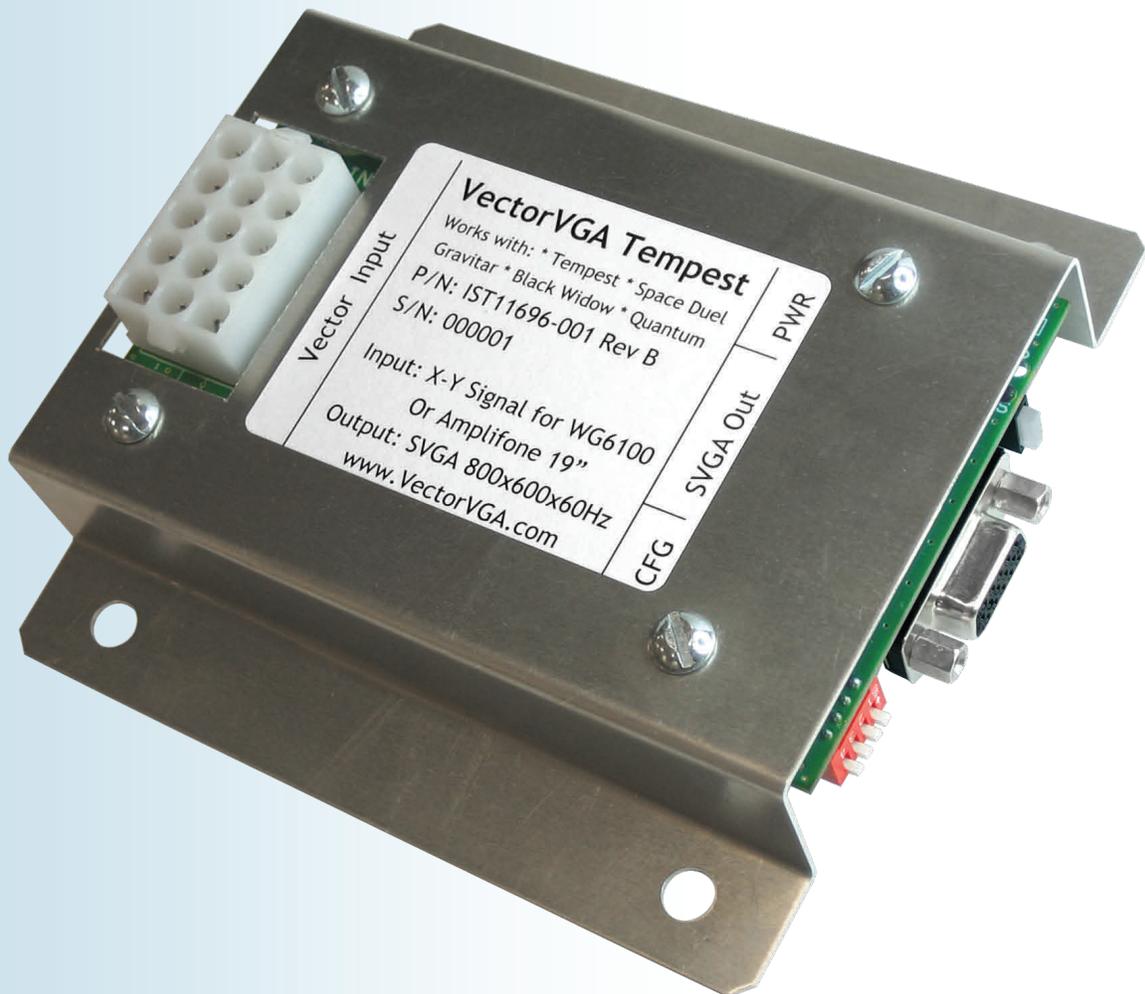


# VECTORVGA

# Tempest User Manual





# Notice Regarding This Product

## **WARNING!**

To install this product you should:

- Be familiar with safe handling procedures for electronic components.
- Be able to use hand tools such as a screwdriver.
- Be able to follow directions.

Arcade machines are designed to be serviced and are subsequently well built, but by modifying any device you accept the risk that you may break something.

## **PLEASE READ THESE INSTRUCTIONS COMPLETELY BEFORE STARTING.**

All attempts have been made to make this an easy and clean installation but please note that all machines and parts are not made exactly the same way. You will need to use common sense if the instructions differ significantly from what you encounter in your own machine.

## Product Warranty / Service

Imaging Systems Technology, Inc. warrants that the equipment furnished will be free from defects in material and workmanship for a period of thirty days from the date of shipment. During the warranty period, we shall, at our option, either repair or replace any product that proves to be defective under normal operation.

This warranty shall not apply to equipment that has been previously repaired or altered outside our plant in any way as to, in the judgment of the manufacturer, affect its reliability. Nor will it apply if the equipment has been used in a manner exceeding its specification or if the serial number has been removed.

Imaging Systems Technology, Inc. does not assume any liability for consequential damages as a result from our product uses, and in any event our liability shall not exceed the original selling price of the equipment. The remedies provided herein are the customer's sole and exclusive remedies. In no event shall Imaging Systems Technology, Inc. be liable for direct, indirect, special or consequential damages whether based on contract or of any other legal theory.

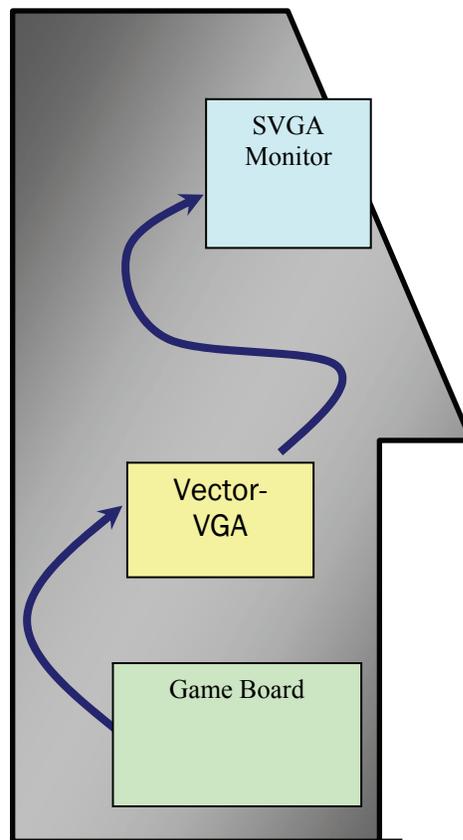
The equipment must be returned postage-prepaid. Package it securely and insure it. You will be charged for parts and labor if the warranty period is expired or the product proves to be misused, abused, or has unauthorized repairs or modifications.

# Introduction

Vector arcade games were ahead of their time with sharp, bright, high-resolution graphics. They are fun to own and operate, but the Achilles' heel of the vector arcade game is the unreliable monitor. Vector monitors are hard to find, expensive, and likely to fail and require expensive repairs. VectorVGA Tempest enables you to use a new, reliable, high quality SVGA monitor in your vector arcade game without fear of vector monitor problems.

VectorVGA Tempest installs in a working arcade machine without any modifications to the wiring harness or cabinet. It simply plugs into the monitor connector from the wiring harness, converts the vector signal to a standard SVGA signal, and allows you to use any SVGA monitor. Make sure to verify that your SVGA monitor is compatible with the SVGA Monitor Specification in this manual. If your game has very dark smoked glass, like Tempest, you may need to replace it with a much lighter tint because standard monitors aren't as bright as vector monitors. Finally, be sure to verify the RMS supply voltage coming from your game wiring harness. If it is out of spec, it could be the reason that the vector monitor failed, and may damage the VectorVGA board as well. Damage caused by out-of-spec power voltage is not covered under the warranty.

VectorVGA Tempest works by receiving analog vector video from the game board and digitizing the analog signals. The digital vector information is rendered and frame-buffered, then output as a standard SVGA video signal. The power LED is Green to indicate that the converter is receiving power and a valid vector signal. If there is a problem with the vector signal from the game, the power LED turns Red. Four DIP Switches configure the converter for use in your specific game. The switches allow you to rotate the screen 180°, correct for the small pincushion difference between the Wells-Gardner 19K6100 and Amplifone monitors, fine-tune line quality with the Gamma setting, and can display a checkerboard pattern for LCD monitor pixel sync. Be sure to set the DIP switches before installing the converter.



*VectorVGA Signal Flow Diagram*

# Arcade Game Compatibility

VectorVGA Tempest is designed to replace the Wells-Gardner 19K6100 monitor and Amplifone 19” monitor in the following games:

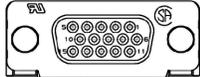
- Atari Tempest (Wells-Gardner 19K6100 monitor)
- Atari Space Duel (Wells-Gardner 19K6100 monitor)
- Atari Gravitar (Wells-Gardner 19K6100 monitor)
- Atari Black Widow (Wells-Gardner 19K6100 monitor)
- Atari Quantum (Amplifone 19” monitor)

VectorVGA Tempest is specifically optimized for *these* games and will not provide good results in other games. If the converter is used in other games that use the Wells-Gardner 19K6100 or Amplifone monitors, it will not harm the converter but line colors may not be correct and there may be some undesirable visual artifacts including flicker and line tearing.

# SVGA Monitor Specification

VectorVGA Tempest outputs a standard SVGA video signal that can be used with any SVGA monitor. The SVGA video signal is 800 x 600 pixel resolution. The complete video output specification is shown below. **Be sure to confirm that your monitor can accept this video format.**

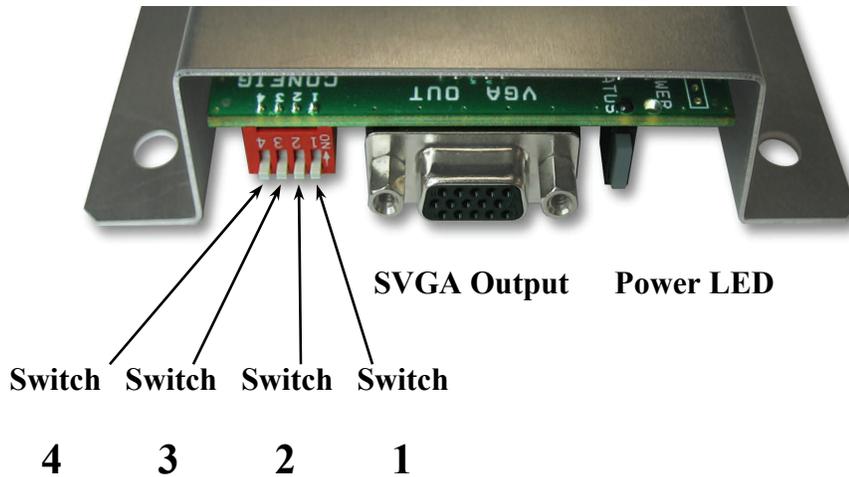
There are many different types of monitors that may be used with VectorVGA Tempest. These include CRT computer monitors, LCD computer monitors, open-frame SVGA arcade monitors, and anything else that accepts an SVGA video signal. Note: ***CGA, EGA, and VGA open-frame arcade monitors won't work.*** Your monitor must accept *SVGA* video.

SVGA Output Specification	
Connector:	DE-15 Female 
Resolution:	800 x 600 pixels
Vertical Refresh Rate:	60 Hz
Horizontal Refresh Rate:	38 kHz
Aspect Ratio:	4:3
RGB Output Level:	0.7V
RGB Output Impedance:	75Ω double terminated
Sync Signal Level:	3.3V TTL
Hsync Polarity:	Negative
Vsync Polarity:	Positive

For the easiest installation and the most authentic original look, an open-frame SVGA arcade monitor is recommended. The 19" Wells-Gardner WGE1995 monitor gives good results and is recommended. It is available directly from Wells-Gardner at [www.wgec.com](http://www.wgec.com). You may wish to order it with two extra side rails, four self-tapping screws to install the side rails, and a power cable.

# DIP Switch Settings

There are four DIP switches that configure the VectorVGA Tempest converter for use in your particular arcade game. Set each DIP switch according to the recommendations below.



## ***DIP Switch 1: Rotate***

Set this switch according to the orientation of the monitor in the game. When this switch is ON, the picture will rotate 180°, otherwise rotation is 0°.

### **Switch 1: Rotate Setting**

		
Horizontal	Vertical, 90° CCW	Vertical, 90° CW
Switch 1 = OFF	Switch 1 = OFF	Switch 1 = ON

## ***DIP Switch 2: Pincushion Correction***

Set this switch according to your arcade game. This setting compensates for the pincushion and linearity difference between games designed for the Wells-Gardner 19K6100 and Amplifone monitors.

Hint: if this switch should be OFF for your game, and the lines aren't straight, consult your arcade game manual for the procedure to adjust *Linearity*.

### **Switch 2: Pincushion Correction Setting**

<b>Arcade Game</b>	<b>Switch 2</b>	<b>Notes</b>
Tempest	OFF	Correction on game board
Space Duel	OFF	Correction on game board
Gravitar	OFF	Correction on game board
Black Widow	OFF	Correction on game board
Quantum	ON	Correction on monitor

## ***DIP Switch 3: Gamma***

Set this switch according to the type of your SVGA monitor. This setting adjusts for the different monitor gamma values between most CRT and LCD monitors. This is a subjective setting and it is recommended to try each setting and use whichever looks better. This should be set so the thickness of diagonal lines appears the same as the thickness of horizontal and vertical lines, and overall line quality looks best. The difference will be subtle. Here are recommended settings to start:

### **Switch 3: Gamma Setting**

<b>Monitor Type</b>	<b>Switch 3</b>	<b>Notes</b>
LCD	OFF	Gamma = 1.5
CRT	ON	Gamma = 2.2
Other	Try both	See which looks better

### ***DIP Switch 4: Monitor Calibration***

This switch should always be OFF. This is an advanced setting to improve video quality on LCD monitors and other digital displays that have a “pixel sync” or “auto adjust” feature. When the monitor is properly calibrated, the picture is sharper. When Switch 4 is ON, the displayed checkerboard pattern provides an optimal pattern for pixel synchronization.

#### **Switch 4: Monitor Calibration Screen**

<b>Mode</b>	<b>Switch 4</b>	<b>Notes</b>
Normal	OFF	Normal operation
Calibration	ON	Calibration screen for digital monitors

If your digital monitor supports pixel sync, follow these steps:

1. Turn on the game, VectorVGA Tempest converter, and monitor.
2. Set Switch 4 to ON. This displays a grid pattern on the monitor.
3. Activate the monitor “pixel sync” or “auto adjust” function.
4. Set Switch 4 to OFF when “pixel sync” is finished.

# Installation

Now that you have read the entire manual up to this point (right?), you are now ready to install the VectorVGA Tempest converter. Be sure to have your arcade manual handy because you may need it to remove the vector monitor and adjust the video settings on the game board.

## *Before You Start*

- Verify that your monitor supports SVGA.
- Test the monitor supply voltage at the vector monitor plug. Use a multi-meter set in AC (RMS) Voltage mode. The voltage between pins 13 & 14, and 14 & 15 should measure between 20.0 and 32.5 VAC<sub>RMS</sub>. If the voltage is outside this range, DO NOT USE VECTORVGA UNTIL THE PROBLEM IS FIXED. Damage to the VectorVGA board caused by out-of-spec voltage is not covered by the warranty.
- Know how you will mount your monitor in the cabinet. An open-frame 19" arcade monitor is a drop-in replacement, but any other kind of monitor will require a custom mounting solution.
- Set the VectorVGA Tempest DIP switches.
- Have a replacement for the original smoked glass (if needed).
  - Recommended: Acrylic sheet, translucent with gray tint, 0.236" thickness, cut to same dimensions as original smoked glass. Try [www.mcmaster.com](http://www.mcmaster.com) or a local glass or sign shop.

## *Installation Steps*

1. Unplug your arcade game and SVGA monitor.
2. Follow your arcade manual's instructions to remove the vector monitor.
  - » Do not dispose of the vector monitor! Sell or give it to an arcade enthusiast who wants it.
3. Install your SVGA monitor.
4. Optional Step: Replace very dark smoked glass with a lighter piece of tinted acrylic (if necessary).
5. Plug the wiring harness monitor connector into the VectorVGA Tempest converter.
6. Plug the VGA cable from your SVGA monitor into the VectorVGA Tempest converter.
7. Mount the VectorVGA Tempest converter in a suitable location inside the cabinet. Use #10 screws.
8. Plug in and turn on your arcade game and SVGA monitor.
9. Adjust SVGA monitor picture settings
  - » Set DIP Switch 4 to ON. This provides a full-screen pattern.
  - » Adjust monitor settings until the picture is centered, full size, straight, and bright.
  - » Set DIP Switch 4 to OFF.
10. Adjust your game board AVG settings. Follow your arcade game manual instructions to adjust the screen settings on the game board.
  - » Hint: You may need a second person, or a carefully placed mirror, to watch the screen in front while the game board is adjusted in the back. You may find it easier to adjust the game board with the monitor sitting beside you out side of the cabinet.

**Optional Step #1:** Pixel Sync for a sharper picture. (LCD and digital monitors only)

If your digital monitor supports “pixel sync,” or “auto,” follow the instructions for DIP Switch 4: Monitor Calibration.

**Optional Step #2:** Adjust Gamma for optimal lines.

Fine-tune the line quality by trying both VectorVGA Gamma settings. Follow the instructions for DIP Switch 3: Gamma.

You are now done and ready to play your arcade game! If you have any problems, see the Troubleshooting section.

# Troubleshooting

Problem: The game is On and the screen is completely black. The VectorVGA power LED is OFF (milky white).

Answer: Plug the wire harness monitor connector into the VectorVGA Vector Input.

Answer: Test power coming from the wire harness monitor connector. The AC voltages between Pin 13 to Pin 14, and between Pin 14 and Pin 15 should be 25 VAC<sub>rms</sub> each.

Problem: The game is On and the screen is completely black. The VectorVGA power LED is Green.

Answer: Verify that the monitor supports 800 x 600 x 60 Hz SVGA video signal.

Answer: Check the vector video signal. The R, G, B, or X, Y signals may not be changing.

Problem: The game is On and the monitor shows the error signal “Frequency Out of Range.”

Answer: The monitor cannot support 800 x 600 x 60 Hz mode. Use a monitor that supports SVGA.

Problem: The picture is upside down.

Answer: Flip **DIP Switch 1**.

Answer: Flip the monitor.

Problem: The lines on the screen aren't straight; they're slightly curved. My game requires **DIP Switch 2** to be *OFF*.

Answer: This can be adjusted on the game board. Consult your arcade game manual on how to adjust *Linearity*.

Problem: The lines are too dark / too bright *and* the diagonal line thickness is different than horizontal and vertical lines.

Answer: Try changing the Gamma setting, **DIP Switch 3**, with settings ON and then OFF. Use whichever setting looks better.

Answer: Try different monitor Gamma settings (if available in the monitor OSD menu).

Problem: The screen shows VectorVGA Tempest splash screen. How do I get rid of it?

Answer: Flip **DIP Switch 4**.

Problem: The screen shows a small, jumbled, clump of lines, and that is all.

Answer: Check the vector video signal. The R, G, and B signals are toggling (this is good), but the X and Y signals are not connected or not changing.

Problem: All the lines are only being drawn on one horizontal / vertical line on the screen.

Answer: Check the vector video signal. The X or Y signal is not connected or not changing.

Problem: The graphics are stretched / shrunk in one or both directions.

Answer: This can be adjusted on the game board. Consult your arcade game manual on how to adjust *horizontal* or *vertical screen size*.

Problem: The graphics are not centered on the monitor.

Answer: This can be adjusted on the game board. Consult your arcade game manual on how to *center the video output*.

Problem: The monitor is *really* dark and I'm using the arcade game's original smoked glass.

Answer: The original smoked glass is too dark for normal raster monitors. Replace it with a piece of tinted acrylic that isn't as dark. Also, increase the monitor intensity using the monitor controls, but this is usually not enough to overcome the darkness of the original glass. Replacement glass recommendations are given in the *Before You Start* section.

Problem: My CRT monitor is mounted vertically and the colors don't look right.

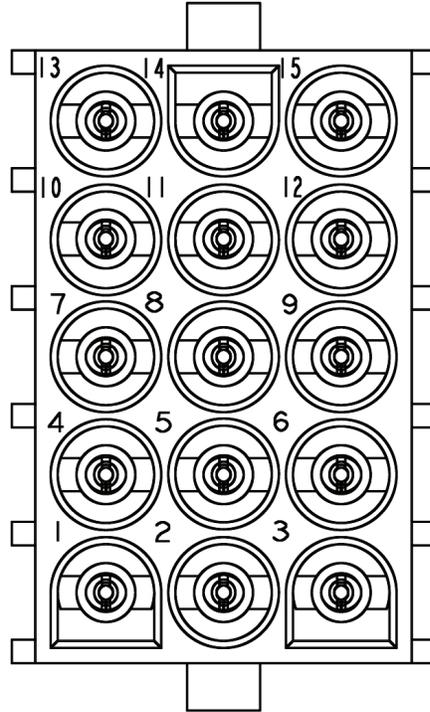
Answer: The monitor needs to be degaussed, but the only way to fully degauss a CRT monitor is to turn it off for about 15 minutes to let it cool down, turn it on, and degauss it via the OSD menu or the degauss button. When a CRT is vertically oriented, it will need to be degaussed every time it is moved. The magnetic field of the earth deflects the electron beam in a CRT monitor when it is mounted vertically.

# Vector Input Specification

The Vector Input connector is pin-compatible with the Wells-Gardner 19K6100 and Amplifone monitors. The vector input specification and connector pinout are included for reference.

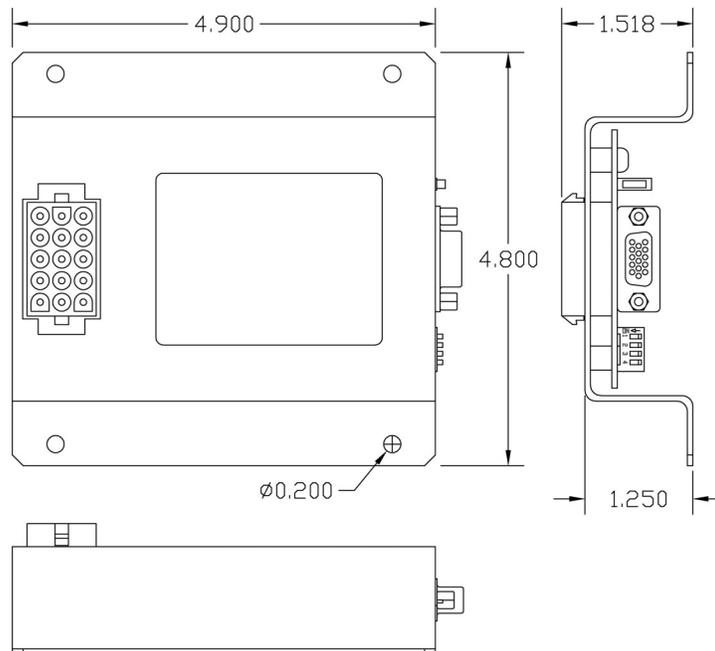
<b>Vector Input Specification</b>	
Connector:	15-pin AMP Header, Male pin
X Input Level:	±8V
X Input Impedance:	2.4 kΩ
Y Input Level:	±6V
Y Input Impedance:	2.4 kΩ
X & Y Bandwidth:	1.6 MHz
RGB Input Level:	1V Black, 3.5V Max
RGB Input Impedance:	1.0 kΩ
RGB Bandwidth:	2.0 MHz
Power:	25 VAC <sub>rms</sub> Center Tapped
	+30% / -20%, 3W

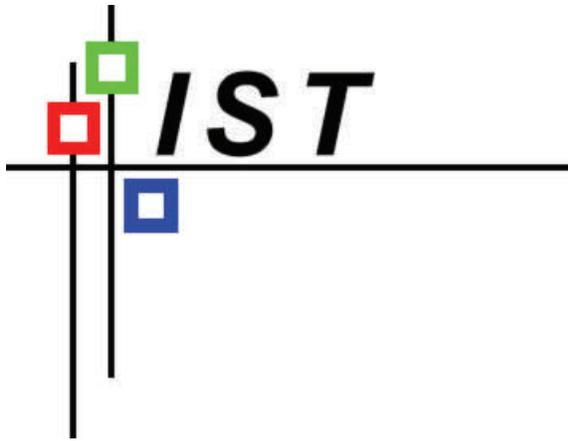
Vector Input Pinout	
Pin	Signal
1	Red
2	Green
3	Blue
4	Red Gnd
5	Green Gnd
6	Blue Gnd
7	X
8	Y
9	N.C.
10	X Gnd
11	Y Gnd
12	Earth Gnd
13	25 VAC <sub>rms</sub>
14	Power Gnd
15	25 VAC <sub>rms</sub>



## Board Dimensions

The board with enclosure measures 4.90" x 4.80" x 1.52".





## VECTORVGA TEMPEST

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