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USER'S MANUAL

PIXCI® D
Revision 5

7 March 2000

For use with:
PIXCI® D Rev. 1.0 thru 3.0

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Printing: 8-Mar-2000

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1. Installation

Thank you for purchasing imaging products from EPIX, Inc. We expect them to perform to their specifications and we are available on the Internet, FAX, and telephone to help with installation or to answer questions about the use of our products for your application.

The PIXCI® D, D24, or D32 imaging board, for the PCI bus, is packed in a static dissipative bag. Please keep the bag and box in which the board was shipped should the need arise to return the board. Prior to opening the bag, place the bag near the PC into which the board will be installed.

The board may be installed prior to the XCAP software, or the software may be installed first.

Turn off the power and remove the cover from the PC (if one is used with the PC) into which the PIXCI imaging board is to be installed.

1. Select a vacant PCI bus slot and remove the metal bracket and screw covering the back panel slot with which it is aligned. Consult the reference manual for the PC if there is any doubt about which slot is a PCI bus slot.
2. Use of a static free area and a wrist strap connected to the PC or to the static free area is suggested during installation. Walking can generate static electricity. Keep your feet stationary while removing the PIXCI imaging board from the anti-static bag. Hold the bag and the PC at the same time, or place the bag on the PC chassis and hold the chassis to dissipate the static charge that may have been created while transporting the board to the PC.
3. Remove the PIXCI imaging board from the anti-static bag and insert it into the PCI bus connector. This can require up to 15 pounds of force. Do not use too much force as the board may not be inserted into the connector correctly, and the result can be damage to the connector and the board. Consult the reference manual for the PC if there is any doubt about which slot is a PCI bus slot. Note that some PCI bus slots may require a 3.3 volt compatible board. As of the date of this manual, the PIXCI D32 is only available for 5 volt PCI slots. Do not attempt to install the board in a 3.3 volt slot or in an AGP slot.
4. Replace the screw to secure the PIXCI imaging board in the slot.

1.1. Cabling Connections

Refer to the "Connections" chapter for a signal list and drawing of the cable connections between the PIXCI and the Dalsa camera(s).

1. Remove the power from all equipment to be connected.
2. Following the cabling figure in the "Connections" chapter, connect the cable between the PIXCI, camera, and power supply. The PIXCI end of the cable has a 68 pin SCSI style miniature D connector. Do not plug it into a SCSI card. Connect the other end of the cable into the respective camera connectors.
3. Power up the camera, PC, and monitor(s).
4. On boot-up, if Windows asks for a driver for the newly installed hardware:
   a. If XCAP software is provided on compact disk (CD), then insert the CD into the CD drive. Indicate that Windows is to use:

```
    d:\drivers\win95    (for Win 95/98)
    d:\drivers\winNT    (for Win NT)
    d:\drivers\win2K    (for Win 2000)
or
    d:\drivers          (older cd's, all Win versions)
```

   replacing "d:" with the CD drive's letter.

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b. If XCAP software is provided on diskette, then insert XCAP diskette #1 into the diskette drive. Indicate that Windows is to use:

```
        a:\drivers\win95    (for Win 95/98)
        a:\drivers\winNT    (for Win NT)
        a:\drivers\win2K    (for Win 2000)
    or
        a:\                 (older diskettes, all Win versions)
```

replacing "a:" with the diskette drive's letter.

5. Install XCAP software by following the instructions in the XCAP Software Installation chapter in this manual.
6. Operate XCAP by following the instructions in in the XCAP Software Guide chapter in this manual.
7. Check for display of the video source on the VGA monitor by clicking on the Capture and then the Snap menu in the View window or by using the shortcut menu.
8. Note that for line scan cameras, either an external vertical drive signal or the "Internal" vertical drive selection must be used.
9. If it is not possible to display an image from the video source, check for the presence of vertical drive by clicking on "PIXCI," "PIXCI Status," and "PIXCI-Unit x Status" (where x is the number of the board being used). The number reported in the "Vertical Sync Count" box should be increasing if vertical drive is being received from the camera. If it is not increasing, check the connections and power to the camera. If that fails, refer to the "In Case of Trouble" chapter in this manual.
10. If installation has been successful, remove power from the computer.
11. Replace the PC's cover (if one is used).
12. End of installation procedure.

The size and the number of images that can be stored in DRAM on the motherboard is a function of the amount of DRAM that is not needed by the operating system. Windows 98 requires approximately 20 megabytes. XCAP reserves 4 MB of memory for image buffers. If more memory is required for image sequences, the "Driver Assistant" in the "PIXCI Open/Close" menu should be used to set the reserved memory size.

The PIXCI imaging board can capture and store full resolution images to DRAM on a burst mode PCI motherboard provided that other devices do not compete for PCI bus bandwidth. The data transfer capabilities of the motherboard may limit the size of the image that the PIXCI imaging board can transfer to memory on the motherboard. Some PCI motherboards do not support burst mode on the PCI bus. Some PCI motherboards limit bursts to four 32 bit transfers. Some PCI motherboards must have their configuration EEPROM set to enable PCI bus burst mode. PCI bus transfers from other devices will compete for data transfer time with images to be transferred from the PIXCI imaging board to memory on the motherboard. ISA bus transfers will also compete for data transfer time with images to be transferred from the PIXCI imaging board to memory on the motherboard. The updating of clocks and other background tasks may interfere with the capture of images. These tasks should be disabled if error messages indicate that video transfers have been interrupted.

1.2. Compatible Motherboards - Partial List

The following configurations have been tested with video sources with 100 MB per second burst modes. Contact EPIX, Inc. or an EPIX, Inc. distributor for pricing on any of the motherboards listed below.

Motherboards with a 100 MHz CPU bus are recommended. For fast display updates, EPIX recommends motherboards with an Advanced Graphics Port (AGP) and an AGP VGA. An AGP VGA can provide at least twice the video update rate that a PCI VGA can provide. EPIX can provide complete, tested computer systems with a PIXCI and all required software installed as well as tested AGP VGA boards and motherboards.

Manufacturer	Model	Chipset	Clock & CPU
Intel	SE440BX	Intel 440BX	667 MHz Pentium II w/AGP
Intel	NE440BX	Intel 440BX	350 MHz Pentium II w/AGP
Intel	AL440LX	Intel 440LX	266 MHz Pentium II w/AGP
Intel	PD440FX	Intel 440FX	233 MHz Pentium II
Intel	TC430HX	Intel 430HX	200 MHz Pentium MMX
QDI	Titanium II B	Intel 430TX	200 MHz Pentium MMX

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QDI	Titanium II B	Intel 430TX	233 MHz AMD K6

1.3. Non-Compatible Motherboards - Partial List

The following configuration(s) have been tested with the Hitachi KP-F110 camera and intermittently do not keep up with a transfer rate sufficient to prevent buffer overflow, which means lost data. There are many other PCI bus motherboards that will NOT operate successfully. Use one of the motherboards from the list above or purchase one from EPIX, Inc.

Manufacturer	Model	Chipset	Clock & CPU
Intel	VS440FX	Intel 440FX	200 MHz Pentium Pro

1.4. VGA Boards

- Windows and XCAP: Any 24 bit S/VGA compatible display system.
- Windows and XCOBJ: Any S/VGA compatible display system.
- DOS and XCOBJ: Any S/VGA with VESA support and a monochrome or color monitor.
- Display of false colored images on S/VGA requires VESA mode 112 support.
- For Windows or DOS an S/VGA with a color monitor is suggested.
- The capabilities of the S/VGA board(s) limit the number of images that can be displayed per second, the number of gray levels that can be displayed, and the size of the image that can be displayed.
- Dual monitor (with dual SVGA) display under Windows 98 has been tested with the PIXCI. Note that the update rate is slower than with a single monitor display.

---

2. Connectors

The PIXCI D imaging board has a 68 pin connector which is accessible thru the bracket that mounts the board to the computer chassis. Single ended cables are available for connecting to a camera or other source of digital video. A wire list for the single ended cable is shown below.

2.1. PIXCI D 68 Pin Connector and Single Ended Cable Signal List Part 1

PAIR No. and COLOR	Interface Signal 68 pin MALE Pin No.	Name	Interface Signal Type
34:Orange/Violet	**1**	GND	GND
34:Violet/Orange	**35**	GND	GND
17:Tan/Gray	**2**	MSBA+	RS422 Input
17:Gray/Tan	**36**	MSBA-	RS422 Input
18:Brown/Pink	**3**	MSBA-1+	RS422 Input
18:Pink/Brown	**37**	MSBA-1-	RS422 Input
33:Orange/Blue	**4**	MSBA-2+	RS422 Input
33:Blue/Orange	**38**	MSBA-2-	RS422 Input

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19:Brown/Orange	**5**	MSBA-3+	RS422 Input
19:Orange/Brown	**39**	MSBA-3-	RS422 Input
16:Tan/Violet	**6**	MSBA-4+	RS422 Input
16:Violet/Tan	**40**	MSBA-4-	RS422 Input
6:White/Green	**7**	MSBA-5+	RS422 Input
6:Green/White	**41**	MSBA-5-	RS422 Input
7:White/Blue	**8**	MSBA-6+	RS422 Input
7:Blue/White	**42**	MSBA-6-	RS422 Input
32:Orange/Green	**9**	MSBA-7+	RS422 Input
32:Green/Orange	**43**	MSBA-7-	RS422 Input
20:Brown/Yellow	**10**	MSBB+	RS422 Input
20:Yellow/Brown	**44**	MSBB-	RS422 Input
1:White/Tan	**11**	MSBB-1+	RS422 Input
1:Tan/White	**45**	MSBB-1-	RS422 Input
15:Tan/Blue	**12**	GND	GND
15:Blue/Tan	**46**	GND	GND
8:White/Violet	**13**	MSBB-2+	RS422 Input
8:Violet/White	**47**	MSBB-2-	RS422 Input
31:Orange/Yellow	**14**	MSBB-3+	RS422 Input
31:Yellow/Orange	**48**	MSBB-3-	RS422 Input
21:Brown/Green	**15**	MSBB-4+	RS422 Input
21:Green/Brown	**49**	MSBB-4-	RS422 Input
5:White/Yellow	**16**	MSBB-5+	RS422 Input
5:Yellow/White	**50**	MSBB-5-	RS422 Input
2:White/Brown	**17**	XXX	NC
2:Brown/White	**51**	XXX	NC

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2.2. PIXCI D 68 Pin Connector and Single Ended Cable Signal List Part 2

PAIR No. and COLOR	Interface Signal 68 pin MALE Pin No.	Name	Interface Signal Type
14:Tan/Green	**18**	XXX	NC
14:Green/Tan	**52**	XXX	NC
9:White/Gray	**19**	MSBB-6+	RS422 Input
9:Gray/White	**53**	MSBB-6-	RS422 Input
30:Pink/Gray	**20**	MSBB-7+	RS422 Input
30:Gray/Pink	**54**	MSBB-7-	RS422 Input
22:Brown/Blue	**21**	MSBA-8+	RS422 Input
22:Blue/Brown	**55**	MSBA-8-	RS422 Input
4:White/Orange	**22**	SCOUT+	RS422 Input
4:Orange/White	**56**	SCOUT-	RS422 Input
3:White/Pink	**23**	SCIN+	RS422 Output
3:Pink/White	**57**	SCIN-	RS422 Output
13:Tan/Yellow	**24**	FLD+	RS422 Input
13:Yellow/Tan	**58**	FLD-	RS422 Input
10:Tan/Brown	**25**	FENA+	RS422 Input
10:Brown/Tan	**59**	FENA-	RS422 Input
29:Pink/Violet	**26**	LENA+	RS422 Input
29:Violet/Pink	**60**	LENA-	RS422 Input
23:Brown/Violet	**27**	TRG+	RS422 Input
23:Violet/Brown	**61**	TRG-	RS422 Input
12:Tan/Orange	**28**	STR+	RS422 Output
12:Orange/Tan	**62**	STR-	RS422 Output
11:Tan/Pink	**29**	PCLK+	RS422 Input

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11:Pink/Tan	**63**	PCLK-	RS422 Input
28:Pink/Blue	**30**	EXP+	RS422 Output
28:Blue/Pink	**64**	EXP-	RS422 Output
24:Brown/Gray	**31**	MSBA-9+	RS422 Input
24:Gray/Brown	**65**	MSBA-9-	RS422 Input
27:Pink/Green	**32**	MSBB-8+	RS422 Input
27:Green/Pink	**66**	MSBB-8-	RS422 Input
26:Pink/Yellow	**33**	MSBB-9+	RS422 Input
26:Yellow/Pink	**67**	MSBB-9-	RS422 Input
25:Pink/Orange	**34**	GND	GND
25:Orange/Pink	**68**	GND	GND
SHIELD	**68**		GND

NOTES:
1. Use cable: 34 pair, **MADISON 28 AWG 105 Ohm SCSI-P Cable Type CL2/FT1**. Length: 2 meters.

CONNECTOR:
1. 68 pin cable receptacle: HONDA PCS-XE68MA and Cover

2.3. PIXCI D 10 Pin Header Signal List

Signal Name	IN/OUT	Pin Number	Pin Number	IN/OUT	Signal Name
Ground		1	2		Option +5 VDC
External Trigger In	I	3	4	I	External Trigger In
Frame- Differential FEN-	I	5	6	I	Frame+ Differential FEN+
Strobe- Differential STR-	O	7	8	O	Strobe+ Differential STR+

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Reserved	-	9	10	-	Reserved

See the Trigger and Camera Integration Register Programming section of this manual in the Camera Control Register chapter for more information on these signals.

Pin 1 is connected to Ground.

Pin 2 is optional +5 volts to the PCI bus. Pin 2 was changed to an option to prevent destruction of components when the 10 pin header is installed incorrectly.

Pins 3 & 4 are the differential inputs for the trigger signal. These inputs are connected to pin 61 and 27 of J2, the 68 pin connector.

Pins 5 & 6 are the differential inputs for the framer enable (vertical) signal. These inputs are connected to pin 59 and 25 of J2, the 68 pin connector.

A 10 pin header and cable to 9 pin D-Subminiature connector is available to connect external signals to the PIXCI D thru a second slot with a bracket mounting the D-Subminiature connector.

---

3. Software Installation

XCAP-Plus, XCAP-Std, or XCAP-Lite, are easy to install, by following the instructions below.

While XCAP is easy to install, like most manufacturers of PC software, we recommend as a precaution that a hard disk backup be performed before installing XCAP.

3.1. For Windows 95 - Windows 98

1. Install Files:
   a. If XCAP is provided on diskette(s):
      i. Insert XCAP diskette #1 into the A: or B: drive.
      ii. Execute the SETUP program, from a command prompt, or via the Windows "Start", "Run":

```
> A:SETUP
or
> B:SETUP
```

      iii. Follow the installation program's directions, such as to select an installation directory, and insert additional diskettes (depending upon version) as instructed.
   b. If XCAP is provided on a compact disk (CD):
      i. If your PC is set to allow automatic execution of loaded CDs, the CD's interactive index program will be executed automatically. Otherwise, execute the index program, from a command prompt, or via the Windows "Start", "Run":

```
> Z:SETUP       (replace Z with drive letter for your CD)
```

      ii. Select "Setup PIXCI(R) Imaging Software" and "XCAP Imaging Application". Click "OK".
      iii. Follow the installation program's directions, such as to select an installation directory.
   c. If XCAP is provided via the internet:
      i. Download:

```
ftp.epixinc.com/software/XCAPWI.EXE
```

      from the EPIX, Inc. ftp site.
      ii. Execute the downloaded program, from a command prompt, or via the Windows "Start", "Run":

```
> XCAPWI.EXE
```

      iii. Follow the installation program's directions, such as to select an installation directory.
      iv. Delete the downloaded .EXE file from your PC's hard drive.
   d. The installation procedure creates a new program group, containing XCAP and several .TXT files. The .TXT files contain these installation instructions, a list of distributed files, corrections or additions to this manual, or other up-to-date information. One file, PCITIPS.TXT, contains the *PC Configuration Tips*, which provides tips for resolving hardware and software conflicts.
2. Create Shortcut - Drag & Drop (optional):
   a. From the program group created by the installation program, click and drag the icon for XCAP over to the desktop

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and drop.

3. Create Shortcut - Manual (optional):
   a. Right click on the Desktop.[1]
   b. Select "New".
   c. Select "Shortcut".
   d. Set:

```
Command Line:   InstallDir \ XCAPW95
Name:           XCAP
```

   replacing "InstallDir" with the name of the installation directory chosen above. Select "OK".
4. Install Authorization Key (for XCAP-Plus and XCAP-Std):
   a. XCAP-Plus and XCAP-Std, but not XCAP-Lite, are provided with an authorization key; about the size and shape of a printer cable's connector (5.5×4.5×1.6 cm), but having 25 pin connectors at both ends and no cable attached. If provided, connect the authorization key to printer port 1, 2, or 3. If a printer cable was attached to the printer port, reconnect the printer cable to the back of the authorization key. The authorization key will not affect normal printer operation.

      Do not connect the authorization key to a 25 pin serial (RS-232) port, or to any other interface which happens to use the same style connector; the authorization key will not function, might be permanently damaged, and the warranty will be void!

      The authorization key must remain attached to the printer port while XCAP is running. If the authorization key is missing, or disconnected while XCAP is running, then XCAP-Plus or XCAP-Std will behave similar to the XCAP-Lite version; selected image processing and analysis tools will not be operational.

5. Install PIXCI® Imaging Board Driver:
   a. If the PIXCI® imaging board's driver wasn't loaded when the PC was powered up (as described under *Hardware Installation*), instruct Windows to load the appropriate driver: Click "Start", "Control Panel", "System", "Device Manager", and "Other Devices". Select "PCI MultiMedia Video Device" (which appears if a PIXCI® board driver was never installed), or "PIXCI(R) Video Capture Board" (which appears if a PIXCI® board driver was previously installed). Click "Driver", "Change Driver", and "Other". Select "PCI MultiMedia Video Device" or "PIXCI(R) Video Capture Board". Click "Have Disk", select DRIVERS\WIN95 within the chosen installation directory, such as C:\XCAP\DRIVERS\WIN95, and click "OK".

      Note that the "quick reboot" offered by the (some versions of the) Device Manager does not properly install EPIXXC32.VXD; a full shutdown and reboot is required. The shutdown and reboot can be delayed until after the installation is completed.

6. Set Frame Buffer Memory Size (optional):
   a. By default, 4 megabytes of frame buffer memory is allocated.
   b. Under Windows 95/98, frame buffer memory must be allocated during Windows' initialization, as specified in the Windows' SYSTEM.INI file. If additional frame buffer memory is desired, then at the end of the Windows' SYSTEM.INI file, add a section:

```
[EPIX_XC]
PIXCI=-IM <memorysize>
```

      replacing the "<memorysize>" with the desired memory size in Kbytes. Windows must be rebooted for the new specification to take effect.

      Windows 95/98 limits the maximum amount of allocatable frame buffer memory, dependent upon what other devices are installed, the total PC memory size, and other factors.

      Less than the requested amount of frame buffer memory may be allocated. If no memory could be allocated, the PIXCI® imaging board will not be usable; reporting "Can't allocate frame buffer memory". Otherwise, within XCAP, the amount of frame buffer memory can be checked under *PIXCI®*, *PIXCI® Open/Close*.

7. Configure S/VGA:
   a. A "High Color (16 bit or 65536 Color)", "True Color (24 bit or 16777216 Color)", or "True Color (32 bit)" setting for the display adapter (S/VGA) is required for proper display of images and overlay graphics. The "True Color (24 bit or 16777216 Color)" or "True Color (32 bit)" is suggested for higher quality, and quicker, display of images and overlay graphics. This may be checked and/or modified via Windows "Start", "Control Panel", "Display", "Settings".
   b. In Windows 95, under "Control Panel", "Display", "Plus!", the "Show window contents while dragging" must be disabled (this feature is not present in older versions of Windows 95). Or in Windows 98, under "Control Panel", "Display", "Effects", the "Show window contents while dragging" must be disabled.
   c. After changing the settings a full shutdown and CTRL+ALT+DEL reboot should be used. The quick restart offered by older versions of Windows, and the dynamic VGA reconfiguration performed by newer versions of Windows, may not re-initialize all devices properly.

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8. Reboot Windows.
9. XCAP is now ready to run, clicking "Start", "Programs", "XCAP Imaging", and finally "XCAP for Win 95/98".

3.2. Win 95 - Win 98 - Esoterica

3.2.1. Windows 95/98 - Manual Installation

Use of EPIXXC32.INF, above, provides automatic installation of EPIXXC32.VXD in most circumstances. The following information allows manual installation, correcting problems, or integration with an OEM's procedures.

1. The EPIXXC32.VXD must be copied to the Windows SYSTEM directory, typically:

```
C:\WINDOWS\SYSTEM
```

2. Using the Registry Editor (REGEDIT) provided with Windows, create an entry such as:

```
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Class\Unknown\0000
```

   replacing the \0000, if such an entry already exists, with the next available sequential number. This entry must contain:

```
DevLoader=      "epixxc32.vxd"
DriverDesc=     "PIXCI(R) PCI Video Capture Board"   (optional)
InfSection=     "Unknown"
StaticVxD=      "epixxc32.vxd"
```

3. Using the Registry Editor, edit the existing entry for PIXCI® SV2 or PIXCI® SV3:

```
(Win 95)    HKEY_LOCAL_MACHINE\Enum\PCI\VEN_8086&DEV_1223\BUS_**&DEV_**&FUNC_**
(Win 98)    HKEY_LOCAL_MACHINE\Enum\PCI\VEN_8086&DEV_1223&SUBSYS_00000000&REV_**\BUS_**&DEV_**&FUNC_**
```

   or the existing entry for PIXCI® SV4:

```
(Win 95)    HKEY_LOCAL_MACHINE\Enum\PCI\VEN_109E&DEV_0350\BUS_**&DEV_**&FUNC_**
(Win 98)    HKEY_LOCAL_MACHINE\Enum\PCI\VEN_109E&DEV_0350&SUBSYS_00000000&REV_**\BUS_**&DEV_**&FUNC_**
```

   or the existing entry for PIXCI® D, PIXCI® D24, or PIXCI® D32:

```
(Win 95)    HKEY_LOCAL_MACHINE\Enum\PCI\VEN_10E8&DEV_80D6\BUS_**&DEV_**&FUNC_**
(Win 98)    HKEY_LOCAL_MACHINE\Enum\PCI\VEN_10E8&DEV_80D6&SUBSYS_00000000&REV_**\BUS_**&DEV_**&FUNC_**
```

   or the existing entry for PIXCI® A:

```
(Win 95)    HKEY_LOCAL_MACHINE\Enum\PCI\VEN_10E8&DEV_82B1\BUS_**&DEV_**&FUNC_**
(Win 98)    HKEY_LOCAL_MACHINE\Enum\PCI\VEN_10E8&DEV_82B1&SUBSYS_00000000&REV_**\BUS_**&DEV_**&FUNC_**
```

   where the **'s may be any digits (assigned and created by Windows after detection of the PIXCI® imaging board). This entry must contain:

```
Class=          "Unknown"
ConfigFlags=    00 00 00 00
DeviceDesc=     "PIXCI(R) PCI Video Capture Board"   (optional)
Driver=         "Unknown\0000"                      (substitute 0000)
Mfg=            "EPIX, Inc."                         (optional)
```

   where the "0000" is replaced by the sequential number used in the previous step.
4. Reboot Windows.

3.2.2. Windows 95/98 - Forcible Frame Buffer Memory Allocation

As described above, frame buffer memory allocated by EPIXXC32.VXD during Windows startup is limited to a small percentage of total PC memory.

A larger frame buffer memory can often be obtained by reserving memory before Windows starts:

1. In C:\CONFIG.SYS[2], add a line:

```
DEVICE=C:\XCAP\DRIVERS\WIN95\EPIXXC.SYS -IM <framebuffermemorysize>
```

   after DEVICE=HIMEM.SYS, replacing "<framebuffermemorysize>" with the desired frame buffer memory size, in Kbytes. Alternately, the second form reserves "<reservememorysize>" Kbytes, for Windows and allocates (almost) all of the remaining memory for use as frame buffer memory.
2. Edit the Windows' SYSTEM.INI file, add a section:

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```
[EPIX_XC]
PIXCI=-IM 0
```

so that EPIXXC32.VXD doesn't reserve and waste additional frame buffer memory.

3. Reboot Windows.

This technique allows most of the PC's memory to be reserved as frame buffer memory (e.g. typically all but 8 or 16 megabytes, as required by Windows). However, the memory is unavailable to Windows, even when the PIXCI® imaging board's driver is not open.

If the specified amount of frame buffer memory could not be allocated, EPIXXC.SYS will attempt to allocate smaller amounts. If no memory can be allocated EPIXXC.SYS, will display an error message during Windows startup, and XCAP will not run, stating "Can't allocate frame buffer memory".

3.2.3. Windows 95/98 - Authorization Key - Manual Installation

Use of the procedures above provides automatic installation of the authorization key's driver, needed under Windows 95/98, for XCAP-Plus and XCAP-Std (but not needed for XCAP-Lite). The following information allows manual installation, correcting problems, or integration with an OEM's procedures.

1. The file HARDLOCK.VXD must be copied to the Windows SYSTEM directory, typically:

```
C:\WINDOWS\SYSTEM
```

or placed in the same directory as XCAP, typically:

```
C:\XCAP
```

Normally, all LPT ports are scanned for the authorization key. Should other hardware use, or overlap, one of the LPT I/O port addresses, the search may be restricted to specific I/O ports. In AUTOEXEC.BAT, specifying:

```
SET HL_SEARCH=378p
SET HL_SEARCH=278p,378p
```

forces only the I/O port addresses listed (in hexadecimal) to be searched. Note that setting HL_SEARCH from a DOS box has no effect, as the setting is not "carried back" from DOS into the Win 95/98 environment.

3.3. For Windows NT

XCAP requires Win NT Version 4 with Service Pack 3 or later. You must be logged on an Administrator, or have equivalent privileges, to complete the installation procedure.

1. Install Files:
   a. If XCAP is provided on diskette(s):
      i. Insert XCAP diskette #1 into the A: or B: drive.
      ii. Execute the SETUP program, from a command prompt, or via the Windows "Start", "Run":

```
    > A:SETUP
or
    > B:SETUP
```

      iii. Follow the installation program's directions, such as to select an installation directory, and insert additional diskettes (depending upon version) as instructed.
   b. If XCAP is provided on a compact disk (CD):
      i. If your PC is set to allow automatic execution of loaded CDs, the CD's interactive index program will be executed automatically. Otherwise, execute the index program, from a command prompt, or via the Windows "Start", "Run":

```
> Z:SETUP       (replace Z with drive letter for your CD)
```

      ii. Select "Setup PIXCI(R) Imaging Software" and "XCAP Imaging Application". Click "OK".
      iii. Follow the installation program's directions, such as to select an installation directory.
   c. If XCAP is provided via the internet:
      i. Download:

```
ftp.epixinc.com/software/XCAPWI.EXE
```

      from the EPIX, Inc. ftp site.
      ii. Execute the downloaded program, from a command prompt, or via the Windows "Start", "Run":

```
> XCAPWI.EXE
```

iii. Follow the installation program's directions, such as to select an installation directory.
iv. Delete the downloaded .EXE file from your PC's hard drive.

d. The installation procedure creates a new program group, containing XCAP and several .TXT files. The .TXT files contain these installation instructions, a list of distributed files, corrections or additions to this manual, or other up-to-date information. One file, PCITIPS.TXT, contains the *PC Configuration Tips*, which provides tips for resolving hardware and software conflicts.

2. Create Shortcut - Drag & Drop (optional):
   a. From the program group created by the installation program, click and drag the icon for XCAP over to the desktop and drop.
3. Create Shortcut - Manual (optional):
   a. Right click on the Desktop.[3]
   b. Select "New".
   c. Select "Shortcut".
   d. Set:

```
Command Line:   InstallDir \ XCAPWNT
Name:           XCAP
```

   replacing "InstallDir" with the name of the installation directory chosen above. Select "OK".
4. Install Authorization Key (for XCAP-Plus and XCAP-Std):
   a. XCAP-Plus and XCAP-Std, but not XCAP-Lite, are provided with an authorization key; about the size and shape of a printer cable's connector (5.5×4.5×1.6 cm), but having 25 pin connectors at both ends and no cable attached. If provided, connect the authorization key to printer port 1, 2, or 3. If a printer cable was attached to the printer port, reconnect the printer cable to the back of the authorization key. The authorization key will not affect normal printer operation.

   Do not connect the authorization key to a 25 pin serial (RS-232) port, or to any other interface which happens to use the same style connector; the authorization key will not function, might be permanently damaged, and the warranty will be void!

   The authorization key must remain attached to the printer port while XCAP is running. If the authorization key is missing, or disconnected while XCAP is running, then XCAP-Plus or XCAP-Std will behave similar to the XCAP-Lite version; selected image processing and analysis tools will not be operational.

   b. Run the authorization key utility program provided with XCAP by "Start", "Run":

```
> C:\XCAP \ HLDINST -install
```

   c. Or, in command prompt mode, switch to the chosen installation directory:

```
> CHDIR C:\XCAP
```

   and execute:

```
HLDINST  -install
```

   to run the authorization key utility program.
5. Install PIXCI® Imaging Board Driver:
   a. If the PIXCI® imaging board's driver wasn't loaded when the PC was powered up (as described under *Hardware Installation*), instruct Windows to load the appropriate driver: Click "Start", "Programs", and "Windows NT Explorer". Within the chosen installation directory, such as C:\XCAP, find and highlight file DRIVERS\WINNT \EPIXXCNT.INF. From the menu bar, select "File" and "Install".
6. Configure S/VGA:
   a. A "High Color (16 bit or 65536 Color)", "True Color (24 bit or 16777216 Color)", or "True Color (32 bit)" setting for the display adapter (S/VGA) is required for proper display of images and overlay graphics. The "True Color (24 bit or 16777216 Color)" or "True Color (32 bit)" is suggested for higher quality, and quicker, display of images and overlay graphics. This may be checked and/or modified via Windows "Start", "Control Panel", "Display", "Settings".
   b. In Windows 95, under "Control Panel", "Display", "Plus!", the "Show window contents while dragging" must be disabled (this feature is not present in older versions of Windows 95). Or in Windows 98, under "Control Panel", "Display", "Effects", the "Show window contents while dragging" must be disabled.
   c. After changing the settings a full shutdown and CTRL+ALT+DEL reboot should be used. The quick restart offered by older versions of Windows, and the dynamic VGA reconfiguration performed by newer versions of Windows, may not re-initialize all devices properly.
7. Reboot Windows.
8. XCAP is now ready to run, clicking "Start", "Programs", "XCAP Imaging", and finally "XCAP for Win NT".

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3.4. Win NT Esoterica

3.4.1. Windows NT - Manual Installation

Use of EPIXXCNT.INF, above, provides automatic installation of EPIXXCNT.SYS in most circumstances. The following information allows manual installation, correcting problems, or integration with an OEM's procedures.

1. The EPIXXCNT.SYS must be copied to the Windows SYSTEM32\DRIVERS directory, typically:

   ```
   C:\WINNT\SYSTEM32\DRIVERS
   ```

2. Using the Registry Editor (REGEDIT) provided with Windows, create an entry such as:

   ```
   HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\EPIXXCNT
   ```

   This entry must contain:

   ```
   ErrorControl  =  0x00000001
   Group         =  "Extended base"
   Start         =  0x00000001
   Type          =  0x00000001
   ```

   and may, as described below, also contain:

   ```
   PIXCI         =  "-IM <memorysize>"
   ```

   Create an entry such as:

   ```
   HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\EventLog\System\EPIXXCNT
   ```

   This entry must contain:

   ```
   EventMessageFile = "%SystemRoot%\System32\IoLogMsg.dll"
   TypesSupported   = 0x00000007
   ```

3. Shut down and restart Windows.

3.4.2. Windows NT - Frame Buffer Memory Allocation

Under Windows NT, frame buffer memory must be allocated during Windows' initialization.

The requested frame buffer memory size must be specified in the Registry entry described above, using an entry named "PIXCI", such as:

```
PIXCI         =  "-IM <memorysize>"
```

replacing the "<memorysize>" with the desired memory size in Kbytes. If no frame buffer memory size is specified, a default size of 4 megabytes is used. Windows must be rebooted for the new specification to take effect.

Windows NT limits the maximum amount of allocatable frame buffer memory, dependent upon what other devices are installed, the total PC memory size, and other factors. Using the Control Panel's Device Manager to select Boot or System priority startup for EPIXXCNT.SYS allows more frame buffer memory to be allocated than selection of Automatic startup.

Less than the requested amount of frame buffer memory may be allocated. If no memory could be allocated, XCAP will not run, stating "Can't allocate frame buffer memory". Otherwise, within XCAP, the number of available frame buffers can be checked under *PIXCI®*, *PIXCI® Video Setup*, *Resolution*. As the frame buffer memory is allocated once during Windows initialization; the contents of frame buffers are retained as XCAP is closed and restarted, but lost if Windows is restarted.

3.4.3. Windows NT - Forcible Frame Buffer Memory Allocation

As described above, frame buffer memory allocated by EPIXXCNT.SYS during Windows startup may be limited to a small percentage of total PC memory.

A larger frame buffer memory can be obtained by limiting the amount of memory recognized by Windows NT, and then instructing EPIXXCNT.SYS to explicitly use a section of memory without allocating it from Windows NT:

1. Edit C:\BOOT.INI, restricting Win NT to use no more than a set amount of memory: by copying an existing configuration line, adding /MAXMEM=XX (where XX is in Mbytes) and changing the prompt name, such as changing:

   ```
   [operating systems]
   ```


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```
multi(0)disk(0)rdisk(0)partition(7)\WINNT="Windows NT V 4.00"
```

to

```
[operating systems]
multi(0)disk(0)rdisk(0)partition(7)\WINNT="Windows NT V 4.00 [NT=64M PIXCI=256M]"  /MAXMEM=64
multi(0)disk(0)rdisk(0)partition(7)\WINNT="Windows NT V 4.00"
```

Do not copy this new line exactly as is; the first portion of the line must be copied from an existing configuration line in your C:\BOOT.INI file. The text between quotes appears as a boot selection prompt, use of "[NT=64M PIXCI=256M]" is a suggested reminder, but not required. Keeping the original configuration line, as a boot selection option, is highly recommended as a backup.

2. Edit the registry entry for EPIXXCNT.SYS:

   ```
   HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\EPIXXCNT
   ```

   On the "PIXCI" field add:

   ```
   -IA <image_memory_adrs_in_kbyte>
   -IM <size_of_image_memory_in_kbyte>
   -MB 8192
   ```

   In practice, all three fields are on the same line. Be certain that the -IA address is equal to (or above) the specified /MAXMEM limit; INCLUDING exact base2 to base10 conversions! (i.e. for /MAXMEM=64, the smallest legal value of -IA is 65536, not 64000!). Likewise, be certain that the -IA plus -IM values do not exceed the amount of memory available!
3. Reboot, using the newly added boot selection.

For example, for a PC with 1 gigabyte of memory, allocating 256 Mbyte for Windows and the remainder for frame buffer memory, use:

```
/MAXMEM=256
```

in C:\BOOT.INI, and use:

```
PIXCI = -IA 262144 -IM 786432 -MB 8192
```

in the registry entry. Note that 262144 is 256×1024, and 786432 is (1024-245)×1024.

Note that if this memory allocation method is used, program access to image data may be is slower. Thus, the video display rate (and image processing) may be slower, but the video capture rate (such as sequence capture) is not adversely affected. This method of memory allocation is primarily used for video rate acquisition of long sequences, followed by off-line analysis or saving of the sequence.

3.4.4. Windows NT - Authorization Key - Manual Installation

Use of HLDINST.EXE, above, provides automatic installation of the authorization key's driver, needed under Windows NT, for XCAP-Plus and XCAP-Std (but not needed for XCAP-Lite). The following information allows manual installation, correcting problems, or integration with an OEM's procedures.

1. The file HARDLOCK.SYS must be copied to the Windows SYSTEM32\DRIVERS directory, typically:

   ```
   C:\WINNT\SYSTEM32\DRIVERS
   ```

2. The file HLVDD.DLL must copied to the Windows SYSTEM directory, typically:

   ```
   C:\WINNT\SYSTEM
   ```

   or placed in the same directory as XCAP, typically:

   ```
   C:\XCAP
   ```

3. Using the Registry Editor (REGEDIT) provided with Windows, create an entry such as:

   ```
   HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\HardLock
   ```

   This key must contain values:

   ```
   ErrorControl  =  0x00000001
   Group         =  "Extended Base"
   Start         =  0x00000002
   Type          =  0x00000001
   ```

   or, if using REGEDT32, the values should appear as:

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```
ErrorControl:REG_DWORD:0x1
Group:REG_SZ:ExtendedBase
Start:REG_DWORD:0x2
Type:REG_DWORD:0x1
```

4. Shut down and restart Windows for the new registry entries to take effect.
5. If the authorization key is connected to a non-standard printer port, an additional entry may be required:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\HardLock\Parameters
```

which contains a value:

```
IoPortAddress0  = 0x????            (for REGEDIT)
IoPortAddress0:REG_DWORD:0x????     (for REGEDT32)
```

where the "????" is replaced with the parallel port's I/O address in hexadecimal. As before, Windows must be shut down and restarted.

3.5. For Windows 2000

1. Install Files:
   a. If XCAP is provided on diskette(s):
      i. Insert XCAP diskette #1 into the A: or B: drive.
      ii. Execute the SETUP program, from a command prompt, or via the Windows "Start", "Run":

```
    > A:SETUP
or
    > B:SETUP
```

      iii. Follow the installation program's directions, such as to select an installation directory, and insert additional diskettes (depending upon version) as instructed.
   b. If XCAP is provided on a compact disk (CD):
      i. If your PC is set to allow automatic execution of loaded CDs, the CD's interactive index program will be executed automatically. Otherwise, execute the index program, from a command prompt, or via the Windows "Start", "Run":

```
> Z:SETUP       (replace Z with drive letter for your CD)
```

      ii. Select "Setup PIXCI(R) Imaging Software" and "XCAP Imaging Application". Click "OK".
      iii. Follow the installation program's directions, such as to select an installation directory.
   c. If XCAP is provided via the internet:
      i. Download:

```
ftp.epixinc.com/software/XCAPWI.EXE
```

      from the EPIX, Inc. ftp site.
      ii. Execute the downloaded program, from a command prompt, or via the Windows "Start", "Run":

```
> XCAPWI.EXE
```

      iii. Follow the installation program's directions, such as to select an installation directory.
      iv. Delete the downloaded .EXE file from your PC's hard drive.
   d. The installation procedure creates a new program group, containing XCAP and several .TXT files. The .TXT files contain these installation instructions, a list of distributed files, corrections or additions to this manual, or other up-to-date information. One file, PCITIPS.TXT, contains the *PC Configuration Tips*, which provides tips for resolving hardware and software conflicts.
2. Create Shortcut - Drag & Drop (optional):
   a. From the program group created by the installation program, click and drag the icon for XCAP over to the desktop and drop.
3. Create Shortcut - Manual (optional):
   a. Right click on the Desktop.[4]
   b. Select "New".
   c. Select "Shortcut".
   d. Set:

```
Command Line:   InstallDir \ XCAPW2K
Name:           XCAP
```

   replacing "InstallDir" with the name of the installation directory chosen above. Select "OK".
4. Install Authorization Key (for XCAP-Plus and XCAP-Std):
   a. XCAP-Plus and XCAP-Std, but not XCAP-Lite, are provided with an authorization key; about the size and shape of

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a printer cable's connector (5.5×4.5×1.6 cm), but having 25 pin connectors at both ends and no cable attached. If provided, connect the authorization key to printer port 1, 2, or 3. If a printer cable was attached to the printer port, reconnect the printer cable to the back of the authorization key. The authorization key will not affect normal printer operation.

Do not connect the authorization key to a 25 pin serial (RS-232) port, or to any other interface which happens to use the same style connector; the authorization key will not function, might be permanently damaged, and the warranty will be void!

The authorization key must remain attached to the printer port while XCAP is running. If the authorization key is missing, or disconnected while XCAP is running, then XCAP-Plus or XCAP-Std will behave similar to the XCAP-Lite version; selected image processing and analysis tools will not be operational.

b. Run the authorization key utility program provided with XCAP by "Start", "Run":

```
> C:\XCAP \ HLDINST -install
```

c. Or, in command prompt mode, switch to the chosen installation directory:

```
> CHDIR C:\XCAP
```

and execute:

```
 HLDINST  -install
```

to run the authorization key utility program.

5. Install PIXCI® Imaging Board Driver:
   a. If the PIXCI® imaging board's driver wasn't loaded when the PC was powered up (as described under *Hardware Installation*), instruct Windows to load the appropriate driver: Click "Start", "Programs", and "Windows NT Explorer". Within the chosen installation directory, such as C:\XCAP, find and highlight file DRIVERS\WIN2K \EPIXXCNT.INF. From the menu bar, select "File" and "Install".
6. Configure S/VGA:
   a. A "High Color (16 bit or 65536 Color)", "True Color (24 bit or 16777216 Color)", or "True Color (32 bit)" setting for the display adapter (S/VGA) is required for proper display of images and overlay graphics. The "True Color (24 bit or 16777216 Color)" or "True Color (32 bit)" is suggested for higher quality, and quicker, display of images and overlay graphics. This may be checked and/or modified via Windows "Start", "Control Panel", "Display", "Settings".
   b. In Windows 95, under "Control Panel", "Display", "Plus!", the "Show window contents while dragging" must be disabled (this feature is not present in older versions of Windows 95). Or in Windows 98, under "Control Panel", "Display", "Effects", the "Show window contents while dragging" must be disabled.
   c. After changing the settings a full shutdown and CTRL+ALT+DEL reboot should be used. The quick restart offered by older versions of Windows, and the dynamic VGA reconfiguration performed by newer versions of Windows, may not re-initialize all devices properly.
7. Reboot Windows.
8. XCAP is now ready to run, clicking "Start", "Programs", "XCAP Imaging", and finally "XCAP for Win 2000".

3.6. Win 2000 Esoterica

3.6.1. Windows 2000 - Manual Installation

Use of EPIXXCNT.INF, above, provides automatic installation of EPIXXCNT.SYS in most circumstances. The following information allows manual installation, correcting problems, or integration with an OEM's procedures.

1. The EPIXXCNT.SYS must be copied to the Windows SYSTEM32\DRIVERS directory, typically:

```
C:\WINNT\SYSTEM32\DRIVERS
```


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2. Using the Registry Editor (REGEDIT) provided with Windows, create an entry such as:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\EPIXXCNT
```

   This entry must contain:

```
ErrorControl  =  0x00000001
Group         =  "Extended base"
Start         =  0x00000001
Type          =  0x00000001
```

   and may, as described below, also contain:

```
PIXCI         =  "-IM <memorysize>"
```

   Create an entry such as:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\EventLog\System\EPIXXCNT
```

   This entry must contain:

```
EventMessageFile = "%SystemRoot%\System32\IoLogMsg.dll"
TypesSupported   = 0x00000007
```

3. Shut down and restart Windows.

3.6.2. Windows 2000 - Frame Buffer Memory Allocation

Under Windows 2000, frame buffer memory must be allocated during Windows' initialization.

The requested frame buffer memory size must be specified in the Registry entry described above, using an entry named "PIXCI", such as:

```
PIXCI         =  "-IM <memorysize>"
```

replacing the "<memorysize>" with the desired memory size in Kbytes. If no frame buffer memory size is specified, a default size of 4 megabytes is used. Windows must be rebooted for the new specification to take effect.

Windows 2000 limits the maximum amount of allocatable frame buffer memory, dependent upon what other devices are installed, the total PC memory size, and other factors.

Less than the requested amount of frame buffer memory may be allocated. If no memory could be allocated, XCAP will not run, stating "Can't allocate frame buffer memory". Otherwise, within XCAP, the number of available frame buffers can be checked under *PIXCI®*, *PIXCI® Video Setup*, *Resolution*. As the frame buffer memory is allocated once during Windows initialization; the contents of frame buffers are retained as XCAP is closed and restarted, but lost if Windows is restarted.

3.6.3. Windows 2000 - Forcible Frame Buffer Memory Allocation

As described above, frame buffer memory allocated by EPIXXCNT.SYS during Windows startup may be limited to a small percentage of total PC memory.

A larger frame buffer memory can be obtained by limiting the amount of memory recognized by Windows 2000, and then instructing EPIXXCNT.SYS to explicitly use a section of memory without allocating it from Windows 2000:

1. Edit C:\BOOT.INI, restricting Win 2000 to use no more than a set amount of memory: by copying an existing configuration line, adding /MAXMEM=XX (where XX is in Mbytes) and changing the prompt name, such as changing:

```
[operating systems]
multi(0)disk(0)rdisk(0)partition(7)\WINNT="Windows 2000"
```

   to

```
[operating systems]
multi(0)disk(0)rdisk(0)partition(7)\WINNT="Windows 2000 [NT=64M PIXCI=256M]"  /MAXMEM=64
multi(0)disk(0)rdisk(0)partition(7)\WINNT="Windows 2000"
```

   Do not copy this new line exactly as is; the first portion of the line must be copied from an existing configuration line in your C:\BOOT.INI file. The text between quotes appears as a boot selection prompt, use of "[NT=64M PIXCI=256M]" is a suggested reminder, but not required. Keeping the original configuration line, as a boot selection option, is highly recommended as a backup.
2. Edit the registry entry for EPIXXCNT.SYS:

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```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\EPIXXCNT
```

On the "PIXCI" field add:

```
-IA <image_memory_adrs_in_kbyte>
-IM <size_of_image_memory_in_kbyte>
-MB 8192
```

In practice, all three fields are on the same line. Be certain that the -IA address is equal to (or above) the specified /MAXMEM limit; INCLUDING exact base2 to base10 conversions! (i.e. for /MAXMEM=64, the smallest legal value of -IA is 65536, not 64000!). Likewise, be certain that the -IA plus -IM values do not exceed the amount of memory available!

3. Reboot, using the newly added boot selection.

For example, for a PC with 1 gigabyte of memory, allocating 256 Mbyte for Windows and the remainder for frame buffer memory, use:

```
/MAXMEM=256
```

in C:\BOOT.INI, and use:

```
PIXCI = -IA 262144 -IM 786432 -MB 8192
```

in the registry entry. Note that 262144 is 256×1024, and 786432 is (1024-245)×1024.

Note that if this memory allocation method is used, program access to image data may be is slower. Thus, the video display rate (and image processing) may be slower, but the video capture rate (such as sequence capture) is not adversely affected. This method of memory allocation is primarily used for video rate acquisition of long sequences, followed by off-line analysis or saving of the sequence.

3.6.4. Windows 2000 - Authorization Key - Manual Installation

Use of HLDINST.EXE, above, provides automatic installation of the authorization key's driver, needed under Windows 2000, for XCAP-Plus and XCAP-Std (but not needed for XCAP-Lite). The following information allows manual installation, correcting problems, or integration with an OEM's procedures.

1. The file HARDLOCK.SYS must be copied to the Windows SYSTEM32\DRIVERS directory, typically:

```
C:\WINNT\SYSTEM32\DRIVERS
```

2. Using the Registry Editor (REGEDIT) provided with Windows, create an entry such as:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\HardLock
```

This key must contain values:

```
ErrorControl  =  0x00000001
Group         =  "Extended Base"
Start         =  0x00000002
Type          =  0x00000001
```

or, if using REGEDT32, the values should appear as:

```
ErrorControl:REG_DWORD:0x1
Group:REG_SZ:ExtendedBase
Start:REG_DWORD:0x2
Type:REG_DWORD:0x1
```

3. Shut down and restart Windows for the new registry entries to take effect.
4. If the authorization key is connected to a non-standard printer port, an additional entry may be required:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\HardLock\Parameters
```

which contains a value:

```
IoPortAddress0  = 0x????            (for REGEDIT)
IoPortAddress0:REG_DWORD:0x????     (for REGEDT32)
```

where the "????" is replaced with the parallel port's I/O address in hexadecimal. As before, Windows must be shut down and restarted.

---

4. Getting Started

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This chapter will guide the user through the initial steps common to most applications using the PIXCI imaging board: capturing, viewing, examining, and saving images. This guide isn't intended to discuss every feature of every window, just the most important features to "get up and running".

By following the previous instructions, at this point:

a. The PIXCI imaging board has been installed.
b. The camera has been connected to the PIXCI imaging board.
c. The XCAP software has been installed.
d. For XCAP-Plus or XCAP-Std, but not XCAP-Lite, the authorization key has been installed on the printer port.
e. The PIXCI driver for Windows 95/98, Windows NT, or Windows 2000 has been installed.
f. The S/VGA has been set for 16 bits (minimum required), or 24 or 32 bits (preferred), per pixel.
g. The PC has been rebooted (Ctrl+Alt+Del) so that the installed driver and the modified S/VGA settings (if any) have taken effect.

The following instructions are intended to be used while operating the PC; pictures of the S/VGA are intentionally not shown, in favor of focusing the reader's attention on the real S/VGA screen.

4.1. Start XCAP

Start XCAP by clicking:

```
Start (on the Windows Taskbar)
XCAP Imaging
```

and then clicking:

```
XCAP for Win 95/98
XCAP for Win NT
or  XCAP for Win 2000
```

as appropriate.

The XCAP Main Window now appears.

4.2. Open PIXCI Imaging Board

In the XCAP Main Window, click:

```
PIXCI
PIXCI Open/Close
```

A dialog box appears.

Clicking:

```
Open
```

opens the PIXCI imaging board for use, removes the Open/Close dialog, creates a PIXCI Image Viewer window showing the first PIXCI frame buffer, depending on imaging board model and camera used, may create an Adjust dialog with commonly used camera and video capture adjustments, and creates a Shortcuts Toolbar for accessing the most commonly needed features.

The following windows are now active:

1. The Main Window, which has options for reconfiguring the PIXCI imaging board, and features unrelated to the PIXCI imaging board, such as loading images into image buffers unrelated to video capture hardware.
2. The PIXCI® Image Viewer window, from which the PIXCI® frame buffers are captured, viewed, examined, processed, measured, and saved.
3. The PIXCI® Shortcut Toolbar, with shortcuts for the most commonly needed features relating to the PIXCI® imaging board and its frame buffers.
4. Optionally, an Adjust dialog, with commonly used camera and video capture adjustments.

If XCAP has already been installed, it may have been configured with one or more variations. One variation eliminates the Main Window, automatically opening and displaying the PIXCI® Image Viewer. Another variation allows the Shortcuts and/or Adjust features to be attached to the The PIXCI® Image Viewer window, rather than detached into their own windows. A third variation selects whether the Shortcuts and/or Adjust features appear automatically, or only when

```
Capture
Adjustments
```


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or

```
Capture
Shortcuts
```

are clicked. These variations allow custom configuration of XCAP, but don't affect the functionality of the Shortcuts or Adjustments features.

4.3. PIXCI® D, D24, D32 Video Configuration

The PIXCI® D, D24, and D32 imaging boards are customized for a specific camera. XCAP identifies the specific PIXCI® D, D24, or D32 imaging board, and defaults to capturing full video resolution from the specific camera.

4.3.1. Video Resolution

Reducing the video resolution (the number of pixels captured per line and column) allows capturing more video frames in a given size of frame buffer memory.

From the Main Window, click:

```
PIXCI®
PIXCI® Video Setup
Resolution
```

Modify:

```
Data Pixels per Line
Data Lines per Field


Frame Buffer: 2 Fields      (i.e. interlace)
Frame Buffer: 1 Field
```

as per your application's needs. (Some multi-tap cameras, or cameras with Bayer pattern pixels may not operate correctly if the resolution is modified incorrectly). or The:

```
Image Buffers in Memory
```

shows the number of frame buffers available with the current selections. Click:

```
OK
```

4.3.2. Saving the Video Configuration

The selections under the Main Window:

```
PIXCI® Video Setup
```

and under the PIXCI® Image Viewer:

```
Adjustments
```

are automatically saved when the PIXCI® imaging board is closed, and/or XCAP is exited. When the PIXCI® imaging board is next opened (from the XCAP Main Window clicking):

```
PIXCI
PIXCI Open/Close
Camera & Format
```

You may choose:

```
Open w. last used Video Setup
```

to use the previous video setup, or choose:

```
Open w. default Video Setup
```

to start afresh with the default video format and resolution.

4.4. Capturing Images

Once the PIXCI® imaging board is opened for use, images may be captured from the PIXCI® Image Viewer, clicking:

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```
Capture
Snap
```

or

```
Capture
Live
```

The *Snap* captures a single image into the current frame buffer, while *Live* continuously captures images into the current frame buffer, continuously updating the image shown on the S/VGA.

The *Live* mode may be used to adjust the camera's focus, aperture, and position. The *Live* mode may be halted by clicking:

```
Capture
UnLive
```

A *Live* followed immediately by *Unlive* has the same effect as *Snap*.

If the current video resolution and frame buffer memory size allows more than one frame buffer, clicking:

```
Capture
Adjustments
```

provides the:

```
Current Frame Buffer:   0
```

or sometimes shortened to:

```
Current Buffer:   0
```

which may be incremented or decremented at any time, whether in *Live* or *UnLive* mode. The dialog reached by clicking:

```
Capture
Adjustments
```

has convenient buttons which duplicate the *Snap*, *Live*, and *UnLive* features.

As three of the most commonly used operations, the *Snap*, *Live*, and *UnLive* are also available in the Shortcuts Toolbar, in the top row, at the fifth and sixth from the left. The Shortcuts also allow changing the current frame buffer; in the top row, the four icons at the left switch to the first frame buffer, the next frame buffer (e.g. current buffer +1), the previous frame buffer (e.g. current buffer -1), and the last frame buffer, respectively.

4.5. Examining Images

4.5.1. Altering How the Image is Displayed

The PIXCI Image Viewer can be moved and resized, using standard Windows techniques (drag the window's title bar, drag the window's corner, etc). By default, the captured image is displayed with resizing, so that the entire image fits within the Image Viewer.

For many engineering applications, examination of individual pixel values is critically important. Resizing the image may "hide" defective pixels; resizing an image with interlace jitter may turn odd/even line striping into bars of striping.

To view the exact pixels, from the PIXCI® Image Viewer, click:

```
View
Display
Resize: None (1 to 1)
```

Each image pixel is now displayed as exactly one S/VGA pixel. Of course, depending upon the image resolution, S/VGA resolution, and window size, the entire image may not fit. If the image doesn't fit, then (a) Scroll bars appear, allowing the viewed portion of the image to be panned and scrolled throughout the entire image, and (b) Moving the mouse with right button held over the displayed image causes panning or scrolling (if there is more image to be seen in the direction the mouse is moving).

Note that when:

```
Resize: None (1 to 1)
```

is selected, the displayed image's aspect ratio may not appear correct; the aspect ratio can't be corrected without some form of resizing or resampling!

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4.5.2. Zoom

To magnify the image, from the PIXCI® Image Viewer, click:

```
View
Zoom, Pan, Scroll
Zoom On
```

The magnification factor can be adjusted with:

```
Zoom Ratio
```

When magnified, only a portion of the image is visible. As described above, the viewed portion may be panned and scrolled through the entire image with the scroll bars, or by moving the mouse over the image with right button held.

4.5.3. Numeric Pixel Values

To examine numeric values of pixels as a table, from the PIXCI® Image Viewer, click:

```
Examine
Pixel Peek
```

A table of pixel values for a portion of the image appears, showing pixel values in the neighborhood of the displayed X and Y coordinates. The portion of the image numerically displayed can be moved by using the scroll bars, or by entering new X and Y coordinates.

The portion of the image which is numerically displayed can also be moved interactively by clicking:

```
Coord<=>Cursor
```

A cursor now appears over the image window (the Pixel Peek window may have to be moved to the side so that both the pixel peek window and the image viewer window can be seen); clicking the mouse on the image viewer window moves the cursor to that position, and repositions the numerically displayed portion of the image to be centered at that position.

To examine pixel values as a two dimensional graph, click:

```
Examine
Pixel Plot
```

and

```
Controls
Where
and Plot Row
or  Plot Column
```

A graph of pixel values for a line (column) of the image appears, showing pixel values along the line (column) at the displayed Y (X) coordinate. The line (column) of the image which is shown can be moved interactively by clicking:

```
Coord<=>Cursor
```

A cursor now appears over the image window; clicking the mouse on the image window moves the cursor to that position, and repositions the displayed line (column) to that Y (X) coordinate.

4.6. Saving Images

To save an image, from the PIXCI Image Viewer, click:

```
File
Save Image
```

Choose a file format, such as:

```
TIFF
JPEG/JFIF
BMP
PCX
Targa (TGA)
X/Y Binary
X/Y ASCII
```

TIFF is an industry standard, and the most commonly used image file format; TIFF is suggested for saving and reloading an image into XCAP, and suggested for exporting images to other programs which support TIFF. The JPGE/JFIF is also a commonly

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used image file format and provides high, but lossy, compression. The BMP, PCX, and TGA formats are useful when exporting an image into other programs that don't support TIFF; but these file formats support only 8 bits per pixel component (such as 8 bit monochrome or 24 bit RGB). The X/Y Binary and X/Y ASCII export raw pixels, left to right, top to bottom, with no excess information such as dimensions, bit depth, date, format, etc; these are useful for exporting images to a spreadsheet (X/Y ASCII), or to your own program that can assume the image's dimensions and can simply read a 2-D array of values.

After selecting a file format, enter a file name:

```
File Name:  xx.tif
```

and click

```
OK
```

to save the image. Or, use the:

```
Browse
```

button to access the standard Windows File Dialog, click

```
Accept
```

to accept the filename selected by browsing, and click

```
OK
```

to save the image.

---

5. XCAP Software Guide

XCAP is a family of sophisticated, interactive, imaging programs specifically designed to support the PIXCI series of imaging boards, but also able to process and analyze images from other imaging sources. Several versions of XCAP are available: XCAP-Std, XCAP-Plus, XCAP-Lite, and XCAP-Demo. All versions share the same user interface and menu structure, but selected features in XCAP-Std, XCAP-Lite, and XCAP-Demo are not operational. XCAP is distributed on CD, diskette(s), or downloadable from the EPIX, Inc. website. After installation, a 12 character identification code[5] is entered to configure XCAP as either XCAP-Std, XCAP-Plus,[6], or XCAP-Lite; or, lacking a valid code, configured as XCAP-Demo to browse, but not use, XCAP's features.

XCAP-Std is an interactive, imaging program designed for scientific, industrial, and machine vision applications. XCAP-Std supports the PIXCI imaging board, providing video format and resolution configuration; continuous (live), video rate sequence, and triggered capture; and single or sequence, zoomed or resized, display. The image frame buffers of PIXCI imaging boards can be loaded, examined, processed, analyzed, measured, printed, annotated, and saved.

XCAP-Std also allows loading and analyzing a pre-existing image or image sequence with size, pixel depth, and color space independent of the PIXCI imaging board's configuration; XCAP-Std can be used with pre-existing images even when the PIXCI imaging board is not present. XCAP-Std can also acquire images from TWAIN compliant devices.

XCAP-Plus provides extra, advanced, features in addition to all of the capabilities of the XCAP-Std, such as support for specialized, optional, hardware.

XCAP-Lite is a basic version of XCAP-Std. XCAP-Lite provides similar image acquisition and PIXCI imaging board control capabilities, video format and resolution configuration; continuous (live), video rate sequence, and triggered capture; and single or sequence, zoomed or resized, display. XCAP-Lite also provides some of the image loading, examining, printing, and saving features, but minimal processing, measurement, analysis, and scripting features are functional. XCAP-Lite can also be used with pre-existing images, but only while the PIXCI imaging board is present and opened for use.

XCAP-Demo allows browsing through the dozens of processing, measurement, analysis, and graphics features provided in XCAP-Plus, XCAP-Std, or XCAP-Lite. Images can't be loaded from, or saved to, files. Nor can the PIXCI imaging board be operated with the XCAP-Demo version.

As XCAP-Plus, XCAP-Std, and XCAP-Lite share many common features, this manual typically refers to all versions as XCAP, except where explicitly differentiated.

The XCAP programs are organized into two major types of windows, the Image Viewer Window and the Main Window.

For each image, or sequence of images, an Image Viewer Window shows that image, or a selected image of that sequence, and via its menu bar allows viewing, examining, processing, analyzing, or drawing upon that image (sequence). The Image Viewer Window associated with the PIXCI imaging board's frame buffers also provides features for capturing new images. There can be

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multiple Image Viewer Windows for the same image (sequence), allowing, for example, viewing the image both zoomed and unzoomed, or simultaneous viewing of different images of a sequence.

The Main Window allows creating new image (sequences), and thus new Image Viewer Windows, either by loading a new image from file, explicit specification of the new image's dimensions, or by opening the PIXCI imaging board for use. Video setup for the PIXCI imaging board, such as modifying the video resolution or color space, are also in the Main Window; these features destroy and re-create the PIXCI imaging board's Image Viewer Window. The Main Window also provides features not directly associated with an image (sequence), such as scripts, RS-232 device control, and features to customize XCAP.

5.1. The Main Window

The XCAP main window provides a menu bar with *File*, *Images*, *Scripts*, *Utility*, *PIXCI®*, and *Help* features.

5.1.1. Main Window - File

The main window's *File* allows loading of pre-existing images into new image buffers, displaying attributes about pre-existing images, and acquiring images from TWAIN compliant devices.

The *Load New Image* and *Load New Image Sequence* creates a new image buffer (sequence) with dimensions, pixel depth, and color space matching a specified TIFF, BMP, or multimedia format file(s), and loads the image(s) from the file(s). This feature, and the image buffer (sequence) created, is unrelated to the PIXCI imaging board's frame buffers. After creation and loading, the new image (sequence) is displayed, processed, and analyzed in The Image Viewer Window, described below. The XCAP-Lite version does not provide the *Load New Image Sequence* feature.

The *Image File Info* displays information about a specified TIFF or BMP format file without loading the image. The information displayed includes the image's dimensions, pixel depth, color space, palette option, and other file format specific information.

The *TWAIN Select Source* and *TWAIN New Acquire* allow using XCAP as a TWAIN Application, acquiring images from TWAIN compliant imaging devices (TWAIN Sources). The *TWAIN Select Source* allows selecting which TWAIN Source is to be used, and the *TWAIN New Acquire* allows acquiring one image from the TWAIN Source. The XCAP-Lite version does not support being used as a TWAIN Application.

The *Window List* displays a list of active windows belonging to XCAP; selecting a window causes that window to appear, if previously hidden, and/or to appear over other windows (subject to the priority of selected windows to always appear "on top").

5.1.2. Main Window - Images

The main window's *Images* allows creating new image buffers and activating any existing image windows that may not be on-screen.

The *New Image* creates a new image buffer, or sequence of image buffers, with specified dimensions, pixel depth, color space, and palette. This feature, and the image buffer created, is unrelated to the PIXCI imaging board's frame buffers. After creation, the new image is displayed in an The Image Viewer Window, as described below.

Underneath *New Image* are listed all existing image windows, whether for PIXCI imaging board frame buffers, or for independent image buffers. (The image window for PIXCI imaging board frame buffers appears only after the PIXCI imaging board has been opened for use, see below). An image window which has been closed and thereby off-screen can be reactivated by clicking the image window's name.

5.1.3. Main Window - Scripts

The main window's *Scripts* provides features for recording and playing scripts. A script recording contains most of the user's interactions with the windows of XCAP; playing the script duplicates the original actions.

Some user actions are not recorded. Using the mouse to drag the cursor or other graphic across an image is not recorded as these actions are highly dependent upon image content (such as the typical scenario of dragging the cursor until it is positioned next to an artifact in a captured image), would likely be inappropriate to other captured images, and would consume a significant amount of disk space. Instead, after positioning the cursor interactively the user can record the final position by clicking the appropriate numeric cursor coordinates. Features activated with keys, or clicking icons are not currently recorded; such features can also activated by other means, which are recorded.

A recorded script is in a human readable form and can be altered with any common editor capable of handling ASCII text, allowing scripts to be modified or combined. A selected script may be executed automatically after XCAP starts, this feature is set in *Utility*, *Program Setup*, *Startup Script*.

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The *Load Tool Bar* provides one or more user-defined tool bars of shortcuts, each shortcut represented by an icon which, when clicked, executes a user-specified script. Each shortcut may also specify an optional keyboard key which, when pressed, also executes the user-specified script.

The *Script Remote Control* allows using XCAP as a hidden, off-screen, "black box"; any end-user application that can manipulate text files, can also remotely control XCAP.

The XCAP-Lite version does not support recording scripts, creating user-defined tool bars, or the remote control feature. The XCAP-Lite version can play scripts previously created with XCAP.

5.1.4. Main Window - Utility

The main window's *Utility* provides an assortment of features which are of secondary importance; features which allow fine tuning of XCAP, or features needed in relatively few circumstances.

The *Black Board* allows customizing XCAP, creating non-procedural programs, and collecting data. The black board allows inter-connecting the numeric and text field of other windows; computed results, such as center-of-mass, may be written onto the black board - parameters for other features, such as the coordinates of a displayed grid, may be extracted from the black board - combining these automatically repositions the grid as the center of mass is recomputed! Other features allow computed values (similar to a spreadsheet), "push"ing buttons, timed updates, creating a report to file or an RS-232 port, collecting data, and graphing the black board's contents. The XCAP-Lite version allows use of the *Black Board* for computing values (similar to a spreadsheet), but does not allow inter-connections with other features or creating reports or graphs.

A *Message Log* window lists warnings and errors that arise from performing various operations. By default, the message log window appears automatically when a message is added, and disappears a few seconds later. Auto appearance, auto hide, and audible clicks can be disabled (from the message log window's menu bar). The menu-bar's *Message Log* allows explicit activation of the message log window.

The *Program Setup* shows information about the installed XCAP components, such as their revision level, and sets various configuration options. For versions of XCAP which require an authorization key, it also shows the ID of the key required by the instant copy of XCAP.

The *Program Setup* allows specifying the name of a script to be executed when XCAP starts, whether warning dialog's (if any) are to be shown, whether previously saved settings are to be loaded, and other similar initial or terminal conditions.

The *Program Setup* also enables user-defined translation of XCAP labels and messages for use in non-English speaking countries. The XCAP-Lite version does not support creating user-defined translated labels and messages, but may use translated labels and messages previously created with XCAP.

The *Windows Info* displays information about the current Windows environment, such as memory usage and the S/VGA display adapter's features, as reported by Windows. The *Java Info* displays information about the status of Java, under which XCAP runs. Both of these features are primarily of use in resolving questions submitted to EPIX, Inc. Technical Support.

The *Window Style* allows setting some characteristics of XCAP windows, such as color or character size and font. Some characteristics of window style are instead controlled by the Windows Control Panel.

The *Audio Clip* allows recording and playing short audio "clips".

The *RS-232 Control* allows controlling devices connected via the RS-232 port. The *RS-232 Control* is designed specifically for device control, including options to communicate with byte values, rather than as a common "terminal emulator".

The *I/O Port Peek & Poke* allows controlling arbitrary devices accessible via I/O port peeks and pokes. This feature must be used with caution; peeking or poking arbitrary ports will cause computer malfunction! This feature is not available under Windows NT.

The *Screen Capture* allows capturing the current S/VGA screen graphics, saving the graphics to a file, or printing the graphics. The *Screen Capture* also allows capturing numeric and textual parameters into a text file, suitable for loading into a spreadsheet or other programs. The XCAP-Lite version does not support screen capture.

5.1.5. Main Window - PIXCI®

The main window's *PIXCI®* allows initiating access to the PIXCI imaging board and provides configuration options. Actual operation of the PIXCI imaging board is performed through the PIXCI image viewer window's menu-bar.

The *PIXCI® Open/Close* allows opening access to, or closing access to, the PIXCI imaging board. Once open, the model (and submodel, as appropriate) of the PIXCI imaging board is available via the *Board Info* button. After opening, the contents of the PIXCI image board's frame buffer(s) are displayed in The Image Viewer Window, and a tool bar of PIXCI® Image Viewer -

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Capture - Shortcuts is shown, as described below.

The *PIXCI® Video Setup* allows configuring the video format, video resolution and other, model specific, video characteristics. For example, for PIXCI SV2, SV3, and SV4 models, the *PIXCI® Video Setup* allows selecting NTSC, RS-170, S-VIDEO, CCIR, or PAL, allows selecting the video window size and capture resolution, and selecting other video acquisition characteristics. For other models, such as the PIXCI® D, fewer options may be provided, as the PIXCI® D models are camera specific.

The current video setup is automatically saved when access to the PIXCI imaging board is closed, and reloaded when the PIXCI image board is later opened. The *PIXCI® Save Video Setup* and *PIXCI® Load Video Setup* may be used to explicitly save or reload the current video setup, such as to choose amongst several favorite setups, or to export the current video setup to the XCIP program or the XCOBJ library.

The *PIXCI® Status* shows the PIXCI imaging board's current status, such as the state of the TTL trigger input(s) and output(s), the number of elapsed video fields, the board's model and submodel, and configured image memory size.

The *PIXCI® Connections* provides, as appropriate for the specific model of PIXCI imaging board, a map of the board's connections, connectors, option jumpers, and adjustments.

The *PIXCI® Camera Info* provides a list of cameras and video formats supported by XCAP and various PIXCI® imaging boards. The *PIXCI® Camera Info* also allows viewing a non-operational Capture - Adjustments dialog (i.e. the "Control Panel", which provides integrated control of both imaging board and any supported camera.

The *PIXCI® TWAIN Sourcery* allows using XCAP, in conjunction with the PIXCI® TWAIN driver, as a component of a "smart" TWAIN Source, allowing other applications to capture images from the PIXCI® imaging board, while XCAP provides imaging board, camera controls, and, optionally, image preprocessing. (The XCAP-Lite version does not provide image preprocessing). See the PIXCI® TWAIN driver documentation for additional details. The *PIXCI® TWAIN Sourcery* should not be confused with *TWAIN New Acquire*; the former allows XCAP to provide image data to other, TWAIN compliant applications; the latter allows XCAP to accept image data from other TWAIN compliant sources. The *TWAIN New Acquire* should never be used to attempt to acquire image data from the *PIXCI® TWAIN Sourcery*!

The *PIXCI® Image-Pro Sourcery* allows using XCAP, in conjunction with the PIXCI® Image-Pro driver, as a component of a "smart" video source, allowing Image-Pro to capture images from the PIXCI® imaging board, while XCAP provides imaging board, camera controls, and, optionally, image preprocessing.

5.2. The Image Viewer Window

Each image buffer (sequence), or frame buffer (sequence), is displayed in an image viewer window, which is the focus of activity for examining, processing, or analyzing that image buffer (sequence). The image viewer window provides a menu bar with *File*, *View*, *Examine*, *Modify*, *Measure*, *Draw*, *AOI*, and *Help* features. The image viewer window associated with the PIXCI imaging board's frame buffer(s) also provides a *Capture* feature.

5.2.1. Image Viewer - File

The image viewer window's *File* allows saving, loading, or printing the image, shows information about the image's dimensions, pixel depth and color space, and allows closing the image viewer window.

The *Load Image* and *Save Image* allow saving or loading the image in a variety of file formats. The *Load Image*, unlike the *Load New Image* described above, loads an image file into the current image buffer, resizing and/or color converting to fit the image buffer's existing dimensions, pixel depth, and color space.

For image viewer windows associated with an image buffer sequence, the *Save Image Sequence* and *Load Image Sequence* allow saving or loading multiple images of the sequence as a numbered sequence of image files, or as a single TIFF or AVI format image file with multiple images. The XCAP-Lite version does not support loading or saving of image buffer sequences in a single operation; however multiple uses of *Load Image* or *Save Image* can load or save each image buffer of a sequence.

The *E-Mail Image* allows directly e-mail'ing the image, in a variety of file formats, from within XCAP. The XCAP-Lite version does not support the *E-Mail Image* feature.

The *Print, Windows* and *Print, PXIPL* allow printing the image; the former printing via Windows and supporting a wide variety of printers, the latter printing via the PXIPL library and supporting only the most popular printers, but providing precise control of print options. The XCAP-Lite version does not allow printing via the PXIPL library.

The *Attributes* shows the image's (or image sequence's) dimensions, pixel depth, and color space.

The *Duplicate Image* allows creating a new image buffer, and copying the image, in one step. It optionally allows copying the image's current appearance, as modified by the palette and graphics, instead of the underlying image. The XCAP-Lite version

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does not provide *Duplicate Image*.

The *Copy to Black Board* allows copying the image's pixel values into the Black Board. The XCAP-Lite version does not provide *Copy to Black Board*.

The *Close Viewer* closes the window, but does not destroy the image (sequence). The *Close & Dispose of Image* closes the window and destroys the image (sequence). The image viewer window associated with the PIXCI imaging board's frame buffer(s) does not provide a *Close & Dispose of Image*; an image viewer window is available whenever the PIXCI imaging board is open for use.

5.2.2. Image Viewer - View

The image viewer window's *View* provides options governing the appearance of the displayed image.

The *Full Screen* allows displaying the image in the full S/VGA screen, with little or no window "frame" around the image. A mouse click, anywhere on the S/VGA, restores the previous mode. The XCAP-Lite version does not provide the *Full Screen* feature.

The *Always On Top* allows forcing the image viewer window, and its subwindows, to always be "above" other windows; subject to the other windows' also requesting *Always On Top*, and the whims of the host operating system. This option is typically needed only when XCAP is being used in combination with other applications, such as in conjunction with the *PIXCI® TWAIN Sourcery* or *PIXCI® Image-Pro Sourcery* feature.

For images composed of index pixels and palette, the *Image's Palette* allows manipulating the image's attached palette; for images of other types, the *Image's Palette* is not selectable. For all images, the *Viewer's Palette* allows manipulating a palette which is not attached to the image. Either can be used for contrast enhancement, adjustment of black level and gain, or, for monochrome images, false coloring. Either, or neither, of the palettes can be selected for use under *Misc Options*.

For image sequences, the *Sequence Play* allows "playing" the sequence, image by image, at a selected rate. The *Sequence Thumbnails* shows a window in which each image of the sequence is a small "snapshot"; clicking a snapshot selects that image for display by the image viewer window. The XCAP-Lite version does not provide the *Sequence Thumbnails*.

The *Cursor* allows activating a cursor over the image, which may be positioned via coordinates, or by clicking the mouse on an image feature.

The *Display* allows selecting how the image is displayed: (a) No resizing so that there is a one to one relationship between an image pixel and a displayed S/VGA pixel and is quickest, although the entire image may not fit within the window and must therefore be panned and scrolled, (b) Resize by nearest neighbor which is relatively quick, or (c) Resize by bilinear interpolation which may produce better results for continuous tone images, but is slower. For the resize modes, the aspect ratio can also be modified. For the image viewer window associated with the PIXCI imaging board's frame buffer(s), the *Display* provides additional features, identical to the *Live Options* described below.

The *Zoom, Pan, Scroll* allows magnifying the displayed image, and panning and scrolling to view different portions of the image under magnification. For image sequences, a specific image of the sequence can be selected for display. In addition to panning and scrolling via explicit coordinates and via scrollbars, holding the right mouse button and moving the mouse over the image also implements panning and scrolling.

The *Misc Options* allows selecting which palette, if any, is to be used during display and during file loads and saves. An option to display only even lines, or only odd image lines, allows avoiding interlace artifacts during display.

Each image buffer (sequence) may have several simultaneously active viewers, allowing, for example, viewing the same image buffer both magnified and unmagnified. The *Launch 2nd Viewer* creates a second image viewer window into the same image buffer (sequence), with the same features as the original image viewer window. The XCAP-Lite version does not provide the *Launch 2nd Viewer* feature.

5.2.3. Image Viewer - Examine

The image viewer window's *Examine* provides options to examine the image.

The *Pixel Peek* allows numeric display of the pixel values in the vicinity of the image cursor.

The *Pixel Peek & Poke* allows numeric display and modification of the pixel value at the image cursor.

The *Pixel Plot* displays a two dimensional graph of pixels values along a selected image line or column, all image lines, or for image sequences, a vector. Features attached to the graph show specific pixel values and descriptive statistics such as lowest value, highest value, mean value, and standard deviation. The XCAP-Lite version does not provide a graph of all image lines, and does not provide descriptive statistics.

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The *Pixel 3D Graph* displays a three dimensional graph projection of the image.

The *SMPTE VITC* allows searching the image for valid SMPTE Vertical Interval Time Codes and displaying the decoded codes.

The XCAP-Lite version does not provide the *SMPTE VITC* features.

5.2.4. Image Viewer - Modify

The image viewer window's *Modify* provides image processing operations which modify the image, modify each image (independently) in a sequence (typically named "Sequence ...") or modify one or more images in a sequence by combining data from across multiple images (typically named "... Sequence)."

The *Patterns* draws various test patterns in the image. The *Sequence Patterns* does the same on each image of a sequence.

The *Set* sets image pixels to a specified value. The *Sequence Set* does the same on each image of a sequence.

The *Arithmetic* provides pixel arithmetic, such as adding a constant value. The *Sequence Arithmetic* does the same on each image of a sequence. The *Src+Dst Arithmetic* does the same with distinct source and destination images.

The *Binning* provides averaging or integrating pixel values in "bins" of a checkerboard. The *Sequence Binning* does the same on each image of a sequence. The *Src+Dst Binning* does the same with distinct source and destination images.

The *Contrast Modification* allows modifying the image's contrast. The *Sequence Contrast Modification* does the same on each image of a sequence. The *Src+Dst Contrast Modification* does the same with distinct source and destination images.

The *Convolution* allows convolving the image with user-defined kernels. The *Sequence Convolution* does the same on each image of a sequence. The *Src+Dst Convolution* does the same with distinct source and destination images.

The *Correlation Map* allows correlating, or matching, a kernel image over a larger image, resulting in a profile image whose intensity, at each location, varies in proportion to the degree of match, at that location. The *Sequence Correlation Map* does the same on each image of a sequence. The *Src+Dst Correlation Map* does the same with distinct source and destination images.

The *Edge Detection* provides Kirsch, Sobel, and other standard edge detectors. The *Sequence Edge Detection* does the same on each image of a sequence. The *Src+Dst Edge Detection* does the same with distinct source and destination images.

The *FFT* provides Fast Fourier Transforms and Discrete Fourier Transforms. The *Sequence FFT* does the same on each image of a sequence. The *Src+Dst FFT* does the same with distinct source and destination images.

The *Interlace & Flicker* provides line and pixel shuffling operations. The *Sequence Interlace & Flicker* does the same on each image of a sequence. The *Src+Dst Interlace & Flicker* does the same with distinct source and destination images.

The *Morphology* provides morphological operations with user-defined kernels. The *Sequence Morphology* does the same on each image of a sequence. The *Src+Dst Morphology* does the same with distinct source and destination images.

The *Noise Generator* allows adding pseudo-random noise with uniform and other distributions to an image. The *Sequence Noise Generator* does the same on each image of a sequence. The *Src+Dst Noise Generator* does the same with distinct source and destination images.

The *Normalization* provides single image normalizations. The *Sequence Normalization* does the same on each image of a sequence. The *Src+Dst Normalization* does the same with distinct source and destination images.

The *Rotation & Shift* provides image rotations and shifts. The *Sequence Rotation & Shift* does the same on each image of a sequence. The *Src+Dst Rotation & Shift* does the same with distinct source and destination images.

The *Spatial Filtering* provides low pass, high pass, and other filters. The *Sequence Spatial Filtering* does the same on each image of a sequence. The *Src+Dst Spatial Filtering* does the same with distinct source and destination images.

The *Threshold* allows thresholding an image against user-defined, fixed, boundary values. The *Sequence Threshold* does the same on each image of a sequence. The *Src+Dst Threshold* does the same with distinct source and destination images.

The *Threshold, Adaptive* allows thresholding an image against boundary values which are automatically adjusted. The *Sequence Threshold, Adaptive* does the same on each image of a sequence. The *Src+Dst Threshold, Adaptive* does the same with distinct source and destination images.

The *Warp* allows "rubber-sheet" transformations governed by a list of initial and final fiducial locations. The *Sequence Warp* does the same on each image of a sequence. The *Src+Dst Warp* does the same with distinct source and destination images.

The *Copy & Resize* allows copying and resizing an image from one image buffer to another.

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The *Pair Arithmetic* provides pixel arithmetic, such as summation, between one image buffer and another. The *Src+Dst Arithmetic* does the same with distinct pair of source and destination images.

The *Pair Normalization* allows normalizing various attributes of an image, based upon a second reference, or background, image. The *Src+Dst Normalization* does the same with distinct pair of source and destination images.

The *Sequence Average* allows forming the average or sum of an image sequence.

The *Difference Sequence* allows forming the difference of each pair of images of an image sequence.

The *Tile Sequence* allows forming a grid of reduced images from an image sequence.

For image copy and other image processing operations utilizing a distinct source and destination, the image viewer window from which the operation is selected is always the modified destination; an image (or sequence) associated with a different image viewer window can be selected as the unmodified source.

The XCAP-Lite version only provides the *Patterns* and *Set* features.

5.2.5. Image Viewer - Measure

The image viewer window's *Measure* provides features for image measurement and analysis, including user-defined coordinate systems and mapping intensities into user-defined units.

The *Intensity Calibration* allows creating a mapping (correspondence) from monochrome image pixel values into user-defined units, for example from grey level into brightness, or grey level into density of material.

The *Spatial Calibration* allows creating a mapping (correspondence) from pixel X,Y coordinates into a user-defined H,V coordinate system. The H,V coordinates may be translated, scaled, and/or rotated with respect to X,Y coordinates.

The *Histogram* computes and displays a graph of the image's histogram.

The *Mass & Moments* computes and displays various moments of the image.

The *Line Profile* displays a two dimensional graph of pixels values along an arbitrary oriented line, arc, polyline, Bezier, and other curves.

The *Radial Mass Plot* displays a two-dimensional graph of the sum of pixel values versus the pixels' distance from an origin.

The *Ruler* overlays a ruler on the image, with user-defined length, width, and tick marks, all based on the H,V coordinate system. Multiple rulers can be overlayed on each image.

The *Protractor* overlays a protractor on the image, with user-defined radius, arc, and tick marks, all based on the H,V coordinate system. Multiple protractors can be overlayed on each image.

The *Cartesian Reticle* overlays a Cartesian coordinate reticle on the image, based on the H,V coordinate system. Multiple Cartesian reticles can be overlayed on each image.

The *Polar Reticle* overlays a polar coordinate reticle on the image, based on the H,V coordinate system. Multiple polar reticles can be overlayed on each image.

The *Distance & Angle Crosshairs* provides spatial calibration and measurement of absolute position, relative position, length and angles. While these capabilities are also available elsewhere in Image Viewer - Measure and Image Viewer - Draw, the *Distance & Angle Crosshairs* collects chosen features to provide a single dialog with the equivalent of a so-called "Video Crosshair Overlay & Measurement" system.

The *Shape Analysis* provides descriptive statistics about the shape of elliptical, rectangular, or polygonal regions.

The *Blob Analysis* identifies image blobs, based upon thresholding the image into foreground and background, and provides descriptive statistics about the blobs found.

The *Particle Tracking* provides identification and tracking of particles (blobs) over a sequence of images. Individual particles are detected based upon a thresholded (bi-level) image. In one method, multiple image occurrences of a common particle are identified across a sequence of images by position extrapolation and verification. In a second method, vectors of particles which are close together are compared and expected to yield consistent magnitude and direction. In a third method, which requires the fewest setup parameters, common particles are grouped by nearest neighbor. For any method, the particle's trajectories are displayed and reported.

The *SubPixel Edger* overlays a line or curve tool on the image, analyzes the pixel values under the line or curve finding edges to

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subpixel accuracy, and displays the position of the edges both graphically, on the image, and numerically.

The *Ellipse Fitter* overlays an elliptical pattern of subpixel edger tools on the image, and computes a best fit elliptical curve from the edges found.

The *Correlation Finder* correlates, or matches, a kernel image over a larger image, showing the coordinates of, and displaying a box around, the best match(es).

The XCAP-Lite version does not provide the *Intensity Calibration*, *Spatial Calibration*, *Histogram*, *Mass & Moments*, *Radial Mass Plot*, *Ruler*, *Protractor*, *Cartesian Reticle*, *Polar Reticle*, *Distance & Angle Crosshairs*, *Shape Analysis*, *Blob Analysis*, *Particle Tracking*, *SubPixel Edger*, *Ellipse Fitter*, or *Correlation Finder* features. The *Line Profile* is limited to straight lines.

5.2.6. Image Viewer - Draw

The image viewer window's *Draw* provides features for drawing graphics and text over the image. One or more of: line, circle with aspect ratio correction, rotated rectangle, rotated ellipse, arc of circle with aspect ratio correction, arc of rotated ellipse, annulus, arc of annulus, rectangular frame, list of points, polygon, polyline (connected line segments not closed into a polygon), Bezier curve, or Bezier region (Bezier curve closed to form region), rotated text, and arrow may be overlayed over the image (non destructive) or written into the image. The individual menu items such as Text, Line, Rectangle, etc. allow quick drawing of graphics or text. The *Graphic Manager* permits drawing the same graphics or text, but in addition manages a list of graphic or text objects, including loading and saving of the graphic or text objects.

The *Image Overlay* feature allows overlaying a second image, containing graphics on a "transparent" background, over the current image.

The *Paint Brush* feature allows interactive "painting" onto the image with selectable color, patterns, and "brush" shapes.

The *Paint Fill* feature allows filling (flooding) an image region with "paint" of selectable color and patterns, using specified pixel values as the boundary terminating the "filling".

The XCAP-Lite version only provides the graphic line feature.

5.2.7. Image Viewer - AOI

The image viewer window's *Aoi* allows defining areas of interest (AOI) and regions of interest (ROI) upon which future image processing, measurement, analysis, print, load, and save features will operate. As used in XCAP, an "AOI" is a rectangular area with sides parallel to the image axis, while an "ROI" is of arbitrary shape, such as an ellipse or rectangle which may be rotated with respect to the image axis, or an arbitrary path or polygon. The image print, load, save, and many other features only allow use of an AOI; selected image processing, measurement, analysis and other features also allow use of an ROI.

The *Set AOI* defines the default area of interest and color space upon which future image processing, printing, load, and save features will operate.

The *Set ROI* defines the default region of interest and color space upon which future image measurement, analysis, and other selected features which accept an ROI will operate.

The *Set Full Image* quickly sets the default area of interest and region of interest to the image's full dimensions, and the default color space to the image buffer's natural color space, without entering the *Set AOI* or *Set ROI* dialog.

The *AOI/ROI Manager* maintains a list of often used areas of interest (AOI) and regions of interest (ROI).

Within each of the image processing, measurement, analysis, print, load, and save features a different AOI (or ROI, if applicable) can be selected, temporarily overriding the default AOI (or ROI). Within the feature, the new AOI (or ROI) can be specified numerically or interactively drawn, or an AOI (ROI) previously defined within the *AOI/ROI Manager* can be selected.

5.2.8. Image Viewer - View - Shortcuts

A tool bar of icons provides shortcuts for accessing often used features of The Image Viewer Window. Selected shortcuts can also be activated by key clicks when the tool bar window as the "input focus" (e.g. Windows has highlighted that window's title bar). The shortcuts provided are:

a. Switch to first buffer of sequence (*Key HOME*).
b. Switch to next buffer of sequence (*Key PAGE UP*).
c. Switch to previous buffer of sequence (*Key PAGE DOWN*).
d. Switch to last buffer of sequence (*Key END*).
e. Copy image to new image buffer.

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f. Adjust palette.
g. Zoom, scroll, and pan.
h. Peek at numeric pixel values.
i. Two dimensional plot of line or column of pixel values.
j. Histogram of pixel values.

The first four shortcuts appear only for The Image Viewer Windows which access a sequence of images.

The shortcuts may either be attached and part of The Image Viewer Window, or may be detached into its own window, as set by *Display* under Image Viewer - View.

5.2.9. PIXCI® Image Viewer - Capture

The image viewer window associated with the PIXCI image board's frame buffer(s) has *Capture* which provides for capturing images from the PIXCI imaging board and other features associated with the PIXCI imaging board. Any additional image viewer windows created by *Launch 2nd Viewer* do not provide *Capture*, but only view, modify, examine, and/or draw the frame buffers.

The *Adjustments* allows setting common adjustments, as suitable for the model of the PIXCI imaging board in use. For example, for PIXCI® SV2, SV3, and SV4 models, the *Adjustments* allows selecting the video input connection and adjusting the gain, black level, hue, and saturation. Less frequently used, and more esoteric, adjustments may be found under *PIXCI® Video Setup*, described above.

The *Shortcuts* activates or deactivates the PIXCI® Image Viewer - Capture - Shortcuts, described below.

The *Snap* captures and displays a single image. The *Live* continuously captures and displays images; the *UnLive* terminates the *Live* mode, displaying the last captured image.

The *First Buffer* switches to the first buffer of the frame buffer sequence, the *Next Buffer* switches to the next buffer of the frame buffer sequence, the *Previous Buffer* switches to the previous buffer of the frame buffer sequence, and the *Last Buffer* switches to the last buffer of the frame buffer sequence.

The *GIO Event Capture* provides single or sequence image capture, each image triggered in conjunction with the image board's general purpose (previously referred to as an external TTL) input and output signals. The XCAP-Lite version does not provide the sequence option of the *GIO Event Capture* feature.

The *Sequence Capture* allows capturing a timed sequence of images. The *Sequence Capture* may be started by an event, or run continuously until stopped by an event. Events include mouse clicks, time of day, and the imaging board's general purpose (previously referred to as external TTL) inputs; when used with general purpose input events the *Sequence Capture* differs from *GIO Event Capture* in that the former starts the entire sequence upon a single event (trigger), while the latter captures one or more images each in response to an event (trigger). The XCAP-Lite version does not provide the event option(s) of the *Sequence Capture* feature.

The *Waterfall Display* displays a chosen line of the frame buffer, in a "waterfall" fashion, updating the screen once per field, or as often as the host computer's speed allows. This feature is primarily intended for adjusting line scan type cameras. The waterfall display is intended only for viewing; it can't be analyzed, and can be saved only as a side effect of *Screen Capture*.

The *Video to Disk* allows recording and playing video to and from disk. The record/playback frame rate depends upon the image resolution, host computer speed, and hard disk capabilities. The XCAP-Lite version does not provide the *Video to Disk* feature.

The *Video to StreamStor* allows recording and playing video to and from Boulder Instruments StreamStor High-Speed Disk Recorders, allowing recording at video rate with almost all cameras and resolutions. The *Video to StreamStor* is provided only in the XCAP-Plus version.

The *RGB Merge* allows interpreting and viewing three monochromatic frame buffers as a single color (e.g. RGB) image, with adjustments for registration and coloring. The XCAP-Lite version does not provide the *RGB Merge* feature.

The *Quad Pixel Merge* allows interpreting and viewing four monochromatic frame buffers, each one captured after shifting the image sensor by ½ pixel horizontally and vertically, as a single high resolution image. The XCAP-Lite version does not provide the *Quad Pixel Merge* feature.

The *Frame Average* allows performing recursive, continuous, averaging of live video frames (or fields) and viewing the live result. The XCAP-Lite version does not provide the *Frame Average* feature.

The *Live Options* combines the *View - Display* options, above, with additional choices governing *Live* mode. During *Live* mode, the PIXCI imaging board can, (a) Capture continuously into the specified frame buffer, however the image shown on the S/VGA may contain portions from different video frames, (b) Snap, display to the S/VGA, and repeat, however the image display rate will be slower, or (c) Alternate capturing into the specified frame buffer and the last frame buffer (dual buffering). On host

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computers with insufficient PCI bandwidth to simultaneously capture into host computer memory and display from host computer memory to the S/VGA, option (b) reduces the required bandwidth by approximately half.

5.2.10. PIXCI® Image Viewer - Capture - Shortcuts

A tool bar of icons provides shortcuts for accessing often used features of the PIXCI imaging board, and is an extension of the Image Viewer - View - Shortcuts described above. Selected shortcuts can also be activated by key clicks when the tool bar window as the "input focus" (e.g. Windows has highlighted that window's title bar). The shortcuts provided are:

a. Switch to first buffer of frame buffer sequence (*Key HOME*).
b. Switch to next buffer of frame buffer sequence (*Key PAGE UP*).
c. Switch to previous buffer of frame buffer sequence (*Key PAGE DOWN*).
d. Switch to last buffer of frame buffer sequence (*Key END*).
e. Snap single image (*Key S*).
f. Toggle between:
    - Live mode - continuously capture and display images (*Key L*), and
    - Unlive mode - cease continuously capturing and displaying (*Key U*).
g. Duplicate image.
h. Adjust palette.
i. Zoom, scroll, and pan.
j. Peek at numeric pixel values.
k. Two dimensional plot of line or column of pixel values.
l. Histogram of pixel values.
m. Sequence acquire.
n. Sequence display.

The shortcuts may either be attached and part of PIXCI® Image Viewer Window, or may be detached into its own window, as set by *Display* under Image Viewer - View.

5.3. Other Features

Other useful features of XCAP are associated with many, or all, of its windows.

Most windows of XCAP provide fields for numeric entry. Typically, to the right of the numeric entry field are two buttons. Left clicking a button allows incrementing or decrementing the numeric value. Right clicking either button (or the area between buttons), yields an options menu. The options menu typically provides the following:

i. Selecting the base to which integer numbers are displayed, or the format and precision to which non-integer numbers are displayed.
ii. Changing the increment and decrement values applied when the buttons are left clicked.
iii. Activating a "ScrollPad" (a miniature scroll bar which overlays the displayed number) allowing adjustment of the numeric value with mouse clicks and drags.
iv. Selecting units and range for display of angles, such as 0 to 360 degrees, -180 degrees to +180 degrees, 0 to 2pi radians, or -pi to +pi radians.
v. Connecting the field to receive new content from a specified cell of the *Black Board*, or connecting the field to transmit its content to a specified cell of the *Black Board*.
vi. Providing a larger field in which to view or enter a number.
vii. Providing a field in which an entered mathematical expression is evaluated to a numeric value.

Numeric fields which only display computed results, text entry fields, and text display fields, may provide some of the above options - accessed by right clicking the field.

Some windows of XCAP provide fields for entry of pixel colors. Typically, the color can be entered numerically, and a small color "swatch" appears next to the color entry field, showing the selected color. Right clicking the swatch activates a color cylinder from which new colors may be selected by mouse clicks.

Editing of numeric and text fields follows (one of the many) Windows conventions. In brief, mouse click once or use left/right arrow keys to position the caret - characters are inserted at the caret as typed. Double mouse click to highlight all text or single click and drag to highlight a portion of text - a Delete or Backspace removes the highlighted text, a character replaces the highlighted text, and the left/right arrow keys cancel the highlight mode.

5.4. Road Map - Main Window

```
Main Window
```


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```
File
    Load New Image
    Load New Image Sequence
        TIFF
        JPEG/JFIF
        BMP
        Multimedia
    Image File Info
    TWAIN Select Source
    TWAIN New Acquire
    Window List
     -- List of current windows
    Exit


Images
    New Image
    - List of current images -


Scripts
    Script Record
    Script Play
    Script Remote Control
    Script Edit
    Script Tools
    Load Tool Bar
    Freeze Display
    Thaw & Refresh Display


Utility
    Black Board
    Message Log
    Audio Clip
    RS-232 Control
    Screen Capture
    I/O Port Peek & Poke
    Program Setup
    Windows Info
    Window Style
    Java Info


PIXCI®
    PIXCI® Open/Close
        Board Info
        Driver Assistant
    PIXCI® Video Setup
        Format  (dependent on imaging board)
        Resolution
        Sync
        Custom


    PIXCI® Save Video Setup
    PIXCI® Load Video Setup
    PIXCI® TWAIN Sourcery
    PIXCI® Image-Pro Sourcery
    PIXCI® Status
    PIXCI® Connections
    PIXCI® Camera Info


Help
    About
    License
    XCAP Release Notes
    XCAP Reference Manual
    PC Configuration Tips
```

5.5. Road Map - PIXCI Image Viewer Window

```
PIXCI Image Viewer Window


    File
        Save Image
            TIFF
            JPEG/JFIF
            BMP
            PCX
            Targa
            X/Y Binary
            X/Y ASCII


        Load Image
            TIFF
            JPEG/JFIF
```


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```
            BMP
            X/Y Binary
            X/Y ASCII


        Save Image Sequence
            One TIFF w. Sequence
            One AVI w. Sequence
            Sequence of TIFF
            Sequence of JPEG/JFIF
            Sequence of BMP
            Sequence of PCX
            Sequence of Targa (TGA)
            Sequence of X/Y Binary
            Sequence of X/Y ASCII


        Load Image Sequence
            One TIFF w. Sequence
            Sequence of TIFF
            Sequence of JPEG/JFIF
            Sequence of BMP
            Sequence of X/Y Binary
            Sequence of X/Y ASCII


        E-Mail Image
        Save Frame Buffer Memory
        Load Frame Buffer Memory
        Print, Windows
        Print, PXIPL
        Duplicate Image
        Copy to Black Board
        Attributes
        Close Viewer


    View
        Full Screen
        Always On Top
        Shortcuts
        Image's Palette
        Viewer's Palette
            Black & Gain
            Numerically
            Band Coloring
            Bit Slice
            Bit Transposition
            White Balance


        Sequence Play
        Sequence Thumbnails
        Cursor
        Display
        Zoom, Pan, Scroll
        Misc. Options
        Launch 2nd Viewer


    Examine
        Pixel Peek
        Pixel Peek & Poke
        Pixel Plot
            Plot Row
            Plot Column
            Plot Buffer
            Plot All Rows


        Pixel 3D Graph
        SMPTE VITC


    Modify
        Patterns [Sequence Patterns]
        Set [Sequence Set]
        Arithmetic [Sequence Arithmetic] [Src+Dst Arithmetic]
            Complement Pixels
            Bit Wise Logical AND Pixels w. Mask
            Bit Wise Logical XOR Pixels w. Mask
            Bit Wise Logical OR Pixels w. Mask
            Bit Shift Left
            Bit Shift Right
            Add Constant with Pixels
            Multiply Constant with Pixels
            Add Uniform Random Dither to Pixels
            Add Gaussian Random Dither to Pixels
            Halftone, Threshold & Carry
            Halftone, Dot Construction
            Gamma Correction
```


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```
Binning [Sequence Binning] [Src_Dst Binning]
    Average
    Integrate
Contrast Modification [Sequence Contrast Modification] [Src+Dst Contrast Modification]
    Stretch Contrast, Pixel Value Endpoints
    Stretch Contrast, Histogram Percentile Endpoints
    Invert Contrast
    Histogram Modification


Convolution [Sequence Convolution] [Src+Dst Convolution]
    Convolve: Convolve(PixelValue)
    Convolve: Abs(Convolve(PixelValue))
    Convolve: PixelValue Convolve(PixelValue)
    Convolve: PixelValue Abs(Convolve(PixelValue))


Correlation Map [Sequence Correlation Map] [Src+Dst Correlation Map]
Edge Detection [Sequence Edge Detection] [Src+Dst Edge Detection]
    Edge Magnitude: Laplacian
    Edge Magnitude: Vertical
    Edge Magnitude: Horizontal
    Edge Magnitude: Sobel
    Edge Magnitude: Kirsch
    Edge Magnitude: Roberts
    Edge Gradient: Log Sobel
    Edge Gradient: Log Sobel Absolute
    Edge Gradient: Log Kirsch
    Edge Gradient: Log Roberts
    Edge Gradient: Thin, Minimal Effect
    Edge Gradient: Thin, Maximal Effect


FFT [Sequence FFT] [Src+Dst FFT]
    FFT to Log Magnitude
    Root Filter
    Gaussian Filter
    Inverse Gaussian Filter


Interlace & Flicker [Sequence Interlace & Flicker] [Src+Dst Interlace & Flicker]
    Shuffle Line Order to Field Order
    Shuffle Field Order to Line Order
    Transpose Line Pairs
    Transpose Column Pairs
    Shuffle Line Pairs to Pixel Pairs
    Shuffle Pixel Pairs to Line Pairs
    Deflicker: Average Line Pairs
    Deflicker: Filter Singularity


Morphology [Sequence Morphology] [Src+Dst Morphology]
    Erode
    Dilate
    Open
    Close
    Boundary
    Hit Miss
    Medial Axis Thin
    Skeleton Thin


Noise Generator [Sequence Noise Generator] [Src+Dst Noise Generator]
    Uniform Noise
    Gaussian Noise
    Rayleigh Noise
    Negative Exponential Noise
    Salt & Pepper Noise


Normalization [Sequence Normalization] [Src+Dst Normalization]
    Normalize Intensity, Blobs & Background
    Normalize Row Mean
    Normalize Column Mean


Rotation & Shift [Sequence Rotation & Shift] [Src+Dst Rotation & Shift]
    X, Y Shift
    Flip
    Skew Left/Right
    Skew Up/Down
    Rotate


Spatial Filtering [Sequence Spatial Filtering] [Src+Dst Spatial Filtering]
    Low Pass Filter
    Sharpen Filter
    Median Filter
    Rank Low (Erode) Filter
    Rank High (Dilate) Filter
    Edge Enhance: Sobel
```


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```
            Edge Enhance: Sobel Absolute
            Edge Enhance: Kirsch
            Edge Enhance: Roberts


        Threshold [Sequence Threshold] [Src+Dst Threshold]
        Threshold, Adaptive [Sequence Threshold, Adaptive] [Src+Dst Threshold, Adaptive]
        Warp [Sequence Warp] [Src+Dst Warp]
        Copy & Resize
        Pair Arithmetic [Src+Dst Pair Arithmetic]
            Add: Dist+Src Modulo PixelSize
            Add: Min(Dst+Src, MaxPixValue)
            Subtract: (MaxPixValue+(Dst Src))/2
            Subtract: (MaxPixValue+(Src Dst))/2
            Subtract: (Dst Src)Modulo PixelSize
            Subtract: (Src Dst)Modulo PixelSize
            Subtract: (Src Dst)Modulo PixelSize
            Subtract: Max(Dst Src, 0)
            Subtract: Max(Src Dst, 0)
            Subtract: Abs(Dst Src)
            Bit Wise AND: Dst & Src
            Bit Wise XOR: Dst ^ Src
            Bit Wise OR: Dst | Src
            Average: (Src+Dst)/2
            Product: (c0*Src+c1)*(c2*Dst+c3)/c4
            Product: (c0*Dst+c1)/(c2*Src+c3)
            Ratio: (c0*Dst+c1)/(c2*Src+c3)
            User Defined f(PixA, PixB)


        Pair Normalization [Src+Dst Pair Normalization]
            Contrast Modify & Match
            Background Correction, Subtractive
            Background Correction, Ratio
            Spot Mask Correction


        Sequence Average
            Average Sequence
            Integrate Sequence
        Difference Sequence
        Tile Sequence


    Measure
        Intensity Calibration
        Spatial Calibration
        Histogram
        Mass & Moments
            Center of Mass
            Center of Mass, Binary
            Moments


        Line Profile
        Radial Mass Plot
        Ruler
        Protractor
        Cartesian Reticle
        Polar Reticle
        Distance & Angle Crosshairs
        Shape Analysis
        Blob Analysis
        Particle Tracking
        SubPixel Edger
        Ellipse Fitter
        Correlation Finder


    Draw
        Arrow
        Text
        Point
        Points
        Bezier Curve
        Circle
        Circle Arc
        Ellipse
        Ellipse Arc
        Line
        Parallel Lines
        Path Curve
        Polyline
        Rectangle
        Window
        Annulus
        Annulus Arc
        Bezier Region
        Elliptical Annulus
        Elliptical Annulus Arc
        Path Enclosed
        Polygon
```


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```
        Rectangular Frame
        Graphic Manager
        Image Overlay
        Paint Brush
        Paint Fill


    AOI
        Set AOI
        Set ROI
        Set Full Image
        AOI/ROI Manager


    Utility [Only with option for combined Main & PIXCI Image Viewer Windows]


    Capture
        Adjustments
        Shortcuts
        Snap
        Live
        UnLive
        First Buffer
        Last Buffer
        Next Buffer
        Previous Buffer
        Sequence Capture
            Single Sequence
            Single Sequence, Event Start
            Continuous Sequence
            Continuous Sequence, Event Stop
        GIO Event Capture


        Waterfall Display
        Video to Disk
        Video to StreamStor
        RGB Merge
        Quad Pixel Merge
        Frame Average
        Live Options


    Help
        Vis-a-Vis
```

Optionally, the Main Window and the PIXCI Image Viewer Window's may be combined, with the following features of the Main Window added to the PIXCI Image Viewer Window:

```
    File
        Exit
    Utility
        Message Log
        Program Setup
        Windows Info
        Window Style
        Java Info


    Capture
        PIXCI® TWAIN Sourcery
        PIXCI® Image-Pro Sourcery
        PIXCI® Connections
        PIXCI® Video Setup


    Help
        XCAP Release Notes
        XCAP Reference Manual
        PC Configuration Tips
        License
        About
```

5.6. XCAP Software Feature Comparison

Feature	XCAP-Plus	XCAP-Std	XCAP-Lite	XCAP-Demo
File -				
- Load New Image	Yes	Yes	Yes	No
- Load New Image Sequence	Yes	Yes	No	No

- Image File Info	Yes	Yes	Yes	Yes
- TWAIN New Acquire	Yes	Yes	No	No
Images -				
- New Image	Yes	Yes	Yes	Yes
Scripts -				
- Record	Yes	Yes	No	No
- Play	Yes	Yes	Yes	No
- Remote Control	Yes	Yes	No	No
- Load Tool Bar	Yes	Yes	No	No
Utility -				
- Black Board	Yes	Yes	No	No
- Message Log	Yes	Yes	Yes	Yes
- Audio Clip	Yes	Yes	Yes	No
- RS-232 Control	Yes	Yes	Yes	Yes
- Screen Capture	Yes	Yes	No	No
- I/O Port Peek & Poke	Yes (w)	Yes (w)	Yes (w)	Yes (w)
PIXCI® -				
- Open/Close	Yes	Yes	Yes	No
- Driver Assistant	Yes	Yes	Yes	No
- Video Setup	Yes	Yes	Yes	No
- Save Video Setup	Yes	Yes	Yes	No
- Load Video Setup	Yes	Yes	Yes	No
- TWAIN Sourcery	Yes	Yes	Yes	No
- Image-Pro Sourcery	Yes	Yes	Yes	No
- Status	Yes	Yes	Yes	No
- Connections	Yes	Yes	Yes	Yes
- Camera Info	Yes	Yes	Yes	Yes
Help -				
- XCAP Release Notes	Yes	Yes	Yes	Yes
- XCAP Reference Manual	Yes	Yes	Yes	Yes
- PC Configuration Tips	Yes	Yes	Yes	Yes
File -				
- Save Image	Yes	Yes	Yes	No
- Load Image	Yes	Yes	Yes	No
- Save Image Sequence	Yes	Yes	No	No
- Load Image Sequence	Yes	Yes	No	No
- E-Mail Image	Yes	Yes	No	No
- Print, Windows	Yes	Yes	Yes	No
- Print, PXIPL	Yes	Yes	No	No
- Duplicate Image	Yes	Yes	No	No

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- Copy to Black Board	Yes	Yes	No	No
View -				
- Full Screen	Yes	Yes	No	No
- Palette	Yes	Yes	Yes (a)	Yes (a)
- Sequence Play	Yes	Yes	Yes	Yes
- Sequence Thumbnails	Yes	Yes	Yes	Yes
- Cursor	Yes	Yes	Yes	Yes
- Zoom, Pan, Scroll	Yes	Yes	Yes	Yes
- Launch 2nd Viewer	Yes	Yes	Yes	Yes
Examine				
- Pixel Peek	Yes	Yes	Yes (b)	Yes (b)
- Pixel Peek & Poke	Yes	Yes	Yes	Yes
- Pixel Plot Row	Yes	Yes	Yes (p)	Yes (p)
- Pixel Plot Column	Yes	Yes	Yes (p)	Yes (p)
- Pixel Plot Buffer	Yes	Yes	Yes (p)	Yes (p)
- Pixel Plot All Rows	Yes	Yes	No	No
- Pixel 3D Graph	Yes	Yes	Yes	Yes
- SMPTE VITC	Yes	Yes	Yes	No
Modify -				
- Patterns	Yes	Yes	Yes	Yes
- Set	Yes	Yes	Yes (c)	Yes (c)
- Arithmetic	Yes	Yes	No	No
- Binning	Yes	Yes	No	No
- Contrast Modification	Yes	Yes	No	No
- Convolution	Yes	Yes	No	No
- Correlation Map	Yes	Yes	No	No
- Edge Detection	Yes	Yes	No	No
- FFT	Yes	Yes	No	No
- Interlace & Flicker	Yes	Yes	No	No
- Morphology	Yes	Yes	No	No
- Noise Generator	Yes	Yes	No	No
- Normalization	Yes	Yes	No	No
- Rotation & Shift	Yes	Yes	No	No
- Spatial Filtering	Yes	Yes	No	No
- Threshold	Yes	Yes	No	No
- Threshold, Adaptive	Yes	Yes	No	No
- Warp	Yes	Yes	No	No
- Copy & Resize	Yes	Yes	No	No
- Pair Arithmetic	Yes	Yes	No	No
- Pair Normalization	Yes	Yes	No	No
- Sequence Average	Yes	Yes	No	No

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- Difference Sequence	Yes	Yes	No	No
- Tile Sequence	Yes	Yes	No	No
Measure -				
- Intensity Calibration	Yes	Yes	No	No
- Spatial Calibration	Yes	Yes	No	No
- Histogram	Yes	Yes	No	No
- Mass & Moments	Yes	Yes	No	No
- Line Profile	Yes	Yes	Yes (p,d,f)	Yes (p,d,f)
- Radial Mass Plot	Yes	Yes	No	No
- Ruler	Yes	Yes	Yes (d)	Yes (d)
- Protractor	Yes	Yes	No	No
- Cartesian Reticle	Yes	Yes	Yes (d)	Yes (d)
- Polar Reticle	Yes	Yes	No	No
- Dist. & Angle Crosshairs	Yes	Yes	No	No
- Shape Analysis	Yes	Yes	No	No
- Blob Analysis	Yes	Yes	No	No
- Particle Tracking	Yes	Yes	No	No
- SubPixel Edger	Yes	Yes	No	No
- Ellipse Fitter	Yes	Yes	No	No
- Correlation Finder	Yes	Yes	No	No
Draw -				
- Arrow	Yes	Yes	Yes	Yes
- Text	Yes	Yes	No	No
- Point	Yes	Yes	No	No
- Points	Yes	Yes	No	No
- Bezier Curve	Yes	Yes	No	No
- Circle	Yes	Yes	No	No
- Circle Arc	Yes	Yes	No	No
- Ellipse	Yes	Yes	No	No
- Ellipse Arc	Yes	Yes	No	No
- Line	Yes	Yes	Yes	Yes
- Parallel Lines	Yes	Yes	No	No
- Path Curve	Yes	Yes	No	No
- Polyline	Yes	Yes	No	No
- Rectangle	Yes	Yes	No	No
- Window	Yes	Yes	Yes	Yes
- Annulus	Yes	Yes	No	No
- Annulus Arc	Yes	Yes	No	No
- Bezier Region	Yes	Yes	No	No
- Elliptical Annulus	Yes	Yes	No	No
- Elliptical Annulus Arc	Yes	Yes	No	No
- Path Enclosed	Yes	Yes	No	No

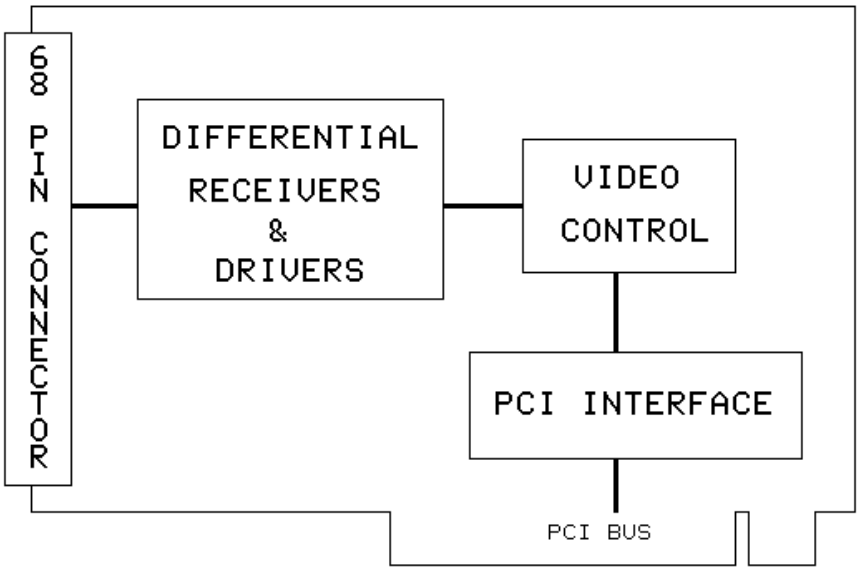
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- Polygon	Yes	Yes	No	No
- Rectangular Frame	Yes	Yes	No	No
- Graphic Manager	Yes	Yes	Yes	Yes
- Image Overlay	Yes	Yes	No	No
- Paint Brush	Yes	Yes	No	No
- Paint Fill	Yes	Yes	No	No
Capture -				
- Adjustments	Yes	Yes	Yes (e)	No
- Shortcuts	Yes	Yes	Yes	No
- Single Sequence	Yes	Yes	Yes	No
- Single Sequence at Event	Yes	Yes	No	No
- Continuous Sequence	Yes	Yes	Yes	No
- Continuous Sequence at Event	Yes	Yes	No	No
- GIO Event Capture Single	Yes	Yes	Yes	No
- GIO Event Capture Sequence	Yes	Yes	No	No
- Waterfall Display	Yes	Yes	Yes	No
- Video to Disk	Yes	Yes	No	No
- Video to StreamStor	Yes	No	No	No
- RGB Merge	Yes	Yes	No	No
- Quad Pixel Merge	Yes	Yes	No	No
- Frame Average	Yes	Yes	No	No

Notes: For XCAP-Lite, the PIXCI imaging board is assumed installed and open for use. For XCAP-Demo, images can't be loaded or captured; a "synthetic" image can be created for viewing. (a) The View, Palette feature does not include save, load, import, or export. (b) The Examine, Pixel Peek feature does not include save. (c) The Modify, Set feature does not include non-rectangular regions. (d) The Measure features do not include calibration. (e) The Capture, Adjustments do not include save, load, or export. (f) The Line Profile is limited to straight lines. (p) All plotting features do not include statistics, save, or export options. (w) I/O Port Peek & Poke feature available only under Windows 95 and Windows 98.

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6. Block Diagram



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PIXCI D, PIXCI D24, & D32 Block Diagram

6.1. Differential Receivers and Drivers

The differential receivers and drivers convert data from differential to single ended TTL signals. Differential signals are used to provide improved noise performance over single ended TTL signals.

6.2. Video Control

A field programmable gate array (FPGA) is used for image data formatting, video windowing, camera triggering, exposure timing, trigger conditioning, strobe generation, and buffering of data from the differential receivers to the PCI interface.

6.3. PCI Interface

The PCI bus interface provides interrupt generation, PCI configuration registers, first-in and first-out buffers, and PCI bus master and target control.

---

7. Specifications

7.1. Signal Input and Output:

Either EIA RS-422 or EIA RS-644 (LVDS) drivers and receivers are installed.

7.1.1. EIA RS-644 Low Voltage Differential Signaling Devices (LVDS)

- National Semiconductor DS90C031TM driver.
  Voltage Output Low Minimum: 0.9 Volts.
  Voltage Output High Maximum: 1.6 Volts.
  Absolute Maximum Output Voltage Range: -0.3 volts to VCC +0.3 volts.
- National Semiconductor DS90C032TM receiver.
  Voltage Input Low Maximum: 0.8 Volts
  Voltage Input High Minimum: 2.0 Volts
  Absolute Maximum Input Voltage Range: -0.3 volts to VCC +0.3 volts.

7.1.2. EIA RS-422 Differential Devices

- AM26C31 driver.
  Voltage Output Low: 0.4 Volts at 20mA.
  Voltage Output High: 2.4 Volts at -20mA.
  Absolute Maximum Output Voltage Range: -0.5 volts to +7 volts.
- AM26C32 receiver.
  Voltage Input Low: 0.8 Volts
  Voltage Input High: 2.0 Volts
  Absolute Maximum Input Voltage Range: -11 volts to +14 volts.

7.1.3. Resolution:

Pixels: 8 to 4096 pixels per line. Pixel offset from horizontal drive: 0 to 8 pixels less than the number of pixel clocks per line from the camera.

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Lines: 1 to 4096 lines per image. Line offset from vertical drive: 0 to 1 less than the maximum number of lines from the camera.

7.1.4. Frame Rate

The frame rate of the camera determines the frame rate of the PIXCI® D.

7.1.5. Bus Requirements

- 32 bit, PCI bus master, 33 MHz PCI slot, without shared interrupts.
- 1.55 Amps @ +5 Volts
- 4.913 inches long by 4.20 inches high (short slot).

7.1.6. Transfer Rates

Requires a burst mode PCI motherboard capable of sustained transfer rates to motherboard DRAM equal to or greater than the peak byte transfer rate of the camera. A motherboard with an AGP slot for the VGA adapter or AGP VGA on the motherboard is suggested. For a list of tested motherboards, see the "Installation" chapter or contact EPIX or an EPIX distributor for suggested motherboards.

7.1.7. Display - DOS

- Any S/VGA with VESA support and a monochrome or color monitor. Display of color images requires VESA mode 112 support.

7.1.8. Display - Windows

A 24 bit per pixel Windows compatible display system. Display resolution as per installed VGA device driver.

7.1.9. Connections

- 68 pin SCSI type connector. AMP part number 787170-7 or equivalent used on board.
- Cables optionally available.

Specifications subject to change without notice.

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8. Software and Related Manuals

Extensive software is available as a ready-to-run programs or as programmer libraries for DOS or Windows NT/98/95. The software provides control for the capturing of images and image sequences, triggered capture, scaling, cropping, image processing, measurement, analysis, and display.

8.0.1. XCAP^{tm}

A powerful, interactive, ready-to-run program for Windows 2000/NT/98/95. XCAP has an extensive set of image processing functions. Features include image sequence capture, triggered capture, display, processing, printing, archiving, analysis, and calibrated measurement. Processing of images with up to 16 bits per pixel is supported. XCAP is available in four versions and is described in the chapter "XCAP"Software"Guide."

8.0.2. XCOBJ^{tm}

The royalty free XCOBJ Library empowers C/C++ and Windows programmers to control the PIXCI series of imaging boards. XCOBJ supports all versions and options of the PIXCI series.
Up to eight PIXCI imaging boards, of the same version and with the same options, can be operated selectively or simultaneously; allowing parallel control for multi-camera vision of a single event or object, or selective control for capturing multiple,

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independent, events or objects.
Through the unique flexibility of XCOBJ and the PIXCI imaging boards, single frames or video sequences of standard or nonstandard video sources can be captured, analyzed, displayed, and archived.
XCOBJ provides high level services, allowing programmers to concentrate on the imaging application, rather than focusing on board level programming and I/O ports. For virtually all applications, board level programming can be ignored!
XCOBJ automatically recognizes different versions and options of the PIXCI imaging cards, providing consistent access to features, and hiding hardware details and differences. Fundamental services, such as setting resolution, capturing, and accessing image data, are compatible with C libraries for other EPIX imaging board families; allowing easy porting and reuse of application programs.
The XCOBJ C/C++ libraries of object code allow embedding PIXCI control into user-written applications. Under Windows, the XCOBJ DLL also enables access from existing Windows applications which support "hooks" into DLLs.

8.0.3. PXIPL^{tm}

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9. In Case of Trouble

9.1. Software Problems - XCAP Error Messages

After XCAP is started and prior to the display of the first menu, the software checks for the presence of required BIOS software, the presence of the PIXCI D imaging board, and performs other tests. If any of the software checks fail, an error message will be displayed.

If error messages about ``FIFO Overflow'' are displayed, check the PC's setup menu to see if PCI burst mode is enabled. If burst mode is not enabled, the number of pixels per line may be limited to 200 pixels or less. Disable the clock in the taskbar on Windows 95 or NT. Disable any other Windows applications that may periodically start. Typing ``Ctrl-Alt Del'' in Windows will give a list of applications that are running.

9.2. Hardware Problems

Some problems do not cause software error messages. Some problems may prevent the computer from powering up. Some problems may prevent the software from accessing the PIXCI D imaging board. These types of problems can be due to:

Power Supply	Insufficient power for the boards installed.
Touching Boards	One board's components are touching another board.
Defective Cable(s)	Camera cable has an open or short.
Video Input	Defective or incompatible video source.
Defective PIXCI D imaging board	Defective integrated circuit, bad solder joint, physical damage, or static damage.
Motherboard	No PCI burst mode or no PCI BIOS. Defective PCI connector. PCI slot is not bus master capable. PCI slot shares interrupts or other resources with adjacent slot.
S/VGA	S/VGA board is too slow, has insufficient memory, or is not a PCI board.

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9.2.1. Power Supply Problems

The PC power supply usually has a printed rating of power available for the four standard PC voltages. The PIXCI D imaging board uses 1.4 amps from the +5 volt supply. If other devices and the PIXCI D imaging board use more power than the power supply can provide, the power supply will shut down. In marginal situations, this may not happen until an operation is performed that requires additional power, such as increasing the number of pixels per line. Try removing non-essential boards from the system.

9.2.2. Touching Boards

If the components of one board touch those of another, damage to one or both boards can occur. Move one of the touching boards at least one slot away from the other.

9.2.3. Defective Cable

If the camera cable is broken or shorted, the board may not function or may intermittently function.

- Try another cable.
- Test the cable for shorts or opens with an ohmmeter.

9.2.4. Camera Input

If the camera is defective, has the lens closed or covered, or has the exposure set for a time that is too short for the amount of light available, a black image will be captured.

- Select the ``Modify" menu and select ``Patterns." Write a test pattern to image memory which will be displayed on the monitor. Snap an image to see if the test pattern is written over by the camera's video data. If the test pattern is not overwritten, the camera, camera cable, or camera power supply may be defective.
- If the test pattern is overwritten, the camera lens may be closed, the cap may be covering the lens, or the exposure may be too short.

9.2.5. Motherboard

- If the motherboard does not support PCI burst mode, does not have a PCI BIOS, or the PIXCI D imaging board does not operate correctly, try another motherboard. Call EPIX for a list of suggested motherboards.
- The PCI bus connector on the motherboard may be defective. Try another PCI bus slot or another motherboard.
- The PCI bus slot may not support a PCI master. Try another PCI bus slot or another motherboard.
- The PCI bus slot may be wired to share interrupts or other slot resources with one of the adjacent slots. Try another PCI bus slot or another motherboard.

9.2.6. S/VGA Board

If the S/VGA board has insufficient memory, is not a PCI board, does not support PCI burst mode, or the XCAP software does not operate correctly, try another S/VGA board. Call EPIX for a list of suggested S/VGA boards.

9.3. If All Else Fails

If none of the above suggestions have solved the problem, call your distributor (if you purchased the board thru a distributor), or FAX or e-mail EPIX for technical support. In the FAX or e-mail, include error messages that were displayed, describe symptoms observed, and steps taken to attempt to solve the problem. It is helpful to call from a phone near the computer with the PIXCI D imaging board installed.

The PIXCI D imaging board can be damaged during shipment. If damage is visible, check the shipping container for damage, and notify the freight carrier.

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If the board must be returned for test or repair, call EPIX for a Return Materials Authorization (RMA) number. Be prepared to describe the problem that has been encountered and what steps have been taken to attempt to correct it. Please include a written description of symptoms, error messages, and steps taken to attempt to solve the problem with the packing list for the material returned.

9.4. Testing Signals with an Oscilloscope

There are test vias on the board that are labelled HACT and VACT. These signals are located on the left and right side of the 208 pin chip at location A5 in the upper right of the board.

HACT is connected to pin 81 on the left side of the chip.

VACT is connected to pin 178 on the right side of the chip.

When a pixel clock, horizontal drive, and vertical drive are connected to the board and the XCAP software has programmed the vertical and horizontal counters correctly, the VACT signal will go high on the first horizontal line that has been programmed to be the first active line. The HACT signal will go high when on the first pixel on the line that has been programmed to be the first active line. Note that the HACT signal will also go high at other times and the VACT signal must be used as a trigger signal for checking the timing of HACT.

At location D1, the 26C32 differential receiver has outputs: FBPCK (pixel clock, pin 3), HDN (horizontal drive, pin 5), and VDN (vertical drive, pin 11).

The pixel clock is used to clock camera data on the rising edge. Horizontal and vertical drive are used to accept camera data when high. HACT and VACT are derived from HDN and VDN.

---

10. Hardware Revision Description

10.1. PIXCI D

PIXCI D Revision list

1. Revision 0.0: Board not released.
2. Revision 1.0: First release.
3. Revision 1.0A: Shorted out ferrite beads on EXP-, STRB-, and USR-.
   Converted ferrite beads to pullup resistor options for EXP+, STRB+, and USR+.
   Added pullup resistor to BQ32.
4. Revision 2.0: Added +5 volts, TRG+-, FEN+-, and STR+- to 10 pin header.
5. Revision 2.1: Added 3.3 volt power connection for FPGA.
   Error: Some motherboards do not provide 3.3 volts to the PCI bus.
6. Revision 3.0: Added 3.3 volt regulator for the FPGA. Removed +5 volts from pin 2 of the 10 pin header. Pin is not connected (floating).

---

11. Certification and Warranty

11.1. Certification and Testing

The PIXCI® D imaging board has been tested per EMC directive 89/336/EEC and has met the following test requirements:

- EN 50081-1/01.92,
- EN 55022/08.94 class B
- EN 61000-4-2/03.95
- ENV 50204/03.95

These test are more commonly known as the ``CE" test. The testing was performed to class B which has a more restrictive emission limit than the FCC class B limit.

If you find that the computer system in which the PIXCI® D is installed is causing interference with other devices, try increasing

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the distance between the devices, reorienting (turning) the devices, or using additional shielding on the computer system (such as placing covers on the computer and installing metal shields in unused slots or over unused drive slots).

The camera connected to the PIXCI® D may be the source of radiation. To determine if the camera is the source of interference, remove power to the camera or reorient the camera. If a shielded camera cable is not being used, use a shielded cable. If the camera is the source of interference, contact the camera manufacturer.

11.2. Limited Warranty

EPIX, Inc. warrants to the original purchaser of the PIXCI® D board that the PIXCI® D board shall be in good working order for a period of one year from the date of shipment from EPIX, Inc. Should this product fail to be in good working order at any time during this one year warranty period, EPIX, Inc. will, at its option, repair or replace this product at no additional charge except as set forth below. Repair parts and replacement products will be furnished on an exchange basis and will be either reconditioned or new. All replaced parts and products become the property of EPIX, Inc.
This limited warranty does not include service to repair damage to the product resulting from accident, disaster, misuse, abuse, or non-EPIX, Inc. modification of the product.
Limited warranty service may be obtained by delivering the product during the one year warranty period to an EPIX, Inc. distributor or to EPIX, Inc. and providing proof of the purchase date. Insure the product or assume the risk of loss or damage in transit. Prepay shipping charges to EPIX, Inc. or to the distributor. Use the original shipping container, or the equivalent, and static dissipative packaging material.
EPIX, Inc. hereby disclaims all other express and implied warranties for this product, including the warranties of merchantability and fitness for a particular purpose. Some states do not allow the exclusion of implied warranties, so the above limitations may not apply to you.
If this product is not in good working order as warranted above, your sole remedy shall be repair or replacement as provided above. In no event will EPIX, Inc. be liable to you for any damages, including any lost profits, lost savings or other incidental or consequential damages arising out of the use of or inability to use such product, even if EPIX, Inc. or an authorized EPIX, Inc. distributor has been advised of the possibility of such damages, or for any claim by any other party.

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12. Footnotes

[1] If modifying a previously installed XCAP: Right click the XCAP icon, select "Properties", select "Program", and modify the "Name" or "Command Line" as needed.

[2] If the PC is configured with a selective boot option (i.e. so as to boot Windows or boot old DOS), be sure to modify the correct CONFIG.SYS.

[3] If modifying a previously installed XCAP: Right click the XCAP icon, select "Properties", select "Program", and modify the "Name" or "Command Line" as needed.

[4] If modifying a previously installed XCAP: Right click the XCAP icon, select "Properties", select "Program", and modify the "Name" or "Command Line" as needed.

[5] The identification code is provided on a card enclosed with the CD or diskette(s), and is also shown on the packing list. The card and the identification code may be required as proof of purchase for future software upgrades. Keep the card in a safe place!!

[6] XCAP-Std and XCAP-Plus also require an authorization key to activate all features.

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