Cosmo Compress Technical Report

Section 1 Product Overview

Cosmo Compress™ is an option card used in conjunction with Indy Video, Indigo^2 Video and Galileo Video. It provides compression and decompression of incoming and outgoing video to the CCITT/ISO JPEG standard.

1.1 Product Features

Cosmo Compress has these features:

- Compression and decompression in ratios from 5:1 to 100:1, depending on the source material (the minimum compression ratio to sustain a real-time video frame rate compression will be higher)
- Frame and field compression/decompression modes: up to 30 frames/second or 60 fields/second
- NTSC and PAL square-pixel formats and CCIR 601 525/625 formats (with 601 video option)
- Data transfers
  - Single-frame transfers to and from workstation host memory in 8-bit per component 4:2:2 YUV, 24-bit RGB
  - Transfers of NTSC- or PAL-sized images, to and from video option card and peripherals via digital video port
- Arbitrary scaling for decompressing video to host memory for playback using the Philips SAA7186 Digital Video Scaler
- Fixed scaling
  - Incoming images from the SGI Digital Video port can be scaled by 2 or 4 before compressing (using decimation)
  - Outgoing images sent to the SGI Digital Video port can be zoomed by 2 or 4 using pixel/line replication
- Output synchronization to external source via digital video port

1.2 Physical Characteristics

Cosmo Compress is a single wide GIO expansion board for the Indy. It occupies a single GIO slot in the Indigo^2 chassis.

Cosmo Compress uses the C-Cube CL560 Image Compression Processor to compress and decompress live video and rendered graphic images. Cosmo Compress interfaces with the host over a 32-bit GIO bus interface using two DMA channels; one channel is for compressed data, the other for uncompressed data. Cosmo can display decompressed video using Galileo Video via the SGI digital video interface, or by transferring data to host memory to be displayed by the graphics subsystem.

When decompressing video to host memory, Cosmo Compress can arbitrarily scale images by piping the uncompressed data through the Philips SAA7186 scaling chip. Images captured through the SGI digital video interface can be scaled horizontally, vertically, or both by a factor of 2 before compressing. This compressed data can then be zoomed back to full size when played back over the SGI digital video interface. See Figure 1.

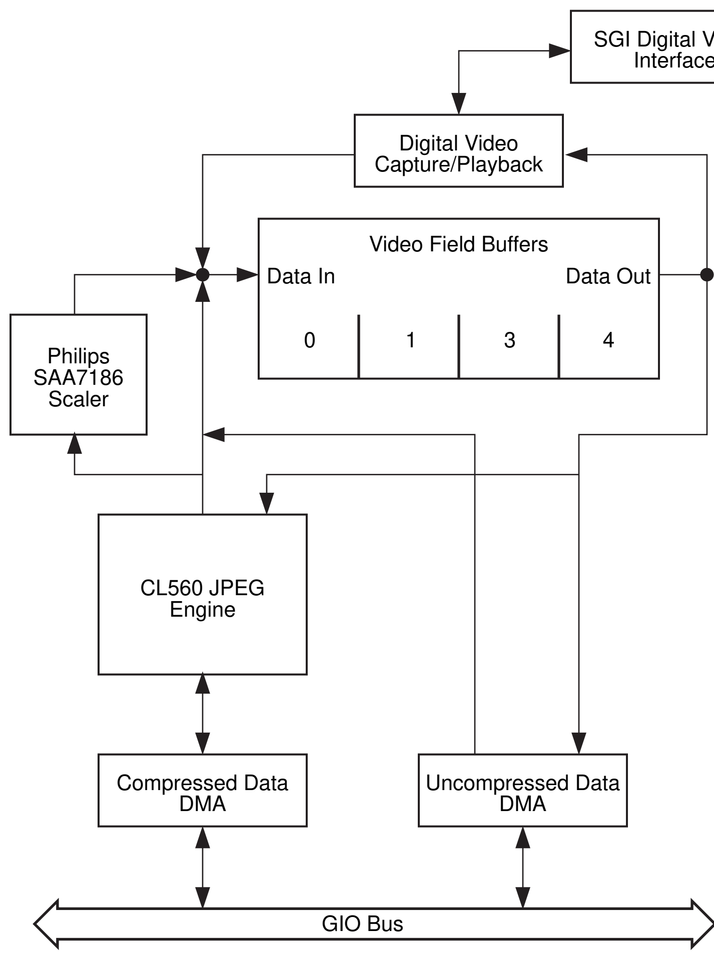

Figure 1: Cosmo Compress Block Diagram

Section 2 How to Use Cosmo Compress

The Compression Library, part of the digital media development option, can address three independent board functions:

- Compression/decompression
- Image routing
- Compression ratio

2.1 Compression/Decompression

Images are compressed and decompressed by the C-Cube CL-560 processor. All registers and tables may be addressed individually.

2.2 DMA Transfers

Direct memory access (DMA) to host memory is by way of the GIO bus. The bus interface supports three logically-independent channels: two for DMA operations (as a GIO master device) and one for programmed I/O, or PIO, operations (as a GIO slave device).

The DMA channels are designated the Compressed Image Channel (CIC) and the Uncompressed Image Channel (UIC). They transfer data to the input and output FIFOs on the C-Cube CL-560 processor.

2.3 Image Routing and Manipulation

Cosmo Compress has three ports for image-data transfers: digital video, CIC DMA, and UIC DMA. Table 1 shows important features of the ports.

Port	Interface	Features
Digital video	Interface via cable to the programmable, bidirectional channel of the digital expansion port on the Galileo Video option cards	• 8-bit • 4:2:2 YUV format, 50 and 60 Hz; pixel resolution up to 768x576 depending on video option card
CIC DMA	Compressed data interface to host memory	• 32-bit • JPEG compressed data
UIC DMA	Interface to host memory	• Primary port • 32-bit • 4:2:2 YUV, 24-bit RGB • Uncompressed images only

Table 1: Image-Data Transfer Ports

Section 3 Hardware Features

The Cosmo Compress expansion board is divided into three logical parts:

- Digital video interface
- Image processor
- GIO bus interface

Figure 2 is a system level block diagram showing the Cosmo Compress and video subsystem boards.

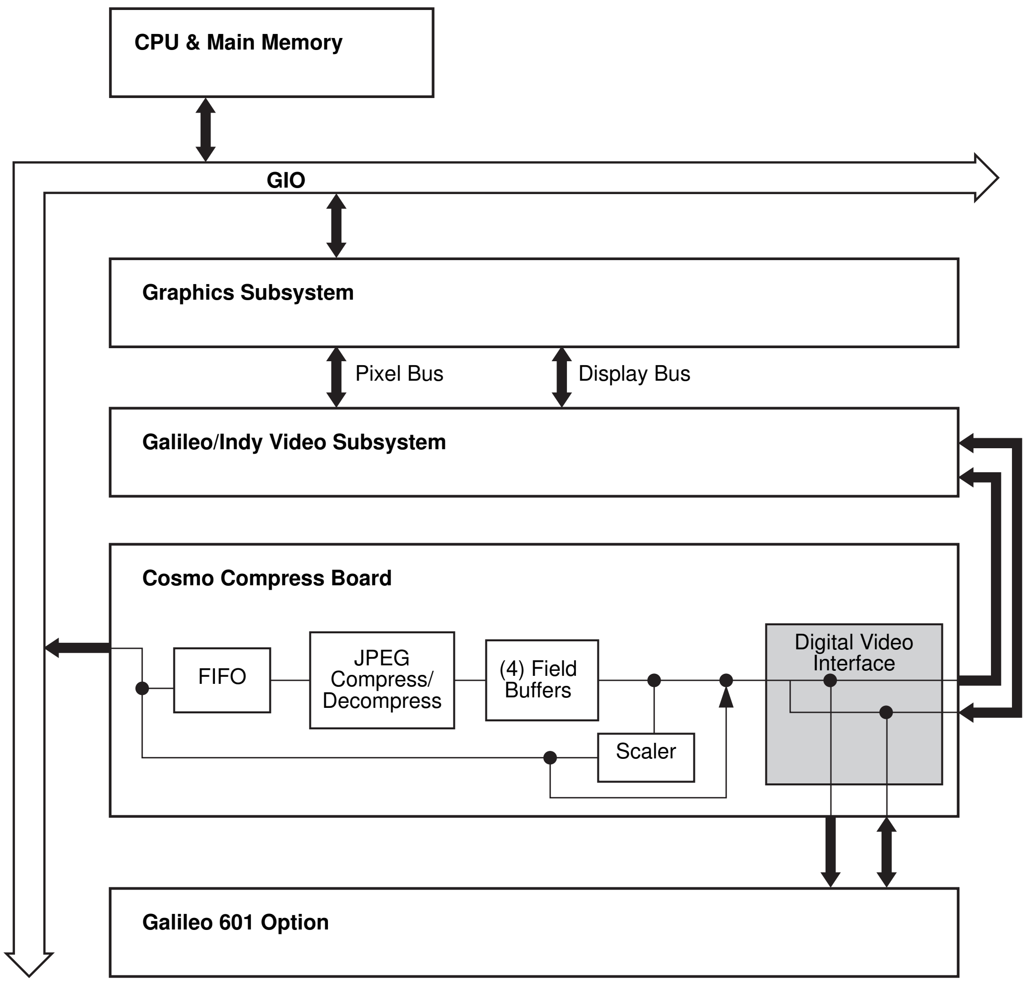

Figure 2: Cosmo Compress System Level Block Diagram

3.1 Digital Video Interface

The interface to the digital video port is an 8-bit wide, bidirectional interface. The port connects Cosmo Compress to the video option card or a peripheral device. (see the Galileo Video or Indy Video/Indigo2 Video sections of this report).

3.2 Image Processor

The C-Cube CL-560 provides quantization tables for control of the compression ratio, which varies from 5:1 to 100:1 (the minimum compression ratio to sustain a real-time video frame rate compression will be higher).

Section 4 Software Features

Software for Cosmo Compress follows Silicon Graphics successful strategy of providing common functionalities in a library of device-dependent and device-independent routines addressed through an API. Libraries insure that upgrades are compatible with current releases, that applications developed for one product can be ported easily to other products, and that functions provided by one library will interface reliably and consistently with the functions of other libraries.

The software consists of the following:

- Compression Library
- Video daemon
- Kernel (device driver)
- X window system server

4.1 Compression Library

The Compression Library provides an API that will be common to all Silicon Graphics video products. Through the API, video applications developed for one Silicon Graphics product can be designed to run on all other Silicon Graphics products. Applications designed for a simpler product can be made to run on more complex products with little or no modifications; applications designed for more complex products can return error codes when they run on simpler products and calls are made to an unavailable parameter.

Applications written to the Compression Library API will be able to access the other Silicon Graphics libraries, such as Video Library and Graphics Library.

4.2 X Window System Server

The window system server is responsible for positioning windows, loading color map tables and clipping the graphics screen around the video.

Section 5 Specifications

Table 2 lists Cosmo Compress specifications.

Board Function	Specification	Value	Comment
Compression	Processor	C-Cube CL-560	
	Standard	CCITT/ISO JPEG	
	Modes	Real time	To/from digital video port; 60 fields/second, 30 frames/second; or 50 fields/second, 25 frames/second
		Single frame	To/from host memory
Scaling of decompressed images	Processor	Philips SAA7186 Digital Video Scaler	to/from host memory
	Scaling factors	Arbitrary Size	
SGI digital video to video option card	Frame size	640x486 pixels	
		768x576 pixels	
		720x486 pixels	
		720x576 pixels	

Table 2: Cosmo Compress Expansion Board Specifications