The CRT is designed to prevent spurious light from reaching photographic film during long time exposures. Light output uniformity is tested to assure that the information content of the displayed image is an accurate representation of the input signals.

Considerable effort has been taken in developing the structural, thermal, RFI, and modular characteristics of this mechanical frame to provide you with the best possible display for your OEM system.

All frequently used controls are adjustable from the front panel for maximum accessibility when the display is mounted in a rack, cabinet, or system. The most frequently used controls, such as intensity, focus, and position have knobs while infrequently used controls such as astigmatism, trace align, and X and Y gain are screwdriver adjustments. The 1336A has a 10-turn dial on the intensity control to allow precise resetting of trace brightness for repeatable photographic results. A front panel door covers the controls of the 1332A, 1333A, and 1335A for a more pleasant appearance and reduces the chance of misadjustment by untrained personnel. The ac line switch is mounted on the rear panel to prevent inadvertent turn-off and allows the display to be powered through the common system power bus.

Serviceability

Construction of these displays is modular, rugged, and extremely serviceable. Printed circuit boards are plug-in type with interconnections through edge connectors and multiconductor wire strips that connect to sockets on the boards. Serviceability also extends to CRT replacement which, with a knowledgeable technician, can be accomplished in approximately ten minutes. Calibration time is kept to a minimum with easily accessed and independent adjustments.

Options and accessories

A wide range of options are available to permit you to tailor the display to your specific requirements; refer to Specifications for a complete listing. Accessories available include rack mounting kits, OEM half module frames and rack slides, and BNC shorting caps for use with certain Options. For convenient system interconnection, Model 10488A 3.6 m (12 ft) Display Cable is available as an accessory. Model 197A Opt 001/006 camera is adapted for direct recording of 1332A, 1333A, 1335A, and 1336A displays. Refer to the individual display data sheets for a complete description of accessories.

1332A, 1333A, 1335A, and 1336A/P Specifications

Vertical and horizontal amplifiers

Response (1332A, 1333A, 1335A)

Rise time: ≤70 ns (10% to 90% points) for full screen deflection or less.

Bandwidth: dc to approx 5 MHz for 7.6 cm (3″) deflection (1332A), 5.1 cm (2″) deflection (1333A, 1335A).

Phase shift (1332A, 1335A): <1° dc to 1 MHz (measured with X and Y gain set to max).

Deflection factor (horizontal and vertical): 100 mV/div (1 V p-p for 10 div deflection horizontal; 0.8 V p-p for 8 div deflection, vertical). Adjustable from approx 80 mV/div to 200 mV/div (1336A, 100 mV/div to 200 mV/div).

Settling time: (1332A, 1333A, 1335A) signal settles to within one spot diameter of final value in ≤300 ns. (1336A) signal settles to within ±0.5 spot diameter of final value in <500 ns.

Linear writing speed (1332A, 1333A, 1335A): ≥25.4 cm/μs (10 in./μs).

Inputs: rear panel BNC connectors with shield grounded. (1336A) fully differential. (1332A, 1333A, 1335A) fully differential inputs available, see Options.

Input RC: (1332A, 1333A, 1335A) approx 1 MΩ shunted by ≤60 pF, (1336A) approx 10 k Ω shunted by ≤70 pF; internally switchable to 50Ω.

Maximum input: ±50 V (dc + peak ac) for high input impedance. ±2.5 V (dc + peak ac) for 50Ω input impedance.

Dynamic range: beam may be deflected off screen up to ½ screen diameter in any direction provided that the zero input position is on screen, without degradation of specification.

Crosstalk: (1332A, 1333A, 1335A) ≤0.254 mm, 0.010 in., (1336A) ≤0.038 mm, 0.0015 in., with one input terminated in 50Ω and the other axis excited by a 1 V, 500 kHz signal.

Drift

Position: ≤0.5 mm/hr and ≤1.02 mm (0.040 in.) in 24 hr with covers installed and after 15 min. warmup.

Gain: <1% under all combinations of specified line voltage with covers installed after 15 min. warmup and temperature between +20°C and +55°C (+68°F and +131°F).

Common mode rejection ratio: (1332A, 1333A, or 1335A Opt 106 only) at least 40 dB (100:1) up to 10 kHz for 1 V (full screen) inputs; at least 25 dB) (18:1) at 1 MHz for 1 V (full screen) inputs.

Z-axis amplifier

Rise time: (1332A, 1333A, 1335A) ≤25 ns, (1336A) ≤40 ns; cw bandwidth approx 5 MHz.

Blanking range: a 1 V change in Z-axis input voltage causes a full scale change in brightness.

Linearity (1336A): light output varies linearly with Z-axis input voltage within 20%.

Blanking polarity: (1332A, 1333A, 1335A) a positive-going input Z-axis voltage increases brightness. (1336A) fully differential; a positive or negative-going input into the positive or negative inputs, respectively, increases brightness.

Input: rear panel BNC connectors with shield grounded. (1336A) fully differential. (1332A, 1333A, 1335A) fully differential inputs available, see Options.

Input RC: (1332A, 1333A, 1335A) approx 1 megohm shunted by <60 pF. (1336A) approx 10 kΩ shunted by <70 pF; internally switchable to 50Ω.

Maximum input: ±50 V (dc + peak ac) for high input impedance; ±2.5 V (dc + peak ac) for 50Ω input impedance.

Gain: internally adjustable over 2.5:1 attenuation range.

Light output stability (drift): spot photometer measurements of light output made at one hour intervals will not vary more than 10% from previous measurement for any location within the useable display area, under all specified conditions of line voltage and temperature with intensity set to >5% of peak brightness.

Cathode-ray tube (1332A)

Type: electrostatic focus and deflection, approx 22.5 kV accelerating potential, aluminized P31 phosphor (see Options for other phosphors).

Viewing area: 114 cm² (17.7 in.²), approx 9.6 cm vertically by 11.9 cm horizontally (3.8 in. × 4.7 in.).

Quality area: center 9 div horizontally and center 7 div vertically.

Graticule: 8 × 10 div internal graticule. 1 div = 1.2 cm (0.47 in.).

Spot size: ≤0.3 mm (0.012 in.) at center screen. Does not vary by more than 10% over entire quality area with intensity held constant, measured using shrinking raster method. Line resolution is approx 31.5 lines/cm (80 lines/in.).

Line brightness: at least 170 cd/m² (50 fl) at a writing speed of 0.254 cm/μs (0.1 in./μs), 60 Hz refresh rate, P31 phosphor, 0.3 mm (0.012 in.) spot size.

Geometry: <3% pincushion and barrel distortion over useable display area.

Linearity: <3% of full scale along major axes.

Cathode-ray tube (1333A)

Type: electrostatic focus and deflection, approx 12 kV accelerating potential, aluminized P31 phosphor.

Viewing area: 80 cm² (12.4 in.²), 8 cm vertically by 10 cm horizontally (3.1 in. × 3.9 in.).

CATHODE-RAY TUBE DISPLAYS

Models 1332A, 1333A, 1335A & 1336S (cont.)

Quality area: 8 cm vertically by 10 cm horizontally (3.1 in. × 3.9 in.).
Graticule: none, see Options.
Spot size: ≤0.20 mm (0.008 in.,) over entire quality area. Measured using shrinking raster method, line resolution is approx 49 lines/cm (125 lines/in.).
Light output
Line brigthness: 34.3 cd/m² (10 fl) at a writing speed of 0.254 cm/μs (0.1 in./μs), 60 Hz refresh rate, P31 phosphor, 0.02 mm (0.008 in.) spot size.
Uniformity: with a 1:1 photograph of the CRT display using Polaroid Type 107-084 film, input signals adjusted for uniform stimulation of the entire CRT screen area and exposure parameters adjusted for an average reflection density of 0.3 to 0.6 in the resultant print, the difference between any two points on the photograph in a centered 7 × 9 cm rectangular area is less than one step on a Kodak 12-step gray scale.
Linearity: <3% of full scale along major axes.
Stray emission: no stray emissions from the CRT will be visible on Polarity Type 107 ASA 3000 film after a 30 min. time exposure with the camera lens set to f/1.9, 1:1 magnification ratio.

Cathode-ray tube (1335A)

Type: electrostatic focus and deflection, approx 8.5 kV accelerating potential, aluminized P31 phosphor.
Viewing area: 72.2 cm² (11.2 in.²), approx 8 cm vertically by 10 cm horizontally (3.1 in. × 3.9 in.).
Quality area: center 9 div horizontally and center 7 div vertically.
Graticule: 8 × 10 div internal graticule, 1 div = 0.95 cm (0.37 in.).
Geometry: <3% pincushion and barrel distortion over useable display area.
Linearity: <3% of full scale along major axes.
Conventional (non-store) parameters
Spot size: 0.254 mm (0.010 in.) over entire quality area. Measured using shrinking raster method. Non-stored line resolution is approx 39 lines/cm (100 lines/in.).
Line brightness: 68 cd/m² (20 fl) at a writing speed of 0.254 cm/μs) (0.1in./μs), 60 Hz refresh rate, P31 phosphor, 0.0254 mm (0.010 in.) spot size.
Persistence: approx 40 μs.
Storage parameters
Stored resolution: approx 20 lines/cm (51 lines/in.).
Brightness: >680 cd/m² (>200 fl) in WRITE mode.
Erase time: <500 ms.
Storage time: >1 min. at full brightness in WRITE mode, extending to >30 min. in STORE mode at lower brightness.
Variable persistence: continuously adjustable from 0.2 s to full storage (one minute).
Dot writing time: will store a dot anywhere inside the quality area having an unblanking time of 1 μs.
Writing speed: >50 cm/ms.

Cathode-ray tube (1336A)

Type: mono accellerator, approx 5 kV accelerating potential, P11 phosphor, electrostatic focus and deflection.
Viewing area: 80 cm² (12.4 in.²), approx 8 cm vertically by 10 cm horizontally (3.1 in. × 3.9 in.).
Quality area: a 7 × 9 cm rectangle with a 1 cm radius on each corner.
Graticule: none (see Options).
Resolution: 100 lines/cm (254 lines/in.) within quality area, measured using shrinking raster method.
Spot shape: ratio of major to minor diameter of spot ≤1.5:1 within quality area.
Light output: 3.5 μW using a 4 × 4 cm 128-line focused raster with an 80% duty cycle and a 1 cm² radiometric detector in contact with the CRT face, P11 phosphor. With P31 phosphor, 6μW (see Options).
Light output uniformity
Overall: the light output varies by ≤16% between any two points within the quality area.
Incremental: the derivative of light output with respect to position is ≤6%/cm averaged over any 2% p-p change anywhere within the quality area.
Geometry: <3% pincushion or barrel distortion within quality area.
Linearity: <3% of full scale along major axes.

Remote programming (1335A)

(TTL compatible, except Variable Persistence)
Remotely programmable functions: Erase, Write, Store, Conventional, and Variable Persistence.
Remote selection: a single TTL control line disables the front panel Erase, Write, Store, Conventional, and Variable Persistence functions and transfers control to the remote inputs.
Control enable: separate TTL inputs to enable front panel Erase and/or Variable Persistence controls during remote operation.
Variable persistence: an external dc voltage between 0 and +10 V sets the persistence. Or, a pot can be connected through the Remote Input connector to control persistence if 10 Vdc is not available.
Erase verify: a TTL High output during Erase (will drive ten low power gates).

Safety protection (1332A, 1333A, 1335A)

Implosion: transparent safety panel between CRT and bezel protects viewer (Opt 561 or 330).
X-ray emission: <0.5 mr/hr measured with Victoreen Model 440 RF/C.
UL listing: with Opt 315 and 561 meets Underwriters Laboratories Listing 478 for Electronic Data Processing Equipment; with Opt 330 meets Underwriters Listing for Dental and Medical Electronic Equipment.
NOTICE: these displays are designed and manufactured primarily for OEM system applications. Therefore, without Opt 315 or Opt 330, the top and bottom protective covers are not provided and internal wiring connections of HAZARDOUS VOLTAGES ARE EXPOSED and operator protection must be provided by the purchaser and/or user of the instrument. If in doubt order Opt 315 or 330 which provide the covers.

Safety protection (1336A/P)

UL listing: meets Underwriters Laboratories Listing 478 for Electronic Data Processing Equipment and Underwriters Listing 544 for Dental and Medical Electronic Equipment.
X-ray emission: <0.5 mr/hr measured with Victoreen Model 440 RF/C.

General

Inputconnectors: (1332A, 1333A, 1335A) rear panel BNC for X, Y, and Z inputs with shields grounded. (1336A) two rear panel BNC for each axis.

Front panel controls (1332A, 1333A, 1335A)
Knobs: position X, position Y, focus, and intensity.
Pushbuttons (1335A): Erase, Write, Store, and Conventional.
Screwdriver adjustments: Trace Align, Astigmatism, Gain X, and Gain Y.

Front panel controls (1336A)
Knobs: Intensity (10-turn knob with turns-counting dial), Position X, Position Y.
Screwdriver adjustments: Trace align, X gain, Y gain, Focus (focus adjustment requires special tool, supplied with Model 1336A).

Line power indicator: front panel lamp.

Operating environment: temperature,0°C to +55°C (+°F to +131°F), non-operating, −40°C to +70°C (−40°F to +158°F); humidity, 5% to 95% relative humidity at +40°C (+104°F); altitude, to 4600 m (15 000 ft), non-operating to 7000 m (25 000 ft); shock, 30 g level with 11 ms duration and ½ sine wave shape; vibration, vibrated in three planes for 15 min. each with 0.254 mm (0.010 in.) excursion, 0.38 mm (0.015 in.) excursion, for 1336A/P, 10 to 55 Hz.

Line power (1332A, 1333A, 1335A): selectable 100, 120, 220, or 240 Vac, +5%, −10% (−20%, 1333A; 48 Hz to 66 Hz*; max power (1332A) 50 VA (approx 40 W), (1333A) 60 VA (approx 50 W), (1335A) 65 VA (approx 55 W). Average power dissipation at 60 Hz and 120V without any options is approx 24 W (1332A), approx 40 W (1333A) approx 35 W (1335A).

Line power (1336A/P): selectable 100, 120, 220, or 240 V ac, +5% to −20%; 48 to 66 Hz*; max power 125 VA (approx 100 W).
*Units meet all electrical specifications 48-440 Hz, but do not meet ac line to chassis leakage requirements of UL 544 (Medical and Dental) Listing above 66 Hz.

Size: 146 H (including feet) × 213 W × 524 mm D (5¾" × 8⅜" × 20⅝"). Standard 1336P Power Supply is 335 mm D (13³/₁₆"); order 1336P Opt 018 for same depth as 1336A

Weight
1332A, 1333A, 1335A: net, 8.6 kg (19 lb) with covers and feet; shipping, 10.5 kg (23 lb). Covers, feet, tilt stand, and trim are not supplied with standard displays.
1336A: net, 7.1 kg (15¾ lb). Shipping 10.2 kg (22¼ lb).
1336P: net, 7 kg (15½ lb). Shipping 10 kg (22 lb).

Accessories supplied (1332A, 1333A, 1335A): one blue contrast filter, one 2.3 m (7.5 ft) line cord (90° IEC to NEMA 5-15P, 3-conductor for use in Canada, Mexico, Japan, and the United States), one Operating and Service Manual, and for the 1335A one remote program connector.

Accessories supplied (1336S): one clear CRT implosion shield, one Operator's Note, one 2.3 m (7.5 ft) line cord (90° IEC to NEMA 5-15P, 3-conductor for use in Canada, Mexico, Japan and the United States), one 1.5 m (5 ft) cable for interconnection of power supply and display module.

OPTIONS (1332A, 1333A, 1335A) — Price

X and Y amplifiers

Deflection factor
100: 500 mV/div, 5 p-p for full-screen deflection — add $20
101: 1 V/div, 10 V p-p for full-screen deflection — add $20

Polarity
105: negative X and Y inputs move beam up and right (BNC connectors) — N/C
106: full differential inputs, shield grounded (BNC connectors) — add $25

Input impedance
110: 50 ohms — add $10

Rise time
120 (1332A): 25 ns X & Y amplifier rise time — add $200

Z-axis input (video amplifier)

Blanking range
200: 0 to 5 V — add $10
201: 0 to 10 V — add $10

Polarity
205: negative input unblanks trace, BNC connector with shield grounded — N/C
206: fully differential input, BNC connector with shield grounded — add $15

Input impedance
210: 50 ohms — add $10

Gain characteristics
215: light output varies linearly (±20%) with a linear change in Z-axis input voltage (gamma correction) — add $15

Digital input
216: TTL blanking level. High state (+2.5 V to +5 V) blanks any analog Z-input signal. Low state (0.0 V to 0.8 V) returns blanking to analog Z-axis input. — add $50

Cathode-ray tube

Graticule/phosphor type
004 (1332A): P4 aluminized phosphor with 8 × 10 div internal graticule — add $30
007* (1332A): P7 aluminized phosphor with 8 × 10 div internal graticule and amber contrast filter — add $30
011 (1332A, 1333A): P11 aluminized phosphor with 8 × 10 div internal graticule — add $30
031 (1333A): P31 aluminized phosphor with 8 × 10 div internal graticule — N/C
039 (1332A): P39 aluminized phosphor with 8 × 10 div internal graticule — add $30
604 (1332A): P4 aluminized phosphor without internal graticule — add $30
607* (1332A): P7 aluminized phosphor with amber filter, without internal graticule — add $30
611 (1332A, 1333A): P11 aluminized phosphor, without internal graticule — add $30
631 (1332A, 1335A): P31 aluminized phosphor, without internal graticule — N/C
639 (1332A): P39 aluminized phosphor without internal graticule — add $30
*P39 phosphor is recommended in lieu of P7.

Magnetic shield
550 (1332A): full magnetic shield on CRT — add $95

Contrast filters
NOTE: the plastic filter serves as integral implosion protection for the viewer, therefore these displays cannot be ordered without the standard or an optional filter
561: clear, replaces filter supplied with standard and some optional phosphors, and is required for UL EDP Equipment Listing — N/C
562 (1332A, 1335A): clear, RFI coated surface also includes metalized front panel — add $150

CATHODE-RAY TUBE DISPLAYS

Models 1332A, 1333A, 1335A & 1336S (cont.)

General

Ac line cords

300: 2.3 m (7.5 ft) removable, 240 V max, 3-conductor 90° IEC to Great Britain, Singapore — N/C

301: 2.3 m (7.5 ft) removable, 240 V max, 3-conductor IEC to Australia, New Zealand — N/C

302: 2.3 m (7.5 ft) removable, 240 V max, 3-conductor 90° IEC to East and West Europe — N/C

303: 2.3 m (7.5 ft) removable, 240 V max, 3-conductor IEC to NEMA 6–15P (USA, Canada, Japan, Mexico) — N/C

304: 77 cm (30 in.) coiled, extends to 1.8 m (6 ft), removable, 120 V max, 3-conductor IEC to NEMA 5–15P (USA, Canada, Japan, Mexico) (not available with Opt 315 or 330) — add $5

307: hospital grade power cord — add $10

AC line voltage tolerance

310 (1332A, 1335A): +5%, −20% tolerance at 100, 120, 220, 240 Vac setting. Increases power dissipation to approx 50 watts (1332A), 60 watts (1335A) — add $50

Front and rear panel modifications

322: replaces standard intensity control with a 10-turn control with counting dial — add $50

323: front panel screwdriver adjustments on left side of front panel changed to internal adjustments — add $10

324: (1332A, 1333A) adds 25-pin connector to X, Y, and Z-axes signal inputs wired to the positive signal inputs (input capacitance is increased to approx 120 pF) — add $30

325 (1332A): scale illumination to illuminate phosphor background for photographing internal graticule (available with standard P31 phosphor and Opt 011 and 039 only) — add $60

326: front panel controls on right side changed to screwdriver adjustments. These include intensity, focus, position X, and position Y (also includes scale illumination when Opt 325 is ordered for 1332A). When Opt 322 is specified with Opt 326, the intensity control is as described in Opt 322 and the focus, position X, and position Y become screwdriver adjustments — add $25

Safety protection

315: includes covers, feet, trim, and tilt stand (required for UL EDP Equipment Listing) — add $70

330: meets requirements for UL Listing for Dental and Medical Electronic Equipment. Includes special three-conductor ac line cord, specially marked covers, feet, tilt stand, trim, UL label, and Opt 561 — add $75

580: meets requirements for Canadian Standards Association Safety Certification. Includes Opt 315 with CSA labeling — add $75

Operating/service literature

910 (1332A): extra set of product manuals — $4

910 (1333A, 1335A): extra set of product manuals — $5

OPTIONS (1336A Display Module)

X and Y amplifiers

Deflection factor

100*: 500 mV/div, 5 V p-p for full screen deflection — add $5

101*: 1 V/div, 10 V p-p for full screen deflection — add $5

Input impedance

110: 50 ohms — add $5

Z-axis input (video amplifier)

Blanking range

200*: 0 to 5 V — add $5

201*: 0 to 10 V — add $5

Digital input

216: TTL blanking level. High state (+2.5 V to +5 V) blanks any analog Z-input signal. Low state (0.0 V to 0.8 V) returns blanking to analog Z-axis input. Rear panel input through BNC connector — add $50

217: same as 216 except polarity reversed — add $50

Cathode-ray tube

Graticule/phosphor type

011: P11 phosphor with 8 × 10 div internal graticule (1 div = 1 cm) — N/C

031: P31 phosphor with 8 × 10 div internal graticule (1 div = 1 cm) — add $30

631: P31 phosphor in place of P11, without internal graticule — add $30

Front and rear panel modifications.

323: all knob controls on front panel (Intensity, Position X, Position Y) changed to screwdriver adjustments — add $25

324: add 25-pin connector to rear panel. X, Y, and Z-axes signal inputs wired to the positive signal inputs (input capacitance is increased to approx 120 pF) — add $30

Safety

331: meets HTM8 listing for use in Medical Equipment — add $50

332: meets CSA standard for use in Medical Equipment — add $50

333: meets VDE standard for use in Medical Equipment — add $50

OPTIONS (1336P Power Supply Module)

AC line cord

300: 2.3 m (7.5 ft) removable, 240 V max, 3-conductor 90° IEC to Great Britain, Singapore — N/C

301: 2.3 m (7.5 ft) removable, 240 V max, 3-conductor IEC to Australia, New Zealand — N/C

302: 2.3 m (7.5 ft) removable, 240 V max, 3-conductor 90° IEC to NEMA 5–15P (USA, Canada, Japan, Mexico) — N/C

303: 2.3 m (7.5 ft) removable, 240 V max, 3-conductor IEC to NEMA 5–15P (USA, Canada, Japan, Mexico) — N/C

304: 77.2 cm (30 in.) coiled, extends to 1.8 m (6 ft) removable, 120 V max, 3-conductor IEC to NEMA 5–15P (USA, Canada, Japan, Mexico) — add $25

NOTE: units ordered with Opt 300-304 are not UL Listed for use in medical and dental systems (UL 544).

Safety

331: meets HTM8 listing for use in Medical Equipment — add $50

332: meets CSA standards for use in Medical Equipment — add $50

333: meets VDE standards for use in Medical Equipment — add $50

Connecting cable

001: 0.3 m (1 ft) interconnecting cable in lieu of 1.5 m(5 ft) cable — N/C

002: no interconnecting cable for supplying power to display module — N/C

Cabinet length

018: cabinet length same as 1336A. Includes locking hardware to attach power supply module to display module. Assembled pair are one standard EIA rack width. Rack mounting flanges, with or without handles, and pivoting or fixed slides are available for rack mounting the combined units; see Cabinets, System II. — add $25

Ordering information

1332A Small Screen Display	$1400
1333A Small Screen Display	$1700
1335A Small Screen Display	$2030
1336S (Complete System)	$4450

OEM discounts available