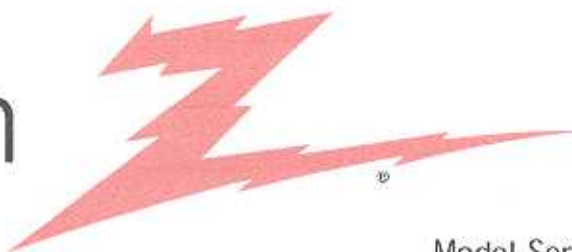


# zenith



Model Series:

PR0900X  
KPPR0900X

## SERVICE MANUAL

Product Type: Digital Projection Monitor  
Chassis: C9  
Manual Series: PV-148  
Manual Part #: 923-3378  
Model Line: Z  
Product Year: 1997

Addendum  
Spring Focus System  
Updated Parts List  
Refer to Service Manual PV-148/C9  
Projo, Part Number 923-3289

## CONTENTS

Parts List . . . . .	1	Final Detailed Geometry/Convergence Setup . . . . .	8
Setup and Alignment Procedure . . . . .	2	Digital Display Setup Procedure . . . . .	9
Installation Prerequisites . . . . .	2	Convergence of Red and Blue onto Green . . . . .	10
System Check and Physical Setup . . . . .	3	Convergence Control Illustration . . . . .	11
Floor/Ceiling Setup Configuration . . . . .	4	Setup Mode Functions (Remote) . . . . .	12
Physical Setup to Screen . . . . .	5	Specifications for Pro900 RGB Sync . . . . .	13
Preliminary Alignment Setup . . . . .	6	Vertical and Horizontal Timing Chart . . . . .	14

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# PRODUCT SAFETY SERVICING GUIDELINES FOR AUDIO-VIDEO PRODUCTS

## IMPORTANT SAFETY NOTICE

When servicing this product, under no circumstances should the original design be modified or altered without permission from Zenith Electronics Corporation. All components should be replaced only with types identical to those in the original circuit and their physical location. Wiring and lead dress must conform to original layout upon completion of repairs.

Special components are also used to prevent x-radiation, shock and fire hazard. These components are indicated by the letter "X" included in their component designators and are required to maintain safe performance. No deviations are allowed without prior approval by Zenith Electronics Corporation.

Circuit diagrams may occasionally differ from the actual circuit used. This way implementation of the latest safety and performance improvement changes into the set is not delayed until the new service literature is printed.

**Caution:** Do not attempt to modify this product in any way. Never perform customized installations without manufacturer's approval. Unauthorized modifications will not void the warranty, but may lead to property damage or user injury.

Service work should be performed only after you are thoroughly familiar with these safety checks and servicing guidelines.

## Graphic symbols



The exclamation point within an equilateral triangle is intended to alert the service personnel to important safety information in the service literature.



The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the service personnel to the presence of noninsulated "dangerous voltage" that may be of sufficient magnitude to constitute a risk of electric shock.



The pictorial representation of a fuse and its rating within an equilateral triangle is intended to convey to the service personnel the following fuse replacement caution notice: **CAUTION, FOR CONTINUED PROTECTION AGAINST RISK OF FIRE, REPLACE ALL FUSES WITH THE SAME TYPE AND RATING AS MARKED NEAR EACH FUSE.**

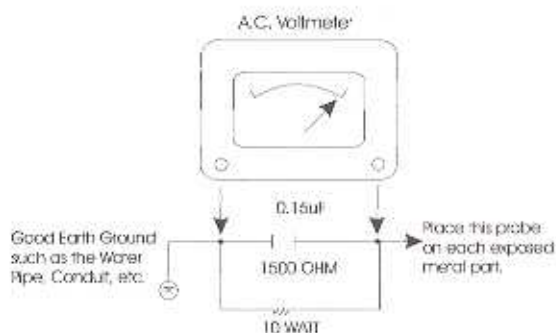
## SERVICE INFORMATION

While servicing, use an isolation transformer for protection from AC line shock.

After the original service problem has been corrected, make a check of the following:

## FIRE AND SHOCK HAZARD

1. Be sure that all components are positioned to avoid a possibility of adjacent component shorts. This is especially important on items transported to and from the repair shop.
2. Verify that all protective devices such as insulators, barriers, covers, shields, strain reliefs, power supply cords, and other hardware have been reinstalled per the original design. Be sure that the safety purpose of the polarized line plug has not been defeated.
3. Soldering must be inspected to discover possible cold solder joints, solder splashes, or sharp solder points. Be certain to remove all loose foreign particles.
4. Check for physical evidence of damage or deterioration to parts and components, for frayed leads or damaged insulation (including the AC cord), and replace if necessary.
5. No lead or component should touch a receiving tube or a resistor rated at 1 watt or more. Lead tension around protruding metal surfaces must be avoided.
6. After re-assembly of the set, always perform an AC leakage test on all exposed metallic parts of the cabinet (the channel selector knobs, antenna terminals, handle and screws) to be sure that set is safe to operate without danger of electrical shock. **DO NOT USE A LINE ISOLATION TRANSFORMER DURING THIS TEST.** Use an AC voltmeter having 5000 ohms per volt or more sensitivity in the following manner: Connect a 1500 ohm, 10 watt resistor, paralleled by a .15 mfd 150V AC type capacitor between a known good earth ground (water pipe, conduit, etc.) and the exposed metallic parts, one at a time. Measure the AC voltage across the combination of 1500 ohm resistor and .15 mfd capacitor. Reverse the AC plug by using a non-polarized adapter and repeat AC voltage measurements for each exposed metallic part. Voltage measured must not exceed 0.75 volts RMS. This corresponds to 0.5 milliamp AC. Any value exceeding this limit constitutes a potential shock hazard and must be corrected immediately.



## X-RADIATION

1. Be sure procedures and instructions to all service personnel cover the subject of x-radiation. The only potential source of x-rays in current TV receivers is the picture tube. However, this tube does not emit x-rays when the HV is at the factory-specified level. The proper value is given in the applicable schematic. Operation at higher voltages may cause a failure of the picture tube or high-voltage supply and, under certain circumstances, may produce radiation in excess of desirable levels.
2. Only factory-specified CRT anode connectors must be used.
3. It is essential that the service personnel have available an accurate and reliable high-voltage meter.
4. When the high-voltage circuitry is operating properly, there is no possibility of an x-radiation problem. Every time a color chassis is serviced, the brightness should be run up and down while monitoring the high voltage with a meter, to be certain that the high voltage does not exceed the specified value and that it is regulating correctly.
5. When troubleshooting and making test measurements in a product with a problem of excessively high voltage, avoid being unnecessarily close to the picture tube and the high voltage power supply. Do not operate the product longer than necessary to locate the cause of excessive voltage.
6. Refer to HV, Br, and shutdown adjustment procedures described in the appropriate schematics and diagrams (where used).

## IMPLOSIONS

1. All direct view picture tubes are equipped with an integral implosion protection system; take care to avoid damage during installation.
2. Use only the recommended factory replacement tubes.

## TIPS ON PROPER INSTALLATION

1. Never install any receiver in a closed-in recess, cubbyhole, or closely fitting shelf space over, or close to, a heat duct, or in the path of heated air flow.
2. Avoid conditions of high humidity such as: outdoor patio installations where dew is a factor, near steam radiators where steam leakage is a factor, etc.
3. Avoid placement where draperies may obstruct venting. The customer should also avoid the use of decorative scarves or other coverings that might obstruct ventilation.
4. Wall- and shelf-mounted installations using a commercial mounting kit must follow the factory-approved mounting instructions. A product mounted to a shelf or platform must retain its original feet (or the equivalent thickness in spacers) to provide adequate air flow across the bottom. Bolts or screws used for fasteners must not touch any parts or wiring. Perform leakage tests on customized installations.
5. Caution customers against mounting a product on a sloping shelf or in a tilted position, unless the receiver is properly secured.
6. A product on a roll-about cart should be stable in its mounting to the cart. Caution the customer on the hazards of trying to roll a cart with small casters across thresholds or deep pile carpets.
7. Caution customers against using a cart or stand that has not been listed by Underwriters Laboratories, Inc. for use with its specific model of television receiver or generically approved for use with TVs of the same or larger screen size.
8. Caution customers against using extension cords. Explain that a forest of extensions, sprouting from a single outlet, can lead to disastrous consequences to home and family.

# PRODUCT SAFETY SERVICING GUIDELINES FOR AUDIO-VIDEO PRODUCTS

## HIGH-VOLTAGE SHUTDOWN CIRCUITS FOR X-RADIATION PROTECTION

This projector incorporates several high-voltage (H.V.) shutdown circuits including two redundant overvoltage shutdowns. These have been factory preset and locked. Under normal operation no adjustment should be necessary. However, if any servicing is done involving these critical safety circuits, especially the focus and G2 block assembly (A-18212-01), the H.V. sweep transformer (X4902) and the three potentiometers (RX4993, RX4985, RX4910), they need to be checked for proper operation and if necessary reset by the procedure specified below. Failure to do so may result in violation of Federal Standards for X-Radiation.

To check the H.V. and the proper functioning of the H.V. shutdown circuits you will need:

- An accurate (+/- 1%) 40kV H.V. meter.
- A 10k, 20% 1/2 watt potentiometer.
- A 3k, 5%, 1/4 watt resistor.
- Tune wire leads with small clip-on terminals configured as pictured in the external H.V. adjust test circuit.

To check the H.V. Trip Points

Connect the H.V. meter to the focus and G2 block assembly in place of one of the three C.H.T. Anode connections, using a suitable H.V. probe.

**Caution: DO NOT disconnect the H.V. lead from the H.V. SMPS module (9-1504) to the focus and G2 block assembly (A-18212).**

Power up the unit and measure the H.V.

It should be 32.0kV +/- 500 volts.

If it is not in specification, RX4910 should be replaced with a new factory specified part and adjusted to 32.0kV and sealed with 205-460 cement.

Power down unit and attach external H.V.

Adjust test circuit by connecting leads as shown to RX4910 and RX4911 on the 9-1504.

These points are accessible so this can be done without removing the module from the chassis.

Set the external potentiometer (R-ext) to midrange.

Power up the unit and set R-ext for 32.0kV.

Next, very slowly turn R-ext to increase H.V. toward 36.5kV.

After 35.0kV but before reaching 36.5kV, the high voltage should shutdown and remain off, and the red L.E.D. (DX4950) located on the edge of the main heatsink on the 9-1504 should illuminate brightly.

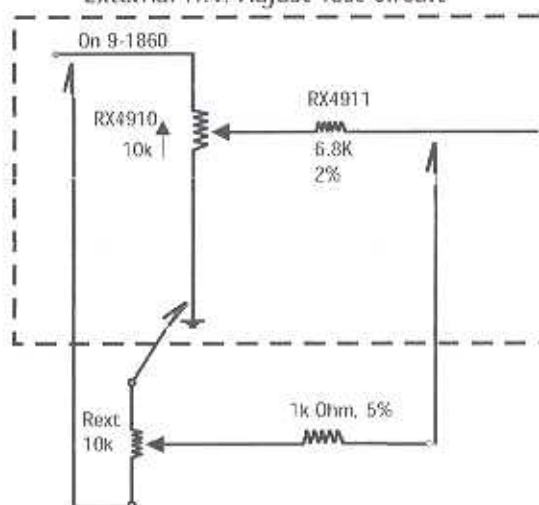
Power-down unit to reset.

Return R-ext to midrange position.

Temporarily ground the H.V. shutdown override test point (13AX) on 9-1504 using clip lead.

This defeats the first shutdown so the second (redundant) shutdown can be tested.

## External H.V. Adjust Test Circuit



Power-up unit.

Very slowly increase H.V. using R-ext toward 36.5kV.

After 35.0kV but before 36.5kV the H.V. should shutdown and remain off and the red L.E.D. should illuminate.

Power-down unit.

Remove temporary ground jumper from test point 13AX and disconnect external H.V. adjust test circuit.

If the high voltage overvoltage circuits failed to perform within specified ranges, it may be necessary to replace RX4910, RX4985 and RX4993 with new factory parts and to go through the dual H.V. set-up procedure specified below. If this also fails to correct the problem, the shutdown circuits will need to be serviced in proper working order or the 9-1504 module replaced.

## Dual H.V. Set-Up Procedure

1. Turn R4985 and R4993 fully counterclockwise.  
Adjust H.V. adjust (RX4910) to mid-point.  
Power-up unit.
2. Adjust RX4910 to 35.3kV +/- 200 volts.
3. Adjust RX4985 clockwise very slowly until trip occurs (H.V. drops to Zero and red L.E.D. lights).  
Power-down unit.
4. Power-down unit to reset and ground test pin 13AX temporarily.  
Turn RX4910 to midrange.  
Power-up unit.
5. Reset H.V. with RX4910 to 35.3 kV.
6. Adjust RX4993 very slowly clockwise till H.V. trips again.  
Power-down unit.
7. Remove jumper from test pin 13AX and set RX4910 to midrange.  
Power-up unit.
8. Adjust RX4910 to 32.0kV +/- 100 volts.
9. Permanently lock these three pots down with 205-460 cement.



# TABLE OF CONTENTS

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## Table of Contents

Parts List .....	1
Pro900 Setup and Alignment Procedure.....	2
Procedure Overview .....	2
Installation Prerequisites .....	2
System Check and Physical Setup .....	3
Set Floor/Ceiling and Front/Rear Configuration .....	3
Mounting Projector System .....	3
Projector/Display Surface Physical Setup.....	3
Setup Signal Sources.....	3
Floor/Ceiling Setup Configuration .....	4
Physical Setup to Screen.....	5
Preliminary Alignment Setup .....	6
Yoke Ring Magnet & Astigmatator Alignment.....	6
Rough Geometry/Convergence Setup of Green.....	6
Rough Geometry/Convergence of Red/Blue.....	6
Yoke Ring magnet and Astigmatator Alignment .....	6
Astigmatator Alignment Procedure .....	7
Ceiling/Front Projection .....	7
Final Detailed Geometry/Convergence Setup .....	8
Green Geometry Setup.....	8
Red to Green Convergence .....	8
Blue to Green Convergence .....	8
Red to Green to Blue Convergence .....	8
Video Blanking .....	8
Geometry/Convergence other Aspect Ratios .....	8
Digital Display Setup Procedure Geometry Convergence .....	9
Digital Display Setup Procedure - Convergence of Red & Blue onto Green .....	10
Convergence Control Illustration.....	11
Setup Mode Functions (Remote Control).....	12
Specification for Pro900 RGB Sync Inputs.....	13
Vertical and Horizontal Timing Chart .....	14

# COMPONENT PARTS

A: PR0900X

B: KPPRPRO900X

MODEL #/SERVICE #	PR0900X	KPPRPRO900X
DIODE (GREEN)	103-328	103-328
SCREW, MACHINE 8-32 X 0.500 ZN	112-2289-11	112-2289-11
SCREW, THD FORM 0.164-10 X 1.000 TP B	112-2644-01	112-2644-01
AC LINE CORD	11-380-02	11-380-02
SCREW, MACHINE 8-32 X 0	114-1124-20	114-1124-20
SCREW, THD FORM 6-10 X 0	114-1435-01	114-1435-01
SCREW, MACHINE 0.250-20	114-1558-02	114-1558-02
SCREW, MACHINE 10-32 X 0	114-1559	114-1559
SCREW, THD FORM 8-18 X 0.375 TP B BP	114-802-01	114-802-01
SCREW, THD FORM 8-18 X 0	114-802-15	114-802-15
OPTIC PLATE BRACKET	12-10633-01	12-10633-01
BRKT PS MTG.	12-10647	12-10647
BRKT PCB/JK PK	12-10648	12-10648
BRKT LEFT SIDE	12-10649-02	12-10649-02
BRKT RIGHT SIDE	12-10650-02	12-10650-02
BRKT BOTTOM REAR	12-10651	12-10651
BRKT BOTTOM CENTER	12-10652-02	12-10652-02
BRKT VERT CONVERG	12-10654-01	12-10654-01
BRKT HINGE	12-10655-01	12-10655-01
BRKT RIGHT PCB (2)	12-10657	12-10657
BRKT CENTER PCB	12-10658	12-10658
BRKT CENTER PCB RETAINER (2)	12-10659	12-10659
BRKT VERT OUT SIDE (2)	12-10660	12-10660
BRKT SWEEP XFORMER	12-10662	12-10662
JK PACK/CUSTOMER CONTROLS PANEL	12-10668	12-10668
BRKT PC CHASSIS SUPPORT	12-10669	12-10669
BRKT VERT (14)	12-10670	12-10670
BRKT CENTER PCB	12-10671	12-10671
BRKT FOCUS BLOCK	12-10673	12-10673
BRKT FRONT FAN MTG (2)	12-10679-02	12-10679-02
BRKT SIDE FAN MTG (2)	12-10680-02	12-10680-02
PCB RETAINER (2)	12-10695	12-10695
CEILING MOUNT BRACKET (2)	12-10743	12-10743
FOCUS MODULE BRKT	12-10792	12-10792
BRKT PCB MOUNT (9-1504-02)	12-10825	12-10825
BRKT PCB MOUNT (9-1505-02)	12-10825-01	12-10825-01
REMOTE	124-205-11	124-205-15
Z-TRACK	124-207-02	124-207-02
SHIELD PROTECTIVE BARRIER	126-3635	126-3635
CABINET GRILL RIGHT (VENTILATION)	138-1929	138-1929
CABINET GRILL LEFT (VENTILATION)	138-1930	138-1930
CABINET TOP	14-12239	14-12239-03
CABINET FRONT	14-12240	14-12240
CABINET BOTTOM	14-12241	14-12241
FAN, 12VDC (4)	141-227-11	141-227-11

MODEL #/SERVICE #	PR0900X	KPPRPRO900X
IR RECEIVER REAR	162-35	162-35
BUMPER ADJUSTABLE CABINET FOOT	166-328	166-328
CRYSTAL WINDOW IR	192-872	192-872
OPERATING GUIDE	206-3275	206-3134-01
INSTALLATION GUIDE	206-3276	206-3152-01
INTERCONNECT DIAGRAM	28-3924	28-3924
CONNECTER & CABLE ASSY, 11 CONTACT	50-1778	50-1778
CONNECTER & CABLE ASSY	50-1986-35	50-1986-35
CONNECTER & CABLE ASSY-TO CIRCUIT	50-2587-01	50-1986-01
SW PUSH BUTTON (7 SW)	85-1691	85-1691
MODULE AC/DC CONVERTER	9-1500-02	9-1500-02
SWEEP/SMPS 157 WATT	9-1501-02	9-1501-02
SWEEP/SMPS 151 WATT	9-1502-02	9-1502-02
SWEEP/SMPS 188 WATT	9-1503-02	9-1503-02
HV SW	9-1504-03	9-1504-03
HORIZONTAL DEFLECTION	9-1505-02	9-1505-02
DIGIT. SIG. PROCESS	9-1506-02	9-1506-02
JK PK ASSY	9-1507-02	9-1507-02
ANALOG CONVERGENCE MODULE	9-1509-02	9-1509-02
CONVERG./V.DEFL	9-1510-02	9-1510-02
VIDEO OUTPUT (3)	9-1512-03	9-1512-03
SYS CONT/LOW LEVEL SCAN RGB PROCESS	9-1515-02	9-1515-02
MAIN CARRIER	9-1516-02	9-1516-02
DIGITAL CONTROL MOD	9-1571-02	9-1571-02
MODULE HIGH VOLTAGE	9-1594-02	9-1594-02
DEFLECTION YORE (3)	95-4465	95-4465
LENS & HOUSING (2)	A-18137	A-18137
KEYBOARD ASSY (STEREO)	A-18153	A-18153
PANEL ASSEMBLY - CONVERGENCE	A-18211	A-18211
FOCUS/G2 BLOCK	A-18212	A-18212
IR DET/AMP (FRONT)	A-18236	A-18236
FRAME ASSEMBLY	A-18242	A-18242
ELECTRONICS CARRIER	A-18243-01	A-18243-01
PANEL ASSEMBLY - POWER SUPPLY	A-18244	A-18244
CABLE AND HARNESS ASSEMBLY	A-18264	A-18264
CABLE AND HARNESS ASSEMBLY B	A-18268	A-18268
CRT (GREEN)	A-18552-01	A-18552-01
CRT (BLUE)	A-18553-01	A-18553-01
CRT (RED)	A-18554-01	A-18554-01
FRAME ASSEMBLY ELECTRONICS & OPTICS	A-18555-01	A-18555-01
PURITY/CONVERGENCE MAGNET ASSY (3)	A-7690-07	A-7690-07
MAGNET ASSEMBLY STATIC CONVERGENCE	A-7690-07	A-7690-07
KEYBOARD ASSY 7 POSITION	F-50905	F-50905

# DIGITAL DISPLAY SETUP PROCEDURE

## Pro900 Setup and Alignment Procedure

### Procedure Overview

There are several situations to consider when performing the setup procedure for the Pro900 System. The setup procedure will vary depending on the required physical and signal configuration.

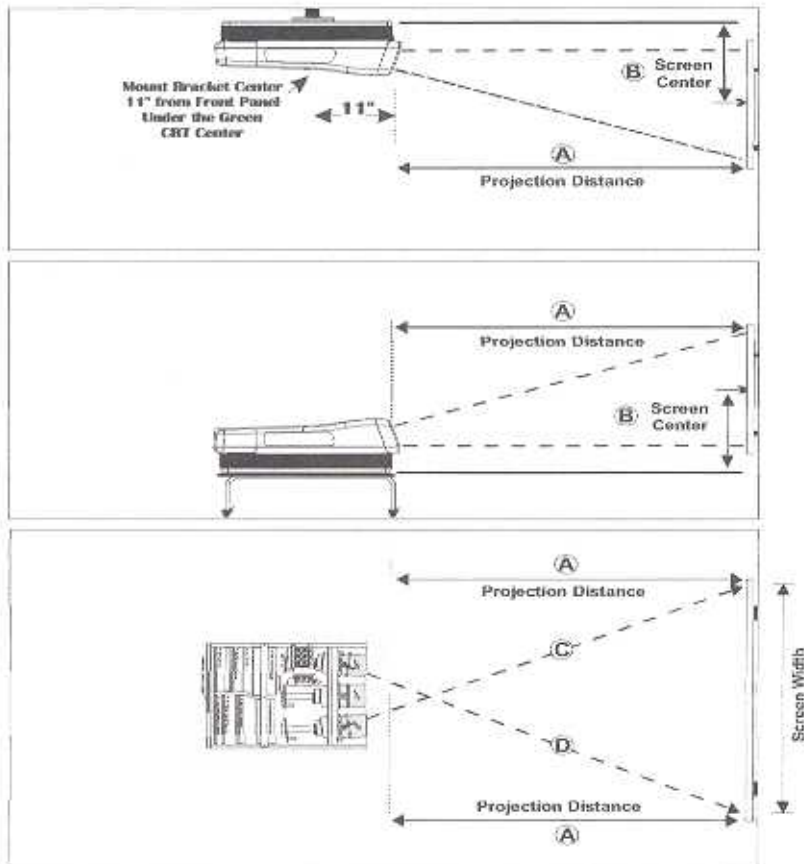
The simplest setup is that of a new "factory configured" projector. Under these conditions the unit has been aligned for ceiling/front projection and a 80" wide display at a projected distance of 95 7/16". In this case, using the customer's signal source, only minor blanking, phase, and convergence touch up is required.

If the display size is changed, to other than 80" wide or the unit is to be floor mounted, completion of the full setup procedure is required.

Setup, after a hardware repair, is the other condition. Replacement of a CRT usually require minor alignment steps (yoke, astigmatator, focus, and reconvergence). Replacement of modules, in the vertical, horizontal deflection, or convergence systems, usually requires that most all alignment steps to be performed.

## 1. Installation Prerequisites

1. Mounting Configuration Determination - Floor or Ceiling.
2. Projection Configuration Determination - Front or Rear.
3. Determine Display Size and Screen Aspect Ratio (Shape).
4. List All Signal Source(s) and Format(s).
5. Check Projection Installation Area - Before Installation.
6. Survey Installation Area For Power and Signal Source Requirements.
7. Test Pro900 system before modifying its configuration.
8. Install and setup the Pro900 system.





# DIGITAL DISPLAY SETUP PROCEDURE

## II. System Check and Physical Setup

### 1. Pro900 Check Out Before Changes to Configuration

#### **IMPORTANT**

*Do Not Connect Power until you verify correct setup of the 120/220 VAC jumper on the 9-1500 power supply.*

Refer to the figure below.

- Connect all the customer's RGB and Composite Video Source(s) to the Pro900 jack pack.
- Turn on the Pro900 and Signal Source(s).
- Verify that the Pro900 recognizes all source signals.
- Verify that the Pro900 operates correctly.
- Turn the Pro900 off and disconnect AC power.

### 2. Set Floor/Ceiling and Front/Rear Configuration

Refer the figures on page 4.

- Remove the Pro900 top cover.
- 9-1510 Module set vertical deflection and horizontal/vertical convergence connectors.
- 9-1505 module set horizontal deflection connectors.
- 9-1509 module set dynamic focus switch SW7001.

### 3. Set Red and Blue CRT Point Angles

- Remove nylon rod shipping spacers (or shipping wedges).
- Set Red CRT point angle according to display width.
- Set Blue CRT point angle according to display width.

Refer to figure on page 5.

**Note:** *The Pro900 unit is shipped with spacer shims between the CRT and lens assemblies these must be removed to setup CRT mechanical focus. Refer to figure on page 7 lens focus procedure.*

### 4. Mounting Projector System.

Mount the Pro900 system according to prearranged plans of the customer. Verify mounting point, hardware, signal connections, and power connections.

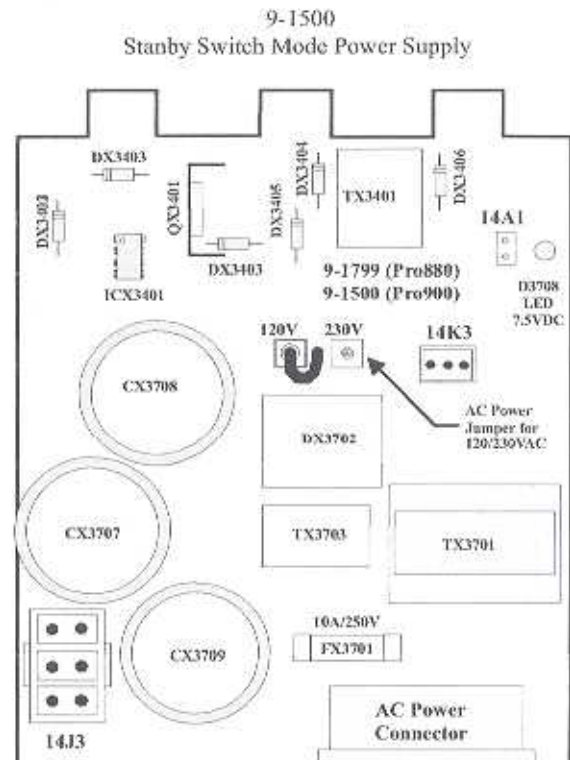
**Note:** *It is recommended that preliminary setup be done on the floor before hanging a ceiling configured system.*

### 5. Projector/Display Surface Physical Setup

- Set the projector to screen distance according to display width. Refer the figures on pages 4 and 5.
- Set projector height according to display size. Refer the figures on pages 4 and 5.
- Adjust projector's position for no horizontal skew to display screen.
- Verify that Green CRT center is centered (+/-1/8") to the screen horizontal center.
- Stabilize projector and screen mounting hardware.
- Verify that setup of steps "a" through "d" did not change.

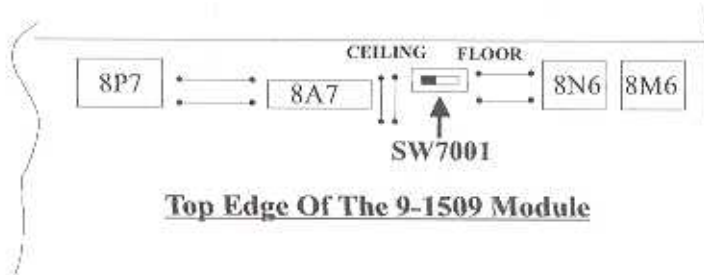
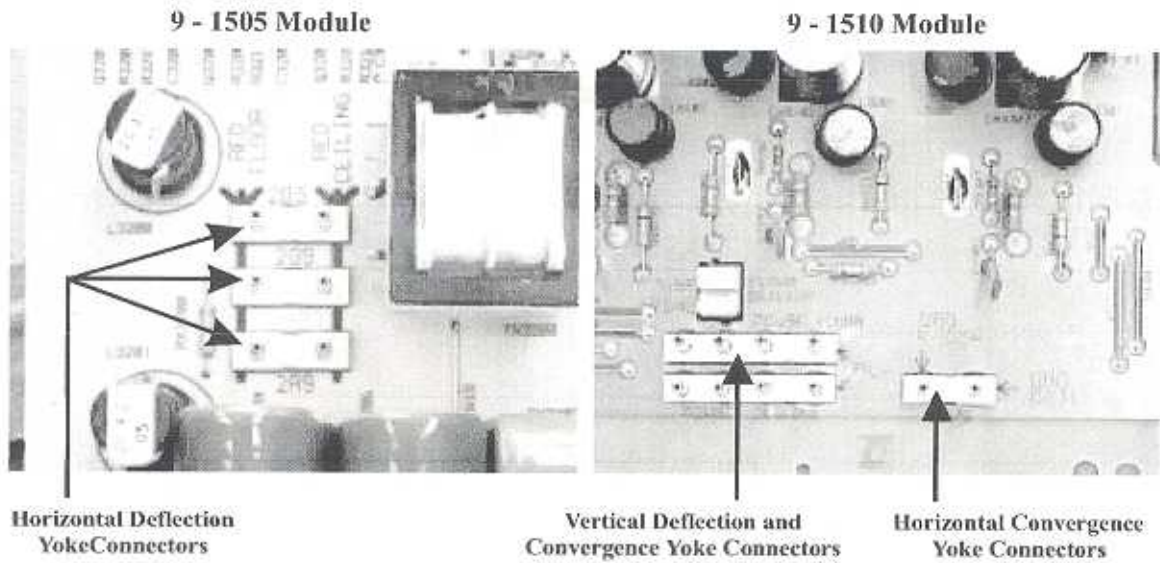
### 6. Setup Signal Sources

- Connect the RGB and/or Video Source(s) to Pro900 jack pack.
- Reconnect AC power.
- Turn on the Pro900 and Signal Source(s).
- Verify that the Pro900 recognizes all source signals.
- Set Ceiling/Floor setup menu option.



9-1502-02 \$357,61  
 module smps/sweep 181W

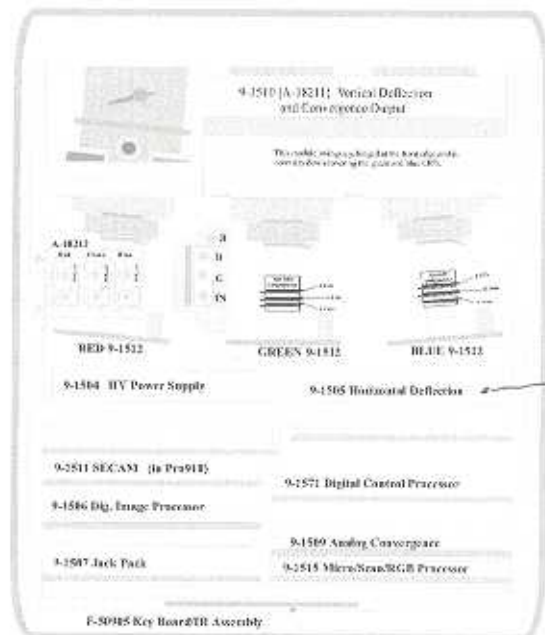
## DIGITAL DISPLAY SETUP PROCEDURE



### Floor/Ceiling Setup Configuration

**The Floor/Ceiling Setup Must Be Completed Before Convergence Is Started.**

1. On the 9-1505 deflection module you must set the three main horizontal yoke cables to FLOOR or CEILING.
2. On the 9-1510 vertical deflection/convergence driver module you must set the vertical deflection/convergence and the horizontal convergence yoke connectors to FLOOR or CEILING.
3. On the 9-1509 convergence/vertical generator module you must set SW7001 to FLOOR or CEILING, for the dynamic focus setup.
4. In the system setup menu you must setup the FLOOR or CEILING option for the geometry offsets.



9-1505-02  
 \$762,64  
 Module  
 Horiz.  
 Deflection

bin TRAVO



# DIGITAL DISPLAY SETUP PROCEDURE

## Pro900/880 Projection System Display Setup Distances Table

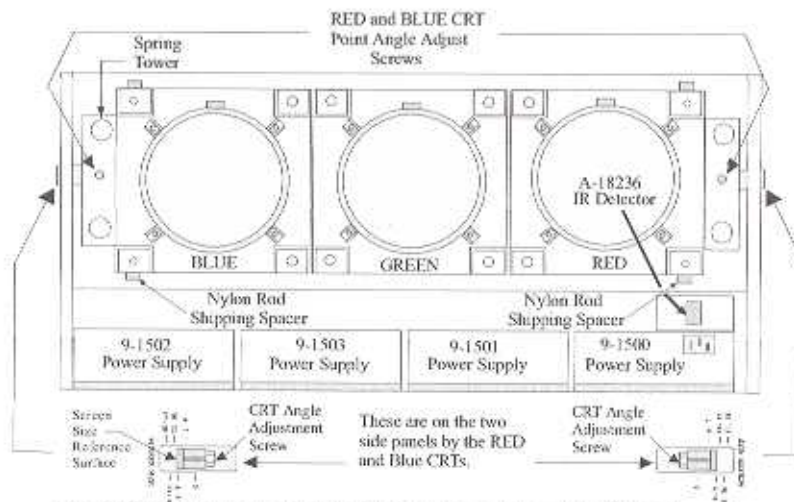
Screen Width	"A" Projection Distance	"B" Screen Center	"Peerless" Mount Center
48"	58 5/8"	26 3/8"	11"
60"	72 7/8"	30 3/4"	11"
80"	96 3/8"	36"	11"
96"	115 1/2"	43 5/8"	11"
120"	143 1/2"	52 3/8"	11"
144"	171 7/8"	61"	11"
160"	190 5/8"	66 3/4"	11"
200"	237 7/8"	81 1/8"	11"

### PHYSICAL SETUP TO THE SCREEN (for all aspect ratios)

1. Set distance "A" according to selected display width (\* or calculate distance in inches "A" = 1.179 x width) +2.063.

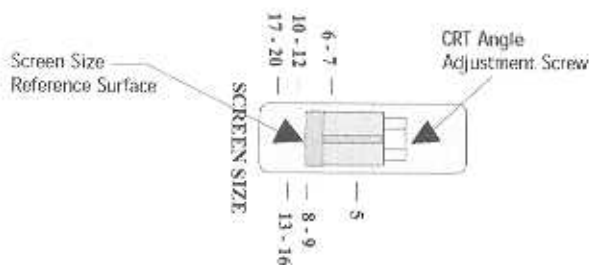
**NOTE:** distance "A" is measured from the cabinet panel front directly below the green CRT lens.

2. Calculate Display Center "B" from a reference line projected from bottom of cabinet. Display Center "B" = A x 0.3057 + 8.44.
3. Set projector's height using measurement "B". This references the bottom of cabinet to display center. When doing a ceiling mount be sure to allow for dimensions of mounting bracket hardware.
4. Adjust for no horizontal twist and verify that the green CRT is at the display horizontal center by making measurements "C" and "D" equal. **NOTE:** the light path start is straight out from the bottom of green CRT lens opening.
5. Verify distance "A" has not changed.
6. The Peerless ceiling mount center is 11" from the "A" distance reference point on the Pro900.
7. Set Red and Blue CRT point angle for selected screen size.



This projection system comes set up for Ceiling Mount and a display width of 80". To change the display width the four shipping wedges or two shipping spacer rods for the RED and BLUE CRTs must be removed. This allows the RED and BLUE CRT point angles to be set for the new display width.

### Screen Size Adjustment



Width Min. (in.)	Width Max. (in.)	Screen Size
48	55	5-6
55	72	6-7
72	91	8-9
91	120	10-12
120	156	13-16
156	192	17-20

# DIGITAL DISPLAY SETUP PROCEDURE

## III. Preliminary Alignment Setup

The following procedures are intended for complete "Geometry/Convergence" setup. Use the customer's signal for doing DC centering, phase, and size adjustments. You can use the internal patterns for shape and convergence if the customer signal sources do not have a cross hatch pattern.

If you are realigning a single CRT, due to replacement, or doing alignment touch up perform the following steps, as needed.

### 1. Yoke Tilt Alignment

Use a cross hair or cross hatch pattern. Monitor only the center most horizontal line of the pattern to check yoke tilt.

**Do Not** Use SW9501, on the 9-1510 module, to disable convergence. Disable only the horizontal circuit. The vertical is not to be disabled.

a. Set Horizontal DC centering to "0" (red, green, blue).

b. Set Vertical DC centering:

Floor: Red = -30; Green = -20; Blue = -30.

Ceiling : Red = 30; Green = 20; Blue = 30.

c. In Geometry Mode set Green, Red, and Blue "SKEW" H = 0 and "SKEW" V = 0.

d. Adjust the Red, Green, and Blue yokes for no horizontal tilt or twist.

### 2. Rough Geometry/Convergence Setup of Green

When aligning green, some controls are enabled in Geometry only. This is why the alignment starts by using green in the geometry mode of setup.

a. Using the setup remote control press **SETUP** and **RED**. This will put the system into the **GEOMETRY MODE**.

b. Using the setup remote control press **RED MUTE** and **BLUE MUTE**. You should see only the green video.

c. Roughly setup the shape of the green display using the appropriate Skew, Bow, Key, etc. controls. Adjust linearity, size, or phase using the customer's video signal. Refer to pages 9, 10, and 11 for the convergence remote control and procedure notes.

### 3. Rough Geometry/Convergence of Red and Blue

a. Using the remote control return to the **SETUP** Mode and select the internal cross hatch pattern.

b. Press **RED** and mute the green and blue video.

c. Roughly setup the shape of the red display using the appropriate Skew, Bow, Key, etc. controls. Adjust linearity, size, or phase using the customer's video signal. Refer to pages 9, 10, and 11.

d. Press **Green Mute** to display green and red video at the same time.

e. Using Point Angle adjustment screws, align the vertical center line of the red pattern to the vertical center line of the green pattern.

f. Using DC vertical center align the horizontal center line of the red pattern to the horizontal center line of the green pattern.

g. Adjust red Size and Lin T/B - L/R to roughly match the green pattern size. Refer to pages 9, 10, and 11.

h. Press **BLUE** and mute the green and red video.

i. Roughly setup the shape of the blue display using the appropriate Skew, Bow, Key, etc. controls. Adjust linearity, size, or phase using the customer's video signal. Refer to pages 9, 10, and 11.

j. Press **Green Mute** to display green and blue video together.

k. Using Point Angle adjustment screws, align the vertical center line of the blue pattern to the vertical center line of the green pattern.

l. Using DC vertical center, align the horizontal center line of the blue pattern to the horizontal center line of the green pattern.

m. Adjust blue Size and Lin T/B - L/R to roughly match the green pattern size. Refer to pages 9, 10 and 11.

n. Press **QUIT** and **ADJ TOGGLE** to store the adjustments.

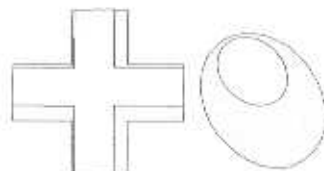
### 4. Yoke Ring Magnet and Astigmatator Alignment Verify Only - This is not a normal field adjustment.

The astigmatator assembly should be mounted 62.5 mm from the video output module (from the front edge of the video output module to the six pole rings). Refer to the figure on the bottom of page 8.

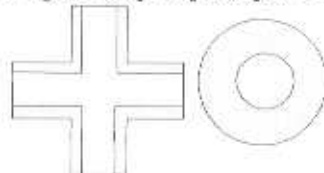
#### Astigmatator Alignment Verification Test

Adjust for the best electrical and mechanical focus.

Verify spot alignment by rotating Green electrical focus slightly CW to CCW. The Dot shape should not tail or flair. The bright area should remain in the center of the haloed area. Refer to the figure below.



**Bad Centering and shape adjust 2 pole and 4 pole**



**Good Shape and Centering**

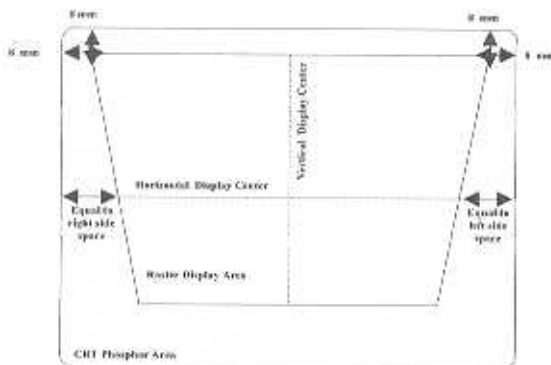


# DIGITAL DISPLAY SETUP PROCEDURE

If this test shows a need for astigmatator alignment perform steps a to n below.

## Astigmatator Alignment Procedure

- Set display/sync mode to Forced Mode 6 (HDTV33) and select a cross hatch or dot pattern.
- Cut off Red and Blue video or cover the CRT lens assemblies.
- Set the astigmatator 2, 4, and 6 pole magnets to the zero position (ring tabs together and pointed straight up).
- Set Green electrical focus slightly CCW. This is to make a near display center dot dimly haloed with a bright center. The haloed effect will also be visible with the cross hatch lines.
- Use the astigmatator 2 pole magnet (refer to the figure on page 6) to center the bright spot within the halo. You may also use an intersection, of the cross hatch, to center the bright area within the haloed area.
- Use the astigmatator 4 pole magnet to shape the halo and bright spot as round as possible.
- Use the astigmatator 6 pole magnet, if needed, to help shape the halo and spot round.



The center of the video pattern display should be in the center of the CRT phosphor area. Video pattern display is vertically centered below the horizontal center of the display.

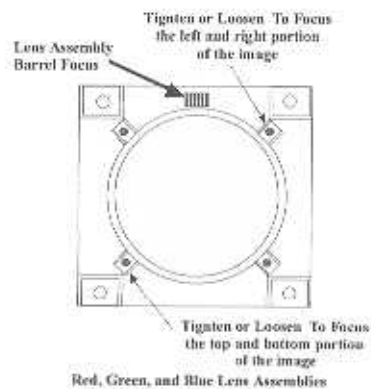
- Use the main yoke magnets to position the signal source video pattern center to the CRT face center. Refer to the figure below.
- Repeat steps e thru h as needed to obtain the smallest and best round Green center dot.
- Verify spot alignment by rotating Green electrical focus slightly CW to CCW. Dot shape should not tail or flair and bright area should remain in center of haloed area.
- Repeat steps e thru j as needed to obtain the smallest and best round Green center dot with no shape flaring.

- Adjust for best electrical and mechanical focus.
- Repeat steps d thru m for the Red and Blue displays.
- Exit forced mode 6 and return to normal video. Set Brightness and Contrast to 50.

**Note: The yoke adjustments should not be touched during the remaining setup steps.**

**5. Ceiling/Front Projection Lens Angle Focus Alignment** If this Pro900 system is equipped with the lens assembly focus spring, the following procedure must be completed. This procedure must be completed as part of the system mechanical focus procedure. See the figure below.

- Turn on projector, project a crosshatch pattern on the screen. Cover up both blue and red lenses. Work only on green lens.
- Adjust mechanical and electrical focus to obtain best image possible in the center of the picture.
- Tighten all 4 lens mounting screws.
- Loosen all 4 lens mounting screws 3 full turns.
- Loosen lens focus adjustment knob, fully extend lens barrel. Adjust mechanical focus while observing vertical center line. If upper portion of image comes to focus before the lower portion of the image, tighten or loosen lower left screw until both upper and lower portions of the image come to focus simultaneously. It's recommended to tighten the screws 1/8 - 1/4 turn each time for adjustment.



- Adjust mechanical focus while observing horizontal center line. If right portion of image comes to focus before the left, tighten or loosen lower left screw until both right and left portions of image come to focus simultaneously. It's recommended to tighten the screws 1/8 - 1/4 turn each time for adjustment.
- Adjust focus mechanically and electrically to obtain best overall image.
- Cover green lens and uncover red lens.



# DIGITAL DISPLAY SETUP PROCEDURE

- i. Repeat step **b** thru **g** for red.
- j. Cover red lens and uncover blue lens.
- k. Repeat step **b** thru **g** for blue.
- l. Re-install Pro900 top cover.
- m. Turn off sync forced mode 9 and return to normal video viewing or sync forced mode 11.

## IV Final Detailed Geometry/Convergence Setup

Use the video patterns generated by the customer's signal source for final alignment. If this is not possible use internal cross hatch pattern only to do the geometry and convergence. The customer's signal for must be used blanking, size, centering and phase.

### 1. Green Geometry Setup

- a. Return to the geometry and convergence modes and setup green display with precision. Each step should be done by measuring display and not guess work.
- b. Store green setup.

### 2. Red to Green Convergence Setup

- a. Return to the convergence mode and setup the red display with precision. Convergence red display to green display using all necessary controls.
- b. Store red setup.

### 3. Blue to Green Convergence Setup

- a. Return to the convergence mode and setup blue display with precision. Convergence red display to green display using all necessary controls.
- b. Store blue setup.

### 4. Red to Green to Blue Convergence Setup

- a. Return to the convergence mode and setup red and blue display with precision. Convergence red display to green display using all necessary controls.
- b. Store completed setup.

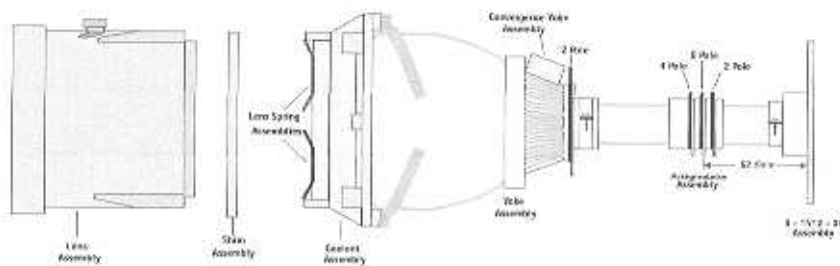
### 5. Video Blanking Setup Using the Customer's Signal

- a. Access Blanking/Phase feature of setup menu.
- b. Select TOP/LEFT BLANKING feature.
- c. Using small arrows adjust top and left edges (increasing setting number) until edge begins to crop or frame the video. Decrease number until cropping just stops. Now decrease number value two more.
- d. Select BOTTOM/RIGHT BLANKING feature and repeat step c.
- e. Press **ADJ TOGGLE** and save settings.

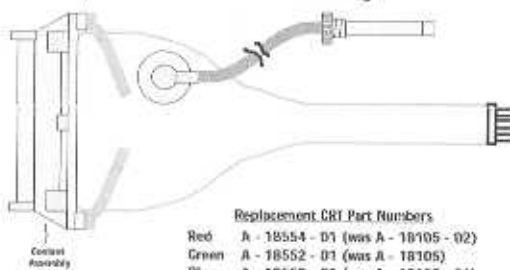
## V. Geometry/Convergence of Other Aspect Ratios

- 1. Geometry/Convergence setup must be accomplished for each required aspect ratio of each signal format used (Video, S-Video, RGB VGA400, VGA480, SVGA, etc.).
- 2. Each of the ten standard signal format memory custom locations also has a custom location for each of associated aspect ratios.

Installed Pro900 CRT Assembly



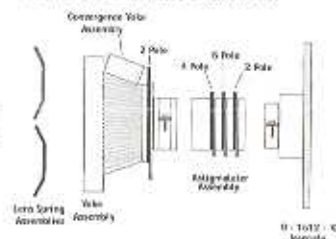
Replacement CRT Assembly



Replacement CRT Part Numbers

Red	A - 18554 - 01 (was A - 18105 - 02)
Green	A - 18552 - 01 (was A - 18105)
Blue	A - 18553 - 01 (was A - 18105 - 01)

Transferred Assemblies



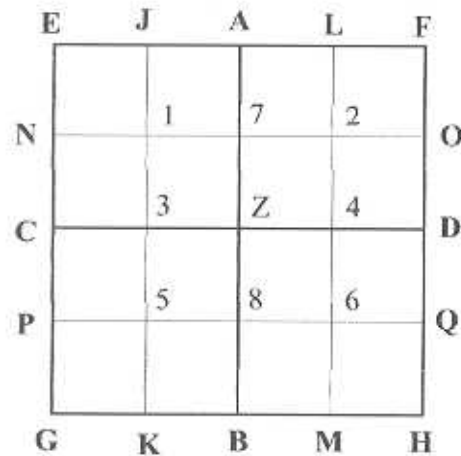
# DIGITAL DISPLAY SETUP PROCEDURE

## DIGITAL DISPLAY SETUP PROCEDURE GEOMETRY CONVERGENCE

Geometry controls all three colors at the same time.

Button	Adjustment	Goal
1. SIZE	H. Size	Set to fill screen at C and D. (Use external source <b>not</b> internal test pattern)
2. SIZE	V. Size	Set to fill Screen at A and B. (Use external source <b>not</b> internal test pattern.)
3. SMALL ARROWS	H&V Video Phase	Set the position of the external source to be centered on the screen.
4. SKEW	V. Skew	Level line C-D.
5. BOW	Bow V.	Straighten line C-D (note that some screen frames are curved).
6. SKEW	H. Skew	Line A-B edges equal distance to screen edge.
7. BOW	H. Bow	Straighten Line A-B
8. LIN TB LRH.	Lin L-R	Set equal widths CZ-ZD
9. LIN TB LRV.	Lin T-B	Set equal height AZ-ZB
10. LIN C	H. Lin C	Set box width at center equal to average of left and right box widths and size.
11. LIN C	V. Lin C	Set box heights at center equal to average of top and bottom box widths and size.
12. KEY	V. Key	Set bottom edge G-H straight with respect to screen border.
13. PIN	V. Pin	Set for straight bottom edge, line G-H (corners G & H move, center B is stable.)
14. S-ING	V. 'S'	Set for straight bottom edge, line G-H (middle areas K & M move in opposite direction, center B; and ends G & H are stable).
15. W-M	V. W-M	Adjust for straightest line G-H (middle areas K & M move in same direction, center B and ends G & H are stationary).
16. KEY	H. Key	Set right edge F-H straight with respect to screen border (top and bottom move in opposite directions; center D is stable.)
17. PIN	H. Pin	Set for straight right edge, line F-H (corner F&H move, center D is stable.)
18. S-ING	H. 'S'	Set for straight right edge, line F-H (middle areas G & Q move opposite and center D and ends F & H are stable.)
19. T/L KEY	V. Top Key	Set top edge E-F straight with respect to screen border.

Button	Adjustment	Goal
20. T/L PIN	V. Top Pin	Set for straight top edge, line E-F.
21. T/L S	V. Left S	Set for straight edge, line E-F (middle areas J & L move opposite; center A and ends E & F are stable).
22. T/L KEY	H. Left Key	Set left edge E-G straight with respect to screen border top and bottom move in opposite directions, center C is stable).
23. T/L PIN	H. Left Pin	Set for straight left edge, line E-G (corners E & G move, center C is stable).
24. T/L S	H. Left S	Set for straight left edge, line E-G (middle areas N & P move opposite; center C and ends E & G are stable).
25. IN KEY	H. In Key	Set J-K and L-M straight with respect to line E-G, A-B, and F-H (adjust for minimal internal keystone; top bottom move in opposite directions; centers 3 and 4 are stable).
26. HV PIN	H. In Pin	Set J-K and L-M straight (adjust for minimal internal pincushion).
27. W-MV	W-M	Average error for straightest lines G-H and E-F (middle areas K & M, and J & L move in same direction; center B, A and ends G & H, are stationary).



# DIGITAL DISPLAY SETUP PROCEDURE

## DIGITAL DISPLAY SETUP PROCEDURE CONVERGENCE OF RED AND BLUE ONTO GREEN

It is desirable to Mute color you are not adjusting. Select the color you want to adjust by pressing the RED or BLUE button.

opposite direction; center D and ends F & H are stationary).

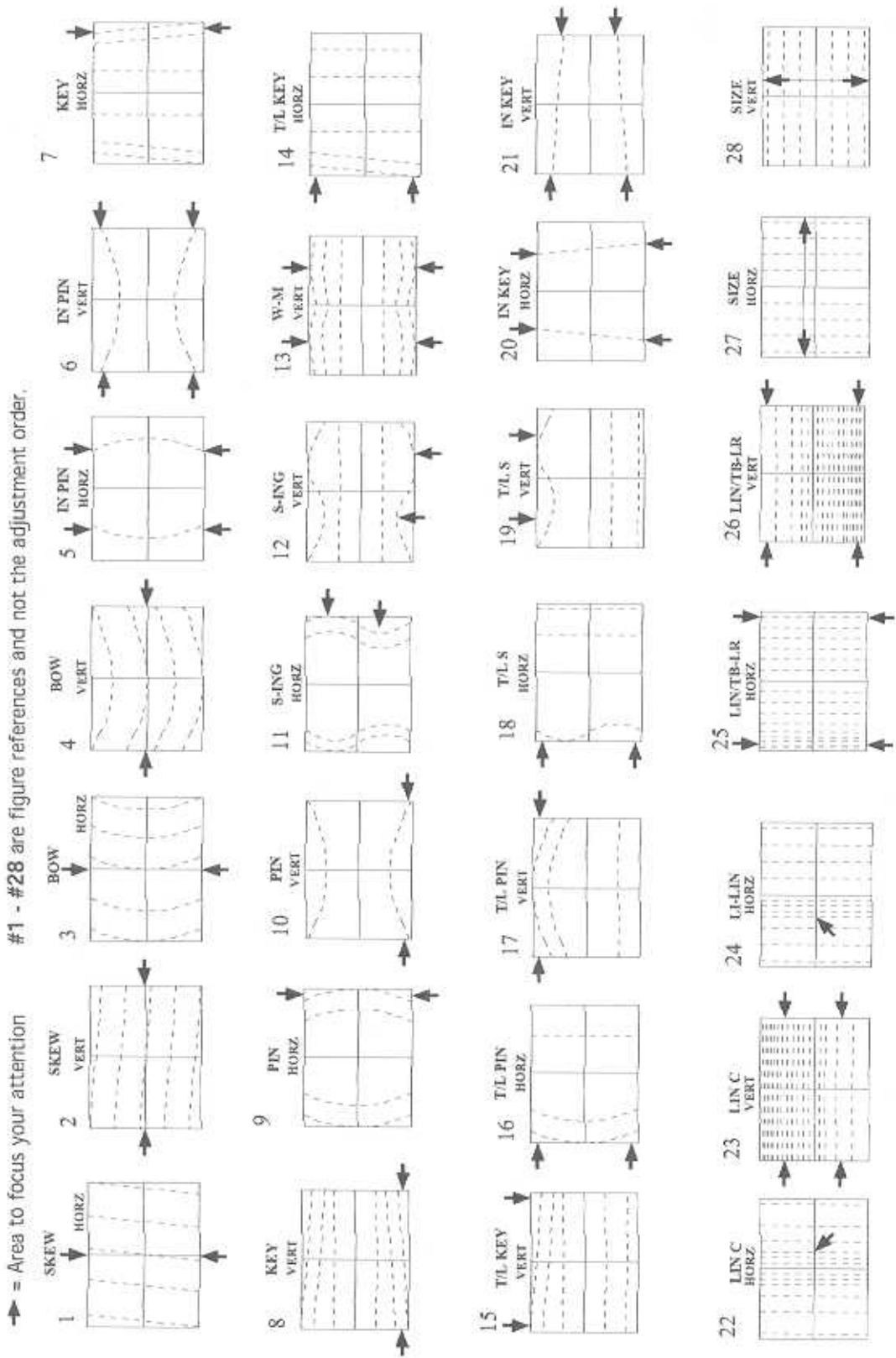
Button	Adjustment	Goal	Button	Adjustment	Goal
1. SMALL ARROWS	H. & V. Statics	Set center of video for best overlap with Green (this may have to be 'tweaked' during this alignment procedure.)	20. T/L KEY V. Top Key		Balance error with Green at top corners E & F straight with respect to screen border (left and right move in opposite directions; center A is stable).
2. SIZE	H. Size	Set to match Green at C and D.	21. T/L KEY V. Top Pin		Match Green at top edge corners E & F (corners E & F move in same direction; center A is stable).
3. SIZE	V. Size	Set to match Green at A and B.	22. T/L S-ING V. 'S'		Balance error at bottom edge in areas J & L (middle areas J & L move in opposite directions; center A and ends E & F are stationary).
4. SKEW	V. Skew	Match Green at C and D.	23. T/L KEY H. Left Key		Balance error with Green at left corners E & G (top and bottom move in opposite directions; center C is stable).
5. BOW	V. Bow	Match Green at C and D.	24. T/L PIN H. Left Pin		Match Green at left edge corners E & G (corners E & G move in same direction, center C is stable).
6. SKEW	H. Skew	Match Green at A and B.	25. T/L S-ING H. 'S'		Balance error at left edge in areas N & P (middle areas N & P move in opposite directions; center C and ends E & G are stationary).
7. BOW	H. Bow	Match Green at A and B.	26. IN KEY H. In Key		Average error with Green in middle areas J, K, and L, M (ends move in opposite direction centers J & 4 are stable, may require iteration with H. Skew, H. Key).
8. LIN T-B L-R	H. Lin L-R	Match Green at C and D; Iterate with H. Size if necessary.	27. IN PIN H. In Pin		Match Green in middle areas J, K, and L, M (ends move in same direction; center is stable; may require iteration with H. Bow, H. Pin).
9. LIN	V. Lin T-B	Match Green at A and B iterate with T, B L-R V. Size if necessary.	28. IN KEY V. In Key		Average error with Green in middle areas N, O, and P, Q (ends move in opposite direction centers 7 & 8 are stable, may require iteration with V. Skew, V. Key).
10. LIN C and H. SIZE	V. Lin C and SIZE	Match Green at 4, center line vert axis, midway between Z and D.	29. IN-PIN V. In Pin		Match Green in middle areas N, O and P, Q (may require iteration with V. Bow, V. Pin)
11. LI-LIN	H. LI-LIN	Match Green at 3, center line vert axis, mid between C & Z and LI-LIN (Press button twice to get the second function.) Caution: H. LIN C also affects this; adjust in correct order above.)	30. Touch up all controls		Due to the interaction of IN-Controls, Key Controls and Pin controls for best overall convergence, it may be necessary to tweak the other controls. This should only require minor adjustments of each control.
12. LIN C	V. Lin C	Match Green at 7 and 8.			
13. KEY	V. Key	Balance error with Green at bottom edge G-H (left and right edges move in opposite directions; center is stable).			
14. PIN	V. Pin	Match Green at right edge corners G & H (corners G & H move in same direction; center B is stable).			
15. S-ING	V. 'S'	Balance error at bottom edge in areas K & M (middle areas K & M move in opposite directions; center B and ends G & H are stationary).			
16. W-M	V. W-M	Balance error at bottom edge in areas K & M (middle areas K & M move in same direction, center B and ends G & H are stationary).			
17. KEY	H. key	Balance error with Green at right edge corners F & H (top and bottom move in opposite directions; center D is stable).			
18. PIN	H. Pin	Match Green at F & H (corners F & H move in same direction; center D is stable).			
19. S-ING	H. 'S'	Balance error at right edge in areas D & Q (middle areas D & Q move in			

It may be necessary to perform this procedure twice to get optimal performance.



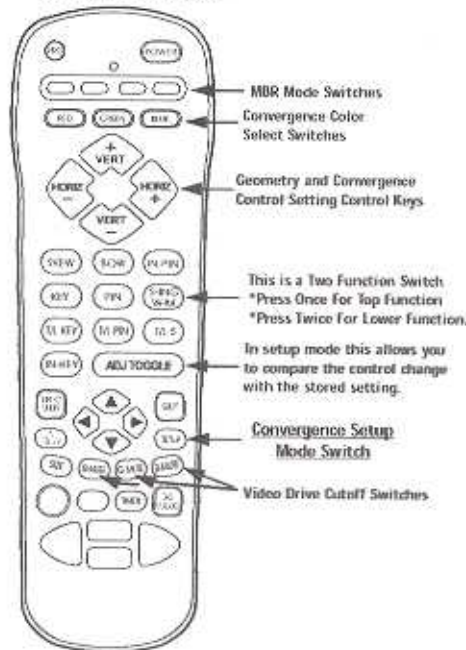
# DIGITAL DISPLAY SETUP PROCEDURE

## Convergence Control Illustration



## DIGITAL DISPLAY SETUP PROCEDURE

Setup Mode Functions



- When entering the setup mode the system is in the **Geometry Mode** (the shape controls adjust all three colors at the same time). To adjust an individual color (i.e. Red to adjust SKEW) you must press the **Red Select** button. This will put the system into the **Convergence Mode** (the shape controls adjust one color at a time). To return to the Geometry Mode press the **Red Select** button a second time.
- When adjusting all colors (**Geometry Mode**) the little arrow keys at the bottom are for **video phase adjust** only. When pressed the remote will switch the geometry control to phase. If the arrow keys have not been touched for a few seconds, remote will automatically switch back to the geometry control lasted used before using the small arrows.
- When adjusting an individual color (**Convergence Mode**) the little arrow keys at the bottom are for **DC Centering** only. When pressed the remote will switch the convergence control to DC Centering. If arrow keys have not been touched for a few seconds, remote will automatically switch back to the convergence control lasted used before using the small arrows.
- The setup controls, on the On screen display, are usually labeled with Horz/Vert, T/L (top/left), or B/R (bottom/right) and a number value indicating the current setting.
- To see what effect the **New Setting** compared to the **Stored Setting** has on the display press the **ADJ TOGGLE** key on the remote. Adjust toggle allows switching between the two settings before committing to a change.
- After making changes and adjustments be sure to **SAVE THE NEW SETTINGS**. If a major change has been made, new module, new CRT, or a change in the physical setup, readjust and store the geometry/setup for each of the formats and aspect ratios being used.
- To **escape the setup mode**, with out saving changes press the **Quit** button twice.
- Caution** - shut all the Pro900 timers and signal source power conserve features off before starting convergence. If the video signal is lost, convergence mode will quit with no chance to save work.
- To access the **Forced Mode Menu** press **SETUP** and **GREEN SELECT**.
- To access the current sync and video format being used press **GREEN MUTE**.
- To access the elapsed time display press and hold **LIN C/LI-LIN**, until the regular menu disappears, then press **TIMER** or **H-Pulse** key.
- To set the **unit IR Code** (for use when multiple units are in the area) press and hold **LIN C/LI-LIN**, until the regular menu disappears, then press **9, 9, 9, and ADJ TOGGLE**.
- See the **MENU** chapter for **COPY FORMAT** procedure information - refer to page 34 section 5.6.
- To Aid with the alignment procedure: it is recommended to mark the center of the screen and the center of all four sides with masking tape. Use drafting type tape that will not leave any marks. This will return calibration points for convergence and CRT alignments.

# DIGITAL DISPLAY SETUP PROCEDURE

## Specification for Pro900 RGB Sync Inputs Version 2.1 December 21, 1995

### I. Sync Inputs

There are three Sync signal inputs for use with RGB sources:

- a) SYNC-ON-GREEN (SOG) - through the Green video input BNC jack, terminated 75 ohms.
- b) HORIZONTAL/COMPOSITE (H / Comp) - through a BNC jack on 9-1515 Combo module, software switchable termination 2K/75 ohms.
- c) VERTICAL (V) - through a BNC jack on the 9-1515 Combo module, software switchable termination 2K/75 ohms.

### II Compatability

- a) SYNC-ON-GREEN - negative-going sync on Green video input, either EIA or SMPTE (HD) spec compatible.
- b) HORIZONTAL/COMPOSITE
  - 1) Analog/TTL Mode - TTL-level computer syncs (VGA, SVGA, Macintosh) , NTSC/PAL/SECAM studio/commercial horizontal/composite analog sync.
  - 2) Special composite Mode - NTSC/PAL/SECAM or SMPTE HD studio/commercial negative composite or tri-level analog sync (Black Video).
- c) VERTICAL - TTL-level computer syncs (VGA, SVGA, Macintosh) , NTSC/PAL/SECAM studio/commercial negative vertical analog sync.

### III. Frequency Range

- a) SYNC-ON-GREEN - Horizontal component: 15kHz to 50kHz  
Vertical component: 50 to 100 Hz
- b) HORIZONTAL/COMPOSITE - Horizontal component: 15kHz to 50kHz

Vertical component: 50 to 100 Hz

- c) VERTICAL - 50 to 100 Hz

### IV. Amplitude

- a) SYNC-ON-GREEN - Sync portion: 300mV, +/- 150mV
- b) HORIZONTAL/COMPOSITE
  - 1) Analog/TTL Mode - 0.7Vp-p to 5Vp-p
  - 2) Special composite Mode - 300mV, +/- 150mV
- c) VERTICAL - 0.7Vp-p to 5Vp-p

### V. Polarity

- a) SYNC-ON-GREEN - negative
- b) HORIZONTAL/COMPOSITE
  - 1) Analog/TTL Mode - positive or negative
  - 2) Special composite Mode - negative
- c) VERTICAL - positive or negative

### VI. Pulse Width or Duty Cycle

- a) SYNC-ON-GREEN - Minimum sync pulse width = 400nS
- b) HORIZONTAL/COMPOSITE -
  - 1) Analog/TTL Mode - Max duty cycle of sync pulse ( $V_{sync\ in} = 0.7Vp-p$ ) = 15%  
Max duty cycle of sync pulse ( $V_{sync\ in} = 1.4Vp-p$ ) = 30%
  - 2) Special composite Mode - Minimum sync pulse width = 400nS
- c) VERTICAL - Max duty cycle of sync pulse ( $V_{sync\ in} = 0.7Vp-p$ ) = 15%  
Max duty cycle of sync pulse ( $V_{sync\ in} = 1.4Vp-p$ ) = 30%



# DIGITAL DISPLAY SETUP PROCEDURE

## Vertical and Horizontal Timing Chart

Parameter	Units	Symbol	Formula	1	2	3	4	5	6	7	8	9
H Frequency	KHz	HF	Given	15.734	15.623	15.488	15.469	31.469	31.750	35.000	45.000	48.363
V Frequency (Field)	Hz	VF	Given	59.940	50.000	70.085	59.940	70.086	80.000	88.667	60.000	6.004
H Resolution	Pixels	HR	Given	720	720	720	640	640	1920	640	1280	1024
V Resolution	Lines	VR	Given	487	575	400	480	350	1080	480	720	768
Aspect Ratio	AR	AR	Given	4:3	4:3	4:3	4:3	4:3	16:9	4:3	16:9	4:3
Interface	Y/N	Int	Given	Y	Y	Y	Y	N	Y	N	N	N
H Sync Polarity		HP	Given	NOTE 1	NOTE 1	N	N	N	NOTE 2	NOTE 2	NOTE 2	N
V Sync Polarity		VP	Given	N	N	N	N	N	N	N	N	N
Pixel Frequency	MHz	PF	Given	33.500	28.321	28.321	25.175	25.175	74.250	30.240	74.250	65.000
Pixel Time	ns	PT	Given	74.074	74.074	35.309	39.722	39.722	13.458	33.069	13.458	15.385
Total Pixels/line	Pixels	PL	Given	858	864	900	800	800	2300	964	1650	1344
Line Time	us	LT	Given	63.557	64.000	31.778	31.778	31.778	29.620	28.571	28.571	20.67222222
Total Lines/Frame	Lines	L/F	Given	525	625	449.0	525.0	449.0	1125	525	750	806
Total Lines/Field	Lines	L/Fld	(L/Frames)*2	282.5	312.5	449.0	525.0	449.0	562.5	525.0	750.0	806.0
Frame Time	ms	TFrame	Given	33.367	40.000	14.268	16.683	14.268	33.333	15.000	16.667	16.666
Field Time	ms	Tfld	Given	16.684	20.000	14.268	16.683	14.268	16.667	15.000	16.667	16.666
Horiz. Active	us	TActive	Given	52.557	52.000	25.423	25.422	25.422	44	64	70	24
Horiz. front porch	us	Hfp	Given	24	21	9	8	8	44	64	70	24
Horiz. front porch	us	Hfp(T)	Given	1.778	1.550	0.318	0.318	0.318	0.392	2.116	0.943	0.369
H Sync width	us	Hsw	Given	64	64	108	96	96	88	64	80	136
H Sync width	us	Hsw(T)	Given	4.741	4.741	3.813	3.813	3.813	1.185	2.116	1.077	2.092
Horiz. back porch	us	Hbp	Given	50	59	63	56	56	148	96	220	160
Horiz. back porch	us	Hbp(T)	Given	4.481	5.704	2.224	2.224	2.224	1.893	3.175	2.063	2.462
Horiz. Blank	us	HBlank	Given	138	144	180	160	160	260	224	370	320
Horiz. Blank	us	HBlank(T)	Given	11.000	12.000	6.356	6.356	6.356	3.771	7.407	4.993	4.923
H Blank %	%	HBl%	Given	20.000	20.000	20.000	20.000	20.000	12.727	25.926	22.424	23.810
Vert. Active/Field	Lines	VActive	Given	243.5	287.5	400	480	350	540	480	720	768
Vert. Active/Field	Lines	VActive(T)	Given	15.48	18.40	12.711	15.253	11.122	16.000	13.714	16.000	15.880
Vert. front porch	us	Vfp	Given	3	2.5	6	3	3	3	3	5	3
Vert. front porch	us	Vfp(T)	Given	190.67	160.00	190.67	95.33	101.688	49.26	85.71	111.11	62.00
V Sync width	us	Vsw	Given	3	2.5	2	2	2	2	3	5	6
V Sync width	us	Vsw(T)	Given	190.67	160.00	63.56	63.56	63.56	148.15	58.71	111.11	124.00
Vert. back porch	us	Vbp	Given	13	20	41	40	63	15.5	39	20	29
Vert. back porch	us	Vbp(T)	Given	826.24	1280.00	1302.91	1271.10	2065.54	459.26	1114.29	444.44	600.00
Vertical Blank	us	VBlank	Given	19	25	49	45	99	23	45	30	38
Vertical Blank	us	VBlank(T)	Given	1207.58	1680.00	1557.14	1429.99	3145.98	666.67	1283.71	666.67	785.72
V Blank %	%	VBl%	Given	7.238	8.000	10.913	8.571	22.049	4.000	8.571	4.000	4.715
Vertical Retrace	us	TrV	Given	1016.91	1440.00	1334.66	1219.10	607.41	1200.00	555.56	723.72	555.56
Format source		FCC	Given	CCIR	VESA	VESA	VESA	VESA	SMPT	SMPT	SMPT	VESA

NOTE 1: NTSC, PAL and SECAM syncs are specified as positive or negative composite video. RGB implementations do not vary as standards (CGA, MCGA, etc.), but the numbers given here assume the CCIR recommended standard timing with any type of sync input as a possibility. Identifying the television source used for timing. Items in RGB mode cannot therefore rely on any type of polarity, but should be adaptive to any sync type. The blank porch video timing position should always be used for the NTSC & PAL. RGB formats. NOTE 2: The draft SMPTE spec only identifies a 3-level sync-on-green as the sync format for the HD format. However, HD video equipment or set top boxes could use either separate or composite TTL syncs of indeterminate polarity. Identifying the HD format should always be used for the HD format.

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