MASTER No. TACK SW1-3 off

PARTS NO. OS3-093

ATARI®

EC-101

SYNCHRONIZER

INSTRUCTION MANUAL

PCB is PB7C4A
DAUGHTER PB7C2A

		S2	S3
MTR 900 TACH=40 =		2	8
X850	80	5	0
MTR 70 30 PS	30	5	0
	15 IPS 40	2	8

Steve! this book has the traces for our synthesizer. DON'T CHOP ANYTHING! I will show you a new SPEC sheet!!

EDITION NO.3
ISSUED: APR. 1987

90's MARK PAUL

TOM DEFANTI

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Model Number:

Serial Number:

Date of Purchase:

Name and address of the dealer where the machine was purchased and the power requirements (voltage and frequency) of the machine.

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SECTION 1

INTRODUCTION

1.1 GENERAL

The EC-101 is a high performance in-machine synchronizer module designed to take advantage of the unique capabilities of the MTR-90 II Series transport. When equipped with the EC-101 module, the MTR-90 II is capable of maintaining frame accurate synchronization with a master Time Code source in both forward and reverse directions from 0.2 X to 2.5 X play speed, and typically will park within two frames of the master machine.

1.1.1 Applicable Software Versions

This manual is intended for use with Software Version 2.20 and greater. Section 4.3 describes the hardware updates necessary to upgrade an EC-101 from Version 1.xx to Version 2.20.

If you are currently using an EC-101 with Version 2.10 software, no hardware modifications are necessary to upgrade to Version 2.20.

The EC-101 displays the Version Number of the software which which it is equipped on the CB-121 display for about 3 seconds, each time the EC-101 is powered up.

1.1.2 Using this Manual

This manual is divided into eight sections beginning with this INTRODUCTION which contains general information about the synchronizer and about the manual.

The second section is the REFERENCE GUIDE which contains a keyed guide to the controls and indicators. This REFERENCE GUIDE provides detailed information about each control and its functions. You should use this section of the manual when you have a question about the function of a particular control or indicator.

The third section is the OPERATIONS section which describes the operation of the Synchronizer. The EC-101 is a Time Code based synchronizer, and therefore requires good Time Code in order to operate correctly. Section 3.1 provides information about Time Code levels and signal routing to help ensure good code.

The fourth section, INSTALLATION AND SET-UP, contains the information required when first installing the EC-101 in the MTR-90 II and interfacing to the Master machine. Section 4.3 describes the modifications necessary when upgrading from software Version 1.xx to Version 2.20

The fifth section of the manual lists the SPECIFICATIONS of the EC-101 Synchronizer.

The sixth section, the APPENDIX contains information necessary when programming a computer to control the EC-101 using the BTX\Cipher Shadow command set.

The seventh section of the manual contains an INDEX to the manual. The index, in alphabetical order, allows you to go directly to the page that contains the information that you need.

The eighth section of the manual contains the SCHEMATICS for all electronics and printed circuit boards.

The information and procedures in Section 4, INSTALLATION AND SETUP should be followed carefully when the EC-101 is first installed and interfaced with the Master machine. Installation into MTR-90 II series tape recorders prior to Serial Number Suffix "I" involves installing new connectors onto the Mother II printed circuit board, and requires care and patience. In many situations interface with the Master machine requires only an audio cable carrying Time Code. The EC-101 requires tach pulses and direction tally from the Master machine only if the Master machine does not reproduce usable Time Code at Fast Wind or Shuttle speeds.

Please read Sections 2 and 3 carefully before using the Synchronizer. If you need information about a specific operation, or instructions on how to perform a particular function, refer to the instructions in Section 3.

1.1.3 Conventions within this Manual

Generally, this manual uses all upper case type to describe a switch or control when that item is similarly labeled on the machine (e.g., the ENABLE button). Where a switch or button is not labeled, or the reference is less clear, only the first letter of the item is capitalized (e.g., the Cue lever near the CUE button). Machine status or operating modes are described with an upper case first letter (e.g., you press the MODE SELECT button to place the synchronizer in Offset Display mode). Normal parentheses ( ) are used for examples and parenthetic comments. Square brackets [ ] are used for references to callouts in certain illustrations. The square brackets in a particular sub-section are either all referenced to the same figure, as noted in that sub-section, or are individually referenced (such as [Fig. 2-1, 3], meaning callout "3" in Figure 2-1).

The terms Master and Slave refer to the relationship between the two machines being locked together by the Synchronizer. In an Audio-For-Video situation, the Master machine is usually the video tape recorder, and the audio tape recorder is usually the Slave. In this case the audio tape recorder (Slave) follows the video tape recorder (Master) so that the multi-track audio remains in exact sync with the picture. When the Master machine goes into Fast Wind or Shuttle modes the Slave will "chase" the Master attempting to catch-up. In Play mode, the Slave maintains a precise speed and location match with the Master. When this condition has been achieved, the Slave is said to be "Locked" to the Master. In an Audio-For-Audio situation, one of the audio tape recorders is designated the Master and one the Slave. When this manual refers to offsets or differences between Master and Slave we are really referring to offsets or differences in time code values between the Time Code from the Master and the Time Code from the Slave. The term "offset" refers to a desired difference between the Master and Slave Time Codes. Offsets are used to synchronize tapes with Time Codes which were not recorded at the same time, and therefore have different time code values recorded for the same event.

1.2 INTRODUCTION TO TIME CODE

1.2.1 The Development of Longitudinal Time Code

Time code has its roots in the earliest attempts to link sound to picture. The early methods of synchronizing an audio playback device to the motion picture camera/projector relied upon a physical connection (a rotating shaft, a chain and sprockets, etc.) between the sound (on a disk or cylinder) and the picture (on sprocketed film). The link between sound and picture was never accurate because there was no one-to-one relationship between the media for recording picture (film) and the media for recording sound (disk or cylinder). As audio recording and film technologies developed, and electrical sound recording appeared, the recording of the sound track on the same medium as the picture offered a solution. By recording the sound as an optical image on film, the need for a one-to-one correspondence between sound and picture was met. The sound and picture recorder/reproducers could again be mechanically "interlocked" to record and playback picture and sound in synchronization. The development of electrical (Sel-Syn) interlock systems allowed picture and sound to be accurately synchronized with only electrical connections between the machines. As technology improved further and the magnetic recording of sound became wide spread, magnetically coated sprocketed film (full-coat) replaced optical image sound recording. This met the film industry's audio/picture synchronization needs for many years, developing into multi-track multi-machine studios in which a great number of sound tracks could be run, forward and backwards, in exact synchronization with the projected picture. Both picture and sound film rolls had an identifiable "sync" mark at the beginning of each reel, and as long as the sync marks were lined up correctly at the beginning of the session, all the tracks of audio would remain in sync with the picture.

The invention of video tape recording changed all that. Although video tape has electronic control track pulses for internal machine synchronization which can be viewed as electronic sprocket holes, there was now no one-to-one relationship between picture media (video tape) and the sound media. It also soon became apparent that the cut and splice editing techniques developed for film and audio were not

applicable to video tape. The process of electronic editing demanded better accuracy than the various ways of electronically marking the edit points could offer and several non-compatible edit codes which could be recorded on the tape along with the picture for location reference were brought out by various manufacturers.

The Society of Motion Picture and Television Engineers (SMPTE) developed the American National Standard Time and Control Code for Video and Audio Tape for 525 Line/60 Field Television Systems (SMPTE Time Code) in 1969 to end the chaos of competing codes. The SMPTE Time Code was quickly adapted to European TV and film standards, and adopted by the European Broadcast Union (EBU), creating a world-wide Time Code standard. This standard Time Code has been modified to fit the changing needs of the broadcast industry. The current implementation of SMPTE/EBU Time Code was approved in 1981.

One of the disadvantages of Longitudinal Time Code, when applied in a video environment, is that it cannot be read when the video tape is not moving (still-frame) or moving very slowly. This lack led to the development of Vertical Interval Time Code (VITC). In VITC, the time code word is recorded in the portion of each picture frame that does not appear on the screen (the vertical interval). This inclusion of the Time Code with the picture insures that usable time code will be present whenever picture is present.

For an in-depth discussion of SMPTE/EBU Time Code (both Vertical Interval and Longitudinal) please refer to THE TIME CODE HANDBOOK, by Walter Hickman, published by Cipher Digital.

1.2.2 Structure of the Longitudinal Time Code word

Standard (plain vanilla, monochrome TV) SMPTE Longitudinal Time Code is a continuous data stream of digital "1"s and "0"s at 80 bits per frame, with (nominally) 30 frames per second. A digital "one" is an additional transition from high to low (or vice versa) within a bit cell, also called a sub-frame. This yields a nominal data rate of 1200 Hz for a word of all zeros, or 2400 Hz for a word of all ones, easily

within the bandwidth recordable on an analog audio tape recorder. This scheme allows the Time Code to be self-clocking and recognizable in both directions.

NOTE: Some manufacturers of Time Code equipment electronically calculate 100 "sub-frames" for each 80 bit word. The EC-101 uses 80 sub-frames per frame.

There are several (four) varieties of SMPTE/EBU Time Code, used for different applications.

The simplest is "plain vanilla" Time Code, used for monochrome (B & W) video recording. This "plain vanilla" Time Code produces 30 frames per second. This 30 frames per second rate corresponds to the frame rate for monochrome video, whereas color video operates at a rate of 29.97 frames per second. This difference led to the development of "drop frame" Time Code, in which frames are skipped (or dropped) to account for the 108 frames per hour difference between the 30 frame calculation and the 29.97 frame rate at which the information was recorded. To make matters more confusing, most motion picture uses of Time Code are at the film rate of 24 frames per second, while the European film and video users both utilize the EBU implementation at 25 frames per second.

Keep these differences in mind when using time coded tapes from sources beyond your control. If you mix Time Code types and time base references when attempting to synchronize tapes, you will inevitably run into errors which do not allow you to properly sync up the material. It is good practice to ask "what is the Frame Rate of the code on this tape? 29.97 or 30?", "is the Time Code on this tape Drop or Non Drop frame?", "is the Time Code SMPTE or EBU?" and "what time base reference was used by the Time Code Generator when this tape was recorded?". The answers to these two questions will reveal any major incompatabilities before the tapes are threaded on the machines.

It is common practice in "audio only" situations to use non-drop Time Code referenced to 60 Hz (30 frames). This practice can lead to problems if the Time Coded audio tape is taken to an video editing facility. It is recommended that all Time Code be recorded as "drop" or "non-drop" frame Time

Code referenced to color video sync (59.94 Hz, 29.97 frames per sec) to prevent incompatabilities in the future.

The EC-101 Synchronizer will operate using any variety of time code, but will not operate properly with SMPTE Time Code on one machine and EBU or FILM Time Code on the other machine. The EC-101 "learns" which type of Time Code is in use, and displays the results, after the first 3 - 5 seconds of Time Code from each machine, when first "waking up" from power off. The variety of Time Code can be changed either by resetting the EC-101 from the CB-121 front panel, or by turning the MTR-90 II Off and back On. The EC-101 must then "learn" the Time Code type again.

1.3 INTRODUCTION TO SYNCHRONIZATION

1.3.1 What is a Synchronizer and what does it do

A synchronizer is a device to lock together, or synchronize, two or more tape machines, either audio or video tape recorders or, more commonly, a combination of video and audio machines. The synchronizer uses the Time Code words, and sometimes tach pulses, to bring the Slave machine into exact synchronization with the Master machine. The EC-101 reads the Time Code from the Master and from the Slave. If they are different the EC-101 uses the transport controls of the MTR-90 II (Slave) to cause it to chase after the Master. When the Time Code from the Slave is the same as that from the Master (with any desired offset taken into account) the EC-101 uses the phase of the Time Code signal to lock the Slave capstan speed to that of the Master to within 50 microseconds.

1.3.2 EC-101 Applications

The EC-101 Synchronizer can be used in several situations in Audio-for-Video and Audio-Post-Production as well as multi-track audio recording studios.

In one popular application, the EC-101 is used to lock two MTR-90 II audio tape recorders together to provide 46 track (one track on each machine is used for Time Code) recording and playback capabilities. In this application, the CB-121

Synchronizer Remote Control unit would generally not be necessary. If the same Time Code is applied to both multi-track tapes simultaneously, no offsets between Master and Slave should need to be introduced, and the Slave machine will chase and lock to the Master machine. Only one CB-115 Auto-locator needs to be used to cause both tape transports to perform as if they were one 46 track MTR-90 II. Because the software for the EC-101 is optimized for use with a Video machine as the Master, the Slave (MTR-90 II) lags behind the Master by as much as 2 (Time Code) minutes. When the EC-101 is used to synchronize two MTR-90 IIs this long lag tends to degrade lock-up time performance. To correct this situation, and provide shorter lock-up times version "F" software (for example 2.20F) is available, which reduces lock-up times to approximately 6 seconds. Contact OTARI or your OTARI dealer if you are using the EC-101 to lock two MTR-90 IIs together.

Another common application finds the Slave MTR-90 II providing multi-track audio in exact sync with picture from a video recorder. This allows multi-track sound track scoring and "sweetening" to be recorded and mixed while using the picture as reference.

The EC-101's RS-232 interface allows it to be controlled by a BTX/Cipher Softouch Controller or any controller which issues the same commands.

The MTR-90 II can also be used to "layback" audio onto a video tape. When used in this application, a Video Layback Kit (available from OTARI or your OTARI dealer) must be installed. The necessary modification instructions are contained in the Layback Kit.

The EC-101 can be used with the Layback Kit after performing one modification which directs the 9600 Hz capstan control signal to the MTR-90 II Rear panel, where it is accessible for use by the Layback Capstan Pre-Scaler unit. Use of the EC-101 for Video Layback also requires that the EC-101 software be updated to "L" version (for example V2.20L).

Further information, and modification instructions, about using the EC-101 with the Layback Kit is contained in the Layback Kit documentation.

SECTION 2

CONTROLS AND INDICATORS - REFERENCE GUIDE

2.1 CONTROLS AND INDICATORS ON THE SYNCHRONIZER MODULE

NOTE: Numbers in brackets [] refer to the callouts in Figure 2-1.

[1] LOCK indicators > - <

These three indicators illuminate to display Lock and Chase Status.

The > indicator is illuminated when the Slave is behind lock and is chasing forward (F.Fwd). This indicator is continuously illuminated when the difference between Master and Slave is greater than 1 minute, and flashes when the difference is between 1 minute and 1 frame.

The - (LOCK) indicator is illuminated when the EC-101 has achieved Frame and Phase lock between the Master and Slave machines. This indicator is continuously illuminated to indicate Phase lock between the two machines.

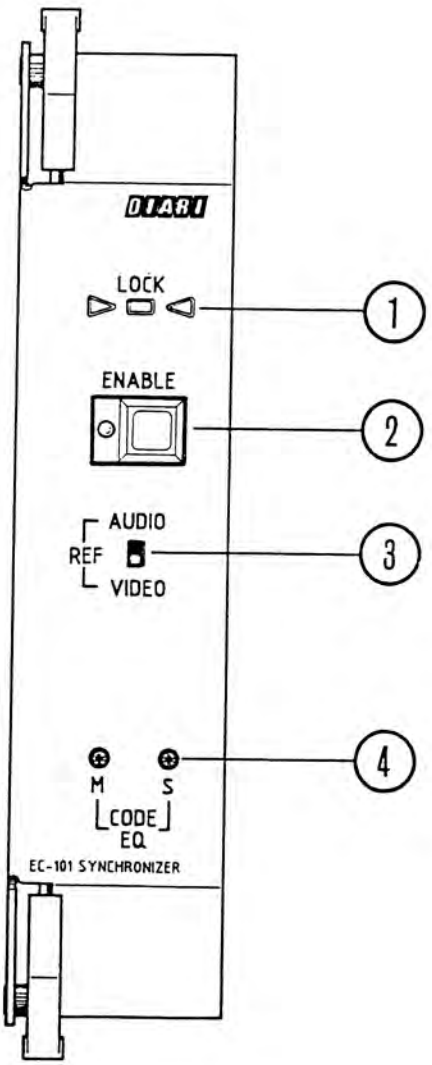


Figure 2-1 Controls on the EC-101 Module Front Panel

The < indicator is illuminated when the Slave is ahead of lock and is chasing backward (Rewind). This indi-

cator is continuously illuminated when the difference between Master and Slave is greater than 1 minute, and flashes when the difference is between 1 minute and 1 frame.

[2] ENABLE button and indicator

Pressing this button alternately Enables or Disables the Synchronizer. The indicator is illuminated when the unit is Enabled.

NOTE: The EC-101 "wakes up" from Power Off Disabled. If the EC-101 is first Enabled by pressing the ENABLE button on the EC-101 Module, the Synchronizer will not accept any subsequent commands from the CB-121 Remote Control Unit. If the EC-101 is first Enabled from the ENABLE button on the CB-121, or from the RS-232 port, the unit will continue to accept commands from the Remote Control unit. Please refer to Section 3.2.1 for information about "waking up" the EC-101 synchronizer.

[3] REF. AUDIO/VIDEO switch

Setting this switch to the Video position causes the Synchronizer to use the Video signal connected to the VIDEO IN connector on the rear of the MTR-90 II as the phase reference for resolving the capstan speed of the Slave machine. This position should be used when a central source of "house sync" is provided to phase lock all video and audio machines. Please refer to Section 4.8.3 for information about using PAL video as a reference signal.

When this switch is set to the Audio position, the EC-101 uses the Master Time Code as the phase reference for resolving the capstan speed of the Slave machine. This position should be used when the time code has been recorded "non-synchronously", that is without reference to an outside sync source, or when a source of video sync reference is not available. When the Master Time Code is used as the phase reference, any wow and flutter in the Master machine will be transferred to the Slave machine.

[4] CODE EQ M and S trimmers

These trimmers adjust the equalization of the Time Code readers for the Master and Slave Time Code inputs respectively to optimize the high speed performance of the Time Code readers.

2.2 CONTROLS AND INDICATORS ON THE CB-121 REMOTE UNIT

NOTE: Numbers in brackets [] refer to the callouts in Figure 2-2.

[1] 8 Digit Time Display (H, M, S, F)

This 8 digit display (with leading minus sign) can be selected to show Master Time Code, Slave Time Code, Offset, or Difference times. The display is also used in Offset entry mode to show the digits of the offset time as they are entered.

[2] NO TC indicator

This indicator illuminates to indicate the EC-101 is not receiving valid Time Code from the Master or from the Slave machine.

[3] DF indicator

This indicator illuminates when Drop Frame Time Code (Bit 10 = "1") is being received from the Master or Slave machine as selected by the DISPLAY - MODE SELECT button [8].

[4] Mode Indicators MASTER, SLAVE, OFFSET, DIFFERENCE

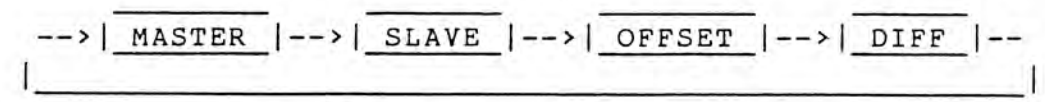
These four indicators show the Display Mode of the CB-121 Remote Control as selected by the DISPLAY - MODE SELECT button.

MASTER - When this indicator is illuminated, the Time Code being received from the Master is displayed. The DF indicator illuminates to indicate that Drop Frame Time Code is being received from the Master machine.

SLAVE - When this indicator is illuminated, the Time Code being received from the Slave is displayed. The DF indicator illuminates to indicate that Drop Frame Time Code is being received from the Slave machine.

OFFSET - When this indicator is illuminated, the stored Offset between the Master Time Code and the Slave Time Code is shown. When this indicator is illuminated, and the EC-1Ø1 is Enabled, the Offset may be adjusted by pressing the TRIM buttons [14 and 15], or Stored by pressing the STORE/CLEAR button [11].

DIFF - When this indicator is illuminated, the difference (in Hrs, Mins, Secs, and Frames) between the Slave Time Code and Lock condition is shown.



Sequence of Display Modes as selected by the DISPLAY MODE button.

[5] LOCK indicators > - <

These three indicators illuminate to display Lock and Chase Status.

The > indicator is illuminated when the Slave is behind lock, and is chasing forward (F.Fwd). The indicator is continuously illuminated if the difference between Master and Slave is greater than 1 minute, and flashes if the difference is between 1 minute and 1 frame.

The - (LOCK) indicator is illuminated when the EC-1Ø1 has achieved Frame and Phase lock between the Master and Slave machines. The indicator is continuously illuminated to indicate Phase lock between the two machines.

The < indicator is illuminated when the Slave is ahead of lock and is chasing backward (Rewind). The indicator is continuously illuminated if the difference between Master and Slave is greater than 1 minute, and flashes if the difference is between 1 minute and 1 frame.

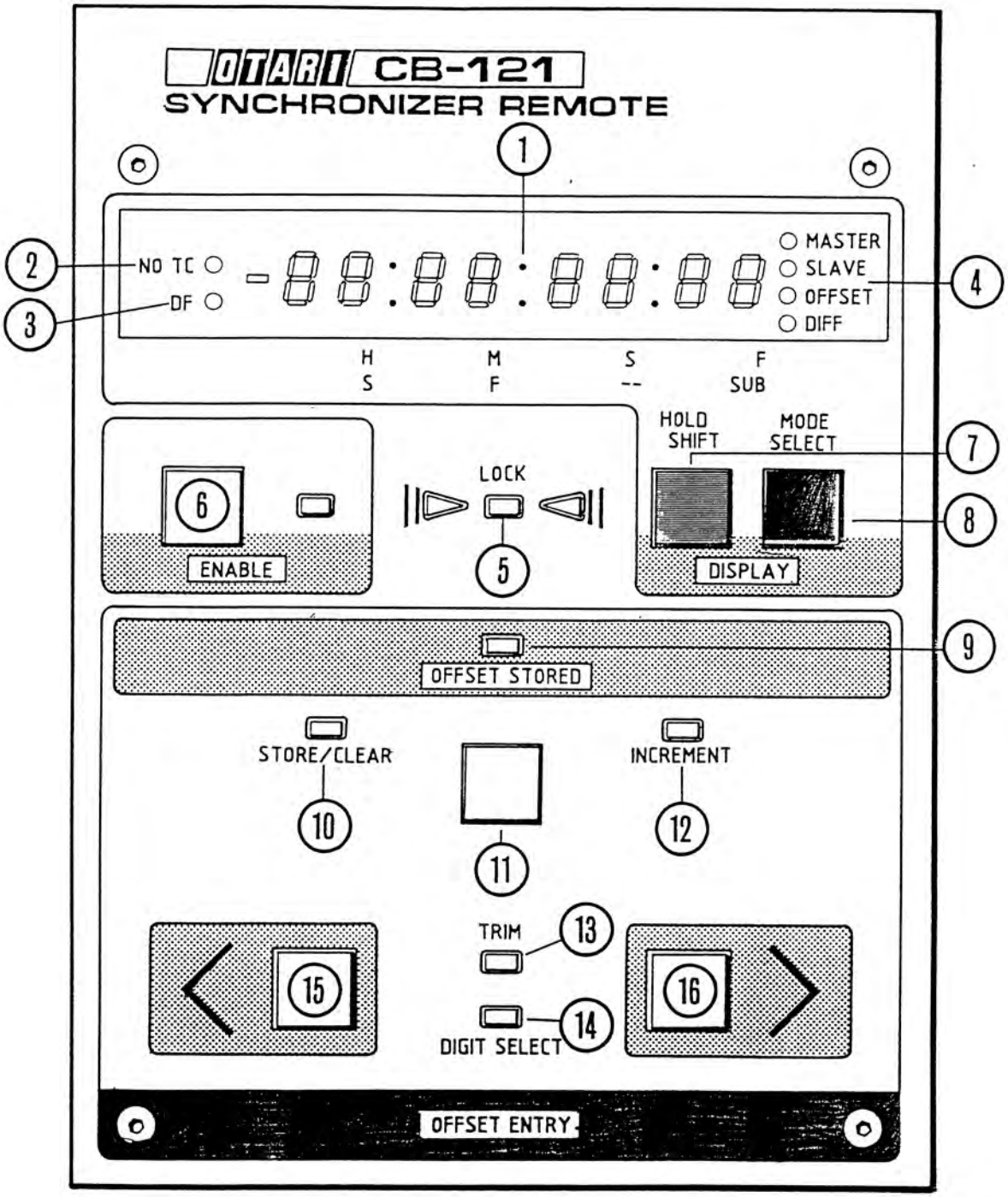


Figure 2-2 CB-121 Front Panel Controls

[6] ENABLE button and indicator

Pressing this button alternately Enables or Disables the Synchronizer. The indicator is illuminated when the EC-101 is Enabled.

If the EC-101 is first Enabled by pressing the ENABLE button on the EC-101 Module, the Synchronizer will not accept any commands from the CB-121 Remote Control Unit. If the EC-101 is first Enabled from the ENABLE button on the CB-121, or from the RS-232 port, the unit will continue to accept commands from the Remote Control unit. If the EC-101 is first enabled from the ENABLE button on the EC-101 Synchronizer Module, the Display will remain dark, indicating that the EC-101 will not accept commands from the CB-121 Remote Control.

When the Synchronizer is Enabled, and Offset Display mode has been selected, the OFFSET ENTRY buttons [15, and 16] continuously adjust (trim) the amount of Offset between the Master and the Slave.

When the Synchronizer is Disabled, and Offset Display mode has been selected with the DISPLAY - MODE SELECT button [8], the OFFSET ENTRY buttons [15 and 16] are used to enter and store time offsets between Master and Slave.

[7] DISPLAY - HOLD/SHIFT button

Pressing this button causes the Time Code Display to freeze, at the instant the button was pressed, and to show the Time Code from Master or from Slave or the Difference between the Master and Slave, depending upon the Display Mode selected. The appropriate Mode indicator [4] flashes to indicate that the display is "on hold". The display will "unfreeze" upon pressing this button again or upon pressing the DISPLAY - MODE SELECT button.

Pressing this button while Offset Display mode has been selected causes the Display to toggle between showing Hours, Minutes, Seconds, and Frames and showing

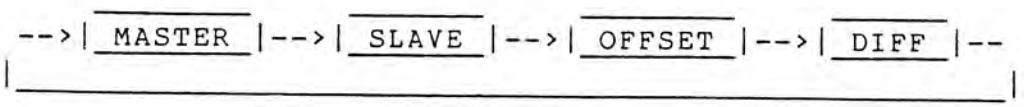
Seconds, Frames, and Subframes of offset between the Master and Slave. The Sub-Frame display mode is indicated by two dashes displyed between the Frame and Sub-Frame values.

Pressing this button simultaneously with the MODE SELECT button, and while holding them, pressing the ENABLE button when 0:0:0:0 is displayed (Master tape not moving) causes the EC-101 to be Reset to its Power On condition.

NOTE: Pressing any two buttons (except the ENABLE button) simultaneously causes the Tach Pulse rate of the Master machine (if connected and in Play mode) to be shown on the display.

[8] DISPLAY - MODE SELECT button

Repeatedly pressing this button sequentially selects the four Display Modes. See [4] above for a description of each mode.



Sequence of Display Modes as selected by the DISPLAY MODE button.

[9] OFFSET STORED indicator

This indicator is illuminated when an offset between Master and Slave other than zero is stored.

[10] STORE/CLEAR indicator

This indicator is illuminated to show that the associated button is used to Store or Clear an Offset between Master and Slave.

[11] STORE/CLEAR/INCREMENT button

If the EC-101 is in Offset Display mode, and is Disabled, pressing this button increments (increases by one) the count of the digit selected by the DIGIT

SELECT/TRIM buttons [15 and 16].

If the EC-101 is in Offset Display mode, and the offset has been changed, you must press the DISPLAY - MODE SELECT four times (until the display once again displays the offset), before this button will Store the current offset.

When the DIGIT SELECT indicator is illuminated, the first time this button is pressed the rightmost digit of the Time Display will begin to flash.

Holding this button pressed for 3 seconds when the EC-101 is Enabled causes the offset to be Cleared (set to zero).

[12] INCREMENT indicator

This indicator is illuminated when the EC-101 is Disabled, to show that the associated button [11] is used to Increment the selected digit of the displayed Offset entry.

[13] TRIM indicator

When the EC-101 is Enabled, this indicator is illuminated to indicate that the associated buttons are used to continuously adjust (trim) the Offset between the Master and Slave.

[14] DIGIT SELECT indicator

When the EC-101 is Disabled, and Offset Display mode has been selected, this indicator is illuminated, to show that the associated buttons are used to select the digit of the Offset display that will be incremented by the STORE/CLEAR/INCREMENT button.

[15] DIGIT SELECT/TRIM button (left arrow button)

Pressing this button, when the TRIM indicator is illuminated, causes the Offset between the Master and Slave to be increased, initially at the rate of 20 subframes per second. After the button has been held pressed for

4 seconds the rate of change increases to 1 frame per second, and after an additional 5 seconds, the rate of change increases to 5 frames per second.

Pressing this button when the DIGIT SELECT indicator is illuminated causes the digit selected for modification to be shifted one position to the left. If this button is the first button pressed after entering Digit Select mode, the leftmost digit of the Time Display will be the first digit selected for change. The selected digit will flash. Pressing this button when the "tens of hours" digit is flashing causes the "minus sign" digit to be toggled from Off to On or vice versa.

[16] DIGIT SELECT/TRIM button (right arrow button)

Pressing this button when the TRIM indicator is illuminated causes the Offset between the Master and Slave to be decreased, initially at the rate of 20 subframes per second. After the button has been held pressed for 4 seconds the rate of change increases to 1 frame per second, and after an additional 5 seconds, the rate of change increases to 5 frames per second.

Pressing this button when the DIGIT SELECT indicator is illuminated causes the digit selected for modification to be shifted one position to the right. If this button is the first button pressed after entering Digit Select mode, the rightmost digit of the Time Display will be the first digit selected for change. The selected digit will flash. Pressing this button when the "units of frames" digit is flashing causes the display to shift to Frames, Seconds, two dashes, and Subframes. The "tens of subframes" digit will then be selected. Pressing this button again causes the Units of Subframes to be selected.

2.3 CONNECTIONS ON THE REAR PANEL

NOTE: Numbers in brackets [] refer to the callouts in Figure 2-3.

[1] VITC ACCESSORY - 25 Pin D connector

This connector is used only to interface the Tach and Direction signals from the Master to the EC-101.

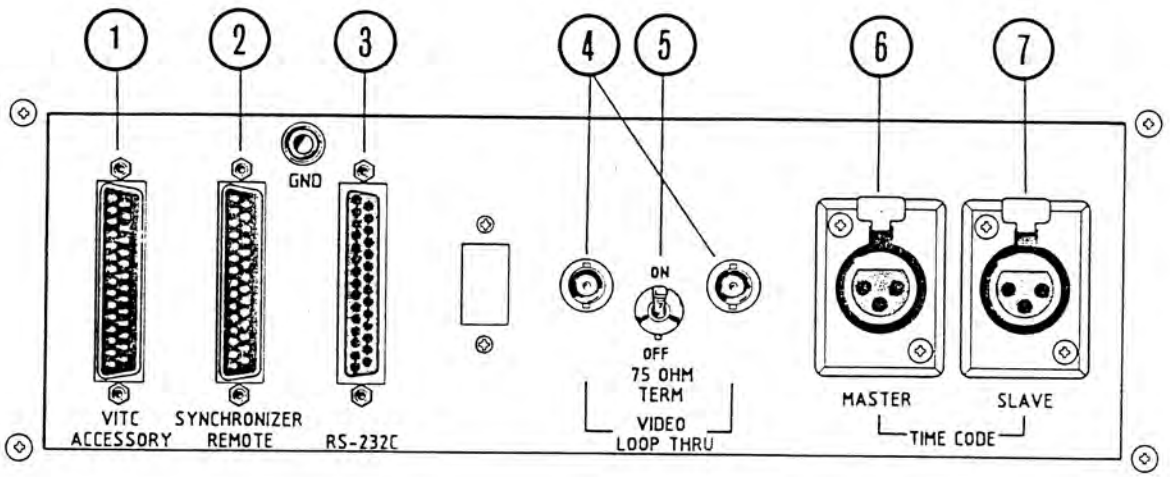


Figure 2-3 Rear Panel Connectors

[2] SYNCHRONIZER REMOTE - 25 Pin D connector

The Optional CB-121 Synchronizer Remote Control unit attaches to this connector. Operation with cable lengths longer than 66 ft (20 m) is not recommended. See Table 2-2 for connector pinout.

[3] RS-232 - 25 Pin D connector

This connector is used to interface the EC-101 to a BTX/Cipher Softouch Controller or other computer control system. See Table 2-1 for connector pinout.

[4] VIDEO LOOP THROUGH - BNC connectors

These connectors are used to connect the EC-101 Synchronizer to an external video sync reference source,

such as "house sync". The input is either bridging or terminating as selected by the 75 OHM TERM switch [5].

[5] 75 OHM TEPM ON/OFF switch

When this switch is in the On position, the VIDEO LOOP THROUGH connectors are terminated with a 75 Ohm resistor. When this switch is in the Off position, the VIDEO LOOP THROUGH connectors represent a bridging input.

[7] MASTER TIME CODE - 3 pin XL type connector

The SMPTE/EBU Time Code from the Master tape machine is input to the EC-101 at this connector. The input level range is -10 to +10 dBm referenced to 0.775 V. The input speed range is 1/20 to 60 times play speed.

[8] SLAVE TIME CODE - 3 pin XL type connector

The SMPTE/EBU Time Code from the Slave tape machine (MTR-90 II) is input to the EC-101 at this connector. The input level range is -10 to + 10 dBm referenced to 0.775 V. The input speed range is 1/20 to 60 times play speed.

RS-232C CONNECTOR

Pin Number	Signal
1	Frame Ground
2	Data In to EC-101 (RD)
3	Data Out from EC-101 (TD)
4	N/C
5	N/C
6	N/C
7	Signal Ground
8 through 25	N/C

Table 2-1 RS-232 connector pinout

SYNCHRONIZER REMOTE Connector

Pin Number	Signal
1	Ground
2	Ground
3	Ground
4	Ground
5	+ 5 VDC
6	+ 5 VDC
7	+ 5 VDC
8	+ 5 VDC
9	+ 5 VDC
10	Ground
11	Ground
12	Ground
13	Ground
14	D0
15	D1
16	D2
17	D3
18	D4
19	D5
20	D6
21	D7
22	WRITE LEDS
23	WRITE DIGIT
24	READ SWITCH
25	N/C

Table 2-2 SYNCHRONIZER REMOTE connector pinout

SECTION 3

OPERATION

This section describes the operation of the EC-101 Synchronizer. Refer to Section 2 for a description of each control and indicator on the EC-101. Section 3.3 describes the operation of the EC-101 Synchronizer with the BTX/Cipher Softouch controller. For detailed information regarding the BTX/Cipher Softouch command set refer to the APPENDIX.

3.1 PREREQUISITE TO OPERATION - GOOD CODE

The requirement for "good code" is confronted in every facet of a Time Code based recording, editing, or synchronization system.

3.1.1 Synchronous vs. Non-Synchronous Time Code

In video production facilities it is common practice to distribute video sync from a central source as "house sync", and to synchronize all the various video equipment to that signal. Using this "house sync" as a phase reference for the Time Code Generator and the Synchronizer yields "synchronous" Time Code, which will always "resolve" to the time base of the "house sync" source.

Audio-only facilities rarely have a central source of "house sync", so it is important that the phase reference for the recorded Time Code be stable and repeatable. A crystal based pilot generator (such as an OTARI EC-400 Series Resolver) provides a phase reference many times more stable than the AC mains. The use of "non-synchronous" Time Code will cause errors if used with Time Code of a different frame rate. The use of 30 frame/sec Time Code with with a 29.97 frames/sec phase reference will cause an error of 108 frames (3.6 seconds) per hour which would require repeated correction by the synchronizer.

3.1.2 Time Code Levels on Tape

It is an accepted practice to record Longitudinal Time Code on an outside track of the multi-track audio tape, and on Audio Channel 2 of a video tape. The Time Code should be recorded on the Slave tape for the MTR-90 II at approximately -6 VU referenced to 250 nWb/m. Follow the recommendations of the manufacturer regarding recording level on various other machines.

3.1.3 Time Code Signal Routing

It is recommended that the Time Code signal from the Master tape recorder be connected directly to the Master Time Code Input on the lower rear panel of the MTR-90 II, not routed through a patch panel, especially if the patch panel is located in the mixing console, as the Time Code may cause objectionable crosstalk into the audio channels.

The Time Code from the output of the appropriate channel of the Slave (MTR-90 II) should be connected to the Slave Time Code Input using a short XL to XL cable.

3.2 OPERATING THE EC-101

3.2.1 "Waking Up" and Enabling the EC-101

When first turning On the Power to the EC-101 (MTR-90 II), the EC-101 displays the Software Version number briefly (about 3 seconds) and then the display blanks.

The EC-101 must first "learn" the type of Time Code being used before it can be enabled. To teach the EC-101 what type of Time Code is being used:

1. Play the Master tape (with Time Code) for about 5 seconds. The left digits of the CB-121 will display the Master Time Code frame rate.

2. Play the Slave tape (with Time Code) for about 5 seconds. The right digits of the CB-121 will display the Slave Time Code frame rate.

3. Press the ENABLE button to Enable the EC-101. NOTE: If the EC-101 is first Enabled using the ENABLE button on the EC-101 Synchronizer Module, the Synchronizer will not accept commands from the CB-121 Remote Control unit. If the EC-101 is first enabled from the CB-121 Remote Control or from the RS-232 port, the Synchronizer will continue to accept commands from the CB-121 Remote Control. The EC-101 can then be Enabled and Disabled from the ENABLE button on the Synchronizer module without affecting CB-121 operation.

   NOTE: IF THE ENABLE BUTTON SEEMS TO HAVE NO EFFECT, IMMEDIATELY AFTER APPLYING POWER OR AFTER RESETTING THE UNIT, PLACE BOTH MACHINES IN PLAY FOR A FEW SECONDS TO ALLOW THE EC-101 TO LEARN THE FRAME RATE OF THE CODES BEING USED, BEFORE PRESSING THE ENABLE BUTTON.

NOTE: When operating with Time Code which crosses a "day" boundary, for example, a tape which begins at 23:55:00.00 and ends at 00:25:00, enter the appropriate offset before Enabling the EC-101, or insure that both Master and Slave are in the same "day" when first playing each tape to teach the EC-101 the Time Code type in use. If the EC-101 does not learn the correct "day" of each Time Code, the Slave will search 23 Hours in the wrong direction to find the Master.

3.2.2 Selecting Time Code Type (24/25/29/30 fps)

To change Time Code type (from FILM to SMPTE for example):

1. Reset the EC-101 by holding the SHIFT and SELECT buttons until "0 0 0 0" is shown on the display, then, while still holding the SHIFT and SELECT buttons, press the ENABLE button once. It is also possible to Reset the EC-101 by turning Off the Power to the MTR-90 II and then turning it back on.

2. Then play the tape on each machine for about five seconds to teach the EC-101 the new Time Code frame rates.

NOTE: The EC-101 will not operate with SMPTE time code on one machine and EBU or FILM Time Code on the other.

The EC-101 will operate properly with either Drop Frame or Non-Drop Frame time code on either machine. The DF indicator on the CB-121 will indicate which type of code is coming from which machine.

Time Code Compatibility Chart

SLAVE \ MASTER		NDF 30	DF 29	EBU 25	FILM 24
SMPTE REF 59.94 OR 60HZ	NDF 30	OK	OK	NO	NO
	DF 29	OK	OK	NO	NO
EBU 25 REF 50HZ		NO	NO	OK	NO
FILM 24 REF 48HZ		NO	NO	NO	OK.

Offsets and differences are entered and displayed as Non-Drop Frame time. When using Drop Frame code on one machine and Non-Drop Frame code on the other, the Time Display will show different time code values for Master and Slave when the machines are parked or locked. This is due to the differences in numbering methods between Drop Frame and Non-Drop Frame Time Code. The DIFFERENCE display mode will indicate 0:00:00 difference when the machines are locked.

3.2.3 Basic Chase Operation

3.2.3.1 Time Code Only operation

The EC-101 can be used with only Time Code connected from the Master machine to the Synchronizer. In this mode of operation, it is necessary that the Master machine produce usable Time Code when in Fast Wind modes, to allow the EC-101 to chase. If the Master machine does not produce usable Time Code at wind speeds, it is recommended that Tach Pulses be used for chase operation. If this is not possible, long lockup times will result because the Slave machine (MTR-90 II) will stop when the Master machine ceases producing Time Code and will wait until Time Code is again produced by the Master, to begin its chase operation.

3.2.3.2 Chase Using Tach Pulses (Tape Lifters Out)

If the Master machine does not produce usable Time Code at Fast Wind speeds, the EC-101 can use Tach Pulses from the Master for chase operation. The EC-101 will not "lock" to tach pulses, but will use them when the Master is in Fast Wind modes.

Switches Sw 2 and Sw 3 must be set to correspond to the tachometer pulse rate of the Master machine. Refer to Table 4-2 for the switch settings corresponding to the Master tach rate.

A. To determine the Tach Pulse rate of the Master machine:

Enable the EC-101 from the CB-121, then Disable the EC-101 from the CB-121, then place the Master in Play mode (at normal Play speed). Press and hold any two buttons, except the ENABLE button, on the CB-121, and the Master Tach rate will be shown on the CB-121 display.

B. To use Tach pulses from the Master and Slave (MTR-90II) machines:

1. Find the Master machine tach rate at PLAY speed in Table 4-2. Read up the column to the top row to find the correct setting for Sw 3. Read across

the row to the left column to find the correct setting for Sw 2. Set Sw 2 and Sw 3 to the correct positions.

2. Set DIP Sw 1-3 to the ON position to enable the EC-101 to operate using Tach Pulses from the Master.

SERVICE NOTE: If the EC-101 is extended, using the Extender PCB, when changing the position of Sw 1-3 (to On or to Off) reset the MTR-90II by turning the Power Off then back On.

3. If it is desired to use the tape lifters on the MTR-90II in Fast Wind, thereby using tach pulses from the Slave whenever in Fast Wind modes, set Sw 1-1 to the ON position.

4. Connect the Tach Pulses from the Master to Pin 15 of the VITC Accessory connector.

5. Connect the Direction Tally from the Master to Pin 14 of the VITC Accessory connector.

6. Connect the Ground return from the Master to Pin 1 of the VITC Accessory connector.

NOTES:

A. Tach Pulses and Direction Tally from Master must be TTL level.

B. The EC-101 will learn the polarity of the Master Direction Tally from the first two seconds of Time Code in Play mode (at the same time it learns the Time Code type).

C. Since the EC-101 updates only the Seconds display when using Tach pulses from the Master or Slave, if Time Code is lost in Play (lock) mode, the Slave (MTR-90II) will enter Chase until Time Code is restored.

If Sw 1-3 is <u>not</u> On, and Time Code from the Master is lost, the Slave will stop until good Code is regained.

D. Even when operating using Tach pulses from the Slave, (Sw 1-1 On) the Slave Time Code channel must be "wide-banded" to allow it to produce good Time Code at wind speeds because, the EC-101 will use Tach pulses from the Slave (MTR-90 II) when in chase mode by activating the tape lifters after the tape reaches a set speed. The EC-101 will then deactivate the lifters as the tape speed decreases just before parking or locking to the Master machine. The lifters are activated, and deactivated to assure proper parking and lock up times.

E. When using Tach Pulses from the Master and Slave, lock-up times following a long search will be longer then normal (4-6 Sec.) due to parking location inaccuracy. Allow more Pre-Roll time when operating in this mode.

3.2.4 Entering an Offset while the tape is stopped

To synchronize tapes with known time differences between their recorded Time Codes, such as would happen when recording Time Code at different times or locations without benefit of "Jam Sync", the desired difference between the Master and the Slave may be entered into the EC-101 from the CB-121 Synchronizer Remote unit.

NOTE: When operating with Time Code which crosses a "day" boundary, for example, a tape which begins at 23:55:00.00 and ends at 00:25:00, enter the appropriate offset before Enabling the EC-101, or insure that both Master and Slave are in the same "day" when first playing each tape to teach the EC-101 the Time Code type in use. If the EC-101 does not learn the correct "day" of each Time Code, the Slave will search 23 Hours in the wrong direction to find the Master.

1. Disable the EC-101 by pressing the ENABLE button. The associated indicator will be extinguished when the unit is Disabled.

2. Press the DISPLAY MODE - SELECT button until the OFFSET indicator becomes illuminated. The INCREMENT and DIGIT SELECT indicators will be illuminated.

3. Press the DIGIT SELECT - TRIM (arrow) buttons to select the first digit to enter. Pressing the Left Arrow button first will cause the leftmost digit of the Time Display to be selected, pressing the Right Arrow button first will cause the rightmost digit to be selected. The selected digit will flash. Use the STORE - INCREMENT button to increment the displayed digit to the desired value.

4. Press the DIGIT SELECT - TRIM buttons again to select the next digit for entry. If the Tens of Hours digit is selected, the next press of the Left Arrow button toggles the "minus" sign On and Off. If the Ones of Frames digit has been selected the next press of the Right Arrow button causes the display to Shift to Frames, Seconds, two dashes, and Subframes. The Tens of Subframes digit will be selected.

5. Repeat Steps 3 and 4 for each digit until the desired offset time is shown on the display.

3.2.5 Capturing an Offset while the tape is stopped

It is often possible to locate points on both Master and Slave machines that are readily identifiable when the tape is stopped. The difference between two such points may be "captured" by the EC-101 while the tapes are stopped.

1. Press the ENABLE button on the CB-121 Remote Control unit to Disable the Synchronizer. The associated indicator will be extinguished.

2. Using the transport controls, move the Master tape to the desired location.

3. Using the transport controls, move the Slave tape to the desired location.

4. Press the DISPLAY - MODE SELECT button until the OFFSET indicator is illuminated.

5. Press the ENABLE and then the STORE/CLEAR/INCREMENT buttons quickly, to store the difference between the Master and Slave as the Offset. The OFFSET STORED

indicator will be illuminated. If the buttons are not pressed quickly, the EC-101 will try to move the Slave to the last Master location as soon as the ENABLE button is pressed.

NOTE: If the TRIM buttons have been used to modify the offset being shown on the display, you must press the DISPLAY - MODE SELECT four times (until the offset is once again shown on the display) before the STORE button will store the offset. This prevents accidental storage of undesirable offsets.

3.2.6 Trimming an Offset while the tape is moving and locked

The EC-101 allows the offset between the two machines to be adjusted while the tape is moving.

1. With the EC-101 Enabled press the DISPLAY - MODE SELECT button until the OFFSET indicator is illuminated.

2. The STORE/CLEAR and TRIM indicators will be illuminated to indicate the function of the associated buttons.

3. Using the TRIM (left and right arrow) buttons, bring the Slave tape into the desired synchronization with the Master tape. Holding the TRIM buttons will cause the Slave tape to gain or lose time (difference) in relation to the Master tape. The longer the button is held pressed, the higher the rate of change in Slave tape speed.

4. When the Slave has reached the desired synchronization (time relationship) with the Master, the difference between Master and Slave has been stored as the offset, and the difference is automatically set to zero. The OFFSET STORED indicator will remain illuminated to indicate that the new offset has been stored.

   To Trim an offset to Sub-Frame accuracy, the Sub-Frames digits must be shown on the Offset Display. Press the HOLD/SHIFT button to display the Sub-Frames before final Trim adjustments are made.

NOTE: After the TRIM buttons have been used to modify the offset being shown on the display, you must press the DISPLAY - MODE SELECT four times (until the offset is once again shown on the display) before the STORE button will capture a new offset. This prevents accidental storage of undesirable offsets.

The EC-101 will retain this offset until it is changed or Cleared by holding the STORE/CLEAR button pressed for 3 seconds, or until the power to the MTR-90 II turned Off or Reset from the front panel.

3.2.7 Using the EC-101 to Resolve the Slave (MTR-90 II) to House Sync (Comp Video) signal.

The EC-101 can be used without a Master machine to resolve the Playback speed of the MTR-90 II to a source of composite video house sync.

1. Use a "Y" cable to connect the Slave machine Time Code channel output to both the Master and Slave Time Code inputs on the EC-101 rear panel.

2. Connect a source of composite video house sync to the VIDEO input connector on the rear panel.

3. Set the SPEED MODE switch on the MTR-90 II Remote Control to the Internal (Int.) position.

4. Set the AUDIO/VIDEO switch on the front panel of the EC-101 synchronizer module to the VIDEO position.

5. Thread the tape to be used on the MTR-90 II, and put the machine into Play mode for about 5 seconds. If the CB-121 is connected it will show the Slave (MTR-90 II) Time Code frame rate in both the Master and Slave positions of the display.

6. Set the SPEED MODE switch on the MTR-90 II Remote Control to the External (Ext.) position.

7. Enable the EC-101 by pressing the ENABLE button. The MTR-90 II capstan speed will now be controlled by the EC-101 resolving the phase of the MTR-90 II Time Code

to the house sync signal.

3.3 OPERATION WITH THE CIPHER/BTX SOFTOUCH CONTROLLER

The EC-101 responds to the BTX/Cipher Softouch command set, which allows the EC-101 to be used in fully pre-programmed recording/editing situations. Refer to the APPENDIX for more information regarding the Softouch command set.

3.3.1 Connecting the EC-101 to the Softouch Controller

The EC-101 should be connected to the SLAVE 2 or SLAVE 3 port of the SofTouch Control system, and will respond to commands to the SLAVE tape transport.

Use the 25 conductor flat cable provided with the SofTouch controller.

3.3.2 Notes on operation with the Softouch Controller

A. When executing "Punch In loops" using the Softouch controller, while using mixed Drop and Non-Drop Frame Time Codes, the Softouch Controller will display a "Slave Not Locked" error message at the end of the loop, even though the machines were properly locked and the Punch In was properly executed. This is due to the difference in numbering systems between Drop and Non-Drop Frame Time Code.

B. When using the EC-101 under RS-232 control from a Softouch Controller, it is advisable to disconnect any other synchronizer (even though it is in "Bypass") from the EXT. CLOCK connector on the MTR-90 II Rear Panel. Failure to do so may result in variation in the MTR-90 II tape speed during Locked operation.

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SECTION 4

INSTALLATION AND SETUP

If you have received your EC-101 pre-installed by your OTARI dealer, including Version 2.20 Software, please skip Sections 4.1, 4.2, and 4.3. You should periodically perform the MTR-90 II transport Alignment procedures in Section 4.4 to insure optimum performance from your EC-101.

If you are installing an EC-101 in an MTR-90 II having a Serial Number Suffix previous to letter "I" (A through H inclusive), you must perform all the Installation procedures in Section 4.1, 4.2, and 4.3 before proceeding to the MTR-90 II Transport Alignment procedures in Section 4.4.

If you are installing an EC-101 in an MTR-90 II having Serial Number Suffix "I" or later, skip the procedures in Section 4.1. Install the EC-101 according to the procedures in Sections 4.2 and 4.3 before proceeding to the MTR-90 II Transport Alignment procedures in Section 4.4.

If you are updating an EC-101 installation which is equipped with software Version 1.1X through 1.20, perform only the Update procedures described in Section 4.3 before performing the MTR-90 II Transport Alignment Procedures in Section 4.4.

4.1 INSTALLATION IN MACHINES WITH SERIAL NUMBER SUFFIX PRIOR TO "I"

If you are installing an EC-101 for the first time in an MTR-90 II having a Serial Number Suffix before "I" (A through H), perform the instructions in Sections 4.1, 4.2, and 4.3 before performing the MTR-90 II Transport Alignment procedures in Section 4.4.

4.1.1 Installation of CN 50 - CN 59 on Mother II PCB (Refer to Figure 4-1)

Installation of the EC-101 Synchronizer in MTR-90 II tape recorders having Serial Number Suffixes A - H requires that

additional connectors be added to the Mother II PCB (lower card cage mother board). Installation of these connectors requires removing the Mother II PCB completely from the machine. Machines having Serial Number Suffix "I" and later have the necessary connectors already installed on the Mother II PCB.

1. Turn Off the Power to the MTR-90 II.

2. Disconnect the AC power cord and any audio, remote control, or Auto Locator connectors attached to the MTR-90 II.

3. Remove the Control PCBs from the lower card cage of the machine. (Reel Control, Transport Control, Capstan Control, CPU, I/O Control, Tape Counter, and Bias Control PCBs).

4. Remove the lower rear panel by removing 4 phillips head screws with dress washers and nylon washers.

5. Remove four screws holding the External Connector Panel to the bottom of the machine chassis. The panel may now be carefully moved away to gain access to the connecting cables.

6. Disconnect connectors CN 19, 22, 25, 26, 29, and 32 from the Mother II PCB. The flat ribbon cable connectors have latches which must be released before removal. Make sure each cable is marked with the corresponding connector number. The External Connector Panel can now be removed and set aside.

7. Carefully remove the remainder of connectors from the Mother II PCB. There are 23 connectors to be removed. NOTE: There is no mating connector for CN 20 on the Mother II PCB.

   NOTE: Be sure that each cable and connector that you remove is marked with the corresponding CN number. It is possible to damage either the MTR-90 II or the synchronizer if you make a mistake in reinserting the connectors.

8. Remove the 20 phillips head screws, visible through the holes in the Mother II PCB, holding the edge connectors to the card cage frame. The Mother II PCB can now be completely removed from the MTR-90 II.

9. Install the EI connectors provided, onto the back of the Mother II PCB at CN 9. This is most easily done by placing the Mother II PCB on a work bench with the edge connectors down, and fitting each new EI connector into its respective position, and soldering it in place.

   Make sure that all the connectors are oriented so the pins are on the LEFT side when facing the pins (<u>like all the other EI connectors on the Mother II PCB</u>).

   NOTE: It is helpful to use small self-adhesive labels to number the new connectors installed on the Mother II PCB.

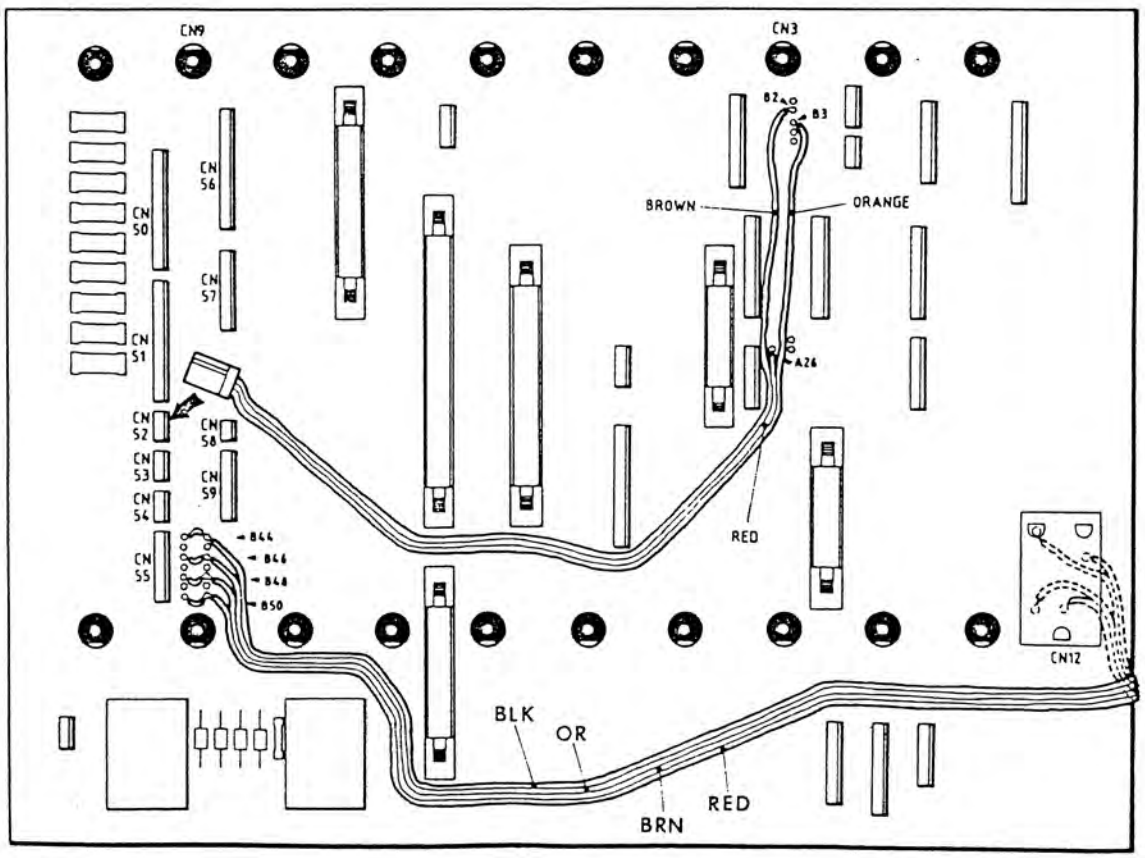


Figure 4-1 Location of Connections on Mother II PCB

CN#	Function	# of pins	Location on CN 9	Cable P/N
50	Controller	12	A6 - A17	ZA-69C
51	Transport	12	A19 - A30	ZA-69C
52	Reel Info	3	A32 - A34	ZA-6MA
53	Slave Time Code	3	A36 - A38	ZA-69H
54	Master Time Code	3	A40 - A42	ZA-69G
55	Power	7	A44 - A50	ZA-69F
56	VITC (Master Tach)	12	B2 - B13	ZA-69C
57	Spare Port	8	B16 - B23	
58	Comp Video	2	B33 - 34	ZA-69J
59	RS-232	7	B36 - B42	ZA-69D

Connectors added to Mother II PCB

Check all connections to make sure that no short circuits or solder bridges have been created.

10. Turn the Mother II PCB edge connector side down, and solder the supplied Reel Info cable (ZA-6MA) to connector CN 3 as follows:

Brown: CN 3 Pin A26
Red: CN 3 Pin B2
Orange: CN 3 Pin B3

Plug the connector end of the cable into newly installed CN 52.

11. Solder one end of the Power Supply cable to CN 9 as follows:

    Black: CN 9 Pins 44 A & B
    Red: CN 9 Pins 5Ø A & B
    Brown: CN 9 Pins 48 A & B
    Orange: CN 9 Pins 46 A & B

    To insure good connections, jumper the A and B contacts together before connecting the Power Supply Cable. The supplied 16 gauge wire will not fit into the PCB eyelets. Solder directly to the edge connector pins.

12. Solder the other end of the Power Supply cable to the Front side (same side as the edge connectors) of CN 12 (the large molex connector in the corner of the Mother II PCB) as follows:

Color	Location on CN 12	Function	Location on CN 9
Black	Pin 4	Ground	Pin 44 A & B
Red	Pin 11	+5 Volts	Pin 5Ø A & B
Brown	Pin 12	+15 Volts	Pin 48 A & B
Orange	Pin 3	-15 Volts	Pin 46 A & B

    NOTE: There are no PCB eyelets provided for these connections, carefully solder directly to the Molex connector pins. Route the wires under the lower right side of the Mother II PCB.

13. Reinstall the Mother II PCB on to the card cage frame by replacing the 2Ø screws removed in Step 8.

14. Reconnect the cables removed from the Mother II PCB connectors (except for those going to the External Connector Panel). Make sure that each connector is reconnected properly.

4.1.2 I/O CONTROL PCB Update

MTR-9Ø IIs having Serial Number Suffixes "A" and "B" require that the I/O CONTROL PCB be modified to provide enough control range to operate correctly with the EC-1Ø1.

NOTE: This section applies ONLY to "A" and "B" suffix MTR-9Ø IIs.

I/O PCB Modification

Parts Required:

1	36Ø ohm 1/4 watt carbon film resistor
1	8.2 V Zener Diode (1/2 watt)
24	gauge hookup wire
1	1 mFd capacitor (C 32 Replacement)

If the software on the MTR-9Ø II CPU PCB is Vers. 1.1 through 1.5, capacitor C 32 on the I/O PCB must be changed to a 1 mFd capacitor.

If the PB9A463 number on the I/O PCB has no letter suffix (e.g., PB9A463_) the following modification will insure that the wind speed has enough control range for proper operation with the synchronizer.

1. Turn Off the Power to the MTR-9Ø II, remove the I/O Control PCB and place it on the workbench.

2. Unsolder only the cathode (banded end) of diode D 3, and remove it from the hole in the PCB.

3. Into the hole just created, place one end of a 36Ø ohm 1/4 watt resistor.

4. Connect the cathode (banded end) of D 3 to the unattached end of the 36Ø ohm resistor just installed.

5. To the junction of the 36Ø ohm resistor and the cathode of D 3, connect the cathode (banded end) of the 8.2 V zener diode.

6. Connect the anode of the zener diode to the anode end of D 4.

7. Remove LED D 11.

8. Connect a piece of 24 gauge wire from the place where the cathode of D 11 was, to the leg of IC 49 marked IN (near the connector fingers).

4.1.3 Capstan Control PCB Replacement

MTR-90 IIs having Serial Number Suffix "A" require that Capstan Control PCBs having PB9A459 without any letter suffix be replaced with a Capstan Control PCB having board part number PB9A459A to operate properly with the EC-101. If such replacement is necessary, please contact OTARI or your OTARI dealer.

4.1.4 Lower Rear Panel Replacement

MTR-90 IIs having Serial Number Suffixes before "I" require that the Lower Rear Panel be replaced. A replacement Lower Rear Panel will be supplied by OTARI if required. When replacing the Lower Rear Panel, use the Fan Guard from the old Lower Rear Panel.

4.2 INSTALLATION PROCEDURES FOR ALL MTR-90 IIs

The procedures contained in this section and Section 4.3 are applicable to ALL new EC-101 installations. If your MTR-90 II has Serial Number Suffix "A" through "H" inclusive, you must first perform the installation procedures in Section 4.1.

If you are updating an EC-101 which has been operating with Version 1.10 through 1.20 Software, you should perform only the update procedures in Section 4.3.

4.2.1 Installation of Sub Panel PCB

NOTE: Connectors CN 50 - CN 59 are located near CN 9 on the Mother II PCB. Connectors ECN 4 - ECN 14 are located on the (supplied) Sub Panel PCB (PB-7DAA). The cables are marked

with the number of the corresponding connector.

Remove the Lower Rear panel if it has not been removed.

1. Mount the Sub Panel on the new Lower Rear Panel using four screws provided.

2. Connect Remote Controller Cable ZA-69C from CN 50 of the Mother II PCB to ECN 4 of the Sub Panel PCB.

3. Connect VITC Interface Cable ZA-59C from CN 56 of the Mother II PCB to ECN 5 of the Sub Panel PCB.

4. Connect RS-232 Cable ZA-69D from CN 59 of the Mother II PCB to ECN 6 of the Sub Panel PCB.

5. Unplug the two connectors attached to CNs 8 and 9 on the External Connector PCB (not the Mother II PCB), and plug them into ECN 8 and ECN 9 on the new Sub Panel PCB.

6. Connect Cable ZA-69E from CN 8 of the External Connector PCB to ECN 10 of Sub Panel PCB.

7. Connect Cable ZA-69C from CN 9 of the External Connector PCB to ECN 11 of Sub Panel PCB.

8. Connect the Transport Control cable ZA-69C from ECN 7 of the Sub Panel PCB to CN 51 on the Mother II PCB.

9. Connect the Master Time Code cable ZA-69G from the Sub Panel PCB to CN 54 on the Mother II PCB. Connect the Slave Time Code cable to CN 53. These cables are attached to the XL type connectors on the Sub Panel. Make sure that you do not interchange the Master and Slave cables.

10. Connect the Comp Video cable ZA-69J from the Sub Panel PCB to CN 58 on the Mother II PCB. This cable is connected to the BNC connectors on the Sub Panel.

11. Connect the Power Supply cable ZA-69F from ECN 12 of the Sub Panel PCB to CN 55 on the Mother II PCB.

12. Fold up any slack in the flat cables, and carefully

install the Lower Rear panel using the four screws removed earlier.

STEP	FROM	TO	CABLE (PARTS #)
1	CN55 (MOTHER II PCB)	ECN12	55 — 12 ZA-69F
2	CN54 (")	MASTER T.C. CONNECTOR	54 — M ZA-69G
3	CN53 (")	SLAVE T.C. CONNECTOR	53 — S ZA-69H
4	CN59 (")	ECN6	59 — 6 ZA-69D
5	CN58 (")	COMP. VIDEO CONNECTOR	58 — ZA-69J
6	CN51 (")	ECN7	51 — 7 ZA-69C
7	CN57 (")	----------	----------
8	CN50 (")	ECN4	50 — 4 ZA-69C
9	CN56 (")	ECN5	56 — 5 ZA-69C
10	UNPLUG CN8 AND CN9 FROM EXTERNAL CONNECTOR PCB.		
11	CONNECT CN8 AND CN9 TO ECN8 AND ECN9 RESPECTIVELY.		
12	CN9 (EXT. CN. PCB)	ECN11	9 — 11 ZA-69C
13	CN8 (")	ECN12	8 — 12 ZA-69E

Table 4-1 EC-101 Connections

13. Connect the MTR-90 II Remote Control (CB-113) to the REMOTE connector and set the Speed Mode switch (VARI, FIX, EXT) to the EXT position.

14. Reinstall the MTR-90 II Control PCBs in their proper slots in the lower card cage. Do not install the EC-101 in Slot 9 yet!

15. Connect the Power Cable to the MTR-90 II and plug it in.

16. Check all MTR-90 II transport controls and functions for proper operation. There should be no changes in operation from the operation before the installation. If any function or control does not function, or behaves strangely, turn Off the Power, and check all your connections.

17. Insert an MTR-90 II Extender PCB (PB-78A) into Slot 9 and measure the voltages as follows:

Pin 44 A & B	Ground
Pin 46 A & B	-15VDC
Pin 48 A & B	+15VDC
Pin 50 A & B	+ 5VDC

If all voltages and transport functions are correct, turn Off the Power to the MTR-90 II and install the EC-101 in Slot 9 in the lower card cage.

4.2.2 ROM Replacement

In order for the EC-101 to function properly with the MTR-90 II Transport, the MTR-90 II's program instructions, contained in a Read Only Memory IC (MTR-90 IIs having Serial Number Suffix prior to "J" contain 3 ROM ICs) must be replaced with an updated version. The correct version for use with the EC-101 is Version 1.79.

1. Turn Off the Power to the MTR-90 II and remove the CPU PCB (board # 4 in the lower card cage).

2. Carefully remove the IC from the socket at IC 49, (ICs 49, 50, and 51 in MTR-90 IIs having Serial Number Suffixes prior to "J"). The IC is most easily removed using a tool designed for that purpose, but lacking that, a small screwdriver can be used by slipping the blade of the screwdriver between the IC and the

socket from the edge connector end of the board, and prying gently up to free the IC from the socket. (Be careful not to crack any of the ceramic disk capacitors).

3. The replacement ICs for earlier (pre "J") MTR-90 IIs are numbered 1, 2, and 3. Carefully insert IC 1 into IC socket 49 with the notched end of the chip toward the notched end of the socket. Be very careful to make sure that no pins become bent or incorrectly inserted.

4. Repeat Step 3, inserting IC 2 into the socket for IC 50, and IC 3 into the socket for IC 51.

5. Reinstall the CPU PCB into its slot in the lower card cage.

6. Turn On the Power to the machine, and check to insure that the Green LED on the CPU PCB front panel illuminates within 5 seconds, and that each function and mode is operating properly.

4.2.3 Transport Control PCB Reverse Resolve Modification

The EC-101 Synchronizer offers the capability to resolve (maintain exact capstan speed synchronization) in Reverse Play mode. If this capability is desired in the MTR-90 II, a small PCB (PB-4ARA) must be installed on the Transport Control PCB.

NOTE: Optimum performance in Reverse Resolve (Phase Lock in Reverse Play) mode requires that the Master tape machine have good wow and flutter and speed stability specifications. OTARI suggests the use of an MTR-90 or MTR-20 for the Master machine in such applications.

1. Turn Off the Power to the MTR-90 II, and remove the Transport Control PCB (board #3) and place it on the workbench.

2. Using an IC desoldering tool, carefully remove IC 22 from the Transport Control PCB. Clean the holes left by the removal of the IC.

3. Solder the 16 pin IC socket into the space vacated by IC 22. Insure that the notch in the socket faces in the same direction as the notch in IC 22.

4. Mount the Reverse Play PCB (PB-4ARA) in the socket just installed, and secure it in place with the stand-off provided.

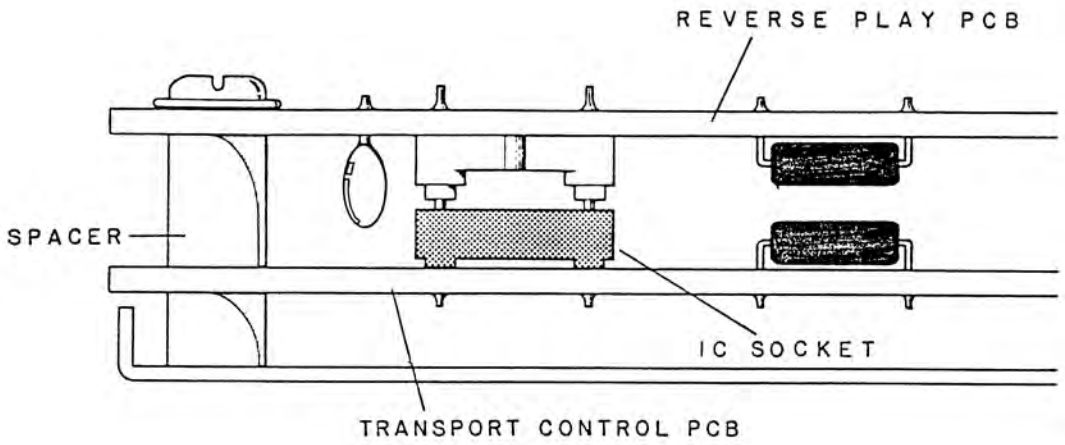


Figure 4-2 Transport Control PCB Modification

4.2.4 Wide Band Audio Channel Modification

The MTR-90 II must be able to reproduce usable Time Code at fast wind speeds to function properly with the EC-101 Synchronizer. There are several methods available to accomplish this. The best method is to have an audio channel PCB modified for Time Code through the installation of a WBR-1 Wide Band modification kit. This modification provides optional (if requested at the time of installation) switch selection of Audio or Time Code operation. The second, simpler, method involves minor modifications to an audio channel PCB, making that audio PCB into a dedicated Time Code channel which then cannot be used for audio.

If you cannot dedicate an audio PCB to Time Code use, then

you should contact your OTARI dealer regarding the installation of a WBR-1S kit on one of your audio PCBs (possibly your spare).

MODIFICATION OF AN AUDIO CHANNEL PCB FOR DEDICATED WIDE BAND USE:

1. Turn Off the Power to the MTR-90 II and remove the audio channel PCB from the channel to be used for Time Code, or modify a spare PCB.

2. Install a 10K ohm resistor across R 101.

3. Install a 10K ohm resistor across R 125.

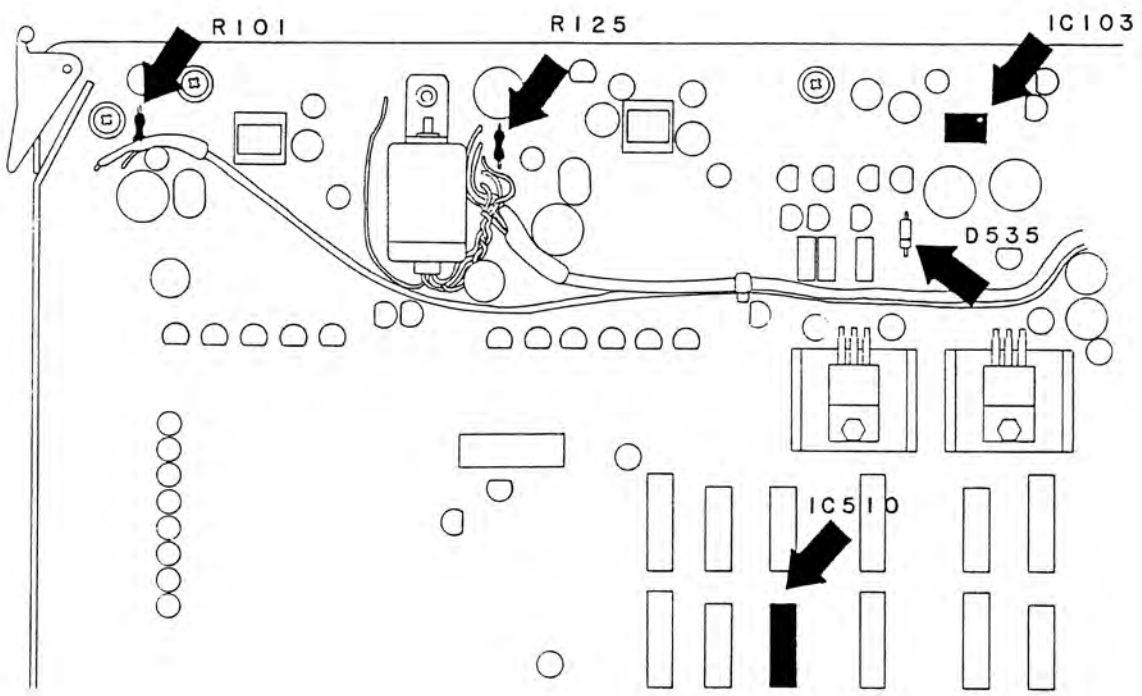


Figure 4-3 Location of Components on Audio PCB

4. Connect a wire from Pin 6 of IC 510 to Pin 14 of IC 510. (This connection defeats the Stop-to-Play Mute for this channel).

5. Connect a wire from the cathode (banded end) of D 535 to IC 103 Pin 8. (This connection defeats the Fast-Wind attenuation for this channel).

4.3 UPDATES TO EC-101s HAVING VERSION 1.xx SOFTWARE

If you are updating a previous EC-101 installation which has been operating using Version 1.xx (1.10 - 1.20) software, or are installing an EC-101 in a new machine, perform the installation procedures in this section before performing the MTR-90 II Transport Alignment procedures in Section 4.4.

4.3.1 Features and Functions added to Vers 2.xx

Version 2.xx adds the ability to chase using tach pulses from Master and Slave, removing the requirement that the tape contact the heads at all times. Version 2.xx also adds the ability to operate with the BTX/Cipher Softouch Controller, or with any computer controller using the BTX/Cipher Softouch Command set. Version 2.xx also adds the ability to operate properly with 24 Frame Film Time Code on both machines. Version 2.20 and later software now also provides improved performance when operating the Slave (MTR-90 II) at 30 ips.

4.3.2 Slave Tach and Direction Modifications

A modification must be made to allow the EC-101 to recognize the direction of the Slave (MTR-90II).

NOTE: The following modification (Steps 1 - 9) have been performed on all EC-101s shipped after November 1, 1986.

1. Remove the Lower Rear Panel from the MTR-90II.

2. Remove the four screws which hold the EC-101 Interface Sub-panel to the MTR-90II rear panel. Be careful not to disconnect any of the cable assemblies leading from the Sub-Panel PCB.

3. On the back of the Sub-Panel PCB (the side closest to the MTR-90II Rear Panel), connect a jumper from ECN 9 Pin 12 to ECN 7 Pin 12. This is most easily done by attaching the jumper to the rear of the EI connectors.

4. Check to see that the cable assembly which connects CN 51 to ECN 7 contains 12 conductors. If it does not contain 12 conductors, disconnect the cable assembly from both connectors, and insert a wire into Pin 12 of each end of the cable assembly. (Contact OTARI or your OTARI dealer if this wire or connector is required).

5. Reinstall the Sub-Panel PCB on the Interface Sub-Panel, making sure that all the cable assemblies are properly connected.

6. Reinstall the MTR-90II Lower Rear Panel.

7. On the EC-101 Main PCB, remove the solder from one of the feedthrough holes which are located between Pins 25 and 30 of the PCB edge connector. This feedthrough hole will be used as a "pass through" for an insulated wire, so the feedthrough must be completely clear of solder. The easiest method of cleaning out the feedthrough is to use "solder wick" and/or a "solder sucker" to remove the solder which normally fills the hole.

8. On the top (component) side of the EC-101 Main PCB, solder one end of a piece of 30 ga. teflon insulated wire to PCB Edge Connector Pin A 30. Feed the wire through the feedthrough just cleaned to the back side of the Main PCB.

9. Connect the wire to IC 6 Pin 17. Make sure that the wire is not shorted to the conductor at the feedthrough.

4.3.3 Master Tach and Direction Modifications

NOTE: The following modifications (Steps 1 - 9) have been performed on all EC-101s shipped after April 1, 1986.

1. On the bottom (dip side) of the EC-101 Main PCB, cut the trace between Edge Connector finger B5 and IC 6 Pin 17.

2. On the bottom (dip side) of the EC-101 Main PCB, cut the trace between Edge Connector finger B36 and the end of R 77 which is closest to the EC-101 Front Panel.

3. On the bottom (dip side) of the EC-101 Main PCB, connect a jumper from Edge Connector finger B5 and the end of R 77 which is closest to the EC-101 Front Panel.

4. On the bottom (dip side) of the EC-101 Main PCB, connect a jumper from IC 54 Pin 12 to CN 3 Pin 5.

5. On the top (component side) of the EC-101 Main PCB, cut the trace leading to IC 48 Pin 9.

6. On the bottom (dip side) of the EC-101 Main PCB, connect a jumper from IC 48 Pin 9 to IC 48 Pin 14 (+ Vcc).

7. On the bottom (dip side) of the EC-101 CPU PCB, cut the trace leading to IC 14 Pin 8.

8. On the bottom (dip side) of the EC-101 CPU PCB, cut the trace leading to IC 13 Pin 8.

9. On the bottom (dip side) of the EC-101 CPU PCB, connect a jumper from IC 11 Pin 23 to connector ECN 1 pin 5.

4.3.4 RS-232 Connection Modification

The EC-101 must be modified in order to use the 25 conductor flat cable provided with the SofTouch Controller.

NOTE: The following modifications (Steps 1-4) have been performed on all EC-101s shipped after April 1, 1986.

1. On the top (component side) of the EC-101 CPU PCB, cut the trace leading from CN 1 Pin 19 to IC 14 Pin 4.

2. On the bottom (dip side) of the EC-101 CPU PCB, cut the trace leading from CN 1 Pin 18 to IC 15 Pin 11.

3. On the bottom (dip side) of the EC-101 CPU PCB, connect a jumper from CN 1 Pin 19 to IC 15 Pin 11.

4. On the bottom (dip side) of the EC-101 CPU PCB, connect a jumper from CN 1 Pin 18 to IC 14 Pin 4.

This modification reverses Pins 2 and 3 of the RS-232 connector to allow a "straight through" cable to be used without modification of the cable.

4.4 MTR-90 II TRANSPORT ALIGNMENT PROCEDURES

In order for the EC-101 to function optimally, the MTR-90 II transport must be adjusted to factory specifications. The following procedures are taken from the Transport Alignment section of the MTR-90 II Operations Manual with a few organizational changes.

To perform these adjustments, the Transport Deck Plate Cover must be removed.

4.4.1 Transport Deck Skin removal

1. Loosen the four allen head cap screws that secure the head assembly top cover, lift it off, and set it aside.

2. Loosen the four allen head cap screws that secure the head assembly trim plate, lift the trim plate up and forward so the cutout clears the head cables, unplug the ribbon cable connector from the Counter Display PCB, and set the trim plate aside.

3. Loosen the two allen head cap screws and remove the splicing block and dress plate.

4. Loosen the hex head cap screw that secures each of the swing arm guards, pushing the swing arms back to get clear access, lift the guards, and set them aside.

5. Remove both reel turntable guard rings (not the turntables), by removing the three allen head cap screws securing each guard ring, and lifting each ring straight up.

6. Remove the two oval head phillips screws, dress washers, and nylon flat washers from the rear flange of the transport cover plate, lift the plate straight up and set it aside. Be careful not to scratch the tension arm rollers while removing the plate. The clearance around the Tension Arm Rollers is very small, carefully move the deck plate until you can lift it up and off the machine.

4.4.2 Swing Arm Travel Adjustment.

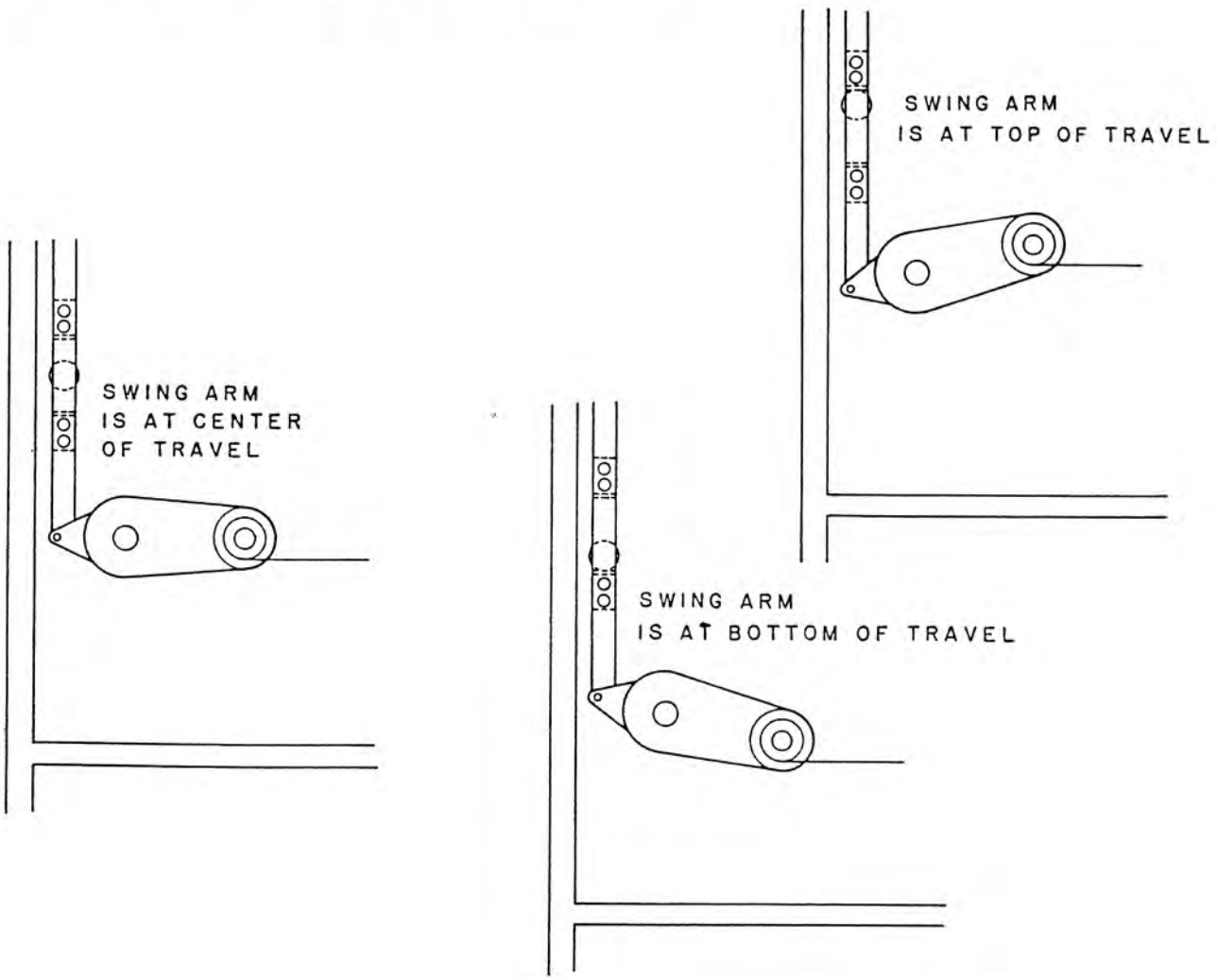


Figure 4-4 Swing arm travel limit adjustment.

Two L-brackets on the linkage of each swing arm restrict swing arm travel when they contact a rubber-padded post screwed to the deck plate. Two hex screws secure each of the L-brackets to the linkage; the extremes of swing arm travel can be adjusted by loosening these screws and sliding the L-brackets. Check the supply and takeup swing arms and adjust as required.

1. Turn Off the Power to the machine.

2. Extend the Reel Control PCB (board #1).

3. Attach a DC voltmeter (DVM or VOM) to TP 3 (swing arm voltage test point) and a ground (G) test point.

4. Turn On the Power to the machine.

5. Secure the swing arm at its center position. (Dots on the swing arm and on the transport deck plate indicate the center position). The voltmeter should read 0.0 V +/- 0.03 V (30 mV). If not, adjust the black potentiometer under the deck plate by loosening the 2 small phillips screws that hold the potentiometer brackets in place. Be sure to tighten the screws securely when completed.

6. Adjust the L-bracket on the takeup swing arm linkage so that the voltmeter reads 0.6 V +/- 0.03 V (30 mV) when the swing arm is at its lower position.

7. Adjust the other L-bracket on the takeup swing arm linkage so that the voltmeter reads 0.6 V +/- 0.03 V (30 mV) when the swing arm is at its upper position.

8. Connect the voltmeter to TP 4 on the Reel Control PCB, and repeat Steps 5 through 7 for the Supply swing arm.

NOTE: After the above steps have been completed, the swing arm in its lower position will be approximately 65 mm (2.47") from the outer rib on the front of the transport deck plate. When in its upper position, the swing arm will be approximately 100 mm (3.8") from the same reference point. Refer to Figure 4-4 for details regarding the measurement positions.

4.4.3 F.FWD/REW Solenoid Adjustment
Refer to Figure 4-5

The fast forward/rewind damping solenoid is the larger one (the solenoid nearest the rear of the deck plate) of the pair associated with each swing arm. It can be moved back and forth after loosening six phillips screws beneath the deck plate. Repeat the procedure below for the supply and takeup sides of the transport.

1. Turn Off the Power to the machine.

2. Hold the swing arm at the middle of its range of travel (e.g., so the punch mark on the top side of the swing arm is in line with the punch mark on the deck plate.)

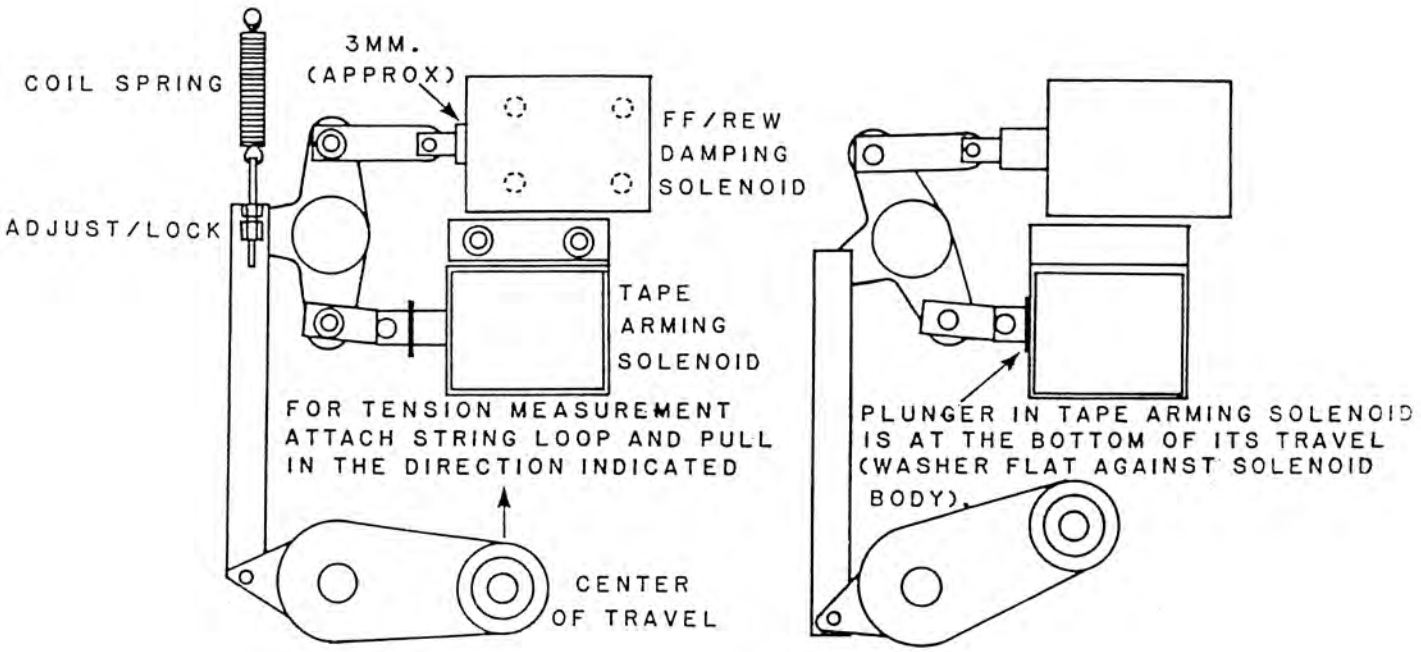


Figure 4-5 Solenoid Adjustments

3. Inspect the plunger in the damping solenoid. The plunger will protrude from the solenoid body toward the linkage. About 3 mm of the plunger should be visible between the body and the point where the plunger diameter is reduced for mating with the linkage (refer to Figure 4-5). If necessary loosen the solenoid mounting screws and adjust its position. Repeat the measurement several times and average the results to minimize the effects of linkage play.

4.4.4 Swing Arm Tension Check and Adjustment

When the power is on and the Servo system has been armed, the swing arm tension is solenoid controlled only in F.FWD and RWD modes. The tension of the coil spring on each swing arm should be checked periodically, and adjusted as required to maintain accurate functioning. Repeat the following procedure for the supply and takeup sides of the transport.

1. Turn Off the Power to the machine.

2. Attach a spring scale to the swing arm post, using a loop of string or twine.

3. Pull the scale toward the rear of the deck plate until the swing arm is in the middle position (as shown in Figure 4-5). The mark on the swing arm, and the mark on the deck plate will be in line, and parallel to the front of the machine. The spring scale should indicate between 400 and 450 grams (300 - 350 grams for 1" tape); if not go to Step 4.

4. Loosen the double nut by holding the portion closest to the support bracket stationary, and unscrewing the other half. Then adjust the nut as required to obtain 400 - 450 grams tension (300 - 350 grams for 1"). For smoother operation, it is a good practice to obtain the same measurement for both the Supply and Takeup swing arms, +/- 10 grams.

5. Tighten the double nut to lock it in place.

6. After completion of this adjustment, make sure that there is some tension on the spring, even when the

Tension Arm is in its lower position.

NOTE: When this adjustment is correct, the tape tension measured between the swing arm and the reel with a Tentelometer should be between 260 and 300 grams.

4.4.5 Reel Tension Servo Adjustment. The following adjustments can be made with the deck plate cover installed, and without tape.

Upper and Lower Limit Adjustment

1. Turn the power Off, and extend the Reel Control PCB (board #1). Turn the power On, and monitor TP 3 or TP 4 (take-up and supply respectively) with a DC Voltmeter (DVM or VOM) using a Ground test point on the same PCB.

2. Adjust the swing arm potentiometer by loosening the two screws that secure the potentiometer to its bracket. Adjust the potentiometer mounting for 0.0 Volts while securing the arm at its center position. Line up the lower flange of each swing arm roller with the mark on the dress collar attached to the deck plate cover.

3. Move the takeup swing arm all the way to its upper position (toward the rear of the transport) and hold it there.

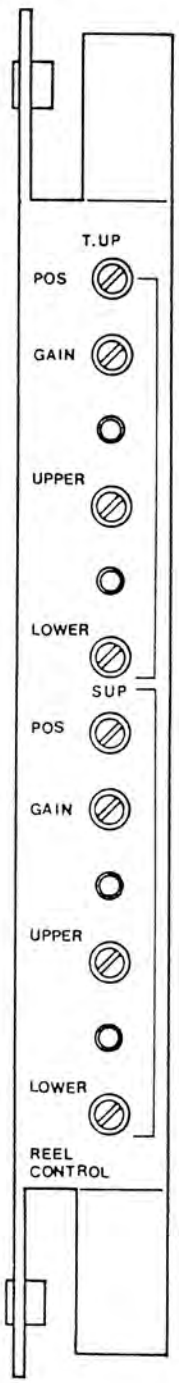


Figure 4-6 Location of Controls on Reel Control PCB

4. Use a small screwdriver to adjust the T.UP UPPER trimmer (third from the top of board #1) until the green LED above it just turns on. This should place the swing arm about 1/4" from its upper position when the green LED turns Off.

5. Allow the swing arm to return to its lower position. Make sure the dress collar does not interfere with the arm moving all the way down (toward the front of the deck plate).

6. Adjust the T.UP LOWER trimmer (fourth from the top on board #1) until the yellow LED beneath it just turns On. This should place the swing arm about 1/8 - 1/4" from the lowest position when the yellow LED turns Off.

7. Repeat Steps 3 through 6 for the supply swing arm, adjusting the SUP UPPER, and SUP LOWER trimmers (next to the bottom and at the bottom of the circuit board). It is good practice to adjust the settings of the UPPER trimmers and green LEDs to be as balanced as possible between take-up and supply arms.

Preliminary Center Position and Gain Adjustments

1. Turn Off the machine and extend the Reel Control PCB. Using the DC voltmeter, monitor TP 1 or TP 6 (takeup and supply respectively) using a ground test point on the same PCB. By moving the supply and the takeup swing arms fully upward and downward, (one arm at a time) adjust the corresponding gain trimmer for a total deviation of 8 Volts. (6 V for 7", 3.5 - 4 V for 5" plastic video reels). The positive and negative deviation should be equal within Ø.6 Volt.

2. Return the swing arms to their center positions, and while continuing to monitor the same test points, adjust the POS trimmers for zero Volts.

3. Repeat Step 1 if the POS adjustment has affected the positive and negative voltage deviation.

NOTE: If the positive and negative voltage deviation can not be made to be equal (within Ø.6 V); recheck the

Swing Arm Travel adjustment procedure in 4.3.2.

Tape Tension Check

1. Load a 10 inch reel of tape onto the transport, and wind until the tape is evenly distributed between the takeup and supply reels.

2. Visually check the position of the swing arms while in Stop mode. They should be within 2 mm of their dress collar markings.

3. While in Stop mode, use a Tentelometer or other tension gauge to check the tension on the portion of the tape between each swing arm and its adjacent reel. The tension should be between 260 and 300 grams for 2" tape or 170 - 200 for 1" tape.

4. If the deviation from the above specification is within +/- 20 grams, you can use the POS (position) trimmers to correct the tension.

5. If the tension is more than 20 grams out of specification, DO NOT ADJUST THE POS TRIMMERS. Instead, the swing arm spring (under the transport deck cover) must be readjusted (refer to Section 4.4.4).

Reel Motor Tracking with Capstan

The potentiometers for adjusting the motor tracking voltages are located on the Transport Control PCB (board #3 in lower card cage).

1. Turn Off the power to the machine, and extend the Transport Control PCB with the extender PCB.

2. Turn On the power and thread a 10 inch reel of tape onto the transport, and wind until the tape is evenly distributed between the takeup and supply reels. Disconnect the capstan motor by unplugging the UNIVERSAL MATE-N-LOCK connector located to the left of the capstan motor beneath the deck plate.

3. Place the machine into Rewind mode. Using your hand, spin the capstan roller counterclockwise. Adjust potentiometer VR 1 on the Transport Control PCB so tape moves very slowly onto the supply reel (about 5 ips or one capstan rotation in 2 seconds).

   NOTE: An alternate method of adjustment is to monitor the Capstan Tach output with a frequency counter at TP 102 or TP 202 of the Capstan Tach Amp PCB and adjust VR 1 for 800 Hz during the stable part of the frequency curve. Refer to Figure 4-7.

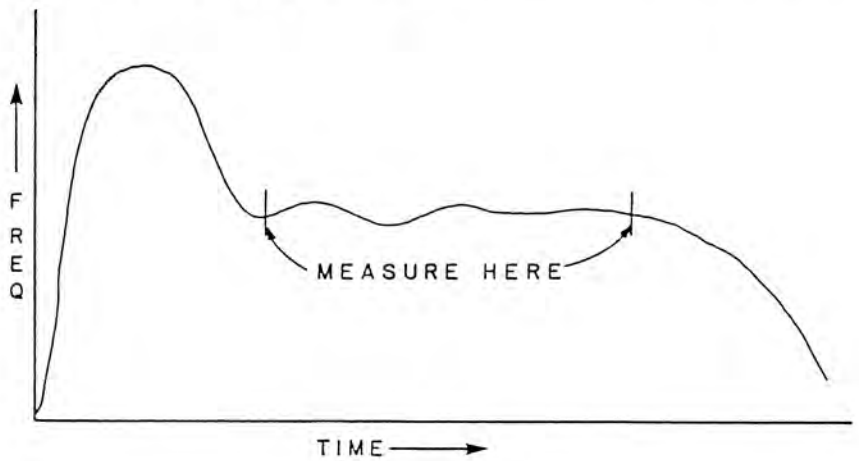


Figure 4-7. Frequency at TP 102 vs. time.

4. Place the machine into Fast Forward mode, and spin the capstan roller clockwise. Adjust potentiometer VR 2 on the Transport Control PCB so tape moves very slowly onto the takeup reel. It is important to balance the two adjustments as closely as possible. Continued rotation of the capstan roller for more than 15 seconds at a time during this procedure, will cause invalid results.

   NOTE: This is not an overly critical adjustment, but it will affect the performance level of the EC-101 Synchronizer if grossly misadjusted.

5. Press the STOP button, turn Off the power to the machine, reconnect the capstan motor, and reinstall the Transport Control PCB in its proper position in the card cage.

6. Turn On the Power to the MTR-90 II, and load the Master and Slave machines with tape having good Time Code.

7. Play the Master and Slave tapes for about 5 seconds each to allow the EC-101 to learn the type of Time Code on each machine.

8. Move the Master tape to a location approximately 2 minutes ahead (+2 min) of the present Slave location. Enable the EC-101, the Slave will search forward to the +2 minute time location. If the Slave overshoots the parking point, decrease the setting (turn counter clockwise) of VR 2 on the MTR-90 II Transport Control PCB. If the Slave undershoots the location, increase the setting of VR 2.

   NOTE: For best EC-101 operation, the optimum trimmer settings are as high as possible without parking overshoot.

9. Disable the EC-101 and repeat Step 8 using Time Code having a location two minutes behind the current Slave location. Adjust VR 1 for smooth parking from Rewind.

10. Repeat Steps 8 and 9 using locations five minutes ahead and five minutes behind the current location. This is to eliminate any interaction between VR 1 and VR 2.

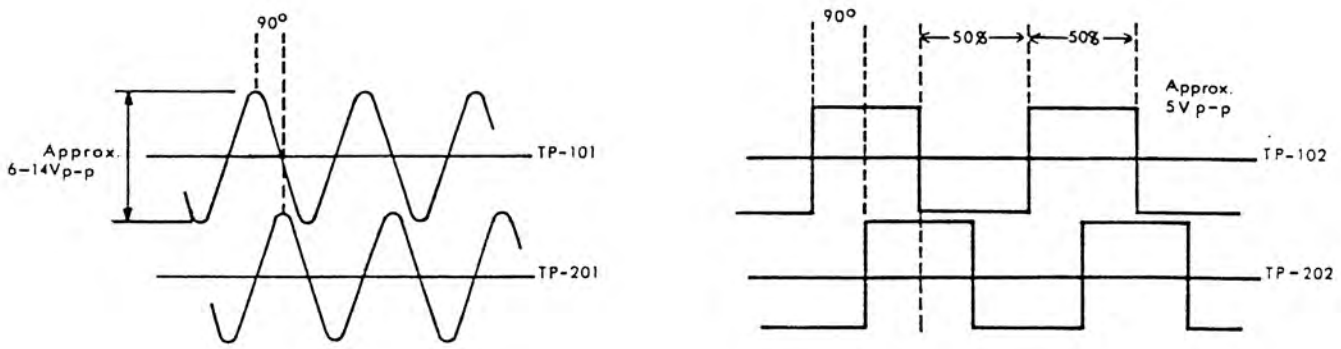
4.4.6 Capstan Servo Adjustment.

1. Turn Off the Power to the machine and extend the Capstan Control PCB (board #2).

2. Turn On the Power to the machine.

3. Initialize the reel servos, and place the machine in Play mode.

4. Check the output of the capstan tach with a dual-trace oscilloscope connected to TP 101 and TP 201 of the Tach Sensor Amp. PCB mounted under the capstan motor. The signals at TP 101 and TP 201 should be no more than 50% different in amplitude. If they are OK, then go on to Step 6.



a) Output Waveforms

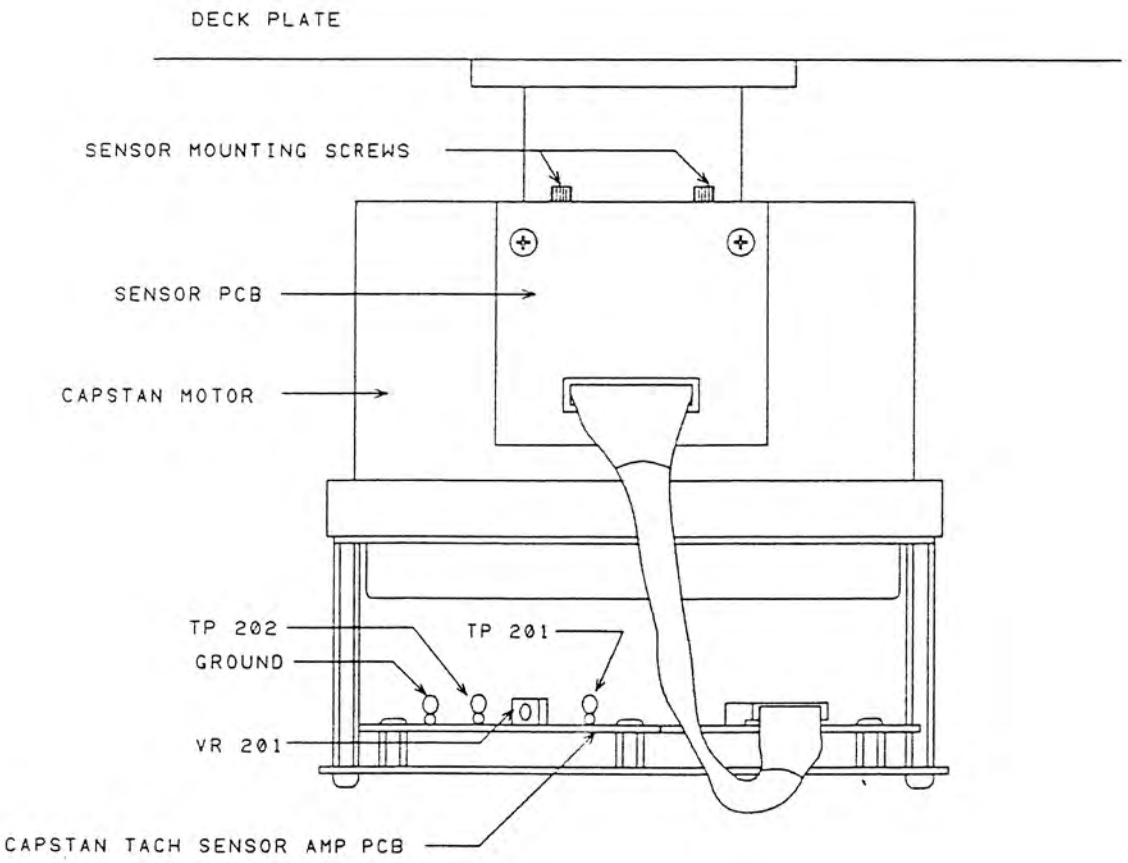


Figure 4-8 Capstan Tachometer adjustment

5. If necessary, the position of the capstan tach sensor can be adjusted to meet the above specification. Adjustment of the amplitude will also affect the phase relationship between the two signals. (Figure 4-8 b).

   The Tach Sensor is accessible by opening the meter panel and removing the capstan motor. To remove the capstan motor, remove the Transport Cover Plate and remove the three allen screws that secure the motor to the deck plate. Leave the capstan motor connected to the machine and support it with an object to allow it to be operated. Initialize the reel servos by propping the Tension Arms up with foam or similar, and put the machine into Play mode.

   Observe the waveforms at TP 101 and TP 201 on the Tach Sensor Amp PCB with the dual-trace oscilloscope. Trigger the scope trace from the signal at TP 101.

   Slightly loosen the two socket head screws on the upper portion of the Capstan Motor which mount the Tach Sensor Assembly.

   Adjust the position of the Tach Sensor, by using a circular motion and moving it in and out of the Motor body, until the sine wave signals both reach maximum level. If the maximum level of the two signals is still more than 50% different, then the Tach Sensor Assy. requires replacement.

6. Observe the waveforms at TP 102 and TP 202. Adjust VR 101 and VR 102 until the tach pulse waveform has a 50% duty cycle (Figure 4-8 a). The phase of the signal at TP 102 should lead the signal at TP 202 by 90 degrees. If it does not adjust the position of the capstan tach sensor. Adjustment of the phase will also affect the amplitude of the signal.

   It may be necessary to repeat Steps 5, 6 and 7 several times until amplitude, phase and duty cycle relationships are all correct.

   Turn Off the Power to the MTR-90 II, reinstall the Capstan Motor, and recheck the results obtained above.

4.4.7 Capstan Control and I/O Control Adjustment.

1. Turn Off power to the machine and extend the Capstan Control PCB.

2. Turn On the power and engage the reel servo system by threading the machine with tape.

3. Put the machine into Play mode.

4. Stop the machine. Adjust VR 6 for 0.0 Volts at TP 10. (Applies to machines with serial number suffixes "B" and later.)

5. Connect a dual-trace oscilloscope to TP 1 and TP 3 on the Capstan Control PCB.

6. Put the machine into Play mode, and confirm that both waveforms have 50% duty cycles and TP 1 leads the waveform at TP 3 by 90 degrees.

7. Monitor TP 102 or TP 202 on the Capstan Tach PCB (under the capstan motor) with a frequency counter.

8. Adjust VR 4 FAST DAMP on Capstan Control PCB (front panel) to the center of its adjustment range.

9. Put the machine into Fast Forward or Rewind mode. Adjust VR 3 FAST GAIN on Capstan Control PCB (front panel) to maximum and observe the Wind Frequency. Turn VR 3 counterclockwise until the frequency decreases by 2.5 kHz, +/- 0.5 kHz.

   NOTE: Adjustments to the wind frequencies should be made after the speed stabilizes.

10. Adjust VR 1 FAST SPEED on I/O Control PCB (front panel) to maximum clockwise position.

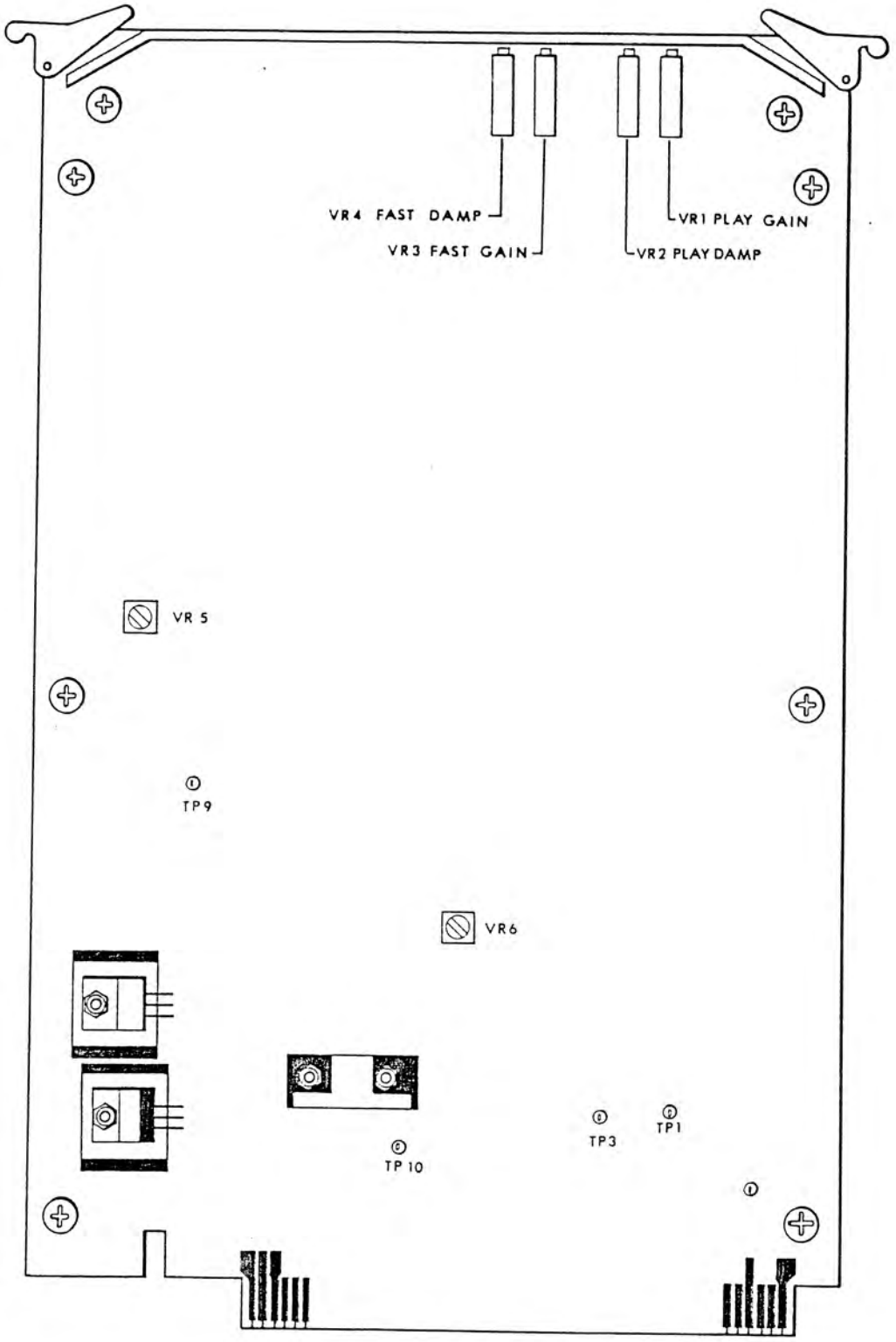


Figure 4-9 Location of Controls on the Capstan Control PCB

11. Wind the tape until there is equal tape on the Supply and Takeup reels. Check the Fast Forward and Rewind frequencies, they should be no more than 500 Hz apart. If there is a difference of more than 500 Hz, adjust VR 5 on the Capstan Control PCB for equal Fast Forward and Rewind speeds.

12. Turn Off the power and extend the I/O Control PCB.

13. Adjust VR 3 on I/O Control PCB to obtain frequency reading of 52 kHz, +/- 0.5 kHz while in Fast Forward or Rewind mode.

14. Stop the machine, and press CUE to enter Cue Shuttle mode.

15. Adjust VR 2 On I/O Control PCB to obtain a frequency reading of 900 Hz - 1 kHz in Forward Cue Shuttle mode at bit-1 speed (yellow LED flashing, arrow solidly lit). NOTE: When observing the frequency in Reverse Cue mode, the frequency will be slightly higher. This condition is normal.

16. Remove the extender board and observe the counter for 600-800 Hz at bit-1 speed. Extend the PCB and readjust if necessary to obtain 600-800 Hz with the extender removed. The extender causes a noticeable frequency difference. This condition is normal.

17. Put the machine into Fast Forward or Rewind and adjust VR 1 FAST SPEED on the I/O Control PCB (front panel) to obtain a frequency reading of 48 kHz.

    NOTE: Do not leave VR 1 fully clockwise, or a time delay will occur when going from fast wind modes to other modes of operation.

18. Verify that the frequencies observed during Steps 16 & 17 are still correct, as some interaction of the trimmers may have occurred.

19. Turn Off the power to the machine and remove the extender board. Thread the machine with a tape containing a

pre-recorded 1 kHz sine wave. With the tape at the beginning of the reel (heads) put the machine into Play mode.

20. Using an oscilloscope, monitor the line outputs and check the time required for the tape to reach play speed (i.e., for the signal on the scope to reach 1 kHz). To reach 15 ips should take 0.5 sec, 30 ips 0.8 seconds. If the tape is not getting up to speed in the appropriate time, adjust VR 1 PLAY GAIN (on the front panel of the Capstan Control PCB) clockwise. If the tape is overshooting the speed, turn the VR 1 trimmer counterclockwise to minimize the overshoot. Return to the beginning of the reel to confirm start-up and overshoot specification.

    NOTE: It is necessary to set SW 1-4 on the Transport Control PCB to the On position to observe the audio output as the machine comes up to speed.

21. While still in play mode adjust VR 2 PLAY DAMP (on the front panel of Capstan Control PCB) counterclockwise until the tension arms start showing instability, then turn VR 2 clockwise until the tension arms stabilize. Once stability is achieved, continue turning the trimmer clockwise 2 more full rotations.

4.5 SETTING UP THE EC-101 BEFORE USE

The EC-101 Synchronizer has only four internal controls that require adjustment for proper operation. The Capstan Speed Control frequency of the EC-101 must be matched to the Transport, the Gain and Offset of the Digital to Analog Converter (DAC) must be adjusted to provide optimum performance, and the Tachometer pulse rate from the Master machine must be selected if you will be using Tach pulses when Time Code from the Master is not available.

Synchronizer Setup mode is entered by setting DIP Sw 1-4, on the EC-101 PCB, to the On position. Setup mode is then initiated by pressing the ENABLE button on the EC-101 Synchronizer Module.

S1-4 ON off on off

The EC-101 will perform three internally programmed Setup tests to help the operator adjust the EC-101 for proper operation. First the EC-101 will enter Play Speed Adjustment mode, in which the 9600 Hz output of the Synchronizer Module is adjusted to insure that the Play Speed when the Synchronizer is not locked (free-wheeling) is correct. Second, the Synchronizer enters DAC Offset Adjustment mode, in which the DAC offset is adjusted for zero tape motion. Third, the Synchronizer enters DAC Gain Adjustment mode, in which the Gain of the DAC is adjusted to give maximum wind speed.

1. Turn Off the Power to the MTR-90 II, and extend the EC-101 using the Extender PCB.

2. Set DIP Sw 1-4 to the On position to initiate Setup mode.

3. Place a reel of tape on the left (supply) reel table, place an empty takeup reel on the right reel table, and thread the machine with tape.

4. Apply Power to the MTR-90 II. The ENABLE indicator will begin to flash.

5. Set the SPEED INDICATOR MODE switch on the MTR-90 II Remote Control to indicate Speed in %.

6. Set the SPEED MODE switch on the MTR-90 II Remote Control to the Ext. (External) position.

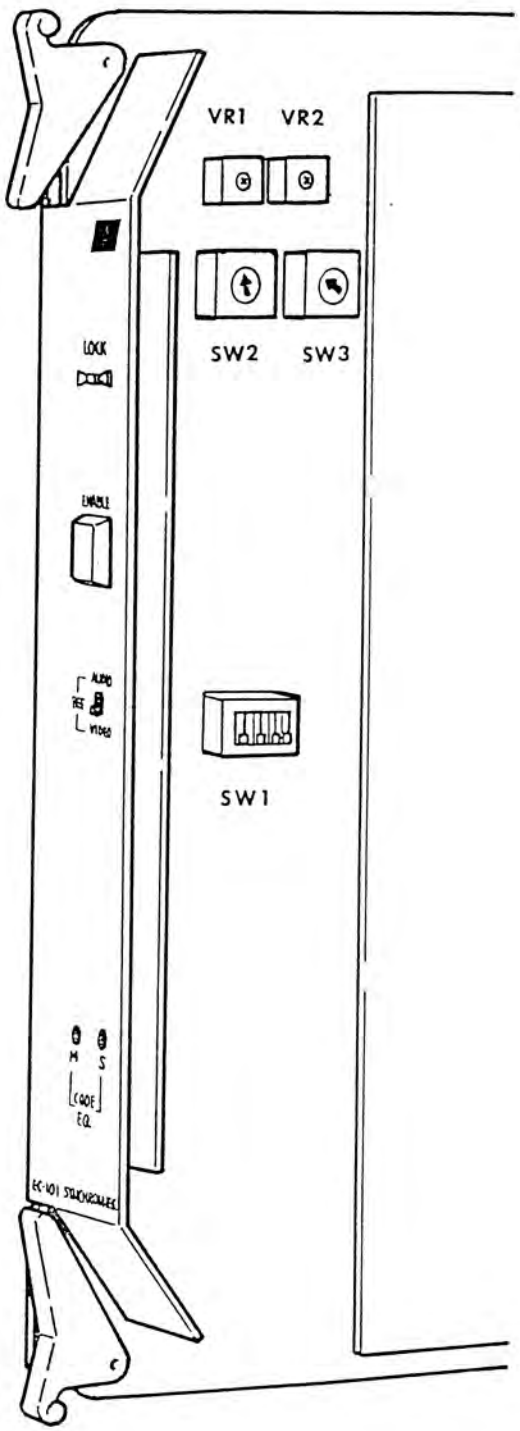


Figure 4-10 Location of Controls On the EC-101 PCB

7. Press the ENABLE button once to begin Speed Adjustment mode. The < indicator on the front panel will flash. The MTR-90II will enter Play and the tape will move.

8. Adjust the added Capstan Speed trimpot on the EC-101 PCB until the SPEED DISPLAY on the MTR-90II Remote Control indicates 100%. If this trimmer is not present, it is recommended that it be added. Please refer to the modification instructions in Section 4.8.1.

9. Press the ENABLE button again to indicate Adjustment Complete. Wait until the < stops flashing before proceeding.

10. Press the ENABLE button again to enter Offset adjustment mode.

11. The - (LOCK) LED will be illuminated, the tape will move slightly and then the LOCK LED will start to flash, indicating that the EC-101 is ready for Offset adjustment.

12. Adjust RV 1 on the EC-101 PCB until the tape just stops moving.

13. Press the ENABLE button to indicate "Adjustment Complete". The LED in the ENABLE button will begin to flash.

14. Press the ENABLE button again to initiate the GAIN Adjustment.

15. The LED in the ENABLE button will be illuminated, the tape speed will increase to Fast Forward speed and then the > LED will begin to flash.

16. Once the > LED begins to flash, adjust RV 2 so that the fast wind speed is just below the maximum speed.

NOTE: This is most easily done by holding a business card (or similar) against the ribbed portion of the Capstan or Tach roller, and adjusting RV 2 so the pitch

of the sound produced is just below maximum (turn RV 2 until the pitch reaches maximum, and then turn RV 2 down slightly).

17. Press the ENABLE button again to indicate "Adjustment Complete". The LED in the ENABLE button will flash, indicating that you may turn off the power to the machine or you may press the ENABLE button again to begin the Capstan Speed Adjustment again.

18. Turn Off the Power to the MTR-90 II and set DIP Sw 1-4 to the Off position to exit from Setup mode before removing the Extender PCB and returning the EC-101 to its slot.

4.6 SELECTING TACHOMETER RATE

If the Master machine you are using will not reproduce Time Code at Fast Wind or Shuttle speed, the EC-101 will utilize tachometer pulses from the Master to provide chase information to the Slave machine. To use tach pulses you must set switches Sw 2 and Sw 3 to correspond to the number of tach pulses per second produced by the Master at Play speed.

To determine the Tach Pulse rate of the Master machine:

"Wake Up" the EC-101 by playing 5 seconds of Time Code from each machine. Enable the EC-101 at the CB-121 and place the Master in Play mode (at normal Play speed). Press and hold any two buttons, except the ENABLE button, on the CB-121, and the Master Tach rate will be shown on the CB-121 display.

Instructions for using Table 4-2:

NOTE: If you are not using tach pulses set Sw 2 and Sw 3 to ANY position except 0, 0 or 0, 1.

1. Find the tachometer pulse rate corresponding to the output from your Master machine in the Table.

2. Read up the column to the top row to find the setting of Sw 3.

3. Read across the row to the left column to find the setting for Sw 2.

Sw 3 POSITIONS

Sw 2 POSITIONS	Ø	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Ø	*	*	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
2	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
3	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
4	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
5	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
6	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
7	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
8	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
9	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
A	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
B	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
C	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
D	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
E	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
F	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

TABLE 4-2 Master Tach Pulse Rate Selection Switch Positions

4.7 M and S TIME CODE EQUALIZATION ADJUSTMENT

These two adjustments optimize the reproduce equalization of the Master and Slave Time Code readers for best performance at fast wind speeds.

Adjustment of these controls is not critical to the operation of the EC-101 except under circumstances of poor Time Code or limited Time Code channel bandwidth.

1. Thread both Master and Slave with tapes containing Time Code recorded at a level between 0 and -6 VU. Wind the tape until there is equal tape pack on both supply and take-up reels.

2. Connect an oscilloscope with 20 MHz vertical bandwidth to the left side of R 58 and Ground.

3. Place the Master machine in Fast Wind and make sure that the Time Code channel reads between 0 and -6 VU.

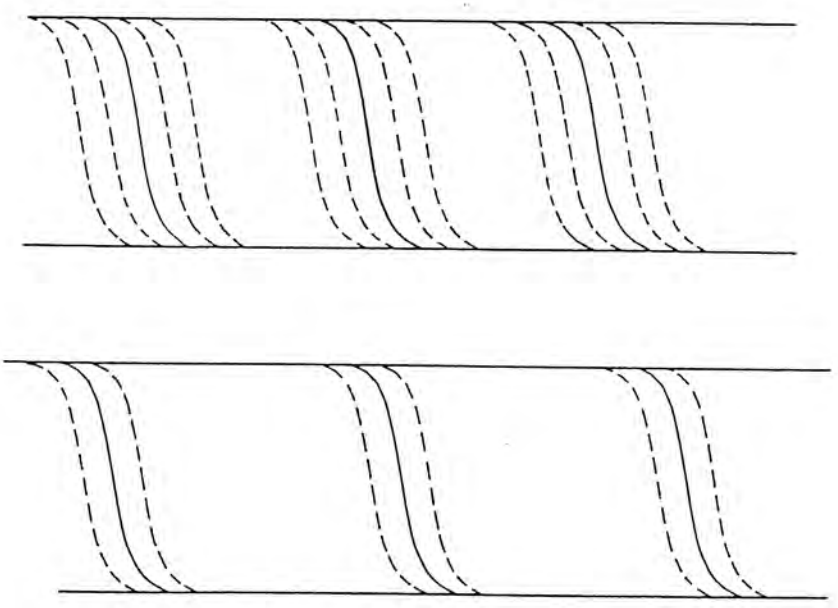


Figure 4-11 Time Code Equalization adjustment waveforms

4. Adjust the sweep, trigger, and level controls on the oscilloscope until a display similar to the one shown in Figure 4-11 is obtained.

5. Adjust the M CODE EQ trimmer [Fig 2-1, 4] until the zero crossing transitions are as completely superimposed on one another as possible as shown in Figure 4-11 b.

6. Place the master machine into Rewind and observe the transitions. If necessary readjust the M CODE EQ trimmer for the best compromise between Fast Forward and Rewind.

7. Connect the oscilloscope to the left end of R 44 and repeat steps 3 through 6 using the S CODE EQ trimmer.

NOTE: When adjusting the Slave (MTR-90 II) it may be necessary to press the CUE button on the transport to retract the tape lifters and allow the tape to contact the heads.

4.8 OPTIONAL MODIFICATIONS

4.8.1 Softouch "Preview Mode"

This modification allows the Softouch controller to switch any Slave channel which is in Record Ready to Input Monitor by executing the "Preview" command.

NOTE: MTR-90IIs containing an EC-101 installed by OTARI do not contain this modification.

1. Remove the Lower Rear panel of the MTR-90II.

2. Remove the four screws which attach the Connector Panel Assembly in the left lower corner of the frame.

3. Insert an EI connector containing one wire onto CN 57 Pin 1 on the Mother II PCB.

4. Solder the other end of the wire to CN 3 Pin 8 of the MTR-90II External Connector PCB (PB-77H).

4.8.2 Play Speed Accuracy Improvement

Due to component variations, some EC-101s do not produce precisely 9600 Hz to the MTR-90II when "free-wheeling" (not

Locked). The following modification provides a user adjustment to insure that the EC-101 produces exactly 9600 Hz in Play mode. This adjustment needs to be performed only once for each MTR-90II in which the EC-101 is installed. It may be necessary to readjust if the EC-101 is moved from one MTR-90II to another.

NOTE: All EC-101s shipped after November 1, 1986 contain this modification.

Parts Required:

1 10 kOhm single turn PCB mount trimpot (Leads facing down)
1 27 kOhm 1/4 watt resistor

Procedure:

1. On the top (component side) of the EC-101 Main PCB, locate IC 16. Near IC 16 locate R 21.

2. Remove R 21 from the PCB.

3. Insert one side of the 10 kOhm trimmer into the hole vacated by R 21 which is nearest C 68.

4. Solder one end of the 27 kOhm resistor to the other hole vacated by R 21.

5. Connect the two remaining trimmer leads together, and solder them to the free end of the 27 kOhm resistor.

Adjustment:

1. Install the EC-101 in the MTR-90II with an extender PCB.

2. Set DIP Sw 1-4 to the On position.

3. Set the SPEED MODE switch on the MTR-90II Remote Control to the Ext. position.

4. Turn On the power to the MTR-90II.

5. Set the SPEED DISPLAY on the MTR-90II Remote Control to display tape speed as %.

6. Press the ENABLE button once to enter Speed Adjustment mode. The MTR-90II will enter Play and the tape will move.

7. Adjust the new trimmer on the EC-101 PCB until the SPEED DISPLAY on the MTR-90II Remote Control indicates 100%.

   NOTE: If there is not enough adjustment range to reach 100%, change the value of the 27 kOhm fixed series resistor to bring the trimpot to the center of its mechanical travel. The limited range of this trimmer is necessary to make it insensitive to vibration and temperature changes.

8. Press the ENABLE button to indicate "Adjustment Complete"

9. The LED in the ENABLE button will flash indicating that you may turn Off the Power to the MTR-90II and remove the EC-101 from the extender PCB.

   NOTE: After Step 8 you can press the ENABLE button again to continue with the DAC Gain and Offset Adjustment procedures if desired.

10. Turn Off the Power to the MTR-90 II, remove the EC-101 from the extender PCB and re-install it in the MTR-90 II. Re-check the adjustment made in Step 7 to make sure that the extender PCB has not affected the measurement.

10. Turn Off the Power to the MTR-90 II, remove the EC-101, and set DIP Sw 1-4 to the Off position. Re-install the EC-101 in its slot.

4.8.3 Modification for use with NTSC and PAL/SECAM Video Reference signal

The EC-101 must be modified if it is to be used with 625 line PAL or SECAM standard video as the Video Reference

signal. If operation with both NTSC and PAL/SECAM is desired, a toggle switch can be installed on the front panel of the EC-101 Synchronizer module.

NOTE: If the switch is to be installed, perform only steps 1, 2, and 3. Do not perform Steps 4, 5, and 6 when installing a switch.

To modify the EC-101 to accept PAL or SECAM Video Reference:

1. On the top (component side) of the EC-101 Main PCB, cut the trace between IC 21 Pin 6 and IC 22 Pin 11. Refer to Figure 4-12a for trace location.

2. On the top (component side) of the Main PCB, cut the trace between IC 21 Pin 2 and IC 22 Pin 12.

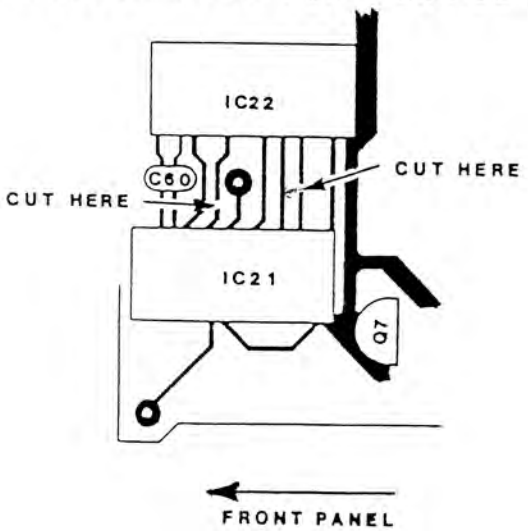


Figure 4-12a Location of Traces for PAL/NTSC Modification

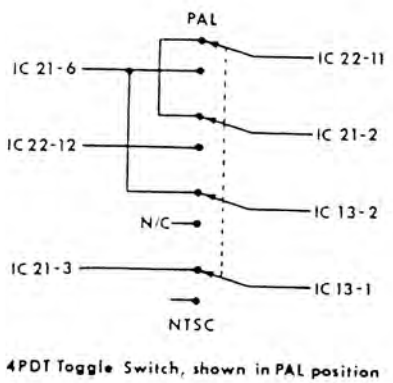


Figure 4-12b PAL/NTSC Switch

3. If the NTSC/PAL switch is to be installed, connect the 4PDT toggle switch as shown in Figure 4-12 b. Do not complete Steps 4, 5, and 6 if you are installing the switch.

4. On the bottom (dip side) of the Main PCB, connect a jumper from IC 21 Pin 2 to IC 22 Pin 11.

5. On the bottom (dip side) of the main PCB, connect a jumper from IC 13 Pin 2 to IC 21 Pin 6.

6. On the bottom (dip side) of the main PCB, connect a jumper from IC 13 Pin 1 to IC 21 Pin 3.

IMPORTANT: If the switch is not installed, this modification prevents NTSC standard video from being used as the Video Reference signal.

4.9 IN CASE OF DIFFICULTIES

If the Slave machine refuses to "lock up" to the Master there are several things that you should check before assuming that the "Synchronizer is no good".

* Check to make sure that you really have good Time Code on the appropriate tracks of both the master and Slave tapes.

* Check for Ground Loops. Sometimes a 60 Hz hum will prevent the Time Code readers from recognizing the signal as Time Code.

* Make sure that the Time Code output from the Slave is connected to the SLAVE TIME CODE INPUT. Make sure the Master is connected to the MASTER input. If these two connectors are reversed the Synchronizer will never lock.

* Check to make sure that the channel you have chosen for Slave Time Code has been "wide band" modified, either with a WBR-1 kit or the modification in Section 4.2.4.

Code signals on tape deteriorate easily when duplicated without regeneration.

* Make sure that the MTR-90 Remote Control is properly connected and that the SPEED MODE switch is in the EXT. position.

* Make sure that the Time Base Reference used for both Master and Slave Time Code is the same, i.e., 59.94 Hz for both, or 60.00 Hz for both etc.

* Make sure that there are no discontinuities in either the Master or Slave Time Code, such as might have resulted from an edit made after the tape was striped with Time Code.

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SECTION 5

SPECIFICATIONS

5.1 PERFORMANCE SPECIFICATIONS

Lock Stability:	+/- 50 microseconds
Wow and Flutter:	0.01% - 0.02% added to Slave W & F.
Typical Time To Lock From Park using 14" reels:	3 seconds to quoted Wow and Flutter
Varispeed Lock:	+/- 50% of Play Speed in both directions
Varispeed Chase (Positional lock within 1 frame):	1/10 to 2 X play speed in both directions
Time Code Reader Speed Range:	1/20 to 60 X play speed (depending on signal quality)
Time Code Reader Input Level:	-10 to +10 dBm Ref. 0.775V
Typical Lockup Rate:	30 Frames/Second
Typical Overshoot Fast Wind to Park:	0 Frames.

5.2 PHYSICAL SPECIFICATIONS

Dimensions

EC-101 Synchronizer Module:	7.8 in. (198 mm) High X 1.6 in. (40 mm) Wide X 12 in. (304 mm) Long

CB-121 Synchronizer Remote: 4.6 in. (117 mm) High X 1.2 in. (30 mm) Wide X 6.3 in. (161 mm) Long

Weight

EC-101 Synchronizer Module: 2 Lb (0.84 kg)

CB-121 Synchronizer Remote: 1 Lb (0.48 kg)

5.3 OPTIONAL ACCESSORIES

CB-121 Synchronizer Remote with 33 ft (10 M) Cable

5.4 ELECTRICAL REQUIREMENTS

+ 5 VDC
+ 15 VDC
- 15 VDC

The EC-101 normally receives all required power from the MTR-90.

APPENDIX

PROGRAMMING FOR CONTROL OF THE EC-101 USING THE BTX\CIPHER SOFTOUCH COMMAND SET

This version of software for the EC-101 incorporates control of the EC-101 by a BTX/CIPHER SofTouch controller, or equivalent. The EC-101 responds to the "Shadow" command set, except for those functions, like Master GOTO, that the EC-101 cannot perform.

Commands from the SofTouch controller to the EC-101 are sent as ascii codes, and responses from the EC-101 to the controller are sent as an escape character followed by hex data bytes.

The commands to the EC-101 fall into four groups:

1. Transport Commands
2. Mode Control Commands
3. Register Control Commands
4. Broadcast Mode Control

Refer to Table 1 for a complete list of commands.

1. TRANSPORT CONTROL COMMANDS

These commands cause the MTR-90II to perform some desired action, such as Fast Forward, Rewind, Stop, etc.

These commands are initiated by sending the EC-101 an ascii character corresponding to the desired command. For example, for MTR-90II Fast Forward send a 'q' (no quotes), or ascii 71; for MTR-90II Rewind send an 'r' or ascii 72.

For a GOTO command, the location is sent to the EC-101 first, as ascii numbers followed by the GOTO command 'o'. For example MTR-90II GOTO 10 23 45 29 would be sent as '10234529o' ascii or 31,30,32,33,34,35,32,39,6f hex.

If a sign character (+ or -) is sent with any GOTO location, that location will be treated as being relative to the current tape location. For example '-5 00 o' will cause the

MTR-90II to goto a location which is 5 seconds previous to the current tape location.

IMPORTANT: The EC-101 cannot stack commands, each command must be sent to and acknowledged by the EC-101 before another command will be accepted. If another command is sent before the first is acknowledged, the second command may be completely ignored, or it may be partially executed.

2. MODE CONTROL COMMANDS

These commands change the control mode of the EC-101, such as CHASE, AUTO, ADVANCE, RETARD,etc. These commands are initiated by, first sending the ascii character for the selected system or device function, and then sending the ascii character corresponding to the hex nibble (4 bits) for the desired mode. Refer to Table 2 for Mode Control Command nibbles.

For example, to turn CHASE on, first send 'H' or 48 ascii, then send the hex conversion of the control nibble (1000 in this case) as ascii character 38.

Another example; to toggle SLOWLOCK and turn FRAMESYNC on, send 'h' or ascii 68, because both are "DEVICE FUNCTION B" commands. Then, to toggle SLOWLOCK the nibble is 11__, and to turn FRAMESYNC On, the nibble is __01. So the resulting command byte is 1101, which converts to D hex which is ascii 44. Therefore the complete command sequence is 'h' 'D' (no quotes), or 68 44 ascii.

3. REGISTER CONTROL COMMANDS

These commands allow the EC-101 internal control registers to be examined or set. There are 9 "scratch pad" registers, 5 delay registers, a Master TC register, a Slave TC register, an offset register, and the communication buffer.

The communications buffer receives all locations sent to the EC-101. The data contained in the communications buffer may be transferred to and from any of the other registers.

To store a location into one of the "scratchpad" registers, first send the location, as ascii characters, then send the

STORE command 'b' or 62 ascii, then the desired register number.

For example, to store +00 01 00 23 in register 4, send '+ 0 0 0 1 0 0 2 3 b 4' or 2B 30 30 31 30 30 32 33 62 34 ascii.

To use the contents of a register for a GOTO etc., the register contents must first be recalled to the communications buffer. To recall the contents of a register to the communications buffer send the EC-101 'c' or 63 ascii followed by the register number. For example, if the desired Goto location has been previously stored in Register 5, send 'c','5' to recall the register contents, and then send 'o' to cause the Slave to Goto the location.

There are 5 "delay" registers (Record-In 'v', Record-Out 'w', Mute-In 't', Mute-Out 'u', and Programmed Stop 's') in which locations may be stored so that the desired action takes place at the stored location. For example, to execute a Punch-In at location 00 00 11 22, send '0 0 0 0 1 1 2 2 b v' or 30 30 30 30 31 31 32 32 62 76 ascii.

CAUTION: If the communication buffer is cleared while holding the location, or if all zeros are sent, or if the Store command is omitted, the slave (MTR-90II) will punch-in right away, without waiting for the tape to arrive at the desired location. Refer to Table 3 for a list of register numbers and functions.

4. BROADCAST MODE CONTROL COMMANDS

The EC-101 will send status, Slave Time Code, and Master Time Code information back to the controller only when Broadcast Mode is selected. Broadcast mode may be selected as Continuous or Single. In Continuous Broadcast mode, the EC-101 will send the status and time code information to the controller every 30-40 msec. In Single Broadcast mode, the EC-101 will send to the controller only once. The selection of information to be sent from the EC-101 to the controller is made by setting a bit in the Broadcast Request word for each message to be sent to the controller. To initiate Broadcast mode, first send the Broadcast Request word, followed by the command 'e'. For example, to have the EC-

101 send the Master Time code, Slave Time code, and 7 status bytes, the required Broadcast Request word is 0011 1110 or '3 E'. Send '3 E' or 33 45 ascii, followed by 'e' (set Broadcast Mode).

Messages from the EC-101 to the SofTouch or controller are sent as hex codes preceded by an escape character (1b hex). Refer to Table 3 for further information regarding messages from the EC-101 to the controller.

For example: If the controller sends the EC-101 a 'p' (slave Play command), the EC-101 will respond with 1B 50 hex, indicating that the 'p' command was received, and can be executed.

All messages begin with an Escape character (1b hex) followed by a handshake or Header byte:

00 - 7F hex Handshaking Bytes

01 - 07 h = NACK: These bytes indicate that there was an error in the last byte received

08 h = ENQ: This is sent out upon Power-up to tell the Softouch that the Ec-101 is on-line and is sent every 3-4 secs until the Softouch sends a Set Broadcast command.

10 - 7F h = ACK These bytes are an echo of the last byte received.

80 - BF hex Header Bytes

80 - 81 h = Master SMPTE TC Field 0/1 LTC

88 - 89 h = Slave SMPTE TC Field 0/1 LTC

The first four bytes of Time Code in Hex would then follow.

90 - BF hex Non SMPTE Information

93 h = 3 Bytes of Status Information follow
95 h = 5 " " " " "
97 h = 7 " " " " "

The Status Bytes are listed in Table 4

	9C h	= Unsigned Offset (5 bytes follow)
	9D h	= + Offset (5 bytes follow)
	9E h	= - Offset (5 bytes follow)
A0 - BF hex	Response Messages	
	A0 h	= Resend of last echo
	A1 h	= Requested Memory Byte follows (Refer to Table 2 System Function A RAM operations)
	B4 h	= Unsigned Communication Buffer Contents
	B5 h	= + " " "
	B6 h	= - " " " (5 bytes follow)
C0 - FF hex	Proprietary OTARI codes to be implemented in later revisions	

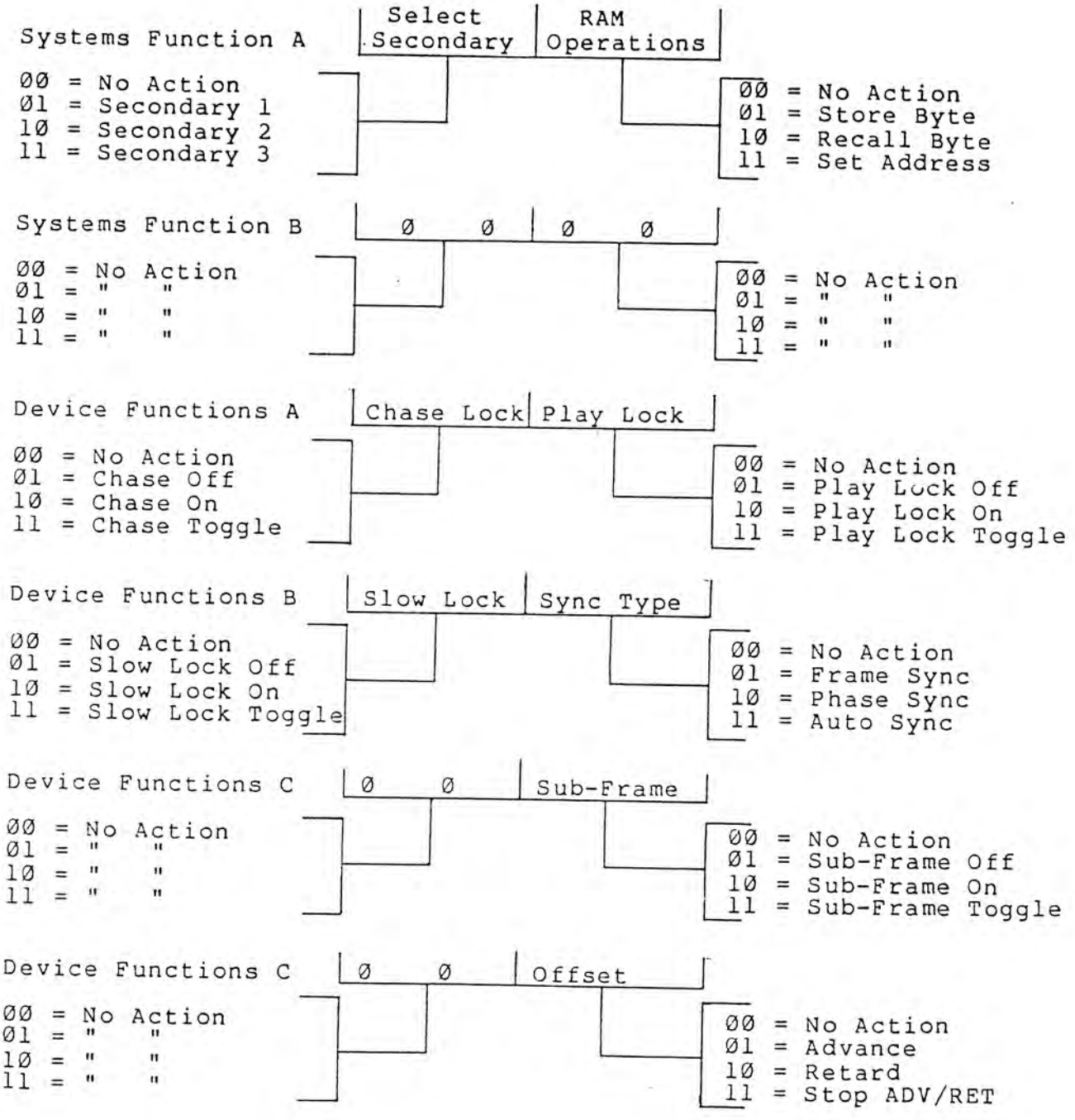
TABLE A-1 COMMANDS

Ø = Ø (Hex)	? = Resend Last Echo
1 = 1 (Hex)	@ = n/a
2 = 2 (Hex)	+ = +
3 = 3 (Hex)	- = -
4 = 4 (Hex)	
5 = 5 (Hex)	
6 = 6 (Hex)	
7 = 7 (Hex)	
8 = 8 (Hex)	
9 = 9 (Hex)	
A = A (Hex)	a = CLEAR Communications Buffer
B = B (Hex)	b = STORE from Comm Buffer
C = C (Hex)	c = RECALL to Comm Buffer
D = D (Hex)	d = TRANSMIT Comm Buffer
E = E (Hex)	e = SET Broadcast function
F = F (Hex)	f = n/a
G = Select System Functions A	g = Select System Functions B
H = Select Device Functions A	h = Select Device Functions B
I = Select Device Functions C	i = Select Device Functions D
J = LTC T.C. - Master	j = LTC T.C. - Slave
K = n/a	k = n/a
L = n/a	l = n/a
M = n/a	m = n/a
N = Offset Register	n = n/a
* O = Master GOTO	o = Slave GOTO
* P = Master PLAY	p = Slave PLAY
* Q = Master F.FWD	q = Slave F.FWD
* R = Master REWIND	r = Slave REWIND
* S = Master STOP	s = Slave STOP
* T = Master MUTE IN	t = Slave MUTE IN
* U = Master MUTE OUT	u = Slave MUTE OUT
* V = Master VARIABLE	v = Slave RECORD IN
W = n/a	w = Slave RECORD OUT
X = Clear Delay Registers	x = Reserved for Future Use
Y = n/a	y = " " " "
Z = n/a	z = " " " "

* The EC-1Ø1 will not execute commands for Master actions

n/a = command not implemented in this version of software

TABLE A-2 SYSTEM FUNCTIONS COMMANDS



BROADCAST REQUESTS:

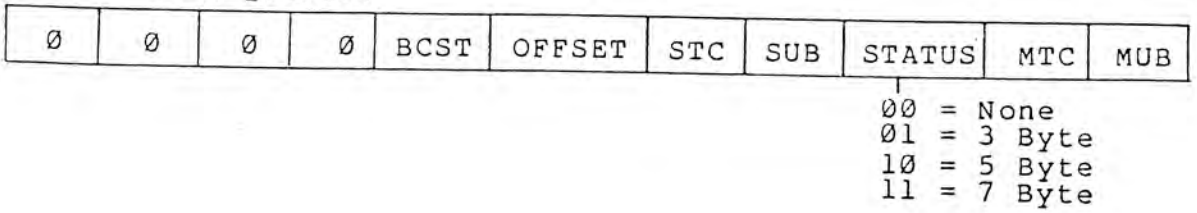
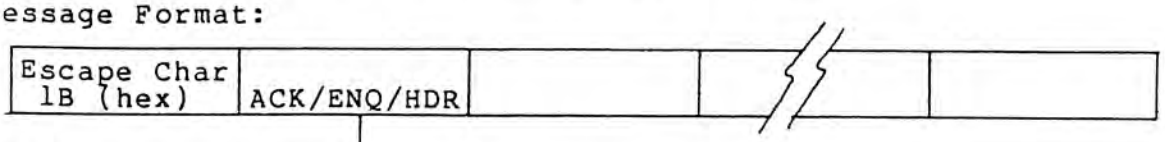


TABLE A-3 BROADCAST MESSAGES

Message Format:



A. 0 X X X X X X X — Handshaking Byte

- 0 0 0 0 0 0 0 0 — Status Byte
  - 0 X X X — NACK: Reception error-status returned
    - Invalid Command
    - Parity/Framing
    - Other (Including Input overflow)
  - 1 X X X — ENQ: Wake-up Sent on Power-Up
  - 0 0 1 X X X X — ACK: Reception OK - Input Char echoed
    - Non-ascii character 10 - 1F HEX
  - n n n X X X X — ACK: Reception OK - Input Char echoed
    - ascii char - Hex 20 to Hex 7F

B. 1 0 X X X X X X — Header - Primary/Secondary Devices

- 0 X X X X X — Broadcast Messages
  - 0 X X X X — SMPTE Code (all 4 byte messages)
    - 0 = Field 0 / 1 = Field 1
    - 0 = Time Code / 1 = User Bits
    - 0 = LTC / 1 = VITC
    - 0 = Primary / 1 = Secondary
  - 1 X X X X — Non-SMPTE Information
    - 0 X X X — Status Information
      Number of Bytes
    - 1 X Y Y — Other Information
      - 00 = Unsigned
      - 01 = Plus Sign
      - 10 = Minus Sign
      - 0 = MSG Type 0
      - 1 = MSG Type 1
- 1 X X X X X — Response Messages
  - 0 0 X X X — Miscellaneous
    - 000 = Resend of ACK/NACK (1 Byte)
    - 001 = Requested Memory Byte (1 Byte)
  - 1 0 X Y Y — Communications Buffer Contents
    - 00 = Unsigned
    - 01 = Plus Sign
    - 10 = Minus Sign
    - 0 = Content Type 0
    - 1 = Content Type 1

C. 1 1 X X X X X X — Reserved for Future use

TABLE A-4 STATUS BYTES

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
BYTE 1	Master Goto	Master Motion 000 = Stopped 100 = Forward 101 = Reverse 110 = Play	Master Play	Master Dir	-	Master Drop Frame	Master Code	Locked
BYTE 2	Slave Goto	Slave Motion 000 = Stopped 100 = Reverse 101 = Forward 110 = Play	Slave Play	Slave Dir	Slave Record Active	Slave Drop Frame	Slave Code	Sub-Frame
BYTE 3	Slow Sync	Auto Sync	Sync Mode 0=Phase 1=Frame	Play Lock	Chase Lock	Error Cond. Exists	Frames/Second 00 = 24 01 = 25 10 = 30 11 = N/A	
BYTE 4	Master Stop Delay	-	-	Master Mute-On Delay	Master Mute-Off Delay	-	Master Mute Active	Master Color Frame
BYTE 5	Slave Stop Delay	Slave Rec On Delay	Slave Rec Off Delay	Slave Mute-On Delay	Slave Mute-Off Delay	-	Slave Mute Active	Slave Color Frame
BYTE 6	Master Play Tally	Master Rew Tally	Master F.Fwd Tally	Master Stop Tally	Master Pause Tally	-	Master Tach Error	Master Calib Request
BYTE 7	Slave Play Tally	Slave Rew Tally	Slave F.Fwd Tally	Slave Stop Tally	Slave Pause Tally	-	Slave Tach Error	Slave Calib Request

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MTR-90 Ⅱ SYNCHRONIZER
EC-101
SYNCHRONIZER REMOTE
CB-121

CIRCUIT DIAGRAM

OTARI PART No.	DESCRIPTION	DWG No.
EC1010A	WIRING DIAGRAM	3-12714
ZA57A0A	WIRING DIAGRAM	4-40042
PB7CX0A	FRONT PANEL PCB ASSEMBLY	4-40043
PB7CY0A	SYNCHRONIZER FRONT END	3-12897
PB7CY0B	SYNCHRONIZER MAIN LOGIC	3-12711
PB7CY0C	SYNCHRONIZER I/O	3-12712
PB7CZ0A	SYNCHRONIZER CPU	3-12710
PB7DA0A	SUB PANEL PCB ASSEMBLY	3-12713
PB7DB0A	SYNCHRONIZER REMOTE PCB ASSEMBLY (CB-121)	3-10581
PB4AR0A	REVERSE PLAY MODE PCB ASSEMBLY (MTR-90 Ⅱ)	4-40044
PB7DD0A	MOTHER BOARD Ⅱ ASSEMBLY (MTR-90 Ⅱ)	3-15376

REVISED 4 JULY 1989

✱1 THESE CONNECTORS ARE NORMALLY PLUGGED INTO CN8 AND CN9 ON EXTERNAL CONNECTOR PCB (PB-77H).

ZA-69C

ECN5 12 11 10 9 8 7 6 5 4 3 2 1 / 22 23 24 25 14 17 18 21 15 16 19 20

SUB PANEL P.C.B. PB-7DAA

ECN2 DB-25M

VITC ACCESSORY

ECN4 ZA-69C

1	READ SW.	A5 / B5
2	WRITE DIGIT	
3	WRITE LEDS	
4	D0	
5	D1	A10 / B10
6	D2	
7	D3	
8	D4	
9	D5	
10	D6	A15 / B15
11	D7	
12	GND	

CN9

CN56

D6	1	
D5	2	
D2	3	
MST TACH	4	
D7	5	
D4	6	
D3	7	
MST DILECTION	8	
READ SPEED	9	
RESD VITC	10	
A1	11	
A0	12	

CN57

STANBY	1	→ CN3-8 ON PB-77H
D3	2	
D4	3	
D6	4	
D0	5	
D2	6	
D5	7	
D7	8	

MTR-90II

✱2

SPEED	1
SUP. REEL	2
T.UP REEL	3

CN9-A32 CN9-A33 CN9-A34 CN3-A26 CN3-B2 CN3-B3

MOTHER BOARD II ASSEMBLY PB-7DDB

ECN1 DB-25M REMOTE

GND(1~4,10~13)

+5V(5~9)

GND(1~13)

EXT.CLOCK CONNECTOR

25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

✱1 ECN9

FWD/REV	12	
+5V	11	
CAP. TACH OUT	10	
EXT. CLOCK	9	
GND	8	
9.6K REF.	7	
TACH OUT	6	
REWIND	5	
FAST FWD	4	
STOP	3	
PLAY	2	
RECORD	1	

✱1 ECN8

SPD. COM.	9	
SPD.REF.VOLT	8	
SMPTE CUE	7	
LIFTER DEF.	6	
REW	5	
F.F.	4	
STOP	3	
PLAY	2	
REC	1	

ZA-69C

ECN7

9600Hz		
		A20 / B20
EXT. DC		
REWIND		
STOP		
RECORD		
EXT.SPD.CNT.		A25 / B25
FAST FWD		
LIFTER DEF.		
PLAY		
SLV. TACH		
SLV DIRECTION		A30 / B30

CN51

✱2 CN52-1 CN52-2 CN52-3

CN58

COMP VIDEO H	1	
COMP VIDEO L	2	

✱2 MODIFICATION APPLIED TO ZA-57Z ONLY.

J1 75 J2

J4 ZA-69H

SLAVE LO	1	A35 / B35
SLAVE HI	2	
GND	3	

CN53

J3 ZA-69G

CN54

MASTER LO	1	A40 / B40
MASTER HI	2	
GND	3	

NOT USED	1	
NOT USED	2	
CTS	3	
FRM GND	4	
SIG GND	5	
DATA IN	6	
DATA OUT	7	

CN59

ECN12 ZA-69F

CN55

GND		A45 / B45
-15V		
+15V		
+5V		A50 / B50

→ CN12-4 → CN12-3 → CN12-12 → CN12-11 ✱2

ZA-69J

ECN6 ZA-69D

RS-232C ECN3 DB-25F

3 2 7 1 4 24 25 / 7 6 5 4 3 2 1

EXTERNAL CONNECTOR PCB PB-77H

CN8 1 2 3 4 5 6 7 8 9

ZA-69E

ECN10

CN9 1 2 3 4 5 6 7 8 9 10 11 12

ZA-69C

ECN11

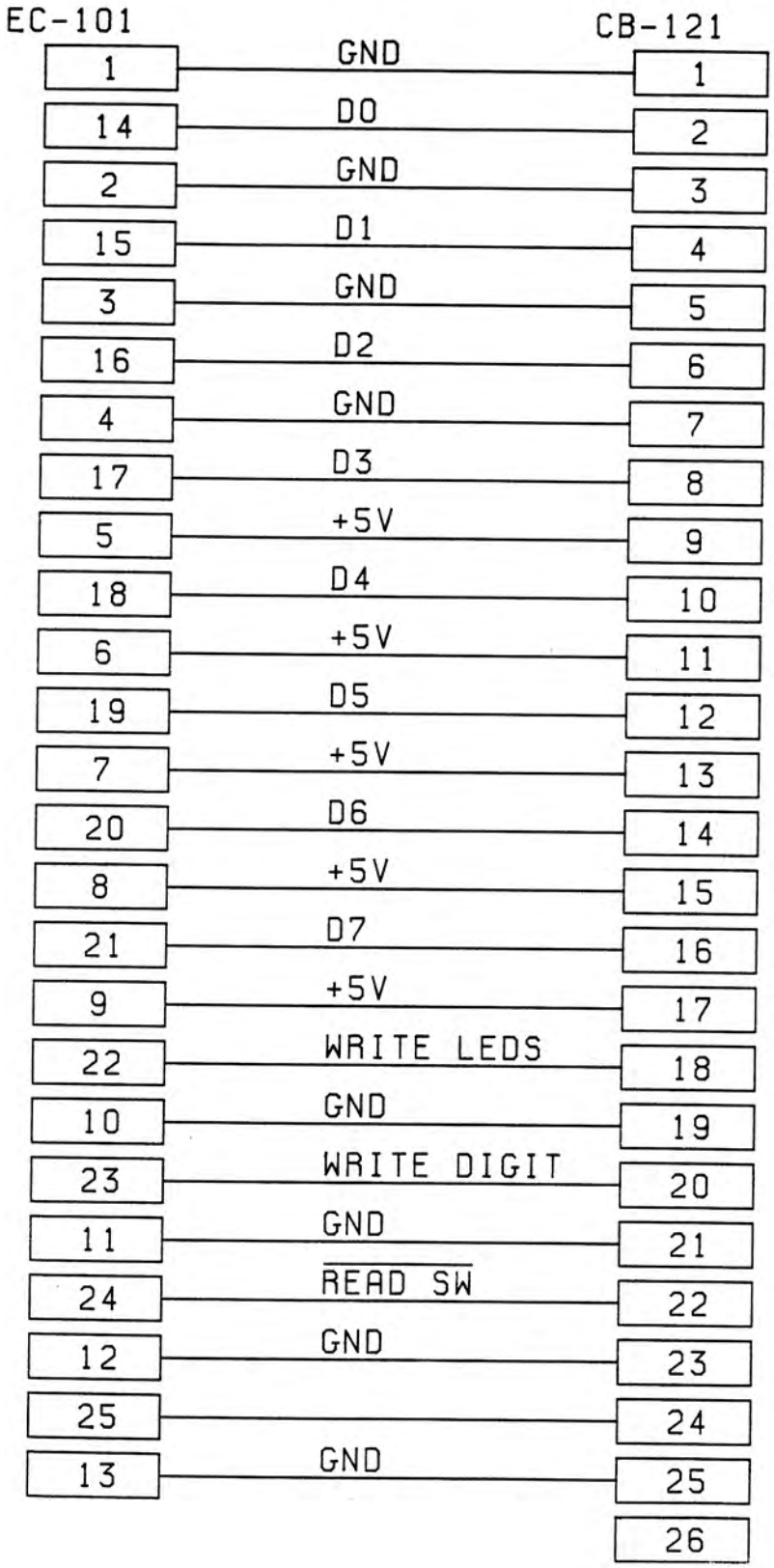
CN3 8 → CN57-1

ON MOTHER BOARD II PB-7DDB

CABLE ASSY ZA-6JF

NAME	WIRING DIAGRAM
PART NO.	EC1010A
APPLIED	

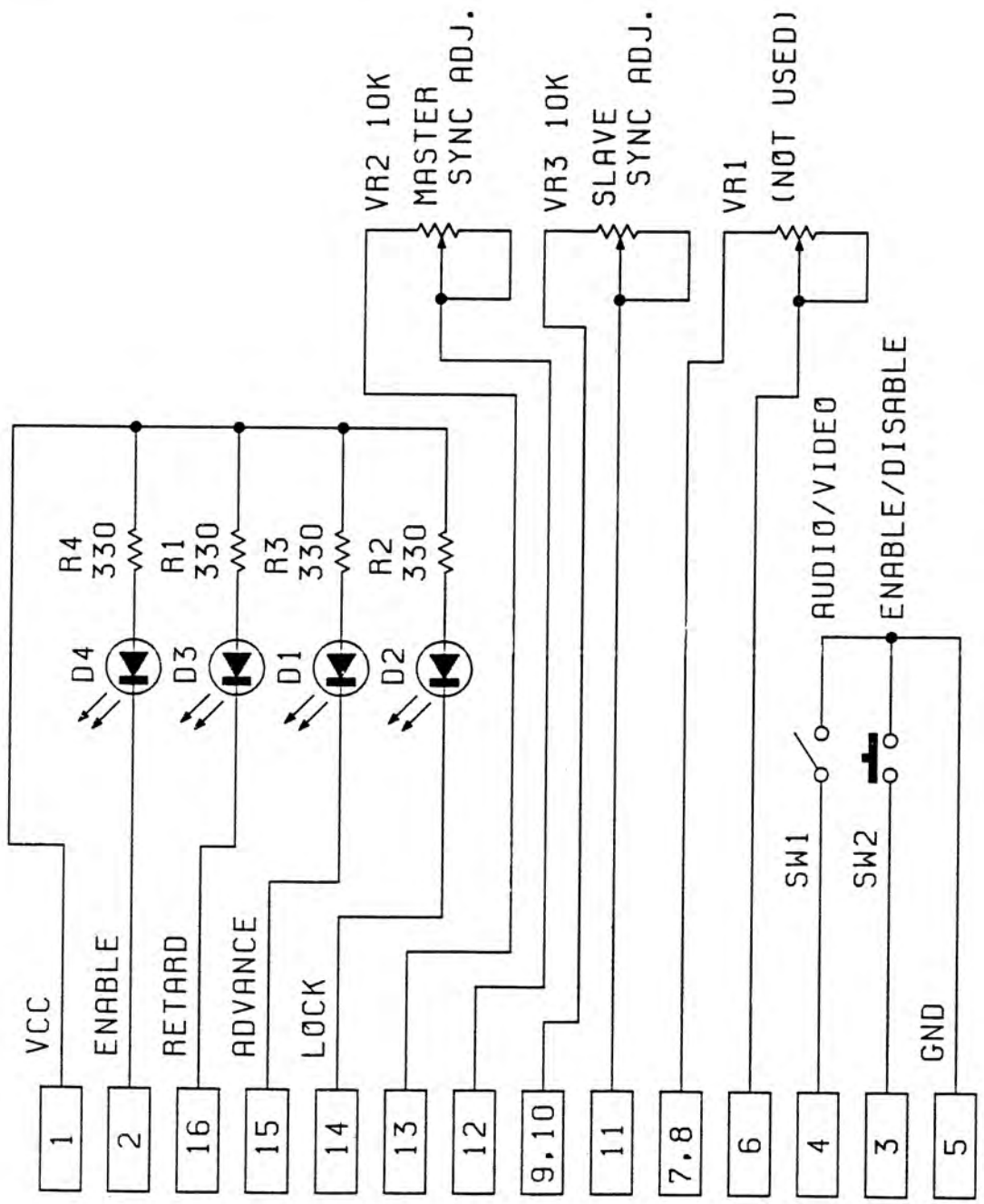
DWG. NO. 3-12714



NAME	WIRING DIAGRAM
PART NO.	ZA57A0A
APPLIED	

DWG. NO. 4 . 40042

REF. NO.		STARI PART NO.	DESCRIPTION
VR	2,3	RV414207	GF06P-10K
D	1,3	PN-0241-	LN428YP
	2	PN-0240-	LN342GP
SW	1	WH31036-	HSW-0834-01-010
	2	WH11206C	DP2-101-GL5
CN	1	CN316260	PS-16SD-D4T1-1



NAME	FRONT PANEL PCA
PART NO.	PB7CX0A
APPLIED	EC-101

DWG. NO. 4 . 40042

REFERENCE NO.		ATARI PART NO.	DESCRIPTION
IC	1	IM5221P	M5221P
	7.10	IM5223P	M5223P
	8.9	ILM311	LM311
	11	ITL710CP	TL710CP
	21	IMC14081	MC14081B
	22	IMC14520	MC14520BCP
	23	IMC14013	MC14013B
	32	IMC14584	MC14584B
	52	IMC14538	MC14538B
Q	5.6.7	QC1815BL	2SC1815BL
D	4~13.17.18	PN-0199	FDH9615
	14.15.16	PNSM1-02	SM1A-02

A37 T. C. IN +
A36 T. C. IN -
A38 GND
SLAVE TIME CODE AUDIO IN

A41 T. C. IN +
A40 T. C. IN -
A42 GND
MASTER TIME CODE AUDIO IN

B33 COMP. VIDEO HI
B34 COMP. VIDEO LOW

AB48 +15V
AB44 GND
AB46 -15V
AB50 +5V
AB44 GND

B5 MASTER TACH PULSE

CN3: RESET 9

RCONSW
SLAVE TC
MASTER TC

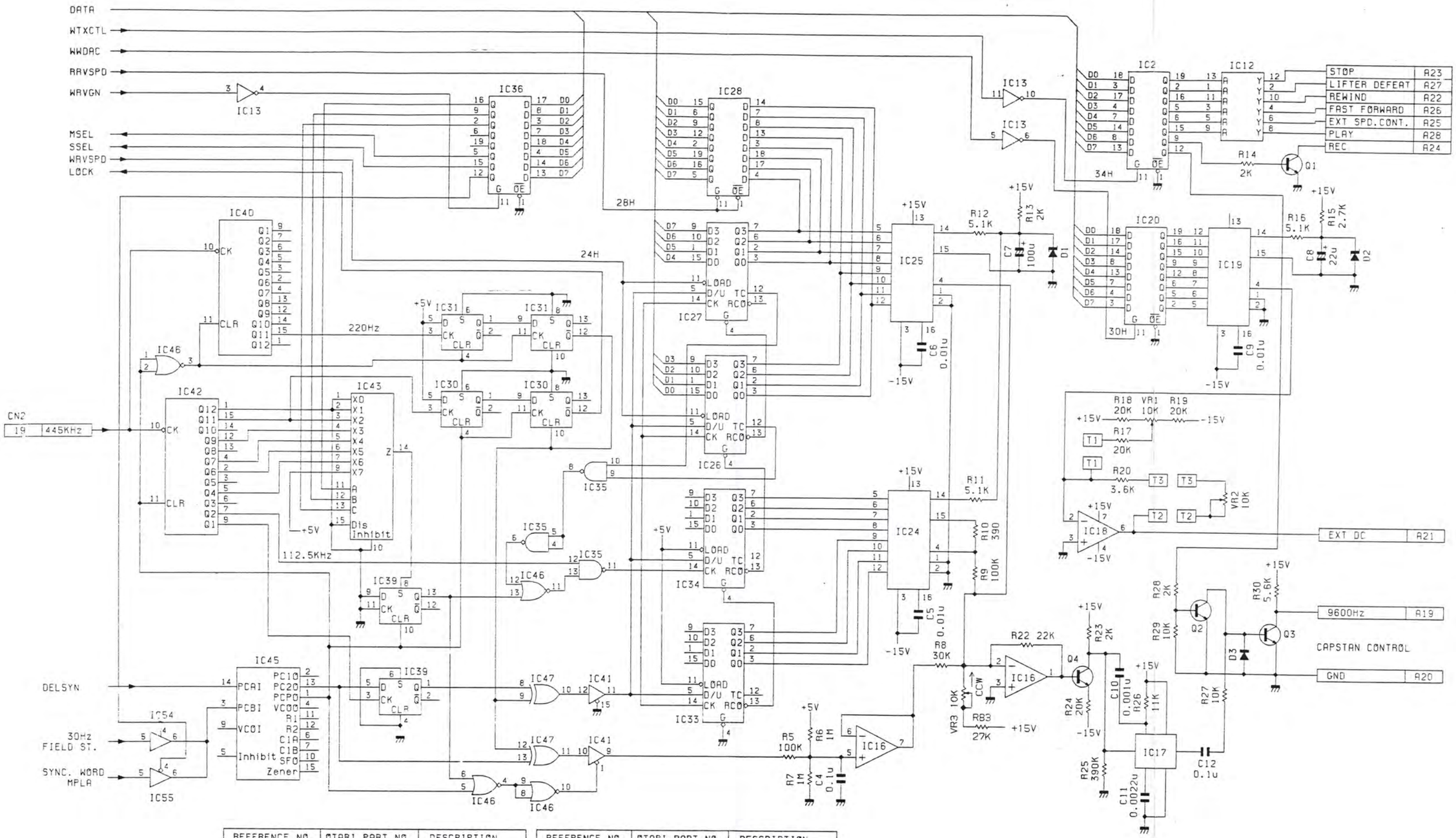
30Hz FIELD STRIPPER

CN2: 445KHz 19

MASTER TACH

NAME	SYNCHRONIZER FRONT END
PART NO.	PB7CY0A
APPLIED	

DWG. NO. 3-12897



REFERENCE NO.		OTARI PART NO.	DESCRIPTION
IC	2.20.28.36	IQ373	74HC373
	12	IA06N	SN7406N
	13	IQ04	74HC04
	16	IM5221P	M5221P
	17	ILM566CN	LM566CN
	18	IHC741C	uPC741C
	19.24.25	INE5008N	NE5008
	26.27.33.34	IQ191	74HC191
	30.31.39	IMC14013	MC14013B
	35	IQ00	74HC00
	40.42	IMC14040	MC14040BCP

REFERENCE NO.		OTARI PART NO.	DESCRIPTION
IC	41	IMC14503	MC14503BCP
	43	IMC14512	MC14512BCP
	45	IMC14046	MC14046BCP
	46	IMC14001	MC14001B
	47	IMC14070	MC14070BCP
	54	IQ126	74HC126
	55	IQ125	74HC125
Q	1.2.3.4	QC1815BL	2SC1815BL
D	1.2	PN-0011	RD5.1EB3
	3	PN-0199	FDH9615

NAME	SYNCHRONIZER MAIN LOGIC
PART NO.	PB7CY0B
APPLIED	PB-7CYB

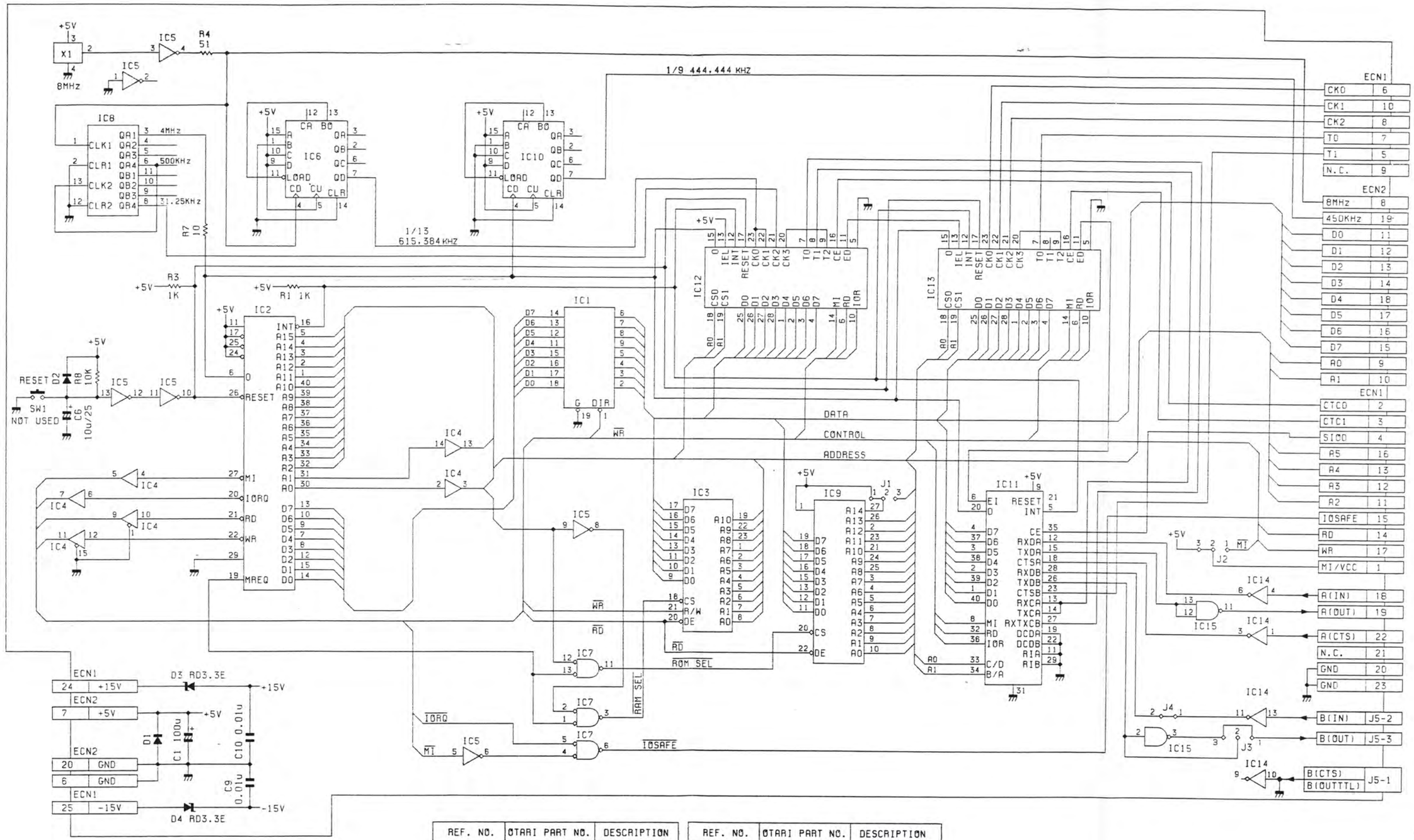
DWG. NO. 3-12711

REFERENCE NO.	ATARI PART NO.	DESCRIPTION
IC 3,57	1Q373	74HC373
4	1QT245	74HCT245
5,6,37,56,58	1Q244	74HC244
13	1Q04	74HC04
14	1Q08	74HC08
15	1Q32	74HC32
21	IMC14081	MC14081B
32	IMC14584	MC14584B
29,38,44	1Q138	74HC138
48	1Q00	74HC00

REFERENCE NO.	ATARI PART NO.	DESCRIPTION
IC 49,53	1Q74	74HC74
50,51	1-0055	TIME CODE READER
54	1Q126	74HC126
55	1Q125	74HC125
SW 1	WH98008	A6B-4102
2,3	WH90126	KDR16

NAME	SYNCHRONIZER I/O
PART NO.	PB7CY0C
APPLIED	PB-7CYC

DWG. NO. 3-12712

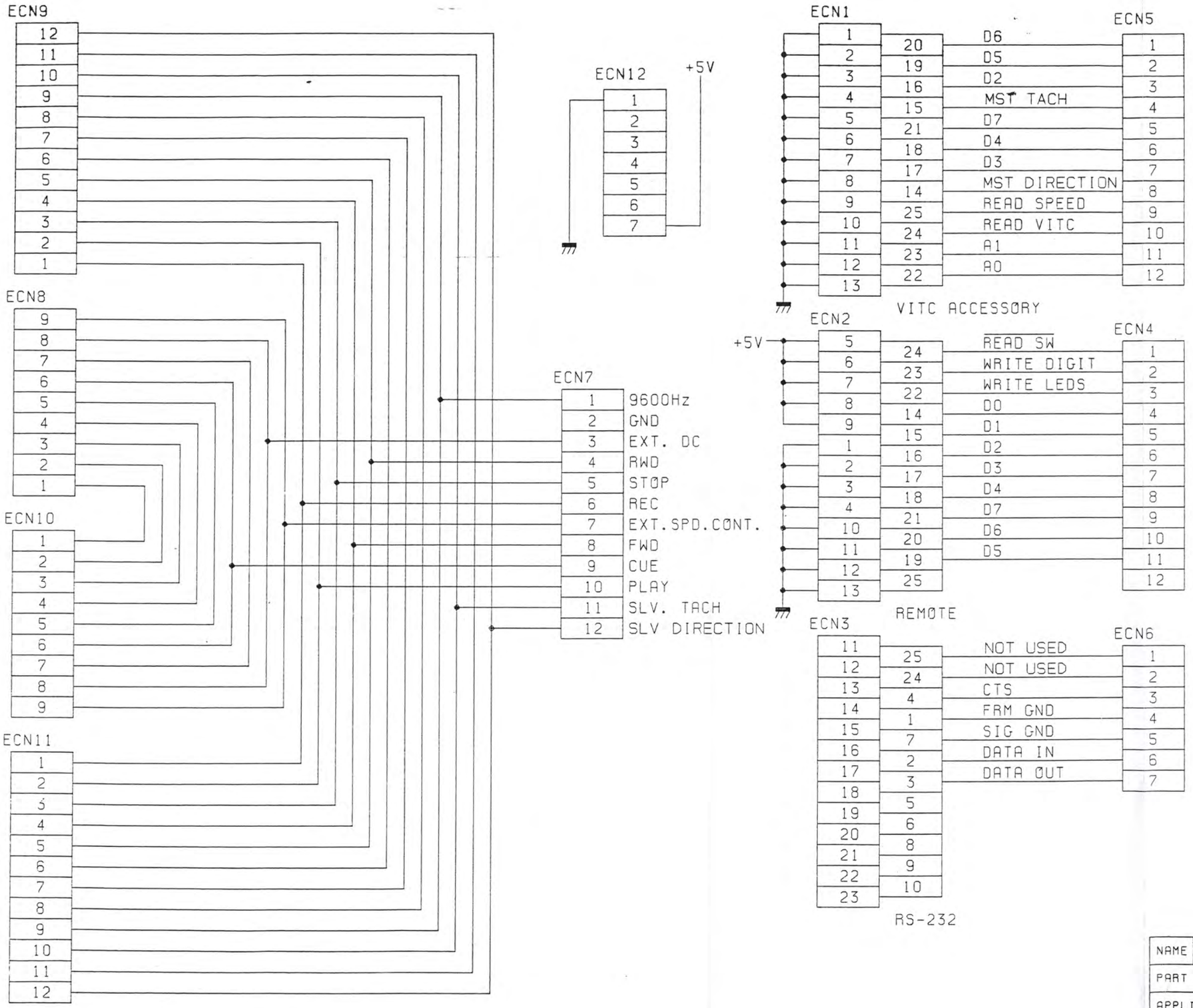


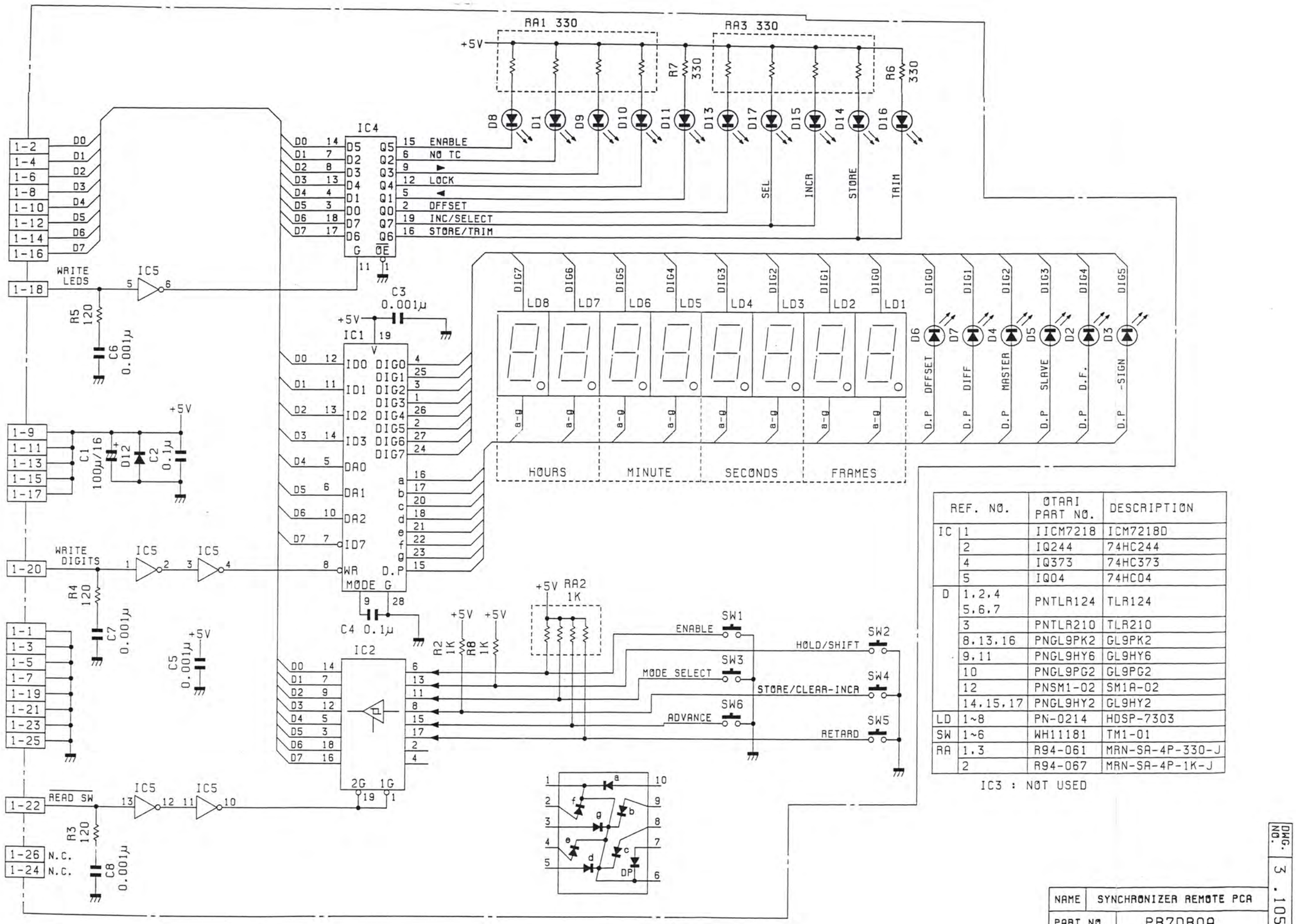
REF. NO.		OTARI PART NO.	DESCRIPTION
IC	1	IQT245	74HCT245
	2	I-0084	Z80A-CPU
	3	I-0021	HM6116P-4
	4	IQT367	74HCT367
	5	IQ04	TC74HC04P
	6,10	IQ193	TC74HC193P
	7	IQT32	74HCT32

REF. NO.		OTARI PART NO.	DESCRIPTION
IC	8	IQ393	TC74HC393P
	9(EPROM)	IM5L2764	M5L2764K
	11	I-0086	Z80A-DART
	12,13	I-0088	Z80A-CTC
	14	IG189AN	SN75189AN
	15	IG188N	SN75188N
X	1	PZ4C028	LQV-8M00-012

NAME	SYNCHRONIZER CPU
PART NO.	PB7CZ0A
APPLIED	PB-7CZA

DWG. NO. 3-12710


ECN9
12
11
10
9
8
7
6
5
4
3
2
1
ECN12
+5V
1
2
3
4
5
6
7
ECN1
1
2
3
4
5
6
7
8
9
10
11
12
13
20
19
16
15
21
18
17
14
25
24
23
22
D6
D5
D2
MST TACH
D7
D4
D3
MST DIRECTION
READ SPEED
READ VITC
A1
A0
ECN5
1
2
3
4
5
6
7
8
9
10
11
12
VITC ACCESSORY
ECN8
9
8
7
6
5
4
3
2
1
ECN7
1 9600Hz
2 GND
3 EXT. DC
4 RWD
5 STOP
6 REC
7 EXT.SPD.CONT.
8 FWD
9 CUE
10 PLAY
11 SLV. TACH
12 SLV DIRECTION
ECN10
1
2
3
4
5
6
7
8
9
ECN11
1
2
3
4
5
6
7
8
9
10
11
12
ECN2
+5V
5
6
7
8
9
1
2
3
4
10
11
12
13
24
23
22
14
15
16
17
18
21
20
19
25
READ SW
WRITE DIGIT
WRITE LEDS
D0
D1
D2
D3
D4
D7
D6
D5
ECN4
1
2
3
4
5
6
7
8
9
10
11
12
REMOTE
ECN3
11
12
13
14
15
16
17
18
19
20
21
22
23
25
24
4
1
7
2
3
5
6
8
9
10
NOT USED
NOT USED
CTS
FRM GND
SIG GND
DATA IN
DATA OUT
ECN6
1
2
3
4
5
6
7
RS-232
DWG. NO.
3-12713
NAME
SUB PANEL PCA
PART NO.
PB7DA0A
APPLIED
PB-7DAA

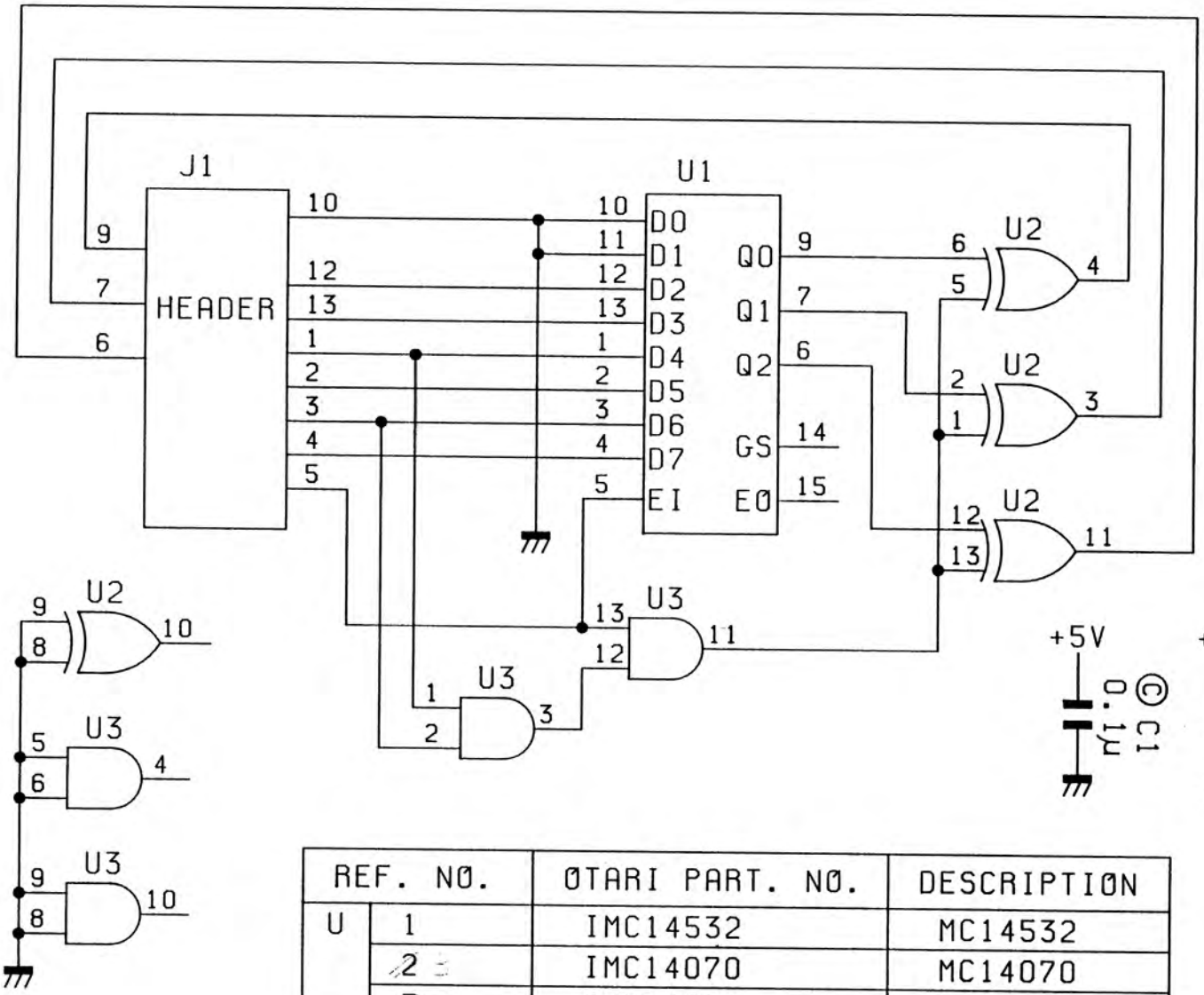


REF. NO.		OTARI PART NO.	DESCRIPTION
IC	1	IICM7218	ICM7218D
	2	IQ244	74HC244
	4	IQ373	74HC373
	5	IQ04	74HC04
D	1,2,4 5,6,7	PNTLR124	TLR124
	3	PNTLR210	TLR210
	8,13,16	PNGL9PK2	GL9PK2
	9,11	PNGL9HY6	GL9HY6
	10	PNGL9PG2	GL9PG2
	12	PNSM1-02	SM1A-02
	14,15,17	PNGL9HY2	GL9HY2
LD	1~8	PN-0214	HDSP-7303
SW	1~6	WH11181	TM1-01
RA	1,3	R94-061	MRN-SA-4P-330-J
	2	R94-067	MRN-SA-4P-1K-J

IC3 : NOT USED

NAME	SYNCHRONIZER REMOTE PCA
PART NO.	PB7DB0A
APPLIED	

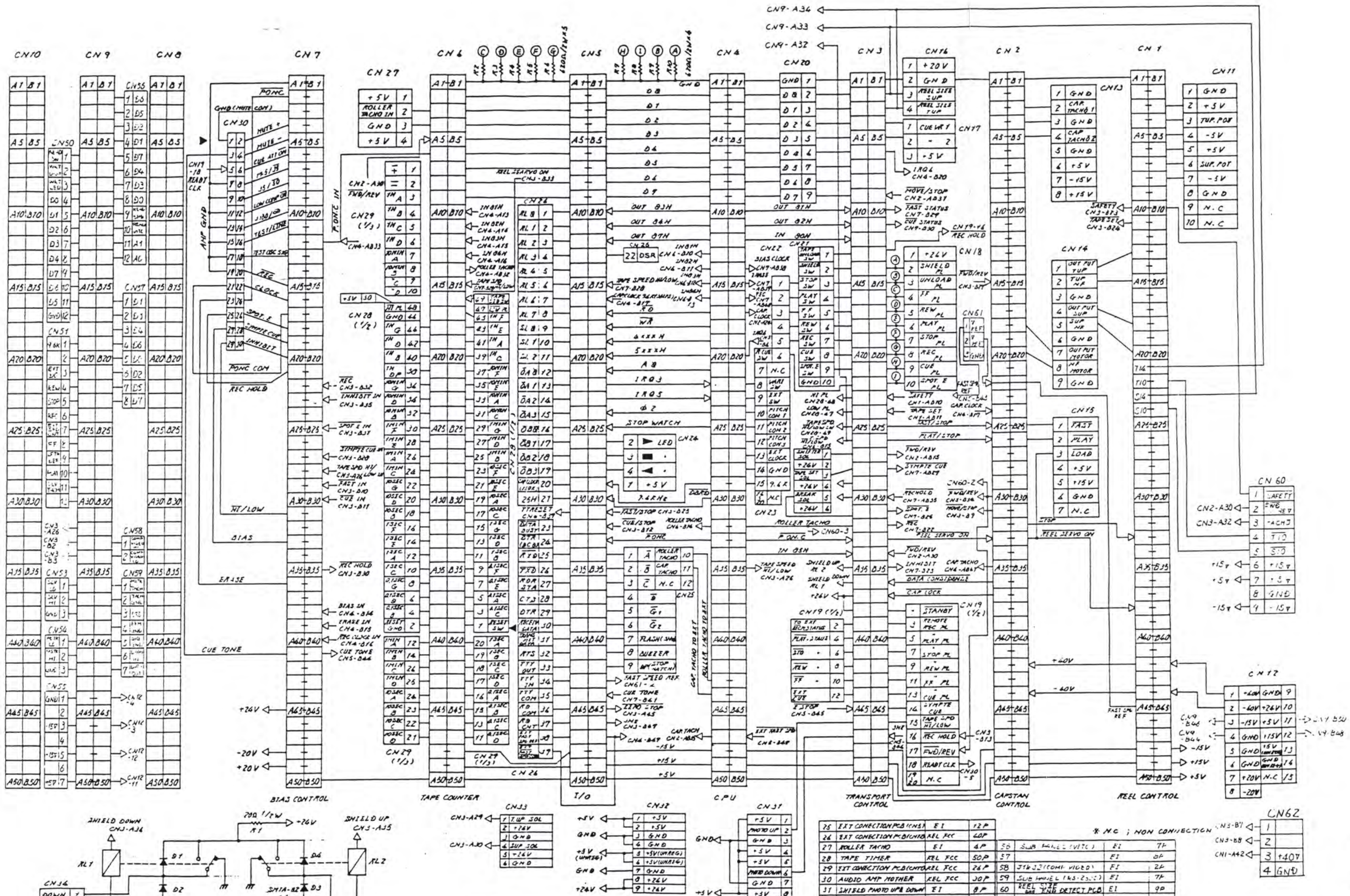
DWG. NO. 3.10581



REF. NØ.		ØTARI PART. NØ.	DESCRIPTIØN
U	1	IMC14532	MC14532
	2	IMC14070	MC14070
	3	IMC14081	MC14081
J	1	CN916193	616-AG1

NAME	REVERSE PLAY MODE PCA
PART NØ.	PB4ARØA
APPLIED	

DWG. NO. 4 .40044



CN.NO	TO - - -	CN. DESCRI	PIN
1-10	CONTROL PCB	KEL	100P
11	TUP & SUP POT.	EI	10P
12	POWER SUPPLY	U. M.	15P
13	CAP TACHO PCB	EI	8P
14	MOTOR POWER TR	EI	9P
15	HOUR METER PCB	EI	7P
16	REEL SIZE SENSE PCB	EI	4P
17	CUE VR	EI	3P
18	DECK CONTROL PL	EI	10 P
19	EXT CONECTION PCB(CN8)	KEL FCC	20 P
20	N. C	EI	9P
21	DECK CONTROL SW	EI	10 P
22	EXT CONECTION PCB (CN7)	KEL FCC	20P
23	BACK SOL.	EI	6P
24	CUE LED PCB	EI	6P
25	EXT CONECTION PCB(CN5)	EI	12P
26	EXT CONECTION PCB(CN10)	KEL FCC	40P
27	ROLLER TACHO	EI	4P
28	TAPE TIMER	KEL FCC	50P
29	EXT CONECTION PCB(CN10)	KEL FCC	26P
30	AUDIO AMP MOTHER	KEL FCC	30P
31	SHIELD PHOTO UP & DOWN	EI	8P
32	EXT CONECTION PCB(CN10)	EI	9P
33	T. SUP SOL	EI	6P
34	SHIELD DRIVE	EI	3P
50	SUB PANEL PCB(REMOTE)	EI	12P
51	〃	EI	12P
53	J4 CONNECTOR	EI	3P
54	J3 〃	EI	3P
55	SUB PANEL PCB	EI	7P
56	SUB PANEL (VITC)	EI	7P
57		EI	6P
58	J1 & J2 (COMP VIDEO)	EI	2P
59	SUB PANEL (RS-232C)	EI	7P
60	REEL SIZE and END DETECT PCB	EI	9P
61		EI	3P
62		EI	4P

※ N.C ; NON CONNECTION

MTR-90II-EC-101

OTARI [illegible] Electric Co.,Ltd

NAME MOTHER II

PART No. PE:?:DOA

DWG No. 3 . 15376

3 . 15376

3.1.2 Time Code Levels on Tape

The Time Code should be recorded on the Slave tape for the MTR-90II at approximately (-6)VU referenced to 250 nWb/m.

The Time Code from the output of the appropriate channel of the Slave (MTR-90 II) should be connected to the Slave Time Code Input using a short XL to XL cable. Time Code from the Master should be connected to the Master Time Code Input XLR.

3.2.1 "Waking Up" and Enabling the EC-101

When first turning On the power to the Synchronizer (MTR-90II), it displays the software Version number briefly (about 3 seconds) and then the display blanks.

The EC-101 must first "learn" the type of Time Code being used before it an be enabled. To teach the EC-101 what type of Time Code is being used:

1. Play the Master tape (with Time Code) for about 5 seconds. The left digits will display the Master Time Code frame rate.

2. Play the Slave tape for about 5 seconds. The right digits will display the Slave Time Code frame rate.

3. Press the ENABLE button to Enable the synchronizer.

3.2.4 Entering an Offset while the tape is stopped

1. Disable the EC-101 by pressing the ENABLE button. The associated indicator will be extinguished when the unit is Disabled.

2. Press the DISPLAY MODE - SELECT button until the OFFSET indicator becomes illuminated. The INCREMENT and DIGIT SELECT indicators will be illuminated.

3. Press the DIGIT SELECT - TRIM (arrow) buttons to select the first digit to enter. Pressing the Left Arrow button first will cause the leftmost digit of the Time Display to be selected, pressing the Right Arrow button first will cause the rightmost digit to be selected. The selected digit will flash. Use the STORE - INCREMENT button to increment the displayed digit to the desired value.

4. Press the DIGIT SELECT - TRIM buttons again to select the next digit for entry. If the Tens of Hours digit is selected, the next press of the Left Arrow button toggles the "Minus" sign On and Off. If the Ones of Frames digit has been selected the next press of the Right Arrow button causes the display to Shift to Frames, Seconds, two dashes, and Subframes. The Tens of Subframes digit will be selected.

5. Repeat Steps 3 and 4 for each digit until the desired offset time is shown on the display.

3.2.5 Capturing an Offset while the tape is stopped

1. Press the ENABLE button on the CB-121 Remote Control unit to Disable the Synchronizer. The associated indicator will be extinguished.

2. Using the transport controls, move the Master tape to the desired location.

3. Using the transport controls, move the Slave tape to the desired location.

4. Press the DISPLAY-MODE SELECT button until the OFFSET indicator is illuminated.

5. Press the ENABLE and then the STORE/CLEAR/INCREMENT buttons quickly, to store the difference between the Master and Slave as the Offset. The OFFSET STORED indicator will be illuminated. If the buttons are not pressed quickly, the EC-101 will try to move the Slave to the last Master location as soon as the ENABLE button is pressed.

NOTE: If the TRIM buttons have been used, you must press the DISPLAY-MODE SELECT four times (until the offset is once again shown on the display) before the STORE button will store the offset. This prevents accidental storage of undesirable offsets.

3.2.6 Trimming an Offset while the tape is moving and locked

The EC-101 allows the offset between the two machines to be adjusted while the tape is moving.

1. With the EC-101 Enabled press the DISPLAY-MODE SELECT button until the OFFSET indicator is illuminated.

2. The STORE/CLEAR and TRIM indicators will be illuminated to indicate the function of the associated buttons.

3. Using the TRIM (left and right arrow) buttons, bring the Slave tape into the desired synchronization with the Master tape. Holding the TRIM buttons will cause the Slave tape to gain or lose time (difference) in relation to the Master tape. The longer the button is held pressed, the higher the rate of change in Slave tape speed.

4. When the Slave has reached the desired synchronization (time relationship) with the Master, the difference between Master and Slave has been stored as the offset, and the difference is automatically set to zero. The OFFSET STORED indicator will remain illuminated to indicate that the new offset has been stored.

NOTE: After the TRIM buttons have been used to modify the offset being shown on the display, you must press the DISPLAY - MODE SELECT four times (until the offset is once again shown on the display) before the STORE button will capture a new offset.

The EC-101 will retain this offset until it is changed or Cleared by holding the STORE/CLEAR button pressed for 3 seconds, or until the power to the MTR-90 II is turned Off or Reset from the front panel.