

TCR-200

SMPTE TIME CODE

READER -GENERATOR



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INTRODUCTION

The TCR- 200 is a time code reader or generator plug-in card for ISA Bus, IBM-PC's and compatibles.

There are two modes of operation for the TCR-200:

1. It can be used with a TSR or NLM to synchronize the clock in a PC or Server to a master time code. In addition, it can be used as a SMPTE linear time code reader, under keyboard control, displaying the code on the screen as hours, minutes, seconds, and frames. The reader is compatible with all formats of the SMPTE linear time code including drop frame.
2. It can also generate time code, allowing the user to set the start time and start and stop time code generation. Time code generation can continue while other programs are executing on the PC. Another program (smptegen.exe) can be run as a background TSR to generate time code that is locked to the computer clock

THE SMPTE GENERATOR FUNCTION IS AN EXTRA COST OPTION AND MAY NOT BE INCLUDED WITH ALL CARDS.

OPERATIONAL MODES

TIME CODE READER/GENERATOR

The TCR-200 can be used as a direct Time Code reader/generator. On the support software distribution disk the program SMPTE.EXE allows the card to be used as a time code reader/generator. Running this program gives one of two menus, a reader or a generator menu. These menus can be toggled by using the F1 key. The program can be exited by using the F10 key.

Time Code Reader

When in the reader menu, the card is configured as a time code reader. At the bottom of the menu the current time code as read is displayed. If there is no time code being fed to the card, the words NO SMPTE are displayed instead.

Time Code Generator

The generator menu has several options. The generation of time code can be started and stopped with the F2 and F3 keys.

F4 allows the user to enter a new time code. If the generator is running at the time this function is selected, it will be stopped and the user can enter a new time code. The generator must then be started by pressing F2.

F5 stops the generator and presets the time code to 1:00:00/00. This is a common start time for programs that utilize time code. Starting a program at this point assures that the program will not cross 0:00:00/00, but will have some room at the beginning for adding lead-ins, etc. The generator must be started following preset by pressing F2. F6 synchronizes the time code generator to the PC clock. This makes it easy to synchronize two or more PC's to the same time. The generator starts immediately.

Note that the generator is not stopped upon exit from this program. The generator continues to operate in a background mode even after the program has been exited. The program, SMPTE program does not use interrupts.

INTERRUPTS

Interrupt setting and usage in PCs is somewhat complicated by the fact that different plug-in cards and other functions within the PC can be set to use the same interrupts. Generally this will result in erratic operation or failure of the card or system to operate.

AVAILABLE INTERRUPTS

INTERRUPTS

5	Free in ATs
7	LPT 1, first parallel or printer port
10 - 11 - 12 -15	available to all plug-in cards

PORT ADDRESS

As with interrupt, port addressing in PCs is complicated by the fact that other plug-in cards within the PC can be set to use the same port address. Generally this will result in erratic operation or failure of the card or system to operate.

DEFAULT PORT ADDRESS

The TCR-200 is tested and shipped from the factory set to port address 310h. Should it be necessary to use another address, the jumper pins located on the card can be set to other addresses.

ALTERNATE PORT ADDRESS

If an address other than 310h is used, it is necessary to enter the new address in the command line when invoking `smpteset.com`. See section below for details.

TIME CODE SYNCHRONIZER

PC TIME - WHEN UPDATED

The internal PC time (both the software and CMOS clock) will be set upon first receipt of time code, when time code is regained after being lost and thereafter once per minute at the 30 second point.

FREE-WHEELING MODE

When the source of master time code is a C&A GPS-100, an option is available to indicate the status of the GPS-100 time code signal.

Because of atmospheric and other conditions it is possible for the GPS-100 to become temporarily un-locked (un-synchronized) with the GPS satellites. When this occurs the GPS-100 will go into a “*free-wheeling*” mode whereby it continues to generate time code that is not locked to the GPS satellites. In this “*freewheel*” mode the time code will remain (under normal conditions) within < 100 ms of true time over a 24 hour period.

Upon re-acquisition of satellite signal (re synchronization with the GPS satellites) the GPS-100 will automatically revert to the “Normal”, i.e. locked mode.

The /G option will enable the display of the “GPS status: Normal” or “GPS status: Freewheel” status message.

The /G option should not be enabled unless the source of time code is a C&A GPS-100 . Use of this feature requires GPS-100 firmware version 2.2 or later.

SOFTWARE SELECTABLE OPTIONS

TCR-200 Interrupts

Description

TCR-200 interrupts 5 - 7 - 10 - 11 - 12 and 15 may be selected by jumper J4 on the card. Jumper the card correctly prior to insertion in the machine.

Default Mode

Default mode is interrupt 5

Command Line Parameter

I (or i)

Port Address

Description

Set the port address. Valid port addresses are 300, 310, 320 & 330. For setup of port address switch see Hardware Details.

Default Mode

Default port address is 310h.

Command Line Parameter

P (or p)

Setting of CMOS Clock

Description

When the TCR-200 is used to synchronize the PC clock , synchronization of the CMOS clock can be turned on or off. This entry has no effect on the setting of the software clock which will continue to be set, once per minute, at the 30 second point.

Default Mode

Default mode is normally ON (CMOS clock is set)

Command Line Parameter

D (or d) CMOS clock set disabled

Hourly Offset

Description

When receiving UTC (universal coordinated time) or time code from a different time zone, a plus or minus hourly offset can be specified. The hourly offset can be set from -11 to +12 hours.

Default Mode

Default mode is normally off

Command Line Parameter

O (or o) enable hourly offset

GPS-100 Status:

Description

The /G option will enable the display of the “*GPS status: Normal*” or “*GPS status: Freewheel*” status message.

When the /G option is enabled, the time is not set if the GPS-100 is in the *Freewheeling* mode.

The /G option should not be enabled unless the source of time code is a C&A GPS-100 .

Default Mode

Default mode - display is normally off and PC Time is set when in locked & freewheeling mode

Command Line Parameter

/G (or g) enables GPS status display and disables setting of time when GPS-100 is in freewheeling mode

Quiet Startup Option:

Description

Disable display of TSR software settings during startup

Default Mode

Default mode is normally off

Command Line Parameter

Q (or q) used to enable quiet startup feature

Date Decoding:

Description

Decode date from the time code user bits if available. This function has been validated for C&A & (some) Leitch time code generators only. It may not work with other time code sources.

Do not invoke this parameter unless you are sure that correct date information is encoded in the user bits. The TCR card could read and interpret invalid data bits as date information and cause the date of the PC clock to be set incorrectly.

Default Mode

Default mode is normally off

Command Line Parameter

L (or l) used to enable date decoding

Daylight Savings Time Adjustment:

Description

Automatically adjusts PC clock ahead one hour at 2AM on the first Sunday in April and then back one hour at 2AM on the last Sunday in October. **Use of this option *REQUIRES* the use of the date decoding option.**

Default Mode

Default mode is normally off

Command Line Parameter

T (or t) used to enable automatic daylight saving

SMPTESET.COM

The program `smpteset.com` sets the PC's clocks in accord with the above described software switches. It is invoked by the following command line:

```
smpteset /Ix/D/Pxxx/O-x/Q/L/T/G
```

where:

/Ix	= interrupt x
/D	= CMOS clock set disabled
/Pxxx	= Port Address xxx (in hex)
/Ox	= hour offset
/Q	= quiet startup
/L	= decode date - if available
/T	= enable automatic daylight saving adjustment
/G	= enable GPS-100 status display

Example:

```
smpteset /I5/D/P300/O-4/Q/L/T
```

where:

/I5	= interrupt 5
/D	= CMOS clock set disabled
/P300	= Port Address set to 300 (hex)
/O-4	= hour offset set to minus (-) 4 hours
/Q	= no display of smpteset parameters
/L	= decode date
/T	= enable daylight saving auto adjust

All of these software switches are optional. If none are entered after `smpteset`, the software will:

- - default to interrupt #5
- - CMOS clock set to on
- - default to port address = 310
- - no hourly offset
- - GPS-100 status mode is off
- - `smpteset` software parameters will be displayed at startup
- - date will not be decoded
- - daylight saving adjustment will not be made

Show Command-Line Software Switches/Options

For operator convenience while setting up the `smpteset` program the command `smpteset/?` will display all of the command line options that are available.

SMPTESET Memory Requirements

Once started, the SMPTESET program remains in memory, occupying approximately 2.5K of memory. It keeps the PC clock time equal to the received time with an accuracy of \pm several milli-seconds.

Automatic Starting of SMPTESET.COM

The smpteset program can be started automatically each time the computer is booted by using the AUTOEXEC.BAT file of the computer. If smpteset.com is invoked by the AUTOEXEC.BAT file the computer clock will be automatically locked to the external time code signal (if available) each time the system is turned on or rebooted.

Runs Under DOS & Windows

SMPTESET will load as a TSR and run under all current versions of DOS and Windows including Windows for Workgroups. It can be relocated (under DOS) to run in high memory.

TIME CODE GENERATOR

The TCR-200 can be used to generate time code synchronized to the PC internal clock. The program SMPTEGEN.COM performs this function. SMPTEGEN is invoked as follows:

USING SMPTEGEN

SMPTEGEN /x

Where x is the interrupt number to be used by the card. This interrupt is set by the jumper J4 on the card. The card is shipped from the factory with interrupt jumpered to 5. Jumper the card correctly prior to insertion in the machine. If interrupt 5 is used, type:

SMPTEGEN /5

If interrupt 7 is used, type:

SMPTEGEN /7

ALL INTERRUPTS ARE NOT AVAILABLE IN GENERATOR MODE

The only interrupts that can be used in the generator mode are:
5 and 7

ALL PORTS ARE NOT AVAILABLE IN GENERATOR MODE

The only port that can be used in the generator mode is port 310h.

NOTES

Once started, the SMPTEGEN program remains in memory, occupying less than 2K of memory. It keeps the generated time equal to the PC (software) clock at all times. Normally SMPTEGEN will be installed in the AUTOEXEC.BAT file of the computer.

While SMPTESET or SMPTEGEN is running, the program SMPTE cannot be run since these programs assume control of the TCR-200 card.

HARDWARE DETAILS

INPUT/OUT CONNECTIONS

The time code input is balanced. Pins 2 and 3 of the DB-15 connector are for input, with pin 1 used for ground. Polarity is not important on the input or output. If an unbalanced input or output is used, ground the other pin.

(An optional DB-15 male plug to unbalanced BNC female adapter is available from C&A.)

Time code output (if available) is on pins 5 and 6 with 4 being the associated ground. The input and output levels are pre-set to 0 dBm.

Setting the Output Level

The time code output level is preset at the factory to 0 dBm. This level can be adjusted by varying the setting of R20. This pot is labeled OUT on the card.

With the card in the generate mode, adjust R20 until the desired level as measured on the output terminals is achieved. Turning the control to the right increases the output level.

Setting the Input Level

The input level control, R6, is adjusted at the factory for a nominal input level of approximately 0dB (as measured with an audio voltmeter) or 1.6 VPP. This setting gives an input range of approximately -15 to +15 dB. Should field adjustment be necessary use the following procedure.

- Run the program smpte.exe and place the card in the reader mode.
- Supply the card with a smpte time code signal with an input level within the range of -15 and +20dB.
- The incoming smpte time code frames should be read and displayed on the screen without any hesitations or jumps.
- If the incoming time is not displayed, adjust the input level control R6 until a stable, smooth flowing time display is achieved. No further adjustments should be required unless there is a major change in input level.

PORT SELECT

The TCR time code card is set at the factory to an address of 310h and the software defaults to that address. If another address is used the pin jumpers must be set correctly and a new port address must be entered on the smpteset.com command line.

Pin Jumper Connections

The correct jumper installation, should the pin jumpers be accidentally changed on J5 & J6 or for using other port addresses are:

Pin Jumper Location	P5	P6
<u>Port 300h</u>	jumper	jumper
<u>Port 310h</u>	no jumper	jumper
<u>Port 320h</u>	jumper	no jumper
<u>Port 330h</u>	no jumper	no jumper

The software supplied with the card supports only the above port addresses. *The address selected by the jumpers and the address entered on the smpteset.com line must agree and be one of the above listed ports. If the addresses are set incorrectly the TCR-200 card will not work and the computer could lock up or operate erratically.*

PROBLEMS - TROUBLESHOOTING

All TCR-200 cards are checked for proper operation before shipment and unless physical damage to the card is found, the TCR-200 is probably functional. The most common problems found during installation are interrupts, port conflicts and input signal levels in that order.

If a problem with operation is found or suspected, perform the following procedures: *(Note that some of these operations require technical knowledge of PC's)*

- Make sure that the interrupt that is selected on the TCR-200 card agrees with the interrupt that is specified in the command line and, most importantly, that no other card in the PC is set to the same interrupt as the card.
- Check that the port address, set with the switches on the card, agrees with the port address that is specified in the command line and, most importantly, that no other card in the PC is using the same port address as the card.
- If it is certain that there is no conflict with the interrupt or port address, then as described in step 4, verify that the input level is within capture range of the card.
- Feed SMPTE time code into the TCR-200 and run the program smpte.exe from the DOS prompt. With this program running the TCR menu will come up.
- Select F1 to start the TCR-200 in a reader mode
- The menu will either say No SMPTE or display the incoming time code. The time code, frame count display, should be continuous and smooth, without any hesitations or jumps.
- If the time is not displayed properly, adjust the input level control, first clockwise then and counter clockwise to see if a stable time display can be found. (Note that the level control is a 12 or 15 turn pot.)
- If no SMPTE time display can be found, either the card is not functioning, something is wrong with the PC or the incoming time code is invalid.
- If, after adjustment, the SMPTE time display is OK, the SMPTE.exe program is executing properly and the smpteset.com program will also execute properly.
-
- After step #9, and after running smpteset.com, the PC still does not lock to the incoming time code, then it is very-very likely that there is a conflict with interrupts or ports.

If these steps do not resolve the problem, contact the factory.

OTHER SOFTWARE ACCESSIBLE FEATURES

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USING THE TCR WITH CUSTOMIZED PROGRAMMING.

INTERRUPT:

- The interrupt is jumper setable on the card and is usually set to 5.
- I/O Address: Normally set to 310h (Jumper selected).
- The interrupt is generated immediately following time code receptions where the seconds field is 30 and frames field is 0.
- Additional interrupt options are available at beginning and end of time code and upon response to the PC system.
- Interrupts are also generated when timecode is lost and regained.
- Time is set once per minute.

TCR Commands:

The process for sending a command to the TCR is:

- Output command to 310h
- Read 310h and wait the commands response. This step is required if you are using a fast PC. The response time for messages is several milliseconds.
- To avoid busy waiting for command response, the card can be set to generate an interrupt upon response, allowing for a fully interrupt driven support routine.

COMMANDS:

```

;
;Name:      commandPC
;
;Description: Receives commands from the PC and executes them.
;
;
;   Commands :      .....response
;
;   0000xxxx - Set frame units ..... 24h
;   0001xxxx - Set user group 2 4 bits ..... 25h
;   001000xx - Set frame tens ..... 26h
;   0011xxxx - Set user group 2 4 bits ..... 27h
;   0100xxxx - Set seconds units ..... 24h
;   0101xxxx - Set user group 3 4 bits ..... 25h
;   01100xxx - Set seconds tens ..... 26h
;   0111xxxx - Set user group 4 4 bits ..... 27h
;   1000xxxx - Set minutes units ..... 24h
;   1001xxxx - Set user group 5 4 bits ..... 25h
;   10100xxx - Set minutes tens ..... 26h
;   1011xxxx - Set user group 6 4 bits ..... 27h
;   1100xxxx - Set hours units ..... 24h
;   1101xxxx - Set user group 7 4 bits ..... 25h
;   111000xx - Set hours tens ..... 26h
;   1111xxxx - Set user group 8 4 bits ..... 27h
;
;
;   28h - Clear enhanced (29-2f) features ..... 28h
;   29h - Set host interrupt on each response ..... 29h
;   2ah - Set host interrupt at end of time code ..... 2ah

```

```

;      2bh - Set host interrupt at start of time code ..... 2bh
;      2ch - Set writes to buffer time .....2ch
;      2dh - Set writes to generator time (default) ..... 2dh
;      2eh - Set buffer time valid for send .....2eh
;      2fh - Set host interrupt once/second ..... 2fh
;
;      e8h - Rec Time read request.....e8h
;      e9h - Gen Time read request .....e9h
;      eah - Set stopped mode ..... eah
;      ebh - Set receive mode .....ebh
;      ech - Set generating mode ..... ech
;
;      edh - Get current mode ..... eah, ebh, ech
;      2 dummy commands are for synchronization
;      eeh - Dummy command ..... eeh
;      efh - Dummy command ..... efh
;
;      68h - read rfru  frame units .....0000xxxx
;      69h - read rug1  user group 1 4 bits.....0001xxxx
;      6ah - read rfrt  frame tens .....001000xx
;      6bh - read rug2  user group 2 4 bits.....0011xxxx
;      6ch - read rsecu seconds units .....0100xxxx
;      6dh - read rug3  user group 3 4 bits.....0101xxxx
;      6eh - read rsect seconds tens .....01100xxx
;      6fh - read rug4  user group 4 4 bits .....0111xxxx
;
;      a8h - read rminu  minutes units .....1000xxxx
;      a9h - read rug5  user group 5 4 bits.....1001xxxx
;      aah - read rmint  minutes tens.....10100xxx
;      abh - read rug6  user group 6 4 bits.....1011xxxx
;      ach - read rhru  hours  units.....1100xxxx
;      adh - read rug7  user group 7 4 bits.....1101xxxx
;      aeh - read rhrt  hours  tens .....111000xx
;      afh - read rug8  user group 8 4 bits.....1111xxxx

```

Interrupt status values:

```

;      68h - Time set interrupt (seconds=30, frames=0)
;      69h - Gained time code
;      6ah - Lost time code
;      6bh - End of time code interrupt (After user group 8)
;      6ch - Start of time code interrupt (After last sync bit)
;      6dh - Once/second interrupt (at frames=0)
; no smpte is indicated by a frame unit of h'f (normally impossible)

```

The process for initializing the card is:

- Send Set Receive Mode (ebh).
- Set interrupt vector in PC.
- Activate interrupt vector in PC. (unmask)

Interrupt handler does this:

- Read timecode from card
- Set PC clock from timecode.

Read timecode is:

- Rec Time read request (e8h). This causes the current time to be copied into a reading area. This is done to allow accurate asynchronous reads.
- Read each 4 bit smpte group using commands 68h-afh. Obviously, if you don't need the user bits, don't read them. These can be read in any order.

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