

# DIGISTAR

## II

## Technical Overview

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# Digistar II Technical Overview

## 1.0 Introduction

Evans & Sutherland's star projection system, Digistar II, is a real-time, computer graphics based system intended to entertain and educate large audiences. Show producers can create environments that completely immerse audiences in 3D real-time computer generated images.

Digistar II is a special-purpose computer graphics system that can do everything a conventional planetarium system can do in addition to other advanced features. Besides simulating traditional planetarium objects, Digistar II generates new special effects, such as dynamic proper motion and travel through three-dimensional space.

Digistar II can display these kinds of images and effects:

- Stars
- Planets and moons
- Asteroids and comets
- Eclipses and transits
- Constellations
- Coordinate lines
- Nebulous objects
- Meteors and comets
- Mathematical models
- Chemical structures
- Architectural models
- Movement through 3D space
- Movement through time
- Classic planetarium motions
- Proper and space motions
- Stellar Parallax

A Digistar II show can be designed to run completely preprogrammed or use live input. Real-time manipulation of show segments, objects, dates, and eyepoint locations is possible.

## 2.0 System Components

The major components of a Digistar II system, as described in following sections, are as follows:

- Workstation
- Graphics processor
- Projector
- Peripheral input devices
- SMPTE time controller
- Graphics monitor
- Isolation transformer

- Optional Sun/Moon projectors
- Software
- Documentation

The Digistar II star projector is located in the center of the theater. The isolation transformer is typically located in a control room adjacent to the console. The remainder of the equipment can be located at the theater control console.

## 2.1 Workstation

A desktop workstation is utilized as the host computer for a Digistar II system. The workstation performs a number of functions such as command parser, file server, show editor, and file manager.

The workstation includes typical items such as:

- CPU case
- Monitor
- Keyboard
- Mouse
- Tape drive
- Ethernet hub

Digistar II has provision for accepting external control from an automation system, such as Spice. External control for Digistar II is provided through an RS-232 serial port.

## 2.2 Graphics Processor

Several of the major features of the graphics processor are:

- 64K x 64K addressable xy positions on the graphics monitor and projector
- Two defocus bits
- Remote projector control
- Ethernet interface
- Multiple processors for real time performance

The E&S Digistar II Graphics Processor is the workhorse of the system. It is housed in a separate cabinet about the size of a full tower PC and fits comfortably under a desk. This cabinet is a specially modified VME enclosure. It contains a real time processor card, two digital signal-processing cards, and a special video card. The two HDSP digital signal processor cards use a total of 14 DSPs to perform transformations on data handed down from the real time processor card. The Vector Generator card produces custom video signals needed by the graphics monitor and projector.

The graphics processor produces successive images at a rate sufficient to provide smooth motion as the eyepoint or models change position and attitude. Images may be defocused to simulate solid surfaces and nebulous objects.

## 2.3 Projector

Projecting the image generated by the graphics processor over the entire surface of the dome requires a high resolution/high brightness projector. The projector's fish eye lens has a 160 degree field of view. By locating the projector 10 degrees below the spring line of the dome, the projected image will cover a complete 180 degree hemisphere.

The Digistar II system uses a unique projector for displaying images on the dome. High power deflection amplifiers are used to draw precise images and a separate focus amplifier provides the ability to defocus images for model effects like clouds. The image from a 7-inch hyper-brilliant CRT is projected through the 160-degree fisheye lens.

## **2.4 Peripheral Input Devices**

In addition to providing the capability to start and stop pre-programmed shows, Digistar II allows interactive real time control using peripheral input devices. These devices aid the user in developing shows and presenting live performances.

### **2.4.1 Button Box**

A button box is supplied to perform user assigned functions. Each button event can start a complete show, play a small show segment, or draw a single object. Buttons may be labeled and reassigned on the fly or defined from a show file. The button box may be located away from the console to allow remote operation of the Digistar II system such as might be required for live lectures.

### **2.4.2 Control Dials**

The control dials allow the user to manipulate objects with an input device rather than typing in changes on a keyboard. The user may attach the dials to various functions such as manipulating the observer's location, scaling the size of an object or adjusting the brightness of an object.

## **2.5 SMPTE Time Controller**

A SMPTE time controller is included with Digistar II to synchronize events that occur in the Digistar show with sound cues, lighting, and special effects projectors found in typical planetarium theaters.

SMPTE time codes are usually stored on a single track of a multi-track tape deck. When the sound track is played back, SMPTE is read as a continuous stream of time stamps. The controller decodes the SMPTE signal and sends the timing information back to the workstation via the graphics processor.

The SMPTE time code controller supplied with Digistar II can act as a master or slave device. As a master, all other theater devices will listen to time as determined by Digistar II. As a master, it can also be used as a source for recording SMPTE on the tape. Normally, Digistar II acts as a slave so that it listens to time codes generated by another device.

## **2.6 Graphics monitor**

A graphics monitor is included to display images sent to the projector. Since the monitor is located at the operator console, it is useful for developing shows without the use of the projector. This saves wear and tear on the projector and allows the user to work with normal ambient lighting.

## **2.7 Isolation Transformer**

Since power line noise can produce unwanted artifacts in the projector's image, an isolation transformer is included to provide ac power line filtering for all the Digistar II components. The transformer also provides ac voltage conversion for operation anywhere in the world. The 5 kVA transformer accepts line voltages between 200 and 240 Vac 50/60 Hz.

The isolation transformer does not protect against loss of main power. A customer supplied uninterruptable power supply (UPS) might be required for installations with frequent power problems.

### 3.0 Optional Sun/Moon Projectors

An optional Sun/Moon package is also available in a single or dual projector configuration. Video projectors are used to display color images of the Sun, Moon, and any other circular object. The projectors are mounted on slewable mounts which allow images to be directed anywhere on the dome. Since the projectors are controlled by Digistar II, they are easily synchronized with the show script.

### 4.0 Software

Digistar II uses E&S's own simple command language with a graphical user interface. Modeling of 3D objects is done outside of the Digistar II software using commercially available CAD packages. Once the models have been created, they are converted to a format useable by Digistar. Final show production comes together with the addition of SMPTE time codes and projector commands.

The workstation includes its own operating system and a set of utilities for file management and text editing.

### 5.0 Documentation

Each Digistar II system is provided with three manuals in addition to the workstation documentation. The three manuals are also included in an electronic version which can be viewed on the workstation.

The *Digistar II Site Preparation Guide* describes installation requirements. Illustrations and specifications are given to correctly locate the Digistar II equipment in a new or existing theater.

The *Digistar II User's Guide* details operation of the system. This manual includes a detailed command summary, show building techniques, and operator workstation management.

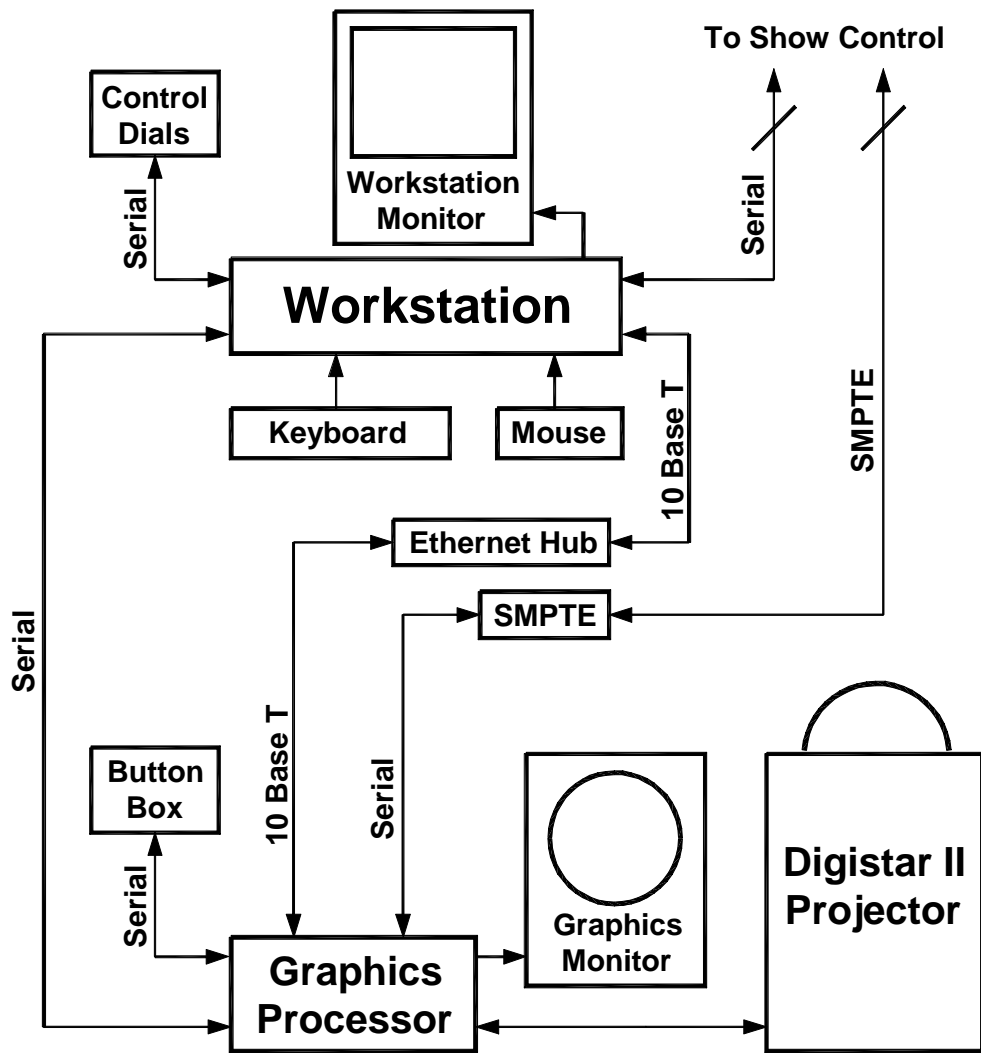
The *Digistar II Technician's Guide* provides technical information for system maintenance. Each system component is detailed without delving into the component level. A section on troubleshooting aids in isolating problems to replaceable modules. The maintenance section describes routine maintenance and adjustment procedures.

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*Digistar II Block Diagram*