SI-2K Digital Cinema Camera
User Manual

Thank you for purchasing this Silicon Imaging/P+S Technik Product. Before operating this unit, please read the Instructions carefully to ensure best possible performance.

Art.No. 22709 v0807

SiliconImaging

P+S TECHNIK

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Introduction

The SI-2K Digital Cinema Camera and SI-2K Mini Camera Head are camera systems operating in conjunction with SiliconDVR software.

SiliconDVR Software controls the SI-2K Mini from either the Recording Unit or a PC Laptop/Workstation. Silicon DVR is preinstalled on the Recording Unit and auto-starts by switching on the Recording Unit.

The device is designed to be controlled by a touchscreen monitor. Therefore all dedicated control buttons at the camera have been removed. All features can be controlled by the SiliconDVR Software interface via touchscreen, built-in Mousepad or common IT driven input devices such as keyboard and mouse.

This is a new approach in camera control and user interface.

Thank you for purchasing the SI-2K camera,

P+S Technik and Silicon Imaging

Important Safety Instructions

Read all of these instructions carefully.

Keep these instructions.

Heed all warnings.

Follow all instructions.

Do not use this apparatus near water.

Clean only with dry cloth.

Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.

Do not install near any heat sources as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.

Protect the power cord from being walked on or pinched particularly at plug, convenience receptacles, and the point where they exit from the apparatus.

Only use attachments/accessories specified by the manufacturer.

Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with this apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury tip-over.

Unplug this apparatus during lightning storms or when unused for long periods of time.

Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

Do not leave in direct sunlight (or at least cover camera from heavy sunlight i.e. with flags)

Only use camera in advised temperature range from 0 to +40° Celsius / 32°-104° Fahrenheit

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CAUTION
RISK OF ELECTRONIC SHOCK
DO NOT OPEN

CAUTION
TO REDUCE THE RISK OF ELECTRIC SHOCK,
DO NOT REMOVE COVER (OR BACK).
NO USER SERVICEABLE PARTS INSIDE.
REFER SERVICING TO QUALIFIED SERVICE
PERSONNEL.

The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of non-isolated "dangerous voltage" within the products enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (service) instructions in the literature accompanying the appliance.

WARNING
TO REDUCE THE RISK OF FIRE OR SHOCK
HAZARD, DO NOT EXPOSE THIS EQUIPMENT
TO RAIN OR MOISTURE:

CAUTION
TO REDUCE THE RISK OF FIRE OR SHOCK
HAZARD AND ANNOYING INTERFERENCE, USE
THE RECOMMENDED ACCESSORIES ONLY.

CAUTION
TO REDUCE THE RISK OF FIRE OR SHOCK
HAZARD, REFER CHANGE OF SWITCH SET-
TING INSIDE THE UNIT TO QUALIFIED SERVICE
PERSONNEL.

FCC NOTE
This device complies with Part 15 of the FCC Rules. To assure continued compliance follow the attached installation instruction and do not make any unauthorized modifications.

This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when equipment is operated in a commercial environment. This equipment, generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference in which case the user will be required to correct the interference at his own expense.

Replace Battery with part. No. CR2032 only. Use of another battery may present a risk of fire explosion.

CAUTION
Battery may explode if mistreated. Do not recharge, disassemble or dispose of in fire.

ATTENTION
At the end of its useful life, under various state and local laws, it is illegal to dispose of batteries into your municipal waste stream.

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Contact Information

Web Support:

http://www.siliconimaging.com/DigitalCinema/
http://www.pstechnik.de/en/digitalfilm-si2k.php

Support Forum:

http://www.siliconimaging.com/support_forum/index.php

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SI 2K Manual

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Table Of Contents

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Delivery Content

Thank you for choosing SI-2K Digital Cinema Camera products. Please check your delivery content with the following parts and accessories listing and your order confirmation:

1) SI-2K Mini Camera Head (#22000)

- SI-2K Mini Camera Head equipped with the IMS (Interchangeable Mount System)
- 10 m GigaBit Ethernet cable Lemo 12 pin to RJ45 for Data connection (#22710)
- 12 V Power Supply XLR 4 pin (#23327)
- 2 m Power connection cable Lemo 8 pin to XLR 4 pin (#22711)
- Software License for CineForm RAW Encoder, Iridas SpeedGrade Embedded and Silicon DVR

2) SI-2K Recording Unit (#19000)

- SI-2K Recording Unit with top handle, interface for 15 mm rods and quick lock connection
- Mains lead cleat
- Audio Adapter Sub D to XLR – 2 channel IN and OUT (#23405)

3) SI-2K Digital Cinema Camera and Recording System (#22736)

- SI-2K Camera Head (#22000) including all accessories as mentioned above
- SI-2K Recording unit (#19000) including all accessories as mentioned above
- 5 m Data & Power Connection cable for remote connection between SI-2K Mini Camera Head and SI-2K Recorder unit Lemo 12 pin to Lemo 12 pin (#23059)

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Mechanical Specifications

FRONT

BACK

LEFT

TOP

BOTTOM
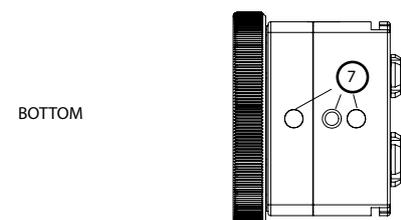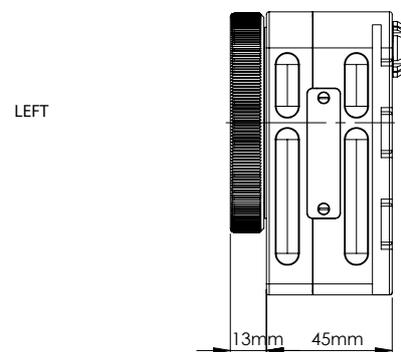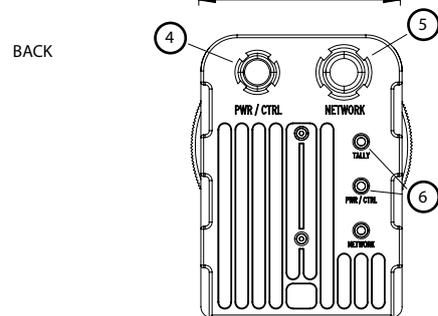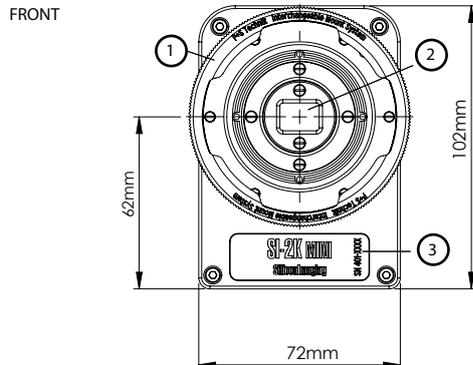
SI-2K Mini Camera Head

1) IMS Interchangeable Mount System
2) 2/3" CMOS Sensor 2K with optical
    Low Pass filter
    (Frame SIze 10.24 mm x 5.76 mm)
3) Serial number SI-2K
4) Lemo 8-pin socket "PWR/CTRL"
    (+12 V DC power supply / multicam
     sync signal)
5) Lemo 12-pin socket "NETWORK"
    (data connection to Recording Units)
6) Status LED's
    (data connection to Recording Units)
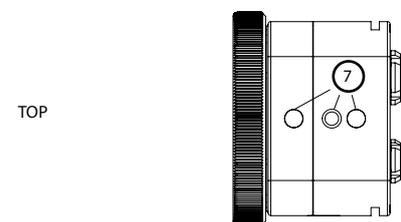7) 2 x 1/4 screw threads for accessories
    (i.e. side handle, MiniRig support bridge,
    tripod plate, etc.)

Weight: approx. 550 grams
Dimensions: approx. 72 mm x 102 mm x 58 mm
(WxHxD)
Power Consumption: 0.5A/12V DC

Mechanical drawing views with callout numbers 1–27. Dimensions: 81mm, 81mm, 36mm, 36mm, 62mm (top left view); 280,50 and 20,22 Sensor surface to P+S Technik IMS (bottom left view).

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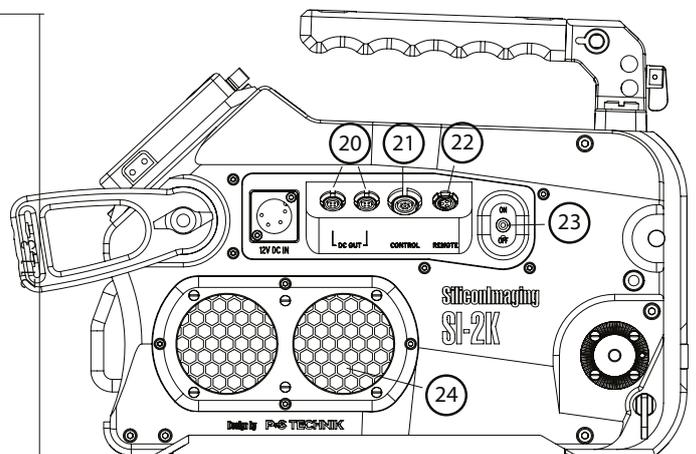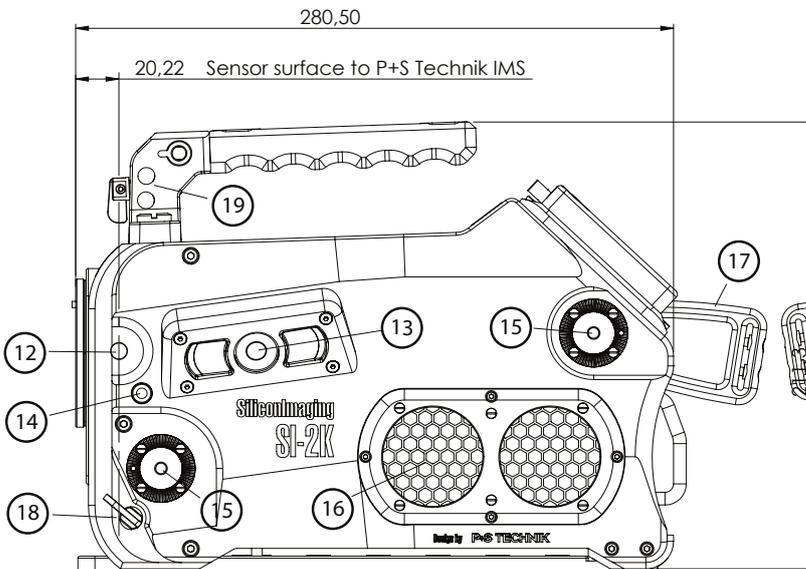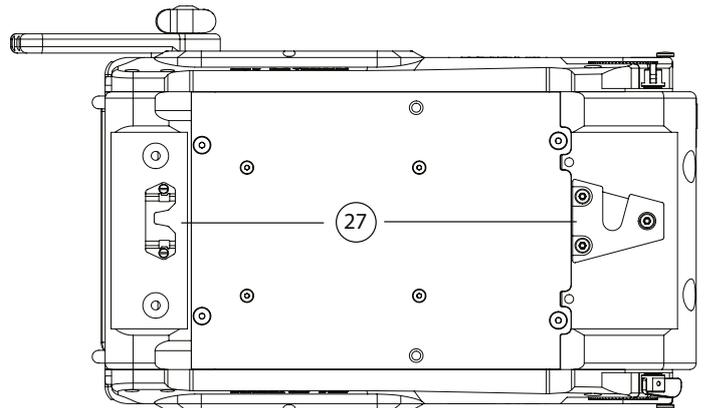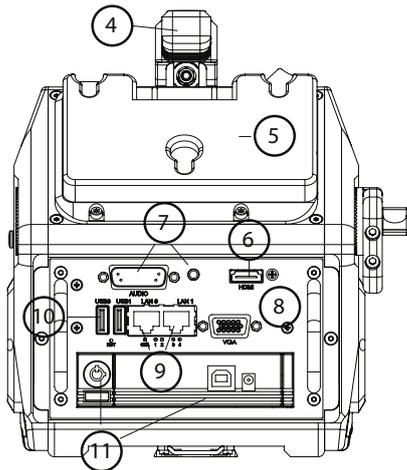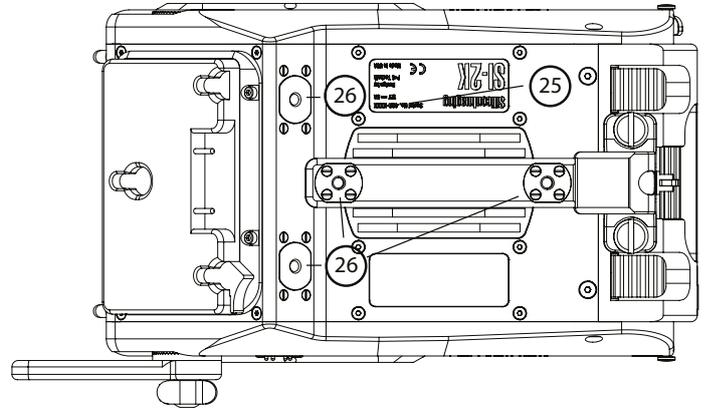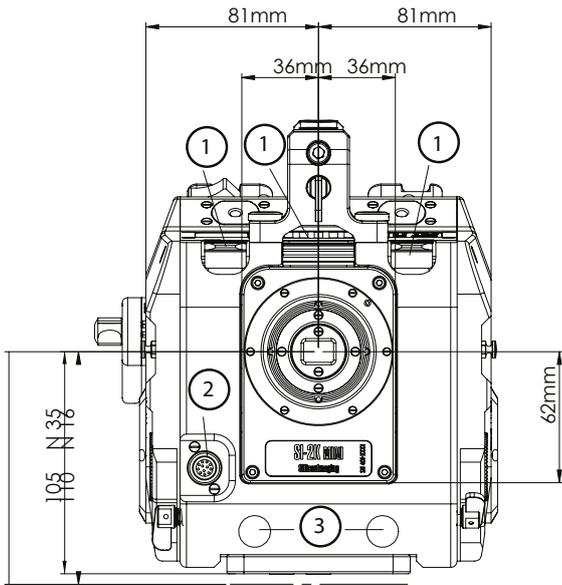
SI-2K Recording Unit

1) SI-2K Mini tray with Camera Head connectors and locker bars
2) Hirose 12-pin (+Batt power)
3) Lightweight support prepared for 15 mm rods
4) Handle with vIewfinder holder mechanics
5) Anton Bauer Gold Mount (Battery Mount)
6) HDMI out (Standard Computer DVI Signal Secondary Monitoring 1280x720 60 Hz)
7) Audio I/O left: Sub-D to Breakout Cable, right: headphones out 3.5 mm
8) VGA out (Primary Monitoring)
9) LAN 0: Gigabit Ethernet DHCP enabled
   LAN 1: Gigabit Ethernet data connection to alternate SI-2K Mini Camera Head
10) 2 x USB
11) Detachable recording media cartridge (i.e. hard disk)
12) Tape hook indicating focal plane of sensor
13) User interface for OnScreen navigation mouse selection (left button, mouse pad, right button)
14) Tally light
15) Multi-purpose rosettes (hand grip, magic arms, extensions, monitors)
16) Ventilation slots with air filter (AIR-IN)
17) Cable tie bracket
18) Locking clamps for lightweight support rods
19) Multipurpose 3-axis electronic viewfinder mount
20) 2 x DC OUT Lemo 4-pin Socket (5 V regulated/12 V regulated/ Battery Voltage unregulated)
21) CONTROL socket for synchronizing cameras
22) Remote socket for external RUN signal to camera
23) ON/OFF power switch
24) Ventilation slots with air filter (AIR-OUT)

Weight: approx. 6400 grams
(SI-2K Recording Unit + SI-2K Mini + Hard Disk)
Dimensions: approx. 290 mm x 210 mm x 160 mm (WxHxD)
Power Consumption: 5A/12V DC

Quick Start Guide

SI-2K Mini Camera Head

The SI-2K Mini is a small camera head with a 2/3" single chip CMOS sensor working with a Bayer pattern. The frame size is 10.24mm x 5.76mm (w x h) (16mm frame: 10.3mm x 7.5mm) (w x h).
The data output of the SI-2K Mini is transfered via Gigabit Ethernet on a Lemo 12 pin connector for maximum reliability. A second connector for I/O and power is also provided.

The mounting system for lens mounts relies on the P+S Technik Interchangeable Mount System (IMS). The intermediate mount is a precise modular system that enables the camera operator to exchange lens mounts in the field in seconds while maintaining the accuracy required for cinema quality optics.

¼" x 20 mounting holes are provided on both the top and bottom of the SI-2K Mini for maximum flexibility. On the back cover the SI-2K carries three LED lights indicating Power (green), Data (blue) and Record (red). In addition the SI-2K Mini can easily be attached to the front of a SI-2K Recording Unit.

SI-2K Digital Cinema Camera System

The SI-2K is a complete camera system consisting of a SI- 2K Mini camera head front end (removable), a processing unit, I/O, removable storage all in a ruggedized housing. The camera runs the SiliconDVR™ software and records in Cineform RAW™ format on a removable recording media. Many ergonomic options are available – LCD touchscree n, electronic and optical viewfinders, shoulder rig, cable sets and other tools to facilitate the use of the camera.

Mechanical Preparation

Mounting the SI-2K Mini camera head

The SI-2K Mini is mounted (i.e. to the SI-2K Mini Rig, to the ergonomic hand grip or a tripod) either from the top or bottom by 1/4"x20 mounting holes. Two mounting holes are provided along with one alignment hole. Depending on the mounting system, the mounting holes can be used to provide different spacing between the mounting hole and alignment pin.
The unused mounting hole (top or bottom) can be used for accessories such as the ergonomic hand grip or viewfinder or touchscreen on a flexible arm.

Removing and Inserting the Mini from the Recording Unit

The SI-2K Mini Camera Head is mounted to the front of the SI-2K Recording Unit with a special locking system. After raising the locker bars, the SI-2K Mini must be manually eased forward until the power and Ethernet connections are automatically disconnected.
Extension cables can be provided by Silicon Imaging and P+S Technik to operate the SI-2K Mini tethered to the front of the SI-2K Recording Unit.

1. Pull up Locker Bars
2. Press Fixture Button and pull out the SI-2K Mini carefully straight.
3. To insert the SI-2K Mini, follow the instructions in reverse direction.

1.

2.

3.

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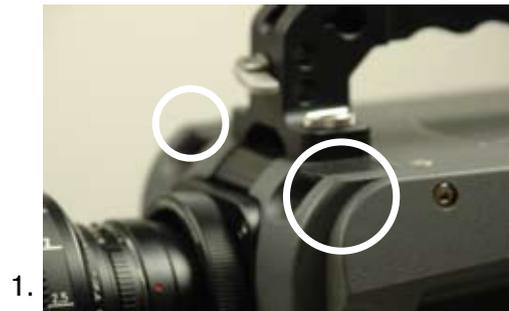
Mounting Accessories to the SI-2K Recording Unit

The bottom mount on the SI-2K matches a Sony Quick-Lock mounting plate. With a baseplate the Recording Unit can be adapted to various other systems like 16 mm and 35 mm bridge plates available from Silicon Imaging and P+S Technik.

Rosettes are available at both side, the front and back of the camera for accessory mounting.

The front of the SI-2K is prepared for lightweight lens support and accepts 15 mm rods. On the sides near the front is a small locking lever that can lock the rods in place.

Handle

The handle provides a well balanced grip for the camera in addition to a flat top mounting surface available by 1/4x20" mounting holes. The handle is removable for top-rigging the camera. In addition a three axis viewfinder holder for the electronic view finder is integrated.

Inputs & Outputs

Power

SI-2K Mini Camera Head

For standalone operation, power is applied to the PWR/CTRL, either from a battery pack such as the Anton Bauer Dionic 90 via the Mini Rig battery holder or from an AC power supply using the appropriate cable. The data is transmitted over a separate cable from the NETWORK connector to a workstation or laptop computer.

For operation tethered to an SI-2K Recording Unit, a special tether cable is used with integrated power and data over the single NETWORK connector. The purpose of this is to minimize cabling involved in POV shooting.

SI-2K Recorder Unit

External Power
For battery operation, a standard Anton Bauer battery mount is available on the top rear of the camera. A fully charged AntonBauer Hytron 140 battery will provide over 2 hours of operation. Other suppliers batteries can be used with adapter plates.

Alternatively an external +12V DC power can be supplied to the XLR 4-pin connector on the right rear of the camera. AC power supplies to match the inputs and connectors required for various countries are available.

Auxiliary power to other devices like the viewfinder or other peripherals can be taken from the auxiliary power outlets. In battery operation the D-Tap on the side of the battery mount serves as an additional power connector for accessories as well. Please note that the D-Tap connector is unswitched. Any device connected to this power source will continue to discharge the battery when camera is turned off

DC Power output
On the right rear of the camera, adjacent to the +12 V DC IN are two power connectors for supplying external devices. Each is a locking Lemo connector with 4 pins for +5 V regulated, +12 V regulated, +12 V unregulated and ground. Adapter cables are available.
The SI-2K provides many of the input and output capabilities that might be associated with a workstation class computer in a video village scenario. In addition to the standard camera functions, there are USB 2.0 ports for future expansion, increased data storage capacity and a secondary DVI(HDMI) video

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output capable of display of 720p live video at full resolution.
The SI-2K Mini only requires power and data connections since the remainder of the functions are provided by the computer attached to the SI-2K Mini.

Power Switch
Please use the power switch on the right side of the camera to power down the camera prior to removal of the battery pack. Expect a delay of up to 30 seconds from the time power is applied to the live operation of the camera.   Whenever possible , shut down Windows properly using the Shutdown Icon in your SI Folder.

Front 12-pin Hirose connector
The 12-pin hirose on the front of the SI-2K provides power input for B4 lens servo motors mounted on the camera using the B4 lens adapter.

Monitoring

Monitoring option with the SI-2K should be conceived as <u>pure Video-Assist</u> Function. Due to recording performance it is only a low-res representation of the high quality picture recorded. For realtime display of the hi-res stream (up to 2K) captured, a low quality and low resolution debayer algorithm is used to display the image. On Set it is proven to be sufficient for focus and framing control supported by several focus assist functions provided inside SiliconDVR.
NOTE: If recording in quad (preview) mode please note that the camera is designed as a film camera and focus pulling classically has to be achieved via tape based markings.

Monitoring with the SI-2K Recording Unit:

Primary Monitoring:
The VGA Port carries the Primary Display which is able to show the SiliconDVR User Interface and Recording Information.

• 8.4" LCD Touscreen Monitor
The 8.4" LCD Touchscreen monitor requires a VGA video input (VGA connector on the rear panel of the SI-2K Recorder Unit), USB connection (rear panel) for touchscreen operation and power (available on the non-operator side panel). The 8.4" LCD Touchscreen monitor includes an active VGA signal splitter and offers an additional VGA output i.e. for use with the electronic viewfinder.

• Electronic Viewfinder
The electronic viewfinder requires a VGA video input (VGA connector on the rear panel of the SI-2K Recorder Unit) and power (available on the non-operator side panel).
Note:
If using the electronic viewfinder at the same time as the LCD Touchscreen, use the additional VGA output on the back of the LCD monitor to connect the

viewfinder.

Secondary Monitoring:
The HDMI signal is used to show the secondary display which is a representation of the image recorded, it shows up without user interface and can be turned on and off inside SiliconDVR user interface. The HDMI Port at the SI-2K Recording Unit carries a DVI Signal (1280 x 720 @ 60Hz). By using off-the-shelf HDMI to DVI Converters every kind of DVI Monitor can be fed.

There are manufacturers who provide solutions to convert the resulting DVI signal to HD or SD SDI video signal (i.e. Doremi DSDI-20). Please be aware that the SI-2K is rather designed as a Digital Cinema Camera than for purposes as a video camera.

Notes on the HDMI Port:
If your DVI or HDMI monitor does not work instantly at the HDMI Port, please quit SiliconDVR application and manually restart it again. If it still does not work, the output device does not support given resolution and/or frequency. Please also note, that using the HDMI Port instead of splitting the VGA signal for monitoring slows down overall performance !

Audio

Audio input is provided on the 15-pin 'D-sub' connector at the top of the electronics bay. An adapter cable terminates in two XLR connectors for stereo microphone inputs and two XLR connectors for stereo output. Note that these are not balanced inputs and should only be considered for scratch audio. Internal acquisition runs at 16 bit, 48 KHz per channel.

For quality recording, the M-Audio MobilePre external audio interface has been tested and is compatible with the SI-2K. Other audio devices are not supported by the camera and SiliconDVR.

A 1/8" stereo headphone jack for sound monitoring is provided to the right of the microphone connector.

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Recording Data and Storage

SI-2K Mini Camera Head

In addition to supplying power, the PWR/CTRL connection can be used for an external RECORD switch input and for hardware synchronization of multiple cameras using special cables provided by the manufacturer.

The NETWORK input is a standard Gigabit Ethernet data path using a more rugged Lemo connector for better data integrity. Cables are available in various lengths that terminate in:
- a male RJ-45 connector for input into a computer or a laptop or the LAN 1
  connector on the backside of the SI-2K recorder unit
- a female Lemo for tethered use with an SI-2K Recorder Unit – in this case
  power for the SI-2K Mini head is provided via the same cable

The maximum length of the connection is 30 m when the camera head is powered through this connection and 100 m if only data is transferred. Then the camera heads needs to be power from battery or mains on shorter distance into the PWR/CTRL socket.

SI-2K Recording Unit

The SI-2K Recording Unit is delivered with one removable hard disk carrier (Digital Standard Magazine) and a 160 GB hard disc for recording. The media carrier is connected to the SATA bus system of the Recording Unit.

The supplied Digital Standard Magazines are compatible with any 2.5" laptop hard discs, 5400 rpm or faster. Bear in mind that faster drives might be more useful when connected to an editing station, but will reduce battery life and generate more heat in the SI-2K.

Additional carriers, also for different media like i.e. RAID hard disk setups or solid state memory (Digital Raid Magazine, Digital Magazine SSD), are available from P+S Technik or Silicon Imaging. Please read the FAQ section on Recording and Storage on our website for more information.
 NOTE : Please swap drives during turned-off state of the camera !

Optional Recording Media
Optional carriers can support two hard discs enabling Raid use in Level 1 (Mirror for Security) and 0 (Stripe for Performance) as well solid options in the near future.

In addition, any mapped hard disk can be used for recording. This includes any device that are connected via the external USB ports. Be sure that any external drive supports a sustained throughput of 40 MB/sec. Two extra USB 2.0 ports are available on the back.

IMPORTANT:
If you want to use additional USB recording devices on the SI-2K please always add and remove them on and from the RUNNING SYSTEM (hot plug). Do NOT perform a reboot with any USB storage device attached to the SI-2K!! For more information please refer to the chapter Notes on Write Protection Filter.

Ethernet
Two gigabit Ethernet ports are available on the rear of the camera for future use. These will be used for integrating the camera into a fully networked video village (LAN 0) for file transfer and camera control of an attached SI-2K Mini Head (LAN 1).

Files and File system

There are two ways recording RAW Data from the Camera.

1. Uncompressed RAW at a Data Rate of up to 100 MB/sec (approx.) resulting in *.siv files.

For displaying images recorded in this format, the IRIDAS Product Line (www.iridas.com) supports both *.siv and cineform *.avi.

2. CineFormRAW (compressed) at a maximum data rate of currently 30 MB/sec (approx.) resulting in *. avi or *.mov files.

For displaying images recorded in this format, the free decoder plugin Neo Player (http://www.cineform.com/products/Downloads/DownloadNEOPlayerStart.htm) can be installed to run CineForm decoded movie files inside Windows Media Player or Quicktime Player Applications.
The standard file system on the disk enclosed by the exchangeable hard disk carrier must be formatted in NTFS.

Compressed CineForm RAW:
160 GB will approximately record 90 minutes at lowest compressed data rate (1 GB = 1024 MByte; recording time depends on settings and picture information).

Uncompressed:
160 GB will approximately record 25 minutes in uncompressed mode.
(1 GB = 1024 MByte; recording time depends on settings and picture information).

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Start the Camera

- Connect Accessories like Viewfinder or VGA or DVI Monitor.
- Connect Powersupply or Battery
- Dock your Magazine and Turn it on with the knob at the docking frame.
- Switch on the SI-2K Recording Unit

Boot time takes about one minute.

Camera Operation

To operate the camera either use the LCD Touchscreen functionality or in addition use the integrated mouse pad on the left side of the camera body. The sealed mouse pad is provided with a joystick-style cursor control and left and right mouse buttons. This enables the camera operator to make selections when no touchscreen is available (such as when only the electronic viewfinder is used).

In addition USB operating tools like a computer mouse, track ball or keyboard can be used with the SI-2K Recording Unit when connected to the USB connectors at the rear of the camera.

Create a Project

After Silicon DVR has started, browse to UTILITY MENU > NEW PROJECT and name a project on Harddrive D:\. Make sure, that the recording Harddisk is not C:

Note:

Read more about the Utility Menu in Chapter SiliconDVR Software > Software Operation

Browse to UTILITY MENU / CAMP REFS and change following recommended Settings for the current Versions of SI-2K Recording Unit running v571 of SiliconDVR:

FAN MODE = 2

QUALITY = 4

CINEFORM RAW

DISPLAY PREV = QUAD

DISPLAY REC/PLAY = HEX
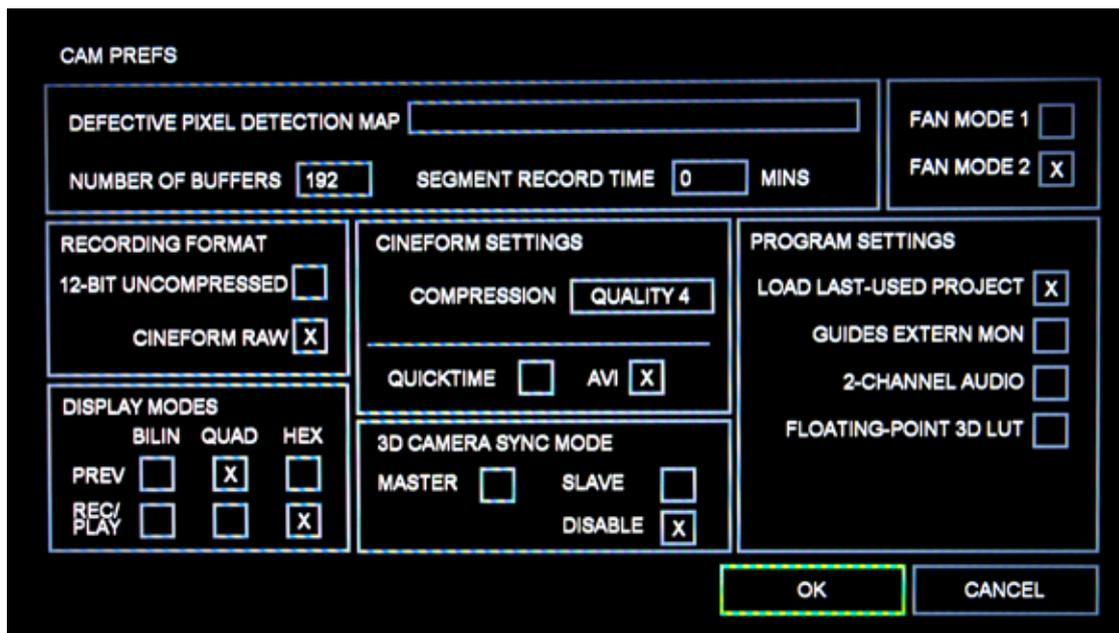
IMPORTANT:
Please note, that the software is designed for cross system use. That means that functionality could exceed recording systems which are restricted in performance. That makes the system futureproof in terms of upgrade options, but the user has to be careful in choosing settings.

Inside SiliconDVR go to UTILITY MENU/CAM PREFS to access Recording and View Settings.

Notes on CAM PREFS Settings:
Overall Performance and Stability of the System are depending on the Settings you choose inside CAM PREFS. Especially Display Modes combined with Resolutions and Framerates.

Confirm CAM PREFS with OK and EXIT UTILITY MENU to access RECORD Button.

Notes on Fan Mode Settings:
FAN MODE 1 varies the fan-speed based on the processor temperature. So at low temps, the fans run slower (and are quieter), and when the temps are hot, they run faster. This mode is good to use when outside or in hot environments. The processor has a protection mechanism that down-clocks the processor if it goes over 100C. Also recording is disabled when you hit 100C. So there are no worries about frying the processor (there is also a temp indicator in the status bar that lets you know the temp of the processor).

FAN MODE 2 keeps the fans running full-blast when not recording, and quiets them when recording. In fan mode 1, when it's hot, the camera does not get quieter when you're in hot temps, but if you are in a sound-critical environment,

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this can pose a big problem. Fan mode 2 will keep the fans quiet no matter what, although again, recording will stop at 100C. But once recording stops, the fans kick in at full-speed to keep the camera as cool as possible before the next recording.

Set Resolution and Frame Rate

- Browse to RESOLUTION / FRAME RATE and choose i.e.:
      2048 x 1080 @ 25p

- Confirm RESOLUTION / FRAME RATE with OK

- After that, the System will prompt to "SET BLACK". Close Lens and Iris to Set Black with for all Gains. If not, please choose "SET BLACK" manually.

Set Black

NOTE: better set black more often than prompted as the fixed pattern noise changes with the temperature of the camera !

- Cover the lens with the lens cap

- Browse to MAIN MENU and press SET BLACK

- Tick the check box, if you want to SET BLACK for all gains

- Press OK to start process, remoce lens cap only after process is finished

SET BLACK calibrates the black level of the sensor, performing a correction of any fixed pattern noise and column-to-column variations created from inconsistencies in the analog-to-digital conversion process, as well as removing any hot or deviant pixels. Fixed pattern noise on a CMOS sensor looks like a fixed „screen-door" effect, or like fixed vertical lines going down the image, and is typically visible in darker or gained up portions of the image.

All CMOS sensors have this attribute, but because this fixed pattern noise is a black pure offset, it can easily be removed through a subtraction process which the SET BLACK operations performs. Furthermore, Altasens CMOS sensor designs exhibit extremely low amounts of fixed pattern noise, further enabling the SI-2K to maintain clean blacks after a calibration operation.

After a SET BLACK operation, SiliconDVR saves the black frame for that resolution on the disk, so that it can be recalled the next time you boot the program or swich modes. This prevents the user from having to repeatedly cover the lens and SET BLACK. It also saves a listing of deviant pixels that are masked out, preventing them from being embedded in the recorded RAW files.

The frequency of having to SET BLACK will depend on the shooting environment and the subject matter. Typically after approximately five minutes from a cold boot, the camera will reach a temperature stabilization point where any further deviation will be insignificant compared to that which occured in the first five minutes.

Another black recalibration may not be necessary for hours thereafter, espcially if one is shooting complex scenery or brighter scenery that is not against dimly lit flat white subject matter (where fixed pattern noise, if it's apparent will typically be the most visible). If one is shooting in hot environment, or is changing the environment rapidly, black recalibrations may be necessary.

Also for dark scenes where the shadows are gained up higher, black recalibration may be required more often to make sure that there are no inconsistencies in the blacks with fixed pattern noise that gain may result from temperature variations within the camera as it runs.
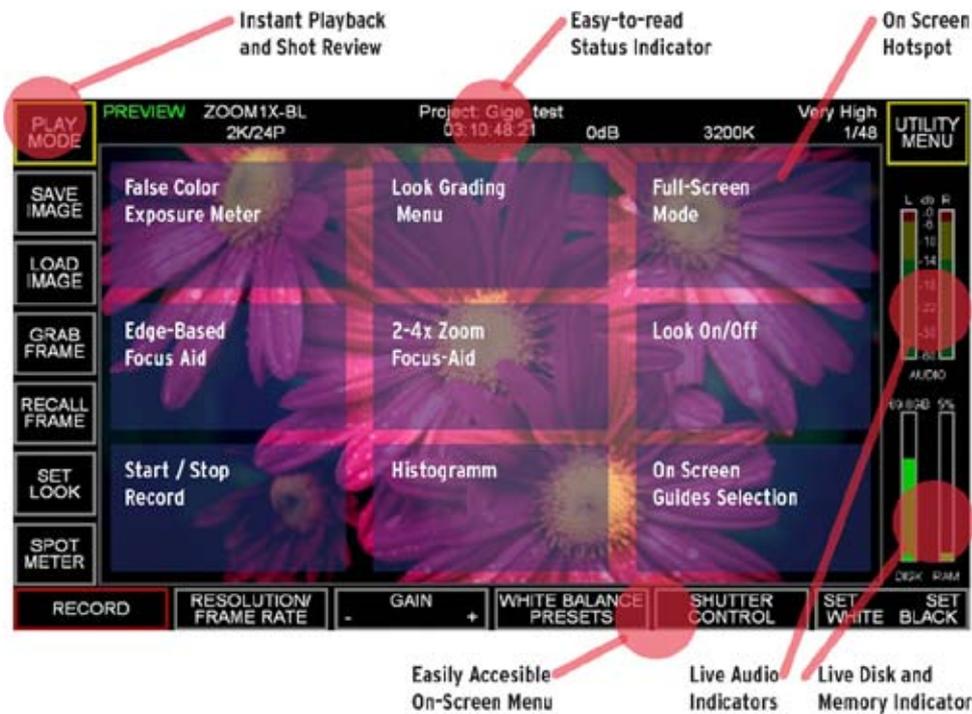
SiliconDVR and Operating System

SiliconDVR Software is a Windows Application. The SI-2K Digital Recording Unit runs an embedded Windows Version.

SiliconDVR Interface has been designed to record and playback files and to embed metadata such as non-destructive colour information or timecode.

The Interface is mainly designed for touchscreen use for smooth and quick operation. However it is also possible to control it via mouse or touchpad systems.

Note:
The on-screen Hotspots inside the picture area are touch sensitive for quick access tools for focus and exposure control.

The picture below shows the arrangement of the hot spots. For a detailed explanation of tools and the menu structure of SiliconDVR in general refer the the chapter SiliconDVR > User Interface

False Color Exposure Meter:
Luminance Distribution in a Scene on a pixel per pixel basis. Red is clipped and therefore overexposed. "Colour Temperature" shows the Luminance. Black/ Blue "cold" analog to low luminance, Orange/Red "warm" analog to high luminance.
Edge based Focus Aid:
Objects in Focus are marked in Red Color, whereas the rest of the picture is turned grey.
Star/Stop Record:
Record Hotspot
Look Grading Menu:
Embedded IRIDAS Colorgrading Interface.

Focus Aid Zoom:
Zoom and pan around for critical Focus adjustments.

Histogram:
A Histogram is displayed in the bottom of the screen to measure the overall exposure. As the Histogram graphically overlays the Recording Preview Picture, the overall performance will drop. Do not use the Histogram permanently.

Full Screen Modes:
Different Fullscreen Modes to switch on/off the User Interface are accessible here.

Look On/Off:
on/Off Toggel for 3D LUT defined in SET LOOK

On Screen Guides Selection
On Screen Guides features Overlay Masks of 16:9, 1.45:1, 2.39:1, 4:3 Safe Area ratios.

After quitting SiliconDVR (UTILITY MENU – QUIT) , the Windows Desktop shows up. A "SI" Folder on the Desktop links all necessary Windows Functions such as Windows Shutdown or ActivateRaw.exe.

Look Control

The idea behind Iridas Looks is to SIMULATE the color characteristics of the target medium such as a Filmprint or even an HD Monitor, since the RAW image itself looks flat.

Please note
that this is only a tool to simulate colors inside the SiliconDVR without affecting the RAW Image itself! Iridas .look files represent non-destructive color metadata based on 3D look up tables in a 32-bit floating point environment.

These can be modified with the integrated Iridas Speedgrade Version, which can be accessed through the hot spot button upper middle of the preview image.

Optional the .look files can be generated with the IRIDAS Software such as the Speedgrade Product Family and imported to the SI-2K Recoding Unit through USB connection.

SiliconDVR already carries preset .look files (C:Program Files\ Silicon Imaging\Silicon DVR\Data*.look

Exposure Control

ISO Rating
The CMOS sensor in the SI-2K is approximately „daylight" balanced for 5600K at ISO 160.

When shooting green-screen or blue-screen footage, in order to prevent higher digital gains (that in-turn produce higher noise) in the blue and green channels in order to match the response of the red channel, it is suggested to shoot with daylight balanced light-sources. Also daylight balanced light-sources will extend the „useable" dynamic range of the image around 1/3 to 1/2 f-stop (because the red-channel will not clip first).
With Tungsten Lighting and shooting at 3200K the sensitivity is approx. ISO 250.

Shutter
To convert from a shutter based on a time-based method (such as 1/Xth of a second) to a shutter based on a degree angle correlating to the spinning reflex mirror of a film camera, use this equation:

1 / [(360 degrees / Target angle) * Target Frame Rate] = Time based shutter (in 1/Xth of a second format)

So for instance, a 180 degree shutter at 24fps will equate to:
1 / [(360 degrees / 180 degress) * 24] = 1/48th of a second

A 144 degree shutter angle at 24fps will equate to:
1 / [(360 degrees / 144 degrees) * 24] = 1/60th of a second

Silicon Imaging

SiliconDVR Software

Software Activation and Licensing

There are two levels of software activation required for a fully operational work-flow:

1) the CineForm RAW encoder that works in conjunction with the SI-2K DVR application to encode the video stream, and the CineForm editing tools for your editing suite.

Silicon DVR is the Control Center for Recording and Camera Setup. A requirement to run Silicon DVR on the Camera or on a separate Workstation is the License and the Activation.

If you have purchased a Recording Unit by P+S Technik, the embedded SiliconDVR runs an activation personally licensed to you.
It should already be activated ! Do NOT deactivate by yourself.
If the license does not run on your device, please contact helpdesk@pstechnik.de.

SiliconDVR is shipped with a Cineform Serial Number with a limited number of activations (3 Activations): CFR2K-XXXXXXXXXX .
Activation is the important step to a working license and needs Serial Number and the System Code and a Name for referring the Activation.
This kind of activation is valid for Silicon DVR Version 1.571 and lower Versions.

Cineform Activation is needed to run SiliconDVR Application.

If SiliconDVR is not activated

You need a separate Internet Connection Line. Do not use Internet Connection on your Recording System with Silicon DVR Software installed to prevent misuse or virus attacks (Recording Unit or laptop/workstation). If you would like to deactivate or reactivate Licenses on the Recording Unit

How to de-activate or re-activate SiliconDVR

Note:
Please note, that you only have limited number of activations, you can activate your SiliconDVR three times. For re-use please take care to properly deacti- vate your system. We strongly recomend to contact our technical support team before de-activating or re-activating your license.
Please email to helpdesk@pstechnik.de

What shall I do if SiliconDVR is not activated

You need a separate internet connection line. Do setup an internet connection on your SI-2K Recording System with Silicon DVR Software installed to pre- vent misuse or Virus Attacks. (Recording Unit or Laptop/Workstation).

If you would like to deactivate or reactivate licenses on the SI-2K Recording Unit follow these steps:

1) Run ActivateRaw.exe
C:\Program Files\ CineForm\CineformRAW-2K-Codec\ActivateRaw.exe

2) If activated the pop up window shows Name, Serial Number, Activation Key, System Code. The System Code is generated randomly and automatical- ly on your system at that time. These are unique fingerprints of your hardware system

3) If not activated, please go to http://www.cineform.com/register.html and follow the instructions. Make sure you correctly type your email address, as the activation code is sent to you via email. Iif you consider to use our support and helpdesk, please always carboncopy or forward activation code with your product serial to helpdesk@pstechnik.de

4) Remember exact User Name given carefully since it is case and letter sensitive

5) Transfer emailed Activation Code and User Name into the popup window textfields and press activate.

Please note
that you only have limited number of activations. For re-use please take care to properly deactivate your system.
Only exception to connect your recording system to the internet it to reach the activation server for deactivation of your license! We recomend to contact our technical support team before deactivating your license - helpdesk@pstechnik.de

SiliconImaging

Notes on Write Protection Filter

Quit SiliconDVR (UTILITY MENU – QUIT), the Windows Desktop shows up. A folder named "SI" on the desktop links to all necessary Windows Functions such as Windows Shutdown or ActivateRaw.exe. The "Write Filter" toolset to turn on and off the Write Filter is situated here.

Why do we need a Write Filter?

In order to give the system a much higher reliability the software is equipped with a Write Filter that protects the whole internal system drive (path c:\) of SI-2K from having new data written on it.

This provides additional protection against corruption after the operating sys-ten (OS) has booted and prevents recordings to be stored directly on the internal system drive (path c:\), which would fill up the drive and shuts down the camera.

When does the user need to disable the Write Filter?

Normally you do not need to touch the write filter function.

IMPORTANT:
In normal operation mode the Write Filter MUST be "enabled" all the time – otherwise you run into danger of a corrupted software image and therefore a complete breakdown of your SI-2K camera. Even with enabled write protection you can change all settings within the SiliconDVR software.

There are three occasions when the Write Filter must temporarily be disabled:
1. Upgrade to a new version of SiliconDVR (lean or full installation)
2. CineFormRAW Activation
3. Any changes need to be performed by a user on the system like monitor resolution

How to deactive/reactivate the Write Filter?

IMPORTANT:
Systems will be shipped with FBWF enabled – it should be enabled for normal camera operation.

- Write Filter can be disabled by clicking on the short cut in the SI folder, "Dis-able Write Filter and Reboot" (Note that to change the state of the Write Filter, you cannot do a power off shutdown, only a normal shutdown)

- After the automatic reboot, the Write Filter will be disabled and SiliconDVR can be upgraded, the CineForm key inputted or any other necessary changes on the system can be performed

- After these activities are completed in disabled mode, there is another short-cut, "Enable Write Filter and Reboot". Selecting that will re-enable the Write Filter and reboot. After the reboot, the Write Filter will be enabled and the system will be ready for normal use. The state of the Write Filter (enabled or disabled) can always be determined by opening a console window and typing "fbwfmgr".

Restriction when using USB storage for recording

There is a conflict between the BIOS setting of the SI-2K camera and the Write Protection Filter on the system drive (CF Card - path c:\). So when attaching an additional USB recording Device (like a USB thumb drive/ USB stick/ USB HDD) besides the SATA drive in the internal 2.5" Drive slot AND rebooting the system, the Write Protection for the system drive (CF Card - path: c:\) of the SI-2K gets mixed up. At the same time recording onto that additional USB storage device is not possible.

Solution

If you want to use additional USB recording devices on the SI-2K please always add and remove them on and from the RUNNING SYSTEM (hot plug). Do NOT perform a reboot with any USB storage device attached to the SI-2K!!

Cineform RAW™ Encoder

For the SI-2K Digital Cinema Camera, the encoder will already be activated at the factory and nothing else needs to be done by the user. Up to 3 computers can be activated for recording at one time. Activations can be removed at the registrations website.

For the PC user, after the SiliconDVR software is installed, there will be a CineForm directory added to the start menu. A program called ActivateRAW must be run on the machine that will do the capturing. ActivateRAW will create a system code ("finger print") for this computer. Then, go to the registration site: **http://www.cineform.com/register.html** and enter this system code ("finger print"), serial number, company name, and e-mail address. An activation key will be e-mailed to the email address provided. Enter the Name and Activation Code into the ActivateRAW dialog EXCACTLY as they appear in the activation e-mail you received, and an activation confirmation message should appear. If the encoder is updated there should be no need to reactivate the new version.

SiliconImaging

Prospect 4K

Note: Any editing suite used in conjunction with a CineForm tool should be installed prior to the CineForm application.
Once installed, run the Activate.exe utility located in the Windows Start Menu:
Start > All Programs > CineForm > Prospect4K

Copy the 8-digit System Code from the dialog box. Then, go to the registration site: **http://www.cineform.com/register.html** and enter the system code, serial number company name, and email address. An activation key will be emailed to the address provided.

When you have received the activation code, run the Activate.exe utility and enter both the Name and Activation Code exactly as they appear in the email you received, and an activation confirmation message should appear.

NOTE: If your machine does not have Internet access you can still activate by managing the Internet transactions on any machine that does have Internet access.

Neo 4K and Prospect 4K License Notes

The Neo 4K and Prospect 4K software are each licensed for operation on one machine at a time. The licenses can be moved easily from one machine to another by deactivating the first machine and activating a second machine. Visit **www.cineform.com/register.html** for details.

When using the integrated SI-2K camera, when the SI-2K Mini is detached from the front of the SI-2K, SiliconDVR can still be used for recording on up to three total computers (including the SI-2K Recording Unit). To record with the same SI-2K Mini on a workstation or laptop, a second CineForm RAW software license must be procured from Silicon Imaging.

SiliconDVR User Interface

SiliconDVR consists of three main user interface screens to make general settings, operate the camera and playback recorded clips. In the following the three menu screens UTILITY MENU, MAIN MENU and PLAYBACK MENU and their tools are described in order of first use.

The Status Information is visibly in all three menu screens.

Status Information

Status indicators are placed at the top of the screen to indicate the current settings and mode of the camera.

Preview / Play / Record Mode
Displays the current operating mode of the camera.

Zoom/Mode/Resolution/Rate
Displays the zoom level (1-4), quadlet (Q) or bilinear (B) display and the present frame size and frame rate.

Project / Timecode
Displays the current project name and time used for the file timestamp.

Gain
The current gain setting

White Balance
Displays which of the presets or a user defined white balance LUT.

Compression
Displays the compression mode selected in the Utility menu.

Shutter Speed
Displays the current shutter speed

Silicon Imaging

Utility Menu

Always leave the MAIN MENU and go to the UTILITY MENU, when you first start the camera to make the basic settings and create a project name. Access the UTILITY MENU from the upper right corner of the MAIN MENU.

Each time the Record mode is entered, a new file will be created in the Project directory with a file name of the project followed by a timestamp. This creates an easy sequence of takes automatically.

Camera Preference Menu (CAM PREF)

Basic information about the operation of the camera is set in this menu.

- **Number of Buffers**
This is the number of frame buffers used by the DVR to store incoming camera data prior to Cineform RAW™ encoding. These buffers can be used to extend recording time when the encoder can not maintain the rate of incoming data – encoding continues and the buffers slowly fill until recording must be stopped to allow the buffer to empty. This is important for high frame rate shooting, 2K modes and scenes with a very high level of complexity as this slows the encoding process. TAKE CARE ! The number of buffers you choose diverging from the default setting could impact camera's stability.

- **Defective Pixel Detection Map**
Most defective pixels are automatically found and replaced using the black reference. If known pixels are bad, a separate file indicating each bad pixel can be created. The format is a tab delineated text file with an x coordinate, <tab>, y coordinate <cr> for each bad pixel.

- **Default Boot Frame-Rate / Resolution**
This is the default value for the camera and may be set to new values elsewhere.

- **Cineform RAW Compression Quality**
Adaptive Mode) The adaptive recording mode will dynamically change the compression to meet the scene complexity, maximizing the quality setting while preventing the RAM buffer from overflowing. So if the camera changes to Quality level 1, it will, when presented with a scene that can be recorded at Quality 4, increase the quality back up that higher setting. After a recording is finished, the last recording quality setting is used as initial starting point. Should a scene have changed radically, the recording will very quickly go back up to Quality 4 once the recording starts back up. You will not be „stuck" at Quality 1 if the scene can be encoded at a higher quality setting.

Quality 4) 3.5:1, or approximately 18-20MB/s from a 2K/24P stream at 0db gain.

Quality 3) 5:1 compression, or approximately 15-16MB/s from a 2K/24P stream at 0db gain.

Quality 2) 8:1 compression (approx), or approximately 10MB/s from a 2K/24P stream at 0db gain.

Quality 1) 10:1 compression, or approximately 8MB/s from a 2K/24P stream at 0db gain.

- **12 Bit Uncompressed**
Uncompressed raw sensor data (as opposed to Cineform RAW™) is streamed to the hard disk. If the disk access rate cannot keep up with the incoming video data rate, then the RAM buffer will fill and, once filled, stop the recording. Data rates depend on frame rate and resolution, but require up to 100 MB/sec.

The following check boxes provide a method for controlling the operation of the camera and software on startup.

- **Load Last Used Project**
When checked, the camera will automatically add the next recording to the previously selected project files, appending the current date stamp.

- **Auto Load Preferences**
The state of the camera when last used is stored and automatically restored when the camera is restarted.

- **Auto Save Black Image**
The last used black image is used for the next camera restart. Otherwise, the operator will be prompted to capture a new black image for each time the camera is restarted.

- **Audio**
The camera or computer audio inputs are sampled at 48 kHz, 16 bits per sample, two channels. Any device may be used as long as it is able to operate as a standard Windows audio device, showing up in the Windows Device Manager. This includes many (but not all) Firewire and USB audio interfaces.

- **External Display**
A second high resolution monitor can be connected. It is possible to display full HD on this monitor for real-time viewing. Typically a 1280x720 DVI monitor is connected and enabled in the Windows settings menu. This button will then enable the live output interpolated by either the quadlet or bilinear methods. The bilinear will take more system resources (CPU time) so it is important to have sufficient resources available.

Silicon Imaging

Project Setup

The Open Project and New Project buttons allow the user to create a new project or open a previously existing project.

- **New Project**

The project setup screen selects the location for the main project file (<project>.sil) and all of the individual captures. The project can be stored on any drive - exepect the system drice C:\ - with a drive letter mapped into the system representing an internal, external or network share as long as the continuous throughput to the drive is at least 15MB/sec.

IMPORTANT:

Do not use the C: drive as this is the system drive. Filling up this drive will disable recording.

The directory tree is negotiated by selecting subdirectories to move down the tree or the double dot (..) to move up one level. The onscreen keypad is used to enter a project name.

For computer operation, the keyboard can be used for file name entry.

Open Project
Use this menu to access an excisiting project saved on a drive

Timecode Settings

Type: Record Run
The timecode increments only when recording; i.e. the clock does not increment if not in recording mode.

Type: Free Run
The timecode always increments.

Source: Preset
This mode uses the timecode setting from the Preset Timecode Settings dialog area. Can be used in record or free run modes.

Source: Slave LTC
The preset timecode settings in the dialog section area ignored. The timecode is read from the external Adrienne USB time code reader.

Source: Time of Day
In this mode, the PC clock is used.

Preset TimeCode Settings
This section is used to input the timecode.

Color Bars

A standard color bar pattern can be sent to the display monitors – both the internal and an external. This pattern assists the user in doing a color alignment. A properly aligned monitor is strongly suggested in conjunction with 3D LUT 'looks' to view the actual look as it will appear.

Flip Image

Ground glass converters require that the incoming video image be flipped, top to bottom or left to right for correct viewing.

Quit

When using the SI-2K Mini with a laptop or workstation, this will exit the DVR application. <ctl> Q can also be used.

Serial Com

The camera head (SI-2K Mini) and the DVR are separate functional units. The SI-2K Mini has an internal processor running camera firmware. The control is over a virtual serial interface transmitted via the gigabit interface. For testing purposes, it is possible to send commands directly to the camera, bypassing normal GUI interfacing. This should only be done as suggested by P+S and SI.

Load Firmware

The firmware in the SI-2K Mini can be updated in the field. On occasion the operator may be provided by SI with a file. This file is pointed to by Load Firmware and will be automatically sent to the SI-2K Mini head for updating.

Main Operation Menu

Black Setting

During the initial use, the software will detect a lack of a black reference image and automatically requests the capture of a reference:

Completely cover the lens and click on OK. This performs two functions. First, the image black level is set for every pixel. Second, a bad pixel map will be created for any pixels that are outside of the normal range of offsets and corrected automatically in the RAW file.

There are two control areas of the viewfinder. First is the set of touch buttons surrounding the live display. Second, for the most often used operator functions, there is a nine location 'hot spot' grid superimposed on the viewfinder. More information on this and other aspects of the main screen are described in a section below.

Set White/Set Black

Set Black has been described above for setting both the black level and bad pixel map. White balance allows the user to create a unique white balance table based on the current image. A white card exposed to approximately a 70% level occupying 100% of the image area is placed in front of the lens and the SET WHITE is selected. Alternatively, the loupe can be used for more localized metering.

White Balance Presets

There are standard white balance presets to approximate the temperature of typical lighting conditions. If a user white balance is created, this is added to the list of options.

Gain (+/-)

The analog gain of the camera is incremented and decremented from -3dB to 12 dB in increments of 3 dB. More gain provides more light sensitivity at the expense of increased image noise, analogous to increasing ISO ratings of film.

Resolution/Frame Rate

The standard resolutions supported are 2K (2048x1152 / 2048x1080 / 2048x856), 1080p (1920x1080), 720p (1280x720), 540p (960x540).
For 2K, the supported frame rates are 23.976 and 24fps. For 1080p, the supported frames rates are the same as 2K plus 29.97 and 30fps.

For 720p, the frame rate is currently 72fps. An upcoming software release will add 12, 18, 21, 23.976, 24, 25, 30, 48, 50, 60, 72 to the already existing 85 fps.

In time-lapse mode, every N th frame is captured. For example, if the frame rate is set to 24 fps and the Nth frame is set to 48, one frame will be captured every two seconds.

Shutter Control

The shutter speed of the electronic shutter is selectable over the range of 1/48th of a second to 1/500th of a second.

Syncro-Scan Offset
To synchronize with monitors and fine tune the shutter speed, syncro-scan offsets the start of the exposure time in the frame. Every increment moves the start of the frame exposure (shortening the exposure time) by X lines.

Extended Shutter Mode
The exposure time can be extended over multiple frames in this mode.

Record

The Record button or Record hotspot initiates recording in the currently selected mode. The file is saved in the project directory previously selected and the name that will be saved is the current project name, data and time as an avi file. If the buffer fills to capacity, recording will stop and the existing captured video will be saved. Recording can begin once the buffer has been filled.

Status Information in Main Menu

Audio
The audio level for the stereo inputs selected at the operating system level is shown. Level adjustments are done through the sound control panel that is part of Windows or with whatever toolkit was provided with the sound capture hardware. An indicator shows with the sound level has reached clipping.

Silicon Imaging

RAM Buffer Indicator

The buffer space allocated in the CAM PREFS menu is used to buffer the incoming video. This buffer space is shown visually and numerically. When the buffer is filled, the recording operation will stop. No data to that point will be lost but no further data can be recorded until the buffer is emptied to disk.

The buffer gauge is an excellent troubleshooting tool. A slowly rising buffer indicates that the CPU is not able to compress the incoming data at a fast enough rate. A very rapidly filling buffer usually indicates that the disk system is not accepting data at a fast enough rate. This is typical for uncompressed mode.

RAM Buffer Overflow

The on-board RAM buffer prevents any dropped frames from occurring during capture. Should disk speed in the case of Uncompressed 12-bit recording or the processor speed in the case of CineForm RAW recording not be capable of keeping up with the recording rate, eventually the RAM buffer will be consumed, and recording must stop. When this occurs a message box appears notifying the end-user that the RAM-buffer que is being written out to disk. After the RAM buffer is flushed and the recorded contents are safely written to disk, the live preview will resume. This functionality ensures that files are always safely written out to disk, and with enough RAM also allows under-powered machines to safely record in uncompressed 12-bit or high-resolution CineForm RAW.

Remaining Disk Space

The amount of available disk space on the currently selected disk is shown.

The potential for problems recording increase as the disk reaches capacity. Because a disk is a series of concentric circles rotating at a fixed speed, the write speed slows as you reach inner tracks. Also, if the disk has been used a number of times and has had individual files erased, the disk can become fragmented, again slowing the access rate.

Hot Spots on the Preview Screen

Hot spots are nine areas in an invisible tic-tac-toe pattern in the main viewing screen. Each area either toggles a function on and off or sequences through a series of options for that mode.

The basic layout is:

False Color Exposure Zone Meter

Zebra or pseudo-color is an exposure tool. Unlike the spot meter, which gives you the exact exposure in a small area, zebra divides the exposure into ranges and provide a visual indication for the entire image.

The meaning of each color is shown by the key in the metering area.

Instant Playback and Shot Review — Easy-to-read Status Indicator — On Screen Hotspot — False Color Exposure Meter — Look Grading Menu — Full-Screen Mode — Edge-Based Focus Aid — 2-4x Zoom Focus-Aid — Look On/Off — Start / Stop Record — Histogramm — On Screen Guides Selection — Easily Accesible On-Screen Menu — Live Audio Indicators — Live Disk and Memory Indicator
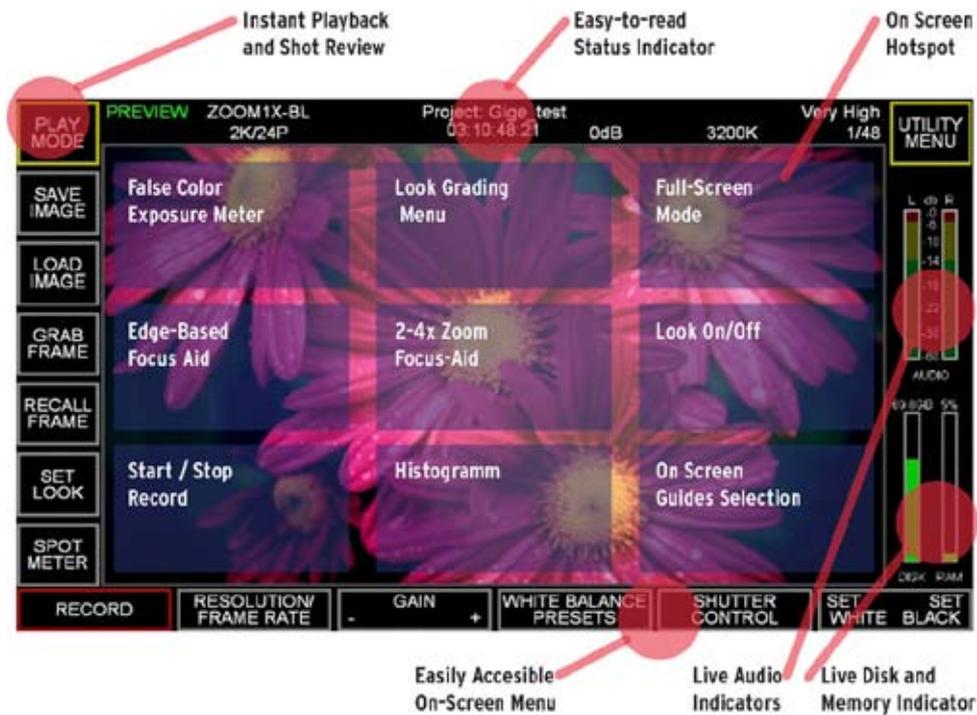
Edge-Based Focus Assist

When the focus assist is enabled, a real-time Sobel edge detector is run.
As an edge in the picture turns redder, it is in better focus. This is because the edge is sharper. This does not mean that the smoother areas are out of focus, just that they have no well defined edges.

Record

A recording can be begun either by using the touch button Record at the lower left or by using the hot spot in the lower left. In either case, the word RECORD will show in the upper left and continue until the hot spot is hit again. The clip will automatically be saved to a file with a file name comprised of the project and the time the recording began.

Look Control Menu

In this menu you can adjust your .look files with the intergrated color correction tools. Please refer to the chapter LOOK CONTROL for further information.

Zoom

To assist in focusing, a centered zoom mode is available. Each time the center of the screen is selected, the image cycles through a zoom of 1x, 2x, and 4x. The level of magnification is shown on the upper status bar.
Using the widgets on the screen during the zoom mode allows the user to scroll around the zoomed in window.

Silicon Imaging

Histogram

A real-time histogram is displayed across the bottom of the image.
Individual channels of red, blue and green are shown. This is a total histogram of the image showing the number of pixels (vertical axis) vs. the digital value from dark to bright on the horizontal axis.

Full Screen

Full screen sequences through three states. These are the standard display with all menus and information, a maximized viewfinder with basic project information superimposed and maximized viewfinder with no information.
In all of these modes, the hotspots are still active.

Look On / OFF

Enables or disables the look (3D LUT) feature. This feature applies to display only – recorded data will not have the look stored as metadata.

On-Screen Guides

If the final output format is known, guide bars can be added to the screen to assist in creating video that can be cropped while maintaining the required field of view. Multiple taps on the hot-spot toggle through a series of guides. These guidelines have no effect on the recorded frame resolution or picture area.

Additional Tools

Spot Meter/Loupe

A 10 pixel by 10 pixel section of the display is enlarged with a 4x zoom. This spot meter shows the average luminosity within the enlarged area.

If a white balance is done while the spot meter is active, only the white region within the loupe is used for the white balance.

Frame Store Operations

There is a single frame buffer that can be used for previewing of compositing effects and single frame capture. Since is only one buffer available, loading a new image into the frame-store buffer erases the older image that was currently in the buffer. The controls for the frame-store are on the upper left-hand side of the main screen.

Save Image

The current image in the preview is stored as a dng, jpg, dpx and bmp format in the current project directory.

Load Image

A bmp file is loaded into the frame buffer. Note that only *.bmp files can be read.

Grab Frame

The current live image is loaded into the frame buffer.

Recall Frame

Three display modes are cycled by repeated selection of Recall. Live video, frame buffer image and a 50% live/buffer composite are shown. This composite does not effect recorded video.

Playback Menu

Within Play mode, the most recent clip recorded can be played back or a previously generated clip can be loaded using the Load New File button. In either case files are played in the viewfinder.
A timeline is shown at the bottom of the display that can be clicked on to see different portions of the clip.

Export DNG

The current clip is exported to DNG format using the same filename.

Look Control

Set Look and Look Library

The SET LOOK command opens the LOAD CAMERA LOOK LIBRARY. Inside this library control panel are a selection of up to 4 .looks that can be loaded and quickly selected between, and also controls for modifying those looks, selecting preview and record LUT's, and managing which .look files are placed inside of a project's folder for inclusion with recorded files.
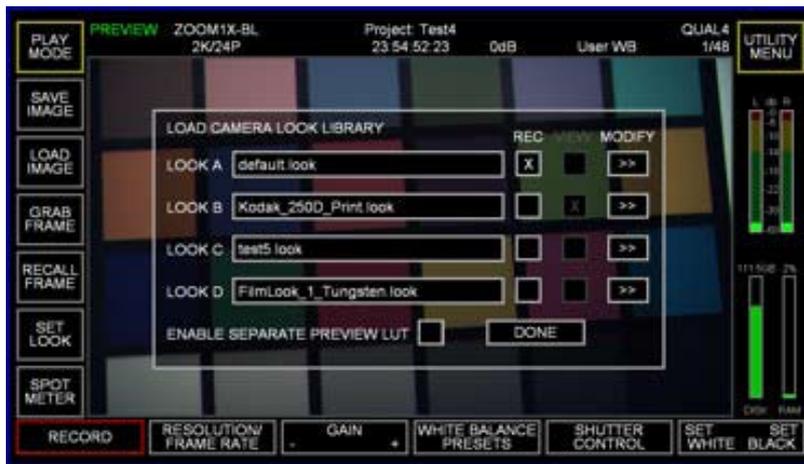
LOOK A, B, C, D are the four looks that are made available for quick-switching between look files without having to go into the file system browser in order to select a look file each time one is desired. Also all .look files that are loaded into this library control panel are copied into the project directory so that any .look that was potentially used on-set is also available with the recorded files in post-production/editing. If the user selects a new file to load into the library from the file system, or modifies and saves a new .look file, at the time of adding the .look to the list (replacing what was there), that new .look is added to the project directory. The older .look file that was replaced is not deleted from the recording project directory, so that any .looks that could have been recorded with files in the project directory are safely maintained.

In order to load up a new .look file into slots A, B, C, or D, simply click on the name of the file and the file-browser will open into the /SilconDVR/Data/ folder of the recording machine. If there is another location where you want to load the .look file from (such as a thumb-drive), simply browse to that new location using the file browser directory controls (the .[dir] and ..[dir] selection at the top of the file-browser screen or the drive selection letters). If a .look is loaded from another directory that is not the /SiliconDVR/data directory, SiliconDVR will automatically copy that LUT into the /data directory for future use so that the user will not have to continually browse to remote directories just to call up the same .look file.

There are two important columns of note in the LOOK LIBRARY, the REC and VIEW selection columns. When the ENABLE SEPARATE PREVIEW LUT check-box is selected, this allows the end-user to select a different .look file for recording and embedding as metadata in the header of the AVI/QT file, versus what will be viewed on screen. Typical use of this application is for users who want to record with a LOG or RAW LUT (so that files that are on-disk when they are played back or imported into editorial or color-correction have a LOG LUT applied), but want to view a „normal" print-style LUT in the preview window during shooting. This separation allows the record LUT to not have the effects of the preview LUT „baked" into the LUT that is applied to the metadata of the recorded AVI/QT file. It also aids workflows that are based on a film-calibration system that requires Cineon LOG input. In this situation, a user will set a Cineon-style LUT for the record LUT, but preview with a LUT that has a reverse Cineon curve. The cinematographer, director, and any other viewers will see the „end-result" on-screen during shooting, but the recorded files will have the appearance of a Cineon-calibrated file. When these files are imported into a system with a proper Cineon-reversal LUT, they will appear „normal" again. If the user were to apply the preview LUT to the recorded files, it would interfere with the Cineon-reversal LUT in the post editing bay that was expecting Cineon-LOG input. Should a situation like this occur though, because the LUT's are metadata, they can be swapped out in post to calibrate the files to whatever standard is needed.

When swapping between LOOKS A, B, C, and D, the image in the preview and on the external monitor will change live with each selection, aiding the user in selecting the correct LUT. After the selection process is complete, the user can press the DONE button and proceed with recording.

SiliconImaging

IRIDAS Color Correction Mode

Hitting the MODIFY button in the LOOK LIBRARY will open up the IRIDAS color-correction control panel. This control panel has a powerful set of comprehensive controls that allows the end-user to color-correct the preview image in real-time to obtain the look for the image they desire in-camera. It utilizes the same 32-bit floating point color-correction engine of the IRIDAS SpeedGrade OnSet family for high-precision color-correction operations.

The IRIDAS color-correction control panel is split into three main areas: 1) the control panel modes and metering indicators, 2) file management and luminance separation controls, and 3) the control surface itself.

There are a total of three control surfaces to chose from with CONTROL SET 1, CONTROL SET 2, and the KEYER. Each of the two main control sets (1 and 2) are segmented between controlling the entire luminance range with the OVERALL control, or isolated to just the HIGHLIGHTS, MIDTONES, and SHADOWS.

CONTROL SET 1 comprises the hue-offset color-wheels and controls for color offset (additive), gamma, and color gain.

CONTROL SET 2 has additional controls over color temperature, contrast/pivot, overall gain, and saturation.

Right-clicking on any of the color-adjustment widgets activates a „virtual track-ball" mode. This allows the user to move the mouse around like a trackball control for fine increments of the image. This is especially effective with the color-hue wheels in CONTROL SET 1. To exit the virtual trackball mode, right-click a second time.

Clicking on the histogram indicator swaps between a live histogram and a vectorscope. An important note about the histogram and vectorscope in the IRIDAS control panel is that unlike the indicators in the main GUI, these IRIDAS-specific indicators reflect the values of the look applied to the RAW image data, not the underlying RAW values like the main GUI indicators. This is because the main GUI indicators are ideally suited for measuring the exposure of the RAW image data, where-as the histogram and vectorscope in the IRIDAS control panel allows the user see how their color-correction is affecting the final image. Clipping that happens during exposure is unrecoverable, hence the indicators in the main GUI cover the RAW data only. If the RAW data is not clipped, then clipping from the .look file can be recovered in post. Therefore for the main GUI it is vital that the user have live information on the exposure level of the RAW data and not the effects of the .look file which can be misleading for actual exposure-level of the RAW image data.

The general workflow the IRIDAS color correction mode is that a user loads a pre-existing .look file (typically the current .look file) into the LOOK LIBRARY, and then modifies it using the MODIFY button associated with that look. Alternatively the IRIDAS control panel can be opened by clicking on the top-middle hot-spot, at which point it will modify the current .look.

The control panel uses the current .look XML to set the color-correction controls as an initial base for starting a color-correction from. So for instance, if the gamma and color-gain operations were modified in the .look XML, the initial screen when loading the IRIDAS control panel would reflect those changes to those controls in the interface color-wheels and sliders.

When the user has completed a color-correction, it is very important to first press the SAVE button in order to save-out a new .look file. Then the user can press the DONE button and see their new .look in the main GUI and replaced in the LOOK LIBRARY slot. At this time it is also copied into the main project directory for access in post-production. Simply pressing the DONE button cancels the current correction and exits the IRIDAS control panel with no modification to the .look file.

Silicon Imaging

Keyer Module

The Keyer mode in the IRIDAS color correction panel is a special mode that allows users to preview keys on-set in the context of the subject they are shooting. Keys can be set on either green or blue-screen using a real-time RGB difference keyer, and backgrounds can be composited behinds subjects to give the shooter an indication of how a final key and composite in post will look. „Problem Areas" and other green or bluescreen issues can be quickly diagnosed and solved on-set rather than waiting to defer decisions to post where mistakes can cost time and money, especially if re-shoots or extensive rotoscoping is required.

Another important aspect of the keyer module is that the settings are saved inside the .look XML, so when the user recalls the .look and applies it to the same clip inside another IRIDAS compatible application, the keyer settings are transmitted intact, and the same key is applied to the footage in post as was visualized on-set, giving a WYSIWYG keying experience from set-to-post. The distinction though needs to be made between the keyer and other color metadata information that also travels with the .look file. The keyer itself is a filter, and is therefore not a part of the 3D LUT that the user is creating when making color-corrections in the IRIDAS control panel. Therefore when the user opens up a clip they have recorded in post in an NLE or other media player, the keyer information will not be applied to the clip by the CineForm codec engine, which is only applying the 3D LUT portion of the .look file to the clip in real-time. In order for the keyer settings to be re-applied to a clip in-post as they were in the camera, the .look must be applied to the clip in an IRIDAS compatible application, so that the same filter-graph that the IRIDAS engine is creating in the camera to preview the live green or bluescreen can be correctly accessed and reproduced in post.

The keyer is downstream of the color-correction filter path of the IRIDAS pipeline, therefore modifications in the color-corrector portion of the control panel will affect the quality and other aspects of the key. This can be especially effective in allowing the user to color-correcting the image for the optimal key.

The RGB difference keyer works on a „threshold" principal, where the lower the threshold, the more green or blue is keyed out. The general workflow is that the user picks the screen color using the GREEN or BLUE buttons, and then reduces the threshold until a proper key is made.

The default background behind the key is a GREY MATTE, and this substitutes a neutral grey color for the keyed out areas of the image to show the user the quality of the edge-matte, and it also helps to pick out any areas of bright or dark corruption on the green-screen such as excessive noise, glare, false edges, etc. In order to view the background image, simply click the GREY MATTE button, and it will toggle off.

If an image is already in the frame-store of the camera, the user can see this image by toggling the GREY MATTE off, but if there is no image in the frame-store, then the background will simply be black. By clicking on the LOAD MATTE IMAGE, the user can load up a .bmp image as a background to visualize the effectiveness of the key. This image will also be loaded into the internal frame-store of the camera, so it will be available after exiting the IRIDAS control panel as well.

By default, the keyer is in a COMPOSITE mode that composites either a GREY MATTE or background image from the framestore with the keyed out foreground image. Alternatively the user can isolate the ALPHA, the BACKGROUND, or the FOREGROUND using the associated buttons on the interface. If the user would like to make additional color-corrections to the image in CONTROL SET 1 or 2 without having the keyer active, activating the FOREGROUND mode will deactivate the compositing effects of the keyer.

After the key is made, simply hit the „SAVE" button, and save out the new .look file. After pressing the DONE button, the user will be taken back to the main screen, where the key will then be applied to the subject in real-time in the main preview display. Note that if there was no background image loaded into the framestore of the camera to composite behind the keyed source image, there will be a black background in the keyed out areas of the subject image.

Silicon Imaging

Shooting with the SI-2K

Lens Selection

The lenses used with the Silicon Imaging cameras will have tremendous effect on the final quality of the image. No amount of post processing can repair content shot with poor optics.

C-Mount

The requirements for a C-mount lens to work:

1) The lens must be C-mount and not CS-mount (same thread, different back focal length, the CS-mount is used mostly for surveillance)

2) The lens must have an image circle of at least 2/3" (the real sensor size is 10.24 mm x 5.76 mm or a 11.75 mm diagonal) or vignetting will occur.

3) The lens should not be designed for 3 chip cameras. (these lenses have differing path lengths for each color and the lens corrects for that)

If the lens differs from 2/3", there is a multiplying factor. For Super-16 lenses, the multiplier is about 1.1, for 35 mm lenses, it is about 2.5.

PL-Mount

An Arri PL-mount can optionally be used. Super 16 lenses are an ideal match in optical circle size and have minimal magnification. 35 mm lenses will work, but will have a 2.4x magnification factor for 2K images.

B4-Mount

Because the SI-2K is a single chip camera, from an optical point of view, it behaves more like a film camera than typical 3 chip cameras. The B4 adapter includes optics to correct for the color path length that is inherent in 3 chip digital camera systems. B4 lenses designed for 2/3" sensors are an excellent match.
Note: Please use B4 Lenses on the B4 Mount only for HD Resolutions to prevent cushioning-

Other Mounts

Other lens mounts are available (see the pricelist on-line). Keep in mind that 35mm lenses will include a magnification factor.

Cleaning Optics

Ideally, the optics behind the optical low pass filter (OLPF) should remain clean. If debris does get behind the filter, two screws with pads to protect the filter can be removed to give the user access to both the back of the filter and the sensor cover glass.

All cleaning should be done with the same care as would be shown with a quality lens. First, compressed air should be used (without shaking the can to avoid spraying propellant). Next a soft lens brush can be used to dislodge particles. If this fails to properly clean the optics, a liquid optic cleaner and lens tissue, micro fiber cloth or lintless lens swab can be used with care.

Silicon Imaging

Exposure Control

Introduction And RAW Pipeline
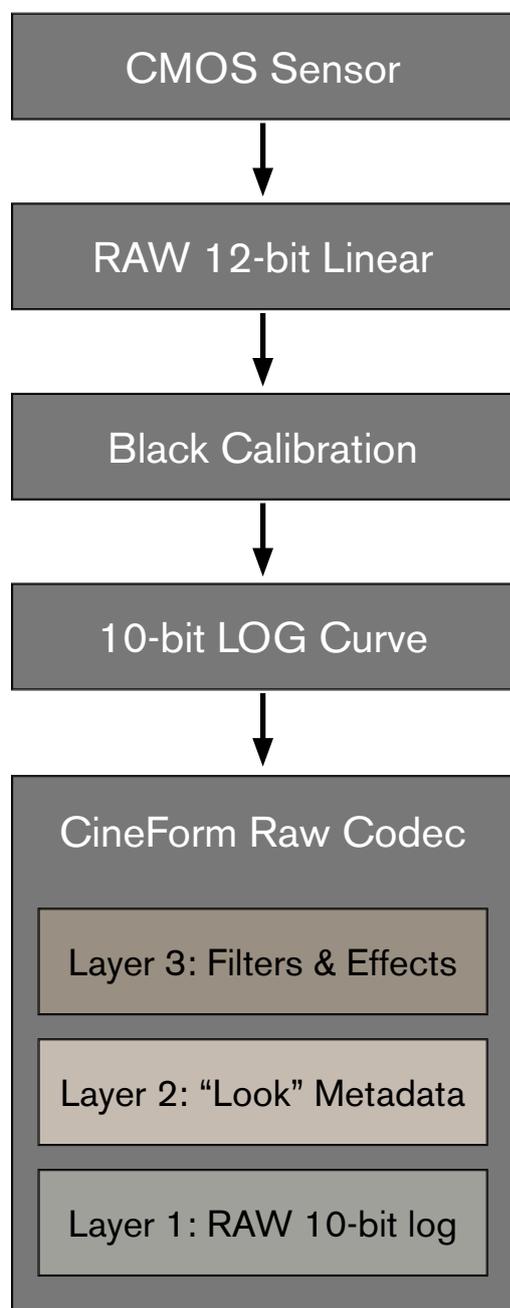
Figure 5.1: RAW Data Pathway

At the heart of the SI-2K camera system is an Alta-Sens 2/3" CMOS sensor with an overall dynamic range of 69 db from the noise floor to white-clip. Using an on-board A/D converter, data is converted from analog signals on the CMOS chip to a photometrically linear 12-bit signal that is then transferred as RAW data over 1000BASE-T from the camera head to the PC controller, whether it is an external system in the case of the SI-2K MINI, or the internal embedded system in the SI-2K.

Once the RAW data is inside the PC, its black-clip level is calibrated and the linear 12-bits is converted to 10-bits using a simple logarithmic profile curve. This is a fixed value curve, designed to give the maximum quality for creating an information-rich digital negative without wasting bits or encoding too much noise in the visual domain. A logarithmic curve is used as it is a more natural representation of the way the human visual system reacts to light, and has a two-fold advantage: it preserves the photometric dynamic range from the 12-bit linear data (linear data is not gamma corrected and would look very dark on a normal monitor) while also optimizing the image for compression into CineForm RAW™.

After the 10-bit LOG curve is applied, the image is sent to the encoder and then written to disk in the camera-native color-space and no white-balance is applied. This minimal amount of signal processing allows for the maximum dynamic range from the camera to be preserved into post. All color information that is used to normalized the data on the screen is saved as a separate layer of metadata at the time of recording, allowing the end-user to make an unlimited amount of adjustments in post by adjusting the metadata layer rather than making non-reversible adjustments to the RAW data.

The layer-based approach of the CineForm RAW™ codec allows a host program that does not have the ability to natively work with RAW data, such as all current NLE systems and post-compositing tools, to work with the RAW file formats as if it was another native RGB/YUV codec file by "wrapping" the RAW data in an AVI or QuickTime format and then presenting that data to the program in a native format it can read.

The RAW RGB format conversion is done on-the-fly in real-time at the codec level, and at 32-bit perchannel floating point resolution, allowing for super white and black values to be preserved. Because the host application sees the RAW data through the codec wrapper as native RGB or YUV data, normal filters and effects in the host application can be applied to the image without destroying the underlying RAW data information.

Should a filter (Layer 3 in Figure 5.1) or the .look file 3D LUT (Layer 2 in Figure 5.1) "clip" data that is still present in the RAW data (Layer 1 in Figure 5.1), the CineForm RAW codec is able to preserve the over-white values in it's native 32-bit floating point processing color-space. In applications that are 32-bit floating point aware, these clipped values can be brought back into the visual space by additional dynamic range compressing filters.

Exposure Meters

SiliconDVR provides three methods to give the user feedback for exposure control. There is a Spot Meter which reads back an average luminance value for a 10x10 pixel area, a False color 6-zone meter for allow the user to see what pixels are falling in a given luminance range in the context of the entire image (rather than a waveform which is an abstraction that does not allow the user to actually see what pixel values are exposed at a given value in the context of the image), and an on-screen RGB/CMY histogram display.

To use the Spot Meter, click on the SPOT METER button in the lower left-hand corner of the main screen. A box will appear on-screen showing the luminance value that corresponds to an average of the center 10-pixels. By clicking on the screen, the spot meter can be moved around to various locations and used to sample different points of the scene for exposure values. The scale of the spot meter is from 0-100%

The 6-zone false color exposure meter is used to visualize the luminance value of a given pixel in the context of the scene. Dark blue values are for shadow areas below 20% luminance, and the scale increases through various colors until red is reached, representing near clipping and clipped values. The zone meter is a continuous gradient, where-cross-over values allow the DP to see exactly where on the scale of 0%-100% a pixel value is exposed at, rather than threshold values which would only show what given zone a pixel is being exposed at.

Note: The exposure controls monitor the RAW 10-bit log data, not the modifications of a .look file 3D LUT. This is so the D.P. can see the effects of exposure on his digital negative, providing as much information as necessary to get the look desired rather that accidentally clipping data because the .look 3D LUT was higher-contrast and masking valuable information to maintain a proper exposure at the RAW data level.

Nominal Exposure Control

The RAW 10-bit log curve of the SI-2K camera delivers over 11 f-stops of dynamic range. By nominally exposing the native log curve at an ISO of 320 under a 3200K light-source and 250 under a 5600K light-source, 4.7 f-stops of dynamic range can be visualized between an 18% middle grey card and the highlight clip point. An additional 5.6 f-stops is available below the middle-grey point using this exposure setting. Additionally these settings should set the 18% grey card to a luminance of 40% per the ITU-R709 specification for an 18% grey card reflectance value.

Because the SI-2K shoots RAW digital information and preserves the entire dynamic range of the sensor data for the end-user, the SI-2K has a nominal ISO value for a given 18% grey-card reflectance value, but not a "fixed" ISO value. Should the dynamic range of a scene require less than 4.7 f-stops between middle-grey and white-clip, the D.P. can decrease the ISO of the camera, rating it at ISO 200 or 160, etc. in order to gain signal-to-noise ratio basically pushing more data to the "top" of the dynamic range curve where there is less noise in the signal. When rated at ISO 160 under a 3200K light-source for instance, the camera will have only 3.7 f-stops between an 18% grey card exposed at 40% luminance and 100% white-clip, 1 f-stop less than at ISO400, but the overall noise-level of the signal will be reduced. Alternatively one can expose an 18% grey card at 50% reflectance, and this will have the same net effect as rating the camera at ISO 160.

Note: In the mid-tones there is approximately a 12% reflectance meter difference for 1 f-stop of exposure change. This value changes slightly as one exposes towards the extremes of the curve.

Exposing with the Histogram

To achieve the best exposure for a given scene, and preserve the maximum amount of clean data in the RAW "digital negative", one should try to expose "to the right" on the histogram.
The on-screen histogram in the SI-2K represents a distribution graph of the amount of all the values in a scene. Moving towards the left of the histogram describes darker values, while moving towards the right of the histogram describes lighter values. At either end is the maximum and minimum values that can be stored in a 10-bit encoded file. The height of a given point on the histogram describes the amount of pixels exposed at a given value along the 10 bit scale. When more pixels in a scene are exposed at a given value, the graph is taller at that point.

By exposing "to the right", the D.P. sets the camera's exposure so that for a given scene, as much of the scene value information as possible is contained towards the right-side of the histogram without letting values clip. Using this methodology in combination with the 6-zone exposure meter, the D.P. can exactly visualize the exposure for a given scene, knowing not only the value distribution of the pixel values in the scene, but what pixels correspond to the different values settings, especially those pixels that are at or near the clip value of the sensor's ADC.

Using .look 3D LUT files

The SI-2K camera system has an integrated 3D LUT engine that utilizes IRIDAS .look files and color-correction data from Speedgrade OnSet. By exporting a DPX color image to Speedgrade using the SAVE IMAGE button (see Chapter 3), the user is able to color-correct the RAW 10-bit log data, and then re-apply that color-correction information back into the camera for real-time shooting and visualization of their desired "look". The implications of this workflow are quite powerful, considering that a 3D LUT can describe any series of non-linear color-correction changes including gamma correction, saturation, hue-shifts, selective secondary corrections, etc. This essentially makes the camera a "blank-slate", where using the RAW 10-bit log data as a reference source, an unlimited amount of variations and/or visualizations can be achieved to make the camera "look" like almost anything imaginable.

During recording the .look file information is saved in a layer above the RAW 10-bit log data, and is rendered in real-time during playback at the codec level. This makes the .look metadata non-destructive, and .look files can be swapped out in the post process if they are not deemed to be the desired LUT the D.P. would have applied to the footage. Because the .look file is a portion of the real-time pathway in the codec decoding engine, swapping a .look file is a real-time operation that does not require re-rendering for visualization. Also because the CineForm RAW codec engine has a 32-bit floating point processing pipeline, any information that a .look file might "clip" when applied to the RAW data can be retrieved using the host color-correction filters of the NLE, DI, or compositing application as long as the RAW data itself is not clipped.

In the film world, the relationship between a .look file and the RAW 10-bit log data is analogous the difference between the original color negative and the film print. Typically the D.P. exposes the negative, and then during the printing stage, he will apply color-corrections and exposure adjustments to "print-up" or "print-down" the negative and achieve his desired results. As a non-destructive metadata layer above the RAW 10-bit log data, the .look file modifies the RAW data in a similar way, only that now an unlimited amount of variations in film-prints can be visualized non-destructively if one chooses. Furthermore the DP can shoot on-set and use the .look 3D LUT files to non-destructively visualize what the end-print will look like, and adjust his lighting scenarios and fill-ratios to fit the look he is trying to achieve.

SiliconImaging

A

Technical Specifications

Digital Cinema Initiatives Compliant 2K
Digital Cinema Camera

- 2/3" 16:9 high-dynamic range CMOS Imaging sensor with 5um pitch

- Full-raster, 2K DCI-compliant resolution progressive scan sensor

- Direct-to-Disk Recording

- AVI and Quicktime files compatible with widely spread Cineform De coders and Iridas Products

- Removable Optical Low Pass Filter

- 12 bit A/D conversion and 48 bit digital signal processing

- 10+ F-stops dynamic range

- 180° film shutter equivalent with variable speed control

- Sensitivity at 0 db: ISO 250 at 3200K and ISO 160 at 5600K
Other Sensitivities at 3200K: +3db ISO320 , +9db ISO640, +6db ISO500, +12db ISO1000

Integrated Recording Software SiliconDVR

- SiliconDVR Software controlled Camera Environment

- 2K Formats: 2048x1152 (12,16,18,21,23.97,24,25 fps)
    DCI   2048x1080 (12,16,18,21,23.97,24,25,29.97,30 fps)
    Scope   2048x856   (12,16,18,21,23.97,24,25,29.97,30,40 fps)
    HD Formats: 1920x1080 (12,16,18,21,23.97,24,25,29.97,30 fps)
                1280x720   (12,16,18,21,23.97,24,25,29.97,30,40,50
                ,59.94,60,72,85 fps)
- Special Formats: 960x540 (150 fps)

- Overcranking and undercranking for special effects (12~72fps)

- Time-Lapse Recording

- Visually lossless CineForm RAW™ wavelet-based codec using SiliconDVR
   recording software

- Cineform 3.5 : 1 compression 10 bit Log

- uncompressed recording mode 12 bit Lin

- Auto-file naming and project management with metadata

- Up to 4 hours of recording on 160GB HDD in highest quality mode

Metadata-Manage Color Pipeline

- Industry's first complete color-managed pipeline from acquisition through post

- IRIDAS look-management through Speedgrade interface for unlimited colorization possibilities

- IRIDAS looks are completely non-destructable and are full integrated into CineForm RAW™ color pipeline

- Non-destructive user-selectable white balance modes: 3200K, 5600K, User and None

- 32-bit floating point rendering pipeline with support for super white and black points

- Non-destructive metadata adjustments and post-processing using Prospect 4K™ and IRIDAS toolset

Touchscreen LCD and User Interface

- HD-resolution 8.4" Touchscreen LCD with advanced image-scaling technology

- 4-wire resistive Interface with Integrated USB controller

- Support for seperate electronic viewfinders via on-board digital and analog outputs

- Exposure Meter with 6-level false-color zebras

- Per-channel live histogram display

- Edge-detection focus-aid mode

- 2-4x Digital Focus Assist

- 4x Loupe and integrated spot meter and focus tool

- Safe-zone Markers for 16:9 / 4:3 / 1.85:1 / 2.35:1

- Virtual VTR interface

- File management and metadata capabilities

Audio and SMPTE Timecode Support

- L/R balanced line-level inputs with 16-bit/48Khz sampling

- L/R balanced line-level outputs with 16-bit/48Khz sampling

- Audio Recording multiplexed into .AVI

- Speaker/Headphone output

- SMPTE time-code embedded into AVI files

- SMPTE time-code syncing to external LTC USB devices

- On-screen Audio Level Left/Right indicators with overload warning

Optical, Mechanical and Power Requirements

- Full compatible with Anton Bauer Gold-Mount battery system (14.4V Nominal)

- DC Power Regulation 11.5~19V.

- 12V/5A total power consumption

- Interchange C, F, B4, and PL lens mounts without re-collimation using the Unversal Lens Mount System

- Ultra-tough Alloy chassis

- Operating temperature from 0°C to 40°C

- Storage temperature from -20°C to 60°C

SiliconImaging

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