

Formatting Guidelines for Figures, Tables, and Captions

Figures and tables are vitally important adjuncts to technical documents and presentations. They provide a means to visually communicate information that would be too cumbersome or confusing to address verbally or using text. Even so, the link between figures and tables and the text that they enhance must be a strong one, and each should support the other. A key ingredient of this link is the caption. It not only provides a type of title for the figure or table, but it also serves as an opportunity to summarize the linked text for busy readers. Moreover, the figure or table number embedded in the caption functions as an anchor point for the text that refers to it. Where and how the reference to a figure or table appears in the text should also be carefully considered.

The sections below discuss some of the most important aspects of using figures, tables, and captions in documents. The information is not exhaustive since the purpose of this guide is only to highlight the fundamentals. More detailed information is available in a variety of technical writing resources such as the IEEE Editorial Style Manual [1].

Figures

A figure, in the context of technical writing, is any visual depiction of information that cannot easily be incorporated into the text-based narrative of a document (although it is possible for a figure to consist of nothing but text). Figures can take myriad forms, including diagrams, photographs, plots, and screen captures from test and measurement equipment. They efficiently convey information in a way that text cannot.

However, a figure can easily distract or confuse a reader if it is not incorporated into the text properly. Various standards for presenting visual information have evolved over time, and most readers will expect a document to adhere to those standards. One that does not might be discarded out of frustration or because the reader thinks that the author is too incompetent to have anything valuable to say.

Listed below are some fundamental points to consider when adding a figure to a document. The focus is primarily on the presentation of technical data and images, but many of the points apply to more general usages of figures as well.

1. Drawings, diagrams, and plots (graphs) should be easy to read and produced using a software package, if possible. Neatly hand-drawn diagrams might be acceptable in relatively informal documents (such as an internal progress report), but professionally prepared diagrams should be used in important documents. Any text in the figure should be large enough to read without zooming. Digital photographs should use the minimum resolution necessary for clarity and sharpness while keeping the document file size reasonable.
2. Figures (with their associated captions) should be able to stand alone as much as possible. Busy readers will sometimes look only at the figures and tables and their captions in a document and not read much or any of the text in the body. That means that the meaning of a figure should be as self-evident as possible.

3. Figures should appear in a document as soon as possible after they are referred to, preferably on the same page. If there is not enough room on the page for the figure after its first reference, then the figure should appear at the top of the next page. Figures that appear before they are referenced can lead to confusion since the reader will not yet have any context.
4. Any figure included in a document should be referred to by number or other reference method in the body of the text and explained. Unreferenced figures should rarely be used in a technical document. Do not force the reader to deduce on their own why the figure is there and what information it is supposed to convey. One exception is the use of small decorative images to highlight headers or embellish the document. Even so, such images should have a strong and unambiguous connection to the text.
5. A text reference to a figure should not use a spelled-out number. For example, use “Figure 1” instead of “Figure One”. The word “Figure” should be capitalized in this type of reference and is usually spelled out, although the abbreviation “Fig.” is sometimes used. Avoid splitting the word “Figure” and the figure number at line breaks. In Microsoft Word, type CTRL-SHIFT-space instead of just the space key to prevent a line break.
6. Figures should be numbered in the order in which they appear in a document. That is, the reader should encounter Figure 1 first, then Figure 2, etc.

The formatting of figures is another important aid to clarity. The list below outlines some of the most critical formatting issues. However, it is not exhaustive. Consult the IEEE Editorial Style Manual [1] or other high-quality references for more specialized situations.

1. Include some amount of white space (two to three lines is typical) before and after the figure to avoid a cramped or cluttered look.
2. Figures should normally be horizontally centered on the page or within a page column.
3. Avoid placing boxes around plots, diagrams, and other figures. White space is usually sufficient to set the figure apart. Boxes often lead to a cluttered look.
4. Label individual curves in multi-curve plots. A common example is a plot of the input and output voltages of a circuit on the same oscilloscope screen. Tell the reader which curve corresponds to each physical quantity. Be careful about referring to oscilloscope traces by color; the document might be photocopied in black & white. While individual traces can be identified in the figure caption (e.g., “The solid line is v_{in} , and the dashed line is v_o .”), it is better to use a legend or to label the curves directly on the plot. Labeling might have to be done manually if the plot is a screen image captured from a piece of test equipment. If space is constrained, then variables can be used to label curves in the legend or on the plot, but full text labels (e.g., “Output Voltage” instead of “ v_o ”) are preferable.
5. While modern software has simplified the use of color in plots, remember that documents are often photocopied or printed in black & white. It is therefore wise to use different line styles (e.g., dashed, dotted, dash-dot) for individual curves in addition to different colors. Moreover, remember that many people are color blind or have other vision impairments and might not be able to discern the different colors you use.

6. Carefully consider how color photographs will appear if they are photocopied or printed in black & white. If the preservation of color is essential to understanding the meaning of the image, then consider adding supplemental information in the caption.
7. Screen images (such as from an oscilloscope) should be obtained using image capture software. Cameras should not be used because the images they produce frequently have glare, are tilted due to parallax issues, and might miss some of the screen or include too much visual clutter around the screen. A captured image has a much more professional appearance.
8. Give each trace in a plot sufficient line thickness to make it easy to see. The default line thickness used in graphing software is often too thin. *Matlab* is notorious for this.
9. Label plot axes, and indicate the applicable units on each axis. Full text labels are preferable to variables (e.g., “Output Voltage” instead of “ v_o ”). However, the units in the axis labels should not normally be spelled out (e.g., “V” instead of “volts”). The units should be chosen to make the tick mark labels easy to read (e.g., “1.2 μA ” is easier to read than “1.2E-6 A”).
10. Figure titles normally should not be used if a caption is present that makes the title redundant. One exception is the case of multiple plots in a single figure (e.g., Fig. 1a, Fig. 1b, etc.); in that case, plot titles might be helpful.
11. If you give a data plot a title, make sure that it is descriptive and provides additional information. Do not simply repeat the vertical and horizontal axis labels in a “Quantity 1 vs. Quantity 2” kind of format (e.g., “Voltage vs. Time”). If for some reason you do refer to a plot using the “Quantity 1 vs. Quantity 2” format in the text, remember that the dependent variable (the vertical axis) goes before “vs.”, and the independent variable (the horizontal axis) goes after.

Tables

Tables should be used when a visually structured organization of numerical or textual information enhances its meaning or if the information is so important that it should be highlighted. However, in the case of data sets obtained from measurements, a plot will almost always present the data more clearly than a table, especially if there are more than a half dozen or so data points. Like figures, tables can enhance the presentation of information in a way that text cannot, but improper formatting and a lack of attention to well established standards can distract or irritate the reader.

Some fundamental guidelines regarding the use of tables are listed below.

1. Tables should be easy to read and preferably produced using a software package. Headings, numerical values, and other text should be in a sufficiently large font to read without zooming. The font size should be the same as or not much smaller than the size of the main text font.
2. Tables should stand alone as much as possible. Busy managers will sometimes look only at the tables (and figures) and their captions in a document and not read much or any of the text in the body. That means that the meaning of a table should be as self-evident as possible.

3. Tables should appear in a document as soon as possible after they are referred to, preferably on the same page. If there is not enough room on the page for the table after its first reference, then the table should appear at the top of the next page. Tables that appear before they are referenced can lead to confusion since the reader will not yet have any context.
4. Avoid splitting a table between pages. If there is no way to avoid it, as in the case of a very long table, then consider repeating the headings at the split at the top of the next page. Also add a new caption that indicates that the table is continued.
5. Any table included in a document should be referred to by number or other reference method in the body of the text and explained. Unreferenced tables should never be used in a technical document. Do not force the reader to deduce on their own why the table is there and what information it is supposed to convey.
6. A text reference to a table should not use a spelled-out number. For example, use “Table 1” instead of “Table One”. The word “Table” should be capitalized in this type of reference. Avoid splitting the word “Table” and the table number at line breaks. In Microsoft Word, type CTRL-SHIFT-space instead of just the space key to prevent a line break.
7. Tables should be numbered in the order in which they appear in a document. That is, the reader should encounter Table 1 first, then Table 2, etc.

As with figures, the formatting of tables is an important aid to clarity. Some of the most critical issues are listed below. Consult the IEEE Editorial Style Manual [1] or other high-quality references for specific situations that are not covered here.

1. Include some amount of white space (at least one or two lines) before and after the table to avoid a cramped or cluttered look.
2. Normally, tables should be horizontally centered on the page or within a page column.
3. Every table column should have a header consisting of very brief but descriptive text or a variable name and its unit, if appropriate. The unit, if one is needed, should be placed in parentheses or square brackets.
4. Units should be indicated in the header, not placed next to each value in every row. One exception is the % symbol; it is often kept with the listed values. (The % symbol is really a way to indicate a fraction; it implies that the value is divided by 100. The symbol is therefore part of the value and is not really a unit.)
5. The entries in the table should be organized so that the values of independent variable(s) are listed along the left side and the dependent variables are listed along the top. Each row should correspond to an individual independent variable value, and the dependent variables should form most of the headings. Another way to view this is that the variables along the top are functions of the values listed in the left-most column. For example, suppose that three voltages have been recorded at evenly spaced time intervals. The left-most column heading in the table should be “Time,” and three more column headings (to the right of “Time”) would correspond to the three voltages being measured. The instances in time at which the voltages are measured would form the first (left-most) table

column because time is the independent variable. Thus, each row corresponds to a particular point in time. It is possible to have multiple independent variables; they should occupy the left-most columns.

6. Use only enough dividing lines or shading to make the table easy to read. Excessive use of delineations leads to a cluttered look and can cause eye fatigue.
7. Decimal points should be aligned in columns if possible. Microsoft Word has a special tab character that does this. Check the “Ruler” box in the View menu and look in the upper left corner of the document window for a box with a tab character in it. (The left tab character is usually the default and looks like a tiny upper-case letter L.) Click on the box until the decimal point alignment character appears. It looks like an upside-down letter T with a dot to the upper right.
8. Do not use excessive numerical precision. If your data are reliable to only two digits of accuracy, then list values using only two significant digits.
9. Use the same number of decimal places for each value listed in a column unless the number of significant figures varies. Use trailing zeros, if necessary, but only if they do not imply greater precision for the value than really exists.

Captions

The development of good captions that effectively link figures and tables to the main body of the text is often neglected by authors. That is unfortunate because busy readers will sometimes look only at the figures and tables and their captions in a document and not read any of the text in the body. That means that annotations and captions need to be specific, thorough, and highly descriptive. Most of the guidelines for writing captions are the same whether they are for figures or tables, but there are important differences as well. Some of the more frequently encountered issues (but certainly not all of them) are listed below.

1. Figure captions should be placed below figures, never above, but table captions should be placed above tables, never below. The caption might or might not be centered or indented, depending on the style of the publication. The first line of the caption is usually not indented relative to the rest of the caption text.
2. A caption should be highly descriptive and refer directly to the figure or table it accompanies. It should immediately indicate to the reader what information the visual aid is meant to convey. The caption might summarize the relevant points covered in the accompanying text in the body of the document. However, the caption should never sound like it belongs in the body and therefore should not normally include narrative text.
3. The first phrase of the caption is the most important one and should serve as a type of title. It should therefore have a form much like a title (but not capitalized) rather than sentence (subject-verb-object) form. The caption should never start with “This figure (or table) shows...” since that is obvious and therefore wastes space and adds clutter. Complete sentences after the initial phrase can be added if further elaboration is necessary.

4. Include a period at the end of a caption even if it is not a complete sentence. (This is the usual practice, but the IEEE guidelines have an unusual exception for tables and state that table captions should not end in a period in IEEE publications.)
5. Do not capitalize every word in a caption. Use normal sentence capitalization rules. Most textbooks and high-quality periodicals like *IEEE Spectrum* (and Wikipedia as well) specify sentence case, not title case, for captions in their publications. (Curiously, the IEEE prescribes an unusual large-cap/small-cap style for table captions for many of its publications. That style is rarely used anywhere else.)
6. Depending on the style of the publication, the captions might use a different font and/or font size from that of the main text. Moreover, figure captions might use fonts and/or font sizes that differ from table captions.
7. Graphics, whether they are pictures, diagrams, plots, or other visual aids, should be called “figures,” not “graphs” or some other term. The caption should therefore begin with “Figure N.” where “N” is the figure number. Arabic numerals (the most commonly used type) are almost always preferred over Roman numerals or letters. The numeral should be followed by a period and then the caption text should follow the period. Depending on the style of the publication, the text “Figure N.” might or might not be in bold face or highlighted in some other way.
8. Likewise, tables should be called “tables,” not “figures” or some other term. The caption should begin with “Table N.” where “N” is the table number. Arabic or Roman numerals might be used, depending on the publication, although Arabic numerals are more common. The numeral should be followed by a period, and then the caption text should follow the period. Depending on the style of the publication, the text “Table N.” could be highlighted in some way.
9. Include some amount of white space between the caption and the table to improve readability and avoid a cluttered look.
10. Do not directly copy captions from other sources (such as where an image is obtained). Express the concept in your own words, adapted to your particular context. If you do copy or paraphrase any caption text, remember to cite the source.

Reference

- [1] *IEEE Editorial Style Manual*, IEEE Periodicals, Piscataway, NJ, 2017.