HIGH-SPEED, HIGH-PERFORMANCE DISPLAY PROCESSOR WITH 60 Hz COLOR

Lexidata’s new 3700 display processor provides unparalleled price/performance for high-speed graphics applications. The 3700 combines writing speeds of up to 42 million pixels per second with the power of Writable Control Store (WCS) programmability, downloadable character fonts, a versatile bit-slice architecture...and the availability of 1280x1024 50/60 Hz non-interlaced color. The result is the premier product in the Lexidata System 3000 family of compatible display processors.

FEATURES
- Available 1280x1024, 50/60 Hz Non-Interlaced Color or Monochrome
- Writing Speeds Up to 42 Million Pixels Per Second in Block Mode
- 750 Nanoseconds Per Pixel Vector Write Time
- Writable Control Store Programmability
- A Variety of Flexible Configurations
- Up to 4096 Colors
- Plug Compatible With Lexidata 3400

BENEFITS
- Displays Bright, Flicker-Free Color or Monochrome Graphics
- Provides Extremely Fast Fills and Horizontal Vectors
- Displays Complex Drawings Quickly
- Allows User to Add Specialized High-Speed Functions
- Serves Multiple Application Requirements
- Displays Color or Greyscale Images
- Runs Existing Software Without Modifications
HARDWARE DESIGNED FOR HIGH-PERFORMANCE APPLICATIONS

1280x1024 50/60 Hz Color or Monochrome

The 3700's 50/60 Hz non-interlaced configuration updates the entire screen in one pass, sixty times per second. With the high refresh rate, short persistence monitor phosphors can be used for brighter, more vivid colors. Even horizontal lines show no visible flicker. The 3700's high resolution provides the additional benefit of exceptional display detail and clarity.

Lexidata first introduced 1280x1024 50/60 Hz non-interlaced monochrome systems in 1979. The Company's long-time experience in the graphics display industry allows it to now offer this technology in color at prices even lower than many competing interlaced systems.

Up to 42 Million Pixels Per Second in Block Mode

Special hardware in the 3700 allows the high-resolution, non-interlaced configuration to write in blocks of up to 80 pixels simultaneously, resulting in speeds of up to 42 million pixels per second. The circuitry automatically prompts the processor to write in blocks instead of individual pixels whenever appropriate. This is especially important for area fills which require writing large numbers of pixels. The result is virtually instantaneous fills—an important feature for CAD/CAM users concerned with mechanical design, IC design, and PC layout.

750 Nanoseconds Per Pixel Vector Write Time

When not writing in blocks, the 3700 writes at 750 nanoseconds per pixel, continuously, not just in bursts or during retrace. This measure of display processor performance is critical for overall throughput in line drawing applications. Complex drawings are displayed quickly on the 3700, increasing user productivity. High-speed drawing capability allows complex objects to be dragged smoothly across the screen. And the 1280x1024 50/60 Hz non-interlaced display eliminates the smearing that long-persistence phosphors create.

WCS Programmability

The 3700 provides a standard 4K Writable Control Store programmability feature. This allows the user to add powerful graphics functions by taking full advantage of the 3700's speed. The 3700 processor handles multiple operations simultaneously, independently of user-written code, which allows the speed of parallel operations without the difficulty of writing special pipelined code. Easy-to-use cross assemblers are available for a variety of host computers, including the Digital Equipment Corporation VAX™ family of 32-bit computers.

Configuration Flexibility for the OEM

The 3700's modular design separates major system functions onto different boards, allowing a variety of configurations. Five basic systems are available, using three different lookup tables. (See Figure 1 and the 3700 Configuration Summary.) Included are 640x512 50/60 Hz, two versions of 1280x1024 25/30 Hz, and two versions of 1280x1024 50/60 Hz systems. These basic configurations can be combined with desired options to create systems suited to most any application.

3700 LOOKUP TABLES

<table>
<thead>
<tr>
<th>LUT</th>
<th>Input Bits</th>
<th>Simultaneous Colors</th>
<th>Output Bits Per Channel</th>
<th>Color Palette</th>
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<tbody>
<tr>
<td>4x4</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>4096</td>
</tr>
<tr>
<td>8x8</td>
<td>8</td>
<td>256</td>
<td>8</td>
<td>16.7 M</td>
</tr>
<tr>
<td>12x8</td>
<td>12</td>
<td>4096</td>
<td>8</td>
<td>16.7 M</td>
</tr>
</tbody>
</table>

Figure 1. A VARIETY OF LOOKUP TABLES—Three different lookup tables are available to meet the various application needs of the 3700 user. The 16-color capability of the 4x4 lookup table is sufficient for most line drawing applications. The 8x8 provides 256 colors for more demanding applications, while the 12x8 offers 4096 simultaneous shades needed for color or greyscale images.

Continuous Access to Pixel Memory

The 3700's interleaved, dual-ported memory design assures the processor of continuous access to pixel memory. Pixel update and display refresh occur continuously, not just during monitor retrace periods. This continuous pixel memory access is especially important for functions which require reading and writing of pixels (i.e. as in the case of fills).
**Downloadable Character Fonts**

A separate Random Access Memory (RAM) is provided on the 3700 for storing user-defined characters and symbols. Multiple fonts can be defined using any matrix size up to 64x64 pixels. Fonts of different sizes can be stored simultaneously. Once defined, the characters can be placed anywhere on the screen with a simple function call. The 16K bytes of character RAM provide ample storage for a wide range of characters and symbols.

**A SYSTEM ARCHITECTURE BUILT FOR SPEED**

The 3700 display processor is uniquely designed for speed. Each system component module has been optimized for fast operation. Data from the host computer is transferred to the 3700 via a 16-bit parallel Direct Memory Access (DMA) port, which operates at up to one megaword per second. An input buffer stores commands, increasing total system throughput while reducing communications loading. Commands are pulled out of the buffer and executed by the 3700's bipolar processor in a 185-nsec instruction cycle time. A separate memory controller outputs the pixel data from the dual-ported memory, allowing display refresh to occur concurrently with display memory updating. (See Figure 2.) An optional pan/zoom controller provides zoom in integer increments (other systems usually increment zoom in powers of 2), as well as smooth vertical scrolling and horizontal panning.

![Diagram](image_url)

Figure 2. DISTRIBUTED PROCESSING – The 3700 distributes processing functions to specialized hardware. Serial communication to peripheral devices is handled by a separate microprocessor. A separate controller, located in the processor, handles display refresh from the dual-ported display memory.
High-Speed Processor Handles All Primitives

While many displays simply use the processor to "set up" a dedicated graphics controller, the 3700 processor handles all graphics operations directly. Complex operations can therefore be executed quickly, without having to work through the primitives of a graphics controller. This is especially important when adding new functions through the Writable Control Store feature. The 185-nsec instruction cycle of the processor ensures that all functions run fast, not just particular primitives.

Distributed Processing for Serial Communications

The 3700 provides a distributed approach to serial communications. Rather than burdening the main processor (or the host) with time-consuming peripheral handling, all serial communications are controlled by the 3700's Serial Communications Processor (SCP), a microprocessor-based option with on-board intelligence that deals with such tasks as data packing and unpacking, I/O buffering, peripheral setup and error detection.

**POWERFUL, COMPATIBLE Firmware – EGOS 3**

EGOS 3 is the latest, most powerful version of Lexidata's popular EGOS (Extended Graphics Operating System) firmware package. Since EGOS 3 is compatible with earlier versions of EGOS, existing software will run without modification. Current EGOS users will notice one change, however, unprecedented speed. All hardware enhancements

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Figure 3. POWERFUL COMMANDS – The EGOS 3 command set is designed to address a variety of graphics needs. This example shows how one type of fill works on non-contiguous areas.
have been implemented transparently. Just plug in the 3700 and it runs significantly faster than previous EGOS systems. (For a complete listing of EGOS commands, see the 3700 Command Summary.)

**An Upgrade Path for the Future**
EGOS 3 is a member of a growing Lexidata family of compatible firmware. Future firmware revisions will introduce new capabilities without modifying existing functions. These new functions will continue to meet the changing needs of the graphics industry. And, since the firmware is designed to adapt to changing hardware trends, EGOS users will be able to take full advantage of technology advances as they occur.

**FLEXIBILITY TO SATISFY A VARIETY OF INDUSTRY APPLICATIONS**

**CAD/CAM**
Since productivity is the key to successful CAD/CAM applications, display speeds are an important consideration. The 3700's fast vector write times ensure that drawings are displayed quickly. Its speed is so rapid that complex (even filled) objects can be dragged easily and quickly. The WCS programmability allows the user to add specific features (such as a proprietary protocol) or special primitives (such as a spline). The availability of 1280x1024 50/60 Hz color or monochrome allows the clarity of high resolution to be combined with the ergonomic benefits of a high refresh rate display.

**PC/IC**
Printed Circuit (PC) and Integrated Circuit (IC) design systems typically require high-quality graphics to increase user productivity. IC designs require many filled rectangular areas, while PC applications use many horizontal and vertical lines. The block writing capability at up to 42 million pixels per second makes the 3700 particularly well-suited for these requirements. Its 50/60 Hz non-interlaced configuration adds the extra advantage of ultra-high refresh, providing flicker-free horizontal lines and filled areas.

**Mapping**
The 3700's high-speed fills are excellent for mapping applications which require filled areas. The downloadable text fonts allow easy map annotation and special symbol handling. With configurations offering up to 256 colors at 1280x1024, the 3700 provides the power and features necessary for a successful mapping system.

**Workstations**
The system builder can combine the 3700's speed and flexibility with an existing computer hardware/software base to optimize user productivity. Parallel DMA host interfaces are available for Digital Equipment Corporation VAX,” PDP-11™” and Q-BUS,”” and Data General Corporation NOVA,”” and ECLIPSE™ systems; as well as other popular host computers.

**SUMMARY**
Lexidata's new 3700 display processor combines the performance, features, and functionality needed for today's interactive graphics applications. High-speed vectors ensure virtually instantaneous screen updates. 1280x1024 50/60 Hz non-interlaced refresh offers the user the comfort of bright, flicker-free color, as well as high resolution. The 3700's WCS programmability allows OEMs to add the functions (and hence the value) that their customers demand. And, with EGOS 3, the 3700 provides a pathway to the future, at prices that will open up a whole new range of lower-priced, high-performance graphics systems.
3700 COMMAND SUMMARY

The 3700’s EGOS 3 is a powerful command set which combines graphics, imaging, hardware set-up and peripheral I/O functionality. Its straightforward format and multiple operational modes simplify application development.

INITIALIZATION
DSCFG    Configure
DSCHAN   Set channel masks
DSCLR    Clear display
DSCGF    Get configuration
DSCGH    Get channel masks
DSCSF    Set configuration

TEXT FUNCTIONS
DSSAO    Set text parameters
DSTXT    Display text
DSSF     Delete font
DSCGCD   Get character definition
DSCGF    Get font definition
DSCGTA   Get text control character (action character) enable
DSCGTC   Get text foreground/background colors
DSCGF    Get text current font
DSCGI    Get text position increment mode
DSCGM    Get text write mode
DSCGT    Get text character path
DSCGT    Get text rotation
DSCTS    Get text scale factor
DSCGT    Get text ‘text cursor display’ mode
DSCGT    Get text video mode
DSCGTW   Get text window
DSCGT    Get text current x,y position
DSCSCD   Set character definition
DSCSF    Set font definition
DSCSTA   Set text control character (action character) enable
DSCSTC   Set text foreground/background colors
DSCSF    Set text current font
DSCSI    Set text position increment mode
DSCSM    Set text write mode
DSCSTP   Set text character path
DSCSTR   Set text character rotation
DSCSTS   Set text scale factor
DSCSTT   Set text ‘text cursor display’ mode
DSCSTV   Set text video mode
DSCSTW   Set text window
DSCSTX   Set text current x,y position

GRAPHICS FUNCTIONS
DARC     Arc
DCIR     Circle
DCVEC    Chained vectors
DS DIM    Set write mode, line weight and pattern, and fill enable

DSEFIL   Edge flag fill
DSPNT    Display points
DSPOLY   Fill polygon
DSRECT   Draw a rectangle
DSSNR    Random pixel read
DSRNW    Random pixel write
DSSFIL   Seed fill
DSVEC    Display vector
DSDSP    Get display parameters
DSBUFF   Set memory buffer attributes
DSCBF    Get memory buffer attributes

IMAGE FUNCTIONS
DSBMV    Block move/copy
DSGET    Sequential read
DSLIM    Set rectangular limits
DSPPR    Packed pixel read
DSPPW    Packed pixel write
DSPUT    Sequential write
DSRUNL   Run length encoded write
DSLML    Get sequential read/write limits

PAN/ZOOM FUNCTIONS*
DSZOM    Zoom and pan
DSCGM    Get zoom parameters
DSMOV    Movie
DSMRG    Zoom margins
DSGMG    Get margin parameters
DSGMO    Get movie parameters

HARDWARE CURSOR FUNCTIONS
DSCXY    Set cursor position
DSCER    Erase matrix cursor
DSCLD    Load matrix cursor
DSCSL    Select cursor
DSCGS    Get cursor selection

BLINK CONTROL FUNCTIONS*
DSCBC    Blink control
DSCBL    Blink rate
DSCBC    Get blink control parameters
DSCBL    Get blink rate

PERIPHERAL CONTROL FUNCTIONS*
DSGXY    Read cursor position, switches
DSITAB   Initialize data tablet
DSRTAB   Read data tablet
DSSL     Set trackball/joystick lights
DSCKB    Get keyboard data, set lamps

LOOKUP TABLE FUNCTIONS
DSLUL    Lookup table ramp load
DSLRT    Lookup table read
DSLWT    Lookup table write

MISCELLANEOUS/CONTROL FUNCTIONS
DSEC   Set echo mode
DSLY    Delay
DSGRRR   Get most recent error
DSVSN    Wait on vertical sync

*Hardware/configuration dependent.
3700 SYSTEM SPECIFICATIONS

Alphanumeric
Alphanumeric character fonts are provided which support upper and lower case text, numerals, and punctuation. The standard font types are:

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<thead>
<tr>
<th>Character</th>
<th>Box</th>
<th>Case</th>
<th>Resolution</th>
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</thead>
<tbody>
<tr>
<td>5x7</td>
<td>7x11</td>
<td>upper/lower</td>
<td>640x512</td>
</tr>
<tr>
<td>7x9</td>
<td>9x14</td>
<td>upper/lower</td>
<td>1280x1024</td>
</tr>
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</table>

Downloadable Fonts
RAM Size – 16K bytes.
Character Definition – Programmable, up to 64x64 pixel matrix.

Hardware Options
Pan/Zoom – 1x, 2x, 3x... to 16x selectable over the screen area.
Serial Communications Processor – Microprocessor-based. Up to 19.2K baud operation. Four dedicated ports handle peripherals and/or host.
Hardware Cursor – Size and shape of cursor is user-definable within 64x64 pixel matrix. Full screen cross-hair cursor is also software selectable.

Data Transfer Rate
Up to one megaword (16 bits/word) per second.

Performance
Vector Write After Set-Up – 750 nsec per pixel, continuous.
Block Vector Write (1280x1024, 50/60 Hz system) – 23 nsec per pixel, continuous.

Power Requirements
115 VAC ± 10% 47-63 Hz (3 wire)
230 VAC ± 10% 47-63 Hz (3 wire)
600 watts average.
Requirements vary depending on configuration size.

Environmental Requirements
Operating Temperature
10 to 40 degrees C

Storage Temperature
-35 to 70 degrees C

Operating Relative Humidity
10% to 90% (non-condensing)

Storage Relative Humidity
10% to 90% (non-condensing)

Altitude
8,000 ft.

Acoustic Noise Level
The acoustic noise level shall not exceed the NC-60 noise criteria curve.

Chassis Dimensions
8-slot: 5.25” high x 19” wide x 27” deep.
12-slot: 8.75” high x 19” wide x 27” deep.

Weight
8-slot: 40-70 lbs. including power supply.
12-slot: 60-100 lbs. including power supply.

3700 CONFIGURATION SUMMARY

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<td>1 plane</td>
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<td>16</td>
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