Model 5300
Timecode Analyzer

Instruction Manual

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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	Preliminary manual	July 95
1.1	Chapter 4 Technical description, drawings, parts lists added	July 95

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1. INTRODUCTION

The Model 5300 LTC/VITC Time Code Analyzer combines the latest LSI technology with sophisticated microcontroller firmware to provide a powerful, flexible time code analyzer system. The model 5300 is a dual LTC/VITC reader / analyzer and multi-function character inserter. Its power and flexibility are unsurpassed in time code analyzer applications. A 16 digit alphanumeric display can be quickly delegated to show the required data. The Time Code Analyzer contains an LTC and VITC reader that can be operated independent of each other, or can be linked to form an auto LTC/VITC reader. The Time Code Analyzer can be configured in one of four basic operating modes:

- Full speed (1/30 to 70 times play) LTC reader.
- Full speed (still to greater than 40 times play) VITC reader.
- Auto LTC/VITC reader automatically switches between LTC and VITC inputs reading whichever is valid.

The model 5300 time code analyzer has a time code learn feature which scans the incoming code and gives a summary of the LTC and VITC that it finds. For LTC it identifies parameters such as whether LTC is coming in, code level, and time code flags. For VITC it identifies parameters such as what lines VITC is on, what type of CRC was used, and time code flags. The time code learn can be set to do one pass, or it can be set up in a continuous mode.

The 5300 has the ability to monitor a variety of timecode conditions and report on them in several different ways. A time code monitor window on the character inserter will pop up when certain alarm conditions are met. This allows the user to determine what types of problems he wishes to monitor, and when he wishes to be notified of the problems.. This information is also available on the front panel display. An audible alarm can be programmed to sound when one of the alarm conditions is triggered to alert the operator of a problem. A serial monitor port outputs a complete report as error conditions are encountered. This data includes the error type and the last good timecode number before the error condition, to aid in locating faults on a video tape. The serial monitor port may be connected to a computer or a serial printer to provide a hard copy of the analysis report.

The Session key allows the user to ‘reset’ the error counters and start a new capture session. This increments a session number which is available on the serial output, so that error reports can be unambiguously related to specific tapes.

The Time Code Analyzer detects the following time code problems:

- LTC levels less than a user definable minimum or greater than a user definable maximum
- LTC phasing errors
- Colour phase errors
- Time code drop outs
- LTC and VITC that do not match
- Invalid code numbers
- Counting sequence errors in the time bits
- Counting sequence errors in the user bits

The Time Code Analyzer is designed to work as a companion to the Evertz 5010 Time Code Master and 4015 and 4025 Film Footage Encoders reading all the data formats that these devices generate.

Film edge numbers (KeyKode) which have been encoded into the user bits by the 4015 or 4025 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 Time Code Analyzer 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 model 5300 Time Code Analyzer 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 Time Code Analyzer 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 Time Code Analyzer 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 four independently positionable windows to show time and user bits, code flags, LTC/VITC differences, and time code errors simultaneously. Three character sizes and the choice of white or black characters with or without contrasting background mask are selected from the front panel. An additional phase monitor window shows LTC phase and colour phase of the incoming timecode.

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 Time Code Analyzer to be conveniently configured for particular customer requirements.

The Time Code Analyzer 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 4 chapters : Introduction, Installation, Operating Instructions, and Technical Description.

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

1.2. DEFINITIONS

COLOUR FRAME: If a time code generator is locked to an RS-170A or 8 field PAL video signal, and an intentional relationship between

the video colour frame sequence and the time code is desired, the code is said to be colour framed. A flag bit is set in the code to indicate this mode. The 5300 Analyzer has the ability to detect when incoming code was recorded with the colour flag bit on, and whether the colour sequence is in the same colour sequence or colour phase with the reference video.

CRC: Cyclic Redundancy Code. This is a 8 bit check word used in vertical interval timecode. It allows the reader to detect if the VITC on a particular line is valid. By using different encoding methods of the CRC, it is also possible to encode different types of data, such as KeyKode, without confusing the reader. The 5300 can use 3 different types of CRC's. The Normal CRC is used for all SMPTE 12 M standard VITC, normally found as the address code on video tapes. The KeyKode CRC is used by the Evertz 4025 to encode KeyKode information. The Production CRC is used by the Evertz 4025 in its 3-line VITC mode to encode production timecode.

DROP FRAME: In NTSC systems, where the frame rate is 29.97002618 frames per second, the drop frame mode permits time of day indexing of the frame numbers by dropping certain frame numbers. Specifically, frames 0, and 1 at the beginning of each minute except minutes 0,10,20,30,40,& 50, are omitted, to compensate for an approximate timing error of 108 frames (3 seconds 18 frames) per hour. A flag bit is set in the time code to signal when the drop frame mode is in effect.

EBU: Refers to the European Broadcasting Union

EDGE NUMBER: The manufacturers of motion picture film stock print a frame identifying number along the edge of the film, during the manufacturing process. These numbers, also known as KEY NUMBERS, occur at one foot, or half foot intervals, hence they have also become known as footage numbers. The film frames between the edge numbers are identified by interpolation from one edge number to the next.

Traditionally, these numbers have been only human-readable. The task of properly identifying the correct number is somewhat tedious, and prone to error, so much care must be taken in establishing the reference frame's number.

GEN LOCK: In order to ensure that the timecode to video relationship is fixed, according to SMPTE/EBU specifications, a video reference must be supplied to the 4025 Film Footage Encoder. Normally, the gen lock signal is the program video out from the telecine, onto which the vertical interval time code (VITC) is being applied. When VITC is not being used, the gen lock signal is usually the colour black system reference to which the

telecine is itself genlocked. The gen lock reference is necessary, even if vertical interval time code is not being used.

KEYKODE: Machine readable bar-coded edge numbers introduced by Eastman Kodak in 1988, and subsequently standardized for all film manufacturers by the Society of Motion Picture and Television Engineers. AGFA refers to it as BAR Code, and FUJI as MR Code. For the sake of consistency throughout this manual we shall refer to it as KeyKode.

KEY INFO: The part of the KeyKode number that does not fit into the user bits of time code. The Key Info data normally consists of the film manufacturer ID, the film emulsion letter, and the first four prefix digits. When using the 4025's "full KeyKode" modes, the complete KeyKode information is encoded into a secondary VITC line pair.

LINEAR TIME CODE: A digital code used for timing and control purposes on video tape and associated audio tape machines. It is recorded on a longitudinal track with audio characteristics and is referred to as LTC (Sometimes this code is also referred to as longitudinal code or SMPTE). Each 80 bit code word is associated with one television frame, and consists of 26 time bits, 6 flag bits, 32 user bits and 16 sync bits.

PREFIX: The edge numbers are usually composed of a group of digits that remain constant throughout the length of the roll, and a count number, which increments every foot or half foot. The constant numbers, are referred to as the prefix. The count numbers are referred to as the footage number.

2/3 PULLDOWN: Film is typically viewed at 24 frames per second (fps) while NTSC video is viewed at 30 fps. To compensate for this difference in the frame rates, telecines use a 2/3 pulldown. Since each video frame is comprised of two video fields, video is viewed at 60 fields per second. Telecines can transfer 24 film frames to 60 video fields (30 video frames). The resulting ratio is 24:60 or 2:5, which means 2 film frames every 5 video fields. The 2/3 implies that one of the film frames is transferred to 2 video fields, the following film frame is transferred to 3 video fields, and so on.

SMPTE: Refers to the Society of Motion Picture and Television Engineers.

USER BITS: 32 bits in the time code are user assignable. They typically are used to contain reel numbers, scene and take numbers, or other user-oriented data.

USER BIT TRANSFER: In some applications it may be desirable to transfer the user bit data from the reader tape, and generate

new time information. In other applications, both the time and user bit information should be transferred. In applications where time data has been transferred to the user bits the Reader mode will have to be set to TIME TIME mode.

VERTICAL INTERVAL TIME CODE: A digital code used for timing and control purposes on video tape recorded in the vertical blanking interval of the video picture, and is referred to as VITC. Each 90 bit code word is associated with one television field, and consists of 26 time bits, 6 flag bits, 32 user bits, 18 sync bits, and an 8 bit error check (CRC) code.

Figures

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2. INSTALLATION

2.1. REAR PANEL CONNECTIONS

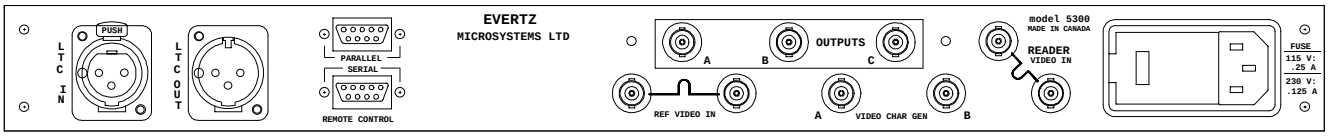


Figure 2-1: Rear Panel Layout

The following sections describe the purpose of the rear panel connectors of the 5300. Figure 2.1 above shows the rear panel connectors provided on the Time Code Analyzer. Sections 2.1.1 to 2.1.5 describe the specific signals that should be connected to the 5300. Figure 2-2 gives a typical connection diagram for connecting the Time Code Analyzer.

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 the LTC reader

2.1.2. Video Connections

REF VIDEO IN: A BNC loop for input of gen-lock video to the 5300. A stable colour black reference must be connected to this input for proper operation of the time code analyzer. A 75 ohm termination must be provided.

READER VIDEO IN: 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 LTC/VITC modes This signal is also used to provide a gen-lock reference for the LTC translator output.

VIDEO CHAR GEN 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 serial monitor communications to a computer. This output

may also be connected to a serial printer to get a hard copy of the serial monitor messages. The baud rate must be configured using the SERIAL BAUD RATE menu item of the engineering Setup menu. (See chapter 3)

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

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

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

2.1.4. Test Signal Connections

Three BNC’s provide test signal outputs which can be viewed on an oscilloscope.

A A BNC connector with the colour frame pulse which has been extracted from the video connected to the REF VIDEO IN loop

B A BNC connector with the VITC line Select pulse. This signal is high during the lines where VITC reading is enabled.

C A BNC connector with the decoded LTC signal. This signal is high when the LTC has a 1 bit and low when the LTC has a zero bit. This output is best viewed on an oscilloscopw where the colour frame pulse is used as a trigger.

2.1.5. Power Connections

LINE: The 5300 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 5300 Time Code Analyzer 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 up 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 READER 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 labeled VIDEO CHAR GEN OUT A and B, are provided to drive a preview monitor and a video recorder. Characters are keyed into the video connected to the READER 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 READER 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 labeled REMOTE CTL provides 6 parallel control inputs for remote control of some of the model 5300 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		Not used
	8	General Purpose Input
4		Not used
	9	Output 1
		Output 2

2.7.2. Serial Time Code Monitor output

The Time Code Analyzer is fitted with a nine pin subminiature 'D' connector for serial communications. This port is used to output the serial monitor data to a computer or serial printer. The serial port provides both RS-232-C and RS-422 levels as shown below.

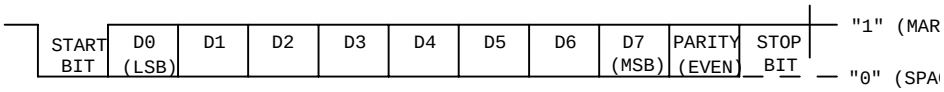
Pin		Description
1		Frame Ground
	6	Transmit Common

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

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 BAUD RATE menu item of the Engineering setup menu is used to set the baud rates.

2.8. SAMPLE CONFIGURATIONS

Figure 2-2 illustrates the typical setup for analyzing LTC and VITC. 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 Time Code Analyzer to ensure correct timing of the output LTC to the video. (See the TRANSLATOR menu selections in section 3.7) A stable gen-lock video reference must be applied to the REF VIDEO input loop for proper operation of the analyzer.

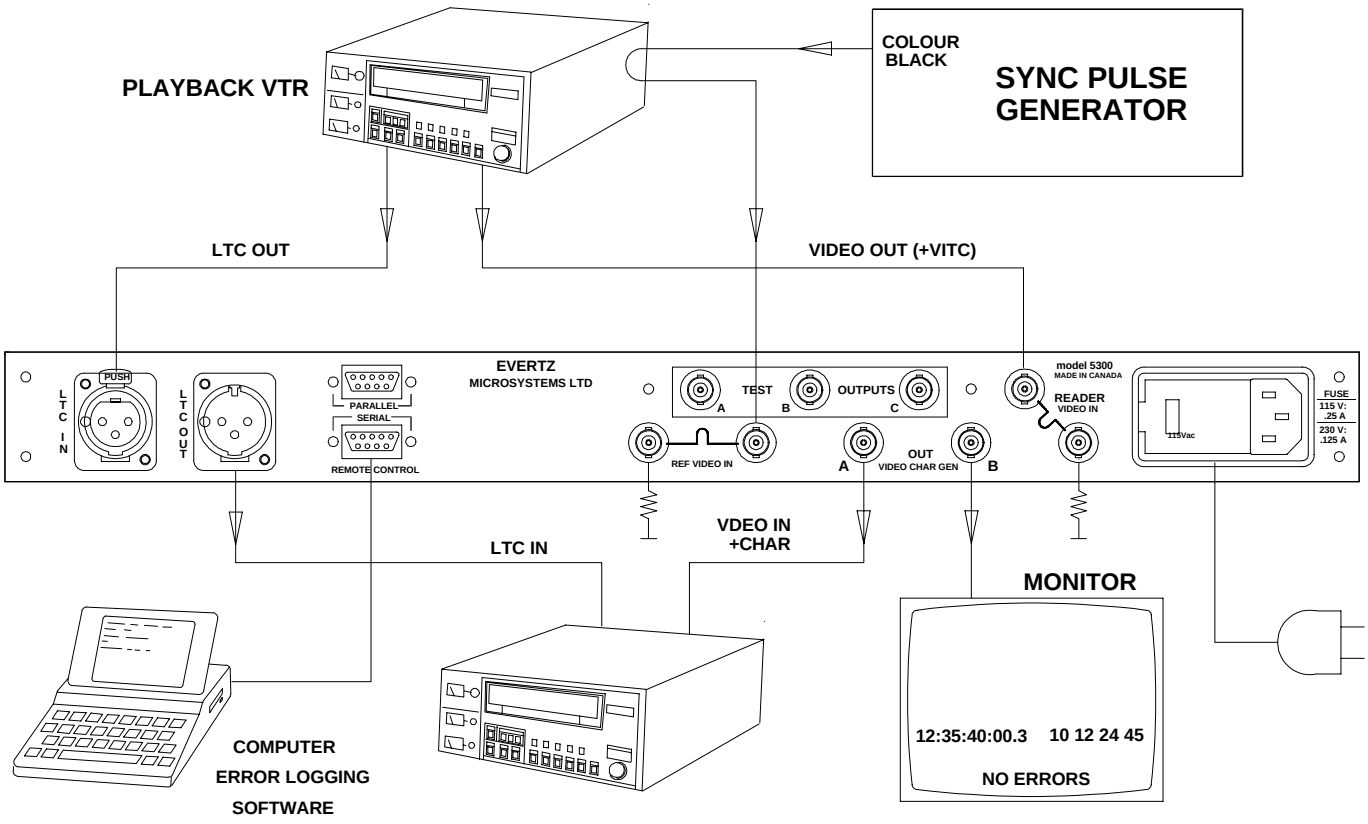


Figure 2-2: Typical Connections

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Figures

3. OPERATING INSTRUCTIONS

The Model 5300 Time Code Analyzer is a powerful tool to aid in the diagnosis of all sorts of time code problems. It contains both an LTC and VITC reader and multi-function character inserter. A 16 digit alphanumeric display can be quickly delegated to show the reader data or the results of various time code monitoring functions. The Analyzer's LTC and VITC readers can be operated independent of each other, or they can be linked to form an auto LTC/VITC reader. The Analyzer can be configured in one of four basic operating modes:

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

The character inserter is also used to show the time and user bits currently being read, and three additional time code monitor windows. One window shows either the LTC code phase with respect to video, or the colour phase of the code with respect to the reference video input. Another window is used to show various error conditions that can be determined by the user. The third window is used to monitor the time code flag bits, time code reader status, and the difference between the incoming LTC and VITC codes. Each of the windows can be turned on and off, and all of the windows except the time code phase can be positioned by the user.

3.1. FRONT PANEL OVERVIEW

The Time Code Analyzer 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. It also provides displays of LTC phase with respect to the video, time code colour phase with respect to the reference input and, a variety of time code error conditions. Operational control is handled by 16 front panel keys. Eight LED's provide operational status at a glance.

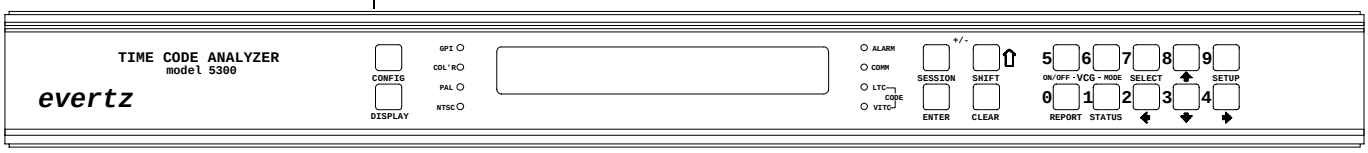


Figure 3-1: Front Panel Layout

3.1.1. Overview of the Pushbuttons

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

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 3.12)

DISPLAY Is used to select what data is being displayed on the front panel alphanumeric display.

SESSION Is used to begin a new error logging session. This resets all error counters that have been selected in the Alarms menu. If you are in the time code learn function, pressing the **SESSION** key toggles from continuous learn to single pass learn. (See section)

REPORT Displays a screen on the VCG which summarizes the error conditions that have been detected by the Analyzer.

STATUS Displays a status screen on the VCG which summarizes the current operational modes of the Analyzer. 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 setup 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)

ENTER Is used to initiate various data entry modes. It is also used to confirm actions such as loading and saving user configurations.

CLEAR Is used to cancel data entry modes, and to exit the setup and VCG window select modes.

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. The following is an overview of the main shifted functions.

SHIFT + SESSION Initiates a time code scanning function that attempts to learn the characteristics of the incoming time code such as whether LTC is present, what level LTC is at, what lines VITC is on, what VITC CRC is being used, etc. A summary report is displayed on screen and on the serial port. (See section 3.6.3)

SHIFT + STATUS Displays firmware revisions on the character generator and the front panel. Pressing the **CLEAR** key or **SHIFT + STATUS** will remove this screen.

SHIFT + CONFIG Stores user configurations. (See also section 3.12)

SHIFT + SETUP Enters the Engineering SETUP menu which is used to configure various installation time settings such as video standard, display brightness, serial port baud rate, etc.

3.1.3. Status Indicators

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

GPI Reserved for future use

COL'R Indicates that a valid colour framed video reference is present.

PAL Indicates that the Time Code Analyzer 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 Time Code Analyzer 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.

ALARM When it is blinking it indicates that one of the alarm conditions has been triggered

COMM Indicates that a message is being sent out the serial port.

LTC Indicates that there is code being read by the LTC reader.

VITC Indicates that there is code being read by the VITC reader.

3.2. FRONT PANEL DISPLAY FUNCTIONS

The **DISPLAY** key is used to select which data is being displayed in the alphanumeric display. Press the **DISPLAY** key one or more times to select the data you wish to display. When you are showing the reader data, the four left characters of the front panel display indicate whether time or user bits is being displayed. Examples of each front panel display are shown below

`LTM  12:45:30:00`	LTC Reader Time
`LUB  12 34 56 78`	LTC Reader User Bits
`VTM  12:45:30:00`	VITC Reader Time
`VUB  12 34 56 78`	VITC Reader User Bits
`<5....0....5>`	LTC Phase
`COL PHS: FIELD 1`	Time Code Colour Phase
`NO ERRORS`	Time Code Analysis

When the Reader Assignment is set to LTC, the VTM and VUB will not be shown. When the reader assignment is set to VITC, the LTM and LUB will not be shown. When the reader assignment is set to LTC/VITC only the reader which is currently active will be shown. (For example when the LTC reader is reading, LTM or LUB 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:

`OFFS  00:00:00:00`	Programmed Time Code Offset between LTC and VITC readers

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

Four separately positionable character windows are available. Two of the windows are used to display the reader time and user bits. One window is used to display any condition that has triggered on of the alarms. The other window is used to monitor time code status such as flag bits, and difference between LTC and VITC. 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 of the windows are displayed and their position on the screen. The VCG drop down menu of the setup menu is used to select character size and style.

3.3.1. Selecting and Positioning the 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 Time highlighted. Use the arrow keys (🡅, 🡇, 🡄, 🡆) to position the reader 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 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 again to advance to the time code monitor window and alarm windows. The arrow keys are used to position the monitor and alarm windows. These windows must be turned on and off using the appropriate items on the MONITOR menu. Press **CLEAR** to return to normal display mode.

> **For example**: to move only the reader User Bits window down 1 line, leaving the other windows in the same place, press **VCG MODE** two times and press the 🡇 key. Press the **CLEAR** key to return to the normal display mode.

The Time Code Phase window is always located at the bottom of the screen. It cannot be repositioned. Use the Phase Monitor item on the Monitor menu to turn it on and off.

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. SETUP MENU - OVERVIEW

The key to the operational flexibility of the Analyzer lies in the powerful setup menu system which uses the built in character generator. This method of configuring the Analyzer 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.

The Analyzer 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.
To enter the setup 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.

RDR
- **ASSIGNMENT**
  - LTC
  - VITC
  - LTC/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
  - PRODUCTION
- **DISPLAY**
  - PROCESSED
  - DIRECT
- **FILM TYPE**
  - 35 MM 16 FRM/FT
  - 16 MM 20 FRM/KEY
  - 16 MM 40 FRM/FT
- **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

MONITOR
- **VISUAL ALARM**
  - OFF
  - ON
- **AUDIBLE ALARM**
  - OFF
  - ON
- **SERIAL MONITOR**
  - OFF
  - ON
- **CODE PHASE**
  - LTC PHASE
  - COLOUR PHASE
  - OFF
- **LTC VS VITC**
  - OFF
  - ON
- **CODE FLAGS**
  - OFF
  - ON
- **CODE ERRORS**
  - OFF
  - ON

ALARMS
- **LTC PHASE**
  - ALARM TRIGGER
  - OFF 01 BITS
- **COLOUR PHASE**
  - OFF
  - ON
- **LTC VS VITC**
  - OFF
  - ON
- **CODE DROPOUTS**
  - ALARM TRIGGER
  - OFF 01 DROPS
- **CODE VALIDITY**
  - ALARM TRIGGER
  - OFF 01 FAILS
- **TIME CODE SEQ**
  - ALARM TRIGGER
  - OFF 01 ERRS
- **USER BITS SEQ**
  - ALARM TRIGGER
  - OFF 01 ERRS
- **LTC LEVEL**
  - ALARM TRIGGER
  - MIN MAX
  - OFF 0.1 3.0

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: Setup Menu Overview

RDR ASSIGNMENT
- Assign ltc
- Assign vltc
- Assign ltc / vitc

RDR MODE
- Mode time data
- Mode time time
- Mode time edge
- Mode info+edge
- Mode data data
- Mode time date

RDR VITC LINES
- Vitc ln start = 10
- Vitc ln end = 12

RDR VITC CRC
- Crc normal
- Crc keykode
- Crc production

RDR DISPLAY
- Display process
- Display direct

RDR FILM TYPE
- Type 35 mm 16 frm
- Type 16 mm 20 frm
- Type 16 mm 40 frm

RDR FILM RATE
- Rate 25 fps
- Rate 24 fps
- Rate 30 fps

RDR EDGE STYLE
- Style generic
- Style evertz

RDR EDGE FORMAT
- Format 4 dig
- Format 5 dig
- Format 6 dig
- Format 7 dig

VISUAL ALARM
- Visual alrm off
- Visual alrm on

AUDIBLE ALARM
- Audible alrm off
- audible alrm on

SERIAL MONITOR
- Serial mon off
- Serial mon on

MON CODE PHASE
- Code phase ltc
- Code phase colour
- Code phase off

MON LTC VS VITC
- Ltc vs vitc off
- Ltc vs vitc on

MON CODE FLAGS
- Code flags off
- Code flags on

MON CODE ERRORS
- Code errors off
- Code errors on

ALRM LTC PHASE
- Alrm ltc phs off
- Alrm ltc phs 01

ALRM COLOUR PHS
- Alrm col phs off
- Alrm col phs on

ALRM LTC VS VITC
- Alrm l vs v off
- Alrm l vs v on

ALRM DROPOUTS
- Alrm dropout off
- Alrm dropout 01

ALRM VALIDITY
- Alrm valid off
- Alrm valid 01

ALRM TM SEQUENCE
- Alrm tm seq off
- Alrm tm seq 01

ALRM UB SEQUENCE
- Alrm ub seq off
- Alrm ub seq 01

ALRM LTC LEVEL
- Ltc level off
- Ltc min 0.1 V
- Ltc max 3.0 V

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

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
LTC
VITC
LTC/VITC

The READER drop down menu is used to program various reader modes for the reader. The ASSIGNMENT item, determines whether the reader is reading LTC, VITC or both LTC and VITC. The rest of the menu items on the READER menu controls various reader modes such as VITC Line numbers, whether user bits contain static numbers or time information, etc. (See section 3.6). The MONITOR drop down menu is used to determine whether the visual alarm window, the time code phase monitor window, and code monitor window will be displayed or not. The MONITOR menu is also used to turn on the audible alarm and the serial monitor. (See section 3.6). The ALARM drop down menu is used to determine what error conditions will trigger the visual and audible alarms (See section 3.7). 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 3.8).

To aid in finding the descriptions of the various menu items in sections 3.5 to 3.9, the drop down menu item 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 Analyzer, 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

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.

CONFIG
- **VIDEO TYPE**
  - AUTO
  - NTSC
  - PAL
- **HORZ CHAR SIZE**
  - HORIZONTAL
  - CHAR SIZE = 10
  - ← → TO ADJUST
- **DISPLAY LEVEL**
  - DISPLAY LEVEL = 2
  - ↑ ↓ TO ADJUST
- **TRANSLATOR MODE**
  - REGENERATE
  - RESHAPE
- **LTC OUT LEVEL**
  - 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
  - 4800
  - 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**
  - NOT APPLICABLE
- **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 4800
- 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
- Not applicable

RAM TEST
- Not applicable

Figure 3-5: Engineering Toolbox Front Panel Menus

3.5. PROGRAMMING THE READER SETUP FUNCTIONS

The READER drop down menu is used to program various reader modes such as selecting LTC or VITC operation for the reader, VITC Line numbers, whether user bits contain static numbers or time information, etc. Figure 3-6 shows the items on the READER drop down menu. The following descriptions appear in the order they appear on the menu.

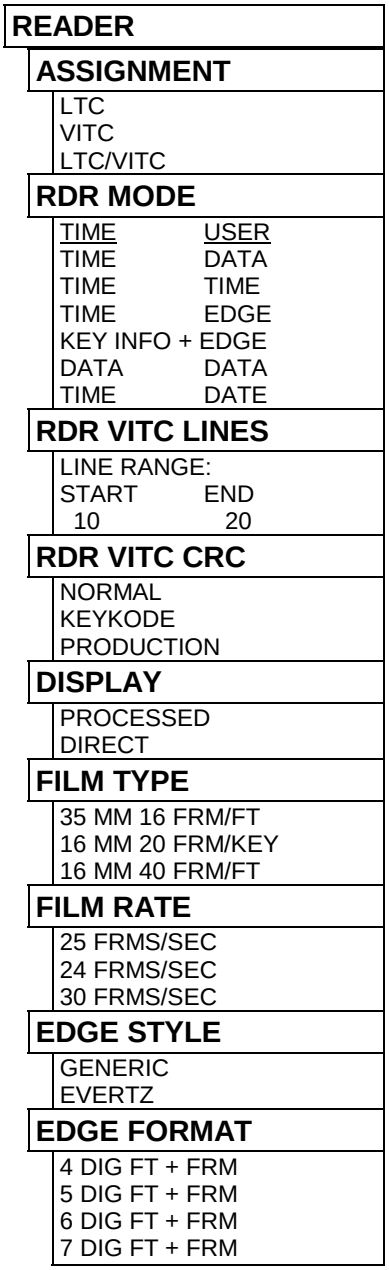


Figure 3-6: READER Drop Down Menu

3.5.1. Selecting the Reader Hardware Configuration

ASSIGNMENT
LTC
VITC
LTC/VITC

The **ASSIGNMENT** menu is used to select how the reader hardware is configured. The model 5300 can be configured in three different ways.

Select **LTC** to configure the reader for Linear Time Code (LTC) reading only. The LTC LED will be on when the 5300 is reading LTC.

Select **VITC** to configure the reader for Vertical Interval Time Code (VITC) reading only. The reader can be set to recover VITC from different ranges of video lines. The VITC LED will be on when the 5300 is reading VITC.

Select **LTC/VITC** to configure the reader 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. THE LTC and VITC LEDs indicate when the LTC and VITC readers are reading code. When **LTC / VITC** is selected, the 5300 can be set to compare the LTC and VITC reader data and show the differences in the LTC vs VITC display.

3.5.2. 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 contain 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 Evertz 5010 time code generator).

3.5.3. Setting The VITC Reader Line Range

VITC LINE

LINE RANGE:
START END
10 20

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.

3.5.4. Selecting the VITC CRC

VITC CRC

NORMAL
KEYKODE
PRODUCTION

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.

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.

3.5.5. Controlling the 'Look ahead' Compensation

DISPLAY
PROCESSED
DIRECT

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.

3.5.6. Selecting the Film Related Modes

The **FILM TYPE**, **FILM RATE**, **EDGE STYLE** and **EDGE FORMAT** items are used to set up the reader 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 is set to **TIME EDGE** or **KEYINFO + EDGE**. In other modes the message **NOT IN A FILM MODE** will be displayed.

FILM TYPE
35 MM 16 FRM/FT
16 MM 20 FRM/KEY
16 MM 40 FRM/FT

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

Select **35 MM 16 FRMS/FT** if you are using 35 mm film 4 perf stock.

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.

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.

EDGE FORMAT
4 DIG FT + FRM
5 DIG FT + FRM
6 DIG FT + FRM

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.

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

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.

3.6. PROGRAMMING THE TIME CODE MONITOR FUNCTIONS

The MONITOR drop down menu is used to determine whether the visual alarm window, the time code phase monitor window, and code monitor window will be displayed or not (See section 3.5). The MONITOR menu is also used to turn on the audible alarm and the serial monitor. Figure 3-9 shows the items on the VCG drop down menu. The following descriptions appear in the order they appear on the menu.

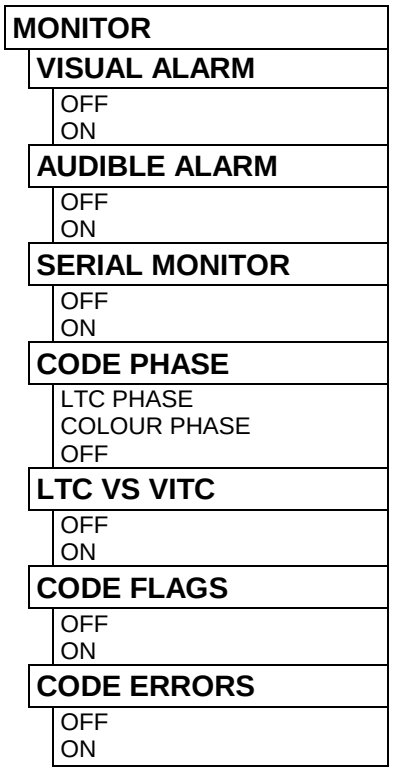


Figure 3-7: Monitor Drop Down Menu

3.6.1. How To Signal Time Code Errors Using the VCG - The Time Code Monitor Window

VISUAL ALARM
OFF
ON

The Time Code monitor window of the VCG is used to show various alarm conditions that have been triggered. When there are no alarm conditions triggered, the window is automatically blanked.

The **VISUAL ALARM** menu item is used to turn the Timecode Alarm monitor window on and off. This window shows the last alarm condition that has been triggered. The individual alarm triggers and their thresholds are set up using the ALARM menu items. (See section 3.7)

Use the VCG MODE button and the arrow keys to position the window to the desired location on the screen.

3.6.2. How To Signal Time Code Errors Using the Audible Alarm

AUDIBLE ALARM
OFF
ON

The **AUDIBLE ALARM** menu item is used to turn the Audible Timecode Alarm on and off. This intermittent beeping tone will sound when one of the alarm conditions has been triggered. If the alarm condition disappears, the audible alarm will continue to sound to alert the user that there has been a problem. The last alarm condition triggered is shown on the front panel monitor display (press the DISPLAY key one or more times to view the monitor display), or in the VCG Time Code monitor window. The individual alarm triggers and their thresholds are set up using the ALARM menu items. (See section 3.7)

The Alarm conditions can be reset by pressing the SESSION button.

3.6.3. How To Signal Time Code Errors Using the Serial Port Monitor

SERIAL MONITOR
OFF
ON

The **SERIAL MONITOR** menu item is used to turn the serial port monitor on and off. The serial port monitor gives a complete list of the timecode problems that have occurred throughout the tape. This output can be used to drive a serial printer, or a computer logging software. The serial monitor identifies alarm conditions that have occurred, the last good timecode number before the alarm condition, when LTC and VITC are reading, etc. When the Time Code learn function is activated, a complete report is issued to the serial port to document what timecode was on the tape.

3.6.4. Monitoring LTC Phase And Colour Phase With Respect To The Reference Video

CODE PHASE
LTC PHASE
COLOUR PHASE
OFF

The **CODE PHASE** menu item is used to turn the code phase VCG window on and off. This window is used to display one of two phase measurements

The LTC PHASE window shows the relative phase of LTC with respect to the reference video. This display is useful for identifying unreferenced time code or when time code head alignment causes a severe misalignment of the timecode on the tape.

The COLOUR PHASE window shows the colour phase of timecode with respect to the reference video. The display shows a number from 1 to 4 (1 to 8 for PAL) which is the colour field of the incoming code. This display is useful for identifying time code that has not been properly colour framed when it was recorded.

3.6.5. Comparing the LTC and VITC Timecodes

LTC vs VITC
OFF
ON

The **LTC vs VITC** menu item is used to turn the LTC/VITC comparison VCG window on and off. This window is used to display the difference between the time numbers of the LTC and VITC readers, when the Reader assignment is set to LTC/VITC.

Sometimes an intentional offset may occur between the LTC and VITC. In order to cancel out the effect of this offset, you may enter the offset value into the offset register of the 5300. (See section 3.11) This value will then be subtracted from the VITC before the comparison is made.

The comparison window is formatted to look like a timecode number. This number is the VITC minus OFFSET minus LTC)

3.6.6. Monitoring the Time Code Flags.

CODE FLAGS
OFF
ON

The **CODE FLAGS** menu item is used to turn the time code flags VCG window on and off. This window is used to display the six flag bits of the code being read by the 5300. The CODE FLAGS window is located to the right of the LTC/VITC comparison window if it is on.

The flags are shown as a group of six letters and are defined as follows:

Drop Frame Flag	D	
Colour Frame Flag	C	
LTC Parity Flag	P	(only shown when reading LTC)
VITC Field Flag	F	(only shown when reading VITC)
Binary Group Flag 1	1	
Binary Group Flag 2	2	
Binary Group Flag 3	3	

3.6.7. Monitoring the Time Code Reading Error Flags.

CODE ERRORS
OFF ON

The **CODE ERRORS** menu item is used to turn the time code error monitor VCG window on and off. This window is used to display three low level reading error conditions on the active reader. The CODE ERRORS window is located to the right of the CODE FLAGS window if it is on.

The error conditions are shown as a group of three letters and are defined as follows:

Hardware Error	H	dropouts, bad VITC CRCs, etc.
Validity	V	invalid data values for the programmed reader mode
Sequence	S	invalid counting sequence for the programmed reader mode

3.7. PROGRAMMING THE ALARM FUNCTIONS

The ALARM drop down menu is used to determine what error conditions will trigger the visual and audible alarms. Figure 3-9 shows the items on the VCG drop down menu. For alarms that have only on or off settings, select the appropriate setting using the up or down arrow keys. For alarm values that have pre-settable trigger points, use the left or right arrow keys to turn the alarm on or off. When the alarm trigger number is highlighted, it may be adjusted using the up or down arrows. The following descriptions appear in the order they appear on the menu.

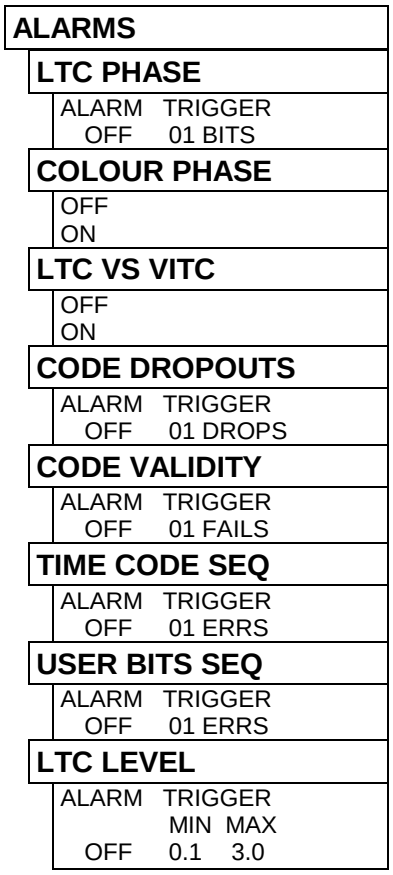
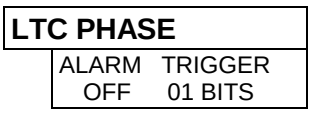


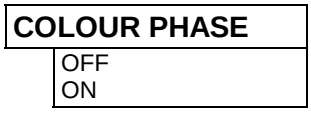
Figure 3-8: Alarm Drop Down Menu

3.7.1. LTC Phase Alarm



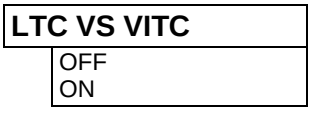
This item sets the alarm for LTC phase errors. The alarm trigger is measured in terms of LTC bits with respect to the reference video.

3.7.2. Colour Phase Errors



This item sets the alarm for colour phase errors. Any Colour phase errors with respect to the referenced video will trigger the alarm.

3.7.3. LTC / VITC Comparison Alarm



This item sets the alarm for LTC / VITC comparison errors. Whenever the VITC - OFFSET is not equal to the LTC, the alarm will be triggered.

3.7.4. Code Dropouts Alarm

CODE DROPOUTS	
ALARM	TRIGGER
OFF	01 DROPS

This item sets the alarm for code dropout errors. When the number of code dropouts exceeds the threshold, the alarm will be triggered.

3.7.5. Code Validity Alarm

CODE VALIDITY	
ALARM	TRIGGER
OFF	01 FAILS

This item sets the alarm for code validity errors. These errors are due to unexpected timecode data values for the programmed mode of operation (i.e. frames numbers greater that 30, etc.) When the number of code validity errors exceeds the threshold, the alarm will be triggered.

3.7.6. Time Code Sequence Alarm

TIME CODE SEQ	
ALARM	TRIGGER
OFF	01 ERRS

This item sets the alarm for counting sequence errors in the time bits. These include skipping or duplicate numbers, or out of sequence numbers. The correct counting sequence for the user bits is determined by the READER MODE setting on the Setup Menu (See section 3.5.2) When the number of time counting sequence errors exceeds the threshold, the alarm will be triggered.

3.7.7. User Bits Sequence Alarm

USER BITS SEQ	
ALARM	TRIGGER
OFF	01 ERRS

This item sets the alarm for counting sequence errors in the user bits. These include skipping or duplicate numbers, or out of sequence numbers. The correct counting sequence for the user bits is determined by the READER MODE setting on the Setup Menu (See section 3.5.2) When the number of user bit counting sequence errors exceeds the threshold, the alarm will be triggered.

3.7.8. LTC Level Alarm

LTC LEVEL		
ALARM	TRIGGER	
	MIN	MAX
OFF	0.1	3.0

This item sets the alarm thresholds for LTC level measurements. The Alarm is triggered when the LTC level is less than the minimum or greater than the maximum values.

3.8. PROGRAMMING THE CHARACTER GENERATOR FUNCTIONS

The VCG drop down menu is used to select various characteristics of the VCG display. Figure 3-9 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 3-9: 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 the reader 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.

3.9. 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 3-10 shows the items on the CONFIGURATION drop down menu. The following descriptions appear in the order they appear the menu.

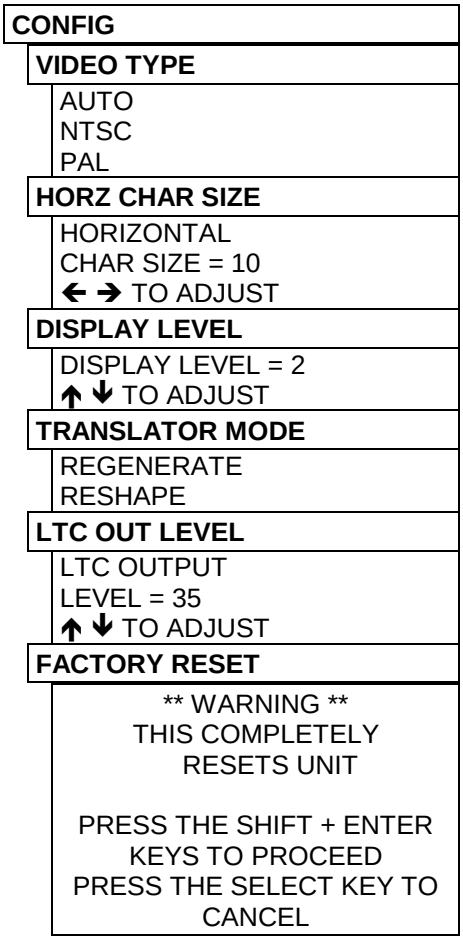
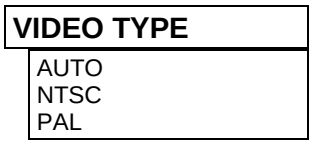


Figure 3-10: CONFIGURATION Drop Down Menu

3.9.1. Selecting the Video Standard

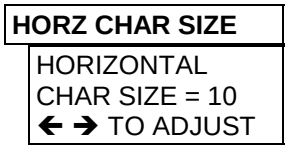
The **VIDEO TYPE** menu item is used to select the video standard of the program video. Changing the video standard will affect the settings of the VITC LINE RANGE menu setting. Make sure that you re-check this setting when you change the video standard.



Select **AUTO** if you want to have the 5300 auto detect PAL and NTSC video.

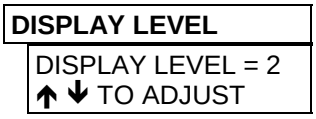
Select **NTSC** if you are using NTSC video.
Select **PAL** if you are using PAL video.

3.9.2. Adjusting The Horizontal Character Size



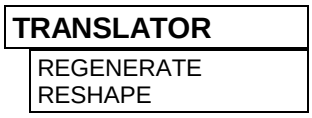
The **HORZ CHAR SIZE** menu item is used to adjust the character width. Use the ← and → keys to adjust the right side of the raster.

3.9.3. Adjusting the Front Panel Display Brightness



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

3.9.4. Selecting the Operating Mode of the LTC Translator



The **TRANSLATOR** menu item is used to select the function of the LTC translator output. When the reader 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 the reader is configured to read VITC, the LTC output provides an LTC translation of the incoming VITC. When the reader is configured as an LTC/VITC reader, the LTC output provides a regenerated output from what ever 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 **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.

The translator cannot be set to RESHAPE mode unless the reader assignment is set to LTC.

3.9.5. Adjusting the Level of the LTC Translator Output

LTC OUTPUT
LEVEL = 35 ↑ ↓ 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.

3.9.6. Resetting the Analyzer to its Factory Defaults

FACTORY RESET
** WARNING ** THIS COMPLETELY RESETS UNIT PRESS THE SHIFT + ENTER KEYS TO PROCEED PRESS THE SELECT KEY TO CANCEL

The **FACTORY RESET** menu item is used to reset the 5300 to the factory default parameters. Press the **SHIFT + ENTER** keys when the sub menu screen is displayed to reset the 5300 to factory defaults. The 5300 will perform a power-on configuration before returning to the normal operating mode.

3.10. 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 5300 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		Not used
	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.

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.

3.11. COMPARING LTC AND VITC WITH A KNOWN OFFSET - THE OFFSET REGISTER

The OFFSET register for the LTC / VITC comparison mode allows you to cancel out a known offset between the LTC and VITC readers. The LTC/VITC comparison window would then show 00:00:00:00 when the numbers match. The value entered into the Offset register will be subtracted from the VITC reader time before it is compared with the LTC. Offset values between 00:00:00:00 and 12:00:00:00 indicate that the VITC reader is leading the LTC reader. Offset values greater than 12:00:00:00 indicate that the LTC reader is leading the VITC reader. Offsets greater than 12:00:00:00 can also be entered as negative offsets.

Example 1:

```
VITC Reader:     01:00:00:00
Offset:          00:00:01:00
LTC Reader:      00:59:59:00
```

Example 2:

```
VITC Reader:     01:00:00:00
Offset:          23:59:59:00
LTC Reader:      01:00:01:00
```

Example 3

```
VITC Reader:     01:00:00:00
Offset:         -00:00:01:00
LTC Reader:      01:00:01:00
```

In order to perform an exact comparison of the LTC and VITC times make sure the OFFSET is set 00:00:00:00

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

Press the **ENTER** key to recall the last value that you entered into the OFFSET 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. Press the **SHIFT** key to toggle the +/- value of the offset. 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.

3.12. STORING & RECALLING USER CONFIGURATIONS

The 5300 has the ability to store 7 user configurations. All seven user configurations store the current settings of all items on the setup menu and most items of the Engineering menu.

3.12.1. Storing User Configurations

Press **SHIFT & CONFIG** to enter the configuration store mode of the 5300. 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.

3.12.2. Recalling User Configurations

Press **SHIFT & CONFIG** to enter the configuration load mode of the 5300. 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 3.10)

3.13. TIME CODE ERROR MESSAGES

The 5300 analyzer is designed to find a wide variety of time code problems and reports them in several different ways. Figure 3-11 summarizes the time code errors that are detected, and gives the messages that you will find on the front panel, in the VCG error window, and on the serial port monitor. The following sections give a more detailed description of what the error messages mean and give some suggestions on possible causes for these time code problems and how to correct them.

Error Number	Front Panel	Character Inserter	Serial Monitor
1	LTC PHASE ERR	LTC PHASE ERROR	LTC PHASING
2	COLOUR PHASE ERR	COLOUR PHASE ERROR	COLOUR PHASING
3	LTC DROPOUT ERR	LTC DROPOUT ERROR	LTC DROPOUT
4	VITC DROPOUT ERR	VITC DROPOUT ERROR	VITC DROPOUT
5	LTC VALID ERR	LTC VALIDITY ERROR	LTC VALIDITY
6	VITC VALID ERR	VITC VALIDITY ERROR	VITC VALIDITY
7	LTC TM SEQ ERR	LTC TIME SEQ ERROR	LTC TIME SEQUENCE
8	VITC TM SEQ ERR	VITC TIME SEQ ERROR	VITC TIME SEQUENCE
9	LTC UB SEQ ERR	LTC UB SEQ ERROR	LTC UB SEQUENCE
10	VITC UB SEQ ERR	VITC UB SEQ ERROR	VITC UB SEQUENCE
11	LTC LVL > MAX	LTC LEVEL > MAX	LTC LEVEL > MAX
12	LTC LVL < MIN	LTC LEVEL < MIN	LTC LEVEL < MIN
13	LTC NOT EQ VITC	LTC NOT EQUAL VITC	LTC NOT EQUAL VITC

Figure 3-11: Analyzer Error Message

Figures

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4. TECHNICAL DESCRIPTION

4.1. OVERVIEW

The Model 5300 LTC/VITC Time Code Analyzer combines the latest LSI technology with sophisticated microcontroller firmware to provide a powerful, flexible time code analyzer system. The model 5300 is a dual LTC/VITC reader / analyzer and multi-function character inserter. Its power and flexibility are unsurpassed in time code analyzer applications. A 16 digit alphanumeric display can be quickly delegated to show the required data. The Time Code Analyzer contains an LTC and VITC reader that can be operated independent of each other, or can be linked to form an auto LTC/VITC reader. The Time Code Analyzer can be configured in one of four basic operating modes:

- Full speed (1/30 to 70 times play) LTC reader.
- Full speed (still to greater than 40 times play) VITC reader.
- Auto LTC/VITC reader automatically switches between LTC and VITC inputs reading which ever is valid.

4.2. JUMPERS AND SWITCHES

Figure 4-2 shows the location and function of the switches and jumpers inside the Time Code Analyzer. The jumper positions marked in **bold** face type are the default settings.

4.2.1. DIP Switch Functions

The main circuit board of the 5300 contains an 8 position DIP switch which is used to invoke various diagnostic and calibration functions. The functions of each switch are described below.

Switch	Name	Normal	Function when Open	Function when Closed
1	Not used	Open	Normal operation	Colour Framer calibration
2	Not used	Open	Normal operation	Reserved
3	Not used	Open	Normal operation	
4	Not used	Open	Normal operation	
5	Not Used	Open	Normal operation	Reserved
6	Factory Reset	Open	Normal operation	Resets 5300 to factory defaults on power up
7	Not used	Open	Normal operation	Enables Engineering Diagnostics
8	Not used	Open	Normal operation	

Figure 4-1: DIP Switch Functions

When in Diagnostics mode the following key presses initiate various diagnostics modes.

DISPLAY Displays the complete character font on the VCG screen.

4.2.2. 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
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 using small character set EPROM.
		Installed	Connects Char EPROM U35 address A15 to LCA U36 when using larger Character set EPROM. Jumper JP9 must also be in the '256' position. Jumper JP9 must be in 1,2 position.
JP8	Char EPROM CE	**Pin 2,3**	Board link installed connects Char EPROM CE to ground.
		Pins 1,2	Board link cut and shunted to connects Char EPROM CE to +5 Volts after the LCA loads.
JP9	Char EPROM Size	**Pin 2,3**	Board link installed connects Char EPROM U35 Address A14 to +5 volts.
		Pins 1,2	Board link cut and shunted to connects Char EPROM U35 Address A14 to LCA U36.
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 shunted to connects MCU EPROM U19 Address A15 to +5 volts for use with 256K size EPROM.
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.

JP3, JP4, JP10, JP11,JP16, JP20, JP21, JP22 JP23 Not applicable for 5300

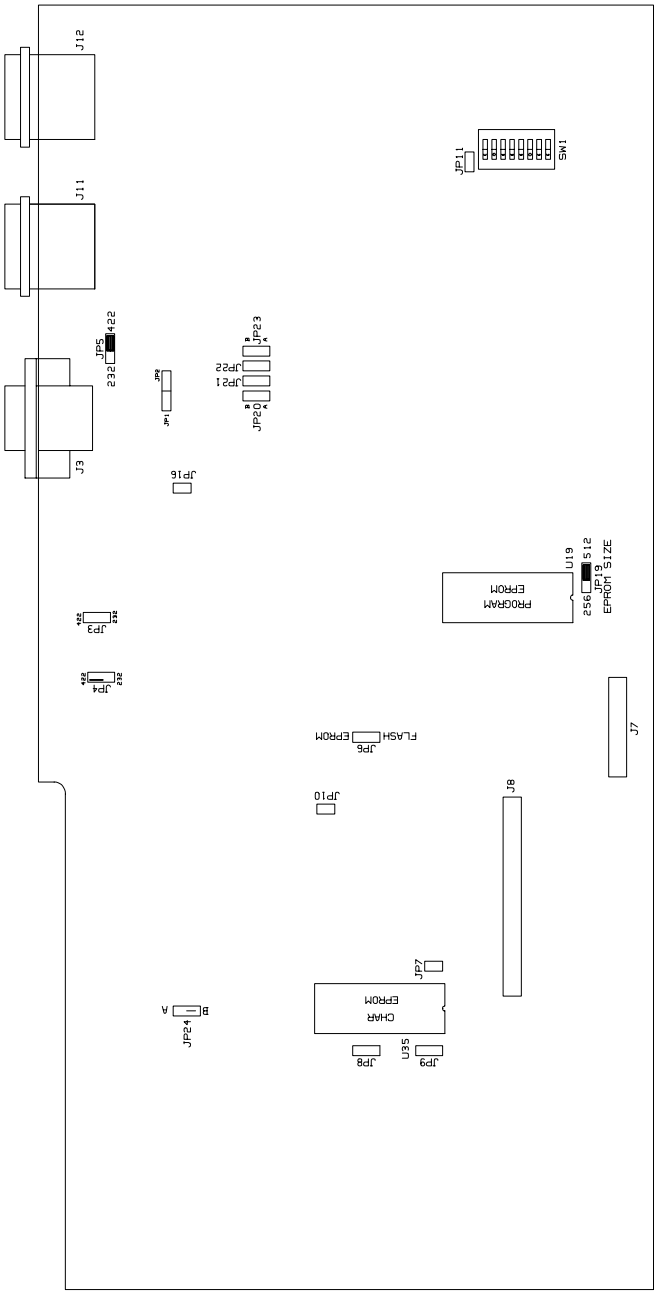

Figure 4-2: Main Board Jumper Locations

4.3. CIRCUIT DESCRIPTION

The Time Code Analyzer 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 LTC re-shaper/translator
5 High speed VITC Reader
6 Character generator video sync separator keyer
7 Character generator logic
8 Colour Frame Detector

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 5300 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.

4.3.1. Microcontroller (5200-33)

At the heart of the 5300 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.

4.3.2. 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.

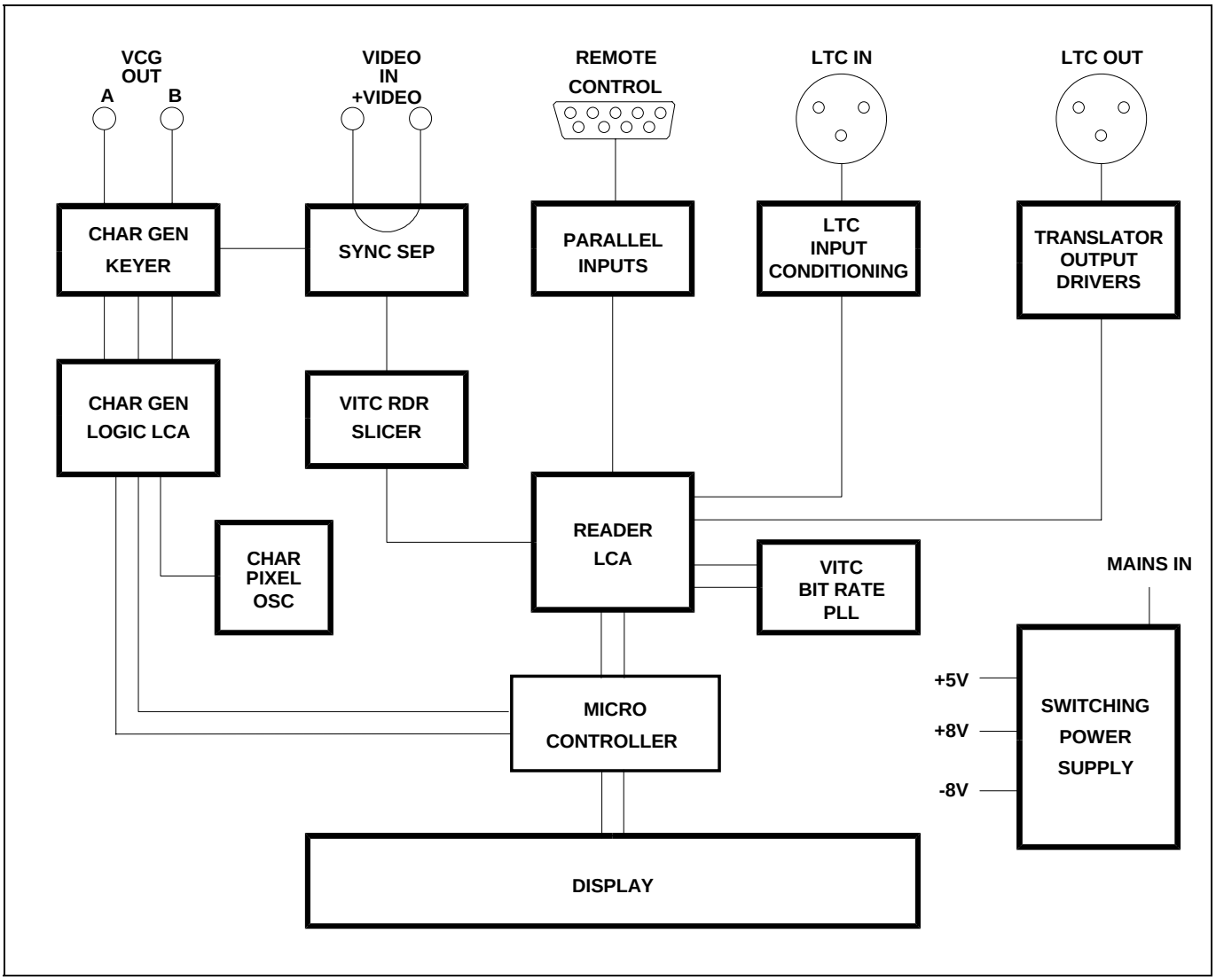

Figure 4-3: Block Diagram

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 ↓ or ↑ 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 🡻 or 🡹 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
CONFIG	41	DISPLAY	01
ENTER	02	CLEAR	03
VCG MODE	45	VCG ON/OFF	44
REPORT	04	STATUS	05
SESSION	42	SHIFT	43
SELECT	46	SETUP	48
🡹	47	🡸	06
🡻	07	🡺	08

Figure 4-4: Keyboard Scan Codes

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

Incoming LTC is decoupled and amplified by U9 and associated components. The output of U9 is fed to a positive and negative peak detector circuit consisting of U10a and U10b and associated components. The positive peak voltage is fed to analog to digital converter U4 to measure the level of the incoming LTC. The positive and negative peak voltages are used to set the correct slicing thresholds for the data comparators U10c, and U10d which 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 U25 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.

4.3.4. LTC Re shaper/ Translator (5200-32)

When the 5300 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 5300 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.

4.3.5. 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.

4.3.6. 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 5300 and to channel A of your oscilloscope and terminate it. Connect one of the video outputs of the 5300 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.

4.3.7. Character Generator Logic (5200-35)

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.

4.3.8. Reference Video and Colour Framer (5200-34) & (5200-37)

The Reference Gen-lock video is buffered by Q8 and Q6 and distributed to the reference video sync separator. The sync separator U54 (EL4581) slices the input video at 50% of the sync tip level to provide precision timing for the colour frame circuitry. The sync separator provides H Sync, V Sync and a Frame pulse (active high for field 1) and a back porch pulse to colour framer circuitry U49 and associated components..

Monostable U49a is triggered by the leading edge of HSYNC and times out about 6 usec later. U49b is triggered by the trailing edge of U49a, generating a burst sample window (test point FCW) at the mid point of the burst which is fed to the LCA U25. The length of the WINDOW is slightly less than one half cycle of subcarrier (approx. 90 nsec).

Burst, (test point CB) extracted from the video by U56a and buffered by U56b is fed to LCA U25. In the LCA, the WINDOW is ORed with line count 10 (6 for PAL) and fed to the clock input of a phase discriminator flip flop. If a positive going transition of burst occurs during the WINDOW, in the first field of a frame, then the flip flop is clocked on, generating a colour frame pulse (test point TPD7) input to the MCU.

When the 5300 is in the non colour frame mode, the back porch signal from the sync separator (test point FBP) is Ored with line count 10 (6 for PAL) and fed to the clock input of a phase discriminator flip flop. If a positive going transition of burst occurs during the FBP, in the first field of a frame, then the flip flop is clocked on, generating a burst present pulse (test point TPD7) input to the MCU. This signal is used to detect the PAL 4 field colour frame sequence.

Calibration of the colour frame detector is accomplished in software by adjusting digital potentiometer (U48). Separate calibration values are maintained in the 5300's nonvolatile memory for PAL and NTSC. The colour frame circuitry is calibrated at the factory and should not require any field calibration. If you do need to calibrate the colour frame detector, use the following procedure. To enable adjustment of the NOVPOT, you need set DIP switch 1 on the main circuit board to the On (Closed) position. The front panel display will show a display similar to:

`COLFRM POT N : 10` for **NTSC** or `COLFRM POT P : 10` for **PAL**

Then this message is displayed, the rightmost digits of the display indicate the value of the NOVPOT. The numbers do not have any absolute

meaning, but are only a reference used in calibration. Use the ↑ key to adjust the NOVPOT up and the ↓ key to adjust the NOVPOT down.

The generator REF VIDEO input must be connected to an RS-170-A NTSC or a 8 field PAL video source and properly terminated. The unit must also be set up to operate in the colour frame mode. This is accomplished by using the **COLOUR FRAME** menu item of the Setup menus. Select **4 FIELD** for NTSC or **8 FIELD** for PAL.

Your will need a sync pulse generator with a colour field #1 identification pulse output and a dual channel oscilloscope to perform the calibration.

1. Display the colour field #1 ID pulse from your sync generator on channel A of your oscilloscope. Set up the time base to show two pulses (usually 20 msec / div.). Set up your oscilloscope to trigger from channel A.

2. Connect channel B of your scope to test point ALARM (located near the large square integrated circuit U25).

3. Use the ↓ key on the 5010 to adjust the NOVPOT down to its lowest value. Gradually increase the NOVPOT value using the ↑ key until a pulse appears on channel B of your scope. This pulse should be approximately one video field in length and should occur in field 7 for PAL and field 3 for NTSC. The pulse on channel B should be two fields before the second pulse of channel A. See Figure 5-6 for PAL and Figure 5-7 for NTSC. Write down the NOVPOT value where the pulse first appears correctly.

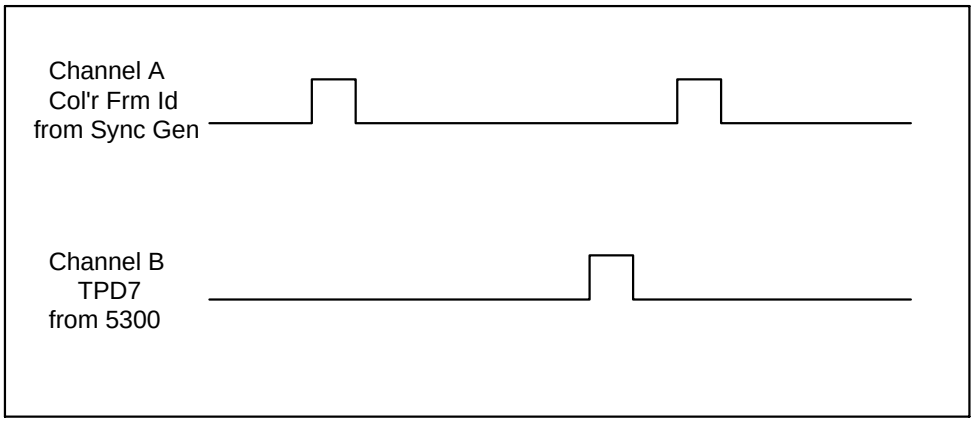

Figure 4-5: PAL Colour Frame Calibration

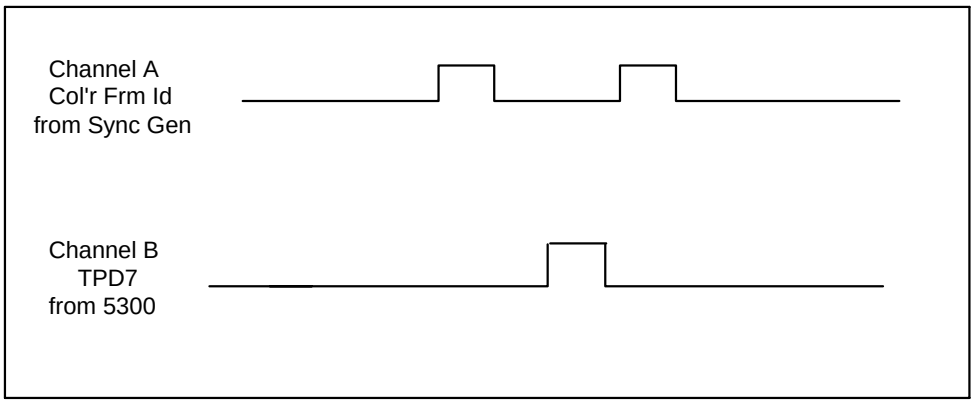

Figure 4-6: NTSC Colour Frame Calibration

4. Continue adjusting the NOVPOT value up until the pulse on channel B disappears. Write down the NOVPOT value where the pulse first disappears.

5. Using the ↓ key adjust the NOVPOT value down until it is at the mid point between the upper and lower values. For example: If the upper value is 15 and the lower value is 8, set the NOVPOT to 11. The COL'R LED should be On.

6. Repeat the procedure for the other video standard as required.

7. Set DIP switch #1 to the Off (open) position to return the 5300 to its normal operating mode.

4.4. UPDATING TO A NEW FIRMWARE VERSION

The Time Code Analyzer 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 Time Code Analyzer.

1. Connect the 5300 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 5300 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.

5300 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 232 Transmit

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 AM52A1.ZIP

3. To set up the 5300 for programming at 38400 baud hold down the ↑ key while you apply power to the 5300. When the 5300 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 5300 for programming at 9600 baud hold down the ↓ key while you apply power to the 5300. When the 5300 completes its boot-up sequence, the front panel will display `LOAD FLASH - 9600`

4. The 5300 firmware is contained in an Intel HEX format file and is callled 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 5300. Run FL.EXE, with the appropriate '.hex' file as the first argument. For example:

   FL AM52A1.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 AM52A1.HEX /p2

If you set up the 5300 for programming at 9600 baud you will need to use additional command line parameter to specify the baud rate as follows:

FL AM52A1.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 5300 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 5300. The Flash loader will give a status report as it sends each line of the HEX file to the 5300. During programming the 5300 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 5300 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 5300 will automatically switch to its FLASH program memory if programming is successful. As a part of the 5300 boot-up cycle it will say `SWITCH TO FLASH` to indicate that it is running on the FLASH EPROM now.

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