RICOH

Y017/Y018/Y019/Y023
Service Training

Rigel-PJ1 cx/cwH/cwL/cxL

Slide 1

Version 1.0

This training course provides service technician training for the Rigel-PJ1 cx/cwH/cwL/cxL series.

This section provides an overview of the machine, and the options that can be installed.

What Models are there in the Series?

- **Rigel-PJ1 cx (Y017): PJ X5260**
  - 4950 lumens, XGA resolution
- **Rigel-PJ1 cwH (Y018): PJ WX5150**
  - 3850 lumens, WXGA resolution
- **Rigel-PJ1 cwL (Y019): PJ WX5140**
  - 3000 lumens, WXGA resolution
- **Rigel-PJ1 cxL (Y023-21): PJ X5140**
  - 3000 lumens, XGA resolution

- **These are standard models for medium-size class and conference rooms.**
- **The models in this series cannot be used as network projectors.**
  - Wired LAN capability is only for device management purposes.
    - » Projector Management Utility: Remote management using PJLink
    - » Web Control: Management system like Web Image Monitor
  - @Remote is not supported.

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- Standard model: Higher than an entry level model but lower than a high-end model.

Main Specifications

	Rigel-PJ1 cx (Y017) PJ X5260	Rigel-PJ1 cxL (Y023-21) PJ X5140	Rigel-PJ1 cwL (Y019) PJ WX5140	Rigel-PJ1 cwH (Y018) PJ WX5150
Type	DLP			
Brightness (average)	5000 lm	3000 lm	3200 lm	4000 lm
Lamp type	300W Mercury lamp	230W Mercury lamp		300W Mercury lamp
Resolution	XGA (1024 x 768)		WXGA (1280 x 800)	
Keystone	Vertical, adjustable by user			
Projection Screen Size	32 " - 307 " (81.3 – 780 cm)			
Projection Distance	1.2 - 10m (3.28 to 32.8 ft)			
Dimensions (W × D × H)	398 x 129 x 303.5	306 × 238 × 97		
Weight	7.6 kg (16.75 lbs)	3 kg (6.6 lbs)		
Power Consumption	300W (251W in Eco mode)	230W (190W in Eco mode)		300W (230W in Eco mode)
Speaker	8W x 1	5W x 1		
Wireless LAN	No			
Wired LAN	For control purposes only (PJLink)			
USB	Yes (for service purposes only)			
HDMI	Yes			

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- See the specifications table in the service manual for more details.

Features

- This product can be installed by users, except when mounted on a ceiling.
- Almost all service parts can be replaced as units/assemblies.
- No special facilities are required to replace parts.
- There is no operation panel, but LEDs show the symptoms for troubleshooting (blinking/lit, number of times the LEDs blink, etc).
- A service mode is available.

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No additional notes

Consumables and Options

- **Replacement lamp**
  - Rigel-P1 cx
    - » 300W mercury lamp (Y208): Type 8
    - » Life: 2500 hours (normal mode), 3500 hours (Eco mode)
  - Rigel-PJ1 cwH
    - » 300W mercury lamp (Y205): Type 5
    - » Life: 2500 hours (normal mode), 3500 hours (Eco mode)
  - Rigel-PJ1 cwL/cxL
    - » 230W mercury lamp (Y206): Type 4
    - » Life: 2500 hours (normal mode), 4000 hours (Eco mode)
  - The lamp is regarded as having reached its yield when its maximum brightness has decreased to 50% of the original level.
  - When this occurs, a message to this effect is projected.
- **3D glasses (Y107)**
  - DLP link is a technology that allows DLP projectors to transmit 3D data.
  - DLP link technology sends data seamlessly to the glasses between frames to create a 3D image.

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- For more about DLP link: http://www.dlp.com/projector/dlp-innovations/dlp-link.aspx

Reliability Information

- **Average monthly projection time: 55.0 hrs/month**
  - 2.50 hrs/day x 22 working days/month
- **Failure Rate**
  - 1st year: 0.00254 cases/unit/month
  - 2nd year: 0.00302 cases/unit/month
  - 3rd year: 0.00382 cases/unit/month
  - The failure rate of a projector increases with its total power-up time. This is due in part to the failure characteristics of optical engines in projectors.

Slide 7

No additional notes

Lamp Near-end/End Alerts

- **There is no near-end alert.**
  - The lamp end alert occurs when the machine calculates that the life time has expired.
  - If used in Normal Mode only, the alert appears after 2,500 hrs projection time
  - If used in Eco Mode only, the alert appears after 4,000 hrs projection time (3,500 hrs for cwH and cx)
  - If the user switches between modes, the machine calculates when to display the alert based on how long the lamp was used in each mode.

Slide 8

No additional notes

Disposal of Broken Lamps

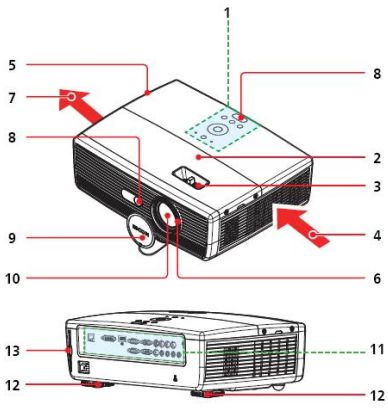
- **Projector lamps normally contain mercury vapour.**
- **These lamps can rupture due to impact or being used longer than their life expectancy.**
  - The time that the breakage will occur differs widely for each lamp and its circumstances of use.
- **These lamps must be disposed of in accordance with local environmental regulations.**

Slide 9

No additional notes

Appearance (Y017)

External View



1. Control panel
2. Lamp cover
3. Zoom lever
4. Ventilation (inlet)
5. Speaker
6. Focus ring
7. Ventilation (outlet)
8. Remote sensor
9. Lens cap
10. Lens
11. Connection ports
12. Adjustable feet
13. Filter

Slide 10 10

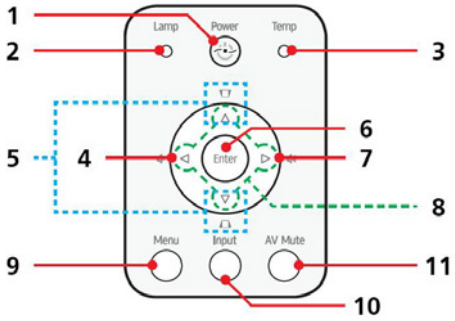
Filter

- A filter will be provided for the China versions of the other models (Y018, Y019, Y023). Installation will be explained in a technical bulletin.

Appearance (Y017)

Operation Panel

- The three LEDs (power, lamp, temp) are used to show symptoms for troubleshooting.



Remote Controller

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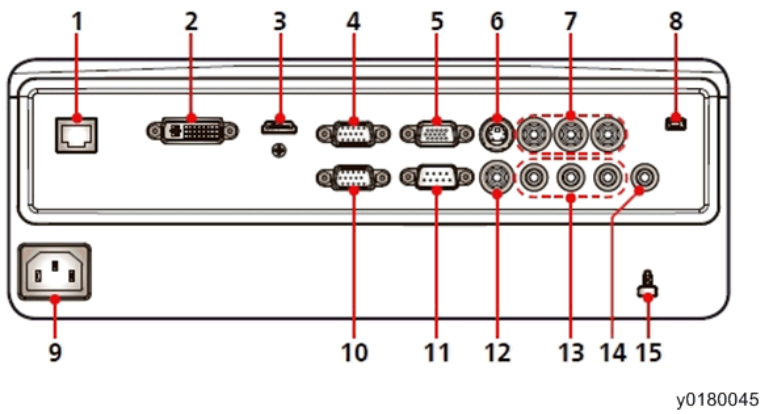
- 1. Power and Power indicator: Indicates the projector's power status.
- 2. Lamp indicator: Indicates the projector's lamp status.
- 3. Temp indicator: Indicates the status of the projector's interior temperature.
- 4. Volume -: Decreases speaker volume.
- 5. Keystone: Use to adjust the image to compensate for distortion caused by tilting the projector.
- 6. Enter: Select or confirm settings.
- 7. Volume +: Increases speaker volume.
- 8. Four Directional Select Keys: Use to select items or make adjustments to your selection.
- 9. Menu: Press "Menu" to launch the Onscreen display (OSD), or to go back to the previous menu.
- 10. Input: Switch between Computer1, Computer2 , Component, Video, S-Video, DVI, and HDMI.
- 11. AV Mute: Momentarily turn the audio and video off/on.

- Maximum operating range for the remote control is about 23.0' (7m) and 15° in front of the projector.

Appearance (Y017)
Connection Ports



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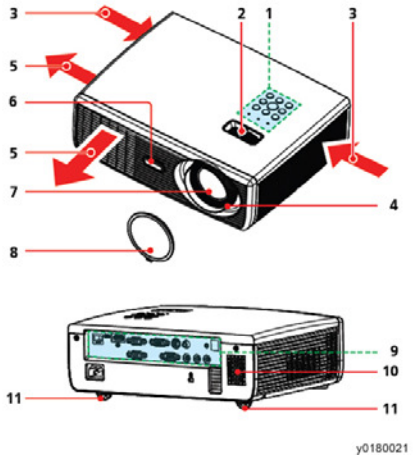
- 1. LAN terminal: Use this port for settings via the network.
- 2. DVI terminal
- 3. HDMI terminal: Input for digital signals from a HDMI (High-Definition Multimedia Interface) compatible digital source.
- 4. COMPUTER 1 IN terminal: Input for analog RGB signals from a computer or a component video signal (Y/PB/PR) from video equipment.
- 5. MONITOR OUT terminal: Output for analog RGB signals or component video signal (Y/PB/PR) to another device.
- 6. S-VIDEO IN terminal: Input for S video signals from video equipment.
- 7. Component IN terminal: Y/PB/PR terminals (from left to right)
- 8. Service Port: Use this port to update the firmware.
- 9. AC IN socket: Connect the supplied power cord.
- 10. COMPUTER 2 IN terminal
- 11. PC CONTROL terminal (RS232 Compliant)
- 12. VIDEO IN terminal: Input for video signals from video equipment.
- 13. AUDIO IN terminal (from left to right): Input for audio signals from a computer or video equipment.
  - (1) For S-VIDEO and VIDEO
  - (2) For COMPUTER1, COMPUTER2, and DVI
  - (3) For COMPONENT AUDIO-OUT terminal
- 14. AUDIO-OUT terminal
- 15. Anti-theft lock hole (Kensington™ Lock)

Appearance (Y018/Y019/Y023)

External View



1. Control panel
2. Zoom ring
3. Ventilation (inlet)
4. Focus ring
5. Ventilation (outlet)
6. Remote sensor
7. Lens
8. Lens cap
9. Connection ports
10. Speaker
11. Adjustable feet

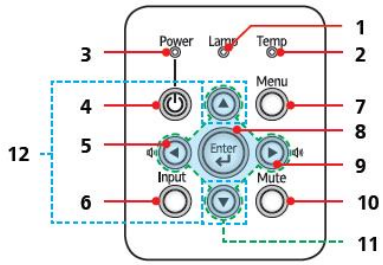
Slide 13

13

No additional notes

Appearance (Y018/Y019/Y023)
Operation Panel

- The three LEDs (power, lamp, temp) are used to show symptoms for troubleshooting.



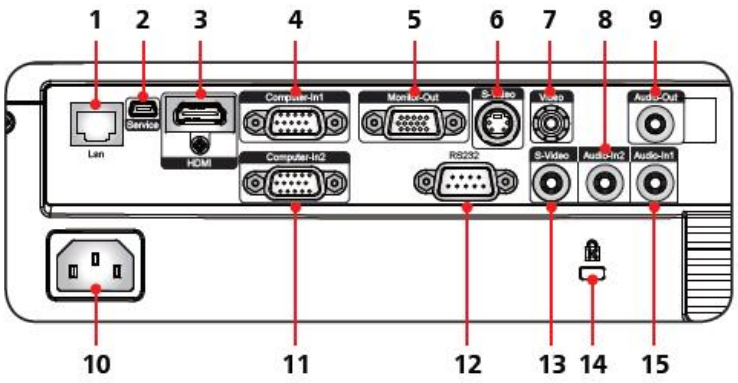
Remote Controller

Slide 14

- 1. Lamp indicator: Indicates the projector's lamp status.
- 2. Temp indicator: Indicates the projector's temperature status.
- 3. Power indicator: Indicates the projector's status.
- 4. Power: Turns the power on/off
- 5. Volume -: Decreases the speaker volume.
- 6. Input: Press "Input" to choose from the RGB, Component, S-Video, HDMI and Composite sources.
- 7. Menu: Press "Menu" to launch the Onscreen display (OSD), or to go back to the OSD main menu.
- 8. Enter: Use this to confirm your section of items in a menu.
- 9. Volume +: Increases the speaker volume.
- 10. Mute: Turns the audio and video off/on.
- 11. Four Directional Select Keys: Use to select items or make adjustments to your selection.
- 12. Keystone Adjustment: Use to adjust the image to compensate for distortion caused by tilting the projector.

- Maximum operating range for the remote control is about 23.0' (7m) and 30° in front of the projector.

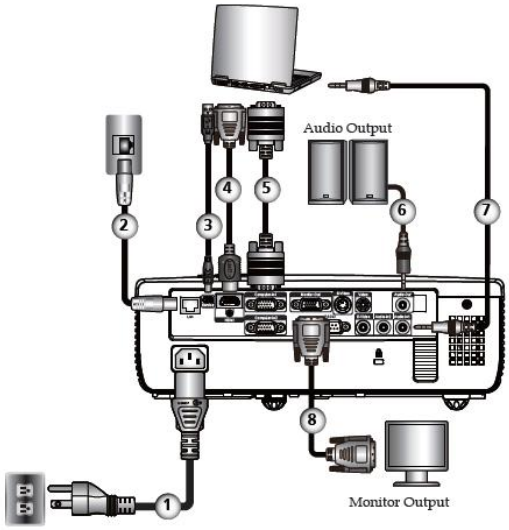
Appearance (Y018/Y019/Y023)
Connection Ports



Slide 15 15

- 1. LAN terminal: Use this port for settings via the network.
- 2. SERVICE Port: Use this port to update the firmware.
- 3. HDMI terminal: Input for digital signals from a HDMI (High-Definition Multimedia Interface) compatible digital source.
- 4. COMPUTER 1 IN terminal: Input for analog RGB signals from a computer or a component video signal (Y/PB/PR) from video equipment.
- 5. MONITOR OUT terminal: Output for analog RGB signals or component video signal (Y/PB/PR) to another device.
- 6. S-VIDEO IN terminal: Input for S video signals from video equipment.
- 7. VIDEO IN terminal: Input for video signals from video equipment.
- 8. AUDIO IN2 terminal (For COMPUTER IN2): Input for audio signals from a computer or video equipment.
- 9. AUDIO OUT terminal
- 10. AC IN socket: Connect the supplied power cord.
- 11. COMPUTER 2 IN terminal
- 12. PC Control terminal (RS232 compliant)
- 13. AUDIO IN2 terminal (For VIDEO and S-VIDEO)
- 14. Anti-theft lock hole
- 15. AUDIO IN1 terminal (For COMPUTER 1 IN): Input for audio signals from a computer or video equipment.

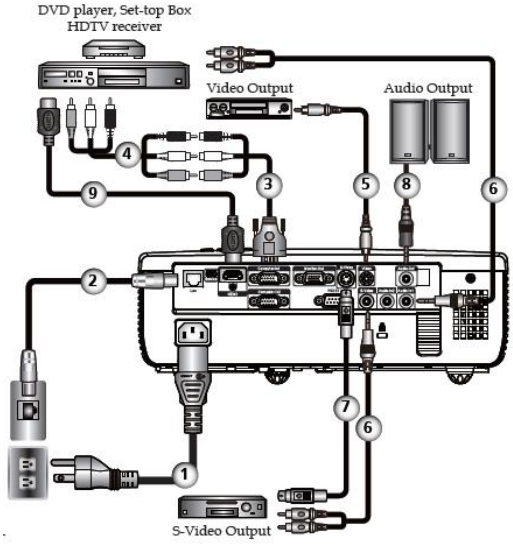
How to Use the Connection Ports - 1



Slide 16

1. Power cord (supplied)
2. LAN cable
3. USB cable
4. HDMI/DVI cable
5. RGB cable (supplied)
6. Audio out cable jack to jack
7. Audio in cable jack to jack
8. Monitor out cable

How to Use the Connection Ports - 2



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1. **Power cord (supplied)**
2. **LAN cable**
3. **COMPONENT-RGB Cable**
4. **3 RCA Component Cable**
5. **Composite video cable**
6. **Audio in cable jack to jack**
7. **S-Video cable**
8. **Audio out cable jack to jack**
9. **HDMI cable**

Turning Power On

- Turn the projector on first, then the signal sources.

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No additional notes

Turning Power Off

- **Press the "Power" button to turn off the projector lamp. When you see a message on the display, press the "Power" button again to confirm.**
- **The cooling fan continues to operate for about 60 seconds for cooling cycle and the Power indicator will flash red. When the light stops flashing, the projector has entered standby mode.**
  - If you wish to turn the projector back on, you must wait until the projector has completed the cooling cycle and has entered standby mode. Once in standby mode, simply press "Power" to restart the projector.
- **Disconnect the power cord.**

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No additional notes

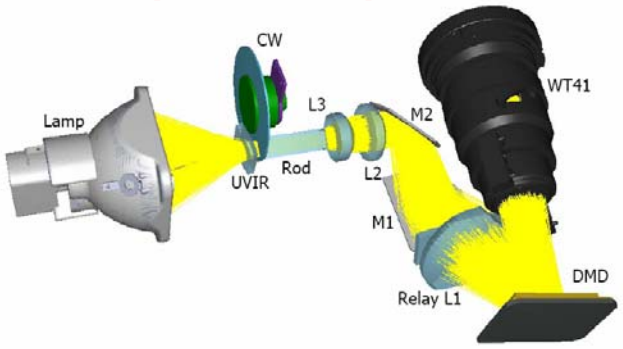
Warning Indicators

- When the “Temp” indicator lights red, and ‘Temperature Error’ appears, the projector has overheated. The projector will automatically shut itself down.
- When the “Temp” indicator flashes red (0.5 sec on, 0.5 sec off) and ‘Fan Error’ appears on-screen, the fan failed. Stop using the projector and disconnect the power cord from the electrical outlet.

Slide 20

No additional notes

Optical Components



- The DMD chip is the central part of this type of projector.
- A DMD chip consists of many small pixel-sized mirrors laid out on a semi-conductor chip. Light shone on the DMD chip is reflected by all these tiny mirrors. (For a chip with 1024 x 768 resolution, there are 786,432 small mirrors.)
- Light is shone onto the chip through a fast-spinning color wheel (CW in the diagram) that has a red sector, a green sector, and a blue sector.
- This light is reflected off the chip and out through a lens onto a screen.

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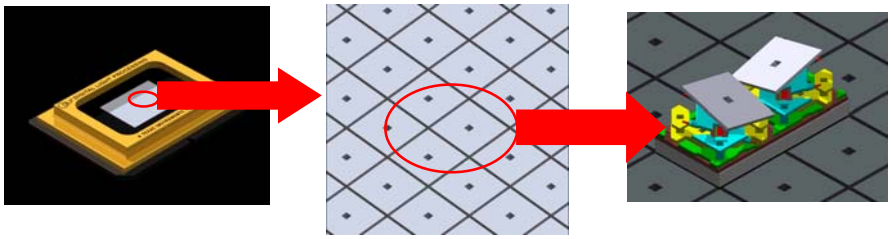
- Lamp: Light source
- UV-IR Filter: Lets visible light through (wavelengths between 380~780nm) and prevents UV and IR damage to other optical parts.
- CW (Color wheel): The wheel has a red segment, a green segment, and a blue segment. The wheel rotates to provide red, green, and blue light (the color of the output beam changes from red, to green to blue)
- Integrating Rod: Gives the light a uniform luminous flux.
- L3: Condensing lens. Condenses divergent light.
- L2: Condensing lens. Works with L3 to condense divergent light.
- M1: Mirror 1. Changes the light direction.
- M2: Mirror 2. Changes the light direction.
- Relay L1: Condenses and magnifies divergent light before it goes to the DMD.
- DMD Chip: Contains micro mirrors to generate the image
- Projection Lens (WT41 in the diagram): Projects the image onto the screen.

DMD Chip

- R, G, and B signals from the image generating device are sent to the DMD chip, and timed so that the red signal arrives at the same time that the red part of the wheel is in the beam path, and similarly for the green and blue signals.
- The DMD chip generates the R, G, and B images by re-positioning the micromirrors using micromachined hinges to make different pixelated images for each colour (meaning that each micromirror has an ON and an OFF position).
- For SVGA resolution, the mirrors are 16-micrometer squares, with a gap of about 0.8 micrometers between each mirror.



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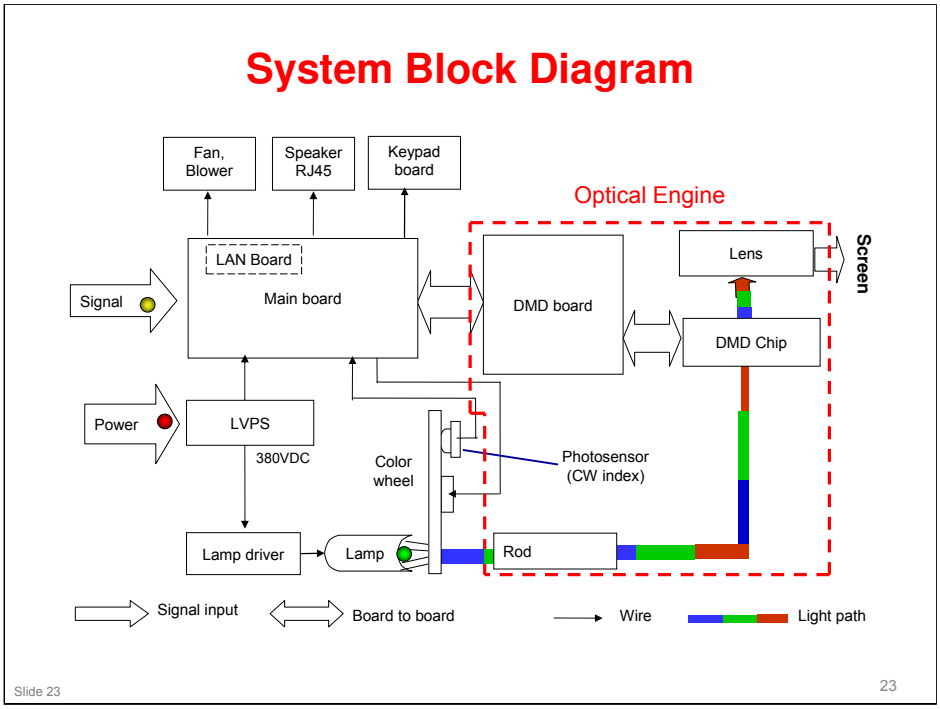
No additional notes



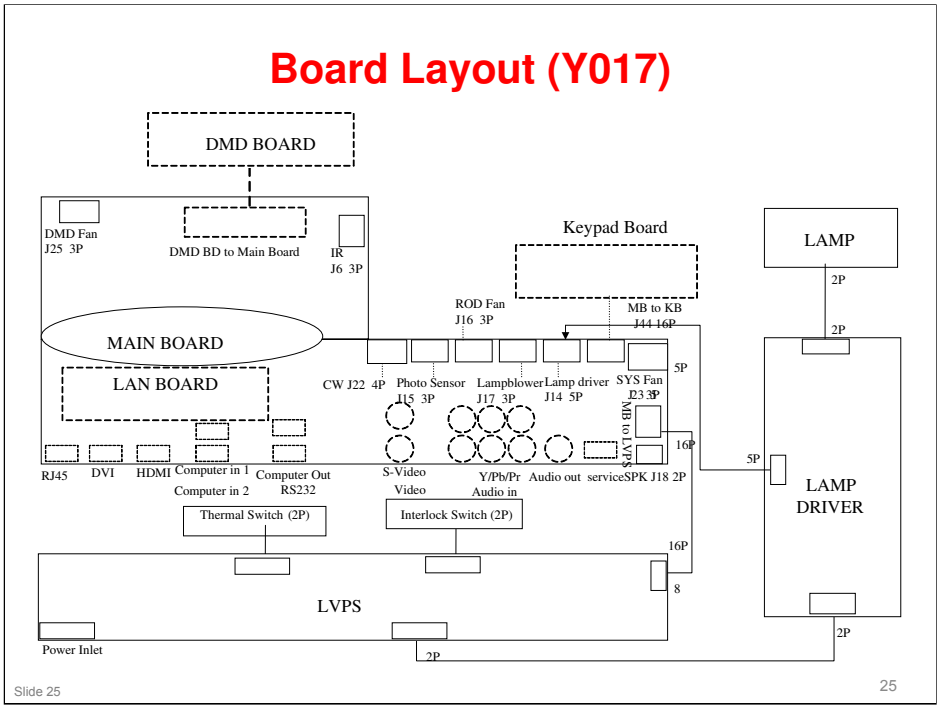
- This diagram shows how signals flow between boards.
- It also shows the light path from the lamp through to the lens.
- The light changes between red, green, and blue as the color wheel turns.
- The red dotted lines indicate the components of the optical engine.

Boards

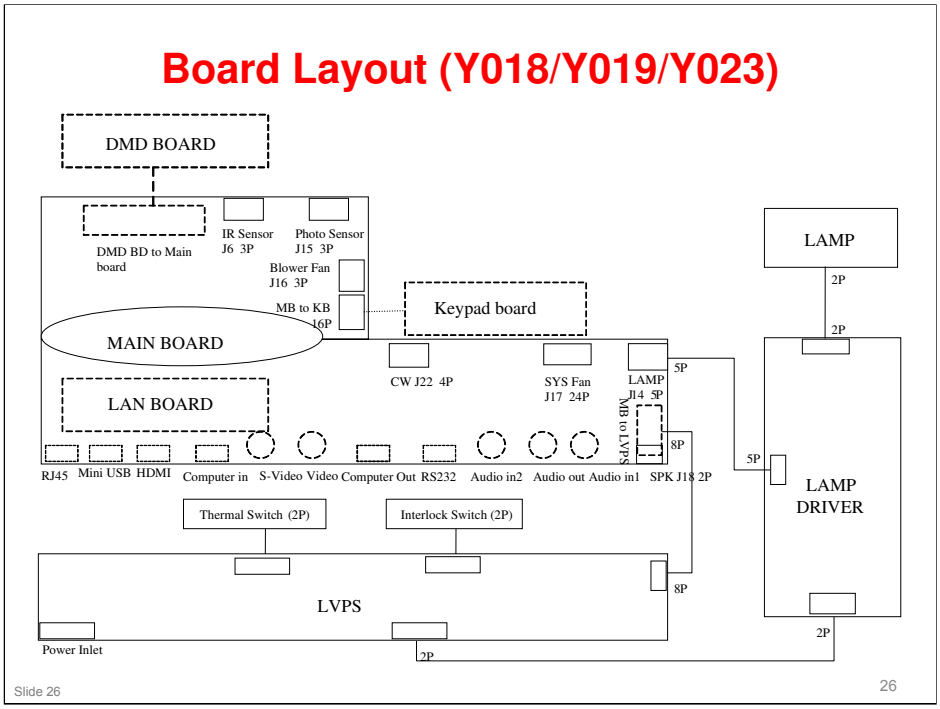
- **Main board (MB): Power/signal control and processing**
- **DMD board (DMD BD): Image signal processing and DMD control**
- **LVPS (DC-DC): Power supply, passes signals between boards**
  - LVPS means Low Voltage Power Supply
- **Lamp driver (Ballast): Starts the lamp**
  - When the lamp is being lit, the voltage is over 10,000V.

Slide 24

No additional notes



- This diagram shows how to connect the cables to the main board and other parts.



- This diagram shows how to connect the cables to the main board and other parts.

This section explains the basic points about servicing the machine.

Swap and Repair

- This product is intended for 'swap-and-repair'.
- If the projector needs repairs, it is taken away from the customer site and a temporary replacement is provided to the customer.

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No additional notes

Antistatic Clothing

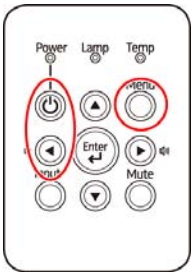
- To protect the components from damage, wear anti-static clothing when you disassemble the machine.

Slide 29

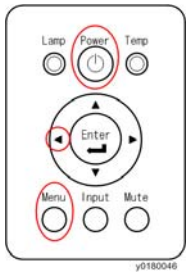
No additional notes

Entering Service Mode

Y018/Y019/ Y023



Y017



- **Press "Power", "Left", "Left" and "Menu" sequentially to get into service mode.**
  - Note: You can use the remote controller for this.
- **For a list of functions in the service menu, see 'System Maintenance - Service Mode - Service Mode Settings' in the service manual.**

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No additional notes

LED Display

Y017

Y018/Y019/Y023

- **The status of the three LEDs on the front panel indicate the machine's condition.**
  - See the table 'LED Display' in the Troubleshooting section of the service manual.
- **The LEDs for the Y017 are in a different order from the Y018/Y019/Y023. See the previous slide for details.**

Slide 31

No additional notes

This section explains important points about replacing parts.

Parts Replacement

- **After replacing parts, some adjustments may be needed. See the table in the service manual.**
  - This table and the procedures are in the following section of the service manual: Replacement and Adjustment - Electrical Adjustment - Adjustment Points vs Part Replaced
  - Whenever you replace a component, check this table to see if you have to do any of these procedures. The text in the Replacement and Adjustments procedures does not always refer to this table.
  - Fan RPM calibration: The Y017 and Y018 models have two blowers. Fan RPM calibration is only for the blower near the lamp.

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- OSD: On Screen Display

Replacing the Lamp

- To replace the lamp, unplug the power cord and then wait for 60 minutes.

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No additional notes

Replacing the Main Board

- The main board contains a record of the lamp usage hours.
- If you have to change the main board, make a note of the lamp hours before you remove the board.
- Then use ‘Rewrite Lamp Hours’ after you install the new board, to store this number in the new board.

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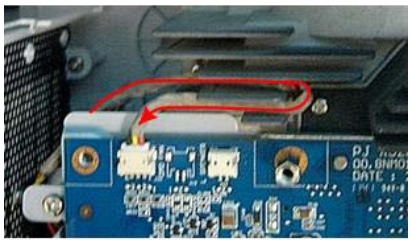
No additional notes

Main Board Cable

Y018/Y019/Y023



Y017

- **Don't fold or make a crease in the FPC cable (red circle).**
  - Y017: Kepe the cable loose; do not tighten it. Route the cable as shown

Slide 36

No additional notes

Optics Engine (Y018/Y019/Y023)

- When you reinstall the Optics Engine, route the cable (yellow line) through the hook (red circle) as shown.

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No additional notes

Optics Engines

- These are not the same for each model.
- Make sure that you have the correct assembly for the model that you are working on.
- The optics engine contains the DMD board, DMD chip, lens, and rod.
- These cannot be replaced as individual parts.

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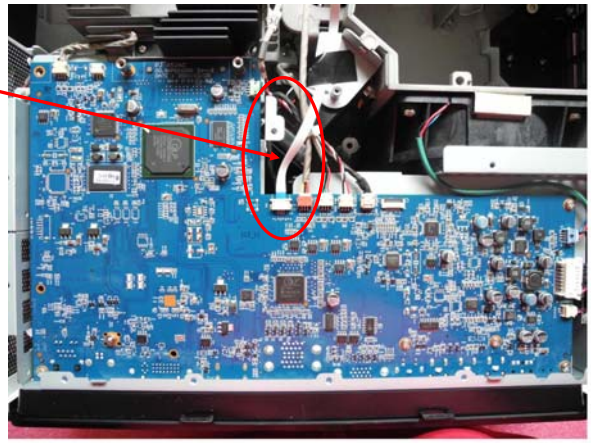
No additional notes

Replacing the Color Wheel

Keep the flat cable slack; do not tighten it

Don't fold the flat cable



- Avoid touching the glass parts of the color wheel.
- Y017: Be careful with the cable, as shown above

Slide 39

No additional notes

Color Wheel Index Adjustment

- **Do this after replacing the color wheel.**
- **Also, do this adjustment if color appears abnormal after changing the main board.**

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- The adjustment is in service mode. Note that the adjustment appears in two different menus. These adjustments are the same.

Rod Adjustment

- Adjust if there are yellowish or bluish parts in the image.

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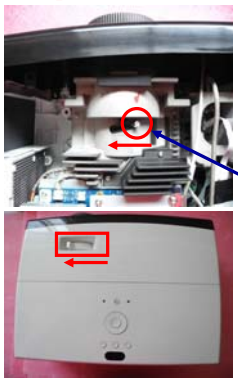
No additional notes

Attaching the Top Cover

Y018/Y019/Y023



Y017

- When you reattach the top cover, turn the zoom ring of the lens to the end as shown.

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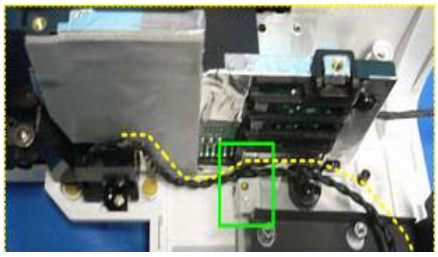
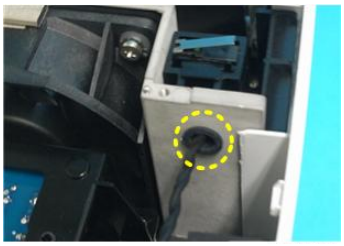
No additional notes

Interlock Switch



Y018/Y019/Y023



Y017

- **When you reinstall the Interlock Switch, do the following:**
  - Y018/Y019/Y023: Route the cable (yellow line) along the lamp driver as shown.
  - Y017: Pass the cable through the hole (yellow circle) in the Fan Shielding when you reinstall the Interlock Switch.

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No additional notes

Thermal Switch Cable (Y017)

- This cable must be fixed as shown above.

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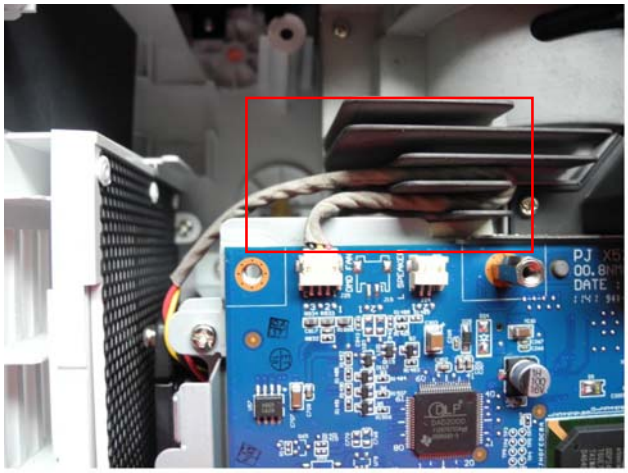
No additional notes

DMD Fan Cable (Y017)



- Arrange the DMD fan cable as shown.

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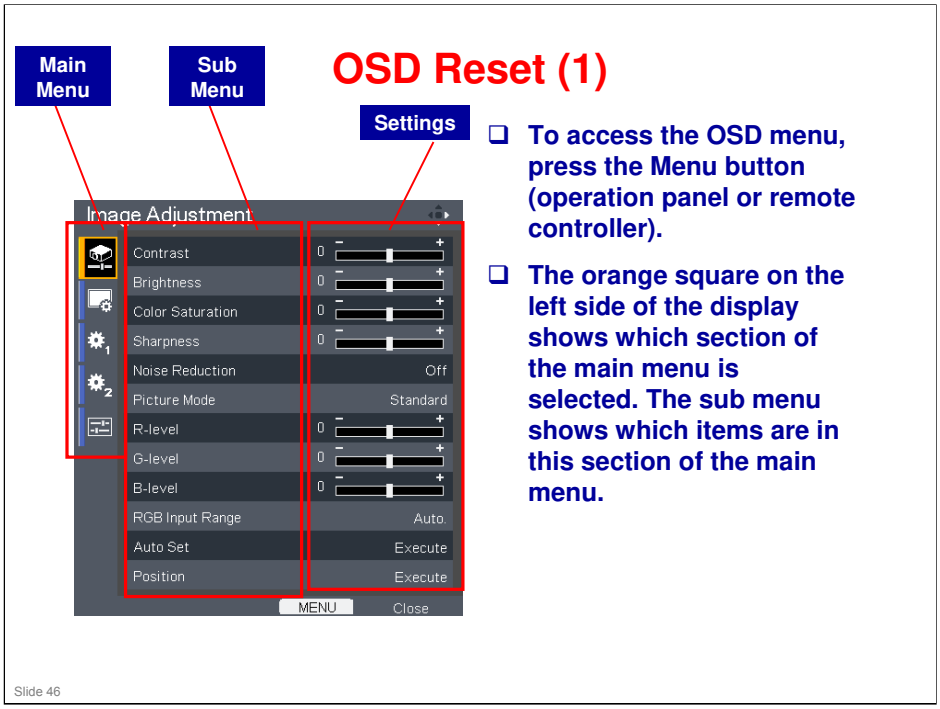
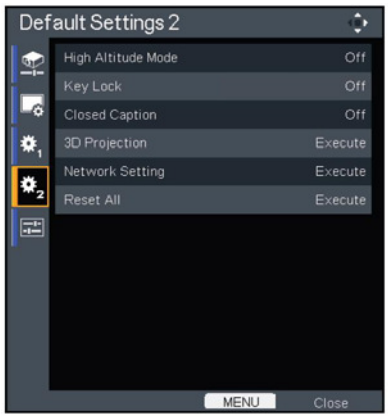
No additional notes



- This is not explained in the service manual, so we explain it here.

OSD Reset (2)



- In the main menu, select Default Settings 2.
- Then select Reset All and Execute.
- This returns all adjustments and settings to the factory settings.

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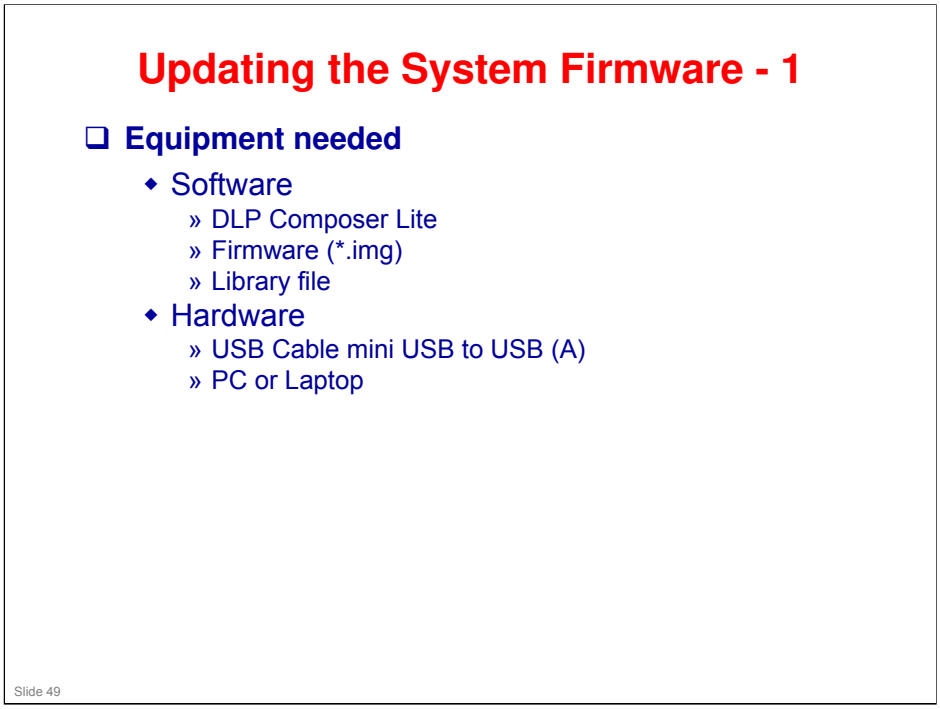
No additional notes

This section explains the basic points about updating the firmware.
This is the same as for the Antares-PJ1.



- The detailed procedure is in the System Maintenance - Firmware Update section of the service manual.

Updating the System Firmware - 2

- **Preparation**
  - Install DLP Composer Lite
  - Install a USB driver for the DLP device
  - Enter the Firmware Update Mode
    - » Y018/Y019/Y023:
      - – Hold the "Power" button and plug in the power cord.
      - – The Power/Lamp/Temp LEDs will light red after around 10 seconds, then release the "Power" button.
    - » Y017:
      - – Hold the "Power" and “Menu” buttons and plug in the power cord.
      - – The Power/Lamp/Temp LEDs will light red after around 2 seconds, then release the "Power" and “Menu” buttons.
  - Connect the Projector to the PC
    - » Use a mini USB cable
- **Update the firmware**
  - Use DLP Composer Lite.
    - » The procedure takes several minutes.
  - When "Download completed" appears on the screen:
    - » Unplug the mini USB cable and power cord.
    - » Plug in the power cord, then restart the projector and get into Service mode to check the system firmware version.

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No additional notes

Updating the Network Firmware

- **Equipment Needed**
  - Software
    - » Network firmware file (*.bin)
  - Hardware
    - » LAN cable (Ethernet crossover cable)
    - » PC or Laptop
- **Procedure**
  - Set up the projector and your computer.
    - » Your browser must not be set up to use a proxy server.
  - Use a web browser on your computer to update the firmware.
  - The procedure takes about 1 minute.

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- The detailed procedure is in the System Maintenance - Firmware Update section of the service manual.

Background Information

Types of Projectors

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- This section briefly explains the various projector technologies on the market.

Types of Projectors

- **There are 4 main types.**
  - CRT projectors: These use three cathode ray tubes (blue, green, and red).
  - LCD projectors: These use three LCD filters to create red, green, and blue images.
  - DLP projectors: DLP (Digital Light Processing) was developed by Texas Instruments. It uses micro-mirror devices and rotating color wheels
  - LCOS projectors: LCOS (liquid crystal on silicon) uses liquid crystals as mirrors, instead of filters

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No additional notes

CRT Projectors

- These use three cathode ray tubes (blue, green, and red).
- They have better contrast than LCD and DLP projectors.
- They also have good resolution. But they are bulky, heavy, and difficult to adjust.

Slide 54

No additional notes

LCD Projectors

- LCD projectors appeared during the early 1990s, and are now the main type of projector.
- Three LCDs receive electrical signals from an image-generating device. One receives signals for the red part of the image, one the green, and one the blue. In this way, each LCD holds a pattern of pixels.
- Then, red light is shone through the LCD with the red part of the image, and green and blue light are used for the other two LCDs.
- After passing through the LCD filters, the three beams are combined and projected.
- LCD projectors give bright, high-resolution output, and they are easy to adjust. They are also cheap.

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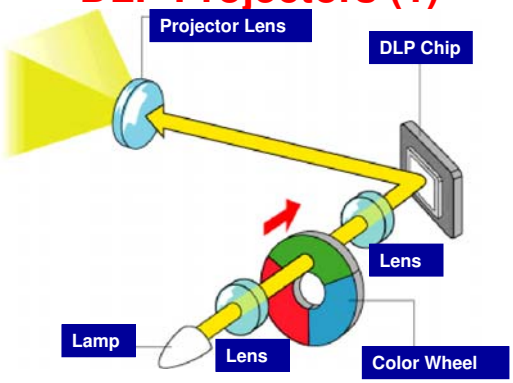
No additional notes

DLP Projectors (1)



- The DLP chip is the central part of this type of projector.
- A DLP chip consists of many small pixel-sized mirrors laid out on a semi-conductor chip. Light shone on the DLP chip is reflected by all these tiny mirrors. (For a chip with 1024 x 768 resolution, there are 786,432 small mirrors.)
- Light is shone onto the chip through a fast-spinning wheel that has a red sector, a green sector, and a blue sector. This light is reflected off the chip and out through a lens onto a screen.

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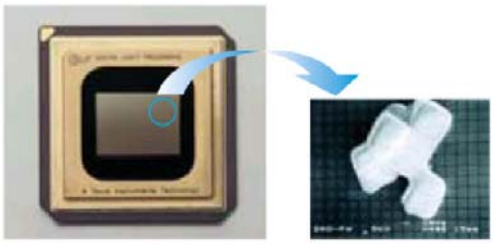
- DLP (Digital Light Processing) was developed by Texas Instruments in 1987.
- The DLP chip is also known as a Digital Micromirror Device (DMD).
- DLP technology uses light reflection, which leads to a brighter image than a light-transmission type of device such as an LCD projector.

DLP Projectors (2)

- R, G, and B signals from the image generating device are sent to the DLP chip, and timed so that the red signal arrives at the same time that the red part of the wheel is in the beam path, and similarly for the green and blue signals.
- The DLP chip generates the R, G, and B images by re-positioning the micromirrors using micromachined hinges to make different pixelated images for each colour (meaning that each micromirror has an ON and an OFF position).
- The mirrors can switch over every 15 microseconds, so moving images can be projected.
- For SVGA resolution, the mirrors are 16-micrometer squares, with a gap of about 0.8 micrometers between each mirror. Below, we can see the size of the mirrors compared to a grain of table salt.



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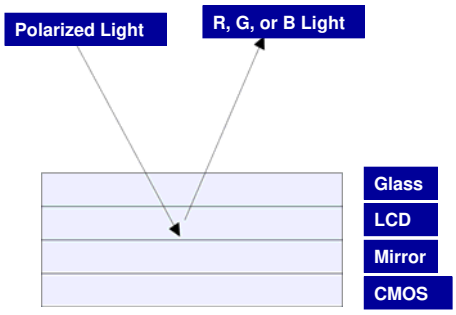
No additional notes

LCOS Projectors



- In LCoS, a liquid crystal cover is applied to the surface of a semiconductor chip that has a highly reflective coating. There are one of these assemblies for red, green, and blue.
- The RGB images are sent to these semiconductors, and beams of light are reflected off these and recombined before being projected to the screen.
- LCD projectors give bright, high-resolution/high-contrast output, and they are easy to adjust. But they are adversely affected by dust and vibrations.
- The layout of the machine is similar to the LCD projector, except that LCoS plates are used instead of LCD plates.

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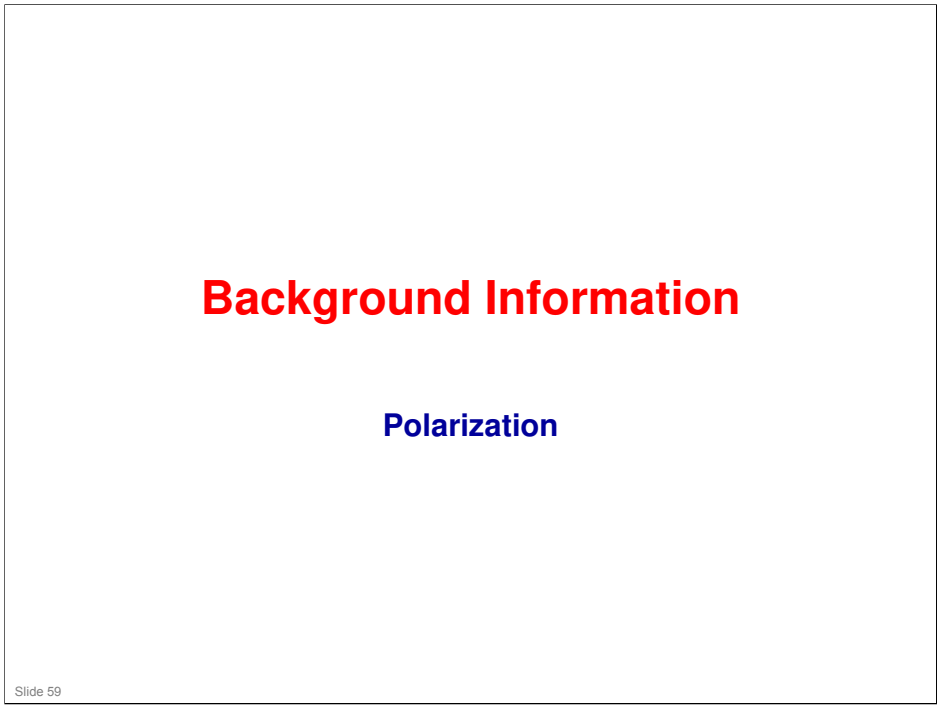
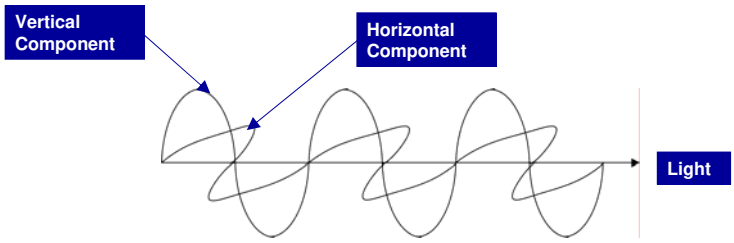
- LCOS: Liquid Crystal on Silicon
- The diagram shows a simplified cross section of an LCoS panel.



No additional notes

What is Polarization?



- Polarization refers to the orientation of the electric field.
- It is convenient to think in terms of up-down (vertical), and left-right (horizontal).
- If the polarization is at an angle, then this polarization can be thought of as having up-down and left-right components.

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No additional notes

Polarizing Filter

- **In a polarizing filter, the arrangement of the molecules allows (for example) the up-down component to pass through, but not the left-right component.**
  - Think of a rope passing through a picket fence (with vertical slits).
  - If you vibrate the rope in a horizontal direction, the fence will block the vibrations.
  - If you vibrate the rope in a vertical direction, the vibrations in the rope will pass thought the gaps in the fence.

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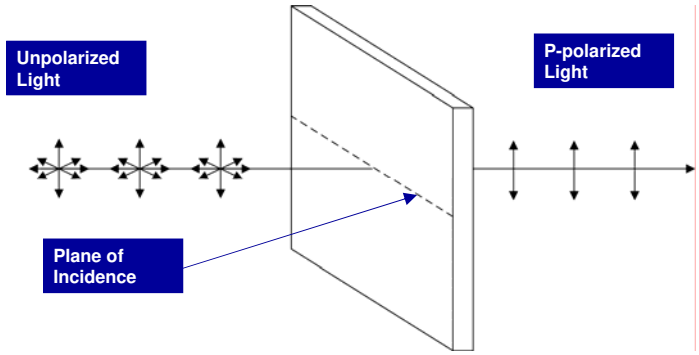
No additional notes

S- and P- Polarization



- If the electrical field is polarized parallel to the plane of incidence (in other words, horizontal), it is said to be p-polarized.
- If the field is polarized perpendicularly to the plane of incidence (vertical), it is said to be s-polarized.

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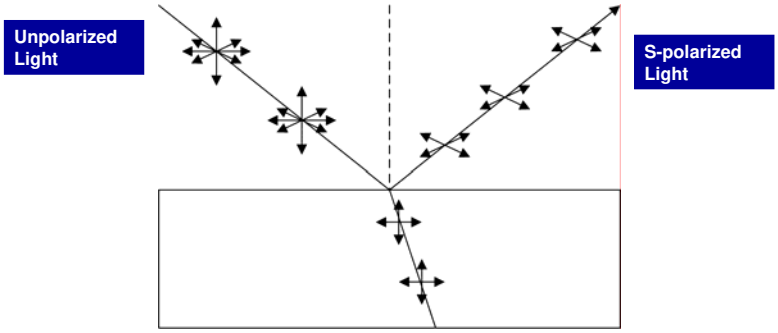
- This diagram shows the case of a p-polarizing filter.

Polarization by Reflection



- Reflection off certain non-metallic substances can polarize light.
- If the angle is correct (different for each mineral, depends on the arrangement of molecules in the mineral), the reflected light will be completely s-polarized.
  - The refracted light will be at least partially p-polarized.

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No additional notes

Background Information

Terms and Definitions

Slide 64

- Some details in this section may not apply to this model.

Terms and Definitions - 1

- **Aspect Ratio**
  - This is the ratio of the horizontal to vertical dimensions of the screen. For a normal television, the aspect vratio is 4:3. For HDTV, it is 16:9. For SXGA, it is 5:4.
- **Resolution**
  - This is expressed as the number of dots across the image versus the number of dots down the image. the larger the number, the higher the resolution.
  - Here are the resolutions of some common video graphic standards.
    - » VGA (Video Graphic Array): 40 x 480
    - » SVGA (Super VGA): 800 x 600
    - » XGA (Extended Graphic Array): 1024 x 768
    - » WXGA (Wide VGA): 1280 x 800
    - » SXGA (Super XGA): 1280 x 1024
    - » UXGA (Ultra XGA): 1600 x 1200

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No additional notes

Terms and Definitions - 2

- **Dichroic Mirror**
  - A dichroic mirror reflects light of a certain frequency range and allows all other light to pass through.
  - LCD projectors contain two of these mirrors, to split the light up into three beams.
- **Polarized Light**
  - Light waves oscillate in the same way as sound waves.
  - If the waves oscillate in one plane only, the light is said to be polarized.
  - Light reflected by a polarizing screen is polarized, and is brighter than light reflected from a non-polarizing screen.
- **Residual Image**
  - When an image on a display changes, a residual image of the previous image can remain for some time.
  - In serious cases, it can last for more than 1 minute.
  - LCD panels normally do not have this problem.

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No additional notes

Terms and Definitions - 3

- **Air Filter**
  - Air is drawn into the projector to cool its internal components. The air filter prevents dust from being pulled into the projector with this air. If the filter becomes dirty, air cannot pass through properly, and it will become hot inside the projector.
  - Every 100 hours, a message will appear, asking the user to clean the air filter.
  - Do not operate the projector without the filter.
  - The message will appear the first time the user switches the power on after the 100-hour limit has been reached. The message will stay on-screen for 30 seconds, or until the user operates the projector.
- **Brightness and Focus of Outer Parts of the Projected Image**
  - Generally, when an image is projected, there are differences between the center of the image and the outer parts. The center is typically brighter than the outer parts. The focus can be better or worse at the center than at the edges.

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No additional notes

Terms and Definitions - 4

- **Suspension from the Ceiling**
  - This machine can be suspended from the ceiling, if the required metal supports are fitted.
  - These metal supports are not supplied with the projector.
- **Changing the Lamp**
  - The first time that the power is turned on after the lamp has been used for 3000 hours, a message is displayed for the user.
  - The message disappears if you press the center part of the circular ‘arrow’ button.
  - The hours of lamp use are calculated as follows: Lamp use time + Normal mode usage time - Eco mode usage time.

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- Eco mode is the lower brightness mode that can be selected by the user. It is not an Energy Star function.

Terms and Definitions - 5

- **Lux, Lumen, Candela**
  - The brightness of a lamp is generally measured in lumens, and ambient brightness and light reflected from a screen is generally expressed in lux.
  - Lumen
    - » This ANSI unit is used to measure the amount of light emitted from a light source. In the ANSI procedure for measuring the brightness of a source, the light is directed onto a screen. The area of the screen is divided by 9, and the brightness at the center of each of these is measured. The average of these is taken to be the brightness of the source in lumens.
  - Lux (lx)
    - » This is a measure of the intensity of illumination. It can be expressed as lumens/square meter.
    - » Outside on a sunny day, the intensity is 15,000 to 20,000 lux.
    - » Inside a room with electric light, it is 1,500 lux.
    - » In a room lit by candlelight, it is 2 lux.
  - Candela
    - » This is often used for projectors with a built-in light source, such as a television. It is normally expressed as candelas per square meter. The candela is a measure of the strength of a light source, and cd/m2 expresses its brightness.
    - » cd/m2 = (lumens x screen gain)/(screen area m2 x π)
    - » Screen gain: Brightness increases with screen size.

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- Example of conversion between lumen, lux, candela
  - 1. From lumen (lm) to lux (lx)

    For a 40-inch screen with a 4:3 aspect ratio, the area is about 0.5 m2.

    For 1000 ANSI lumens, the amount in lux is: =1000/0.5, = 2000 lux
  - 2. From lumen (lm) to candelas (cd/m2)

    For a 40-inch projector with a screen gain of 2 (double that of an OHP projector screen), cd/m2 is:

    (1000x2)/(0.5×3.14) = 2000/1.57 = 1274 cd/m2

Terms and Definitions - 6

- **Uneven colour**
  - This term is used when the contrast and color of the image is not constant. There are many possible causes for this.
- **Gradation**
  - Between white and black, there are shades of grey. The number of levels between white and black are called gradations. The higher the number of gradations, the greater effect on the image, but if the contrast is not high, this effect is cancelled.
- **Color Separation**
  - A computer video signal is separated into a black-and-white signal and a colour signal. In a projector, it is separated into three colors (red, green, blue). The condition of the components that separate the light will have an effect on the quality of the image.

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No additional notes

Terms and Definitions - 7

- **Contrast**
  - In general, this is the ratio between the bright and dark parts of an image. A high contrast gives a clear image. A projector with an internal light source is unaffected by external light sources gives a high contrast image that is clear.
- **Jitter, Flickering**
  - Jitter is noise in the image that is mainly caused by temporary fluctuations in the movement of rotating components, such as the motors that drive the heads in a VCR unit. The effects can be seen on vertical lines in the image.
  - Flickering of the image also can occur.

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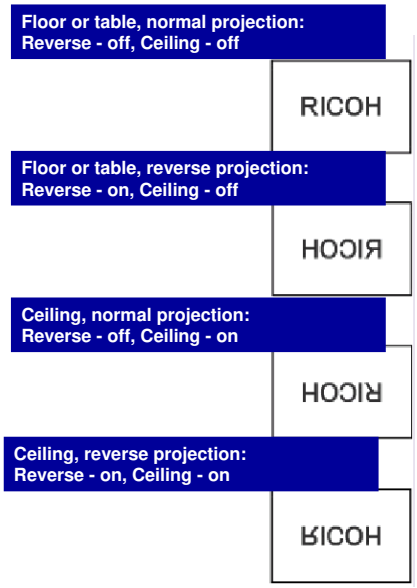
No additional notes

Terms and Definitions - 8



- **Image Adjustments**
  - If the projected image is flickering or blurred, in the wrong position, and so on, the horizontal position, vertical position, and synchronization can be adjusted.
    - » Flickering is often caused by inaccurate synchronization of the image data signal to the LCD panel.
  - The image settings (reverse, ceiling) depend on how the projector is set up.
  - The following settings from the image adjustment menu can be used to adjust the projected image.
    - » Contrast (weak/strong), brightness (dim/bright), colour strength for red green and blue, image quality (soft/sharp).

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- Reverse, ceiling: These are in the customer settings menu.

Terms and Definitions - 9

- **Gamma correction**
  - This adjusts the signal level to get the correct VT response characteristics (V: input voltage, T: amount of transmitted light).
- **Trapezoidal image correction (Keystone correction)**
  - Depending on the angle of projection, the projected image will be distorted into a trapezoidal shape, instead of a rectangular shape.
  - The projector contains a sensor that detects the angle of projection in 15-degree increments, and the image is automatically corrected. This is known as Keystone Correction.
- **Projection Distance**
  - This is the distance from the projection lens to the screen. For a larger screen, the distance becomes longer (the distance is directly proportional to the screen size).

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No additional notes

Terms and Definitions - 10

- **Screen Gain**
  - A measure of how brightly a screen displays an image.
  - The higher the screen gain, the brighter the screen.
- **Relation between Screen Gain and Brightness**
  - Generally, the larger the screen, the darker it is. If you choose a screen with a higher gain, the brightness is preserved to some extent.
  - Also, choose a screen to suit the room. In a long room, use a high luminance screen. In a wide room, a high viewing angle screen.

	White screen for OHP projection	High viewing angle screen	High luminance screen
Viewing angle (horizontally)	1 (wide)	2	3
Brightness	3 (dark)	2	1
Price	1 (cheap)	2	3
Screen gain	3 (low)	2	1

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Screen Size Conversion Table

- Screen size (inches) is measured diagonally across the screen from top left to bottom right.

	4:3		16:9			4:3		16:9	
Size (in)	L (mm)	W (mm)	L (mm)	W (mm)	Size (in)	L (mm)	W (mm)	L (mm)	W (mm)
30	457	610	374	664	170	2591	3454	2116	3757
40	610	813	498	885	180	2743	3648	2240	3978
50	762	1016	623	1107	190	2896	3861	2365	4199
60	914	1219	747	1328	200	3048	4064	2489	4420
70	1067	1422	871	1547	210	3200	4267	2614	4641
80	1219	1626	996	1768	220	3353	4470	2738	4862
90	1372	1829	1120	1989	230	3505	4674	2863	5083
100	1524	2032	1245	2210	240	3658	4877	2987	5304
110	1676	2235	1369	2431	250	3810	5080	3112	5525
120	1829	2438	1494	2652	260	3962	5283	3236	5745
130	1981	2642	1618	2873	270	4115	5486	3360	5966
140	2134	2845	1742	3094	280	4267	5690	3485	6187
150	2286	3048	1867	3315	290	4420	5893	3609	6408
160	2438	3251	1991	3536	300	4572	6096	3734	6629

Terms and Definitions - 11

- **Ad hoc mode and Infrastructure mode**
  - There are two ways to connect to a PC using W-LAN.
  - Ad hoc mode is used to connect to a PC without using a W-LAN access point.
  - Infrastructure mode is used to connect to a PC through a W-LAN access point. In this mode, connection to the internet is possible, so security is provided by means of MAC address filtering.
- **JPEG Joint Photographic Experts Group**
  - This is a compression technology to facilitate the storage and transmission of still colour images. The data is reduced in a manner that is not visible to the eye, but a compression of 1/100 is achieved.
- **MPEG Motion Picture Experts Group**
  - This is a compression technology to facilitate the storage and transmission of moving colour images. There is more data than in a still image, so compression is important for efficient storage and transmission.
  - Depending on the degree of compression, there are MPEG-1、MPEG-2、and MPEG-4 standards.
  - MPEG-2 gives better results than MPEG-1, but a dedicated circuit is required for playing the image.

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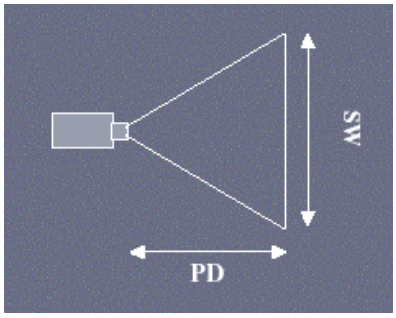
No additional notes

Throw Ratio

- Throw Ratio = PD/SW



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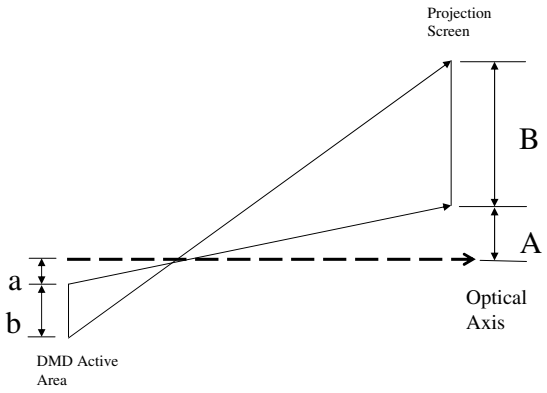
No additional notes

Projection Lens Offset



- Offset = [(A+B)/B]x100% =[(a+b)/b]x100%

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No additional notes

No additional notes