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Software Revision:_____

AEC-BOX-89
PARALLEL ADAPTER FOR SERIAL REMOTE VTR'S
INSTRUCTION MANUAL

ADRIENNE ELECTRONICS
CORPORATION

Second Edition January 1997

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*** FCC NOTICE ***

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

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INTRODUCTION

Adrienne Electronics Corporation (AEC) developed the AEC-BOX-89 in order to provide a simple and low cost way of controlling serial remote video tape machines with parallel machine control systems, or more simply with pushbutton or relay closures. The box monitors the parallel inputs, sends the appropriate commands to the tape machine, and keeps the tally outputs up to date.

The AEC-BOX-89 parallel inputs are active low, with 10kohm resistor pull-ups to an internal +5V supply. They can be driven by relay closures, pushbuttons, open collectors, 5V logic signals, etc.. Basic functions such as PLAY, PAUS, STOP, FFWD, REWD, and RECD are implemented.

The parallel outputs are open collector active low, with 10kohm resistor pull-ups to +5V, capable of sinking up to 20mA. This is sufficient for driving LED's, optoisolators, and logic gates.

A 100mA, +5V output from the box provides power for turning on LED's or optoisolators in conjunction with the active low parallel output lines.

The AEC-BOX-89 can be customized, if needed, to adapt to other VTR protocols and/or to implement other commands. Please let us know if you need something a little different, or if you come up with any ideas on how to improve the existing product.

GETTING STARTED QUICKLY

If you want to use your AEC-BOX-89 right away, without reading the whole manual, just do the following:

1) Plug the AC power cord into a suitable voltage AC outlet.
2) Use a serial data cable to connect the 9-pin RS232/RS422 "D" connector (on the box) to your VTR. Note that this connector has a standard 9-pin RS422 pinout, but has a NONSTANDARD RS232 PINOUT (is NOT the same as IBM PC/AT's).
3) Pull parallel input pins 1-6 and 20-21 to GND to make the tape machine PLAY, STOP, etc., as outlined on page 7.

If communications with the VTR are not established, the "STATUS" LED will blink OFF periodically. If something doesn't work, you will have to carefully read the INSTALLATION, LED OPERATIONS, and/or TROUBLESHOOTING sections of this manual. Looking through this entire manual will enhance your use and enjoyment of this product, and is thus highly recommended.

AEC-BOX-89 SPECIFICATIONS

PARALLEL INPUTS:

Impedance	10kohms to +5V typical
Logic LOW Level	+0.8V maximum
Logic HIGH Level	+2.4V minimum
Polarity	Active LOW
Pulse Width	30ms minimum, no maximum
Response Time (2)	50ms maximum

PARALLEL OUTPUTS:

Impedance	10kohms to +5V typical
Logic LOW Level	+0.4V maximum @ -20mA
Logic HIGH Level	+4.0V minimum @ 50uA
Polarity	Active LOW
Response Time (3)	50ms maximum

TALLY SUPPLY OUTPUT:

Output Voltage	+4.5V to +5.5V
Output Current	100mA maximum

MISCELLANEOUS:

Box Dimensions (4)	16cm wide x 5cm high x 21cm long
Box Weight	1.2kg
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) Time from input LOW to VTR command message complete.
(3) Time from VTR status change to outputs valid.
(4) Allow at least 6cm front and rear for cables and connectors.

RS422 SERIAL CONNECTION "TO VTR":
This 9-pin D connector has the same pinout as is found on most VTR CONTROLLERS. Thus a standard 9-pin RS422 cable with no crossed lines will make the proper connection to the VTR. If you are making your own RS422 cable, the following chart indicates the pinout of this connector:

Pin #	Function
1	Chassis GND
2	RX422-
3	TX422+
4	Transmit GND
5	------
6	Receive GND
7	RX422+
8	TX422-
9	Chassis GND

Notes:
1) Tiny pin numbers are molded into the connector face.
   Be careful not to be "off by one".
2) The pinout is that of an ESbus CONTROLLER.

RS232 SERIAL CONNECTION "TO VTR":
This 9-pin D connector has a NONSTANDARD RS232 PINOUT (is NOT the same as found on IBM PC/AT's). Thus A CUSTOM RS232 CABLE IS REQUIRED to make the proper connection to a VTR having a standard pinout RS232 port. We of course recommend that you purchase such a cable from us (see ordering guide in the back of this manual). If you must make your own RS232 cable, the following chart indicates the pinout of this RS232 connector:

Pin #	Function
2	Receive Data
5	Transmit Data
9	Chassis GND

Notes:
1) Tiny pin numbers are molded into the connector face.
   Be careful not to be "off by one".
2) Our transmit line should be connected to the VTR's receive
   line, and vice-versa.

PARALLEL CONTROL AND TALLY POWER CONNECTIONS:
The 37-pin D connector contains the following power/ground pins:

Pin #	Function	Mnemonic
8	Tally +5V Supply	PWR
33	Chassis Ground	GND

PARALLEL CONTROL INPUT CONNECTIONS:
The 37-pin D connector contains the following control input pins:

Pin #	Function	Mnemonic	Priority
1	-Play	PLAY	1
2	-Pause	PAUS	2
3	-Stop w. Standby ON	STOP	3
4	-Stop w. Standby OFF	STOP	4
5	-Fast Forward	FFWD	5
6	-Rewind	REWD	6
20	-Eject	EJCT	7
21	-Record	RECD	8

Notes:
1) Tiny pin numbers are molded into the connector face.
   Be careful not to be "off by one".
2) All inputs are active LOW (must pull to GND to activate).
3) If several inputs are LOW, the highest priority input will be
   used, and the rest will be ignored.

PARALLEL TALLY OUTPUT CONNECTIONS:
The 37-pin D connector contains the following tally output pins:

Pin #	Function	Notes
9	-PLAY	Goes high (off) during RECD or EDIT.
10	-PAUS	Tape not moving, yet is in playback mode.
11	-STOP	Any kind (standby status is ignored).
12	-LOCAL	VTR switch has disabled remote control.
13	-FFWD	Any forward tape motion except PLAY.
14	-REWD	Any reverse tape motion.
25	-EJCT	Also low if tape is missing.
26	-RECD	Also low during edits.

Notes:
1) Tiny pin numbers are molded into the connector face.
   Be careful not to be "off by one".
2) All outputs are active LOW (are pulled to GND when valid).

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.

AC POWER INPUT VOLTAGE RANGE SELECTION
(continued)

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.

DIP SWITCH PROGRAMMING

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	Box Protocol Bit #2
7	Box Protocol Bit #1
6	Box Protocol Bit #0
5	0 (reserved)
4	0 (reserved)
3	0 (reserved)
2	0 (reserved)
1	0 (reserved)

The three "Box Protocol" bits function as follows:

8	7	6		
0	0	1	=>	Sony Protocol Bus Monitor (listen/tally only)
0	0	0	=>	Sony Broadcast Protocol (RS422/38400/8/ODD)

Other protocols will be added as sufficient demand arises.

DIP SWITCH PROGRAMMING
(continued)

Factory Default Setting:
Unless you requested otherwise, the factory default setting is Sony Broadcast Protocol, 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!

Throughout the following discussion you may want to refer to the AEC-BOX-89 schematics which are in the back of this manual. If your box has been customized in any way for your application, 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 3 minutes 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.

A special +5V, 100mA power source is generated by the 78L05 voltage regulator in the Q13B position. This power source is brought out to J2 pin 8 where it can be used to turn on LED's, optoisolators, and other low current external devices.

Output latch U17 drives the tally output lines via open collector transistors Q26-Q33. Resistor network RN23 provides a 10kohm pull-up (to +5V) for each output line. The drivers for the tally output lines are specially designed to ensure that no RF emissions will creep out of the box through these lines.

Input buffer U20 is used by the microcomputer to read the status of the parallel input lines. These digital inputs are then debounced via software to avoid problems. Resistor network RN16 provides a 10kohm pull-up (to +5V) for each input line. Resistor networks RN20 and RN21 protect U20 against transient damage.

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 box operating modes, baud rates, and other features. A low voltage reset circuit and a watch dog timer inside U7 improve system reliability.

Serial data from microcomputer U7 is translated to RS232 levels by U2, and is translated to RS422 levels by U1. U1 also translates received RS232 and RS422 data for use by the microcomputer. Nine pin "D" connector J1 contains the RS232 and RS422 data lines.

AEC-BOX-89 GENERAL OPERATIONS OVERVIEW

The AEC-BOX-89 continuously scans, debounces, and prioritizes the parallel input lines. The priorities of the various input lines are shown in the table on page 7. If two or more input lines are being held low simultaneously, only the command message associated with the highest priority input is sent to the VTR. Command messages are sent to the VTR approximately every 20ms for as long as the associated input line is held low.

The AEC-BOX-89 also continuously obtains the VTR's status via the serial port, then sets the appropriate tally output lines low. These output lines reflect the true status returned by the VTR, even if the VTR sends contradictory information. For example, it is possible for the PLAY and STOP outputs to be low simultaneously if that's what the VTR says it is doing. We figured that if a machine is unhappy, you should know about it.

The "STATUS" LED on the front of the box will blink OFF if the box feels that something abnormal is going on. See the LED OPERATIONS section on page 14 for details.

STOP/PAUSE/STILL/STANDBY NOTES

You may have already noticed that we have provided three separate parallel inputs for stopping the tape (other than EJECT):

1) "PAUSE" or "STILL" means that the scanner is spinning, the tape tension is ON, and the video output is in playback mode. This mode is typically used just prior to entering PLAY mode, since the VTR is ready to roll immediately.

2) "STOP WITH STANDBY ON" means that the scanner is spinning, tape tension is released, and the video output is in E-E mode (although machines with TBC's may appear to be in playback). Saves tape and head wear, yet can roll fairly quickly.

3) "STOP WITH STANDBY OFF" means that the scanner is OFF, tape tension is OFF, and the video output is in E-E mode. Minimizes tape/head/scanner wear, but takes time to spin up.

There is a LOT of confusion and variation in the industry as to how machines respond to the above three serial commands. In addition, most machines will shut themselves down automatically (to save head and tape wear) after predetermined periods of inactivity. We'll leave it up to you to select the commands which are most appropriate for your situation.

AEC-BOX-89 LED OPERATIONS

The "STATUS" 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 16 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 (contact factory).

Thereafter, if the LED blinks OFF occasionally (or constantly), the box hardware is working OK, but it is indicating that there is something unusual with the serial data path or the VTR.

Failure to establish communications with a VTR, or any other serial communications errors, will result in the LED being toggled quickly for about 500ms, after which it stays ON for about 500ms. Continual VTR communication errors cause continual bursts of LED toggling, separated by about 500ms. This is the pattern you will see if you turn on the AEC-BOX-89 while it is not connected to anything (besides AC power).

If the VTR communications path is OK, but the VTR is in the LOCAL mode or the tape is missing, the LED will toggle at a steady 1Hz rate. This lets you know that the VTR isn't being controlled by the AEC-BOX-89, even though the status lines will all be valid.

If the AEC-BOX-89 senses a serial data loopback condition (TX connected to RX), it will enter the diagnostics mode. If only the serial loopback path is detected, the LED will toggle at a 4Hz rate. If parallel loopback is also detected, the LED will toggle at a faster 8Hz rate. See the DIAGNOSTICS section on page 15 for full details.

Note that no matter what is going on inside the box, the LED will always come on at least once per second. This way you will know that the power supply is OK.

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

AEC-BOX-89 DIAGNOSTICS

In our experience, whatever can go wrong will go wrong, so we have included several diagnostic routines to help you debug your system, cables, and to verify that our box is working properly:

VTR Communications Test:

If you remove all connections to your AEC-BOX-89 (except AC power), you will notice a special LED flashing pattern on the front of the box. This indicates that the box is not connected to a VTR. The VTR's power could be off, cable unplugged, cable broken, incorrect cable used, box switches set wrong, etc.. Refer to the TROUBLESHOOTING GUIDE on page 16 for details. If you connect a VTR to the box and this particular LED flashing pattern goes away, then you know that the VTR connection is OK.

VTR Not Ready Test:

If VTR communications are OK, but the tape is missing or the VTR is in LOCAL mode (remote control disabled), the box LED will toggle slowly (about 1Hz). Load a tape, and/or switch the VTR from LOCAL to REMOTE, and the box LED should no longer blink.

RS232 Serial Loopback Test:

If you think that the box's RS232 lines may be bad, disconnect all cables, then short pins 2 and 5 together on the box's 9-pin "D" connector. The box LED will toggle at 4Hz if the RS232 transmit and receive circuits are OK.

RS422 Serial Loopback Test:

If you think that the box's RS422 lines may be bad, disconnect all cables, then short pin 2 to pin 8, and short pin 3 to pin 7, on the box's 9-pin "D" connector. The box LED will toggle at 4Hz if the RS422 transmit and receive circuits are OK. If not, make sure that you are shorting the right pins to each other, as it is very easy to be "off by one".

Serial Cable Test:

Perform the appropriate serial loopback test on the far end of the serial cable you are using (short TX and RX lines together). The LED will toggle at 4Hz if the cable and box are both OK.

Parallel Inputs and Outputs Test:

First get into a serial loopback mode as described above. Then short any parallel output pin to any parallel input pin. The box LED will toggle at 8Hz (twice as fast) if the selected input/output lines are OK. For example, short pin 1 to pin 9. See page 7 for a listing of all the parallel input/output pins.

AEC-BOX-89 TROUBLESHOOTING GUIDE

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

Problem #1: Status 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 3 minutes, then turn back on. Thermal "fuse" will then be cooled and reset.
d) Fix broken LED wiring.
e) Return AEC-BOX for power supply repairs.

Problem #2: Status 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: Status LED blinks OFF during operations:
Solutions :
a) See the LED OPERATIONS section of this manual. The box is trying to tell you something.

Problem #4: Box indicates no VTR connected:
Solutions :
a) Turn on power to the VTR.
b) Make sure cable connected to both box and VTR.
c) Use the correct type of serial cable.
d) Make sure the box is set up properly for the type of VTR being controlled (see page 10).
e) Do serial loopback diagnostics to make sure the box and serial cable are both OK.

Problem #5: Status LED toggles at 1Hz (=> LOCAL or no tape):
Solutions :
a) Load a tape into the VTR.
b) Turn VTR switch from LOCAL to REMOTE.

Problem #6: Box isn't controlling the VTR:
Solutions :
a) See problems 3-5 above and their solutions.
b) Disconnect all parallel connector wiring, then short pin 1 to chassis. VTR should PLAY.
c) Check control lines going to box.
d) Remember that control inputs are active LOW.

Problem #7: Tally signals from box are incorrect:
Solutions :
a) Disconnect your wiring, then verify tally pins.
b) Check tally lines coming from box.
c) Remember that tally outputs are active LOW.
d) Some tallies include several conditions, such as ANY reverse tape movement indicates REWIND.

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.