1 SELECT A SITE FOR THE EYEGAZE SYSTEM

a) The Eyegaze System should be set up in an environment with fluorescent lighting. There should be little or no daylight or incandescent light. (Ambient infrared light from the sun or incandescent lights competes with the light from the Eyegaze System's light emitting diode (LED) and degrades eyetracking performance.)

b) The Eyegaze System is a table-top system. Figure 1 illustrates the major elements of the system and shows one way that it might look after it is set up. Choose alternative layouts to suit your requirements.

c) Choose a sturdy table, desk or bench to put the Eyegaze System on. The edge of the table must have a lip that will accept the monitor arm clamp. See Section 2.

d) Choose a position on the table to attach the clamp. The clamp should be located so that the monitor will be in a comfortable position for the subject and so there is freedom in the swing of the arm to move the tray right to left and front to back. The clamp may be located on the rear or side of the table.
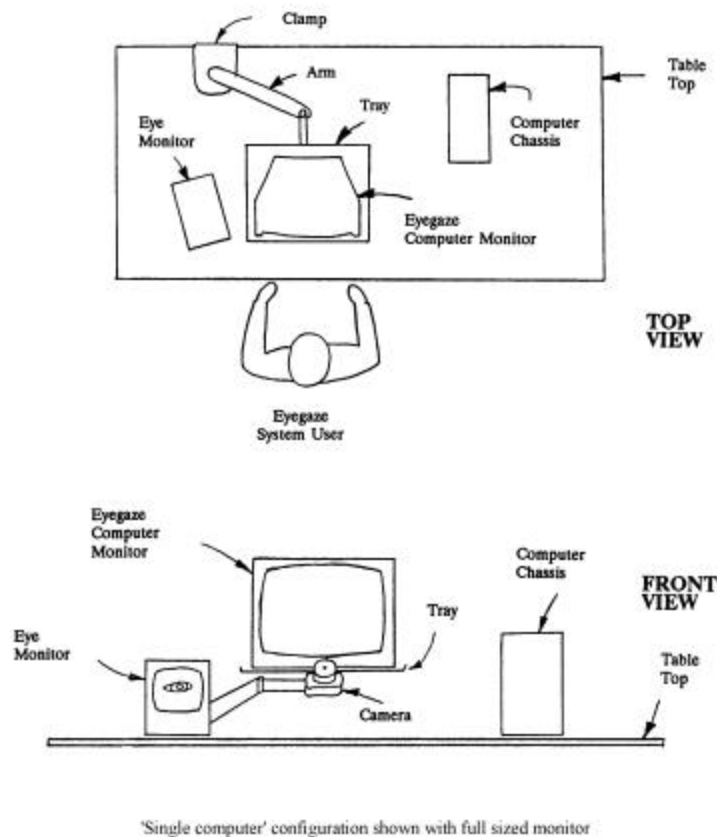

Figure 1: Eyegaze Component Layout

2 MOUNT THE CLAMP, ARM AND TRAY FOR THE COMPUTER MONITOR

For Full-Sized Monitors -- For Flat-Panel Monitors, see arm manufacturer instructions.

a) Attach the monitor arm clamp to the table as shown in Figure 2.

b) Attach the monitor arm to the clamp by sliding the socket on the shoulder of the arm over the post on the clamp.

c) Attach the monitor tray to the arm by sliding the post on the bottom of the tray into the socket on the wrist of the arm.

d) Place the computer monitor on the tray to test the stability of the tray.

e) Remount the clamp if necessary. If the monitor cannot be swung easily to a comfortable position for the subject, the clamp should be remounted. Note which way the clamp needs to be moved for proper positioning of the tray in front of the subject. Remove the monitor, tray, arm and clamp. Reposition the clamp on the table and reattach the clamp, arm, tray, and monitor.
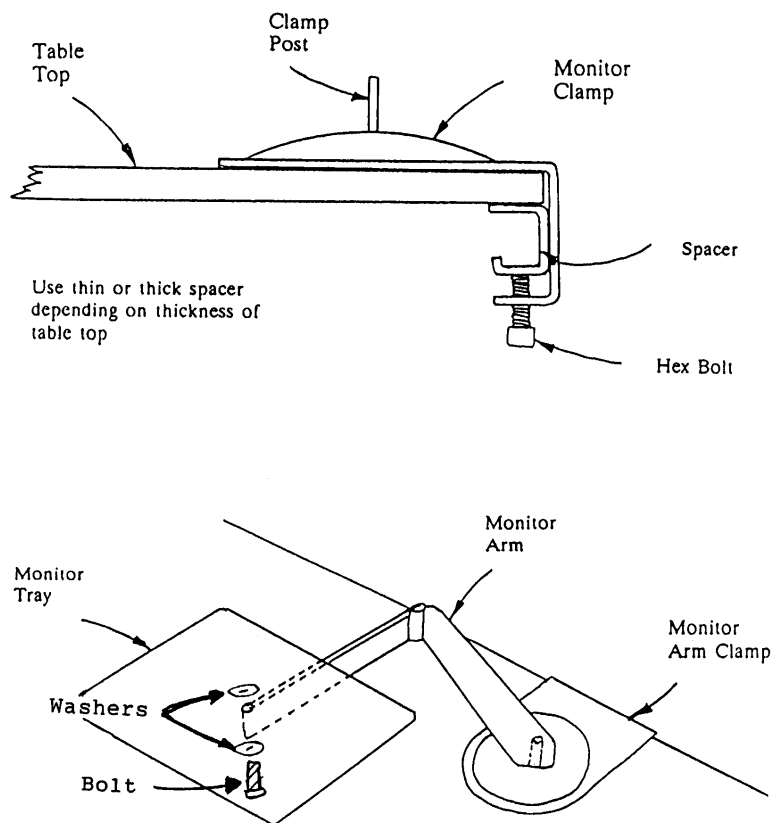
Figure 2: Monitor Arm Clamp Mount for Full Sized Monitors

3   POSITION THE COMPUTER MONITOR ON THE TRAY - (FULL-SIZED MONITOR)

a) If the computer monitor has a swivel base, remove it. (See Section 1.12 of the <u>Users Guide</u>, "Keeping the Monitor Display in the Tracking Cone".)

b) As illustrated back in Figure 1, position the monitor on the tray so that the screen is centered over the camera bracket, and so that the front surface of the screen is approximately aligned with the front edge of the tray.

c) It is recommended that the monitor display not be larger than 17" (diagonal screen measure). If a larger monitor is desired, a special modification to the camera is required. (See Section 1.13 of the <u>User's Guide</u>, "Accommodating Large Monitors".)

4 MOUNT THE VIDEO CAMERA ON THE CAMERA BRACKET

a) Attach the camera to the camera bracket as illustrated in Figure 4. Four screws go through the bottom camera bracket into the bottom of the camera.

NOTE:
The camera is positioned between the upper lower brackets. After mounting, the labeling on the rear of the camera should be right side up, and the LED wire should come out the bottom of the camera.

b) Make sure the switches on the rear of the camera are set as shown at the top of Figure 3. The proper position is marked with a dab of white paint.

c) Set the camera f-stop to f1.3 and set the focus range to infinity. Figure 4 shows the locations of the f-stop and focus rings on the camera lens. Both rings should be turned fully to the right.

d) Focus Ring Adjustment for Binocular, Fixed-Camera Eyegaze Systems. To start with, both rings on both cameras should be turned fully clockwise Figure 4 (from the user point of view). This opens the f-stop to their maximum values of f 1.3, and causes the lenses to focus as far out as they can. (The focus range on the lens says infinity, but because the lenses are mounted on 5mm lens extensions, the maximum focus range is actually about 26 inches). To get maximum tolerance to head motion, it is desirable that both cameras be focused at the same range. Thus, after you have turned both focus rings fully clockwise, it may be desirable to cock one of the focus rings slightly counter-clockwise to get the two cameras to focus equally. To do this fine focus-ring adjustment:

1) Turn the Eyegaze system on and put it into an eyetracking mode - such as calibration – where both sets of on-screen eye images are visible.

2) Turn the focus rings on both cameras fully clockwise. (The focus ring is the front ring on each lens. At the same time, reconfirm that the f-stop rings, i.e. the rear rings, are also set fully clockwise.)

3) Sit in front of the system with your face square toward the camera.

4) Move your head back and forth very slowly until you are in optimum focus on both cameras. Check the focus condition on each eye by observing the "focus-indicator" bar that moves up and down between the expanded and full-field eye images. The eye is in perfect focus if the bar is centered on the reference mark.

5) If both eyes do not come into focus at the same range, move one of the focus rings off its infinity mark. Play around, moving one or the other focus ring off infinity, until you get
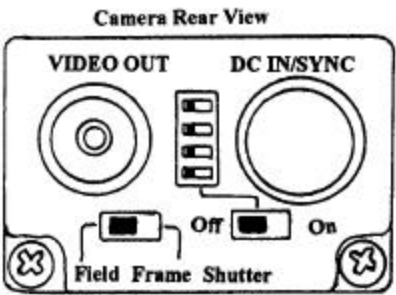
both cameras in focus simultaneously - with one ring at infinity and the other just off infinity.

NOTE:
Any focus ring adjustment off of infinity should be quite small – only a few degrees, not an eighth of a turn or more. Once adjusted, it may be desirable to lock the focus-ring with a piece of tape.
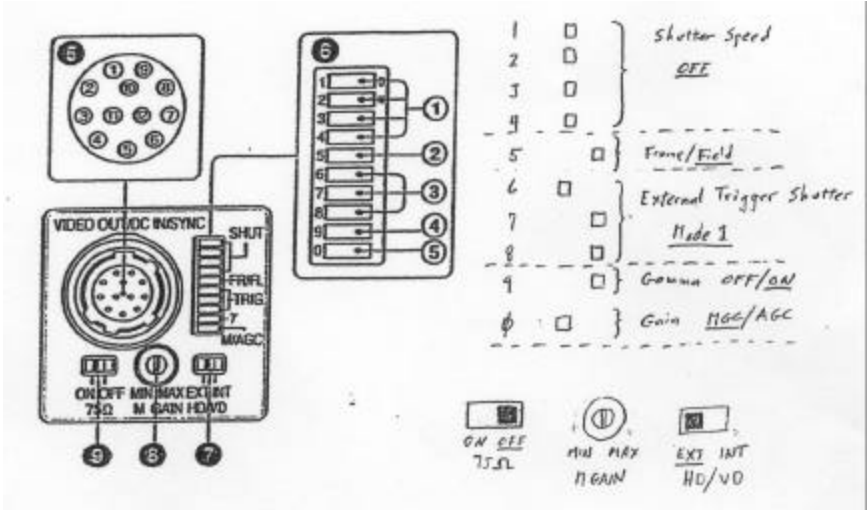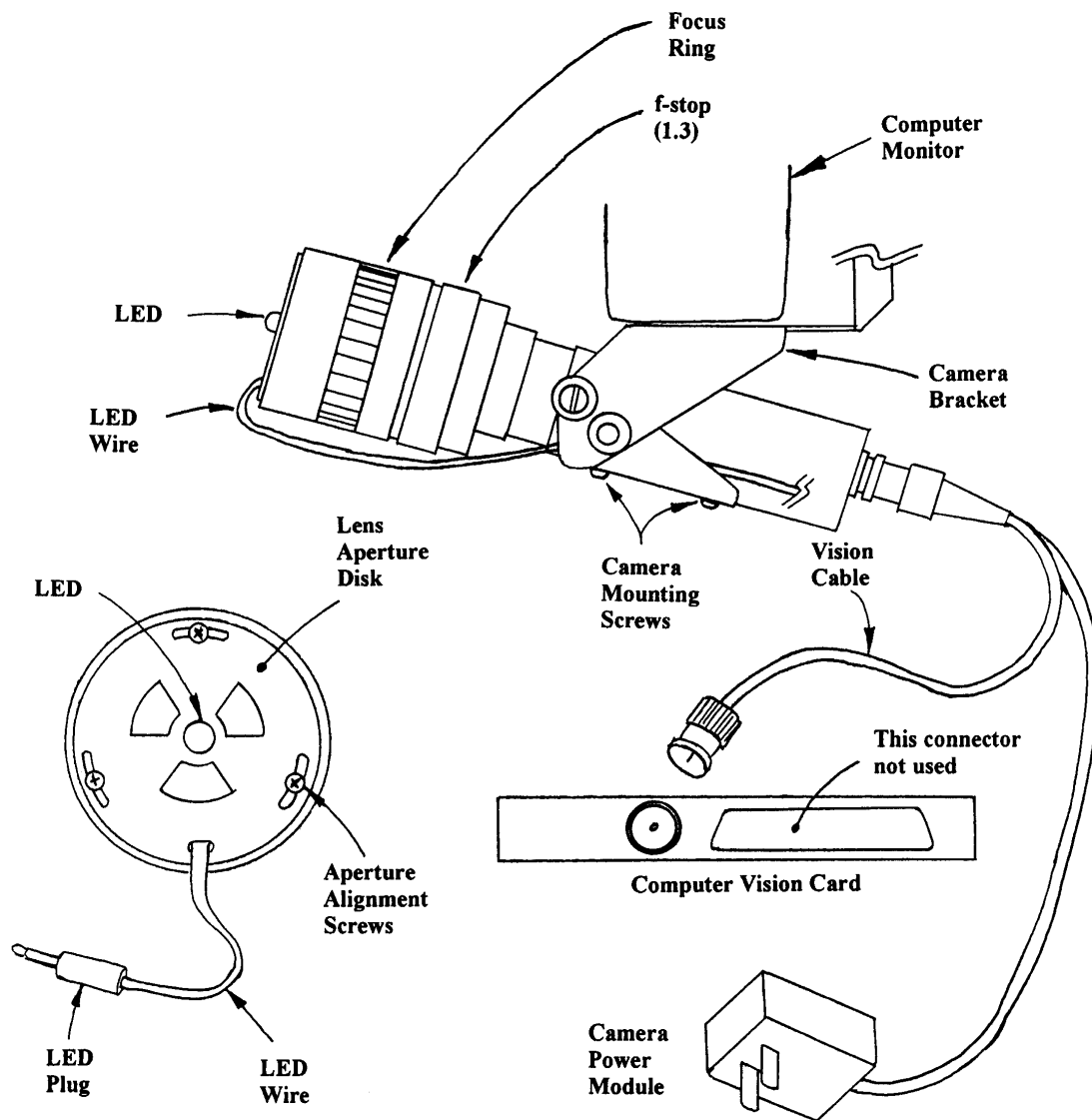

Sony Camera Settings

Hitachi Camera Settings

Figure 3: Camera Settings

Figure 4: Camera Assembly

5 PLACE THE EYE MONITOR ON THE TABLE

a) As illustrated back in Figure 1, place the Eye Monitor on the table to the right or left of the computer monitor. Position it so that the subject can easily check his eye position in the camera image. If the eyetracker is used in an application where the Eye Monitor would distract the subject, special care needs to be taken to find ways to keep the subject in focus and within the camera's field of view during operation.

b) The Eye Monitor may have one or more switches on the back. Their proper settings are marked. Make sure all the switches are set to their marked positions.

6   PLACE THE COMPUTER CHASSIS

Place the computer chassis on or below the table, whichever is more convenient.

7   ATTACH THE CABLES

a) Place the power surge protector in a convenient location for turning the Eyegaze System on and off. If there are many devices to be attached to the Eyegaze System, plug the extra power strip into the surge protector. Plug the power for the following devices into the surge suppressor and/or power strip:

    1) Computer chassis
    2) Computer monitor
    3) Eye Monitor
    4) Camera power pack

b) Verify that the power from the camera power pack is attached to the camera as shown in Figure 4.

c) Plug the keyboard into the computer.

d) Plug the computer monitor cable into the computer card marked "VGA".

e) Attach the vision cable as illustrated in Figure 4. If using an Eye Monitor, attach the BNC connector on the vision cable to "Video In" on the Eye Monitor, and connect a BNC cable between the Eye Monitor "Video Out" and the frame grabber card in the computer.

f) Plug the jack on the LED wire (see Figure 4) into the socket on the back of the computer labeled "LED".

8   TEST EYEGAZE SYSTEM OPERATION

a) Power the Eyegaze System on, go into the C:\EYEGAZE directory, and run the demonstration program GAZEDEMO. GAZEDEMO begins by running the calibration procedure. (Technically, GAZEDEMO spawns the CALIBRAT program.) See Section 3 "Preparing for Subject for Eyetracking Operation" for guidelines on how to sit the subject in front of the system and how to aim the camera at the subject's eye. See Section 2, "Calibrating the Eyegaze System" for guidelines on how to do the calibration.

b) After completing calibration, the GAZEDEMO program simply displays a cross on an otherwise blank screen at the location where the Eyegaze System computes the gazepoint. The cross is yellow as long as the system is tracking the eye and the gazepoint is calculated to be on the active portion of the screen. The cross turns green if the Eyegaze System is tracking the eye but the gazepoint is calculated to be outside the active region of the screen. The green cross is plotted at the point on the screen closest to the predicted gazepoint. The cross turns red when the Eyegaze System is not tracking the eye.

c) To exit the GAZEDEMO program, press the Escape key.

9   SET THE EYEGAZE SYSTEM UP AS A PERIPHERAL TO A CLIENT COMPUTER

For Double Computer Configurations

a)   If it is desired to track a person's gaze on a monitor from a computer other than the Eyegaze System computer, configure the system as shown in Figure 5 this "double-computer" configuration, the Eyegaze System acts as a peripheral device to the Client computer. The Eyegaze System can be commanded either to send the gazepoint data to the Client computer in real time or to collect the gaze data in its own disk files for later analysis. -- The single vs. double computer configurations for the Eyegaze Analysis System are discussed in Sections 3 and 4 of the Programmer's Manual.

b)   Place the client computer's monitor on the Eyegaze monitor arm, so that the Eyegaze System's camera can monitor the subject's eye while he interacts with the Client computer's display.

c)   If using Ethernet communication between the two computers: Make sure an Ethernet card is installed in both computers and connect an Ethernet cable between the two computers.

If using serial communication between the two computers: Select an available COM port on both the Client and Eyegaze computers and connect a null-modem cable between these two ports.

d)   See the "Eyegaze System's Programmer's Manual" for software programming details.
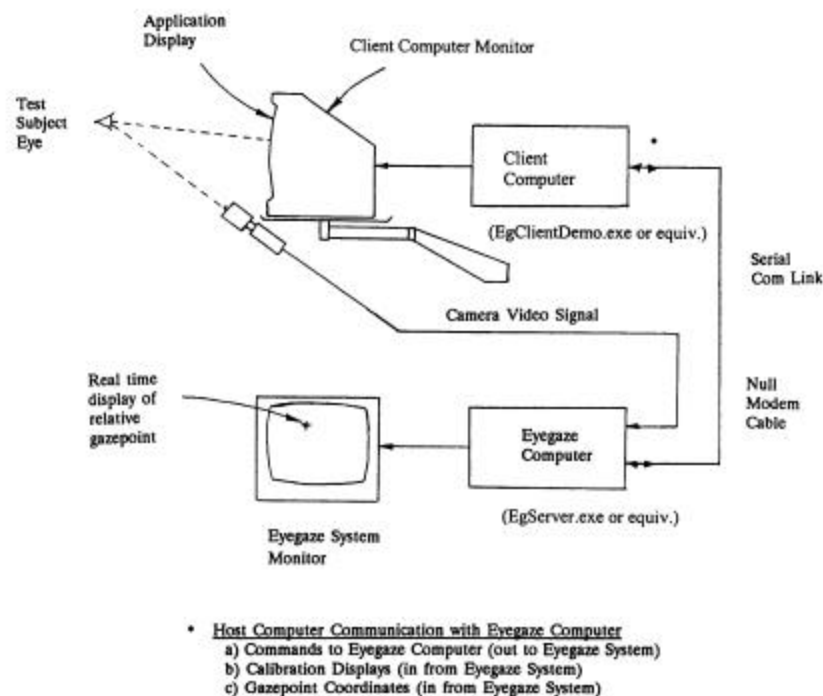
Figure 5: Connections for Eyegaze System Used as a Peripheral Device to a Client Computer

10   TROUBLE SHOOTING

<u>Increasing Memory in the Computer</u>

When changing the amount of memory in the computer, it is necessary to change the boot record. The Matrox digitizer/libraries requires dedicated memory in the computer system. The Matrox software tells Windows to use only a specified amount when it boots up so that it can keep the top portion for itself.

To change the boot record, you can either edit the Boot.ini file directly, or use the Matrox configuration utility:

Start -> Programs -> Matrox Imaging Products -> MIL Configuration

There are 4 tabs at the top. Click on Non-paged memory. Change the "computer memory size" to the new amount (X MB). This program is fairly 'dumb', i.e. it's incapable of figuring out how much memory is actually present. Click OK and then reboot.

LC TECHNOLOGIES EYEGAZE ANALYSIS SYSTEM
SECTION 5: INSTALLATION MANUAL
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LIST OF FIGURES