PTZ Robotic Cameras

Version S / Version C

Version S

Version C

PTZ Manual version 2, January, 1999

PTZ Manual version C, February, 2002

PTZ Manual version 3, August, 2003

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Chapter 1 Introduction

*Activ*Media Robotics' Pan-Tilt-Zoom (PTZ) Robotic color cameras are fully integrated accessories for *Activ*Media mobile robots. The PTZ camera systems include the Sony EVI-D30 or the Cannon VC-C4 with custom signal and power cables, mounting hardware, and software for integration on the robot and control through client applications, including ACTS, ARIA, and Saphira.

We'll install your PTZ camera on a new robot, or you can easily add the system to your existing *Activ*Media robot. The PTZ camera supplies standard NTSC video, so it can be used for a variety of applications, from simple video surveillance to state-of-the-art vision sensing. The PTZ Robotic Camera software includes C- and a C++-language libraries for use with all distributed *Activ*Media Robotics software and your own client applications, and come with source code for custom modifications.

Components

If you ordered the PTZ Robotic Camera with your *Activ*Media robot, some items may already be attached:

- ✓ Version S: Sony EVI D-30 (NTSC)
  OR
- ✓ Version C: Canon VC-C4 (NTSC)
- ✓ Remote Control Handset
- ✓ VISCA Control Cable
- ✓ Power Cable
- ✓ RCA Video Cable
- ✓ Mounting Screws
- ✓ Camera Manuals

Accessories

The PTZ Robotic Camera attaches and extends the capabilities of a variety of video and vision systems and applications. For instance, your *Activ*Media Robotics PTZ Robotic Camera is approved for use with *Activ*Media Color Tracking System (ACTS) software. And either capture and digitize the PTZ camera's video signal with an onboard framegrabber in your robot's computer (PTZ Custom Vision), or send it offboard with an audio/video (A/V) wireless transmitter to a receiver and framegrabber in a basestation computer for real-time video surveillance (PTZ Surveillance System) as well as for your own vision research.

For more information about *Activ*Media Robotics Video and Vision options, browse our website (`http://wwww.activmedia.com/robots`) and/or contact us or your regional ActivMedia sales partner directly (`sales@activmedia.com`).

Table 1. *Activ*Media PTZ Camera Accessory Options

Component	PTZ Complete	PTZ Tracking	PTZ Vision	PTZ Surveillance
Onboard framegrabber	X	X	X	
Offboard framegrabber	X			X
AV Transmitter-receiver pair	X			X
ACTS Color-Tracking Software	X	X	X	X

Where to get PTZ Robotic Camera Software

The Linux and Win32 versions of the PTZ Robotic Camera Software comes on CD-ROM with every *Activ*Media Robot, included in the Saphira 6.2 and ARIA directories along with all the other distribution software we provide. Updates and other platform-based versions are available online from the *Activ*Media Robotics support website:

`http://robots.activmedia.com/ARIA` (both cameras)

`http://robots.activmedia.com/ptzsys` (Saphira 6.2; Sony EVI-D0)

`http://robots.activmedia.com/vcc4` (Saphira 6.2; Cannon VC-C4)

Be sure to choose the software version that matches your computer's operating environment; `ptzsys.exe` for Win32 computers or `ptzsys.tgz` for Linux OS, for example.

Related Resources

The PTZ Robotic Cameras software depends on a working knowledge of your *Activ*Media robots. Consult their operations manual for details. Obtain copies of the latest manuals from our support website:

`http://robots.activmedia.com/docs`

We announce *Activ*Media Robotics' software-related updates and new versions, as well as share ideas and code, through email-based newsgroups:

`pioneer-users@activmedia.com` (general interest newsgroup)

`robotsnews@activmedia.com` (for product news)

To join—and please do join—simply send an email message (also substitute robotnews for pioneer-users):

To: **pioneer-users-request@activmedia.com**
From: ***<your return email address goes here>***
Subject: <choose one command>
help (returns instructions)
lists (returns list of newsgroups)
subscribe
unsubscribe

Our SmartList-based listserver will respond automatically. Once subscribed, send your email comments, suggestions, and questions intended for the worldwide community of Pioneer users:

> To: **pioneer-users@activmedia.com**
> From: **<your return email address goes here>**
> Subject: **<something of interest to all members of pioneer-users>**

Access to the pioneer-users newslist is limited to subscribers, so your address is safe from spam. However, the list currently is unmoderated, so please confine your comments and inquiries to that concerning *Activ*Media robot operation and programming.

If something seems (or clearly is) broken with the software, your *Activ*Media robot, and/or PTZ Robotic Camera, send an email message

```
To:  pioneer-support@activmedia.com
```

and a team of experts will leap to the rescue. (We reserve the right to reply only to bone fide support questions.)

Chapter 2 Hardware Installation

The PTZ Robotic Camera requires some assembly, even if you had ordered it with a new *Activ*Media robot.

If your PTZ Robotic Camera came with your new *Activ*Media robot, the signal, power, and VISCA serial-control cables should be attached and hanging loosely from the robot. They need only to be plugged in. Skip to Mounting the Camera.

However, if you purchased your PTZ Robotic Camera separately from your robot, you will need to perform a more complicated installation, specifically to attach the signal and power cables inside your robot.

Power, Signal and Control Cable Installation

Since the PTZ camera cabling differs somewhat for each model, please consult the Operation Manual for your specific *Activ*Media robot to expose its internal components and to locate the various connections and connectors.

Power Cable

Depending on the model and year, one end of the camera's 12VDC power cable plugs into the 12-position latch-lock header on the "legacy" motor-power board, or into the 4-position minifit AUX1 (RADIO) or AUX2 switched power connector on the Pioneer 2-*Plus* or Pioneer 3 motor-power board. Feed the other end of the cable through the console near the camera, such as through the console port of the DX or AT.

For the Pioneer 3 and 2-Plus robots, power to the camera is switched through the respective AUX1 (RADIO) or AUX2 pushbutton on the robot's User-Control side panel. Another switch on the camera itself may also control power.

Serial Control Cable

Normally, software control of the PTZ Robotic Camera happens through an auxiliary serial port on your *Activ*Media robot's microcontroller, as attached via the VISCA serial cable.[1] Accordingly, plug the 10-position IDC socket on one end of the VISCA control cable into its mating AUX serial port on the back edge of your C166-based Pioneer 2/PeopleBot's microcontroller.

For all of the latest (H8S-based) *Activ*Media robots, including the Pioneer 2-DX8, -AT8, *Plus*-series, and all Pioneer 3 and Performance PeopleBots, plug the 5-position minifit end of the VISCA signal cable into the AUX1 serial port on your robot's H8S microcontroller. You could also install the camera control into the AUX2 serial port, but that's not the default configuration and you may need to note that difference in your software (ARIA, too).

Feed the VISCA connector end of the camera's serial control cable out next to the power cable.

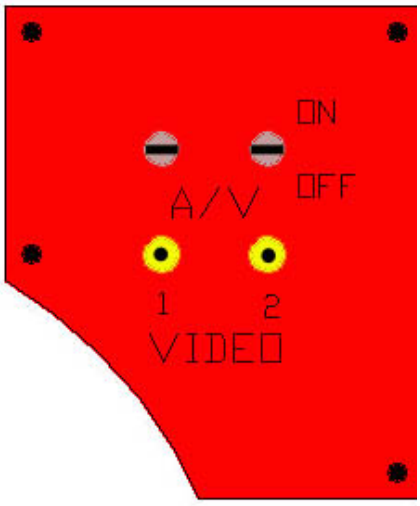

Figure 1. Pioneer 2 video side-panel (not for later H8S-based Pioneers)

[1] You may also connect the PTZ Robotic Camera to a serial port in the onboard computer or a piggyback laptop. (You'll need to supply the cable.) ARIA supports this option, too.

Video Out

Older, C166-based Pioneer 2 robots have a special video side panel where you may attach an A/V transmitter and monitor live video from the camera. Feed the RCA end of that side-panel's cabling, or otherwise from the video signal cable that comes with the camera, from next to your onboard PC's framegrabber and out next to the loose camera power and serial cables. Insert the connector into the framegrabber (see manual for details).

PeopleBot and AT Video Panels

Special Video connection panels for the Pioneer 2-AT and all PeopleBot robots are integrated with the onboard computer controls. Customer installation is not recommended.

NOTE

The Video and A/V switches on the Video Panel do not control power or signal from the camera; they switch power to the optional A/V transmitter.

The video output ports with the yellow RCA-style sockets on the Video Panel are active whenever the camera power is ON.

Mounting the Camera

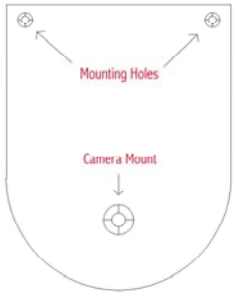

Figure 2. Version C (Canon) mounting plate

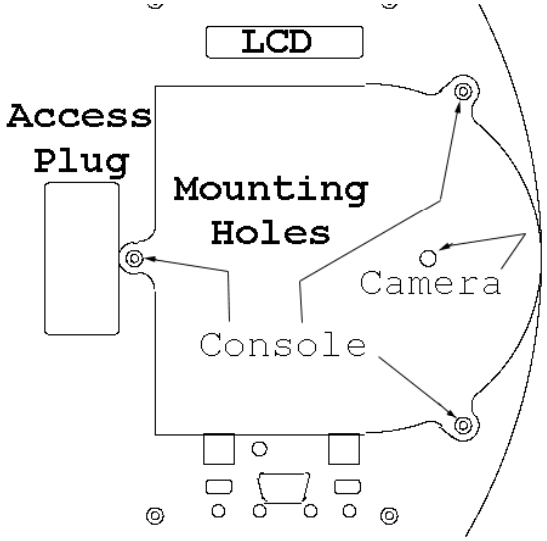

Figure 3. Version S (Sony) mounting plate and position on Pioneer 2 Console

The camera comes detached from the robot for safe shipment. We recommend mounting it to the front of your robot, centered on top of the Pioneer 3 or 2 robot's console or underneath the top console of the Performance PeopleBot. We have prepared your *Activ*Media robot with mounting holes, and include the mounting screws with the PTZ Robotic Camera installation kit.

To mount the PTZ Robotic Camera, use the hex wrenches that came with your robot. You may need to temporarily remove screws that secure other attachments to the robot while installing the camera, such as the front-most screws on the Pioneer 3 or 2 console that hold the front sonar array.

Line up the screw holes on the mounting plate of the PTZ camera with the prepared screw holes on the robot. Insert the screws that came with the camera and fasten tightly.

Power, Control, and Signal Cables

Cabling for the PTZ camera should be hanging loosely out of a nearby access port, such as the one in the center of the Pioneer 3 robot's console. Insert the distinctive power plug into the camera's DC IN socket; the yellow RCA-style plug into the camera's yellow VIDEO OUT socket; and the 8-pin mini-DIN plug into the camera's VISCA IN socket.

You have completed the installation.

Testing the Connections

Switch ON the PTZ Robotic Camera, as well as the MAIN POWER of your *Activ*Media Robot. The version S camera should run through a pan and tilt initialization cycle while the robot starts its systems. Version C cameras have a green LED on its pedestal indicating power.

With a separate cable, plug into the RCA Video signal connector 1 or 2 on the Video Panel, or into the camera's VIDEO OUT socket (replacing the connected cable) and the other end into an NTSC monitor. You should see a full-color image. Use the hand-held controller that comes with the camera to test its pan, tilt, and zoom features.

Chapter 3 PTZ Robotic Camera Software

Your PTZ Robotic Camera comes with software support for controlling the pan, tilt, and zoom features of the camera through your ActivMedia robot's operating system, such as P2OS and AROS. In addition, we provide C- and C++-language-based libraries and source code for integration of the PTZ Robotic Camera with your client applications.

Server-Level Communications

When attached to auxiliary serial port of your robot's microcontroller, integrated control of the PTZ Robotic Camera happens through the client-connected HOST serial control port. If you want to communicate with the camera directly through those ports at the lowest client-server level, use the AROS/P2OS `TTY2` command #42 with a string argument to have that string sent out the AUX(1) port of the controller to the attached serial device, namely the PTZ camera. Similarly, use the AROS-only `TTY3` command #66 to send a string argument to the AUX2 port, if the camera is attached there.

AROS and P2OS also maintain circular buffers for incoming serial data from its AUX(1) or AUX2 serial ports. On request, AROS/P2OS sends successive portions of the buffers to your client via the HOST port in the respective `SERAUXpac` (type = 176; 0xB0) and `SERAUX2pac` (type = 184; 0xB8) SIPs. Use the `GETAUX` command 43 for AUX1 or `GETAUX2` command number 67 for AUX2. Use the integer argument value of zero to flush the contents of the respective buffer. Use an argument value of up to 253 bytes to have AROS wait to collect the requested number of incoming AUX-port serial bytes and them send them in the respective `SERAUXpac` or `SERAUX2pac` SIP.

Look for details of the ActivMedia Robotics' OS client command packet contents and protocols in your robot's user guide or technical reference. Camera-specific commands are found in their respective programmer's manuals. Look for them on the CD-ROM of software and documentation that came with your robot or at our support website in **http://robots.activmedia.com/docs**.

ARIA and Saphira 8.x Client Controls

C++-based client-side programs developed with *Activ*Media Robotics Interface for Applications (ARIA) software, including Saphira 8.x clients, have immediate access to and control of the PTZ Robotic Cameras as attached either through the HOST-to-AUX ports of the robot microcontroller or directly to the onboard PC. See the demonstration `vcc4_demo.cpp` or `sonyPTZdemo.cpp` programs in the `examples/` directory of your ARIA distribution for examples. Also review the `ArVCC4` and `ArPTZ` classes in the extensive ARIA documentation.

Briefly, the default is the PTZ Robotic camera attached to the AUX(1) serial port of your robot's microcontroller. Accordingly, an `ArRobot` pointer is passed to the constructor and is the connection through which camera commands are sent.

Alternatively, set an `ArDeviceConnection` via `setDeviceConnection` to create a communication channel to the camera when it is attached to a dedicated serial port on the host PC.

Saphira 6.x Plugins

Whereas ARIA supports both Version S and Version C PTZ Robotic Cameras as part of the standard distribution, the now antiquated C-language-based Saphira 6.x plugins come separately. Those client-side distribution archives for the S and C Robotic Camera versions are named `ptzsys` (`.tgz` or `.exe`) and `vc_c4` (`.tgz` or `.exe`), respectively.

For the Linux version of the Saphira 6.x plugin, copy the `tar` and compressed `ptzsys` or `vc_c4` archive file (.tgz suffix) into the top-level directory where you have previously installed Saphira; `/usr/local/Saphira/ver62`, for example. Then `uncompress` and `untar` the files:

```
% tar -zxvf ptzsys.tgz (or vc_c4.tgz)
```

Table 2. Contents of PTZ Robotic Camera Saphira 6.x plugin

$SAPHIRA/	Description
colbert/ptzsys.so or vc_c4.so	Shared object library for Saphira/Colbert
colbert /ptzdemo.act or vcc4_demo.act	Colbert demo exercises PTZ camera
devices/ptzsys/ptzsys.c or vc_c4/vc_c4.c	Plugin source file
devices/ptzsys/ptzsys.h or vc_c4/vc_c4.h	Plugin header file
devices/ptzsys or vc_c4 /makefile	Library makefile
devices/ptzsys/ or vc_c4/readme	Latest updates and system description

For the Windows version, download from the support website or locate on the *Activ*Media CD-ROM the ptzsys.exe or vc_c4.exe file. Double-click the program icon to execute the self-extracting archive and choose, when prompted, to install the extracted files into the top-level directory where you have previously installed Saphira; `C:\Saphira\ver62`, for example.

Table 3. Contents of Win32 version of Saphira 6.x plugin

$SAPHIRA\path	Description
colbert\ptzsys.dll or vc_c4.dll	Saphira/Colbert shared library
colbert \ptzdemo.act	Colbert activity demo exercises camera
devices\ptzsys\ptzsys.c or vc_c4/vc_c4.c	Shared library source file
devices\ptzsys\ptzsys.h or vc_c4/vc_c4.h	Shared library header file
devices\ptzsys\ptzsys.dsw or vc_c4.dsw	MSVC++6.x workspace for plugin compilation
devices\ptzsys\ptzsys.dsp or vc_c4.dsp	MSVC++6.x project for plugin compilation
devices/ptzsys/ or vc_c4/readme	Latest updates and system description

The Saphira C-language-based application development environment automatically manages Pioneer communications and P2OS/AROS command packets. The PTZ Robotic Camera software includes Saphira functions and related arguments to create Saphira-mediated client applications for control of the camera. Inspect the `$(SAPHIRA)/devices/ptzsys/ptzsys.c` or `/vc_c4/vc_c4.c` source files for details.

Table 4. PTZ camera version S plugin functions and variables

void sfPTZCamInit(void)	Initialize the camera and reset to center (0,0 degrees)
void sfPTZCamPan(int deg)	Pan to an absolute position ± 95 degrees
void sfPTZCamTilt(int deg)	Tilt to an absolute position ± 20 degrees
void sfPTZCamPanTilt(int pan, int tilt)	Pan and tilt to an absolute position ± degrees
void sfPTZCamZoom(int val)	Zoom to 0 (longest) to 1023 (closest) position
sfPTZCamPanAngle	Current Pan angle (int degrees)
sfPTZCamTiltAngle	Current Tilt angle (int degrees)

To use the PTZ System software with your Saphira 6.x clients and interactively through the Colbert command window, load the shared PTZ Camera object

library into the Colbert interpreter that comes with Saphira versions 6.1 and later. Pull down the Saphira client's `File` menu and select to load the shared library, or type the Colbert direct command.

For example, type in the Colbert interaction window:

```
> load ptzsys.dll
```

to install the S-version camera commands into your Saphira client.

ATTENTION

You must first connect with your *Activ*Media robot to send commands to the PTZ Robotic Camera.

Alternatively, you may load the PTZ camera shared library from within a Colbert program. Use the identical `load` command as from within the interaction window. See the PTZ Robotic Camera Colbert demo programs that come with the software for examples (look in the Saphira `colbert/` directory).

Finally, you may load the library automatically from within the Saphira client code. After starting the Colbert Evaluator (sfRunEvaluator() typically in the Saphira client's startup section:

```
sfLoadEval("vc_c4");  /* use ptzsys for the version S camera */
```

Table 5. Version C PTZ Camera Saphira plugin commands and variables

int sfVCC4Init(void)	Initialize the camera and reset to center (0,0 degrees); returns 0 success or –1 fail.
void sfVCC4Power(int power)	Power OFF (0) or ON (1)
void sfVCC4Stop(void)	Stop moving; current positions may be invalid
void sfVCC4Resume (void)	Resume motion to achieve last position command
void sfVCC4PanSlew(int speed)	Sets pan speed
void sfVCC4TiltSlew (int speed)	Sets tilt speed
void sfVCC4PanTilt (int pan, int tilt)	Pan and tilt to an absolute position ± degrees
sfVCC4PanAngle	Current Pan angle (float degrees)
sfVCC4TiltAngle	Current Tilt angle (float degrees)
sfVCC4PanSpeed	Current pan speed
sfVCC4TiltSpeed	Current tilt speed

In all cases, Saphira loads and initializes the shared library (`sfLoadInit` section of the library). Your software, including the Colbert interaction window and activities, thereafter has access to the library commands, as described in nearby Tables.

All libraries include a help section which describes the commands and variables, as accessed through the Colbert Interaction Windows. For example,

> help vc_c4

lists the implemented commands and variables in the vc_c4 Saphira plugin that are available to your Saphira/Colbert programs.

Chapter 4 Appendix A

Sony D30/31 Camera Specifications

Image Sensor	1/3" IT CCD
Effective Pixels	768(H) x 494(V) NTSC; 752(H) x 585(V) PAL
Horizontal Resolution	460 TV lines NTSC; 450 TV lines PAL
Vertical Resolution	350 TV lines NTSC; 400 TV lines PAL
Lens	12X Zoom, f=5.4 - 64.8 mm; F=1.8 - 2.7
Angle of View (H)	48.8 degrees (wide angle) - 4.3 degrees (telephoto)
Angle of View (V)	37.6 degrees (wide angle) - 3.3 degrees (telephoto)
Minimum illumination	7 lux / F1.8
Pan Angle	+-100 degrees; max 80 degrees / second
Tilt Angle	+-25 degrees; max 50 degrees / second
Weight	1,200 g

Canon VC-C4 Camera Specifications

Video Standard:	NTSC
Total Number of Pixels:	410,000 (380,000 effective pixels)
TV-Line:	460 TV L
Minimum Illumination:	6 lux (2 lux at gain-up mode)
SNR:	48 dB
Horiz, Field of View:	3 to 47.5 degrees F(65 degrees with Wide angle lens adapter)
White Balance:	Auto
Exposure:	Auto/Manual
Focus:	Auto/Manual
Focus Length:	4 to 64mm, F1.4 to 2.8
Zoom:	16x
Pan Angle:	+/- 100 degrees F(+/- 170° VC-C4R)
Pan Speed:	1 to 90 degrees/sec (+10°, -90° VC-CR)
Tilt Angle:	+90/-30 degrees F
Tilt Speed:	1 to 70 degrees/sec
Menu mode by Super Impose:	Camera setting, Display setting, etc..
Preset Position:	9 Positions

Controllable # by one IR:	9 Units
Cascade control:	9 Units
Control:	RS232 Serial, RTS/CTS has to be active (up to 19.2 kbps)
Power:	13V, 12W
Size (W x D x H) inches:	4 x 4.48 x 3.58
Weight:	0.83 lbs. (375 grams)
Operating Temperature:	32 degrees F

Chapter 5 Warranty & Liabilities

Your *Activ*Media Robot is fully warranted against defective parts or assembly for one year, and the PTZ Robotic Camera System for 90 days after it is shipped to you from the factory. This warranty explicitly *does not include* damage from shipping or from abuse or inappropriate operation, such as if the robot is allowed to tumble or fall off a ledge, or if it is overloaded with heavy objects.

The developers, marketers, and manufacturers of Pioneer shall bear no liabilities for operation and use of the robot or any accompanying software and accessories except that covered by the warranty and period. The developers, marketers, or manufacturers shall not be held responsible for any injury to persons or property involving the Pioneer Mobile Robot in any way. They shall bear no responsibilities or liabilities for any operation or application of the robot, or for support of any of those activities. And under no circumstances will the developers, marketers, or manufacturers of the robot take responsibility for support of any special or custom modification to robot or software.

19 Columbia Drive
Amherst, NH 03031
(603) 881-7960
(603) 881-3818 fax
http://www.mobilerobots.com