PINNACLE VIDEO WORKSTATION™
Series

PRIZM™ Option

OPERATOR'S MANUAL

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WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Notification as required by FCC Rules, Section 15.818.

This manual was produced by Technology Media Enterprises

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SECTION 1
HOW TO USE THIS MANUAL

Thank you for purchasing and using the Pinnacle PRIZM option. If you are not already familiar with with them, we welcome you to the family of Pinnacle products. Before proceeding with this manual, please take some time to familiarize yourself with the 2000/3000 Series Operators and Installation manuals. If you already have a Series 2000/3000 Video WorkStation™ and are now installing a PRIZM option, read the PRIZM Installation Manual before continuing with this document. If the Series 2000/3000 Series Video WorkStation has been purchased with the PRIZM option already installed, continue with this Operator's Manual.

The operational information in this manual complements the Series 2000/3000 Series Operator's Manual. In certain cases, this manual updates operational features described in the Series 2000/3000 Series Operator's Manuals. Certain keycaps and keycap locations on the Control Panel are changed, as well as menus. Menu and keycap enhancements are described in the Description Of Menus section of this manual.

This Operator's Manual is divided into several sections:

PRIZM Overview	Gives an overall idea of the features and capabilities of the PRIZM 3-D Image Manipulator system.
Concepts of Three-Dimensional Manipulation	Provides important information about manipulating objects in three-dimensional space. The section describes how three-dimensional concepts are implemented in the Pinnacle PRIZM 3-D Image Manipulator.
Description of Menus	Covers how to gain access to and interpret menus and control panel keys to use the PRIZM option.

[1] *Video WorkStation is a registered trademark of Pinnacle Systems, Inc.*

Basic Operation

Describes how to perform basic operations, such as how to place, rotate, and add effects to an image.

Sequencing Operation

Explains how to create and edit sequences using the PRIZM 3-D Image Manipulator. This section also covers the basic theory of sequencing and how sequencing concepts are implemented in the Pinnacle PRIZM 3-D Image Manipulator.

SECTION 2
PRIZM™ OVERVIEW

PRIZM is an add-on option and upgrade to the Pinnacle 2000 and 3000 series Video WorkStations. It incorporates sophisticated three-dimensional image manipulation features and connects to the 2000/3000 Series WorkStations through cables. Installation instructions and packaging information for PRIZM are described in the PRIZM Installation Manual. PRIZM provides a range of effects to augment the standard two-dimensional effects of the 2000/3000 Series WorkStations, and includes rotations, and true perspectives. Additionally, curved effects are also available with the Curved Effects Option.

PRIZM features true three-dimensional perspective, rotation about the X, Y, and Z axes, and object placement in three-dimensional space. PRIZM can also manipulate live or frozen video images in three-dimensional space and create sophisticated still images in conjunction with the 2000/3000 Series Montage Buffer. Using the FreezeFile™ option, a still created through a combination of two- and three-dimensional effects can be stored and later retrieved for further manipulation. PRIZM also features a sophisticated three level image hierarchy for image manipulations.

After PRIZM is installed, the features of the 2000/3000 Series WorkStations are still available. A user can perform pushes, wipes, and other transitions, as well as other two-dimensional 2000/3000 Series effects, within an image positioned and rotated in three-dimensional perspective (or warped with the Curved Effects Option).

The sequencing features of the 2000 and 3000 Series digital effects package are extended to the three-dimensional space with the PRIZM option. This allows all three-dimensional placements, rotations, and perspectives to be preprogrammed in a sequence for playback. Additionally, four smooth path parameters have been added to allow users to create sophisticated sequences. These parameters are tension, continuity, weight, and bias. The Z-axis manipulations provided by the PRIZM allows for complex motion paths using the three level image manipulation hierarchy.

Sequences that have been created with 2000/3000 Series WorkStations will run with the PRIZM option. When they are loaded, they will run exactly as before. When these sequences are edited, PRIZM will update and correct a copy of the original sequence in memory. The user is given the opportunity to save a PRIZM version of the changed file at the end of the editing session. However, the original sequence created with the 2000/3000 Series WorkStations will not be altered. Because the algorithms used to produce sequences for the PRIZM option are superior to the 2000/3000 Series WorkStations, sequences created with previous systems will look better when they are run with the PRIZM option.

SECTION 3
CONCEPTS OF THREE-DIMENSIONAL IMAGE MANIPULATION

This section describes the basic concepts used in the Pinnacle PRIZM Three-Dimensional Image Manipulator. The image that the user sees on the video monitor screen depends on manipulations of a source image and an "eye point" in an imaginary three-dimensional space. The "eye point" (perspective point) maps the manipulated source image onto the two-dimensional screen of the video monitor. Figure 1 shows the mapping of a three dimensional image onto a two-dimensional screen.

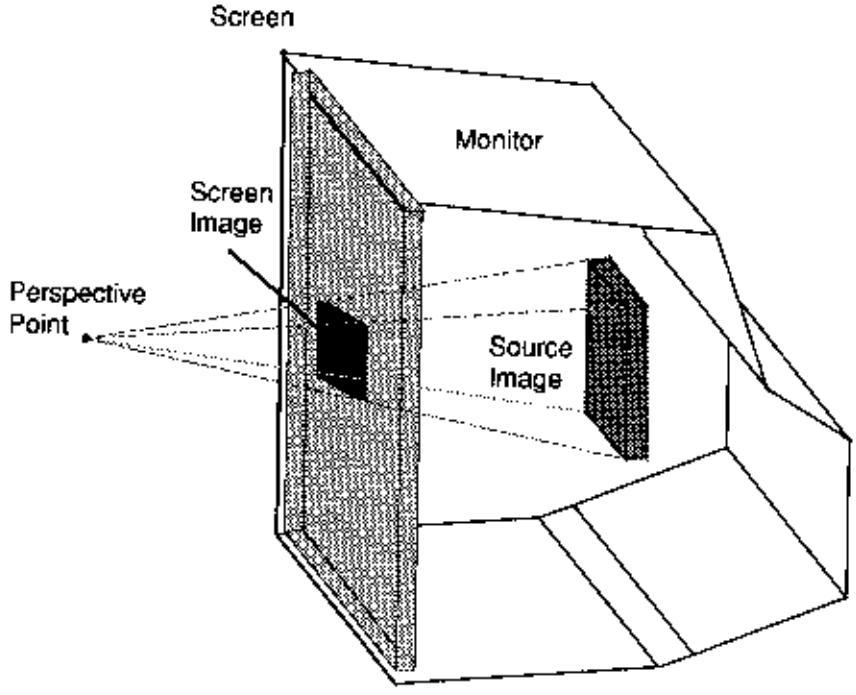


Figure 1. Mapping of a 3-D Image on a 2-D Screen

The labels used in Figure 1 are described below:

Perspective Point. An imaginary point in three-dimensional space from which the source image is viewed. The Perspective Point is typically referred to as the "Eye Point".

Screen. A flat planar surface that records an image or an object. The screen corresponds to the physical screen of the video monitor.

Source Image. A flat video image manipulated in a three-dimensional space. It is projected onto a two-dimensional screen.

Screen Image. A two-dimensional mapping of the source image onto the screen. This final image depends on the position of the perspective point and the position and orientation of the source image. The locations of the perspective point and the source image are always relative to the center of the video screen.

When operating the PRIZM, all image manipulation is done in a three-dimensional space which is defined by "X", "Y" and "Z" coordinates. The user alters the rotation, placement, and size of the image, and the placement of the perspective point. The image on the video screen depends on the placement of the perspective point and on the final position, rotation, and shape of the original video image.

Concepts which are central to an understanding of PRIZM three-dimensional manipulation are coordinates, rotation, placement, rotational axes, axis-relative placement, image hierarchy, and the perspective point. The paragraphs that follow describe each of these concepts.

Coordinates

The coordinate system used in the three-dimension environment is "X,Y,Z" where: X refers to the left-right, Y refers to up-down, and Z refers to the forwards-backwards direction. Figure 2 shows the coordinate system.

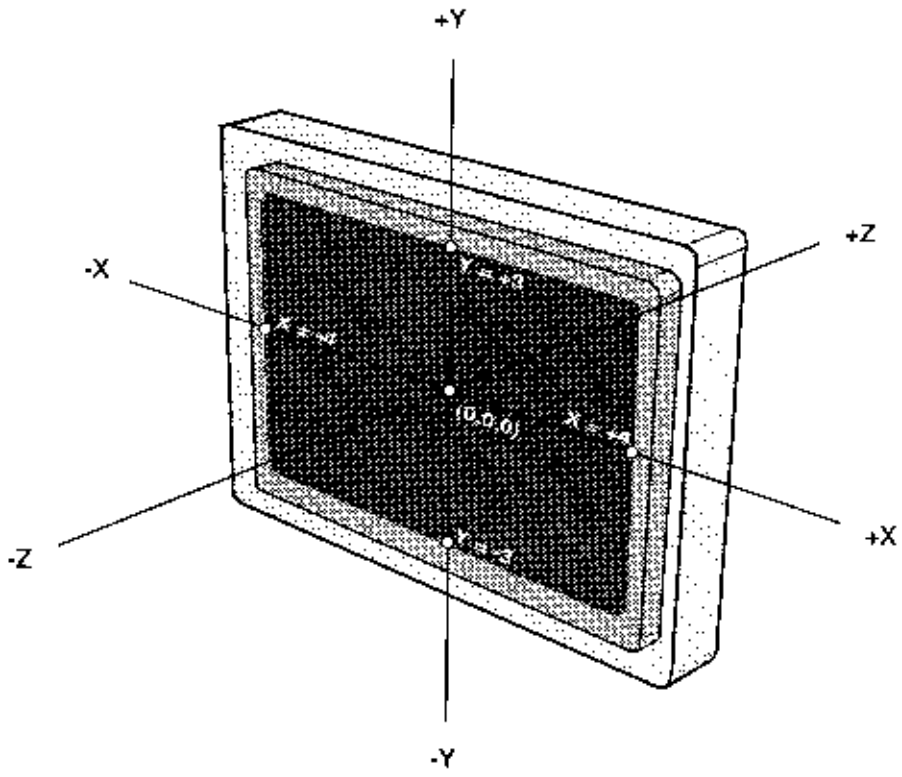


Figure 2. Coordinate System

An object can move closer to the viewer or farther away along the Z axis, up or down along the Y axis, and to the left or right along the X axis. The object can be rotated, and placed relative to any or all three rotational axes. Placements are named for the axis the image is moving *along*. Thus, an "X" placement moves the image right or left. Rotations are named for the axis the image is rotated *around*. Consequently, a "Y" rotation causes one side of the image to move "forward" and the other side to move "backward".

Rotation

Figure 3 shows the Joystick assignments to rotation. The controls are somewhat like those of an airplane with up-down (X-axis), turn (Y-axis), and bank (Z-axis) describing movement *around* the three axis. The point where the three axes intersect is called the point of rotation. By default, the axes meet at the center of the source image. The point of rotation is therefore at the center of the image. The Joystick is allocated to rotation when the LED on the ROTATE key is lit and the LED on the PLACE key is out.

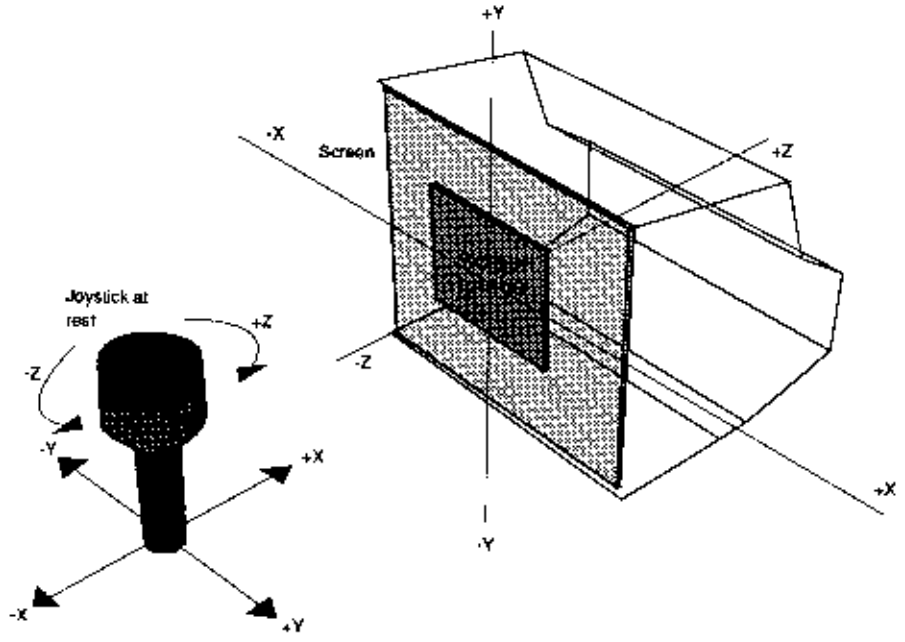


Figure 3. Joystick Assignments to Rotation

The top knob of the Joystick controls rotation around the Z rotational axis, as illustrated in Figure 4. When the top knob is rotated to the right, the image is rotated to the right and when it is rotated to the left, the image rotates to the left about the Z axis. Press the CENTER key while ROTATE is selected to center the rotation.

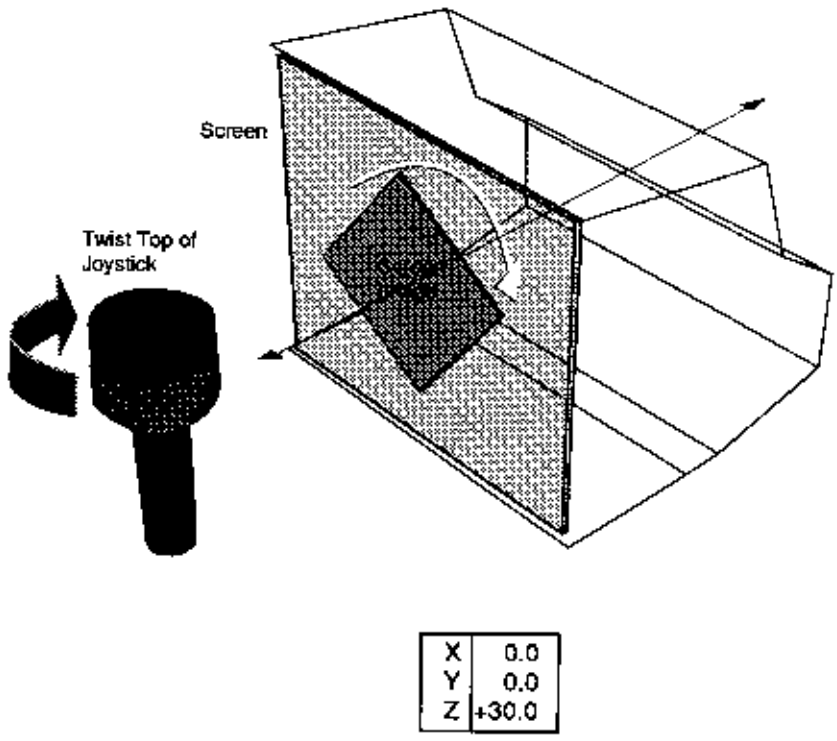


Figure 4. Rotation About The Z-Axis

Moving the Joystick forwards and backwards controls rotation around the X axis, as illustrated in Figure 5. When the Joystick is moved towards the user, the top of the image comes forward, and when it is moved away, the top of the image moves back, as the image rotates about the X axis. Image rotation about the X axis puts the image in perspective.

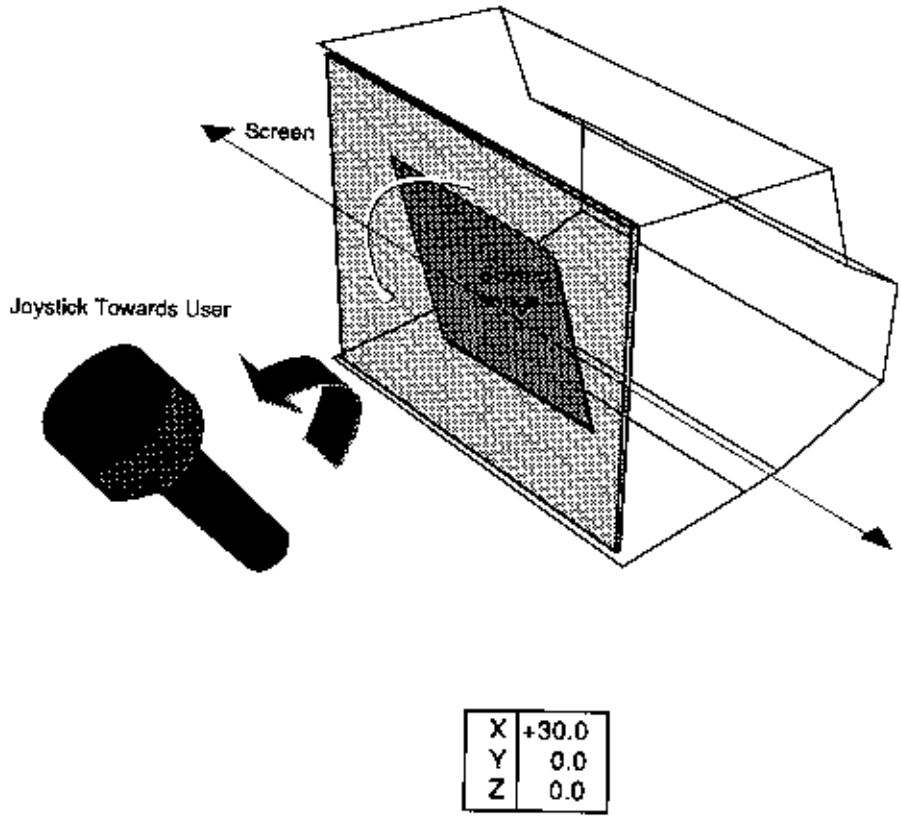
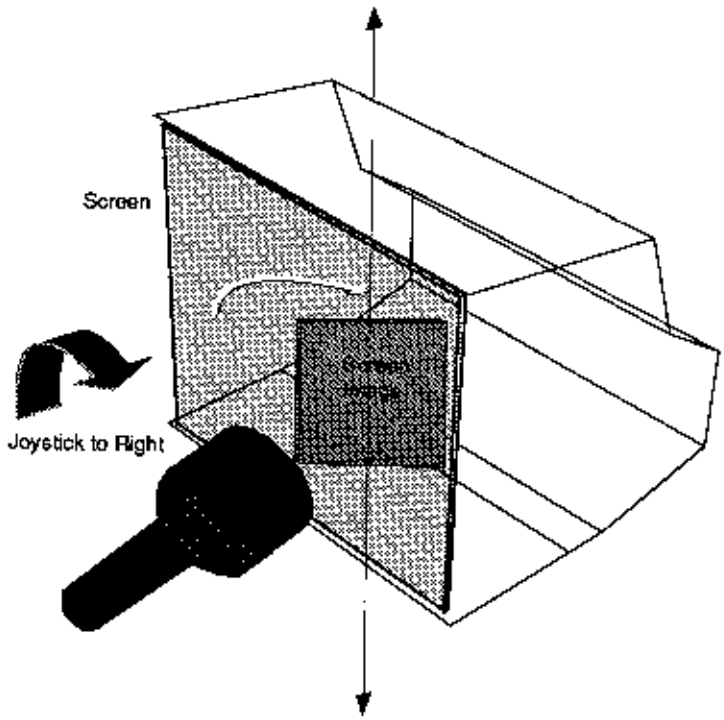


Figure 5. Rotation About The X-Axis

Figure 6 shows the Y-axis control of the Joystick. Moving the Joystick left and right controls movement around the Y axis, as illustrated. When the Joystick is moved to the left, the left edge of the image moves away, and when it is moved to the right, the right edge of the image moves away, as the image rotates about the Y axis. Image rotation about the Y axis puts the image in perspective.



X	0.0
Y	+30.0
Z	0.0

Figure 6. Rotation About The Y-Axis

Placement

Placement of the source image occurs when it is moved from one place to another in the three-dimensional space. By default, the point of rotation is set to the center of the source image, and moves when the source image is moved. Figure 7 shows the Joystick assignments for placement.

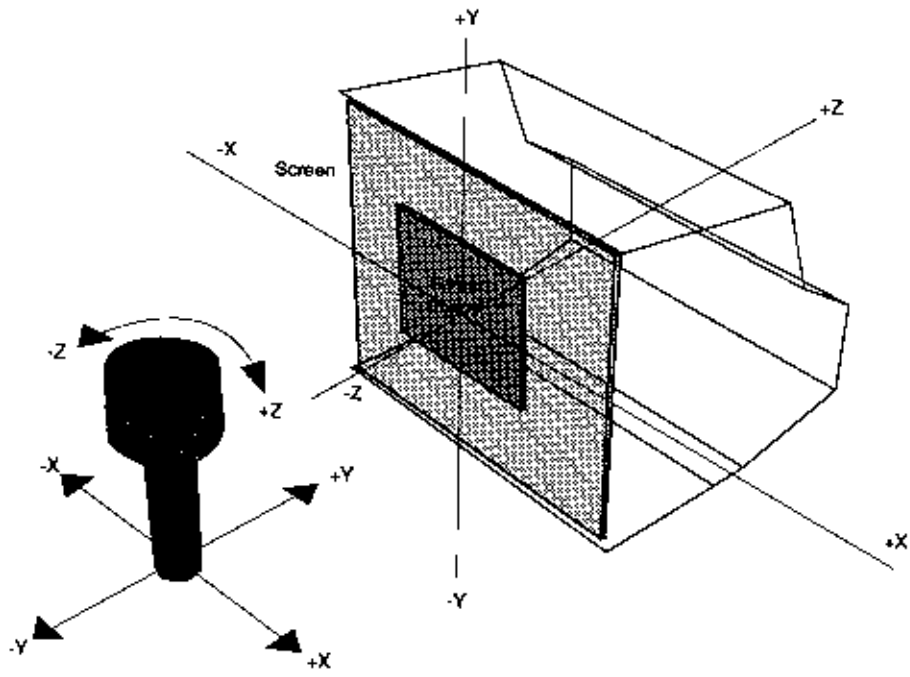


Figure 7. Joystick Assignments to Placement

Axis-Relative Placement

The source image can be moved relative to the point of rotation. The difference in position between the source image and point of rotation positions is refererred to as the axis-relative placement. This means that the point of rotation can be placed independently of the image, including outside of the image. This allows for the rotation of an image around any point - not only its own center. For example, an image can be moved to the right until the point of rotation lies on its left edge.

The joystick assignments for axis-relative placement are the same as for placement, as shown in Figure 7. To reiterate: "Placement" moves the image *and* the point of rotation, and "Axis-relative Placement" moves the image while the point of rotation remains stationary. Axis-Placement moves the point of rotation while the image remains stationary.

Using axis-relative placement can cause interesting results, such as the image appearing to be translated in three-dimensional space. This can also result in unexpected actions, such as the image suddenly disappearing from view. Figure 8 shows both cases, where the source image at the top angle will appear to be translated and the bottom angle will drop from view.

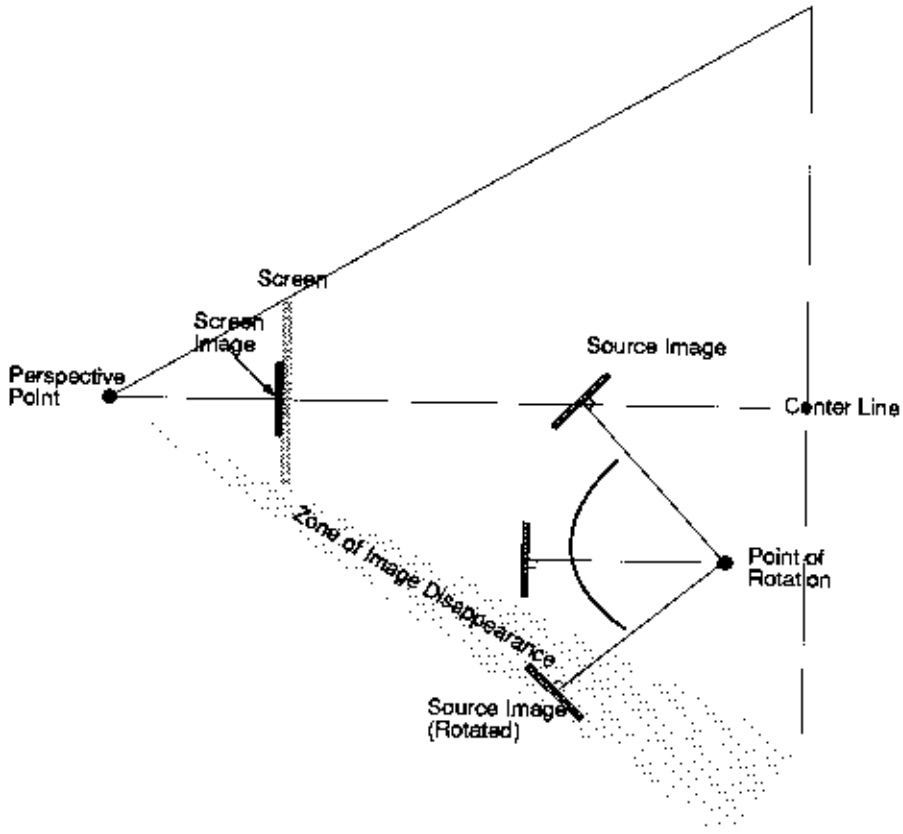


Figure 8. Results of Rotation Point Placement

Figure 9 shows the default settings for the point of perspective projection, video screen, and the source object location.

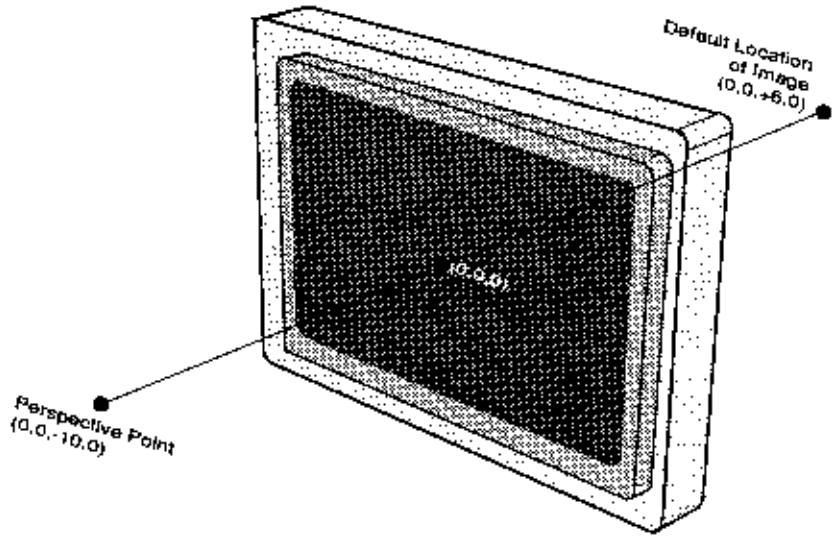


Figure 9. Default Settings for Display

Image Hierarchy

The discussion so far has been about rotation, two types of placement, and scaling. The combination of these actions can be thought of as a single "level" of image manipulations. The three-dimensional model of the PRIZM 3-D Image Manipulator employs three levels of image manipulation which are called source, object, and global. The image hierarchy will be used when creating sequences. For most manipulations, a single level will be adequate. However, when complex motions are needed, such as rotation around several different points of rotation, the three-level hierarchy is most useful. The three levels of manipulation effect the original video system in the manner shown in Figure 10.

Because the PRIZM is an option to the 2000/3000 Series, a unique feature is that three-dimensional manipulation is done "down stream" to the two-dimensional control. This means that all 2000/3000 Series two-dimensional effects are available to the user, and operate within the source image. In essence, the levels of source, object, and global occur after another "level" which allows for control of the source image size, cropping, and placement in two-dimensional space.

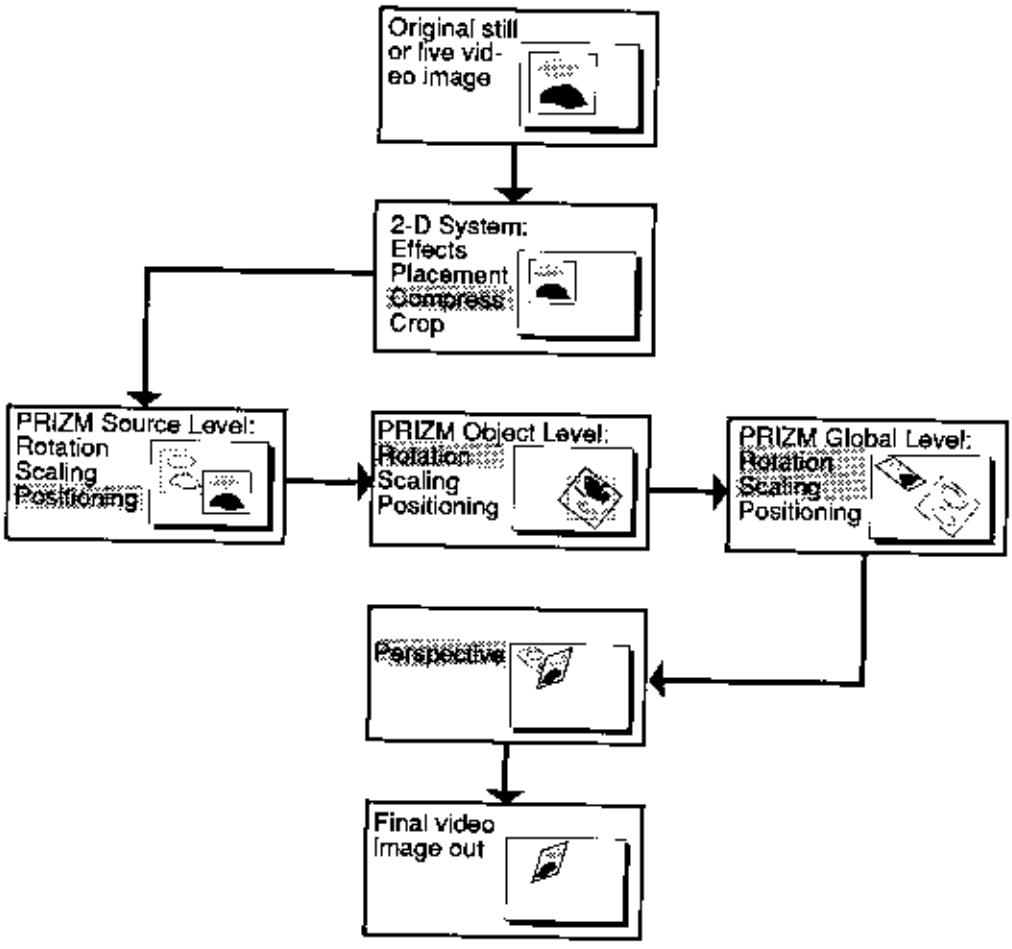


Figure 10. Image Manipulation Levels

As can be seen in Figure 10, the output of each level is the input to the next level down stream. The solid arrow lines show the direction of level interaction: the original source image goes first to the two-dimensional manipulations (and effects), second to the 3-D manipulations, third to perspective, which maps it onto the screen. As indicated in Figure 10, the direction of image manipulation for the three-dimensional manipulations is from source, to object, then to global levels.

The direction arrows in Figure 10 show the level manipulations for a representative source image. The source image enters the two-dimensional system to be compressed. It then is positioned in the PRIZM source level, rotated in the object level, and rotated and scaled in the global level. Then the image is projected onto the video screen.

Extremely complex sequences can be produced because the motions can be defined at the source image level, and object level and the global level. Imagine, for example, that an image should start out positioned on the left side of the screen, rotating around it's own center. This manipulation can be performed at the source level. Then, while the picture continues to rotate around it's center, it then begins to rotate about the center of the screen. This manipulation could be performed at the object level.

The Perspective Point (Eye Point)

The three levels of PRIZM image manipulation place and orient an image in an imaginary three-dimensional space. The perspective point then maps the image into the real world of the flat video screen. By default, the perspective point is positioned on the user's side of the video screen, at the center of the screen. The perspective point is a little farther away than the width of the video screen. (The screen width = "8.0" and the perspective point = "10.0").

The mapping of the imaginary image onto the video screen is changed by manipulating the position of the perspective point in the X, Y, and Z axes. Figure 11A shows an example of an extreme case, where an image is rotated 45 degrees about the X axis. It will map onto the video screen so that it appears to be turning away from the user. If the perspective point is moved down along the Y axis, the screen image will become shorter. It will eventually appear as a single line, as shown in Figure 11B. Moving the perspective point in Figure 11B causes changes in the size of the screen image.

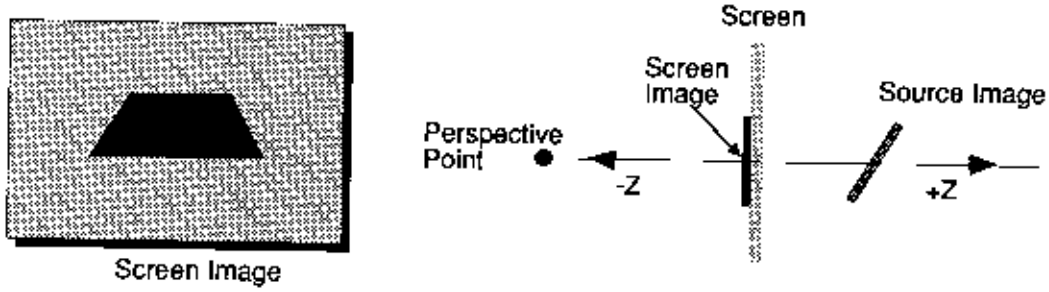


Figure 11A. Rotation of Image About the X Axis

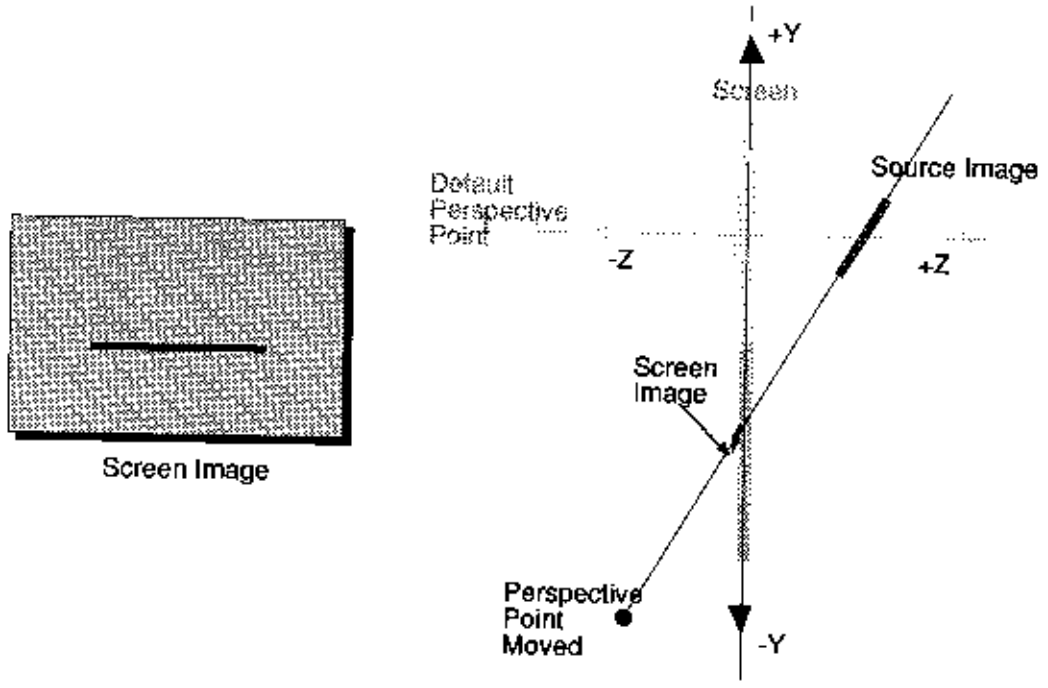


Figure 11B. Changing Perspective of a Rotated Image

Starting from the default position, as the perspective point is moved, along the z axis further from the screen, the "amount" of perspective is reduced. Another way to think of it is that the apparent change in size from the "front" of a rotated image to the "back" of it will be less, as shown in Figure 12. The source image must be moved away from the screen at the same rate the point of perspective moves. Otherwise, moving the point of perspective will result in both reduced perspective and an increase in size.

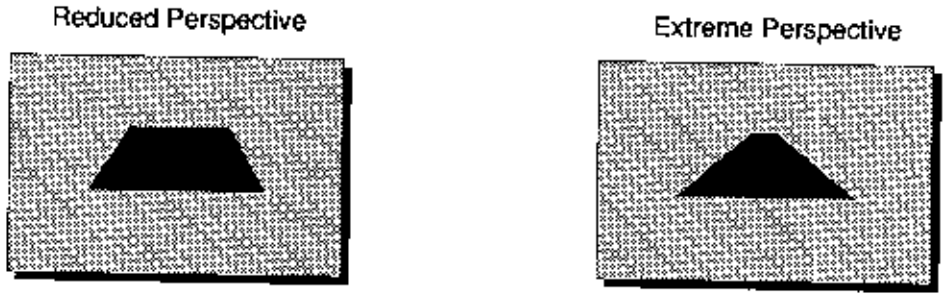


Figure 12. Change In Amount Of Perspective

As the perspective point approaches infinity along the Z axis, a "parallel projection" effect is achieved. In this case the "amount" of perspective is reduced to nothing, and the size of the screen image approaches that of the source image. The PRIZM system allows the user to toggle back and forth between parallel and perspective projection.

The following paragraphs describe other effects that occur when the relationships between the image source and the point of perspective are manipulated. The figures accompanying the paragraphs below illustrate how the final image will appear on the video screen.

As shown in Figure 13, when the screen is between a source image and the perspective point, the screen image is always reduced in size.

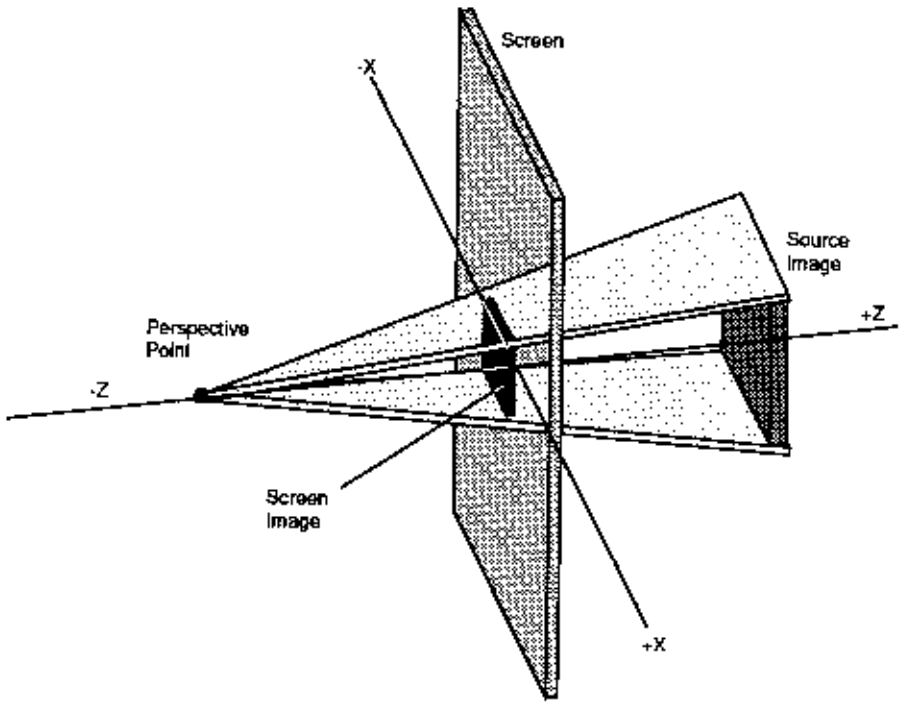


Figure 13. Perspective Point Movement-Image Reduction

Figure 14 illustrates how the screen image is increased in size when the source image lies between the screen and the perspective point.

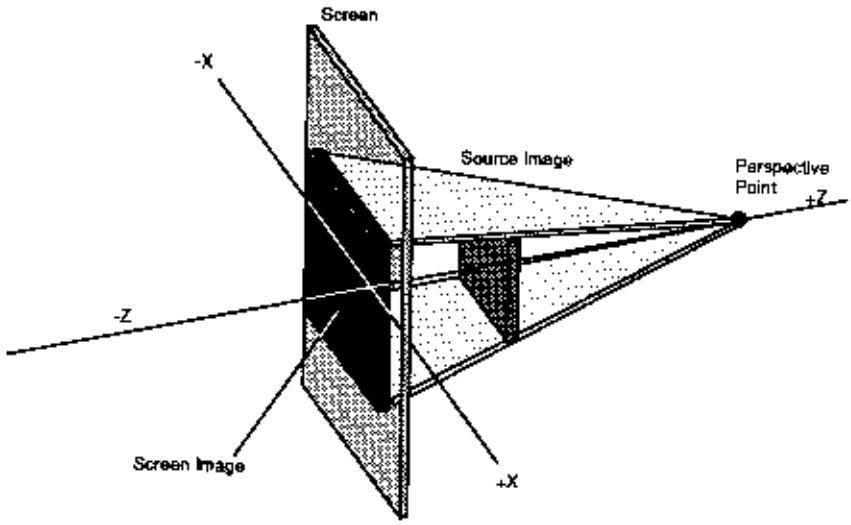


Figure 14. Perspective Point Movement-Image Enlargement

Figure 15 illustrates the fact that the screen image is inverted horizontally when the perspective point is between the source image and the screen.

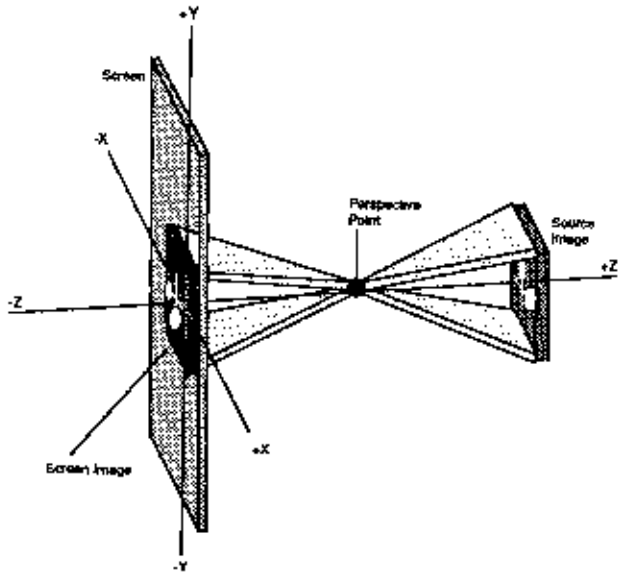


Figure 15. Perspective Point Movement-Image Inversion

Figure 16 illustrates how moving the perspective point closer to the screen causes the reduction or expansion of the screen image to be more extreme.

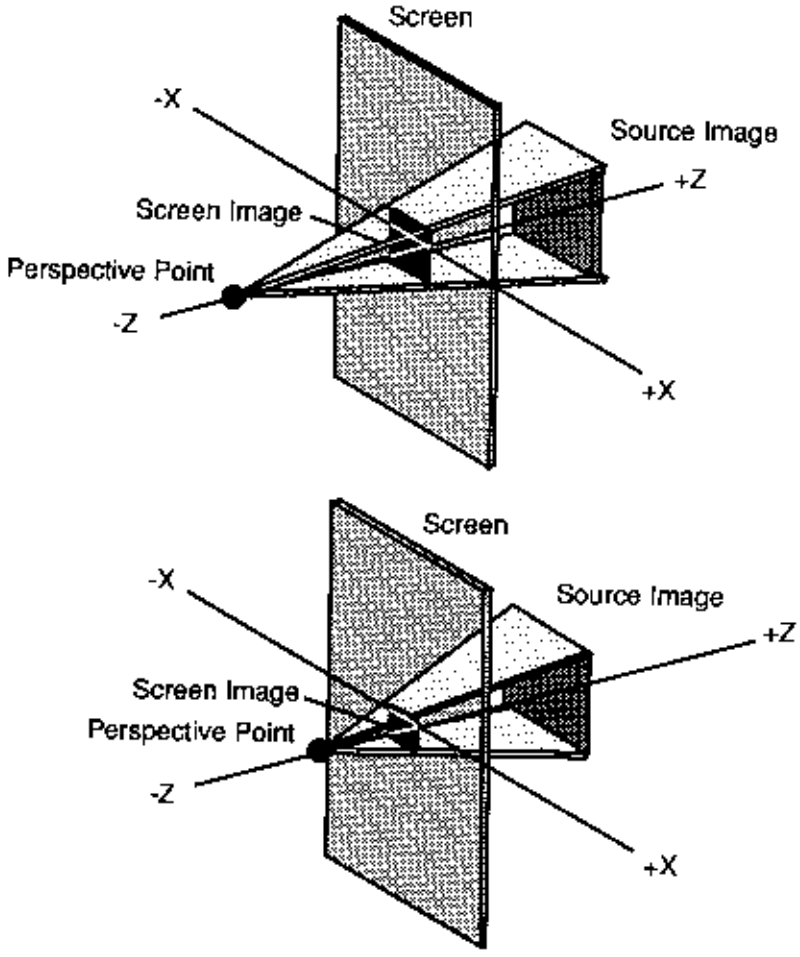


Figure 16. Perspective Point Movement-Reduction/Expansion Levels

SECTION 4
DESCRIPTION OF MENUS

The PRIZM option presents an operating environment that is consistent with the 2000/3000 Series operations. Menus are accessed from the Control Panel by pressing the key that corresponds to the menu. Figure 17 shows the arrangement of the keyboard and keys that access all menus in the PRIZM option. Figure 17 also shows which keys have been added or changed to the 2000/3000 Video WorkStations, and which ones have been moved.

The DUR (Duration) and LIMIT keys have been removed from the Control Panel for the PRIZM option. The Duration and Path menus have been combined into a single Path Menu. The Limit function is not needed in the PRIZM option.

When the PRIZM option is installed, all 2000/3000 menus operate in the same way as they do without the PRIZM option, with the exception of the following menus:

- Setup
- Information
- Status
- Sequence
- Duration/Path Menu
- PRIZM Effects

These menus are changed to accommodate the PRIZM three-dimensional features. Note that a "PRIZM Effects" menu has been added. Please refer to the 2000/3000 Series Operator's Manuals for more details concerning other menus. For information on the Setup menu refer to the PRIZM Installation Manual.

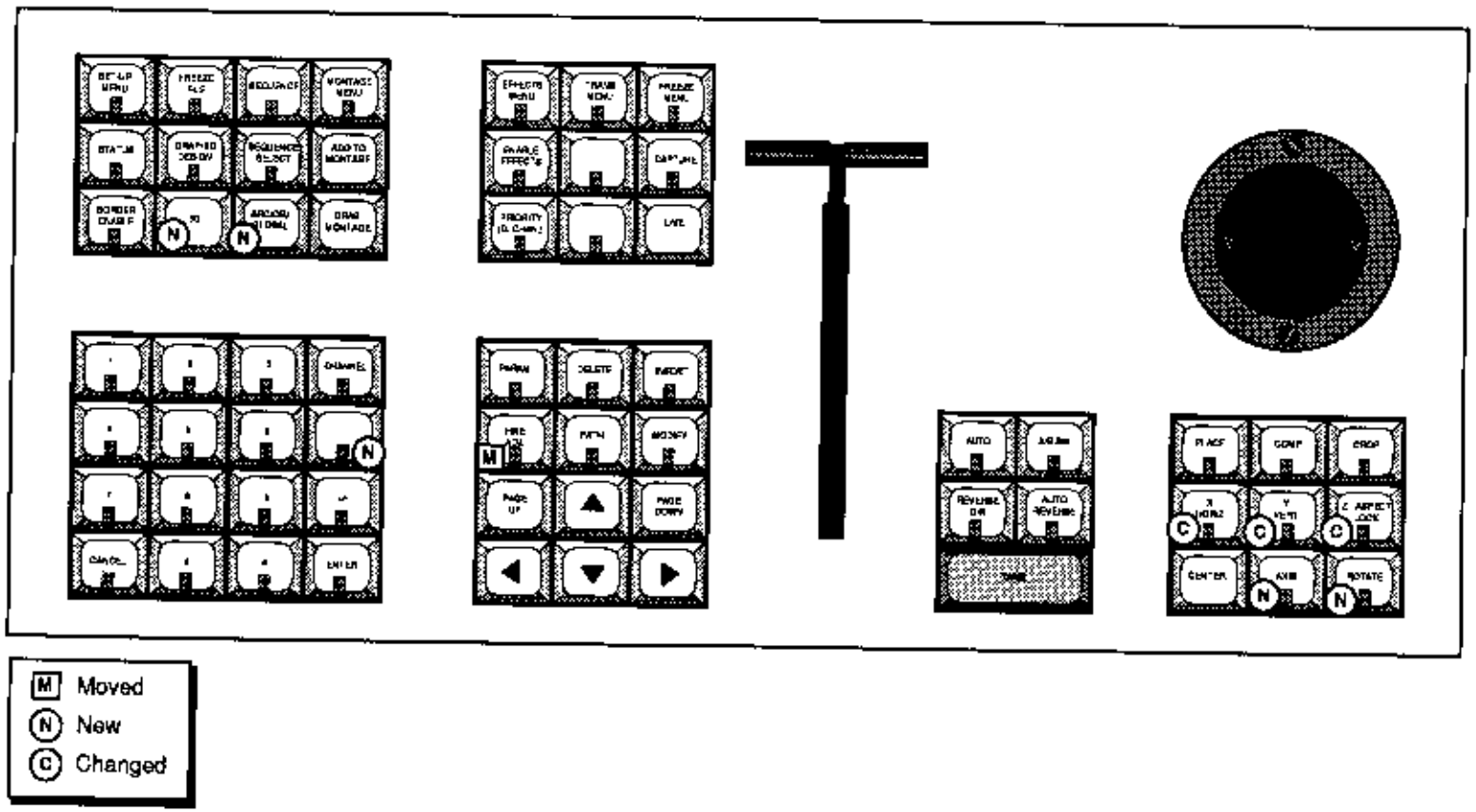


Figure 17. PRIZM Control Panel

Information Menu

The Information Menu is automatically shown when the system is first turned on, and is displayed at the bottom of the screen. It shows the current allocation of the Joystick and the TAKE key, as well as some information on the position of the video image. Figure 18 is an illustration of the Information Menu. Table 1 describes items in the Information Menu.

Figure 18. Information Menu

Label	Description
Panel	Shows the panel allocation to normal, sequence-edit, or sequence-run.
Joystick	Indicates the allocation of the Joystick. The top line indicates whether 2-D mode or one of the following 3-D hierarchy levels is active: • Source • Object • Global

Table 1. Information Menu

Label	Description
Joystick	The second line shows parameters controlled by the Joystick. For 2-D manipulations these are: • Place • Compress • Crop • Place-Compress • Place-Crop For 3-D manipulations these are: • Place • Compress • Crop • Axis Rel • Rotate • Place-Compress • Place-Rotate • Place-Crop • Place-Axis The third line indicates whether the FINE-ADJUST function is on.
Take Key	Toggles between TAKE and Fader Bar with the AUTO MODE key. Indicates the functions activated by the TAKE key: a standard transition, or the name of a sequence. The percent sign indicates how far the transition/sequence has progressed. When allocated to the Fader Bar, this menu field shows the transition name and the percent sign indicates the Fader Bar position.

Table 1. Information Menu (Continued)

Label	Description
Axis	Indicates the offset of the center of the image from the rotational axis.
Rotate	Indicates the rotation of an image around the X,Y, and Z axes.
Placement	Indicates the placement of the rotational axis, relative to the center of the screen.
Size	Indicates the size of the screen image.

Table 1. Information Menu

Status Menu

The Status Menu shows the state of the entire PRIZM system on two sheets, and is nearly identical to sheets 1 and 5 of the Sequence Menu. Pressing the STATUS key once displays the first sheet of the Status Menu, and pressing it twice displays the second sheet of the Status Menu. The information displayed on the first Status Menu sheet includes: the orientation and size of an image in three-dimensional space, which effects are active, and the two-dimensional image position, size, and cropping. The second Status Menu sheet displays all levels - source, object, and global of the current keyframe.

Several ways of controlling Status Menu field items provide the user with an intuitive means of accessing and controlling the various functions and the effects it shows. Although specific exceptions apply, the general methods for controlling the Status Menu functions are described below:

- The user can position the cursor in the Status Menu, and change any values by using the Numeric Keypad.

- Non-numeric menu fields can be enabled and disabled by pressing the ENTER key. The ENTER key is used on most fields to increment through choices or numbers.

- When the NEGATIVE (-) key is lit, the ENTER key decrements through choices or numbers.

- The FINE ADJUST key affects the scale of the increment/decrement function of the ENTER key.

- Moving the Joystick will change the values in the fields to which the Joystick is assigned.

- Pressing the STATUS key when the Status Menu is displayed will show Sheet 2 of the Status Menu. Press the STATUS key again to display the first sheet of the Status Menu.

Figure 19 illustrates Sheet 1 of the Status Menu. Press the STATUS key to access the Status Menu.

Sheet 1 of the Status Menu is divided into four sections, as described in the paragraphs below:

Section 1 Provides 3D Axis and image placement information about an image for all three hierarchy levels - source, object, and global. The position relative to the rotational axis is given. This section also provides image size information for all three levels. To manipulate sizing in the different hierarchy levels, press the SOURCE/OBJECT/GLOBAL key to access the desired level.

Section 2 Provides image cropping information on the source level. This section also provides information on the type of PRIZM transition being used, PRIZM effects (such as Perspective), and

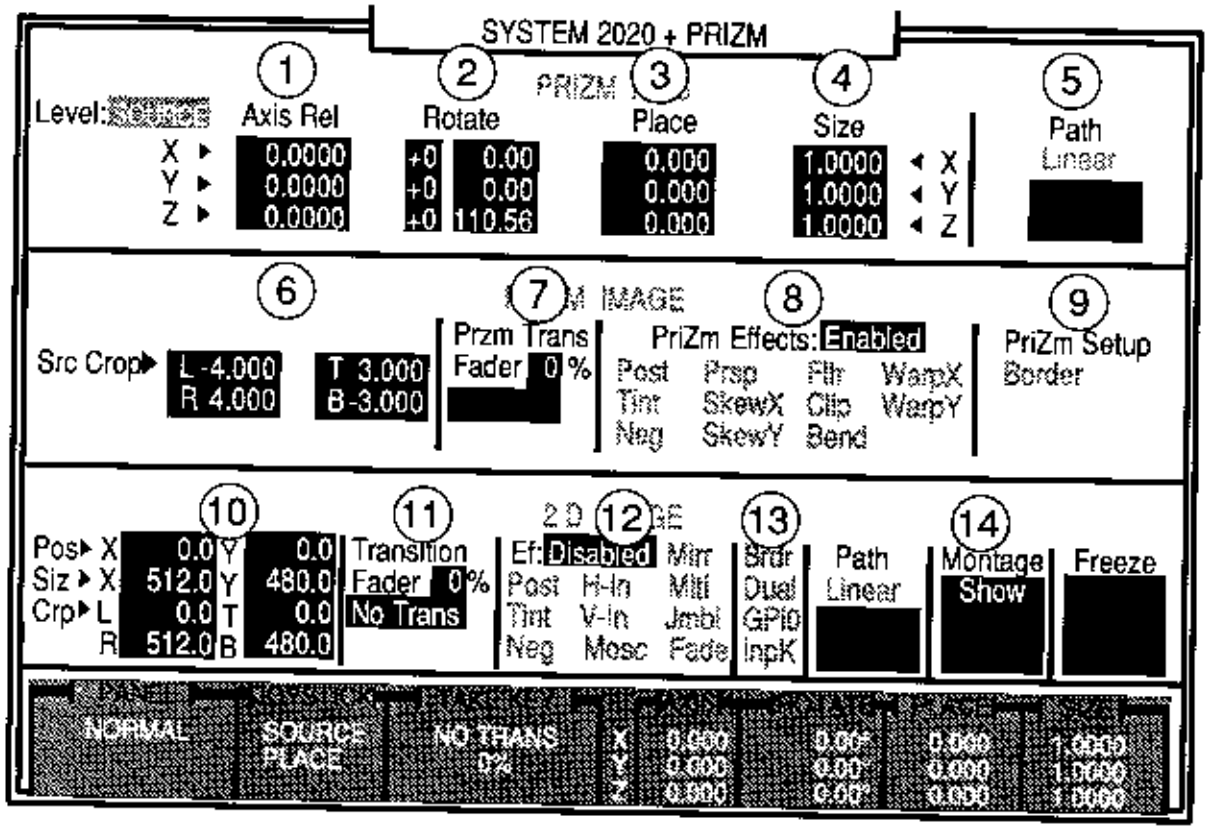


Figure 19. Status Menu

	3D system information (such as Border). Section 2 provides several pop-up menus that are associated with the Border, Skew, and Perspective functions.
Section 3	Provides 2D image position, size, and crop information about the image. Also provided are 2D image attributes, 2D transition type, effects, and 2D system information. Section 3 provides several pop-up menus that are associated with the various effects, transition types, and 2D system information.
Section 4	Displays the Information Menu. See the description on the Information Menu in Table 1 above for details.

Table 2 describes items of each section in the Status Menu.

Location	Label	Description
1	Axis Rel	Indicates the Axis-Relative placement of an image for all three hierarchy levels - source, object, and global. All axes are indicated: the range is from -30.000 to +30.000 in Y and -40.000 to +40.000 in X and Z.
2	Rotate	Indicates the three-dimensional rotation status for all three hierarchy levels. The angles vary from 0 to 359.00 degrees.

Table 2. Status Menu