



Graphics Software Suite

X11™ & OpenGL®

Features

- Comprehensive set of optimized Graphical User Interface (GUI) software
- Full-featured X Windows X11R6 server
- Optimized OpenGL software API
- Video Capture API supporting the Xv Extension (PMC-702, PMC-704, VME-712) and OpenGL textured video capture integration (PMC-704)
- Integrated client-side X11 and OpenGL libraries including direct rendering
- Motif toolkit support (PMC-700, PMC-702)
- Complete set of documentation
- Support under both VxWorks and INTEGRITY for PowerPC (PPC)
- Support for PMC-700/702/704/706/724 and VME-712
- Compatible with 3rd party applications such as VAPS from eGENUITY Technologies and the Interface Development Suite (IDS) from Tilcon Software

Introduction

Curtiss-Wright Controls Embedded Computing offers a complete suite of Graphical User Interface (GUI) software to help developers easily develop and maintain their graphics applications. This Graphics Software Suite (GSS) can include the full X11 Server and OpenGL support. Developed, optimized and supported by a team of in-house software developers, the GSS provides optimal integration between graphics software and hardware and allows developers to more effectively develop their graphical applications.

In the mission critical, aerospace and defense marketplace, OpenGL and the X Window System have been adopted as the standard Application Programmer Interfaces (APIs) for embedded graphics development and deployment. Complex applications in this domain consist of high performance human machine interfaces such as cockpit flight displays, situation awareness displays, command and control stations, and sensor information displays.

X11 and OpenGL

Curtiss-Wright provides a complete X Window System server (the X11 server) with various extensions, including the SGI-defined OpenGL GLX extension for use with our graphics products - including the PMC-700, PMC-702, PMC-704, PMC-706 and the SVME/DMV-712. The GLX extension provides a convenient windowing environment allowing OpenGL applications to be rendered therein.

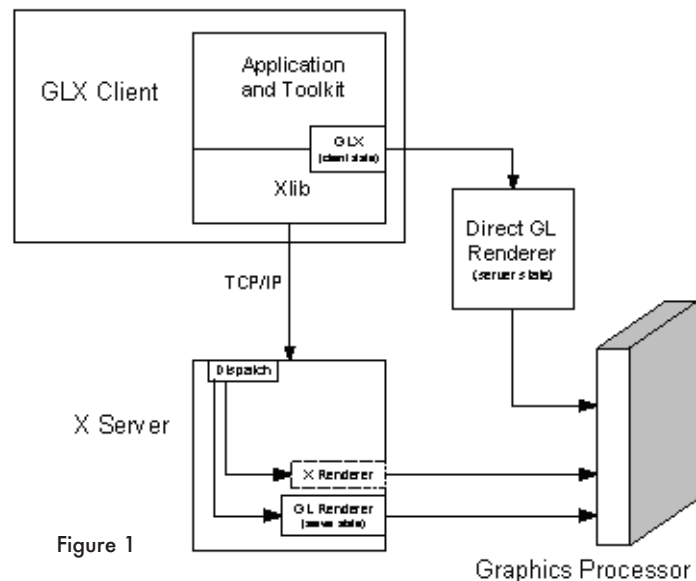
The X11 server supports the display of X11 applications using combinations of different graphics boards, allowing users to install hardware specific to the system's requirements. For example, two separate graphics PMCs from Curtiss-Wright such as one PMC-704 and one PMC-706 can be configured to run on the same Single Board Computer (SBC), or on two different SBCs mounted within the same chassis.

The following X extensions are supported by the X Server implementation:

- BIG-REQUEST
- GLX
- SGI-GLX
- SYNC
- MIT-SUNDRY-NONSTANDARD
- FontCache
- MIT-SHM
- SHAPE
- XC-MISC
- XTEST
- Xvideo

Contact your Curtiss-Wright sales representative or account manager for an update to the above list.

Motif support is available directly from Curtiss-Wright Controls Embedded Computing for the PMC-700, PMC-702 and VME-712. The Motif library is an X Toolkit, and the Motif Window Manager, mwm, is an X client that uses the Motif X Toolkit. Motif clients fall under the class of X clients. Motif implementations are available on the open market for porting should your application require it.

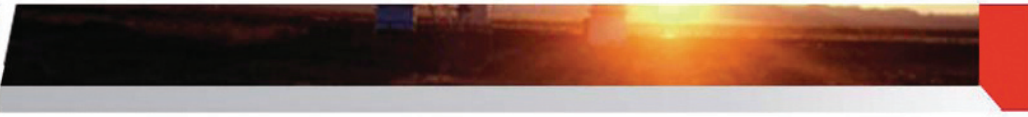


Pointing devices (such as mice or trackballs) and keyboards are supported in the X server by a variety of means. The most common is to use the serial ports on the host SBC but USB as well as named devices or pipes can also be used.

OpenGL is the premier environment for developing portable, interactive 2D and 3D graphics applications. Since its introduction, OpenGL has become the industry's most widely used and supported graphics API. OpenGL enables application portability and improves project time to market by incorporating a broad set of rendering, texture mapping, and visualization functions.

Since OpenGL graphics drivers encapsulate information about the underlying hardware, the application developer is freed from having to design for specific graphics hardware features.

The OpenGL extensions of the package are implemented according to the Silicon Graphics® GLX™ standard which provides full OpenGL capabilities in the X Window System environment. The GLX library is based on the X Window System (X11R6.4) and is OpenGL 1.1 (PMC-700, PMC-702, SVME/DMV-712) or OpenGL 1.3 (PMC-704, PMC-706).



The following OpenGL 1.3 extensions are supported for the PMC-704/706:

- GL_ARB_multitexture
- GL_ARB_texture_border_clamp
- GL_ARB_texture_cube_map
- GL_ARB_texture_env_add
- GL_ARB_texture_env_combine
- GL_ARB_texture_env_crossbar
- GL_ARB_texture_env_dot3
- GL_ARB_texture_mirrored_repeat
- GL_ARB_transpose_matrix
- GL_EXT_abgr
- GL_EXT_bgra
- GL_EXT_blend_color
- GL_EXT_blend_func_separate
- GL_EXT_blend_minmax
- GL_EXT_blend_subtract
- GL_EXT_compiled_vertex_array
- GL_EXT_copy_texture
- GL_EXT_draw_range_elements
- GL_EXT_packed_pixels
- GL_EXT_rescale_normal
- GL_EXT_separate_specular_color
- GL_EXT_stencil_wrap
- GL_EXT_subtexture
- GL_EXT_texture_cube_map
- GL_EXT_texture_env_add
- GL_EXT_texture_env_combine
- GL_EXT_texture_env_dot3
- GL_EXT_texture_lod_bias
- GL_EXT_texture_object
- GL_EXT_texture3D
- GL_EXT_vertex_array
- GL_NV_blend_square
- GL_SGIS_multitexture
- GL_SGIS_texture_border_clamp
- GL_SGIS_texture_edge_clamp
- GL_SGIS_texture_lod

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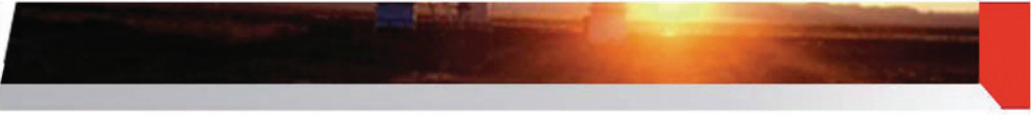
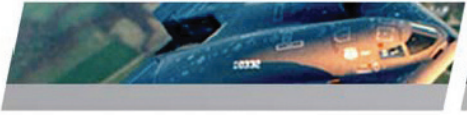
The OpenGL driver supports both direct and indirect mode rendering. In direct mode, the GL library does not use X protocol. Instead, the GL library directly invokes the OpenGL rendering code (see Figure 1). Using this method of rendering provides a more efficient communication path to the graphics hardware. Use of the direct mode feature increases the overall performance of an OpenGL intensive application by reducing the messaging overhead incurred with the indirect mode. In indirect mode the X TCP/IP transport mechanism is the interface between the client and the server.

A truly unique feature of the Curtiss-Wright Controls Embedded Computing GSS is its support for the concurrent execution of multiple OpenGL applications. Developers therefore have the flexibility to choose whether their software solution uses a single OpenGL window or multiple OpenGL windows. The advantages of this feature are:

- platform independence: allowing for easier transition of existing applications to the embedded platform and minimizing the need for software rework
- design independence: allowing the system integrator and developers to functionally partition their application software into individual components each controlling a separate window are on the display

Host and Target Support

Consistent with the changing Defense and Aerospace markets, the GSS is supported under a variety of Operating Systems from market-leading vendors. Please see the ordering information for the complete list.



Embedding the GSS

Use of the Graphics Software Suite may require the use of a file system for the storage and manipulation of data. During the development phase of a project, Network File System (NFS) can be used to provide this file system. Once embedded, however, a flash file system will typically be required.

The following drivers support embedding the GSS:

MemDRV (for VxWorks)

This driver allows the I/O system to access memory directly as a pseudo-I/O device. Memory location and size are specified when the device is created. This feature is useful when data must be preserved between boots of VxWorks or when sharing data between CPUs. Additionally, it can be used to build some files into a VxWorks binary image (having first converted them to data arrays in C source files, using a utility such as *memdrv-build*), and then mount them in the filesystem; this is a simple way of delivering some non-changing files with VxWorks.

TrueFFS (for VxWorks)

TrueFFS for Tornado is an integrated flash file system for WindRiver's Tornado development environment for embedded products. TrueFFS for Tornado makes it possible for embedded systems developers to implement ruggedized, reliable solid-state storage using a wide variety of embedded flash memory devices by emulating a hard disk drive under the VxWorks DOS files system.

NicheFile (for INTEGRITY)

The InterNiche NicheFile Portable File System is a complete drop in module that enables embedded systems developers to add read/write capability to RAM, flash or disk. The file system will map to a preexisting file system so

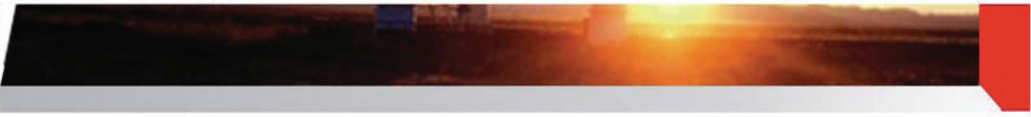
that the developer can add RAM based file capability without changing the existing file system. All RAM based files can be backed up to FLASH using a single command or API call. Logical devices such as UNIX-like `/dev/mem` or `/dev/null` can easily be added.

Video Capture Software

The Capture API's purpose is to provide a hardware-abstracted library to allow developers to manipulate and access video data produced by Curtiss-Wright's PMC-724 and PMC-704 and has been designed to be platform-independent for future deployment on future hardware products. In order to provide display capability, an Xv driver or OpenGL extension will interface with the display device's X Window system and/or OpenGL driver. The Xv or OpenGL driver makes use of the Capture API to manipulate the capture hardware. The Capture API Xv driver and OpenGL extension are available as part of the Curtiss-Wright X Server and OpenGL product available for your display hardware. The software is also structured such that it can be used independently of any display system. The capture interface provides the ability to perform high-speed, real time, 32-bit double word transfers to a PCI mapped memory location. In order to help accelerate development efforts, example demonstration applications are provided.

Video capture is supported in a variety of formats. Analog video formats include both composite signals such as NTSC and PAL, as well as separate video formats (RGB) such as those described by VESA and STANAG 3350. Digital video capture is supported through the LVDS receiver.

The capture driver for use with the PMC-704 is available on the 181, 182, 183, Champ-AV4 (416) and 122 host cards. It is intended to be coupled with either PMC-704 or PMC-706



for display. The standalone capture product, PMC-724 is supported with this same driver on the 179, 181 and 712 host cards. It is intended to be coupled with either PMC-700, PMC-702 or VME-712 for display. In both cases, up to two PMCs can be supported. For the PMC-702, capture support is fully integrated into the X11/OpenGL driver distribution.

Genlock capability is also available for PMC-702, VME-712 and PMC-704. This allows the display's video timing to be matched against a reference signal. This may be used to synchronize two displays, to synchronize a display against a capture device, etc. The genlock system detects the presence of the specified reference signal. When the signal is not present, the genlock system will cause the display to generate its own timing. When the reference signal is present, the genlock system will first match the display's horizontal rate to the reference, and then adjust the display's vertical timing to fall in line with the reference's vertical timing. It requires two sequential vertical refreshes of the correct frequency for the reference signal to be detected and utilized.

3rd Party Toolkits

Curtiss-Wright Controls Embedded Computing has teamed with several 3rd Party companies, to augment the GSS offering with a range of industry-leading toolkits and consulting services, namely:

eNGENUITY Technologies - VAPS

VAPS is a software tool suite that is available for rapid prototyping, designing, testing, and deploying Human-Machine interfaces. VAPS enables the development of dynamic, interactive, real-time graphical interfaces for complex applications such as the displays and controls found in military & aerospace applications.

Tilcon - Interface Development Suite (IDS)

Tilcon IDS is a fast and cost effective way to create today's demanding embedded graphical interfaces by using a user-friendly design tool with a drag & drop, WYSIWYG editor. Screens can be fully customized and simulation capabilities deployed with the click of a button, allowing developers to simply tie graphical objects to their data source using the Tilcon API.

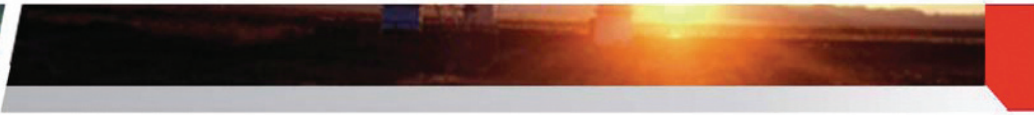
Development License

A Development License provides users with the development rights for unlimited developers within one project, on one site. The software driver is supplied in object code format in order that it may be linked with user applications. The object code can be easily integrated into a standard Tornado II or Multi environment as applicable. Included with the package are all necessary object code, header files, user manuals, and sample test applications. The Development License is provided with a 90-day access to software maintenance services via TechNet.

Runtime License

The Runtime License grants the user the right to deploy/use the Graphics Software Suite along with their application. An individual Runtime License is required for each graphics card that will be executing the GSS. A Runtime License is required for each PMC module sold when using the GSS.

Note: There is no Runtime license requirement for the PMC-724 product.



Software Maintenance and Support

Software maintenance is available in 12 month increments (discountable if purchased in group of 3 or more years) and is delivered primarily through TechNet, our 24/7 web-based support tool. This includes:

- On-going software maintenance updates (BSPs and drivers) as they become available
- Automatic e-mail notifications
- Access to fixes, upgrades, downloadable patches and workarounds
- Technical documentation, updates and errata
- Pin-out configuration utilities, troubleshooting wizards and interactive tutorials
- Technical application notes
- "As-is" sample code and example applications
- Downloadable software products and demos

The Software Maintenance Program is governed by a Software Maintenance Agreement which is available on the Curtiss-Wright Controls Embedded Computing web site.

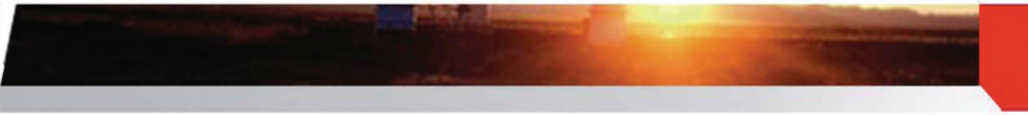
In addition to TechNet, the Customer Support team is ready to assist with installation, application troubleshooting, and operation of our software and hardware. Customers can access these support services through phone, fax, and e-mail during business hours. See the Curtiss-Wright Controls Embedded Computing web site for details.

Ordering Information

Applicable to PMC-700, PMC-702, PMC-724, VME-712, PMC-704 and PMC-706 products. The development software, runtime licenses and maintenance are sold separately from the graphics hardware.

Development Software					Real-Time Operating System Support			
					Host		Target	
Development Software Part Number	Associated Hardware	OpenGL	X11	Motif	IDE	Host OS (CPU)	RTOS	CPU type
DSW-DEV-700-010	PMC-700	1.1	X11R6.4	2.1.30	Tornado 2.0.2/2.2.1	Windows (Intel) or Solaris (Sparc)	VxWorks 5.1/5.5	PowerPC
DSW-DEV-702-010	PMC-702	1.1	X11R6.4	2.1.30	Tornado 2.0.2/2.2.1	Windows (Intel) or Solaris (Sparc)	VxWorks 5.1/5.5	PowerPC
DSW-DEV-724-000	PMC-724	See "Video Capture Software" section			Tornado 2.0.2/2.2.1	Windows (Intel) or Solaris (Sparc)	VxWorks 5.1/5.5	PowerPC
DSW-DEV-724-005	PMC-724				Multi 4.2.1	Windows (Intel)	Ingegrity v5.0.6	PowerPC
DSW-DEV-712-010	VME-712	1.1	X11R6.4	2.1.30	Tornado 2.0.2/2.2.1	Windows (Intel) or Solaris (Sparc)	VxWorks 5.1/5.5	PowerPC
DSW-DEV-704-000	PMC-704	1.3	X11R6.4	-	Tornado 2.2.1	Windows (Intel) or Solaris (Sparc)	VxWorks 5.5	PowerPC
DSW-DEV-704-005	PMC-704	1.3	-	-	Multi 4.2.1	Windows (Intel)	Ingegrity v5.0.6	PowerPC
DSW-DEV-706-000	PMC-706	1.3	X11R6.4	-	Tornado 2.2.1	Windows (Intel) or Solaris (Sparc)	VxWorks 5.5	PowerPC
DSW-DEV-706-005	PMC-706	1.3	-	-	Multi 4.2.1	Windows (Intel)	Ingegrity v5.0.6	PowerPC

For any differing requirements or additional RTOS support, please contact your local Curtiss-Wright sales representative. Development software must be licensed once per project, per site.



Software Maintenance

Annual software maintenance can be purchased for multiple years at a discount. Please consult with your local Curtiss-Wright Controls Embedded Computing sales representative.

Yearly Software Maintenance Part Number	Associated Development Software Part Number	Associated Hardware
MNT-DEV-700-010	DSW-DEV-700-010	PMC-700
MNT-DEV-702-010	DSW-DEV-702-010	PMC-702
MNT-DEV-724-000	DSW-DEV-724-000	PMC-724
MNT-DEV-724-005	DSW-DEV-724-005	PMC-724
MNT-DEV-712-010	DSW-DEV-712-010	VME-712
MNT-DEV-704-000	DSW-DEV-704-000	PMC-704
MNT-DEV-704-005	DSW-DEV-704-005	PMC-704
MNT-DEV-706-000	DSW-DEV-706-000	PMC-706
MNT-DEV-706-005	DSW-DEV-706-005	PMC-706

Runtime Licenses

Runtime License Part Number	Associated Hardware
DSW-RTL-700-010	PMC-700
DSW-RTL-702-010	PMC-702
DSW-RTL-712-010	VME-712
DSW-RTL-704-000	PMC-704
DSW-RTL-706-000	PMC-706

Contact Information

To find your appropriate sales representative, please visit:

Website: www.cwcembedded.com/sales

Email: sales@cwembedded.com

For technical support, please visit:

Website: www.cwcembedded.com/support1

Email: support1@cwembedded.com

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