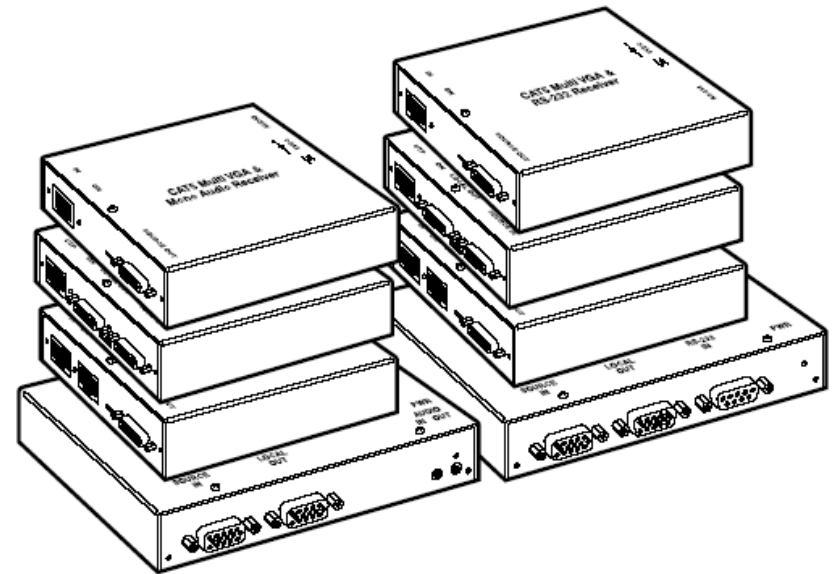




**CAT5 Multi VGA System
(VGA and RS-232)
Dual Daisychainable
Receivers with Skew
Compensation**



**FEDERAL COMMUNICATIONS COMMISSION
AND
INDUSTRY CANADA
RADIO FREQUENCY INTERFERENCE STATEMENTS**

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

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le

Règlement sur le brouillage radioélectrique publié par Industrie Canada.

EUROPEAN UNION DECLARATION OF CONFORMITY

The manufacturer declares that this product meets the requirements of EU Directive 89/336/EEC.



**NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT
INSTRUCCIONES DE SEGURIDAD**

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en librerías o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

APPENDIX C. Serial Encoder/ Decoder Daughterboard Settings

The single-port serial transmitters and single-port and dual daisychainable serial receivers contain an internal encoder/decoder daughterboard that can be reconfigured from its simplex operation default setting for bidirectional operation.

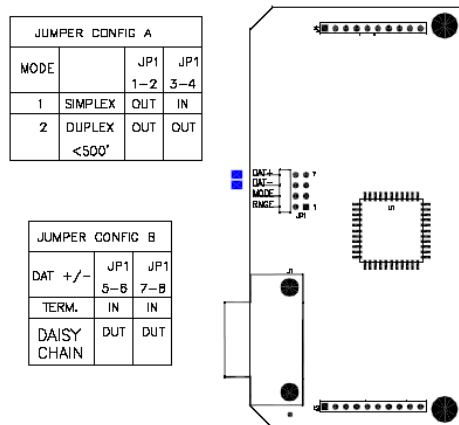
The encoder/decoder daughterboard hardware configuration is done via jumper settings. These jumpers are used to set the various modes of operation..

Encoders are installed in transmitters and decoders are installed in receivers.

To access the Encoder/Decoder daughterboard on transmitters and receivers:

1. Make sure the unit is powered OFF
2. If necessary, unplug all cables to the unit.
3. Unscrew the top screw as well as the two set screws in the DB25 connector. Lift the cover off

For reference Table C-1 shows the input/output jumper configurations for the DB9 connector



**Table C-1. AC1004A/AC1015A/AC1016A
encoder/decoder settings**

12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

TRADEMARKS USED IN THIS MANUAL

Any trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.

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Appendix B. Setting Sync Signal Output Termination

In some cases, it may be necessary to disable the 75-ohm termination of the video outputs on the CAT5 Multi VGA System units. This can be done by opening the case of each unit and installing jumpers on the circuit board. The settings disable/enable the 75-ohm termination on individual units. For instance, changing a transmitter termination affects the local monitor port only; it doesn't affect the receivers. Conversely, changing a receiver affects the output port of the receiver, not the transmitter. The following diagrams show the jumper locations for each type of assembly.

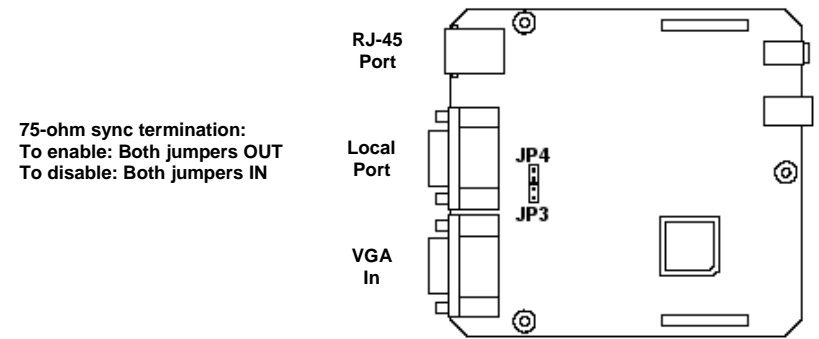


Figure B-1. 1-port transmitter.

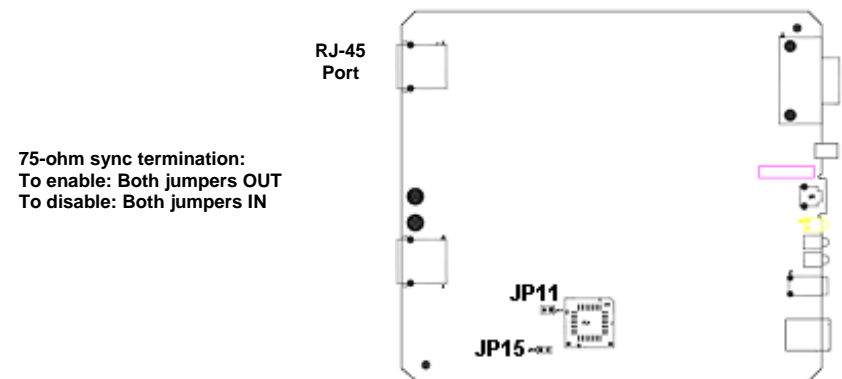


Figure B-2. dual daisychainable receiver.

1. Specifications

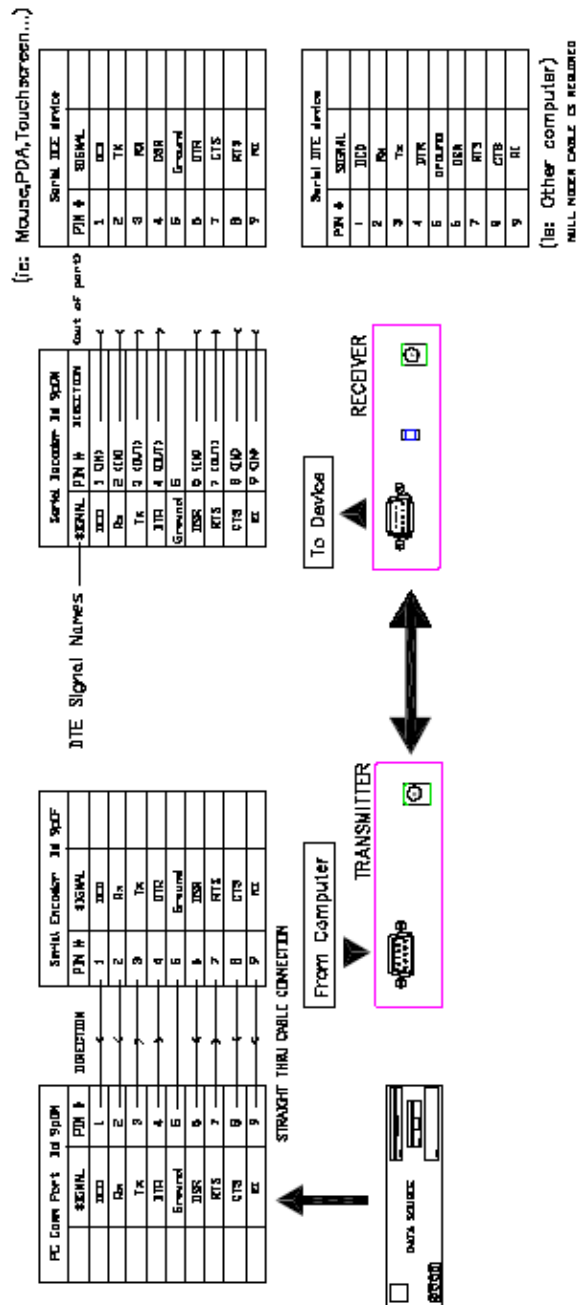


Figure A-1. DB9 serial connector.

Cable Required: Between transmitter and receiver(s): Category 5 shielded or unshielded twisted pair (STP or UTP), though STP is virtually never necessary

Compliance: CE; FCC Class A, IC Class/class A

Video Support: VGA, SVGA, XGA, XGA-2, RGBHV, RGB

Resolution and Refresh Rate: At 1000 ft. (305 m) or less: Up to 1920 x 1440 at up to 70 Hz;
At 1500 ft. (457 m) or less: Up to 1600 x 1200 at up to 60 Hz;
See the **Maximum Distance** specification

Transmission: Transparent to users (automatic, no delay)

Required Source

Impedance: Video OUT: 75 ohms;
Audio models: Audio OUT (if any): 600 ohms maximum

Required Destination

Impedance: Video IN: 75 ohms;
Audio models: Audio IN (if any): 600 ohms minimum

Bandwidth: Video (3 dB): DC to 8 MHz

Maximum Differential

Input and Output: Video: 0.55 volts peak-to-peak;
Audio: 0.5 volts peak-to-peak

Differential

Insertion Loss: Video: 0 dB maximum at 4 MHz;
Audio: 1 dB maximum at 1 MHz

Audio

Characteristics: AC1013A–AC1014A only;
Channels: Monaural (mono);
Bandwidth (+1 to -3 dB maximum): 20 Hz to 30 kHz,

Serial

Characteristics: AC1015A–AC1016A only:
 Protocol: Asynchronous; transparent to data format;
 transparent to data rates up to 19.2 kbps;
 Operation: AC1015A: Simplex or full duplex,
 user-selectable;
 AC1016A: Simplex (broadcast) only

Maximum

Distance: Total end to end, from source device to farthest destination device, over good CAT5 cable (assuming A/V source outputs signal at normal strength):
 AC1013A, AC1015A: Up to 1000 ft. (305 m) at resolutions up to 1920 x 1440 up to 70 Hz;
 AC1014A, AC1016A: Up to 1500 ft. (457 m) at resolutions up to 1600 x 1280 up to 75 Hz

Connectors: AC1013A: (1) 3.5-mm, (2) RJ-45, (1) HD15 F;
 AC1014A: (1) 3.5-mm, (2) RJ-45, (1) HD15 F;
 AC1015A: (1) DB9 M (DTE), (2) RJ-45, (1) HD15 F;
 AC1016A: (1) DB9 M (DTE), (2) RJ-45, (1) HD15 F;

All: (1) rear-mounted 5-pin DIN F power inlet

Temperature

Tolerance: Operating: 32 to 104°F (0 to 40°C);
 Storage: -4 to +140°F (-20 to +60°C)

Humidity

Tolerance: Up to 80% noncondensing

Enclosure: Steel

Power: From utility-power (mains) outlet to power inlet, through detachable external power supply: Input: 100 to 250 VAC @ 50 or 60 Hz (autosensing);
 Output: +5 VDC;
 Consumption: 5 watts maximum

Size: AC1013A–AC1016A:
 1.2"H x 5.6"W x 6.2"D (3.0 x 14.2 x 15.7 cm);

Weight: AC1013A–AC1014A: 1.4 lb. (0.64 kg);
 AC1015A–AC1016A: 1.4 lb. (0.64 kg);

Appendix A. Cabling Pinouts

Table A-1. HD15 video connector.

Pin	RGBHV (VGA)	RGBS	RGsB
1	Red +	Red +	Red +
2	Green+	Green+	Green+
3	Blue+	Blue+	Blue+
4	—	—	—
5	Gnd	Gnd	Gnd
6	Red-	Red-	Red-
7	Green-	Green-	Green-
8	Blue-	Blue-	Blue-
9	—	—	—
10	Gnd	Gnd	—
11	Gnd	Gnd	—
12	—	—	—
13	H Sync	C Sync	—
14	V Sync	—	—
15	Gnd	Gnd	—

Problem: “Blue shift” of video signal (a slight blue haze appears in areas of the screen that normally would appear black, or a slight blue tint appears in areas that would normally appear white). This is most often seen in applications that use inexpensive monitors, but it sometimes occurs with more expensive equipment.

Solution:

1. Go into the monitor’s menu and select the “Blue-Black Level” function.
2. Use the appropriate command to reduce the level.
3. Reduce the “Blue-Black Level” until the black areas in the image truly appear black. For monitors with a “Blue Drive” adjustment, reduce this setting until the white areas of the screen appear normal.

Problem: “Green shift” or “green washout” on multimedia signals.

Solution: Please contact Technical Support.
The standard video/serial model (AC1004A–AC1007A) is designed to function with DC coupled signals in which the black level is referenced to 0 volts. Nearly all VGA cards function this way.
Some media servers, however, provide AC coupled signals and can cause a green color shift in the video. This is a result of the sync clamping on the red and blue channels of the video/serial model.
For five-component (RGB/H&V) AC coupled video, an optional DC restoration adapter needs to be installed between the Accoupled source and the transmitter. Technical Support can provide you with ordering and installation information.

4.2 Calling Black Box

If you determine that your CAT5 Multi VGA System is malfunctioning, do not attempt to alter or repair it. It contains no user-serviceable parts. Contact Black Box at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- the nature and duration of the problem.
- when the problem occurs.
- the components involved in the problem.
- any particular application that, when used, appears to create the problem or make it worse.

4.3 Shipping and Packaging

If you need to transport or ship your CAT5 Multi VGA System:

- Package it carefully. We recommend that you use the original container.
- If you are shipping the CAT5 Multi VGA System for repair, make sure you include everything that came in the original package. Before you ship, contact Black Box to get a Return Authorization (RA) number.

2. Introduction

2.1 Overview

The CAT5 Multi VGA System extends VGA video signals over ordinary Category 5 cable. All models support RGBHV, RGB, and VGA video, and they use a transmitter-to-receiver setup. They can be used as video splitters as well as video extenders.

This manual covers CAT5 Multi VGA System Long Range Receivers with Audio (AC1013A–AC1014A) and CAT5 Multi VGA System Long Range Receivers with RS-232 (AC1015A–AC1016A).

The CAT5 Multi VGA System Long Range Receivers feature integrated skew compensation that can be varied in 1 ns increments to 32 ns total per color channel to cancel the effects of skew in CAT5 cables. This feature allows you to use CAT5e and CAT6 cables to lengths up to 1500 ft.

For information on the respective transmitter unit, please refer to the appropriate manual included with the transmitter.

The video/audio models enable you to broadcast line-level mono audio, along with video from your computer, to as many as 100 computer monitors up to 1000 or 1500 feet (305 or 457 m) away over CAT5.

The video/serial models transmit VGA signals at the same distance to RS-232 devices, such as touchscreen displays or newer plasma monitors that have RS-232 serial inputs. They do this by transmitting full modem or uni-directional serial signals along with the video signals over CAT5.

When using the receiver model AC1016A, serial communication mode is unidirectionally broadcast. In this mode, all other CAT5 Multi VGA System devices must be of the simplex serial type.

CAT5 Multi VGA System receivers are available with dual daisychainable connections. The dual daisychainable receiver output is used when the same signal is distributed to multiple display devices across a single CAT5 cable in a daisychain or loop-through fashion.

The serial receivers contain an internal Serial Digital Board (SDB) that can be reconfigured from its default setting for simplex operation to bidirectional operation. This way, you can connect touchscreens and high-end video projectors with interactive features. The bidirectional setting isn’t an option on the AC1016A model because they receive serial data in one direction only (from transmitter).

All models support refresh rates/resolutions up to 1600 x 1200 @ 60 Hz at up to 1500 feet (457 m) and 1920 x 1440 @ 70 Hz up to 1000 feet (305 m).

WARNING

This equipment is not intended for, nor does it support, distribution through an Ethernet network. Do not connect these devices to any sort of networking or telecommunications equipment!

2.2 Package Contents

You should have received the following when ordering a CAT5 Multi VGA System receiver:

- The receiver.
- External power supply (100–250 VAC, 50–60 Hz, autosensing) with cord.
- This manual.

2.3 Equipment You May Also Need

- Audio cable with RCA jacks.
- Video cable with HD15 connectors.
- Serial cable with DB9 connectors.
- CAT5 cable.

2.4 Compatible Cabling

CAT5 cabling for the CAT5 Multi VGA System must be pinned to the TIA-EIA T568B wiring specification. We also highly recommend that all CAT5 cables be pre-terminated and tested. Cables terminated on-site or in an existing infrastructure should be tested before use to ensure compliance with the TIA-EIA T568B specification. Using incorrectly terminated CAT5 cables can damage the CAT5 Multi VGA System.

4. Troubleshooting

4.1. Common Problems

In most cases, nearly every issue with the CAT5 Multi VGA System can be resolved by checking the CAT5 termination and making sure that it's pinned to the TIA/EIA 568B wiring specification. However, there may be other problems that cause the system to not perform as it's designed. Below are solutions to the most common installation errors.

- | | |
|------------------|--|
| Problem: | No video signal at the transmitter local port or at the receiver. |
| Solution: | <ul style="list-style-type: none"> • Check that both units are powered. • Make sure the CAT5 cable is terminated correctly per the TIA/EIA 568B wiring specification. • Is the display device powered on and functioning?
In some cases, the video termination may be mismatched. The transmitters and receivers ship with 75-ohm termination as the default. To disable termination, see Appendix B. |
| Problem: | Video signal is poor. |
| Solution: | <ul style="list-style-type: none"> • Have all receiver settings been finished (see sections 3.4). • Check all cable connections. • The video signal's refresh rate may be set too high. Reset to a lower refresh rate in your monitor-configuration menu. • There may be a delay skew issue. Call Technical Support. |
| Problem: | Audio is poor. |
| Solution: | <ul style="list-style-type: none"> • Powered speakers are required. Make sure speaker power is ON. • Check input source levels from the source device. Make sure the audio source is not overdriven or underdriven. |
| Problem: | Serial communication doesn't work correctly. |
| Solution: | <ul style="list-style-type: none"> • Are the serial devices connected properly? Are the serial parameters correct for source/destination devices? • Are the serial cables terminated correctly? If a null-modem cable is used, it must be placed at the receiver end. • When using RS-232 transmitters or receivers, the serial signal is a unidirectionally broadcast mode only. In this mode, all other CAT5 Multi VGA System devices must be the simplex serial type. For assistance, contact Technical Support. • The last device in a quad hub or daisychain configuration must be a standard receiver unit with a terminated serial board. |

3.4.2 Skew Compensation Settings

For cable lengths greater than 500 feet, the Skew Compensation Module is included to adjust for signal timing differences due to differing pair lengths within the CAT5 cable. Using the delay switches, skew may be compensated from 0 to 32 nanoseconds in 1 nanosecond increments on each color pair.

An image file is available to assist in these settings. See Figure 3-14 for an example.

1. Using the up/down dipswitches, adjust each color to align the Red, Green, Blue lines so that they are stacked on top of each other as a single line.
2. Make fine adjustments until color fringing is minimized.

Notes:

The dipswitches are additive. i.e. if the 16, 4, and 1 switches are on, this would give a 21 nanosecond delay.

Not all colors will have the same delay settings.

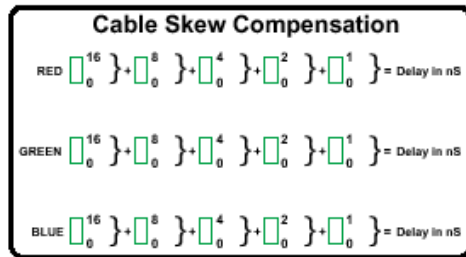


Figure 3-13: Adjustment locations

Cable Skew Compensation Setting Utility

Adjust skew equalizer to align Red, Green and Blue lines so they are stacked one on top of the other. Next, check white and black lines. Make fine adjustments until there is a minimum of color fringing.

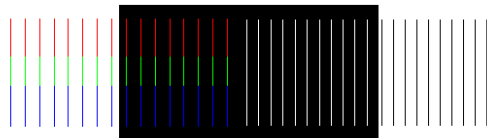


Figure 3-14: Image Adjustment Utility

3. Setup and Installation

3.1 Data Mode Configuration

AC1015A receivers are configured in full modem bidirectional serial modes. If you are using the daisy chain option or a quad hub transmitter, this mode must be changed to uni-directional broadcast. To do this, configure the internal Serial Digital Board (SDB) if you want to change the transmitters/receivers serial mode operation (See **Appendix C**). This configuration should be done before making any cable connections and applying power.

AC1016A receivers only operate in uni-directional broadcast mode and cannot be changed. Please use the appropriately configured serial transmitter unit.

3.2 Cabling Considerations

- We recommend mounting and connecting all cabling to the CAT5 Multi VGA System components before applying power.
- Makes sure that the CAT5 cable you intend to use has been tested to comply with the TIA/EIA 568B wiring specification.

3.3 Making the Connections

3.3.1 CONNECTIONS AND SETUP IN GENERAL

This section contains figures showing connections with the specific CAT5 Multi VGA System models. In general, however, the connection and setup procedure at both transmitter and receiver ends is as follows:

At the transmitter end:

1. Connect the source video to the CAT5 Multi VGA System transmitter video input port, which is an HD15 connector labeled SOURCE IN.
2. If desired, attach a local monitor via the local monitor port to LOCAL OUT.

NOTE

The single-port units with audio have a single audio input. So, for audio capabilities on the attached monitor, you'll need an audio splitter.

3. Make your audio or serial connections.

For audio versions: Connect the audio input to the AUDIO jack.

For RS-232 versions: Connect the serial input to the RS-232 (DB9 female) port.

4. Connect the CAT5 cable to the transmitter.
5. Apply power on the transmitter. The LED should light and, if there's a local monitor attached, a video image should appear on the monitor's screen.

At the receiver end:

1. Connect the SOURCE OUT HD15 connector to the display unit, and attach any audio or serial connections depending on the model of CAT5 Multi VGA System
2. Make sure that the CAT5 cable connection(s) from the transmitter are secure.
3. Apply power. The LED should light and video should appear on the display (make sure display is powered ON).
4. To adjust video levels and skew compensation see **Section 3.4**.

3.3.2 CONNECTIONS ON THE SINGLE-PORT VGA/AUDIO (AC1000A–AC1013A, AC1014A)

The single-port units with audio (AC1000A–AC1013A, AC1014A) support video and audio signals over CAT5 cable. The audio signal is line-level audio, and powered speakers are required. Note that there's a single connection for audio input. If you use a local station, you'll need an audio splitter for that jack. (For more information, call Technical Support.) You can also use the transmitters and receivers to make video-only connections without mono audio. Figure 3-1 shows the Single-Port CAT5 Multi VGA System with Audio Transmitter connections, and Figure 3-2 shows the receiver connections.

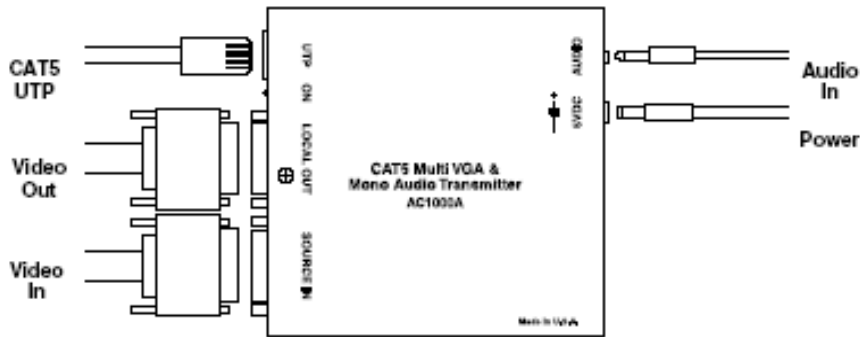


Figure 3-1. Transmitter connections on the AC1000A.

3.4 Video Adjustment

3.4.1 Cable Distance Compensation Settings

In order to get the highest quality video signals from your CAT5 Multi VGA System , please follow the instructions and diagrams below:

An Image Adjustment Utility is supplied on the enclosed disk to assist in these settings. Simply open in in any image browser on a computer. If the image file can not be downloaded, use a utility to draw a black box on a white background.

Before you begin, ensure the Coarse Select LED is set to the short range, the Fine Adjust knob is fully counter clockwise and, if applicable, all Skew Compensation switches are in the down, or 0 position.

1. Use the Coarse Select Button to switch the LED so that the white area to the right of the black box has minimal shadowing. See Figure 3-12. (This setting should not result in a brighter trail next to the window).
2. Turn the Fine Adjust know clockwise until the shadow next to the black box just disappears. The brightness in the white area should be the same as the white area above and below the black box.

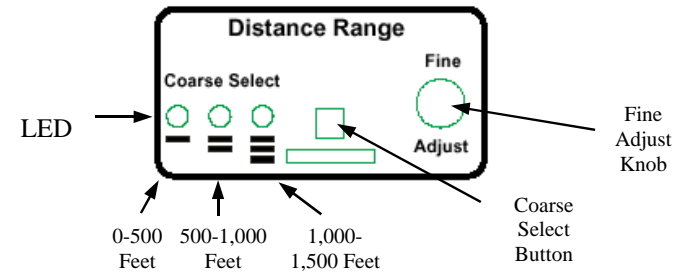


Figure 3-11: Adjustment locations

Distance Compensation Setting Utility

Adjust Cable Compensation control to obtain a minimum shadowing effect in the white area to the right of the black window



Figure 3-12: Image Adjustment Utility

3.3.6 A TYPICAL QUAD HUB TRANSMITTER–RECEIVER APPLICATION

Figure 3-10 shows an application in which a Quad Hub CAT5 Multi VGA System Transmitter is linked to four Single-Port CAT5 Multi VGA System Transmitters. Optional audio and serial connections are not shown.

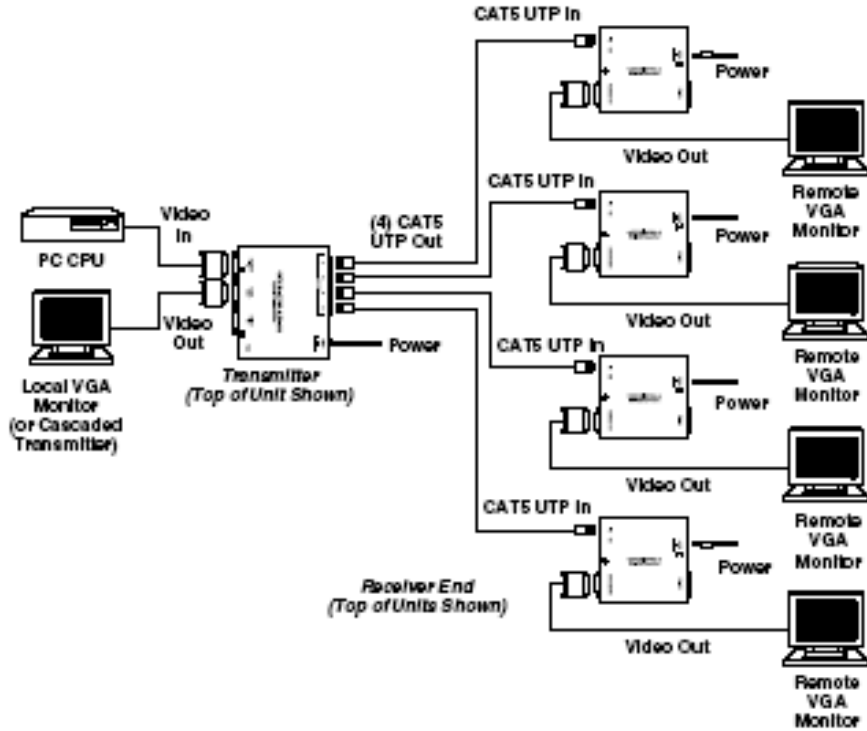


Figure 3-10. Quad hub to receiver connections.

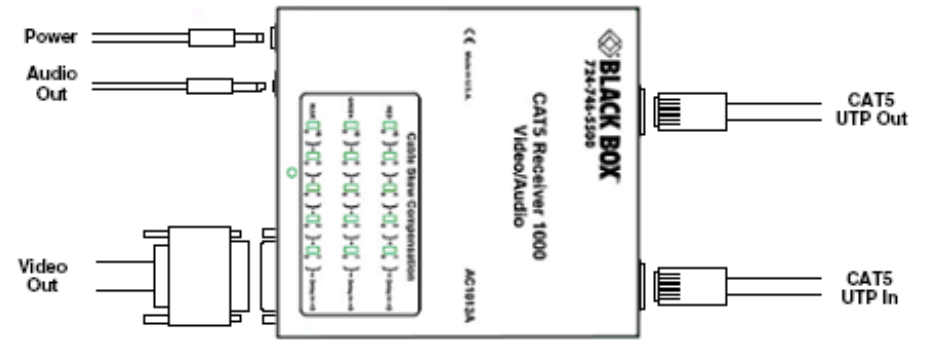


Figure 3-2. Receiver connections on the AC1013A.

3.3.3 CONNECTIONS ON THE SINGLE-PORT VGA/RS-232 (AC1004A–AC1005A)

The Single-Port CAT5 Multi VGA System with RS-232 (AC1004A–AC1005A) supports video and full-modem serial (RS-232) signals over CAT5 cable. You can also use the transmitters and receivers to make video-only connections without serial communications.

Figure 3-3 shows the Single-Port CAT5 Multi VGA System with RS-232 Transmitter connections, and Figure 3-4 shows the receiver connections.

NOTE

Even though both transmitter and receiver units contain audio jacks, audio is not supported on the RS-232 version. Plugging in audio cables will interfere with the RS-232 serial communications.



Figure 3-3. Transmitter connections on the AC1004A.



Figure 3-4. Receiver connections on the AC1005A.

3.3.4 CONNECTIONS ON THE QUAD HUB VGA/AUDIO TRANSMITTER (AC1003A) OR QUAD HUB VGA/RS-232 TRANSMITTER (AC1007A)

The quad hub (four-port) transmitter is used when the same signal is distributed to multiple display devices. You set it up and cable it the same as you would with the single-port transmitter. Figure 3-5 shows how connections are made on the audio quad hub (AC1003A) version, and Figure 3-6 shows how connections are made on the serial RS-232 quad hub model (AC1007A).

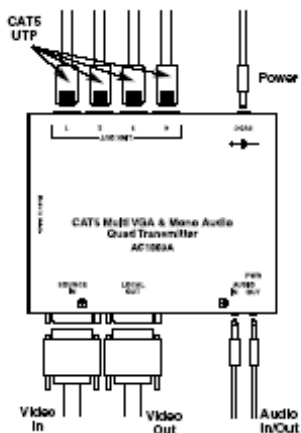


Figure 3-5. Quad hub connections on the AC1003A.

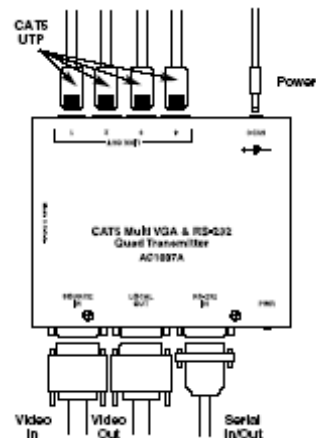


Figure 3-6. Quad hub connections on the AC1007A.

NOTE

Serial communication mode is unidirectionally broadcast when using transmitters and daisychained receivers and AC1016A receivers. In this mode, all other CAT5 Multi VGA System devices must be of the simplex serial type. For more information, contact Technical Support.

3.3.5 A TYPICAL SINGLE-PORT TRANSMITTER–RECEIVER APPLICATION

Figure 3-9 shows a typical application in which the single-unit transmitter (AC1000A or AC1004A) is connected over CAT5 to a receiver (AC1013A, AC1014A, AC1015A, or AC1016A). Although the figure shows optional audio and RS-232 connections, no model supports both audio and RS-232 communications. You can use the audio or RS-232 units as video-only transmitters/receivers, too.

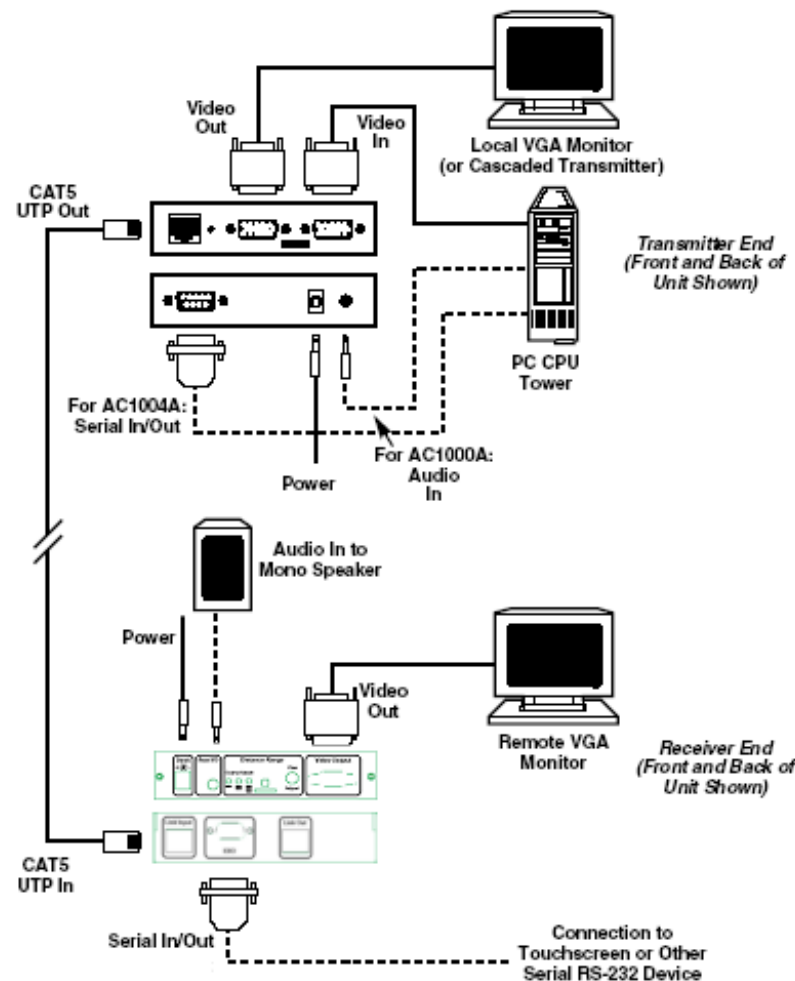


Figure 3-9. Transmitter to receiver connections.