Installing the Model 630047 PIVCAM 13-8 or 630055 PIVCAM 14-10 Image Capture System

Sections

Figures

Tables

Installing the Model 630047 PIVCAM 13-8 or Model 630055 PIVCAM 14-10 Image Capture System

This section gives instructions on how to install and align the Model 630047 PIVCAM 13-8 and Model 630055 PIVCAM 14-10 Image Capture System.

Scope

After completing this section, you will have done the following:

- ❑ Installed the camera.
- ❑ Connected the camera to the Frame Grabber in the computer and to the Synchronizer.
- ❑ Checked out the camera-to-Synchronizer and the camera-to-Frame Grabber connections using the INSIGHT™ software.

Manufacturer's Declaration of Conformity

TSI Incorporated hereby certifies that, to the best of its knowledge and belief,

- ❑ The instrument documented in this manual meets the essential requirements and is in conformity with the relevant EC Directive(s).
- ❑ The CE Marking has been affixed on the instrument.
- ❑ The Declaration of Conformity certificate is included with the instrument.

Unpacking and Checking the Packing List

Carefully unpack the other components of the image capture system, making sure they arrived in good condition. Do ***not*** discard the case. If the camera needs to be shipped back to TSI for repair or service, it ***must*** be returned in this case.

If there are signs of damage, contact the nearest TSI sales office or representative or the Fluid Mechanics Division at TSI. See “Service Policy” on the Warranty page at the beginning of this manual for further details.

Compare all the components you received with those listed in Table 1. If any parts are missing, contact TSI. See "Getting Help" in "About This Manual" section for the address and phone number.

Table 1
Packing List for the Model 630047 PIVCAM 13-8 Camera Image Capture System with PIVCAM 13-8 Frame Grabber

Qty	Model Number	Description	Part Number
1	630047	PIVCAM 13-8 Camera System including:	
		1 PIVCAM 13-8 CCD Camera	630147
		1 PIVCAM 13-8 Frame Grabber	
		1 Camera-to-Frame Grabber Cable, Duplex BNC	
		1 28-mm FL F/2.8 Nikkor Lens	610046
		1 Ring, Lens Extension 14-mm F-Mount	2806063
		1 Camera Power Cable	1098899
		1 Coaxial Cable	1303677

Table 2
Packing List for the Model 630055 PIVCAM 14-10 Camera Image Capture System with PIVCAM 14-10 Frame Grabber

Qty	Model Number	Description	Part Number
1	630055	PIVCAM 14-10 Camera System including:	
		1 PIVCAM 14-10 CCD Camera	630155
		1 PIVCAM 14-10 Frame Grabber	
		1 Camera-to-Frame Grabber Cable, Duplex BNC	
		1 28-mm FL F/2.8 Nikkor Lens	610046
		1 Ring, Lens Extension 14-mm F-Mount	2806063
		1 Camera Power Cable	1098899
		1 Coaxial Cable	1303677

Assumptions

At this point in your system installation, TSI assumes you have completed these steps:

- ❑ The computer system is set up with the INSIGHT software loaded and tested. The Frame Grabber is installed and tested.
- ❑ The laser system is installed and aligned.
- ❑ The LASERPULSE Synchronizer is connected to the computer and has been tested.

WARNING

Do *not* turn the laser on during any of the steps given in this section of the PIV systems manual.

Installation Overview

To install the camera, you need to complete the following steps:

Step 1. Install the camera on a tripod.

Step 2. Connect the camera to the LASERPULSE Synchronizer and to the PIVCAM 13-8 or PIVCAM 14-10 Frame Grabber.

Step 3. Check out the camera-to-Synchronizer and the Camera-to-Frame Grabber connections.

Before installing the camera, be sure to read and take the following precautionary measures.

Important

Failure to read and implement the following experimental practices can void the camera warranty.

WARNING

The Camera warranty is void if these warnings are *not* followed:

- ❑ Uncontrolled laser light, such as laser reflections from objects, can seriously damage camera sensors. Do ***not*** turn the laser on during any of the steps given in this section of the PIV systems manual.
- ❑ Make sure the lens cap is on the camera during and after installation. Remove the lens cap only after the experiment has been suitably set up.
- ❑ Replace the lens cap when making any changes to your experiment.
- ❑ Do *not* oversaturate the camera pixels. Oversaturation can be seen as streaks around particle images or objects in the flow grow in size and appear blurred.

Preventing Camera Damage Due to Laser

PIV measurements require enough laser lightsheet intensity to get good exposures of the small tracer particles used to follow the fluid flow. When the laser intensity is high enough to give near full-scale intensity levels for the particle images, but below pixel saturation, damage to the camera CCD chip can happen if a specular reflection goes into the camera. Specular reflections can be caused by objects in the flow such as the flow model and also by droplets and bubbles. If the laser damage threshold is exceeded within the image area, a pixel or group of pixels may be damaged.

The pixel damage can be seen as magenta or white pixels when the lens cap is on. If the laser damage happens on the CCD chip outside of the image area, the image output

circuitry could be damaged. When this happens the entire image could turn black.

The visible signs of laser damage **may be delayed** from the time that the laser exposure caused the damage. If a trace on the CCD is damaged, it may not fail right away. Either more laser exposure or electrical current may increase the damage and lead to eventual failure.

Reducing Risk of Camera Damage

There are several issues you need to consider to reduce the risk of camera damage:

Remove Sources of Specular Reflections

When designing the experiment, try to minimize the reflections. Making a model out of Plexiglas can scatter less light than metal. Have a laser lightsheet exit the experiment. Use black tape to absorb light and cover reflection sources. Use black tape to block reflections between the experiment and the camera.

Use the Camera Lens Cap When Making Changes to the Experiment Alignment

Reflections are more likely to happen during experiment setup or changes. Be sure to protect the lens by having the lens cap on the camera during this time. When you have the laser, experiment, and camera in place, look for reflections and high-intensity scattered light before removing the lens cap. Once the system has been aligned, mount the experiment, laser, and camera securely so that changes in alignment do not happen.

Align the System to Avoid Specular Reflections Entering the Camera

If a reflection cannot be removed from the experiment, position the camera so that the reflected light does not enter the camera lens. Verify this with the lens cap on before taking images.

Do Not Set Up Experiments with a Wall at the Top of the Image

The non-imaging area of the CCD chip most sensitive to laser damage is to the upper-right of the pixel area (as when viewing the image on the monitor). If you align your experiment with an object at the top of the image, a high-level scattered laser light will hit this area. If possible, configure your experiment so that there are no objects or walls at the top of the image. If this is not possible, you could block light between the experiment and the camera so that it does not strike the CCD.

Considerations in Bubbly Flows and Sprays

Air bubbles in water scatter much more energy than the tracer particles used for measuring the water velocity. If the exposure is set so that the tracer particles are giving good exposures, the light scattered from the bubbles may be high enough to damage the CCD. To make these two-phase flow measurements, use two cameras and fluorescent tracer particles. The water phase is captured using fluorescent particles and an orange filter to remove the 532-nm laser light. The bubble phase is measured using the 532-nm light scattered off bubbles with the camera aperture reduced so that the camera is not saturating with the bubbles.

Liquid spays can have a large droplet size range. If you set the exposure for the small drops, the large droplets may scatter

enough light to damage the camera. In spray experiments, the exposure must be set for the largest drops.

Step 1: Installing the Camera on a Tripod

This step involves mounting the camera on a sturdy base. You can mount the camera on a sturdy tripod.

The camera has two ¼–20 tapped screw holes at the bottom that can be used to mount it on any base.

Mounting the Camera on a Tripod

Follow these steps to mount the camera on a tripod:

1. Attach the tripod to the camera using one of the two ¼–20 tapped screw holes on the camera.
2. Attach the 14-mm lens extension ring.
3. Screw the lens to the camera and extension ring.

Step 2: Connecting the Camera to the Frame Grabber and the Synchronizer

Follow these steps to connect the camera to the Frame Grabber and the Synchronizer.

***Note**: If you have the Model 610035 Synchronizer, you need to use the separate power supply provided to power your camera.*

Caution

Make sure the Synchronizer and computer is turned off. Do *not* connect or disconnect the Frame Grabber and camera with either the camera or computer power on. This would damage the camera or the Frame Grabber.

1. Locate the Frame Grabber-to-Camera Duplex Coaxial cable. One BNC connector is red the other blue on each end.
2. Locate the camera power cable—it has a 2-pin round connector on the Synchronizer end and a larger 4-socket connector on the camera end.
3. Locate the Frame Grabber trigger BNC cable.
4. Connect the Frame Grabber-to-Camera cables making the following connections. Refer to Figure 1 as you make these connections.

Table 3
Camera/Frame Grabber Connections

Cable	From	To
BNC Duplex Cable with Red and Blue connectors	Frame Grabber Red to Serial In Blue to Serial Out	Camera Red to Serial Out Blue to Serial In
Camera Power Cable	Synchronizer Camera Power 12V Camera 1 or Camera 2	Camera Power Connector
BNC Coaxial	Synchronizer TTL Camera Trigger	Frame Grabber Camera Trigger

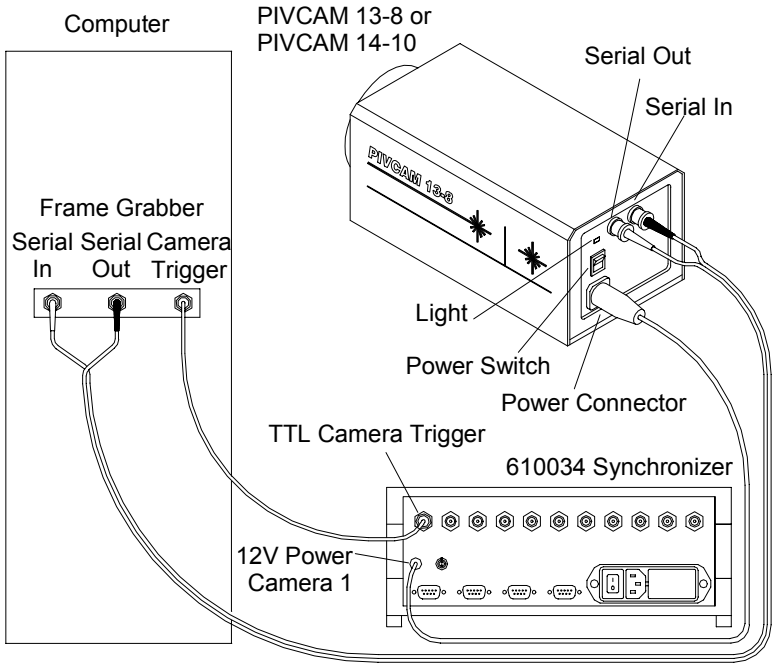

Figure 1
Connecting the Camera to the Synchronizer and the Frame Grabber

WARNING

Do *not* have the laser on during the camera installation.
All of the checkout procedures are done using room light.

Step 3: Checking Out Camera Connections

Perform the following steps to verify that all the connections have been made properly:

1. Turn on the Synchronizer and the computer and start the INSIGHT software.
2. Turn on the camera power switch. The Power LED light will turn on. If the camera light does not come on, verify that the Synchronizer is on by looking at the front panel power light, and that the camera power cable is connected.
3. Verify that the camera light is Green. If the light is Blinking Red/Green, this means that the camera is not at operating temperature, but is communicating with the Frame Grabber. Wait for the camera to come to operating temperature. If it is Red, it means that the camera is not able to communicate with the Frame Grabber. Verify that the computer power is on. Then check that the transmit and receive cables are connected properly. Try switching the two BNC cables at the camera.
4. In the INSIGHT program, select **Component Setup**. The Component Setup dialog box appears.
5. Click on the **Laser Setup** tab in the Component Setup dialog box and make the following selections:

Option	Value
Model	LASERPULSE Mini YAG
Flashlamp Frequency	15

6. Select the following options from the **Capture** tab:

Option	Value
Exposure Mode	Free Run
Capture Mode	Continuous

7. Click on the **Capture** button. The camera starts taking exposures.

8. Focus the camera by viewing the video image on the computer monitor. Adjust the light level using the lens aperture. If the image does *not* appear on the monitor, check the cables and the Camera Model selection in the **Camera Setup** tab. Make sure there is plenty of light and the aperture is open and the lens cap is off. If you get a time-out error, make sure the Exposure Mode is set at **Free Run**.

9. Change the Exposure Mode to **Synchronized**.

10. In the Timing Dialog, select **3.75 Hz** with PIVCAM 13-8 or **5 Hz** for PIVCAM 14-10 for the Pulse Repetition Rate parameter. Press **Apply**.

11. Press the **Capture** button. The camera should start acquiring images at the Pulse Repetition Rate.

12. Select the following options from the **Capture** tab:

Option	Value
Exposure Mode	Synchronized
Capture Mode	Continuous

Click on **Frame B** on the top of the screen.

13. Select the following options from the **Capture** tab:

Option	Value
Exposure Mode	Synchronized
Capture Mode	Sequence

Click on **Frame B**.

14. Press the Sequence Setup button.

Sequence Setup	Save to RAM
Number of Captures	2

Click on **Frame A**.

15. Press the **Capture** button.

16. Playback the images captured. A sequence of dark and bright images should appear. Click on **Frame A** and a dark image appears. Click on **Frame B** and a bright image should appear. This verifies that the camera is in triggered exposure and the system is grabbing image pairs. The Frame A images have a short exposure time and the Frame B images have a long exposure time.

    You have now checked out all of the connections between the camera, Frame Grabber, computer, and Synchronizer.

Troubleshooting

New Hardware Found Windows® XP Message

Install the driver using the Windows XP installation procedure. Place the INSIGHT Installation CD into the CD drive and use the Have Disk option. Navigate to the drivers folder on the INSIGHT Installation CD. For more detailed instructions look in the INSIGHT Installation manual.

Frame Grabber Properly into the Computer, INSIGHT with PIVCAM 13-8 Installed

The Frame Grabber must be installed in a PCI slot in the computer or the following error message will appear when Windows NT is started:

```
"Error:  cannot locate PCI card or card driver
while initializing camera zero.
```

Camera Light Codes

Red

The camera is not making communications with the Frame Grabber. If the transmission and receive cables are connected incorrectly, the light will stay Red. Try switching the Red and Blue BNC cables between the Serial In and Serial Out connectors on the camera.

Blinking Red/Green

Camera not at operating temperature. The PIVCAM 13-8 and PIVCAM 14-10 have thermoelectric coolers to lower the CCD temperature and reduce the image noise. It will take a period of time for the camera to come to operating temperature after being turned on. If the camera is operated in a hot environment, it may not have sufficient cooling capacity to achieve operating temperature. The camera can be used when not at temperature, but the image will have increased noise levels.

Green

The camera is OK. Camera is connected to the Frame Grabber and at operating temperature.

Camera Power Off or Not Connected to Frame Grabber

If the camera power is off or not connected to the Frame Grabber when INSIGHT is started, the following error message will appear.

```
Error:  No Camera connected while initializing
camera 0
```

Verify that the camera power is on by checking the camera power switch and light. If the camera light is Red, it is not connected to the Frame Grabber properly.

Windows® is a registered trademark of Microsoft Corporation.

Camera Will Not Focus On Close Objects
The camera was designed for use with a 14-mm lens extension ring for normal focusing. This 14-mm space allows the camera to use the Schimpflüg condition for Stereoscopic PIV. If the camera focus cannot be focused, verify that the 14-mm extension is between the lens and the camera. The lens has a minimum focus distance. If you are trying to focus on objects closer than this minimum distance, either add another lens extension or use a different lens.

System Will Not Frame Straddle
The PIVCAM 13-8 and PIVCAM 14-10 require a 610035 Synchronizer or a 610032/610034 Synchronizer with a PROM revision level 6.3 or higher. The Synchronizer revision level can be read in the **Component Setup | Synchronizer Setup** dialog in the Version field. If the Synchronizer in not version 6.3 or higher, contact TSI for information about upgrading the Synchronizer.

Next Step

Once the Image Capture System is installed and you have *not* ordered any other additional components, you are ready to use your PIV system.

If you have ordered additional components refer to *Options/Additional Components.*