AC101I INTEGRATING VIDEO PROCESSOR

Physical Measurement Redefined™

Now with the power of SCSI

Data Design Corporation
7851-A Beechcraft Avenue
Gaithersburg, MD 20879
(301) 670-1157

January 1999

CONTENTS

1 AC101I GENERAL DESCRIPTION

The AC101I Integrating Video Processor is a specialized image capture system designed specifically for the additive accumulation of multiple images. This design is a variation of the Data Design Solid State VCR (SSVCR) line of ultra fast local memory video transient recorders. The AC101I contains 512K x 32 bits of static RAM for exceptionally fast mathematical sum accumulation of frame data at up to 32 bits per pixel to form a single frame integration of multiple frames. Data from high speed array cameras as well as standard low speed sources are captured to local memory for later retrieval by a host computer. Control and data communications with the host are performed through a standard SCSI-2 interface.

Several array cameras are supported by the AC101I baseline design. NTSC video sources are supported for 512 x 480 pixels interlaced and 512 x 240 pixels noninterlaced. Dalsa high speed array cameras are also supported for 128 x 128 pixels and 256 x 256 pixels. Support for other cameras can be provided upon request. Typical SSVCR reduced window operation is not supported in the baseline AC101I design due to its limited usefulness in a single frame system but can also be incorporated upon request.

Front panel interfaces include camera sync and video connections, connections for an NTSC display monitor, and inputs for external trigger and control signals. SSVCR products such as the AC101I also include an infrared (IR) control receiver which allows the SSVCR to be operated from a TV remote control. This feature is generally used for development purposes and is therefore not specifically supported in the baseline design, though specific IR control features can be provided upon request.

The AC101I is sized to fit neatly in a half height PC drive bay or it can be provided in an external SCSI enclosure. The specific packaging arrangement is provided as requested. A simple control panel application is included for operation of the AC101I from a Windows NT/95 PC host. Source code for the control panel is also included to expedite user development of specialized applications.

1.1 Specifications Summary

General

Data Interface
SCSI-2

Power Requirements
+5 VDC @ 2.0 A
+12 VDC @ 0.5 A
or 120VAC @ 0.2 A

Ambient Temperature Range
0 to 50 degrees C

Package Size
Half height PC drive 8"x6"x1.5"
External case 10"x10"x2"

Features

Memory
256K x 32 Static RAM Accumulator
(Expandable to 512K x 32)

Maximum Pixel Rate
16 MHz

Storage Modes
Single Frame Overlay
Integrate Every N
Integrate on Trigger

Standard Supported Cameras
Dalsa CA-D1-0128 (128x128)
Dalsa CA-D1-0256 (256x256)
NTSC (Interlaced and Noninterlaced)
Sony XC-7500 (2I and 1N modes)

Aux I/O Features
Composite Sync
Subtract Operation
Trigger Gating I/O

Camera Sync Modes
Internal and External Supported

Host Controlled Settings
Analog Gain and Offset
Display Resolution
Lookup Table

Standard Software
Windows NT/95 Control Panel
Programming Support Library

Front Panel I/O Connections

Video Input	0-1V	50 Ω
Real Time Display	0-1V	75 Ω
Memory Display	0-1V	75 Ω NTSC Video Typical
External Trigger	2.5V	TTL Rising Edge Into 470 Ω
Aux	2.5V	TTL Into 470 Ω
Camera	Power and Sync Signals	

1.2 Setup and Installation

The AC101I is designed to operate as a standard SCSI-2 peripheral connected to a host computer. To use the Data Design control panel software, the AC101I must be installed in a PC system and connected through Adaptec SCSI hardware and software. This manual assumes that the AC101I will be installed in a PC with a supplied SCSI adapter. If other SCSI devices exist in the target PC, consult Data Design for installation guidelines.

With a target installation system selected, install the included Adaptec SCSI adapter card and associated software in accordance with the Adaptec installation instructions. If the AC101I is to be installed in the PC housing, select an empty drive bay and install the AC101I in the PC as if it were a SCSI hard drive. If the AC101I is provided in an external SCSI case, connect it to the SCSI adapter card at the rear of the PC as part of the external SCSI device chain using the provided SCSI cable. In either case, be sure that the SCSI bus is properly terminated at both ends by following the Adaptec instructions on termination and using the provided terminators as required. The SCSI address is set on the DIP switches at the back of the AC101I. The default is 4. If other devices are installed on the SCSI bus, be sure that the AC101I has a unique address. Refer to Appendix A for information on changing the SCSI address.

If the AC101I is in an external case, be sure that it is turned on before booting the PC or at least at the same time so that it may be found by the SCSI drivers which are loaded as the PC boots. Boot the PC and use the Adaptec SCSI Explorer to verify that the AC101I is properly installed by verifying that it is visible on the SCSI bus. Note that on Windows 95 systems the plug and play software will identify new hardware. Since the drivers for the AC101I are not plug and play in nature, cancel the request to install the drivers and, if possible, request that Windows 95 not identify the device as new hardware again.

The Data Design control panel software can only be installed on 32-bit Windows platforms including Windows NT and Windows 95. Install the control panel by running SETUP.EXE from the WINCP directory on the distribution CD. The setup process is a standard Windows automated setup. Just follow the on screen instructions. When the setup is complete, start the control panel. If the control panel starts without error, the AC101I hardware and software are properly installed.

2 AC101I CONTROLS AND INTERFACES

The AC101I is a standard SCSI-2 device with the majority of control functions performed by the host computer through the SCSI bus. Most front panel connections are reserved for camera control and data signals. The following discussion covers interfaces existing on the front panel and the technical details of the SCSI interface. Refer to section 3 for an overview of the PC control panel software.

2.1 Front Panel Inputs and Outputs

The connectors on the AC101I front panel provide connection to camera, NTSC monitor, and electrical trigger signals. Unless otherwise noted, the front panel signals are provided on standard female Lemo connectors. A coax cable with a standard male Lemo connector should be used for signal connection. This section describes the function of each of these connections.

2.1.1 Camera Connector

A 25-pin female D-shell connector at the center of the front panel provides power, control, and sync connection to a variety of cameras. An interface cable is provided for the camera for which support was requested. Cables for Dalsa array cameras and Sony NTSC cameras are standard items. Others cameras can be supported upon request. Because the camera connector interfaces to rather delicate circuitry, the electrical pinout of this connector is kept proprietary to discourage alternate use of these connections.

2.1.2 Aux Port

The *Aux* port can accept a TTL level input signal which can be used as an active high trigger enable or subtract enable to further control the integration function. When used as a TTL input, this port is terminated in 470 ohms to ground. The *Aux* port can also be used as a composite sync output or internal trigger signal output. The function of the *Aux* port is set by the SW3 switch bank which is further described in Appendix A.

2.1.3 External Trigger Input

This TTL level input signal is used to trigger the capture of a frame on the rising edge when the AC101I is in the triggered integrate mode. The input is terminated in 470 ohms to ground. Since most cameras, including those supported by the AC101I baseline design, do not allow a frame capture to be restarted at will, this signal is generally interpreted to mean that the next frame to start after the trigger is received is to be stored or accumulated.

2.1.4 Video Input

This is port serves as an analog video input from a camera or other video source. The level is typically in the 0 to 1 volt range. For NTSC sources, this input accepts a standard RS-170 NTSC composite video signal form which all sync information is derived for data storage purposes.

2.1.5 Real Time Display

This analog video output provides an analog representation of digital video data as it is converted from the analog video input. This allows the function of the video analog-to-digital converter (ADC) to be verified. It can also be used to view certain effects of the digitizer function such as quantization error or offset. If the video input is an NTSC source, the real time display output can be connected to an NTSC monitor for viewing in real time.

2.1.6 Memory Display

This analog video output provides an NTSC composite video signal for display of data stored in memory when the AC101I is placed in the display mode. For NTSC composite video sources, this output will also provide a usable representation of stored data even during store or integrate modes of operation. See the following section for information on operating modes. Since the output digital-to-analog converter (DAC) is an 8-bit video DAC and the AC101I contains a 32-bit memory accumulator for each pixel, the 8-bit section of each pixel to be displayed must be specified through the setting of the display resolution as described in the next section. This setting can be changed at any time, thus allowing systems with NTSC video sources to monitor integration activity on an NTSC monitor connected to this port.

2.1.7 IR Input

Data Design SSVCR products such as the AC101I include an infrared (IR) control receiver which allows the SSVCR to be operated from a TV remote control. This feature is generally used for development purposes and is therefore not specifically supported in the AC101I baseline design, though specific IR control features may be provided upon request. Contact Data Design with requirements.

2.2 Host Computer Interface

The AC101I is connected to the host computer through a standard SCSI-2 interface. The AC101I is connected to the SCSI bus via a 50-pin ribbon cable for the internal PC mounting option or through a 50-pin low density SCSI A-cable at the back of the external enclosure.

The host interface is entirely a software function. Firmware in the AC101I responds to SCSI commands received over the SCSI bus to perform various functions. Data Design has developed a programming interface library for the PC with routines which abstract these commands for use in software development. These routines are contained in a Windows dynamic link library (DLL) called VIDIN32.DLL and communicate to the AC101I through the Adaptec SCSI driver software. This DLL also supports other products of the SSVCR family. The DLL and a C language header file declaring the included routines can be found in the DRVLIB directory on the distribution CD. The VIDIN32.DLL is also installed automatically with the AC101I control panel interface described in section 3 below. Visual Basic source code is included for the control panel interface to facilitate user adjustments. The DLL can also be accessed equally well from other Windows programming environments such as C and LabVIEW.

This section describes the abstracted function of each command supported by the AC101I and how to access it though the DLL. Since it is assumed that the majority of applications will be PC oriented, the details of the SCSI bus operation are not included here but are available from Data Design should they be required. To encourage disciplined use of a common interface, source code for the DLL is not included, but is available from Data Design for the support of special needs.

2.2.1 Establishing Communication with the AC101I

Before any operations can be performed with the AC101I, the DLL must be instructed to locate the SSVCR on the SCSI bus and initialize certain internal parameters. This is accomplished by use of the following DLL function.

*int find_vcr(DWORD *memsize, char *model_string)*

If the SSVCR is found, its address on the SCSI bus is returned. If no SSVCR is found, then a -1 is returned. The memsize and model_string parameters will contain data when an SSVCR is successfully found but are not relevant to the operation of the AC101I. In the baseline design, only one SSVCR may be on the SCSI bus at once.

As an alternative initialization method, the following function may be called.

int vidinst_init(void)

This function initializes the DLL and establishes communication with the SSVCR. It returns only a 1 or 0 for success or failure respectively. This method is useful where the various other parameters of *find_vcr* are not useful or difficult to deal with. This function is typically used in LabVIEW and similar environments.

2.2.2 Operational Commands

The majority of the functionality of an SSVCR product is controlled by a set of operational commands to perform such functions as setting operating mode, setting gain and offset, and others. The commands are supported through a DLL function with the following prototype.

int faw_cdb(BYTE function, BYTE subaddress, WORD dataword)

The origins of the function and argument names are legacy SSVCR design and should be taken at face value. The functionality supported by the AC101I is summarized in the following table. A successful execution of this function will return a one. A zero will be returned if problems are encountered.

Command	Function	Subaddress	Data Word
Select Operating Mode	200	0 = Store 1 = Display 2 = Integrate 3 = Triggered Integrate 4 = Readout	
Clear Memory	211		
Gain	212	3 = Gain Adjust 2 = Offset Adjust 1 = Display Resolution 0 = Store Skip	New Gain New Offset New Display Resolution New Store Skip
Standard Lookup Table	213	0 = No Translation 1 = Invert 2 = 8 Shades of Gray 3 = Blackness	
Standard Camera Table	215	2 = Dalsa 128x128 3 = Dalsa 256x256 0 = NTSC Interlaced 5 = NTSC Single Field 7 = Sony Single Field	

The following is brief description of each of the settings in the table on the previous page.

Operating Mode:

Store — Frame data are stored without integrating. Each new frame overwrites the previous frame in the lower eight bits of each pixel accumulator.

Display — Accumulated pixel data are displayed on a local NTSC monitor connected to the *Memory Display* port from the accumulator byte specified by the *Display Resolution* as described below

Integrate — Frame data are stored with each pixel data point added to the data in the memory accumulator for that pixel. Frames are stored at the maximum rate of the camera. The *Store Skip* setting can be used to slow this rate to every Nth frame.

Triggered Integrate — Frame data are integrated as in *Integrate* mode but only the frames which begin after the receipt of each trigger are stored.

Readout — This mode allows frame data to be read over the SCSI bus. It must be set before each frame data read operation begins even if no other mode has been set since a prior read operation. This mode will also clear the display resolution setting which will have to reestablished by a later command.

Clear Memory:

This command is used to reset the memory accumulators to zero before the start of an integrate operation.

Gain:

The Gain command is an overloaded command used to set several one byte parameters as follows.

Gain — This is a qualitative gain setting of an analog amplifier on the video signal. It is generally set for good viewing during setup. The range is 0 to 255.

Offset — This is a qualitative offset setting of an analog amplifier on the video signal. It is generally set for good viewing during setup. The range is 0 to 255.

Display Resolution — This setting determines which bits of the pixel accumulator are displayed on the local NTSC monitor connected to the front panel *Memory Display* port. In the range of 0 to 5 each setting addresses a starting 4-bit nibble for the byte to be displayed. Settings 6 and 7 cause the display to present

a pseudo log image of the entire 32-bits of each pixel by displaying a byte with bit contents as follows.

Display Resolution = 6

MSB 14 12 10 8 6 4 2 0 LSB

Display Resolution = 7

MSB 22 20 18 16 14 12 10 8 LSB

These display modes can be used to obtain a qualitative view of the status of the integration operation.

Store Skip — This setting can slow the store rate of the AC101I for a particular camera by specifying how many frames to skip between stores. The range is 0 to 7 where a setting of 0 causes every frame to be stored, 1 causes every other frame to be stored and so on. While this setting applies to all modes of integration, it is generally not useful in triggered mode and should be set to zero before starting a triggered integration session.

Standard Look Up Table:

This command is used to select one of four preloaded look up tables. These tables determine what data value should be stored for each value of pixel data which could result from an eight bit analog-to-digital conversion. There are therefore 256 values in a lookup table. A custom lookup table can also be loaded as described below. Lookup tables are useful for highlighting, thresholding, discrimination, pattern searching, and other functions.

Standard Camera Table:

Cameras supported by an SSVCR product are described by an internal table describing certain parameters of the camera. Selecting a camera table selects which camera parameters, and thereby which camera, to use during store operations. Some SSVCR products allow the assignment of a custom table to adjust these parameters. Custom camera tables are not supported by the baseline AC101I design. Also note that the AC101I is generally configured to work with the camera with which it is shipped. The AC101I firmware supports all cameras of the baseline design but certain additional hardware configuration will be required to use a Dalsa camera as opposed to an NTSC source. See Appendix A for more information.

2.2.3 Installing A Custom Look Up Table

A custom lookup table (LUT) may be installed in the AC101I with the following function.

*int set_custom_lut(BYTE *lut)*

This function accepts an array of 256 bytes to be installed as the lookup table with the zeroth byte corresponding to the translation for pixel data of zero. The values of the lookup table are the values actually stored or accumulated in memory. The function returns a 1 or 0 for success or failure of the setup operation respectively. The new table will overwrite the currently selected LUT position. A custom LUT can be useful for highlighting, thresholding, discrimination, pattern searching, and other functions.

Ex) Install a lookup table with zeros in the first N locations and values corresponding to the index thereafter to implement a thresholding function for eliminating dark counts or other unwanted background light.

2.2.4 Retrieving and Using Video Data

Frame data may be retrieved from the AC101I using the following function.

*int retrieve_data(unsigned long DatLen, char *filename)*

The *DatLen* parameter specifies how many bytes are to be retrieved. The *filename* parameter specifies the file in which the data are to be stored. The function returns a 1 or 0 for success or failure of the transfer respectively.

Note that the AC101I has 32-bits (four bytes) for each pixel. Therefore, the transfer length specified must be four times the number of pixels in the frame. The data are transferred and stored in big endian format (most significant byte first). Note that there is no frame pointer to set in the AC101I. Since there is only one frame of storage, the frame pointer is essentially always at zero.

The DLL includes convenient functions for translating image data to a bitmap which can be displayed and used in a variety of Windows applications. The function prototypes are as follows.

*int reduce_pixels(char *source, char *destination, BYTE start_nibble)*
*int video_to_bitmap(char *filename, LONG x, LONG y, int bits_per_pixel, int interlaced)*
*int stretch_single_field_bitmap(char *source, char *destination)*

The *reduce_pixels* function accepts a *source* file with 32-bit pixels and for each pixel saves an 8-bit pixel in the *destination* file from the 8-bits starting with the specified *start_nibble* of the source 32-bit pixel. This reduces the source file to an 8-bit video data file. The function returns a 1 or 0 for success or failure respectively and will present instructive messages about any errors which occur when possible. A successful operation will result in an 8-bit video data file at the specified destination.

The *video_to_bitmap* function can accept the 8-bit video data output of the *reduce_pixels* function and convert it to a 256 color (shades of gray in the SSVCR case) bitmap file. The input file is specified in the *filename* argument. For AC101I data the *bits_per_pixel* argument should be set to 8. The *interlaced* argument can be set to one to reconstruct the two fields of an interlaced image such as the two fields of an NTSC video source. Otherwise *interlaced* should be set to zero. The *x* and *y* arguments represent the size of the image and must be multiples of sixteen. The function returns a 1 or 0 for success or failure respectively and will present instructive messages about any errors which occur when possible. A successful operation will result in a file with the same base name as the *filename* argument but with the *.bmp* extension.

The *stretch_single_field_bitmap* function accepts an 8-bit RGB bitmap image typically from the output of the *video_to_bitmap* function and stretches it to twice its vertical size by writing each line of the source file to the destination file twice. This is useful for translating a bitmap created from a single field of an interlaced camera to one which represents the correct physical aspect ratio of the entire frame. The function returns a 1 or 0 for success or failure respectively and will present instructive messages about any errors which occur when possible. A successful operation will result in a new bitmap file with twice as much data and appropriately modified header information.

3 AC101I CONTROL PANEL SOFTWARE

A Windows control panel application is included on the distribution CD in the WINCP directory and is installed as described in section 1.2 above. This is a standard Windows application which provides an intuitive interface to the AC101I. The control panel was designed in Visual Basic for ease if modifcation while using the functions of the VIDIN32.DLL library for detailed operation of the AC101I. The source code for the control panel is included on the distribution CD in the VB directory for reference and as a starting point for further specialized application development. This section describes the operation of the AC101I from the control panel application.

3.1 Control Panel Basics

The control panel main window is a dialog style window containing the basic controls for the AC101I system along with a view box for display of stored data. A bright red indicator at the upper left of the control panel indicates the current operating mode of the AC101I. The four button controls below the mode indicator are used to set the mode of operation. Several other controls establish various parameters of operation. The menus accessible at the top of the control panel provide access to additional operating parameters of the AC101I and control panel. This section describes the operation of the various controls and menus.

3.1.1 Selecting A Camera

Before any data can be captured with the AC101I, the connected camera must be specified. The *Camera* menu at the top of the control panel provides a list of cameras supported by the AC101I baseline design. The camera with the check next to it is the one currently in use. Select the camera to be used. The AC101I will be configured accordingly and a check will appear next to the selected camera. The control panel view box will be resized to represent the aspect ratio of the camera selection. The selection will be saved when the control panel application is closed and will be automatically configured when the control panel is next started.

Note that the AC101I is generally configured to work with the camera with which it is shipped. The control panel and the AC101I firmware support all cameras of the baseline design but certain additional hardware configuration will be required to use a Dalsa camera as opposed to an NTSC source. See Appendix A for more information.

3.1.2 Operating Mode Buttons

Overlay Store

Clicking the *Overlay Store* button will cause the AC101I to enter the store mode and begin storing frame data in memory. Each new frame overwrites the previous frame and the process continues until the mode is changed. In this mode, only the lower eight bits of the memory accumulators are in use. The *Displayed Bits* control is set to the lower eight bits. The *Gain* and *Offset* can be adjusted in this mode. No image will be displayed in the view box on the control panel. However, if the video source is an NTSC composite signal, the *Real Time Display* output on the front panel can be used to view the camera image on an NTSC monitor. A similar signal will be available on the *Memory Display* output but will represent the data being stored.

Integrate

Clicking the *Integrate* button will cause the AC101I to enter the integrate mode with the requirements specified in the *Frame Timing* box. In this mode each new frame stored is added pixel by pixel to the values in the memory accumulators. The memory accumulators will not be cleared by entering integrate mode. The process continues until another mode is entered. To help prevent accidental loss of data, the control panel restricts entry to modes other than display. However, the *Clear* button is available only during integration and is typically used at least once on the start of a new integration session. If the *Timed Integration* option is checked in the *Options* menu, integration will terminate in display mode automatically in a specified amount of time.

Clear

The *Clear* button is enabled only in integrate mode. Clicking this button will clear the memory accumulators and thereby restart the integration session. This will typically be done at least once after the integration session has first been started. This button does not affect the progress of a timed integration.

Integration Time

The *Integration Time* dialog displays a text box when the *Timed Integration* option in the *Options* menu is checked. A time may be entered in minutes from 1 to 999. If the timer is active when integrate mode is entered, a countdown begins which upon termination will cause the control panel to return to display mode automatically. If the timer is not active, an indication will be displayed and integration sessions must be terminated manually by clicking *Display*. Clicking *Clear* will not affect the integration timer. However, stopping and restarting the integration session manually will reset the integration timer.

Display

Clicking the *Display* button will cause the AC101I to enter the display mode. If the *Display In View Box* option in the *Options* menu is checked, the control panel will first enter readout mode and retrieve frame data for display in the control panel view box. When this action is complete, an image will be displayed on an NTSC monitor connected to the *Memory Display* output on the front panel of the AC101I; and optionally the same image will be displayed in the control panel view box. The pixel data in the memory accumulators will be displayed by both devices as an eight bit image. The eight bits used in constructing the display are selected with the *Displayed Bits* control.

Focus Mode

Clicking the *Focus Mode* button will cause the AC101I to enter a mode of sequentially altering between the overlay store mode and the display mode. This is equivalent to clicking *Overlay Store* and *Display* repeatedly. This mode is useful when setting the gain, offset, and focus of a camera which does not provide an NTSC composite signal that can be viewed from the *Real Time Display* output. While the AC101I is in store mode, these parameters can be adjusted. The results can be viewed on an NTSC monitor connected to the *Memory Display* output and optionally in the control panel view box when the AC101I enters display mode. The *Gain* and *Offset* control can be adjusted when the control panel is not reading data as indicated by the hour glass cursor. To stop the focus mode operation, click the *Focus Mode* button (which now shows *End Focus Mode*) again when the arrow cursor shows. Focus Mode is primarily useful for video sources with other than NTSC format. NTSC sources can be viewed and therefore focused using an NTSC monitor connected to the *Real Time Display* output at any time or by connection to the *Memory Display* output when in overlay store mode.

3.1.3 *Gain* and *Offset* Controls

The *Gain* and *Offset* controls set analog parameters of the input video amplifier. These can be adjusted at any time and in any mode. Clearly, these parameters will not affect previously stored data. Therefore, these controls are generally adjusted only during setup. At that time these controls can be adjusted for the desired image characteristics. These settings will be saved when the control panel application is closed and will be automatically configured when the control panel is next started.

3.1.4 *Frame Timing* Settings

The radio buttons in the *Frame Timing* box are used to select a method of specifying what frame data to add to the memory accumulators during an integration session. These specifications include triggered and frame skip operation.

If *Store Every N* is selected, the number in the adjacent box is used as N. This number can be adjusted from 1 to 8 with the adjacent arrow buttons. The camera is always operating and providing data at full speed. In the *Store Every N* mode, for every frame stored there are 0 to 7 frames (N-1) skipped. This in effect slows the rate at which frame data are accumulated, thereby lengthening the potential integration period without decreasing the frame speed.

If *Wait for T rigger* is selected, then the only data which are added to the accumulators will come from the first frames to start after receipt of each electrical trigger on the front panel. To achieve proper operation in this mode, the store skip setting is coerced to zero (N= 1). Note that the start of frame is not synchronized to the trigger signal. The camera is always operating and providing data at full speed. The trigger causes the next frame to start to be the one stored. If the trigger frequency is faster than the frame rate, then every frame will be stored.

3.1.5 *Displayed Bits* Control

The *Displayed Bits* control below the control panel view box is used to specify which bits in the memory accumulators are to be displayed as pixels in the view box and presented on the *Memory Display* output on the AC101I front panel. With each cyan bar representing a bit of the 32-bit pixel data accumulators, the yellow highlighted region represents the bits to be displayed. Click on the control near an unhighlighted bit to move the highlight and thus the bits to be displayed. The control panel coerces the displayed bits in *Overlay Store* and *Focus Mode* to the lower eight bits.

The operation of the view box and the *Memory Display* output will be affected by this setting. With an NTSC video source, an NTSC monitor connected to the *Memory Display* output can be used to view the progress of integration by displaying higher order bits as integration progresses. Only the *Memory Display* output can be assigned the display resolution settings 6 and 7. These are selected when the highlight is moved to the highest order bits. This is the sixth setting for the view box and the view box will show an image from the bits indicated by the entire highlighted region. A red highlight can be moved to select display resolution of 6 or 7 to be used by the *Memory Display* output. When the red highlight is at the highest bits (30 and 31) on the *Displayed Bits* control, a display resolution of 7 is active in the AC101I. When the red highlight is at bits 28 and 29, a display resolution of 6 is active in the AC101I.

3.2 Lookup Tables

Data generated from the analog-to-digital conversion of the video signal is an 8-bit quantity. The range is from darkness represented by 0 through saturation level of brightness represented by 255. The meaning of these numbers in physical terms varies with the gain and offset of the video amplifier.

All converted video data are passed through a lookup table (LUT) where data points from the conversion serve as an index. The data at the location so addressed in the table are the data stored for that particular pixel. To have no affect on the video data, each location in the LUT must be loaded with a number equal to its index.

The LUT menu on the control panel offers the selection of one of several LUT options built into the AC101I along with the ability to specify a custom LUT. The active LUT is indicated by a check mark. Upon selecting a desired LUT, a check mark will appear next to the selection and the AC101I will be configured accordingly. The LUT selection will be initialized to *No Translation* option when the control panel is started as this setting is normally required for setup operations.

The built in LUT options are as follows. The *No Translation* option is a LUT for which the element data are equal to the index, thereby providing data to the memory equal to that from the conversion of the video signal. The *Invert* option is a LUT which contains the ones compliment of the index at each location thereby providing an image where the brightest spots are shown the darkest and darkest spots are shown the brightest (a negative image). The *Eight Shades of Gray* option contains a LUT which separates the 256 shades of gray represented by the converted video signal to eight shades of gray in corresponding levels of brightness.

Choosing to specify a *Custom* LUT will open a new dialog box. This dialog box can remain open while operating the control panel. A LUT can be viewed and edited using the controls of the *Lookup Table Preview and Edit* box. The index is displayed in the upper box and can be adjusted with the arrow buttons. The data for the displayed index are presented in the lower text box and can be edited. All LUT values are set equal to the index when the dialog is opened in order to simplify the development of commonly needed LUT's. The data are displayed and edited in decimal or hexadecimal depending on the setting of the adjacent radio buttons. The LUT specified in the edit box is loaded to the AC101I by clicking *Load to AC101I*. When a new custom LUT is loaded, a check mark will appear next to the *Custom* selection in the LUT menu on the control panel main window.

The LUT specified in the custom LUT edit box can be saved to a file by specifying a file name in the familiar file dialog controls in the custom LUT dialog box and clicking *Save To File.* Custom LUT data can be loaded from a file to the edit box, but not to the AC101I, by specifying a file name and clicking *Read from File* or by double clicking the file name in the file selection box. This operation will read the first 256 bytes of the specified file and fill the custom LUT edit box. The loaded LUT can then be viewed, edited, and loaded to the AC101I as described above.

3.3 Saving Frame Data

Frame data can be saved to a file using the *Save Frame* option under the *File* menu. Selecting this option opens a familiar file dialog box. Specify a file name and click *Ok*. The frame data memory accumulators will be read from the AC101I and saved to the specified file. Note that these frame data are the data in the AC101I memory, which are generally but are not necessarily the data last displayed in the control panel view box. To be sure of what is being saved, save the frame data immediately after entering the display mode and before doing anything else with the AC101I.

Frame data will be stored with 32 bits per pixel. The four byte word will be stored with the most significant byte first in the file. The frame data can also be stored as a bitmap by selecting the check box option *Save As 256-Color Bitmap*. In this case, a 256 color (shades of gray) bitmap is created using the byte then specified with the *Displayed Bits* control on the control panel. If video data is from a single field of an interlaced camera, the check box *Stretch Single Field* will also be available when a bitmap is specified. When selected, this option stretches the saved bitmap to contain an image representative to the correct physical aspect ratio of the entire frame. Resulting bitmap files can easily be imported into other Windows applications for documentation purposes.

3.4 Source Code Description

One of the benefits of the control panel is that it can be changed to suit a particular need by modification of the included source code. The control panel is written in Visual Basic, which is a self documenting Windows scripting language that allows rapid development of a user interface through deployment of high level functions and control objects. The Visual Basic project and related files are found in the VB directory on the distribution CD. The control panel calls on the services of the VIDIN32.DLL library to interface with the AC101I. The declarations of DLL routines and all global variables are found in the declarations section of the MODULE1.BAS code module.

Appendix A
AC101I HARDWARE CONFIGURATION SWITCH SETTINGS

The AC101I has two banks of user configuration switches. These switches configure certain parameters of AC101I operation, most of which are not configurable from the host. The switch banks are labeled SW1 and SW3. SW1 is the bank of eight switches accessible at the back of the unit. SW3 is a bank of four switches accessible at the top of the unit near the AUX connector. The following tables summarize the functions of these switches.

S1	S2	S3	S4	S5	S6	S7	S8	Function
OFF	ON	OFF						Default Camera = Dalsa 128x128
ON	ON	OFF						Default Camera = Dalsa 256x256
OFF	OFF	OFF						Default Camera = NTSC Interlaced
ON	OFF	ON						Default Camera = NTSC Single
ON	ON	ON						Default Camera = Sony Single
			ON					AC101I Generates Sync
			OFF					AC101I Uses Camera Sync
				ON				Memory Display is NTSC Format
				OFF				Memory Display is CCIR Format
					ON	ON	ON	SCSI Address = 0
					ON	ON	OFF	SCSI Address = 1
					ON	OFF	ON	SCSI Address = 2
					ON	OFF	OFF	SCSI Address = 3
					OFF	ON	ON	SCSI Address = 4
					OFF	ON	OFF	SCSI Address = 5
					OFF	OFF	ON	SCSI Address = 6
					OFF	OFF	OFF	SCSI Address = 7

Note: ON = Switch Down

Table A.1 SW1 Settings

The default camera setting defines the camera parameters to be used by the AC101I until defined otherwise be the host computer. When a host control panel is in use, this setting will generally not be relevant. The S4 switch controls the source of the sync signal for store operations. For most cameras supported by the AC101I baseline design, the AC101I will generate its own internal sync and the switch should be off. With some NTSC cameras, the camera sync may be used to control the store operation. Some AC101I firmware for special cameras may ignore this setting. The S5 switch controls the format of video presented for display on an external monitor from the *Memory Display* output when in display mode. The final three switches select the address of the AC101I on the SCSI bus. This address should be chosen to be unique among devices on the SCSI bus. Generally, addresses 0 and 7 are used for host equipment and should be avoided.

S1	S2	S3	S4	Function
ON	OFF	OFF	OFF	Aux = Trigger Enable Input
OFF	ON	OFF	OFF	Aux = Subtract Enable Input
OFF	OFF	ON	OFF	Aux = Composite Sync Output
OFF	OFF	OFF	ON	Aux = Internal Trigger Output

Table A.2 SW3 Settings

The SW3 settings control the function of the front panel *Aux* port. Only one function may be selected at a time. When the *Aux* port is selected to be a trigger enable input, a TTL low signal at this port will inhibit the trigger and a TTL high will enable the trigger. When the *Aux* port is selected as a subtract enable, a TTL low will specify normal additive integration while a TTL high will specify that new pixel data should be subtracted from the memory accumulators during integration. This signal may be toggled during integration to capture and subtract dark frames to reduce the effects of high dark count sensors. When the *Aux* port is selected to be a composite sync output it can be used to deliver sync signals to a camera requiring this type of sync input. However, none of the cameras supported by the AC101I baseline design use this method. When the *Aux* port is selected to be an internal trigger output a rising edge will be presented on the start of each frame which is to be stored. This is useful for triggering other experimental apparatus, particularly when using a store skip setting greater than zero.

Several other configuration jumpers and switches exist on the board near the video input connector. These are factory set for the support of a particular class of camera. Generally, the AC101I will be shipped for use in conjunction with a particular video source. Although the control panel software and AC101I firmware support all baseline sources, the front end hardware configuration will have to be adjusted to make use of a camera other than that with which the unit shipped. In the baseline design example, these configuration points will have to be changed for use of a Dalsa camera as opposed to an NTSC video source. Contact Data Design for more information.

PRODUCT WARRANTY:

1. Product. The "Product" referred to herein is the computer instrumentation product *AC101I.*

2. Limited Warranty. Data Design Corporation warrants that the Product will perform substantially in accordance with the accompanying documentation for a period of one year from the date of receipt. Any implied warranties on the Product are limited to one year. SOME STATES DO NOT ALLOW LIMITATIONS ON DURATION OF AN IMPLIED WARRANTY, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

3. Remedies. The entire liability of Data Design Corporations and/or its suppliers and your exclusive remedy shall be, at the option of Data Design Corporation, either (a) return of the purchase price you paid or (b) repair or replacement of the Product that does not meet the Limited Warranty and that is returned to the place of purchase with a copy of your receipt. The Limited Warranty is void if failure of the Product has resulted from accident, abuse, or misapplication. Any replacement Product will be warranted for the remainder of the original warranty period or thirty (30) days, whichever is longer. THE FOREGOING CONSTITUTES YOUR SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY. EXCEPT FOR THE WARRANTIES SET FORTH ABOVE, THE PRODUCT AND DOCUMENTATION ARE PROVIDED "AS IS," AND DATA DESIGN CORPORATION AND/OR ITS SUPPLIERS DISCLAIM ANY AND ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

4. Limitations of Liability. The cumulative liability of Data Design Corporation and/or its suppliers to you or any other party for any loss or damages resulting from any claims, demands, or actions arising out of or relating to this warranty shall not exceed the purchase price you paid for the Product and documentation. In no event shall Data Design Corporation and/or its suppliers be liable for any indirect, incidental, consequential, special, or exemplary damages, loss of business profits, business interruption, or loss of business information, even if advised of the possibility of such damages. SOME STATES DO NOT ALLOW THE LIMITATION OR EXCLUSION OF LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

TRADEMARKS:
Commercial names an trademarks mentioned are for identification purposes only and are recognized as the trademarks of the respective owners. AC101I, Physical Measurement Redefined, and SCSICrate are a trademarks of Data Design Corporation.

REVISION LEVEL:

Firmware Version: 2.20
Control Panel Version: 1.20
Manual Release Date: January 10, 1999