

**Operation  
Manual**

**SyncroVision** ®  
**Model 3S**

***Control***  
***Vision*** INC.



**PRELIMINARY**

All rights reserved. Reproduction of this manual, in whole or part, in any form, without the expressed written permission of Control Vision Inc. is prohibited.

<b>1. INTRODUCTION</b>	<b>2</b>
<b>2. GENERAL DESCRIPTION</b>	<b>3</b>
<b>3. SYSTEM COMPONENTS</b>	<b>4</b>
<b>3.1 3S Controller Unit</b>	<b>4</b>
<b>3.1.1 Rear Panel</b>	<b>4</b>
<b>3.1.2 3S Front Panel</b>	<b>5</b>
<b>3.2 C40 Camera Head</b>	<b>6</b>
<b>3.2.1 Focus Tube</b>	<b>6</b>
<b>3.2.2 Lens Cell</b>	<b>6</b>
<b>3.2.3 Focus Tube Shield</b>	<b>7</b>
<b>3.3 X20 Xenon Strobe Unit</b>	<b>7</b>
<b>3.3.1 Optical Fiber Bundle</b>	<b>7</b>
<b>3.3.2 Fresnal Lens Assembly</b>	<b>8</b>
<b>4. OPTIONAL COMPONENTS</b>	<b>9</b>
<b>4.1 Optical Pickoff</b>	<b>9</b>
<b>5. SYSTEM OPERATION</b>	<b>10</b>
<b>5.1 Keypad Operation</b>	<b>10</b>

## 1. Introduction

---



Figure 1.0

SyncroVision is designed for observation of high-temperature processes that are not as bright as arc welding or plasma spray. SyncroVision uses the intense pulse of visible light coming from the xenon strobe to create the video image. High-temperature processes such as those found in steel mill operations or ceramic refractory processes, are normally quite difficult to monitor with the human eye or conventional picture taking equipment. The process detail is submerged within the luminous envelope of heat or flame. When one attempts to use a video or photographic camera, the field of interest is further degraded by the excess sensitivity of the medium, causing over or under exposed areas, delimiting contrast in of the subject. With steel making in particular, one looking to inspect the surface of the freshly poured metal slab can expect to see the bright surface with most of the detail lost in the bright glow of heat and flame.

The goal with SyncroVision is to capture a video image of the subject using intense lighting provided by a strobed light source rather than using the light from the process itself. Also through special optical filtering the image is enhanced giving the user a useful picture of the desired subject matter for research, quality, or process control. This manual describes the SyncroVision system and it's uses in incorporating the use of the xenon strobe units, to obtain these detailed pictures.

Thank-you for your interest in SyncroVision. We at Control Vision Inc. are always eager to assist you in optimizing the SyncroVision's performance for your particular application. We encourage you to call us when contemplating a new application or when encountering a problem. Our goal is to provide innovative vision solutions for science and industry. To this end, if you have any questions or comments regarding SyncroVision or this manual, please feel free to contact us via the following methods:

- phone: 208.523.5506
- fax: 208.523.5520
- E-mail: [vision@controlvisioninc.com](mailto:vision@controlvisioninc.com)
- mail: PO BOX 51505, Idaho Falls, ID 83405-1505

## **2. General Description**

---

SyncroVision is a self contained system incorporating a camera head, control unit, and a Xenon strobe light source. SyncroVision uses the optical energy from this pulsed light source to overwhelm the process light energy.

The optical energy from the strobe unit is transported to the viewing area with either a fiber-optic bundle or through the use of a fresnal lens system. The strobe light is reflected from the site and is, for an instant, much brighter than either the direct or reflected light from the process.

The system exploits this very temporary situation by capturing an image with a special-purpose video camera head that is equipped with a CCD video sensor and a means for very high speed electronic shuttering. The shutter is synchronized with the strobe flash. The strobe is in turn synchronized with the framing of the video sensor and is fired once for each captured video frame.

A conventional video camera has a normal framing rate of 30 frames per second, the effective shutter time (exposure time) is therefore 33.3 milliseconds (or usually 16.7 milliseconds if a solid-state image sensor is used). For SyncroVision the minimum shutter time is 1.25 micro-seconds and it follows that the camera exposure time is reduced by the factor of 26,640:1; the brightness of the molten metal or furnace in the video image is likewise reduced by the same factor, but the optical contribution to the image by the strobe light is not affected because the strobe and shutter are synchronized.

The SyncroVision camera unit is also equipped with a narrow-band optical filter to match the strobes wavelength and further suppress the process lighting. The net combination of both temporal and spectral filtering will typically result in a video image that is free of all of the adverse process lighting effects except perhaps for some minor remaining evidence of smoke or heat waves. Please note that optics for special applications, such as high magnification or long stand off distances can be specified.

***Important! To ensure the proper and safe operation of the SyncroVision system it is highly recommended that the customer read all of the materials provided, including the manual for the strobe unit and that all safety requirements are met prior to operating the SyncroVision system.***

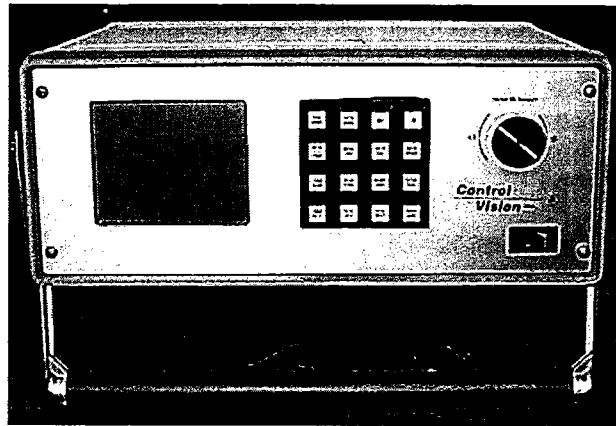
---

SyncroVision is warranted free of defects in materials and workmanship for a period of ninety (90) days. Prior to the return of a unit or any portion thereof, Control Vision Inc. must be consulted with to avoid unnecessary shipping. If the return of the equipment is deemed necessary, a Return Material Authorization (RMA) number will be assigned. This number must be recorded on the outside of the shipping container and on packing list.

---

### 3. System Components

---

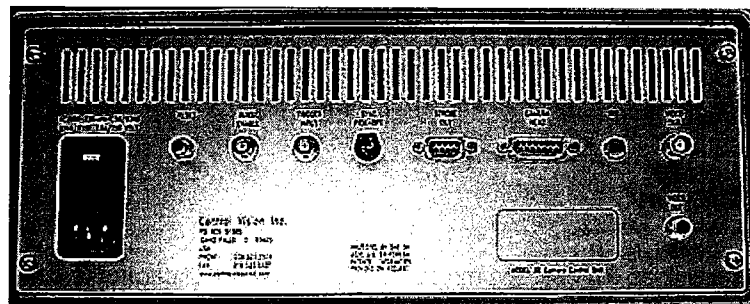


**Figure 3.0**

#### 3.1 3S Controller Unit

The model 3S controller contains all the necessary electronics to operate the camera system. The unit is compatible with 120/240 volt, 50/60 Hz, AC input. The rear panel has all the necessary connections for both internal and external triggering operation of the camera and light source. The front panel has an international on-off switch, and optical encoder to input various control parameters, a 16 pad key input module, and a large LCD display panel for viewing, at a glance, the systems operating parameters, at the time of operation.

##### 3.1.1 Rear Panel



**Figure 3.1.1**

The 3S rear panel contains all of the input connections to properly operate the camera system.

- AC Input Module- 120/220 volt 50/60 Hz AC input.
- Reset- Use this button to reset the controller system in the unlikely event of a system lockup.

## **Control Vision Inc.**

- Burst Enable- A BNC-style connector is used as input for an external signal used to control the system when in burst mode. The 3S Controller operation can be controlled by an incoming 0-5V, TTL, positive-going signal.
- Trigger Input- A BNC-style connector is used for an external trigger input. The 3S Controller Unit is designed to accept incoming trigger signals in order to synchronize the Camera Head and Strobe unit to external events i.e. rotating machinery. The Trigger Input circuitry will accept trigger signals meeting the following parameters:

Input Impedance:	1 k ohms
Frequency:	1 Hz - 20 kHz
Amplitude:	± 12V
Coupling:	DC

The 3S Controller Unit provides software controls over external trigger voltage threshold and waveform edge.

- Sync Pickoff- This multi pin, locking-style connector, accepts the optional Control Vision Inc. Optical Pick-Off device.
- Strobe Out- This 9 pin, D-sub style connector is used for connecting the Xenon Strobe unit. The cable supplied will only go on one direction and has both a male and female end. The Controller unit accepts the male end of the cable. This port provides the Xenon Strobe with the necessary voltages and trigger signals to synchronize with the camera head.
- Camera Head- This 15 pin, D-sub style connector is used to provide the necessary voltages and trigger signals to the C40 camera head.
- Iris- This port is an optional feature of the 3S Controller Unit. Please contact Control Vision Inc. for information about this feature.
- Video Outputs- The 3S Controller unit provides two video outputs, one in a standard BNC connector, the other through an RCA style connector. Either may be used as input to various video accessories like video tape recorders and monitors.

### **3.1.2 3S Front Panel**

The 3S front panel provides the user the means to input operational parameters and operation the camera system.

- On/Off switch, use to turn the unit on or off.
- Optical encoder input knob- Use this control to change, increase or decrease the selected parameter, in coincidence with the input keypad.
- 16 position key entry pad-This keypad allows easy access to the operational parameters of the 3S controller.
- LCD display- Shows operator how the 3S controller unit is setup and in what mode the system is operating in.

### 3.2 C40 Camera Head

The main body of the C40 camera head is approximately 3.8 cm(1.5 inches) high, 4.9 cm (2 inches) wide, and 8.9cm (3.5 inches) long. The tethered camera head weights approximately .3kgs. The camera head connects to the camera trigger cable via the two different circular connectors on the camera trigger cable. Both connections must be made to ensure proper camera timing with the strobe unit.

#### 3.2.1 Focus Tube

The Focus Tube supports the Lens Cell and Focus Tube Shield. The Focus Tube is attached to the front end of the C40 Camera Head using the four set screws on the front flange of the C40 Camera Head. Short, medium and long Focus Tubes are available, with each length providing a different level of magnification. The Focus Tubes are designed to be interchangeable with the Lens Cell and Focus Tube Shield.

To attach a different Focus Tube, simply remove the tube from the C40 Camera, remove the thumbscrew which secures the Focus Tube Shield and Lens Cell, slide out the Focus Tube and slide in another length Focus Tube and replace the thumbscrew. Reassemble the Focus Tube to the Focus Tube Shield and Lens Cell. Reattach the Focus Tube to the Camera Head. Short and Medium Focus Tubes are shipped with each P60 Camera Head. Contact Control Vision Inc. for additional sizes of Focus Tubes or other magnifications.

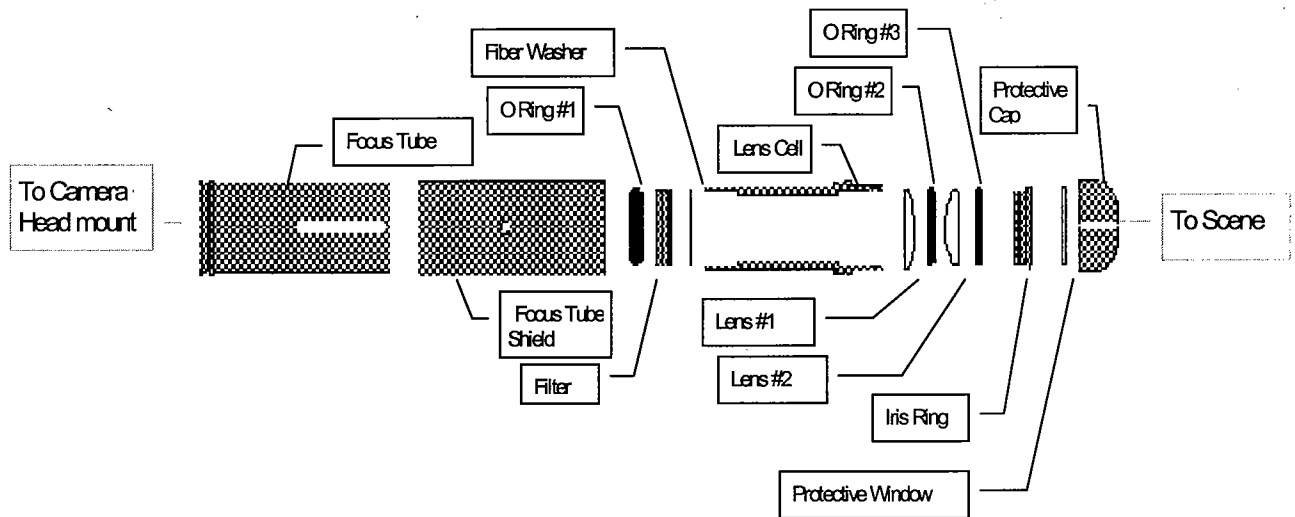


Figure 3.2.1

#### 3.2.2 Lens Cell

The Lens Cells holds the optical components. The front of the Lens Cell is protected from spatter, fumes, etc., by a Copper Protective Cap and an optical grade Protective Window. The Protective Cap slips off the end of the Lens Cell for easy replacement of the Protective Window after the window becomes unacceptably dirty. Spare windows are provided with the Camera Head. Additional windows can be purchased from Control Vision Inc.

## **Control Vision Inc.**

The front end of the Lens Cell incorporates a threaded brass ring to retain the optical elements, O-rings and adjustable iris. The focal length of the Lens Cell is etched on the surface of the brass ring.

**Note: The threaded brass retaining ring should not be removed unless under the direction of Control Vision Inc. personnel.**

The Iris control allows the user to adjust the amount of light entering the Lens Cell, ultimately controlling the level of exposure for the Camera Head. The Iris can be adjusted from the front end of the Lens Cell, using the small protruding pin on the Lens Cell and rotating to either increase or decrease the aperture.

The lens cell includes optical elements to obtain specific magnifications at various stand off distances.

### **3.2.3 Focus Tube Shield**

The Focus Tube Shield is designed protect the Lens Cell from stray light reflections and weld spatter, fumes, etc. The Focus Tube Shield is attached to the Lens Cell, through the slot in the Focus Tube, with a small thumbscrew.

## **3.3 X20 Xenon Strobe Unit**

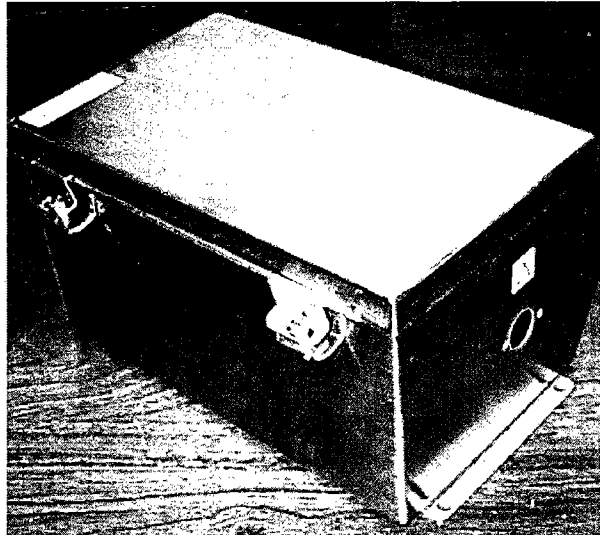


Figure 3.3

The X20 Xenon strobe unit is the light source that allows SyncroVision to obtain high contrast pictures. The strobe trigger cable, connected to the 3S controller unit provides the voltages and trigger signals to the strobe light unit. The strobe unit accepts the female 9 pin D-sub connector end of the strobe trigger cable.

### **3.3.1 Optical Fiber Bundle**



## **Control Vision Inc.**

An optical fiber bundle may be optionally supplied with the system. The fiber bundle incorporates a randomized optical fiber bundle, placed within a strip-wound stainless steel sheath. This sheathing provides both flexibility and protection for the optical fibers. Each end on the cable is polished and sealed with a high-temperature epoxy, capable of with-standing temperatures of up to 500 degrees centigrade. The optical fiber bundle is partially encased in a semi-rigid plastic tube for positioning the end towards the area to be illuminated. One end of the optical fiber bundle is protected from spatter and fumes by a small copper colored cap, holding a clear mica disk. Spare mica disks are supplied. When the mica disk becomes contaminated, remove the small copper cap and replace the clear mica disk with a new one. Additional mica disks can be ordered by contacting Control Vision.

Caution: The optical fiber bundle should not be exposed to very high temperatures (exceeding 500 degrees C), or be used without a protective clear mica window.

### **3.3.2 Fresnal Lens Assembly**

Some applications require use of a fresnel lens with X20 strobe illumination. These applications typically incorporate larger fields of view and greater stand off distances. The Fresnal lens projects the strobe light pulse long distances while enabling the focus of the light pulse to be adjustable to properly illuminate the field of interest.

## 4. Optional Components

---

### 4.1 Optical Pickoff



Figure 4.1

An optical pick-off is supplied as an optional item for those applications requiring external triggering from rotating or moving machinery. (See fig 5.1) The optical pick-off incorporates a sensor unit mounted in a small cradle. The cradle has a 6.35mm (0.25") through hole to accommodate a mounting bolt. Attached to the sensor unit are two small fiber-optic cables approximately 50cm (20") long. The fiber-optic cables are protected by metal obedient cable with a stainless steel end. The obedient cable runs through a PVC pipe which extends about 3/4 up the obedient cable. The PVC pipe provides stability. The optical pick-off is connected to the controller connector panel using a 3m (10ft) cable.

Red light is produced by a LED in the sensor unit and transmitted through one set of small fiber-optic cables. The red light is emitted out the end of this cable and the second set of fiber-optic cables receives any reflected light from the target. Reflection of the red light generates the trigger signal from the sensor unit. (After the optical pick-off is plugged into the controller unit, red light can be seen emitting from the end.)

In most applications, a small piece of self-adhesive reflective tape is attached to the machinery. After the optical pick-off is firmly attached, the end of the optical pick-off is placed close to the tape surface, (approximately 4mm). The tape surface should be moved back and forth in front of the optical pick-off end. A red indicator light on the sensor unit will turn on when reflected light is triggering the sensor unit properly. The indicator light then will turn off when the reflective tape has passed the distal end of the sensor. Moving the tape surface back and forth will result in the red indicator light turning on and off. This indicates that the optical pick-off is set up properly.

**Caution:** Periodically check the optical pick-off during operation to insure that the end has not fallen onto the moving surface.

## 5. System Operation

### 5.1 Keypad Operation

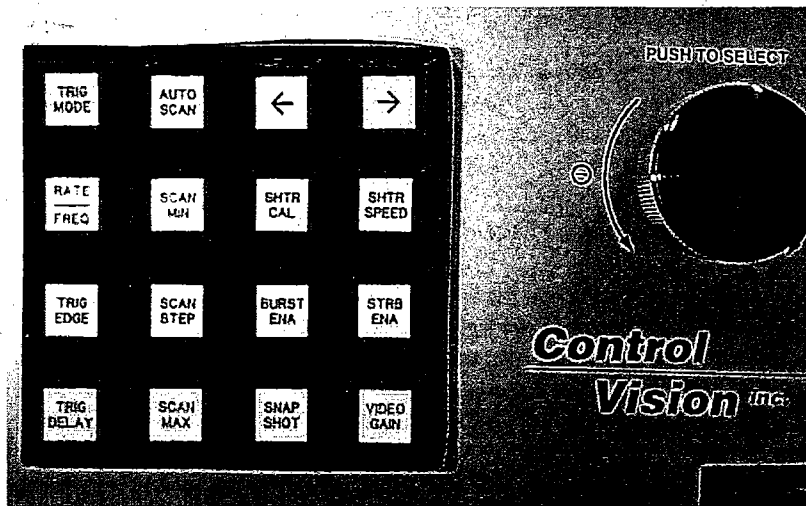


Figure 5.1

- **Left and Right arrow keys-** These keys scroll through the options of the selected menu item.
- **Auto Scan-** This feature allows the controller to **AutoScan** dependent on the **Scan Min/Max** and **ScanStep** values input. AutoScan is a feature that takes the Scan Min value, increments this delay value by the Scan step value, up to the Scan Max value. For example a rotating part is the object of interest using SyncroVision. The rotating part having a hall effect transducer proves a signal every time the shaft completes one turn. This signal input into SyncroVision, can be scanned via delaying the time the signal is received to the actual time the picture is taken. A sequence of pictures can then be taken via the step increment to perhaps show a quarter rotation of the shaft example, up to the Scan Max delay setting.
- **Trig Mode-** Pressing this key highlights and selects the mode menu item on the LCD display.

Using the arrow keys or the optical encoder knob the following is selected:

- **Int. Preset** - The default mode of internally triggering the camera system in frames per second
- **Int. Freq.**- Places the 3S system into the frequency triggered mode,.
- **Ext. Other** - Places the 3S controller into the external trigger mode allowing the use of the optional optical pick-off or externally triggering the unit by and external trigger input signal via the Trigger Input BNC connector on the back panel.
- **Shutter Speed-** This button selects and highlights the **shtr spd** menu item. This allows the operator to adjust the shutter speed of the camera.

## **Control Vision Inc.**

Using the arrow keys or the optical encoder knob the following is selected:

- 1.25 microseconds -16.67 milliseconds
- **Shutter Cal-** This button allows the operator to calibrate the shutter pulse to match the inherent delay of the strobe light source.  
  
This calibration is set at Control Vision Inc. If it is necessary to adjust this parameter, due to replacement of the Xenon strobe, please contact Control Vision Inc. personnel for a step by step guide to help you obtain the optimum results.
- **Scan Min-** This is the delay time in which SyncroVision uses to delay the incoming external trigger signal.
- **Rate/Freq-**
- **Strb Enable-**Enables the strobe unit to emit a pulse of light. If disabled the strobe will not fire.
- **Burst Enable-** The Burst button on the Main Menu sets the system in Burst Mode. Under burst mode, the system will trigger at either the selected internal or the incoming external or optical frequency only when a signal coming into the burst connector is high. (Positive going TTL +5V or higher.) The burst button toggles between Burst Off or Burst On. Check with Control Vision Inc. personnel for guidance on establishing the burst signal.
- **Scan Step-** The delay in which the AutoScan increments the incoming trigger signal.
- **Trig Edge-**Selects either the positive or negative slope of the incoming external trigger signal.
- **Video Gain-** Adjust the video gain of the camera unit to obtain a brighter image.
- **Snap Shot-** This feature allows the operator to snap an instantaneous picture of the field of interest. Useful to use this feature during setup of the camera system as focus and lighting of the field of view is adjusted.
- **Scan Max-** The maximum delay of the AutoScan sequence.
- **Trig Delay-** This is a feature to allow the operator to input a delay time in which the system will wait before it takes a picture upon receipt of a trigger signal.