PERSONAL TBC II™

Model VT-2000

A Time-Base Corrector for
PC Compatible Expansion
Slots

User's Manual
Release Version 1.0
First Edition: July, 1991

DIGITAL
PROCESSING SYSTEMS INC.

DPS Personal TBC II™

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Digital Processing Systems Inc.
55 Nugget Ave., Unit #10, Scarborough,
Ontario, Canada M1S 3L1
Telephone: (416) 754-8090
Fax: (416) 754-7046

Personal TBC II User's Manual

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CHAPTER ONE
Introduction

The Personal TBC II is an infinite window Time Base Corrector suitable for use with all types of consumer/industrial VCRs. This board features both composite (NTSC) and component (SVHS or separate Y and C) inputs. The board also has a reference video input for genlocking, and a composite video output. In addition there is a multi-function Input/Output (I/O) connector which may be configured to provide a second video output, a loop-through for the reference video input signal, or an advanced sync output. This unit also features serial RS-232 control of all of the video parameters via the TBC II control software provided.

The Personal TBC card is designed to work in any IBM PC® or 100% compatible 8 or 16-bit type expansion slot. The card obtains its power from the expansion slot, but DOES NOT require any other buss signals. The serial control data is input via the rear panel RJ-11 connector, or via the on board RS-232 input header. It will therefore operate in an AMIGA PC slot, without requiring an AMIGA PC® bridgeboard.

If you are already familiar with TBCs, you may skip the remainder of this section.

Why do I need a TBC?

The main problem with using a VCR in TV post production is that the sync timing on playback contains excessive timing errors when compared to a stable signal from, for example, a camera or TV signal generator. These timing errors are called time-base errors. The apparent stability of these pictures when viewed on a TV monitior is due to the tracking ability of the horizontal oscillator circuits of the monitor. These pictures are no criterion of stability.

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Before any VCR can be used in broadcasting or serious teleproduction, the time-base errors must be corrected. This is necessary so that the playback signal will be stable at all times and can be used as a source of video in production.

In addition to removing the time-base errors, as described above, the TBC also allows the VCR playback signal to be co-timed (or genlocked) with other video signals. This is necessary so that the tape playback can be mixed with other tapes and with live camera video signals. This genlocking feature is provided by connecting a reference video signal to the TBC reference video input. The TBC then derives all its timing information from this reference video input, and produces a video output whose timing matches that of the reference input.

CHAPTER TWO
Configuration

Before installing the Personal TBC II in your computer, it may be necessary to move some of the jumpers or DIP switches on the card to configure the TBC for your application. Refer to figure 2-1 for the location of the jumpers and DIP switches.

This section provides a detailed description of the functions of each of the jumpers and DIP switches on the card. If you wish, you may skip this section, and simply use the factory default settings, except for the TBC address DIP switches, which you should set as follows:

Switch-5	Switch-4	Switch-3	TBC II Software ID
UP	UP	UP	1'st TBC (VTR-1)
DOWN	DOWN	DOWN	2'nd TBC (VTR-2)
UP	DOWN	DOWN	3'rd TBC (VTR-3)
DOWN	UP	DOWN	4'th TBC (VTR-4)

Multi-I/O Function Jumper:

This three-position jumper field, labelled CHE1 on the TBC card, is used to establish the function of the rear panel multi-I/O connector. It is normally installed in the position labelled 'GENLOCK LOOP', which causes the multi-I/O connector to become a 'loop-through' output of the genlock video input (allowing the same genlock video signal to be routed or 'looped' to multiple locations). If installed at the position labelled 'VIDEO OUT', the multi-I/O connector will become a second video output. If installed at the position labelled 'ADV SYNC', the multi- I/O connector will contain an advanced sync. output, suitable for use with playback VCRs which have an advanced sync input. See Appendix A for more information about using advanced syncs.

Genlock Termination Jumper:

This two-position jumper, labelled CHE2 on the TBC card, allows the genlock video input to be either terminating (75 ohms) or high impedance. This jumper is normally installed in the 'OPEN' position, which makes the genlock video input high impedance, allowing the signal to be 'looped' to multiple destinations. If installed in the 'TERM' postion, the genlock input will become a 75-ohm terminating input.

Serial Data Transmit Control:

This two-position jumper, labelled DHE4 on the TBC card, controls the TBC card RS-232 transmit data function. It is normally installed in the 'MT' position, which causes the TBC card, transmit data output to be high impedance (i.e. the TBC card does not use the RS-232 transmit data line). This allows the RS-232 port to be shared by other applications, while still allowing full software control of the card with the TBC II program provided. If this jumper is installed in the 'TX' position, the TBC card will use the RS-232 transmit data line to send status information when requested according to the protocol outlined in Appendix C.

DIP Switch Settings:

The eight-position DIP switch, labelled DSW1 on the TBC card, is used to setup the various operating modes of the TBC card described below. (Note: all switches are shipped in the 'UP' or ON position):

Switch 8 - Remote Enable

This switch is used to enable/disable the serial remote control feature of the card. This switch is normally set in the 'UP' position, which enables full software control of all the TBC card features.

If you DO NOT intend to use the TBC II control software provided, move this switch to the DOWN position to disable the RS-232 interface, and force all of the video parameters (normally controlled via software) to a unity setting. When operating the card in this

mode, you must use the rear panel genlock timing adjustment switch to establish correct genlock timing (See Appendix D for details). Also, with the remote interface disabled, DIP switch 3 must be used to select either NTSC or SVHS input mode.

Switch 7 - Vertical Blanking Width

This switch sets the number of video lines to be blanked by the TBC card during the vertical blanking interval. This switch is normally set in the 'UP' position, which causes the card to blank the first 21 lines of each field.

If this switch is moved to the DOWN position, only the first nine lines of each field will be blanked.

Note: the video lines between 9 and 21 normally contain signals which are not related to the picture. If these signals are not blanked, they may appear at the top of the picture, or when certain DVE effects are used.

Switch 6 - Hot Switch Enable

This switch controls the TBC card hot switching feature. It is normally set in the 'UP' position, which causes the card to automatically go into a freeze mode (displaying the last good field) whenever the input video signal is lost. If this switch is moved to the DOWN position, the automatic freeze or hot switch will be disabled.

Switches 5, 4, 3 - TBC Address

When installing multiple TBCs in a system, it is necessary to establish a unique address for each card. This address is used by the serial control program to direct commands to individual TBCs. The table below indicates how the switch settings correspond to VTR-1, VTR-2, VTR-3 and VTR-4 on the TBC II software control screen.

Switch-5	Switch-4	Switch-3	TBC II Software ID
UP	UP	UP	VTR-1
DOWN	DOWN	DOWN	VTR-2
UP	DOWN	DOWN	VTR-3
DOWN	UP	DOWN	VTR-4

Normally, the first TBC installed is assigned to VTR-1, the second VTR-2, etc. See Chapter Five for more information on the TBC II control software.

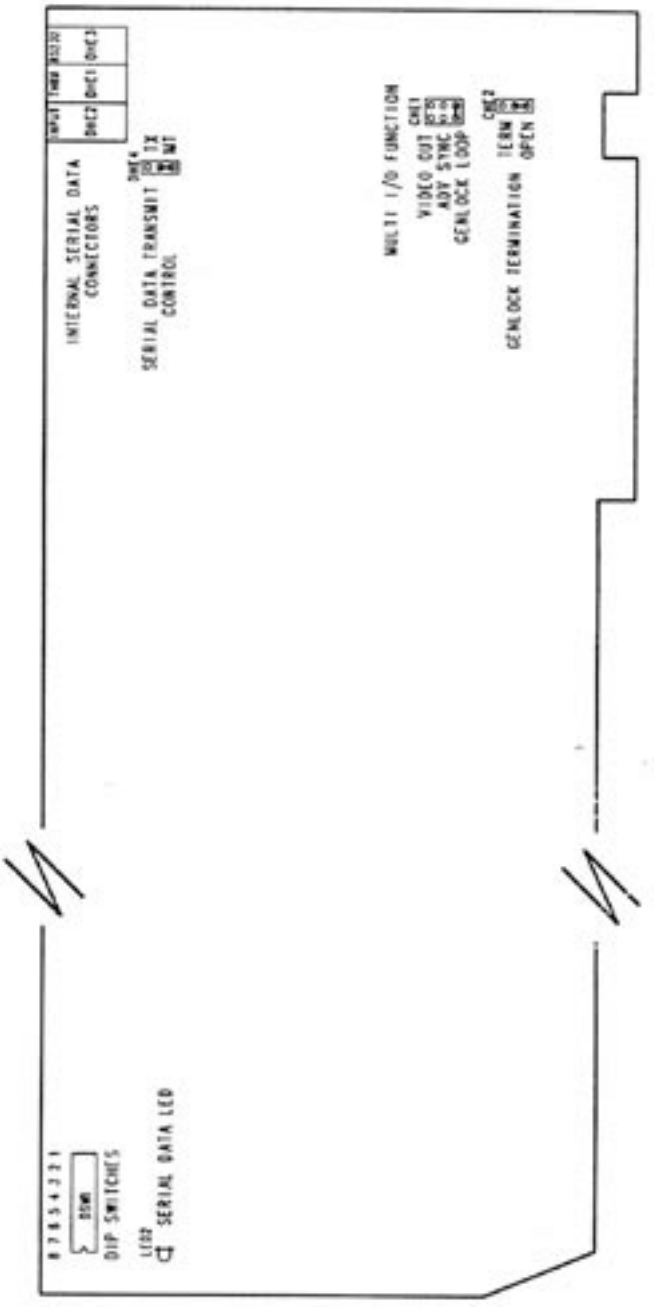
Switch 2 - Serial Baud Rate

This switch selects the baud rate for the serial control interface. It is normally set to the 'UP' position for 31.25kB/s operation (the MIDI standard baud rate). When moved to the DOWN position, a 9600 bps baud rate is selected.

When using the TBC II control software, the baud rate selected by this switch (usually 31.25kB/s) MUST match the baud rate selected on the AMIGA preferences screen. See Chapter Five for details on the TBC II software control.

Switch 1 - Not Used

Figure 2-1. Personal TBC II Jumper Positions



CHAPTER THREE
Installation

This section describes how to install the Personal TBC II card in your computer. The installation procedure is simillar for both IBM and AMIGA type PCs (using the PC compatible expansion slots).

1. Turn off the computer, and disconnect the power cord.
2. Refer to the instructions accompanying your computer for information on how to remove the cover.
3. The computer should contain a number of expansion slots. For the AMIGA PC, use the IBM bridgeboard slots. For IBM compatible PCs, select any convenient empty slot for the Personal TBC card. If the slot is covered, remove the screw that holds the expansion slot cover and remove the cover.
4. Insert the card into the expansion slot on an angle, so that the four BNC connectors exit the rear panel of the computer, and then slide the front of the card into the card guide. Lock the board in place by fastening the retaining bracket with the screw from the slot cover.

For AMIGA type computers, an internal serial cable is provided with the TBC II card, and may be used for the RS-232 connection required for TBC II software control. An external cable is also provided (DB-25 to RJ-11) which may be used for either AMIGA or IBM type PCs. If you want to use the internal RS-232 connection method, perform the following steps:

1. Locate the internal data (12-inch, 3-wire) cable provided with the TBC II card.
2. Refer to figure 3-1, and connect one end of this cable to the AMIGA internal serial data header (Note: this header is located on the AMIGA motherboard, near the rear panel serial DB-25 connector).
3. Connect the other end of this cable to the 3-pin header on the TBC card labelled RS-232 (See figure 2-1).

If you are installing more than one TBC card, perform the following steps to allow the TBC II software to communicate with multiple TBCs:

1. In a multiple TBC card system, one of the TBCs must be connected to the computer's RS-232 port (either internally, as outlined above, or externally using the RS-232 to RJ-11 cable provided). In either case, you must connect the additional TBCs in your system together using the TBC card INPUT data and THRU data connectors. See figure 2-1 in the previous chapter for port location.
2. Locate the short (3-inch, 3-wire) cable provided with the TBC II card.
3. Connect the THRU data output from the TBC (which is or will be connected to the computer's RS-232 port) to the INPUT data connector on the second TBC card to be installed.
4. For additional cards installed, connect the INPUT data connector to the THRU data output of the previous card installed.
5. Make sure that each TBC card in a multiple TBC card system is assigned a unique address (using the DIP switches) as described in Chapter Two.
6. Replace the computer chassis cover.

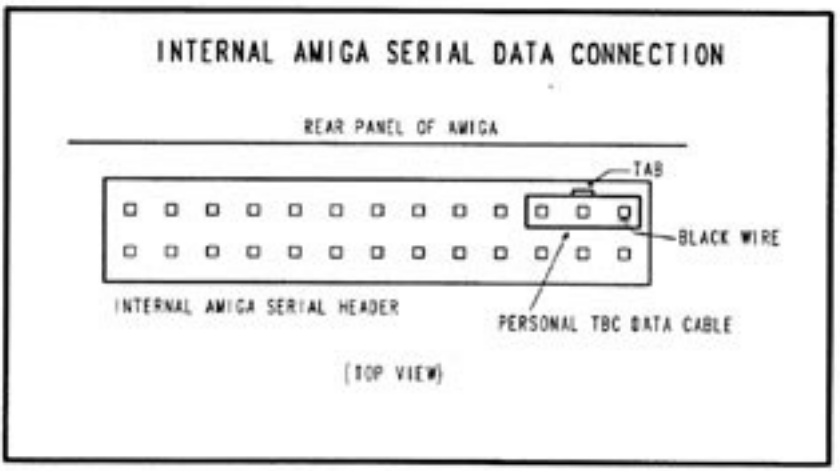


Figure 3-1. AMIGA Internal Serial Data Connection

CHAPTER FOUR
Video Connections

This section describes how to interface the Personal TBC II card with other video equipment in your system. Figure 4-0 shows the location and function of the Personal TBC card I/O connectors, LED, and genlock timing adjustment.

1 - Genlock Timing Adjustment

The rear panel genlock timing adjustment is ONLY used when the TBC II control software is NOT used. Normally, genlock timing is controlled via the TBC II control software.

The genlock timing adjustment is a three-position momentary switch which allows the timing of the TBC card output video signal to be shifted (either advanced or retarded) with respect to the genlock video input applied to the TBC card genlock video input. Adjustment of this control (required ONLY when the TBC II software is NOT used) is explained in Appendix D.

Also, note that any adjustments to this control are stored in non-volatile memory on the TBC card, and are retained when the computer power is turned off.

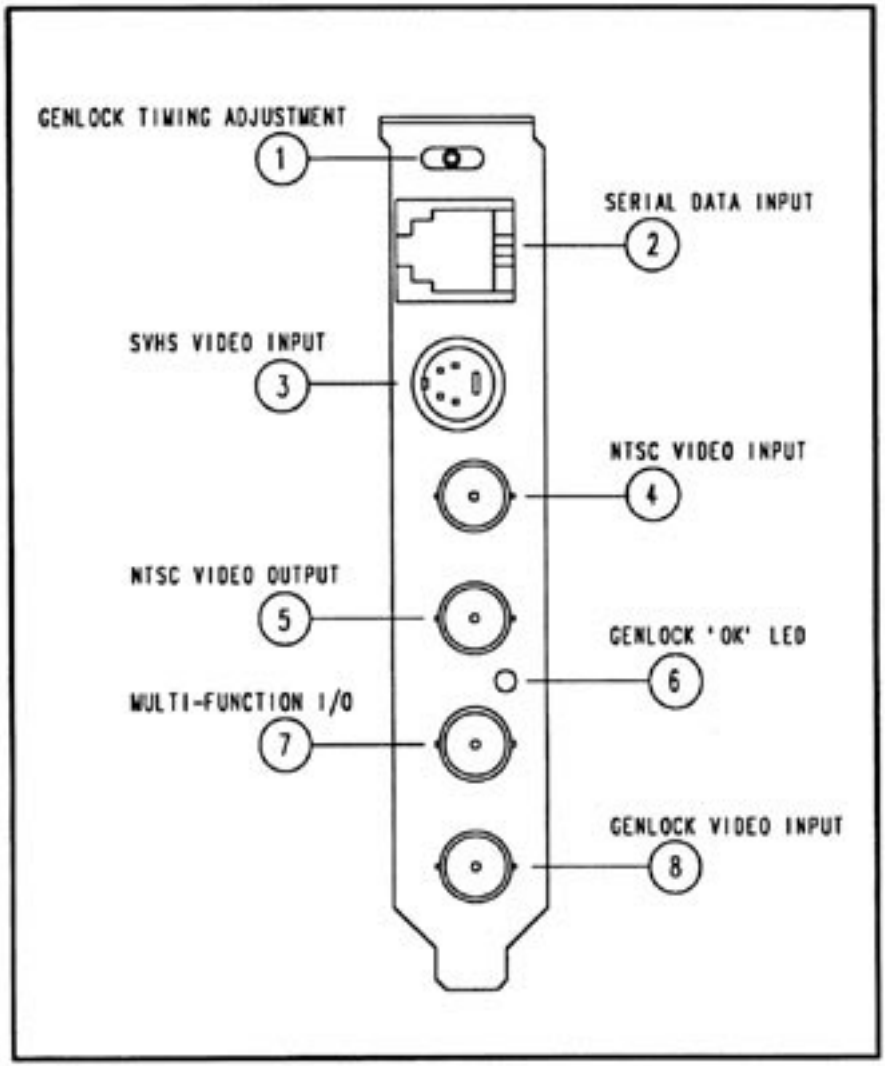
2 - Serial Data Input (RJ-11)

This connector is used with the DB-25 to RJ-11 cable provided, to connect to the computer's RS-232 port. (Note that AMIGA users may use the internal serial data connection, see Chapter Three). To use the TBC II control software provided, one TBC in each system must be connected to the computer's RS-232 port.

3 - SVHS Video Input

This four-pin connector is used to input SVHS type video to the TBC card. It is normally connected to the SVHS video output of the playback VCR using a standard 4-pin to 4-pin S-VIDEO cable. Note: some industrial (JVC) type SVHS players use a 7-pin connector for

Figure 4-0. Personal TBC II I/O Connections



their S-VIDEO output. To interface with such a machine, a 7-pin to 4-pin adapter cable is required.

4 - NTSC Video Input

This BNC type connector is used to input composite NTSC video to the TBC card. It is normally connected to the NTSC video output of a playback VCR, but may be connected to any composite NTSC source (i.e. TV tuner, Laser disk player, camera, etc).

5 - NTSC Video Output

This BNC type connector contains the time-base corrected version of the video input signal.

6 - Genlock OK LED

This LED will light when a valid genlock video signal is connected the the TBC card genlock video input.

7 - Multi Input/Output (I/O) Connector

This is a multi-function I/O connector. The usage of this connector is controlled by the TBC card jumper CHE1 as detailed in Chapter Two. Normally, this connector is used as a 'loop-through' for the genlock video signal. This allows the same genlock signal to be 'looped' to a number of destinations (see examples). This connector may also be used for an advanced sync output by moving CHE1 to the ADV SYNC position. The advanced sync output from this connector can then be connected to the EXT SYNC input on the playback VCR (if the VCR is equipped with this feature). For more information on using the advanced sync, see Appendix A.

The final mode the the multi I/O connector is obtained by moving CHE1 to the VIDEO OUT position. In this case, the multi-I/O connector will provide a second video output which is identical to the main video output.

8 - Genlock Video Input

The genlock video input is used by the TBC card to establish the timing for its video output signal. The signal connected to this input MUST always be a stable (NOT A DIRECT VCR UNTIMEBASE-CORRECTED) signal. When a valid signal is connect to this input, the video output of the TBC card will be co-timed (Genlocked) to this signal, and the genlock OK LED will light.

Interfacing Examples

The following examples illustrate the correct method of interfacing the Personal TBC II card with several different types of video sources. In each case, the output of the TBC card is shown interfaced with a NewTek Video Toaster®. The Video Toaster is typical of most professional video switcher/effects units in that all of its video inputs MUST BE timebase corrected, and co-timed (Genlocked). Also, it is important to note that the Video Toaster derives all of its internal timing from its video-1 (IN-1 on the figures) input, so in each example shown, the connections are made such that all of the toaster inputs will be 'Genlocked' to whatever signal is connected to this input.

Example 1 Single VCR

This example shows how to connect a single (composite or NTSC) VCR to the Video Toaster using the Personal TBC II card. In this example, since there is only one input to the toaster, and it is using the toaster video input-1, there is no need to adjust the genlock timing on the TBC (either via the TBC II control software, or via the rear panel switch) because video input-1 on the toaster is always the master timing reference. Also note that since only a single video source (the VCR) is being handled, there is no need to input a signal to the TBC genlock video input. In this case, the TBC will operate in a 'free running' mode.

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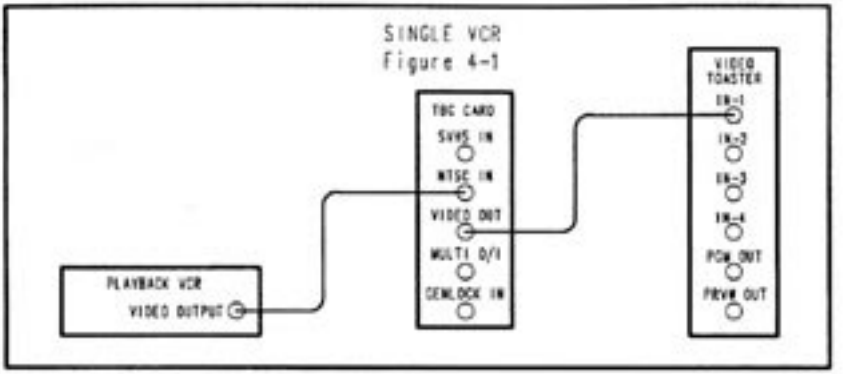
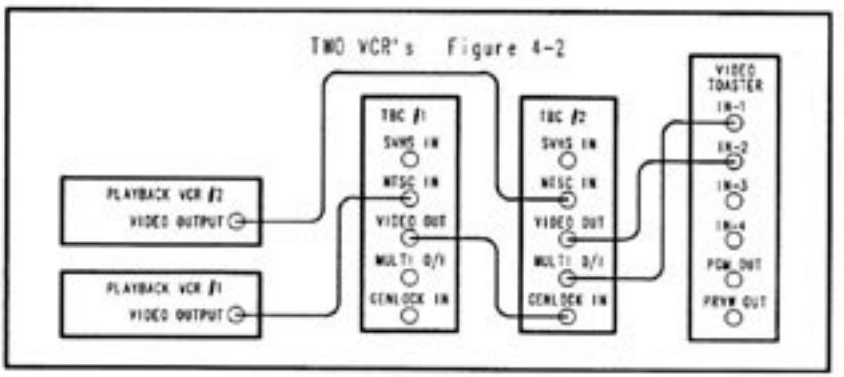


Example 2 Two VCRs

In this example two VCRs are interfaced to the video toaster using two TBC cards. In this case, VCR #1 is connected to TBC #1 which is operated in the 'free running' mode (i.e. no genlock video input is connected to TBC #1). VCR #2 is connected to TBC #2, and the genlock video input of TBC #2 is connected to the video output from TBC #1. (Note: The multi-I/O connector is used as a genlock video 'loop through' on TBC #2 for this example). This connection causes the TBC #2 video output to be co-timed (Genlocked) to that of TBC #1. In this example it will be necessary to adjust the genlock timing control on TBC #2 so that the two signals entering the video toaster (IN-1 and IN-2 in the figure) are exactly co-timed. See Chapter Five for a details on how to use the TBC II control software to perform this adjustment.

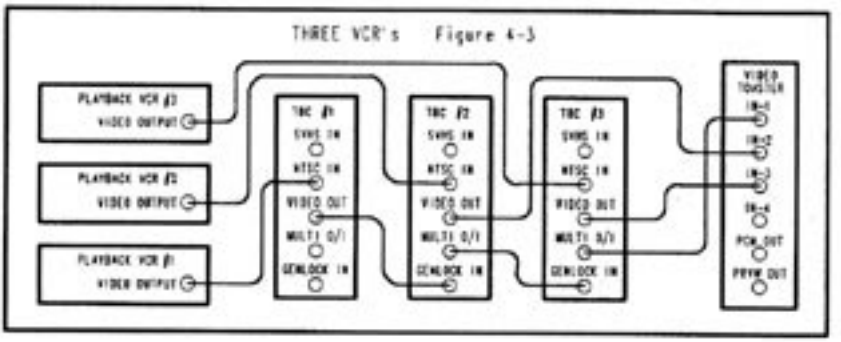
If you are NOT using the TBC II control software, then see Appendix D for details on using the rear panel genlock timing adjustment switch.



Example 3 Three VCRs

In this example three VCRs are connected to the video toaster using three TBC cards. As in the previous examples, TBC #1 (which processes the signal from VCR #1) is the master timing reference (i.e. connected to the toaster IN-1) and, once again is operated in the free running mode (i.e. no genlock video input). TBC #2, and TBC #3 obtain their genlock video inputs from the TBC #1 video output (again using the multi-I/O connector as a 'loop through'). In this example it will be necessary to adjust the genlock timing controls on both TBC #2 and TBC #3. See Chapter 5 for a details on how to use the TBC II control software to perform this adjustment.

If you are NOT using the TBC II control software, then see Appendix D for details on using the rear panel genlock timing adjustment switch.

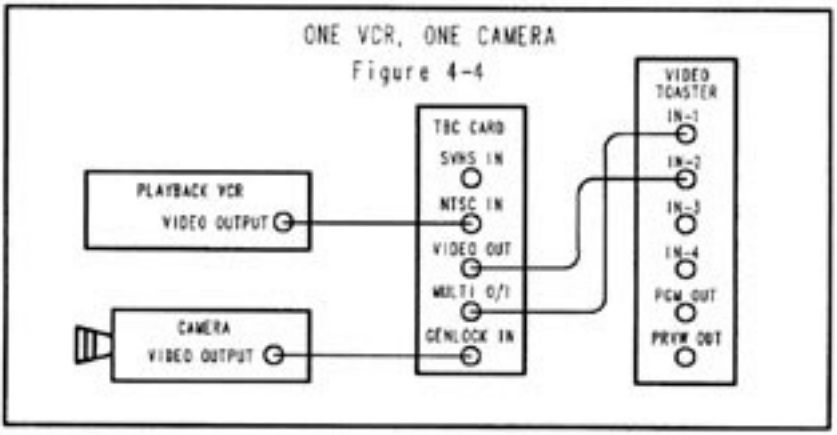


Example 4 One VCR and One Camera

In this example a single TBC card is used to time-base correct, and genlock a single VCR to a camera video feed. In this case the camera video output is used as the master timing reference (i.e. connected to the toaster video IN-1) and is 'looped through' the TBC genlock video input, using the multi-I/O connector as a genlock video loop through. This will cause the TBC output to be co-timed (genlocked) to the camera video signal. In this example, the genlock timing control on the TBC will have to be adjsuted such that its output timing matches that of the camera signal going to toaster input #1. See Chapter Five for a details on how to use the TBC II control software to perform this adjustment.

If you are NOT using the TBC II control software, then see Appendix D for details on using the rear panel genlock timing adjustment switch.

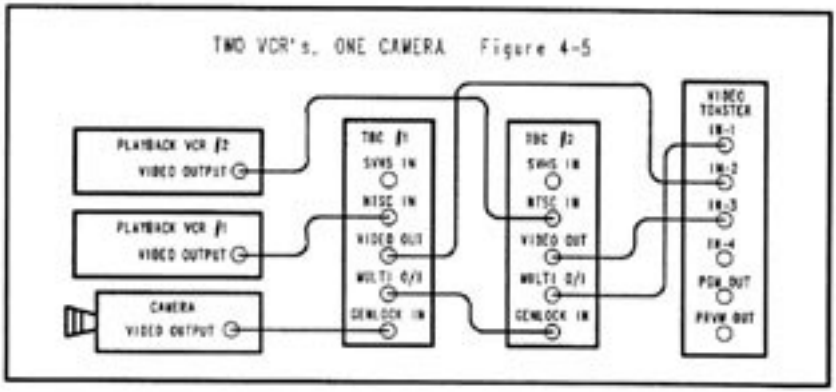
Note: The camera video feed in this example can be from a stand-alone camera or from a camcorder record monitor output. A camcorder playback output cannot be used as a master timing reference, it must be time-base corrected like any VCR playback signal.



Example 5 Two VCRs and One Camera

In this example two VCRs are time-base corrected and genlocked to a camera video signal. As in the previous example, the camera video output is used as the timing reference for the system. The genlock timing controls for the two TBC's in this example must be adjusted so that the video signals entering the toaster on IN-2 and IN-3 in the figure, are exactly co-timed with the signal on IN-1. See Chapter Five for a details on how to use the TBC II control software to perform this adjustment.

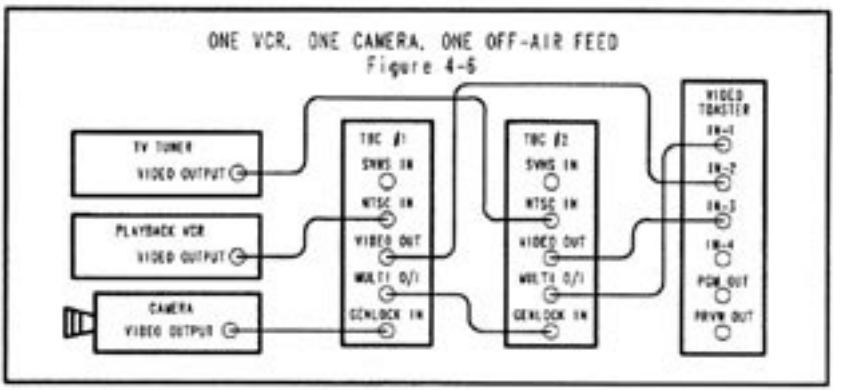
If you are NOT using the TBC II control software, then see appendix D for details on using the rear panel genlock timing adjustment switch.



Example 6 One VCR, One Off-Air feed and One Camera

This example is similar to example 5 except that one of the video feeds is received from a TV tuner. The genlock timing controls for the two TBC's in this example must be adjusted so that the video signals entering the toaster on IN-2 and IN-3 in the figure, are exactly co-timed with the signal on IN-1. See Chapter Five for a details on how to use the TBC II control software to perform this adjustment.

If you are NOT using the TBC II control software, then see appendix D for details on using the rear panel genlock timing adjustment switch.



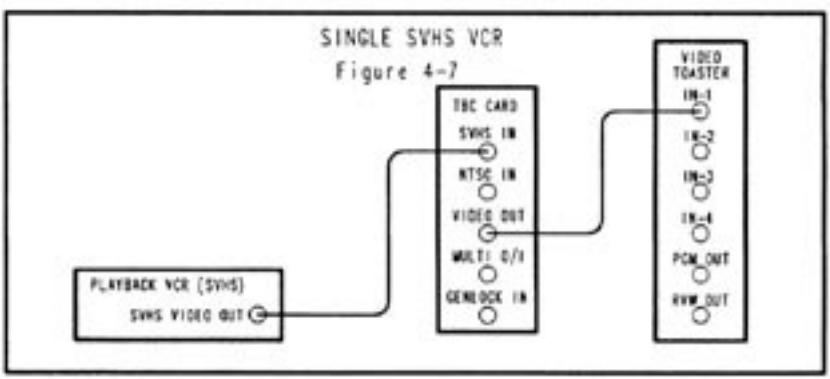
Example 7 Single SVHS VCR

In this example, the TBC card is used to interface an SVHS (separate Y and C output) VCR to the Video Toaster. Most SVHS VCRs also have an NTSC or composite output, which may be used as in the previous examples. Using the SHVS output, as outlined in the next three examples, however will result in better picture quality. In order to use the TBC card in SVHS input mode, it is necessary to connect the SVHS output from the playback VCR to the SVHS input of the TBC card using a standard 4-pin to 4-pin SVHS cable.

Note: The SVHS signal format consists of two separate wires, one for the luminance or black and white information (Y signal) and the other for the chrominance or color information (C signal). This format is sometimes referred to as the Y/C format or Y/C- 3.58 format. Using the SVHS output from a VCR allows the TBC to process the luminance and chrominance information separately, which provides better overall picture quality.

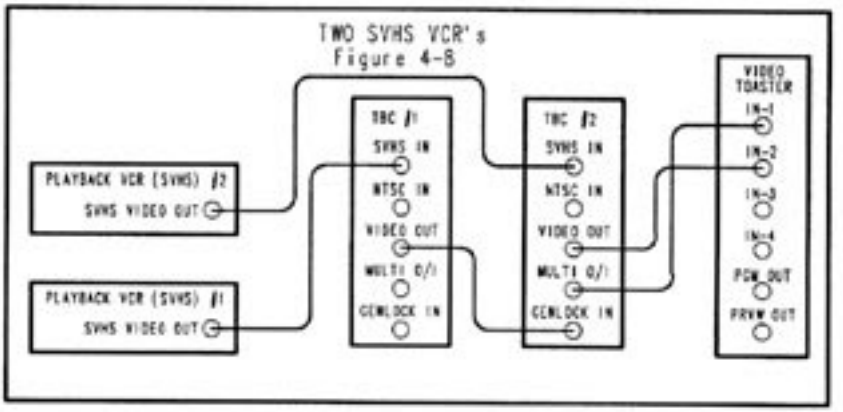
Most SVHS type VCRs use a 4-pin connector to output their SVHS signal. In order to connect this output to the TBC card you use a standard 4-pin to 4-pin SVHS cable.

Some SVHS VCRs (JVC industrial models) use a 7-pin connector to output their SVHS signals. In order to use the TBC card with one of these machines, you must obtain a 7-pin to 4-pin adapter cable. This should be available from the VCR distributor.



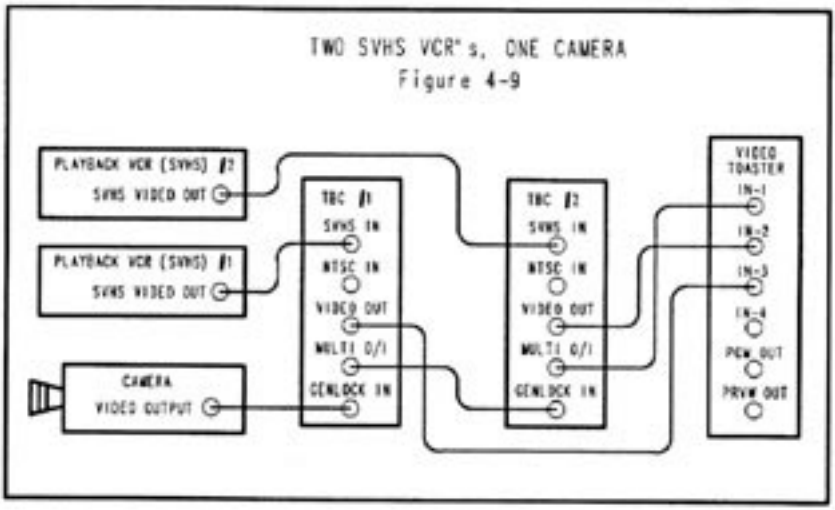
Example 8 Two SVHS VCRs

In this example two SVHS VCRs are interfaced to the video toaster using two TBC cards. See example 7 for details on connecting the SVHS output of the VCRs to the TBCs. As in example 2, TBC #1 is used as the master timing reference for this configuration. The TBC video output is 'looped through' the TBC #2 genlock video input. The genlock timing adjustment is performed in the same manner as for an NTSC type input signal (see Chapter Five).



Example 9 Two SVHS VCRs and One Camera

In this example two SVHS VCRs are time-base corrected and genlocked to a camera video signal. The camera video signal is the master timing reference, and is 'looped through' the genlock video inputs of both of the TBCs. The genlock timing adjustment performed in the same manner as for an NTSC type input signal (see Chapter Five).



Example 10 Using a Laser Disc Player

When using a laser disc player in place of a VCR, refer to examples 1 through 6. All input and output connections remain the same.

CHAPTER FIVE
TBC II Control Software

The TBC II control software program provided with the Personal TBC II card allows the following functions to be manipulated:

- Video Processing (Proc. Amp.) Functions
  - Video Level
  - Black Level
  - Chroma Level
  - Hue Phase
  - Horizontal Position

- Genlock Timing Functions
  - Coarse Timing
  - Fine Timing

- Input Mode
  - NTSC Input
  - SVHS Input

- Frame Memory Control
  - Freeze Mode
  - Live Mode

- Color Balance Control
  - R-Y Shift
  - B-Y Shift

The software can control up to four TBCs at one time, requiring only a single RS-232 port using addressed MIDI protocol.

Installation

From the workbench screen on the AMIGA:

1. Insert the supplied micro-floppy DPS Personal TBC II disk in df0: on the AMIGA.
2. When the icon appears for the TBC disk, click twice to open the TBC disk.
3. Click on the TBC-II icon, and drag it into the workbench screen area.
4. Click on the closed box of the TBC disk.
5. Click twice on the Toaster drawer (the drawer containing the toaster icon, which you use to startup the toaster) to open it.
6. Click and drag the TBC-II icon into this drawer so that it appears in the same drawer as your toaster startup icon.

Running the TBC II Program

Before running the TBC II software, you MUST set the AMIGA preferences for the 80-character mode, and SERIAL preferences for 31.25kB/s, 8 bits, No parity, No Handshaking. Refer to the AMIGA documentation if you do not know how to do this.

Also, make sure that you have connected one of the TBCs to the AMIGA serial port (see Chapter Three).

Normally, the TBC II software is run in the background of the toaster environment, allowing quick changes to be made to video levels without having to exit and restart the toaster. Before trying this, perform the following steps to verify the TBC card operation. For each TBC card in your system:

1. Connect a picture monitor directly to the TBC card video output.
2. Run the TBC II software by double clicking its icon.
3. Select the appropriate VTR-1, VTR-2, VTR-3 or VTR-4 box on the TBC II control screen (see DIP switch setting in Chapter Two).

4. For each TBC card, select the correct input mode (NTSC or SVHS) on the TBC II control screen.

5. Verify that the TBC II software is controlling each card by moving the video level slider while observing the picture monitor.

6. Hold down the right mouse button, and select the 'Save Defaults' options from the TBC II project menu. This will save the correct input mode (NTSC or SVHS) for each TBC in your system.

Once you have installed the TBC II software so that the TBC II icon appears on the same workbench screen as the toaster startup icon, double click on the toaster startup icon to begin the toaster operation as you normally would. When the toaster has initalized, press <Ctrl> (Control Key on the AMIGA keyboard) twice, and then press the <Alt> (Alternate key on the AMIGA keyboard) twice. This four-key sequence will return you to the workbench screen.

Now double click on the TBC-II icon to startup the TBC control software. This will display the main TBC II control screen. At this point you may freely switch between the toaster switcher screen and the TBC-II control screen by using the <Ctrl> <Ctrl> <Alt> <Alt> four-key sequence at any time.

Adjusting Genlock Timing

The next step in configuring most TBC card installations involves adjusting the genlock timing for some or all of the TBCs in your system. Any TBCs in your system which ARE NOT connected to toaster input #1 must have their genlock timing adjusted, so that the video output signal they produce is co-timed exactly with that of toaster video input #1. A simple method of accomplishing this is to use the color bar test signal produced by the toaster when it initializes (select DV2 on the program buss after the toaster initializes), though any colorful signal source can be used. Make a short recording of this signal on the VCR which is connected to the TBC whose genlock timing is to be adjusted. Then, playback this signal while selecting the TBC on the program buss of the toaster. You should see the playback signal appear on your program monitor, but the colors will probably be wrong. Access the TBC II control

software <Ctrl> <Ctrl> <Alt> <Alt> key sequence. Select the appropriate VTR, VTR-1, VTR-2, VTR-3 or VTR-4 on the TBC II control screen. Click on the Genlock Enable box to enable adjustment of genlock timing (normally disabled to prevent inadvertant adjustments). Adjust the genlock timing FINE slider; don't worry if you reach the end of the range, the coarse timing will automatically change, and you can continue adjusting the fine control in the same direction. Continue to move the fine slider until the colors of the playback are correct. If you prefer, you can return to the toaster screen <Ctrl> <Ctrl> <Alt> <Alt> key sequence, and compare the playback signal to the original toaster color bar signal to make this adjustment.

Repeat the above procedure for each TBC requiring genlock timing adjustment in your system. When this is completed, press the right mouse button to access the TBC II project menu, and select the Save Defaults option. This will produce a file containing the input mode, and genlock timing information for each TBC in your system. The TBC II software reads this file whenever it is started so that these settings can be loaded into each of your TBC cards.

Video Processing (Proc. Amp.) Functions

The Proc Amp functions are probably the most often used controls on the TBC II screen. These controls allow the video signal to be modified, so that raw footage from different sources and lighting conditions will 'look good' when edited together. The following is a description of each of these functions:

- Video Level
  This control allows you to change the overall signal level of the video. This results in a changed in the contrast of the displayed picture.

- Black Level
  This control allows you to change the DC level of the video signal. This results in a change in the brightness of the displayed picture.

- Chroma Level
  This control allows you to change the chrominance level of the signal. This results in a change in the amount of color or saturation in the displayed picture.

- Hue Phase
  This control allows you to change the chrominance phase. This results in a change in the color hue of the displayed picture.

- Horizontal Position
  This control allows you to change the horizontal position of the processed video signal. It should not be confused with genlock timing adjustment. This control moves the active video portion of the signal only, leaving all genlock timing unaffected. It is used in certain editing situations when the exact horizontal alignment of two signals being edited is important.

Input Mode Selection

One of two input modes are selectable:

- NTSC mode
  Selects the NTSC input mode. The input signal to this TBC must be connected to the NTSC input BNC.

- SVHS mode
  Selects the SVHS input mode. The input signal to this TBC must be connected to the 4-pin SVHS video input connector.

Note: The selected input mode for each TBC is saved in the TBC defaults file produced by the TBC II software.

Frame Memory Control

One of two frame memory modes are selectable:

- Live mode
  Normal video processing mode.

- Freeze mode
  Freezes a single field of the input video signal when clicked. Note: this freeze will shift horizontally when engaged, it is intended for offline work only, such as locating edit points, etc.

Color Balance Control

Click on the color balance control box to open the TBC II color balance control window. This window consists of a rectangluar area with a cross-hair cursor and the three primary color axis. If you drag the cross-hair cursor around the window, you will change the color balance in the processed video signal as indicated by the change in the rectangular area. This feature is used mainly to correct for footage shot with incorrect white balance. If the white areas of a particular tape or scene do not appear white, this control can be used to correct this. This control may also be used to add a color 'wash' to a scene by dragging the cross-hair cursor in the appropriate direction. (Note: this may work better if the Chroma level control on the main TBC II screen is set to its minimum setting).

Store & Recall Operations

The 10 store and recall boxes are used to save proc amp and color balance settings. The settings will be saved to a disk file called "TBC.data". The UNITY box resets all proc amp and color balance settings to unity. The previous box causes settings present before a recall or unity operation to be restored.

TBC II Project Menu

The TBC II project menu is accessed by holding down the right mouse button. The items in this menu are used for saving and loading default configurations for the TBCs.

- Save Defaults
  This function causes all of the current settings for all TBCs to be saved to a file called "TBC.Defaults". This file is always loaded when the TBC II program is started, and used to establish the initial settings for all TBCs in a system.

- Save . . .
  This function saves all settings for all TBCs to a disk file named by the user. It is normally used to save an alternative configuration (which may require different genlock timing setups, etc) for your system.

- Load Defaults
  This function causes the current "TBC.Defaults" file to be loaded and the settings of all TBCs to be updated to match this file. Note that this operation takes place automatically whenever the TBC II program is started.

- Load . . .
  This function allows an alternative set of TBC settings to be loaded from a file previuously saved using the Save ... function above.

- Quit
  Exits the TBC II program. If any of the TBC settings have been altered, the user is prompted with the option to update the "TBC.Defaults" file.

CHAPTER SIX
Specifications

Video Input (NTSC mode) ..... 1V p-p

Y Input (SVHS mode) ..... 1V p-p

C Input (SVHS mode) ..... 286mV p-p burst level

Video Output ..... 1V p-p

Reference Video Input ..... 1V p-p

Advanced Sync Output ..... 2V p-p

Bandwidth (NTSC mode) ..... 4.2 MHz

(SVHS mode) ..... 5.5 MHz

Correction Window ..... Infinite

Signal-to-Noise ..... >58dB

Differential Phase ..... $<2^{\circ}$

Differential Gain ..... <2%

K Factor:

- Y/C Input 1%
- NTSC Input 3%

Residual Time Base Error ..... <15nS

Serial Data Input ..... RS-232 Levels @ 31.25/9.6kB/s

Proc Amp Controls:

- Video Level ..... ±3dB
- Black Level ..... ±20IRE
- Chroma Level ..... ±6dB
- Hue Phase ..... $\pm 45^{\circ}$
- Horiz Pos ..... ±1uS

Color Balance:

- R-Y Shift ..... ±20%
- B-Y Shift ..... ±20%

Genlock Timing:

Coarse	±4uS
Fine	±360°

Power Consumption	8.4 Watts
	+5V @ 500mA
	+12V @ 400mA
	-12V @ 90mA

APPENDIX A
Using The Advanced Sync Output

The Personal TBC card has the ability to generate an advanced sync signal, which may be jumpered (see Chapter 2) to appear on the multi-I/O connector. This signal can be connected to the EXT SYNC input on the playback VCR. This connection will force the VCR to maintain a playback rate which is, on average, correct for the TBC. Without this connection, the TBC will occasionally have to either repeat or delete frames of video in order to maintain genlock with the reference video input. This normally is not a problem, as the 'frame stuffing' occurs so infrequently (perhaps one frame every twenty minutes or so) that it is not noticeable. The advanced sync connection is normally used when precise 'time-code' editing is being performed.

If you want to use the advanced sync output, make sure to move jumper CHE1 on the TBC card to the ADV SYNC position (as detailed in Chapter Two). Also, be sure to select external sync. mode on your playback VCR (refer to the VCR operating instructions if necessary).

Note: You may have to use a BNC 'T' connector to 'loop' your reference video feed when using the multi-I/O connector for advanced sync output.

APPENDIX B
Troubleshooting

General

When a problem occurs in a complex setup involving multiple pieces of video equipment, always try to reduce the complexity of the setup by disconnecting pieces of equipment until you can obtain a minimum configuration which still exhibits the problem. For the TBC card, connecting a picture monitor directly to the video output will enable you to monitor whether the TBC is correctly processing video, independent of other equipment in your system.

TBC II Software

If the TBC card will not respond to the TBC II software, ensure that the following steps have been performed:

1. Set the AMIGA Serial preferences to 31.25kB/s, No parity, No Handshaking.
2. Set the AMIGA preferences to 80 Characters.
3. At least one of the TBCs must be connected to the AMIGA serial port, and all other TBCs must be connected together internally using the on-card data THRU and data INPUT connectors (see Chapter Three).
4. The TBC address for each TBC card must be unique, and must correspond to the VTR-1, VTR-2, VTR-3 and VTR-4 box selected on the TBC II control screen (See Chapter Two).

System Timing

When adjusting the genlock timing control to obtain a color match (as outlined in Chapter Five) you may notice that when the color match is obtained, the horizontal position of the video signal is not correct. If this happens, use the genlock coarse slider to move the video to the correct position. Also, note that fine adjustment of the horizontal position of the video is possible using the proc amp Horiz slider. When adjusting the genlock timing, the Horiz slider is auto-

matically set to its unity position. Use the genlock coarse slider to obtain the best possible horizontal position match. Then, if necessary, use the Horiz position slider to make fine adjustments for a perfect match.

Video Break-up or Loss of Lock

If the video output from the TBC does not appear correct (i.e. breaks up or loses lock) then observe the LED on the rear panel of the TBC card.

If you are using a genlock video input to the TBC, the Genlock OK LED should be on. If it is not on, or if it is flashing, something is wrong with your genlock video feed. This signal must always be a stable video feed (i.e. either from a camera, another TBC, or a TV signal generator).

Video Output is Frozen

If the video output from the TBC card appears as a frozen picture, the input video has probably disappeared (i.e. tape is past the end of record material). Whenever the TBC card detects that the input video signal is missing, it will freeze the last good picture and display this frame until the input signal returns (referred to as 'hot switching' feature). This feature can be disabled by moving DIP switch 6 (see Chapter Two).

Appendix C
TBC II Software Protocol

This appendix describes the serial data interface to the TBC II card. This information is not required to use the card since the TBC II program provided with the card is normally used to control the card, but rather for users/programmers who want to develop their own custom driver software for the card.

Note that the TBC cards are equipped with a jumper which normally causes the RS-232 transmit data (output from the card) to be high impedance. This is to allow other applications to use the RS-232 port on the AMIGA. The TBC II program provided with the card uses a one-way communications design, and does not make use of the TBC card command response (usually ACK characters). If you want to use two-way protocol (this will also allow certain status information to be transmitted from the TBC to your application), the transmit data control jumper on the TBC card must be moved to the 'TX' position (see Chapter Two).

Electrical Interface

The electrical interface is RS-232 using the Amiga built-in RS-232 port, or any other RS-232 port which may reside on an Amiga expansion card. The bit rate will be set to 31.25kB/S or 9.6kB/S (DIP switch selectable on the TBC, see Chapter Two), with 8 data bits, 1 stop bit, no parity.

Protocol

The software protocol is MIDI compatible format, using the system exclusive feature of the MIDI interface. Communication with the TBCs is initiated when the system exclusive command byte (F0 hex) is received, followed by the TBC ID code (67 hex).

The next byte sent is the TBC address byte, which determines which TBC is being addressed by the command. This is followed by a TBC function select byte, and one or more data bytes. The communications is completed when the MIDI end system exclusive byte is sent (F7 hex).

The following table summarizes the protocol:

HOST: System Exclusive Byte (= F0 hex)
TBC ID Byte (= 67 hex)
TBC Address Byte (= 00-7F hex)
Function Select Byte (= 00-7F hex)
Data Byte 1
Data Byte 2
. . .
Data Byte N
End System Exclusive (= F7 hex)

TBC Response : - ACK Byte (= 40h) or NACK Byte (= 45h)

System Exclusive Byte:
This byte is used in the MIDI protocol to allow manufacturers of MIDI equipment to define messages specific to their own equipment. The system exclusive mode remains in effect until the end system exclusive command is sent.

TBC ID Byte:
This byte is the unique code which identifies the exclusive data for the particular personal TBC.

TBC Address Byte:
This byte determines which TBC the following command is directed to. Each TBC card is equipped with a DIP switch which determines its address according to the table below.

	TBC DIP Switches		
TBC Address Byte	Sw-5	Sw-4	Sw-3
00	DOWN	DOWN	DOWN
01	UP	DOWN	DOWN
02	DOWN	UP	DOWN
03	UP	UP	DOWN
04	DOWN	DOWN	UP
05	UP	DOWN	UP
06	DOWN	UP	UP
40	UP	UP	UP (Master)
7F	All (Ack'ed by master only)		

Note that the last entry in the table selects all TBCs. This allows the parameters of all installed TBCs to be simultaneously updated. If used, this command will be acknowledged by the master TBC only. Normally, when an individual TBC is addressed, the command will be acknowledged by that TBC.

TBC Function Select Byte/Data Byte(s):
The Function byte determines which function on the addressed TBC card will be affected by the command. Most commands follow this byte with two characters that represent the new hex value for the selected function. The table below lists each function, and the associated data bytes:

Function Byte	Data Byte(s)	Description
01h	2 (0,0-F,F)	Set luminance level command 00 = Minimum luminance level FF = Maximum luminance level
02h	2 (0,0-F,F)	Set black level command 00 = Minimum black level FF = Maximum black level
03h	2 (0,0-F,F)	Set chroma level command 00 = Minimum chroma level FF = Maximum chroma level
04h	2 (0,0-F,F)	Set hue command 00 = Max counter clockwise FF = Max clockwise

These first four commands will be used most often. They allow each of the TBC proc. amp. functions to be individually manipulated.

Function Byte	Data Byte(s)	Description
05h	2 (0,0-F,F)	Set Genlock timing Fine 00 = Most Retarded setting FF = Most Advanced setting (0.55nS/increment)
06h	2 (0,0-3,F)	Set Genlock timing coarse 00 = Most retarded setting 3F = Most Advanced setting (140nS/increment)

Commands 05, and 06 are used to adjust the genlock timing of the TBC card. When the genlock timing fine control is incremented from FFh - 00h, the coarse control should be incremented to maintain a continuous control effect. Similarly, when the fine setting is decremented from 00h - FFh, the coarse control should be decremented. Whenever the genlock timing is to be adjusted, the TBC status should be read (see command 0Ah) to ensure that the addressed TBC is in Genlock mode (the system phase is not significant when the TBC is in free-running mode).

The genlock timing control on the TBC card adjusts BOTH horizontal (ie sync timing) and subcarrier phase simultaneously in such a manner as to ALWAYS maintain a zero SCH relationship at the TBC video output (unlike some equipment which allows for separate sync and subcarrier adjustments). The correct adjustment procedure is to firstly obtain the closest possible horizontal phasing (in a studio a waveform monitor would be used, without one, the adjustment can be performed using a split screen). This horizontal phasing should be done by incrementing/decrementing the genlock timing coarse setting in steps of 2 (2 x 140nS = 1 subcarrier cycle) which will move the picture without changing the color phasing.

The fine setting, and the LSB of the coarse setting can now be adjusted for correct color phase. Note that if this adjustment is performed WITHOUT a vectorscope (i.e. by observing the color phase on a picture monitor), it is important that the TBC hue setting be centered, set to 80h, so that correct system timing is achieved).

Function Byte	Data Byte(s)	Description
07h	2 (0,0-F,F)	Set Horizontal position 00 = Most Retarded setting FF = Most Advanced setting

The horizontal position control moves the active video portion of the picture, while NOT affecting the output sync and burst. When proper genlock timing is set, this control is used to move the active video portion of the signal as may be required for certain editing situations. This control should be set to unity (80 hex) when the system phase is manipulated (if the on-screen method of adjusting system phase is used).

Function Byte	Data Byte(s)	Description
08h	1 (0-1)	Input mode Select 0 = NTSC input mode 1 = SVHS input mode

Function Byte	Data Byte(s)	Description
0Ch	1 (0-1)	Freeze/Live mode Select 0 = LIVE mode 1 = FREEZE mode

Function Byte	Data Byte(s)	Description
0Dh	0	Request TBC brief status info.

Command 0D is used to request status information from the TBC. The TBC responds with the following status byte (followed by the normal ACK byte).

Bit 7 Always 0

Bit 6 (Genlock Status) 1 = Genlocked
0 = Free-running

Bit 5 (Input Video Pres) 1 = Input present
0 = No Input present

Bit 4 (Freeze/Live Mode) 1 = Freeze mode
0 = Live mode

Bit 3-0 (Software Version ID)

Function Byte	Data Byte(s)	Description
0Eh	0	Request TBC full status info

This command requests a complete status dump from the addressed TBC. The status information consists of the brief status byte (see command 0Dh), followed by two ASCII characters for each of the proc amp and system phase settings, which represent the hex value of their current setting as indicated below.

Byte	Description
1	Brief status byte (see command 0Dh)
2	MSN of Video Level
3	LSN of Video Level
4	MSN of Black Level
5	LSN of Black Level
6	MSN of Chroma Level
7	LSN of Chroma Level
8	MSN of Hue Level
9	LSN of Hue Level
10	MSN of Fine System Phase
11	LSN of Fine System Phase
12	MSN of Coarse System Phase
13	LSN of Coarse System Phase
14	MSN of Horiz Position
15	LSN of Horiz Position
16	Input Mode 0 = NTSC, 1 = SVHS
17	MSN of Blue Color Balance
18	LSN of Blue Color Balance
19	MSN of Red Color Balance
20	LSN of Red Color Balance
21	TBC ACK byte

Note: MSN = Most Significant Nibble (ASCII 0 - 9 or A - F)
LSN = Least Significant Nibble

Function Byte	Data Byte(s)	Description
10h	2 (0,0-F,F)	Set Blue color balance 00 = Most Neg Blue balance 80 = No Blue balance FF = Most Pos Blue balance
11h	2 (0,0-F,F)	Set Red color balance 00 = Most Neg Red balance 80 = No Red balance FF = Most Pos Red balance

Note: All TBC settings are maintained upon power-down in non-volatile memory on the TBC card.

APPENDIX D
Genlock Timing Adjustment

The rear panel genlock timing adjustment switch should only be used if you are NOT going to use the TBC II control software provided. If you adjust the genlock timing using this switch, any setting will be lost if the TBC II control software is subsequently run. If you are using the TBC II software, refer to Chapter Five for details on setting the genlock timing.

Adjusting the Genlock Timing Switch

The best signal to use to setup the genlock timing is the color bar test signal produced by the toaster when it initializes (select DV2 on the program buss after toaster initialization), although any color video signal can be used. Make a short recording of this signal on the VCR connected to the TBC whose genlock timing is to be adjusted. Then, playback this signal while selecting the TBC on the toaster program buss. You should see the playback signal appear on your program monitor, but the colors will probably be wrong.

Next, press and hold the genlock timing switch on the TBC rear panel until the colors viewed on the screen match, then release the switch. If you 'overshoot the mark', operate the switch in the opposite direction to obtain a match. When done, the setting will automatically be stored in non-volatile memory on the TBC card, even when the computer is powered down; however, it may be necessary to readjust the genlock timing if you recable your system using different length cables, due to the signal delays introduced.

IMPORTANT NOTE

When adjusting the genlock timing switch to obtain a color match, you may notice the horizontal position of the video signal is not correct when the color match is obtained. If this occurs, continue to adjust the genlock timing switch such that the video signal moves horizontally in the desired direction while ignoring the color phase. When the horizontal position is approximately correct, use the genlock timing switch to adjust the color phase.

APPENDIX E
FCC Compliance Statement

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference with radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult a dealer or an experienced Radio/TV Technician for help.

Shielded cables must be used with this unit to ensure compliance with Class A FCC Limits.

FCC ID: I25VT2000PCTBC

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference and (2) This device must accept any interference received, including interference that may cause undesired operation.

APPENDIX F
Warranty

Digital Processing Systems Inc. warrants the original purchaser that this product is in good working condition for a period of two years from the date of purchase. Should this product, in Digital Processing Systems opinion, malfunction within the warranty period, Digital Processing Systems Inc. will repair or replace this product without charge. Any replaced parts become the property of Digital Processing Systems Inc. This warranty does not apply to those products which has been damaged due to accident, unauthorized alterations, repairs or modifications.

Limitations

All warranties for this product, expressed or implied, are limited to two years from the date of purchase and no warranties, expressed or implied, will apply after that period.

The distributor, its dealers and customers agree that Digital Processing Systems Inc. shall not be liable for any loss of use, revenue or profit.

Digital Processing Systems Inc. makes no other representations of warranty as to fitness for purpose of merchantability or otherwise in respect to any of the products sold to the distributor pursuant to this agreement.

The liability of Digital Processing Systems Inc. in respect of any defective products will be limited to the repair or replacement of such products.

In no event shall Digital Processing Systems Inc. be responsible or liable for any damages arising from the use of such defective products whether such damages be direct, indirect, consequential or otherwise and whether such damages are incurred by the distributor or third party.

Warranty Service

Units requiring repair under warranty may be sent directly to Digital Processing Systems Inc. To obtain service under this warranty, first contact:

Digital Processing Systems Inc.
Customer Service Department
(416) 754-8090

and request a Return Material Authorization Number (RMA). This number must be clearly displayed on the units external packaging. Units shipped without an RMA number will not be accepted. Include with the unit, proof of purchase (including date of purchase), a note outlining the problem, and the RMA number.

IMPORTANT: When shipping your unit, pack it securely and ship it prepaid and insured. Digital Processing Systems Inc. will not be held liable for damage or loss to the product in shipment. Priority return air freight charges are the responsibility of the purchaser.