# Model 5150 Afterburner
# LTC/VITC Timecode Reader
# Character Inserter

# Instruction Manual

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Revision 1.2. November 1995

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# INFORMATION TO USERS IN EUROPE

## NOTE

### CISPR 22 CLASS A DIGITAL DEVICE OR PERIPHERAL

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to the European Union EMC directive. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

# INFORMATION TO USERS IN THE U.S.A.

## NOTE

### FCC CLASS A DIGITAL DEVICE OR PERIPHERAL

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

## WARNING

Changes or Modifications not expressly approved by Evertz Microsystems Ltd. could void the user's authority to operate the equipment.

Use of unshielded plugs or cables may cause radiation interference. Properly shielded interface cables with the shield connected to the chassis ground of the device must be used.

## REVISION HISTORY

| REVISION | DESCRIPTION | DATE |
|---|---|---|
| 1.0 | Original issue | Aug. 94 |
| | Manual Change Sheet 1.0-2 inserted | Nov. 94 |
| 1.1 | Manual change sheet 1.0-2 incorporated into manual<br>Preliminary Serial Remote Control added | Jan. 95 |
| 1.2 | Incorporated Serial Remote Control Protocol chapter | Nov. 95 |
| | Manual Change Sheet 1.0-3 inserted | Dec. 95 |
| | Technical Bulletin “B_KKODES.DOC” inserted | Oct. 96 |
| | Manual Change Sheet 1.0-4 inserted | Nov. 96 |

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# Technical Bulletin

**Issue Date: October 23, 1996**
**Revision Date July 18, 1997**
**Revision Date: August 10, 1998**

**Product: 4015, 4025, 5500, 5150**

**Subject: Question Marks in the KeyKode**

**Author: Alan Lambshead**

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If you are seeing a question mark in place of the film manufacturer or film type when reading and displaying KeyKode (see note 1), the reason is as follows. The film bar-code has a human readable component which shows the film manufacturer as a letter ('A','K' or 'F' for Agfa, Kodak and Fuji) and the film type as a letter (ex. 'J' for Kodak 5296 type film). The actual bar-code contains only numbers and so the manufacturer and type must be encoded as a numeric code. For clarity and the convenience of the user, Evertz has chosen to display these codes exactly as shown in the human readable portion of the film. We translate the codes into the alphabetic characters as established by each film manufacturer.

From time to time new film types with new codes are introduced by the film manufacturers. When these new films are read or displayed by existing Evertz software, they may show as a question mark ('?') in place of either the film manufacturer or film type or both. The rest of the bar-code is read and handled correctly. The actual codes are internally used by the software, and the KeyKode foot and frames are completely accurate. Only the display of the codes is affected.

Evertz takes great pains to ensure that the code translation tables are up to date and accurate and we endeavor to obtain the information from the film manufacturers in advance of the release of new film products. The film manufacturers and film products currently supported are shown below on the following chart.

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| Manufacturer | | | Emulsion | | Film Type |
|---|---|---|---|---|---|
| | Code | Letter | Code | Char | |
| **Agfa** | 01 | A | 20 | N | XT 100 |
| | 11 | | 24 | M | XTR 250 |
| | | | 83 | F | XT 320 |
| | | | 84 | S | XTS 400 |
| **Kodak** | 02 | K | 00 | P | 5600 |
| | 12 | | 20 | Y | 5620 Prime Time |
| | | | 22 | E | 5222/7222 |
| | | | 24 | L | 5224 (obsolete stock) |
| | | | 31 | H | 5231/7231 |
| | | | 34 | D | 5234/7234 |
| | | | 43 | A | 5243/7243 (obsolete stock) |
| | | | 44 | V | 5244/7244 |
| | | | 45 | K | 5245/7245 |
| | | | 46 | I | 5246/7246 Vision 250D |
| | | | 47 | B | 5247/7247 |
| | | | 48 | M | 5248/7248 |
| | | | 49 | O | 5249 (obsolete stock) |
| | | | 72 | S | 5272/7272 |
| | | | 74 | Z | 5274/7274 Vision 200T |
| | | | 77 | Q | 5277/7277 |
| | | | 79 | U | 5279/7279 |
| | | | 87 | W | 5287/7287 |
| | | | 89 | R | 5289 Vision 800T |
| | | | 92 | N | 7292 (obsolete stock) |
| | | | 93 | L | 5293/7293 |
| | | | 94 | G | 5294/7294 (obsolete stock) |
| | | | 95 | F | 5295 |
| | | | 96 | J | 5296/7296 |
| | | | 97 | C | 5297/7297 |
| | | | 98 | T | 5298/7298 |
| **Fuji** | 03 | F | 01 | I | FCI (8501, 8601, 8701) |
| | 13 | | 02 | I | FCI (8502, 8602, 8702) |
| | | | 10 | N | F-64 (obsolete stock 05/95) |
| | | | 13 | I | FCI (obsolete stock) |
| | | | 14 | N | F-500 (obsolete stock) |
| | | | 20 | N | F-64D (obsolete stock 05/95) |
| | | | 21 | N | F-64D (8521, 8621, 8721) |
| | | | 22 | N | F-64D (8522, 8622) |
| | | | 30 | N | F-125 (obsolete stock 05/95) |
| | | | 31 | N | F-125 (8531, 8631, 8731) |
| | | | 32 | N | F-125 (8532, 8632) |
| | | | 50 | N | F-250 (obsolete 05/95) |
| | | | 51 | N | F-250 (8551, 8651, 8751) |
| | | | 60 | N | F-250D (obsolete stock 05/95 |
| | | | 61 | N | F-250D (8561, 8661, 8761) |
| | | | 70 | N | F-500 (8570, 8670, 8770) |
| | | | 71 | N | F-500 (obsolete stock) |
| | | | 91 | N | RP (8691 16 mm B/W neg) |
| | | | 92 | N | FG (8592 35mm B/W neg) |

**Film Manufacturers and Film Types (as of August 10, 1998)**

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If the question marks show up when you work with a certain film product, check the above table to see if this code is currently supported. If it is, then you can obtain updated software for your Evertz product which will correct the problem. You may arrange this by requesting that the Software Upgrade Info form for your particular Evertz product be faxed to you. Alternatively, you may download the form from the relevant area of our BBS.

Complete the form with the required information and mark it as a request for a software upgrade. For clarity, add the words "KeyKode question mark fix for -- " and add the particular manufacturer and film type you are having troubles with. This will allow us to ensure that this particular code is in the current version of the software for your Evertz equipment. Fax the form back to us and arrange shipment and payment (if any) details with our office staff. (Sorry, you cannot upload the form to us.)

If it appears that you have stumbled across a new manufacturer code or type that is not in the above table, try to determine the codes being used. The Evertz 5500 KeyKode reader provides a display mode which will show the actual numeric manufacturer and type codes. Request or download the form as above. Mark the numeric codes on the form if this information is available. Fax the form back to us and contact Evertz to determine when the updated software will be available.

The most current software for many of our products is also available via our web page and from our BBS. This will provide a quicker update of your equipment and at no charge. The Evertz models 5500 and 5150 can be updated by via a serial link from a PC which is running our loader program. Other Evertz products such as the 4015 and 4025 require that you have a 'EPROM burner' which can handle Intel Hex files and can program EPROMS of type 27512 and smaller. The appropriate instructions are available in the relevant areas of our BBS.

---------- NOTES ----------

1: KeyKode is a registered trademark of Kodak. This document uses KeyKode to refer to the film bar-code of all film manufacturers.

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# TABLE OF CONTENTS

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# 1. INTRODUCTION

The Model 5150 Afterburner LTC/VITC Timecode Reader combines the latest LSI technology with sophisticated microcontroller firmware to provide a powerful, flexible time code reader system. The Afterburner is a dual LTC/VITC reader and multi-function character inserter. Its power and flexibility are unsurpassed in time code reader applications. A 16 digit alphanumeric display can be quickly delegated to show the required data. The Afterburner contains three separate readers that can be operated independent of each other, or two can be linked to form an auto LTC/VITC reader. The Afterburner can be configured in one of four basic operating modes:

- Reader 1: Full speed (1/30 to 70 times play) LTC reader.
  Reader 2: 0 to 40X speed VITC reader
- Auto LTC/VITC reader automatically switches between LTC and VITC inputs reading whichever is valid.
- Dual VITC reader - reads VITC from two sets of lines on the same video simultaneously
- Triple VITC reader - reads VITC from three sets of lines on the same video simultaneously

The Afterburner is designed to work as a companion to the Evertz 4015 and 4025 Film Footage Encoders. Film edge numbers (KeyKode) which have been encoded into the user bits can be recovered and displayed in standard film format notations as are used by the Film Footage Encoder. In NTSC 24 frame per second transfers, the 3/2 pulldown information is recovered from the encoded user bits and displayed in standard A, B, C, D film frame type convention, when the incoming code is at play speed. The Afterburner reads edge numbers encoded using the proprietary Evertz encoding scheme and can display pulldown information from the VITC in all speeds. This permits unambiguous identification of the film frame pulldown when the VTR is parked on any frame.

The Afterburner provides a fully decoded and regenerated play speed LTC output, containing information related to the reader. In many VTR's, the position of the LTC time code head relative to the video signal can vary quite considerably from machine to machine, causing a code phase shift relative to the video frame. When the reader is configured to read LTC the translator output can be operated in the regenerate or reshape mode. In reshape mode, incoming LTC is restored to the proper waveform, and output in phase with the incoming LTC. In regenerate mode, the incoming LTC is fully decoded and regenerated. When incoming LTC is at normal play speed, the output code is re-phased to the video, thus compensating for any LTC code misalignments from the video. When the reader is configured to read VITC, the LTC output provides an LTC translation of the incoming VITC.

The recovery of recorded LTC time code at other than play speed has always presented some degree of difficulty, particularly with low end 3/4" and 1/2" recorders lacking a separate address track. The high speed reader in the Afterburner employs sophisticated input conditioning and clock and data separator circuits to reliably recover LTC over the full shuttle and wind speed ranges of most VTR's.

The VITC reader is designed for use with non time base corrected video signals. Although the use of time base correctors will enhance the recovery range of the VITC reader, the amount of improvement is dependent on the type of TBC and transport being used. The Afterburner contains all the necessary video processing circuits and therefore, requires no external signals other than the video signal itself. The VITC reader's line range can be easily programmed from the front panel, thus permitting recovery of specific VITC data where multiple sets have been recorded.

The high resolution character inserter provides up to six independently positionable windows to show time and user bits simultaneously. Three character sizes and the choice of white or black characters with or without contrasting background mask are selected from the front panel.

When displaying data recovered from a VITC source, the 'look ahead' compensation can be turned off, allowing field accurate burn-ins of edited material. The field number sequence will be displayed to the right of the frames display. When the data being read was recorded in the non colour frame mode, the field number sequence will be 1,2,1, etc. (1,2,3,4,1, etc. for PAL). When the reader data was recorded in the colour frame mode, the field number sequence will be 1,2,3,4,1, etc. (1,2,3,4,5,6,7,8,1, etc. for PAL).

The Character inserter provides an on screen programming menu system, which is used to configure the various operating modes. The use of drop down menus, and dedicated programming keys, allows the Afterburner to be conveniently configured for particular customer requirements.

The Afterburner has the ability to store several sets of user configurations to allow the user to switch easily from job to job. These setups are maintained in non-volatile memory during power down.

## 1.1. HOW TO USE THIS MANUAL

This manual is organized into 5 chapters : Introduction, Installation, Operating Instructions, Serial Remote Control Protocol, and Technical Description.

**Items of special note for all users are marked with a double box like this.**

**Figures**

# 2. INSTALLATION

## 2.1. REAR PANEL CONNECTIONS

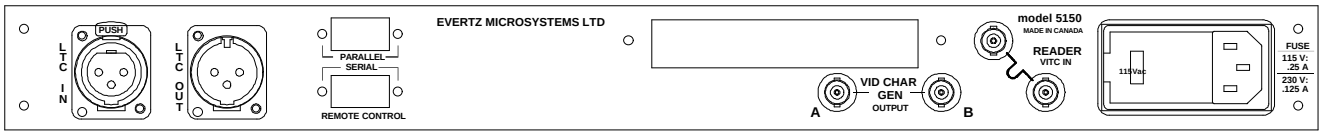



**Figure 2-1: Rear Panel Layout**

The following sections describe the purpose of the rear panel connectors of the 5150. Figure 2.1 above shows the rear panel connectors provided on the Afterburner. Sections 2.1.1 to 2.1.4 describe the specific signals that should be connected to the 5150. Figure 2-2 and Figure 2-3 give sample connection diagrams for connecting the Afterburner.

### 2.1.1. Linear Time Code Connections

**LTC OUT:** A male XLR connector for output of SMPTE / EBU linear timecode from the translator.

**LTC IN:** A female XLR connector for input of SMPTE / EBU linear timecode for reader 1

### 2.1.2. Video Connections

**VIDEO IN + VITC:** A BNC loop for input of program video onto which characters are to be inserted. If the video contains vertical interval time code, it will be read by the reader when it is configured in the VITC or AUTO modes This signal is also used to provide a gen-lock reference for the LTC translator output.

**VCG OUT A & B:** Two isolated BNC connectors with identical outputs of program video with characters inserted. This output is also used to display the on screen programming menu and is normally connected to a video monitor.

### 2.1.3. Remote Control Connections

**SERIAL REMOTE CTL** A 9 pin female 'D' connector used for RS-232/422 communications to a computer.

**PARALLEL REMOTE CTL** A 9 pin female 'D' connector used for parallel remote control inputs.

### 2.1.4. Power Connections

**LINE**: The 5150 may be set for either 115v/60 Hz or 230v/50 Hz AC operation. The voltage selector switch is accessible on the rear panel. The line voltage connector contains an integral slow blow fuse (and a spare one).

## 2.2. MOUNTING

The 5150 Time Code Reader is equipped with rack mounting angles and fits into a standard 19 inch by 1 3/4 inch (483 mm x 45 mm) rack space. The mounting angles may be removed if rack mounting is not desired.

## 2.3. POWER REQUIREMENTS

### 2.3.1. Selecting the Correct Mains Voltage

Power requirements are 115 or 230 volts AC at 50 or 60 Hz, switch selectable on the rear panel. Power should be applied by connecting a 3 wire grounding type power supply cord to the power entry module on the rear panel. The power cord should be minimum 18 AWG wire size, type SVT marked VW-1, maximum 2.5 m in length.

**Before connecting the line power, be sure to select the proper line voltage. Also, check that the line fuse is rated for the correct value marked on the rear panel.**

The power entry module combines a standard IEC 320 power inlet connector, voltage selector switch, two 5 x 20 mm fuse holders (one active, one spare) and an EMI line filter.

To change the mains voltage setting, open the cover of the power entry module using a small screwdriver. Remove the drum selector switch, and re-insert it so that the desired voltage is visible through the opening on the mains connector cover. Check that the correct fuse is in use as shown in section below.

### 2.3.2. Changing the Fuse

The fuse holder is located inside the power entry module. To change the fuse, open the cover of the power entry module using a small screwdriver. The fuse holder on the bottom contains the active fuse. The one at the top contains a spare fuse. Pull the bottom fuse holder out and place a

fuse of the correct value in it. Use slo blo (time delay) 5 x 20 mm fuses rated for 250 Volts with the following current ratings:

| | |
|---|---|
| For 115 Volt operation | 250 mA |
| For 230 Volt operation | 125 mA |

**Never replace with a fuse of greater value.**

Make sure that the arrow is pointing down when you replace the fuse holder. Close the door on the power entry module and connect the mains voltage.

## 2.4. READER VIDEO INPUT

Video associated with the LTC code or video with VITC recorded on it is connected to the VIDEO IN loop. The video input has a high impedance input tapped off the loop through, therefore the input must be terminated with 75 ohms at the end of the line. The input video signal is also used as a reference for the LTC translator output when it is operated in regenerate mode, and the incoming code is at play speed.

## 2.5. CHARACTER INSERTER VIDEO

The input video on which the characters are to be displayed is the same video as the reader uses and is connected to the VIDEO IN loop. The video input has a high impedance input tapped off the loop through, therefore the input must be terminated with 75 ohms at the end of the line.

Two isolated character generator outputs labelled VCG OUT A and B, are provided to drive a preview monitor and a video recorder. Characters are keyed into the video connected to the VIDEO IN loop. Size, position, and style of the character displays are controlled from the on screen programming menu.

In order to use the on screen programming menu system, video must be applied to the VIDEO IN loop and one of the VCG outputs must be connected to a video monitor.

## 2.6. LINEAR TIME CODE IN/OUT

The LTC reader input connects to your head pre-amplifier output. When using an unbalanced input to the reader, the signal should be applied to

pin 3 of the LTC reader input connector. Normally, the unused input, (pin 2) should be connected to ground (pin 1).

A fully decoded and regenerated play speed LTC output is provided containing information related to the Reader. In many VTR's, the LTC time code head position with respect to the video signal can vary quite considerably from machine to machine causing a code phase shift relative to the video frame. When the reader is configured to read LTC the translator output can be operated in the regenerate or reshape mode. In reshape mode, incoming LTC is restored to the proper waveform and output in phase with the incoming LTC. In regenerate mode, the incoming LTC is fully decoded and regenerated. When incoming LTC is at normal play speed, the output code is re-phased to the video, thus compensating for any LTC code misalignments from the video. When the reader is configured to read VITC, the LTC output provides an LTC translation of the incoming VITC. When the reader assignment is set to AUTO, the LTC output provides a translated output of whichever reader is active.

**When using the regenerated LTC output, the video from the tape being read must be looped through the video input (See Section 2.4) to ensure correct phasing of the LTC output to the video. In audio tape applications or other situations where video cannot be looped through the video input, it is advisable to use the reshaped output instead of the regenerated output. To accomplish this use the TRANSLATOR OUTPUT menu selection of the CONFIGURATION Toolbox menu item (See section 3.8)**

## 2.7. REMOTE CONTROL CONNECTOR PIN ASSIGNMENTS

### 2.7.1. Parallel Remote Control

A 9 pin D connector located on the rear panel labelled REMOTE CTL provides 6 parallel control inputs for remote control of some of the model 5150 functions. The pinout of the D connector is as follows:

| Pin | | Description |
|---|---|---|
| 1 | | Frame Ground |
| | 6 | Config Select |
| 2 | | VCG Enable |
| | 7 | Config Load |
| 3 | | Freeze |
| | 8 | General Purpose Input |
| 4 | | Not used |
| | 9 | Output 1 |
| 5 | | Output 2 |

### 2.7.2. Serial Remote Control

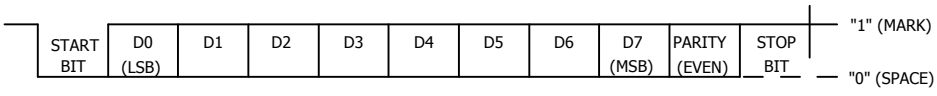
The Afterburner is fitted with a nine pin subminiature 'D' connector for serial remote control from a computer. Using this serial port, the user has access to all the operating modes and data input/output from the Afterburner. Consult chapter 4 of this manual for information on the command protocol. The serial port provides both RS-232-C and RS-422 levels as shown below.

| Pin | Description |
|---|---|
| 1 | Frame Ground |
| 6 | Transmit Common |
| 2 | Transmit “A” (-) |
| 7 | Transmit “B” (+) |
| 3 | Receive “B” (+) |
| 8 | Receive “A” (-) & RS-232 |
| 4 | Receive Common |
| 9 | Frame Ground |
| 5 | RS-232 Transmit |

When pin 8 is connected to an RS-232-C level signal, pin 3 should be connected to ground (pin 4).

The composition of the bit serial data format is as follows:

1 START + 8 DATA + 1 PARITY + 1 STOP




EVEN PARITY: The total of logic 1's in D0 to D7 and PARITY is an even number

Several baud rates are supported. When using the RS-422 standard the preferred baud rate is 38.4 KBaud. When using the RS-232 standard, the preferred baud rate is 19.2 KBaud. The SERIAL menu of the Engineering setup menu is used to set the baud rates.

## 2.8. SAMPLE CONFIGURATIONS

Two sample installation setups are diagrammed below to help properly connect the Afterburner into your system. For other applications contact the factory.

Figure 2-2 illustrates the basic setup for reading LTC and VITC, making off-line cassette copies with character burn-ins, or for dubbing tapes with regenerated time code. Longitudinal code misalignments from the video frame are compensated and the regenerated LTC is properly timed to the

video. The source video must be looped through the video input of the Afterburner to ensure correct timing of the output LTC to the video. (See the TRANSLATOR menu selections in section 3.7)

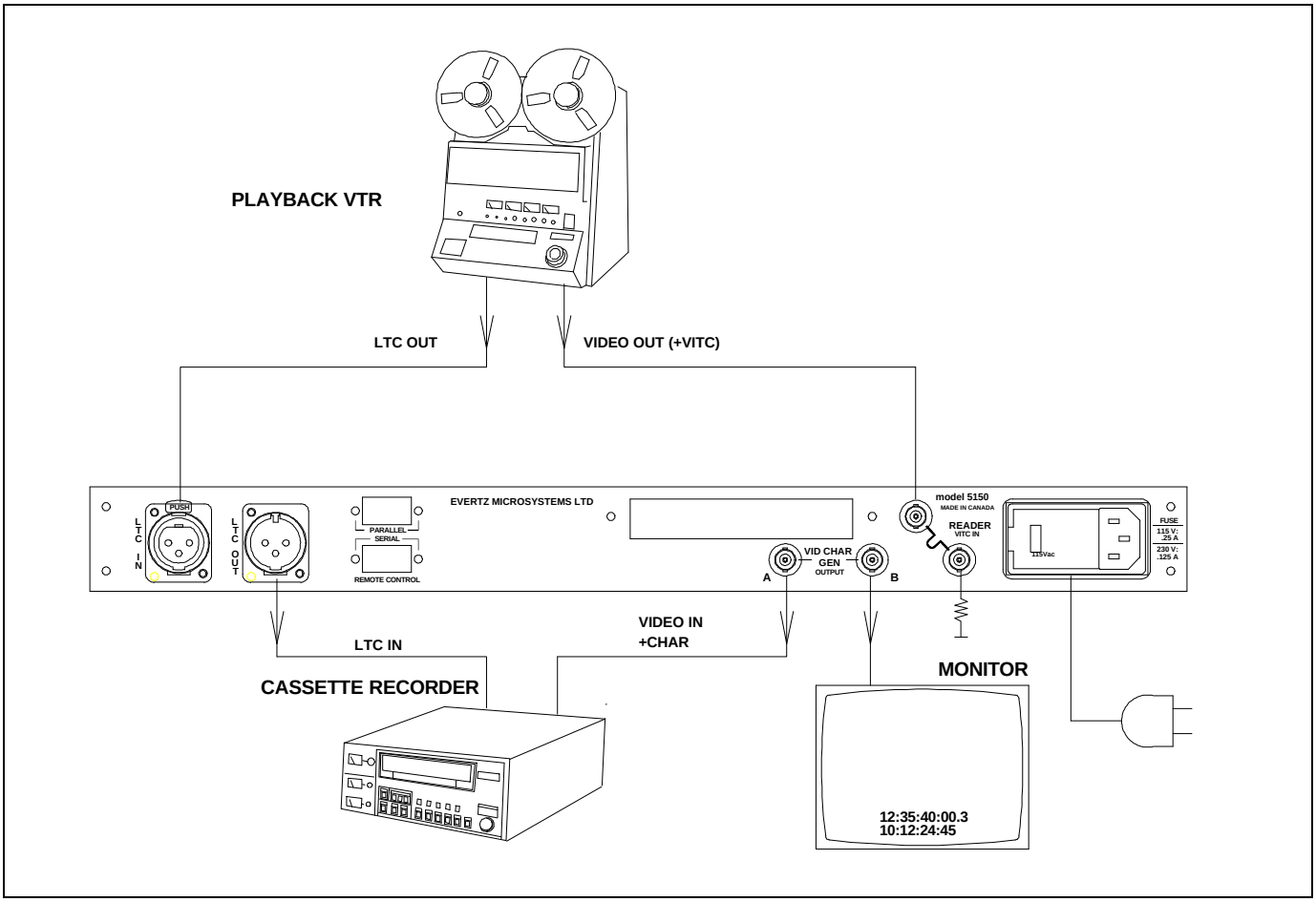



**Figure 2-2: Dubbing and Off-line Character Burn In**

Figure 2-3 illustrates the setup for a VITC/LTC editing system. Using the Afterburner your existing editing system can use LTC only, VITC only or both LTC and VITC together for both edit decision making and editing. The video from each source VTR is looped though the respective Afterburner, which will read VITC whenever it is present on the video. It is important that the VITC is recorded on vertical interval lines that will be reproduced by your VTR in playback. See your VTR manual for further information. If a time base corrector is used, the video output should be fed to the Afterburner prior to TBC processing because many TBCs blank the vertical interval and eliminate the VITC. If it is desired to time base correct the video before the Afterburner, make sure that the lines containing the VITC are passed through the TBC.

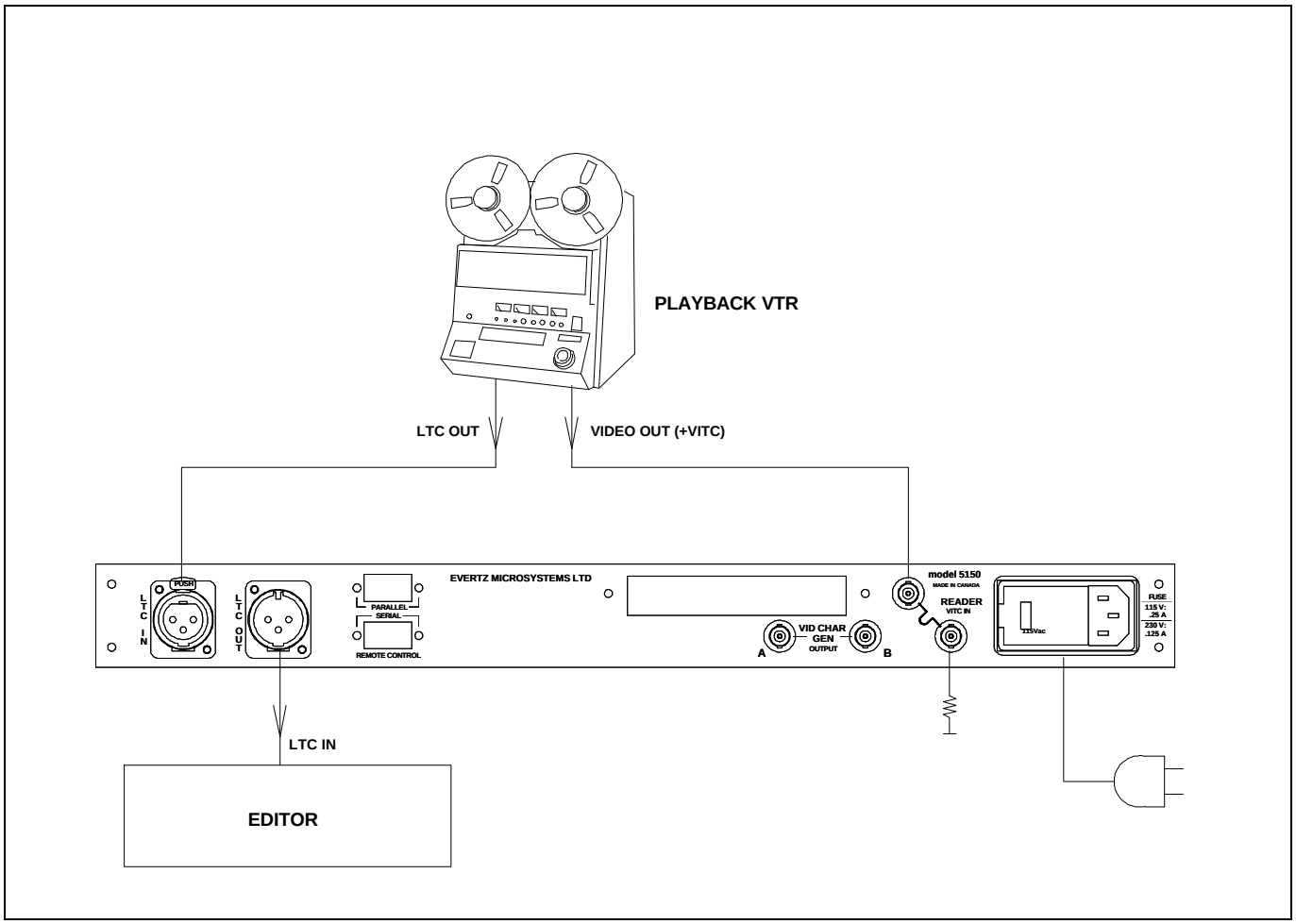



**Figure 2-3: VITC Translation to LTC for Editing**

The recovered VITC is translated to LTC by the Afterburner, which can be read by the LTC reader in the edit controller. The new LTC is generated at approximately play speed so that the edit controller can read it during slow motion decision making and also for cueing and parking the VTR during editing. When the incoming code is at play speed, the LTC is synchronized to the video, so that the edit controller can use it to synchronize the playback and record VTRs during the edit pre-roll interval, just as if it would have used the original LTC from the VTR.

If it is desired to record VITC on the record VTR, a VITC/LTC jam-sync generator such as our 5010-VITC must be used in the place of the Afterburner on the record VTR. During the edit pre-roll, when the record VTR is in playback, the jam-sync generator will follow the numbers read from the record machine. When the record VTR switches from playback to record, the jam-synced VITC will be recorded in the video without interruption. (See model 5010 Instruction Manual for more detailed information).

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# 3. OPERATING INSTRUCTIONS

The Afterburner is a LTC/ triple VITC reader and multi-function character inserter. Its power and flexibility are unsurpassed in time code reader applications. A 16 digit alphanumeric display can be quickly delegated to show the required data. The Afterburner contains three separate readers that can be operated independent of each other, or two can be linked to form an auto LTC/VITC reader. The Afterburner can be configured in one of four basic operating modes:

- Reader 1: Full speed (1/30 to 70 times play) LTC reader.
  Reader 2: 0 to 40X speed VITC reader
- Auto LTC/VITC reader automatically switches between LTC and VITC inputs reading whichever is valid.
- Dual VITC reader - reads VITC from two sets of lines on the same video simultaneously
- Triple VITC reader - reads VITC from three sets of lines on the same video simultaneously

The character inserter provides an on screen programming menu system, which is used to configure the various operating modes. The use of drop down menus and dedicated programming keys, allows the Afterburner to be conveniently configured for particular customer requirements.

## 3.1. FRONT PANEL OVERVIEW

The Afterburner provides a display of time or user bit information from its readers using a 16 digit alphanumeric display on the front panel, or using characters keyed into the input video. Operational control is handled by 16 front panel keys. Eight LED's provide operational status at a glance.

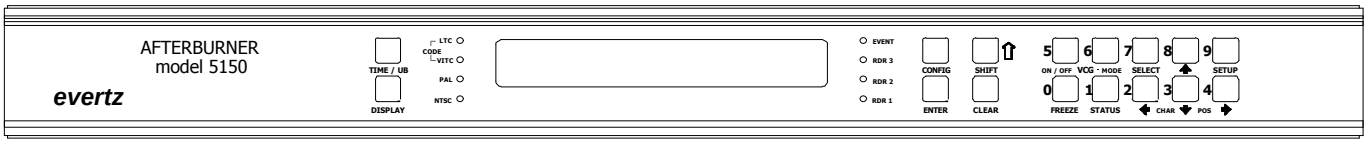



**Figure 3-1: Front Panel Layout**

### 3.1.1. Overview of the Pushbuttons

Sixteen front panel pushbuttons are used to control the operation of the Afterburner.

**TIME/UB** Is used to select whether time or user bit data is being displayed on the front panel alphanumeric display. The leftmost 4 characters of the front panel display whether time or user bits is being displayed, and which reader the data is

coming from. (e.g.: `TIM1 12:34:56:10` indicates that time from reader 1 is being displayed.

**DISPLAY** Is used to select reader is being displayed on the front panel alphanumeric display. The leftmost 4 characters of the front panel display whether time or user bits is being displayed, and which reader the data is coming from. (e.g.: `TIM1 12:34:56:10` indicates that time from reader 1 is being displayed.

**CONFIG** A user screen appears which is used to load user definable configurations. Press the **ENTER** key to load the configuration. Press the CONFIG key again to select another configuration. (see also section 3.11)

**FREEZE** Stops the updating of the reader display data on the front panel and in the VCG. A special character ( **F** ) appears to the left of the numeric display on the front panel, indicating that the display is in Freeze mode. Press the **FREEZE** key again to return to normal update mode.

**STATUS** Displays a status screen on the VCG which summarizes the current operational modes of the Afterburner. Pressing **SHIFT + STATUS** displays the firmware version on the character generator screen.

**VCG MODE** Initiates VCG window select mode and highlights the selected window. Use the arrow keys to move the window, use the **VCG ON/OFF** key to turn the window on or off. Press the **MODE** key again to select the next VCG window. Press the **CLEAR** key to return to the normal VCG display mode.

**VCG ON/OFF** Turns the character generator ON and OFF. When in the VCG window select mode the **VCG ON/OFF** key is used to turn individual windows ON and OFF.

**SETUP** Initiates SETUP mode and displays the on screen programming menu. Pressing the **SETUP** key again exits the SETUP mode.

**SELECT** When in the SETUP mode the **SELECT** key is used to choose items from within a drop down menu or sub menu.

← → ↑ ↓ When in the SETUP mode, the arrow keys are used to move between various items in the menu system.

When in the VCG window select mode, the arrow keys are used to position individual windows on the screen. (see also section 3.3.1)

When not in either the SETUP or VCG window select modes, the arrow keys are used to position all the windows on the screen. (see also section 3.3.2)

### 3.1.2. Overview of the Shifted Key Functions

When the **SHIFT** key is held down the standard meanings of many of the keys are modified. Throughout this manual shifted keys are referred to as **SHIFT + STATUS** for example. When you see this it means to hold the SHIFT key while pressing the other key. Following is an overview of the main shifted functions.

**SHIFT + STATUS** Displays firmware revisions on the character generator.

**SHIFT + CONFIG** Stores user configurations. (see also section 3.11)

### 3.1.3. Status Indicators

There are eight status indicators that show operational status at a glance.

**LTC** Indicates that the data being displayed is from the LTC reader.

**VITC** Indicates that the data being displayed is from the VITC reader.

**PAL** Indicates that the reader time is properly genlocked to a PAL video reference. If it is blinking, it indicates that the PAL video standard is selected, but a valid PAL video reference is not present.

**NTSC** Indicates that the reader time is properly genlocked to a NTSC video reference. If it is blinking, it indicates that the NTSC video standard is selected, but a valid NTSC video reference is not present.

**EVENT** When blinking it indicates that Event register is armed. When it is on solid, it indicates that the Event register has triggered an event.

**RDR 3** Indicates that Reader 3 is reading valid code.

**RDR 2** Indicates that Reader 2 is reading valid code.

**RDR 1** Indicates that Reader 1 is reading valid code.

## 3.2. FRONT PANEL DISPLAY FUNCTIONS

The **DISPLAY** and **TIME/UB** keys are used to select which data is being displayed in the alphanumeric display. Press the **DISPLAY** key one or more times to select the reader you wish to display. Press the **TIME/UB** to change from displaying time or user bits from the selected reader. The

four left characters of the front panel display indicate what is currently displayed. The code **LTC** and **VITC LED's** directly to the left of the display show whether the display data is from LTC or VITC.

| | |
|---|---|
| TIM1 | Reader 1 Time |
| UB1 | Reader 1 User Bits |
| TIM2 | Reader 2 Time |
| UB2 | Reader 2 User Bits |
| TIM3 | Reader 2 Time |
| UB3 | Reader 3 User Bits |

When the reader assignment is set to VITC VITC OFF or LTC VITC OFF TIM3 and UB3 will not be shown.

When the reader assignment is set to AUTO OFF OFF only TIM1 and UB1 will be shown.

There are also some extended displays which are accessible by pressing **SHIFT + DISPLAY**. At this time the only extended display available is:

| | |
|---|---|
| EVNT | Time Code Event Register |

The **FREEZE** key is used to stop updating of the VCG and front panel displays at a particular point in time. When in the FREEZE mode, a **F** is displayed to the left of the numeric characters on the front panel display. Press the **FREEZE** key again to release the FREEZE mode and begin updating of the data.

### 3.2.1. Front Panel Drop Frame Indicators (NTSC Only)

The following special indicators are used between the seconds and frames digits of the front panel time display to identify non drop frame and drop frame code (NTSC only)

| | |
|---|---|
| **Non Drop Frame** | Colon (:) |
| **Drop Frame** | Period (.) |

## 3.3. CHARACTER GENERATOR FUNCTIONS

Six separately positionable character windows displaying time or user bits from each reader are available. The four arrow keys (↑, ↓, ←, →) control the position of all the windows . The **VCG ON/OFF** key selects whether the VCG keyer is on or off. The use of these keys in combination with the **VCG MODE** key selects which windows are displayed and their position on the screen. The VCG drop down menu of the on screen programming menu is used to select character size and style.

### 3.3.1. Selecting and Positioning the Individual Character Inserter Windows

Press **VCG MODE** to enable the window select mode. All windows will appear on the character screen with the window for the reader 1 Time highlighted. Use the arrow keys (↑, ↓, ←, →) to position the reader 1 Time window on the screen. Press the **VCG ON/OFF** key to turn the window on or off. Press the **VCG MODE** key to highlight the reader 1 User Bits window. Use the **VCG ON/OFF** key to turn it on or off and the arrow keys to move it to the desired location. Press the **VCG MODE** key to advance to the next window, etc. Press **CLEAR** to return to normal display mode.

**For example**: to move only the reader 2 Time window down 1 line, leaving the other windows in the same place, press **VCG MODE** three times and press the ↓ key. Press the **CLEAR** key to return to the normal display mode.

### 3.3.2. Positioning the Overall Character Display

In the normal VCG display mode, when none of the windows are highlighted, the arrow keys (↑, ↓, ←, →) move all the displayed windows by the same relative amount. For example, to move all the windows down by one line press the ↓ key.

### 3.3.3. VCG Drop Frame Indicators (NTSC Only)

The following special indicators are used between the seconds and frames digits of the time windows in the character inserter to identify non drop frame and drop frame code (NTSC only)

| | |
|---|---|
| **Non Drop Frame** | Colon (:) |
| **Drop Frame** | Period (.) |

### 3.3.4. VCG Field Identification

When reading VITC, the field number sequence will be displayed to the right of the reader time frames display. When the data being read was recorded in the non colour frame mode the field number sequence will be 1, 2, 1, etc. (1, 2, 3, 4, 1, etc. for PAL). When the reader data was recorded in the colour frame mode, the field number sequence will be 1, 2, 3, 4, 1, etc. (1, 2, 3, 4, 5, 6, 7, 8, 1, etc. for PAL) The field number display may be disabled using the VCG FIELDS item in the VCG menu.

## 3.4. ON SCREEN PROGRAMMING MENU - OVERVIEW

The key to the operational flexibility of the Afterburner lies in the powerful on screen programming menu system which uses the built in character generator. This method of configuring the Afterburner is quick, and

simple, guiding you to the correct setup for your application. Six front panel push buttons (🡐, 🡒, 🡑, 🡓, and **SELECT** and **SETUP**) are used to cycle through the various items on the programming menu.

**RDR 1**

**ASSIGNMENT**

| RDR1 | RDR2 | RDR3 |
|---|---|---|
| LTC | VITC | OFF |
| VITC | VITC | OFF |
| VITC | VITC | VITC |
| AUTO | OFF | OFF |
| 3 | LINE | VITC |

**MODE**

| TIME | USER |
|---|---|
| TIME | DATA |
| TIME | TIME |
| TIME | EDGE |
| KEY INFO + EDGE | |
| DATA | DATA |
| TIME | DATE |

**VITC LINE**

LINE RANGE:

| START | END |
|---|---|
| 10 | 20 |

**VITC CRC**

NORMAL
KEYKODE

**DISPLAY**

PROCESSED
DIRECT

**FILM TYPE**

16 MM 20 FRM/KEY
16 MM 40 FRM/FT
35 MM 3 PERF
35MM 4 PERF
35MM 8 PERF
65/120 5 PERF
65/120 8 PERF
65/120 10 PERF
65/120 15 PERF

**FILM RATE**

25 FRMS/SEC
24 FRMS/SEC
30 FRMS/SEC

**EDGE STYLE**

GENERIC
EVERTZ

**EDGE FORMAT**

4 DIG FT + FRM
5 DIG FT + FRM
6 DIG FT + FRM
7 DIG FT + FRM

**RDR 2**

**ASSIGNMENT**

| RDR1 | RDR2 | RDR3 |
|---|---|---|
| LTC | VITC | OFF |
| VITC | VITC | OFF |
| VITC | VITC | VITC |
| AUTO | OFF | OFF |
| 3 | LINE | VITC |

**MODE**

| TIME | USER |
|---|---|
| TIME | DATA |
| TIME | TIME |
| TIME | EDGE |
| KEY INFO + EDGE | |
| DATA | DATA |
| TIME | DATE |

**VITC LINE**

LINE RANGE:

| START | END |
|---|---|
| 10 | 20 |

**VITC CRC**

NORMAL
KEYKODE

**DISPLAY**

PROCESSED
DIRECT

**FILM TYPE**

16 MM 20 FRM/KEY
16 MM 40 FRM/FT
35 MM 3 PERF
35MM 4 PERF
35MM 8 PERF
65/120 5 PERF
65/120 8 PERF
65/120 10 PERF
65/120 15 PERF

**FILM RATE**

25 FRMS/SEC
24 FRMS/SEC
30 FRMS/SEC

**EDGE STYLE**

GENERIC
EVERTZ

**EDGE FORMAT**

4 DIG FT + FRM
5 DIG FT + FRM
6 DIG FT + FRM
7 DIG FT + FRM

**RDR 3**

**ASSIGNMENT**

| RDR1 | RDR2 | RDR3 |
|---|---|---|
| LTC | VITC | OFF |
| VITC | VITC | OFF |
| VITC | VITC | VITC |
| AUTO | OFF | OFF |
| 3 | LINE | VITC |

**MODE**

| TIME | USER |
|---|---|
| TIME | DATA |
| TIME | TIME |
| DATA | DATA |

**VITC LINE**

LINE RANGE:

| START | END |
|---|---|
| 10 | 20 |

**VITC CRC**

NORMAL
PRODUCTION

**DISPLAY**

PROCESSED
DIRECT

**VCG**

**CHAR SIZE**

TINY
SMALL
LARGE

**CHAR STYLE**

WHITE
WHITE ON BLACK
BLACK
BLACK ON WHITE

**VCG FRAMES**

DISPLAY
BLANK

**VCG FIELDS**

DISPLAY
BLANK

**VCG SYMBOLS**

DISPLAY
BLANK

**Figure 3-2: On Screen Programming Menu Overview**

The Afterburner menu system consists of a main menu with four drop down menus. The titles of each of the drop down menus are shown on the top line of the character display. Selecting an item on one of the drop down menus reveals a sub-menu showing the choices for that item. Figure 3-2 is an overview of the on screen menu system and shows all the menu choices and where you will find the menu items. Note that some menu choices will be hidden depending on the programmed mode of operation.

Abbreviated menu descriptions are also shown on the front panel display, allowing the menu system to be used without a video monitor. Figure 3-3 shows an overview of the front panel menu descriptions for the SETUP menu. When the drop down menu items are selected, they are shown in UPPER CASE. When the sub menus are selected**, they are shown in lower case.**

**RDR ASSIGNMENT**
- Asgn ltc vtc off
- Asgn vtc vtc off
- Asgn vtc vtc vtc
- Asgn auto

**RDR1 MODE**
- R1 mod time data
- R1 mod time time
- R1 mod time edge
- R1 mod info+edge
- R1 mod data data
- R1 mod time date

**RDR1 VITC LINES**
- R1 vtc start = 10
- R1 vtc end = 12

**RDR1 VITC CRC**
- R1 crc normal
- R1 crc keykode

**RDR1 DISPLAY**
- R1 disp process
- R1 disp direct

**RDR1 FILM TYPE**
- R1 35 mm 16 frm
- R1 16 mm 20 frm
- R1 16 mm 40 frm

**RDR1 FILM RATE**
- R1 rate 25 fps
- R1 rate 24 fps
- R1 rate 30 fps

**RDR1 EDGE STYLE**
- R1 style generic
- R1 style evertz

**RDR1 EDGE FORMAT**
- R1 format 4 dig
- R1 format 5 dig
- R1 format 6 dig
- R1 format 7 dig

**RDR ASSIGNMENT**
- Asgn ltc vtc off
- Asgn vtc vtc off
- Asgn vtc vtc vtc
- Asgn auto

**RDR2 MODE**
- R2 mod time data
- R2 mod time time
- R2 mod time edge
- R2 mod info+edge
- R2 mod data data
- R2 mod time date

**RDR2 VITC LINES**
- R2 vtc start = 10
- R2 vtc end = 12

**RDR2 VITC CRC**
- R2 crc normal
- R2 crc keykode

**RDR2 DISPLAY**
- R2 disp process
- R2 disp direct

**RDR2 FILM TYPE**
- R2 35 mm 16 frm
- R2 16 mm 20 frm
- R2 16 mm 40 frm

**RDR2 FILM RATE**
- R2 rate 25 fps
- R2 rate 24 fps
- R2 rate 30 fps

**RDR EDGE STYLE**
- R2 style generic
- R2 style evertz

**RDR 2 EDGE FORMAT**
- R2 format 4 dig
- R2 format 5 dig
- R2 format 6 dig
- R2 format 7 dig

**RDR ASSIGNMENT**
- Asgn ltc vtc off
- Asgn vtc vtc off
- Asgn vtc vtc vtc
- Asgn auto

**RDR3 MODE**
- R3 mod time data
- R3 mod time time
- R3 mod data data

**RDR3 VITC LINES**
- R3 vtc start = 10
- R3 vtc end = 12

**RDR3 VITC CRC**
- R3 crc normal
- R3 crc product'n

**RDR3 DISPLAY**
- R3 disp process
- R3 disp direct

**VCG CHAR SIZE**
- Size tiny
- Size small
- Size large

**VCG CHAR STYLE**
- Style white
- Style wht on blk
- Style black
- Style blk on wht

**VCG FRAMES**
- Frames display
- Frames blank

**VCG FIELDS**
- Fields display
- Fields blank

**VCG SYMBOLS**
- Symbols display
- Symbols blank

**Figure 3-3: Overview of Front Panel Menu**

To enter the on screen programming menus, press the **SETUP** key. The character generator will show the last format screen that was used with the currently selected item highlighted. The two horizontal arrow keys (🡐, 🡒) allow you to move horizontally to another drop down menu when the sub menu is hidden. Using these two keys you can quickly scan the entire menu system for the item you wish to change.

The two vertical arrow keys (🡑, 🡓) allow you to move vertically within the drop down menus. When you have selected the desired menu item, press the **SELECT** key to reveal the sub menu choices for that item. Use the two vertical arrow keys (🡑, 🡓) to move vertically within the sub menu. When you have selected the desired sub menu choice press the **SELECT** key to save your choice and return to the drop down menu.

When you have made all the desired changes, press the **SETUP** key to return to the normal display mode.

**Changes made using the SETUP menu are only activated when you exit the SETUP menu and return to normal display mode.**

**ASSIGNMENT**

| RDR1 | RDR2 | RDR3 |
|---|---|---|
| LTC | VITC | OFF |
| VITC | VITC | OFF |
| VITC | VITC | VITC |
| AUTO | OFF | OFF |

The RDR 1, RDR 2 and RDR 3 drop down menus are used to program various reader modes for each reader. Each of the menus contains the ASSIGNMENT item, which determines which readers are active and whether they are reading LTC or VITC. The rest of each of these menus controls various reader modes such as VITC Line numbers, whether user bits contain static numbers or time information, etc. (see section 3.6). The VCG drop down menu is used to program the size and style of the character generator, and whether the time code frames will be displayed or not (see section 3.5).

To aid in finding the descriptions of the various menu items in sections 3.5 to 3.8, the drop down menu items and its sub menu items are shown in the margin of the manual, next to the description as shown.

### 3.4.1. Engineering Setup Menu

The Engineering Setup menu allows the advanced user to change various internal parameters of the Afterburner, or to invoke several advanced diagnostic modes.

**This menu should be used by advanced users only, as improper use can overwrite user setups.**

The Engineering Setup menu system consists of three drop down menus. The titles of each of the drop down menus are shown on the top line of the character display. Selecting an item on one of the drop down menus reveals a sub-menu showing the choices for that item. Figure 3-4 is an

overview of the Engineering Setup menu and shows all the menu choices and where you will find the menu items. Figure 3-5 shows an overview of the front panel descriptions for the Engineering Setup Menu. Note that some menu choices will be hidden or show the message **NOT APPLICABLE IN CURRENT MODE** depending on the programmed mode of operation.

**CONFIG**
- **VIDEO TYPE**
  - AUTO
  - NTSC
  - PAL
- **HORZ CHAR SIZE**
  - HORIZONTAL
  - CHAR SIZE = 10
  - ← → TO ADJUST
- **DISPLAY LEVEL**
  - DISPLAY LEVEL = 2
  - ↑ ↓ TO ADJUST
- **TRANSLATOR**
  - REGENERATE
  - RESHAPE
- **LTC OUTPUT**
  - LTC OUTPUT
  - LEVEL = 35
  - ↑ ↓ TO ADJUST
- **FACTORY RESET**
  - ** WARNING **
  - THIS COMPLETELY
  - RESETS UNIT
  - USE SHIFT - ENTER KEYS
  - TO PROCEED
  - PRESS THE SELECT KEY
  - TO CANCEL

**SERIAL PORT**
- **BAUD RATE**
  - 38400
  - 19200
  - 9600
  - 2400
- **PARITY**
  - PARITY FIXED TO EVEN
- **WORD SIZE**
  - FIXED TO 8 BITS 1 STOP
- **SERIAL TEST**
  - OFF
  - ON

**DEBUG**
- **RDR DIAGS**
  - NOT APPLICABLE
- **RAM VIEW**
  - NOT APPLICABLE
- **NOVRAM VIEW**
  - TO DEBUG NOVRAM
  - PRESS THE → KEY
- **RAM TEST**
  - NOT APPLICABLE→

**Figure 3-4: Engineering Setup Menu Overview**

**VIDEO TYPE**
- Video type Auto
- Video type Ntsc
- Video type Pal

**HORZ CHAR SIZE**
- Horz size = 02

**DISPLAY LEVEL**
- Disp level = 1

**TRANSLATOR**
- Transl regen
- Transl reshape

**LTC OUT LEVEL**
- LTC level = 00

**FACTORY RESET**
- Use shift+enter

**SERIAL BAUD RATE**
- Baud Rate 38400
- Baud Rate 19200
- Baud Rate 9600
- Baud Rate 2400

**SERIAL PARITY**
- Fixed to even

**SERIAL WORD**
- Fixed to 8 bits

**SERIAL TEST**
- Serial test off
- Serial test on

**READER DIAGS**
- Not applicable

**RAM VIEWER**
- Not applicable

**NOVRAM VIEWER**
- PRESS THE → KEY

**RAM TEST**
- Not applicable

**Figure 3-5: Engineering Toolbox Front Panel Menus**

To enter the Engineering Setup Menu press the **SHIFT + SETUP** keys. The character generator will show the last drop down menu that was used with the currently selected item highlighted. The two horizontal arrow keys (←, →) allow you to move horizontally to another drop down menu. Using these two keys you can quickly scan the entire menu system for the item you wish to change.

When you have made all the desired changes, press the **SHIFT + SETUP** keys to return to the normal display mode.

**Changes made using the Engineering setup menu are only activated when you exit the menu and return to normal display mode.**

The CONFIGURATION drop down menu is used to select the video standard, set the mode and output level of the translator output (see section 3.7). The CONFIGURATION menu items are normally only used during installation. The SERIAL PORT menu is used to set up parameters relating to the Serial remote control port. The DEBUG drop down menu is to turn on various diagnostics displays on the VCG.

## 3.5. ASSIGNING THE OVERALL FUNCTIONS OF THE READERS

The RDR 1, RDR 2 and RDR 3 drop down menus are used to program various reader modes for each reader. Each of the menus contains the ASSIGNMENT item, that determines which readers are active and whether they are reading LTC or VITC. The remaining items on each menu contain items appropriate for the modes supported by that reader. (see section 3.6)

**ASSIGNMENT**

| RDR1 | RDR2 | RDR3 |
|---|---|---|
| LTC | VITC | OFF |
| VITC | VITC | OFF |
| VITC | VITC | VITC |
| AUTO | OFF | OFF |
| 3 LINE | VITC | |

The **ASSIGNMENT** menu, located at the top of each of the three reader drop down menus is used to select how the reader hardware is configured. Each reader has its own drop down menu which allows you to set up its operation independent of the other two readers. (see section 3.6)

The Afterburner can be configured in five different ways. In the modes where one of the readers is OFF, the respective reader is inactive and will not appear on the front panel display or character inserter. In addition when a reader is OFF, its drop down menu consists of only the ASSIGNMENT item.

Select **LTC VITC OFF** to configure reader 1 for Linear Time Code (LTC) reader 2 for Vertical Interval Time Code (VITC). Reader 3 is OFF.

Select **VITC VITC OFF** to configure reader 1 and reader 2 for Vertical Interval Time Code (VITC) reading. Each reader can be set to recover VITC from different ranges of video lines. Reader 3 is OFF.

Select **VITC VITC VITC** to configure reader 1, reader 2 and reader 3 for Vertical Interval Time Code (VITC) reading. Each reader can be set to recover VITC from different ranges of video lines.

Select **AUTO OFF OFF** to configure reader 1 to automatically switch between Linear Time Code (LTC) and Vertical Interval Time Code (VITC) reading. The reader can be set to recover VITC from a specific range of video lines. Reader 2 and reader 3 are OFF.

Select **3 LINE VITC** to configure the Afterburner for reading the 3 Line VITC format. This mode is similar to VITC VITC VITC except that the RDR MODE, VITC CRC, EDGE STYLE and EDGE FORMAT are pre-determined by selecting the 3 LINE VITC assignment. The FILM TYPE and FILM RATE are encoded into the VITC data and are automatically configured when 3 LINE VITC is being read.

## 3.6. SETTING UP THE INDIVIDUAL READERS

The RDR 1, RDR 2 and RDR 3 drop down menus are used to program various reader modes for each reader. Each of the menus contains the ASSIGMENT item, that determines which readers are active and whether they are reading LTC or VITC. (see section 3.5 above) The remainder of these menus control various reader modes such as VITC line numbers, whether user bits contain static numbers or time information, etc. Figure 3-1 shows the items on the RDR1 drop down menu which contains most of the possible reader setups . The menu item descriptions appear in the order they appear on the RDR1 menu, and cover all three reader menus.

### 3.6.1. Selecting the Format of the Time and User Bit Data

| MODE | |
|---|---|
| TIME | USER |
| TIME | DATA |
| TIME | TIME |
| TIME | EDGE |
| KEY INFO + EDGE | |
| DATA | DATA |
| TIME | DATE |

The **MODE** menu item is used to select the type of information that is contained in the time and user bits of the reader.

Select **TIME DATA** when the time bits contains normal time information and the user bits contain numeric data.

Select **TIME TIME** when both the time and the user bits contain time information.

Select **TIME EDGE** when the time bits contain normal time information and the user bits contain encoded film edge numbers. The FILM TYPE, FILM RATE, EDGE STYLE & EDGE FORMAT menu items must be used to select the specific format of the edge number information.

Select **KEY INFO + EDGE** when the time bits contain encoded film manufacture & prefix information and the user bits contain encoded film edge numbers. The FILM TYPE, FILM RATE, EDGE STYLE & EDGE FORMAT menu items must be used to select the specific format of the edge number information. This mode is normally used in conjunction with material encoded with Evertz 4025 Film Footage Encoder operating in one of its "+Keykode" modes and usually requires that the VITC CRC be set to KEYKODE.

Select **DATA DATA** when both the time and the user bits contain numeric data.

Select **TIME DATE** when the time contains normal time information and the user bits contain date information (recorded in the TIME DATE format of the generator).

**RDR 1**

**ASSIGNMENT**

| RDR1 | RDR2 | RDR3 |
|---|---|---|
| LTC | VITC | OFF |
| VITC | VITC | OFF |
| VITC | VITC | VITC |
| AUTO | OFF | OFF |
| 3 | LINE | VITC |

**MODE**

| TIME | USER |
|---|---|
| TIME | DATA |
| TIME | TIME |
| TIME | EDGE |
| KEY INFO + EDGE | |
| DATA | DATA |
| TIME | DATE |

**VITC LINE**

LINE RANGE:

| START | END |
|---|---|
| 10 | 20 |

**VITC CRC**

NORMAL
KEYKODE

**DISPLAY**

PROCESSED
DIRECT

**FILM TYPE**

16 MM 20 FRM/KEY
16 MM 40 FRM/FT
35 MM 3 PERF
35 MM 4 PERF
65/120 5 PERF
65/130 8 PERF
65/120 10 PERF
65/120 25 PERF

**FILM RATE**

25 FRMS/SEC
24 FRMS/SEC
30 FRMS/SEC

**EDGE STYLE**

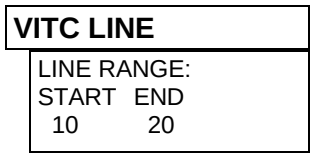
GENERIC
EVERTZ

**EDGE FORMAT**

4 DIG FT + FRM
5 DIG FT + FRM
6 DIG FT + FRM
7 DIG FT + FRM

**Figure 3-6: READER Drop Down Menu**

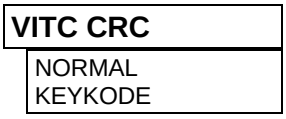
### 3.6.2. Setting The VITC Reader Line Range




The **VITC LINE** menu item is used to select the lines which are enabled for VITC reading. VITC reading is enabled between the lower and higher line numbers shown (inclusive). If the reader is not assigned as a VITC reader then this menu item is not available.

When the **VITC LINE** sub menu is first selected, the START line number will be in reverse video indicating it can be changed. Press the up and down (↑, ↓) keys to change the starting line. Press the right (→) key to highlight the END line, indicating that it can be changed. Press the up and down (↑, ↓) keys to change the ending line.

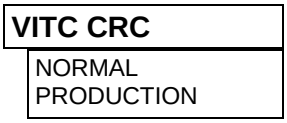
### 3.6.3. Selecting the VITC CRC




The **CRC** menu item is used to select whether the VITC data being read has a normal CRC or the special CRCs used by the ***Evertz*** 4025 Film Footage Encoder. Reader 1 and reader 2 can be set to recover VITC with NORMAL or KEYKODE type CRCs. Reader 3 can set to recover VITC with NORMAL or PRODUCTION timecode type CRCs.

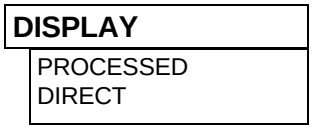
Select **NORMAL** to read VITC data with standard SMPTE/EBU CRC encoding.

Select **KEYKODE** to read VITC data which was encoded with special KEYKODE CRC encoding by a 4025 set to one of its '+KeyKode' modes. Normally this mode is only used when the reader mode is set to KEY INFO + EDGE.




Select **PRODUCTION** to read VITC data which was encoded with special PRODUCTION TIMECODE CRC encoding by a 4025 set to one of its 'three - line VITC' modes. Normally this mode is only used when the reader mode is set to TIME DATA.

### 3.6.4. Controlling the 'Look ahead' Compensation




The **DISPLAY** menu item is used to select whether the normal 'look ahead' compensation for reader dropouts is active or not. Normally, the data is read in one frame and displayed with an 'add 1 frame' compensation. This method guarantees an 'on time' character display for LTC and also helps to cover any minor reader disturbances. In some operational modes it is desirable to disable this feature and to display exactly what is being read. When reading VITC, it is possible to read and display the information in the same video field, thus maintaining field accuracy even in DIRECT mode. The topmost positions of the character generator are not available when in the direct mode.

Select **PROCESSED** to enable normal 'look ahead' compensation. Displays from either the LTC or VITC readers will be 'on time' but will **NOT** follow code discontinuities immediately.

Select **DIRECT** to enable DIRECT display mode. Data is displayed exactly as it is read without 'look ahead' compensation. Displays from the VITC reader will be 'on time' but cannot be positioned at the very top of the raster. Displays from the LTC reader will be behind by two frames.

### 3.6.5. Selecting the Film Related Modes

The **FILM TYPE**, **FILM RATE**, **EDGE STYLE** and **EDGE FORMAT** items are used to set up reader 1 or reader 2 to recover Film edge numbers that have been encoded by the Evertz Film Footage Encoders model 4015 or 4025. These modes need to be set if the reader 1 or reader 2 mode is set to **TIME EDGE** or **KEYINFO + EDGE**. In other modes they are not used.

**FILM TYPE**

- 16 MM 20 FRM/KEY
- 16 MM 40 FRM/FT
- 35 MM 3 PERF
- 35 MM 4 PERF
- 35 MM 8 PERF
- 65/120 5 PERF
- 65/120 8 PERF
- 65/120 10 PERF
- 65/120 15 PERF

The **FILM TYPE** menu item is used to select the number of film frames per key number used on encoded user bits.

Select **16 MM 20 FRMS/KEY** if you are using 16 mm film stock with key numbers every 20 perforations. This is the mode required for film stock with KeyKode numbers.

Select **16 MM 40 FRMS/FT** if you are using 16 mm film stock with key numbers every 40 perforations. This is the mode required for non-Keykoded film stock.

Select **35 MM 3 PERF** if you are using 35 mm film stock with 3 Perf.

Select **35 MM 4 PERF** if you are using 35 mm film stock with 4 Perf.

Select **35 MM 8 PERF** if you are using 35 mm film stock with 8 Perf.

Select **65/120 MM 5 PERF** if you are using 65/120 mm film stock with 5 Perf.

Select **65/120 MM 8 PERF** if you are using 65/120 mm film stock with 8 Perf.

Select **65/120 MM 10 PERF** if you are using 65/120 mm film stock with 10 Perf.

Select **65/120 MM 15 PERF** if you are using 65/120 mm film stock with 15 Perf.

**FILM RATE**
- 24 FRMS/SEC
- 30 FRMS/SEC

The **FILM RATE** menu item is used to select the transfer rate that the telecine was using during the film to tape transfer.

When the VIDEO TYPE is NTSC:
Select **24 FRMS/SEC** to select a transfer rate of 24 (23.97) frames per second.

Select **30 FRMS/SEC** to select a transfer rate of 30 (29.97) frames per second

**FILM RATE**
- 25 FRMS/SEC

When the VIDEO TYPE is PAL:
In PAL systems the film rate is fixed at **25 FRMS/SEC,** indicating a transfer of 25 frames per second.

**EDGE STYLE**
- GENERIC
- EVERTZ

The **EDGE STYLE** menu item is used to select whether the edge numbers have been encoded as normal packed BCD digits, or in a compressed binary format, which allows more digits to be encoded.

Select **GENERIC** if standard BCD encoding has been used. When Generic style is used, either 4, 5 or 6 digits of footage may be selected using the EDGE FORMAT menu item. Digits that are not used for footage numbers are utilized for a static prefix number.

Select **EVERTZ** if binary encoding of edge numbers has been used to compress more data into the available space. When EVERTZ style is used, either 4, 5, 6 or 7 digits of footage may be selected using the EDGE FORMAT menu item. Digits that are not used for footage numbers are utilized for a static prefix number. In addition, three flag bits are encoded into the user bits which contain the pulldown of the given frame.

The **EDGE FORMAT** menu item is used to select the format of the edge numbering scheme. Specifically this affects the number of digits of feet that have been encoded. In GENERIC STYLE there is a total of 8 digits. In EVERTZ STYLE there is a total of nine digits. The right most two are always used for frames. The sub menu choices determine the split between the footage and prefix on the remaining digits.

**EDGE FORMAT GENERIC**
- 4 DIG FT + FRM
- 5 DIG FT + FRM
- 6 DIG FT + FRM

When GENERIC style is used, either 4, 5 or 6 digits of footage may be selected . Digits that are not used for footage numbers are utilized for a static prefix number. Select 4 digit format when using film stock with Keykode numbers.

**EDGE FORMAT EVERTZ**
- 4 DIG FT + FRM
- 5 DIG FT + FRM
- 6 DIG FT + FRM
- 7 DIG FT + FRM

When EVERTZ style is used, either 4, 5, 6 or 7 digits of footage may be selected using the EDGE FORMAT menu item. Digits that are not used for footage numbers are utilized for a static prefix number. In addition, three flag bits are encoded into the user bits which contain the pulldown of the given film frame. Select 4 digit format when using film stock with Keykode numbers.

## 3.7. PROGRAMMING THE CHARACTER GENERATOR FUNCTIONS

The VCG drop down menu is used to select various characteristics of the VCG display. Figure 3-7 shows the items on the VCG drop down menu. The following descriptions appear in the order they appear on the menu.

- **VCG**
  - **CHAR SIZE**
    - TINY
    - SMALL
    - LARGE
  - **CHAR STYLE**
    - WHITE
    - WHITE ON BLACK
    - BLACK
    - BLACK ON WHITE
  - **VCG FRAMES**
    - DISPLAY
    - BLANK
  - **VCG FIELDS**
    - DISPLAY
    - BLANK
  - **VCG SYMBOLS**
    - DISPLAY
    - BLANK

**Figure 3-7: VCG Drop Down Menu**

- **CHAR SIZE**
  - TINY
  - SMALL
  - LARGE

The **CHAR SIZE** menu item is used to select one of three sizes for the character generator's display. The on screen format menus always use the small character size.

The **TINY** character size occupies 8 lines per field for each character row. This permits 28 vertical positions on the raster in NTSC or 32 in PAL.

The **SMALL** character size occupies 16 lines per field for each character row. This permits 14 vertical positions on the raster in NTSC or 16 in PAL.

The **LARGE** character size occupies 32 lines per field for each character row. This permits 7 vertical positions on the raster in NTSC or 8 in PAL.

- **CHAR STYLE**
  - WHITE
  - WHITE ON BLACK
  - BLACK
  - BLACK ON WHITE

The **CHAR STYLE** menu item is used to select whether the background mask will be used and whether the characters will be white or black. The on screen format menus are always white characters keyed into a black background mask.

Select **WHITE** to disable the background and key white characters directly into the picture.

Select **WHITE ON BLACK** to key white characters on a black background mask into the picture.

Select **BLACK** to disable the background and key black characters directly into the picture.

Select **BLACK ON WHITE** to key black characters on a white background mask into the picture.

**VCG FRAMES**
DISPLAY
BLANK

The **VCG FRAMES** menu item is used to select whether the frames will be shown when the time is displayed.

Select **DISPLAY** to display the frames of the time displays.
Select **BLANK** to blank the frames of the time displays. When Frames are blanked, fields will also be blanked.

**VCG FIELDS**
DISPLAY
BLANK

The **VCG FIELDS** menu item is used to select whether the fields will be shown when the time is displayed.

Select **DISPLAY** to display the fields of the time displays.
Select **BLANK** to blank the fields of the time displays.

**VCG SYMBOLS**
DISPLAY
BLANK

The **VCG SYMBOLS** menu item is used to select whether the **T** and **U** symbols will be shown in front of the time and user bit displays of the VCG. When one of the readers is set to the KEYINFO + EDGE mode the symbols are not shown for that reader.

Select **DISPLAY** to display the VCG symbols.
Select **BLANK** to blank the VCG symbols.

## 3.8. PROGRAMMING THE OVERALL CONFIGURATION FUNCTIONS

The CONFIGURATION drop down menu located on the Engineering Setup menu is used to select the video standard, set the mode and output level of the translator output, etc.. The CONFIGURATION menu items are normally required only during installation. See section 3.4.1 for information on using the Engineering Setup menu system.

Figure 3-8 shows the items on the CONFIGURATION drop down menu. The following descriptions appear in the order they appear the menu.

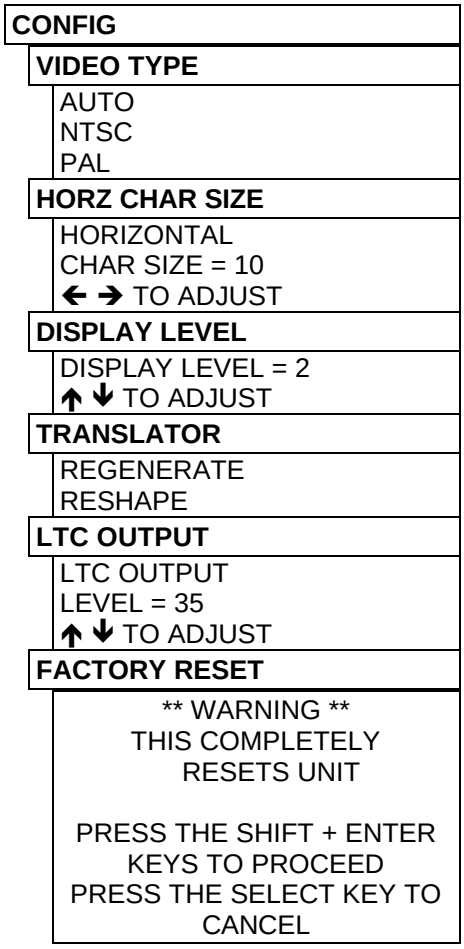



**Figure 3-8: CONFIGURATION Drop Down Menu**

### 3.8.1. Selecting the Video Standard

**VIDEO TYPE**
AUTO
NTSC
PAL

The **VIDEO TYPE** menu item is used to select the video standard of the program video. Changing the video standard will affect the settings of the VITC LINE RANGE menu setting. Make sure that you re-check this setting when you change the video standard.

Select **AUTO** if you want to have the 5150 auto detect PAL and NTSC video.

Select **NTSC** if you are using NTSC video.
Select **PAL** if you are using PAL video.

### 3.8.2. Adjusting The Horizontal Character Size

**HORZ CHAR SIZE**
HORIZONTAL
CHAR SIZE = 10
← → TO ADJUST

The **HORZ CHAR SIZE** menu item is used to adjust the character width. Use the ← and → keys to adjust the right side of the raster.

### 3.8.3. Adjusting the Front Panel Display Brightness

**DISPLAY LEVEL**
DISPLAY LEVEL = 2
↑ ↓ TO ADJUST

The **DISPLAY LEVEL** menu item is used to adjust brightness of the front panel display. Use the ↑ and ↓ keys to adjust.

### 3.8.4. Selecting the Operating Mode of the LTC Translator

**TRANSLATOR**
REGENERATE
RESHAPE

The **TRANSLATOR** menu item is used to select the function of the LTC translator output. The source for the LTC translator can both be either reader 1 or reader 3, and is selected by DIP switch #3. When the switch is open the source is reader 1.. When reader 1 is configured to read LTC the translator output can be operated in the regenerate or reshape mode.

In **REGENERATE** mode, the incoming LTC is fully decoded and regenerated. When incoming LTC is at normal play speed, the output code is re-phased to the video, thus compensating for any LTC code misalignments from the video. When reader 1 is configured to read VITC, the LTC output provides an LTC translation of the incoming VITC. When using the regenerated LTC output, the video from the tape being read must be looped through the video input (see Section 2.4) to ensure correct phasing of the LTC output to the video.

In **RESHAPE** mode, incoming LTC is restored to the proper waveform and output in phase with the incoming LTC. In audio tape applications or other situations where video cannot be looped through the video input, it is advisable to use the RESHAPE translator mode.

When the switch is closed, the source for the LTC translator is reader 3. When the reader assignment is set to 3 LINE VITC, the LTC output

provides an translation of the production time which is stored in the third line of the 3 line VITC

### 3.8.5. Adjusting the Level of the LTC Translator Output

| LTC OUTPUT |
| --- |
| LEVEL = 35<br>↑ ↓ TO ADJUST |

The **LTC OUT LEVEL** menu item is used to adjust the LTC translator output levels. Use the ↑ OR ↓ keys to change the level. The recommended output level setting is 35, which is approximately 1 volt peak to peak.

### 3.8.6. Resetting the Afterburner to its Factory Defaults

| FACTORY RESET |
| --- |
| ** WARNING **<br>THIS COMPLETELY RESETS UNIT<br><br>PRESS THE SHIFT + ENTER KEYS TO PROCEED<br>PRESS THE SELECT KEY TO CANCEL |

The **FACTORY RESET** menu item Is used to reset the 5150 to the factory default parameters. Press the **SHIFT + ENTER** keys when the sub menu screen is displayed to reset the 5150 to factory defaults. The 5150 will perform a power-on configuration before returning to the normal operating mode.

## 3.9. PARALLEL REMOTE CONTROL

A 9 pin D connector located on the rear panel labelled REMOTE CTL provides 6 parallel control inputs for remote control of some of the model 5150 functions. The pinout of the D connector is as follows:

| Pin | | Description |
| --- | --- | --- |
| 1 | | Frame Ground |
| | 6 | Config Select |
| 2 | | VCG Enable |
| | 7 | Config Load |
| 3 | | Freeze |
| | 8 | General Purpose Input |
| 4 | | Not used |
| | 9 | Output 1 |
| 5 | | Output 2 |

**CONFIG SELECT** When used in conjunction with the **CONFIG LOAD** input it provides an alternate method of loading user configurations. Closing the **CONFIG SELECT** input to ground enters Config select mode (the same as pressing the CONFIG key on the front panel). Each time this input is closed to ground, the next user config is selected. When the desired user configuration is selected, hold the **CONFIG SELECT** input low and ground the **CONFIG LOAD** input.

**CONFIG LOAD** When used in conjunction with the **CONFIG SELECT** input it provides an alternate method of loading user configurations. Closing the **CONFIG SELECT** input to ground enters Config select mode (the same as pressing the CONFIG key on the front panel). Each time this input is closed to ground, the next user config is selected. When the desired user configuration is selected, hold the **CONFIG SELECT** low and ground the **CONFIG LOAD** input. Grounding the **CONFIG LOAD** input when the **CONFIG SELECT** input is high exits the Config select mode without loading any configurations.

**VCG ENABLE** Provides an alternate method of turning the character inserter generator On and Off. The character inserter is turned On by a high to low transition on this input, and turned Off by a low to high transition.

**FREEZE** Provides an alternate method of Freezing the front panel and VCG displays. Freeze is turned On by a high to low transition on this input, and turned Off by a low to high transition. A special character ( **F** ) appears to the left of the numeric display on the front panel when the 5150 is in Freeze mode.

**GENERAL PURPOSE INPUT** This input is general purpose in nature and may be used for various purposes, as defined in the Engineering Setup Menu. At this time it is unused.

## 3.10. TIME CODE TRIGGERED EVENT OUTPUTS

The Afterburner now has the ability to generate a contact closure coincident with a timecode value it reads. The contact closure is available on the Parallel Remote Connector Output 1 (pin 9). The timecode coincidence point is entered into the EVENT register. The EVENT register must be armed for the output to activate. The description below tells how to set the EVENT register and how to arm the Events.

To access the EVENT register press the **SHIFT+DISPLAY** buttons. The display prompt will be EVNT. The **ENTER** and **CLEAR** keys are used in conjunction with the numeric keys to set the value stored in the EVENT register.

Press the **ENTER** key to recall the last value that you entered into the EVENT register. The display prompt at the left of the display will blink while data entry mode is active, and the dual functioned keys are now changed to their numeric values. If you want to re-enter this value press the **ENTER** key to complete the data entry.

Pressing any numeric key will clear the previous value and place the new value into the numeric display, starting at the right. Unentered digits are assumed to be zero, hence leading zero digits are not required. When the

required number of digits are entered, then press the **ENTER** key to complete the data entry.

Attempts to enter too many digits, or make illegal entries, i.e. 65 minutes, will result in the display returning to the last valid time entry made. Re-enter the correct value and press the **ENTER** key. Pressing the **CLEAR** key will cancel the data entry mode without changing any data.

The numeric keys return to their normal display functions when the data entry has been completed by pressing **ENTER** or cancelled by pressing the **CLEAR** key. The display prompt will return to its steady On state when data entry mode has been completed.

When the EVENT register is being displayed, press the **SHIFT+SELECT** keys to 'arm' the event register. The EVENT LED will blink when the EVENT register is armed. When the time code being read by Reader 1 matches the value entered into the EVENT register, the event output will be activated for 1 second (closure to ground). The EVENT LED will stay on for approximately 4 seconds when the event is triggered.

## 3.11. STORING & RECALLING USER CONFIGURATIONS

The 5150 has the ability to store 8 user configurations. All eight user configurations store the current settings of all items on the setup menu and most items of the Engineering menu.

### 3.11.1. Storing User Configurations

Press **SHIFT & CONFIG** to enter the configuration store mode of the 5150. The VCG shows that you are ready to store user config 1. Each time you press **SHIFT & CONFIG** the next user config is selected. Press ENTER to store the selected user config. Press clear to return to the normal operating mode.

### 3.11.2. Recalling User Configurations

Press **SHIFT & CONFIG** to enter the configuration load mode of the 5150. The VCG shows that you are ready to load user config 1. Each time you press **SHIFT & CONFIG** the next user config is selected. Press ENTER to load the selected user config. Press clear to return to the normal operating mode.

The parallel remote control port provides an alternate method of recalling user configurations (see section 3.9)

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# 4. SERIAL REMOTE CONTROL PROTOCOL

## 4.1. OVERVIEW

- Four wire communications channel utilized - RS-422 levels. Alternate 2 wire interface using RS-232C levels
- Data transmitted asynchronously, bit serial, word serial with data exchange between the devices being digital.
- Transmission rate is selectable 38.4 K, 19.2K, 9600 Baud supported
- Data words utilized by the interface shall be as follows:

1 START bit + 8 DATA bits +1 PARITY bit + 1 STOP bit.
The parity bit shall denote EVEN parity

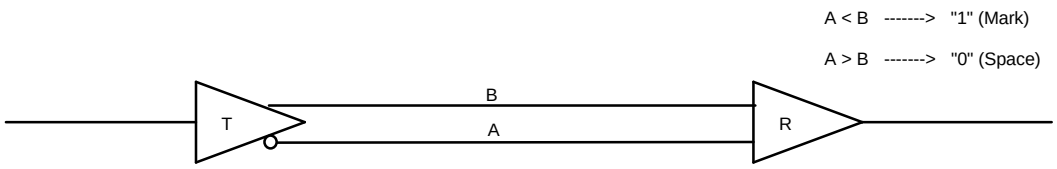
### 4.1.1. Connector Pin Assignment

Interface Connector: 9 pin D-subminiature female (DB-9S)

The pin assignment for the serial port shall be as follows:

| Pin | Function |
|---|---|
| 1 | Frame Ground |
| 2 | Transmit A (-) |
| 3 | Receive B (+) |
| 4 | Receive Common |
| 5 | RS-232 Transmit (Optional) |
| 6 | Transmit Common |
| 7 | Transmit B (+) |
| 8 | Receive A (-) |
| 9 | Frame Ground |

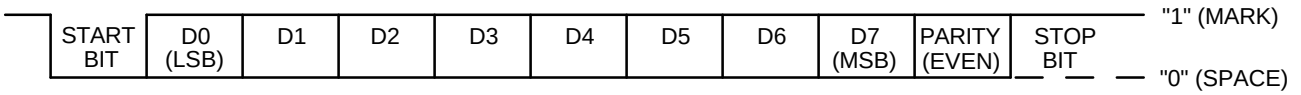
A and B are defined as follows:




### 4.1.2. Data Format

The serial port provides drivers which allow communications in either RS-232C or RS-422 electrical standards. The composition of the bit serial data format is as follows:

1 START + 8 DATA + 1 PARITY + 1 STOP




EVEN PARITY: The total of logic 1's in D0 to D7 and PARITY equals an even number

One of four baud rates is selected using the Engineering SETUP menu. When using the RS-422 standard the preferred baud rate is 38.4 KBaud. When using the RS-232 standard the preferred baud rate is 19.2ÜKBaud.

## 4.2. COMMUNICATIONS PROTOCOL

The Controller shall be denoted as the normal sender of a command (usually a computer). The Device shall be denoted as the normal sender of a Response ( the Evertz unit).

**All command values, arguments and data values shown in this document are expressed in hexadecimal format unless otherwise noted.**

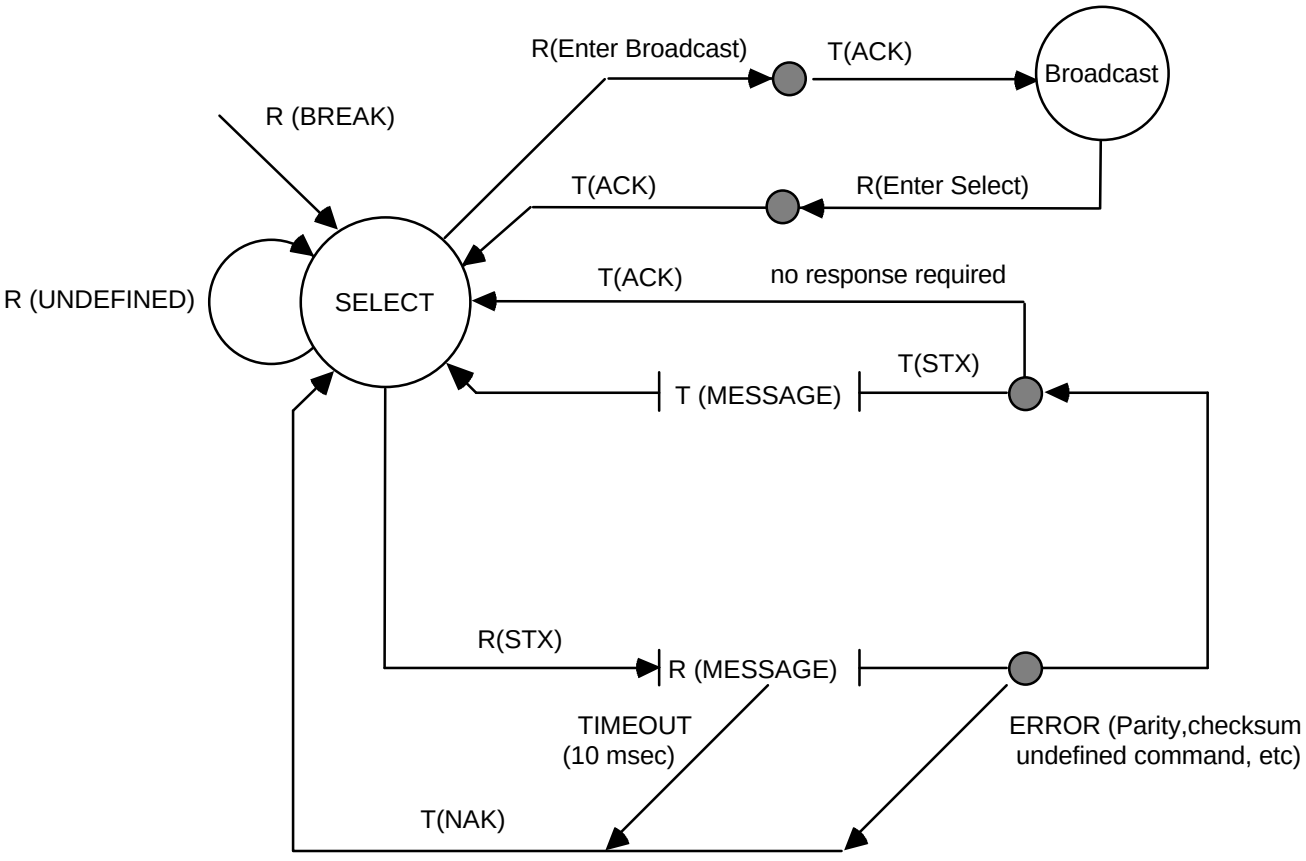



**Figure 4-1: Communications Protocol State Diagram**

The communications protocol is described in Figure 4-1. The Evertz unit (Device) immediately enters the select state upon power-up and remains there unless directed by an Enter Broadcast Cmd (02 hex) to the broadcast communications state. The diagram shows the various states of the device. The designation R( ) indicates the data received from the controller, while the designation T( ) indicates the data transmitted by the Device.

## 4.3. MESSAGE BLOCK FORMAT

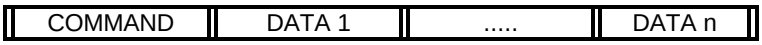
Once communications have been established command messages may be sent to the Device.

Each control message starts with the STX character and ends with a checksum. The message blocks are structured as follows:


| | |
|---|---|
| STX | start of message character (02 hex) |
| BYTE COUNT | count of command message not including the STX, BYTE COUNT or CHECKSUM. |
| MESSAGE | variable length command message. |
| CHECKSUM | the two's complement of the one byte sum of the MESSAGE and the BYTE COUNT. |

The purpose of the checksum is to verify that all the bytes in the message that contain variable data have been received properly. The STX is the only byte that has a fixed value, so it is the only byte not included in the checksum calculation. The checksum is calculated by adding all the variable bytes together. The least significant byte of this sum is then subtracted from 100 hex to compute the checksum. To verify that the checksum is computed correctly, add all the bytes including the checksum but excluding the STX together. The least significant byte of the sum should be zero if the checksum is computed correctly.

The MESSAGE consists of a command and optional bytes of data and is structured as follows:




| | |
|---|---|
| COMMAND | single byte command directed to device. |
| DATA 1...DATA n | variable length, any arguments required by COMMAND. |

If the command message was not accepted by the Device due to a checksum error, parity error or an invalid command the Device will respond with an **NAK** (05 hex) character and re-enter the SELECT state.

If the command message is accepted by the Device and there is no data response required, it will respond with an **ACK** (04 hex) character and re-enter the SELECT state.

If the command message requires a data response, the Device will transmit a response message structured as follows:

| | |
|---|---|
| STX | start of message character (02 hex) |
| BYTE COUNT | count of response message not including STX, BYTE COUNT or CHECKSUM. |
| COMMAND ECHO | Command message echoed |
| MESSAGE | variable length response message consisting of the data requested by the command message. |
| CHECKSUM | The two's complement of the one byte sum of the COMMAND ECHO, MESSAGE and the BYTE COUNT. |

For example, to request the current time code data in BCD format from the reader, the command message would be transmitted as follows:

| 02 | 02 | 66 | 01 | 97 |
|---|---|---|---|---|
| STX | BYTE COUNT | SENSE RDR | BLOCKS | CHECKSUM |

If the current LTC reader time code was 12:45:30:00 Drop Frame the response message would be received as follows:

| 02 | 07 | 66 | 01 | 00 | 30 | 45 | 12 | 01 | 0A |
|---|---|---|---|---|---|---|---|---|---|
| STX | BYTE COUNT | CMD (SENSE RDR) | CMD DATA (BLOCKS) | DATA 1 (FRMS) | DATA 2 (SECS) | DATA 3 (MINS) | DATA 4 (HRS) | DATA 5 (FLAGS) | CHKSUM |

## 4.4. COMMANDS

| **Command from Controlling Device** | | | **Return to Controlling Device** | | |
|---|---|---|---|---|---|
| **CMD** | **DATA BYTES** | **DESCRIPTION** | **CMD ECHO BYTES** | **DATA BYTES** | **NAME** |
| 00 | | Sense Current Mode | 1 | 1 | Current Mode |
| 01 | | Enter Select Mode | | | ACK |
| 02 | | Enter Broadcast Mode | | | ACK |
| 03 | | Enter Programming Mode | | | ACK |
| 0B | 1 | Select Video Standard | | | ACK |
| 10 | | Sense Error Number | 1 | 2 | Error Number |
| 11 | 1 | PROM Version request | 2 | 20 | PROM Name & Version |
| 1B | | Sense Video Standard | 1 | 1 | Video Standard |

**Table 4-1: Systems Commands and their Valid Responses**

| Command from Controlling Device | | | Return to Controlling Device | | |
|---|---|---|---|---|---|
| **CMD** | **DATA BYTES** | **DESCRIPTION** | **CMD ECHO BYTES** | **DATA BYTES** | **NAME** |
| 20 | 1 | Select Char Gen Size | | | ACK |
| 21 | 3 | Preset Char Gen Window Pos'n | | | ACK |
| 22 | 2 | Select Char Gen Window On/Off | | | ACK |
| 23 | 1 | Select Char Gen Global On/Off | | | ACK |
| 24 | 1 | Select Char Gen Style | | | ACK |
| 25 | 1 | Select Char Gen Frames | | | ACK |
| 26 | 1 | Select Char Gen Fields | | | ACK |
| 27 | 1 | Select Char Gen Symbols | | | ACK |
| 30 | | Sense Char Gen Size | 1 | 1 | Char Size |
| 31 | 1 | Sense Char Gen Window Pos'n | 2 | 3 | Char Gen Window Pos'n & Len |
| 32 | 1 | Sense Char Gen Window On/Off | 2 | 1 | Char Gen Window On/Off |
| 33 | | Sense Char Gen Global On/Off | 1 | 1 | Char Gen Global On/Off |
| 34 | | Sense Char Gen Style | 1 | 1 | Char Gen Style |
| 35 | | Sense Char Gen Frames | 1 | 1 | Char Gen Frames |
| 36 | | Sense Char Gen Fields | 1 | 1 | Char Gen Fields |
| 37 | | Sense Char Gen Symbols | 1 | 1 | Char Gen Symbols |

**Table 4-2: Character Generator Commands and their Valid Responses**

| Command from Controlling Device | | | Return to Controlling Device | | |
|---|---|---|---|---|---|
| **CMD** | **DATA BYTES** | **DESCRIPTION** | **CMD ECHO BYTES** | **DATA BYTES** | **NAME** |
| 40 | 1 | Select Reader Assignment | | | ACK |
| 41 | 2 | Select Reader Mode | | | ACK |
| 42 | 3 | Select VITC Reader Lines | | | ACK |
| 43 | 2 | Select VITC Reader CRC | | | ACK |
| 44 | 2 | Select Reader Display | | | ACK |
| 45 | 1 | Define Broadcast Mode | | | ACK |
| 48 | 2 | Select Film Type | | | ACK |
| 49 | 2 | Select Film Rate | | | ACK |
| 4A | 2 | Select Edge Style | | | ACK |
| 4B | 2 | Select Edge Format | | | ACK |
| 60 | | Sense Reader Assignment | 1 | 1 | Reader Assignment |
| 61 | 1 | Sense Reader Mode | 2 | 1 | Reader Mode |
| 62 | 1 | Sense VITC Reader Lines | 2 | 2 | VITC Reader Lines |
| 63 | 1 | Sense VITC Reader CRC | 2 | 1 | VITC Reader CRC |
| 64 | 1 | Sense Reader Display | 2 | 1 | Reader Display |
| 65 | | Sense Reader Broadcast Mode | 1 | 1 | Reader Broadcast Mode |
| 66 | 1 | Sense Reader | 2 | x | Reader Data |
| 67 | | Sense Reader Broadcast Block | 1 | x | Reader Broadcast Block |
| 68 | 1 | Sense Film Type | 2 | 1 | Film Type |
| 69 | 1 | Sense Film Rate | 2 | 1 | Film Rate |
| 6A | 1 | Sense Edge Style | 2 | 1 | Edge Style |
| 6B | 1 | Sense Edge Format | 2 | 1 | Edge Format |

**Table 4-3: Reader Commands and their Valid Responses**

## 4.5. DATA FORMATS

### 4.5.1. Time Format Block

| 10 Frm | 1 Frm | 10 Sec | 1 Sec | 10 Min | 1 Min | 10 Hr | 1 Hr | Flags |
|---|---|---|---|---|---|---|---|---|

The Flags byte is a bitmapped byte of the timecode flag bits as follows:

| | | |
|---|---|---|
| Bit 0 | Drop Frame Flag | 0 = Non Drop Frame, 1 = Drop Frame |
| Bit 1 | Colour Frame Flag | 0 = Non Colour Frame, 1 = Colour Frame |
| Bit 2 | VITC Field Flag | 0 = Field 1, 1 = Field 2 |
| Bit 3 | User Bit Group Flag 0 | |
| Bit 4 | User Bit Group Flag 1 | |
| Bit 5 | User Bit Group Flag 2 | |
| Bit 6 | LTC Flag | 1 = LTC Active |
| Bit 7 | VITC Flag | 1 = VITC Active |

The Binary group flag bits are defined as follows:

| | Bin Grp Flag 2 | Bin Grp Flag 1 | Bin Grp Flag 0 |
|---|---|---|---|
| Character set unspecified | 0 | 0 | 0 |
| Eight bit Alpha-numeric Character set | 0 | 0 | 1 |
| Unassigned | 0 | 1 | 0 |
| Unassigned | 0 | 1 | 1 |
| Unassigned | 1 | 0 | 0 |
| Page/Line (SMPTE 262M) | 1 | 0 | 0 |
| Unassigned | 1 | 1 | 0 |
| Unassigned | 1 | 1 | 1 |

### 4.5.2. Data Format Block

| UB grp 2 | UB grp 1 | UB grp 4 | UB grp 3 | UB grp 6 | UB grp 5 | UB grp 8 | UB grp 7 |
|---|---|---|---|---|---|---|---|

### 4.5.3. Date Format Block

| 10 Day | 1 Day | 10 Month | 1 Month | 10 Yr | 1 Yr | 10T Zone | 1T Zone |
|---|---|---|---|---|---|---|---|

### 4.5.4. Edge Format Block

| Pull | 10 Frm | 1 Frm | 10 ft | 1 ft | 1000 ft | 100 ft | Pre 2 | Pre 1 | 0 | Pre 3 |
|---|---|---|---|---|---|---|---|---|---|---|

In the event that 5,6, or 7 digit mode is selected, the Pre 1, Pre 2 and Pre 3 digits are used to encode footage respectively.

Pull is a bit mapped byte showing the pulldown flags of the edge code. Pull is defined as follows:

| | | |
|---|---|---|
| Field Flag | Bit 0 | |
| PD1 | Bit 1 | |
| PD2 | Bit 2 | |
| PD3 | Bit 3 | |
| not used | Bit 4 | |
| not used | Bit 5 | |
| not used | Bit 6 | |
| Pull_Valid | Bit 7 | 0=Ignore Pulldown, 1=Pulldown valid |

The pulldown flags are defined as follows:

| Film Fr. N+? | Video Fr. M+? | Field # | Pulldown type | PD-3 | PD-2 | PD-1 |
|---|---|---|---|---|---|---|
| 0 | 0 | 1 | A | 1 | 0 | 0 |
| 0 | 0 | 2 | A | 1 | 0 | 0 |
| 1 | 1 | 1 | B | 1 | 0 | 1 |
| 1 | 1 | 2 | B | 1 | 0 | 1 |
| 1 | 2 | 1 | B | 0 | 1 | 1 |
| 2 | 2 | 2 | C | 0 | 1 | 1 |
| 2 | 3 | 1 | C | 0 | 1 | 0 |
| 3 | 3 | 2 | D | 0 | 1 | 0 |
| 3 | 4 | 1 | D | 0 | 0 | 0 |
| 3 | 4 | 2 | D | 0 | 0 | 0 |

### 4.5.5. KeyKode Format Block

| Pull | 10 Frm | 1 Frm | 10 Ft | 1 Ft | 1000 Ft | 100 Ft | Pre 2 | Pre 1 | ... |
|---|---|---|---|---|---|---|---|---|---|

... | Pre 4 | Pre 3 | Pre 6 | Pre 5 | 10 Film | 1 Film | 10 Mfg | 1 Mfg |
|---|---|---|---|---|---|---|---|---|

In the event that 5,6, or 7 digit mode is selected, the Pre 1, Pre 2 and Pre 3 digits are used to encode footage respectively.

Pull is a bit mapped byte showing the pulldown flags of the edge code. Pull is defined in section 4.5.4.

## 4.6. COMMAND AND RESPONSE DESCRIPTIONS

### 4.6.1. System Commands

| | | | |
|---|---|---|---|
| 01 | Enter Select Mode | | |
| 02 | Enter Broadcast Mode | | |
| 03 | Enter Programming Mode | | |
| 04 | Reserved | | |
| 10 | Sense Error Number | | Returns 2 bytes |
| 11 | Sense PROM Version | 1 byte | 00 = Boot PROM version<br>01 = Flash PROM version |
| | Returns the control byte from the command +16 bytes PROM name + 16 bytes PROM version | | |
| 0B | Select Video Standard | 1 byte | Presets the Video Standard that is being used<br>00 = Auto<br>01 = NTSC<br>02 = PAL |
| 1B | Sense Video Standard | | Returns 2 bytes as described in the Select Video Standard Command. |

## 4.7. VIDEO CHARACTER INSERTER COMMANDS

Several of the VCG commands need to specify which VCG window they apply to. The following table defines the VCG window numbers.

| WINDOW NUMBER | DESCRIPTION |
|---|---|
| 01 | Reader 1 Time |
| 02 | Reader 1 User Bits |
| 03 | Reader 2 Time |
| 04 | Reader 2 User Bits |
| 05 | Reader 2 Time |
| 06 | Reader 2 User Bits |

**Table 4-4: VCG Window Numbers**

| | | | |
|---|---|---|---|
| 30 | Sense Char Gen Size | | Returns 1 byte as defined below. |
| 20 | Select Char Gen Size | 1 byte | Selects the size of the VCG Character Font<br>00 = Tiny<br>01 = Small<br>02 = Large |

| | | | |
|---|---|---|---|
| 31 | Sense Char Gen Window Position | Window No | Returns 3 bytes of window position as follows. |

| Vertical Position | Horizontal Position | Window Length |
|---|---|---|

| | | | |
|---|---|---|---|
| 21 | Preset Char Gen Window Position | Window No +1 byte Vertical Position<br>+ 1 Byte Horizontal Position | |

Sets the starting position of a VCG window on the raster.

| SIZE | VERT POSITION | HORIZ POSITION |
|---|---|---|
| Tiny | 0 to 32 are valid | 0 to 32 depending on window length |
| Small | 0 to 16 are valid | 0 to 32 depending on window length |
| Large | 0 to 8 are valid | 0 to 32 depending on window length |

**Table 4-5: VCG Sizes**

| | | | |
|---|---|---|---|
| **32** | **Sense Char Gen Window On/Off** | Window No | Returns 1 byte as defined below. |
| **22** | **Select Char Gen Window On/Off** | Window<br>+ 1 byte | Turns individual windows on and off.<br>00 = Off<br>01 = On |
| 33 | Sense Char Gen Global On/Off | | Returns 1 byte as defined below. |
| 23 | Select Char Gen Global On/Off | 1 byte | Turns all windows on and off.<br>00 = Off<br>01 = On |
| 34 | Sense Char Gen Style | | Returns 1 byte as defined below. |
| 24 | Select Char Gen Style | 1 byte | Selects the Style of the VCG windows.<br>00 = White<br>01 = White on Black<br>02 = Black<br>03 = Black on White |
| 35 | Sense Char Gen Frames | | Returns 1 byte as defined below. |
| 25 | Select Char Gen Frames | 1 byte | Selects whether the frames digits will be shown on the character inserter.<br>00 = Blanked<br>01 = Displayed |
| 36 | Sense Char Gen Fields | | Returns 1 byte as defined below. |
| 26 | Select Char Gen Fields | 1 byte | Selects whether the fields digits (for VITC windows time windows only) will be shown on the character inserter |

| | | | |
|---|---|---|---|
| | | | 00 = Blanked<br>01 = Displayed |
| 37 | Sense Char Gen Symbols | | Returns 1 byte as defined below. |
| 27 | Select Char Gen Symbols | 1 byte | Selects whether the symbols which identify the Character inserter windows will be shown<br>00 = Blanked<br>01 = Displayed |

## 4.8. READER COMMANDS

Several of the Reader commands need to specify which Reader they apply to. This parameter is called the Reader Number.

| | | | |
|---|---|---|---|
| 60 | Sense RDR Assignment | | Returns 1 byte as defined below |
| 40 | Select RDR Assignment | 1 byte | Selects the Reader assignment<br>01 = LTC<br>02 = VITC<br>03 = LTC / VITC |
| 61 | Sense RDR Mode | Rdr No | Returns 1 byte as defined below |
| 41 | Select RDR Mode | Rdr No<br>+ 1 byte | Selects the mode of the reader |

Reader modes set according to the following values

| | DESCRIPTION | |
|---|---|---|
| **MODE** | **TIME** | **UB** |
| 1 | TIME | DATA |
| 2 | TIME | TIME |
| 3 | TIME | EDGE |
| 4 | KEY INFO+ | EDGE |
| 5 | DATA | DATA |
| 6 | TIME | DATE |
| 7 | 3 LINE VITC | |

**Table 4-6: Reader Modes**

| | | | |
|---|---|---|---|
| 62 | Sense VITC RDR Lines | Rdr No | Returns 2 byte as defined below |
| 42 | Preset VITC RDR Lines | Rdr No<br>+ 2 bytes | Selects the VITC lines of the reader |

The VITC reader will read starting at the first line number and ending at the second line numbers. Line numbers are packed BCD format. Valid lines at 6 to 21 for PAL and 10 to 20 for NTSC.

| | | | |
|---|---|---|---|
| 63 | Sense VITC RDR CRC | Rdr No | Returns 1 byte as defined below |
| 43 | Select VITC RDR CRC | Rdr No<br>+ 1 byte | Selects which type of CRC the VITC Reader is looking for.<br>00 = Normal CRC<br>01 = Special CRC |
| 64 | Sense RDR Display | Rdr No. | Returns 1 byte as defined below |
| 44 | Select RDR Display | Rdr No.<br>+ 1 byte | Selects the whether look ahead processing will be applied to the reader display.<br>00 = Processed<br>01 = Direct |
| 65 | Sense Broadcast Mode | | Returns 1 byte as defined below |
| 45 | Define Broadcast Mode | 1 byte | Defines a block of data which will be sent in broadcast mode, and in response to a Sense Broadcast Block command. |

| --- | RU3 | RU2 | RU1 | --- | RT3 | RT2 | RT1 |
|---|---|---|---|---|---|---|---|

Each bit represents a variable length block of data which is requested. Time and User Bits are formatted according to the Select RDR Mode command above. The broadcast data blocks are assembled in the following order:

RT1 RU1 RT2 RU2 RT3 RU3

| | | | |
|---|---|---|---|
| 66 | Sense Reader | 1 byte | Returns Reader data as defined by the following byte: |

| --- | RU3 | RU2 | RU1 | --- | RT3 | RT2 | RT1 |
|---|---|---|---|---|---|---|---|

Each bit represents a variable length block of data which is requested. Time and data are formatted according to the Select RDR Mode command above. The bits are polled and return blocks are assembled in the following order:

RT1 RU1 RT2 RU2 RT3 RU3

| | | | |
|---|---|---|---|
| 67 | Sense Broadcast Block | | Returns the broadcast block as defined by the Define Broadcast Mode command above. |
| 68 | Sense RDR Film Type | Rdr No. | Returns 1 byte as defined below |
| 48 | Select RDR Film Type | Rdr No.<br>+ 1 byte | Selects the film type when the Reader Mode is set to either the TIME EDGE or KEYINFO+EDGE mode.<br>(Reader 1 & Reader 2 only)<br>00 = 35 mm 16 Frm/Key<br>01 = 16 mm 20 Frm/Key<br>02 = 16 mm 40 Frm/Key |
| 69 | Sense RDR Film Rate | Rdr No. | Returns 1 byte as defined below |
| 49 | Select RDR Film Rate | Rdr No.<br>+ 1 byte | Selects the film transfer rate when the Reader Mode is set to either the TIME EDGE or KEYINFO+EDGE mode.<br>(Reader 1 & Reader 2 only)<br>00 = 24 Frames per second (NTSC only)<br>01 = 30 Frames per second (NTSC only)<br>02 = 25 Frames per second (PAL only) |
| 6A | Sense RDR Edge Style | Rdr No. | Returns 1 byte as defined below |
| 4A | Select RDR Edge Style | Rdr No.<br>+ 1 byte | Selects the edge style when the Reader Mode is set to either the TIME EDGE or KEYINFO+EDGE mode.<br>(Reader 1 & Reader 2 only)<br>00 = Generic<br>01 = Evertz |
| 6B | Sense RDR Edge Format | Rdr No. | Returns 1 byte as defined below |
| 4B | Select RDR Edge Format | Rdr No.<br>+ 1 byte | Selects the film transfer rate when the Reader Mode is set to either the TIME EDGE or KEYINFO+EDGE mode.<br>(Reader 1 & Reader 2 only)<br>00 = 4 Digits of Feet + Frames<br>01 = 5 Digits of Feet + Frames<br>02 = 6 Digits of Feet + Frames<br>03 = 7 Digits of Feet + Frames (Evertz style only) |

**Figures**

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# 5. TECHNICAL DESCRIPTION

## 5.1. OVERVIEW

The Model 5150 Afterburner LTC/VITC Timecode Reader combines the latest LSI technology with sophisticated microcontroller firmware to provide a powerful, flexible time code reader system. The Afterburner is a dual LTC/VITC reader and multi-function character inserter. Its power and flexibility are unsurpassed in time code reader applications. A 16 digit alphanumeric display can be quickly delegated to show the required data. The Afterburner contains three separate readers that can be operated independent of each other, or two can be linked to form an auto LTC/VITC reader. The Afterburner can be configured in one of four basic operating modes:

- Reader 1: Full speed (1/30 to 70 times play) LTC reader. Reader 2: 0 to 40X speed VITC reader
- Auto LTC/VITC reader automatically switches between LTC and VITC inputs reading whichever is valid.
- Dual VITC reader - reads VITC from two sets of lines on the same video simultaneously
- Triple VITC reader - reads VITC from three sets of lines on the same video simultaneously

The recovery of recorded LTC time code at other than play speed has always presented some degree of difficulty, particularly with low end 3/4" recorders lacking a separate address track. The high speed LTC reader in the Afterburner employs sophisticated input conditioning and clock/data separator circuits to reliably recover LTC over the full shuttle and wind speed range of most VTRs.

The VITC readers recover VITC from still to over 40 times play speed on non time base corrected video signals. Although the use of time base correctors will enhance the recovery range of the VITC reader, the amount of improvement is dependent on the type of TBC and transport being used. The Afterburner contains all the necessary video processing circuits and therefore, requires no external signals other than the video signal itself.

The video character inserter contains a high resolution character inserter which provides white or black characters keyed into the video with or without a contrasting background. Character size and raster position are software selectable. The character display may be used to show time and user bits. Each of the windows can be turned on and off and positioned independent of each other.

When displaying time recovered from a VITC source, the field number sequence will be displayed to the right of the frames display. When the data being read was recorded in the non colour frame mode the field

number sequence will be 1,2,1, etc. (1,2,3,4,1, etc. for PAL). When the reader data was recorded in the colour frame mode, the field number sequence will be 1,2,3,4,1, etc. (1,2,3,4,5,6,7,8,1, etc. for PAL).

The character inserter is also used for the on Screen Programming menus which are used to set up the various operational modes of the Afterburner.

## 5.2. JUMPERS AND SWITCHES

Figure 5-2 shows the location and function of the switches and jumpers inside the Afterburner. The jumper positions marked in **bold** face type are the default settings.

### 5.2.1. DIP Switch Functions

The main circuit board of the 5150 contains an 8 position DIP switch which is used to invoke various diagnostic and calibrations functions. The functions of each switch are described below.

| Switch | Name | Normal | Function when Open | Function when Closed |
|---|---|---|---|---|
| 1 | Not used | Open | Normal operation | Reserved |
| 2 | Not used | Open | Normal operation | Reserved |
| 3 | Translator Source | Open | Translator Follows Rdr 1 | Translator Follows Rdr 3 |
| 4 | Not used | Open | Normal operation | |
| 5 | Not Used | Open | Normal operation | Reserved |
| 6 | Factory Reset | Open | Normal operation | Resets 5150 to factory defaults on power up |
| 7 | Not Used | Open | Normal operation | |
| 8 | Not used | Open | Normal operation | |

**Figure 5-1: DIP Switch Functions**

### 5.2.2. Jumper Functions

All jumpers except JP5, JP6 and JP19 are printed circuit board links and are installed in the default position. To change the position, the board link must be cut and a wire link must be installed in the desired location.

| | | | |
|---|---|---|---|
| JP1 | Parallel I/O 1 (pin 9) | **Installed** | When link is installed, Output 1 has 4.7K pullup to +5 Volts |
| | | Open | When link is cut open, Output 1 is Open collector |
| JP2 | Parallel I/O 2 (pin 5) | **Installed** | When link is installed, Output 2 has 4.7K pullup to +5 Volts |
| | | Open | When link is cut open, Output 2 is Open collector |
| JP3 | Editor Serial I/O | | Not installed for 5150 |
| JP4 | VTR Serial I/O | | Not applicable for 5150 |

| | | | |
|---|---|---|---|
| JP5 | Remote Serial I/O | **232** | Selects RS232 transmit for pin 5. |
| | | 422 | Disconnects pin 5 for use on RS422 ports |
| JP6 | FLASH / EPROM | EPROM | Installed when main operating firmware is located in EPROM U19. |
| | | **FLASH** | Installed when main operating firmware is located in FLASH PROM U20. EPROM U19 contains boot-up / FLASH programming firmware |
| JP7 | Char EPROM 512K | **Open** | Used when Char EPROM is 128K or 256K. |
| | | Installed | Connects Char EPROM U35 address A15 to LCA U36 when Char EPROM is 512K. Jumper JP9 must also be in the '256' position. |
| JP8 | Char EPROM CE | **Pin 2,3** | Board link installed connects Char EPROM CE to ground. |
| | | Pins 1,2 | Board link installed connects Char EPROM CE to +5 Volts after the LCA loads. |
| JP9 | Char EPROM Size | **128** | Board link installed connects Char EPROM U35 Address A14 to +5 volts for use with 128K size EPROM. |
| | | 256 | Board link cut and Pins 2+3 shunted to connect Char EPROM U35 Address A14 to LCA U36 for use with 256K size EPROM. |
| JP10 | | | Not applicable for 5150 |
| JP11 | Diagnostics 1 | | Not applicable for 5150 |
| JP16 | Diagnostics 2 | | Not applicable for 5150 |
| JP19 | MCU EPROM Size | **512** | Board link installed connects MCU EPROM U19 Address A15 to microprocessor A15 for use with 512K size EPROM. |
| | | 256 | Board link cut and Pins 2+3 shunted to connect MCU EPROM U19 Address A15 to +5 volts for use with 256K size EPROM. |
| JP20 | UART RX | | Not applicable for 5150 |
| JP21 | UART TX | | Not applicable for 5150 |
| JP22 | MCU RX | | Not applicable for 5150 |
| JP23 | MCU TX | | Not applicable for 5150 |
| JP24 | VCG Video In | A | VITC Reader Video connected to RDR IN Loop. VCG video connected to Gen Video In loop. |
| | | B | VITC Reader and VCG Video connected to either RDR IN Loop or Gen Video In loop as selected by U38. |
| | | **A & B** | VITC Reader Video and VCG video connected to RDR IN Loop. U38 not installed. |

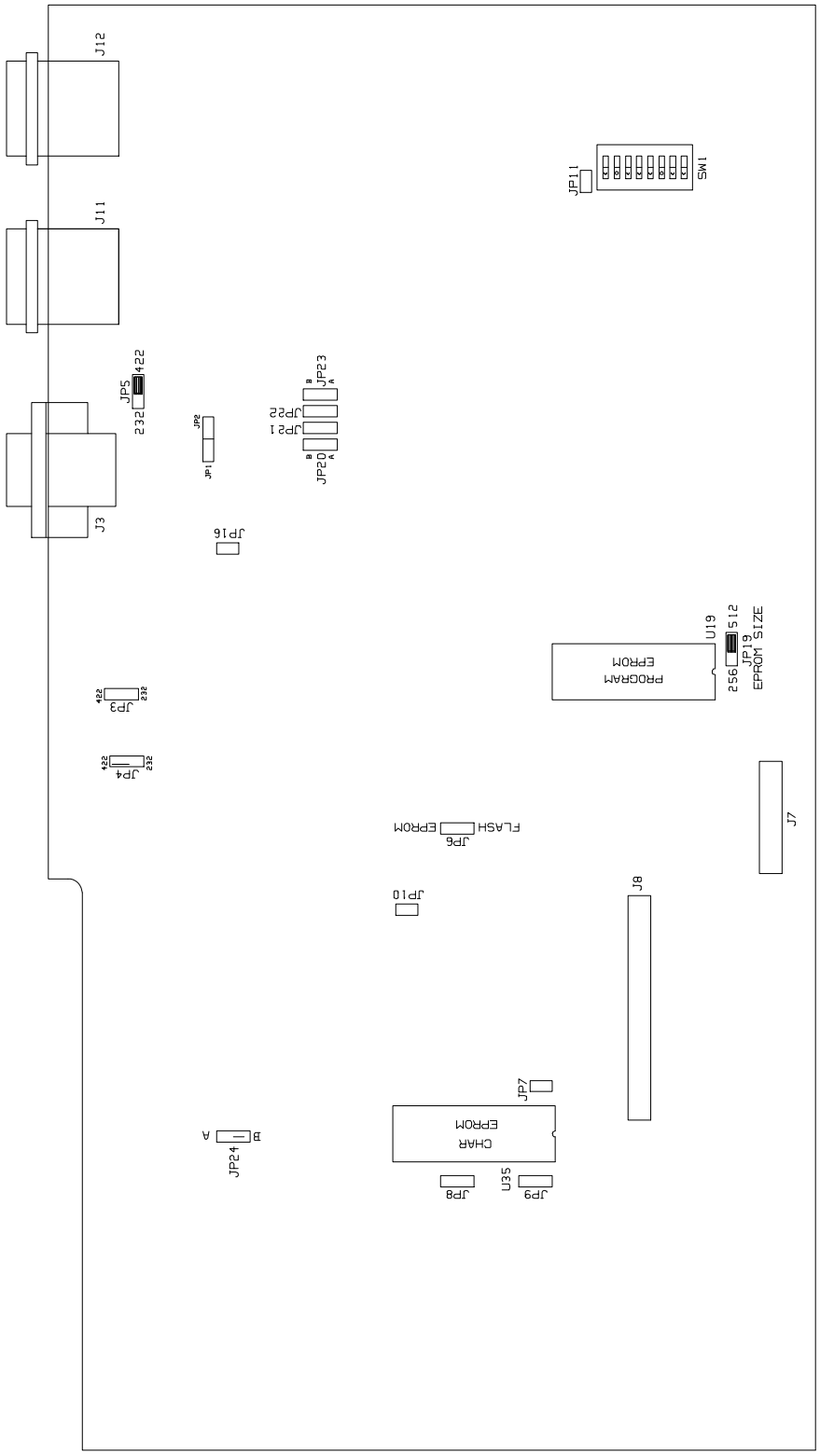


**Figure 5-2: Main Board Jumper Locations**

## 5.3. CIRCUIT DESCRIPTION

The Afterburner reader is a microcontroller based device functionally divided into the following hardware subsystems:

1 Microcontroller & I/O
2 Display and Pushbuttons
3 High speed LTC Reader
4 High speed VITC Reader
5 LTC re-shaper/translator
6 Character generator , sync separator and keyer
7 Character generator logic

The microcontroller, LTC and VITC readers, LTC translator, character generator logic and video processing circuits are all contained on the main circuit card (5200). The display and keypad circuitry is contained on a separate circuit board (5220) which plugs into the main board via a twenty conductor ribbon cable. The relevant schematic drawings are shown in brackets for each section of the circuit. The heart of the Afterburner circuitry are two programmable logic array (LCA) devices. One LCA (U25) contains most of the LTC/VITC reader logic LTC translator logic and the support circuitry for addressing various devices on the board. The other LCA (U36) contains the character generator raster scanning logic.

### 5.3.1. Microcontroller (5200-33)

At the heart of the Afterburner reader is an 8032 microcontroller, (MCU) U17. Its three 8 bit bi-directional ports and 8 bit bus provide peripheral interfacing to the rest of the circuits. Boot-up program memory is contained on EPROM U19, and operating program memory is contained on FLASH PROM U20. Scratch pad and data RAM are provided internally by the MCU. An onboard oscillator, also part of the MCU, is crystal controlled. Its' 15.36 MHz frequency is internally divided by 12, resulting in a processor operating frequency of 1.28 MHz.

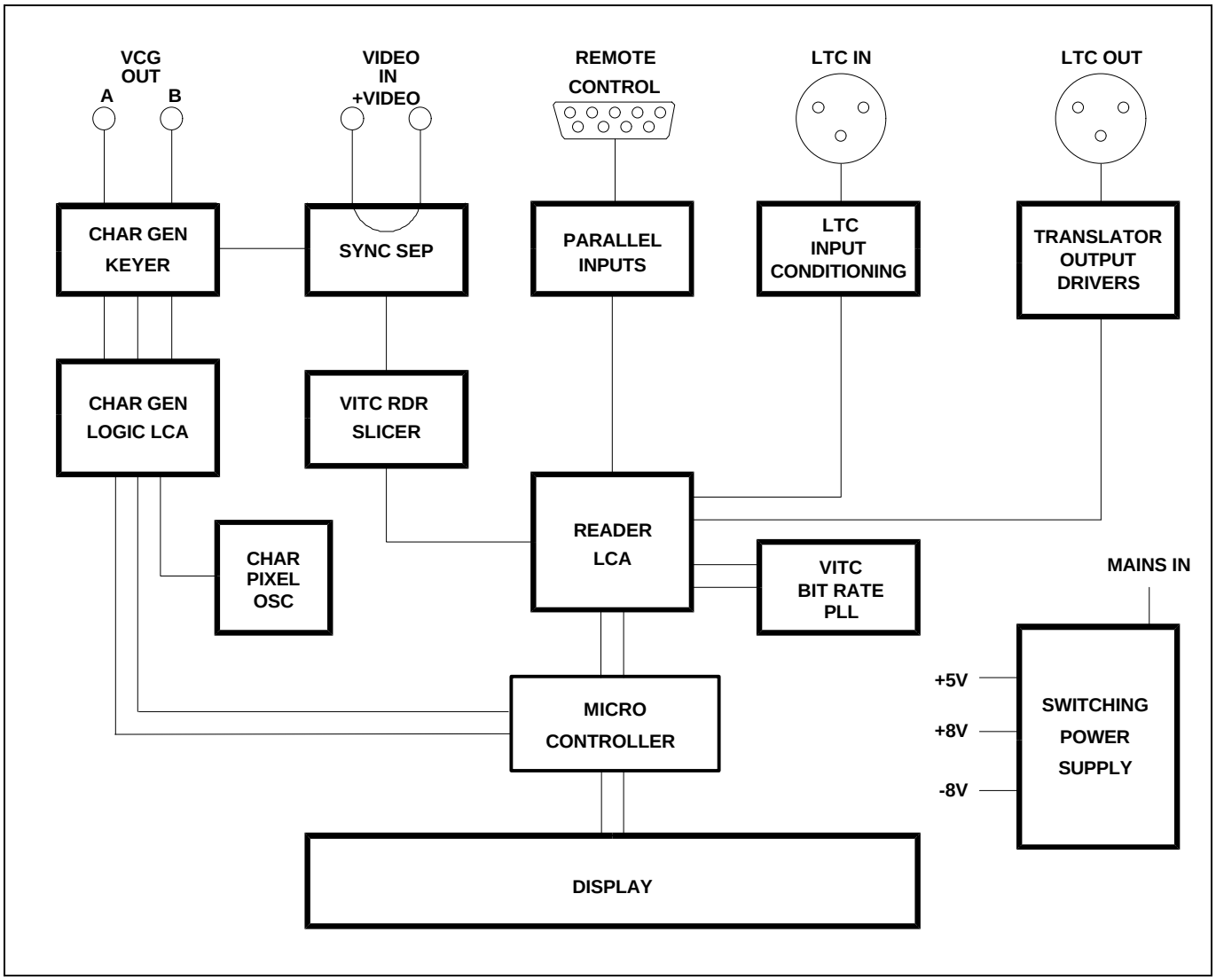


**Figure 5-3: Block Diagram**

### 5.3.2. Front Panel Display and Pushbuttons (5220-31)

A 16 digit alphanumeric display, and a 16 button keypad are contained on a separate circuit card (5220) which is connected to the main circuit board via a 20 conductor ribbon cable.

The 16 digit display is self scanning and contains its own character display memory. Data is written to the displays once per frame. Address Latch U1 generates chip enable and address information to the display devices to allow the MCU to write data to the display and control registers.

The status LEDs are controlled by interface driver U3. This driver is accessed with a serial clock and data stream once per frame. When all the LED information has been shifted into the driver, it is latched there by the LEDSTB signal from the MCU (display header pin 10).

LED diagnostics can be invoked by holding down any Key except up or down arrow on power up. When any key is pressed, all the front panel LED's should come on. To exit LED test mode, remove and re-apply power to the unit.

The 16 pushbuttons are arranged in a 8 x 2 matrix. Data from 8 keys at a time is latched into U2 by signal SH/LD on U2 pin 1. Address decoder U1 selects which set of 8 pushbuttons is latched into U2 using enable lines A0 and A1. Each time a key is pressed, the MCU firmware generates a key scan code corresponding to the position of the key in the key matrix.

Keyboard diagnostics can be invoked by pressing any key except up or down arrow during power up. The front panel display will show the message SCAN CODE and the keyboard scan code. When no keys are depressed, the key scan code is ??. Pressing a key will show the corresponding key scan codes, as shown in the table below. To Exit the keyboard test, remove and re-apply power to the unit.

| Key | Scan Code | Key | Scan Code |
|---|---|---|---|
| TIME/UB | 41 | DISPLAY | 01 |
| ENTER | 02 | CLEAR | 03 |
| VCG MODE | 45 | VCG ON/OFF | 44 |
| FREEZE | 04 | STATUS | 05 |
| CONFIG | 42 | SHIFT | 43 |
| SELECT | 46 | SETUP | 48 |
| ↑ | 47 | ← | 06 |
| ↓ | 07 | → | 08 |

**Figure 5-4: Keyboard Scan Codes**

### 5.3.3. High Speed LTC Reader (5200-32) & (5200-34)

Incoming LTC is decoupled and amplified by U9, U10 and associated components to provide a regenerated reader data signal at the LR test point. This digital representation of the LTC is fed to the LCA where a series of timing pulses generated by the LCA are used to properly decode 0 and 1 bits. The LTC data is extracted by the LCA and is shifted into one half of shift register U26. The LCA generates an LTC RDY signal to the MCU when it has received one frame of data. Direction information derived from the last bit of the sync word is also fed to the MCU. A valid reader sync word toggles a flip flop in the LCA which enables the other half of shift register U26 to collect data from the next frame while the MCU is unloading data from the frame just completed through the LCA.

### 5.3.4. LTC Re shaper/ Translator (5200-32) & (5200-34)

When the 5150 is in regenerate mode, incoming code is recovered by the microcontroller, and is re-timed and re-phased to the reader video. The bit-rate generator, located in the LCA U25, divides the 15.36 MHz crystal frequency down to twice the LTC bit frequency (4798 Hz for NTSC, and 4000 Hz for PAL). An interrupt to the MCU is generated on TO (U25 pin 7) every 4 bits. The MCU writes the next 4 bits to a register in the LCA, and the data is clocked out from the LTCOUT (U25 pin 66) to the LTC shaping circuitry.

When the 5150 is in the reshape mode, the incoming LTC data going into the LCA on LTCBUFA and LTCBUFB is used to drive the LTCOUT output of the LCA directly.

The LTC is shaped to the correct rise and fall times by U11 and associated components, and fed to the output driver U13. NOVPOT U12 is a digitally controlled potentiometer, set from the MCU, and is used to control the output level of the LTC.

### 5.3.5. High Speed VITC Reader (5200-36) & (5200-34)

Reader composite video is buffered by Q2 and distributed to the VITC sync separator and data extractor. The sync separator U44 provides H Sync, V Sync, a Frame pulse (active high for field 1) and a back porch clamp pulse to drive the DC restorer circuitry U43 and associated components. Composite video is buffered and DC restored by U43 to provide clamped VITC video to comparator U45b (test point CRV). Peak detector U45a and associated components provide a reference level to U45a of approximately one half the peak VITC level to ensure proper extraction of the VITC data regardless of the video level. Comparator U45b extracts the VITC data bits from the video (test point VTCO) and sends it to the LCA U25 for further processing.

A phase locked loop consisting of U28, 29, and 30 and associated components extracts the VITC bit rate clock from the data and is used to decode 0 and 1 bits inside the LCA. The LCA validates the cyclic redundancy check (CRC) word and sync bit patterns for the recovered data and generates a VITC ready signal to the MCU. Data is shifted into U23, U24 or U26, depending on the reader assignments where it is unloaded by the MCU. The MCU unloads the VITC data through the LCA.

### 5.3.6. Character Generator Sync Separator and Keyer (5200-36)

The Character inserter composite video is taken from the Reader Video input loop and is buffered by Q2 and distributed to the character generator sync separator and keyer / amplifier. The sync separator U54 provides H Sync, V Sync, a Frame pulse (active high for field 1) and a back porch clamp pulse to drive the DC restorer circuitry U55 and associated components.

The Video keyer U40 is controlled by the VCGKEY signal generated in the LCA U36. VCGKEY switches U40 between the program video path and the VCGWHITE data. When the VCGKEY signal is LOW the active video is passed through the keyer. When the VCGKEY signal is HIGH the VCGWHITE data is added to the black level of the video.

To calibrate the video keyer, connect colour bars from your sync generator to the Reader Video input loop of the Afterburner and to channel A of your oscilloscope and terminate it. Connect one of the video outputs of the Afterburner to channel B of your scope and terminate it. Adjust the **GAIN** trimpot (VR3) so that the output amplitude matches the input. Adjust the **CHAR LEVEL** trimpot (VR2) so that the inserted characters are approximately at the peak white video level.

### 5.3.7. Character Generator Logic (5200-35) & (5200-36)

The majority of the logic for the character generator functions is contained in a programmable logic device (LCA) U36. Its program is loaded from EPROM U35 on power up. The character display is formatted to display 28 (32 for PAL) rows of 32 characters each in the tiny size, 14 (16 for PAL) rows the small size, and 7 (8 for PAL) rows in the large size. Each of the character positions corresponds to one location in static RAM U37. The MCU writes characters into specified locations in the RAM corresponding to the position of the characters on the screen. RAM locations are scanned during each television field. Valid characters address corresponding sections of the character EPROM U35 and are loaded into the LCA one byte (8 bits) at a time. Each byte corresponds to either the left or right half of a character pixel line. The internal logic in the LCA controls how many lines per character and how many character lines there are on the raster according to registers set by the firmware.

The character data is clocked out of the LCA on the VCGWHITE output (U36 pin 73). A special character with all bits set to 1 is written into all positions of the RAM where no characters are to be displayed. These characters disable the keyer by the VCGKEY signal generated in the LCA (U36 pin 79). When other characters are present the VCGKEY signal becomes active, allowing the characters to be keyed into the video signal. The character data is clocked out of the LCA with the dot clock, so that the pixel width is not dependent on propagation delays in the LCA. The pixels are presented to the video keyer U40 through CHAR LEVEL trimpot VR2. A control register in the LCA selects whether the characters will be white or black and whether they will be keyed into a contrasting background. Character style selection is accomplished by the on screen programming menu.

The pixel oscillator consists of monostable U32b and associated components. The oscillator frequency which determines horizontal size of the characters is adjusted by the digital trimpot (NOVPOT) U34 and associated components. The MCU writes different values to the NOVPOT which control the adjustment input to voltage regulator U33, which in turn

sets the voltage present for the RC timing network of the monostable. The starting position of the characters at the left of the screen is determined by monostable U32a. The left position of the characters is adjusted by trimpot VR1.

## 5.4. UPDATING TO A NEW FIRMWARE VERSION

The Afterburner is equipped with an electrically erasable and re-programmable program memory device called a FLASH PROM. This facilitates firmware upgrades in the field. The following procedures should be followed to reprogram the Afterburner.

1. Connect the Afterburner to the computer's serial port. Most computers have two serial communications ports (known as COM1 and COM2). If you have both serial ports available, connect the Afterburner to COM1. There are two different types of connectors commonly used for the COM ports on computers. The diagram below shows the correct cable pinouts for both the 9 pin and 25 pin connector types.

| 5150 Serial I/O Male Description | DB-9 | DB-25 | DB-9 | Computer End Female Description |
|---|---|---|---|---|
| Shield Ground | 1 | 1 | 1 | Shield Ground |
| RS 232 Transmit | 5 | 3 | 2 | RS 232 Receive |
| Ground | 6 | 7 | 5 | Signal Ground |
| RS 232 Receive | 8 | 2 | 3 | RS 232Transmit |

2. If you received the firmware update on floppy disk, insert the reprogramming diskette in the drive of the computer. Change directories to the root of the reprogramming diskette's drive (A: or B:)

   If you received this update from our Support Bulletin Board, change to the directory of your hard disk where you have the upgrade files located. The upgrade files you downloaded have been compressed using PKZIP and will need to be expanded before you can proceed. Expand the upgrade files into this directory by running the PKUNZIP utility (available on our BBS if you do not have a copy) as follows:

   PKUNZIP AB52A1.ZIP

3. To set up the Afterburner for programming at 38400 baud hold down the ↑ key while you apply power to the Afterburner. When the Afterburner completes its boot-up sequence, the front panel will display `LOAD FLASH - 38400.` The default baud rate for reprogramming is 38400.

To set up the Afterburner for programming at 9600 baud hold down the ↓ key while you apply power to the Afterburner. When the Afterburner completes its boot-up sequence, the front panel will display `LOAD FLASH - 9600`

4. The Afterburner firmware is contained in an Intel HEX format file and is called AB52A1.HEX. A Flash Loader software utility (called FL.EXE) was provided along with the upgrade files you received. This utility uploads the HEX file to the Afterburner. Run FL.EXE, with the appropriate '.hex' file as the first argument. For example:

   FL AB52A1.HEX

   This will run the Flash loader program in its default configuration: COM1, 38400 baud, software flow control.

   If you connected the computer using COM2 you will need to use additional command line parameter to specify the COM port as follows:

   FL AB52A1.HEX /p2

   If you set up the Afterburner for programming at 9600 baud you will need to use additional command line parameter to specify the baud rate as follows:

   FL AB52A1.HEX /b9600

   Entering the FL with no file name will generate a usage message to show you all the available options for the Flash Loader program.

5. The Flash Loader will announce that it is erasing the FLASH PROM, The Afterburner front panel display will show `FLASH ERASING...`

6. When the Flash PROM is erased, the Flash loader will start to send the new firmware to the Afterburner. The Flash loader will give a status report as it sends each line of the HEX file to the Afterburner. During programming the Afterburner front panel display will show `LOADING - XXXXX`. The XXXXX will be the actual PROM address currently being programmed.

7. If there are programming errors an appropriate message will be shown on the Afterburner front panel. You will need to abort the Flash loader program by pressing the ALT+x keys on your computer keyboard. (Hold the ALT key down while pressing the x key.) Repeat steps 3 to 6 to try to correct the problem. If you still have trouble, try programming at 9600 baud.

8. The reprogramming will be complete when the Flash Loader announces "Hex file transmitted successfully" and returns you to the DOS prompt. The Afterburner will automatically switch to its FLASH program memory if programming is successful. As a part of the Afterburner boot-up cycle it will say `SWITCH TO FLASH` to indicate that it is running on the FLASH EPROM now.

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## 6. FILM EMULSION CODES

Support has been added for Kodak KY (5620) and Fuji FN 71 (8571) film stocks. The following table shows the Film Types supported in this firmware version.

| Manufacturer | | | Emulsion | | Film Type |
|---|---|---|---|---|---|
| | Code | Letter | Code | Char | |
| **Agfa** | 01 | A | 20 | N | XT 100 |
| | 11 | | 24 | M | XTR 250 |
| | | | 83 | F | XT 320 |
| | | | 84 | S | XTS 400 |
| **Kodak** | 02 | K | 00 | P | 5600 |
| | 12 | | 20 | Y | 5620 Prime Time |
| | | | 22 | E | 5222/7222 |
| | | | 24 | L | 5224 (obsolete stock) |
| | | | 31 | H | 5231/7231 |
| | | | 34 | D | 5234/7234 |
| | | | 43 | A | 5243/7243 (obsolete stock) |
| | | | 44 | V | 5244/7244 |
| | | | 45 | K | 5245/7245 |
| | | | 46 | I | 5246/7246 Vision 250D |
| | | | 47 | B | 5247/7247 |
| | | | 48 | M | 5248/7248 |
| | | | 49 | O | 5249 (obsolete stock) |
| | | | 72 | S | 5272/7272 |
| | | | 74 | Z | 5274/7274 Vision 200T |
| | | | 77 | Q | 5277/7277 |
| | | | 79 | U | 5279/7279 |
| | | | 87 | W | 5287/7287 |
| | | | 89 | R | 5289 Vision 800T |
| | | | 92 | N | 7292 (obsolete stock) |
| | | | 93 | L | 5293/7293 |
| | | | 94 | G | 5294/7294 (obsolete stock) |
| | | | 95 | F | 5295 |
| | | | 96 | J | 5296/7296 |
| | | | 97 | C | 5297/7297 |
| | | | 98 | T | 5298/7298 |
| **Fuji** | 03 | F | 01 | I | FCI (8501, 8601, 8701) |
| | 13 | | 02 | I | FCI (8502, 8602, 8702) |
| | | | 10 | N | F-64 (obsolete stock 05/95) |
| | | | 13 | I | FCI (obsolete stock) |
| | | | 14 | N | F-500 (obsolete stock) |
| | | | 20 | N | F-64D (obsolete stock 05/95) |
| | | | 21 | N | F-64D (8521, 8621, 8721) |
| | | | 22 | N | F-64D (8522, 8622) |
| | | | 30 | N | F-125 (obsolete stock 05/95) |
| | | | 31 | N | F-125 (8531, 8631, 8731) |
| | | | 32 | N | F-125 (8532, 8632) |
| | | | 50 | N | F-250 (obsolete 05/95) |
| | | | 51 | N | F-250 (8551, 8651, 8751) |
| | | | 60 | N | F-250D (obsolete stock 05/95 |
| | | | 61 | N | F-250D (8561, 8661, 8761) |
| | | | 70 | N | F-500 (8570, 8670, 8770) |
| | | | 71 | N | F-500 (obsolete stock) |
| | | | 91 | N | RP (8691 16 mm B/W neg) |
| | | | 92 | N | FG (8592 35mm B/W neg) |

**Figure 6-1: Film Manufacturers and Film Types (as of August 10, 1998)**

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