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SIGNAL CONVERTERS

IN1401 RGB VIDEO SCALER



IN1401

OPERATION MANUAL

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Product Overview

DESCRIPTION

The **IN1401** is an advanced RGB Video Scaler that takes an RGB signal at various scan rates and resolutions and uses sophisticated digital video scaling technology to convert it to a standard VGA video signal.

Industrial and Process Control Applications - The **IN1401** can act as a bridge between the installed base of proprietary process control systems and modern data displays. Because the unit accepts a wide range of standard and non-standard analog video signals and converts them to standard VGA resolutions and refresh rates, it also allows obsolete, long-persistence phosphor monitors to be replaced with standard VGA monitors and flat panel displays. The **IN1401** also provides enhanced ergonomics by converting 50 and 60 Hz input signals to higher, flicker-free refresh rates.

A/V Display System Applications - The **IN1401** provides an economical way to provide high quality video scaling of NTSC and PAL RGB video signals from high-resolution cameras, visualizers, document cameras and other devices featuring an RGB video output. The **IN1401** also provides superb upscaling for 640 x 480, 800 x 600 and 1024 x 768 resolution video signals, making it an excellent companion for LCD and DLP display devices that have marginal on-board video scaling capability. The **IN1401** has been optimized for scaling RGB computer video signals, RGB signals from document cameras, and other video signals that do not contain a great deal of fast motion. The **INLINE IN1402, IN1403, IN1404, IN1404XT and IN1408** Video Scalers are recommended for applications requiring superb video scaling for composite video, S-video, component video and RGB video signals containing fast, continuous motion.

Comprehensive Input Adjustment Controls - are provided to optimize the unit when used with propriety and non-standard input signals. These input signal adjustments include: Total Pixels, Active Pixels, Active Lines, Horizontal and Vertical Blanking, Phase and Scan Type. Once adjustments are made to optimize non-standard input signals, these settings are stored and automatically recalled when the same input signal is encountered again.

Blue Screen - This feature provides a full-screen blue image for set-up and testing purposes. The blue screen output signal (activated via on-screen menu) is always available, even when the input signal is missing or the input settings are incorrectly adjusted. Blue screen is ideal for establishing the desired output resolution, refresh rate and position settings, and to verify the connection to the output display device.

Additional Features Include:

On-Screen Control Menus - provide intuitive control for input and output signal adjustments as well as advanced settings such as reset to factory defaults. **System Info** is a menu option that uses the on-screen display to show comprehensive information about both the input and output signals.

Selectable Output Resolution and Refresh Rate - The **IN1401** offers a wide range of output resolutions to match the optimum or native resolution of virtually any display device.

Output Signal Adjustments - are included for horizontal and vertical positions, brightness and contrast, and individual gain controls for red, green and blue.

RS-232 Serial Control (IN1401-2 Model Only) is provided for all scaler functions including input selections, image adjustments and output settings. The **IN1401-2**'s comprehensive RS-232 control capacity facilitates complete system integration and effortless control when combined with a third party control system.

Data Display Friendly Output - The **IN1401** provides a progressive scan RGBHV output at standard VGA resolutions and refresh rates, ensuring optimal compatibility with a wide range of CRT, LCD, DMD, ILA, D-ILA, HDLA and Plasma Display devices.

Rack Mountable - Two **IN1401** units may be mounted side-by-side using the optional **IN9080** Rack Shelf. A single unit may be rack-mounted using the **IN9080** Rack Shelf and an **IN9088** Half-Rack Blank Plate.

Compatibility

INPUT

The **IN1401** accepts progressive scan and interlaced RGBHV, RGBS or RGsB analog video signals at horizontal scan rates from 15 KHz to 60 KHz. The unit automatically adjusts to different sync formats and a wide variety of input signals including NTSC, PAL and most standard video scan rates.

OUTPUT

The **IN1401** output video signal is compatible with a wide range of CRT, LCD, DMD, ILA, D-ILA, HDLA and Plasma Display devices.

The **IN1401** offers a wide range of output resolutions to match the optimum or native resolution of virtually any display device. The output refresh rate is also selectable as desired. When used with LCD or DMD displays, the 60 Hz output setting is recommended. Higher output refresh rates may be selected for use on CRT type displays in order to reduce flicker and provide enhanced ergonomics. The chart on page 13 indicates the available output resolutions and refresh rates.

Installation

This section offers step-by-step instructions for installing the **IN1401** RGB Video Scaler. An **APPLICATION DIAGRAM** is located on the following page.

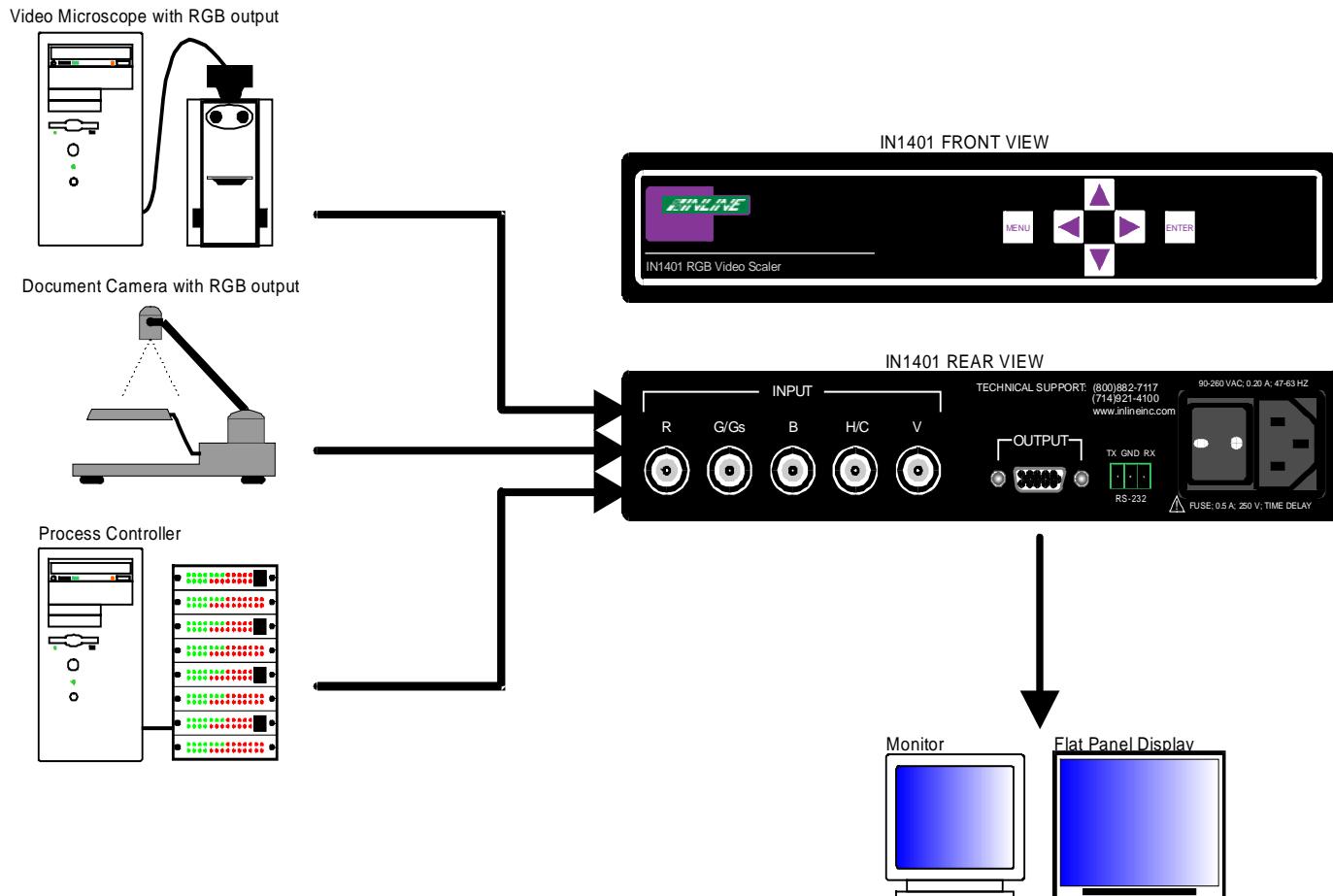
*Note: Read the instructions carefully before initiating the installation procedure. Make sure that there is no power connected to the **IN1401**, and that the power button is off.*

1. Place / install the **IN1401** at the desired location. Make sure that the unit is seated on a flat surface or is securely installed in a standard 19" equipment rack in a 1-U rack space (using the optional **IN9080** rack shelf).
2. Connect the **IN1401** input (BNC connectors) to a data output device (featuring an RGB video output), using three, four or five BNC cables (for RGsB, RGBS or RGBHV, respectively) or a multi-conductor RGBHV, RGBS or RGB "snake". The **IN7000 / IN7200 / IN7300 Series** cables are well suited for this purpose (see RGB Output Cables on page 15). While making connections, take care to insure that the red output is connected to the red input, green output to the green input, etc.

*Note: The **IN1401** will not accept S-Video or composite video signals.*

3. Connect the monitor, flat panel or other VGA display device directly to the **IN1401** output port using a standard 15-pin HD male-to-male VGA cable. INLINE's **IN8000M** Series VGA cables offer exceptional performance and are available in a variety of lengths.
4. Connect power to the **IN1401** using the **IN9230** IEC power cable (included).
5. Turn on the video source, the **IN1401** and the monitor. The scaler has been factory pre-set to support plug and play operation with most display devices. If it becomes necessary to manually adjust / fine-tune the video image, refer to the INPUT SETTINGS section on pages 8 - 11 to achieve optimum picture quality.

IN1401 APPLICATION DIAGRAM



Operation

ON SCREEN MENU

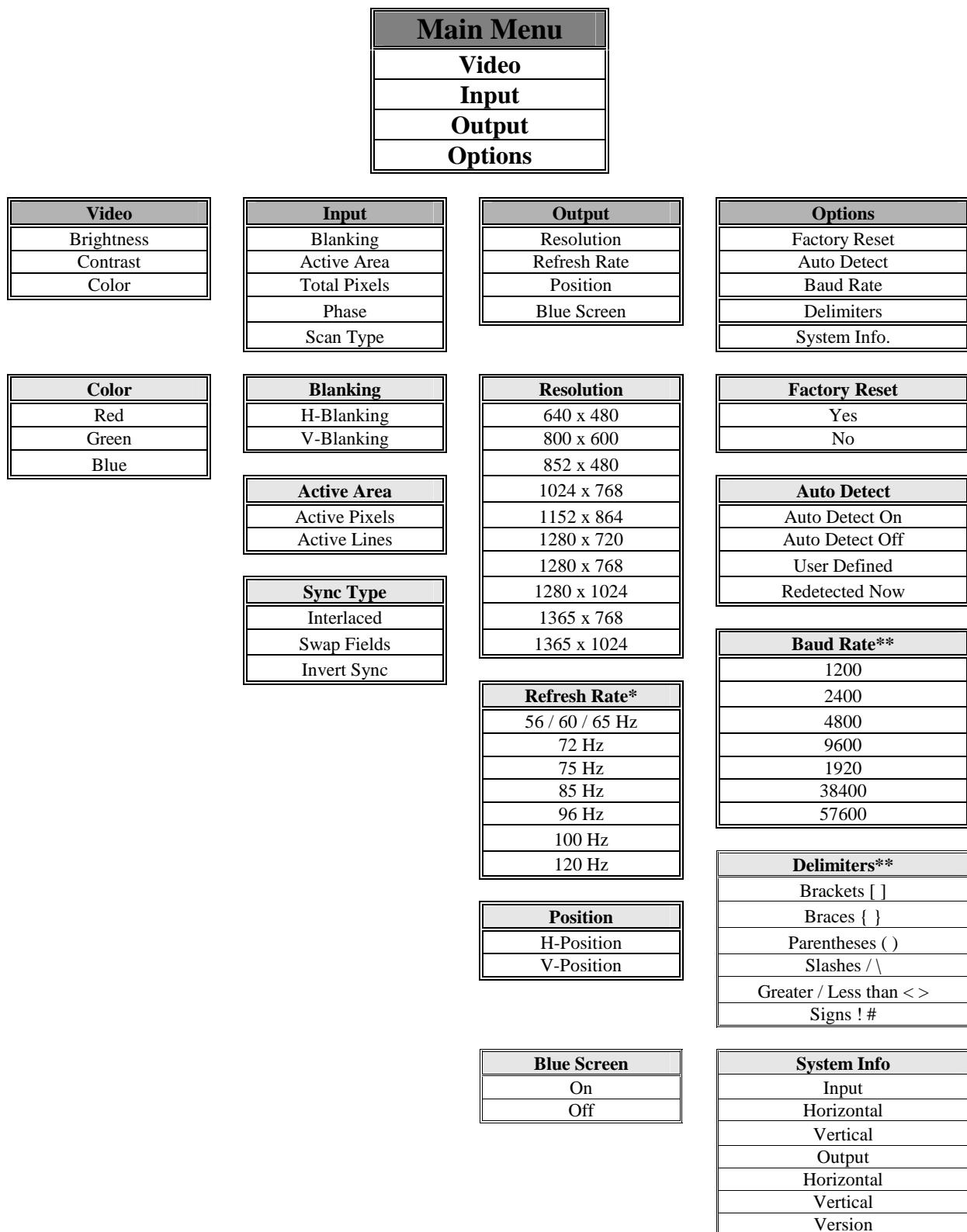
This section offers a description of the on screen menus and their operations. To access the Main Menu, press the **MENU** or **ENTER** Button. Use the arrow buttons to maneuver around within the menu display(s). Press **ENTER** to select a command, and press **MENU** to exit.

The **MAIN MENU** commands and their functions are:

VIDEO	-	Changes input signal video parameters
INPUT	-	Changes input signal-timing parameters
OUTPUT	-	Changes output signal-timing parameters
OPTIONS	-	Displays advanced options

An illustration of the On Screen Display Menu System is provided on page 6, followed by a detailed description of each menu command.

IN1401 ON SCREEN DISPLAY MENU SYSTEM



* Depends on the resolution **Functional for IN1401-2 Only

VIDEO MENU

BRIGHTNESS - Changes the input signal brightness

CONTRAST - Changes the input signal contrast

COLOR - Changes the input signal gain (contrast) for each individual color. Red, green and blue are available.

INPUT MENU

H-BLANKING - The number of pixels per line inside the blanking area that is on the left side of the active area (including the horizontal sync width and the horizontal back porch).

V-BLANKING - The number of lines per frame inside the blanking area that is above the active area (including the vertical sync height and the vertical back porch).

ACTIVE PIXELS - The number of pixels per line inside the active input area.

ACTIVE LINES - The number of lines per frame inside the input active area. For interlaced input signals, this number refers to the lines per frame after de-interlacing, not the number of lines per field.

TOTAL PIXELS - The total number of pixels per line including the blanking on both sides of the input active area (active, horizontal sync width, back porch and front porch). Refer to the Input Settings section on pages 8-11 to determine how to set the total pixels. The total number of lines per frame including the blanking above and below the active area is determined by the input signal and cannot be adjusted by the user.

PHASE - Adjusts the amount of phase shift applied to the input signal.

SCAN TYPE - Three options are available:

- **Interlaced** - for interlaced signals
- **Swap fields** - to switch the interlaced fields (if necessary)
- **Invert Sync** - to switch the sync polarity (if necessary)

OUTPUT MENU

RESOLUTION - Because the **IN1401** only scales up, users must choose an output resolution that is greater than or equal to the input active area, as well as one that is compatible with their monitor. The available resolution rates are listed on page 13.

REFRESH RATE - Allows users to choose the refresh rate that's compatible with their display device.

Note: Not all resolution and refresh rate combinations are available. Refer to the chart on page 13 for a complete listing.

POSITION - Positions the output image on the monitor. Unlike input blanking it does not crop the image or add blank borders.

BLUE SCREEN - Adjusts the output image on the monitor. Available anytime (even when the input settings are incorrectly adjusted or the input signal is missed entirely), the blue screen is used to adjust the outer settings (resolution, refresh rate and position) and verify the image on the monitor. The video and input settings have no effect on the blue screen. Once the output settings have been properly adjusted and verified on the monitor, the blue screen may be turned off to adjust the video and input settings.

OPTIONS MENU

FACTORY RESET - Returns all video, input and output settings to factory default (except the resolution and refresh rate).

AUTO DETECT - Four options are available:

- **Auto Detect On** - The default mode at power up that allows the **IN1401** to automatically detect new input modes and adjust accordingly.
- **Auto Detect Off** - Prevents the **IN1401** from switching back and forth between input modes, or flickering when small input changes occur (such as from a VCR in fast forward or reverse).
- **User Defined** - All input modes have the same user definable settings, however, they are restricted to values close to the input mode detected. If a full range of values is necessary, the user-defined mode may be manually selected.
Note: If auto detect cannot determine the input mode, the user defined mode is selected automatically.
- **Redetected Now** - The **IN1401** automatically reconfigures when each new input mode is detected and each new output mode is selected. In the event that the scaler does not detect a change in the input mode, or should the input / output settings become invalid, the Redetect Now option allows users to initiate a new detection sequence and reload the input / output settings.

BAUD RATE - Allows RS-232 remote users to select the baud rate that matches their remote control device system.

DELIMITERS - Use the on screen menu to select the desired command code delimiters.

INLINE scalers can be set to recognize six sets of leading and end codes when using an RS-232 remote: parentheses (), brackets [], braces { }, slashes \ /, less and greater than < >, and signs !#. If desired, several INLINE products may be connected together on the

same RS-232 serial control line with each device set for a different delimiter pair. Each unit will only respond to codes sent with the appropriate delimiters and will ignore all other codes.

SYSTEM INFO - This screen displays the following system information:

- Input Active Area
- Input Vertical Refresh Rate
- Output Resolution
- Output Vertical Refresh Rate
- Input Horizontal Scan Rate
- If Input is Interlaced
- Output Horizontal Scan Rate
- Program Version Number

Only the input horizontal scan rate and input vertical refresh rate are measured by the **IN1401**. If the input signal includes extra pulses (such as equalization or serration pulses), the input vertical refresh rate may indicate a value lower than the actual rate. All other values are simply repeated as defined by the input and output settings. Although the **IN1401** detects the input mode and adjusts automatically (for the detected input mode and the selected output mode), the system will reflect any changes made to these settings made by the user. This information may be useful for setting other video parameters such as the input total pixels (see input settings below) or for other video equipment connected to the **IN1401**.

INPUT SETTINGS

The **IN1401** adjusts automatically for different input and output modes. However, in cases where the input signal has slightly different timing or is a non-standard mode, some settings may be adjusted manually. All settings for each input and output mode (including non-standard input modes) are stored internally so the adjustments will not have to be repeated after they are optimized. The input settings are shown in Figure 1 and the formulas and figures listed on the following pages will assist in the adjustment of these settings.

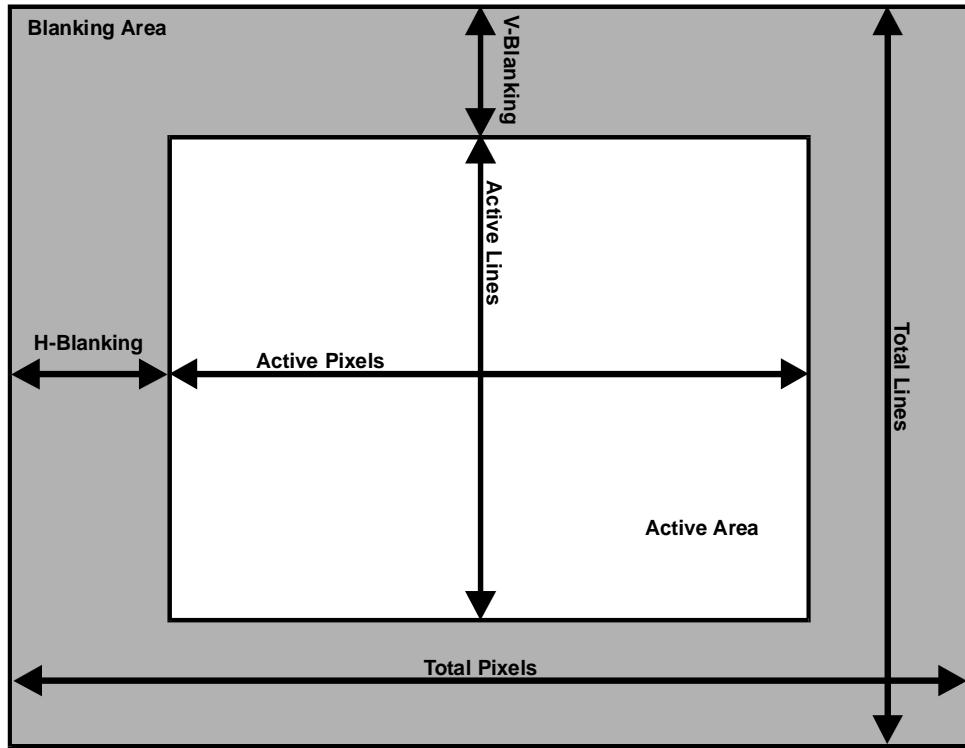


Figure 1. Input Settings

The input settings control the following:

- H-Blanking - Left edge of image
- Active Pixels - Right edge of image
- Total Pixels - Right edge of image
- V-Blanking - Top edge of image
- Active Lines - Bottom edge of image

Use these controls to match the input video signal, framing the actual active area.

Note: Active pixels and total pixels are interactive. Setting one may require re-adjusting the other.

In **Figure 2**, the input blanking is set incorrectly (as indicated by the dashed lines). If the H-Blanking is set less than the *actual* H-Blanking, the **IN1401** will look for the active area before it really occurs. This results in a blank border on the left side of the active area, and cropping on the right side of the active area. This gives the apparent effect that the image is shifted to the right. Similarly, if the V-Blanking is set less than the *actual* V-Blanking, the **IN1401** will again look for the active area before it really occurs. This results in a blank border on top of the active area, and cropping on the bottom of the active area. This gives the apparent effect that the image is shifted down.

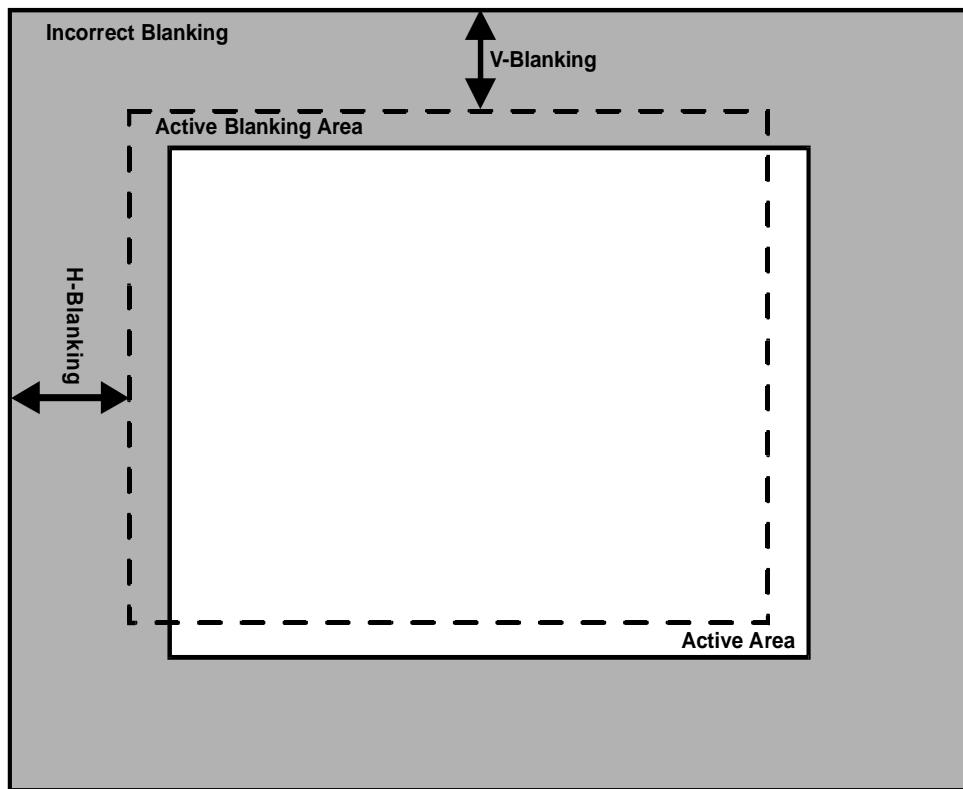


Figure 2. Incorrect Input Blanking

Do not confuse input blanking with the output position. The input blanking adjusts where the electronic scaling process takes effect, which may add blank borders or crop the active area if set incorrectly. The input blanking and active area should be manually adjusted to match the input video signal, framing the actual active area on the monitor.

The output position simply moves the image on the monitor. It does not add blank borders or crop any part of the image. However, the apparent effect of blank borders and a cropped image may be due to the image being incorrectly positioned on the monitor. The blue screen is available to adjust the output image on the monitor. It is available at any time, even when the input settings are incorrectly adjusted or the input signal is missing entirely. Use the blue screen to adjust the output settings (resolution, refresh rate and position) and to verify the image on the monitor. The video and input settings have no effect on the blue screen. Once the output settings have been properly adjusted and verified on the monitor, the blue screen can be turned off, and the video settings may then be adjusted.

In **Figure 3**, the active area is adjusted incorrectly, as shown by the dashed lines. If the active pixels are set less than the *actual* active pixels, the **IN1401** will only look for the active area inside this smaller region. This results in an active area containing fewer pixels than are really present. This gives the apparent effect that the picture is stretched horizontally. Similarly, if the active lines are set less than the *actual* active lines, the **IN1401** will again only look for the active area inside the smaller region. This results in an active area containing fewer lines than are really present. This gives the apparent effect that the image is stretched vertically.

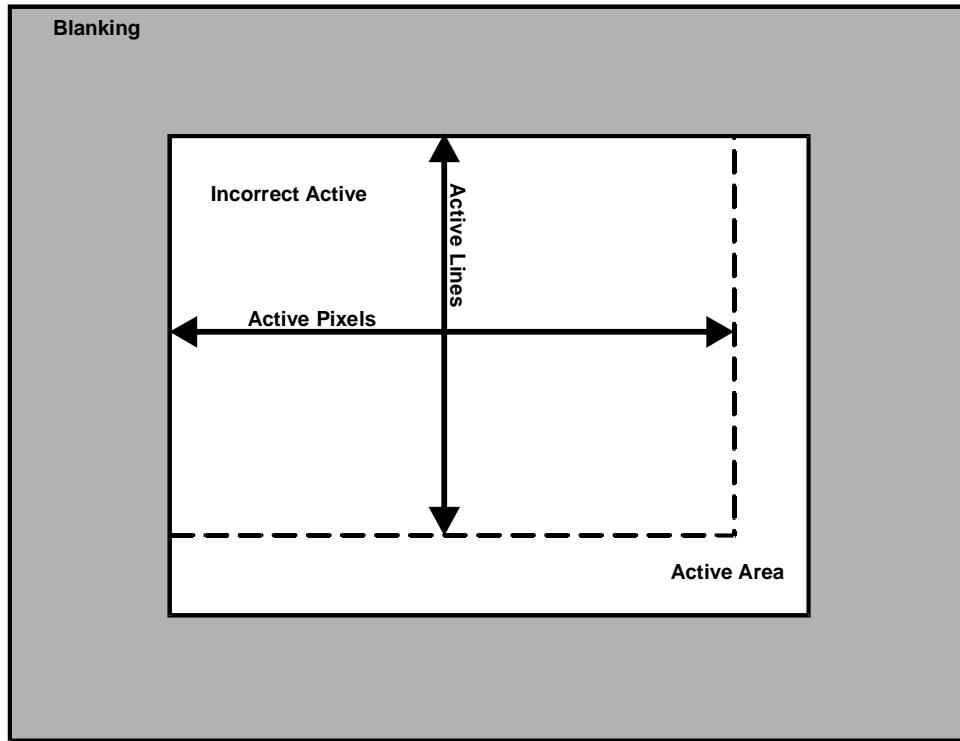


Figure 3. Incorrect Active Area

Depending on the video source, the following input modes may have the same horizontal scan rate and vertical refresh rate. The differences between these input modes will not be detected. The input aspect ratio will automatically be maintained at the output by inserting blank borders around the image. However, if you want to fill the entire monitor, the input aspect ratio may be set by adjusting the active pixels or active lines, according to the input mode. This will stretch the image to fill the entire monitor. The total pixels may also be adjusted to match the input mode as shown in the tables below:

Table 1. Input Modes for Horizontal Scan Rate = 31.5 KHz and Vertical Refresh Rate = 60 Hz

Active Pixels	Active Lines	Aspect Ratio	Total Pixels	
640	480	4:3	780	(progressive NTSC)
640	350	64:35	800	
640	400	8:5	800	
640	480	4:3	800	
720	350	72:35	900	
720	400	9:5	900	(factory default)

Table 2. Input Modes for Horizontal Scan Rate = 15.7 KHz and Vertical Refresh Rate = 60 Hz

Active Pixels	Active Lines	Aspect Ratio	Total Pixels	
768	480	8:5	910	NTSC 14.3
720	480	3:2	858	NTSC 13.5
640	480	4:3	780	NTSC 12.3 (default)

In **Figure 4**, the total pixels are adjusted incorrectly. There are several ways to set the total pixels. It is best to set the total pixels according to the input signal specifications. Otherwise, if the input pixel clock is known, the input total pixels may be calculated using one of the methods shown below:

- **Check the On-Screen Menu:** The input horizontal scan rate, as measured by the **IN1401**, may be found in the options menu under SYSTEMS INFO on page 7.
- **Multiply the input active pixels by 1.3 to approximate the input total pixels.**
- **Adjust the input total pixels to minimize any faint vertical lines** that may be seen within the image, as shown below in Figure 4.

The total pixels may be adjusted to move the lines closer together or further apart. Adjust the total pixels until the lines are furthest apart or until they are completely out of view. If one line still remains, it may be moved out of view using the phase adjustment. The input active pixels and total pixels are interactive. Setting one may require readjustment of the other.

1. Set input total pixels according to input signal specifications.
2. Input total pixels = input pixel clock / input horizontal scan rate.
3. Input total pixels $\approx 1.3 \times$ input active pixels.
4. Set input total pixels to minimize faint vertical lines (see Figure 4).
5. After the input active pixels have been set correctly, adjust total pixels for the correct active width.

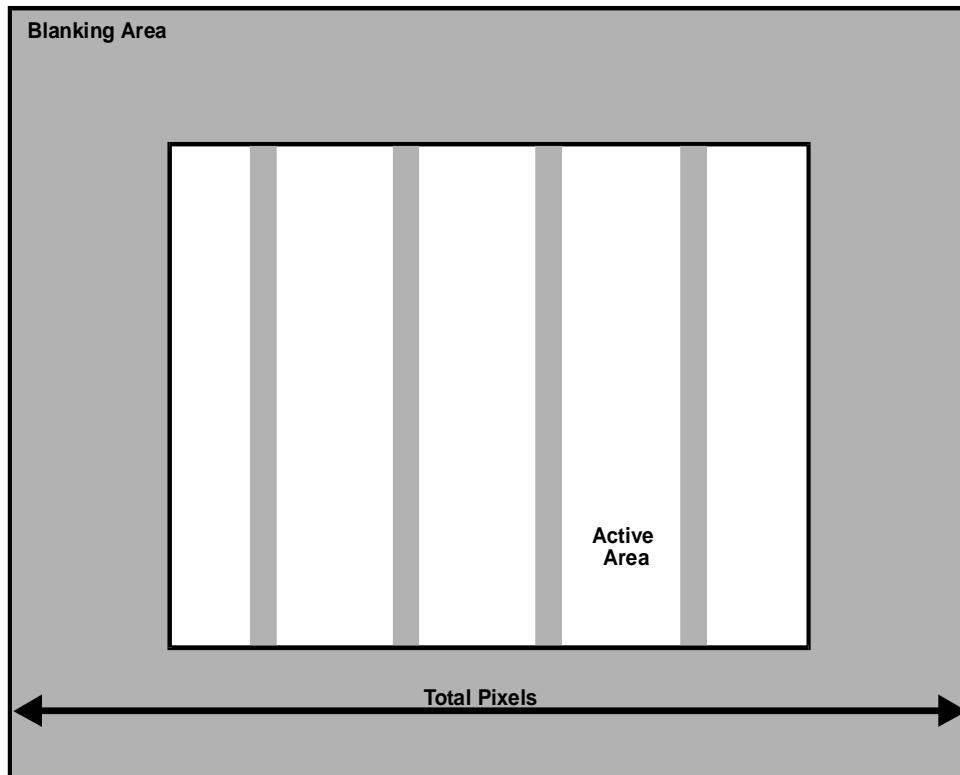


Figure 4. Incorrect Total Pixels

VERY SLOW INPUT SIGNALS

If the input signal is very slow (pixel clock is less than 12 MHz), the **IN1401** may display a poor image as it is only designed for signals above 12 MHz. To improve the quality of the image, simply increase the sampling rate by doubling the number of active pixels and total pixels by using the on screen menu. The number of active lines remains the same. For example:

Parameter	Actual Input Signal	IN1401 Settings
Active Pixels	380	760
Active Lines	286	286
Total Pixels	482	964
Pixel Clock	7.512 MHz	15.024 MHz

OUTPUT MODES

The **IN1401** supports the following Output Modes:

Resolution	Mode	Aspect Ratio*	Refresh Rate (Hz)								
			56	60	65	72	75	85	96	100	120
640 x 480	VGA	4:3									
800 x 600	SVGA	4:3									
852 x 480	HDTV - 480p	16:9									
1024 x 768	XGA	4:3									
1152 x 864		4:3									
1280 x 720	HDTV – 720p	16:9									
1280 x 768		16:9									
1280 x 1024	SXGA	5:4									
1365 x 768	Wide XGA	16:9									
1365 x 1024		4:3									

DEFAULT POWER-UP BUTTONS

An output mode or a factory reset may be selected without the use of the **IN1401** menu. This is particularly useful if the monitor does not display an image or if the image is scrambled. Simply hold down the front panel button while turning on the **IN1401**. To select both an output mode and factory reset, hold down both buttons simultaneously while turning the scaler on.

MENU: 640 x 480 @ 60 Hz
 LEFT: 800 x 600 @ 60 Hz
 UP: 1024 x 768 @ 60 Hz

DOWN: 1152 x 864 @ 60 Hz
 RIGHT: 1280 x 1024 @ 60 Hz
 ENTER: Factory Reset

OUTPUT POSITIONING

The output may be adjusted without entering the main menu sequence. Pressing the arrow keys selects the output position controls if the menu is not on. Afterwards, press enter to save the output position, or press menu to exit without saving the output position.

LOW POWER SLEEP MODE

If no input signal is detected, the **IN1401** will enter a low power sleep mode operation. During this mode, the processor is still active and will continue to monitor the input for any video signal. Upon connection to the video signal, the **IN1401** will automatically return to its normal mode of operation. The **IN1401** menu may be displayed and adjusted without any video signal connected. If the **IN1401** is in its low power mode, press menu or enter to turn on the unit and start the menu. All controls are available. The background will be blue if no signal is present and cannot be turned off until a signal is connected. Upon exiting the menu, the **IN1401** will again return to its low power mode if no signal is present.

MAXIMUM INPUT AND OUTPUT MODES

There are six factors that limit the input and output modes of the **IN1401**:

1. Input Active Pixels \leq Output Active Pixels
2. Input Active Lines \leq Output Active Lines
3. Input Pixel Clock \leq 95 MHz (After De-Interlacing)
4. Intermediate Pixel Clock \leq 95 MHz (After Frame Rate Conversion)
5. Output Pixel Clock \leq 135 MHz (After Image Scaling)
6. $(\text{Input Pixel Clock} + 95) / 1.8 \leq 95$ (Bandwidth Formula)

LIMITATIONS OF SETTINGS

The following criteria must be met for *all* signals. Any attempt to adjust the settings beyond these criteria results in an invalid video signal and will not be allowed. If any setting will not move to the desired value, verify the equations below and refer to the list of problems / solutions on page 17 of the Troubleshooting Section to find the alternate setting required.

Input Total Pixels	$>$	Input H-Blanking + Input Active Pixels
Input Active Pixels	$<$	Input Total Pixels - Input H-Blanking
Input Active Pixels	\leq	Output Active Pixels
Input Active Lines	$<$	Input Total Lines - Input V-Blanking
Input Active Lines	\leq	Output Active Lines
Input H-Blanking	$<$	Input Total Pixels - Input Active Pixels
Input V-Blanking	$<$	Input Total Lines - Input Active Lines

In addition to the above limitations, the predefined input modes only have a full range of 256 units. If a setting beyond +/- 128 units from the default value is desired, the user-defined mode may be selected.

Note: All of the limits listed above apply to the user-defined mode.

Remote Operation (IN1401-2 Only)

RS-232 CONTROL

The **IN1401-2** model has an RS-232 serial control port that accepts serial commands from a control system, computer serial port, or any other device capable of sending out serial ASCII commands at compatible baud rates. A complete listing of RS-232 codes is included on the following pages.

Communication Protocol:

8 data bits
1 stop bit
No parity check
9600 baud (factory default setting)

Baud Rate Selection:

The **IN1401** has a factory default baud rate of 9600 bps and can communicate at baud rates from 1200 up to 57,600. Baud rates can be selected using the Advanced Menu (see page 23).

 **Note:** The baud rate transmitted must match the baud rate selected on the **IN1401**

Command Code Structure and Delimiters:

All commands sent to the unit must contain a leading code, the command code, and an ending code. Each command must be completely executed before the unit will accept a new command.

INLINE scalers can be set to recognize six sets of leading and end codes (delimiters) when using an RS-232 remote: parentheses (), brackets [], braces{ }, slashes \ /, less and greater than < >, and signs !#. The factory default serial delimiters are [].

*Note: Only the **IN1401** that has the same delimiters as the remote controller will respond.*

A complete command consists of:

[The leading code
CH3 The command code.
] The ending code

Example: [CH3] commands the **IN1401** to select channel 3.

Serial Control Cable Wiring

When controlling only one **IN1401** unit, connect the RS-232 cable as follows:

Controller Transmit	to	IN1401 Receive
Controller Ground	to	IN1401 Ground
Controller Receive	to	IN1401 Transmit

When controlling multiple **IN1401** units, connect the RS-232 cable as follows:

Controller Transmit	to	Each IN1401 Receive
Controller Ground	to	Each IN1401 Ground
Controller Receive	to	Only one IN1401 Transmit

Key Concept

*When controlling multiple units, the Controller Receiver Terminal must connect to only one **IN1401** Transmit Terminal. Multiple **IN1401** Transit Lines may not be connected together; otherwise signal contention from multiple units will result. Therefore, “receive” information is only available from one **IN1401** in this configuration. Each unit must be set to different delimiters.*

IN1401 SERIAL COMMANDS

COMMAND	DESCRIPTION	COMMAND	DESCRIPTION
ACI3	set baud rate to 1200	BLUxxx	set blue gain to absolute value (0-255)
ACI4	set baud rate to 2400	BLU?	Return blue gain
ACI5	set baud rate to 4800	BLS0	blue screen ON
ACI6	set baud rate to 9600**	BLS1	blue screen OFF
ACI7	set baud rate to 19,200	BV+	increase input vertical blanking
ACI8	set baud rate to 38,400	BV-	decrease input vertical blanking
ACI9	set baud rate to 57,600	BV@	set input vertical blanking to normal**♦
ACI?	return baud rate	BVxxx	set input vertical blanking to absolute value♦
AL+	increase active lines	BV?	return input vertical blanking
AL-	decrease active lines	BRG+	increase brightness
AL@	set active lines to normal**♦	BRG-	decrease brightness
ALxxx	set active lines to absolute value♦	BRG@	set brightness to normal** (128)
AL?	return active lines	BRGxxx	set brightness to absolute value (000-255)
AP+	increase active pixels by 2	BRG?	return current brightness
AP-	decrease active pixels by 2	CMDCD0	set delimiters to brackets []**
AP@	set active pixels to normal**♦	CMDCD1	set delimiters to braces { }
APxxx	set active pixels to absolute value♦	CMDCD2	set delimiters to parentheses ()
AP?	return active pixels	CMDCD3	set delimiters to less and greater <>
BH+	increase input horizontal blanking	CMDCD4	set delimiters to slashes \ /
BH-	decrease input horizontal blanking	CMDCD5	set delimiters to signs !#
BH@	set input horizontal blanking to normal**♦	CMDCD?	Return delimiters
BHxxx	set input horizontal blanking to absolute value♦	CON+	increase contrast
BH?	return input horizontal blanking	CON-	decrease contrast
BLU+	increase blue gain	CON@	set contrast to normal** (128)
BLU-	decrease blue gain	CONxxx	set contrast to absolute value (000-255)
BLU@	set blue gain to normal** (128)		

COMMAND	DESCRIPTION	COMMAND	DESCRIPTION
CON?	return current contrast	PV?	return current horizontal position
DOWN	front panel down button.	RED+	increase red gain
ENTER	front panel enter key.	RED-	decrease red gain
GRN+	increase green gain	RED@	set red gain to normal***(128)
GRN-	decrease green gain	REDxxx	set red gain to absolute value (0-255)
GRN@	set green gain to normal***(128)	RED?	return red gain
GRNxxx	set green gain to absolute value(0-255)	REF0	set refresh rate to 60Hz**
GRN?	return green gain	REF1	set refresh rate to 72Hz
IM0	set input mode to auto detect ON**	REF2	set refresh rate to 75Hz
IM1	set input mode to auto detect OFF	REF3	set refresh rate to 85Hz
IM2	set input mode to user defined	REF4	set refresh rate to 96Hz
IM3	redetect input mode now	REF5	set refresh rate to 100 Hz
IM?	return input mode state	REF6	set refresh rate to 120Hz
INFO?	return unit version	REF?	return refresh rate
LEFT	front panel left key.	RES000	factory reset
MENU	front panel menu key.	RIGHT	front panel right key.
PH+	increase horizontal position	SCS0	set resolution to 640 x 480
PH-	decrease horizontal position	SCS1	set resolution to 800 x 600
PH@	set horizontal position to normal**◆	SCS2	set resolution to 852 x 480
PHxxx	set horizontal position to absolute value◆	SCS3	set resolution to 1024 x 768
PH?	return current horizontal position	SCS4	set resolution to 1152 x 864
PHS+	increase phase	SCS5	set resolution to 1280 x 720
PHS-	decrease phase	SCS6	set resolution to 1280 x 768
PHS@	set phase to normal**◆	SCS7	set resolution to 1280 x 1024
PHSxxx	set phase to absolute value	SCS8	set resolution to 1365 x 768
PHS?	return phase	SCS9	set resolution to 1365 x 1024
PV+	increase vertical position	SCS?	return current resolution
PV-	decrease vertical position	ST0	toggle interlaced(1=on)
PV@	set vertical position to normal** ◆	ST1	toggle swapped fields(10=on)
PVxxx	set vertical position to absolute value◆	ST2	toggle invert sync(100=on)
		ST?	return scan type (add above numbers)
		UP	front panel up key.

* This Command List is preliminary. The commands are *not* case sensitive.

** Default values when factory reset is performed.

◆ Normal and available values depend on the current input or output mode

Specifications

IN1401 RGB Video Scaler	
Input	
Connectors	(5) Female BNC for RGBHV, RGBS, RGsB
Signal	0.7 Vp-p typical, 75 Ohm impedance
Signal Type	Analog Video, Progressive Scan or Interlaced
Horizontal Scan Rate	15 KHz - 60 KHz
Refresh Rates	50 Hz - 120 Hz
Output	
Connectors	(1) 15-Pin HD Female for RGBHV
RGB Video	0.7 Vp-p typical, 75 Ohm Impedance
Sync	H & V: TTL compatible
Resolution	640 x 480 to 1365 x 1024 (see chart on page 11)
Refresh Rate	60 Hz to 120 Hz (see chart on page 11)
Color Depth	24-bit
General	
RS-232 Control (IN1401-2 Only)	1200 to 57,600 baud, N, 8, 1; 3-Pin Phoenix
Power Supply	Internal Switch Mode: 90 - 260 VAC; 47 - 63 Hz
Power Consumption	15 Watts
Shipping Weight	4 lbs. / 2 Kg
Product Weight	2 lbs. / 0.9 Kg
Dimensions	1.65" x 8.5" x 7.3" / 4.2 cm x 21.6 cm x 18.5 cm
Regulatory Approvals	UL1950, CAN/CSA-22.2 No. 950, 3 rd Edition CE: EN55022 (1987), EN50081-1 (1991), EN50082-1 (1992 and 1994), EN60950-92

Included Accessories

- IN9230 IEC Power Cable, 6' long (USA only)
- Operations Manual

Optional Accessories

VGA Monitor Adapter and Extension Cables

- IN8000M Series - 15-pin HD male to 15-pin HD male, available in various lengths

Installation Cables

IN7000P-5 Series RGBHV Cable: Standard Resolution, Plenum Cable
available in bulk lengths

IN7000P-5K Series RGBHV Cable: Standard Resolution, Plenum Cable
available in 1000' bulk length

Rack-Mount Hardware

- IN9080 - Rack Shelf
- IN9088 - Half-Rack Blank Plate

RGB Input Cables and Connectors				
Cables	1-Conductor	3-Conductor	5-Conductor	6-Conductor
Standard Resolution			IN7000-5	
Standard Resolution, Flexible Plenum			IN7000FP-5	
Ultra High Resolution	IN7200-1	IN7200-3	IN7200-5	IN7200-6
Super High Resolution			IN7300-5	IN7300-6

All cable grades are available in lengths from 3' to 250' pre-terminated with high quality BNC connectors or as bulk cable.

Troubleshooting

Problem: There is no image on the monitor.

Solution 1: Make sure that the **IN9230** IEC power cable is securely plugged into the unit and the A/C source.

Solution 2: Make sure the A/C source is live.

Solution 3: Verify that the power switch is turned on for the video source, the **IN1401** and the monitor.

Solution 4: Verify the connection to the output display device. Even with no input signal, the **IN1401** menu can be displayed. Press MENU or ENTER to gain access to the menu screen.

Solution 5: Select an Output Resolution and Refresh Rate compatible with the monitor being used. Use the default power-up buttons to select an Output Mode without the menu present, then turn on the Blue Screen to verify these settings.

Solution 6: The input / output settings may be incorrect. Although the unit should not allow invalid settings, they may need to be reloaded. If the menu is available, select Options, Auto Detect and Redetect Now to reload these settings.

Solution 7: The output resolution may be less than the input (the **IN1401** can only scale up). Select an Output Resolution that is greater than or equal to the Input Active Area.

Problem: The image on the monitor is scrambled.

Solution: Select an Output Resolution and Refresh Rate compatible with the monitor being used. Use the default power-up buttons to select an Output Mode without the menu present, then turn on the Blue Screen to verify these settings.

Problem: The image on the monitor is stretched horizontally.

Solution 1: The Input Total Pixels may be set too high. Reduce the Input Total Pixels to match the input signal. Refer to the Input Settings section on pages 10-13 to make the necessary adjustment.

Solution 2: Increase the Input Active Pixels to match the input settings.

Solution 3: Increase the Output Resolution to a value greater than the input active area.

Problem: The image on the monitor is compressed horizontally.

Solution 1: Increase the Input Total Pixels setting to match the input signal. Refer to the Input Settings section on pages 10-13 to make the necessary adjustments.

Solution 2: Reduce the Input Active Pixels setting to match the input signal.

Problem: The image on the monitor is stretched vertically.

Solution 1: Increase the number of Input Active Lines to match the input settings.

Solution 2: Increase the Output Resolution to a greater value than the input active area.

Problem: **The image on the monitor is compressed vertically.**

Solution: Reduce the number of Input Active Lines to match the input signal.

Problem: **The image on the monitor is cropped to the left side.**

Solution 1: Reduce the Input H-Blanking to match the input signal.

Solution 2: Increase the Output H-Position to line up the image on the monitor. Use the blue screen.

Solution 3: Adjust the Monitor Position or Size Controls to fit the image on the monitor. Use the blue screen.

Problem: **The image on the monitor is cropped on the right side.**

Solution 1: Increase the Input H-Blanking to match the input signal.

Solution 2: Reduce the Output H-Position to line up the image on the monitor. Use the blue screen.

Solution 3: Adjust the Monitor Position or Size Controls to fit the image on the monitor. Use the blue screen.

Problem: **The image on the monitor is cropped on the top.**

Solution 1: Reduce the Input V-Blanking to match the input signal.

Solution 2: Increase the Output V-Position to line up the image on the monitor. Use the blue screen.

Solution 3: Adjust the Monitor Position or Size Controls to fit the image on the monitor. Use the blue screen.

Problem: **The image on the monitor is cropped on the bottom.**

Solution 1: Increase the Input V-Blanking to match the input signal.

Solution 2: Reduce the Output V-Position to line up the image on the monitor. Use the blue screen.

Solution 3: Adjust the Monitor Position or Size Control to fit the image on the monitor. Use the blue screen.

Problem: **The image on the monitor has multiple faint vertical lines.**

Solution: Adjust the Input Total Pixels until the faint vertical lines move out of view or until only one line remains. Refer to the Input Settings section on pages 10-13 to make the necessary adjustment.

Problem: **The image on the monitor has one faint vertical line.**

Solution: Adjust the Input Phase to move the faint vertical line out of view.

Problem: **Some characters on the monitor appear fuzzy.**

Solution 1: Adjust the Input Total Pixels until all the characters are sharp.

Solution 2: Adjust the Input Phase until all the characters are sharp.

Problem: **The monitor only displays the upper half of the signal.**

Solution: The Input Scan Type is set incorrectly. For non-interlaced signals, select Scan Type and verify that the Interlaced Setting is turned off. Select the Interlaced Setting to toggle on / off.

Problem: **The image on the monitor jitters up and down.**

Solution: The Input Scan Type is set incorrectly. For interlaced signals, select Scan Type and verify that the Interlaced Setting is turned on. Select the Interlaced Setting to toggle on / off.

Problem: **The monitor displays a double image.**

Solution: The odd and even fields are not detected. For interlaced signals, the detection of odd and even fields can be corrected by selecting Scan Type, then Invert Sync.

Problem: The image on the monitor has jagged edges.

Solution: The odd and even fields are swapped. For interlaced signals, the odd and even fields can be switched by selecting Scan Type, then Swap Fields.

Problem: The settings on the IN1401 will not move to the desired values.

Solution 1: The combination of settings on the **IN1401** may be invalid. Please refer to the chart on page 15 (Limitations of Settings) to verify that the adjustments are within the Scaler's operating perimeters.

Solution 2: Your settings may be outside the range of predefined modes. Switch to the User Defined Mode to allow for a full range of settings. Select Options, Auto Defeat, and User Defined.
Note: The user-defined mode must adhere to the setting limitations listed on page 15.

Problem: The Input Total Pixels setting will not decrease.

Solution 1: The Input H-Blanking may be set too high. Reduce the Input H-Blanking to match the input signal.

Solution 2: The Input Active Pixels may be set too high. Reduce the Input Active Pixels to match the input signal.

Problem: The Input Active Pixels setting will not increase.

Solution 1: The Input Total Pixels may be set too low. Increase the Total Pixels setting to match the input signal. Refer to the input settings on pages 10-13 to make this adjustment.

Solution 2: The Input H-Blanking may be set too high. Reduce the Input H-Blanking to match the input signal.

Solution 3: The Output Resolution may be set too low. Select an Output Resolution that is greater than or equal to the Input Active Area.

Problem: The Input Active Lines will not increase.

Solution 1: The Input V-Blanking may be set too high. Reduce the Input V-Blanking to match the input signal.

Solution 2: The Output Resolution may be set too low. Select an Output Resolution that is greater than or equal to the Input Active Area.

Problem: The Input H-Blanking will not increase.

Solution 1: The Input Total Pixels may be set too low. Increase the Input Total Pixels to match the input signal. Refer to the Input Settings section on pages 10-13 to make this adjustment.

Solution 2: The Input Active Pixels may be set too high. Reduce the Input Active Pixels setting to match the input signal.

Problem: The Input V-Blanking will not increase.

Solution: The Input Active Lines may be set too high. Reduce the input Active Lines setting to match the input signal.

Problem: The Output Resolution will not decrease.

Solution 1: The **IN1401** can only scale up. If a lower output resolution is desired, connect a signal with a lower Input Active Area.

Solution 2: The Active Pixels / Active Lines may be set too high. Reduce the Input Active Pixels / Input Active Lines setting to match the signal.

If problems persist, call INLINE Technical Services at (714) 450-1800 for further assistance.

Warranty

- INLINE warrants the equipment it manufactures to be free from defects in materials and workmanship.
- If equipment fails because of such defects and INLINE is notified within three (3) years from the date of shipment, INLINE will, at its option, repair or replace the equipment at its plant, provided that the equipment has not been subjected to mechanical, electrical, or other abuse or modifications.
- Equipment that fails under conditions other than those covered will be repaired at the current price of parts and labor in effect at the time of repair. Such repairs are warranted for ninety (90) days from the day of re-shipment to the Buyer.
- **This warranty is in lieu of all other warranties expressed or implied, including without limitation, any implied warranty or merchantability or fitness for any particular purpose, all of which are expressly disclaimed.**

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