

Combined line scan/TV imager,  
optimized for diagnostic  
ultrasound.

# IMAGING RECORDER

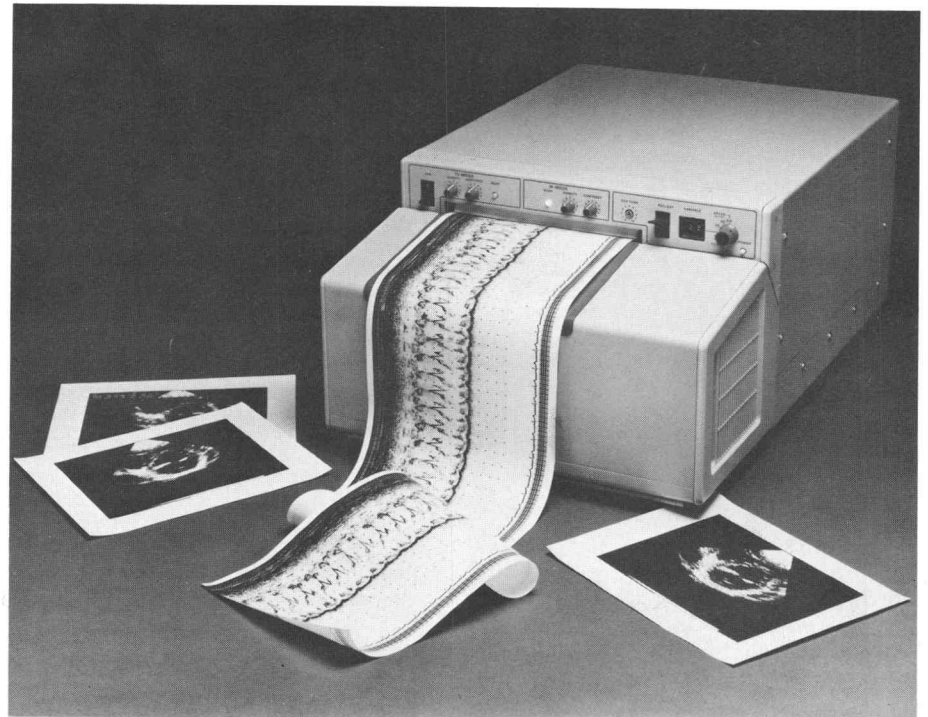
- Superior Image Quality
- Choice of Recording Media
- Significant Cost Savings
- Designed for Heavy Usage
- Available Only to Qualified OEM's

The Tektronix 4635 Imaging Recorder produces high quality gray scale images from both line scan and TV video sources. It is designed specifically for the requirements of medical diagnostic ultrasound. Its ability to consistently produce superior images—so necessary for ultrasound diagnosis—will also suit it well to other applications with similarly exacting quality standards.

**Choice of Recording Media.** The 4635 records with two types of photographic dry silver paper: Tektronix High Performance and Tektronix Standard. High Performance is recommended when extended gray scale is a critical need. Standard paper offers significant cost savings for those applications that can be satisfied by black and white or limited gray scale images.

**The Process Behind the Quality.** Images produced by the 4635 are exposed using a CRT with a fiber-optic faceplate. Tiny fiber-optic filaments in the faceplate transmit the light output of the CRT to the paper. Different exposure methods are used for the line-scan and TV modes of operation:

*Line-scan mode.* In line-scan mode, information is presented a line at a time along the long axis of the faceplate, building up successive lines in a contiguous fashion (Fig. 1). Recording is continuous, and paper speeds range from 10-100 mm/s.



*TV mode.* In this mode of operation, a portion of a TV frame is presented along the short axis of the CRT, parallel to the paper path. This portion, or window, corresponds to a narrow vertical band, perpendicular to the raster lines on a TV monitor (Fig. 2). The window is advanced electronically in synchronization with the paper movement until the entire frame is exposed, producing a large 6" x 8" image.

Following exposure, the paper is advanced through a thermal processor, where the latent image is developed by a heated platen. (Fig. 3) The thermal stability of this platen ensures long term gray scale consistency in images. The fully processed image exits the recorder through a front panel opening.

**The 4635 features a paper cutter.** In line scan mode, the strip chart can be terminated and cut on command. In TV Page mode, the recorder automatically cuts a file-size page.

**Durable Design.** The 4635 is built to stand up to the heaviest usage demands, processing a minimum of 50 rolls of paper (25,000 feet) between planned maintenance.

**Ease of interfacing.** Interfacing with the 4635 is a simple process. In line-scan operation, BNC connections accept analog signals that control deflection (width of strip-chart image) and gray-scale modulation. In TV mode, a BNC connection accepts a composite video signal.

Remote connectors that link the 4635 to a foot switch or other remote input device are also available.

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**Operational flexibility.** The front-panel controls are designed for ease of use and flexibility (Fig. 4). There are separate DENSITY and CONTRAST controls for line-scan and TV modes of operation, allowing the independent optimization of the image characteristics of each mode.

The VTR switch is used to enhance the quality of a single, non-interlaced TV field from a VTR (or other non-interlaced signal source) by electronically filling in the space between the raster lines. The REC/CUT switch is used to initiate and terminate recording.

A few simple adjustments to density and contrast are the only steps needed to switch paper types. Paper loading merely involves loading a cassette. The cassette contains 500 feet of paper, meaning few interruptions for reloading.

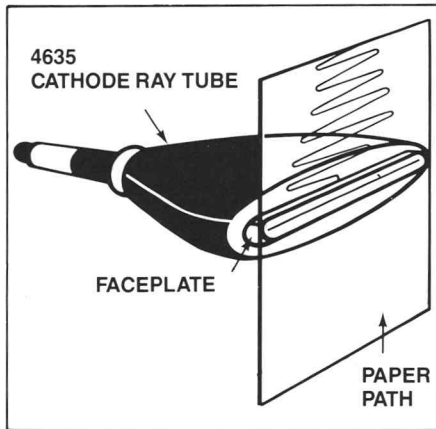


Figure 1.

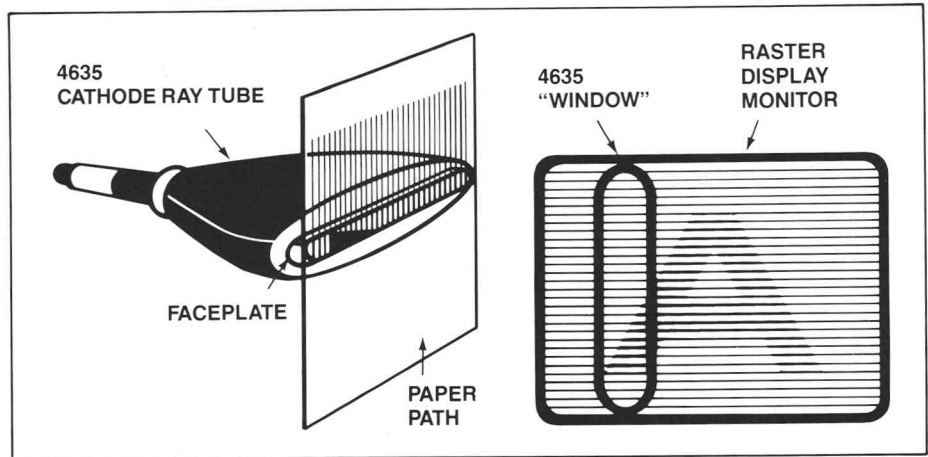


Figure 2.

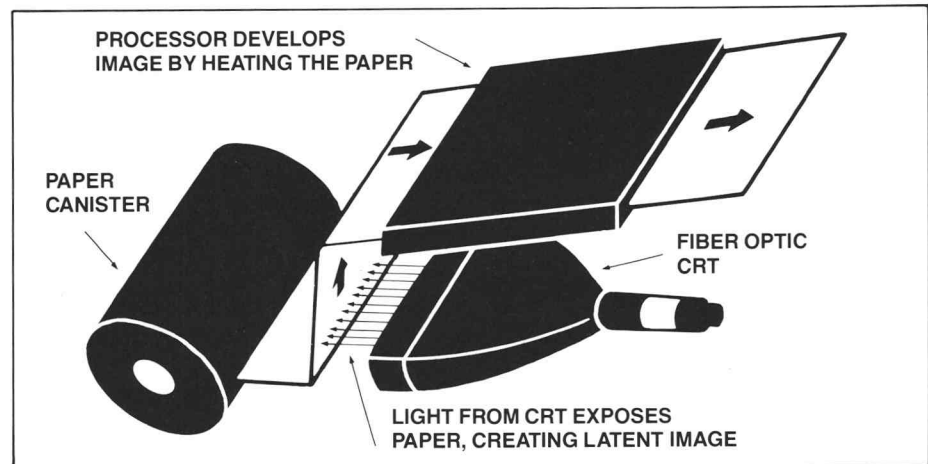


Figure 3.

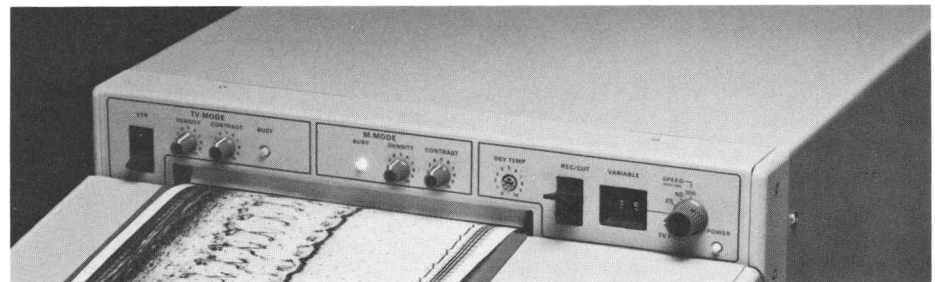


Figure 4.

**Recording Technique:** Photographic dry silver paper is exposed by the light output from a fiber-optic cathode ray tube (CRT)

**Development:** The dry silver paper is heated in an internal processor

**Warm-up Time:** 20 minutes in order to meet all specifications listed

**Copy Time, TV Page**

Total Time: 25 seconds from copy command to copy exit  
 Exposure Time: 8.5 seconds  
 Copy Repetition Rate: Approximately 15 second intervals

**Image Size**

Line Scan: Width from 100 mm to 200 mm  
 TV Horizontal: 150 mm to 210 mm  
 TV Vertical: 112 mm to 158 mm

**Image Formats**

Line Scan: Successive lines written across width of paper, perpendicular to path of exiting paper  
 Raster Scan TV: Raster lines written in direction of paper path

**Image Characteristics**

**Density Range:** Min. density 0.2. Max. density 1.4 for High Performance Paper, 1.2 for Standard Paper

**Shades of Gray:**

TV Page: 12 Levels for High Performance Paper  
 8 levels for Standard Paper  
 Line Scan: 8 levels for High Performance Paper  
 6 levels for Standard Paper

Number of gray levels determined from a gray step image by dividing the measured density range by twice the average standard deviation of densities measured within individual gray levels

**Resolution:** 4 cycles per mm in line scan at 100 microsecond sweep using High Performance Paper. 2 cycles per mm in TV Page

## Recording Media

**Material:** Tektronix High Performance Dry Silver Paper or Tektronix Standard Dry Silver Paper

**Paper Packaging:** Rolls of paper encased in light-sealed cylindrical cassettes

**Paper Roll Dimensions:** 500 ft. (152 m) long, 8.5 in. (216 mm) wide

**Shelf Life** (unexposed): Up to 14 months at 70°F (21°C) at 50% relative humidity; up to 6 months at 100°F (38°C) with small variation in sensitivity. Shelf life is extended if paper is refrigerated.

## Characteristics of Continuous Line Scan Operation

### X-axis (deflection):

Usable range: 100 mm to 200 mm  
Direction: Left to right or right to left, internally selected  
Slew Rate Range: 50 to 500 microseconds for 18 cm deflection  
Retrace Time: 30 microseconds or less for 18 cm deflection  
Repetition Rate: For proper AGC operation, rate must be held constant and fall in the range 750 Hz to 3KHz. Allowing manual adjustment of image density and contrast, rate may vary from 500 Hz to 7 KHz.  
Amplitude: 5.0V to 11.0V for 18 cm deflection  
Offset: Any portion of the signal may be at zero volts. Some portion must be at zero volts.

### Z-axis (intensity modulation):

Amplitude:  $5V \pm 1V$  for maximum modulation  
Polarity: Accepts positive going or negative going signal  
Offset:  $\pm 1V$  DC  
Impedance: 10K ohms  $\pm 10\%$

### Blanking:

Accepts a separate TTL blanking signal or blanking combined with Z-axis modulation. A low TTL input causes blanking. A Z-axis signal with amplitude equal to maximum modulation but of opposite polarity also causes blanking.

## Characteristics of TV (Raster Scan) Operation

### Composite Video Requirements

Line Rate: 15.4 KHz to 16.0 KHz  
Field Rate: 50 to 60 Hz  
Horizontal Sync Pulse Width: 2 to 10 microseconds  
Vertical Sync Pulse Width: 100 to 400 microseconds  
Sync Pulse Amplitude: 20% to 40% of total composite video signal (both vertical and horizontal sync)  
Active Horizontal Line Time: 40 to 60 microseconds  
Backporch Duration: 2.5 microseconds minimum

### TV Video Input

Amplitude: 0.5 to 2V p-p composite video  
Polarity: Positive going video and negative going sync pulses  
Offset: Combined composite video signal and offset must be in range  $-3V$  to  $+6V$   
Impedance: 75 ohms  $\pm 2\%$  or 10.5K ohms  $\pm 5\%$ , switch selectable

## Characteristics of Remote Operation

**Remote TV:** A switch closure or TTL signal initiates a TV image

**Remote Run:** A switch closure or TTL signal initiates and maintains recorder operation

### Connectors for Interfacing

All inputs have BNC connectors. REMOTE inputs also have quarter-inch phone jacks

## Power Specifications

**Line Voltage:** 115V  $\pm 10\%$  is standard.  
Optional line voltages are available (see Options)

**Line Frequency:** 48 to 62 Hz

**Power Consumption:** 800 W maximum peak power demand

## Environmental Characteristics

### Ambient Temperature

Operating: 0 to 35°C (32° to 95°F).  
Maximum operating temperatures limited by paper. Derate maximum operating temperature 1°C for every 1000 feet over 5000 feet elevation.  
Non-Operating:  $-40^\circ\text{C}$  to  $65^\circ\text{C}$  ( $-40^\circ\text{F}$  to  $149^\circ\text{F}$ )

### Humidity

Operating: 15% to 95% non-condensing  
Non-Operating: 0% to 95% non-condensing

### Altitude

Operating:  $-1000$  to 15,000 feet  
Non-Operating: to 50,000 feet

## Physical Characteristics

**Weight:** 75 lbs. maximum without paper

### Dimensions:

Height: 10.47 in (265.9 mm)  
Width: 16.75 in (425.4 mm)  
Length: 26.25 in (666.8 mm)

**Safety:** UL 114

## Options, Accessories and Supplies

- Option A1: 220V  $\pm 10\%$  line voltage. Power cord has Universal European plug
- Option A2: 240V  $\pm 10\%$  line voltage. Power cord has United Kingdom 13A plug.
- Option A3: 240 V  $\pm 10\%$  line voltage. Power cord has Australian 10A plug.
- Option A4: 240V  $\pm 10\%$  line voltage. Power cord has North American 15A plug.
- Option A5: 220V  $\pm 10\%$  line voltage. Power cord has Swiss 6A plug.
- Option 06: Standard configuration
- Option 52: Specify 100V  $\pm 10\%$ , 120V  $\pm 10\%$ , 200V  $\pm 10\%$ , or 230V  $\pm 10\%$ . For 200V or 230V operation, also specify one of the above options for selecting power cord.

### Standard Accessories:

- Instruction Manual
- 1 Roll Tektronix High Performance Dry Silver Paper

### Supplies:

- Tektronix High Performance Dry Silver Paper
- 1 Roll: 006-2432-00
- 4-Roll Carton: 006-2432-01
- Tektronix Standard Dry Silver Paper
- 1 Roll: 006-1603-00
- 4-Roll Carton: 006-1603-01

Some of the products, options and services mentioned in this brochure are not available outside the USA. Contact your local Tektronix representative for details.

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