

PanoMaker® V User Manual

Version 1.0



PREFACE

Thank you for purchasing a PanoMaker. We appreciate your patronage and are committed to providing you with the best technology and best support possible.

The PanoMaker® V is the latest generation of image integration processors from Panoram and follows a decades long tradition of providing the finest electronics in the world for integrating the images from multiple video and data projectors into a single seamless display.

The first PanoMaker was born in 1988 and was used by the National Geographic Society to blend three projectors together for a special show, which celebrated their 100th anniversary. That same hand made device is still in service today at their headquarters in Washington D.C.

The 5th generation PanoMaker® V has come a long way from that first experimental unit. The PanoMaker® V is a computer controlled pure digital image processor, which is capable of handling frame rates and resolutions that meet or exceed the most demanding and leading edge visualization applications.

The PanoMaker® V incorporates three image processing functions for image integration:

Image distortion or warping.

Black Level Management

Soft Edge Blending

Each of these three functions is required to make seamless image arrays using today's projector technology.

CRT PROJECTORS – THE GOOD, THE BAD AND THE UGLY!

The CRT data projectors of the past certainly had limitations. They were not very bright with practical limits in the 250-300 ANSI lumen range. They were tremendously complex in that each projector was really three projectors in a single housing – a red one, a blue one and a green one. This meant constant alignment and maintenance. This was exacerbated by projector arrays. In a standard three-projector array, one needed to essentially maintain 9 projectors in alignment and brightness

For all their disadvantages, CRT projectors also had some capabilities that were lost when projectors became digital. With CRTs, the image was created by scanning an electron beam onto phosphor thereby making the phosphor glow. Because of this, CRT projectors were able to distort the raster (the picture) inside the projector. This was done by warping the electron beam scan. This was tremendously valuable in placing the projector. You could be off axis and still make a square picture. You could also wrap the image onto a cylinder or a compound curve to create highly immersive wrap around displays.

The CRT projectors could also be tuned so that the electron beam was totally extinguished in black areas. A black image was truly black with no phosphor glow whatsoever. Modern projectors use a steady state lamp and some method of turning pixels on and off. In practice, they all leak some light even when the image is supposed to be black.

Because CRT projectors displayed scanned images, they had no native resolution. They could thus flexibly display images of many resolutions and types. This was known as multisync capability. Modern projectors can accept many types of inputs, but must compromise image quality by either scaling the signal up or down to the projector's native resolution before displaying.

These advantages of CRT projectors are far out-shadowed by the tremendous capabilities of contemporary projectors. Take the DLP format. These projectors make images by bouncing light onto a chip filled with millions of microscopic little mirrors on stalks that bend with electronic stimulus. The images are bright, crisp, sharp, pure and stable. These

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types of projectors are available at up to 10,000 ANSI lumens or more. They require very little internal alignment – and once set up will perform consistently for many hundreds of hours without further adjustment.

LCD, LCos and other digital formats are also available. The cost/performance, options on brightness, various resolutions, simplicity and reliability of many of these projectors have completely changes the world of projected imagery.

MADE FOR THE NOW!

The PanoMaker® V and the entire line of Panoram Pure Digital I/O series of processors has been designed to address the special needs of these contemporary projection technologies.

The PanoMaker® V provides the image warping that was previously done by the projector. It also incorporates a special technology that addresses the black part of the image to provide seamless arrays that work with all types of images. Finally it provides the world renown soft edge blending processing that has been the hallmark of the PanoMakers since their inception.

Most importantly, the PanoMaker® V was designed to work at the extreme bandwidths required by today's powerful graphics systems to process SXGA images at stereoscopic frequencies – up to 1280 X 1024 @ 120Hz. If the application does not require the full 120Hz processing capability of the PanoMaker® V, we included the extra inputs and outputs on the unit so that the processing can be split between two projectors allowing a single rack unit to process two channels. This can result in substantial cost savings on a multi-projector array that does not require stereoscopic display.

Other Panoram Pure Digital I/O series processors available or in development address other specialty issues at the extreme edge of display technology including Extreme Bandwidth Scaling, Active to Passive Stereo transforms, Extreme Bandwidth Video Encryption and more.

IMAGE WARPING

The image warping section of the PanoMaker® V uses a silicon processor with the equivalent of 3 gigaflops of processing to smoothly affect the distortion of the image at up to 120 frames per second.

The warping can be dramatic – such as wrapping the image onto a compound curve – as well as subtle – such as lining up high resolution text in the overlap region of blended images. Warping is also essential for edge match displays to compensate for lens barrel distortion, as well as for stacking projectors as neither projector is then perfectly on axis.

The Control Software (GUI) has been designed to parallel the controls on a CRT projector making it familiar and instinctive for the many technicians and users who have been addressing image warping on CRT projectors for years.

There are some controls that you would not find on a standard system including image rotation and complex warp maps for special effects.

BLACK LEVEL MANAGEMENT

Since the projectors will invariably emit some residual photons even when the video signal is at full black, a bright band can be seen in overlap region during dark images where the residual from both projectors doubles up. One solution is to increase the ambient light level in the display theater so that it is higher than the bright band. This is not always realistic, practical or desirable.

The PanoMaker® V has special capabilities to handle this. Essentially, the BLM circuitry raises the black level of the non-overlap region to match that of the overlap. This results in a uniform black area. With the extreme brightness of many of the projectors, a neutral density filter can be placed in front of the lens to once again provide deeper black.

This will reduce the overall brightness but with the powerful top end of the projectors this may not be an issue and can result in a perfectly smooth and rich image in both low and highlight areas.

IMAGE BLENDING

This is the leading realm of PanoMakers since their inception. The PanoMaker® V first allows the user to define the edges of the raster. Then it helps the user to define the center of the overlap. This allows systems to be set up for overlaps of any size from 0% (for edge match) to 100% (stacked projectors). Practically speaking, most seamless array overlaps will range from 12.5% to 25%.

The user can then implement a general blend as well as access the ability to tweak the details of the blend unlike any other seamless edge blender anywhere. This allows the user to perfect their results for a perfectly integrated image.

Previous generations of PanoMakers allowed the user to create a separate curve for each red, blue and green channel to compensate for the different input to output characteristic of each color (known as Gamma). The PanoMaker® V takes a slightly different approach. It allows the user to create a gamma behavior compensation lookup table at the input end of the PanoMaker® V. This means that internally, the behavior of the system is linear. A single blend curve is all it takes to make a blended image. This means a projector array is simpler to set up and to maintain.

The PanoMaker® V software running on an external control computer provides the user access to four separate blend files allowing four different sources to be blended and recalled as needed.

Additionally, the user can use an external control device such as an AMX to send recall requests to the PanoMaker software running on a control computer.

TOTAL SYSTEM

Although you will find that the PanoMaker® V is a highly capable, flexible and reliable device – it is only one component in a total system that must work together as a single integrated imaging system. These components include the sources and their configuration, switching systems, projectors, screens, mechanical design issues, optical design issues and more.

Think of it this way: The PanoMaker is like a carburetor. With it, you can build a powerful engine, but simply plopping a carburetor onto a block of aluminum does not make an engine that works well, or works at all. The PanoMaker® V is a critical component in a total engineered solution. Panoram has support, engineering and consulting services, which you can access to help you succeed with your project. If you need help, be sure to get it early before you commit to other components that may or may not support your desired solution.

SUMMARY

Again we thank you for choosing the PanoMaker® V. We hope your experience with the PanoMaker® V will be a happy, positive and rewarding one. We have always believed that the boundless creativity and imagination of our customers far exceeds our own. Please be sure to stay in touch with us and let us know how our technology is working for you.

User feedback has been instrumental in shaping our products and their capabilities. We'd like to hear from you about your successes and your suggestions for improvements. You can be sure that we will continue to strive to improve and upgrade our product to serve your needs.

TECHNICAL SPECIFICATIONS

OVERVIEW

The PanoMaker V hardware is configured in a 2 RU (3.5" high) standard 19" rack sized case with an internal auto switching power supply and integral cooling fans. This is called the Rack Unit.

The front of the unit has no active controls with all system adjustment being made via a user supplied external control computer running Panoram supplied Control Software and hooked up to the Rack Unit via RS232, USB or Ethernet connection.

Multiple Rack Units can be hooked up to the same external control computer. The typical recommended configuration uses a Network switch/hub to address the multiple units. There is no technical limit to how many PanoMaker V rack units can be hooked up together but practically speaking dozens can be used.

Each PanoMaker V Rack Unit is used to address 1 or 2 projectors.

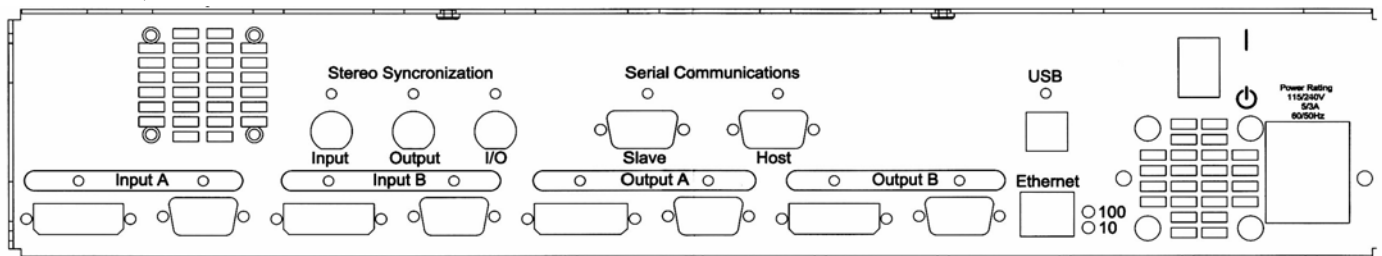
If the high resolution, high frame rate stereoscopic imaging is desired utilizing signals such as SXGA @ 96-120 frames per second, then each projector requires a PanoMaker V Rack Unit.

If high resolution standard frame rate imaging is desired utilizing signals such as SXGA @ 48-72 frames per second, then two projectors can be driven by a single PanoMaker V Rack Unit.

Using two projectors with one Rack Unit, Input and Output A would be for Projector 1. Input and Output B would be for Projector 2.

Each Input and Output features both DVI-I as well as HD-15 connectors. Only one connector can be active on any input or output.

REAR PANEL



INSTALLATION NOTE

The rear panel has an air system which require a space for air flow . Please keep the space open.

Note: Failure to do so can result in system damage from overheating.

Input A VIDEO IN, typically for projector 1 (DVI-I ,HD-15)

Input B VIDEO IN, typically for projector 2 (DVI-I ,HD-15)

Output A VIDEO OUT, typically for projector 1 (DVI-I ,HD-15)

Output B VIDEO OUT, typically for projector 2 (DVI-I ,HD-15)

Stereo Synchronization for Stereoscopic applications (BNC)

Serial Communication (RS232 DB-9) with daisy chain loopthrough

USB

Ethernet (RJ 45)

On/Off switch

AC input for 110 or 220 VAC
(Voltage 110/220 VAC autoswitch)

LED TALLY LIGHT INFORMATION

Input A and B DVI

Green	Plug Detect and Scan Detect
Yellow	Plug Detect
Red	No Plug Detect
LED Off	DVI inactive

Input A and B VGA

Green	VSYNC and HSYNC detected
Yellow	Hsync Freq detected only
LED off	No sync detected

Output A and B DVI

Green	The DVI output is enabled and Plug Detect is active
Yellow	The DVI output is enabled but Plug Detect is inactive.
LED Off	DVI output is disabled.

Output A and B VGA

Green	Analog output is enabled,
LED Off	Analog output not enabled

Both IN/OUT Green

Stereo Signal is present.

Both IN/OUT OFF

Stereo Signal is not present.

OUT LED Green

SYNC is enabled as an output.

OUT LED Yellow

SYNC is enabled as an input.

OUT LED RED

SYNC is enabled as both an output and input NOTE: this is a situation that should be avoided.

Environmental Ranges

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Operating temperature	0 to 35 C (32-95 F)
Storage Temperature	-10 to 65 C (-4 to 149 F)
Operating Humidity	10 to 85% (noncondensing)

Power Requirements	
AC Input Voltage	100-240V 50-60 Hz (autoranging)
Power Consumption	200 W max (depends on mode)

Physical Dimensions	
Weight	17 lb (7.7 kg)
Dimensions (H x W x D)	3.5 x 19 x 13 in. (8.89 x 48.26 x 33.02 cm)

PERFORMANCE SPECIFICATIONS

Control Interface

RS232 Serial	1 Port, chainable
Data rate	38400 bps
USB 1.1 Slave Device	1 Port
Data rate	12 Mbps Max
10/100 baseT Ethernet	1 Port, IEEE 802.3 compliant
Data rate	100 Mbps Max

Video Input

DVI-I	2 Ports
Digital TMDS	
Maximum Pixel Rate	165 Mpix/s
Analog RGB	
Maximum Pixel Rate	200 Mpix/s
Analog Bandwidth	500 Mhz Adjustable
HD15 Analog RGB	2 Ports
Maximum Pixel Rate	200 Mpix/s
Analog Bandwidth	500 Mhz Adjustable

Video Processing

Processing Bandwidth	>164 Mpix/s Average
Capabilities	Image warping Black level adjustment Blending Gamma linearization

Video Output

DVI-I	2 Ports
Digital TMDS	
Maximum Pixel Rate	165 Mpix/s
Analog RGB	
Maximum Pixel Rate	240 Mpix/s
HD15 Analog RGB	2 Ports

Control Software



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©2003 Panoram Technologies, Inc. All Rights Reserved. U.S. Patent No.'s 4974073, 5136390, 6115022 Canadian Patent No.'s 2025624, 2095634 European Patent No. 0556304 German Patent No. 69132409.3 Other Patents Pending

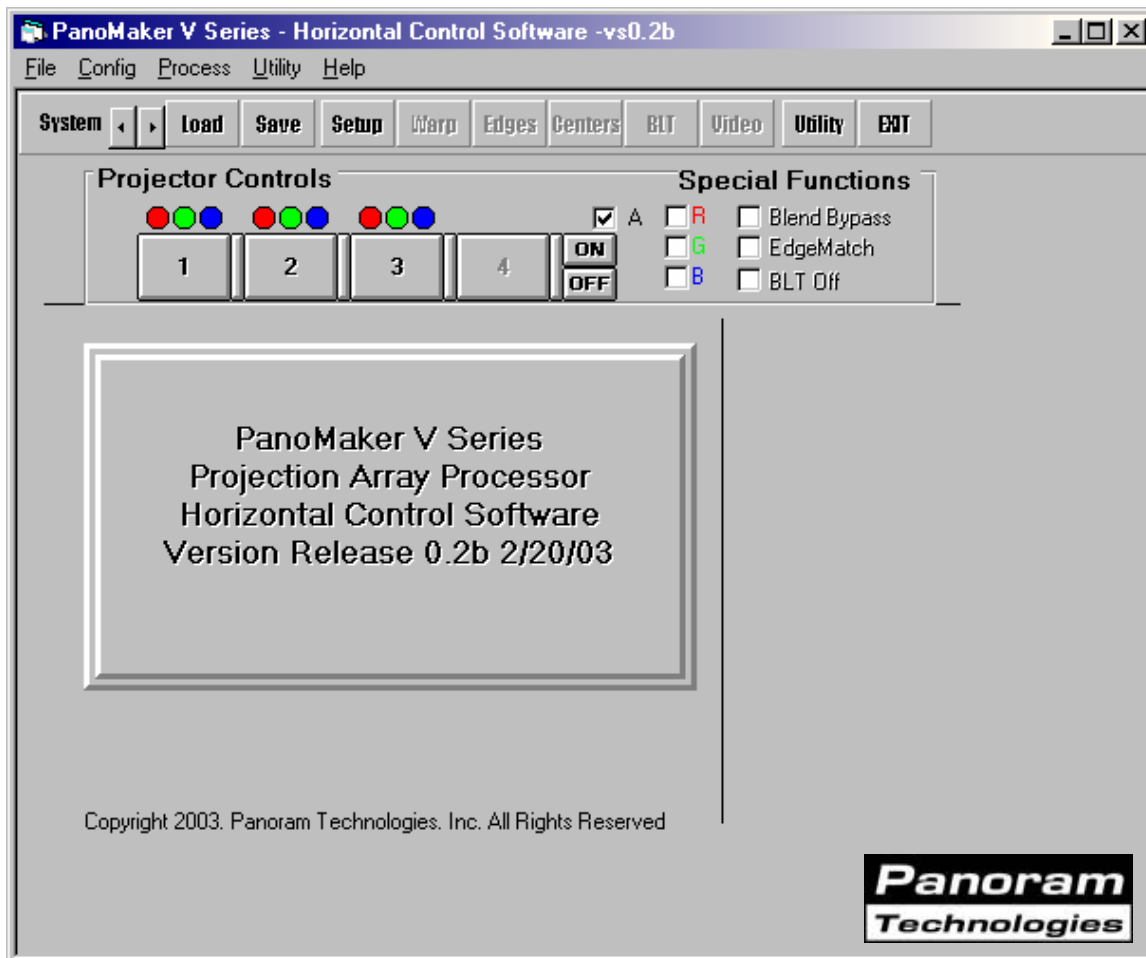
STARTUP SEQUENCE

The PanoMaker V requires a separate dedicated Windows 2000 computer (not included) for setup and control. We recommend a Pentium 4 class computer. It must also be equipped with a monitor that is capable of a minimum of 1024x768 resolution, and a full duplex 100mbit Ethernet port. Although the Panomaker V module can be controlled with Ethernet or RS232, Panoram recommends 100mbit Ethernet is used if possible. A 100mbit Ethernet switch is also required if more than Panomaker V module is used.

The hardware key and key management software will need to be installed prior to operating the Panomaker V control software.

After the software is launched, press the “Operate” button. Pressing the demo button will show the software in operation, however, there will be no control of the Panomaker V modules.

MAIN SCREEN



MODE BAR



The mode bar is at the top of the screen and is visible during all system operations (except warping control). It has nine functions:

1. Load for system setup file retrieval
2. Save for storing system setup files
3. Setup for setting system parameters
4. Warp session will launch a temporary replacement window for warping control.
5. Edges for defining the image area of each projector
6. Centers for defining the center of the overlap region
7. BLT for achieving good edge blends between images with dark backgrounds
8. Video for setting the blending parameters

9. Utility for accessing system utility functions
10. EXIT to quit the program

PROJECTOR BUTTONS



Each projector is represented by a numbered button. In the "A" checkbox, clicking on one of these projector buttons will turn that projector ON or OFF. The RGB Lens tallies indicate the status of the projector and turn gray when the projector is in the OFF mode.

Additionally there is an ON and OFF button that will turn all the projectors ON or OFF.

RGB & A Checkboxes

With the "A" checkbox selected, all three colors of the projector are linked to turn OFF and ON together. With any combination of the R, G and B checkboxes selected, each individual R, G and B color of each projector can be toggled OFF and ON individually. This is very useful during system setup and adjust.

Note: The projector response time is much faster in the "A" checkbox mode.

RBG Tallies

The RGB Lens lights act as tally lights for each active projector in the array. Inactive colors are indicated by the graying of the tallies.

System Select

The System Select allows multiple PanoMaker® Vs to be controlled through one user interface allowing for systems with as many as 256 projectors.

SPECIAL FUNCTIONS

Blend Bypass Checkbox

The Blend Bypass checkbox allows the user to turn the blending ON or OFF. Without blend, the overlap regions between the projectors show up as a bright band. De-selecting the Blend Bypass checkbox returns the system to normal operation.

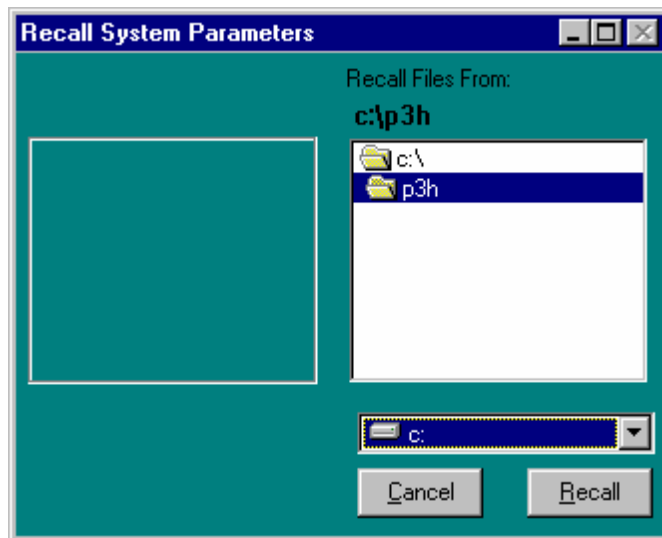
Edgematch Checkbox

Edgematch is a function that allows the user to 'edge cut' the projectors at the center of the overlap. This function is included as a useful utility when the user is trying to color match projectors. With the Blend ON, it is difficult to distinguish color or brightness setting across the blended region.

With Blend OFF, it is equally difficult to distinguish color or brightness settings across the double bright overlap region. With Edgematch invoked, the projectors' images are butted up against one another without blend or overlap making it easy to judge individual projector color settings.

LOAD MODE – SELECTING A FOLDER

Select and open the folder from which to LOAD the parameter files.



NOTE: there are a number of parameter files included in each folder. Selecting the folder is all that is required. There is no need or ability to select an individual file.

When the correct FOLDER has been selected, press the RECALL BUTTON. The user is prompted for a confirmation before the files are loaded.

Canceling the Operation

Click on the CANCEL BUTTON to cancel the LOAD operation and return to the previous mode.

SAVE MODE

The SAVE mode allows the user to copy the PARAMETER FILES to a storage directory. Each storage directory contains all the parameter files for a system setup. Multiple directories can store multiple setups for easy recall.

The SAVE function also provides the capability of creating and naming new folders.

Creating a New Directory

Use the CREATE DIRECTORY button in order to create a new folder.

The DIRECTORY will be created UNDER the current directory selected using the Drive and Folder select windows. The user is prompted for the name of the new DIRECTORY.

Pressing OK creates the NEW DIRECTORY.

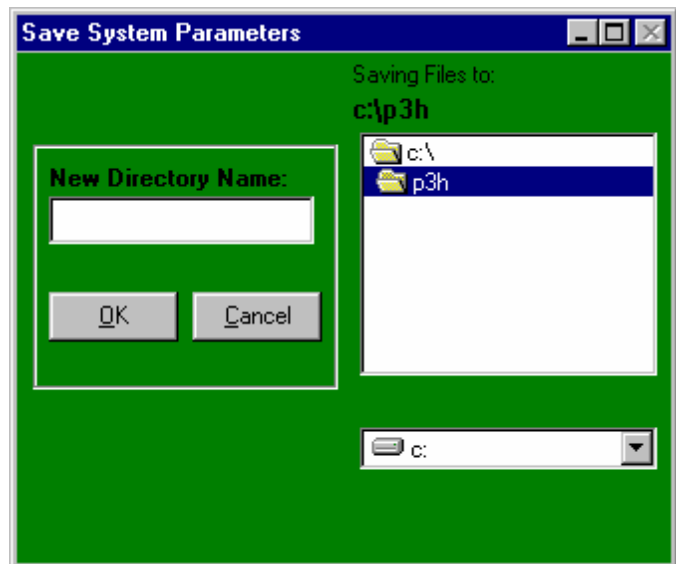
Saving the File

Click the SAVE button to copy the current parameter files to the selected directory.

Canceling the Operation

Click on the CANCEL BUTTON to cancel the SAVE operation and return to the previous mode.

SETUP MODE

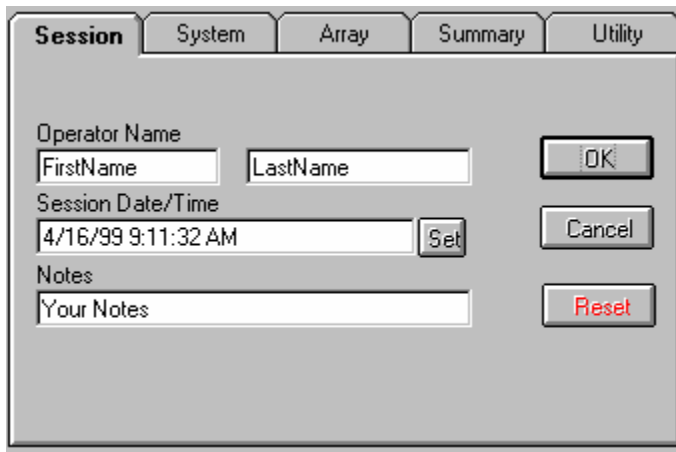


Session

All system maintenance operations are recorded into a system maintenance log. This provides a useful reference of the maintenance activities and is especially useful if there are multiple people maintaining the same system. Data entered into the record fields becomes part of the maintenance log.

Operator Name

This field allows the operator to enter their first and last names.



Session Date/Time

The date and time are based on the current system clock setting. Pressing the SET button will update the field to NOW.

Notes

This section allows the user to enter any maintenance or system operation notes. These notes are automatically logged in the system maintenance log.

Cancel

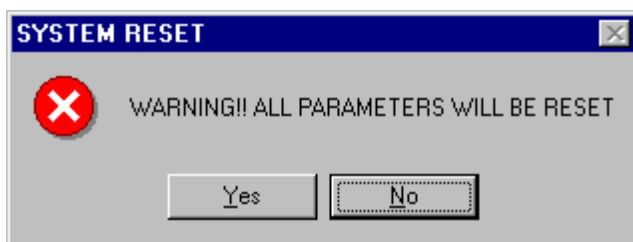
Exits the setup mode.

OK

Moves to the System data page.

Reset

RESET is used to clear all system parameters from the PanoMaker® active memory. It is used when starting with a completely new setup.



Note: The RESET function only clears the parameter data from the PanoMaker®s current memory but does not delete the parameter set from the hard drive if it has been stored there. It is suggested that the current parameter set be saved under a unique file name prior to invoking the RESET button so that the user can return to that parameter set if needed.

Pressing the RESET button brings up a warning dialog.

YES

Clears all system parameters

NO

Return the user to the Session Setup mode.

SYSTEM CONFIGURATION

The screenshot shows a dialog box with five tabs: Session, System, Array, Summary, and Utility. The 'System' tab is active. It contains the following fields and controls:

- System Name:** A text input field with an 'OK' button to its right.
- Location:** A text input field with a 'Cancel' button to its right.
- PanoMaker Info:** A dropdown menu showing 'PanoMaker V Series' with a 'Control' button to its right.
- Projector Type and Model:** Two dropdown menus, 'Type' and 'Model Number', with a 'Comm' button to their right.
- Buttons:** 'Initialize' button at the bottom right.

System Name

This field is used for assigning a system name. This is often useful for customers who are using PanoMaker®s for various display programs.

System Location

This field is used for assigning a particular system to a location. This is often useful for customers who have multiple locations of the same display system.

PanoMaker® Information

This field is for entering the PanoMaker® model and series. Currently this function is for reference only, but is intended to allow for varying PanoMaker® series and model compatibility in the future.

Projector Type and Model

These fields are supplied to allow the user to record this data in the maintenance log.

Cancel

Exits the System Configuration mode.

OK

Moves to the Array data page.

CONTROL

The screenshot shows a 'Setup' dialog box with a 'System' tab. It contains the following settings:

- Channels:** Radio buttons for 'One Channel (Default)' (selected) and 'Two Channels'.
- Communication:** Radio buttons for 'RS232' (selected) and 'Lan (Default)'.
- Number of projectors:** A dropdown menu set to '2'.
- Format:** A checkbox for 'Stereo Image' which is unchecked.
- Buttons:** 'Cancel' and 'OK' buttons at the bottom.

Channels

Determined the system is using one box for one channel or two channels per Panomaker V module.

Communication

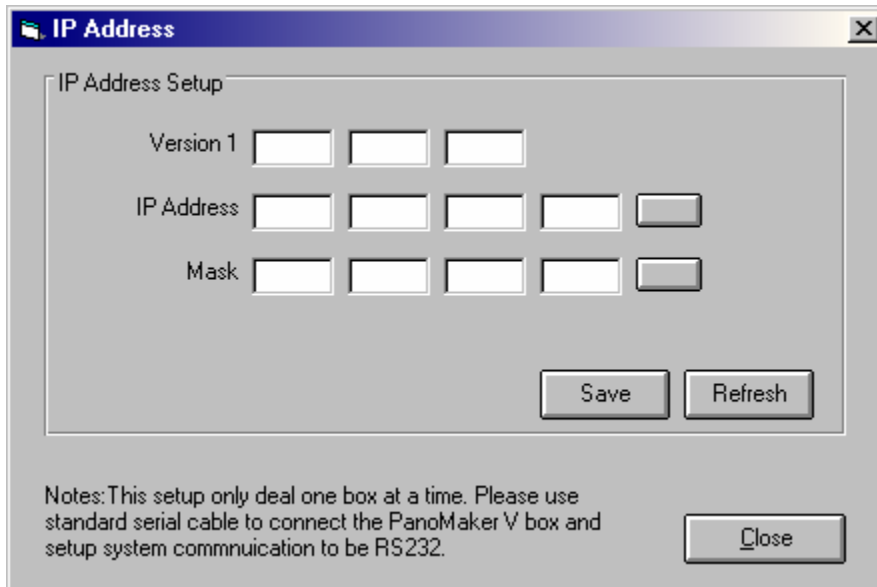
Determined the method of communication between host computer and PanoMaker V.

Number of projectors

Number of projectors for this system.

Format

Support for active matrix stereographic source.



PANOMAKER IP ADDRESSING

As part of the system setup, an IP address must be assigned to each PanoMakerV module (if more than 1 PanoMaker V module is used per control computer). To set the fixed IP address in each PanoMakerV module, one must configure the host computer for RS232 connection and use a serial cable directly from the control computer to each Panomaker V module at a time.

Found under either the Config menu>Networking>IP Address (or the utility tab under setup)

Update Button

Update info into PanoMaker memory.

Save

Save the new IP address and Mask to the PanoMaker flash memory.

Refresh

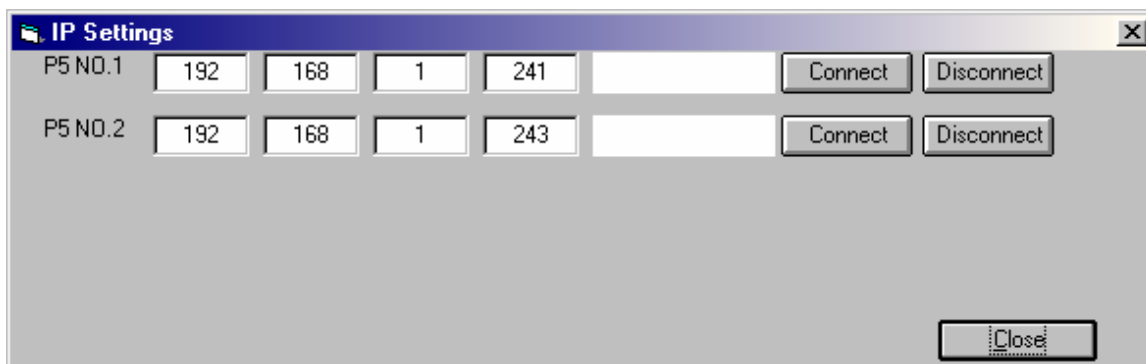
Retrieve the data from the PanoMaker.

Close

Exit IP address setup window.

CONFIG – NETWORK - LINKS

Under top drop down menu bar, select config-> network->link, it will come up a window as below. Please make sure the parameters are match the settings in the PanoMaker box.



Connect

This enables a connection between the PanoMakerV and the control computer.

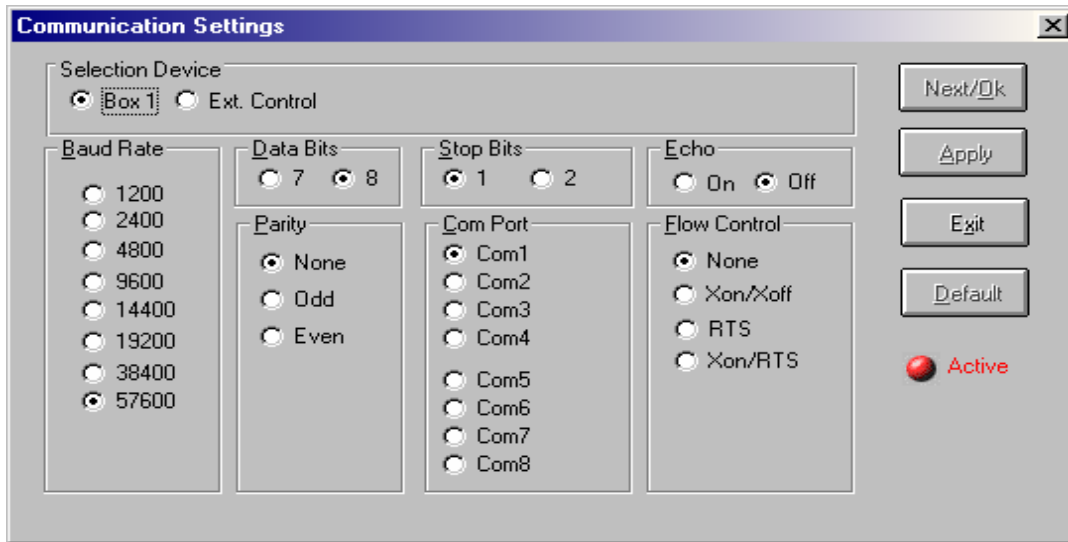
Disconnect

Disconnect the network connection.

Close

Exit IP settings window.

COMMUNICATION SETTINGS



Overview

The PanoMaker® is able to accept certain external control inputs via its serial com port 2 including the ability to turn each projector ON or OFF as well as turning Blend Bypass ON or OFF.

This dialog allows the user to activate this feature and to set a matching protocol to the external device's format.

External Control Setup

- 1: Baud rate (default 9600)
- 2: Data bit (default 8)
- 3: Stop Bit (default 1)
- 4: Echo on/off (default 0)
- 5: Parity check (default n)
- 6: Port number (1-4)
- 7: Hand shake (default 0)
- 8: Directly open port when system boot up!
(1-> on, 0 ->off)

Default Parameter:

- R threshold 1
- Input length 1

Transmit format:

Start with <'piii'> + < Controller> + <chr(13)>

chr(13): Represents the enter or return key.

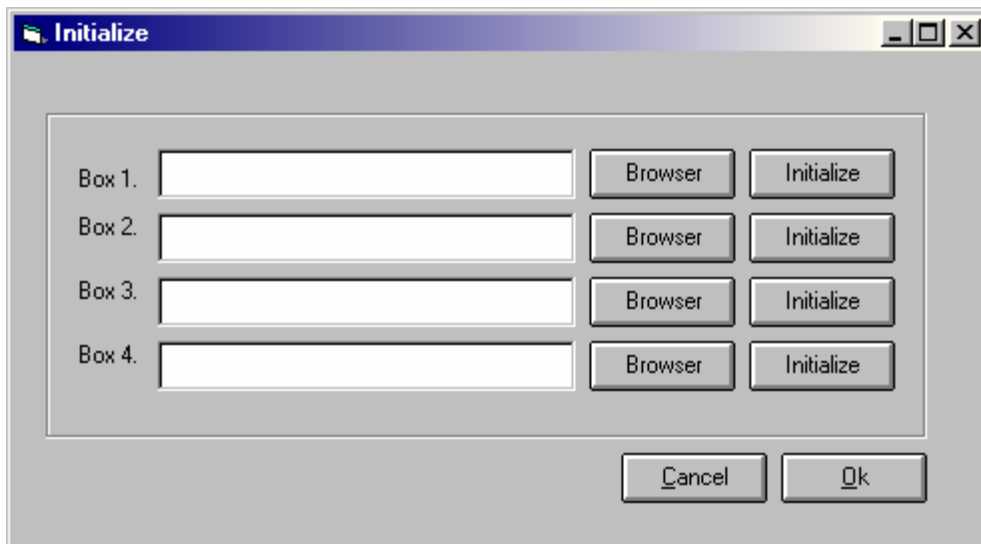
Controller: <2 byte>

- 'r1' Reset Channel 1
- 'r2' Reset Channel 2
- 'r3' Reset Channel 3
- 'r4' Reset Channel 4
- 'i1' Initialize Box 1
- 'i2' Initialize Box 2

Total transmit bytes are 7, include last byte carriage return

For example: 'piir1 '

INITIALIZE



Browser

Located the initialize file.

Initialize

Execute the initialize file.

Cancel

Leave this window closed without save anything.

Ok

Save the initial file location and close this window.

ARRAY CONFIGURATION

Session System **Array** Summary Utility

Projector Aspect 3 : 4

Projector number 3 Projectors

Overlap Percent 25 %

Line Frequency 63.9 Hor.kHz

Frame Rate 60 Hz.

360 Degree Blend Yes No

OK

Cancel

Projector Aspect

This field is for logging the aspect ratio of each individual projector.

Projector Number

This field assigns the number of projector channels being blended in the current setup.

Note: This is an active parameter and will change the operation of the system when changed.

Overlap Percentage

This field is for logging the percentage of overlap being used in the setup.

Line Frequency

This field is for logging the line frequency of the signals being used.

Frame Rate

This field is for logging the frame rate of the signals being used.

Cancel

Exits the Array Configuration mode.

OK

Moves to the Summary data page.

LOG SUMMARY

Session System Array **Summary** Utility

The system " at was modified by FirstName LastName on 4/16/99 9:11:32 AM

Notes:Your Notes

The Array is using 3 Projector Type Model Number projectors, each with a 3:4 aspect ratio using a 25% overlap at a horizontal line rate of 63.9Hor.kHz and a frame rate of 60Hz.

Ok

Log Data

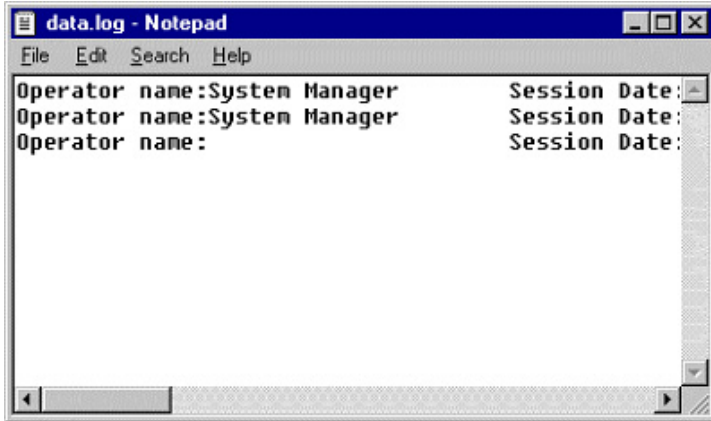
ViewLog

OK

Moves to the Utility page

Log Data

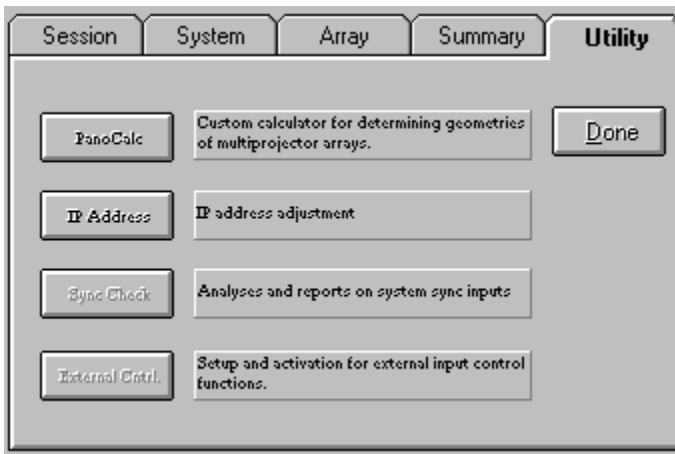
Records the summary information into the system maintenance log and exists the SETUP mode.



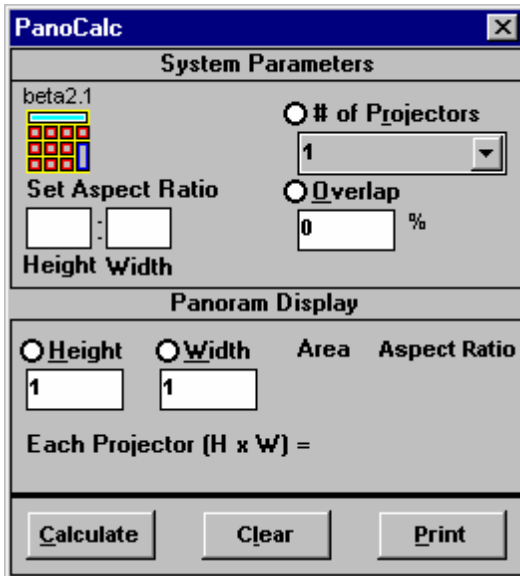
View Log

View Log brings up an editable notepad file of the system maintenance log which can be viewed, edited, saved to the “A” drive, or printed.

UTILITY MODE



PANOCALC



This accommodates the unique variable associated with calculating the geometry of multi-projector overlapped displays, including the:

- Aspect ratio of each projector (4:3, 5:4 16:9 etc...)
- Number of projectors in the array
- Percentage of overlap of the image
- Display height
- Display width
- Display area
- Size of each array image
- Display aspect ratio

In each application, certain parameters are known and others are variable and need exploration. With the PanoCalc, the user provides certain parameters, chooses which variable to solve for and calculates a solution.

PANOCALC FUNCTIONS

Number of Projectors

Allows the user to choose number of projector array elements

Height

Height of individual array element in arbitrary units (i.e. individual image height)

Width

Width of individual array element in arbitrary units (i.e. individual image width)

Overlap

The percentage of overlap or common image area between array or image elements

Aspect Ratio*

Individual image or projector Height to Width stated as a 1:XXX ratio

Height

Total display (image) height in arbitrary units

Width

Total display (composite image) width in arbitrary units

Area*

Total display surface area in arbitrary square units

Aspect Ratio*

Ratio of the total display image Height to Width stated as a 1:XXX ratio

Each Projector (H x W)*

Individual projector dimensions in arbitrary units (Height times Width)

*Note: *Denotes fixed fields (i.e. cannot be changed by typing)*

CONTROLS & BUTTONS

Radio Buttons

Each parameter has a radio button. Pressing the radio button on one of the field allows that parameter to be calculated with respect to the other 5 parameters.

Calculate

Pressing this button calculates the selected parameter

Clear

Pressing this button clears all fields to default values

Print

Pressing this button prints the screen results if you are hooked up to a printer

X

Pressing this button closes the PanoCalc window

PANOCALC ERROR MESSAGES

Please enter a positive Overlap value between 0 and 100.

The value entered in the overlap field is beyond calculating range. Please enter a value between 0 and 100.

Set System Aspect before calculating any parameter.

Before calculating any parameter, please enter the Height and Width (i.e. the aspect ratio of the system).

Actual calculation = (xxx) projectors.

Recommended projector number = (yyy).

The projector calculated value (xxx) is not an integer. Since fractional projector is not possible, the calculator provides closest recommended value (yyy). For different numbers, please recalculate using different parameters.

Projector limit reached (xxx). Projector Value must be between 1 and 16 - Please recalculate.

Video Panoram can be configured using 1 to 16 projectors. The value (xxx) in the error statement shows the current calculated value. Please choose parameters accordingly so that the projector value falls between 1 and 16.

Overlap value error (xxx) - Please reenter new parameters.

The value entered in the overlap field is beyond calculating range. The value (xxx) in the error statement shows the current calculated value. Please choose parameters accordingly so that the overlap value falls between 0 and 100.

Please choose a parameter to calculate.

No focus button is selected. Please choose a parameter to calculate by clicking on a button.

Error calculating <xxx> Please enter valid parameters (i.e. non-alphabet positive numbers).

You have entered an invalid value for calculating the <xxx> parameter. Please re-enter a valid number for calculation.

Printing Error - Please check your printer / print manager / spooler for proper device selection and operation.

The default Windows printer is off-line, not selected or not responding due to some reason. Please correctly configure the printer (using windows Print Manager - setup) and try again.

EDGE BLENDING

Overview

The edge blending operation is implemented using the control software to set up the blend parameters. Most of this setup is related to synchronizing the PanoMaker®V's system memory map with the real-world projection being displayed by the projectors. This means that the setup technician is defining physical location parameters of the display to the PanoMaker's digital memory map. There are three basic phases of this setup:

Set Raster Edges

This defines the edges of the usable image raster. This is done by sliding vertical cursors left to right until they sit on the edges of the usable picture portions on the display screen (not the control computer screen).

Set Center of Symmetry

This defines the center of the overlap region. This is done by sliding two vertical cursors toward the center of the overlap until they are superimposed on the display screen (not the control computer screen).

Curve Blend Mode

This implements a brightness fall off curve between pairs of projectors. The curve is generated by setting "gamma" and "width" parameters for each R, G and B color in the array. These settings are run through a gamma corrected blending algorithm and generate a blending curve between two adjacent projectors. The RGB curves are individually adjusted until a good general blend is achieved on the display screen (not the control computer screen)

Parameter Management

The PanoMaker® generates a number of reference files during setup, which are stored on the system's removable hard disc. This includes the blending parameter files.

These files are referred to by the system during the setup and edit modes and when the system is restarted. Otherwise, all the system-blending parameters are stored directly in the PanoMaker® V memory.

Memory Storage

Each additional blend parameter set is stored on the system's = hard disc in a unique folder, which is created during the SAVE AS operation.

SET RASTER EDGES



Overview

Setting the raster edges synchronizes the image location with the PanoMaker®'s digital blending map. During this mode, the user lets the PanoMaker® know where the edges of the useful image raster is located.

Operation

In the Raster Edge mode, the PanoMaker® turns off all but the first projector. Two vertical cursors are projected on the display. The arrow buttons on the control screen allow the user to move those edge cursors until they are just INSIDE the active image area being projected. When both raster edges have been set for that projector, clicking the SET/FINISH button causes the following action:

1. The PanoMaker® stores the left edge and right edge values for that projector
2. That projector is turned off
3. The next projector is turned on
4. The next pair of cursors is projected on the display

The user sets the edges for all projectors in the array.

When the user presses the SET/FINISH button on the last projector in the array, the PanoMaker® system automatically goes to the Set Symmetry or Centers mode.

Show

Click this button, it will update cursor position on top image.

L

If this button is down position, system will update the cursor position automatically when you step the spin button.

Note: The PanoMaker® cannot generate blends if the raster edge data is not set. When you RESET the system, the blend function is not available until after the raster edges and the blend centers have been set.

Keyboard Equivalents

Many operations in setting up a PanoMaker® system require the user to be looking at the display screen rather than the control screen. With this in mind, a number of keyboard equivalents have been defined and laid out in such a manner that various modes can be operated without taking the eyes off the screen.

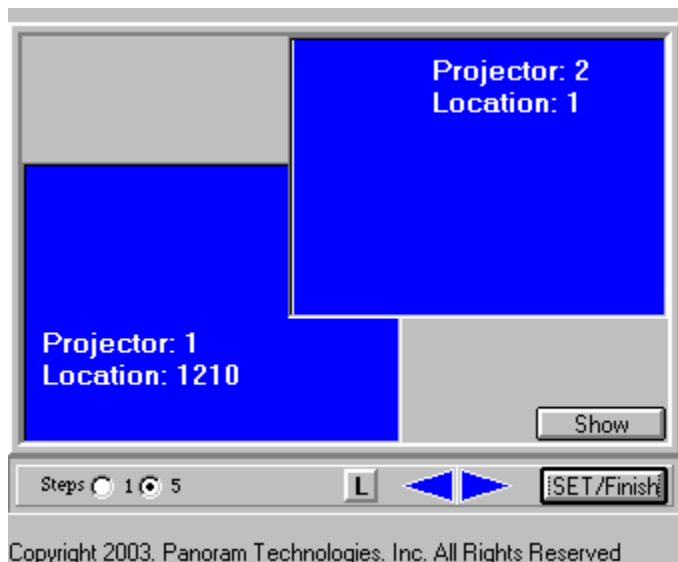
For Raster Edges Mode this includes:

1-3 number keys allow the user to select the projector they would like to adjust the settings on.

, and . keys move the left side cursor to the left and right.

<> keys are the same keys with the shift pressed and move the right side cursor.

s or S keys are like pressing the SET function, but with the keyboard, the last projector loops back to the first using the s key or moves the next setup move with the S key.



Set Symmetry or Centers of Overlap

Overview

Setting the Center of Symmetry tells the PanoMaker®'s digital blending map where the center of the overlap is. This center cannot be calculated from the raster edge data. Sizing of adjacent projectors should be matched exactly. By physically stepping two cursors toward each other, starting from the defined Raster Edges, until they are superimposed defines the actual center of the overlap in the PanoMaker® blending map.

Operation

In the Set Symmetry mode, the PanoMaker® turns off all but the first pair of projectors. Two vertical cursors are projected on the display indicating the Right Raster Edge of the Left Projector and the Left Raster Edge of the Right

Projector. The arrow buttons on the control screen allow the user to move those edge cursors toward one another until they are superimposed in the center of the overlap. When the center of the overlap area has been set for that projector pair, clicking the SET / FINISH button causes the following action:

1. The PanoMaker® stores the center of blend values for that overlap region
2. The projector pair defining the next overlap region is turned ON
3. The next pair of cursors is projected on the display

The user sets the center of symmetry for each overlap region in the array.

When the user then presses the SET / FINISH button on the last projector pair in the array, the PanoMaker® system automatically goes to the Blend Mode.

Show

Click this button, it will update cursor position on top image.

L

If this button is down position, system will update the cursor position automatically when you step the spin left/right arrows.

Note: The PanoMaker® cannot generate blends if the Center of Symmetry data is not set. When you RESET the system, the blend function is not available until after the Raster Edges and the Centers of Symmetry have been set.

Keyboard Equivalents

Many operations in setting up a PanoMaker® system require the user to be looking at the display screen rather than the control screen. With this in mind, a number of keyboard equivalents have been defined and laid out in such a manner that various modes can be operated without taking the eyes off the screen.

For Set Symmetry Mode this includes:

1-2 number keys allow the user to select the projector pairs they would like to adjust the settings on. Please note 1-2 indicates the overlap number not the projector number.

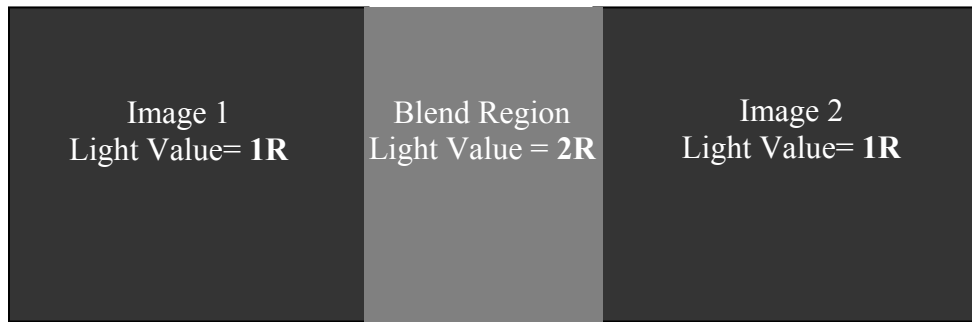
, and . or Shift <> keys move the cursors IN and OUT.

The s key is like pressing the SET function, but with the keyboard, the last projector loops back to the first unless the user presses the shift S key.

BLT MODE

After Edges and Centers have been set as previously described, users of digital projector technology (LCD, DLP, DILA etc.) projectors will probably need to make “black level” adjustments to the video signals feeding each projector.

A video signal’s black level is the electrical value necessary to portray black, or completely dark areas of the video picture. On a CRT (cathode ray tube) technology, this signal level generates no appreciable light value from the light emitting surface of the monitor screen. The same applies to CRT type projectors.



However, LCD and DLP projectors “leak” a small amount of light, even when fed a completely black video picture. This is because images from such projectors are created by shining a light source through, or upon a light modulating element, which does not completely attenuate the light source when

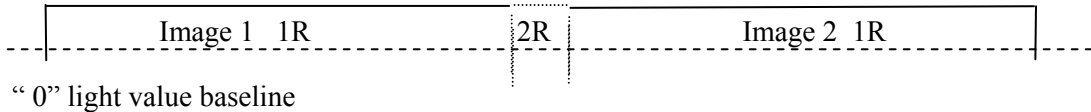
reproducing a black area of the picture. Because of this, dark areas in the picture can show a brighter band of “blackness” in the overlap region where the video image edges overlap:

This issue can be resolved by adjusting the light values of each image (“1 R”) to be slightly higher than the “2R” value of the blend region. Then the image edges are blended using the same techniques as for full brightness video images. If necessary the overall brightness of the resulting wide screen image can then be reduced to create appropriate reproduction of dark or black image areas overall.

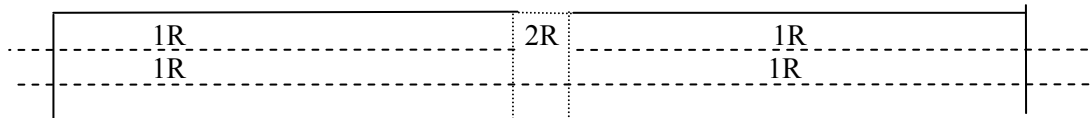
Adjustments are made while observing the effect of changes to projected reference images representing completely “black” signals feeding each projector. The aim is to adjust the system so that the overall brightness balance of each image matches across the screen, so there is a minimal residual black level brightness difference between each image, and in the overlap regions as well.

In practice, PanoMaker® software adjusts residual, leaked black level values to 2R only within the separate projected images, and not in the overlap regions between images.

Before Black Level Adjustments



After Black Level Adjustments



Note that the black level of the two images is increased by a factor of 2, while the “2R” image overlap (blend) region is unaffected. Once this is done, the black levels of both the images and their overlap will be roughly equivalent, and it will be possible to adjust fine blend parameters.

Assuming you’ve set image Edges and Centers, begin black level adjustments by clicking on the "BLT" (Black Level Technology) button on the Main Screen.



The first Color window controls the residual brightness of black signal images cast by each projector. This window is the first to appear when the BLT button is clicked. Projector number 1 is the default projector for color balancing.

OPERATION



Projector Buttons

The top buttons labeled 1, 2, and 3 can turn projectors on or off overall. Blend Bypass and Edge Match buttons turn off blending between projectors, or allow one to access the hard edge alignment of projected images.

Projector Select

The Projector select buttons enable black level residual brightness for each projector. After these factors are set for Projector 1, click on Projector 2. Projector 1 will continue to operate, but control commands will affect Projector 2 only. The same holds for Projectors 2 and 3. Button 4 is for access to other projector sets.

OVERALL BLACK LEVEL

“Brightness” Sliders / Increment Buttons

The double triangle controls adjacent to the white slider allow this factor to be changed in ten step increments. Use these controls to match image to image residual light values.

Using the white slider control the overall black level “brightness” can be raised or lowered, in one step increments.

Sliders

These slide controls work in one step increments when the cursor is clicked above or below the virtual knob on each slide track. The knobs can also be grabbed directly with the cursor. Use these controls to set the color balance of image to image residual light values.

Reset

This button resets the brightness back to default values. Projector 1 is selected.

Display Area

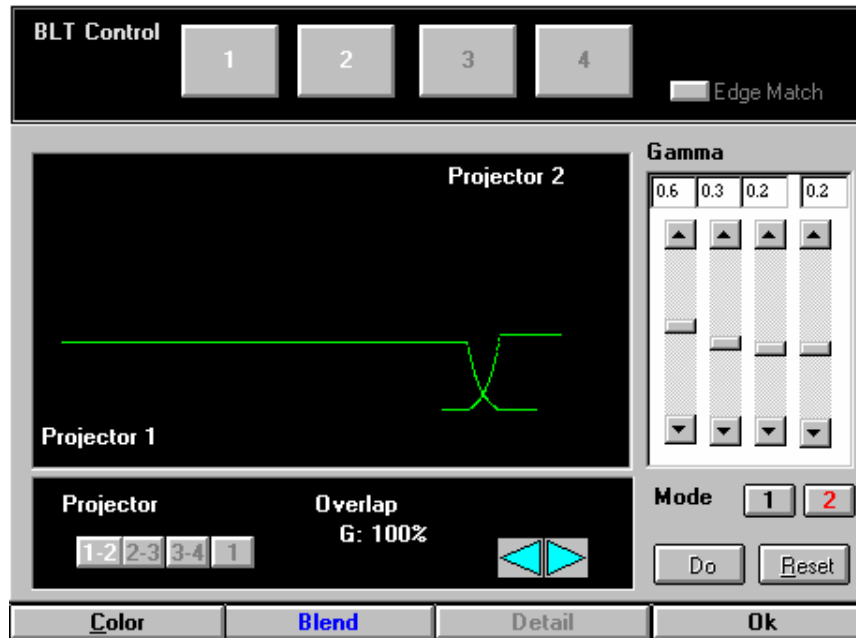
Graphic information area showing representations of control values being entered.

Color, Blend, Detail, OK Buttons

The Color button activates the controls described above. The Blend button brings up a window that allows for a coarse adjustment of the blend area between each separate image, so as to create a seamless transition zone. Detail refers to a window that facilitates detailed tuning of blend parameters adjusted with the Blend controls. The OK button saves settings made with the Blend, and Detail controls, and advances to Video Mode (from the Detail window).

Once residual light brightness values have been adjusted for each projector, click on the Blend Button.

BLEND



Overview

The Blend window sets a rough blend for each overlap region, so as to create a seamless blend between each projector's image when reproducing black reference signals.

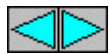
Gamma Sliders

These controls affect the light level in four blend areas within the overlap region between selected projectors (see Projector Select, below). Adjust these to produce a smooth cross fade between the edge of one image and another. The virtual slider knobs can either be grabbed by the cursor, moved ten steps at a time by clicking above or below them, or moved one step at a time by clicking on the triangle buttons at the top or bottom of the slider tracks.

Projector Select

Select Projector 1 and 2, 2 and 3, 3 and 4, **or optional additional projectors** for blending.

Overlap width controls



Clicking the left triangle narrows the width of the overlap area being blended. Clicking on the right hand triangle widens the width of the overlap area.

Reset Button

Resets gamma to default settings.

OK Button

Save changes.

After rough blending each overlap region, open the detail window by clicking the detail button.

Projector Select Buttons



Select Projector 1, 2, or 3 for detailed adjustment of its blend curve. Projector 1 is the default when the Detail window is first selected, and as with the Color and Blend windows, this projector will stay active even when other projectors are selected. Selection of any projector will cause a graphical representation of its blend curve to appear in the Display Area.

Zoom Button

Enlarges or reduces view of the intersection of the vertical cursor and the blend curve.

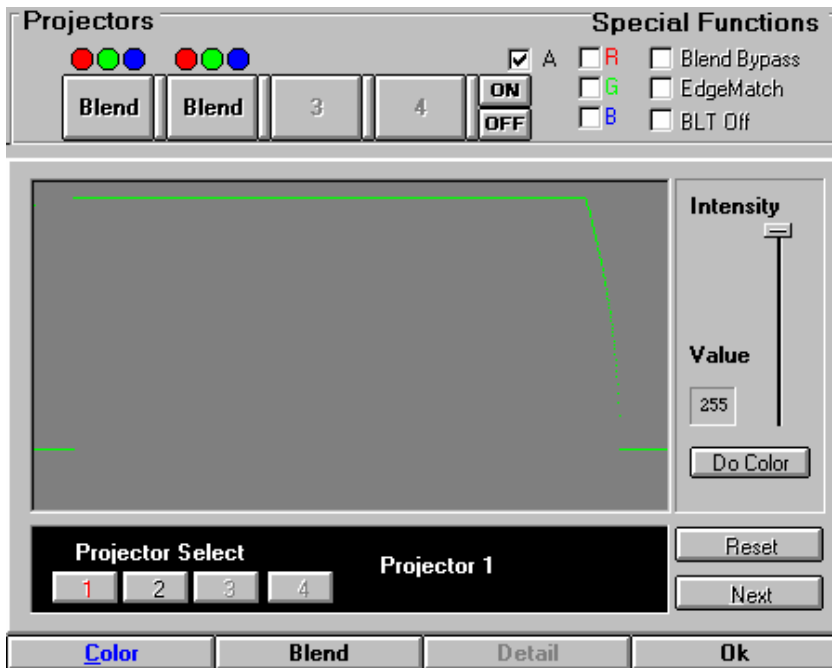
Clear Button

Returns all Detail controls to their default values.

OK Button

Click here to save all changes and advance (from the Detail window) to the Video Mode.

VIDEO COLOR



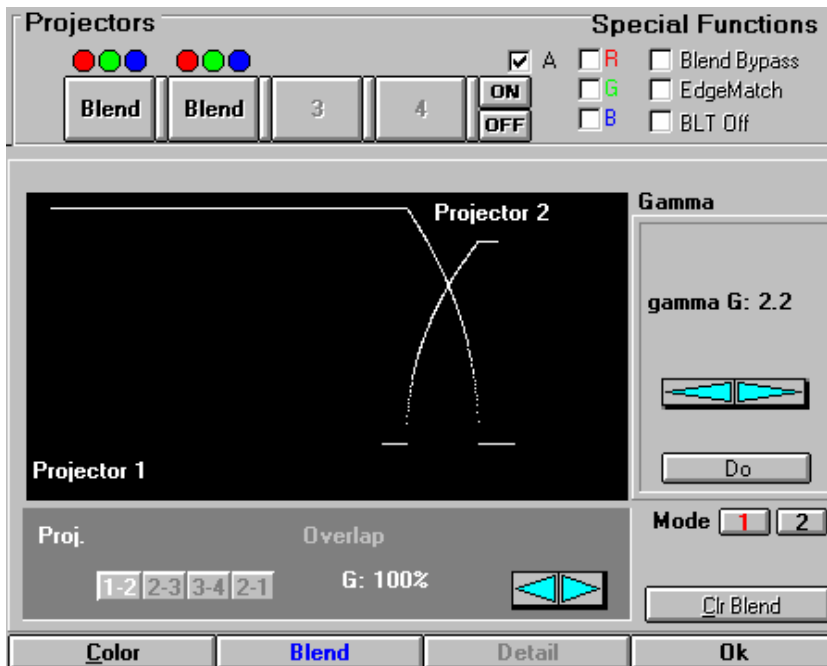
Sliders

These slide controls work in one step increments when the cursor is clicked above or below the virtual knob on each slide track. The knobs can also be grabbed directly with the cursor.

Reset

This button resets the brightness back to default values. Projector 1 is selected.

CURVE BLEND MODE



Overview

The Curve Blend mode sets a rough blend for each overlap region. Different blend curves can be set in each overlap region. Typically these settings are made using horizontal color bars or horizontal gray scale bars. These bars are available to PANORAM customers under license and can be obtained from our website. Contact sales@panoramtech.com to obtain the location key as well as a license for these test and adjust graphics.

Two factors are set for each. They are 'gamma' and 'width' (see below). These settings are combined with the Raster Edge and Symmetry data and sent through a blending algorithm to generate a smooth blending curve for each overlap.

Operation

When the PanoMaker® goes into the Blend Curve Mode, the first overlap region's curve values (between the leftmost pair of projectors) is set using the control arrows for 'gamma' and 'width'. Readouts for each setting appear on the control screen.

Note: Typical gamma settings are between 3 and 4. Typical width settings are between 95% and 85%

OK

When the user presses the OK button, the following occurs:

1. The PanoMaker® stores the blending curve values for that overlap region
2. That next overlap region is selected
3. After the last overlap region, the projector pair loops back to the first pair

Note: To exit the Blend Mode, select another mode button such as Operate.

Blend Region Select

The Blend Select buttons are located at the bottom left of the control screen. Select the projector pair that represents the overlap region to be blended.

Note: The Projector Control Buttons also indicate which projector pairs are being blended.

Detail and Curve Toggle

The detail and curve blend select toggle button is located in the lower center of the window. The button toggles between the Curve Blend and the Detail Blend modes.

During the blending operation, the use may freely toggle back and forth between the modes.

Clear Detail

The detail factors that are added to the Curve blend are retained even if the curve blend parameters are changed.

The Clr Dtl button clears these detail factors.

Keyboard Equivalents

Many operations in setting up a PanoMaker® system require the user to be looking at the display screen rather than the control screen. With this in mind, a number of keyboard equivalents have been defined and laid out in such a manner that various modes can be operated without taking the eyes off the screen.

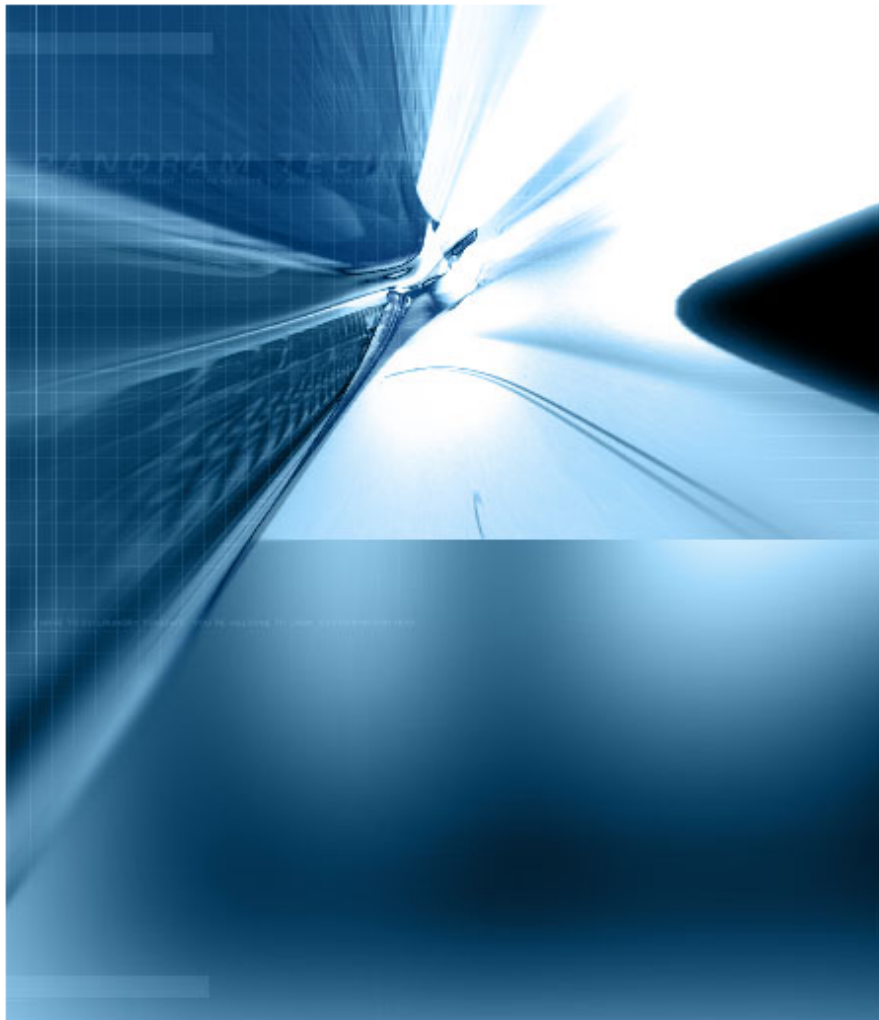
For Blend Curve Mode this includes:

- | | |
|-----------------|---------------------------------------|
| 1-2 number keys | select the overlap region |
| , and . keys | move the 'gamma' value up and down |
| <> keys | move the 'width' values up and down |
| d | selects the DETAIL BLEND MODE (below) |

WARPING SOFTWARE

Panoram Technologies

PanoMaker V User Manual 1.0



**Panoram
Technologies**

PanoMaker™ V

*Warping Software
Version 1.0*

©2003 Panoram Technologies, Inc. All Rights Reserved. U.S. Patent No.'s 4974073, 5136390, 6115022 Canadian Patent No.'s 2025624, 2095634 European Patent No. 0556304 German Patent No. 69132409.3 Other Patents Pending

Fine Tuning the Projector-Screen Relationship Using PanoMaker® V Geometry and Warping Control Software

Fitting the image cast by a modern electronic projector to the exact confines of its projection screen can be a challenge. It is likely that the physical limits of the projector, its light path to the screen, and the screen itself will distort the projector's rendition of the image. Rear projection systems often require a "folded" image path utilizing mirrors to keep projection distances as small as possible. Front projection systems cannot always place a projector dead center to the screen. Often a projector is mounted above or below its screen, which creates a longer light path for either the top or bottom of the image, and creates "key stoning," where parts of the projected image boundaries splay in or out, no longer forming a rectangle with 90° corners. Even the projector lens itself causes the image to "barrel" or curve slightly from top to bottom. If more than one projector is involved in a projected arrays, geometric perfection in the overlap or edge match between projected images is absolutely required.

Panoram Technologies has developed the PanoMaker® V Warping Function to help users adjust the geometry of the projected images. The PanoMaker® is able to perform real time dynamic realignment of every pixel generated in a high-resolution (1280 X 1024 up to 120Hz) video stream being input to a projector. If only 60Hz are required, each PanoMaker® V can handle two such streams and dynamically modify them, compensating for projector/screen image distortion.

For example, if a projector tends to keystone because of a steep projection angle, the PanoMaker® introduces an equal but opposite amount of splay to the image *before* it's projected, which neatly cancels out the effect of the projector-screen relationship. This allows the projector to exactly fill the screen despite the non-ideal projection conditions.

The PanoMaker® V software makes it possible to adjust for very slight to very severe projection distortions, using an interface which allows adjustment of a projected image's horizontal and vertical edges and the image areas contained within. These adjustments are accomplished with eight Global Control Modes that mostly parallel the controls found on traditional CRT projectors. Detailed adjustments of small areas within the projected image can be accomplished using a Detail Mode, which is usually best done after Global changes have been finished.

In either Global or Detail Mode, you can get real time feedback about your adjustment choices by downloading them to the PanoMaker® V, and then watching the results to the projected image itself (after a rendering process performed by the PanoMaker®). Multiple versions of these adjustments can be stored and retrieved from the control computer.

While the Geometry and Warping software has an obvious role in solving conventional projection problems, the warping power available lends itself to some other possibilities as well. Projecting a properly proportioned and focused image on a complexly curved surface becomes possible; imagine projecting the image of someone's features on a screen that closely matches the topography of their face. Or casting the image of an American flag on a wavy screen. The possibilities for special uses for film production, theatre, exhibition, and display purposes are intriguing, exciting, and quite practical once one is up to speed in using the Geometry and Warping software. Whether the need is for slight or radical adjustments to the projected image, the Geometry and Warping controls are relatively easy to use once you're familiar with their functions

What follows is a systematic explanation of these functions. We'll begin with the Geometry and Warping Window in the Border Mode, which is the recommended first step in image adjustments. The following page shows this window and its various controls, followed by a list of each control keyed to the a numbered arrow within the window image. This is followed by a more detailed explanation of each control, and then specific instructions about their use.

INITIAL BORDER MODE

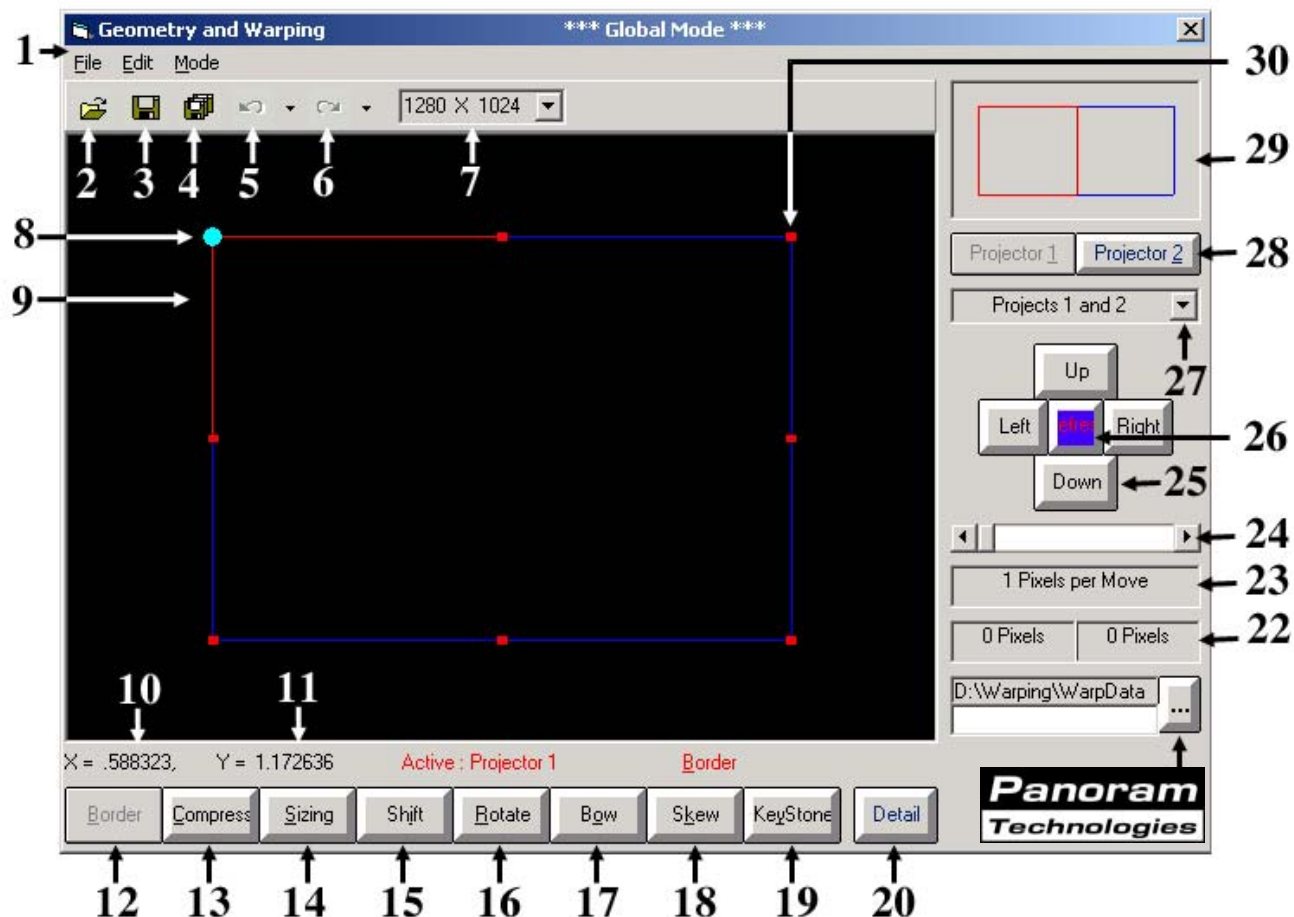


Figure 1 Geometry and Warping Control Window: Initial Border Mode

The illustration shows the Geometry and Warping window in Border Mode, with no changes having been made. The Controls are:

- | | | |
|-----------------------------|-------------------------------|---------------------------------------|
| 1 Menu Bar | 11 Cursor Y Axis Location | 21 Drive/Files Access Window |
| 2 Load Warp (File) | 12 Border Mode Button | 22 X/Y Pixel/Percent/Degree Windows |
| 3 Save Warp (File) | 13 Compress Mode Button | 23 Number of Pixels/Percent/Degrees |
| 4 Save/Download Warp (File) | 14 Sizing Mode Button | 24 Slider/Arrows |
| 5 Undo Command(s) | 15 Shift Mode Button | 25 Movement-Direction Buttons |
| 6 Redo Commands(s) | 16 Rotate Mode Button | 26 Screen Refresh Button |
| 7 Output Resolution | 17 Bow Mode Button | 27 Projector Pair Selector |
| 8 Selected Control Point | 18 Skew Mode Button | 28 Projector Selector Buttons |
| 9 Virtual Screen | 19 Key Stone Mode | 29 Projector Pair Screen |
| 10 Cursor X Axis Location | 20 Detail /Global Mode Button | 30 Control Point (Select with Cursor) |

FEATURES

- 1. Menu Bar** Contains all function menus. These include the usual PC style Filing and Editing commands, plus Mode selection.
- 2. Load Warp File Icon** This icon opens a window dialogue that accesses the drives and then the database in which the user has stored named warp files, which can be recalled to the Virtual Screen, and then downloaded to the PanoMaker® V.
- 3. Save Warp File Icon** This icon saves changes made to named warp files already saved using the Drive/Files access controls (see Item 21, below). Clicking on this icon will open the Save window if you haven't already created a named file name using the Drive/Files controls.
- 4. Save and Download Icon** This icon saves changes to warp files, per the rules noted in Item 3, and also downloads the file's image adjustments into PanoMaker® V so as to affect the image being routed to the projector. The X and Y Axis Locations are replaced by a progress bar while the Save and Download process is being completed.
- 5. Undo Icon** This is used to undo image adjustments. There are 20 levels of Undo.
- 6. Redo Icon** Use this button to redo adjustment steps that have been Undone. There are 20 levels of Redo.
- 7. PM V Output Resolution** Use this drop down menu to select the PanoMaker® V output resolution.
- 8. Selected Control Point** The light blue color indicates that the underlying red control point has been click-selected by the cursor. The controls affect that point, and certain adjacent points to varying degrees.
- 9. Virtual Screen** A rectangular grid that represents the image cast by a projector. Changes made to this grid are reflected in the projected image when those changes are saved under a file name, and simultaneously downloaded into the PanoMaker® V.
- 10. Cursor X Axis Location** Numerical Readout indicating cursor X axis location reference. Zero reference for this factor is the top horizontal boundary of the Virtual Screen.
- 11. Cursor Y Axis Location** Numerical Readout indicating cursor Y axis location reference. Zero reference for this factor is the left vertical boundary of the Virtual Screen.
- 12. Border Mode Button** This is one of eight global adjustment modes. Border Mode deals with adjustments of points along the boundaries of the Virtual Screen.
- 13. Compress Mode Button** Portions of the edges or interior surfaces of the Virtual Screen are "squeezed" closer together, or "stretched" farther apart by moving a selected point.
- 14. Sizing Mode Button** The entire Virtual Screen is expanded or contracted vertically and/or horizontally.
- 15. Shift Mode Button** The entire Virtual Screen is shifted horizontally and/or vertically.
- 16. Rotate Mode Button** Another global adjustment that involves an "axle", around which the entire Virtual Screen is made to rotate.
- 17. Bow Mode Button** The edges of or areas within the Virtual Screen can be made to follow curved lines, which are most prominent at the selection point, but which are also reflected in areas adjacent to that point.
- 18. Skew Mode Button** Skew Mode shifts the vertical and/or horizontal boundaries of the screen in opposite directions, thus skewing the image.
- 19. Keystone Mode Button** This Mode helps eliminate "key stoning", which is the splayed light path that appears when projection angles to the screen are steep because the projector is radically above or below the screen center.

Note: All the corrections made using the Mode buttons can be done using any sequence of Modes desired, and are additive. This means that very complex corrections can be performed by combining adjustments.

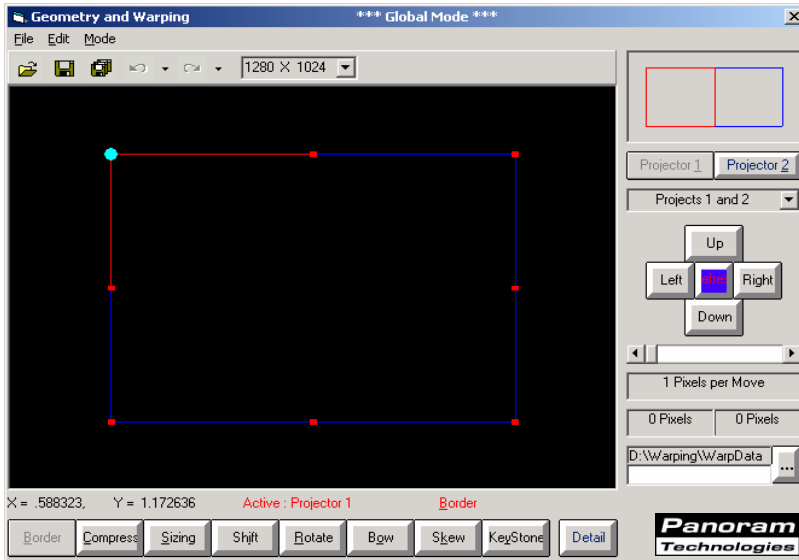
- 20. Detail/Global Modes Button** Clicking this button causes the Detail Mode buttons to appear over the Global mode buttons. Detail Mode allows precise changes to small areas at the boundaries of or within the projected image. The selected area can be a single point and its immediate area, or narrow vertical or horizontal lines of points. This button's label changes to "Global" when in Detail Mode, and vice versa.
- 21. Drive/Files Access Window** Pressing the button (with three dots) opens the Save window which allows access to all drives in the computer through a drop down arrow list. All folders on that drive will appear in the Folders window. These can be opened by click selecting. A selected folder can be used to store warp files created by the user. When a file is saved using the Save and Download Icons (Item 4 above), the changes made to the Virtual Screen will be reflected in the actual projected image, once downloading to the PanoMaker® V is finished.
- 22. X/Y Pixel/Percent/Degree** Windows that show change in the X axis (left window) and the Y axis (right window). These changes can be expressed in Pixels, Percent or Degrees of rotation depending on the Mode selected.
- 23. Number of Pixels/Percent** Number of Pixels/Percent/Degrees moved per click of the Movement-Direction Buttons, as they affect a selected area of the projected image.
- 24. Slider/Arrow Controls** These controls determine how many Pixels/Percent/ or Degrees a selected area of the image is moved or changed by each button click, as in 25, below. Generally the slider is for large changes and the arrow buttons for smaller.
- 25. Movement-Direction Buttons** These controls affect the *direction moved* by the selected control point. Movement along the Horizontal (X) axis is governed by the Left and Right buttons, and on the Vertical (Y) axis by the Up and Down buttons.
- 26. Screen Refresh Button** Used to refresh visual data within the PanoMaker® V when the projected image is frozen or "messed up".
- 27. Projector Pair Selector** A drop down menu to select a pair of continuous projectors for current control.
- 28. Projector Selector Buttons** Selects the projector being controlled in the current projector pair.
- 29. Projector Pair Screen** The projector image selected for adjustment shows as a red rectangle. Projectors that are not selected show as a blue rectangle.
- 30. Control Point (non-selected)** Red dots are the control points within the Virtual Screen that can be click-selected, and then moved using the controls just described. When one is selected, it turns into a larger light blue dot.

Note: The changes made to the Virtual Screen will only be reflected in the actual projected image when those changes have been given a name and file location using the Save window. Then the Save and Download Icon must be click-selected to actually download these changes to the Panomaker® V, and to the file folder selected to store "warp" files. The control functions described in the following pages will have no effect on the projected image until this Save-Download process is complete. For an explanation of this, see "Saving and Loading Files", starting on page 25. It would be a good idea to create a file name before making changes to the Virtual Screen using the controls described on the following pages.

GLOBAL MODE CONTROLS

Global Modes are controls that can affect the entire projected image or large portions of it.

GLOBAL MODE/BORDER MODE



buttons set this factor.

Figure 2 Border Mode - corner selected / no movement commands have been executed

Please note that by default, the upper right corner's control point has been automatically selected (indicated by the light blue dot). Moving this selection point down (using the Down Button) pulls the red top horizontal line downwards too, curving it up to the next control point to the right:

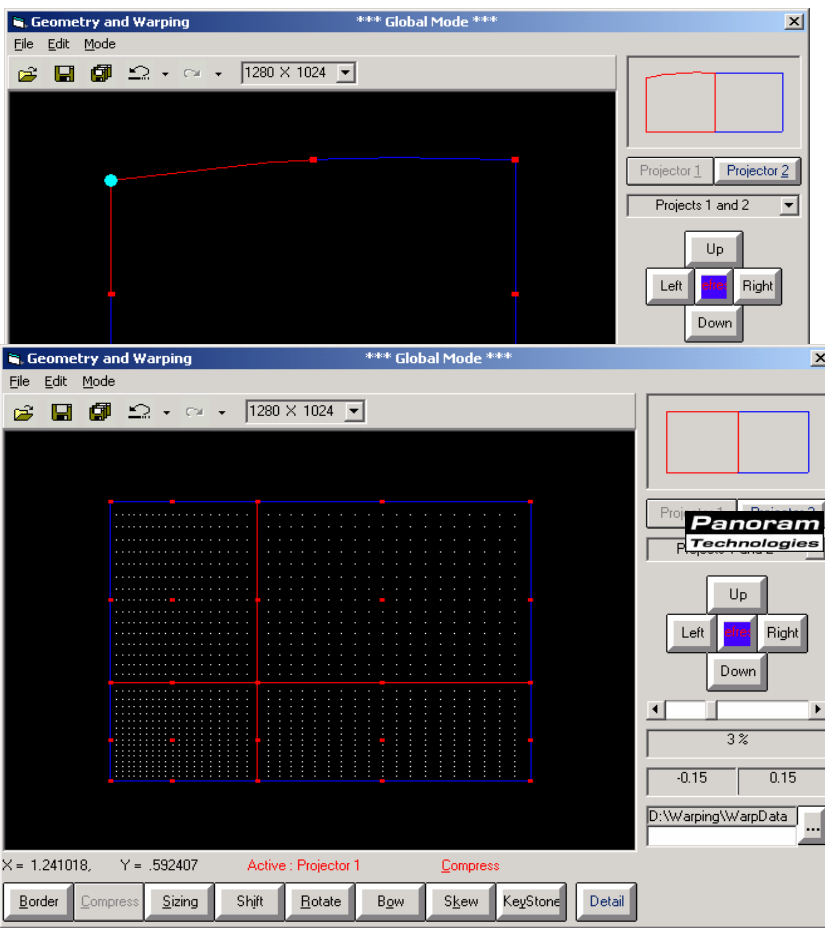


Figure 3 Border Mode - selected corner moved down vertically

Note that the blue line connected to that right hand control point is unaffected by the “move down” command. The Slider control has been used to select 80 Pixels per click on the Down Button, and the Y Axis window shows 80 pixels of downward movement on the Left vertical boundary of the projected image, which is the result of clicking once on the Down button.

Global Mode: Compress Mode is intended as a means to squeeze together or stretch apart selected areas of the projected screen image. This is useful when there's a need to

compensate for areas within the screen that are less than ideally flat. As with all Geometry and Warp adjustments, the adjustments needed will likely be small. But by using the same methods it's possible to make quite radical adjustments to compress (or expand) the projected image over unusual surfaces, while still retaining image proportions.

This is the Compress Mode when first initiated:

Figure 4 Compress Mode - with no changes executed

The red horizontal and vertical lines mark a starting reference point for compression and expansion changes in either direction. The white dots represent points within the projected image that can be moved in concert with these reference lines. The amount of movement displayed by the white dots is proportional to how close they are to one of the reference lines. Notice that the Pixels/Percent/Degrees window shows percentages rather than pixels. Where the white dots move closer together, the projected image shows "squeezing". Where the white dots move farther apart, the projected image shows expansion. A screen with horizontal or vertical areas that are not perfectly flat will tend to cause a widening or shrinking together of image elements. Using the Compression Mode controls to introduce an equal amount of the *opposite* kind of distortion will tend to correct for these problems.

Suppose the screen surface curves slightly away from the viewer on its bottom portion. Moving the horizontal red reference line downwards (using the Down Button) will squeeze together the image elements in the bottom portion of the screen. This squeezing cancels out the expansion effects of the physical curve on the bottom of the screen:

Figure 5 Compression Mode - with lower portion of image compressed horizontally

The white dots in the lower portion of the screen have been "squeezed" closer together. The elements in the projected image will show a similar compression.

It's also possible to make a compression change along the vertical axis (or vice versa) while retaining the horizontal change just described:

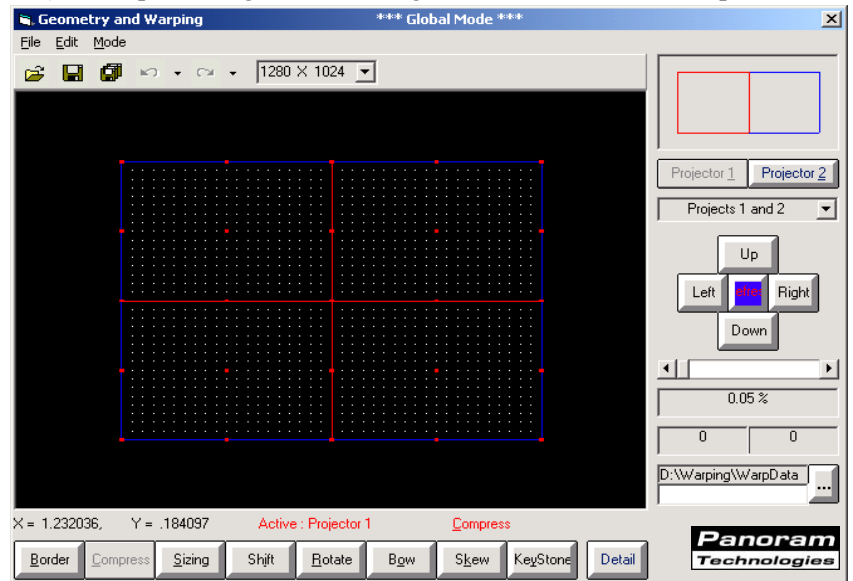
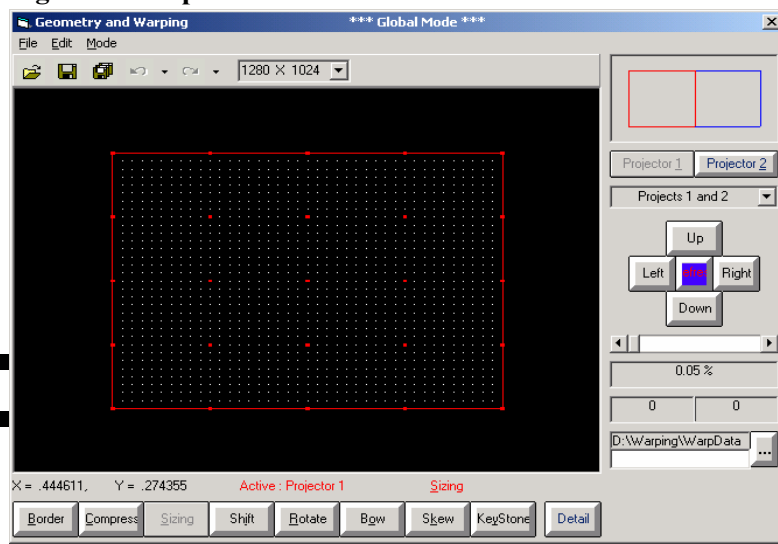


Figure 6 Compression Mode - with both horizontal and vertical compression



Global Mode: Sizing Mode adjusts the overall width and height of the projected screen image. An exact fit of the projected image edges to those of the screen is thus easily accomplished. This is the Sizing Mode screen before any adjustments have been made to the size of the screen image:

Figure 7 Sizing Mode - without any changes to the projected screen image

The rectangular Virtual Screen comes up in its default 4 by 3 proportions. By using the Up/Down and Left/Right buttons either singly or together, the overall size of the projected screen can be altered. For example, here's a decrease in the overall Vertical (Y axis) height of the projected screen, accomplished by clicking on the Down Button:

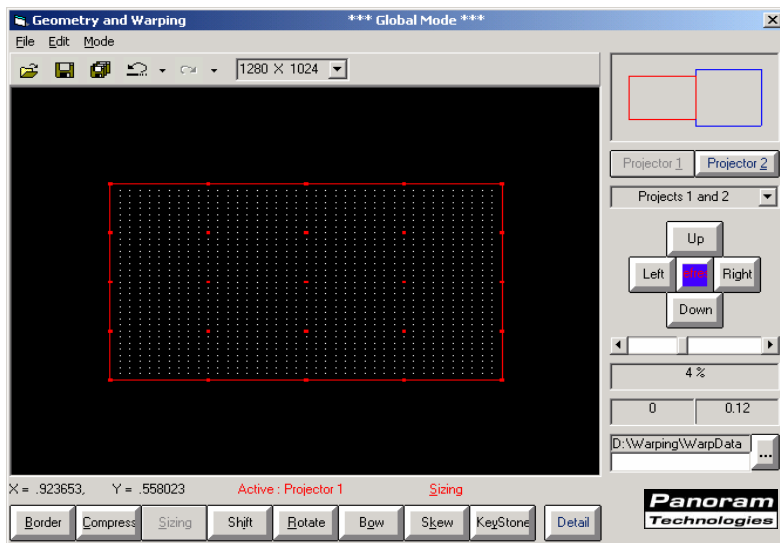


Figure 8 Sizing Mode - showing a decrease in vertical height

Selecting the Left and Right buttons increases or decreases the width of the projected screen image:

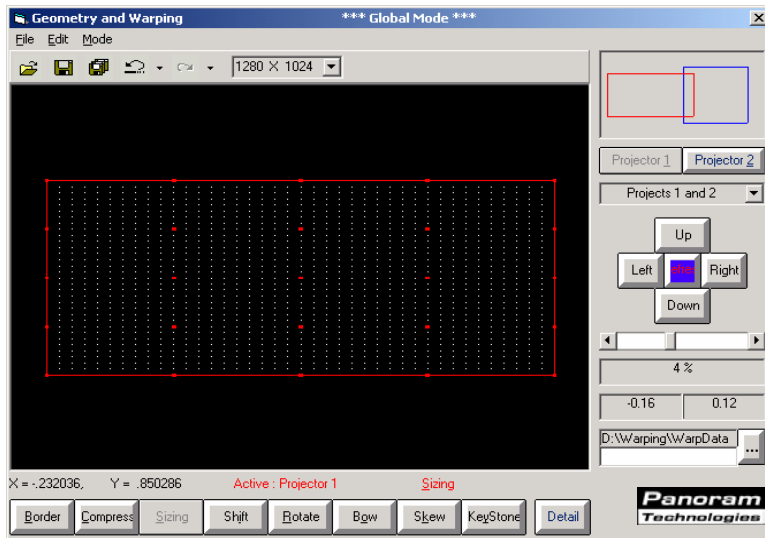


Figure 9 Sizing Mode - with an increase in horizontal scale

Please notice the Sizing Mode expresses changes in screen size as *percentages*; the Slider or Arrow buttons control how much of a percentage change is caused by each click of the Movement-Direction Buttons.

Note: If the actual projected images reach their maximum size, further manipulation of their Virtual Screen representation will have no effect on the projected image.

image to be shifted overall Left or Right, or overall Up or Down. Movements along both these axis can be combined. Obviously, Shift is a good mode for making small projector and screen relationship adjustments once the projector is mechanically and optically aligned to the screen.

Global Mode: Shift Mode allows the projected image to be shifted overall Left or Right, or overall Up or Down. Movements along both these axis can be combined. Obviously, Shift is a good mode for making small projector and screen relationship adjustments once the projector is mechanically and optically aligned to the screen.

Here's the initial Shift Mode screen:

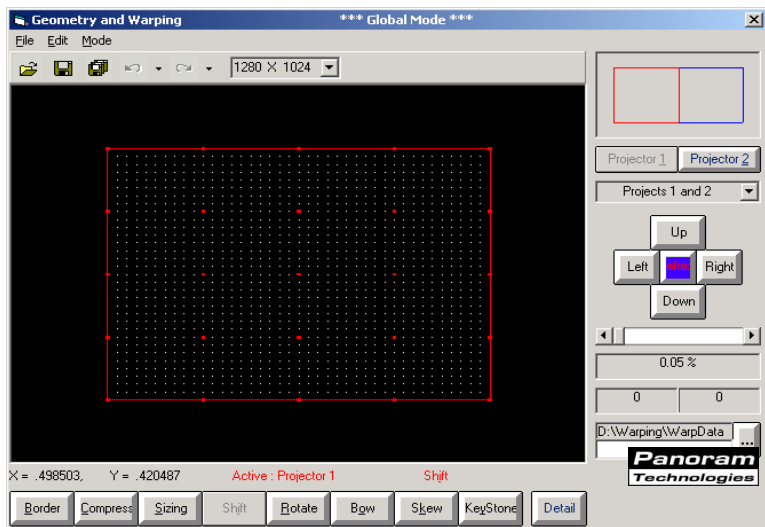


Figure 10 Shift Mode - with no changes initiated

Click-Selecting the Right Movement-Direction button will cause the entire Virtual Screen image to move to the right, by the percentage-per-click selected by the Slider/Arrows buttons. The Virtual Screen can also be moved to the Left, or Up and Down by the same means.

The following illustration shows a 16% rightward shift of the virtual screen caused by click-selecting the Right button four times. The Slider/Arrows controls have been used to select a 4% shift increment/per click of the Movement-Direction buttons:

Global Mode: Rotate Mode The Rotate Mode button brings up this screen:

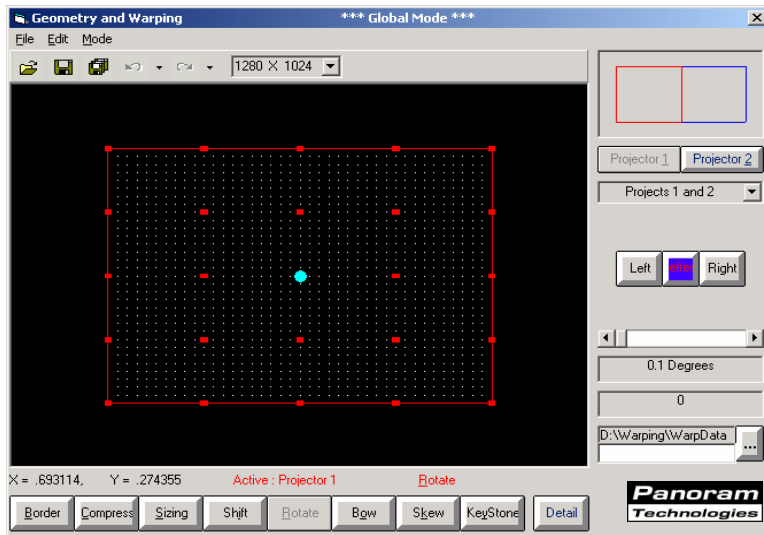


Figure 12 Rotate Mode - with center point selected / No rotation initiated

Note that the light blue control point selected as the “axle” for screen image rotation is in the exact center of the screen image area. Notice also that the Up/Down buttons have disappeared, and the Left and Right buttons actually rotate the image Clockwise (Right button) and Counter Clockwise (Left button). The number of degrees per click has been adjusted to 10° using the Slider or Arrow buttons. This Mode is useful to compensate for screen tilt.

Here’s the Rotate Mode screen as it appears when the Virtual Screen has been rotated counter clockwise 10° using the Left Button:

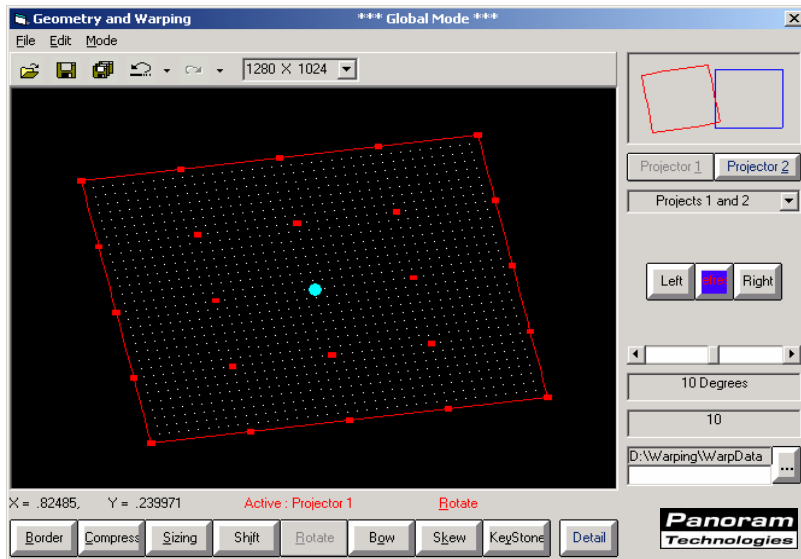


Figure 13 Rotate Mode - with screen image rotated 10° counter clockwise

Global Mode: Bow Mode facilitates projecting a rectangular image onto a screen surface with concave or convex anomalies within the projection area.

Bow Mode is used to compensate for curvilinear projection surface irregularities, or to project a correctly proportioned image over a deliberately “curvey” surface. The Movement-Direction buttons cause the intersection of the X and Y axis to move Up/Down/Right or Left, or a combination of these directions.

Here’s the Bow Mode screen when first selected, with no changes:

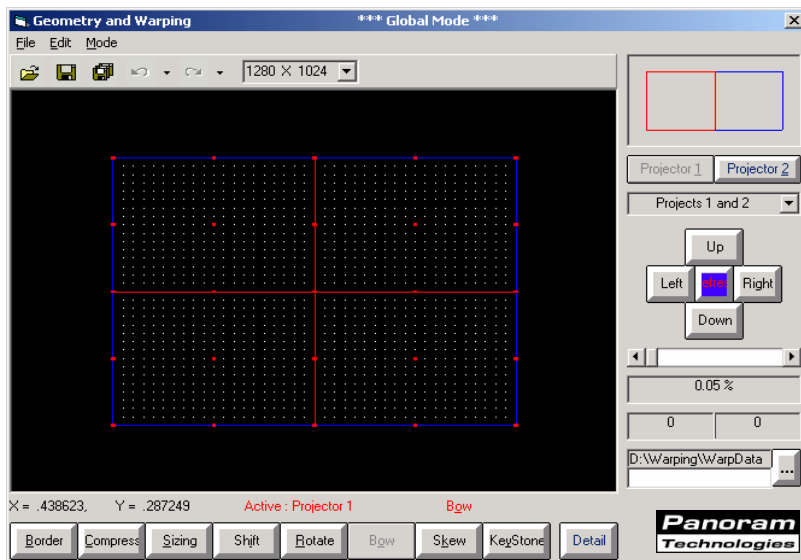


Figure 14 Bow Mode - without changes to the projected screen image

The next figure is the Bow Mode screen after a 10% downward movement of the X axis, along the Y axis. Notice that the white dot grid pattern is “bowed” in concert with the curve of the red X axis line, and that the grid dots below the line are squeezed together, while those above are expanded:

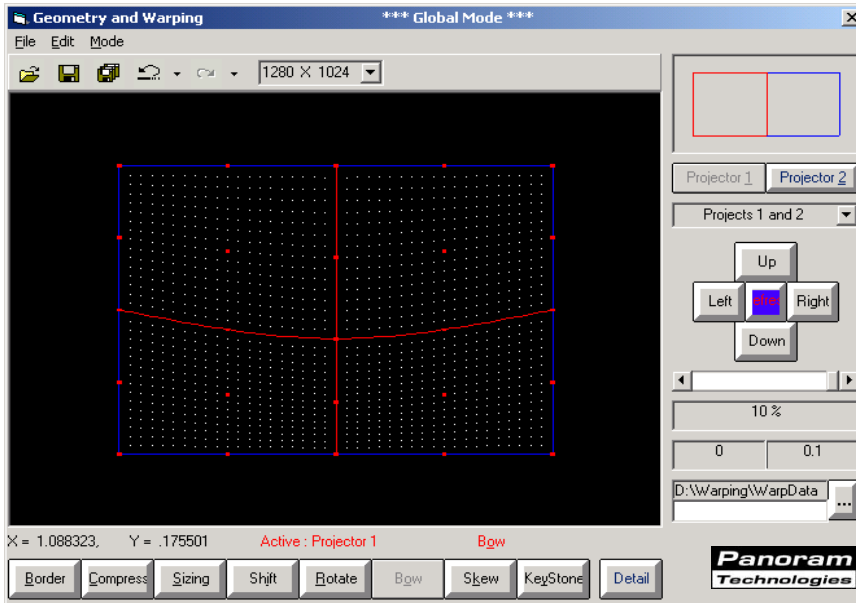


Figure 15 Bow Mode - with 10% down at the center

These characteristics are reflected in the projected image, once rendered by the Panomaker ® V. “Bowing” is expressed as *percentage* of change within the Pixel/Percentage/Degrees Windows.

Global Mode: Skew Mode is used to move opposite (both the vertical and horizontal) screen image edges in opposite directions. This control can be used to compensate for a screen that is itself physically skewed.

Here’s the initial Skew Mode screen:

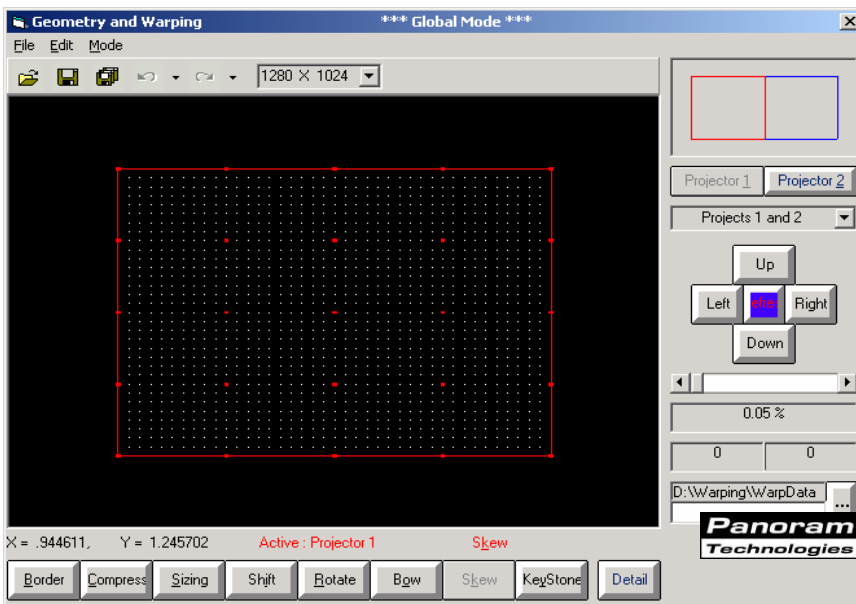


Figure 16 Skew Mode - initial screen with no changes.

Note that the Up/Down and Left/Right buttons are present. Skewing movements are measured as a percentage of positional change from the initial screen layout as seen above. The Slider and Arrow controls allow the user to set the percentage of change per click of the direction buttons.

Both the vertical and horizontal boundaries of the screen image can be skewed as the following illustrations show:

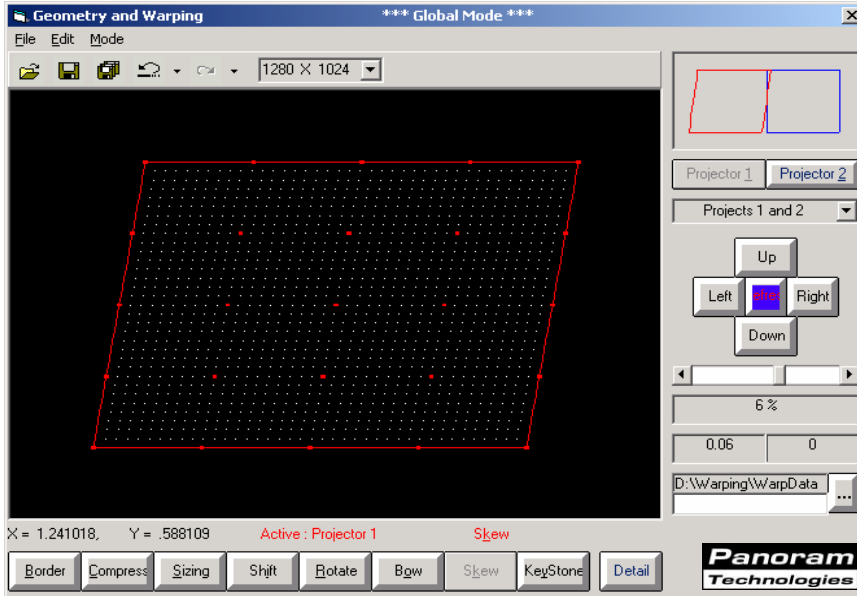


Figure 17 Skew Mode - vertical edges skewed

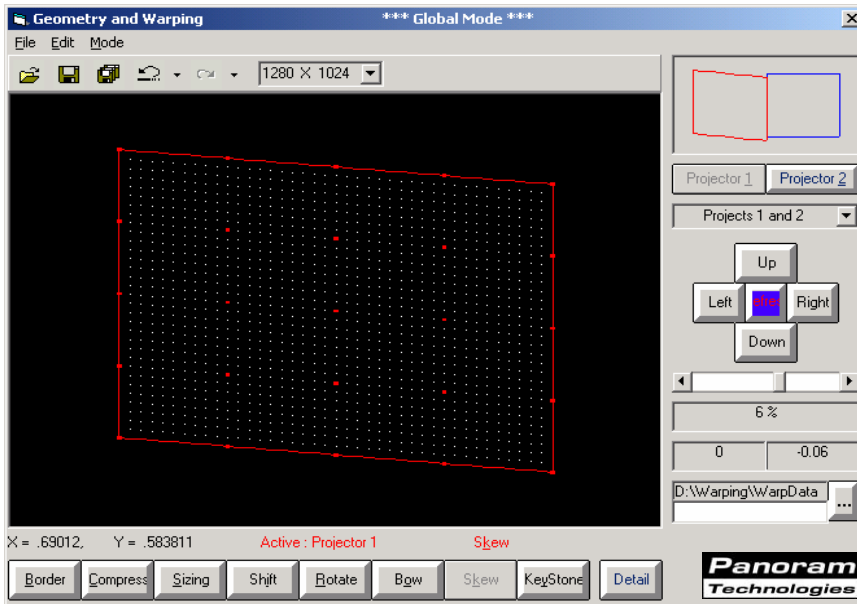
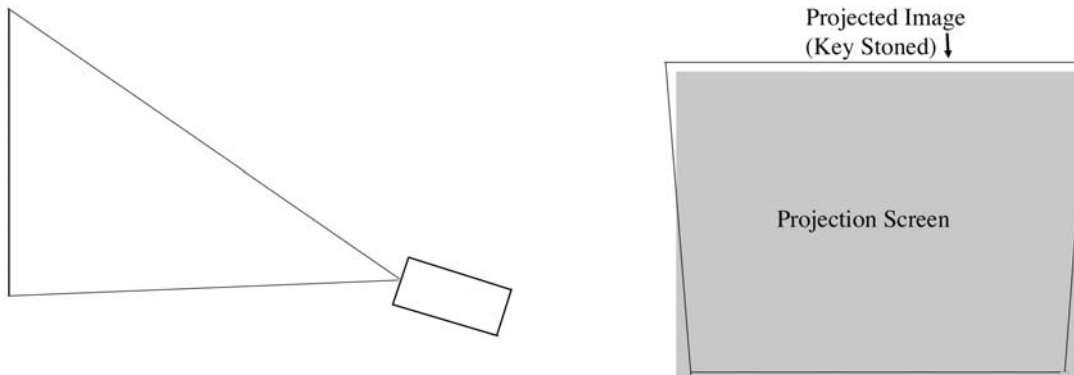


Figure 18 Skew Mode – horizontal edges skewed

GLOBAL MODE – KEYSTONE MODE

As previously mentioned, a projector positioned substantially above or below the center of the screen will tend to cast an image that is not a rectangle because the distance between the opposite screen edges and the optical center of the projector will not be equivalent:



Figures 19 and 20 Projected Image Key Stoning

Selecting the Key Stone Mode Button brings up this screen:

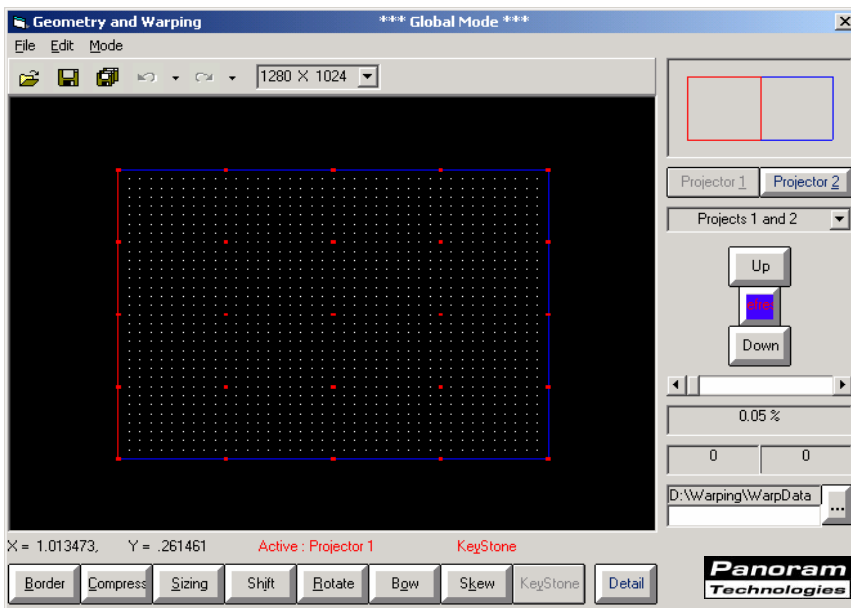


Figure 21 Keystone Mode - without changes to the projected image

Click selecting any of the vertical boundary lines will cause just the Up and Down buttons to be displayed. Clicking the Up Button increases the length of the selected line while Clicking the Down Button decreases that factor. The attached boundary lines will change their lengths to accommodate the change. The Horizontal boundary lines can also be selected, in which case Left and Right Buttons substitute for the Up and Down buttons. Changes to both vertical and horizontal boundaries are additive and interactive as the next set of illustrations demonstrates:

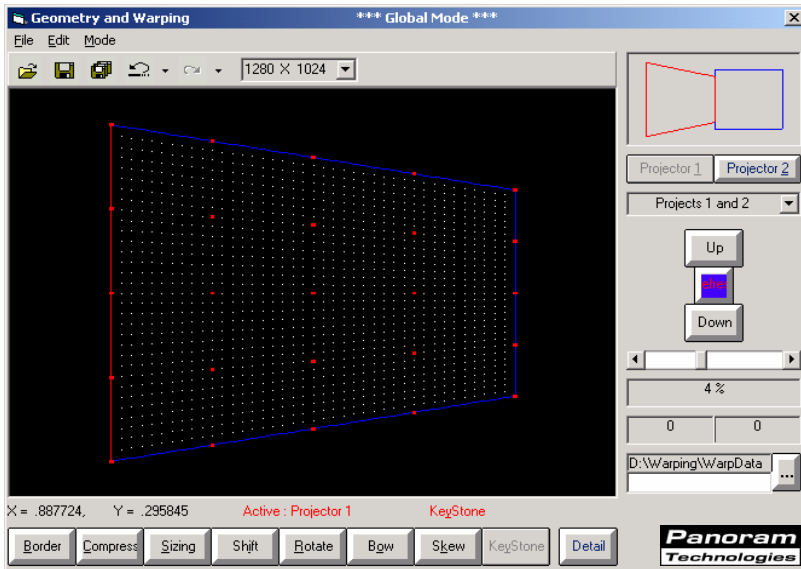


Figure 22 Keystone Mode - left vertical expanded

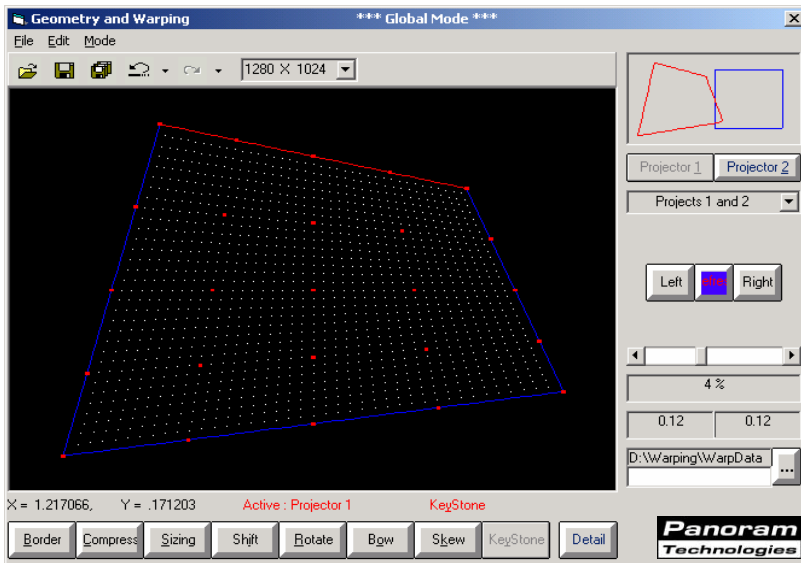


Figure 23 Keystone Mode - top edge contracted
Using the Detail Mode Controls



The Detail Button selects Detail Mode, which is used to fine tune and “tweak” details within the screen image. When the Detail Mode is entered, the global Mode buttons disappear, and are replaced by another set of controls:

Detail Mode: Point Adjust Mode

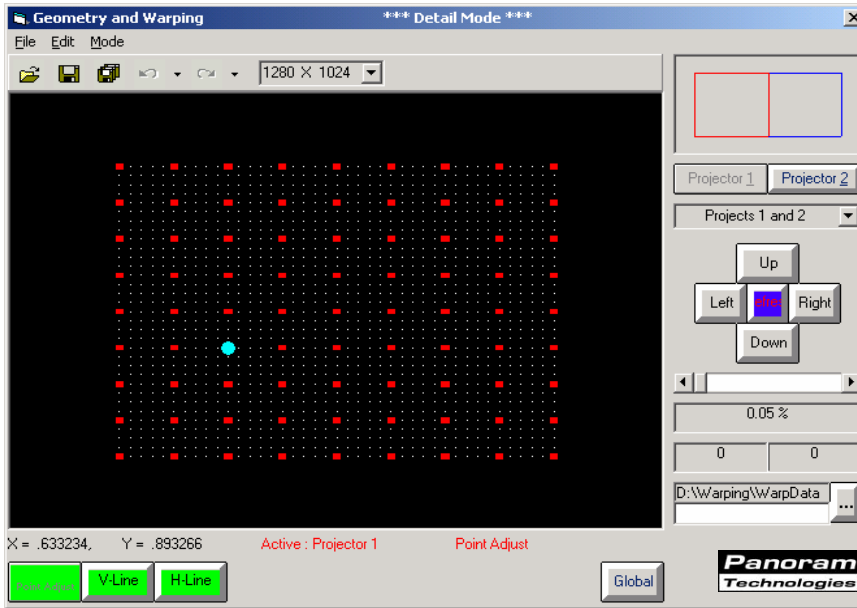


Figure 24 Detail Mode - Point Select with no change

As opposed to the Global Modes where adjustments affect all areas of the projected screen image to varying degrees, Detail mode allows adjustments to separate selected areas within the image. Generally, Global Mode adjustments should be made *before* entering Detail Mode.

In Detail/Point Select Mode any of the control points within the grid can be click-selected, such as the light blue dot in Figure 24, above. Once selected, the Up/Down and Right/Left buttons can be used to shift the selection point in those

directions. The white dots immediately adjacent to the selected point will move in concert with and in proportion to the movement of the selection point. Any point selected can be moved on both the X and Y axis simultaneously. Use Detail Mode Point Select to make subtle changes to the proportions of small areas of the projected image. In addition to the Point Adjust function, Detail Mode allows the user to select an entire line of selection points for X or Y axis movement. This “Line” function features either Vertical or Horizontal line selection:

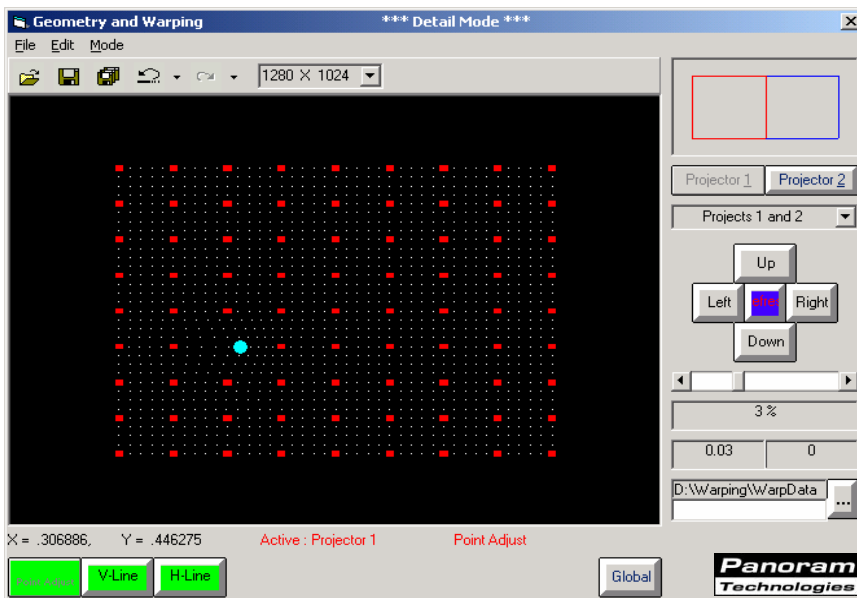


Figure 25 Detail Mode - Point Select with movement to the right

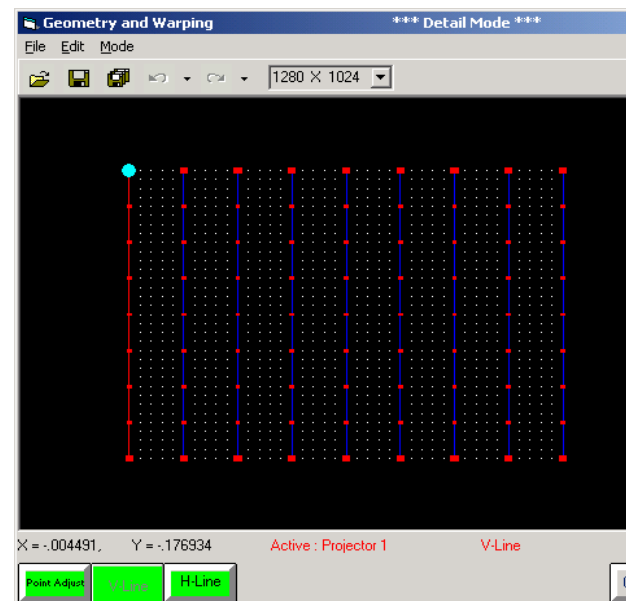


Figure 26 Detail Mode - Vertical Line Selection with no changes

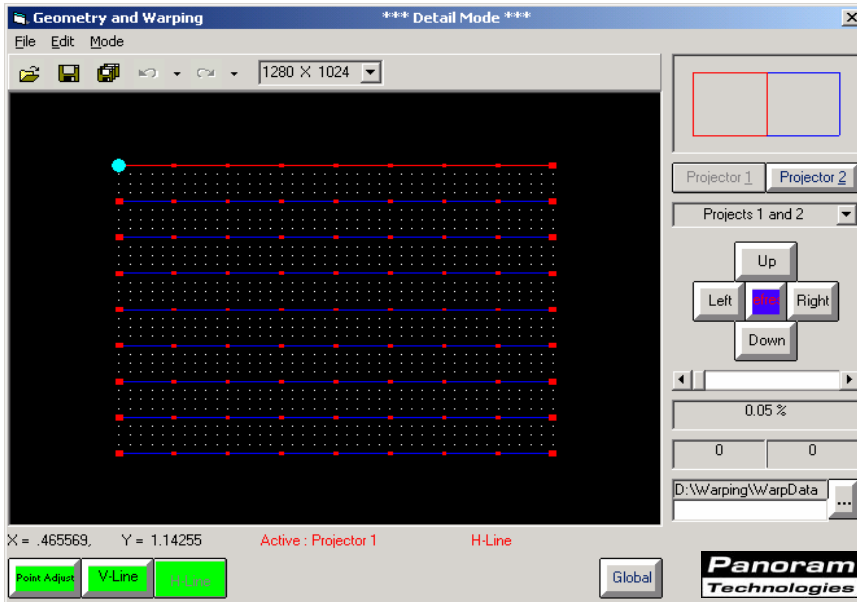


Figure 27 Detail Mode - Horizontal Line Selection with no changes

Any of the vertical or horizontal lines shown above can be click selected, depending on whether the **V-line** or **H-Line** button is activated. The Up/Down and Left/Right Buttons will then cause the entire selected line to move, which will pull and push the adjacent grid of white dots as well. Take a look at the following illustrations to see how much image correction is possible using these techniques:

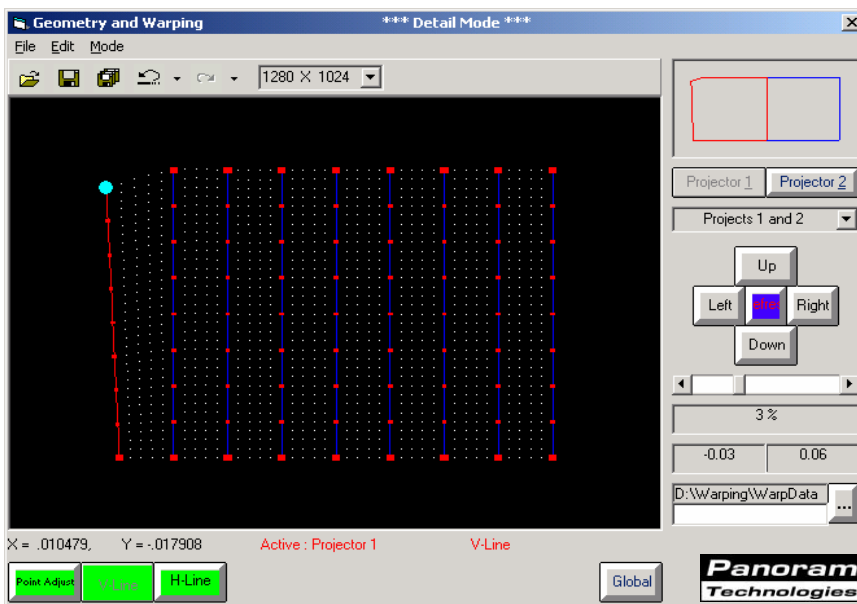


Figure 28 Detail Mode - Vertical Line adjustment

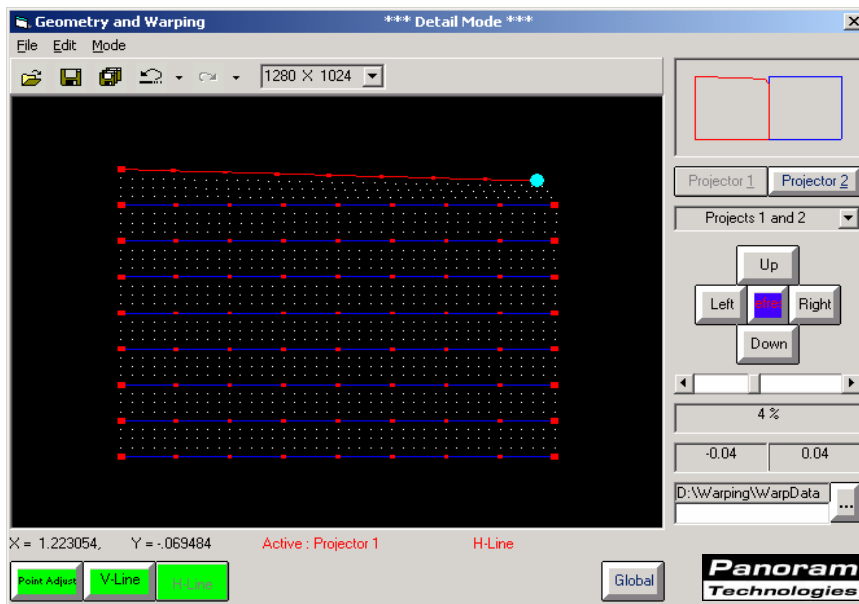


Figure 29 Detail Mode - Horizontal Line adjustment

Detail Mode moves selected points by a percentage moved per control click, which is set by using the Slider or Arrow Buttons.



To return to Global Mode, click-select the Global button, and it will cause the Global Mode controls to appear, and the Detail Mode controls to vanish.

SAVING AND LOADING WARP FILES

Only one projector can be adjusted at one time with the Geometry and Warping application window. The adjustment process involves making changes to the Virtual Screen representation of the projected image, and then Saving/Downloading those changes to the PanoMaker® V. Once downloaded to and rendered by the PanoMaker® V, changes you've made to the Virtual Screen will be reflected in the actual projected image.

To begin the Save process, press the button with three horizontal dots, in the lower right hand corner of the screen, within the Drive/Files Access field:

Figure 30 The Drive/Files Access Window



This action will open the Save window: Using the left hand down arrow, select the drive on which you want to save the file:

Then, release the cursor button. This will open a list of all file folders available on that drive:

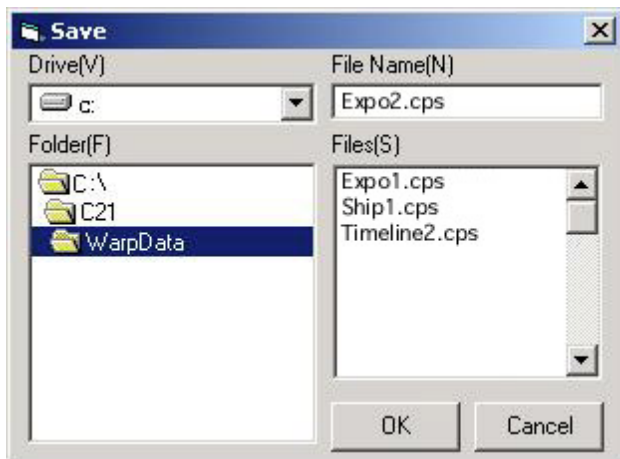


Figure 32 Save window, Selecting a folder, Naming the warp file

Click select the folder in which warp files are stored. Doing so will cause a list of all files in that folder to appear in the File(S) window. You can create a new folder for warp files using the usual methods common to PC's. Use the File Commands drop down List on the Menu Bar (See Page 4, Item 1)

The user needs to name the file in such a way as to make it easy to pick it out from others in the same folder. In general, it's a good idea to include the number of the affected projector as part of the file name. That way you'll be sure that the changes you've made will control the projected image they're

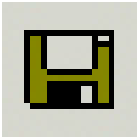
intended for. Choose a file name, then type that name into the File Name(N) window, and select the **OK button**. This will close the Save window. Note that the Drive/Access Window now displays the file name you've created, plus the drive and folder in which that file will be stored:



At this point the “Expo2.cps” file has been named but not saved to the drive and folder you’ve selected within database. To *save* the warp file you’ve named in the previous step, click-select the Save Warp Icon (page 4, Item 2):

This action will save all adjustment parameters for “Expo2.cps” to the WarpData

folder on the C drive.



Click the Save Warp Icon to save further changes under the same name. If you haven’t already named the file as described above, clicking the Save Warp Icon will open the Save window.

To see the effect of Virtual Screen changes on the actual projected image, it’s necessary to not only save the file data under a name, but to *download* this data to the PanoMaker® V. The PanoMaker® will render the video stream coursing through it according to the changes you’ve made to the Virtual Screen. To initiate this process, click-select the Save/Download Icon:



Click-selecting the Save/Download File Icon will set the process of saving and downloading into motion. A progress bar will appear in place of the X and Y cursor position windows (see page 4, Items 10 and 11) as the PanoMaker® renders the actual projected image to reflect changes made to the Virtual Screen.

If you’re not happy with what you see, continue to make changes to the Virtual Screen you feel will have the desired result. Then select the Save/Download File Icon again to save/download these additional changes, and observe the projected result. Further changes to the Virtual Screen will be saved under the same file name already established with the Save window.

If you want to retain the initial changes, but make small alterations to the image while saving these under a slightly different name (i.e. “Expo2.cps” becomes “Expo2.a.cps”) then click-select the button with three dots in the Drive/Files access area to open the Save window again. Change the file name and select the **OK** button. Then select the Save/Download File Icon to save the new version of the file, and to see its effect on the projected image.

If you haven’t already named the file, click-selecting the Save/Download File Icon will open the Save window. Name the file by following the procedure described previously.

LOADING SAVED WARP FILES



Loading existing files into the PanoMaker® V involves selecting those files from the database you’ve been building using the Save/Download procedures just described. Begin by selecting the Load Warp File Icon (page 4, Item 2)

This action will cause the Open Warp File screen to appear.

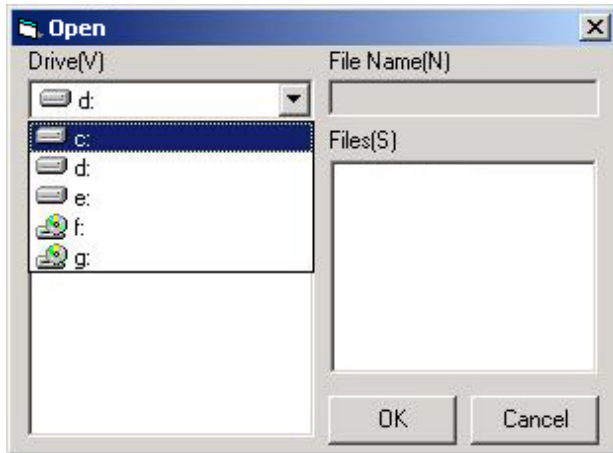
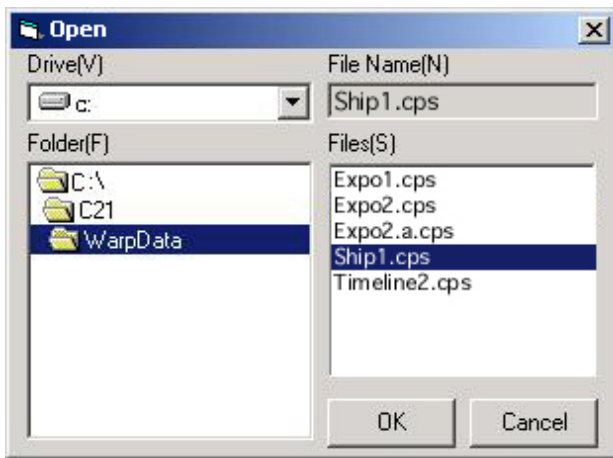


Figure 33 The Open Warp File screen Selecting a drive

If the Open screen is not already “parked” on the last drive/folder destination chosen for Saving, select the drive where you know the folder is located that you’ve been using to save warp files. Letting go of the cursor button will reveal the contents of the drive you’ve selected.

Figure 34 Open Warp File screen



Selecting the file folder and file for loading

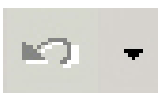
Click-select the folder containing the desired warp file (.cps) within the Folder(F) window. This will bring up a list of the contents of that folder inside the File(S) window. Choose the file you want to download to the Panomaker® V (and thus to the projector) by click-selecting.

Click the **OK** button. The selected file will then be downloaded to the PanoMaker® V, and its name will appear in the File Name(N) window within the Open screen.

The same name will also appear within the Drive/Files Access File Window. The Virtual Screen will show the file as well.

OTHER CONTROLS

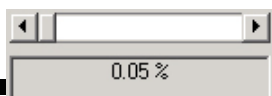
(Also see Page 4 for illustrations of how the following controls appear in the software interface).



The Undo icon - Allows the user to go back one or more steps, and erase the last command given through any of the controls.



The Redo icon - Cancels Undo commands, and reestablishes the commands, in the order given. *There are twenty levels of Undo and Redo.*



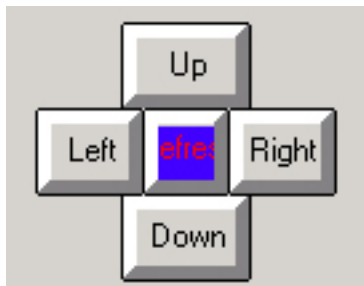
Slider and Arrow - These select how many pixels, percent, or degrees a selected image area is moved by the Movement/Direction Buttons. The window shows the factor set by the

Slider/Arrow Buttons Controls These windows show movement of selected image areas measured along an X and Y axis.

CONTROLS

X/Y Axis Factor

Windows reading in Pixels, Percentages, or degrees of Rotation indicating changes to selected control points (or lines) within the Virtual Screen.

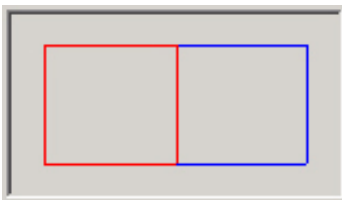


Movement/Direction Buttons

These controls initiate movement of selected areas within the image on the Virtual Screen. The *amount* of change is controlled by the Slider/Arrow Buttons. The *direction* of movement is established by which button is selected.

The **Screen Refresh Button** refreshes the projected image produced by the PanoMaker® .

It does this by resetting the PanoMaker's internal image adjustment parameters. Use this button in situations where the projected image is frozen or otherwise "messed up".



Projector Pair Screen

The blue and red rectangles reflect which projector is selected to have adjustments made to its image. The red rectangle is the selected projector. Two projector systems will appear as two rectangles.

Projector Selector



Use the drop down arrow to select which projector pair (of all those installed) will be available for control by the Software.

Use the **Reset Command** (within the drop down Edit list on the Menu Bar) to cancel all commands given by any of the controls and to return the Virtual Screen back to zero values.

The **Menu Bar** has File, Edit, and Mode drop down lists. The functions made available will be familiar to all PC users.

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PanoMaker® V STANDARD WARRANTY

Warranty. For the first twelve (12) months after the date of purchase of the Panoram PANOMAKER™ V (hereinafter referred to as PANOMAKER®), Panoram Technologies, Inc. (hereinafter referred to as PANORAM) will at its sole discretion, repair or replace any defective unit without charge for labor or parts.

Return Authorization. Upon receipt of a call from Customer to PANORAM to report a problem with their PANOMAKER®, and if the problem cannot be handled by a PANORAM technician by phone and the technician determines that the problem is one which requires factory service, PANORAM will issue a Return Merchandise Authorization Number (hereinafter referred to as RMA#) to Customer. No PANOMAKER® will be accepted at the PANORAM Repair Facility (hereinafter referred to as PANORAM Facility) without a PANORAM issued RMA #.

Shipping. Customer will bear the cost of shipping their PANOMAKER® to the designated PANORAM Facility, and be responsible for that shipment until it has reached the PANORAM Facility (Customer ships defective unit to PANORAM FOB destination)

Upon repair of the defective unit, PANORAM will bear the cost of shipping to Customers specified and PANORAM approved site and be responsible for that shipment until it has reached Customer's location. (PANORAM ships repaired unit to Customer FOB Destination)

The repaired PANOMAKER® will be shipped to Customer via standard ground shipping service. If Customer chooses shipping to be expedited, the repaired PANOMAKER® will be shipped as per Customer's instructions and the cost of shipping will be paid directly by the Customer to the shipper. **IMPORTANT NOTE:** Any PANOMAKER® unit(s) received by PANORAM for repair **MUST** be shipped in its original packaging or packaging purchased from PANORAM. **ANY PANOMAKER® RECEIVED BY PANORAM NOT SHIPPED IN Its ORIGINAL PACKAGING OR PACKAGING PURCHASED FROM PANORAM, WILL VOID ALL WARRANTIES.**

Length of Time to Repair. After receipt of a PANOMAKER® at the PANORAM facility, diagnosis and repair will be complete on a timely basis. It is PANORAM policy to make all best efforts to diagnose and repair unit(s) so they are ready to ship back to Customer within an eight (8) business day period which begins upon signed receipt of the PANOMAKER® at the PANORAM Facility.

Extended Length of Time to Repair. If the length of time to repair the PANOMAKER® exceeds an eighteen (18) business day period, PANORAM will, at its sole discretion and at no charge to the Customer, replace the Customer's defective PANOMAKER® with another unit.

EXCLUSIONS: This warranty is limited and only covers normal use. PANORAM does not warrant and is not responsible for:

Shipping Damage. This means damage resulting from abuse in shipment of the PANOMAKER® when Customer is responsible for shipment. All PANOMAKER® 's must be received in its original packaging or packaging purchased from PANORAM.

Environmental Damage. This Warranty does not cover damage or repairs that are necessary due to floods, winds, fires, lightning, accidents, corrosive atmosphere, excessive exposure to water (moisture) or heat, or any other conditions beyond the control of PANORAM.

Serial Number Defacement. This Warranty is void for the PanoMaker® if the serial number has been changed, removed, or defaced.

Misuse. This Warranty does not cover repairs that are necessary due to:

Incorrect or improper installation or maintenance;

Incorrect or incompatible integration with other components including screen, switchers, projectors, interfaces, sources or other system components;

Voltage conditions, blown fuses, open circuit breakers, or any other inadequacy or interruption of grounded electrical service for any reason;

Abuse, improper servicing, or any other improper operation, including miss-adjustment of any control;

Damage caused by other hardware, software, equipment and cables or accessories not supplied, qualified or approved by PANORAM;

Damage resulting from your failure to back-up your data or other files;

Defects in or caused by associated equipment or

Repair and/or modification of PanoMaker® performed other than PANORAM factory authorized personnel.

WARRANTY TRANSFER: Customer may transfer this warranty if their PanoMaker® is currently under PANORAM's Standard Warranty. In this case, proof of purchase or transference of PanoMaker® must be submitted to PANORAM in writing. Customer may not transfer a warranty more than once in a 90 day period. Customer may transfer any unexpired warranty with the knowledge that the PANORAM Standard Warranty is subject to change without notice.

THIS PANORAM STANDARD WARRANTY IS SUBJECT TO CHANGE AT ANY TIME WITHOUT NOTICE.

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IN NO EVENT SHALL PANORAM OR CUSTOMER BE LIABLE TO THE OTHER FOR SPECIAL, EXEMPLARY, PUNITIVE, CONSEQUENTIAL, INCIDENTAL OR INDIRECT DAMAGES, INCLUDING, BUT NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS OR REVENUE, ECONOMIC LOSS, LOSS OF BUSINESS OPPORTUNITY, LOSS OF GOODWILL, LOSS OF DATA, LOSS OF USE OF THE PRODUCT OR ANY ASSOCIATED EQUIPMENT, COST OF CAPITAL, COST OF SUBSTITUTE OR REPLACEMENT EQUIPMENT, FACILITIES OR SERVICES, DOWN TIME, CUSTOMER TIME, THE CLAIMS OF THIRD PARTIES, AND INJURY TO PROPERTY, REGARDLESS OF THE NATURE OF THE CLAIM OR THEORY OF LIABILITY, INCLUDING BUT NOT LIMITED TO, BREACH OF WARRANTY, BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR STRICT LIABILITY, AND EVEN IF THE OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH LOSS OR DAMAGE.

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THE LIMITATIONS IN THIS SECTION WILL APPLY NOTWITHSTANDING THE FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY.

THIS PANORAM STANDARD WARRANTY IS SUBJECT TO CHANGE AT ANY TIME WITHOUT NOTICE.

