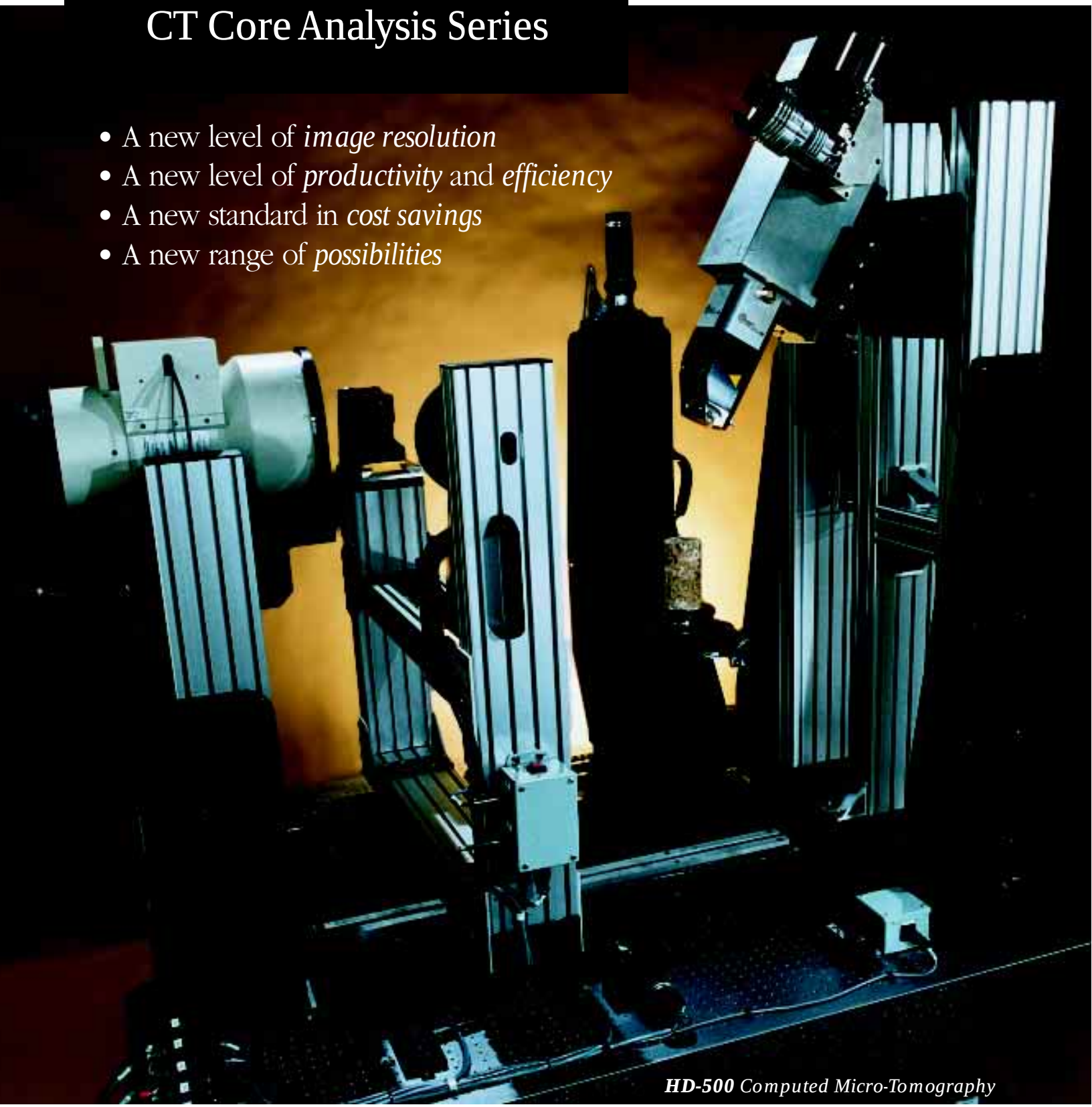
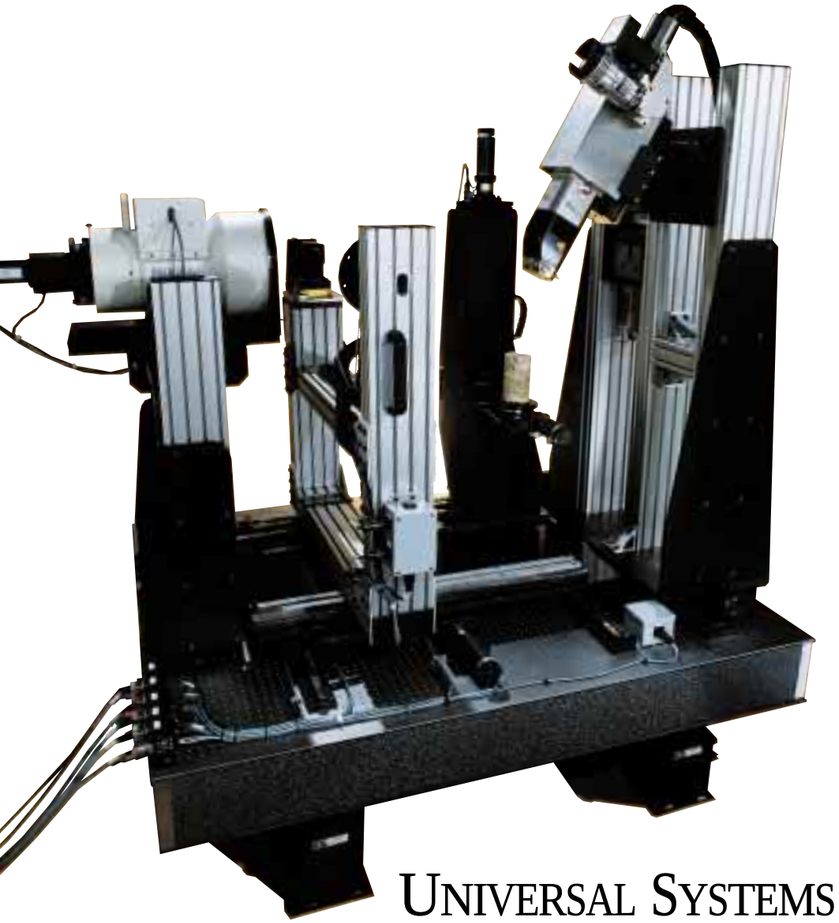
UNIVERSAL SYSTEMS
CT Core Analysis Series

- A new level of *image resolution*
- A new level of *productivity* and *efficiency*
- A new standard in *cost savings*
- A new range of *possibilities*



***HD-500** Computed Micro-Tomography*

UNIVERSAL SYSTEMS



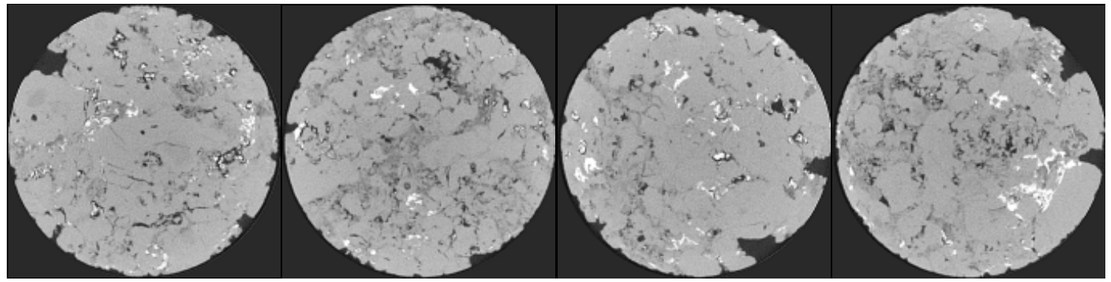
Universal Systems CT Core Analysis Series

Universal Systems advanced line of CT scanners delivers a new level of performance, unprecedented total product integration and the ability to clearly image porous media. Only Universal, the world leader in Core Analysis technology, can offer such progressive innovations in CT Imaging. The Universal Systems CT Core Analysis Series represents a history of proven performance and breakthroughs in CT technology. This series is designed to deliver more comprehensive data, covering the entire spectrum of resolution and budget requirements. The shape of the future in CT scanning has been redefined!

Universal Systems HD-500 Computed Micro-Tomography System

Universal's HD-500 is a combined Computed Tomography (CT) and Real-Time Radiography (RTR) system in one unit specifically designed for core imaging. The system consists of a 225 kV microfocus x-ray system, 225 mm image intensifier, CCD camera, camera interface, Pentium workstation, image processor, color image display, multiaxis manipulator with linear servo drives and monochrome RTR video monitor.

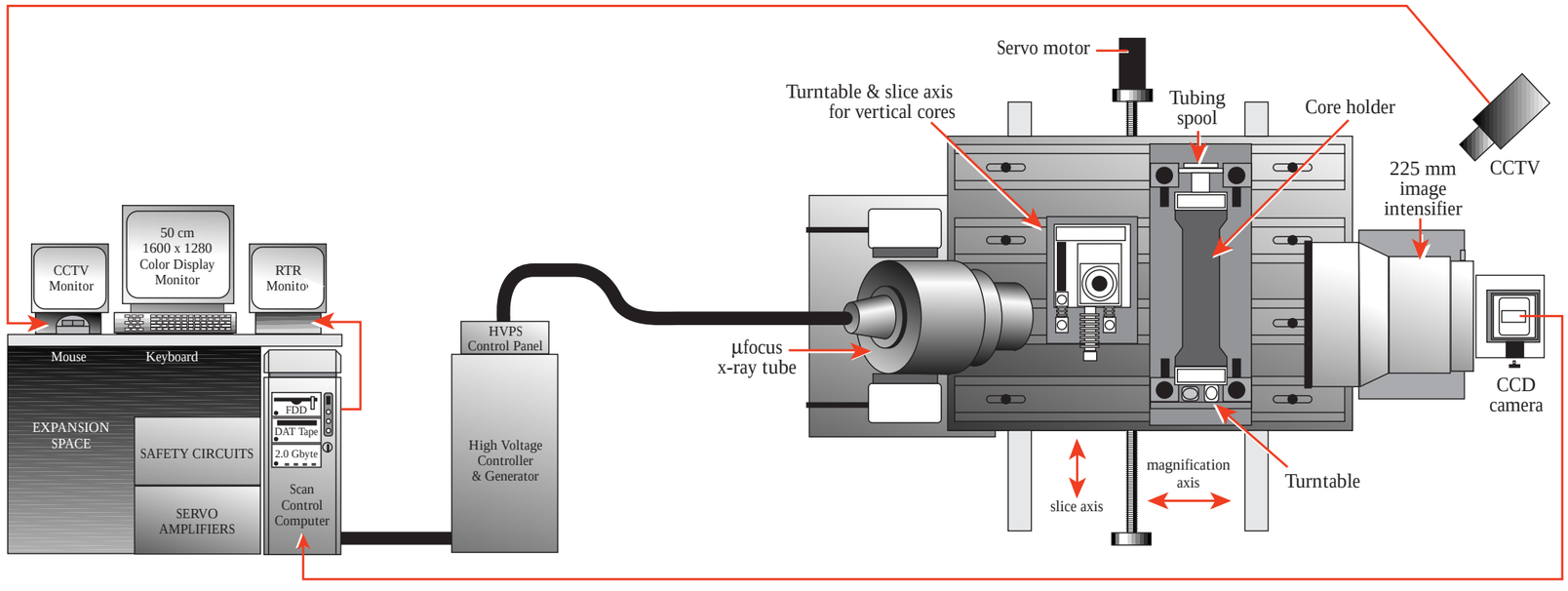
The HD-500 is suitable for ultra-high resolution x-ray inspection of metallic and non-metallic items over a wide range of density and materials. The system produces cross sectional CT images, in-motion RTR images and digitized radiographs (DR). In addition to density mapping, CT provides complete morphology of samples with highly accurate dimensioning capability. CT also provides superior detection capability of extremely small cracks, porosity and voids which are not visible with film radiography.



225 kV source, 2.0 mA .4 mm focal spot, .5 mm slice thickness, 1 min., FOV 90 mm

A custom designed manipulator is provided to scan cores vertically or horizontally. One turntable and linear axis is provided for scanning cores in a vertical orientation. A second turntable, and tubing spool is provided for scanning a core holder in a horizontal orientation. A second linear axis provides slice increment capability for the core holder turntable and center of rotation shifting for the vertical core manipulator. The magnification factor can be varied for either the horizontal or vertical orientation of cores. The source to image intensifier distance remains fixed in order to minimize the amount of calibration effort required when switching from one mode to another. The system is designed to hold an ambient core holder. Pressurized core holders for fluid flow studies, with appropriate plumbing, may be substituted.

The HD-500 includes a variety of integrated software routines providing additional features and image analysis capability. "MPR/3D" is a 3D visualization software package that provides synthetic tomograms and surface shaded views at any angle from CT data sets of contiguous slices. MPR/3D is included with the standard software package. Volume CT (VCT) capability is offered as a software option. VCT acquires up to 100 slices of the object in a single rotation and then reconstructs them.



Worldwide Resources through Comprehensive Service, On-going Support, and Maintenance Programs

Universal shares your goal of achieving the highest quality results as efficiently and cost effectively as possible. Our commitment begins with the development of our advanced CT and NMR systems. By offering the most comprehensive, diverse and respected products we extend our leadership through our continuing support programs for your specific goals. From strategic and comprehensive initiation of the project, to site planning-through installation and application training, Universal delivers more than technical leadership – *we are a true resource and partner to deliver results in all your CT system needs.*

Applications Training

Universal's on-site programs are designed to enhance your understanding of the features and functions of the system and its options. Also available: a supplemental on-site training module with a petrophysical engineer to include the most recent CT tomography experiments and applications.

Highly Trained Service Support

Backing your system is a worldwide service organization providing comprehensive support with field engineers trained to efficiently and effectively meet your needs. Our readily available parts network includes a large central warehouse with computer linked remote locations. Your system is designed to yield unprecedented productivity well into the future.

A Family of Products

Universal pioneered a family of advanced CT and NMR systems available in every price range to meet the specific needs of varied industrial users for geophysical characterization and fluid mechanics in porous media. Our range of flexible products is unparalleled in the industry. Universal designed a full product line responsive to your needs with outstanding performance within your budget and timetable.

UNIVERSAL SYSTEMS

29500 AURORA ROAD, UNIT 16, SOLON, OHIO 44139 • PHONE: 440-349-3210 FAX: 440-498-2188
e-mail: sales@universal-systems.com • Visit our Web Site at: http://www.universal-systems.com

Printed in U.S.A. 9/98

UNIVERSAL SYSTEMS

UNIVERSAL HD-500
Computed Micro-Tomography System

PERFORMANCE SPECIFICATIONS*

- **X-Ray System**

Voltage	10-225 kV;
Current	0-1 mA;
Spot Size vs. Power	3 µm @ 1.5 watts; 10 µm @ 10 watts; 50 µm @ 50 watts; 100 µm @ 100 watts;
Mains Power Requirement	220 VAC, 1Ø, 50/60 Hz, 1,000 VA.

- **Image Intensifier**

Diameter	225 mm nominal;
Spatial Resolution	4.4 lp/mm;
Quantum Detection Efficiency	85% @ 60keV monochromatic.

- **Video Camera**

Type	Solid -state 2/3" CCD;
Signal Format	NTSC video;
Horizontal Resolution	> 430 lines;
S/N ratio	> 43 dB.

- **Object Size & Weight**

  200 mm diameter, 50 kg for horizontal orientation;
  150 mm diameter, 20 kg for vertical orientation;
  The maximum CT image diameter is 250 mm.

- **Slice Width**

  Variable over a range of 10 µm to 10.0 mm.

- **CT Spatial Resolution**

  10 µm for objects up to 4.8 mm diameter (3 µm focus);
  25 µm for objects up to 10 mm diameter (10 µm focus);
  100 µm for objects up to 45 mm diameter (50 µm focus);
  200 µm for objects up to 90 mm diameter (100 µm focus).

- **CT Scan Times**

  18 seconds (512 views);
  33 seconds (1000 views);
  60 seconds (1800 views).

* Specifications noted here subject to change.

UNIVERSAL HD-500
Computed Micro-Tomography System

PERFORMANCE SPECIFICATIONS*

- **CT Contrast Resolution vs. Feature Size**
  0.2% in 10 mm diameter area.

  Scan conditions with microfocus x-ray source: 4 minute scan, 200kV, 0.5mA, 1 mm thick slice of 50 mm cylinder filled with water and using salt solution as the feature at different density.

- **CT Flaw Detectability**

Crack Detection	0.010 x 1 x 1 mm, (width x height x length);
Iron Inclusion	75 μm sphere;
Air Void	150 μm sphere.

  Scan conditions: 4 minute scan, 200 kV, 0.5 mA, 1 mm slice.

- **DR Spatial Resolution**
  (Field of View)/256 for objects up to 200 mm wide.

- **CT Image Display Matrix**
  Software selectable 256^2, 512^2, or 1024^2 x 12 bits (4096 Contrast Scale).

- **Pixel Size in Object**
  Up to 0.8 mm depending on object size.

- **Data Sampling**

Views per scan	Variable up to 2400;
TV frames per view	1- 4;
Samples per view (standard)	512;
Samples per view (LFOV)	Variable up to 900.

- **Reconstruction Times** (512 x 512 image matrix)

# of Views	Standard (sec)	LFOV (sec)
512	18	35;
1000	28	60;
2000	45	130.

* Specifications noted here subject to change.

UNIVERSAL SYSTEMS

29500 AURORA ROAD, UNIT 16, SOLON, OHIO 44139 • PHONE: 440-349-3210 FAX: 440-498-2188
e-mail: sales@universal-systems.com • Visit our Web Site at: http://www.universal-systems.com

UNIVERSAL SYSTEMS

UNIVERSAL HD-400
Computed Tomography System

PERFORMANCE SPECIFICATIONS*

- **X-Ray System**

Voltage	0-225 kV;
Current	0-30 mA;
Small Focus	0.4 x 0.4 mm @ 675 watts;
Large Focus	1.5 x 1.5 mm @ 1,680 watts;
Beam Angle	40° cone (uncollimated);
Mains Power Requirement	208 to 480 VAC, 1Ø, 8 kW;
Collimator	Fan beam is defined via fixed slot in 7 mm thick tungsten alloy plate.

- **Image Intensifier**

Diameter	225 mm nominal;
Spatial Resolution	4.4 lp/mm;
Quantum Detection Efficiency	85% @ 60keV monochromatic.

- **Video Camera**

Type	Solid -state 2/3" CCD;
Signal Format	NTSC video;
Horizontal Resoluiton	> 430 lines;
S/N ratio	> 43 dB.

- **Object Size & Weight**

  200 mm diameter, 50 kg; mounting centers 1220 mm (48 in.) apart to handle cores 1000 mm (39.4 in.) long
  The maximum CT image diameter is 200 mm.

- **Slice Width**

  Variable over a range of 0.4mm to 10.0 mm.

- **CT Spatial Resolution**

  100 μm for objects up to 25 mm diameter;
  200 μm for objects up to 50 mm diameter;
  400 μm for objects up to 100 mm diameter;
  800 μm for objects up to 200 mm diameter.

- **CT Scan Times**

  18 seconds (512 views);
  33 seconds (1000 views);
  60 seconds (1800 views).

* Specifications noted here subject to change.

UNIVERSAL HD-400
Computed Tomography System

PERFORMANCE SPECIFICATIONS*

- **CT Contrast Resolution vs. Feature Size**

  0.2% in 10 mm diameter area.

  Scan conditions: 2 mm thick slice of 100 mm cylinder filled with water and using salt solution as the feature at different density.

- **CT Flaw Detectability**

Crack Detection	0.010 x 2 x 2 mm, (width x height x length);
Iron Inclusion	0.15 mm sphere;
Air Void	0.2 mm sphere.

  Scan conditions: 1 minute scan, 225 kV, 3 mA, 2 mm slice.

- **DR Spatial Resolution**

  (Field of View)/256 for objects up to 200 mm wide.

- **CT Image Display Matrix**

  Software selectable 256^2, 512^2, or 1024^2 x 12 bits (4096 Contrast Scale).

- **Pixel Size in Object**

  0.025 to 0.8 mm depending on object size and display matrix.

- **Data Sampling**

Views per scan	Variable up to 2000;
TV frames per view	1- 4;
Samples per view (standard)	512
Samples per view (LFOV)	Variable up to 900.

- **Reconstruction Times** (512 x 512 image matrix)

# of Views	Standard (sec)	LFOV (sec)
512	18	35;
1000	28	60;
2000	45	130.

* Specifications noted here subject to change.

UNIVERSAL SYSTEMS

29500 AURORA ROAD, UNIT 16, SOLON, OHIO 44139 • PHONE: 440-349-3210 FAX: 440-498-2188
e-mail: sales@universal-systems.com • Visit our Web Site at: http://www.universal-systems.com