Options:_____

Date Received:_____

Software Revision:_____

AEC-BOX-8/18/28
STANDALONE LTC/VITC GENERATORS
INSTRUCTION MANUAL

ADRIENNE ELECTRONICS
CORPORATION

AEC-BOX-8:   LTC Generator with Video Sync Input

AEC-BOX-18: VITC Generator (Adder)

AEC-BOX-28: Simultaneous LTC/VITC Generator

Third Edition   January 1997

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INTRODUCTION

Adrienne Electronics Corporation (AEC) developed the AEC-BOX-8, AEC-BOX-18, and AEC-BOX-28 (collectively referred to as the AEC-BOX-8/18/28) in order to provide a low cost way of generating LTC and VITC without tying up any other equipment.

These boxes automatically sense the video input standard present (NTSC or PAL), and thus they work equally well with EBU (25fps) and SMPTE (30fps) time codes, without modification.

Longitudinal Time Code (LTC) is a specialized audio signal which contains digital time-of-day and frame count information relating to an accompanying video signal. As an audio signal, it can be recorded and played back by video and audio tape machines. LTC is used for audio/video editing, tape logging, and automation.

Vertical Interval Time Code (VITC) is typically present on two video lines in each vertical interval of a video signal. It contains the same information that LTC signals have. VITC cannot be read at high tape speeds (like LTC can), but it can be read at very slow (and even still) speeds, where LTC usually drops out.

Both time code standards have been around for many years, and are sponsored by both SMPTE (for NTSC) and the EBU (for PAL).

Related products include our PC-LTC, PC-VITC, and PC-VLTC families of LTC and VITC readers and generators for IBM PC personal computers, along with other members of the AEC-BOX family of standalone LTC, VITC, video, RS232, and RS422 interface boxes. Call us if you would like further information.

GETTING STARTED QUICKLY

If you want to use your AEC-BOX-8/18/28 right away, without reading the whole manual, just do the following:

  1) Plug the AC power cord into a suitable voltage AC outlet.
  2) If you want to generate VITC, or if you just want to lock
     LTC to video, loop a video signal through the box's BNC's.
  3) Connect "LTC OUT" (if present) to the desired destination.

The box should now be generating LTC and/or VITC (depending on what you ordered). All time code bits will start at "0" unless the EPROM has been specially set to something else for you. If the video input to the box is bad or missing, the power LED will blink off one or more times per second. If something doesn't work, you will have to carefully read the INSTALLATION, LED OPERATIONS, and/or TROUBLESHOOTING sections of this manual. Looking through the entire manual will of course enhance your use and enjoyment of this product, so is highly recommended.

AEC-BOX-8/18/28 SPECIFICATIONS

LTC GENERATOR ("LTC OUT") (AEC-BOX-8 and AEC-BOX-28 ONLY):
```
  Output Level         1Vpp typical
  DC Offset            +100mV maximum
  Output Impedance     100ohms maximum
  Load Impedance       600ohms minimum
  Bits Written         ALL time, user, and embedded bits.
  Time Code Standard   SMPTE/EBU determined by video input
                       (automatically) or by internal switch.
  Color Framing        Not guaranteed.
  Alignment with Video Well within SMPTE/EBU specifications.
  Stability & Symmetry Well within SMPTE/EBU specifications.
```


VIDEO REFERENCE ("SYNC IN") (AEC-BOX-8 ONLY):
```
  Impedance            6kohms typical (Hi-Z)
  Input Level          0.8Vpp to 4.4Vpp (1Vpp nominal)
  DC Offset            +5.0V maximum
  Looping Response     +0.1db maximum, 0-5MHz
  Video Frequency      Must be within 1% of nominal NTSC or PAL.
```


VITC GENERATOR ("VITC ADD") (AEC-BOX-18 and AEC-BOX-28 ONLY):
```
  Impedance            6kohms typical (Hi-Z)
  Input Level          0.8Vpp to 2.2Vpp (1Vpp nominal)
  Input DC Offset      +1.0V maximum
  Looping Response     +0.1db maximum, 0-5MHz
  Video Frequency      Must be within 1% of nominal NTSC or PAL.
  Pulse Shapes         Comply with SMPTE/EBU specifications.
  Bits Written         ALL time, user, and embedded bits.
  Line Selection       Determined by internal switches or EPROM.
  Line Content         Must be blank (black) before addition.
  Time Code Standard   SMPTE/EBU automatically selected.
  Color Framing        Not guaranteed.
```


DIGITAL INPUTS:
```
  Pulse Width          50ms minimum, active low
  Input Low Voltage    0.5V maximum @ 0.5mA
  Input High Voltage   2.5V minimum (will float high)
```


MISCELLANEOUS:
```
  Box Dimensions (2)   16cm wide x 5cm high x 21cm long
  Box Weight           1.0kg
  Power Consumption    4W
  Temperature Range    0 to 50 degrees Centigrade
  Relative Humidity    Up to 95%, noncondensing
```


Notes:
(1) All specifications are subject to change without notice.
(2) Allow at least 6cm in rear for cables and connectors.

"LTC OUT" CONNECTION:
If the LTC generator is installed, RCA jack J5 is the low impedance (100ohm maximum) LTC output ("LTC OUT") connector. Typically it should be connected to the "TIME CODE INPUT" jack on the back of a VTR (can alternatively be connected to an audio input on the VTR). Note that J5's outer conductor is connected to frame ground (the box chassis).

LTC GENERATOR FREQUENCY REFERENCE:
If the LTC generator is installed, you should provide a stable video sync reference if you want its time to properly track the clock on the wall (real time) or an associated video signal. Otherwise the LTC generator will freerun with 0.1% maximum frequency error (off by up to 3.6 seconds per hour).

"SYNC IN" CONNECTION (AEC-BOX-8 ONLY):
It is not mandatory that you provide a video sync reference for the LTC generator, but it is usually a good idea to do so (see above). Simply connect the video reference signal to either of the two "SYNC IN" BNC connectors on the AEC-BOX-8. These two connectors are wired directly together, and have negligible effect on the video signal (see specifications), so it doesn't matter which one is the "input", and you can loop the video signal elsewhere if needed. A normal 1Vpp video or color black signal is normally used for the reference, but the box will also work fine with unterminated (2Vpp) and sync only (4Vpp) signals.

LTC/VITC DROP FRAME TIME CODES:
If an NTSC color signal (29.97fps) is connected to the AEC-BOX-8/18/28, and you want the generator time to match the clock on the wall (real time), be sure to set DIP switch segment 7 high inside the box (see page 10). Otherwise the LTC/VITC generator time will be off by about 3.6 seconds per hour.

"VITC ADD" CONNECTION (AEC-BOX-18 and AEC-BOX-28 ONLY):
If the VITC adder (generator) is installed, you should loop your
video signal through the two "VITC ADD" BNC connectors BEFORE
going to the destination (typically the "VIDEO INPUT" on a VTR).
These two "VITC ADD" connectors are wired together, and have
negligible effect on the video signal (see specifications).   It
is always assumed that the looping video signal level is 1Vpp,
with low DC offset, and that the video cable is properly
terminated with 75ohms both at the video source and at the
destination (which may have an internal termination).   If you
have an AEC-BOX-28, this video signal also serves as the video
sync reference for the LTC generator, and VITC will always be
added to your video signal (like it or not).

"OPTIONS" CONNECTOR:
This 9-pin D connector, which has "socket" type contacts, is used
to enable several optional features. These pins can be left open
(inactive) if you don't have any need for them. The following
chart indicates the present pinout of this connector:

Pin #	Function
1	GROUND
2	-HOLD
3	
4	
5	
6	GROUND
7	-RESET
8	
9	

Notes:
1) Mating connectors should use "pin" type contacts.
2) Tiny pin numbers are molded into the connector face.
   Be careful not to be "off by one".
3) See page 17 for a description of what these pins do.

AC INPUT VOLTAGE RANGE SELECTION

Normally all AEC-BOX's are shipped with the transformer primary
wired for 100-130VAC. Your box will bear a special marking if it
has been wired for 200-260VAC instead. For your own safety,
PLEASE do not proceed unless the line cord has been unplugged!
Just turning off a power switch somewhere is not sufficient!

                        *** WARNING ***

          NEVER OPEN UP THE BOX unless the line cord has
          been unplugged from its AC power source!   To
          do otherwise risks damage to your AEC-BOX, and
          could   even KILL you! We cannot   assume
          responsibility for such careless behavior.

Box Cover Removal:
First you must UNPLUG the AC power cord, remove all other cables,
then remove the bottom cover as follows:
    1) Use a small (#1) Phillips screwdriver to remove the two
       small black screws which are on each side of the box.
    2) Slide off the front and back black plastic bezels.
    3) Turn the box over, then lift off the BOTTOM cover.
Note that you are now exposing yourself to a severe (FATAL) shock
hazard if the box is still plugged in to an AC power source!

Voltage Strap Modification for 200-260VAC:
In the area underneath power transformer T1, you will find four
large holes in a row, with "115V" and "230V" markings adjacent.
Using sharp nosed cutters, or some other appropriate tool, cut
out at least 2mm of the narrow trace next to each of the "115V"
markings. Then solder a short wire between the two holes closest
to the "230V" marking, being careful not to poke the ends of the
wire too far into the holes (could damage power transformer T1).
Also make sure that the wire you added is flush with the bottom
of the board, and will not even come close to touching to bottom
of the box.

Voltage Strap Modification for 100-130VAC:
In the area underneath power transformer T1, you will find four
large holes in a row, with "115V" and "230V" markings adjacent.
Remove the wire between the two holes closest to the "230V"
marking.   Then solder a short wire between each pair of holes
closest to the "115V" markings, being careful not to poke the
ends of the wire too far into the holes (could damage power
transformer T1). Also make sure that the two wires you added are
flush with the bottom of the board, and will not even come close
to touching to bottom of the box.

Box Cover Replacement:
Basically, just follow the earlier instructions in reverse order
(power to the box must be OFF):
  1) Put the bottom cover back in place.
  2) Slide a black plastic bezel onto each end of the unit. The
     box looks better if the two small molding marks are facing
     towards the bottom of the unit.
  3) Reattach the bezels to the chassis with the four small
     black screws you removed earlier. Be careful not to strip
     the threads in the aluminum side extrusions!

Label The Box:
Change the markings on the rear panel as necessary to reflect the
AC voltage that the box is wired to accept, so that the next
person to use this AEC-BOX (possibly yourself) will know what AC
power input voltage it expects to see.

Label The Line Cord:
Attach a small label to the plug end of the line cord, so that
the next person to use this AEC-BOX will know what AC power input
voltage it expects to see.

Test Your Work:
BEFORE connecting any cables to the box, plug it in to the
appropriate AC power source and make sure it works (no smoke).

INSTALLING YOUR OWN AC POWER LINE PLUG

If the plug on the end of the AC line cord is not suitable, you
can cut it off and put on your own. Where possible, please wire
the new plug as follows:
  1) Green = Ground (Chassis)
  2) Blue   = Neutral
  3) Brown = Hot
In no case should the green wire be connected to anything but
ground! Use a continuity tester to verify that the ground lug on
your new power cord is connected directly to the AEC-BOX chassis.

Box Cover Removal:
First you must UNPLUG the AC power cord, remove all other cables,
then remove the top cover as follows:
    1) Use a small (#1) Phillips screwdriver to remove the two
       small black screws which are on each side of the box.
    2) Slide off the front and back black plastic bezels.
    3) Lift off the top cover.
Note that the bottom cover will fall off easily at this point,
exposing you to a severe (FATAL) shock hazard if the box is
still plugged in to an AC power source!

                        *** WARNING ***

            NEVER OPEN UP THE BOX unless the line cord has
            been unplugged from its AC power source!   To
            do otherwise risks damage to your AEC-BOX, and
            could   even KILL you! We cannot   assume
            responsibility for such careless behavior.

Changing DIP Switch (SW1) Settings:
Note that the switches are numbered 1 through 8. Also note the
small "1" and "0" numbers down on the PCB next to the ends of
SW1.   To set a switch to be a "1", simply press down on the "1"
(OPEN) end of that switch. Conversely, to set a switch to be a
"0", simply press down on the "0" end of that switch. All done!

DIP Switch Functionality:

    Switch   Function
       8   NTSC/SMPTE(0) or PAL/EBU(1) Power-On Default
       7   Non-Drop-Frame(0) or Drop-Frame(1) Time Code
       6   0 (reserved)
       5   VITC Line MSB
       4   :   :   :
       3   :   :   :
       2   :   :   :
       1   VITC Line LSB

NTSC/SMPTE vs. PAL/EBU Power-On Default Selection:
When the box is first powered up, or following any other type of
microcomputer reset, this switch determines which video and time
code standards to use INITIALLY. The box will at all times
switch modes (within 5 frames) to match the incoming video
standard, regardless of this switch setting, so its position is
usually unimportant. Useful primarily for cases where there is
no (or may accidentally be no) video input to the box.

Non-Drop-Frame (NDF) vs. Drop-Frame (DF) Selection:
Currently has no effect (is not applicable) for the PAL/EBU case.
For the NTSC/SMPTE case, determines whether or not to skip (drop)
frame counts occasionally, per the SMPTE specification, so that
the time code will track "real time" fairly closely.   See the
INSTALLATION section on page 6 for further details, if needed.

VITC Line Selection:
Switch segments 5(MSB) through 1(LSB) select the first video line
number onto which VITC is to be recorded (binary 0-31).   The
second video line number will automatically be higher by 2
counts.   Invalid numbers are automatically moved to the closest
valid number.   If all five switches are 0, the EPROM settings
(which default to 14 and 16 decimal) are used instead. For more
details on VITC line selection, refer to the VITC GENERATOR
OPERATIONS on page 15, and/or EPROM MODIFICATIONS on page 12.

Factory Default Setting:
Unless you requested otherwise, the factory default setting is
NTSC/SMPTE and Non-Drop-Frame (NDF), with VITC lines 14 and 16
selected (EPROM default), so SW1 will normally be 00000000 for
switches 8-1, respectively.

Box Cover Replacement:
Basically, just follow the earlier instructions in reverse order
(power to the box must be OFF):
  1) Put the top cover back in place.
  2) Slide a black plastic bezel onto each end of the unit. The
     box looks better if the two small molding marks are facing
     towards the bottom of the unit.
  3) Reattach the bezels to the chassis with the four small
     black screws you removed earlier. Be careful not to strip
     the threads in the aluminum side extrusions!

AEC-BOX-8/18/28 EPROM MODIFICATIONS

Several box characteristics can be tailored to your specific application by modifying the EPROM in the box. Whatever is stored in the EPROM becomes the new power-on default.

Please note that should you make these EPROM modifications, you are largely on your own. We cannot analyze your EPROM's for wrong data, wrong addresses, wrong checksum, creating weird combinations of features, and things of that sort.

The proper procedure for making EPROM modifications is:
1) In the chart on the next page, indicate the changes to be made. This is necessary for debugging and technical support reasons.
2) Obtain a blank 27256 type EPROM (note programming voltage!).
3) Copy the entire AEC-BOX EPROM into your EPROM programmer. Save the original EPROM in case your application changes, or in case your EPROM modifications don't work.
4) Using the EPROM programmer, make changes as desired. Make sure the data in the byte you are changing matches the default values shown in the table on the next page.
5) Be sure to calculate and save the new checksum byte.
6) Program your new AEC-BOX-8/18/28 EPROM.
7) Install the new EPROM, then turn on the box. If the LED fails to come on, you probably have a checksum error. You may also have modified something you shouldn't have.

*** IMPORTANT ***

You are authorized to copy and make changes to the firmware (EPROM) for this product only for the memory locations described on the next page. Any other copies or changes constitute an infringement of our copyright (and probably won't work either).

```
Address        Description           Default Value    New Value
 0062h     VITC Generator 1st Line #     0Eh(14d)     _____
 0063h     VITC Generator 2nd Line #     10h(16d)     _____
           (see page 15)

 0067h     Starting Embedded Bits:         00h        _____
           Bit 7 = 0 (reserved)
           Bit 6 = 0 (reserved)
           Bit 5 = Hours Bit 7
           Bit 4 = Hours Bit 6
           Bit 3 = Minutes Bit 7
           Bit 2 = Seconds Bit 7
           Bit 1 = Frames Bit 7  (color frame bit)
           Bit 0 = Frames Bit 6  (SMPTE drop frame bit)
           (these bits get mixed in with the time bits)
           (refer to the SMPTE/EBU standards if needed)

 0068h     Starting Time Bits Frames       00h        _____
 0069h     Starting Time Bits Seconds      00h        _____
 006Ah     Starting Time Bits Minutes      00h        _____
 006Bh     Starting Time Bits Hours        00h        _____

 006Ch     Starting User Bits Frames       00h        _____
 006Dh     Starting User Bits Seconds      00h        _____
 006Eh     Starting User Bits Minutes      00h        _____
 006Fh     Starting User Bits Hours        00h        _____

 7FFFh     Checksum Byte (2)               ??h        _____
```

NOTES:
1) Time bit and user bit data bytes are all packed BCD format.
2) The checksum is chosen so that the single byte sum of ALL of
   the bytes in the EPROM is 00h.

LTC GENERATOR OPERATIONS

This section only applies if the LTC generator is installed. The
LTC output signal appears at the "LTC OUT" RCA jack (J5).

The LTC generator begins with the starting time, user, and
embedded bits found in the EPROM (normally all 0's), then
continuously counts upwards from there until you turn it off.
The LTC phase bit is properly calculated every frame to eliminate
DC content and to allow for simple LTC parity error detection.

If a video sync reference input is present, the LTC output will
automatically be properly synchronized with it. Otherwise, the
LTC output will slowly drift with respect to real time and video
signals, possibly leading to usage problems later. Refer to the
LTC GENERATOR FREQUENCY REFERENCE discussion on page 6 for
further details on LTC/video/clock synchronization.

If a video sync reference dropout occurs, the LTC generator will
keep going at nominal rate until the video sync reference
returns, then will slide smoothly and quickly back   into
alignment.   Thus no counts will be added or lost even if there
are severe video sync reference problems.

VTR RECORDING/DUBBING INSTRUCTIONS

If you are recording LTC/VITC onto a new videotape, first connect
the LTC output of our box to the "TIME CODE INPUT" (or one of the
audio inputs) on the tape machine. Then connect the source video
signal to one of the BNC's on our box, and then use another cable
(ideally no more than 3m long) to connect the other BNC on our
box to the "VIDEO INPUT" on the tape machine. It's best to
terminate the video signal with 75ohms right at the tape machine,
either with a terminator plug or with a VTR's   built-in
termination.   The VTR should then be placed into RECORD so that
all channels get properly recorded.

If you are adding LTC to a videotape which already has a video
signal on it, be sure to connect the video OUTPUT from the VTR to
the BNC's on our box to ensure that our box's LTC output will be
properly phased with the video signal. Our box's LTC output
("LTC OUT") is then normally connected to the "TIME CODE INPUT"
jack on the back of the VTR, or can just as well be recorded over
one of the audio channels. Obviously the VTR should be put into
some kind of special record mode which changes the desired time
code or audio track, but doesn't alter the video signal.

It is impossible to add VITC to a videotape which already has the
desired video on it unless you have a very expensive digital
video tape machine with "pre-read" capability.   Otherwise you
must dub the video to another tape to add VITC.

VITC GENERATOR OPERATIONS

This section only applies if the VITC generator is installed.

The VITC data will be added to the video signal which is present
at the "VITC ADD" BNC connectors. Note that the lines onto which
VITC is to be added MUST BE BLANK (black) in order for things to
work properly. If the incoming video signal drops out, the VITC
generator will keep counting upwards so that the proper data will
be added when the video signal resumes (remains "real time").

The VITC generator begins with the starting time, user, and
embedded bits found in the EPROM (normally all 0's), then
continuously counts upwards from there until you turn it off.
The VITC field ID bit and CRC byte are also automatically and
properly updated every video field.

Normally VITC is added onto two nonadjacent video lines in each
vertical interval (such as our default of 14 and 16 decimal).
This provides redundancy in the event of a glitch in the video
signal during playback. The lines to be used are determined by
internal DIP switch settings (see page 10) or by EPROM data if
internal DIP switches 5-1 are all 0's (see page 13).

If internal DIP switches 5-1 are used, their binary equivalent
(1-31) selects the first line. Our software then always adds two
counts to this number for the second line.

If the EPROM is used to select the line numbers, any valid number
can be chosen for either line (10-22 for NTSC, 6-26 for PAL).
However, the second line number must always be greater than or
equal to the first line number. Only a single line of VITC will
be generated if you load a single line number into EPROM
locations 0062h and 0063h (give both the same number).

In all cases, our software moves the VITC line numbers to the
nearest valid line numbers if needed.

By definition, the VITC generator output is always perfectly
synchronized with the video signal it is being added to, so there
are no possible drift problems as there are with LTC.

Throughout the following discussion you may want to refer to the
AEC-BOX-8/18/28 schematics which are in the back of this manual.
If your box has been customized in any way for your application,
or if your box does not have all possible features installed,
then the descriptions below may not be entirely accurate.

The power supply primary side comprises power transformer T1 and
thermal "fuse" device F1. Of special note is the fact that this
"fuse" does not burn out. If it trips, turn the power OFF for
one minute to let it cool/reset, then turn the power back on.
The power supply secondary side starts with full wave rectifier
DB1, plus large filter capacitors C51 and C52.   The resulting
unregulated DC supply is then passed through voltage regulator
U21(+5V). Zener diodes D18 and D19 protect against overvoltages.
These zeners may short out (fail safe) if overstressed too long.

The box's video sync reference is taken from the two "SYNC IN" or
"VITC ADD" BNC's. Video signals may be looped through the box
with negligible losses, as the BNC's are wired directly to each
other, and the attached circuitry is high impedance. The video
reference signal is DC shifted by C39, then passes through 3-pole
low pass filter R15, C38, L1, and C37, with buffer   Q7.
Transistor Q6 is turned on by each negative sync tip, and thus
generates horizontal sync pulses which are fed to U7 pin 1.   Low
pass filter RN11D, R12, and C36 only allow Q5's collector to go
low during vertical reset pulses.

If the LTC generator is installed, microcomputer (U7) pin 7
drives Q2 on and off as needed to create the desired biphase
coded data pattern. RN9A and C30 create the required sloped
edges, and D12 and D13 limit the amplitude. Buffer transistors
Q4 and Q3 drive the output via AC coupling capacitor C27.   RCA
jack J5 provides the output connection.

If the VITC generator (adder) is installed, pin 26 of proprietary
VITC chip U8 directs current pulses to the "VITC ADD" output
BNC's via current switch Q10, Q11. Assuming that the video
signal being looped through these BNC's is properly terminated,
and assuming that the vertical interval lines are previously
"blank", a well shaped VITC signal will then be added to the
desired vertical interval lines of the video signal.

Microcomputer U7, together with address latch U3 and EPROM U5,
form a completely self contained (but miniature) computer system.
DIP switch SW1 allows easy modification of the default time code
standard, VITC line numbers, and other features. A "watch dog"
timer inside the microcomputer chip resets everything if the
software crashes for some reason. The low voltage detection
circuit centered about Q14 also resets the microcomputer during
power up, power down, and low supply voltage ("brownout")
conditions.

"-HOLD" AND "-RESET" DIGITAL INPUT OPERATIONS

These two digital inputs were added to the standard AEC-BOX-8/18/28 in January 1995, due to numerous requests.

The "-HOLD" input, when taken low, temporarily holds the generator count stationary. Counting resumes as soon as the -HOLD input is released. Throughout the "hold" period, the LTC/VITC generator outputs remain active, repeating the same data over and over again until the -HOLD input is released.

The "-RESET" input, when taken low, resets the generator count to 00:00:00:00. Counting resumes as soon as the -RESET input is released. Throughout the "reset" period, the LTC/VITC generator outputs remain active, repeating the same data over and over again until the -RESET input is released.

The -HOLD and -RESET inputs are sampled only once per frame, so must be held LOW long enough to guarantee that they will be detected. We recommend a 50ms minimum pulse width on the -HOLD and -RESET inputs.

The -HOLD and -RESET inputs have internal pullups to +5V, so they default to the high (inactive) state if left open.

The -HOLD and -RESET inputs can be driven by TTL, CMOS, open collector, or switch closures to ground. See page 7 of this manual for the "OPTIONS" connector pinout.

The so called "POWER" LED on the front of the box behaves in a
variety of ways so that you can have some clues as to what is (or
is not) going on inside the box.

When power is first turned on, a hardware reset circuit forces
the LED to blink ON for a short (barely noticeable) time.   If
this fails to happen, there is something seriously wrong with the
power supply or LED. Check the TROUBLESHOOTING section on page
19 for details.

If the LED blinks on initially, but then fails to come on any
more, there must be some kind of hardware/software problem. This
condition usually indicates an EPROM checksum error caused by
improper user modifications. See the EPROM MODIFICATIONS section
on page 12 for details.

Thereafter, if the LED blinks OFF for about 58ms (very short),
the box is working OK, but it is indicating that the video signal
coming into the box is missing (one blink per second) or contains
sync pulse timing errors (one blink per error).

Since the box automatically adapts itself to both NTSC and PAL
standard video signals, such blinking does not indicate a box
setup problem.   In all cases the box expects to see a high
quality (and stable) video input signal.

This blinking is normal and can be ignored if you are using the
AEC-BOX-8 or AEC-BOX-28 to generate LTC without a video sync
input (will freerun instead).

Note that no matter how many video input errors are detected, the
LED will always come on at least once per second. This way you
will know that the power supply is OK.

If the "POWER" LED stays on all the time, everything must be
running perfectly, and you can go read something else.

This guide lists anticipated problems and their solutions.   If
you really get stuck, call our Service Department.

Problem #1:   Power LED does not blink ON when power is applied:
Solutions : a) Check for presence of external AC power source.
             b) Make sure AC voltage agrees with box wiring.
             c) Leave off for 1 minute, then turn back on.
                PTC "fuse" will then be cooled and reset.
             d) Fix broken LED wiring.
             e) Return AEC-BOX for power supply repairs.

Problem #2:   Power LED blinks ON initially, then stays off:
Solutions : a) May be an EPROM checksum error. If you have
                modified the EPROM, the checksum byte may be
                wrong. See the EPROM MODIFICATIONS section.
             b) Return AEC-BOX for repairs.

Problem #3:   Power LED blinks OFF during operations:
Solutions : a) See the LED OPERATIONS section of this manual.
                Something is wrong with the video signal.

Problem #4:   Box isn't generating LTC.
Solutions : a) Check for shorted/open cable, fittings, etc..
             b) Check your cable for miswired XLR connector.
             c) Use AC voltmeter (or oscilloscope) to measure
                the voltage on the center conductor of the RCA
                jack. Should be about 1Vpp (0.35Vrms).
             d) Get an LTC reader that works.

Problem #5:   Box isn't generating VITC.
Solutions : a) Turn on your video signal generator, camera, etc..
             b) Check for shorted/open cables, fittings, etc..
             c) AEC-BOX-8 doesn't generate VITC.
             d) Roll down (or underscan) your monitor to see the
                little white dots and dashes (VITC) moving on two
                separate lines in the vertical interval.
             e) Check VITC line selection (switches or EPROM).
             f) Incoming video lines must be blank (black).
             g) Reduce the incoming video DC offset (too high).
             h) Use a better quality video input signal.
             i) Get a VITC reader that works.

Problem #6:   Some time code counts are missing:
Solutions : a) SMPTE drop frame counting eliminates some counts.
             b) Use a better quality video input signal.
             c) Use a higher quality tape and/or VTR which does
                not have any dropouts, bit errors, etc..

WARRANTY REGISTRATION

We no longer have a formal warranty registration procedure, but
do like to keep in touch with our end users. If you did not
purchase this product directly from us, please copy the User
Feedback Request form in the back of this manual, fill it out,
then fax or mail it back to us. This way we will know who and
where you are and be able to provide you with the following:
     1) product upgrade and and bug reports,
     2) manual updates and application notes,
     3) safety/recall notices, and
     4) better service in many other ways.

OUR WARRANTY

For the first two years following the shipment of an AEC product,
we will repair or replace, at our option, any such product which
is found to be inoperative due to defects in materials or
workmanship.   Not covered is damage due to unusual electrical
and/or physical abuse. Altered hardware, software, labels, or
other identifying marks may also void the warranty.

GENERAL GUIDELINES

Before sending a product back to us for service, please do the
following (we've found over 90% of returned items work fine):
  1) Check the "Troubleshooting Guide" in this manual.
  2) Call our Service Department for assistance if needed.
  3) Obtain our current return address, and possibly an RMA
     number, before shipping anything back to us.
  4) Package the unit carefully before shipping it (it's yours).

WARRANTY SERVICE PROCEDURES

All you have to do is call our Service Department and describe
the nature of the problem.   We will attempt to fix it over the
phone, but if that doesn't work we will give you an RMA number
and you can ship the defective product back to us.   We will
repair or replace the product and return it to you as soon as
possible.

OUT-OF-WARRANTY SERVICE PROCEDURES

If the two year warranty period has expired, or if the product
has been altered or damaged, we will repair the product for a
charge to be agreed upon before the repairs are begun. Call our
Service Department for assistance. We have the test equipment,
parts, and experience to quickly find and fix any problems.

NUMBER SYSTEM CONVERSION TABLE

This chart will help you make conversions between the various
numbering systems which are used in this manual.

    Hexadecimal   (MSB) Binary (LSB)   Decimal   BCD
----
        0   0 0 0 0   0   0
        1   0 0 0 1   1   1
        2   0 0 1 0   2   2
        3   0 0 1 1   3   3
        4   0 1 0 0   4   4
        5   0 1 0 1   5   5
        6   0 1 1 0   6   6
        7   0 1 1 1   7   7
        8   1 0 0 0   8   8
        9   1 0 0 1   9   9
        A   1 0 1 0   10   invalid
        B   1 0 1 1   11   invalid
        C   1 1 0 0   12   invalid
        D   1 1 0 1   13   invalid
        E   1 1 1 0   14   invalid
        F   1 1 1 1   15   invalid

      (base 16)   (base 2)   (base 10)

        (BCD is an abbreviation for "Binary Coded Decimal")

PACKED BCD NUMBERS

A "packed BCD" byte contains two BCD digits in an 8-bit byte.
Bits 7-4 (upper nibble) contain the upper BCD digit, and bits 3-0
(lower nibble) contain the lower BCD digit.

For example, incrementing BINARY 09h leaves you with 0Ah, but
incrementing PACKED BCD 09h leaves you with 10h. A packed BCD
number such as 0Ah would be invalid, because "A" is not a valid
BCD digit.

Here is one more example, showing the packed BCD format as used
for time bits I/O. The 30 second (half minute) mark would be
read (or written) as a 30h byte, even though 30 decimal is the
same as binary 1Eh.

WHERE/HOW TO ORDER COPIES OF STANDARDS

We suggest that you fax, call, or write the organizations below
for current prices and ordering/payment procedures. Due to
copyright restrictions, we cannot provide standards copies for
you.   It takes some of these organizations up to 2 months to
respond, so plan ahead. Also, please let us know if you find
anything on this page which needs updating. Thanks.

SMPTE Engineering Standards Service
595 West Hartsdale Avenue
White Plains, NY 10607
U.S.A.
Tel: +1-914-761-1100   Fax: +1-914-761-3115
1) SMPTE 207M-1992   ESbus Electrical/Mechanical $16.00
2) SMPTE RP113-1992   ESbus Supervisory Protocol $16.00
3) SMPTE RP138-1992   ESbus Control Message Architecture $13.00
4) SMPTE RP139-1992   ESbus Tributary Interconnection $16.00
5) SMPTE RP163-1992   ESbus System Service Messages $16.00
6) SMPTE RP170-1993   ESbus VTR-Specific Messages $24.00
7) SMPTE RP172-1993   ESbus Common Messages $18.00
8) SMPTE 12M-1986   Time and Control Code for Television $16.00
9) SMPTE 262M   Data Storage & Trans. - Binary Groups $13.00
A) SMPTE RP159-1991   VITC and LTC Relationship $10.00
B) SMPTE RP164-1992   Location of VITC $10.00

European Broadcasting Union (EBU)
Technical Department
Case Postale 67
CH-1218 Grand-Saconnex/Geneve
SWITZERLAND
Tel: +41-22-717.21.11   Fax: +41-22-717.24.81
You must order the "Annual Volume of EBU Official Technical
Texts",
which (for 250 Swiss Francs) includes the following:
1) N12   Time & Control Codes for Television
2) N18   Relationship Between Time Code and PAL 8-Field Sequence
3) I29   Recording of Information in User Bits

Telecommunications Industry Association (TIA)
(formerly part of Electronic Industries Association - EIA)
2500 Wilson Blvd.
Arlington, VA 22201
U.S.A.
Tel: +1-703-907-7700   Fax: +1-703-907-7727
These standards are sold only by Global Engineering Documents:
Tel: 1-800-854-7179   Tel: +1-303-397-2573   Fax: +1-303-397-2740
1) TIA/EIA Standard RS232-E $49.00
2) TIA/EIA Standard RS422-A $51.00
3) TIA/EIA Standard RS485 $60.00