APPENDIX A

MTV Plot Resources

1 PLOT RESOURCES

MTV Plot Resources are `<argument>=<value>` strings used to set properties of a plot. The Plot Resources modify the properties of the dataset and of any plots containing the dataset. The various types of Plot Resources are:

- Plotset Resources
- 3D View Resources
- Dataset Resources
- Curve Resources
- Global Curve Resources

Plot Resources are included as **instruction** lines in the data-stream along with the actual plot data in the MTVDAT data format. Each **instruction** line begins with a percent "%" character and contains one or more argument-value pairs, separated by spaces or tabs. In general, the argument of the `<argument>=<value>` pair is case-insensitive, while the value string is case-sensitive. The example below defines a CURVE2D dataset with properties set using **instruction** lines.

```
$ DATA=CURVE2D NAME="Curve A"

# Plotset Resources
% toplabel = "Hello World"
% grid = True

# Dataset Resources
% splinetype=3   # Curves connected with Quadratic B-splines

# Curve 1 Resources
% linetype=1 linewidth=2 linelabel="Cv 1"
% markertype=3  # Draw the markers too
  0 0
  1 1
  2 2

# Curve 2 Resources
% linetype=2 linewidth=1 linelabel="Cv 2"
% markertype=4  # Draw the markers too
  2 0
  1 1
  0 2
$ END
```

2 PLOTSET RESOURCES

2.1 Overview

Plotset Resources are used to control the shape, size and appearance of a plot.

Plotset Property Argument List				
Name	**Type**	**Default**	**Range**	**Description**
Plot Titles				
xlabel	string	"X-Axis"	N/A	X-Axis Label
ylabel	string	"Y-Axis"	N/A	Y-Axis Label
zlabel	string	"Z-Axis"	N/A	Z-Axis Label
toplabel	string	"PLOT"	N/A	Plot Title
subtitle	string	NULL	N/A	Plot Sub-Title
comment	string	NULL	N/A	User-defined Comment
sidelabel	Boolean	True	True/False	Plot side-labels
sidelabellength labeloffset	integer	0	-100 — 300	Increase/decrease area for side-labels
Plot Aspect-ratio/Appearance				
grid	Boolean	False	True/False	Plot grid
equalscale	Boolean	False	True/False	Equal scaling in X and Y
fitpage	Boolean	True	True/False	Scale plot to fit page
xyratio	double	0.75	0.01 — 4	Plot size ratio (Y/X)
Axis-Scales				
xautorange	Boolean	True	True/False	Automatic tick scaling in X
xticks	integer	4	1 — 50	Number of tickmarks in X
yautorange	Boolean	True	True/False	Automatic tick scaling in Y
yticks	integer	4	1 — 50	Number of tickmarks in Y
zautorange	Boolean	True	True/False	Automatic tick scaling in Z
zticks	integer	4	1 — 50	Number of tickmarks in Z

Plotset Property Argument List				
Name	**Type**	**Default**	**Range**	**Description**
Axis-Scales (continued)				
autorange	Boolean	True	True/False	Automatic tick scaling in X,Y,Z
xlog	Boolean	False	True/False	Logarithmic Scale in X
ylog	Boolean	False	True/False	Logarithmic Scale in Y
zlog	Boolean	False	True/False	Logarithmic Scale in Z
xscale	double	1.0	1e-99 — ∞	Scale factor for X-Axis Label
yscale	double	1.0	1e-99 — ∞	Scale factor for Y-Axis Label
zscale	double	1.0	1e-99 — ∞	Scale factor for Z-Axis Label
xticklabel	string	NULL	N/A	User-specified ticklabels, specified as: xticklabel=(x-coordinate, label)
yticklabel	string	NULL	N/A	User-specified ticklabels, specified as: yticklabel=(y-coordinate, label)
zticklabel	string	NULL	N/A	User-specified ticklabels, specified as: zticklabel=(z-coordinate, label)
innerticks	Boolean	False	True/False	Draw ticks inside plot area
Plot Boundaries				
xmin vxmin	double	Dataset xmin	-∞ — ∞	X-Axis plot boundary
xmax vxmax	double	Dataset xmax	-∞ — ∞	X-Axis plot boundary
ymin vymin	double	Dataset ymin	-∞ — ∞	Y-Axis plot boundary
ymax vymax	double	Dataset ymax	-∞ — ∞	Y-Axis plot boundary
zmin vzmin	double	Dataset zmin	-∞ — ∞	Z-Axis plot boundary

Plotset Property Argument List				
Name	**Type**	**Default**	**Range**	**Description**
Plot Boundaries (continued)				
zmax vzmax	double	Dataset zmax	$-\infty$ — ∞	Z-Axis plot boundary
Miscellaneous Options				
xflip	Boolean	False	True/False	Flip X-Scale
yflip	Boolean	False	True/False	Flip Y-Scale
xabs	Boolean	False	True/False	Plot against abs(x)
yabs	Boolean	False	True/False	Plot against abs(y)
zabs	Boolean	False	True/False	Plot against abs(z)
overlay	Boolean	True	True/False	Modify overlaid datasets

2.2 Resource Specification

Plot Titles

xlabel Specifies the x-axis label. Defaults to "`X-Axis`".

ylabel Specifies the y-axis label. Defaults to "`Y-Axis`".

zlabel Specifies the z-axis label. Used only in 3D plots. Defaults to "`Z-Axis`".

toplabel Specifies the plot title, which appears above the plot itself. Defaults to "`PLOT`".

subtitle Specifies an additional title, which appears in a smaller font below the plot title. By default this title is left blank.

comment Specifies an additional title. This title appears in the upper-right corner of the plot. By default this title is left blank.

sidelabel Specifies whether the curve labels and contour color labels are to be plotted on the side of the plot. Defaults to **True**.

sidelabelength

labeloffset Specifies the additional size in pixels that the area for the side-labels is to be increased or decreased. Negative values decrease the size of the side-label area. Defaults to **0**.

Plot Aspect-ratio/Appearance

grid Specifies whether a dotted grid is drawn within the 2D plot. Grid intervals depends on the axis-scale values. Defaults to **False**.

equalscale Specifies whether the 2D plot is drawn with equally-scaled x and y axes. If **True**, the plot-distance per unit in x and y are set equal; thus if the x-limits are equal to the y-limits the plot will be square-shaped. Note that if x and y differ significantly in magnitude, setting **equalscale=True** will result in a long narrow rectangular plot. If **equalscale=False**, and **fitpage=True**, the x and y scale factors will be chosen such that the plot fills the page. If **equalscale=False**, and **fitpage=False**, the plot is drawn with aspect ratio **xyratio**. Default **equalscale** value is **True**.
Note: Use the View Resource **axisscale** to control the aspect ratio of a 3D plot.

fitpage Used with **equalscale** to set the 2D plot aspect ratio. Defaults to **True**.

xyratio Specifies the 2D plot y:x aspect ratio, i.e., the ratio of the plot-height (y) to the plot-width (x). Used only if both **equalscale=False** and **fitpage=False**. Default value is 0.75.

Axis-Scales

xautorange Specifies whether automatic ranging is used to plot axis-scales on the x-axis. Automatic ranging causes the program to select the best axis-scales possible for the x-axis. Both major and minor ticks are drawn; tick intervals depend on the range of axis-values. When **False**, the axis is drawn with **xticks** equally-spaced major tickmarks. Defaults to **True**.

xticks Sets the number of major ticks on the x-axis. Specifying this option also turns off automatic ranging of the x-axis. Minor ticks are not drawn. Default value is 4.

yautorange Specifies whether automatic ranging is used to plot axis-scales on the y-axis. See the description of **xautorange**. Defaults to **True**.

yticks Sets the number of major ticks on the y-axis. See the description of **xticks**. Default value is 4.

zautorange Specifies whether automatic ranging is used to plot axis-scales on the z-axis. See the description of **xautorange**. Defaults to **True**.

zticks Sets the number of major ticks on the z-axis. See the description of **xticks**. Default value is 4.

autorange Equivalent to setting **xautorange**, **yautorange**, and **zautorange** simultaneously.

xlog Specifies if the x-axis is to be drawn on a logarithmic or linear scale. When **True**, major tick marks are drawn at every logarithmic decade (multiple of 10.0), while minor tickmarks are drawn at every integer value within the decade. Defaults to **False**.

ylog Specifies if the y-axis is to be drawn on a logarithmic or linear scale. Defaults to **False**.

zlog Specifies if the z-axis is to be drawn on a logarithmic or linear scale. Defaults to **False**.

xscale Specifies the scale factor for the x-axis scale labels. This is useful when the x-ordinate values are very large or very small; the scale values are then divided by **xscale** before being placed on the plot. For example, if the plot has major ticks at 1.2e10 and 1.3e10, and **xscale**=1e10, then the tick labels will show "1.2" and "1.3", and a "(× 1e10)" label will be appended to the x-axis label. Defaults to 1.0.

yscale Specifies the scale factor for the y-axis scale labels. See the description of **xscale**. Defaults to 1.0.

zscale Specifies the scale factor for the z-axis scale labels. See the description of **xscale**. Defaults to 1.0.

xticklabel
yticklabel
zticklabel Specifies the label to be used for a given coordinate on the plot boundary. Ticklabels are psecied as a coordinate-label pair enclosed in brackets:

xticklabel `= ( x-coordinate, label )`
yticklabel `= ( y-coordinate, label )`
zticklabel `= ( z-coordinate, label )`

The following example illustrates the use of successive ticklabel statements to specify labels on the plot boundaries.

```
$ DATA=CURVE2D

# Xticklabel specification
% xticklabel = (0.1 "Tick1")
% xticklabel = (0.2 "Tick2")
% xticklabel = (0.3 "Tick 3")

# Now define curve datapoints
0 0
1 1
2 2

$ END
```

innerticks Forces tickmarks to be drawn only on the inside of the plot. Defaults to **False**, in which case tickmarks on the upper x-axis and on the right y-axis are drawn inside the plot, while the tickmarks on the lower x-axis and on the left y-axis are drawn outside the plot.

Plot Boundaries

xmin
vxmin Sets the minimum x-axis value of the plot boundary.

xmax
vxmin Sets the maximum x-axis value of the plot boundary.

ymin
vymin Sets the minimum y-axis value of the plot boundary.

ymax
vymin Sets the maximum y-axis value of the plot boundary.

zmin
vzmin Sets the minimum z-axis value of the plot boundary.

zmax
vzmax Sets the maximum z-axis value of the plot boundary.

Miscellaneous Options

xflip Specifies whether the direction of increasing x is to be reversed. If **False**, the minimum x-value is placed to the left of the maximum x-value on the plot; x increases from left to right. If **True**, the minimum x-value is placed to the right of the maximum x, and x increases from right to left. This gives the appearance of flipping the plot about the x-axis. Defaults to **False**.

yflip Specifies whether the direction of increasing y is to be reversed. If **False**, the minimum y-value is placed underneath the maximum y-value on the plot; y increases from bottom to top. If **True**, the minimum y-value is placed above the maximum y, and y increases from top to bottom. This gives the appearance of flipping the plot about the y-axis. Defaults to **False**.

xabs Specifies if the data is to be plotted against the absolute value of the x-ordinate. Defaults to **False**.

yabs Specifies if the data is to be plotted against the absolute value of the y-ordinate. Defaults to **False**.

zabs Specifies if the data is to be plotted against the absolute value of the z-ordinate. Defaults to **False**.

overlay Specifies if datasets overlaid in the same plot are to be modified. If **True**, the line-types and line-colors of contours and curves are jogged so as to provide contrast between the different datasets. Defaults to **True**.

3 3D VIEW RESOURCES

3.1 Overview

View Resources affect the shape and viewing angle of the 3D plot. These resources are used to select the appropriate view of the 3D plot.

3D View Property Argument List				
Name	**Type**	**Default**	**Range**	**Description**
View Point				
eyepos.x	double	1.0	-∞ — ∞	Eye-position relative to view center
eyepos.y	double	1.5	-∞ — ∞	Eye-position relative to view center
eyepos.z	double	0.5	-∞ — ∞	Eye-position relative to view center
viewcenter.x	double	0.5(xmin+xmax)	-∞ — ∞	View center
viewcenter.y	double	0.5(ymin+ymax)	-∞ — ∞	View center
viewcenter.z	double	0.5(zmin+zmax)	-∞ — ∞	View center
Axis Options				
window.xmin	double	-0.7	-∞ — ∞	Window boundary
window.xmax	double	0.7	-∞ — ∞	Window boundary
window.ymin	double	-0.7	-∞ — ∞	Window boundary
window.ymax	double	0.7	-∞ — ∞	Window boundary
axislabel	Boolean	True	True/False	Draw axis labels
axismove	Boolean	False	True/False	Rotate axis with view
axisscale	Boolean	True	True/False	Apply unequal scaling (plot as cube)
Miscellaneous Options				
leftworld	Boolean	False	True/False	Left-handed coordinate system
hiddenline	Boolean	False	True/False	Apply hidden-surfaces
paintcube	Boolean	False	True/False	Paint plot surfaces

3D View Property Argument List				
Name	**Type**	**Default**	**Range**	**Description**
Miscellaneous Options (continued)				
axisguides	Boolean	True	True/False	Show miniature axis guide

3.2 Resource Specification

View Point

eyepos.x

eyepos.y

eyepos.z Specify the eye-position relative to the view center. The 3D eye-position (or viewing vector) defaults to (1.0, 1.5, 0.5).

viewcenter.x

viewcenter.y

viewcenter.z Specify the view-center about which the 3D data is to be viewed. By default, the view-center is placed at the center of the plot-boundaries, e.g., **viewcenter.x = 0.5(xmin+xmax)**, where **xmin** and **xmax** are the boundaries of the plot in x (specified in Plotset Resources).

window.xmin

window.xmax

window.ymin

window.ymax Specify the relative size of the 2D window in the 3D plot. The 2D window dimensions are used to zoom or pan on selected areas of the 3D plot. By default, **window.xmin=-0.7**, **window.xmax=0.7**, **window.ymin=-0.7** and **window.ymax=0.7**.

Axis Options

axislabel Specifies whether to plot the axis labels in the 3D plot. Default value is **True**.

axismove Specifies whether the plot axis labels and tickmarks rotate as the view is rotated. In a 3D plot, only 1 of 4 possible axes in x, y, or z has labels and tickmarks attached to it. If **axismove** is **False**, the axes are plotted such that the labeled z-axis is always on the left-most side of the plot, while the x and y labeled axes are always on the bottom sides of the view cube closest to the eye. If **True**, the labeled plot axes are fixed to specific coordinates and rotate as the view rotates. The default is **False**.

axisscale Specifies whether the axes are scaled unequally. If **True**, the unequal scaling results in a cube-like plot, where the x, y and z axes have the same length regardless of the actual boundary range. If **False**, the axes are scaled proportionally to the actual boundary range. The default is **True**.

Miscellaneous Options

leftworld Specifies whether to use a left-handed coordinate system or a right-handed coordinate system. If **True**, a left-handed coordinate system is used. The default is **False**, and the 3D plot is displayed using a right-handed coordinate system.

hiddenline Specifies whether polygons are drawn with hidden lines/surfaces. The hiddenline routine uses a simple painter's algorithm; polygons further from the eye are drawn first and obscured or painted over by polygons closer to the eye. Default is **False**.

paintcube Specifies whether the inner surfaces making up the view cube are painted. Default is **False**.

axisguides Specifies whether the miniature axis guides are drawn on the lower left corner of the plot. Defaults to **True**.

4 DATASET RESOURCES

4.1 Overview

Dataset Resources are used to modify the properties of datasets. In general, dataset resources affect the way the data is manipulated and displayed in the plot, e.g., the number of contour slices in a contour plot.

Dataset Property Argument List

Name	Type	Default	Range	Description
Contour Options				
contstyle	integer	1	1 — 3	Contour style 1=Contour Lines 2=Gradated Colored Contours 3=Mesh
contfill	Boolean	False	True/False	Colored contours (contstyle=2)
cstep	double	0.1(cmax-cmin)	0.0 — ∞	Contour step size (linear)
nsteps	integer	10	0 — 50	Number of contour steps (linear)
logsteps	integer	1	1 — 10	Steps per logarithmic decade
contours	string	NULL	N/A	Individual contour specification
cmax	double	Data maximum	-∞ — ∞	Maximum contour level
cmin	double	Data minimum	-∞ — ∞	Minimum contour level
linetypes	integer	2	1 — 3	No of contour linetypes
contlabel	Boolean	True	True/False	Plot contour labels
contclip	Boolean	False	True/False	Clip filled contours
interpolate	integer	0	0 — 3	Contour interpolation style (only for rectangular grids) 0=Rectangle → Rectangle 1=Rectangle → Triangles 2=Rectangle → 4 Triangles 3=Rectangle → Flat Rectangle
bitmap	Boolean	False	True/False	Used with interpolate=3 to draw contours as bitmaps.
logx	Boolean	False	True/False	Contour log-interpolation in x
logy	Boolean	False	True/False	Contour log-interpolation in y

Dataset Property Argument List				
Name	**Type**	**Default**	**Range**	**Description**
logz	Boolean	False	True/False	Contour log-interpolation in z
Mesh Options				
meshplot	Boolean	False	True/False	Plot mesh
boundary	Boolean	True	True/False	Plot boundary
regbound	Boolean	False	True/False	Fill region boundary
fillbound	Boolean	False	True/False	Fill material boundary
Vector Options				
vlog	Boolean	False	True/False	Plot vectors in log-scale
vlogscale	double	-	0 — ∞	Vector scale-factor (log)
vscale	double	-	0 — ∞	Vector scale-factor (linear)
vhead	Boolean	True	True/False	Draw vector arrow-head
vtail	Boolean	False	True/False	Draw vector arrow-tail
Barchart Options				
barmin	double	0.0	–∞ — ∞	Minimum bar extent
Histogram Options				
binwidth	double	0.1(xmax-xmin)	–∞ — ∞	Histogram bin size
binstart	double	xmin	–∞ — ∞	Histogram starting point
Debug Options				
printid	Boolean	False	True/False	Print all element IDs
pointid	Boolean	False	True/False	Print point IDs
nodeid	Boolean	False	True/False	Print node IDs
triaid	Boolean	False	True/False	Print triangle IDs
rectid	Boolean	False	True/False	Print rectangle IDs

Dataset Property Argument List				
Name	**Type**	**Default**	**Range**	**Description**
regionid	Boolean	False	True/False	Print region IDs
Curve Options				
splinetype	integer	0	0 — 6	Spline Type 0=None (Linear) 1=Cubic B-Spline 2=Doubled Cubic B-Spline 3=Quadratic B-Spline 4=Catmull-Rom Spline 5=Cubic Bezier Spline 6=Quadratic Bezier Spline
applyfill	Boolean	True	True/False	Fill curves as requested
Miscellaneous Options				
annotate	Boolean	True	True/False	Plot annotations

4.2 Resource Specification

Contour Options

contstyle Specifies the contour plot style. *c***ontstyle=1** results in contour lines, **contstyle=2** causes the regions between adjacent contours to be filled with gradated colors, while **contstyle=3** causes the 3D surface mesh to be drawn in place of contours. **contstyle=1** and **contstyle=2**, when used in combination with **meshplot=True** causes contours and the underlying mesh to be drawn simultaneously. By default, **contstyle=1**.

contfill Specifies whether to draw contours in gradated colors. **contfill=True** is equivalent to setting **contstyle=2**, while **contfill=False** corresponds to **contstyle=1**.

cstep Causes contours to be selected with a constant step-size of **cstep**. This results in equally-spaced contour increments inside the given [**cmin**, **cmax**] limits. However, the minimum and maximum contour values do NOT necessarily correspond to the minimum and maximum limits of the quantity; the values of the contours are rounded so as to obtain numerically-pleasing values. For example, with **cmin**=0.36 and **cmax**=1.03, contour values of z=0.4, 0.5,... 1.0 are obtained. By default, contours are plotted using a **cstep** value corresponding to roughly 10 equally spaced contours.

nsteps Causes contours to be selected with a constant step-size of **(cmax-cmin)/nsteps**. The contours are selected inclusive of **cmin** and **cmax**, resulting in levels at z=**cmin**, z=**cmin**+i(**cmax-cmin**)/**nsteps**, ... z=**cmax**. For example, with **cmin**=0.36, **cmax**=1.03 and **nsteps**=5, contour values of z=0.36, 0.494, 0.628, 0.762, 0.896, and 1.03 are obtained. If **nsteps**=0, a single contour is drawn at **0.5(cmin+cmax)**. The default value is 10.
Note: If **nsteps** is NOT explicitly specified, the contours are calculated using the **cstep** option, where **cstep** = `rounded_value_of`(**(cmax-cmin)/10**).

logsteps Specifies the number of contours to be plotted in a logarithmic decade. Setting **logsteps** causes contours to be selected with logarithmic spacing, which is preferred for plotting data which ranges widely in magnitude. If **logsteps=1**, the ratio between adjacent contours is 10.0 and contours are rounded to the nearest power of 10. For example, if the quantity ranges in z-value from 0.5e10 to 3.2e15, contours will be plotted at 1e10, 1e11, 1e12, 1e13, 1e14 and 1e15. **logsteps** values greater than 1 cause more than one contour to be plotted per decade, e.g., **logsteps=2** plots contours at 1e10, 5e10, 1e11, etc. The default **logsteps** value is 1.

contours Specifies a string of contour values. This option is used to manually set the number and type of contours in the contour plot. The **contours** string has the syntax:

contours`=([new] value1 value2 ... [linewidth=<>] ...)`

where `value1` etc., are user-defined contour levels; the optional "`new`" character string causes all previously specified contour values to be over-written. Curve properties such as linewidth, linetype, and marker-types for the contours may also be defined in the same line, using curve keywords such as "`linewidth`" and "`linetype`"; see Curve Properties for the detailed specification. Multiple **contours** statements can be used together, provided that each statement is on a separate line; **contours** statements following the first **contours** statement append their contour values to the current list. By default, **contours** is a blank string, and the contour levels are selected automatically using any of **cstep**, **nsteps**, and **logsteps**.

The following example illustrates the use of successive contours statements to set contour levels and the curve properties of the contours.

```
$ DATA=CONTOUR

# Contour step specification
% contours = (0.1 0.2 0.3 lw=2 lt=1 lc=2 mt=2)
% contours = (0.5 0.6 0.7 lw=1 lt=2 lc=3)

# Now define the contour grid
% xmin=0 xmax=2 nx=5
% ymin=0 ymax=1 ny=3
0 0 0 0 0
0 1 0 1 0
0 0 1 0 0

$ END
```

cmin

cmax Specify the range in which contours are to be plotted. These default respectively to the minimum and maximum z-values of the data in the selected dataset.

linetypes Specifies the number of line-types for the contour plot. Valid values range from 1 to 3. The default is to use 2 line-types, in which case major contours are drawn in solid lines while minor contours are drawn dashed.

contlabel Specifies whether contour labels are to be placed on contour lines. **contlabel** is ignored when drawing colored contours (**contstyle=2**).

contclip Specifies if the filled contours are to be plotted for values greater than cmin and cmax. **contclip** defaults to **False**; if **contstyle=2**, then the contours are filled above and below the specified color ranges. For example, if contours are specified at values of 0.1, 0,2 and 0.3, data-ranges less than 0.1 and greater than 0.3 will be filled as well. But if **contclip=True**, then only the contours between 0.1 and 0.3 will be filled with colors.

interpolate Specifies the contour interpolation style for rectangular-grid-based data. By default, **interpolate=0**, and each rectangle in the grid is plotted as is. If **interpolate=1** or **interpolate=2**, each rectangle is split up into 2 or 4 triangles respectively. The distinction between rectangles and triangles is made because the 4 points of a single rectangle in 3D space are often not coplanar. Finally, **interpolate=3** is a special scheme where the data is broken up into planar rectangles with constant z-values; each rectangle is centered about the data-points on the original rectangular grid.

logx

logy

logz Specifies whether contours are to be calculated using logarithmic or linear interpolation. Typically, contour data with a wide range of values is plotted using logarithmically varying steps and logarithmic interpolation in z (**logz=True**). By default, **logx=False**, **logy=False** and **logz=False**.

Mesh Options

meshplot Specifies whether the underlying mesh is to be plotted. Particularly useful for contour plots and mesh-based datasets. Default is **False**.

boundary Specifies whether the outlines of the device materials are to be plotted. Useful only for mesh-based datasets. Default is **True**.

regbound Specifies whether the boundaries of the various device regions are to be drawn. Regions with identical materials are plotted in identical colors. Useful only for mesh-based datasets. Default is **False**.

fillbound Specifies whether the various device regions are to be filled with colors corresponding to different materials. Regions with identical materials are plotted in identical colors. Useful only for mesh-based datasets. Default is **False**.

Vector Options

vlog Specifies whether vectors are to be plotted on a logarithmic or linear scale. If **True**, the length of the vectors is proportional to the logarithm of the vector magnitude. Default is **False**.

vlogscale Specifies the scale factor for vectors plotted on a logarithmic scale. The default scaling is based on the boundary limits of the data and the logarithm of the maximum magnitude of the vectors.

vscale Specifies the scale factor for vectors plotted on a linear scale. The default scaling is based on the boundary limits of the data and the maximum magnitude of the vectors.

vhead Specifies whether the vectors are to be plotted with arrow-heads. Only vectors of sufficient length (as determined by dimensions on the plot) are plotted with arrow-heads. Default is **True**.

vtail Specifies whether the vectors are to be plotted with cross-tails. Default is **False**.

Barchart Options

barmin Specifies the minimum y-extent of each bar in the bar-chart. The 2D bar is drawn from `y=`**barmin** to `y=yval`, where `yval` is the data-point value of the bar. By default, **barmin=0.0**.

Histogram Options

binstart Specifies the beginning point from which the data-values will be collected into bars. The data is collected in ranges of size **binwidth** beginning from `x=`**binstart**. Thus the histogram bars are constructed over the ranges [**binstart**, **binstart** + **binwidth**], [**binstart** + **binwidth**, **binstart** + 2×**binwidth**] and so on. **binstart** defaults to `xmin,` the minimum data value.

binwidth Specifies the collection range or bin size for the histogram. The data is collected in ranges of size **binwidth** beginning from `x=`**binstart**. Thus the histogram bars are constructed over the ranges [**binstart**, **binstart** + **binwidth**], [**binstart** + **binwidth**, **binstart** + 2×**binwidth**] and so on. **binwidth** defaults to `0.1×(xmax-xmin)`, such that 10 histogram bars are plotted.

Debugging Options

printID Specifies whether the various element integer identifiers are to be printed on the plot. Equivalent to setting **pointID**, **nodeID** etc individually.

pointID Specifies whether point integer identifiers are to be printed on the plot. Points are contained in CURVE2D, CURVE3D, CONTCURVE, CONTOUR, GRID4D, PROBABILITY-PLOT and MESH-based datasets. Default is **False**.

nodeID Specifies whether node integer identifiers are to be printed on the plot. Nodes are connected to points, and contained in CONTOUR, GRID4D and MESH-based datasets. Default is **False**.

triaID Specifies whether triangle integer identifiers are to be printed on the plot. Triangles are connected to nodes which in turn are connected to points; triangles are contained in CONTOUR, GRID4D and MESH-based datasets. Default is **False**.

rectID Specifies whether rectangle integer identifiers are to be printed on the plot. Rectangles are connected to nodes which in turn are connected to points; rectangles are contained in CONTOUR and GRID4D datasets. Default is **False**.

regionID Specifies whether region integer identifiers are to be printed on the plot. Regions are connected to nodes which in turn are connected to points; regions are contained only in MESH-based datasets. Default is **False**.

Curve Options

splinetype Specifies if spline interpolation is to be used to connect the points on a curve. Applies to CONTOUR and CURVE datasets only. 6 splinetypes are provided. The *Cubic B-Spline* (**splinetype=1**), *Doubled Cubic B-Spline* (**splinetype=2**), *Quadratic B-Spline* **(splinetype=3**) produce curves that approximate the control points; the curves pass close to but do not go through the actual data points. *Catmull-Rom Splines* (**splinetype=4**) pass through the control points but can produce wild variations in between points. *Quadratic Bezier Spline* (**splinetype=5**) and *Cubic Bezier Spline* (**splinetype=6**) curves hit the midpoints of the control points. The default, **splinetype=0** is to connect the data-points using straight lines.

applyfill Specifies whether curves with specified fills are actually filled. If **False**, only the curve outlines are plotted. Actually a useful debugging aid for inspecting overlapping curves. Applies only to CURVE datasets. Default is **True**.

Miscellaneous Options

annotate Specifies whether annotations attached to the specified dataset are to be plotted. If **False**, the annotations are not plotted. Allows multiple datasets to be overlaid without too much confusion due to overlapping annotations. Default is **True**.

5 CURVE RESOURCES

5.1 Overview

Curve Resources are used to modify the properties of curves in contour and curve datasets. Note that curve resources may be specified using abbreviated keywords, i.e., "`lw=5`" is identical to "`linewidth=5`".

Curve Property Argument List

Name	Type	Default	Range	Description
Line Options				
linelabel	string	NULL	N/A	Curve label
linewidth lw	integer	1	0 — 32	Curve width
linetype lt	integer	1	0 — 10	Curve type 0=None 1=Solid 2=Dashed 3=Dotted 4=Dot-Dash 5=Long-Dots 6=Double-Dot 7=Long-Dash 8=Sparse Dot-Dash 9=Triple-Dot 10=Dot-Dot-Dash
linecolor lc	integer	1	-1 — 10	Line color -1=Background color[a] 0=Foreground color[b] 1=Yellow 2=Blue 3=Green 4=Red 5=Dark Blue 6=Orange 7=Pink 8=Light Pink 9=Cyan 10=Brown

Curve Property Argument List				
Name	**Type**	**Default**	**Range**	**Description**
Marker Options				
markertype mt	integer	0	0 — 13	Marker type 0=None 1=Dot 2=Cross 3=X 4=White Square 5=Black Square 6=White Diamond 7=Black Diamond 8=White Triangle 9=Black Triangle 10=White Inverted Triangle 11=Black Inverted Triangle 12=White Circle 13=Black Circle
markercolor mc	integer	1	-1 — 10	Marker color Refer to linecolors
markersize ms	integer	1	1 — 10	Marker size
Fill Options				
filltype	integer	0	0 — 8	Fill type 0=None 1=Solid 2=Square Crosshatch 3=Left-to-right Diagonal 4=Right-to-left Diagonal 5=Crossed Diagonals 6=Vertical Lines 7=Horizontal Lines 8=Dotted Horizontal Lines
fillcolor	integer	1	-1 — 10	Fill color Refer to linecolors

a. The background color is typically blue on an X11 plot. On a Postscript plot, the background color is always white.
b. The foreground color is typically white on an X11 plot. On a Postscript plot, the foreground color is always black.

5.2 Resource Specification

Lines

linelabel Specifies a label (legend) to be placed to the left of the plot. For contour-curves, the label is placed at various locations on the curve itself. Default is a blank string.

linewidth

lw Specifies the width of the line to be used in drawing the curve. Default is 1.

linetype

lt Specifies the type of line-pattern to be used in drawing the curve. Line-patterns include solid lines, dashed lines and dotted lines. Default is 1 (solid line).

linecolor

lc Specifies the color to be used in drawing the curve. Colors are approximated by gray-scales for black-and-white Postscript plots. Default is 1 (yellow).

Markers

markertype

mt Specifies the markertype to be used in drawing the points on the curve. The default value is 0, in which case markers are not plotted.

markercolor

mc Specifies the color to be used in drawing the markers. Colors are approximated by gray-scales for black-and-white Postscript plots. Default is 1 (yellow).

markersize

ms Specifies the size of markers on the curve. The default value is 1, which is the smallest size.

Fills

filltype Specifies the filltype to be used in drawing the curve. The default is 0, in which case only the outline of the curve is drawn.
Note: The **filltype** is ignored if the Dataset Resource **applyfill** is False.

fillcolor Specifies the color to be used in the fill-pattern. Colors are approximated by gray-scales for black-and-white Postscript plots. Default is 1 (yellow).

6 GLOBAL CURVE RESOURCES

6.1 Overview

Global Curve Resources are used to modify the properties of *all* the curves in contour and curve datasets. These resources are used primarily to set the default properties for curves; Curve Resources are then used to set properties of individual curves. Note that the argument names of Global Curve Resources differ from Curve Resource names only by a "d" in at the beginning of the name.

Global Curve Property Argument List

Name	Type	Default	Range	Description
Line Options				
dlinewidth	integer	1	0 — 32	Curve width
dlinetype	integer	1	0 — 10	Curve type 0=None 1=Solid 2=Dashed 3=Dotted 4=Dot-Dash 5=Long-Dots 6=Double-Dot 7=Long-Dash 8=Sparse Dot-Dash 9=Triple-Dot 10=Dot-Dot-Dash
dlinecolor	integer	1	-1 — 10	Line color -1=Background color[a] 0=Foreground color[b] 1=Yellow 2=Blue 3=Green 4=Red 5=Dark Blue 6=Orange 7=Pink 8=Light Pink 9=Cyan 10=Brown

Global Curve Property Argument List				
Name	**Type**	**Default**	**Range**	**Description**
Marker Options				
dmarkertype	integer	0	0 — 13	Marker type 0=None 1=Dot 2=Cross 3=X 4=White Square 5=Black Square 6=White Diamond 7=Black Diamond 8=White Triangle 9=Black Triangle 10=White Inverted Triangle 11=Black Inverted Triangle 12=White Circle 13=Black Circle
dmarkercolor	integer	1	-1 — 10	Marker color Refer to linecolors
dmarkersize	integer	1	1 — 10	Marker size
Fill Options				
dfilltype	integer	0	0 — 8	Fill type 0=None 1=Solid 2=Square Crosshatch 3=Left-to-right Diagonal 4=Right-to-left Diagonal 5=Crossed Diagonals 6=Vertical Lines 7=Horizontal Lines 8=Dotted Horizontal Lines
dfillcolor	integer	1	-1 — 10	Fill color Refer to linecolors

a. The background color is typically blue on an X11 plot. On a Postscript plot, the background color is always white.
b. The foreground color is typically white on an X11 plot. On a Postscript plot, the foreground color is always black.

6.2 Resource Specification

Lines

dlinewidth Specifies the width of the line to be used in drawing the curve. Default is 1.

dlinetype Specifies the type of line-pattern to be used in drawing the curve. Line-patterns include solid lines, dashed lines and dotted lines. Default is 1 (solid line).

dlinecolor Specifies the color to be used in drawing the curve. Colors are approximated by gray-scales for black-and-white Postscript plots. Default is 1 (yellow).

Markers

dmarkertype Specifies the markertype to be used in drawing the points on the curve. The default value is 0, in which case markers are not plotted.

dmarkercolor Specifies the color to be used in drawing the markers. Colors are approximated by gray-scales for black-and-white Postscript plots. Default is 1 (yellow).

dmarkersize Specifies the size of markers on the curve. The default value is 1, which is the smallest size.

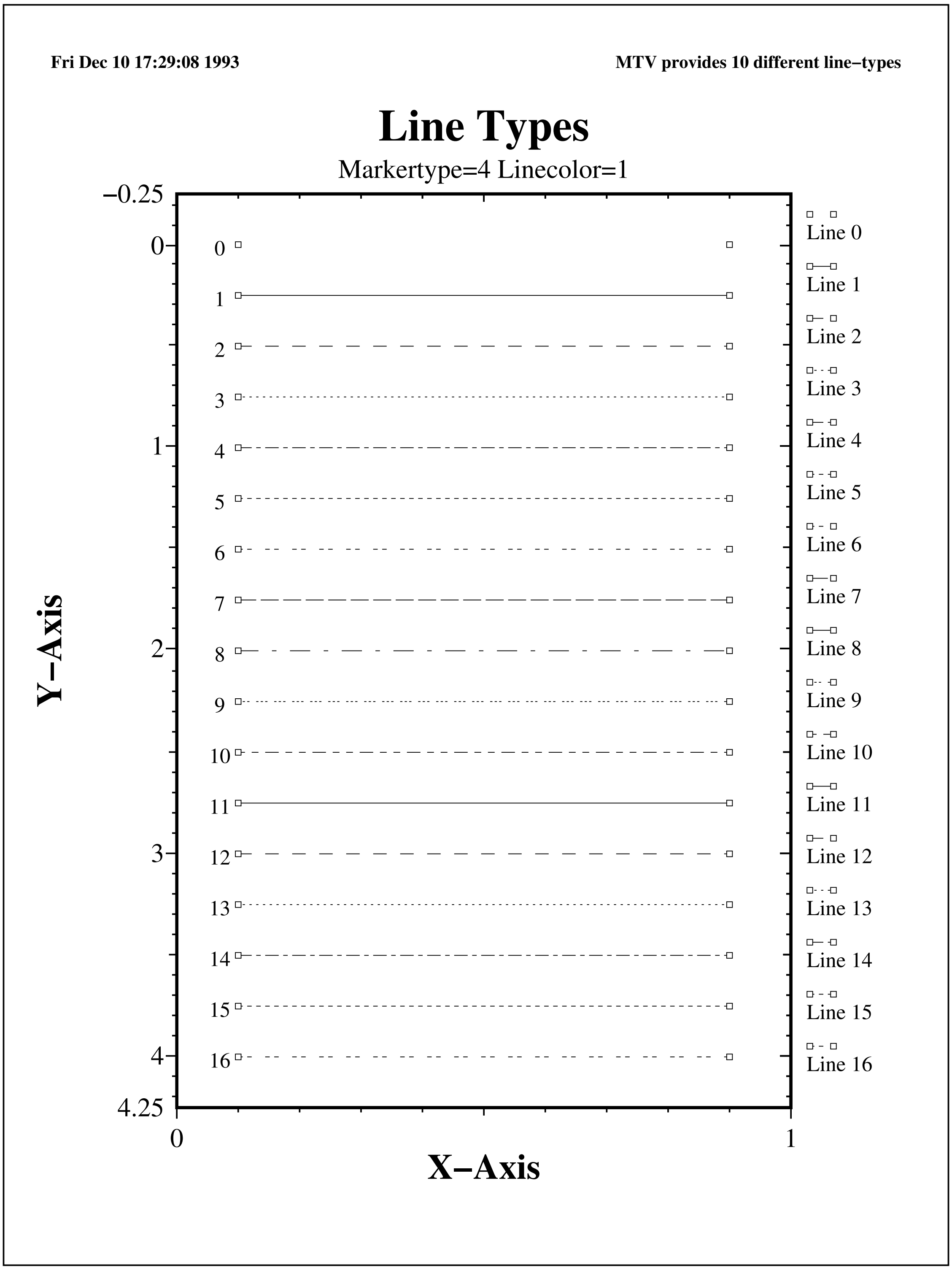
Fills

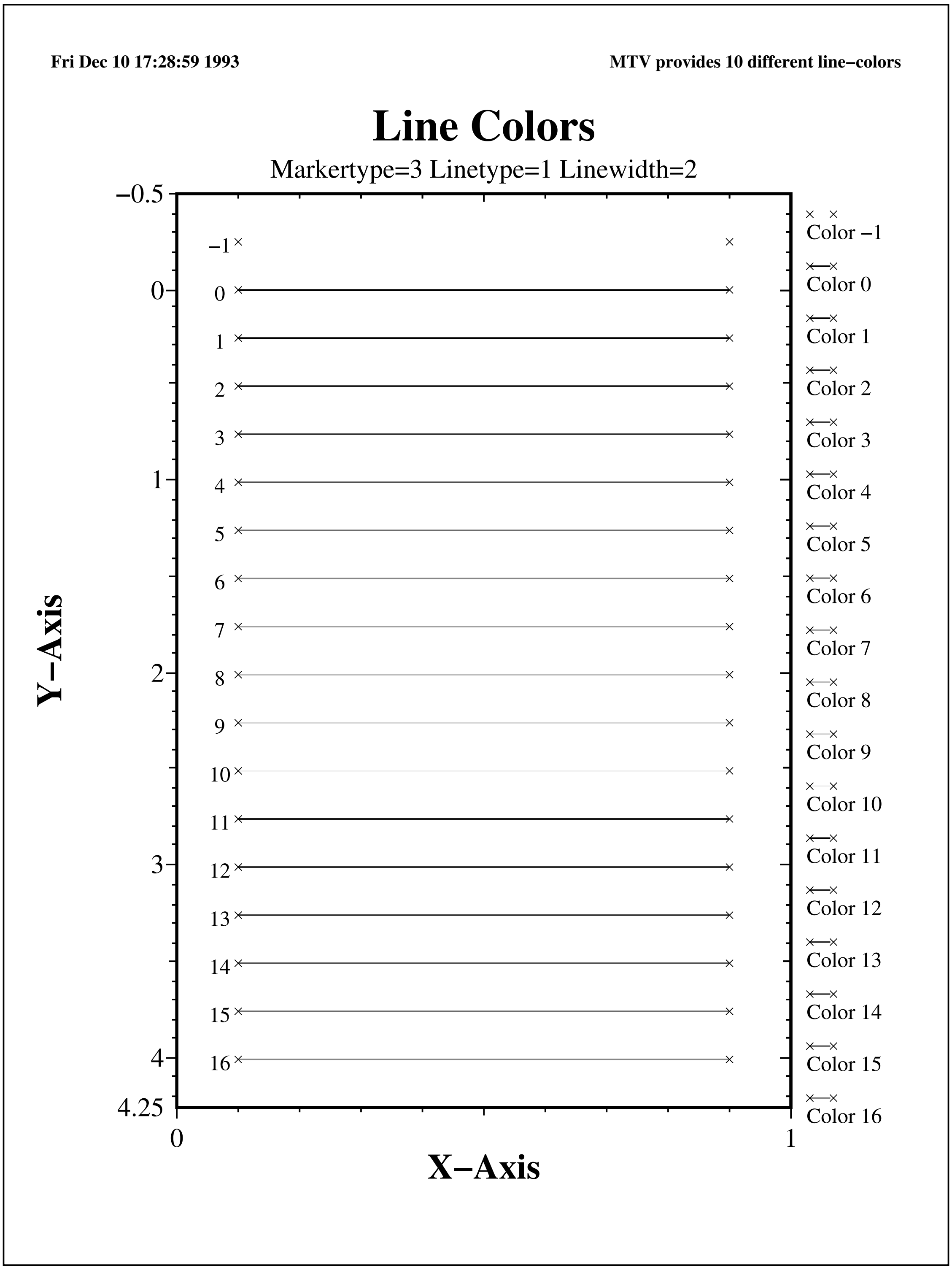
dfilltype Specifies the filltype to be used in drawing the curve. The default is 0, in which case only the outline of the curve is drawn.
Note: The **dfilltype** is ignored if the Dataset Resource **applyfill** is **False**.

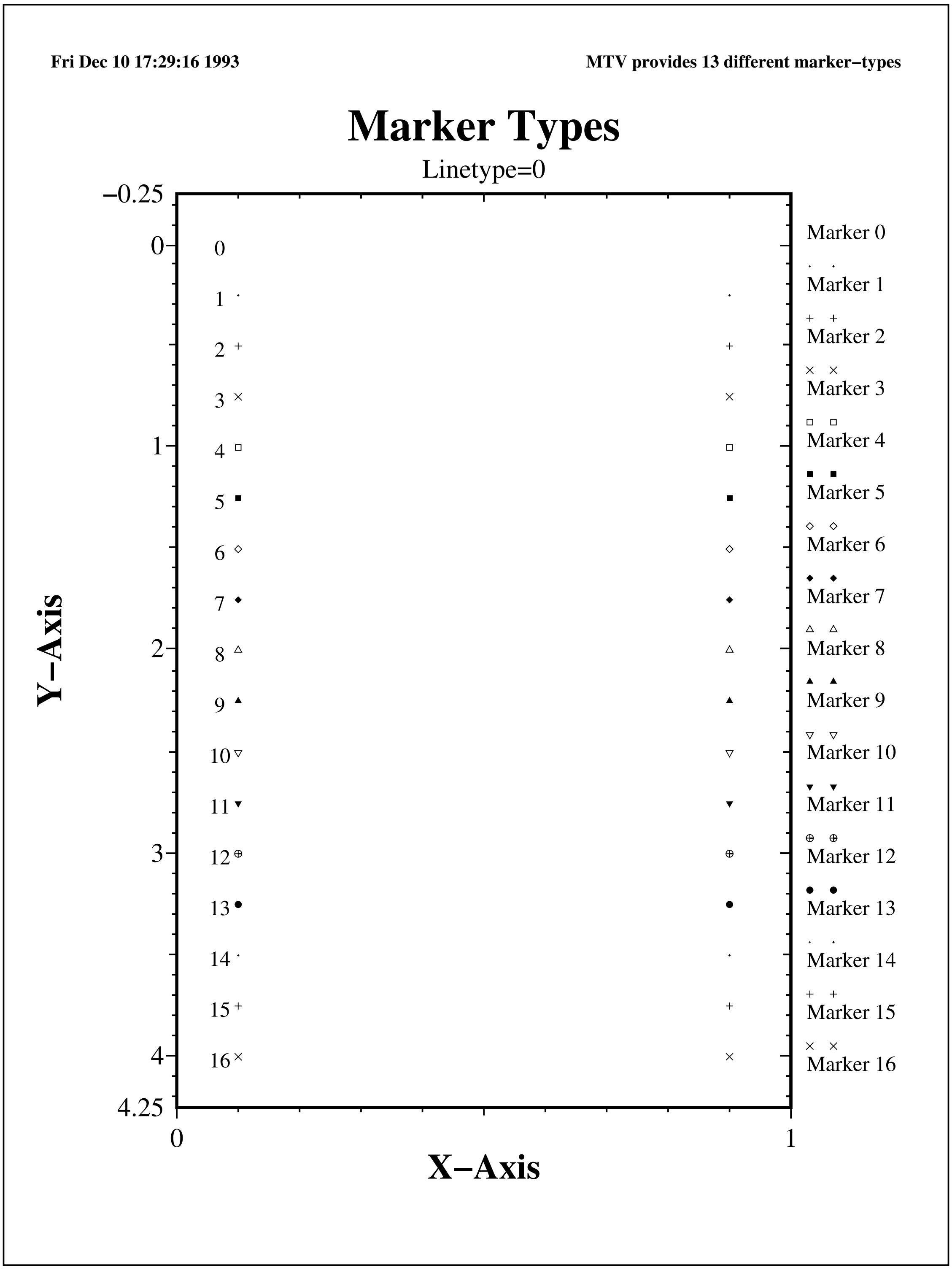
dfillcolor Specifies the color to be used in the fill-pattern. Colors are approximated by gray-scales for black-and-white Postscript plots. Default is 1 (yellow).

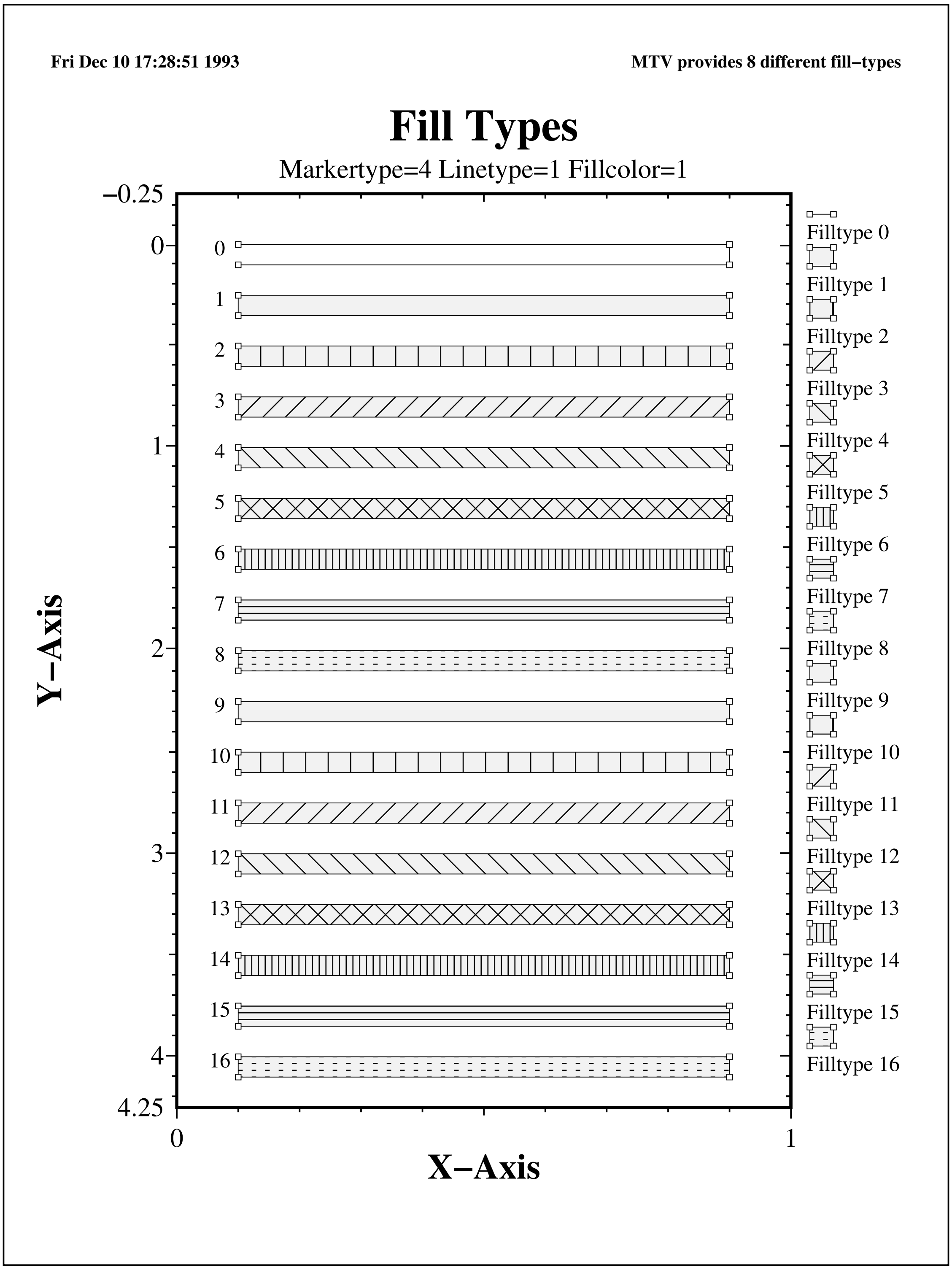
7 CURVE RESOURCE EXAMPLES

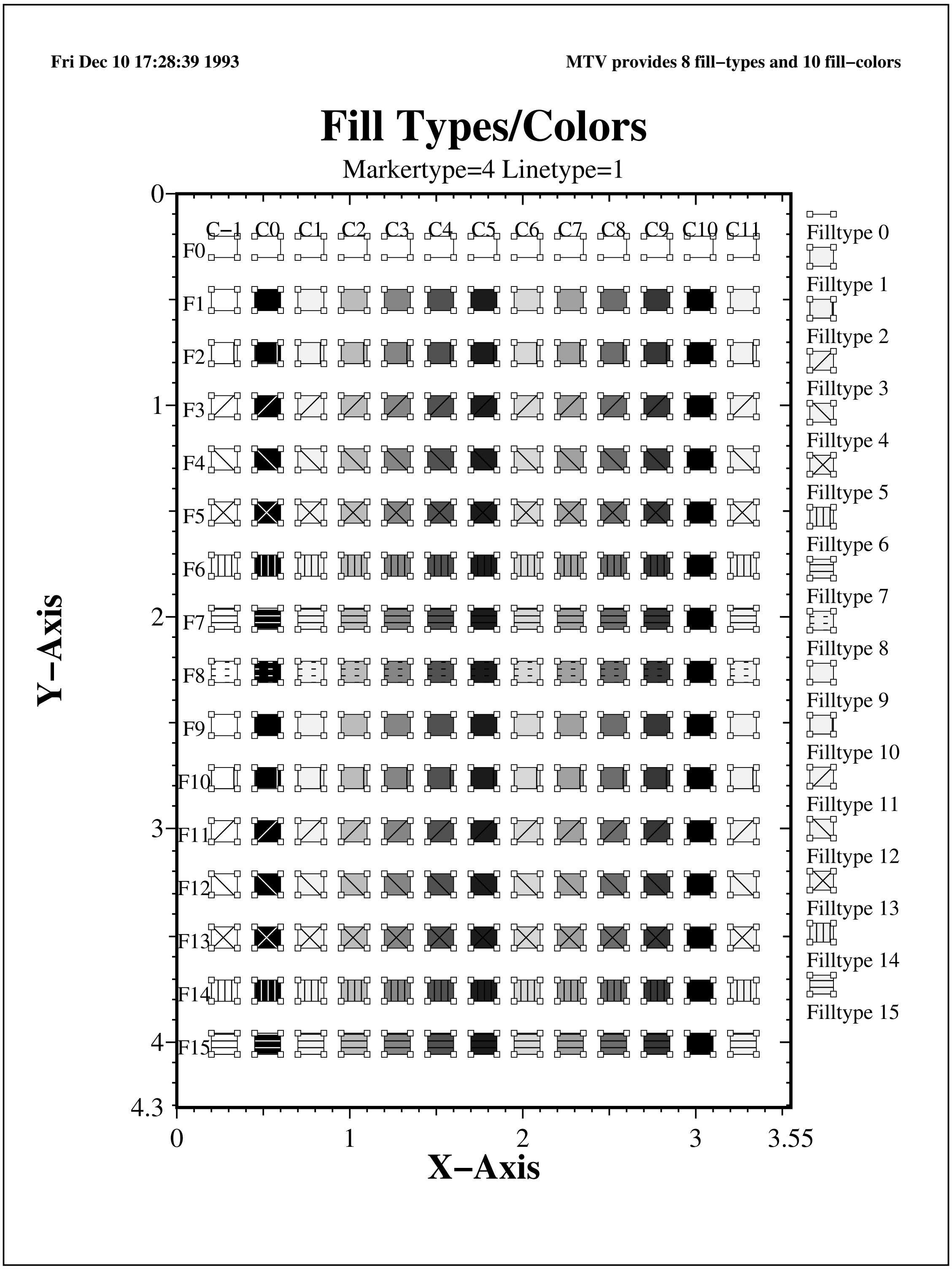
The example plots shown on the following pages illustrate the many different line, marker and fill types available as Curve Resources.


Fri Dec 10 17:29:08 1993
MTV provides 10 different line−types
Line Types
Markertype=4 Linecolor=1
−0.25
0
1
2
3
4
4.25
0
1
X−Axis
Y−Axis
Line 0
Line 1
Line 2
Line 3
Line 4
Line 5
Line 6
Line 7
Line 8
Line 9
Line 10
Line 11
Line 12
Line 13
Line 14
Line 15
Line 16


Fri Dec 10 17:28:59 1993
MTV provides 10 different line−colors
Line Colors
Markertype=3 Linetype=1 Linewidth=2
−0.5
0
1
2
3
4
4.25
−1
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Color −1
Color 0
Color 1
Color 2
Color 3
Color 4
Color 5
Color 6
Color 7
Color 8
Color 9
Color 10
Color 11
Color 12
Color 13
Color 14
Color 15
Color 16
Y−Axis
0
1
X−Axis


Fri Dec 10 17:29:16 1993
MTV provides 13 different marker−types
Marker Types
Linetype=0
−0.25
0
1
2
3
4
4.25
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Marker 0
Marker 1
Marker 2
Marker 3
Marker 4
Marker 5
Marker 6
Marker 7
Marker 8
Marker 9
Marker 10
Marker 11
Marker 12
Marker 13
Marker 14
Marker 15
Marker 16
0
1
Y−Axis
X−Axis


Fri Dec 10 17:28:51 1993
MTV provides 8 different fill−types
Fill Types
Markertype=4 Linetype=1 Fillcolor=1
−0.25
0
1
2
3
4
4.25
Y−Axis
X−Axis
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Filltype 0
Filltype 1
Filltype 2
Filltype 3
Filltype 4
Filltype 5
Filltype 6
Filltype 7
Filltype 8
Filltype 9
Filltype 10
Filltype 11
Filltype 12
Filltype 13
Filltype 14
Filltype 15
Filltype 16



Fri Dec 10 17:28:39 1993
MTV provides 8 fill−types and 10 fill−colors
Fill Types/Colors
Markertype=4 Linetype=1
C−1 C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11
F0
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
F13
F14
F15
Filltype 0
Filltype 1
Filltype 2
Filltype 3
Filltype 4
Filltype 5
Filltype 6
Filltype 7
Filltype 8
Filltype 9
Filltype 10
Filltype 11
Filltype 12
Filltype 13
Filltype 14
Filltype 15
0
1
2
3
4
4.3
Y−Axis
0
1
2
3
3.55
X−Axis