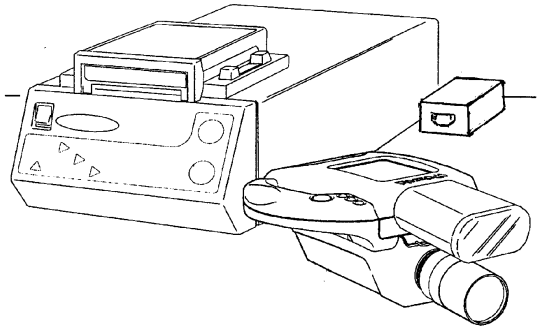
Polaroid

Repair Manual



SP 350 System

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Americas Business Center
Technical Services
201 Burlington Road
Bedford MA 01730
TEL: 1.781.386.5309
FAX: 1.781.386.5988

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1 Description

General

The Studio Polaroid 350 (SP 350) is a low-cost, video-based imaging system which allows the user to frame a subject, freeze a preview of the image, and then take either color or black and white photographs on conventional instant film. There are essentially three major parts to the system: (Figure 1- 1)

- video camera
- photo printer
- power supply

Through the use of optional software, the system can be tied to a Pentium PC. The PC can receive and store images for printing at a later time.

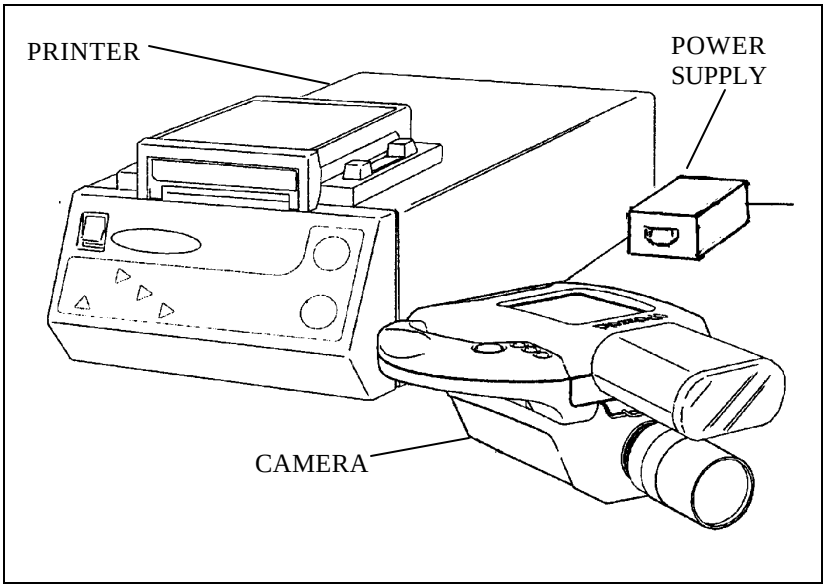


Figure 1- 1 Studio Polaroid 350 system

Target markets for the SP 350 system are portrait photographers, retail stores which offer document photography, and minilabs which provide a variety of photographic end-products. SP 350 photographs can be used for full frame portraits, and in other formats for passports, resume pictures, and a wide number of other picture requirements for government or private documents.

Film used in the SP350 is in the conventional Polaroid instant pack film configuration:

Studio Polaroid Color Film - ISO 125

Polaroid PolaPan Pro 100 Black and White Film - ISO 100

(Other systems being developed use smaller format Viva film or Type 669 color film.)

In use, the film packs are inserted into a Polaroid Model SP149 Film Holder, located on top of the printer. The use of an optional additional film holder makes swapping between color and black and white film simple.

Most of the electronics for the system are housed within the printer chassis. This includes a video grabber board, an image processing mother board and the print engine. The camera is tethered to the printer via a VGA cable which carries signals and power.

Operating power for the entire system is provided by a regulated, external power supply which can be connected to a 110V or 220V AC outlet (the power supply automatically senses the voltage input) and then to the printer via a power inlet connector.

The entire SP350 system is compact, requiring a relatively small footprint in the customer location. The printer weighs 11.44 lbs (5.3 kg) and its dimensions are:

Depth	***Width***	***Height***
18.4 inches (460mm)	9 inches (225mm)	5.6 inches (140 mm)

The camera weighs 3.3 lbs (1.5 kg) and its dimensions are:

Depth	***Width***	***Height***
10.8 inches (270mm)	7 inches (175mm)	4.4 inches (110 mm)

Setup and Operation

For shipment, a travel bracket must be inserted into the film holder location of the printer. (Figure 1- 2)

Caution:

Failure to use the travel bracket during shipment could cause damage to the print engine.

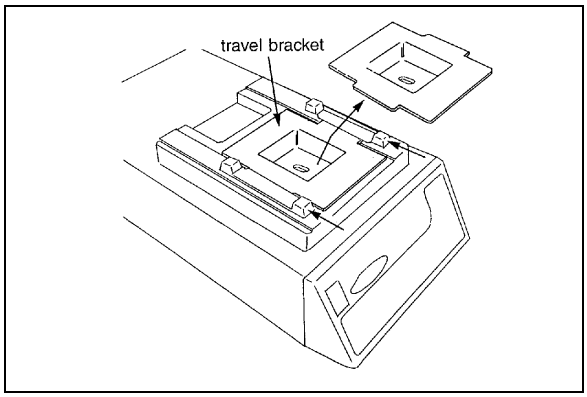


Figure 1- 2 Travel bracket used for shipment

When the system is unpacked and readied for operation, this bracket and its wingnut must be removed and a film holder, loaded with film, installed in its place.

The printer and power supply are normally placed on a table top or counter, with the power supply connected to the printer power inlet connector and its main power cable connected to a 110 V ac or 220V ac outlet. The camera is connected to the printer via its VGA cable and, if desired, a strobe can be installed on the camera hot shoe. (Figure 1- 3) (Note that installing the strobe on the hot shoe requires that you raise the hinged preview screen.)

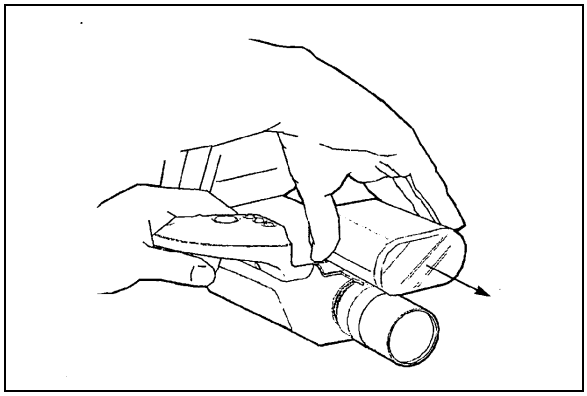


Figure 1- 3 Installing the strobe on the hot shoe

Depending on the system configuration, cables from optional monitors, external computers, and external strobes may be connected to the printer. Additionally, optional studio flood or strobe lighting should be set up, if desired. (Figure 1- 4)

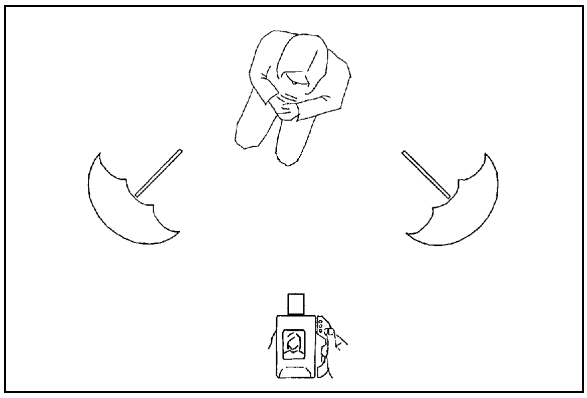


Figure 1- 4 Setting up studio lights

Setting the printer on/off switch to ON, provides power to both printer and camera. During operation, the camera can be hand-held (Figure 1- 5) or can be tripod-mounted (Figure 1- 6).

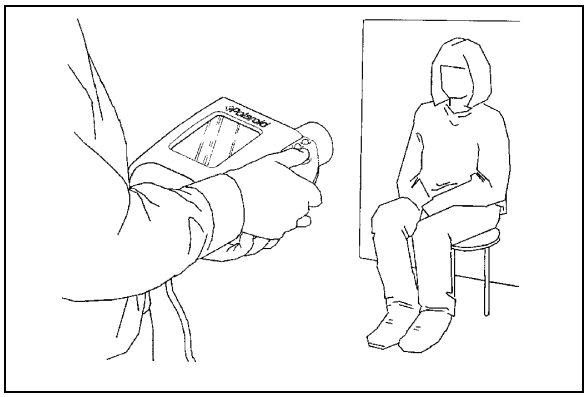


Figure 1- 5 Camera being used in hand-held position

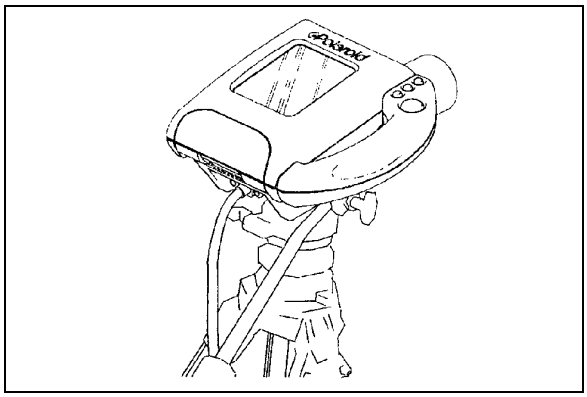


Figure 1- 6 Camera mounted on tripod

The top of the camera is hinged, allowing the preview screen to be tilted upright, making it easier for the operator to check the image. (Figure 1- 7)

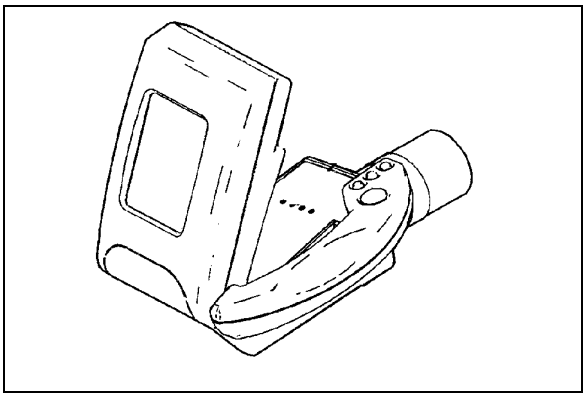


Figure 1- 7 Preview screen in raised position

Four buttons on the camera permit the operator to control the picture-taking sequence (choosing picture format, setting electronics for color or black and white film, freezing the desired image, and taking the picture). These controls are replicated on the printer, so the operator may choose to control these functions from the camera or from the printer. (When done from the printer, the camera is normally tripod-mounted.)

The remaining steps in the process, pulling the tab, timing the development, and peeling the positive from the negative are controlled by switches and indicators on the printer control panel.

Operating Features Recap Chart

The following chart (Table 1- 1) provides a brief overview of the operating features of the SP350 system and the benefits derived from each of them.

Feature	***Benefit***
Uses conventional Polaroid “peel-apart films. (SP color, PolaPan black and white,)	Provides images with true photographic look and feel. Universal acceptance for official documents.
Photographs available in various formats (1-up, 2-up, 4-up, 5-up, 6-up, and 9-up)	Provides user with greater opportunities for additional sales.
Easily interchangeable film holders	Makes it a simple matter to change from color to black and white (and vice versa) without sacrificing unexposed film frames.
Relatively small footprint	Easily accommodated in customer location
Camera LCD panel provides preview of subject.	Virtually eliminates film wasted on retakes because of framing errors (eyes closed, etc)

Feature	***Benefit***
Brightness control	Allows operator to adjust brightness of image seen on LCD panel
Single cable connects camera to printer	Eases setup and eliminates cable clutter
Capability of connection to PC	Allows images to be stored for future use
Strobe synchronization	Allows system to work with external studio lights. No need to use special video lights.
Automatic development timing	Eliminates errors in timing imbibition and frees operator to perform other tasks.
Color compensation controls	Allows operator to optimize colors according to personal preference.

Table 1- 1 Operating features recap

Controls and Indicators

Camera:

The controls and indicators located on the camera are shown in Figure 1- 8 and listed in Table 1-2.

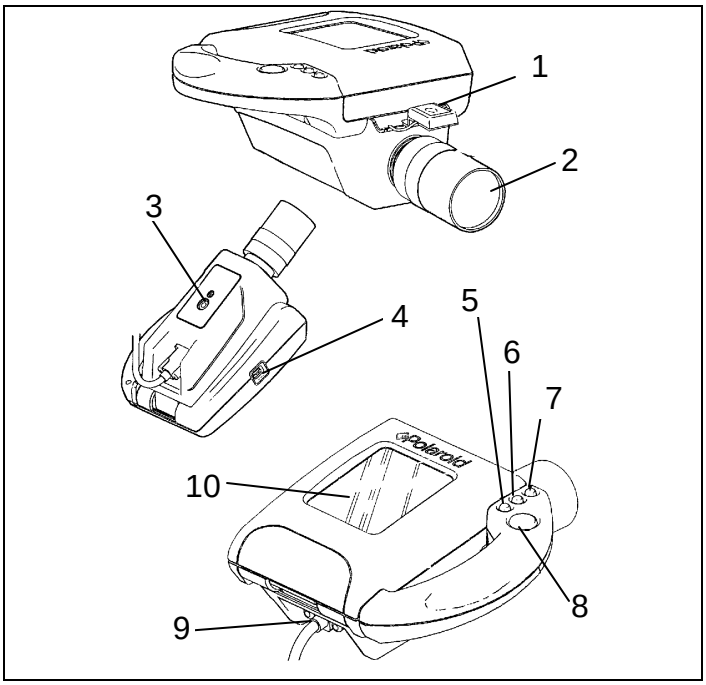


Figure 1- 8 Camera controls and indicators

Number	***Control/Indicator***	***Number***	***Control/Indicator***
1	Hot Shoe	6	Print Button
2	Lens	7	Film Button
3	Tripod Mount	8	Live/Freeze Button
4	Brightness Control	9	VGA Cable
5	Format Button	10	Preview Screen

Table 1- 2 Camera controls and indicators

Hot Shoe:

The hot shoe provides a mounting surface for an optional flash unit. The hot shoe synchronizes the flash to the shutter.

Lens:

The camera has an f/1.4 6x zoom lens with a focal length of 5.7 to 34.2 mm. Its close focus distance is 3.96 feet (1.2 meters).

Tripod Mount:

Capable of being hand-held during use, the tripod mount also allows the camera to be secured to a standard tripod.

Brightness Control:

Mounted on the side of the camera opposite the handle, the brightness control allows the operator to adjust the image seen on the preview screen.

Format Button:

The format button allows the operator to select from six formats: images may be printed 1-up (one image fills the entire sheet of film), 2-up, 4-up, 5-up (two images fill half the sheet and three smaller images fill the other half of the sheet), 6-up, and 9-up.

Print Button:

Comparable to the shutter button on a conventional camera, pressing the print button causes the system to capture the selected image electronically.

Film Button:

Allows the operator to pre-set the camera electronics for black & white film or color film.

Live/Freeze Button:

This button allows the operator to "freeze" the image on the LCD screen. It can be pressed alternately between live and "freeze" until an image suitable to both operator and subject appears on the preview screen.

VGA Cable:

This cable transfer power and signals between the camera and the printer.

Preview Screen:

Shows the subject image, both in the live mode and in the "freeze" mode.

Printer:

The printer controls and indicators are shown in Figure 1- 9 and listed in Table 1- 3.

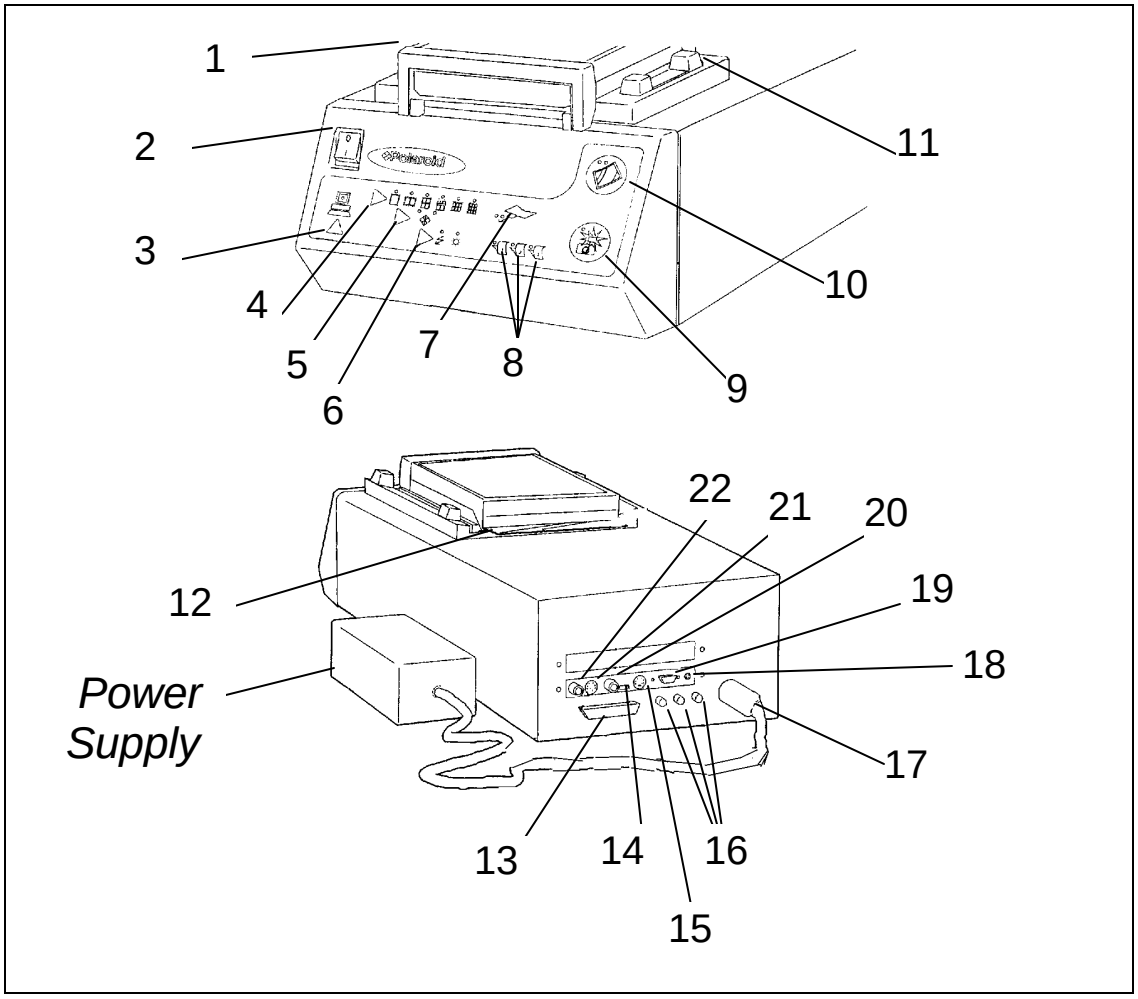


Figure 1- 9 Printer controls and indicators

Number	***Control/Indicator***	***Number***	***Control/Indicator***
1	Film Holder	12	Dark Slide
2	Power Switch	13	PC Parallel Connector
3	PC Switch	14	Video/S-Video Input Switch
4	Format Switch	15	S-Video In
5	Film Switch	16	Color Compensation Controls
6	Lighting Switch	17	Power In connector
7	Pull Tab/Out-of-Film Indicator	18	Strobe X-Sync Connector
8	Film Timing Indicators	19	SP Camera Connector
9	Live/Freeze Switch	20	Video In
10	Print Switch	21	S-Video out
11	Locking Mechanism	22	Video Out

Table 1- 3 Printer controls and indicators

Film Holder:

Holds the film pack. Has a dark slide, allowing the film holder to be removed without exposing unused film frames. Sliding locks firmly secure it to the printer.

Power Switch:

A two-position rocker switch, which when ON, allows power to be delivered to the system electronics.

PC Switch:

This switch enables the system to be connected to a Pentium PC. (A parallel connector is available on the printer rear panel for this purpose.) To use the system with a PC, an optional software package called SP Portrait Manager must be purchased. The software allows images made with the video camera to be stored in the PC for future use. An indicator within the PC symbol on the front panel it lit if the PC is activated.

Format Switch:

Allows the operator to choose which format will be used: 1-up, 2-up, 4-up, 5-up, 6-up, or 9-up. One of the indicators directly over the symbols depicting the formats, will light to indicate the one chosen.

Film Switch:

The film switch is used to set the system for either color film or black and white film. An indicator light signals which film type has been chosen.

Lighting Switch:

Allows the operator to set the system for strobe lighting or flood lighting. An indicator will illuminate to signal which lighting mode has been chosen.

Pull Tab/Out-of-Film Indicators:

The pull tab indicator flashes green to indicate that an image has be captured, exposed onto the film, and is ready to be pulled through the film holder rollers. The out-of-film indicator flashes to indicate that a new film pack should be loaded into the film holder.

Film Timing Indicators:

There are three of these indicators, allowing the development time of up to three pictures to be simultaneously monitored. During the development period, the indicator flashes. When development time is over, the camera beeps and the indicator lights steady for one second.

Live/Freeze Switch:

This switch allows the live image seen on the preview screen to be “frozen” in preparation for printing. A “frozen” image that is not acceptable can be brought back live and then “refrozen” simply by pressing and releasing this button.

Print Switch:

Captures the “frozen” image electronically and initiates the exposure sequence. The print switch is inoperative unless the image is “frozen”. Printing takes 30 - 60 seconds. During this time the indicator above the print switch shows green.

Locking Mechanism:

Part of the film holder, the locking mechanism allows the holder to be secured onto the printer.

Dark Slide:

The dark slide is part of the film holder. During operation, the dark slide should be removed from the holder completely. If the holder is to be removed from the printer with unexposed film remaining inside it, the dark slide should first be reinserted to prevent light from striking the film.

PC Parallel Connector:

Allows the system to be connected to a Pentium PC.

Video/S-Video input Switch:

Allows choice between Y/C video and composite video.

S-Video In Connector:

Allows Y/C video input for capture and print.

Color Compensation Controls:

Allow fine-tuning adjustment of red, green, blue (+ or - 20) to compensate for differences between film batches.

Power In Connector:

The external power supply is plugged in to this connector. The printer operates from a 9V dc supply provided through this connector.

Strobe X-Sync Connector:

An external strobe can be connected here for synchronization with the image capture feature. (System must be set to strobe mode.)

SP Camera Connector:

The system SP300 camera is attached to the printer through this connector.

Video In Connector:

Allows composite video input for capture and print.

S-Video Out Connector:

Allows an optional Y/C video monitor to be attached to the system for image preview purposes.

Video Out Connector:

Allows a composite video monitor to be attached to the system for image preview purposes.

System Reset Function

The Studio Polaroid 350 features a short recovery system reset function which enables the operator to quickly clear the machine in the event of a “hang-up”. It is accomplished by simultaneously pressing the Freeze and Print Buttons. The printer beeps twice and all LEDs on the control panel light. The pixel head moves to the center position, and all pixels light. After two minutes, the LEDs on the panel extinguish, the print head pixels are no longer lit and the print head moves back to the starting position. The machine is now reset and ready for use.

Optional Accessories

Listed below are the accessories which are currently available for the SP350 system:

- Extra film holder
- Stool
- Backdrop
- Die Cutter
- Studio Polaroid strobe lights
- PAL monitor
- Studio Polaroid Portrait Manager software

Specification Tables

System: Operating temperature range (with film):	55 ° - 95 ° F (13 ° - 35 ° C) at 10% - 90% relative humidity, non-condensing
Storage temperature range (no film):	32 ° - 140 ° F (0 ° - 60 ° C) at 10% - 90% relative humidity, non-condensing
Film: General film type:	Conventional Polaroid instant peel-apart film with ten frames per pack
Color:	Studio Polaroid Color, IS0125;
Black and white:	PolaPan Pro 100, ISO 100

Film imbibition time:	***Temp***	***B&W***	***Color***
	75-95 ° F 24 - 35 ° C	30 sec	90 sec
	70 - 75 ° F 21 - 23 ° C	45 sec	90 sec
	65 - 70 ° F	60 sec	120 sec

	18 - 21 ° C		
	60 - 64 ° F 16 - 17 ° C	75 sec	150 sec
	55 - 59 ° F 13 - 15 ° C	90 sec	180 sec

Image area: (3 ¼ x 4 ¼ film)	***Format***	***Image Dimension***	
	1-up	2.9 x 3.8 inches	(73 x 95 mm)
	2-up	1.8 x 2.52 inches	(45 x 63 mm)
	4-up	1.4 x 1.8 inches	(35 x 45 mm)
	5-up two @ three @	 1.4 x 1.8 inches .96 x 1.2 inches	 (35 x 45 mm) (24 x 30 mm)
	6-up	1.2 x 1.44 inches	(30 x 36 mm)
	9-up	.96 x 1.2 inches	(24 x 30 mm)

Camera:

General	PAL video standard
	3.8” LCD display with adjustable viewing angle and brightness control
	Single tube, back lit cold cathode fluorescent tube with diffuser
	1/3” CCD sensor
	Number of effective pixels - 752 horizontal x 582 vertical
	Controls for freeze/live, color/B&W film, print format, take picture
	10 ft (3 meter) cable to printer
	Hot shoe connection for strobe
	Removable Metz Mecablitz 20B5 strobe

Lens:

Focal length	5.7 mm to 34.2 mm
Zoom	6:1 ratio
Aperture	f/1 to f/16
Focus	1.3 m to infinity

Lens Depth of Field:	
f/number	***Maximum Subject Distance***
1	6.7 ft (2.05m)
4	7.4 ft (2.25 m)
8	8.5 ft (2.6 m)
16	12.7 ft (3.85 m)
(Operating in the range of f/4 to f/8 achieves the best depth of field and provides the best image sharpness.)	

Printer:	
Printing method:	Vacuum fluorescent print head
Print quality:	Resolution of 203 dpi; 256 levels for each color
Printing time:	Approximately 20 seconds for B&W; 40 seconds for color

Total print area:	3 ¼ x 4 ¼ inches (73 x 95 mm)
Signal input:	Composite PAL video, Y/C 625 video
Signal output:	Composite PAL video, Y/C 625 video
Power consumption while printing:	Supply 9V, 5A

2 Troubleshooting

The purpose of this section is to assist the repair technician in the identification and diagnosis of problems which may occur in the SP350 system. The listing of these problems is categorized into: 1) hardware problems (printer, camera and ancillary equipment), 2) film problems and 3) operator problems.

In the course of performing this troubleshooting if you suspect the print engine or motherboard to be defective, but, aren't certain which, run the anode voltage test found in Appendix F to help you isolate the problem. Also, before deciding that a hardware problem is the cause of a film defect, be sure that the film itself, is good. (This can be easily done by replacing the film with known good film, completing an operating cycle and observing if the problem still exists.)

Note:

If the print engine is replaced, perform the Print Head Calibration found in Section 3. If the motherboard is replaced, perform the EPROM Check calibration found in Section 3.

Hardware Problems

Hardware Problem	***Probable Cause***	***Corrective Action***
System will not power up *(See Power Up test in Diagnostics section)*	a) Power cable connection loose	a) Check power cable connection to printer.
	b) Supply voltage problem.	b) Check that green LED on power supply is lit to confirm supply voltage is OK.
	c) Defective power supply	c) Swap power supply with known good unit.
	d) Blown fuse on motherboard	d) Replace fuse
	e) Defective power switch cable/connection	e) Check cable connections to switch & motherboard. If OK, check cable continuity. Replace cable as necessary.
	f) Defective power switch	f) Replace power switch.

Hardware Problem	***Possible Cause***	***Corrective Action***
Camera has no power (printer has power) *(See Power Up test in Diagnostics section)*	a) 15 pin VGA cable connection loose b) VGA cable defective c) Camera body pc board defective d) Video board defective e) Motherboard defective	a) Check and tighten cable connection at camera and printer. b) Replace VGA cable. c) Replace camera body pc board d) Replace video board e) Replace motherboard *
No LCD image seen in camera *(See Video Test in Diagnostics section)*	Cable connections or LCD module.	*To narrow possible causes for this problem, do the following:* *Using an external power source, apply 9V DC directly to the LCD module.* *If the LCD back-lights, the problem most likely originates in the camera internal cabling.* *If the LCD does not back-light, the problem most likely originates with the LCD module.* *Continue below.*

**** Perform calibration procedure (EPROM Check) found in Section 3***

Hardware Problem	***Possible Cause***	***Corrective Action***
No LCD image seen in camera (continued) *(See Video Test in Diagnostics section)*	*Connect an external monitor to the system. Cycle the system to freeze an image.* Is the image seen on the monitor? **YES**: a) LCD cable connections in camera loose b) Camera LCD module defective	 a) Tighten cable connections. If necessary replace cables b) Replace camera LCD module
No LCD image seen in camera (continued) *(See Video Test in Diagnostics section)*	Is the image seen on the monitor? **NO:** c) Cables on camera body pc board loose/defective d) Camera body pc board defective	 c) Check cable connections and replace cables as necessary. d) Replace camera body pc board.
No image on external monitor / Image on camera LCD panel OK *(See Video Test in Diagnostics section)*	a) PAL monitor defective b) Monitor cable loose/defective c) Printer video board defective d) Printer motherboard defective	a) *Check video signals to external monitor using Teletest pattern generator. Refer to Diagnostics Section for procedure.* If necessary, replace monitor b) Check cable connection/ replace cable as necessary. c) Replace video board d) Replace motherboard *

**** Perform calibration procedure (EPROM Check) found in Section 3***

Hardware Problem	***Possible Cause***	***Corrective Action***
Unable to make white balance adjustment on camera	Defective potentiometer on camera body pc board	Replace potentiometer of camera body pc board.
Unable to "freeze" image with camera take button (printer control works OK)	a) VGA cable loose or defective b) Camera switch cable loose or defective c) Defective handle pc board assembly	a) Replace VGA cable b) Check cable connections and replace cable as necessary. c) Replace handle pc board assembly
Unable to "freeze" image with printer control (camera control works OK)	a) Printer control panel data cable loose or defective b) Printer control panel defective	a) Check cable connections and replace cable as necessary. b) Replace printer control panel
Unable to "freeze" image with either camera or printer controls	Motherboard defective	Replace motherboard *

**** Perform calibration procedure (EPROM Check) found in Section 3***

Hardware Problem	***Probable Cause***	***Corrective Action***
Unable to select formats from camera button (printer format control works OK)	a) VGA cable loose or defective b) Camera switch cable loose or defective c) Defective handle pc board assembly	a) Check cable connections and replace cable as necessary. b) Check cable connections and replace cable as necessary. c) Replace handle pc board.
Unable to select formats from printer control panel (camera button works OK)	a) Printer control panel data cable loose or defective b) Printer control panel defective	a) Check cable connections and replace cable as necessary. b) Replace control panel
Unable to select formats from either camera or printer	Motherboard defective	Replace motherboard *
Unable to print from camera button (able to print from printer)	a) VGA cable loose or defective b) Camera switch cable loose or defective c) Defective handle pc board assembly	a) Check cable connections and replace cable as necessary. b) Check cable connections and replace cable as necessary. c) Replace handle pc board.
Unable to print from printer control panel (able to print from camera)	a) Printer control panel data cable loose or defective b) Printer control panel defective	a) Check cable connections and replace cable as necessary. b) Replace control panel
Unable to print from either camera or printer *(See Print Image test in Diagnostics section)*	Motherboard defective	Replace motherboard *

**** Perform calibration procedure (EPROM Check) found in Section 3***

Hardware Problem	***Probable Cause***	***Corrective Action***
LEDs on printer control panel do not illuminate *(See LED/Buttons test in Diagnostics section)*	a) Control panel data cable loose or defective b) Control panel defective c) Motherboard defective	a) Check cable connections and replace cable as necessary b) Replace control panel c) Replace motherboard *
Timing beepers on printer control panel do not sound *(See LED/Buttons test in Diagnostics section)*	a) Control panel data cable loose or defective b) Control panel defective c) Motherboard defective	a) Check cable connections and replace cable as necessary b) Replace control panel c) Replace motherboard *

**** Perform calibration procedure (EPROM Check) found in Section 3.***

System strobe will not function	a) Batteries defective b) Hot shoe cable loose or defective c) Strobe defective	a) Replace batteries if charging takes longer than 60 seconds. b) Check cable connection and replace cable as necessary. c) Replace strobe
External strobe will not function properly	a) External strobe cable loose or defective b) Strobe firing too soon or too late (not in synch with shutter) c) Strobe defective d) Video board defective	a) Check cable connections and/or have operator replace cable as necessary. b) External strobe sync jumper on video board not set correctly. See Appendix G c) Notify operator d) Replace video board
Image on preview screen out-of-focus	Lens back focus out of adjustment	*Perform lens back focus adjustment in Diagnostics.*

Film Problems

Film Problem	***Probable Cause***	***Corrective Action***
Spots on printed image *(See Print Image test in Diagnostics section)*	a) Dust on lens b) Dust on blue filter or CCD	a) Clean lens b) Clean using compressed air. If unable to clear particles, replace CCD mount assembly (includes Sony board set) and *perform back focus adjustment. (Section 3)*
Out-of-limits vignetting on printed output *(See Print Image test in Diagnostics section)*	Lens and CCD mount assembly out of alignment.	Re-seat the lens. *If necessary, replace the CCD mount assembly and perform the back focus adjustment as described in Section 3 Diagnostics*

Film Problem	***Probable Cause***	***Corrective Action***
White vertical lines on printed output *(See Print Image test in Diagnostics section)*	a) Print engine requires calibration (Version 2 systems only. Refer to Appendix for procedure to update from version 1 to version 2.)	a) Perform print engine calibration: (Version 2 only - See Appendix E) • *With printer off, insert the dark slide to prevent exposing film.* • *Hold down print switch and live/freeze switch together and turn on printer.* • *Light will be emitted during this calibration. When the light goes out, release the switches and turn off the printer.* The calibration is complete.
	b) Print engine defective	b) Replace print engine & calibrate as above.
Black vertical lines on printed output *(See Print Image test in Diagnostics section)*	a) Debris on print engine	a) Use compressed air to clean print engine
	b) Cable connections between print engine and motherboard loose or defective.	b) Check cable connections and replace cables as necessary.
	c) Print engine defective	c) Replace print engine & calibrate as above.
	d) Motherboard defective	d) Replace motherboard *
Horizontal lines on printed image *(See Print Image test in Diagnostics section)*	Print engine is “sticking” on rails during print travel.	Apply silicon lubricant to rail in print engine. Use care to prevent having lubricant migrate to other areas.

**** Perform calibration procedure (EPROM Check) found in Section 3.***

Film Problem	***Probable Cause***	***Corrective Action***
Incomplete image on printed output *(See Print Image test in Diagnostics section)*	a) Travel bracket wing-nut interfering with print engine movement. b) Print engine "sticking" on rails. c) Print engine defective	a) Remove wing-nut and store it outside of printer. b) Lubricate rails with silicon lubricant. c) Replace print engine and calibrate (see page 24)
Red cast appears on printed output *(See Print Image test in Diagnostics section)*	Sensor/detector in print engine misaligned, jammed or defective	Replace print engine and calibrate (see page 24)
Green or blue cast appears on printed output	Print engine filter jammed.	Replace print engine and calibrate (see page 24)

Operator Problems

Operator Problem	***Probable Cause***	***Corrective Action***
Printed image is black	a) Dark slide in film holder b) Lighting mode selected does not match system setup. c) Lens aperture too small	a) Instruct operator to ensure dark slide removed during use. b) Instruct operator to select strobe or flood according to setup. c) Instruct operator to use larger lens aperture when warranted.
Prints have a green cast.	Film selected on control panel does not match film loaded in holder. (color selected while B&W in holder or vice versa)	Instruct operator to be sure correct film type is selected.
Repeated pattern of white spots on printed image	Film holder rollers dirty.	Instruct operator on proper method/frequency to clean rollers.
Curtain-shaped mark on printed output	Hesitation during film pull from holder.	Instruct operator in proper film pull technique.
Undeveloped edges or corners of printed output	Film tab pulled from holder at an angle.	Instruct operator in proper film pull technique.
Printed output has muddy appearance	Negative and positive separated too soon.	Instruct operator to allow film to develop for the full time recommended.
Printed image very light	Film greatly overexposed	Instruct operator to use smaller lens aperture and/or to light subject properly.
Double exposure seen on printed output	Two images exposed onto same sheet of film.	Instruct operator to be sure to pull film after each exposure.

3 Diagnostics & Adjustments

Introduction

This section provides test and adjustment procedures for the SP350 system. The testing procedures are intended to provide verification of proper operation of the SP350 system. They can also be used to assist in isolating system problems of unknown origin. The adjustment procedures should be used to keep the system components operating within their design parameters.

System testing procedures include:

Power Up - tests whether operating power is being brought to each of the system components

EPROM - allows the user to enter print engine supply voltage values to assure that the system electronics are setup properly

Image Evaluation - guides the user in the evaluation of printed images to be sure that the system is producing acceptable pictures

Video - checks to determine that video signals are being properly transmitted through the system

LED/Buttons - a manual check to determine that all LEDs and buttons on the printer and camera are functioning properly

In addition to the tests above, procedures are also provided which allow you to test and calibrate the camera. The camera checks include:

Back focus adjustment (CS mount adjustment)

White balance - ambient mode

White balance - strobe mode

Auto gain control

Resolution test

Camera/LCD pixel and noise check

Test Equipment Required

To complete the tests in this section, you need the following test equipment:

Pentium PC

Functional test CD ROM #

PAL external monitor (recommended - Sony PVM 14N5U)

Teletest 2 Pattern Generator - Model OZT1110

Y-Cable #

Color Artefact Limit Samples (For image evaluation)

Black & White Artefact Limit Samples (For image evaluation)

System Testing Procedures

Power Up Test

This test examines whether power is being distributed to the printer and camera. It requires no special test equipment.

1. Connect a known good power supply to a working outlet and plug the supply line into the printer.
2. Turn on system power.
3. Observe that the power LED lights on the printer control panel.

   If it does not light, refer to Troubleshooting for possible causes
4. Observe that the preview screen on the camera lights.

   If it does not light, replace the VGA cable with a known good cable and recheck.

   If the screen still does not light, replace the camera with a known good camera and recheck.

   If the screen still does not light, refer to Troubleshooting for possible causes.

EPROM Check

This procedure allows the user to enter print engine supply voltage values to be certain that print engine values and system electronics are properly matched. To complete this procedure, a Pentium PC and the Functional Test CD-ROM is required.

This procedure must be done whenever the print engine or motherboard is replaced.

1. Set up the system as shown in Figure 3-1.

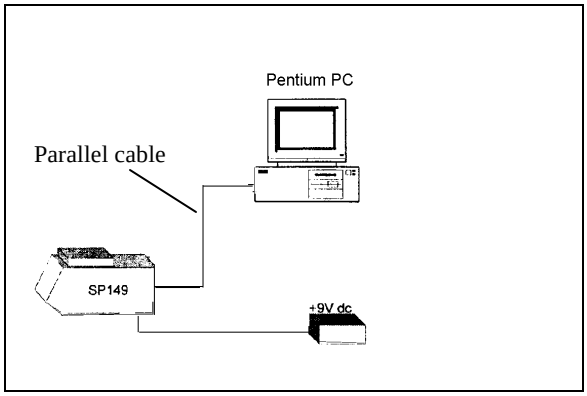


Figure 3- 1 System setup to enter anode voltage values

2. Record the anode voltage values labeled on the replacement print engine.

3. Insert the functional test CD ROM in the PC drive and load the software according to the instructions in Appendix H.

4. Power up the system.

5. Launch the SP149 Test Software by double-clicking it in the Windows desktop. Wait for the functional test screen to appear on the computer monitor. (Figure 3-2)

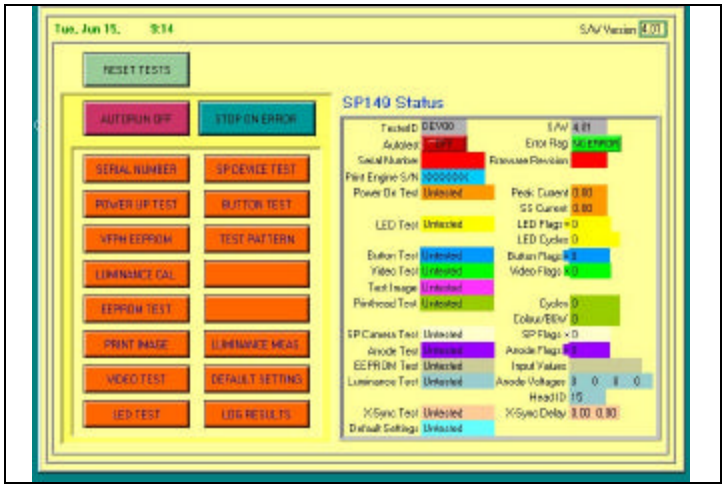


Figure 3- 2 Functional test screen

6. Select EEPROM and enter the print engine anode voltage values (previously recorded from the label on the replacement engine) in the spaces provided on the screen. When the values are entered, the printer electronics are automatically updated.

Image Evaluation Using Acceptance Target No. 5

This test is done to determine if images output by the system meet minimum standards. The test involves printing out a target image and then comparing the image to a set of standards. To complete this procedure, a Pentium PC, the Functional Test CD-ROM, and a set of Color and B&W Artifact Limit Samples is required. (*See Appendix H for instructions on loading the functional test software.)*

Ageing Recovery

Prior to producing any test images, a two minute 60V ageing recovery operation must be performed. This operation can be selected by simultaneously pressing the live/freeze and print buttons while switching power on to the unit.

Printing Acceptance Target No. 5

Note: Set up the system as seen in Figure 3-1. Be certain that color film is in the film holder.

1. Using firmware version V1.1.1.0 with auto-anode calibration setting, launch the SP149 Test Software by double-clicking on it within the Windows desktop (Figure 3-2)

2. Select the *Print Image* button on the screen: The Download Image Test box will now appear.

3. Press the *Select Bitmap Images* button

4. Highlight *SP149 Acceptance Target 5* and press *OK*.

5. Press the *YES* button (dark slide must be out of the filmholder) to print the acceptance target. (See Figure 3-3)

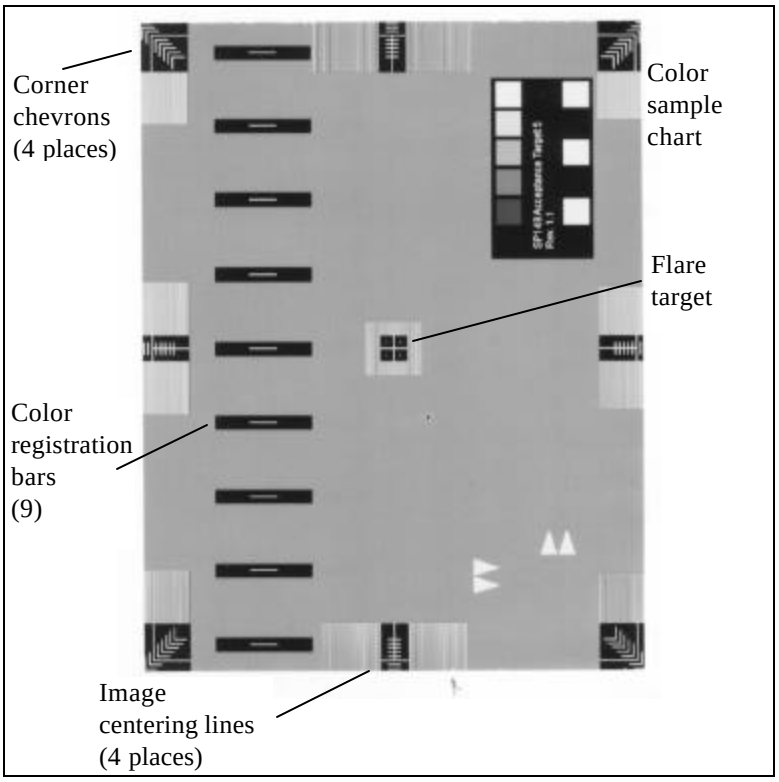


Figure 3- 3 Acceptance target #5

6. Using the button on the printer control panel, change the color setting and take another print.

7. You should now have a color and a black & white print sample of the target.

Filter Fault

Inspect the color test print (see Figure 3-4): If all or part of the image has been printed in one color only, (such as red, green or blue) the printer filter is not being moved between passes. The print engine should be calibrated and if necessary, replaced.

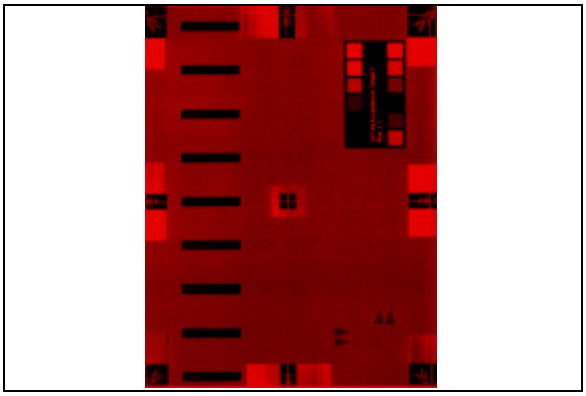


Figure 3-4 Sample printed all in one color

Vertical Color Banding

Inspect the color test print (Figure 3-5): If there are any vertical stripes (of any width) that have a different image tint than the remainder of the image, the print engine is faulty and should be calibrated and if necessary, replaced.

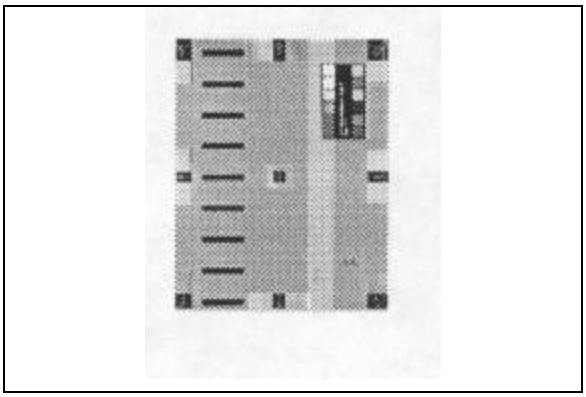


Figure 3-5 Vertical stripes in printed image

Pixel Variation - Color Print

Inspect the color test print (Figure 3-6): If any vertical artefacts appear on the print, measure their brightness against the Color Artefact Limit Samples. No artefact should exceed the brightness of limit sample A2. Additionally, no dark artefact should exceed the darkness of limit sample B3. If either sample is exceeded, the print engine should be calibrated and if necessary, replaced.

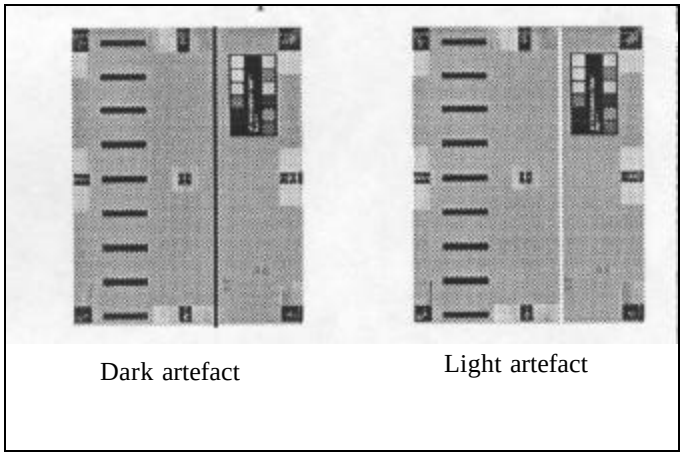


Figure 3-6 Dark and light artefact samples

Pixel Variation - B & W Print

Inspect the Black & White test print (Figure 3-7):): If any vertical artefacts appear on the print, measure their brightness against the B & W Artefact Limit Samples. No artefact should exceed the brightness of limit sample C3. Additionally, no dark artefact should exceed the darkness of limit sample D3. If either sample is exceeded, the print engine should be calibrated and if necessary, replaced.

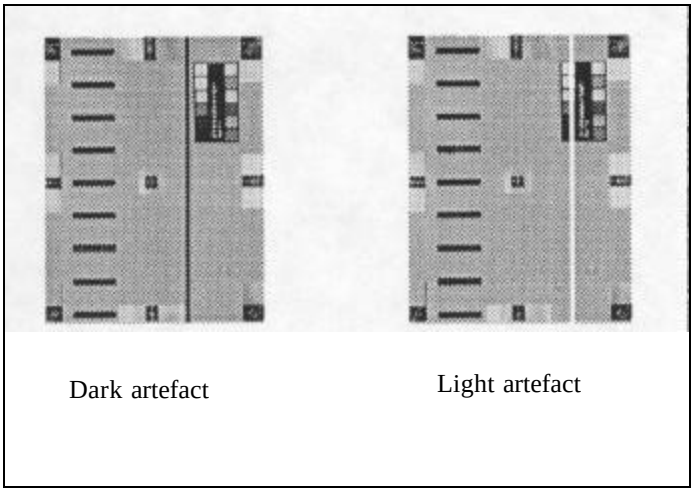


Figure 3-7 Dark and light artefact samples - B & W print

Judder

Inspect the color and black & white prints for evidence of horizontal banding (Figure 3-8). Horizontal banding can appear in two ways:
Gear Judder - multiple bands appear at a fixed distance apart. If this occurs, the print engine is faulty and should be replaced.
One-Off Judder - A single band appears. If this occurs, reprint the image and examine the new print. If the band still appears, the print engine should be replaced.

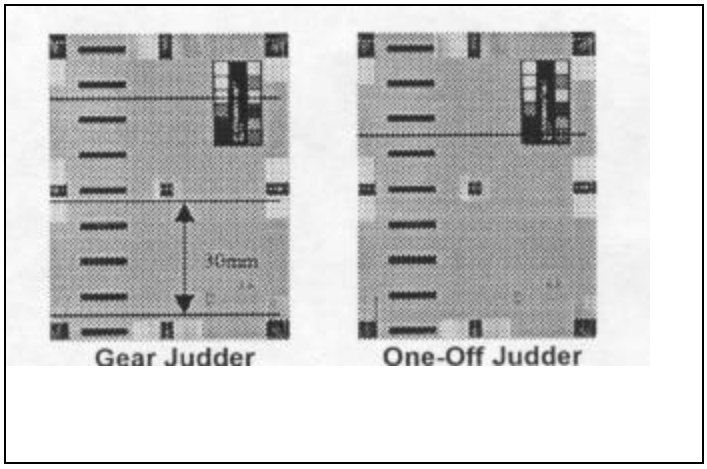


Figure 3-8 Examples of judder

Scan Artefacts - Color and B & W Prints

If the test prints exhibit fine multiple horizontal bands (Figure 3-9), compare them to the Artefact Limit Samples (if available). If the bands in the color print match limit samples F2 or F1, the print is considered acceptable. If the bands in the B & W print match limit samples G2 or G1, the print is considered acceptable.

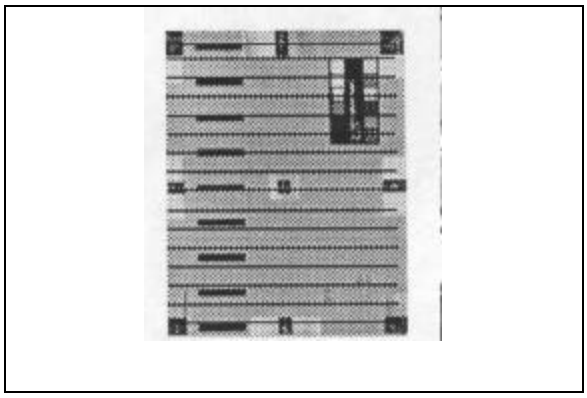


Figure 3-9 Example of fine horizontal banding

Registration Between Passes

Inspect the horizontal blue/green/red registration line using a microscope at 10X magnification. Pay particular attention to the adjacent edges between the colors. Ideally, the lines should look like that seen in Figure 3-10.

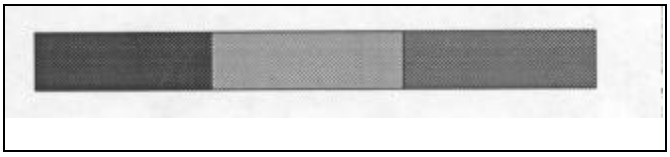


Figure 3-10 Ideal registration line

However, if the line looks like that in Figure 3-11, (with an offset not exceeding ½ the width of the total line) it is still acceptable.

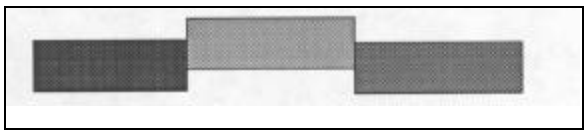


Figure 3-11 Maximum permitted offset of registration line

Flare

Compare the flare target on the test prints with Figure 3-12. Use a microscope at 10X magnification to closely examine one of the single pixels in the target. Ensure that the pixel is a clear full square with no evidence of smudging. If smudging is seen, it is evidence of exposed film around the pixel. Determine the cause of the pre-exposure and correct it.

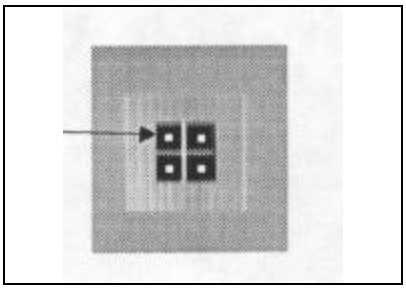


Figure 3-12 Flare target

Image Size

Measure the size of the printed images. As shown in Figure 3-13, the print should measure 71mm X 93mm (+1mm/-2mm)

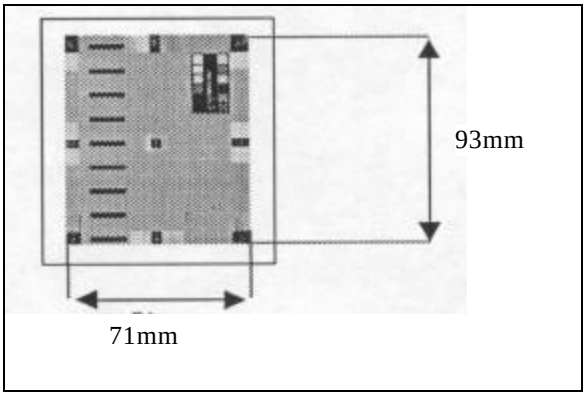


Figure 3-13 Image size

Image Centering

Check that the images are centered by examining the centering lines on the test prints. The longest of the centering lines must be visible at all four midpoint locations on the prints. See Figure 3-14.

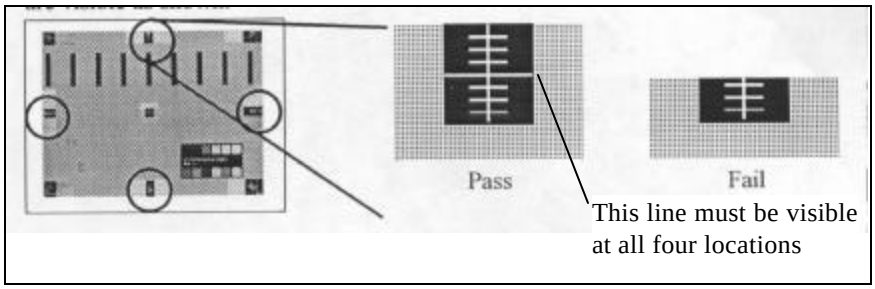


Figure 3-14 Checking image centering

Image Tilt

Inspect the test prints along the horizontal aspect and check the four corner chevron targets. (See Figure 3-15) Count the number of chevrons visible in each of the corners of the black rectangles. The number of chevrons visible in each corner should not differ by more than one. (Note that the whole chevron does not have to be visible.)

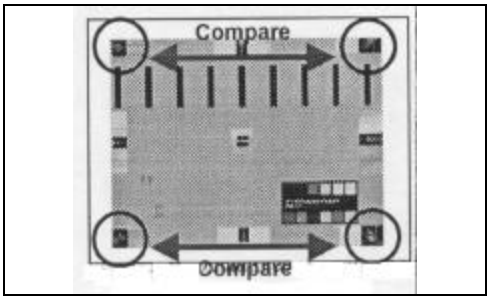


Figure 3-15 Examining corner chevrons for image tilt

Image Skew

Inspect the test prints along the vertical aspect and check the four corner chevron targets. (See Figure 3-16) Count the number of chevrons visible in each of the corners of the black rectangles. The number of chevrons visible in each corner should not differ by more than one. (Note that the whole chevron does not have to be visible.)

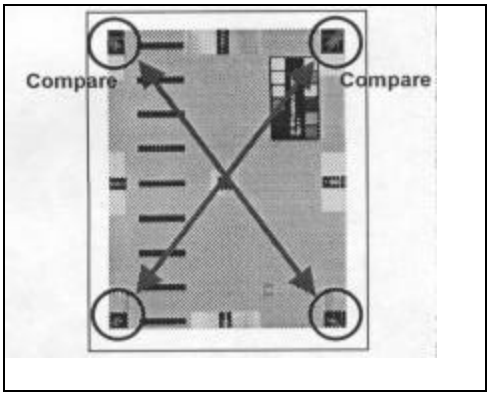


Figure 3-16 Checking for image skew

Print Head Calibration

If the printed images do not meet the limit sample requirements, run the print head calibration:

Insert the dark slide in the film holder.

a. At the printer control panel, hold down the Print button and the live/freeze button simultaneously and power on the printer. The printer will double-beep.

b. Wait until the system times out and then repeat the color and/or black & white image tests as necessary.

c. If the image still does not fall into the limit sample parameters, look for the following:

black lines on the image generally indicate that the board requires replacement

white lines on the image generally indicate that the print engine requires replacement

e. Refer to the Troubleshooting charts for further guidance.

Video Test

This test determines that video signals are being properly transmitted through the printer electronics. The test requires a Pentium PC, and external PAL monitor, and the Teletest 2 pattern generator.

Set up the system as seen in Figure 3-17.

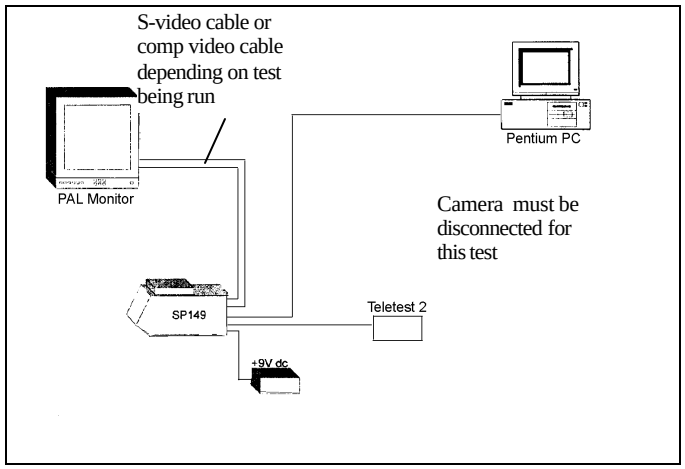


Figure 3- 17 System setup for video test

S Video (Y/C) check:

1. Run a video cable from the DIN S-Video socket on the back of the Teletest 2 pattern generator to the S-Video connector at the back of the printer.

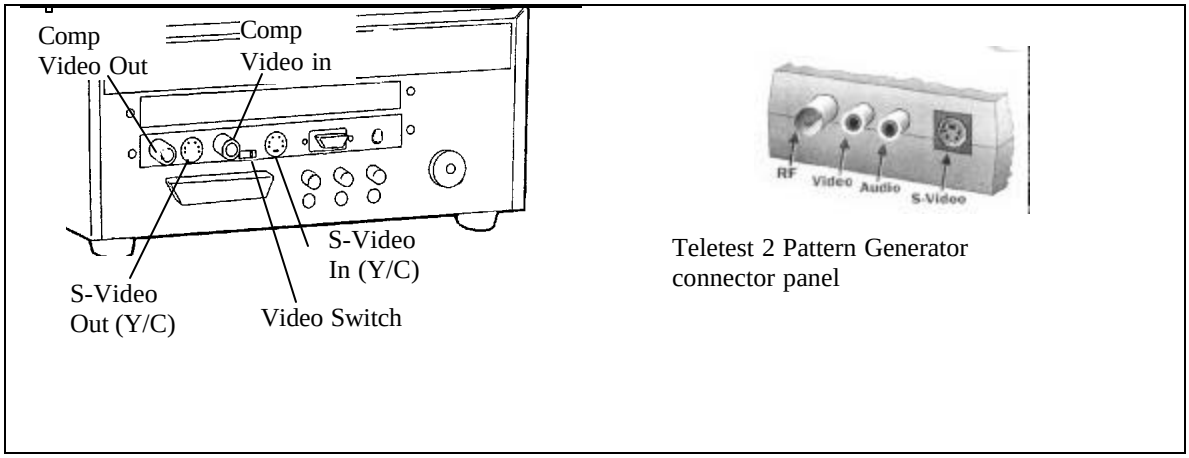


Figure 3-18 S-Video Connectors

2. Set the printer Video switch to Y/C (S-Video).

3. Set the Teletest 2 to Video.

4. Cycle through the test patterns on the Teletest 2 while observing the external monitor. If the patterns do not appear on the monitor, the video board is likely defective and should be replaced.

5. Disconnect the S-Video cable from between the printer and the pattern generator.

Comp Video (CVBS) Check

6. Run a composite video cable from the Video (composite video) socket on the Teletest 2 pattern generator to the Video In connector on the printer. Refer again to Figure 3-18.

7. Set the printer Video switch to CVBS (Video).

8. With the Teletest 2 switch set at Video, cycle through the test patterns while observing the external monitor. If the patterns do not appear on the monitor, the video board is likely defective and should be replaced.

LEDs/Buttons Test

This test determines if the LEDs and buttons on the printer control panel are working properly. No test equipment is required to perform this test.

1. Press the Power Switch to ON and observe that the power on LED lights.

2. Press the PC switch and observe that the PC on LED lights. Set the PC off-line after this step.

3. Press the PRINT FORMAT switch and select each of the formats available. As each is selected, be sure the corresponding LED lights.

4. Press the FILM switch alternately between color and black & white. Observe that the proper LED lights as each is chosen.

5. Press the LIGHTING switch to alternately choose internal strobe and external lighting. Observe that the appropriate LED lights.

6. Press the LIVE/FREEZE switch and observe that the LED lights and the image on the monitor switches between live and freeze.

7. With a frozen image on the screen and film in the film holder, press the PRINT switch. Observe that the green LED lights and stays lit for the entire printing time (30 - 60 seconds).

8. At the end of the printing time, observe that the printer beeps and PULL TAB LED lights.

9. Pull the film tab from the film holder and observe that FILM PEEL TIME LED (indicator #1) flashes for the duration of the imbibition time.

10. Repeat steps 7 through 9 two more times, observing that the printer beeps at the end of each printing time and that FILM PEEL TIME indicators 2 and 3 flash for the duration of film imbibition.

11. Listen for the printer to beep and observe that the FILM PEEL TIME LEDs #1 through #3 show solid color for one second at the end of each respective film imbibition time.

12. Insert the dark slide and remove the film holder from the printer. Install a film holder with an empty pack onto the printer.

13. Freeze an image and press the PRINT switch. Observe that the OUT OF FILM LED lights at the proper time.

If at any time, the appropriate LED or buzzer fails to operate, troubleshoot the system to determine the cause and make the appropriate repair. (See Troubleshooting.) If the system is working OK other than for a defective LED or buzzer, the most likely cause is a defective printer control panel flex which should be replaced.

Camera Functional Tests

Back Focus Adjustment (CS Mount Adjustment)

This adjustment should be performed whenever the camera lens or CS mount has been removed from the camera body or if the lens set screw has been loosened for any reason.. The purpose of the adjustment is to ensure proper focusing throughout the entire range of the zoom lens.

To complete this procedure, set up the system as shown in Figure 3-19. Please note that this setup requires a special Y-cable to connect the camera to the printer and the PC monitor.

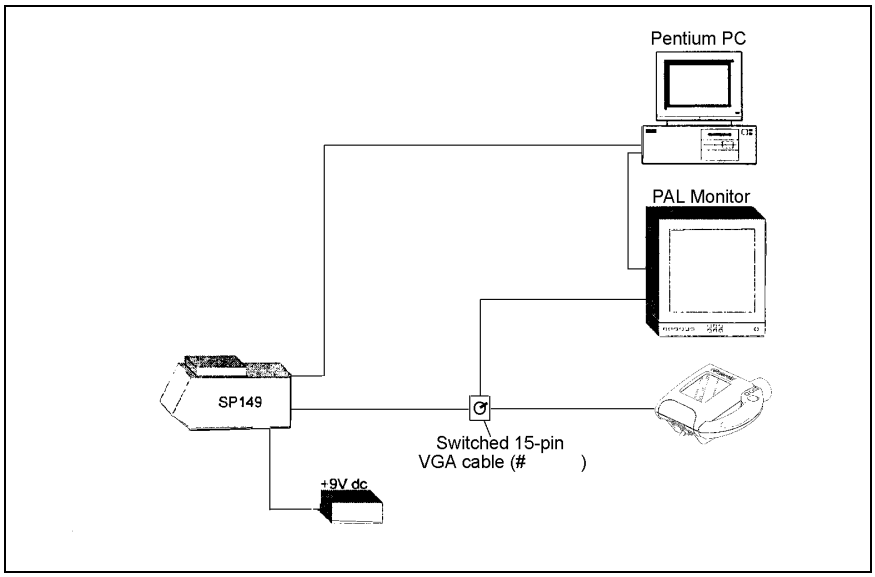


Figure 3- 19 Camera back focus test setup

1. At the front of the monitor, select “Y/C”.

2. Power On the system.

3. Turn off any studio lighting.

4. Set the Resolution Chart (Figure 3-20) 6.5 feet (2 meters) away from the front of the camera lens.

5. Set the lighting switch on the front panel of the printer to the strobe setting.

6. With the lens locking screw fully tightened, set the lens aperture to the lowest possible f number that does not saturate the image (dependent on ambient lighting).

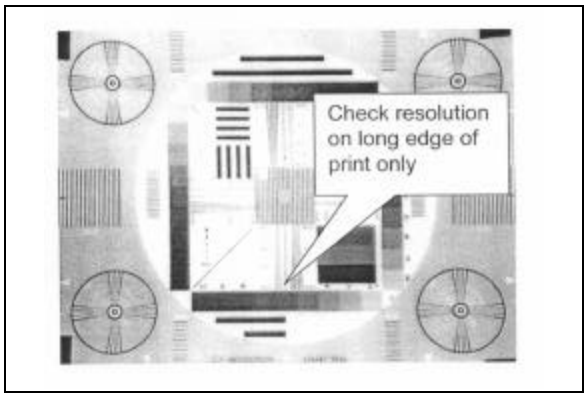


Figure 3-20 Resolution chart

7. Turn the lens to its largest focal length (maximum zoom setting).

8. While looking at the image on the PAL monitor, adjust the focus until the sharpest possible focus is achieved. (400TVL @ 5.7mm lines)

9. Turn the lens to its shortest focal length (minimum zoom setting).

10. Loosen the lens set screw and ***without changing the zoom or focus settings,*** move the lens backward or forward until the monitor image is sharpest. (34.2 mm lines in focus)

11. Repeat steps 7 through 10 as many times as necessary to guarantee the sharpest focus through the full zoom range of the lens. When done, tighten the lens set screw.

Button/Buzzer Check

This test is done to verify proper functioning of the camera buttons and buzzer. Set up the system as shown in Figure 3-19.

1. Select “Video” at the front of the monitor.

2. Power up the system. (Be sure the pc switch on the printer is off.)

3. By repeatedly pressing the print FORMAT button on the camera, cycle through each of the print formats while observing the LEDs on the printer control panel. Be sure each of the LEDs lights in turn as the button is pressed. Leave the setting at 1-up.

4. Using the FILM button on the camera, cycle between color and black & white film. Observe that the appropriate printer control panel LEDs light as each choice is made. Leave the setting at color.

5. With a live image visible in the LCD panel or the monitor, press the camera PRINT button. The camera buzzer should sound.

6. Press the camera LIVE/FREEZE button to ensure that an image can be frozen, then return to the live setting.

White Balance - Ambient Mode (f/5.6 - f/8)

This procedure adjusts the camera white balance setting for ambient mode pictures. Set the camera on a tripod and place the gray card 6.5 feet (2 meters) away from the front of the camera lens. (See Figure 3-21)

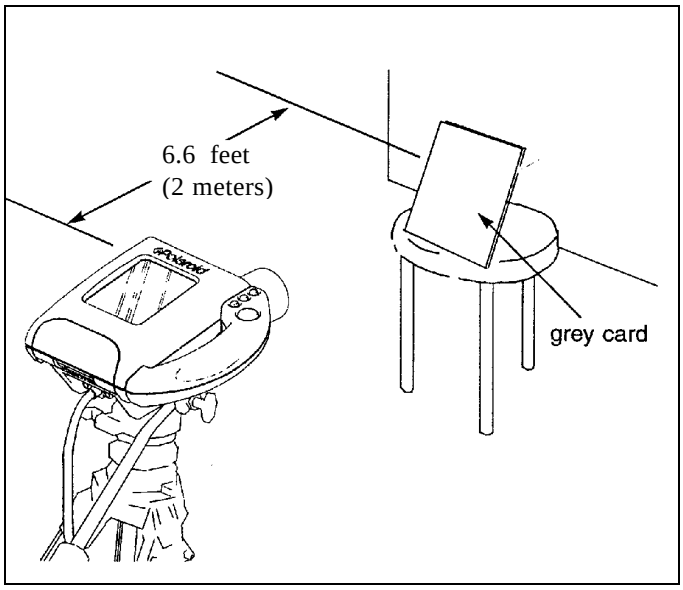


Figure 3- 21 Camera setup for white balance adjustment

1. Turn on the studio lights (3200K).

2. Power up the system in the Calibration mode by simultaneously pressing the Live/Freeze button and the Power button. A double-beep should sound to indicate that you are in the Camera Calibration mode.

3. Select ambient mode on the control panel.

4. While aiming at the gray card, turn the lens to maximum zoom. Set the camera so the bottom half of the LCD image is covered by the gray target.

5. LUMA setting -

    a) Select B & W on the control panel.

    b) Loosen the lens aperture ring screw and, while observing the control panel, turn the camera aperture ring (Figure 3-22) until the 2UP LED flashes. (If the 1UP LED flashes, reduce the f-number; if the 4UP LED flashes, increase the f-number.)

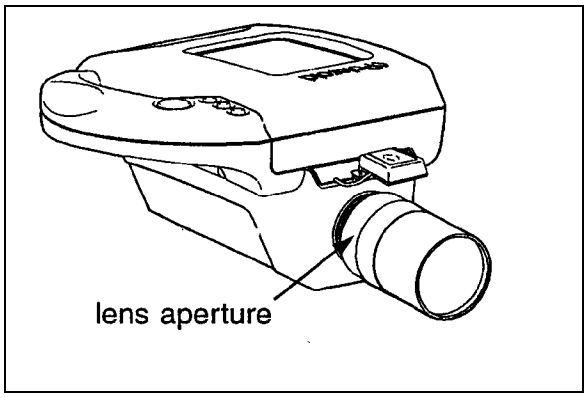


Figure 3- 22 Adjusting camera aperture ring

c) Check that the aperture setting is in the range of f/5.6 to f/8 and tighten the aperture ring screw.

6. Chroma Calibration -

a) Select color at the control panel.

b) Press the Print button until the red Pull Tab LED lights.

c) Adjust the Ambient B-R potentiometer on the camera until the 2UP LED flashes. (If the 1UP LED flashes, turn the potentiometer clockwise; if the 4UP LED flashes, turn the potentiometer counter-clockwise.) (See Figure 3-23)

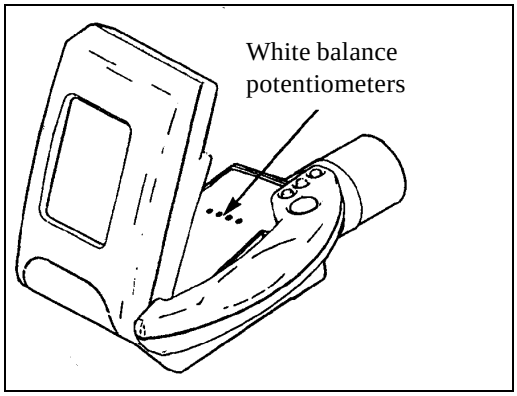


Figure 3- 23 Camera white balance potentiometers

d) Press the Print button until the green Pull Tab LED lights.

e) Adjust the Ambient G-Mg potentiometer on the camera until the 2UP LED flashes. (If the 1UP LED flashes, turn the potentiometer clockwise; if the 4UP LED flashes, turn the potentiometer counter-clockwise.)

f) Ensure that both settings are correct by toggling the Pull Tab LED using the Print button. The 2UP LED should flash for both B-R (red LED) and G-Mg (green LED). Repeat this procedure, if necessary to obtain this goal.

White Balance - Strobe Mode (f/4 - f/5.6)

This procedure adjusts the camera white balance setting for strobe mode pictures. Set the camera on a tripod and place the gray card 6.5 feet (2 meters) away from the front of the camera lens. (See Figure 3-21) Install the strobe on the camera.

1. Turn on the studio lights (3200K).

2. Power up the system in the Calibration mode by simultaneously pressing the Live/Freeze button and the Power button. A double-beep should sound to indicate that you are in the Camera Calibration mode.

3. Select strobe mode on the control panel.

4. While aiming at the gray card, turn the lens to maximum zoom. Set the camera so the bottom half of the LCD image is covered by the gray target.

5. Luma Setting -

   a) Select B & W on the control panel.

   b) Loosen the lens aperture ring screw and, while observing the control panel, turn the camera aperture ring (Figure 3-22) until the 2UP LED flashes. (If the 1UP LED flashes, reduce the f-number; if the 4UP LED flashes, increase the f-number.)

   c) Check that the aperture setting is in the f/4 to f/5.6 range and tighten the aperture ring.

6. Chroma setting -

    a) Select color at the control panel.

    b) Press the Print button until the red Pull Tab LED lights.

    c) Adjust the Strobe B-R potentiometer on the camera until the 2UP LED flashes. (If the 1UP LED flashes, turn the potentiometer clockwise; if the 4UP LED flashes, turn the potentiometer counter-clockwise.) (See Figure 3-23)

    d) Press the Print button until the green Pull Tab LED lights.

    e) Adjust the Strobe G-Mg potentiometer on the camera until the 2UP LED flashes. (If the 1UP LED flashes, turn the potentiometer clockwise; if the 4UP LED flashes, turn the potentiometer counter-clockwise.)

    f) Ensure that both settings are correct by toggling the Pull Tab LED using the Print button. The 2UP LED should flash for both B-R (red LED) and G-Mg (green LED). Repeat this procedure, if necessary to obtain this goal.

Shutter Speed Switching Check

1. Disable the calibration mode by turning the printer off and on again.
2. Remove the color correction filter from the lens.
3. Adjust the strobe on the camera to 100 ASA / 21 DIN.
4. Charge the strobe.
5. Set the lens aperture to f/5.6.
6. Focus on the gray card and press the Freeze button. Check that the image on the monitor and LCD panel is correctly exposed.

Auto Gain Control

This procedure is done to ensure that the auto gain feature of the camera is functioning properly. Setup the system as seen in Figure 3-21 and turn on studio lighting.

1. Power up the system.
2. From the printer control panel, select strobe mode.
3. Set the lens aperture to f/16.
4. Focus on the gray card.
5. Observe the live image seen in the monitor and LCD panel.
6. Change to ambient mode and again observe the image. The image should now be visibly darker than it was in strobe mode

Resolution Test

This test is done to assess the resolution capabilities of the camera. Set up the system as seen in Figure 3-21, but substitute the resolution target in place of the gray card.. Turn on studio lighting.

1. Power up the system.
2. At the printer control panel, select Ambient.
3. Set the lens aperture to f/8, so the image is not saturated.
4. Adjust the zoom until the resolution target fills the field of view.
5. Capture and print an image.
6. Check the print to be sure that 400 lines are visible in one axis of the image. (see Figure 3-24)

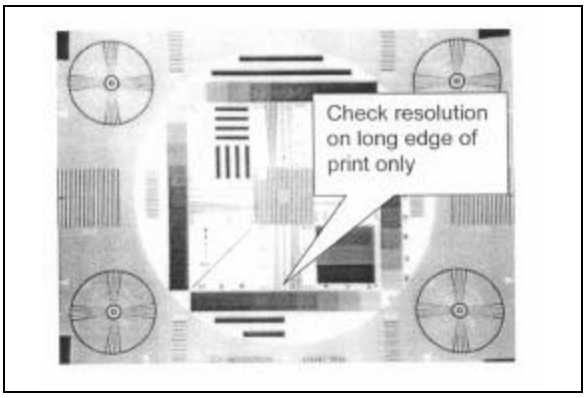


Figure 3- 24 Resolution target

Filter Orientation

This check is done to ensure that the CCD filter in the CS mount is in the correct orientation.

1. Power up the system.
2. At the printer control panel, select Ambient.
3. Set the lens aperture to f/8, so the image is not saturated.
4. Adjust the zoom until the resolution target fills the field of view.
5. Capture and print an image.
6. Check the print to be sure there is no color fringing on the print. If there is, it is an indication that the filter is not correctly installed. The CS mount and Sony board set must be replaced.

Camera/LCD Pixel and Noise Check

This test is run to determine whether any pixels in the camera CCD or LCD are not working properly or whether they are obstructed by foreign matter. Set up the system as shown in Figure 3-21 (with the gray card) and turn on studio lighting.

1. Power up the system
2. At the printer control panel select ambient mode.

3. Set the camera aperture ring to f/5.6.

4. Focus the camera to capture the gray target. Adjust the zoom until the target completely fills the image area.

5. To check for Pixel loss, slowly adjust the aperture ring through its full range while observing the monitor for black or white dots, indicating “dead” pixels. If any are seen, the camera should be rejected.

6. Again, slowly adjust the aperture ring through its full range while observing the LCD panel for “dead” pixels. If any are seen and they are also seen in the monitor, the camera CCD is defective and must be replaced. If they are seen only on the LCD panel, then the LCD panel is defective and must be replaced.

7. As a check on camera “noise”, no unusual patterns should be visible on the monitor during this testing.

8. Use the slow aperture adjustment method while checking the monitor for signs of foreign matter on the camera or lens. Carefully clean the components as necessary.

4 Parts Replacement

General Cautions:

- Unless otherwise indicated, the Studio Polaroid SP350 system should be disconnected from electrical power whenever the covers (printer or camera) are to be removed for service.

- To avoid scratches to the covers, the SP350 system, if possible, should be disassembled on a work bench which has a soft, padded surface.

- To prevent electrostatic discharge damage to the electronics on the printed circuit boards, technicians must be **grounded,** ideally using a wrist or heel strap.

- During disassembly, pay close attention to the manner in which electrical cables are routed. The cables must be routed in **exactly** the same locations when reassembling the unit.

Notes:

- Before starting any repair, refer to Appendix I, Product Change Notifications to determine if any changes have been initiated which would affect the repair.

- *Upon completion of any repairs, you should perform the appropriate diagnostics and adjustments procedure(s) found in Section 3 of this manual.*

- Retain all hardware (screws, washers, etc;) removed in the procedures which follow. It will be used during replacement of affected assemblies.

- If the printer requires disassembly, it is recommended that you upgrade the unit to Version 2 firmware. This is done by replacing the existing flash ROM, AM 29F010 on the motherboard with a new ROM, (part number 1BC408A). The EEPROM Check in Section 3 should be done when the new ROM is installed. Refer to the Addendum for the board layout.

Tools Required

Tool requirements for the disassembly of the Studio Polaroid SP350 system primarily consist of a standard field service tool kit, including metric Allen wrenches. Be sure the following is included in the kit:

- Set of Torx screwdrivers

Photo Printer Repair Procedures

Replacement of the Chassis Cover

Removal

1. Remove the film holder and then remove eight Phillips-head screws and star washers which secure the cover to the chassis. (Figure 4- 1)

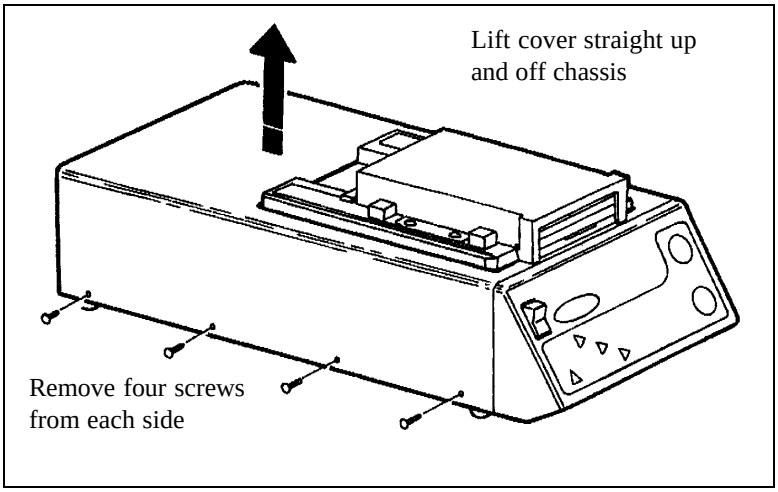


Figure 4- 1 Removal of photo printer chassis cover

2. Lift the cover straight up and free of the chassis.

Installation

Reverse the procedure above.

Replacement of the Print Engine

Removal

1. Remove the film holder from the printer.
2. Remove the cover from the chassis as previously instructed.
3. Locate and disconnect the ribbon data cable from its connector on the print engine. (Note that the connector has two clips which must be opened to allow the ribbon cable to be removed.) (Figure 4- 2)

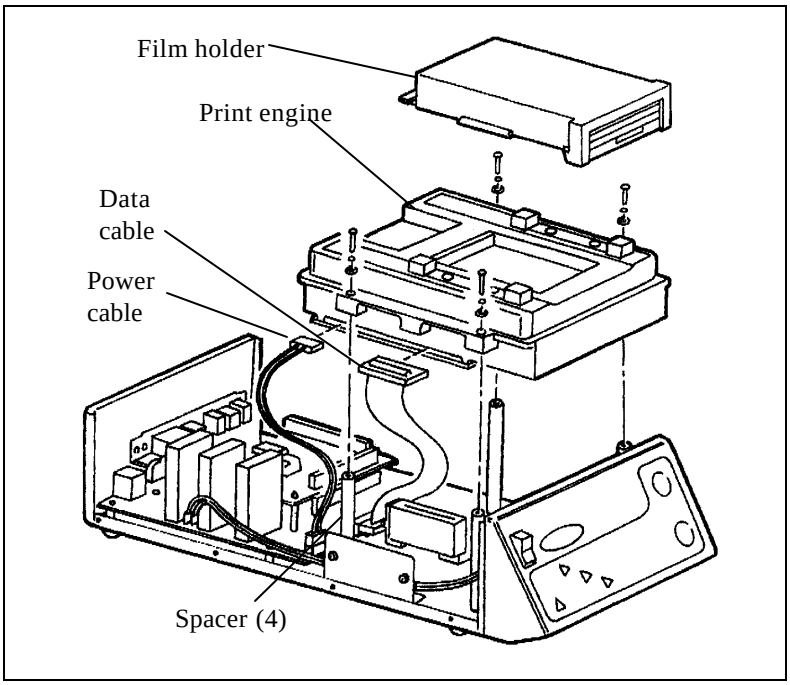


Figure 4- 2 Removing the print engine

4. Locate and disconnect the power cable from its connector on the print head.
5. Remove four Phillips M3x16 screws, four M3 lock washers and four M3 flat washers which secure the print engine to the four spacers of the chassis floor.

6. Lift the print engine free of the chassis.

Installation

Reverse the procedure above.

Use care to prevent over-tightening the screws which hold the print engine to the spacers. Also, be certain that the cables are firmly secured in the print engine connectors.

Compatibility Note: Two versions of print engines are available - a two lens engine (#1BA723A) and a four lens engine (#1BA723B). Refer to the chart below to determine compatibility of these print engines in the printer.

	If printer serial number ends in "B"	***If printer serial number ends in "C"***
2 Lens Print Engine	OK	OK
4 Lens Print Engine	Not compatible	OK

In other words, you can use the 2 lens Print Engine in either printer, but, you cannot use a 4 Lens Print Engine in a "B" configuration printer. Change parts as necessary to assure system compatibility.

Entering anode supply voltage values: *Whenever a new print engine is installed, you must complete the EPROM procedure found in Section 3 Diagnostics and Adjustments. This procedure enters the supply voltage values of the new print engine to properly "set up" the system electronics.*

Replacement of the Power Switch

Removal

1. Remove the cover from the printer chassis as previously instructed.

2. Carefully, pull the two power cable terminals from the spade terminals on the switch. (Figure 4- 3)

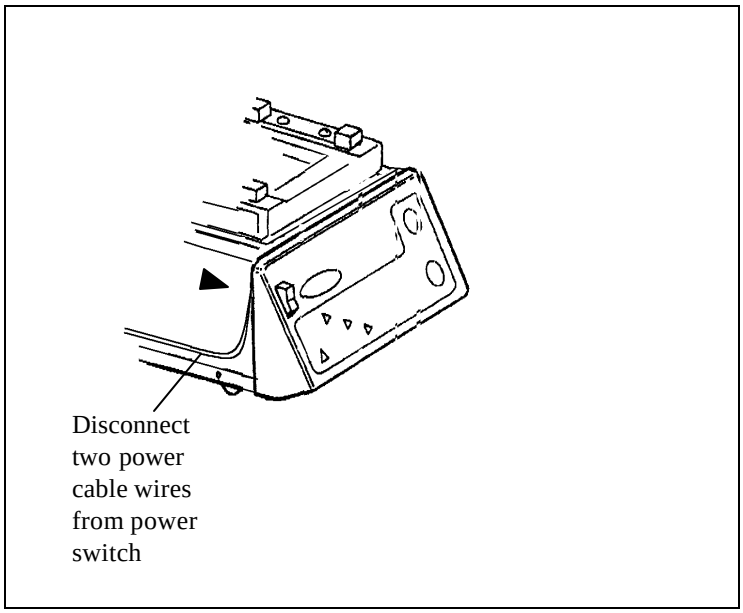


Figure 4- 3 Removing the On/Off switch

3. The switch is held in place in the front panel by friction fit. Push against the back of the switch with a thumb, applying steady pressure. (Cup your other hand in front of the switch to prevent its "flying " across the room.) Push until the switch is free of the panel.

Installation

Reverse the procedure above.

Be certain that the power cable is routed exactly as before.

Replacement of the Video Board and Mother Board

Removal

Note:

The video board is "piggy-backed" on top of the motherboard. Plastic spacers hold the boards together.

Caution:

To prevent damage to connectors on these boards, the boards must be removed from the chassis together.

1. Remove the chassis cover as instructed.

2. Remove the print engine as instructed.

3. Remove two M3 x 12 Phillips-head screws with star washers and two M3 flat washers which secure the video board bracket to the rear of the chassis panel. (Figure 4- 4)

4. Remove two 4 - 40 x .05” Allen-head screws which secure the mother board parallel connector to the rear panel.

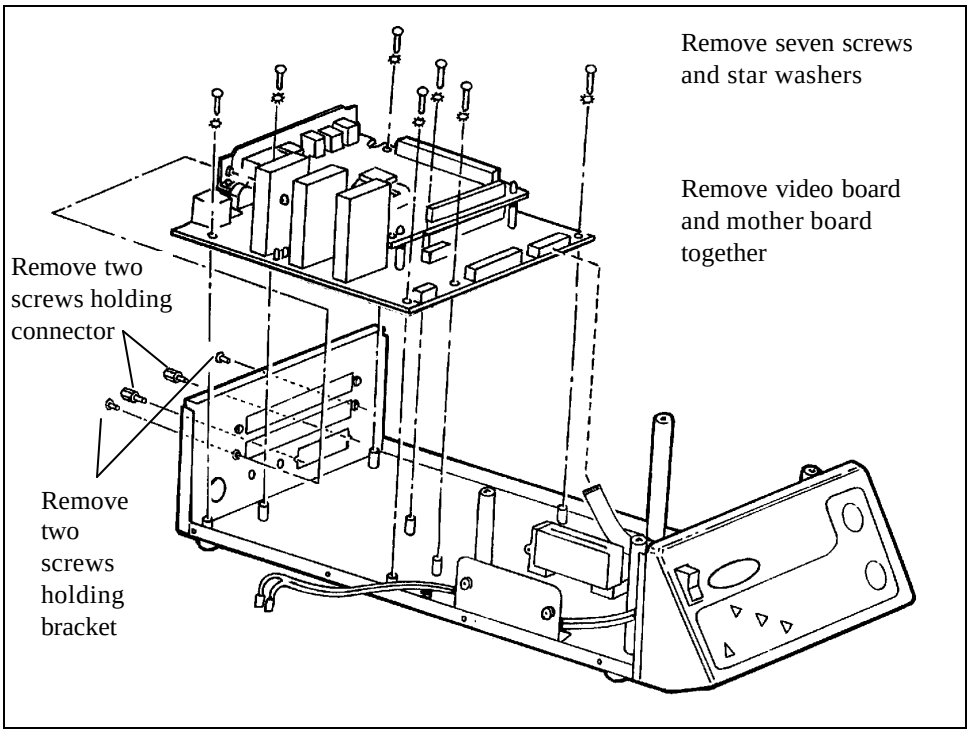


Figure 4- 4 Video board & mother board removal

5. On the mother board assembly, locate and disconnect the following cables:

    a) Control panel data cable from connector J6

    b) Power cable from connector J10

Note:

Two cables to the print engine should have been disconnected when the print engine was removed.

6. Remove seven Phillips-head M3 x 12 screws with star washers and M3 flat washers which secure the mother board to the chassis floor.

7. Remove the video board and mother board from the chassis by lifting them up and forward to allow the controls and connectors to clear the rear panel.

8. Release the video board from the spacers on the mother board as follow:

    a) With needle-nosed pliers, compress the wings on the head of one spacer while carefully pushing upward from under the video board with your other hand. Push up until the hole in the board slides past the spacer head. (Figure 4- 5)

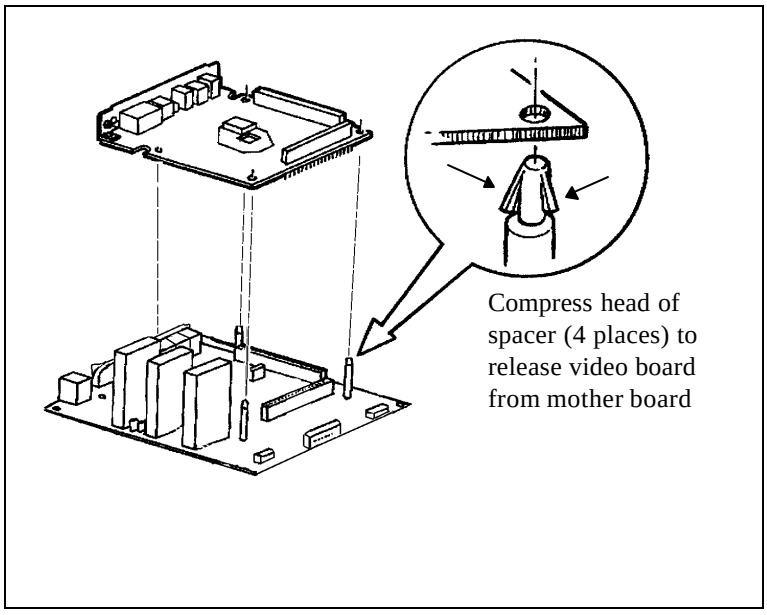


Figure 4- 5 Releasing video board from mother board

    b) Repeat the previous step for the remaining three spacers.

9. Lift the video board up to free it from the mother board. Note that the boards are mated via two 64-pin connectors. Use care to prevent bending the connector pins when lifting the video board free.

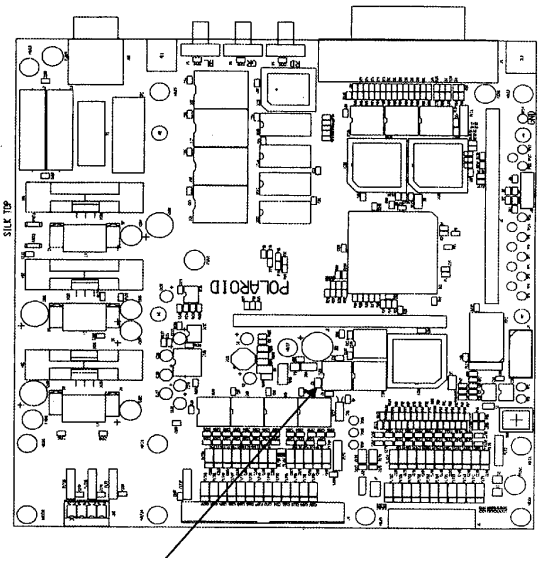
Installation

Reverse the procedure above.

Use special care to carefully align the two 64-pin connectors before mating the two boards. Additionally, use care when aligning the controls and connectors with the openings in the rear panel. Finally, be certain that all cables are routed exactly as they were before the boards were removed from the chassis.

Compatibility Note: Two versions of motherboards are available - Issue 12 and Issue 13. Either of these motherboards can be used as a replacement as long as it is compatible with the print engine which is also available in two versions: 2-lens models (#1BA723A) and 4-lens models (#1BA723B). *The issue of motherboard determines whether the printer carries a "B" or "C" suffix in its serial number.*

The motherboards carry the same part number so the only way to determine which motherboard is being installed is by examining capacitor C7. (Figure 4- 6)



If yellow capacitor C7 is **fitted** (jumped) - **Issue 13**
If capacitor C7 is **not fitted** (jumped) - **Issue 12**

Figure 4- 6 Determining motherboard issue number

Once you have determined the Issue # of the motherboard you are installing, check the following chart to determine compatibility of board and print engine.

	If printer serial number ends with "B" - Motherboard Issue 12	***If printer serial number ends with "C" - Motherboard Issue 13***
2 Lens Print Engine	OK	OK
4 Lens Print Engine	Not compatible	OK

Change parts as appropriate to assure system compatibility.

If you replace an Issue 12 motherboard with an Issue 13 motherboard, cover the "B" suffix in the serial number and mark it "C"

Replacement of the Control Panel Bezel and Data Cable

Removal

1. Remove the cover from the chassis as previously instructed.
2. Remove the print engine as previously instructed.
3. Locate and disconnect the control panel data cable from the mother board.
4. Remove four KC30 x 12 pan head torx screws which secure the control panel bezel to the chassis. (Figure 4- 7)

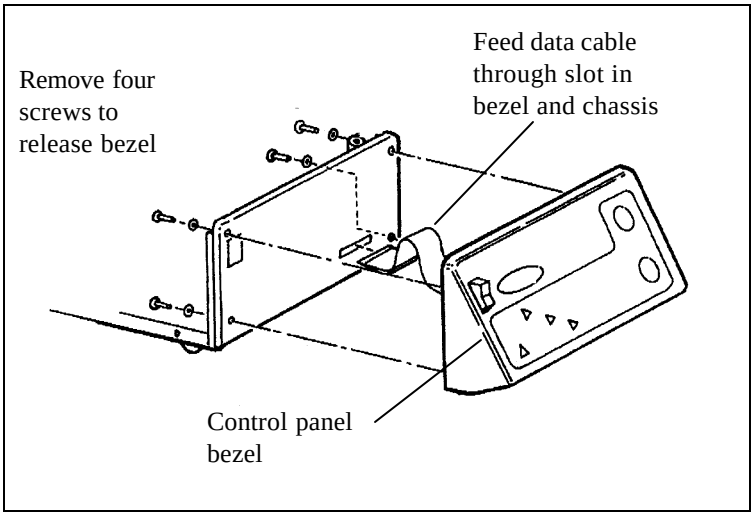


Figure 4- 7 Front bezel removal

5. Carefully pull the front bezel assembly away from the chassis, leading the data control cable through the slot in the chassis.
6. At this point, the data control cable can be removed from the connector on the control panel flex. Reach into the opening in the back of the control panel to pull the cable free.

Installation

Reverse the procedure above.

When installing the control panel cable, be sure it is fully seated in the control panel flex connector. The metallic side of the flex should be facing away from the control panel. Route the cable back to the mother board exactly as it was before removal.

Replacement of the Control Panel Flex Assembly

Removal

1. Remove the cover from the chassis.
2. Remove the print engine.
3. Remove the front bezel assembly
4. Disconnect the control panel data cable from the connector on the mother board.
5. Disconnect the control panel data cable from the connector on control panel flex. Carefully pull the data cable free of the chassis.
6. Peel back the defective control panel flex assembly from the bezel and discard it.

Installation

Reverse the procedure above.

Install the data control cable into the flex connector before adhering the flex to the bezel. (Leave the protective covering on.) Be sure the metallic side of the cable is facing away from the control panel.

Guide the cable through the opening in the bezel and the chassis. Be certain it is routed exactly as it was before it was removed.

Remove the protective covering from the new flex assembly, align it over the front bezel, and adhere the new control panel flex onto the bezel.

Continue to route the data cable to the mother board and install it in the connector.

Camera Repair Procedures

Replacement of the Lens Assembly

Removal

1. Disconnect the cable from the camera. (Figure 4- 8)
2. Unscrew the lens assembly from the lens bracket.

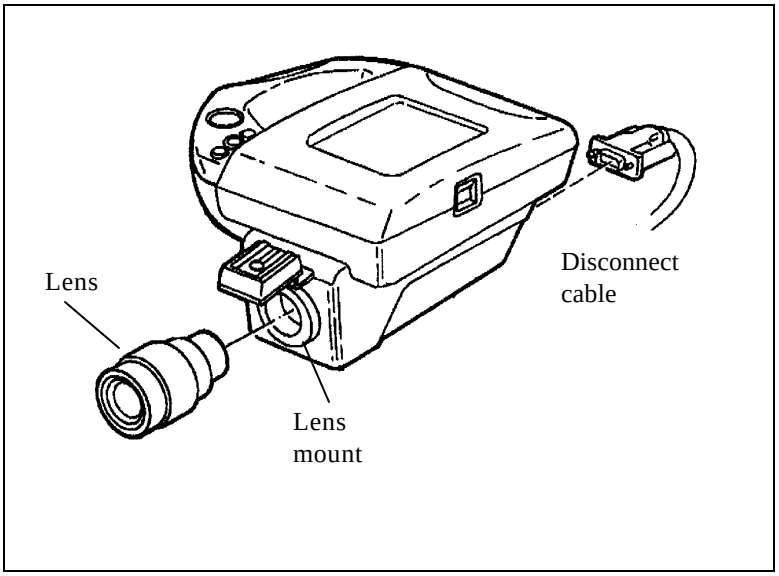


Figure 4- 8 Removing the lens assembly

3. To prevent dust from collecting on the CCD sensor, use a piece of black photographic tape to cover the square opening in the CCD mount assembly. (Located within the lens mount.)

Installation

Reverse the procedure above.

Be sure that all adhesive is removed with the tape.

Whenever the lens assembly is replaced, you must complete the Back Focus adjustment procedure found in Section 3, Diagnostics and Adjustments.

Replacement of the Camera Base

Removal

1. Remove the bottom cover pad from around the tripod mount by peeling it free of the bottom cover. (Figure 4- 9)

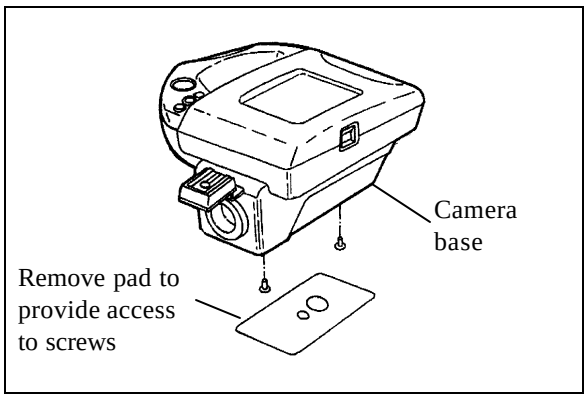


Figure 4- 9 Removal of the camera base assembly

2. Identify and remove two black pan-head M3 screws which secure the camera base to the can assembly.

3. Remove the camera base.

Installation

Reverse the procedure above.

The bottom cover pad previously removed cannot be reused. You must install a new pad.

Replacement of the CS Mount Assembly and Matched Sony PC Board

Note:

The CS mount assembly consists of the CCD mount, the lens bracket, an optical filter kit and the Sony sensor board. These parts are matched and factory-calibrated.

A second Sony pc board is located within the pcb can assembly. ***The CS mount assembly and this Sony pc board are factory-matched and must be maintained as a mated pair to insure optimum performance.*** Hence, the CS mount assembly and the Sony pc board are maintained in the spare parts inventory as a matched pair. If you replace the CS mount assembly, you must also replace the Sony pc board. Conversely, if you replace the Sony pc board, you must also replace the CS mount assembly.

Note:

As part of this procedure you will also remove the **Hot Shoe Assembly**, the **CCD Mount Cover**, the **PCB Can Assembly** and the **Camera Body PC Board Assembly.**

Caution:

To prevent electrostatic discharge damage to the electronics on the printed circuit boards, technicians must be **grounded,** ideally using a wrist or heel strap.

Removal

1. Remove the camera base.
2. Remove four Phillips head screws which secure the CS mount assembly to the metal can. (Figure 4- 10)

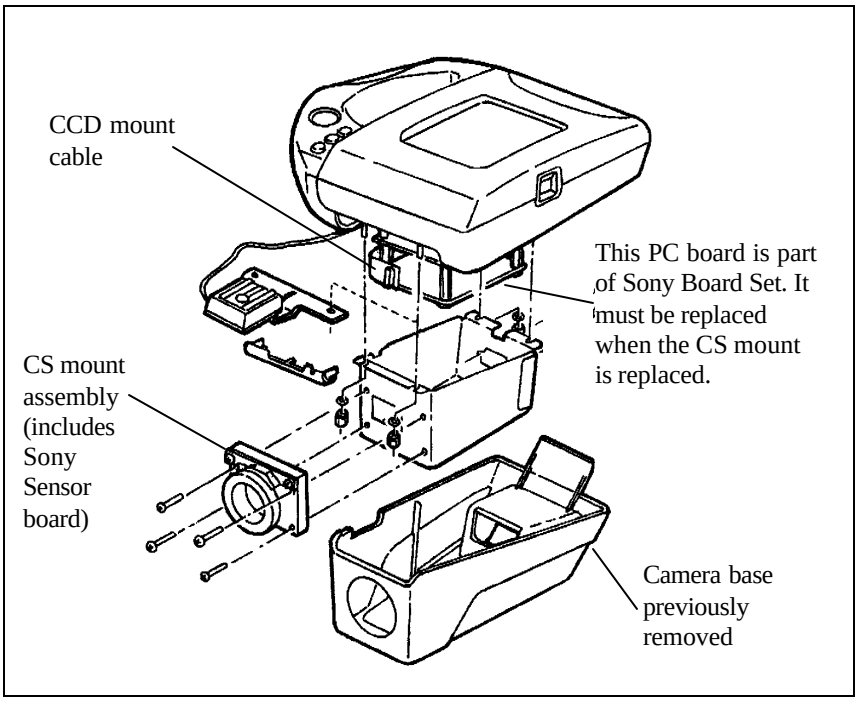


Figure 4- 10 Removing the CS mount assembly

3. Pull the CS mount out to the limit of the electrical connection and release the connector from the CCD mount.

4. Remove the CS mount assembly.

5. Release the large VGA connector from the pc board can assembly by removing two pillar-type screws, and flat washers and gently breaking the nutlok adhesive which further secures it. (Figure 4- 11) (The connector stays with the camera body pc board when released from the can.)

Note:

In the step above, if spring washers are found under the pillar-type screws, do **not** replace them in reassembly.

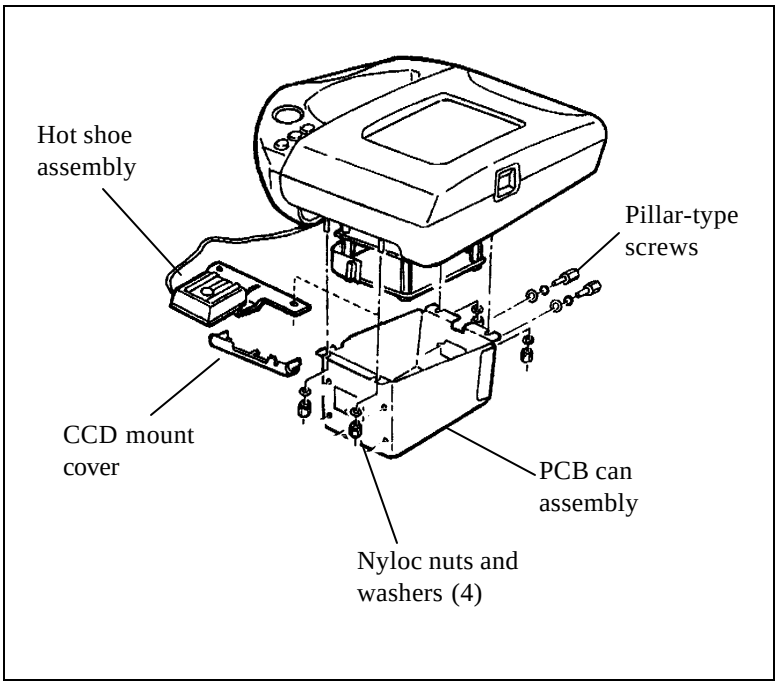


Figure 4- 11 Removing the PCB can assembly

6. Remove four nyloc 5.5mm hex nuts and flat washers which secure the pc board can assembly to threaded shafts on the camera body. Pull the metal can free of the shafts.

7. When the can is released, the CCD mount cover is also released.

Caution:

Cable routing in this area is critical. Before disconnecting cables pay very close attention to the manner in which they are routed. They must be returned to the same locations when the camera is reassembled.

8. Free the hot shoe assembly from the bosses on the camera body and disconnect its cable from the camera pc board. (Figure 4- 12) Remove the hot shoe assembly.

9. Identify and disconnect two cables from the Sony pc board to the camera body pc board.

10. Remove three screws which secure the Sony pc board to the spacers and remove the board.

Note:

Remember the Sony pc board is part of a matched set with the CS mount assembly. If you replace the board, you must also replace the CS mount assembly.

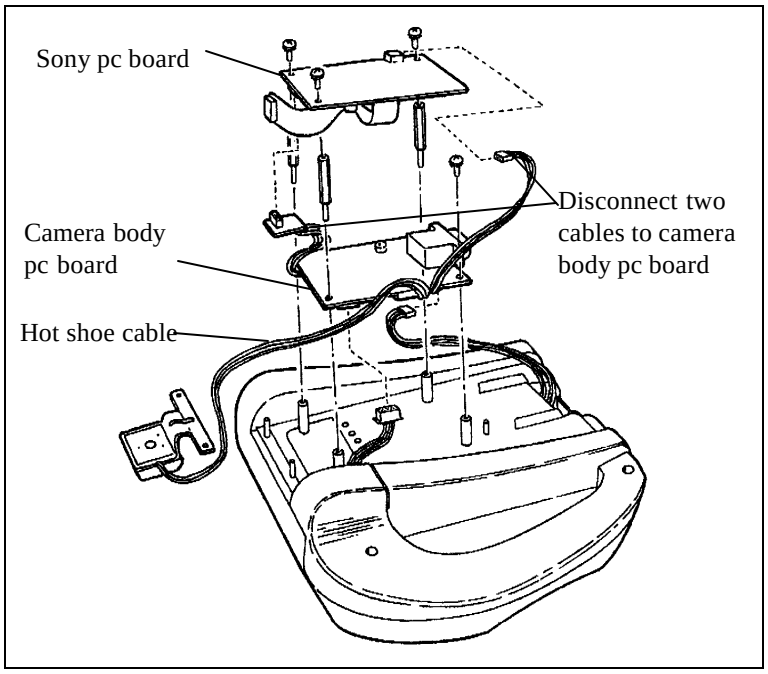


Figure 4- 12 Removing the Sony pc board

11. At this point the camera body pc board may also be removed. Remove the three threaded spacers and the single screw which secure the board to the camera body.

12. Identify, tag and disconnect the remaining cables from the board and remove the board.

Installation

Caution:

To prevent electrostatic discharge damage to the electronics on the printed circuit boards, technicians must be **grounded,** ideally using a wrist or heel strap.

1. Align the camera body pc board over the spacers on the camera body with the large connector facing the pivot area of the camera.

    a) connect the LCD cable to J3 of the pc board

    b) connect the keypad cable to J5 of the pc board

2. Secure the camera body pc board to the camera body using the three threaded spacers and the screw. (Figure 4-12)

3. Connect the camera body pc board cables to the new Sony pc board.

    a) connect the cable CN202 to J4 of the Sony board

    b) connect the cable CN203 to J1 of the Sony board

4. Align the Sony board over the three spacers on the camera body board and secure it using three screws previously removed.

5. Connect the hot shoe cable to the connector on the camera body pc board and then set the hot shoe over the bosses on the camera body in the orientation shown in Figure 4-12.

6. Place the CCD mount cover over the forward edge of the can assembly and secure the can to the camera body using four nyloc nuts and washers. (Figure 4-10)

7. Align the can assembly with the VGA connector and secure the connector to the can using the pillar type screws and flat washers. Sparingly apply a small amount of nutlok adhesive to secure the screws and flat washers. If any adhesive spills, wipe it up using a clean dry cloth. (Figure 4-11)

8. Connect the CCD mount cable between the Sony pc board and the CCD mount and secure the CS mount assembly to the can using the four screws previously removed.

9. Align the camera base over the can and secure it using two screws previously removed.

10. Remove the protective covering from a new rubber pad, align it over the tripod area of the camera base and firmly adhere it in position.

Whenever the CS Mount Assembly is replaced, you must perform the Back Focus adjustment procedure found in Section 3, Diagnostics and Adjustments.

Replacement of the Handle Assembly Components

Caution:

To prevent electrostatic discharge damage to the electronics on the printed circuit boards, technicians must be grounded, ideally using a wrist or heel strap.

Removal

1. Orient the camera as shown in Figure 4- 13, with the top plate swiveled down.

Note:

The camera base assembly is shown removed for clarity. Disassembly of the handle assembly does not require removal of the camera base.

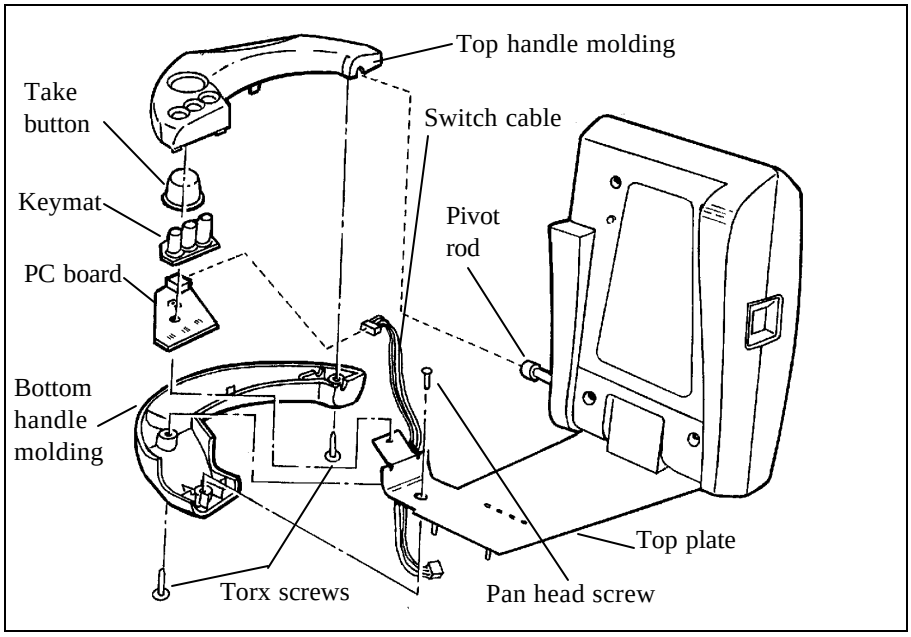


Figure 4- 13 Disassembling handle components

2. Remove two torx screws holding the top and bottom handle moldings together. Note that the forward screw also secures the pc board and the top plate in place. Also note that when the two handles are secured together, they capture a boss at the end of the pivot rod.

3. Remove the pan-head screw that secures the top plate to the bottom handle molding
4. Lift off the top handle molding.
5. Remove the take button
6. Remove the keymat.
7. Disconnect the switch cable from the handle pc board assembly. Make careful note of the manner in which it is routed below the top plate. (This cable terminates at the camera body pc board assembly.)
8. Remove the handle pc board assembly.

Installation:

Reverse the procedure above.

Be certain that the switch cable is properly routed past the top plate.

Also, align the handles over the boss on the pivot rod before securing them.

Replacement of the LCD Assembly and Pivot Assembly

Removal

1. Remove the handle assembly.

Note:

Figure 4-14 shows the camera base and its related components removed from the camera for purposes of clarity in the drawing. It is not necessary to remove the camera base to disassemble the upper and lower camera bodies.

2. As seen in Figure 4- 14, remove four torx screws which secure the lower camera body to the upper camera body. The LCD assembly pivot rod bushings are trapped between the two camera bodies. Use care to prevent their falling free and being lost when the torx screws securing the upper and lower camera bodies are removed.

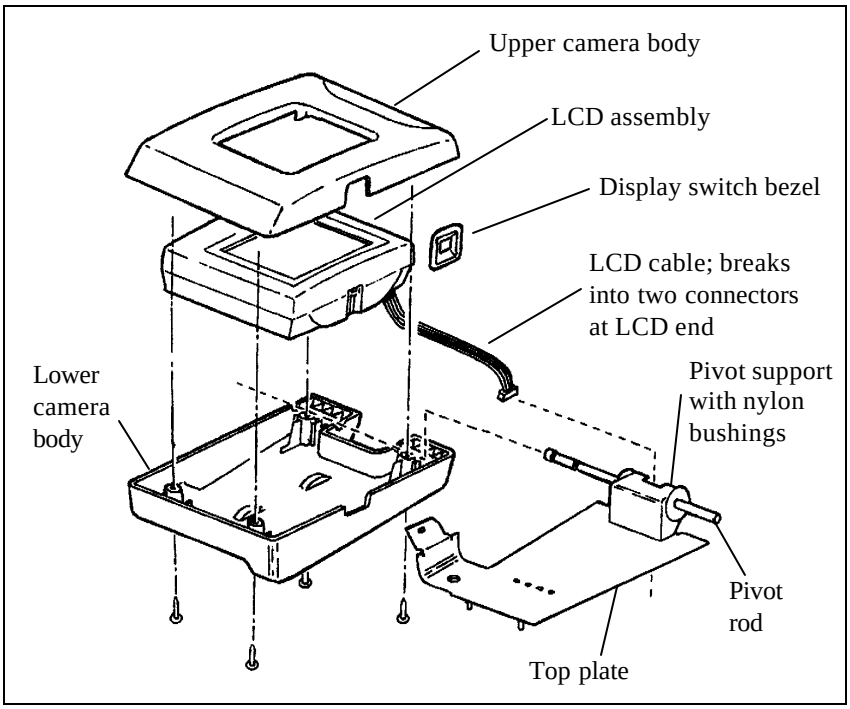


Figure 4- 14 Removing the LCD assembly

3. Lift away the upper camera body from the lower camera body. Remove the rubber display switch bezel from the cutout in the camera body.

4. Disconnect the two LCD cable connectors from the LCD assembly and remove the LCD assembly from the lower camera body.

5. Pivot the top plate so it is 90 degrees to the lower camera body. Pull the LCD cable free of the pivot support. Then, twist the top plate to free the pivot rod from the lower body.

Installation

Reverse the procedure above.

Use care to insure the LCD cable is properly routed through the pivot support before securing the assembly.

Appendix A

Presented on the following pages is the SP149 Electronic Design Data & Technical Guide prepared by the designers of the Studio Polaroid 350 System in Europe. It provides an excellent resource for repair technicians who wish to learn the electronic theory of operation for the system photo printer.

Studio Polaroid 149 Photo Printer

Electronic Design Data & Technical Guide

April 1999

Section Titles

1 Introduction

2 System Overview

3 Video Card

4 Main Card

5 Control Panel

6 Power Supply Unit

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Introduction

1-1 Purpose of Document

This document aims to provide readers with a thorough understanding of the electronic design and technical specifications for the Studio Polaroid 149 Photo Printer.

It provides a "snapshot in time" in its listing of IC technical data and operation modes of the system. New features, film and print formats and application software packages are continually being added to the Studio Polaroid 149 product portfolio. Users are encouraged to contact their local Polaroid sales representative and consult the Polaroid World Wide Web for the latest information regarding new product availability.

This document is not intended to form part of, or replace the Product Design Specification or User Interface Documents.

System Overview

2-1 An Overview of the SP149 System

The Studio Polaroid 149 Photo Printer was launched at the Photokina exhibition in September 1998 as the lowest priced video printer in the Studio Polaroid range. It accepts both Studio Polaroid color "pack" film and Polaroid PolaPan black and white film. It allows the printing of "real" Polaroid instant photos in a full frame portrait configuration (one photo per sheet) and in 2-, 4-, 5-, 6- and 9-shot configurations for passports, resume portraits and other portrait-required government or private documents.

The SP149 Photo Printer can be easily connected to a PC for subsequent image processing or storage. The printer can also accept direct image transfer from the PC for on-the-spot printing, affording retailers the opportunity of servicing clients with new portraits without requiring their presence in the studio or shop. These software products are planned for launch in 1999/2000. The SP149 Photo Printer is designed to fit easily on a shelf or desktop

2-2 Key Features

- Accepts Studio Polaroid colour films and Polapan Pro 100 black and white film
- Removable film holder for easy changes from colour to black and white
- Print selection for 1-up, 2-up, 4-up, 5-up, 6-up and 9-up portraits
- Print Speed: ~40 seconds colour

  ~20 seconds black and white
- Tab pull alarm
- Temperature-controlled film peel timer
- Parallel port for connection to a PC
- Colour compensation controls for fine-tuning of colour balance

The basic printer components are as follows:

a) Film Holder and Dark Slide

b) Film Holder Locking Mechanism

c) Print Engine

d) Power Supply Unit

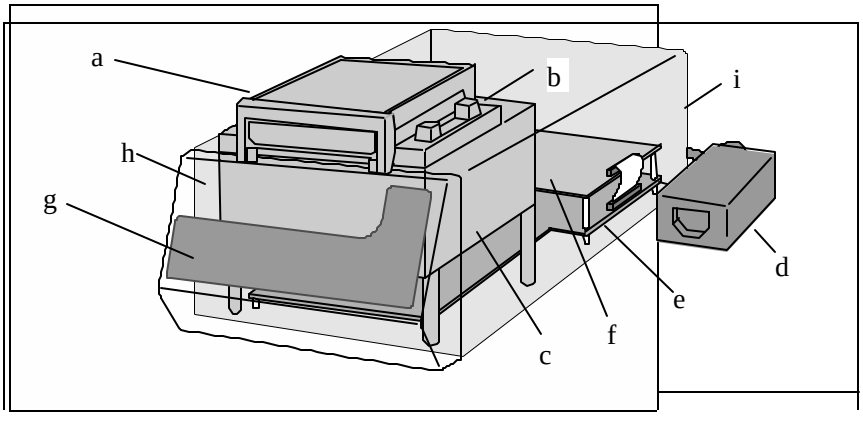
e) Main Card

f) Video Card

g) Control Panel

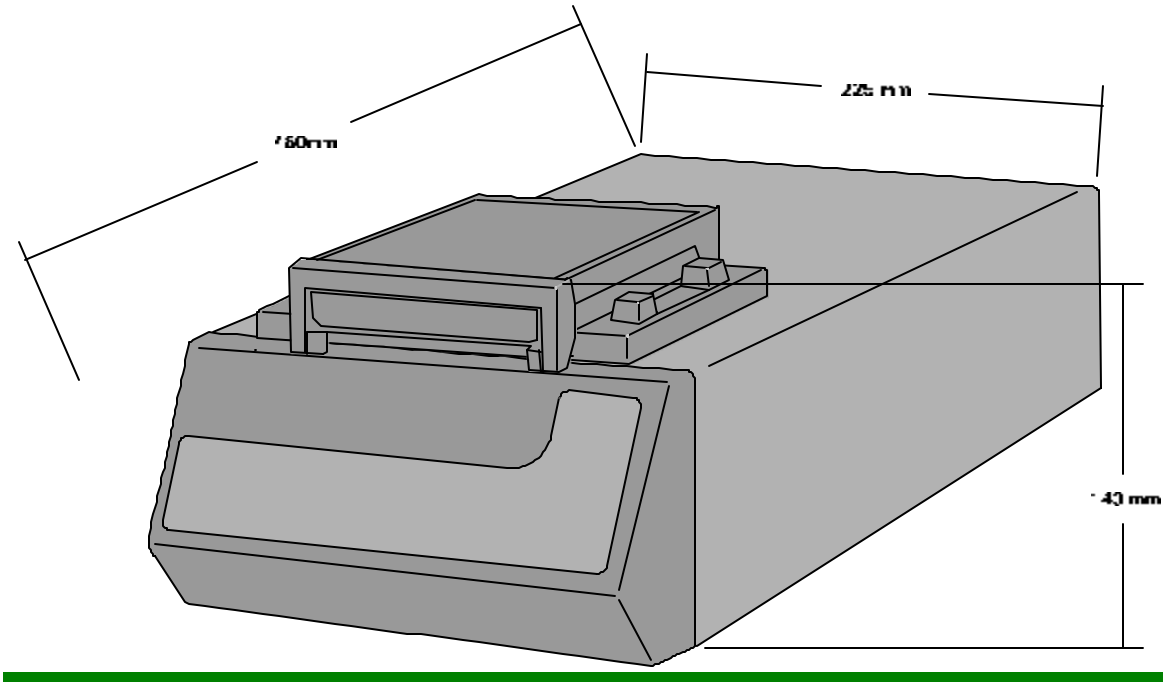
h) Front Bezel

i) Printer Housing



2-3 Physical and Environmental Requirements

♦ The overall dimensions of the printer are governed by the size of the internal components. The approximate dimensions are shown on the following page.



.

- Printer 225 x 105 x 460 mm (w/h/d) 4.9 kg
- Printer (with camera back) 225 x 140 x 460 mm (w/h/d) 5.2 kg

2-4 Operating Temperature and Humidity

With film, the SP350 system shall remain fully functional in ambient temperatures between 13^0 and 35^0C in humidity between 10% and 90%, non-condensing.

The imbibition time required by Polaroid peel-apart instant film will vary according to ambient temperature and humidity:

Temp.	**Studio Polaroid Colour Film (ISO 125)**	**Polapan Pro 100 B/W Film (ISO 100)**

24^0 - 35^0C	90 sec.	30 sec.
21^0 - 23^0C	90 sec.	45 sec.
18^0 - 21^0C	120 sec.	60 sec.
16^0 - 17^0C	150 sec.	75 sec.
13^0 - 15^0C	180 sec.	90 sec.

Video Card

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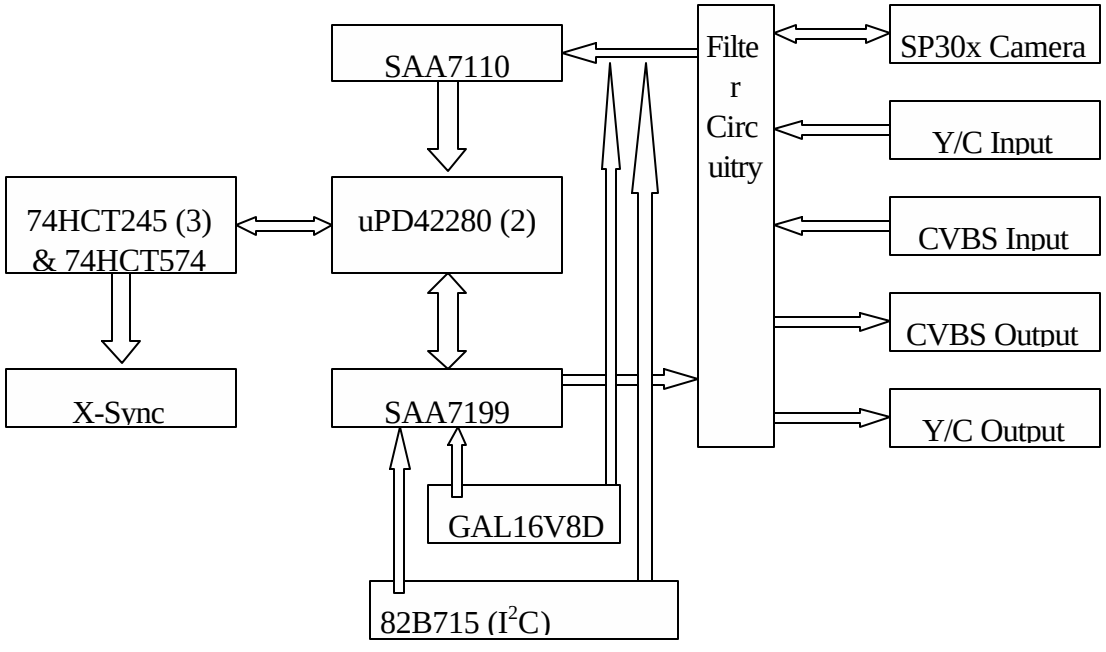
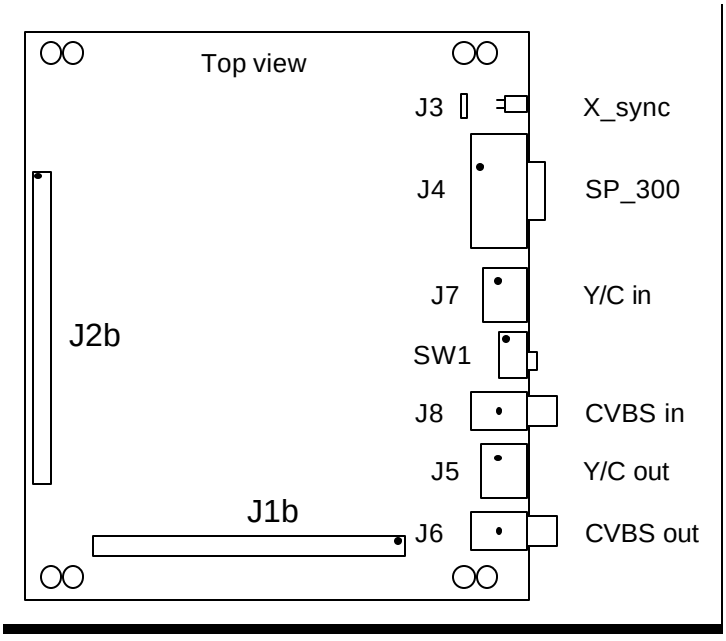
3-2 Theory of Operation

The Video Card is primarily responsible for the input and output of video signals for the SP149 system. Video signals can be Y/C or CVBS in PAL format (Selectable using switch SW1). These video signals pass through some filter circuitry to ensure the correct amplitude and help reduce input 'noise'. Two Philips Multimedia IC's, ***SAA7110A*** and ***SAA7199B***, process the input and output video signals. The power-on control and configuration data for the two Philips IC's is contained in the Gate Array Logic, ***GAL16V8D*** device.
Memory is provided on the Video Card by the two NEC ***µPD42280*** IC's, these act as a 'buffer' between the two Philips IC's and store the video signal field information. Bus interface is controlled by the ***74HCT245*** and ***74HCT574*** IC's. These have 3-state outputs, which allows read, write and isolate operations to the Main Card data bus.
The external strobe sync circuitry is contained on the Video Card. The jumper JP1 can select different sync delays of –0.5, 0 & +1.0ms.

3-3 Block Diagram



3-4 Component Placement



3-5 Component Descriptions

The ***SAA7110A*** is a one chip front end digital multistandard colour decoder (OCF1) on the basis of the DIG-TV2 system with two integrated Analog-to-Digital Converters (ADC's), a Clock Generation Circuit (CGC) and Brightness Contrast Saturation (BCS) control. The CMOS circuit analog front-end and digital video decoder, is a highly integrated circuit for desktop video applications. The decoder is based on the principle of line-locked clock decoding. It operates square-pixel frequencies to achieve correct aspect ratio. Monitor controls are provided to ensure best display. The circuit is I^2C-bus controlled.

The ***SAA7199B*** encodes digital baseband colour/video data into Y, C and CVBS signals (S-video included). Pixel clock and data are line-locked to the horizontal scanning frequency of the video signal. The circuit can be used in a square pixel or in a consumer TV application. Flexibility is provided by programming facilities via MPU-bus (parallel) or I^2C-bus (serial).

The ***GAL16V8D*** is a high performance E^2CMOS PLD Generic Array Logic device. With a maximum propagation delay of 3.5ns it lends itself to applications which can include high speed graphics processing, DMA control and state machine control. It combines a high performance CMOS process with Electrically Erasable (E^2) floating gate technology.

The ***74HCT574*** are CMOS octal D-type flip flops featuring separate D-type inputs for each flip-flop and non-inverting 3-state outputs for bus oriented applications.

The ***74HCT245*** are CMOS octal transceivers featuring non-inverting 3-state bus compatible outputs in both send and receive directions.

The ***µPD42280*** is a high speed field buffer equipped with a memory of 256K words x 8 bit (262, 224 x 8bit) configuration. The high speed and low power consumption are realised in CMOS dynamic circuit. The IC consists of FIFO (First In First Out) configuration, and the read/write operations are possible asynchronously and simultaneously. Because it has a refresh circuit internally, 1 field delay line and time axis conversion etc. are realised easily. Therefore it is suitable for Y/C separation between frames, interpolation between fields, reproduction of freeze picture and frame synchroniser in the digital TV, VCR systems.

The ***82B715*** is a bipolar IC intended for applications in I^2C bus systems. While retaining all the operating modes and features of the I^2C system it permits extension of the practical separation distance between components on the I^2C bus by buffering both the data (SDA) and the clock (SCL) lines.

3-6 Test Point Signals

TP1 - GND

TP2 - SDA, I^2C Data

TP3 - SCL, I^2C Clock

TP4 - C signal (SP30x camera)

TP5 - ID2, SP30x camera identification

TP6 - Y signal (SP30x camera)

TP7 - ID1, SP30x camera identification

TP8 - Y signal (Y/C input)

TP9 - C signal (Y/C input)

TP10 - CVBS signal (CVBS input)

TP11 - GND (case)

TP12 - Y signal (Y/C output)

TP13 - C signal (Y/C output)

TP14 - CVBS GND (CVBS output)

TP15 - CVBS (CVBS output)

3-7 Connector Definition

J1 - Vertical extension bus A

J2 - Vertical extension bus B

J3 - X-Sync

J4 - SP30x Interface

J5 - Y/C Output

J6 - CVBS Output

J7 - Y/C Input

J8 - CVBS Input

JP1 - X-Sync Delay

J1 Pin layout and numbering

Top view

63	61	59	57	55	53	51	49	47	45	43	41	39	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2

Pin Definition

Pin number	Signal name	Description	From	To
1	GND	Ground	-	-
2	A13	Address line	TMS320 (ic1)	Vertical bus
3	A14	Address line	TMS320 (ic1)	Vertical bus
4	A15	Address line	TMS320 (ic1)	Vertical bus
5	A16	Address line	TMS320 (ic1)	Vertical bus
6	GND	Ground	-	-
7	A17	Address line	TMS320 (ic1)	Vertical bus
8	A18	Address line	TMS320 (ic1)	Vertical bus
9	GND	Ground	-	-
10	A19	Address line	TMS320 (ic1)	Vertical bus
11	A20	Address line	TMS320 (ic1)	Vertical bus
12	A21	Address line	TMS320 (ic1)	Vertical bus
13	A22	Address line	TMS320 (ic1)	Vertical bus
14	MEMSEL_A0	Memory select A0	CPLD	Vertical bus
15	A23	Address line	TMS320 (ic1)	Vertical bus
16	TCLK1	Timer/Clock #1	TMS320 (ic1)	Vertical bus
17	MEMSEL_E0	Memory select E0	CPLD	Vertical bus
18	TCLK0	Timer/Clock #0	TMS320 (ic1)	Vertical bus
19	DX0	TMS320 (ic1) Serial Port	TMS320 (ic1)	Vertical bus
20	FSX0	TMS320 (ic1) Serial Port	TMS320 (ic1)	Vertical bus
21	CLKX0	TMS320 (ic1) Serial Port	TMS320 (ic1)	Vertical bus
22	GND	Ground	-	-
23	CLKR0	TMS320 (ic1) Serial Port	TMS320 (ic1)	Vertical bus
24	FSR0	TMS320 (ic1) Serial Port	TMS320 (ic1)	Vertical bus

Pin number	Signal name	Description	From	To
25	MEMSEL_10	Memory select 10	CPLD	Vertical bus
26	DR0	TMS320 (ic1) Serial Port	TMS320 (ic1)	Vertical bus
27	A12	Address line	TMS320 (ic1)	Vertical bus
28	A11	Address line	TMS320 (ic1)	Vertical bus
29	A10	Address line	TMS320 (ic1)	Vertical bus
30	GND	Ground	-	-
31	A9	Address line	TMS320 (ic1)	Vertical bus
32	A8	Address line	TMS320 (ic1)	Vertical bus
33	GND	Ground	-	-
34	A7	Address line	TMS320 (ic1)	Vertical bus
35	A6	Address line	TMS320 (ic1)	Vertical bus
36	A5	Address line	TMS320 (ic1)	Vertical bus
37	A4	Address line	TMS320 (ic1)	Vertical bus
38	GND	Ground	-	-
39	A3	Address line	TMS320 (ic1)	Vertical bus
40	A2	Address line	TMS320 (ic1)	Vertical bus
41	GND	Ground	-	-
42	A1	Address line	TMS320 (ic1)	Vertical bus
43	A0	Address line	TMS320 (ic1)	Vertical bus
44	/INT3	Interrupt line 3	TMS320 (ic1)	Vertical bus
45	/INT0	Interrupt line 0	TMS320 (ic1)	Vertical bus
46	GND	Ground	-	-
47	/INT2	Interrupt line 2	TMS320 (ic1)	Vertical bus
48	/IACK	Interrupt Acknowledge line	TMS320 (ic1)	Vertical bus
49	XF1	Multipurpose I/O pin #2	TMS320 (ic1)	Vertical bus
50	XF0	Multipurpose I/O pin #1	TMS320 (ic1)	Vertical bus
51	GND	Ground	-	-

Pin number	Signal name	Description	From	To
52	/RESET	Reset	TMS320 (ic1)	Vertical bus
53	R/WB	Read/Write control (buffered)	TMS320 (ic1)	Vertical bus
54	GND	Ground	-	-
55	GND	Ground	-	-
56	/RDY	Ready	TMS320 (ic1)	Vertical bus
57	ES1	Expansion select 1	CPLD	Vertical bus
58	GND	Ground	-	-
59	GND	Ground	-	-
60	ES2	Expansion select 2	CPLD	Vertical bus
61	/STRB0_B0	Strobe (Max. range 7M words)	TMS320 (ic1)	Vertical bus
62	GND	Ground	-	-
63	GND	Ground	-	-
64	/STRB1_B0	Dedicated Strobe I/O area's	TMS320 (ic1)	Vertical bus

J2 Pin layout and numbering

Top view

63	61	59	57	55	53	51	49	47	45	43	41	39	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2

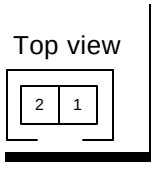
Pin Definition

Pin number	Signal name	Description	From	To
1	+9V	General supply (+9V)	-	-
2	GND	Ground	-	-
3	+9V	General supply (+9V)	-	-
4	+9V	General supply (+9V)	-	-
5	GND	Ground	-	-
6	VCC	General logic power supply (+5V)	-	-
7	VCC	General logic power supply (+5V)	-	-
8	VCC	General logic power supply (+5V)	-	-
9	D31	Data line	TMS320 (ic1)	Vertical bus
10	GND	Ground	-	-
11	D30	Data line	TMS320 (ic1)	Vertical bus
12	D29	Data line	TMS320 (ic1)	Vertical bus
13	GND	Ground	-	-
14	D28	Data line	TMS320 (ic1)	Vertical bus
15	D27	Data line	TMS320 (ic1)	Vertical bus
16	D26	Data line	TMS320 (ic1)	Vertical bus
17	D25	Data line	TMS320 (ic1)	Vertical bus
18	GND	Ground	-	-
19	D24	Data line	TMS320 (ic1)	Vertical bus
20	D23	Data line	TMS320 (ic1)	Vertical bus
21	GND	Ground	-	-
22	D22	Data line	TMS320 (ic1)	Vertical bus
23	D21	Data line	TMS320 (ic1)	Vertical bus
24	D20	Data line	TMS320 (ic1)	Vertical bus

Pin number	Signal name	Description	From	To
25	D19	Data line	TMS320 (ic1)	Vertical bus
26	GND	Ground	-	-
27	D18	Data line	TMS320 (ic1)	Vertical bus
28	D17	Data line	TMS320 (ic1)	Vertical bus
29	GND	Ground	-	-
30	D16	Data line	TMS320 (ic1)	Vertical bus
31	D15	Data line	TMS320 (ic1)	Vertical bus
32	D14	Data line	TMS320 (ic1)	Vertical bus
33	D13	Data line	TMS320 (ic1)	Vertical bus
34	GND	Ground	-	-
35	D12	Data line	TMS320 (ic1)	Vertical bus
36	D11	Data line	TMS320 (ic1)	Vertical bus
37	GND	Ground	-	-
38	D10	Data line	TMS320 (ic1)	Vertical bus
39	D9	Data line	TMS320 (ic1)	Vertical bus
40	D8	Data line	TMS320 (ic1)	Vertical bus
41	D7	Data line	TMS320 (ic1)	Vertical bus
42	GND	Ground	-	-
43	D6	Data line	TMS320 (ic1)	Vertical bus
44	D5	Data line	TMS320 (ic1)	Vertical bus
45	GND	Ground	-	-
46	D4	Data line	TMS320 (ic1)	Vertical bus
47	D3	Data line	TMS320 (ic1)	Vertical bus
48	GND	Ground	-	-
49	D2	Data line	TMS320 (ic1)	Vertical bus
50	D1	Data line	TMS320 (ic1)	Vertical bus
51	D0	Data line	TMS320 (ic1)	Vertical bus
52	GND	Ground	-	-

Pin number	Signal name	Description	From	To
53	GND	Ground	-	-
54	B40001R	VidMod	CPLD	Vertical bus
55	B40000W	VidMod	CPLD	Vertical bus
56	GND	Ground	-	-
57	GND	Ground	-	-
58	B40000R	VidMod	CPLD	Vertical bus
59	SDA	I^2C SDA Data	CPLD	Vertical bus
60	GND	Ground	-	-
61	GND	Ground	-	-
62	SCL	I^2C SCL Clock	CPLD	Vertical bus
63	H1	System Clock 50MHz/2)	TMS320 (ic1)	Vertical bus
64	GND	Ground	-	-

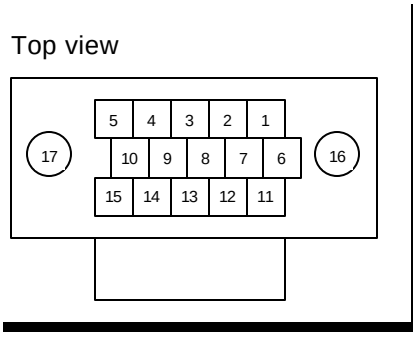
J3 Pin layout and numbering



Pin Definition

Pin number	Signal name	Description	From	To
1	CASE	Case		
1	X_SYNC	Synchronisation output		

J4 Pin layout and numbering

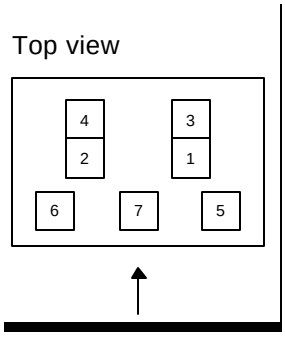


Pin Definition

Pin number	Signal name	Description	From	To
1	CVBS_OUT2	Composite video output 2		
1	CASE	Case		
2	CASE	Case		
3	+9V_CAM	Supply output camera		
4	+9V_CAM	Supply output camera		
5	X_SYNC_INT	X_SYNC output		
6	SCL_E	Serial clock external		
7	CASE	Case		
8	CASE	Case		
9	ID2	Identification 2		
10	SDA_E	Serial Data external		
11	ID1	Identification 1		
12	C_IN2	Colour input 2		
13	CASE	Case		
14	Y_IN2	Luminance input 2		
15	CASE	Case		

Pin number	Signal name	Description	From	To
16	CASE	Case		

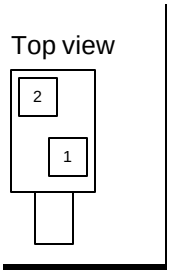
J5 Pin layout and numbering



Pin Definition

Pin number	Signal name	Description	From	To
1	CASE	Case		
1	CASE	Case		
2	Y_OUT	Luminance output		
3	C_OUT	Colour output		
4	CASE	Case		
5	CASE	Case		
6	CASE	Case		

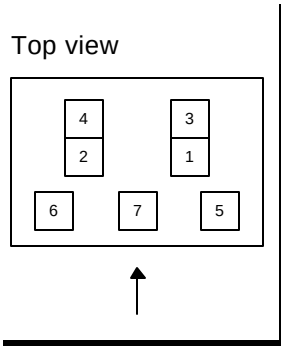
J6 Pin layout and numbering



Pin Definition

Pin number	Signal name	Description	From	To
1	CASE	Case		
1	CVBS_OUT1	Composite video output 1		

J7 Pin layout and numbering

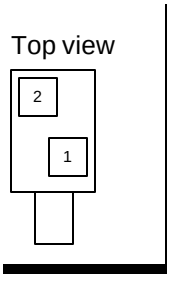


Pin Definition

Pin number	Signal name	Description	From	To

Pin number	Signal name	Description	From	To
1	CASE	Case		
1	CASE	Case		
2	Y_IN1	Luminance input 1		
3	C_IN1	Colour input 1		
4	CASE	Case		
5	CASE	Case		
6	CASE	Case		

J8 Pin layout and numbering



Pin Definition

Pin number	Signal name	Description	From	To
1	CASE	Case		
1	CVBS_IN	Composite video input		

Main Card

4-1 Main Card Table of Contents

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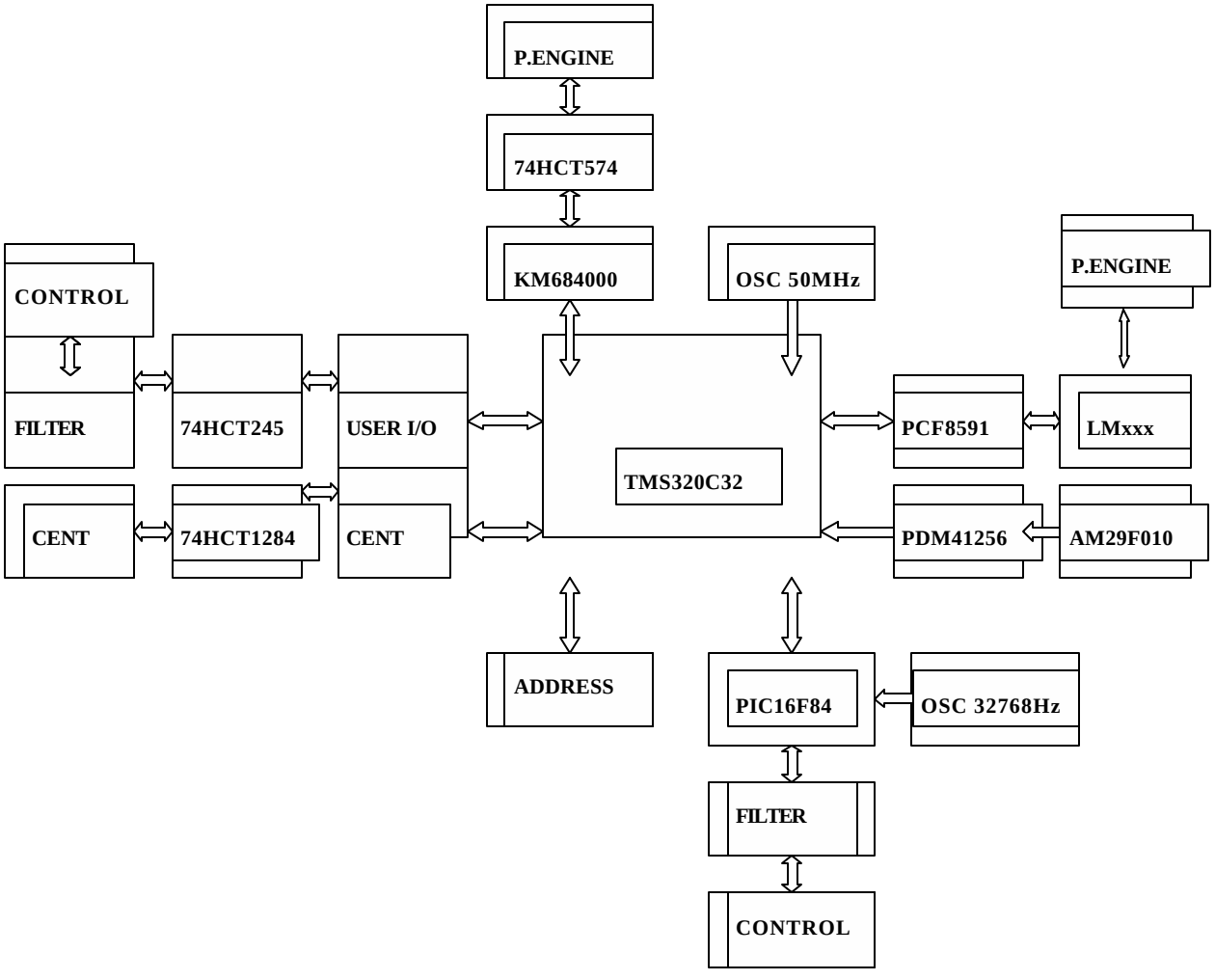
4-2 Theory of Operation

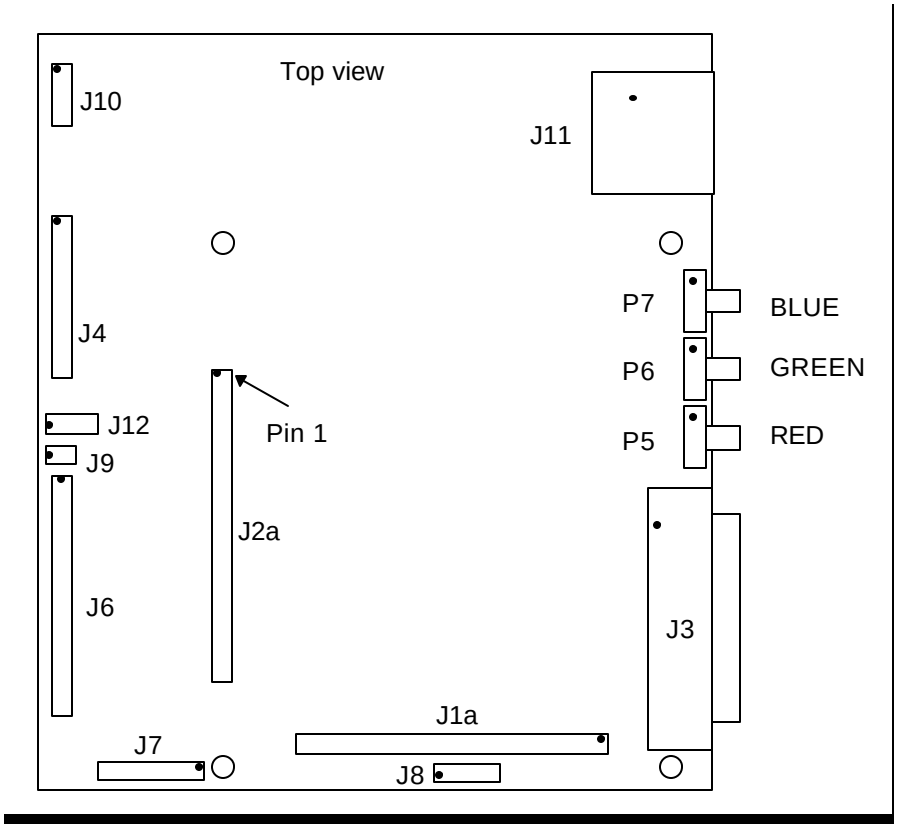
The Main Card is the heart of the SP149 Photo Printer. It contains circuitry for the internal power supplies, control panel interface, print engine interface, image processing and system memory. The circuitry has been designed very similar to the architecture found in Personal Computers (PC's): it has a data, system and control bus centred around a microprocessor (DSP).
The operating program is stored in the flash ROM (***AM29F010***). On power up this is moved into RAM (***PDM41256***) and then into the DSP (***TMS320C32***).The DSP operates on this program and effectively runs and controls 95% of the SP149 functionality. Some additional functionality is handled by the ***PIC16F84*** microcontroller and the three ***XC9536*** CPLD's.
The timing for the film development LED's and the multiplexing of the remaining control panel LED's is done by the ***PIC16F84***. The three ***XC9536*** CPLD's are used for the centronics interface (IC23), user I/O (IC21) and address manager (IC16).
Bus interface is controlled by the ***74HCT245*** and ***74HCT574*** IC's. These have 3-state outputs, which allow read, write and isolate operations.
Interface to the centronics port is done through the ***74HCT1284D*** IC's, effectively acting as a buffer between any externally connected equipment, PC's etc.
The ***LM393***, ***LM336***, ***LM317*** and ***PCF8591*** form the main part of the circuitry used to control the anode voltage of the light emitting element within the print engine.

Power is derived on the Main Card using the regulators situated to the side. The input voltage of 9V is regulated down to 5V and –5V. The four regulators allow the analogue and digital circuitry to use separate regulated supplies preventing noise from being transmitted across the card and ensures that each supply voltage is ‘clean’.

4-3 Block Diagram



4-4 Component Placement



4-5 Component Descriptions

The **TMS320C32** *is a high performance 32-bit floating point Digital Signal Processor (DSP). The device can perform parallel multiply and arithmetic logic unit operations on integer or floating point data in a single cycle. The processor possesses a general purpose register file, a program cache, dedicated auxiliary register arithmetic units, internal dual-access memories, one DMA channel supporting concurrent I/O, and a short machine cycle.*

The **XC9536** *devices are high performance Complex Programmable Logic Devices (CPLD) providing advanced in-system programming and test capabilities for general purpose logic integration. It is comprised of two 36V18 Function Blocks, providing 800 usable gates with propagation delays of 5ns.*

The ***AM29F010*** is a 1Mbit, 5.0 Volt-only Flash memory organised as 131,072 bytes. The byte-wide data appears on DQ0-DQ7. The standard device offers access times of 45, 55, 70, 90 and 120ns, allowing high-speed microprocessors to operate without wait states. To eliminate bus contention the device has separate chip enable (CE), write enable (WE) and output enable (OE) controls.

The ***KM684000B*** is a CMOS 512K x 8 bit low power Static RAM. It has a low data retention voltage of 2V and only requires a single 5V power supply.

The ***74HCT1284*** is a parallel interface chip designed to provide an asynchronous, 4 bit, bi-directional, parallel printer interface for personal computers. Three additional lines are included to provide handshaking signals between the host and the peripheral.

The***TLC7705*** is a micro-power supply voltage supervisor, which provides reset control, primarily in microcomputer and microprocessor systems.

The ***PIC16F84*** is a high performance, CMOS, fully static, 8bit micro-controller. The device has 68 bytes of RAM, 64 bytes of data EEPROM memory, and 13 I/O pins. A timer/counter is also available.

The ***PCF8591*** is a single chip, single supply low power 8bit CMOS data acquisition device with four analog inputs, one analog output and a serial I^2C bus interface. Functions of the device include analog input multiplexing, on-chip track and hold function, 8bit analog-to-digital conversion and an 8bit digital-to-analog conversion.

The ***LM393*** is a low power, low offset voltage, dual comparator. Functions can include simple analog-to-digital converters; pulse, square wave and time delay generators and high voltage digital logic gates.

The ***PDM41256*** is a high performance CMOS static RAM organised as 32,768 x 8bits. It operates from a single 5V power supply and all the inputs and outputs are fully TTL compatible.

The ***74HCT574*** are CMOS octal D-type flip flops featuring separate D-type inputs for each flip-flop and non-inverting 3-state outputs for bus oriented applications.

The ***74HCT245*** are CMOS octal transceivers featuring non-inverting 3-state bus compatible outputs in both send and receive directions.

The ***LM336*** is a precision 2.5V shunt regulator diode. It operates as a low-temperature-coefficient 2.5V zener with 0.2 Ohm dynamic impedance. The 2.5V makes it convenient to obtain a stable reference from 5V logic supplies. Further, since the LM136-2.5 operates as a shunt regulator, it can be used as either a positive or negative voltage reference.

4-6 Test Point Signals

TP1 - SDA, I^2C Data

TP2 - SCL, I^2C Clock

TP3 - H1 RES

TP4 - STRB1 B0

TP5 - H3 EMU

TP6 - RDY

TP7 - STRB0 B0

TP8 - I ACK

TP9 - INT 0

TP10 - INT 3

TP11 - SHZ

TP12 - IO 9 (Centronics CPLD)

TP13 - IO 13 (Centronics CPLD)

TP14 - GND

TP15 (1) - RAW OUT

TP15 (2) - GND

TP15 (3) - RAW IN

TP16 - IO 10 (I/O CPLD)

TP17 - R/W

TP18 - IO 20 (I/O CPLD)

TP19 - IO 13 (I/O CPLD)

4-7 Connector Definition

J1 - Vertical extension bus A

J2 - Vertical extension bus B

J3 - Centronics Interface

J4 - Print Engine Data

J5 - REMOVED

J6 - Control Panel Interface

J7 - JTAG / PIC Programming Interface

J8 - DSP Emulator Interface

J9 - NTC Interface

J10 - Print Engine Power

J11 - External Power Supply Interface

J12 - REMOVED

J1 Pin layout and numbering

Top view

63	61	59	57	55	53	51	49	47	45	43	41	39	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2

Pin Definition

Pin number	Signal name	Description	From	To
1	GND	Ground	-	-
2	A13	Address line	TMS320 (ic1)	Vertical bus
3	A14	Address line	TMS320 (ic1)	Vertical bus
4	A15	Address line	TMS320 (ic1)	Vertical bus
5	A16	Address line	TMS320 (ic1)	Vertical bus
6	GND	Ground	-	-
7	A17	Address line	TMS320 (ic1)	Vertical bus
8	A18	Address line	TMS320 (ic1)	Vertical bus
9	GND	Ground	-	-
10	A19	Address line	TMS320 (ic1)	Vertical bus
11	A20	Address line	TMS320 (ic1)	Vertical bus
12	A21	Address line	TMS320 (ic1)	Vertical bus
13	A22	Address line	TMS320 (ic1)	Vertical bus
14	MEMSEL_A0	Memory select A0	CPLD	Vertical bus
15	A23	Address line	TMS320 (ic1)	Vertical bus
16	TCLK1	Timer/Clock #1	TMS320 (ic1)	Vertical bus
17	MEMSEL_E0	Memory select E0	CPLD	Vertical bus
18	TCLK0	Timer/Clock #0	TMS320 (ic1)	Vertical bus
19	DX0	TMS320 (ic1) Serial Port	TMS320 (ic1)	Vertical bus
20	FSX0	TMS320 (ic1) Serial Port	TMS320 (ic1)	Vertical bus
21	CLKX0	TMS320 (ic1) Serial Port	TMS320 (ic1)	Vertical bus
22	GND	Ground	-	-
23	CLKR0	TMS320 (ic1) Serial Port	TMS320 (ic1)	Vertical bus
24	FSR0	TMS320 (ic1) Serial Port	TMS320 (ic1)	Vertical bus

Pin number	Signal name	Description	From	To
25	MEMSEL_10	Memory select 10	CPLD	Vertical bus
26	DR0	TMS320 (ic1) Serial Port	TMS320 (ic1)	Vertical bus
27	A12	Address line	TMS320 (ic1)	Vertical bus
28	A11	Address line	TMS320 (ic1)	Vertical bus
29	A10	Address line	TMS320 (ic1)	Vertical bus
30	GND	Ground	-	-
31	A9	Address line	TMS320 (ic1)	Vertical bus
32	A8	Address line	TMS320 (ic1)	Vertical bus
33	GND	Ground	-	-
34	A7	Address line	TMS320 (ic1)	Vertical bus
35	A6	Address line	TMS320 (ic1)	Vertical bus
36	A5	Address line	TMS320 (ic1)	Vertical bus
37	A4	Address line	TMS320 (ic1)	Vertical bus
38	GND	Ground	-	-
39	A3	Address line	TMS320 (ic1)	Vertical bus
40	A2	Address line	TMS320 (ic1)	Vertical bus
41	GND	Ground	-	-
42	A1	Address line	TMS320 (ic1)	Vertical bus
43	A0	Address line	TMS320 (ic1)	Vertical bus
44	/INT3	Interrupt line 3	TMS320 (ic1)	Vertical bus
45	/INT0	Interrupt line 0	TMS320 (ic1)	Vertical bus
46	GND	Ground	-	-
47	/INT2	Interrupt line 2	TMS320 (ic1)	Vertical bus
48	/IACK	Interrupt Acknowledge line	TMS320 (ic1)	Vertical bus
49	XF1	Multipurpose I/O pin #2	TMS320 (ic1)	Vertical bus
50	XF0	Multipurpose I/O pin #1	TMS320 (ic1)	Vertical bus
51	GND	Ground	-	-
52	/RESET	Reset	TMS320 (ic1)	Vertical bus

Pin number	Signal name	Description	From	To
53	R/WB	Read/Write control (buffered)	TMS320 (ic1)	Vertical bus
54	GND	Ground	-	-
55	GND	Ground	-	-
56	/RDY	Ready	TMS320 (ic1)	Vertical bus
57	ES1	Expansion select 1	CPLD	Vertical bus
58	GND	Ground	-	-
59	GND	Ground	-	-
60	ES2	Expansion select 2	CPLD	Vertical bus
61	/STRB0_B0	Strobe (Max. range 7M words)	TMS320 (ic1)	Vertical bus
62	GND	Ground	-	-
63	GND	Ground	-	-
64	/STRB1_B0	Dedicated Strobe I/O area's	TMS320 (ic1)	Vertical bus

J2 Pin layout and numbering

Top view

63	61	59	57	55	53	51	49	47	45	43	41	39	37	35	33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2

Pin Definition

Pin number	Signal name	Description	From	To
1	+9V	General supply (+9V)	-	-
2	GND	Ground	-	-
3	+9V	General supply (+9V)	-	-
4	+9V	General supply (+9V)	-	-
5	GND	Ground	-	-
6	VCC	General logic power supply (+5V)	-	-
7	VCC	General logic power supply (+5V)	-	-
8	VCC	General logic power supply (+5V)	-	-
9	D31	Data line	TMS320 (ic1)	Vertical bus
10	GND	Ground	-	-
11	D30	Data line	TMS320 (ic1)	Vertical bus
12	D29	Data line	TMS320 (ic1)	Vertical bus
13	GND	Ground	-	-
14	D28	Data line	TMS320 (ic1)	Vertical bus
15	D27	Data line	TMS320 (ic1)	Vertical bus
16	D26	Data line	TMS320 (ic1)	Vertical bus

Pin number	Signal name	Description	From	To
17	D25	Data line	TMS320 (ic1)	Vertical bus
18	GND	Ground	-	-
19	D24	Data line	TMS320 (ic1)	Vertical bus
20	D23	Data line	TMS320 (ic1)	Vertical bus
21	GND	Ground	-	-
22	D22	Data line	TMS320 (ic1)	Vertical bus
23	D21	Data line	TMS320 (ic1)	Vertical bus
24	D20	Data line	TMS320 (ic1)	Vertical bus
25	D19	Data line	TMS320 (ic1)	Vertical bus
26	GND	Ground	-	-
27	D18	Data line	TMS320 (ic1)	Vertical bus
28	D17	Data line	TMS320 (ic1)	Vertical bus
29	GND	Ground	-	-
30	D16	Data line	TMS320 (ic1)	Vertical bus
31	D15	Data line	TMS320 (ic1)	Vertical bus
32	D14	Data line	TMS320 (ic1)	Vertical bus
33	D13	Data line	TMS320 (ic1)	Vertical bus
34	GND	Ground	-	-
35	D12	Data line	TMS320 (ic1)	Vertical bus
36	D11	Data line	TMS320 (ic1)	Vertical bus
37	GND	Ground	-	-
38	D10	Data line	TMS320 (ic1)	Vertical bus
39	D9	Data line	TMS320 (ic1)	Vertical bus
40	D8	Data line	TMS320 (ic1)	Vertical bus
41	D7	Data line	TMS320 (ic1)	Vertical bus
42	GND	Ground	-	-
43	D6	Data line	TMS320 (ic1)	Vertical bus
44	D5	Data line	TMS320 (ic1)	Vertical bus

Pin number	Signal name	Description	From	To
45	GND	Ground	-	-
46	D4	Data line	TMS320 (ic1)	Vertical bus
47	D3	Data line	TMS320 (ic1)	Vertical bus
48	GND	Ground	-	-
49	D2	Data line	TMS320 (ic1)	Vertical bus
50	D1	Data line	TMS320 (ic1)	Vertical bus
51	D0	Data line	TMS320 (ic1)	Vertical bus
52	GND	Ground	-	-
53	GND	Ground	-	-
54	B40001R	VidMod	CPLD	Vertical bus
55	B40000W	VidMod	CPLD	Vertical bus
56	GND	Ground	-	-
57	GND	Ground	-	-
58	B40000R	VidMod	CPLD	Vertical bus
59	SDA	I^2C SDA Data	CPLD	Vertical bus
60	GND	Ground	-	-
61	GND	Ground	-	-
62	SCL	I^2C SCL Clock	CPLD	Vertical bus
63	H1	System Clock 50MHz/2)	TMS320 (ic1)	Vertical bus
64	GND	Ground	-	-

J3 Pin layout and numbering

Top view

18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19

Pin Definition

Pin number	Signal name	Description	From	To
1	STROBE	Strobe		
1	CEND0	Centronics data 0		
2	CEND1	Centronics data 1		
3	CEND2	Centronics data 2		
4	CEND3	Centronics data 3		
5	CEND4	Centronics data 4		
6	CEND5	Centronics data 5		
7	CEND6	Centronics data 6		
8	CEND7	Centronics data 7		
9	/ACK	Acknowledge		
10	/BUSY	Busy		
11	PE	Paper End		
12	SELECT	Select		
13	NC	Not connected		
14	NC	Not connected		
15	GND	Ground		
16	GND	Ground		

Pin number	Signal name	Description	From	To
17	VHIGH	V high (via 4K7)		
18	GND	Ground		
19	GND	Ground		
20	GND	Ground		
21	GND	Ground		
22	GND	Ground		
23	GND	Ground		
24	GND	Ground		
25	GND	Ground		
26	GND	Ground		
27	GND	Ground		
28	GND	Ground		
29	GND	Ground		
30	/INIT	Init		
31	/ERROR	Error		
32	GND	Ground		
33	NC	Not connected		
34	VHIGH	V high (via 3K3)		
35	NC	Not connected		

J4 Pin layout and numbering

Top view

33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2

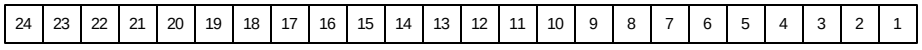
Pin Definition

Pin number	Signal name	Description	From	To
1	L_5V	Print engine logic power supply (+5V)		
1	L_5V	Print engine logic power supply (+5V)		
2	/LINE_EN	Line memory enable		
3	/SEND_DAT	Send image data / next cycle wait		
4	WCLK	Line memory write clock		
5	/WRES	Line memory write reset		
6	DATA0	Image data bit 0		
7	DATA1	Image data bit 1		
8	DATA2	Image data bit 2		
9	DATA3	Image data bit 3		
10	DATA4	Image data bit 4		
11	DATA5	Image data bit 5		
12	DATA6	Image data bit 6		
13	DATA7	Image data bit 7		
14	DATA8	Image data bit 8		
15	DATA9	Image data bit 9		
16	GND	Ground		
17	GND	Ground		

Pin number	Signal name	Description	From	To
18	/PRINT_EN	Print enable		
19	/P_RES	Printer system reset		
20	/ERR	Print error		
21	NC			
22	ROM_CL	Serial EEPROM clock		
23	ROM_DA	Serial EEPROM address / data		
24	/PULL_SW	Pull output film switch		
25	EP_SENS	Film empty sense		
26	GND	Ground		
27	NC			
28	RAW_IN	Anode voltage raw in from print engine		
29	RAW_OUT	Anode voltage raw out to print engine		
30	NC			
31	FIL_CHG	Filter change wanted		
32	RESERVED33	RESERVED33		
33	RESERVED34	RESERVED34		

J6 Pin layout and numbering

Top view

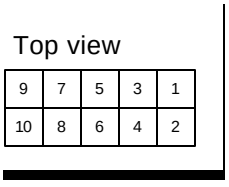


Pin Definition

Pin number	Signal name	Description	From	To
1	NTCO	NTC out		
1	NTCI	NTC in		
2	PRINT	Switch print (sw1)		
3	FREEZE	Switch freeze (sw4)		
4	COLB&W	Switch colour (sw3)		
5	STBAMB	Switch strobe (sw5)		
6	PRTOPT	Switch print option (sw2)		
7	ONLINE	Switch centronics (sw6)		
8	NC	Not connected		
9	LEDPT3	LED peel time 3		
10	LEDPT2	LED peel time 2		
11	LEDPT1	LED peel time 1		
12	LEDBANK2	Ledbank 2		
13	LEDBANK1	Ledbank 1		
14	OUT1	LED print green / NC		
15	OUT2	LED print red / Pulltab green		
16	OUT3	LED 2+2UP / Pulltab red		
17	OUT4	LED 9UP / B&W		
18	OUT5	LED 6UP / Colour		
19	OUT6	LED 4UP / Ambient		

Pin number	Signal name	Description	From	To
20	OUT7	LED 2UP / Strobe		
21	OUT8	LED 1UP / Centronics		
22	GND	Ground		
23	GND	Ground		

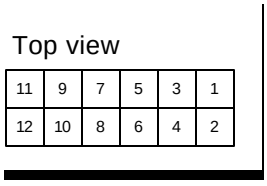
J7 Pin layout and numbering



Pin Definition

Pin number	Signal name	Description	From	To
1	GND	Ground		CPLD
1	TMS	Test Mode input		CPLD
2	TDI	Test Data Input		CPLD
3	TDO	Test Data Output		CPLD
4	VCC	General logic power supply out (+5V)		-
5	TCK	Test ClocK input		CPLD
6	RB6	In-System Prog. mode clock input		PIC
7	GND	Ground		PIC
8	RB7	In-System Prog. mode data in/output		PIC
9	MCLR	In-System Prog. mode enable input		PIC

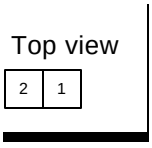
J8 Pin layout and numbering



Pin Definition

Pin number	Signal name	Description	From	To
1	EMU1	Emulator 1		
1	GND	Ground		
2	EMU0	Emulator 0		
3	GND	Ground		
4	EMU2	Emulator 2		
5	GND	Ground		
6	VCC	General logic power supply out (+5V)		
7	NC	Not connected		
8	EMU3	Emulator 3		
9	GND	Ground		
10	H3EMUO	Emulator clock		
11	GND	Ground		

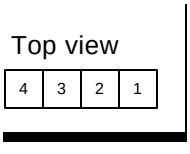
J9 Pin layout and numbering



Pin Definition

Pin number	Signal name	Description	From	To
1	NTCO	NTC out		
1	NTCI	NTC in		

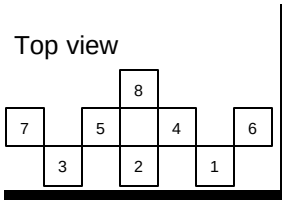
J10 Pin layout and numbering



Pin Definition

Pin number	Signal name	Description	From	To
1	P_5V	Print engine power supply (+5V)		
1	GND	Print engine power ground		
2	M_7V	Print engine motor drive supply (+7V)		
3	GND	Print engine motor drive ground		

J11 Pin layout and numbering



Pin Definition

Pin number	Signal name	Description	From	To
1	+9V_IN	DC input voltage (+9V)		
1	GND	Ground		
2	GND	Ground		
3	+9V_IN	DC input voltage (+9V)		
4	GND	Ground		
5	+9V_IN	DC input voltage (+9V)		
6	GND	Ground		
7	+9V_IN	DC input voltage (+9V)		

Control Panel

5-1 Control Panel Table of Contents

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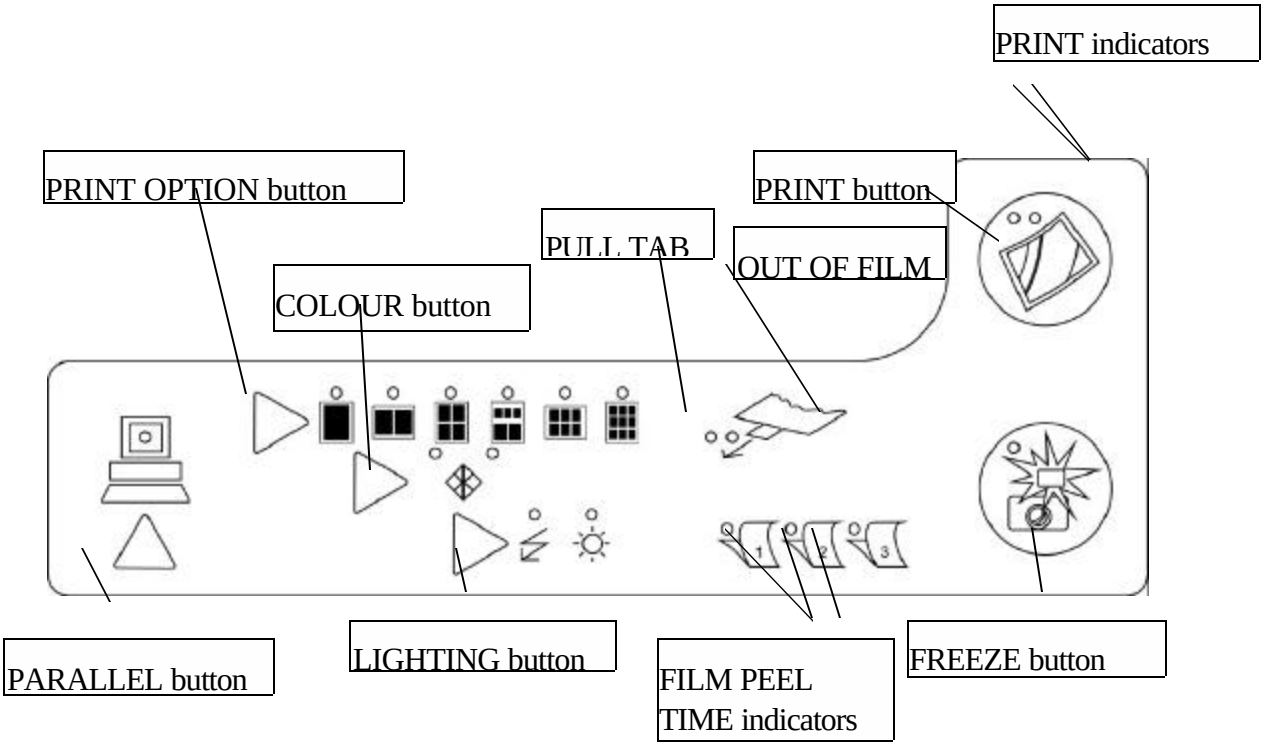
5-2 Theory of Operation

The Control Panel is the interface between the user and the SP149 Photo Printer. Its function is to take the user inputs, switch presses, and convey these to the User I/O CPLD on the Main Card. It also outputs system status to the user by lighting LED's specific to the different operating modes. A Negative Temperature Coefficient (NTC) resistor is situated on the Control Panel and its function is to input the ambient temperature to the system so that an accurate film development time can be calculated.

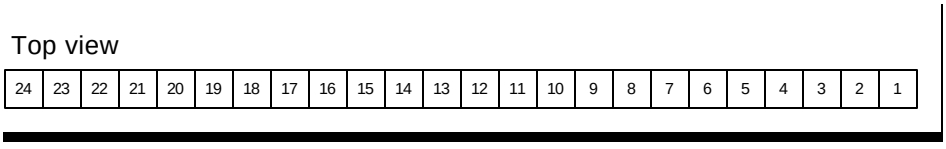


Feature	Description
PRINT button	Will print the frozen image in whichever print option is selected.
FREEZE button	Toggles the video image between the live and frozen image.
PULL TAB indicator	Flashes green when an image has been exposed.
COLOUR button	Toggles the video image between black & white and colour.
PARALLEL button	Toggles between being a video printer and a PC printer.
FILM PEEL TIME indicators	Flash for the duration of the film development time. Can show up to three prints developing at the same time.
PRINT OPTION button	Toggles the print output through 1up, 2up, 4up, 5up, 6up and 9up prints.
LIGHTING button	Pressing the strobe / ambient lighting button will toggle the video input between strobe lighting and ambient (or studio) lighting.

ERROR indicator	Flashes red when the user makes an input error.
BUSY indicator	Flashes green when the Printer is busy.

5-3 Connector Definition

J1 Pin layout and numbering



Pin Definition

Pin number	Signal name	Description	From	To
24	NTCO	NTC out		
23	NTCI	NTC in		
22	PRINT	Switch print (sw1)		
21	FREEZE	Switch freeze (sw4)		
20	COLB&W	Switch colour (sw3)		
19	STBAMB	Switch strobe (sw5)		
18	PRTOPT	Switch print option (sw2)		
17	ONLINE	Switch centronics (sw6)		
16	NC	Not connected		
15	LEDPT3	LED peel time 3		
14	LEDPT2	LED peel time 2		
13	LEDPT1	LED peel time 1		
12	LEDBANK2	Ledbank 2		
11	LEDBANK1	Ledbank 1		
10	OUT1	LED print green / NC		

Pin number	Signal name	Description	From	To
9	OUT2	LED print red / Pulltab green		
8	OUT3	LED 2+2UP / Pulltab red		
7	OUT4	LED 9UP / B&W		
6	OUT5	LED 6UP / Colour		
5	OUT6	LED 4UP / Ambient		
4	OUT7	LED 2UP / Strobe		
3	OUT8	LED 1UP / Centronics		
2	GND	Ground		
1	GND	Ground		

Power Supply Unit

6-1 Power Supply Unit Table of Contents

Theory of Operation 6-2

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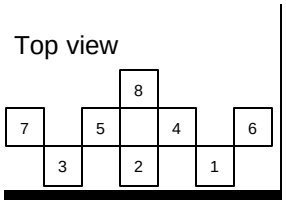
Manufacturer Details 6-4

6-2 Theory of Operation

The Power Supply Unit is the external power source for the SP149 Photo Printer. The unit will accept an AC input voltage between 100 and 240V, 50/60 Hz. The output is regulated at 9V (5.0A) with a maximum wattage of 51W. Connection to the mains supply is made via a ‘figure of 8’ style IEC connector. The connection interface to the SP149 is an 8 pin DIN style connector.

6-3 Connector Definition

J1 Pin layout and numbering



Pin Definition

Pin number	Signal name	Description	From	To
1	+9V_IN	DC input voltage (+9V)		
2	GND	Ground		
3	GND	Ground		
4	+9V_IN	DC input voltage (+9V)		
5	GND	Ground		
6	+9V_IN	DC input voltage (+9V)		
7	GND	Ground		
8	+9V_IN	DC input voltage (+9V)		

6-4 Manufacturer Details

Powersolve Electronics Limited
(currently under review)

Print Engine

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7-2 Theory of Operation

The Print Engine is a Vacuum Fluorescent Print Head (VFPH) module developed by the Futaba Corporation for use in digital photo printers, like the SP149.

The printer structure is made up of three separate parts: a VFPH module, a control mechanism and a film development unit. The VFPH module contains a VFPH, a unity magnification lens and a RGB filter to change the colour emitted from the VFPH. The control mechanism moves the head module along the film at a constant speed.

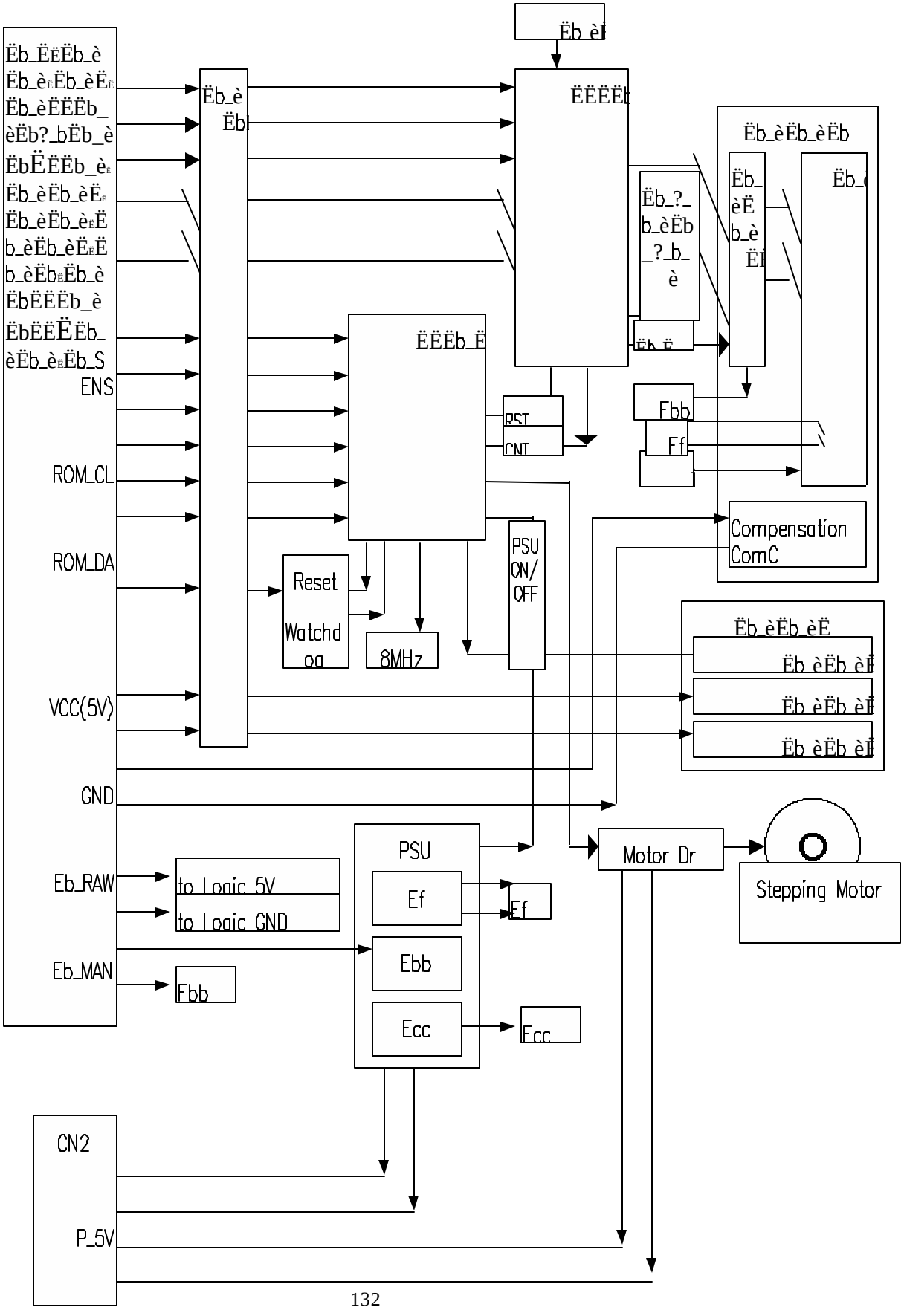
The VFPH with 480 dots is capable of producing an image of 480x640 pixels in coordination with line scanning. The resolution is 217 dots per inch. Luminous elements are arranged in zigzag to the direction of lines, and driver IC's are mounted on both sides to dot arrays, enabling static drive.

The optical unit is thin and compact with SLA. Between the luminous layer and SLA, red, green and blue filters are mounted to allow the formation of full colour images by exposing each colour frame of R, G and B in series after colour selection. For black and white images only the green filter is used to expose the frame although several passes have to be made.

Colour compensation is achieved in the print engine by varying the anode voltage of the light emitting elements within the VFPH module. The light emitting elements have a coating of Phosphor applied to them during the manufacturing process and it is the spectral characteristic

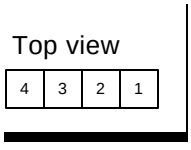
of Phosphor and the film's sensitivity to RGB that makes it necessary to provide a means of compensation. The spectral characteristic of Phosphor is that the green region distributes most energy followed by the blue and red regions. The optimum colour balance is obtained by changing the anode voltage for each colour to adjust the luminous intensity. Accordingly it is possible to expose each colour of RGB by selecting bands of the desired wavelength from the light emitted from Phosphor using the color filters.

7-3 Block Diagram



7-4 Connector Definition

CN2 Pin layout and numbering



Pin Definition

Pin number	Signal name	Description	From	To
1	P_5V	Print engine power supply (+5V)		
2	GND	Print engine power ground		
3	M_7V	Print engine motor drive supply (+7V)		
4	GND	Print engine motor drive ground		

CN1 Pin layout and numbering

Top view

33	31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
34	32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2

Pin Definition

Pin number	Signal name	Description	From	To
1	L_5V	Print engine logic power supply (+5V)		
2	L_5V	Print engine logic power supply (+5V)		
3	/LINE_EN	Line memory enable		
4	/SEND_DAT	Send image data / next cycle wait		
5	WCLK	Line memory write clock		
6	/WRES	Line memory write reset		
7	DATA0	Image data bit 0		
8	DATA1	Image data bit 1		
9	DATA2	Image data bit 2		
10	DATA3	Image data bit 3		
11	DATA4	Image data bit 4		
12	DATA5	Image data bit 5		
13	DATA6	Image data bit 6		
14	DATA7	Image data bit 7		
15	DATA8	Image data bit 8		
16	DATA9	Image data bit 9		
17	GND	Ground		
18	GND	Ground		
19	/PRINT_EN	Print enable		

Pin number	Signal name	Description	From	To
20	/P_RES	Printer system reset		
21	/ERR	Print error		
22	NC			
23	ROM_CL	Serial EEPROM clock		
24	ROM_DA	Serial EEPROM address / data		
25	/PULL_SW	Pull output film switch		
26	EP_SENS	Film empty sense		
27	GND	Ground		
28	NC			
29	RAW_IN	Anode voltage raw in from print engine		
30	RAW_OUT	Anode voltage raw out to print engine		
31	NC			
32	FIL_CHG	Filter change wanted		
33	RESERVED33	RESERVED33		
34	RESERVED34	RESERVED34		

7-5 Manufacturer Details

Futaba Corporation

Appendix B

Presented on the following pages is a listing of definitions for abbreviations used throughout this manual.

Glossary

I^2C - In modern electronic systems there are a number of peripheral ICs that have to communicate with each other and the outside world. To maximise hardware efficiency and simplify circuit design, Philips developed a simple bi-directional 2-wire, serial data (SDA) and serial clock (SCL) bus for inter-IC control. This I^2C-bus supports any IC fabrication process and, with the extremely broad range of I^2C-compatible chips from Philips and other suppliers, it has become the worldwide industry standard proprietary control bus. Each device is recognized by a unique address and can operate as either a receiver-only device (e.g. an LCD driver or a transmitter with the capability to both receive and send information (such as memory). Transmitters and/or receivers can operate in either master or slave mode, depending on whether the chip has to initiate a data transfer or is only addressed. I^2C is a multi-master bus, i.e. it can be controlled by more than one IC connected to it. The basic I^2C-bus, with a data transfer rate up to 100 kbits/s and 7-bit addressing, was originally introduced nearly 20 years ago. But, as data transfer rates and application functionality rapidly increased, the I^2C-bus specification was enhanced to include Fast-mode and 10-bit addressing, meeting the demand for higher speeds and more address space. The I^2C-bus continues to keep pace with advancing technology while retaining its backward compatibility. Mixed designs incorporating new low voltage devices are supported via the I^2C-bus' level shifting capability. And, most recently, High-speed mode has been added; with speeds of up to 3.4 Mbits/s it ensures the capacity of the I^2C-bus to support existing and future high speed serial transfer rates for applications such as EEPROM and Flash memory.

CPLD - Complex Programmable Logic Device

NTC – Negative Temperature Co-efficient. The resistance of the device decreases as the temperature increases.

Y/C – Luminance and Chrominance Video Signal. A video signal that contains two channels, one for luminance and one for chrominance. Luminance is the measure of the brightness of a video signal, chrominance is the hue and saturation of a video signal.

PAL – Phase Alternate Line. A broadcast video standard used in Western Europe, Latin America, Great Britain, South Africa and Australia. The standard specifies two interlaced image fields making up a 625-line frame displayed at 25 frames per second.

RGB – Red, Green & Blue Video Format. This refers to a system where the primary colours are isolated and delivered from the source to the display monitor over separate wires, resulting in high quality pictures.

YUV – A compression scheme that stores luminance and chrominance components separately at different ratios. For example, YUV 4:1:1 combines four bits of luminance information with one bit each of the two chrominance components.

DSP – Digital Signal Processor. A specialised chip and/or system that is dedicated to processing real-time signals.

CVBS – Composite Video. A video signal that combines chrominance (colour), luminance (brightness), and horizontal and vertical synchronisation information.

SLA – SELFOC Lens Array. This is typically composed of one, two or four rows of SELFOC graded-index micro lenses each with equal dimensions and optical properties. It has been used as an optical scanning device for copiers, facsimiles and printers.

Appendix C

Presented on the following pages is a compilation of frequently asked questions about the Studio Polaroid system.

SP350 Frequently Asked Questions

	Question/ problem	Response
	General	
	What is a CCD?	It's a Charge Coupled Device, a type of silicon chip which is light sensitive. Most video cameras use them.
	What is a vfph?	It stands for vacuum fluorescent print head, a new imaging technique whereby phosphor is stimulated to create light which is then magnified and focused onto photographic film through a series of filters..
	What are video artefacts?	These are the imperfections on the final photograph, which are noticeable to the naked eye. They may be scan lines or other phenomena due to the imaging process which detract from the quality of the photo.
	System	
	The system is not powering up.	First check that the connections to the camera and printer are good. Then check to see if the green LED on the power supply is illuminated.
	The system is powered but not responding to button selections.	Check that the p.c. button is not illuminated. The pc button should only be illuminated if the printer is connected to a personal computer
	Printing	
	What's the resolution of the SP149 printer?	Print resolution is 203 dots per inch
	What print formats does the printer support	Currently 1up, 2up, 4up, 5up, 6up and 9up
	Once an image is frozen, can I print a number of different formats of the same image?	Yes, the frozen image is held in the frame grabber memory and can be printed out in a variety of formats. However once a new image is frozen or if the system is switched off the image will be erased from the printer memory.
	What is the filter sequence when printing a colour image?	During the colour printing process the filter sequence applied to the print head is green, blue, red then red (4 pass)
	What is the filter sequence when printing a black and white image?	During the black & white printing process the filter sequence applied to the print head is green, green, green (3 pass). Green filtering yields the best light transmission for exposing B/W film
	Why is an extra red pass required during the colour exposure sequence?	Because the film response to red light is less & also because phosphor gives less light output at red frequencies
	Why does black and white take less time to expose than colour?	Black and white film is exposed using a 3 pass sequence of the green filter only, this takes less time than the colour exposure sequence green, blue, red, red.
	What's the purpose of the colour	These controls have been provided to allow the

	compensation controls located at the back of the printer?	customer to adjust the red, green and blue content of the printed image. This allows the customer to compensate for any batch to batch variation with the film. Note that it does not effect the camera white balance or the frame grabbing process, the colour adjustment is applied after the image capture circuitry.
	Is it possible to test the printer without using the camera?	Yes, it is possible to print a test photograph on the SP149 with no camera connected. First switch the printer OFF at the rocker switch. Secondly, switch the SP149 ON whilst holding the pc button and the print button depressed. Hold the buttons pressed for a few seconds before releasing. Thirdly, press the print button. The SP149 will now print a test colour target verifying that the printer is working okay.
	Do I need the travel bracket & wingnut on the print engine during shipping?	Yes, it MUST be fitted during shipping. If not the print engine will move during shipping damaging the print head drive mechanism. Make sure that you lock the two film back slides holding the travel bracket securely and then tighten the wing nut.
	Power Supply	
	What's the voltage rating of the power supply for the system?	The power supply is auto-switching. It can handle either 220Volt or 110Volt mains power source.
	Question/ problem	**Response**
	Strobe	
	Do I need to use the Metz strobe?	No. It's been provided as a low cost solution for customers who don't have their own lighting. However it does not need to be used with the SP350.
	Why do my strobe batteries keep going flat?	The strobe does not have auto switch –off circuitry. You must remember to switch off the Metz strobe after use or the batteries will quickly run flat.
	Strobe is not firing.	Firstly check that the strobe is correctly seated on the hot shoe. Secondly, the batteries may be running flat. Fit new batteries if it takes longer than 60 seconds for the strobe to charge. Thirdly, if you've installed new batteries, check that the batteries are installed in the correct orientation (one of the batteries should be the opposite orientation from the other two).
	What is the dial with f-stop numbers on the front of the strobe for?	It is not used in SP350 so ignore it. It is there to calculate exposure settings for conventional photography.
	Can I use another more professional strobe (similar to the MP403 unit) on my SP350?	Yes, but you may need to re-calibrate the system depending on the colour temperature of the strobe.
	Slave strobe timing problems. Slave strobes are firing at slightly different times resulting in a poorly captured image, one side of the image is not correctly lit.	Some professional strobes allow the possibility to regulate their light output. In some instances reducing the light output can effect the timing of the strobe. It may be necessary to adjust the strobe sync timing for

		the printer. This can only be done by opening the printer and changing a circuit board jumper setting. This should only be carried out by Polaroid technical staff.
	Calibration Section	
	Is the SP350 calibrated when it leaves the factory?	Yes, it's calibrated for 3200K for tungsten flood lighting and 5500K for strobe lighting
	When do I need to calibrate my SP350 system?	If the customer has their own lighting with colour temperatures different from 3200K & 5500K then you probably need to re-calibrate the system.
	What's the point of the calibration overlay?	It's used to simplify the calibration process for the customer by temporarily hiding buttons and LED indicators that are not required during the calibration sequence.
	What's involved in calibrating the system?	For detailed description please refer to the user manual. Briefly, it is a white balance set-up where the camera colour balance settings are optimised. This may involve adjusting the 4 controls located under the LCD panel using the plastic screwdriver supplied.
	Are the calibration settings stored in the printer memory when I switch off the printer?	Actually it's the camera settings which are adjusted. These settings are independent of the printer and don't change when the system is switched off. Note that the printer is used as a display device only, utilising the LEDs on the front panel to indicate the adjustment required.
	Camera Section	
	Can I use the SP video camera un-tethered (i.e. without the grey cable)?	No it's not possible. The SP video camera gets it's power through the grey cable and the video image is communicated to the printer through the cable.
	LCD Section	
	Image on the LCD panel is very dark	First try adjusting the contrast dial located on the left hand side of the LCD panel. The dial can brighten/ darken the image. Secondly check that the aperture is not stopped down too far. Thirdly, it may be necessary to repeat the calibration process for flood lighting to suit your lighting set-up.
	Question/ problem	**Response**
	How can I adjust the colours displayed on the LCD panel?	There are no user accessible adjustments to adjust the LCD panel other than the contrast dial discussed above.
	Images on the LCD panel are very red.	Initial early shipments of SP350 were dispatched with the LCD saturation level set to maximum which resulted in a very red display on the LCD. The saturation level is now individually set for each panel. This reduces the red saturation. A retrofit procedure to modify these LCD panels is available from the Polaroid Service organisation.
	Film/Image Quality	

	What types of film can I use with the SP350?	The system has been optimised for Studio Polaroid colour P6 Version 5 film and Polapan black and white film. It is possible to use PC Pro 100 and other film types although the results will be sub-optimal.
	Fuji compatibility. Can a customer use the system with Fuji film?	The SP149 does not contain any mechanism or block which will physically prevent the use of Fuji film. However the printer has been optimised for Studio Polaroid and Polapan film. Since Fuji and Polaroid have different characteristics, the results on Fuji film will be sub-optimal.
	How does the image quality from the SP350 system compare with a Mini-portrait 403 photograph?	The SP350 offers a versatile digital imaging solution, whereas the MP403 is an optical photographic solution. The image quality output from the SP350 although excellent will not give the level of image quality offered by the MP403.
	Images from the system are black.	First check that the dark slide has been removed from the camera back. Secondly check that the correct lighting mode has been selected (strobe or flood). Thirdly ensure that the aperture is not stopped down too far.
	Prints are yellow/ green.	Check that you have the correct film type loaded. This may be because you are printing a black and white image onto colour film. Remember the system cannot automatically detect whether colour or black & white film is loaded.
	Repeated white spots on the film.	This may be caused by dirt on the film holder rollers, refer to the user manual on how to clean the rollers.
	Curtain shaped mark or streaks on the film.	This can be caused by hesitating during pulling the film tab. Make sure that you always pull the tab out in one uninterrupted motion.
	Underdeveloped edges or corners of film	Usually caused by pulling the film tab out at an angle which prevents the developer from spreading evenly over the film.
	Muddy prints	Picture has not developed long enough. Develop images for the full time recommended by the system built in timer/ beeper.
	Very light images or none at all	Film has been greatly over-exposed to light.
	Double images	Probably a previous exposed frame was not pulled and developed. You've exposed a new image onto the same frame of film.
	Image contrast seems to differ between the top and bottom of the photograph	This is symptomatic of pulling the film tab at an angle. Ensure the film is pulled horizontally. Make sure that you don't press down on the camera back when pulling the film tab. This may impact the correct spreading of the developer.
	System Operation	

	Can I save a dark setting and a light setting on the SP149 for different skin tones?	No, there is no memory function on the SP149 to store preferred settings for different skin tones.
	Why can't I freeze a new image when printing the previous image?	With the available memory in the system it is necessary for the image to complete the printing sequence before a new image can be stored in the system's memory.

	Question/ problem	Response
	PC Connectivity	
	Is it possible to store or archive a frozen image on the system, to allow the customer to retrieve the image later?	This capability is not currently available, however a software application is under development which will offer the ability to archive an image onto a IBM type Pentium personal computer. This image can then be retrieved at a later date. In addition it will be possible to export the file in a bitmap (.BMP) format. However it will not be possible to import BMP images back into the SP350. Launch for this product is estimated Q1 1999.
	Is it possible to manipulate / enhance a frozen image on a p.c.?	This feature is not available and will not be available with the planned software application release discussed above.
	Lighting Setup	
	How many strobes or flood lights should I use?	Generally it is best with two sources of light (see the user manual for more details)
	What is the minimum recommended distance between the camera and the subject?	Minimum distance is 1.3 metres
	Can I use strobe lighting to illuminate the backdrop behind the subject.	Yes, although it may need to be set to low power as an illuminated backdrop can cause the video image to over expose.

FAQ Document Complied by I Beveridge 10/12/98 (incorporating User manual troubleshooting by L Neville & Product Launch questions by A Burnett)

Version 1.0 Updated: 10/12/98

Appendix D

The optional print engine luminance test requires a special luminance test head, a DAC card which is inserted into the PC, and a special cable for interface between the test head and the PC. The test utilizes the software located on the functional test CD-ROM disk. This CD-ROM must be inserted in the PC drive and its software loaded according to the instructions in Appendix H.

This procedure measures light outputs from the print engine for comparison to design specifications. Anode voltages in the printer are automatically adjusted through the software until the outputs match the specifications.

SP350 Luminance Calibration Overview

The assembled SP350 printer requires calibration in order to provide quality images that show consistency in color balance. To provide a colored image the printer scans the exposed film plane to 4 'passes'. First the print engine scans the photographic plane with a green filter over the print head followed by a blue filter and finally 2 scans with a red filter. A black & white image requires only 3 green passes.

The light brightness across the head during each pass is controlled through the anode voltage. In order to provide the desired level of brightness within an image a standard set of values are evaluated for each pass. These output parameter values are measured in milli-volt/seconds (mVs). These were derived through performing mathematical integration on the 5 signals therein calculating their respective "area-under-the-curve". The mVs value calculated would be an average of the 5 channel readings.
Typical tester signals are shown below in Figure 1.

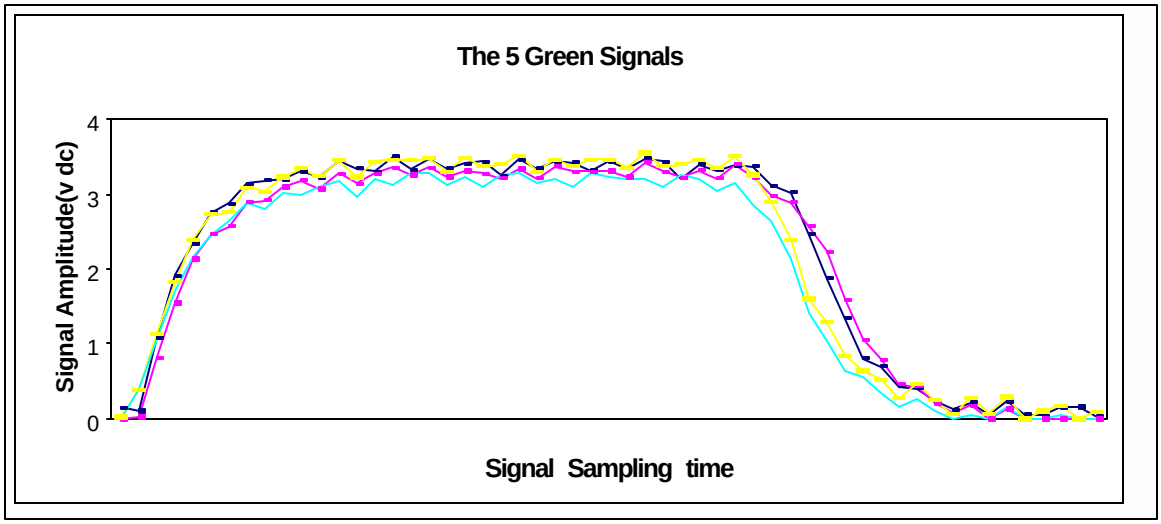


Figure 1. A Typical set of 5 Green Signals

These 'ideal parameters are derived through testing a printer and obtaining consistent quality images for a set of anode voltage values. The light would be repeatedly measured, with the light output values analyzed and a 'set' of values finally confirmed as the 'gold' values. Other printers would typically be calibrated or cloned to these output values. In order to provide this output (and due to the design of the print engine) this usually meant a unique set of anode voltage values for each printer-under-test.

In order to carry out this test a custom designed luminance test head is required, along with a National Instruments PCI-MIO-16E-4 data acquisition card. The purpose of the test head is to

measure the amount of light output by the print head. The data acquisition card is used to sample the light output waveform and then make measurements from the data. This can all be controlled by the application running on the PC.

The test uses the printer aging mode to move the head mechanism to the central point and to vary the anode voltage. The test head has up to 5 light sensitive photodiodes (with filters to remove the IR portion of the light) aligned across the printer in the fast-scan direction and these should be directly above the head mechanism. Calibration is carried out for black & white, green, blue, and red filters. The number of pixels switched on and the intensity of the light are fixed to specific values at the start of each section of the test. The anode voltage is then varied until the intensity of light measured matches pre-defined values. Once all four cycles have been completed a set of four anode voltages are held which can then be stored in the Configuration EEPROM.

Luminance Test Procedure

Special Equipment Required:

Luminance Test Head #

National Instruments Data Acquisition Card # 777383-01

National Instruments ABC Cable #182419-01

Functional Test CD-ROM #

1. Install the National Instruments DAC Card into an empty SCSI bay in the computer.
2. Clamp the Luminance Test Head onto the printer exactly as you would a film holder.
3. Connect the National Instruments ABC cable from the Luminance Test Head to the DAC card connector on the PC. (See Figure 2)
4. Power up the system and insert the Functional Test CD-ROM into the PC. (Its software must be loaded according to instructions in Appendix H.)
5. From the Functional Test main screen, choose LUMINANCE MEAS. (See Figure 4)
6. Follow the screen prompts as the printer runs through an exposure sequence. As necessary, adjust the anode voltages to achieve the proper luminance output.

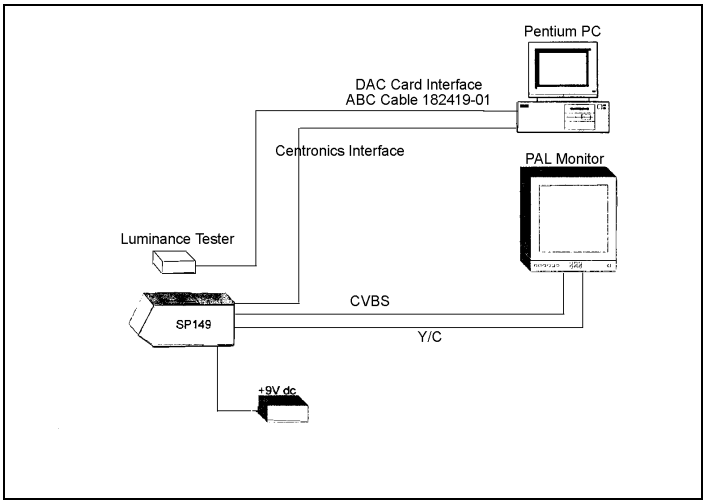


Figure 2 Luminance test setup

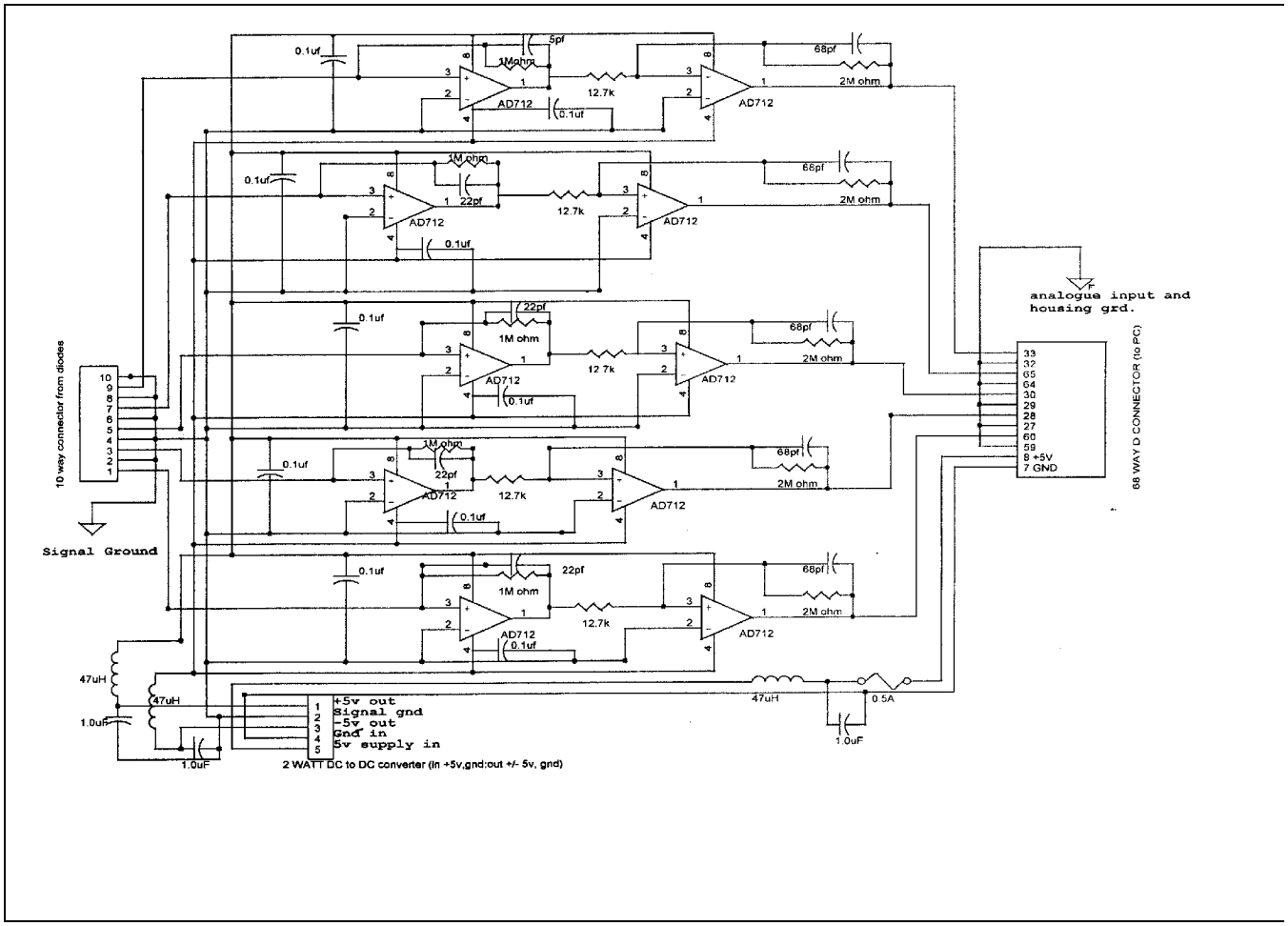


Figure 3 Luminance test head electronic schematic

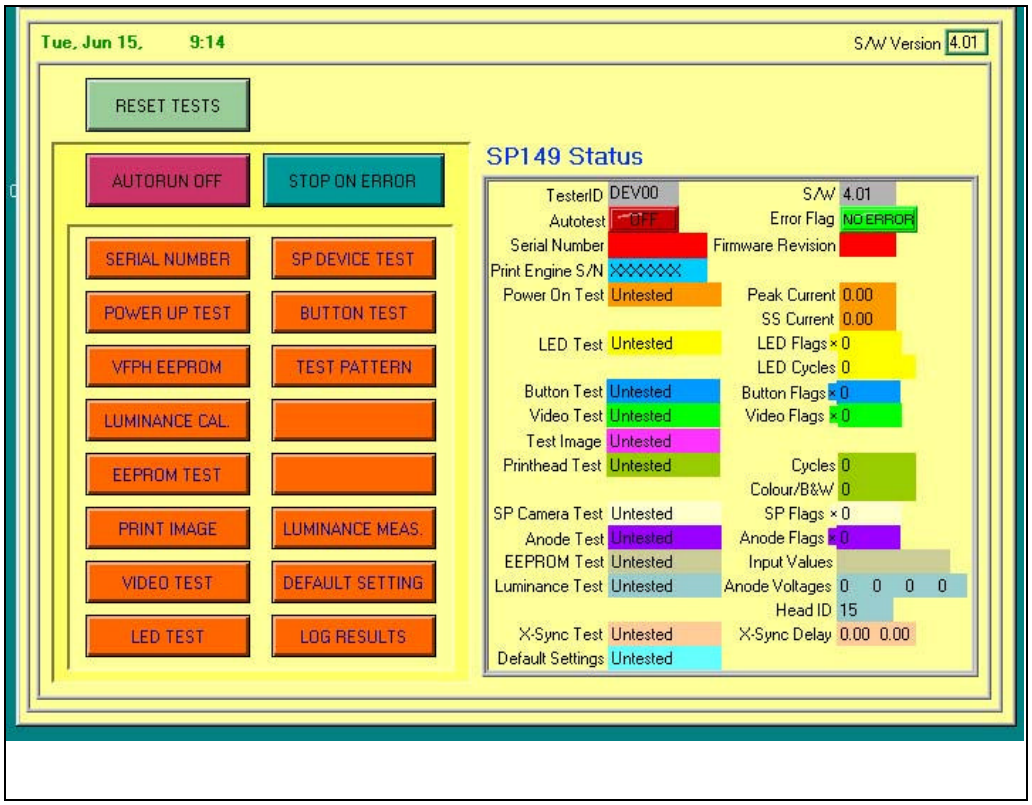


Figure 4 SP350 system functional test main screen

Appendix E

Presented on the following pages are instructions which describe how to change the Flash ROM EPROM on the motherboard to an issue 2 configuration. Following the instructions is a description of the effects of changing the Flash ROM EPROM firmware to issue 2. This firmware is located on Flash ROM chip IC11 on the motherboard.

Note that while updating issue 1 units to issue 2 is desirable, it is not mandatory.

FLASH EPROM IC11 FIRMWARE UPGRADE DIRECTIONS (ISSUE 1 TO ISSUE 2)

Reason for Upgrade: New firmware has a built-in ability to 'Age' the Print Engine. (Ageing is the process where all pixels on the Vacuum Fluorescent print head are illuminated. This revitalizes the output of any pixels that are not frequently used, improving image quality.) There are two Ageing Modes:

Long Recovery (Service Only) - Hold PC Button, Strobe/Daylight Button & Print Button simultaneously at switch on. Two beeps will be heard, and the pixels will be illuminated for 20 minutes.

Short Recovery (Customer Selectable) - Hold the Print & Take buttons simultaneously at switch on. Two beeps will be heard and the pixels will be illuminated for 2 minutes.

Note:
During both tests all LED's on the control panel will be illuminated.

How to check if Issue 2 Flash EPROM is already installed:

A serial number change identifies units with Issue 2 Flash EPROM. The last digit in the number has been changed from an **'A'** to a **'B'.** So a printer with Issue 2 Flash EPROM would have a serial number like C900513B.

Alternatively, the Flash EPROM can be identified by initiating the ageing process as detailed above - if the two beeps are heard, then the unit features Issue 2 Flash EPROM.

Upgrading the Flash EPROM

Note:
In the following steps, refer to the Parts Replacement section -
(Replacement of the Video Board and Motherboard) -
for guidance when disassembling the unit.

Tools Required:

Phillips Screwdriver
Pliers
PLCC Extraction Tool

Earthing (Ground) Strap

Method.

Caution:
Wear an Earth (ground) strap to prevent static discharge damage.

1. Using a Phillips screwdriver, remove the eight screws which secure the printer cover and remove the cover.

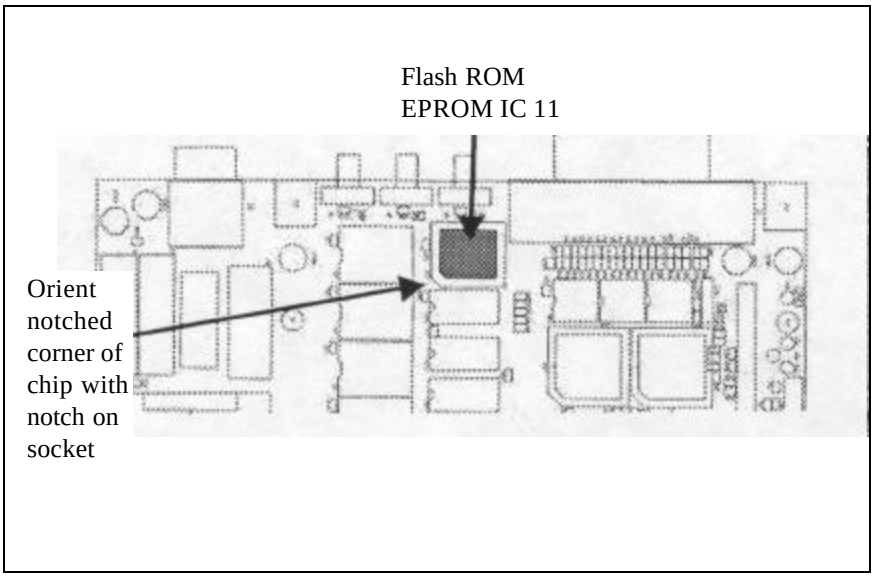
2. Use the screwdriver to remove the two screws which secure the video board bracket at the rear of the unit.

3. Locate the four white support pillars that the Video Board sits on.

4. Use pliers to squeeze the top of one of the pillars while easing the video board upward. Repeat for the other three pillars.

5. To remove the video Board, lift it up while sliding it slightly toward the print engine. This will disengage if from the printer casing. It can now be lifted out and put aside.

6. Locate the Flash EPROM Chip on the Motherboard. It is the socketed chip **IC11**, directly in front of the color adjustment pots as shown in the diagram below:

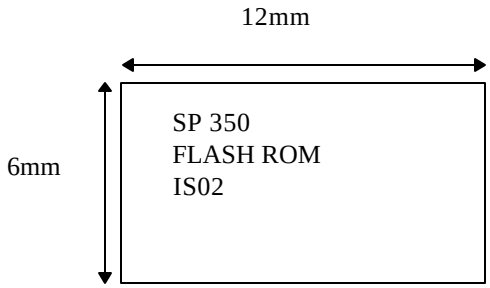


7. Use the PLCC extraction tool to remove the chip from the socket.

8. As shown in the figure above, carefully align the replacement chip over the top of the socket, ensuring that the chipped corner is oriented next to the alignment notch. Push the chip firmly into place.

Caution:
Excessive force should not be required -
Check the orientation again if the chip is difficult to insert.

9. If the existing Flash EPROM chip has been reprogrammed, the label on top of the chip should be replaced. The format of this label is shown below:



10. Test that the chip is inserted properly by reconnecting the power supply & powering up the system holding the Print & Freeze Buttons. If TWO bleeps are heard, the upgrade has been successful. If not, power off & check the chip again.

11 Disconnect the Power Supply and relocate the video board over the support pillars. ***Check that the pins on the underside are correctly aligned with the sockets on the motherboard and that the controls on the board are correctly aligned through the opening at the rear of the printer.***

12. Evenly distribute your fingers over the video board; then, using a single pushing action, carefully push the Video Board into place. Again, check the pin alignment if a notable force is required to do this.

13. Check that all four support pillars have locked the Video board into place.

14. Replace the two screws which secure the video board bracket to the rear casing.

15. Replace the cover and secure it with the eight screws previously removed.

16. Reconnect the power supply & start the ageing process. If TWO beeps are heard the installation has been successful.

17. Carefully tip the printer on its side and upgrade the last letter of the serial number (on the sticker on the underside of the printer) from an A to a B with an ink pen. For example: C900513A becomes C900513B.

Device Detail

The firmware is located on Flash ROM chip IC11.
Manufacturer: AMD
Model: AM29F010, 70 nano second

The issue level of the upgraded device is clearly labeled FLASH ROM ISO2. Device IC11 needs to be removed from the SP149 printer motherboard and replaced with a new reprogrammed chip.

SP149 Details

A unit which has the new Issue 2 firmware can be identified by referring to the product label located on the underside of the printer. The last character of the alphanumeric serial number has changed from A to B.

Example: C900513B

B indicates that the printer is configured with Issue 2 firmware.

This change is effective from March 26, 1999; the first unit shipped has serial number C900513B.

Service and Repair Considerations

The firmware change will be implemented on all new SP149 printers manufactured at the Vale of Leven.

All units returned as part of the Early Returns Program from March 30, 1999 will be upgraded at the Vale of Leven.

It is recommended that when repair centers in Enschede and Bedford are fully equipped with the necessary calibration and test equipment, that they will perform a firmware upgrade on all older units returned for repair.

Until they have this capability, all firmware upgrades will be handled by Vale of Leven manufacturing.

Specific details for the Service and Repair organization on configuration control, upgrade procedure, and device re-programming has not been defined. When it is, the service organization will be notified.

SP149 Firmware Issue 02 Changes

The following is a list of the changes made to Issue 2 firmware.

1. Changes Affecting SP350 User

1.1 White Balance B&W Video

Description:

White balance calibration mode always powered up to Luma (B&W LED). BLTT didn't reset video preview to B&W. Now at power-up in this mode, the video preview is set to match the LED.

1.2 Red LCD at Power-up

Description:

Red LCD at power-up: if the printer was powered down while frozen and in strobe mode then on the next power-up strobe white balance was selected. Now, at power-up live video and ambient white balance are always selected.

1.3 Luminance Data for B&W Print

Description:

Exposing a B&W image now uses luminance data, improving the appearance and enhancing detail in B&W prints.

1.4 B&W Default LUT

Description:

New default LUT for TI00 B&W film. This has been changed in order to allow for the change from Green to Luminance data on the B&W print and also to attempt to lower the anode voltage required. Lowering the anode voltage has the advantage of further improving print quality by improving the consistency of light output from the Vacuum Fluorescent Print Head (VFPH). The LUT can still be controlled through the configuration table.

*1.5 **Long Recovery***

Description:

Added a service recovery mode: defaults to 20 minutes recovery at 60V anode, pixel value 255 (see following). The print data used is uncompensated 10 bit, the upper 8 bits of which are controllable through the configuration table, with the lower 2 bits being set high:

Exposure data = ((8-bit Configuration value) << 2)| 3

Thus a value of 255 translates to 1023, i.e. full intensity.

The duration and voltage used are also controllable through the configuration table.

1.6 Short Recovery

Description:

Add a short-term user selectable recovery period: default 2 minutes at 60V anode with pixel value 255, control as in "Long Recovery".

1.7 Power-up Recovery

Description:

Changed power-up recovery pixel value to the same configuration as "Long Recovery". The default setting for this is 0, i.e. no recovery performed, but can be changed through the configuration table.

2. Changes Affecting In-House Use (Test Equipment etc.)

This section describes changes to the firmware which will not be apparent in normal use, but which will have some effect during test, calibration or servicing and repair of the product.

2.1 Count Camera Button Presses

Description:

Camera button presses were not registered. They are now included along with the control panel button presses.

2.2 Adjust Anode Voltage During Online Recovery

Description:

While in aging recovery mode the anode voltage could not be changed. This is now possible through use of the recovery parallel port command.

2.3 Manufacturing Data in EEPROM

Description:

Added 32 bytes of reserved space to EEPROM to store data from manufacturing test equipment: this data may be anything, decided by the test equipment - e.g. date of calibration; tester configuration etc. The firmware should not write anything to this area.

2.4. Revision Number

Description:

Changed firmware revision to 1. 1.0.0

2.5 Configuration Table Revision

Description:

Change default configuration table version to 4.

2.6 Counting User-selectable Recovery Operations

Description:

Add counting for each of the 2 user selectable recovery operations, along with parallel port commands to read the values. These values are not reset at power-up.

3. Changes Affecting Future Product Releases

3.1. Gray Border

Description:

Print configuration gray border was not loaded from the configuration table. Now it is selected at power-up.

3.2 Viva Formats

Description:

Viva formats have been added (dimensions in mm):

1	60 x 73 (xl)
2	36.25 x 49 (x2)
3	52 x 70 (x 1), 20.5 x 27.5 (x2)
4	28 x 36.25 (x4)
2+2	36.25 x 46 (x2), 24 x 32 (x2)
6Up	24 x 32 (x6)

3.3 No Error Beep Mode

Description:

Added a mode, configurable through the parallel port, to disable error beeping when a button is pressed while printer is Online: T08; 2001; requires a parameter (O or 1) to disable / enable error beeping.

3.4 Printing for Film Types 2 and 3

Description:

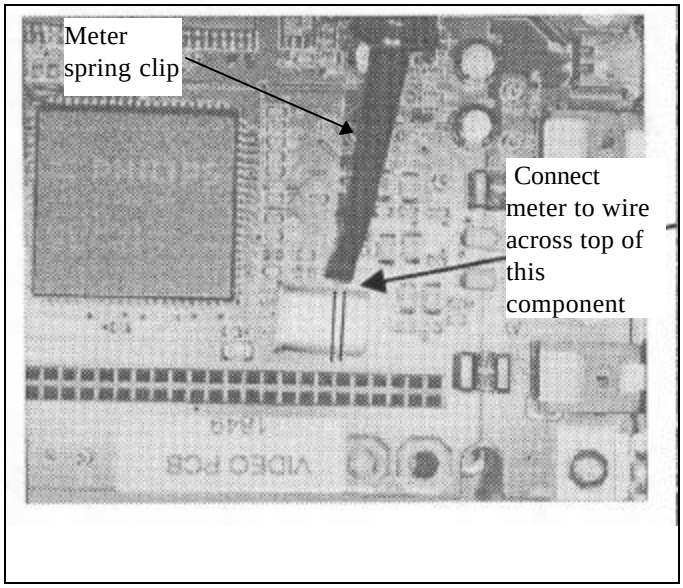
Printing film types 2 or 3 used LUT and print format from film types 0 and 1. Film types 2 and 3 now use their own LUTs and print formats from the configuration table.

Appendix F

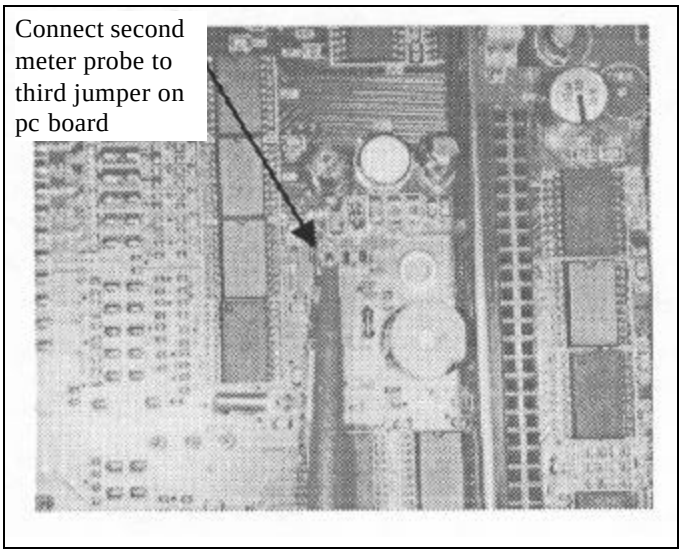
Presented in this appendix is a procedure which allows you to measure anode supply voltages in the printer. Completing this procedure could help you determine whether an equipment problem is traceable to the pc board or to the print engine. A multimeter is required to perform this procedure.

1. Install spring clips on the digital multimeter probes.

2. Open the printer chassis and ground one probe of the multimeter on the video pc board as shown below.



3. Connect the second probe of the multimeter to the **third** jumper on the video pc board as shown in the next illustration.



3. Perform a simulated print sequence to calculate the anode supply voltage for the print engine:

    a. Capture an image using the camera capture button. (The green light should now be visible.)

    b. Now, simultaneously press the Print button and the sensor at the top of the print engine. (The print engine will now perform the color passes.)

    c. As the color passes are being made, the multimeter will display the readings for the anode supply voltage. Record these readings.

Readings between 62 and 72 volts are within specification.

Generally, if the readings fall below 62 volts, there is a problem with the print engine. If the readings rise above 72 volts, there is a problem with the pc board.

Appendix G

The instructions in this appendix tell you how to set the jumper on the Video Board to properly synch the external strobe to the camera shutter.

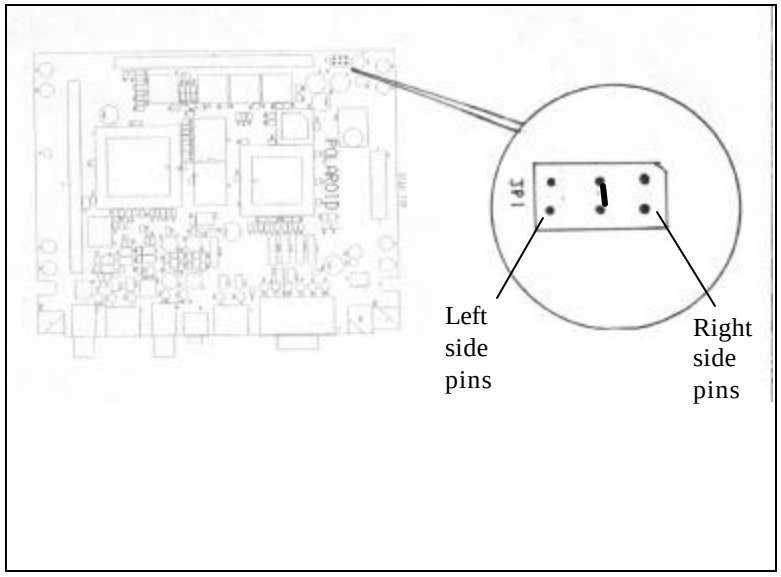
Jumper JP1 is located on the right, rear corner of the Video Board as viewed from the back of the printer. (Adjacent to large connector J2.) See the illustration below.

The default setting from the factory which should accommodate most strobes, has the MIDDLE pins of JP1 jumped. This sets a strobe delay of 412 microseconds.

If it is determined that the strobe is firing too early or too late, (both result in dark pictures) the jumped pins must be changed:

Too early: jump the **right** side pins of JP1

Too late: jump the **left** side pins of JP1



Appendix H

This appendix provides instructions which tell you how to properly load the functional test software.

Procedure for loading SP350 Test Software

Note: Make sure Parallel Port Mode setting in PC bios is set to ECP+EPP, and address is set to 3F8H/IRQ4.

1. Insert the functional test CD-ROM disk into the drive and copy the folder "SP350 Test Software" onto your "C" drive.

2. Open the "SP350 Test Software" folder and double-click on the file "Version 4 System.exe". A screen will prompt you that you are about to uncompress a series of files onto your hard drive; accept the defaults by selecting 'un-zip". This will load the software into C:\SP149\Version 4 System Test\.

3. Open the "SP350 Test Software" folder and double-click on the file "runtime1.exe". A screen will prompt you that you are about to uncompress a series of files onto your hard drive, accept the defaults by selecting 'un-zip". This will load the software into C:\LabVIEW\.

4. Open the just created "LabVIEW" folder and double-click on the file 'setup.exe". This will run an installer, accept the defaults by selecting "Next" when prompted.

The software installation is now complete. To run the test software, go to C:\SP149\Version 4 System Test\ and double-click on the file "SP149 System Test.exe".

Appendix I

This section of the manual is reserved for Product Change Notifications. As you receive new Notifications, be sure to file them here so you will have a complete inventory of changes. This section should be referred to before a repair is attempted on the unit.

PRODUCT CHANGE NOTIFICATION

Commercial Imaging Division

Product: SP302 Video Camera

Description: Resistor Value Change on SP302 Video Camera pcb assembly

Date: 23 August 1999

From: Iain Beveridge **To:** AJ Strijker, F Forti, J Estevez, R Wigfield, I Hassall

CC: S Arroll, A McDaid, J Sweeten, G Jeffrey

Affected Part(s): Camera PCB Assembly

Old Part No(s): 1AK175B

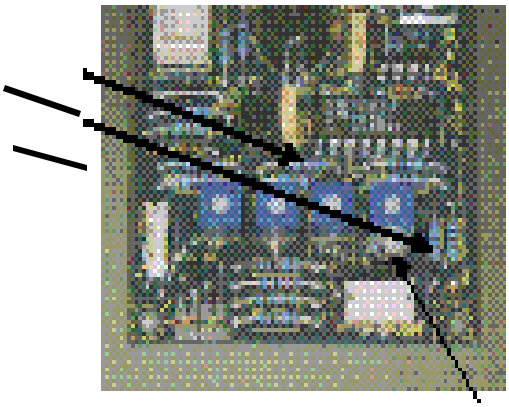
Upgraded Part No(s): Change to part number 1AK175**C**.

Nature Of Update:

Change Resistor R16 from 100 Ohms to 22 Ohms (Tolerance ± 1%), 1/4W.
Change Resistor R11 from 820 Ohms to 680 Ohms (Tolerance ± 1%), 1/4W.

Reason for Update:

To widen the adjustment window for Potentiometer D1 (Blue/Red Correction for Strobe) in order to ensure that cameras can be calibrated with lighting of colour temperature up to 7000K. Cameras will continue to be calibrated at 5600K at Vale of Leven manufacture.



See Service Repair implications note 5

Date of Introduction: Cameras manufactured from the 21 July 1999 onwards will contain the upgraded circuit board. S/N: G902051**A** is the serial number of the **last** SP302 camera produced **without** this upgrade.

S/N: G900001**B** is the serial number of the **first** SP302 camera produced **with** this upgrade.

Configuration Change: Upgraded SP302 video camera product serial numbers end with the letter '**B**' – unmodified products end with 'A'.

e.g.

Serial number: G******'**A**' indicates the SP302 camera does NOT have the new resistor values fitted to thecamera PCB.

Serial number: G******'**B'** indicates the SP302 camera DOES HAVE the new R11 & R16 resistor values fitted to the camera PCB.

Note: The SP302 camera serial number label is located by pivoting the LCD panel open. The serial number label is adjacent to the 4 potentiometer access holes.

Service Repair Implications:

1. There will be no action taken regarding Cameras already produced, as these are already correctly calibrated using the old board.
2. The new board is backward compatible. i.e. it can be fitted into SP302 cameras previously built with the old board.
3. Manufacturing recommend that existing stocks of spare boards held in the Repair Centres should be upgraded by removing R16 & R11 & soldering in the new value resistors as explained above. The resistors are soldered by a wire through-hole connection.
4. Manufacturing recommend if a camera is returned for colour balance problems, its camera printed circuit board should be replaced automatically, or it's resistors replaced to those specified above.
5. Current supplies of camera PCB assemblies have on the silkscreen printed text detailing part number 1AK175**B**. This text will be changed the next time pcb bare boards are manufactured. In the interim video camera PCB assemblies will be shipped with the resistor upgrade although the silkscreen detail will read 1AK157**B** instead of 1AK175**C**.

Important: Following upgrading of the video camera pcb the serial number configuration letter of the camera should be upgraded from A to B.

Note: This upgrade should be applied to all SP302 video cameras used in SP350 and the thermal based SP302 system.

SP302 Video Camera Configuration History Summary. Compiled: 17/8/99

Configuration Level	Date Implemented	Serial Number Range	Hardware Changes	Firmware Changes	Reason for Change	Recalibration Required?	Notes
A	14/08/1998 - 20/7/99	-G902051A					Baseline release
B	21/07/99	G900001B	Resistor Value change R16 and R11 on camera pcb 1AK175B	N/A	To increase voltage sweep of calibra pot. Thereby allowing calibration of SP350 with studio lighting colour temperatures t 7000 K	Yes	Refer to Product Change Notification document issued 20/8/99