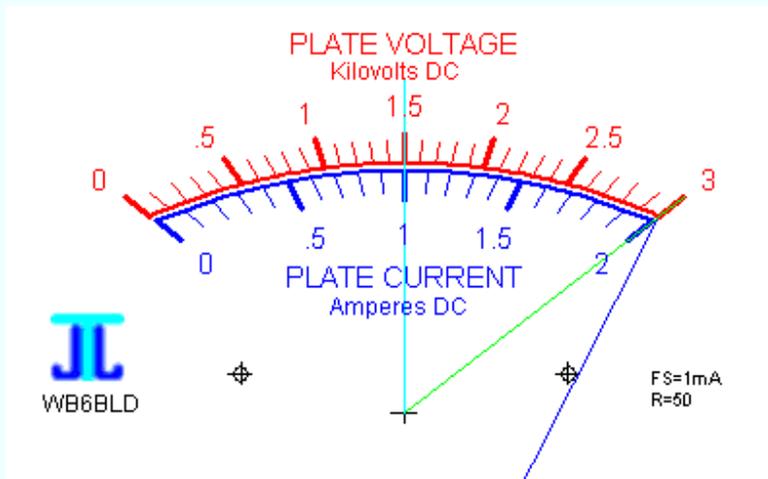
The third entry is "Bottom mm". This is an entry in millimeters and determines how high the highlight is placed on the plate. In this example the bottom is set to 35 (millimeters).

The fourth entry is "Height mm". This entry is also in millimeters and determines how high or thick or wide the highlight is. In this example the length or thickness is set to 1 millimeter.

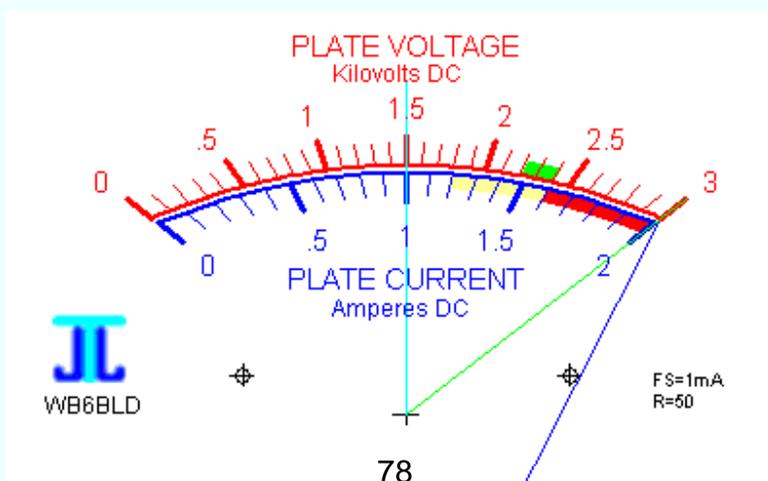
To the left of each of those four entry boxes is a button labeled "H" which, when pressed, offers instant Help about that item.

The fifth and final entry is "Color". This entry is the color of the highlight. If not chosen it defaults to black. When this button is clicked you are taken to a color-entry screen where any color may be chosen for that highlight.

Here is a typical scale as produced by Meter with no highlights:



After a set of highlights has been added, we might see this:



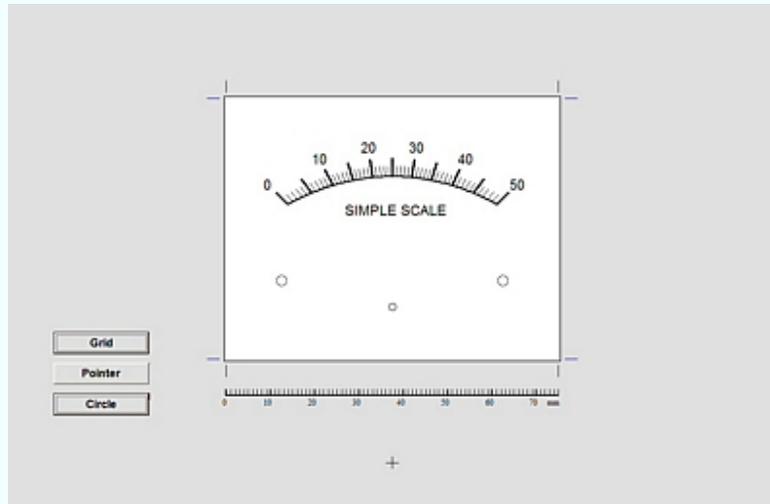
Up to eight such highlights may be added to a plate. This plate illustrates the use of three.

The highlights are printed first on the plate and then the other items are printed on top of them. In this manner the highlights are in the "background" so the other items are not covered or concealed.

## Preview

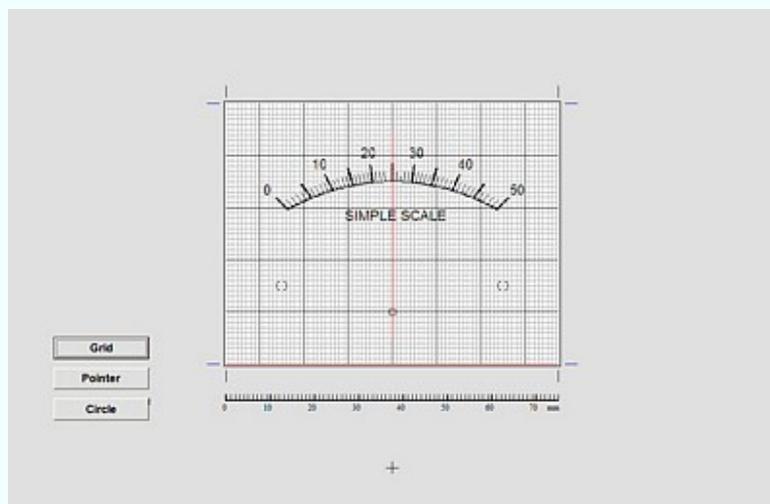
When a design is first retrieved from the hard drive it is shown by immediately going to the Preview window. That window is also called up by clicking on the menubar item **Preview**.

This view of the plate is automatically rescaled to fill a large part of the computer screen. Regardless of how wide or how tall the plate has been dimensioned, the program autoscales the image to fit the screen. This expansion process maintains the ratio of width to height for the plate.



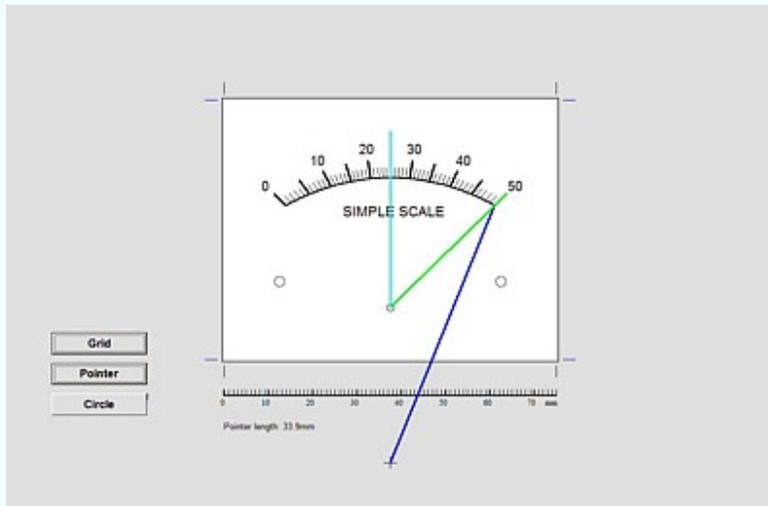
To the left of the image is a button labelled **Grid**. Clicking this button will overlay on top of the image a grid with one millimeter steps, and ten millimeter emphasized steps. The origin of the grid ( $X=0$ ,  $Y=0$ ) is at the bottom and middle of the plate. The grid is useful to estimate the amount an item (such as a text item, a graphic or a scale's "ceiling" value) might need to be moved.

Clicking on the **Grid** button will show the grid like this:



This is a toggling function; click it once to show the grid and again to remove it.

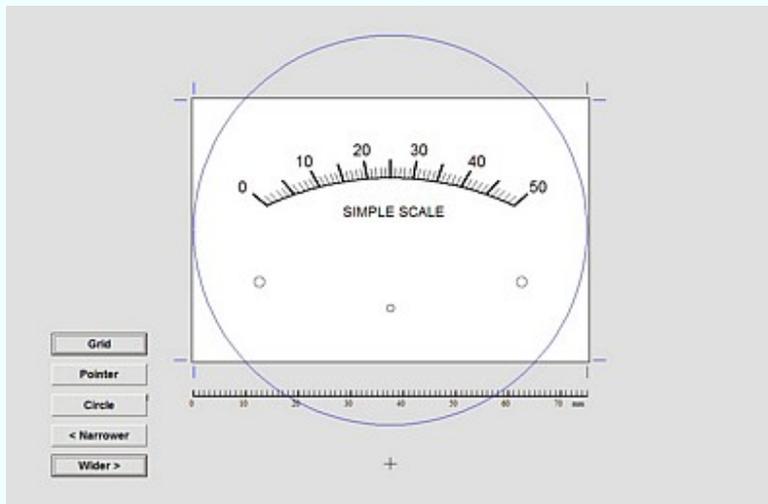
Clicking on the **Pointer** button will show the pointer information. The cyan line shows the pointer at 50% deflection, the green line shows the pointer at 100% deflection and the blue line illustrates the location of the virtual bearing.



This is also a toggling function.

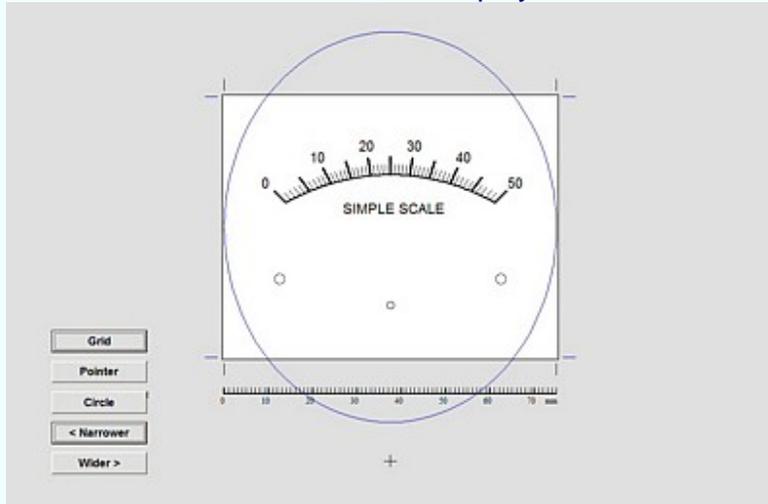
Both the grid and the pointer information may be shown at the same time.

Clicking on the **Circle** button will show a circle centered about the middle of the plate. This may be useful in judging the final appearance of the design when a circular plate is used.



While the circle is shown another pair of buttons is revealed. These are used to step the display in one percent steps to make it wider or narrower. This has no effect on the printed design; it only allows accommodation of various monitor aspect ratios.

Clicking on the **Narrower** button will make the display become narrower as seen here:



Clicking on the **Wider** button will logically make the display become wider.

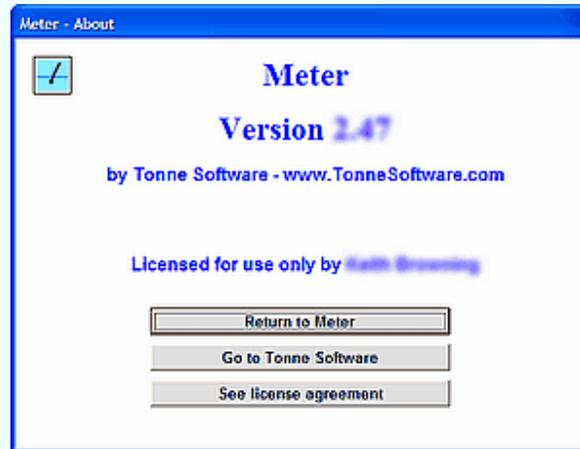
Below the image is a ruler calibrated in millimeters. This is used to assist in adjusting the scale height (bottom to ceiling). All dimensional entries to this program are in millimeters. The printed output from the program also has a ruler. The printed outputs are not autoscaled but rather are printed real-size.

## About Meter

The program **Meter** is designed to draw scales for analog meter movements. It is a very flexible and capable program.

Clicking on the **About** icon in the toolbar brings up the About window.

We now see the program name along with the the version number, copyright notice and licensee.



Clicking on **Go to Tonne Software** will take you to the Tonne Software site, assuming an internet connection is currently available.

Clicking on **See license agreement** will open a window which shows the license agreement.

Meter and its support files Copyright © 2004-2011 James L. Tonne  
All rights reserved.

# Meter Appnote #1

---

This page was written to illustrate the mechanics of changing a meterscale using, of course, *Meter* as the scale design aid. It does not cover the design of a particular scale but rather covers "how to do it" in some practical detail.

We are assuming that you have designed a scale to your specifications using the program *Meter*. For our example we have a two-scale plate, 0-30 volts and 0-4 amperes. And now it is time to mount the scale on the underlying metal plate.



Here we see a meter that we are going to modify by giving it a new scaleplate.

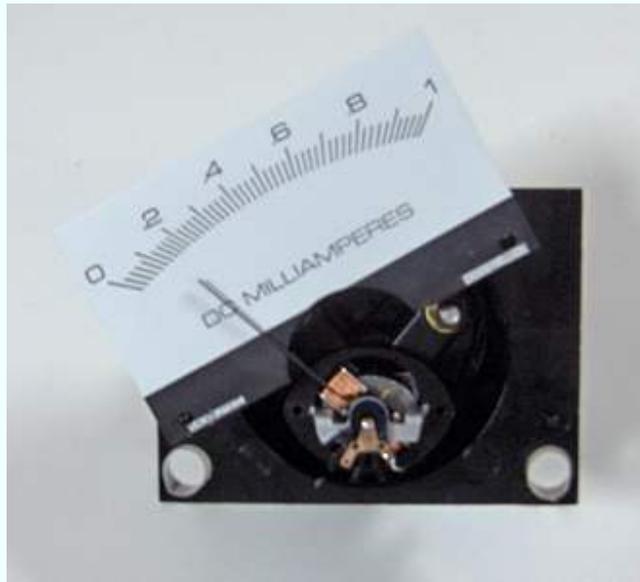


Open the case to access the plate on which the scale is printed. Here we see that perhaps some glue is used to seal the case. Carefully break the seal or otherwise open the case. For those cases that are held together with screws simply unscrew them.



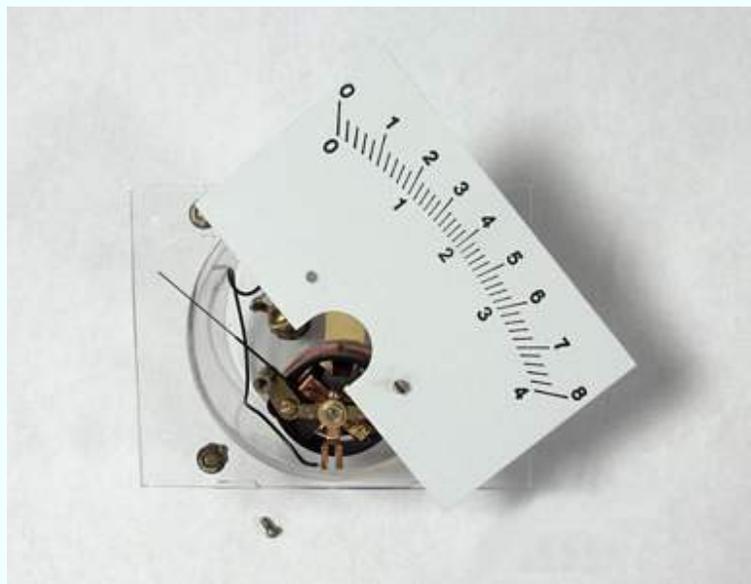
Remove the face (front) of the assembly and set it aside.

**It is very important to keep the entire work area very clean.**



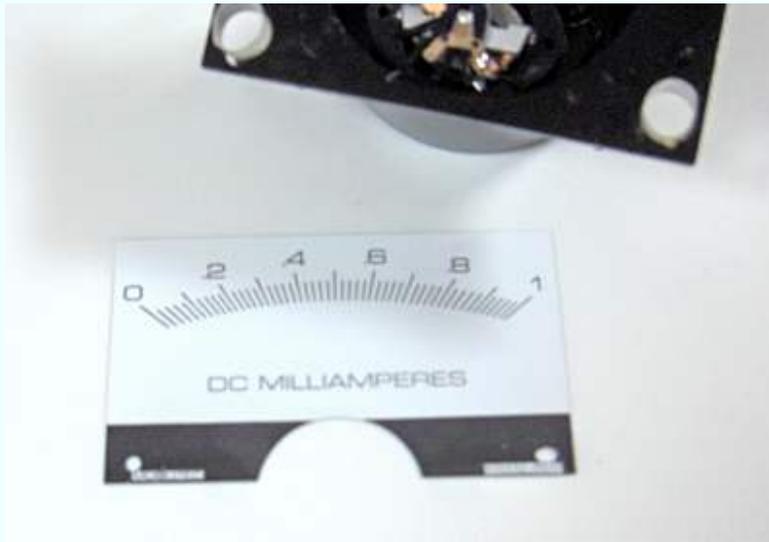
Remove the plate but don't let it touch the pointer.

In this meter the plate was held in place by two small "dimples." To remove the plate without touching the pointer it was rotated to the left.



In this meter the plate was held in place by two screws. To remove the plate it was rotated to the right.

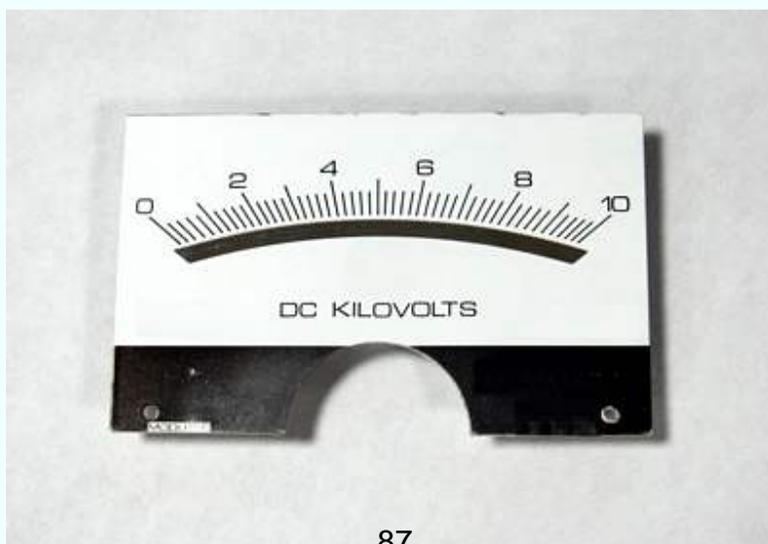
Don't let the plate touch the pointer.



Now we have the plate separated from the meter case.



Place the front cover back on the case so that the interior portion of the meter will be kept clean.



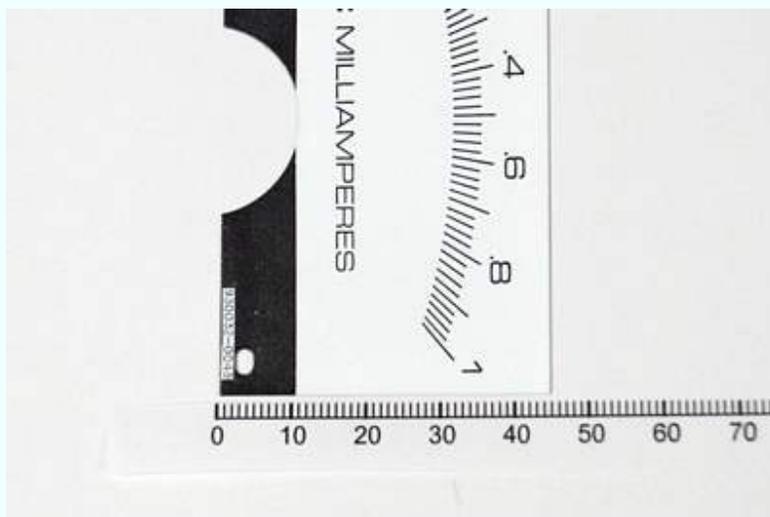
An obstacle that might be encountered is a plate with a "mirror" on it. This can show through most papers on which a scale would be printed. The mirror might very well be a thin sheet of plastic film which has been metalized. The best way to minimize the possibility of the mirror showing through the printed paper is to use a paper which has sufficient thickness. Alternatively you could add another layer of paper between the plate and the printout.

The paper should be bright white and smooth. It does not need to be thick. *Ye scribe* has used old photographs on which to print.



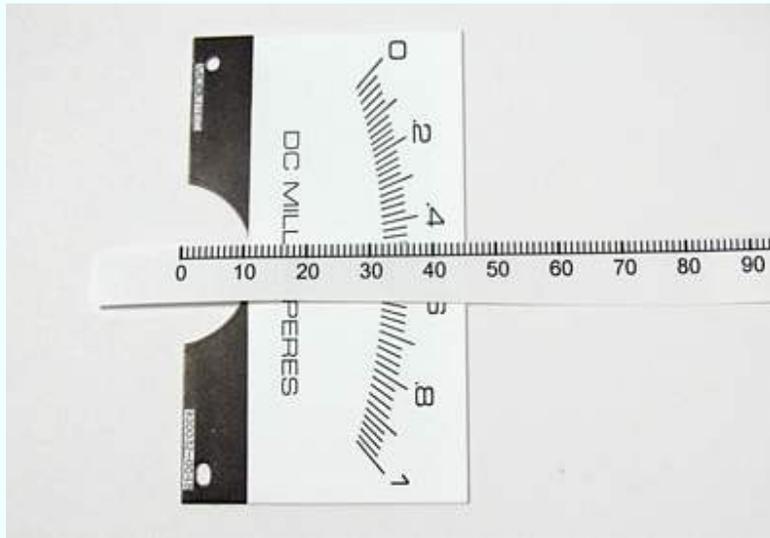
Now we can make various measurements and put them into the program *Meter*.

Measure the plate width (76 mm here).



Measure the plate height (45 mm here).

The measurement of width and height are not critical. If you wish, round them up to the next higher millimeter or more.



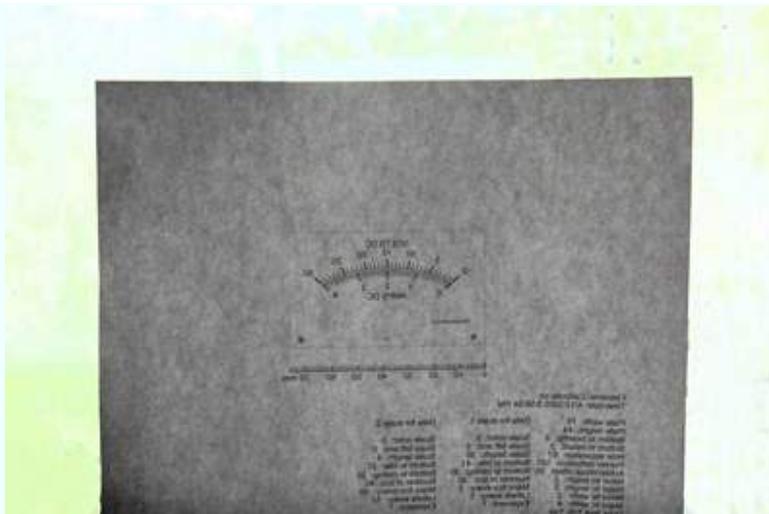
Measure the distance from the plate bottom to the bottom of the arc (32 mm here). In the program *Meter* this item is called "Bottom to scale ceiling."



Now measure the separation between the mounting holes (67 mm here). **This must be an accurate measurement.**



Print a scale and confirm that the mounting hole separation is correct, as shown here by laying the plate on top of the printout.



Place the printout on a window or light table, with the **printing side away from you**.



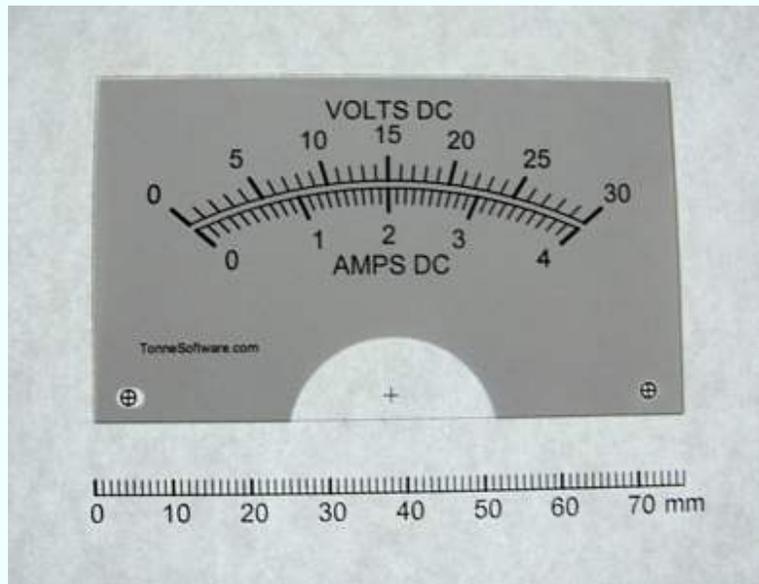
Place the *reverse* side of the metal plate against the non-printed side of the newly-printed scale. (By doing this, the original lettering will not show through the new paper scale.)

If there is some kind of printing on the back side of the original plate, it must be removed using an appropriate solvent. We need a clean surface, without any lettering or marking, onto which we will attach our new scale.

Place the metal plate on the printout with the original scale facing toward you; the plain metal side of the plate will be facing back toward the paper.

Line up the mounting holes on the paper with those on the plate. If the paper is thick enough or opaque enough that the mounting holes cannot be seen, then use a pin to make a small hole ("pinhole") in the middle of each of the printed mounting holes. Center the holes on the metal plate over the pinholes on the paper.

Use plastic tape to form a "hinge" at the top of the plate.  
 (In this photo the hinge cannot be seen. The mounting holes on the plate not appear to be lined up with those on the printout but this is because the plate is displaced from the printout.)



Remove the assembly from the window (or light table) and turn it over to view it from the front side, with the newly-printed scale facing you.

If necessary, reposition the plate on the printout so that the mounting holes on the plate line up precisely with those on the printout.



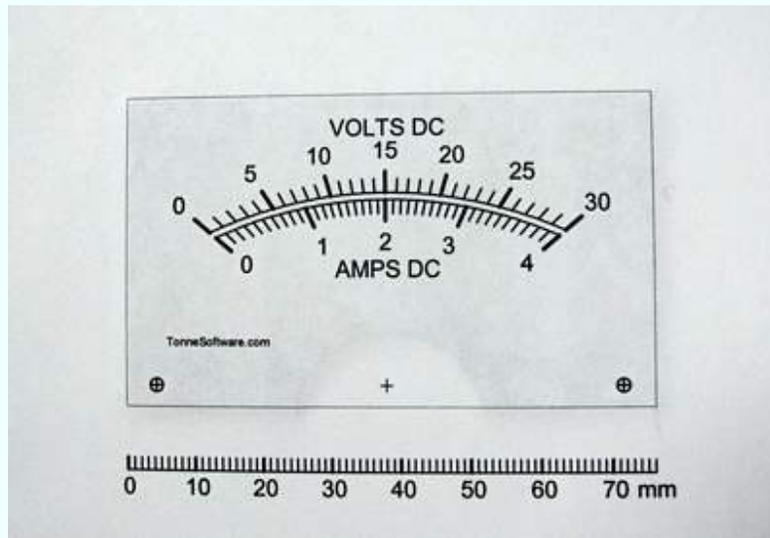
Place the assembly on a worktable with the printing side down (away from you). In this photo the "hinge" can be seen.



Lift up the plate by its "hinge" as shown.

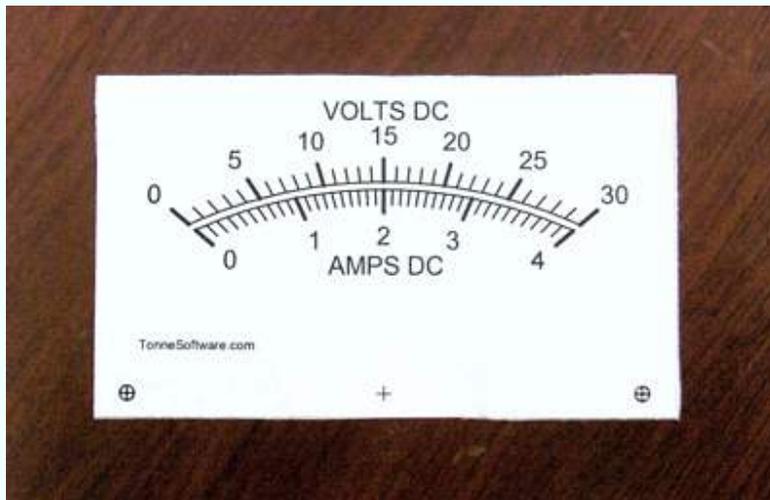
Use a light application of a spray adhesive on the plate and optionally on the paper. Spray adhesives work much better than adhesives that are applied using a brush.

**Do not use "rubber cement"** because the scale will become discolored over time. *Ye scribe* uses 3-M "Spray Mount" Artist's Adhesive. Surely other adhesives may be used.

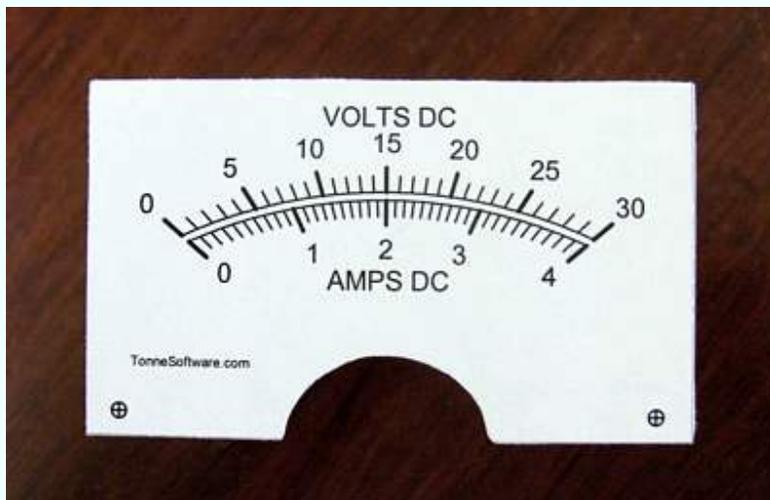


Lower the plate back down to the printout, turn the assembly over and carefully press the paper against the plate.

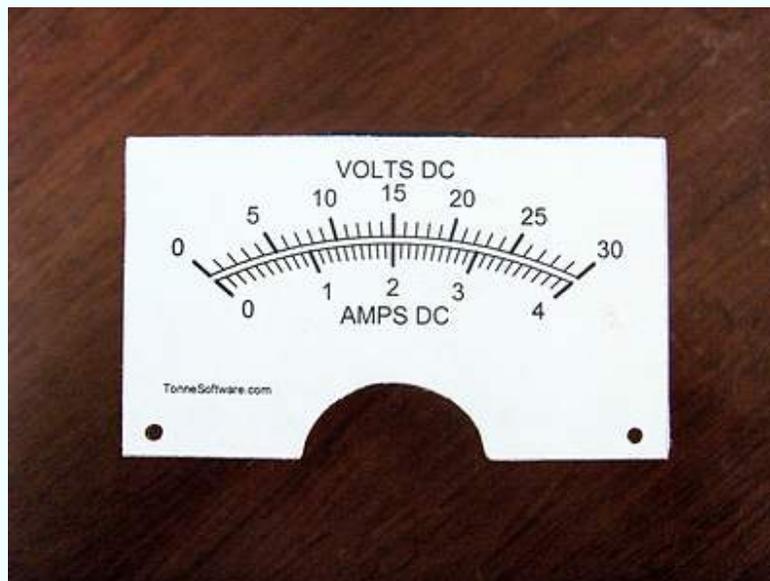
This is what the assembly looks like after you do those things and look at the front.



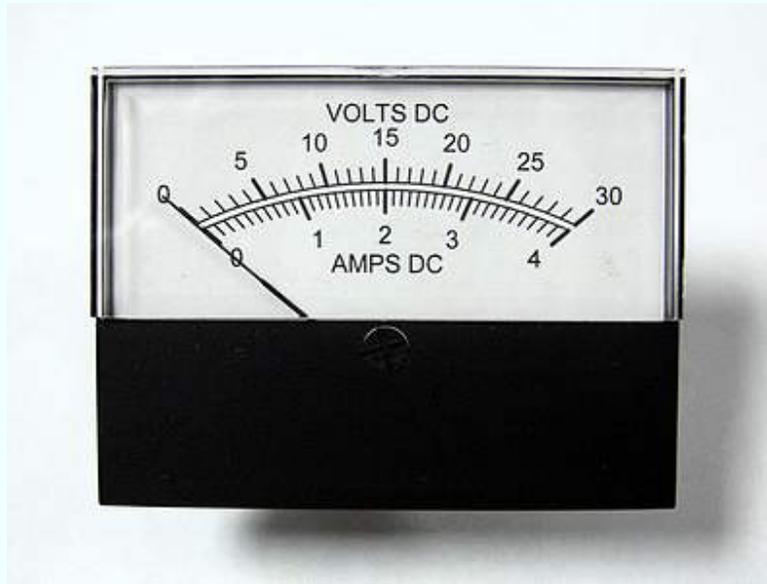
Use scissors or "hobby knife" to trim the edge of the printout.



After the four sides are trimmed use the hobby knife to trim the area around the pointer bearing.



From the front side use a small pen, pencil or other pointed object to clear out the mounting holes.



Open the meter case,  
replace the plate,  
close the case,  
admire your work.

Fin !

Copyright © 2004-2011 James L. Tonne. All rights reserved.