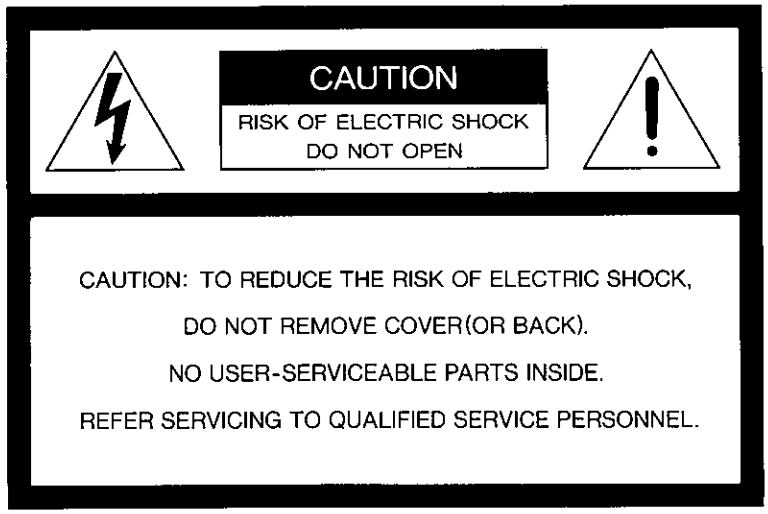
FOSTEX®

Model 4010

TIME CODE GENERATOR READER

Owner's Manual



The lighting flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

"WARNING"

" TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE."

SAFETY INSTRUCTIONS

1. Read Instructions – All the safety and operating instructions should be read before the appliance is operated.
2. Retain Instructions – The safety and operating instructions should be retained for future reference.
3. Heed Warnings – All warnings on the appliance and in the operating instructions should be adhered to.
4. Follow Instructions – All operating and use instructions should be followed.
5. Water and Moisture – The appliance should not be used near water – for example, near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool, and the like.
6. Carts and Stands – The appliance should be used only with a cart or stand that is recommended by the manufacturer.
7. Wall or Ceiling Mounting – The appliance should be mounted to a wall or ceiling only as recommended by the manufacturer.
8. Ventilation – The appliance should be situated so that its location or position does not interfere with its proper ventilation. For example, the appliance should not be situated on a bed, sofa, rug, or similar surface that may block the ventilation openings; or, placed in a built-in installation, such as a bookcase or cabinet that may impede the flow of air through the ventilation openings.
9. Heat – The appliance should be situated away from heat sources such as radiators, heat registers, stoves, or other appliances (including amplifiers) that produce heat.
10. Power Sources – The appliance should be connected to a power supply only of the type described in the operating instructions or as marked on the appliance.
11. Grounding or Polarization – The precautions that should be taken so that the grounding or polarization means of an appliance is not defeated.
12. Power Cord Protection – Power supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit from the appliance.
13. Cleaning – The appliance should be cleaned only as recommended by the manufacturer.
14. Nonuse Periods – The power cord of the appliance should be unplugged from the outlet when left unused for a long period of time.
15. Object and Liquid Entry – Care should be taken so that objects do not fall and liquids are not spilled into the enclosure through openings.
16. Damage Requiring Service – The appliance should be serviced by qualified service personnel when:
    A. The power supply cord or the plug has been damaged; or
    B. Objects have fallen, or liquid has been spilled into the appliance; or
    C. The appliance has been exposed to rain; or
    D. The appliance does not appear to operate normally or exhibits a marked change in performance; or
    E. The appliance has been dropped, or the enclosure damaged.
17. Servicing – The user should not attempt to service the appliance beyond that described in the operating instructions. All other servicing should be referred to qualified service personnel.

TABLE OF CONTENTS

1. INTRODUCTION

If you're new to SMPTE/EBU time code (perhaps you've recently started using our 4030 synchronizer), you may find the amazing number of features on the 4010 a little mind-boggling. To get right to the basics, here are the most common functions you will probably use:

1. Time Code Generation

This is obvious. Please note that the 4010 reads and writes (generates) all forms of SMPTE time code:

a) 24 frames/sec.	For motion picture (SMPTE).
b) 25 frames/sec.	For European film/TV (EBU).
c) 30 frames/sec.	For American film/TV (SMPTE).
d) Drop-frame ("DF").	29.97 frames/sec. with drop frame.
e) 29.97 non-drop.	29.97 frames/sec. without drop frame.

NOTES: SMPTE/EBU stands for Society of Motion Picture and Television Engineers/European Broadcast Union.

2. Time Code Re-Generation

Since time code is a square wave, the leading edge of the wave gets "rounded off" every time you copy the code. After a few dupes, the code becomes unreadable. If you're using a synchronizer, it can drift out of lock. Good studio practice is to always re-generate code whenever you're making a dupe or dub. The 4010 can read the original code and generate the same numbers as "fresh" square waves. If you're getting a video dub from a duping house or production company, you should always re-generate the code because the code on this video tape may not be fresh.

3. Generate Code to Video Sync or Other Sync Pulses

In addition to the points mentioned in #1, the 4010 will generate the sync "word" (SMPTE time code) to video sync (by reading control track pulses). This means that the sync will always be at the beginning of each video frame so your SMPTE-to-video tape timing will always be perfect. If you use a free-running time code generator such as our Model 8700 (which doesn't have an external sync input), the sync word may not be "printed" or lined up at the beginning of each video frame.

While this isn't terribly important for background music, it could prove disastrous for lip-sync work. The 4010 will accept composite video, black burst, etc. it will also accept any kind of pulse input (like neopilot, for you Nagra types) to generate time code.

4. High Speed Reader (or code-only master with the 4030)

The 4010 is capable of reading SMPTE/EBU at virtually any speed (some people call this a wide-band reader instead of a high speed reader). If you need to run the 4030 synchronizer with a code-only master (anything from a slea-zoid home VHS or Beta deck to a 1" type C professional model), the 4010 is capable of figuring our direction and will generate tach pulses for the 4030 (and its slave) to follow. Normally with a code only master, the

slave can only follow when the master is in play mode. With the 4010/4030 combo the slave can follow in all modes (rewind and FF) if you're using a video recorder with address track time code (such as the JVC CR-850, Sony BVU-800 series, or a 1" type C recorder). You will also have the capability of following the video master in search or jog mode.
IMPORTANT TRIVIA NOTE: Address track time code is not the same as VITC (vertical interval time code). The address track is just another longitudinal audio track.

5. Jam Sync

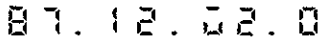
Suppose your ex has accidentally sent your video with SMPTE to the cleaners and it comes back cleaned and pressed but 3 minutes of code are missing. NO PROBLEM! With jam sync, the 4010 remembers the last readable time code number and generates contiguous code numbers from that point on, filling in the damaged or missing code.

6. Event Controllers

These are like having footswitches built into the 4010 that can be programmed to turn on/off at designated points in the time code. You could start/stop CART machines, bypass effects units, etc. These event controllers could also be used to start and stop MIDI devices as "a programmable footswitch." Unlike the 4050, the 4010 does not send out MIDI timing info or song pointer; it only acts as an on/off switch.

Software version number indicating function (After version 1.1)

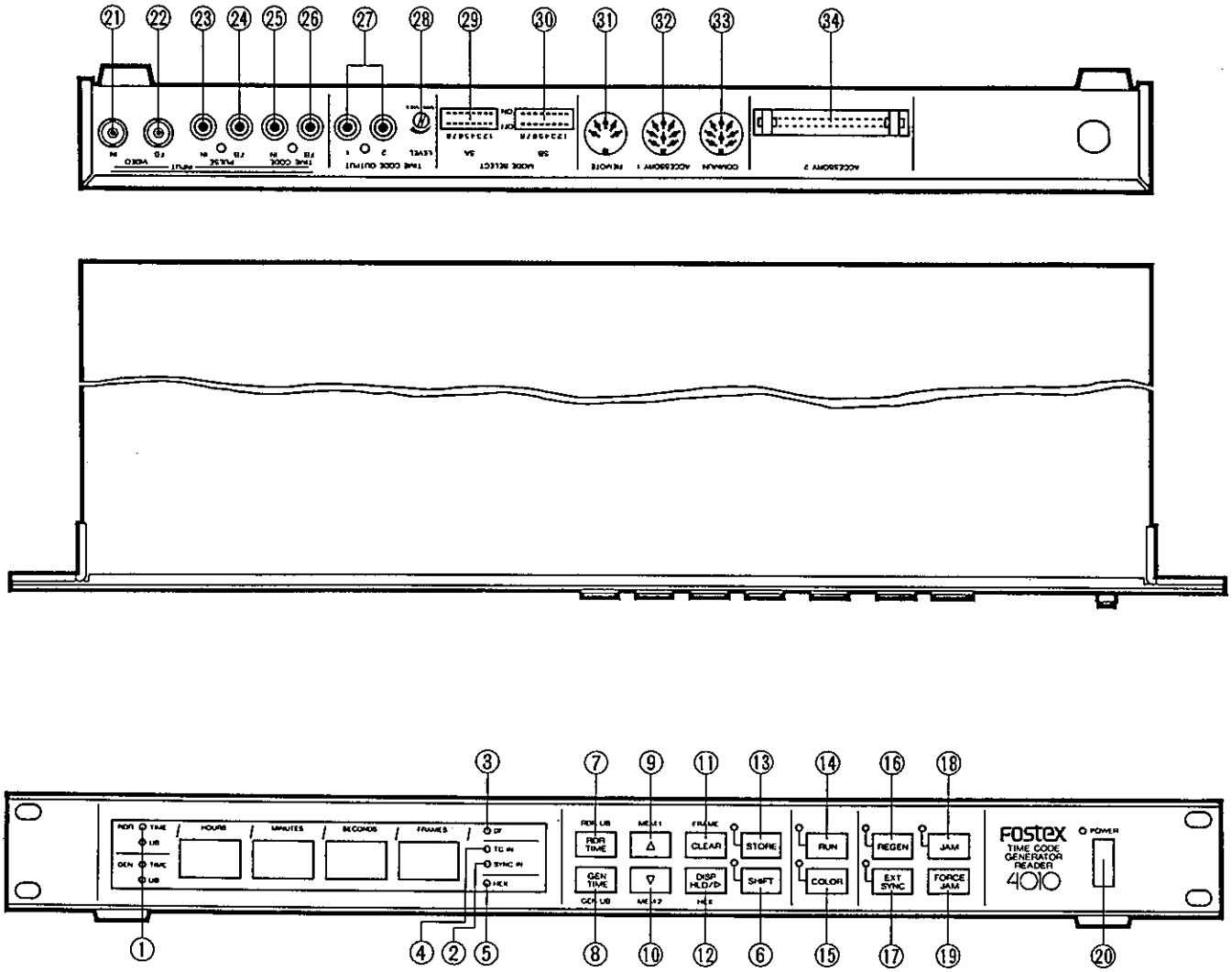
The software version number will be indicated when power is switched on while the upward [Δ] button is held down.

Example: 

It is indicating '87 Dec. Ver. 2.0

The version indicating mode will be cleared and returned to the normal operating state when the CLEAR button is pressed.

2. NAME AND FUNCTION OF THE CONTROLS (Panel lettering indicated by [ ].)



FRONT PANEL

(1) Display indicator [RDR TIME/UB, GEN TIME/UB]

When the data on display is READER TIME/UB (User Bit) or GENERATOR TIME/UB, the corresponding LED Indicator will be lit. Also, when the frame mode is on display (Refer to Section III), the TIME and UB for either RDR or GEN will be lit simultaneously to indicate in which mode it is in. It will not be lit in other modes (i.e. at Edit Mode, etc.).

(2) Sync indicator [SYNC IN]

This indicator is lit when a signal is input to the rear panel VIDEO IN/ PULSE IN connector.

(3) Drop frame indicator [DF]

This is lit when the time code shown on the display is for drop frame. During display of the reader, this is lit when the tenth bit of the time code input is 1, and extinguished when the tenth bit is "0" or that code no longer ceases to exist.

During display of the generator, this is lit when the frame mode is 29.97df and in the RUN/HOLD condition.

(4) Time code input indicator [TC IN]

This is lit when the correct time code is input to the rear panel TIME CODE input pin jack.

(5) Hexadecimal input indicator [HEX]

This is lit when the data, which can be called onto the display during the edit mode, is hexadecimal (Refer to item (12) DISP HOLD/HEX key for method of setting).

(6) Shift key LED [SHIFT]

When any key with a shift mode function is pressed after pressing the SHIFT key, that key will be in the shift mode (The key with a shift mode has a lettering above and below the key). The LED will be lit when the shift mode is entered by pressing the SHIFT key. Then, the shift mode key or this key is pressed again, the LED will go out.

(7) Reader time/user bit key [RDR TIME/RDR UB]

This is pressed to call out on the display the newest time code value read by the reader. If the input is in progress, the display will be in real time, and if the input is not renewed, it will display the last frame.

If the user bit is to be put on the display, this key is pressed after pressing the SHIFT key (6). (Subsequently, follow the same procedure in operating any shift mode key.)

(8) Generator time/user bit key [GEN TIME/GEN UB]

This key is pressed to call the newest value of the generator on the display. The display will always show, to the lat bit, the next to the last frame address that is completely output.

In the shift mode, the generator user bit that is set will be displayed. (It will be set at 00.00.00.00.)

(9) Data count up/memory 1 key [Δ/MEM1]

This key is used for count up of data whose digit period is blinking during the edit mode. It increases by 1 at each key punch and increases continuously when the key is held down for several seconds.

In the shift mode, the MEM1 content is put on display and then enters the EDIT mode. When storing the edited data into MEM1, this key is pressed after pressing the STORE key (13).

(10) Data count down/memory 2 key [▽/MEM2]

This key is used for count down of data whose digit period is blinking during the edit mode. It decreases by 1 at each key punch and decreases continuously when the key is held down for several seconds.

In the shift mode, the MEM2 content is put on display and then enters the EDIT mode. When storing the edited data into MEM2, this key is pressed after pressing the STORE key (13).

(11) Clear/frame mode key [CLEAR/FRAME]

Pressing this key clears the display (00.00.00.00.) and enters the edit mode. In the shift mode, either the reader or generator frame modes will be displayed (The last discriminated frame mode will be displayed for the reader.).

(12) Display hold/hexadecimal key [DISP HOLD >/HEX]

The edit mode will be entered while holding the presently displayed data. Once the edit mode is entered, this key is used to move the editable digit (period LED will blink).

When this key is pressed after pressing the SHIFT key (6) in the edit mode, it acts as the HEX key and will alternate between hexadecimal and decimal the data to be edited. The HEX indicator (5) will be lit in the hexadecimal mode. All eight digits will simultaneously alternate between hexadecimal and decimal.

(13) Store key, store LED [STORE]

This key is used for storing the data on display, while in the edit mode, into the specified memory. The STORE LED is lit and data stored in any specified location when this key is pressed; or when it is pressed again, the LED will be extinguished and the display return to the value immediately prior to pressing this key.

When the data content does not match the specified location or is not required, an ERROR will be indicated. An error will also be indicated when a key with no storing location is pressed.

(14) Generator run/hold key, LED [RUN]

This key determines the modes of RUN, RUN ENABLE and HOLD. It will go to HOLD (the stopped condition) when this key is pressed while in the RUN or RUN ENABLE modes. It will enter the RUN or RUN ENABLE mode (to which mode it enters depends on the other setup and input conditions) when this key is pressed while in HOLD. The LED blinks at a fast rate in the RUN mode and slowly in the ENABLE mode.

(15) Color frame key [COLOR]

This key is used to synchronize the generator output to the color field and create the time code CF flag (Bit No. 11 will be 1). This cannot be induced unless the generator is in HOLD. The generator will not operate properly unless there is no input of a video signal for the external sync signal.

(16) Regenerate key, LED [REGEN]

The key to activate the regenerate operation. When there is no input of a time code, and it is in the REGEN ENABLE mode, signal generation will not start even though the generator is put in the RUN mode. In such a condition, when there is input of the time code, regneration is started. The LED will blink in the ENABLE mode and change to continuous lighting during REGEN.

(17) External sync key, LED [EXT SYNC]
The key for selecting the generator sync source. Each time this key is pressed, it will alternate between external and internal, and the LED will be lit when at external sync. Even though it may be switched to external sync, the generator may not operate properly when there is no signal input or the rear panel DIP switch setting is not proper (LED will blink). This key will be functional only when the generator is in HOLD.

(18) Jam sync key, LED [JAM]
This key permits functioning of automatic switching to internal sync (JAM SYNC) when the sync source exceeds the compensation range and is interrupted during sync generate. This key is functional only when the generator is generating by an external sync signal. When this key is pressed in such a condition, it will enter the JAM ENABLE mode and the LED will blink. Subsequently, if the sync source is interrupted, it will switch to internal sync and the LED will change to continuous lighting.

(19) Force jam key [FORCE JAM]
At the instant this key is pressed while the generator is in RUN by an external sync signal, it will switch to internal sync generating from the frame next to the instant this key was pressed. The EXT SYNC LED (17) will turn off immediately after this switching and the JAM LED (18) will be lit. When it is switched to internal sync by this key, it will not automatically return to the former mode regardless to the rear panel DIP switch setting.

(20) Power switch
This is the Model 4010 main power switch. All registers and functions will be initialized at switch on of power. Also, the rear panel DIP switch setting is read only immediately after switch on of power. The setting cannot be changed after switch on of power.

REAR PANEL

(21) Composite video signal input [VIDEO IN]
This is the composite video signal input receptacle. A composite video signal at a level of 0.5V ∿ 2V (p-p) or a composite sync (black burst) signal at a level within 0.5V ∿ 5V (p-p) is input here.
A time code in sync with this signal can be generated by the front panel EXT SYNC key (17) and setting of the later mentioned DIP switches [(30), (31) and II]. The SYNC range is 22 frame ∿ 33 frame/second.

(22) Composite video signal foldback [VIDEO FB]
This is the foldback receptacle of the signal at (21).

(23) Sync pulse signal input [PULSE IN]
This is the sync pulse input jack. The 24Hz ∿ 30Hz (x1 MODE) or 48Hz ∿ 60Hz (x2 MODE) signal input here must be at a level within 1V ∿ 15V (p-p). A time code in sync with this signal can be generated by the front panel EXT SYNC key (17) and setting of the later mentioned DIP switches [(30), (31) and II]. The time code bit zero starting point will be synchronized with the minus edge of the input signal. SYNC is possi-possible with a signal duty ratio of 0.1% ∿ 50% (Pulse width: 20μs≦).

(24) Sync pulse signal foldback jack [PULSE FB]
This is the foldback jack of the signal at (23).

(25) Time code input [TIME CODE IN]
This is the time code input jack. An L.T.C. at a level within 0.1V ∿ 5V (p-p) is input here.

(26) Time code foldback [TIME CODE FB]
The foldback jack of (25).

(27) Time code output 1, 2 [TIME CODE OUTPUT 1/2]
The generator time code output jacks. 1 and 2 are the same outputs.

(28) Time code output level [LEVEL]
The output level adjusting trimmer pot of the (27) and (28) jacks. The time code output can be adjusted over the range of 0.5V ∿ 5V by this trimmer pot.

(29), (30) Mode select DIP switch [MODE SELECT SA/SB]
The various functions of the 4010 are setup by these switches. Refer to Section 3 Mode Select DIP Switch Setup for detailed explanations.

(31) Remote receptacle [REMOTE]
The generator is externally controlled through this receptacle. Pin assignments are as follows:

Shell		GND
Pin 1	RUN	Run command input
" 2	GND	Ground
" 3	5V 50mA	Power on LED 5V output
" 4	N.C.	No connection
" 5	GEN RUN TALLY	Generator run tally output (Open Collector)

(32) Accessory 1 receptacle [ACCESSORY 1]
External accessories are connected to this receptacle. Pin assignments are as follows:

Shell	GND
Pin 1	GND
" 2	EVENT 1 output- *Note 1
" 3	N.C.
" 4	EVENT 2 output- *Note 1
" 5	INTERFACE DIRECTION input *Note 2
" 6	FRAME TACH output- *Note 3
" 7	DIRECTION output- *Note 3
" 8	5V output

* Note 1: The event output circuits at pins 2 and 4 will be in the open collector ON state for a period of 100msec. from the instant the time code read by the reader matches the content of MEM 1 and MEM 2.
* Note 2: This is the input pin for the forward-reverse direction signal from the Film (Cinecorder) interface.
* Note 3: The frame pulse and its forward-reverse direction discriminating signals synchronized with the time code that is read, is output from this pin. TACH will be a minus pulse and the reverse direction DIR will be a low level signal.

(33) Communication on receptacle
The receptacle for the RS-232C communication signal.

(34) Accessory 2 receptacle [ACCESSORY 2]
The data OUTPUT connector from the reader and generator.

3. SETTING THE MODE SELECT DIP SWITCH

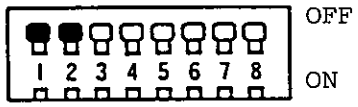
Setting of the rear panel mode select DIP switches (30) and (31) will be explained in the following. Switches in the down position will be ON, and those in the up position will be OFF. As the setting of these switches are read only at switch on of power, if the setting is to be changed, either make the change with the power switched off or make the change, switch off the power, then switch it on again.

SWITCH A (SA)

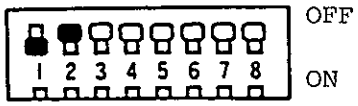
(1) Sync source select [SA: 1, 2]

These are for selecting the input to be synchronized when the 4010 is operated by an external sync signal. Selection is made by combinations of switch 1 and 2 of SA. The combinations and functions are:

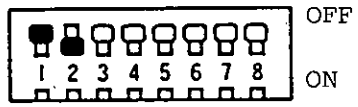
- Time code - Both 1 and 2 at OFF.



- Other than time code - 1 at ON, 2 at OFF.



- Automatic switching between time code and signals other than time code - 1 at OFF, 2 at ON.

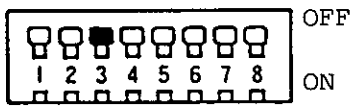


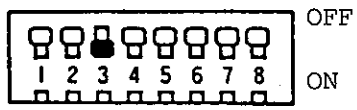
When both 1 and 2 are set to ON, the generator will behave differently. Refer to "5., (3) Pulse Interface Generate" for details.

(2) Video pulse select [SA: 3]

For a sync source other than time code, the 4010 can select either the composite video signal (composite sync signal) or a pulse input. Whether the video input or the pulse input is to be synchronized can be selected by this switch when "other than time code" input is selected by the Sync Source Select switch (1). The signal to which it will sync will be:

- Composite video signal - At OFF.
- Pulse input - At ON.





When "automatic switching" is selected in Item (1), above, it will automatically switch between the signal selected by switch 3 and the time code input.

(3) Pulse rate select [SA: 4]

In the software Version V1.1 and the original V1.0, the TACH pulse rate output from the 4010 could not be selected for each frame but was fixed at 1 pulse/frame.

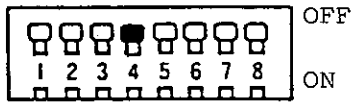
In software Version V2.0, either 1 pulse/frame or 2 pulses/frame setting of the following two types of pulse signals are now possible when "pulse" is selected by the switch in above (2).

* Tach pulse rate output from the 4010 at generate mode (sync to T.C.)

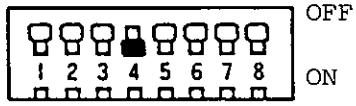
* Pulse rate input to the 4010 at ext generate sync mode

Before switch on of power, if DIP switch SA: 4 is set to the up position (OFF), it will be 1 pulse/frame or in the down position (ON), it will be 2 pulses/frame effective for both two types of pulse signals.

• One pulse at OFF.



• Two pulse at ON.



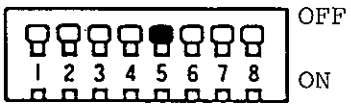
The cable (DIN 8 pin --- FC 20 pin) packaged with the Model 4010 is for supplying the tach pulse and direction signal to the Model 4030 Synchronizer. If time code speed is outside the readable range of the 4030, the 4030 will attempt to detect the tape position by the tach pulse and direction signal. As the 4010 can read the time code in a wide range of tape speed, and can output tach pulses and direction signal, if the recorder is of the type which can output time code in other than normal play speed, the 4030 can consistently detect the tape location without relying on direct tach pulse and direction signal from the recorder with the 4010 connected.

The tach pulse can also be used as the external sync signal to the VTR. The pulse can be supplied at a width of about 200μs and 3Vp-p into a 75Ω load. In a system of ATR master and VTR slave, the pulse generated from the time code is applied as the sync signal to the VTR.

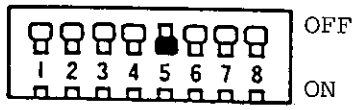
(4) Jam sync internal sync source select [SA: 5]

This is to set at which rate of the internal information it should generate at the point it is switched from external sync generate to internal sync generate while in the jam sync generate mode. Either the internal reference clock or the clock rate at which it was generating by the external sync signal.

• Reference clock at OFF.



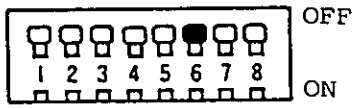
• Previous rate at ON.



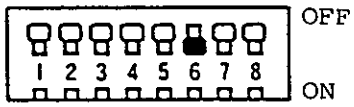
(5) Automatic return of jam sync operation [SA: 6]

During jam sync generate, if the external sync source is interrupted, then switched to internal sync, and subsequently the interrupted sync source is revived, whether it should return automatically to external sync generate or not is set by this switch.

- Will not return to external sync at OFF.



- Will return to external sync at ON.

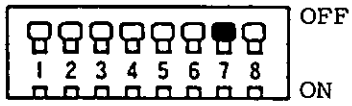


(6)HOLD/RUN ENABLE select [SA: 7]

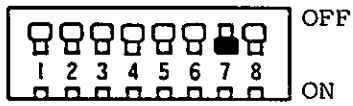
This switch determines whether the generator should HOLD or be in RUN ENABLE when the synchronized external signal is interrupted during normal external sync generation. When HOLD is selected, it will not start generating until the RUN key is pressed again. When RUN ENABLE is selected, it will return to external sync generating when the external sync signal is restored.

If jam sync is selected (by the front panel JAM key) or is set to "sync source automatic switching," these settings will have priority but if generation is unable to continue in spite of these settings, then the setting here will take over.

- HOLD at OFF.



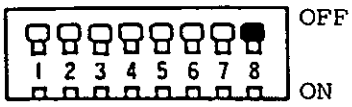
- RUN ENABLE at ON.



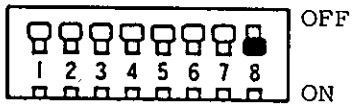
(7) Setting priority when set to sync source automatic switching [SA: 8]

When sync source automatic switching is selected by SA: 1 and 2, to which it should sync when both sync source becomes effective is setup by this switch.

- Other than time code at OFF.



- Time code at ON.



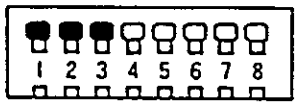
SWITCH B (SB)

(8) Frame mode setting [SB: 1, 2, 3]

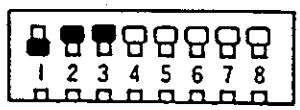
In which frame mode the generator should be at switch on of power is set by these switches. If these switches are set to the frame mode most frequently used, it will save you the trouble of setting up by the edit mode (refer to page 4-1) after switch on of power. After regeneration is started, it will be in the frame mode identical to the time code that is input to the reader at the start.

24, 25, 29.97ND, 29.97DF, 30 FPS

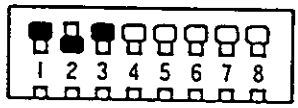
24



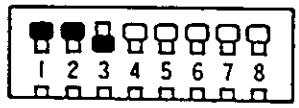
25



29.97ND

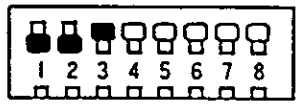


29.97DF



Combinations of 1, 2, and 3, other than the above, are all 24.

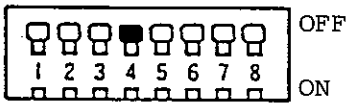
30 FPS

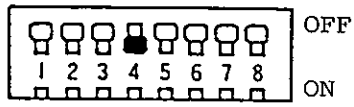


(9) Setting the user bit at regeneration [SB: 4]

This is to determine whether the time code user bit in regeneration should be same as the time code user bit being read by the reader or set to the value in the generator.

- Read user bit at OFF.
- User bit set in the generator at ON.

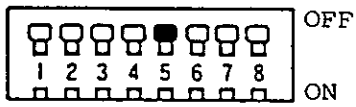


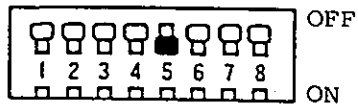


(10) Jam memory selection [SB: 5]

Whether MEM 2 should be used for jam memory or not is set by this switch.

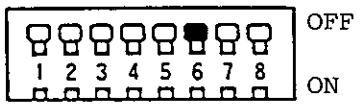
- Use for event memory only at OFF.
- Use for jam memory at ON.



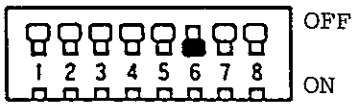


(11) Phase correction bit (Bit No. 59) [SB: 6]
Status of the EBU spec phase correction bit is determined by this switch.

- The 59th bit is fixed at zero at OFF.

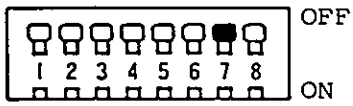


- Will function as the phase correction bit at ON.

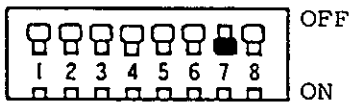


(12) Display method of RDR TIME [SB: 7]
It will show "ON TIME" at OFF and "JUST READ" at ON.
"ON TIME" is the mode of displaying the frame address presently being read. However, as the data of this frame is actually not complete, data immediately before this frame plus 1 will be shown.
"JUST READ" is the mode without "plus 1", or in other words, direct displaying of the immediately prior frame address completed at that instant.

"ON TIME"



"JUST READ"



(13) Setting of the RS-232C I/F baud rate [SB: 8]
This switch determines the RS-232C interface baud rate.

- 9600 baud at OFF.
- 4800 baud at ON.

4. DISPLAY INDICATOR

The numerical display and LED's for indicating what the numerical display is representing are located on the 4010 front panel.

(1) Display indicator

The four LED's at left of the display are the display indicators. These indicators represent the type of data presently shown on the display. They indicate, from top to bottom, reader time data (RDR TIME), reader user bit (RDR UB), generator time data (GEN TIME), generator user bit (GEN UB), and the LED corresponding to the numerical display is lit.

When indicating the frame mode for the type of time code, if the frame mode is by the reader, the reader time and reader user bit; if it is by the generator, the generator time and generator use bit indicators, respectively, will be lit at the same time.

If all four indicators are extinguished, it is in the following edit mode.

(2) Edit mode

When the data on display is in a condition possible for editing, this is called the edit mode. In the edit mode, all four LED indicators will be extinguished and among the four dot LED's at lower right of every second digit of the eight digits, one will always blink. In this state, the two digits at left of this blinking dot, can be changed by the Δ key (9) (plus direction) or the ∇ key (10) (minus direction). The number will change ±1, and if the key is held down, it will change continuously (you cannot edit when the STORE LED (13) is lit). Also, the blinking digit can be moved by one digit each time the ▷ key (12) is pressed.

The edit mode can be entered by pressing the DISP HOLD key (12), the CLEAR key (11), MEM 1 Δ key (9) or MEM 2 key (10), while the display indicator is lit.

To store the edited data into the memory, the corresponding key is pressed after pressing the STORE key (13).

Data range in the edit mode

When not in the HEX mode, the range in change of each two digits by the Δ and ∇ buttons are:

For versions 1.1 and 1.0 - 00:00:00:00 ∿ 99:99:99:99
For versions 2.0 and later - 00:00:00:00 ∿ 23:59:59:29

(3) Data display

The eight digits of the display, for time data, represent two each from the left, the hour, minute, second and frame. For the user bit, from the right, 1st binary group, 2nd binary group, and so on. Therefore, the extreme left digit is the 8th binary group (in the HEX setting, data from 00.00.00.00. ∿ FF.FF.FF.FF. can be established).

When showing the frame mode, one type from among the nine types listed below will be shown on the display.

When in the generator frame mode -	When in the reader frame mode -
24.	24.
25.	25.
29.97dF	29.97dF
29.97nd	nd
30.	

When in the generator mode, if you wish to set it to a frame different from the frame mode set by the DIP switch, put the desired frame mode on the display by the Δ (9) and ∇ (10) keys, then press in the following sequence the STORE key (13) and the GEN key (8).

5. GENERATOR FUNCTION

The 4010 has a generator function possible of four types of operation. They are -

(1) Internal clock generate
(2) External sync generate
(3) Pulse interface generate
(4) Jam sync generate

Following are explanations on the required settings and operation for each of the four types of operation.

(1) Internal clock generate

Required setting: Frame mode setting [SB: 1, 2, 3]
Phase correction setting [SB: 6]

In this operating mode, the various time codes of SMPTE, EBU and FILM are generated by the accurate reference clock contained in the 4010. In regards to SMPTE, three types - the mode at which the frame address will not skip (29.97ND) at the color television frame speed (29.97fps) in addition to time codes of 30fps and 29.97DF - can be generated.
Start address of the time code to be generated, user bit, the DIP switch setting such as the frame mode read in at switch on of power - each of these can be edited.
At switch on of power, the display function will be for showing the generator time and its indication will be 00.00.00.00. As the generator will be in the hold state, the indication remains still. The time code generation starts upon pressing the front panel RUN key (14) and the display will also start indicating.
When the RUN key (14) is pressed again during generate, the generator completes the time code for the current frame, then enter the HOLD state. The display will be stopped at the address next to the last frame address that has been completely output, and when generate is started again, start from this address. Thereafter, the generator hold display will have the same meaning (it could be different, however, when the REGEN key (16) is pressed).
The user bit in the time code being generated can be input from the front panel (refer to the previous section, (2) Edit mode).
When the rear panel DIP switch SB: 6 is at ON, the 59th bit of the code being generated becomes the phase correction bit and the phase will be corrected automatically.

(2) External sync generate

Required setting: Sync source setting [SA: 1, 2]
Video/pulse setting [SA: 3]
Pulse/frame setting [SA: 4]
Run enable, hold setting [SB: 5]

When the front panel EXT SYNC key (17) is pressed, the generator thereafter enters the external sync generate mode. Connect the signal (sync source) to be synchronized to the proper rear panel receptacle and select the signal by the mode select DIP switches (30) and (31).

If the setting is proper and the sync source is being input at the correct speed, external sync generating is started by pressing the RUN key (14) after pressing the EXT SYNC key.
If generate does not start on pressing the RUN key (14), the following cause can be assumed.
When there is no input of a signal, indicators for TC IN (4) and SYNC IN (2) will not be lit. Also, even though a signal is being input, the SYNC IN indicator (2) will not be lit, if this signal is not what is selected by the mode select DIP switch. Even though there is input of a signal, if it is not of a type that cannot be synchronized, press the EXT SYNC key (17) and its LED will start blinking.

(3) Pulse interface generate

Required setting: Sync source setting [SA: 1, 2]
Pulse/frame setting [SA: 4]
Frame mode setting [SB: 1, 2, 3]

In this mode, the 4010 will continue to apply absolute addresses in real time to a film, etc., which does not have it.
The input signal used in this mode are the frame pulse signal such as from the Model 8720 interface (connected to the rear panel PULSE input jack (23)) and the pulse direction signal (applied to the ACCESSORY 1 input via an eight pin DIN connector cable). The correct frame address can be indicated on detecting the direction and amount of movement by reading these two signals.
The method of operation will be explained next. First, the film is stopped at zero position or a point of reference and the 4010 generator time data is cleared. If it is necessary to insert an address other than zero, it must be stored after editing. Next, press the EXT SYNC key (17) and the RUN key (14), and the EXT IN and RUN LED's will blink at a slow rate. Now, if the film is started, the generator display will show the frame address in real time in step with the film motion. If the film travel is at normal speed, the generator will start sync generating and the EXT IN and RUN LED's will change to a constant light. The sync generating range is 21fps ∿ 33fps. At speeds outside this range, the sync signals will not be generated although the display will continue to indicate the addresses.
The RUN key (14) is pressed again to interrupt sync generating.

Color frame lock

The Model 4010 has the function of detecting the color field sequence from the externally applied video signal, then locking to it the generated time code content.

Operation

For color locking, it is necessary for the 4010 generator frame mode setting to match the video signal to be input, and that the 4010 is in the external sync mode. When the COLOR button is pressed while the 4010 is in the external sync mode, it will enter the color lock enable state. In this state, if the 4010 is able to detect the color field sequence, COLOR LED will be lit, and the generator will start functioning when the RUN button is pressed.

If the 4010 cannot detect the color frame in the video signal, the COLOR LED will blink and the generator will not run even though the RUN button is pressed. Whether the 4010 is detecting or not the color frame can be confirmed by the lighting condition of the COLOR LED or if the generator will run or not. However, a more direct confirmation is possible if the following method is used.
Enter the 4010 into the generator frame mode indicating state (NOTE 1). If the right end 2 digits of the 8 digit display is indicating "CF" this means the 4010 is detecting the color frame. If it is not detecting the color frame, nothing will be shown on these 2 digits. In other words, this "CF" does not mean that "color lock is set" but that "it is actually in color lock" or "it is possible of color lock."

(NOTE 1) How to enter the generator frame mode indicating state
With the STO LED not lit (press STO button once if it is lit), press SHIFT, then, FRAME. It is O.K. if both the GEN TIME and GEN UB LED's, on the front panel left end, are lit; if the RDR side LED's are lit, press the GEN TIME button once.

The input signal

The 4010 detects the color field sequence from the composite video signal but when a VTR playback signal is directly input to the 4010, in some cases the color field sequence cannot be detected due to jitters. Follow the next procedure in such a case.
Set the VTR to the external sync mode and for the sync source, apply a stable signal such as from a video generator. Not the VTR playback signal but the same sync source to the VTR is input to the 4010 simultaneously.

Adjusting method

If you cannot achieve color lock although a good stable sync signal is supplied to the 4010, the internal adjustments and the input signal can be assumed to be mismatching. In such a case, adjust by the following steps.
There is one adjusting point, a trimmer, inside the 4010. This is for optimizing the circuit for color field sequence detecting. This trimmer can be found near the time code connector upon removing the upper cover. Use a small flat blade screwdriver to rotate this.

Procedure

1. Select video signal as the sync source by the DIP switch before switching on power to the 4010.
2. A composite video or composite sync signal from a stable signal source such as a sync generator, is applied to the 4010 video input. As the optimum position of the trimmer to be adjusted is affected by the input signal level, set as near as possible to the actual operating condition such as the level and whether external termination will be used or not.
3. The procedures after this are followed after switch on of power. Select the 4010 generator frame mode which matches the video signal specifications. In other words, if it is NTSC, select either 29.97DF or 29.97ND; if PAL/SECAM, select 25.
4. Set the 4010 generator to external sync mode. Thus, if EXT LED is not lit, press the EXT button once.
5. Set to the color enable state. Thus, if COLOR LED is not lit, press the COLOR button once.
6. Enter the generator frame mode indicating state by the procedure outlined in Operation, above.
7. Rotate the trimmer. It can be rotated several turns as it is the multi-turn type. It will rotate freely and emit a clicking sound at both ends of the rotation. Throughout the entire revolution, there are several points where CF is indicated. Any one of these can be selected but the center position of each is the optimum point. In some cases, the center position will slightly drift when the input signal is switched between 'color bar' and 'black burst.' In this case, set at the intermediate point between these two points of drift.

(4) Jam sync generate

Required setting: Internal source at jam sync [SA: 5]
Auto return of jam external [SA: 6]
Jam memory select [SB: 5]

Operation of jam sync

The function of switching the external sync signal to the internal clock to continue generating when the input signal in sync exceeds the correction range and is dropped during external sync generating, is called jam sync.

Difference in operation by the DIP switch setting

The SA: 5 setting determines to which internal clock it should sync when the external sync is switched to internal sync. For the internal clock, either the clock by the generator frame mode or the clock generated from the sync signal before being dropped, can be selected. The clock by the frame mode is identical to that used for internal sync generating.

The setting shall be:

Reference clock when SA: 5 is OFF.
Previous rate when SA: 5 is ON.

The SA:6 setting determines whether the generator should return automatically to the external sync mode or continue to stay in the internal sync mode, when the external sync signal becomes valid again, after the jam caused by the damaged or discontinuous sync signal. The generator will not return if SA:6 is at the OFF position and will return at ON position.

The SB: 5 setting, determines whether MEM 2 should be used for the jam memory or not. Jam memory is the operation of switching to internal sync from the address identical to the frame address stored in MEM 2, and is effective in the jam enable state (blinking of JAM LED).

This operation takes place when SB: 5 is ON. Also, data other than time data (such as HEX data) cannot be stored in MEM 2 (ERROR is indicated) at this setting.

Operation of jam sync

The jam enable state is entered and the LED blink slowly when the JAM key (18) is pressed during external sync generating. While in this state, if either the external sync is interrupted or the jam memory and output address coincide, it will automatically enter jam sync and switch to internal sync generating, the EXT LED will blink and the JAM LED will be lit.

How to use the FORCE JAM key

At the instant the FORCE JAM key (19) is pressed during external sync generating, the frame address at that instant will be output to the last bit and force it to internal sync generating, the EXT SYNC LED (17) will be extinguished and the JAM LED (19) will be lit.

6. REGENERATE FUNCTION

Basic theory and operation of regenerate function

Regenerate is basically one type of external sync generate. The frame address of the generated time code is the same as that input to the reader. In this operation, either the time code itself input to the reader or a signal in sync with the input time code can be used as the external sync source.

The above operation resembles simple waveform shaping but in contrast to waveform shaping which is ineffective on a defective time code, in the regenerate operation, the reader hands over the data to the generator while compensating the missing bit-one to 3 frames, and the generator outputs up to the frame next to when data ceased to arrive from the reader.

Required setting: User bit setting at regenerate [SB: 4]
Phase correction bit setting [SB: 6]

SB: 4 determines whether the time code user bit that is regenerated is to be identical to the user bit in the time code input to the reader (OFF) or to be the data that is registered as the generator user bit (ON).

SB: 6 determines whether or not the phase correction bit (No. 59) is to be made effective.

Procedures in regenerating

As input of the time code is a requirement at regenerating, check to see that the time code input indicator on the display is lit. It is also necessary that the input time code is at the proper speed for generating.

The following operation becomes possible after the above conditions are satisfied.

When time code is used for sync source

There are two methods in regenerating as follows:

When the REGEN key (16) is pressed, the REGEN and EXT SYNC LED will blink slowly to indicate the regenerate enable state. Subsequently, regenerating is started upon pressing the RUN key (14), the RUN LED blink fast, and the REGEN and EXT SYNC LED's will be lit.

When the REGEN key (16) is pressed during external sync generating (by pressing the EXT SYNC key (17), then the RUN key (14)), the frame address will coincide with the input time code at that instant, and regeneration is started (actually, after output of the last bit of the frame address output at the instant the key is pressed). Regenerating is ended when the input time code ceases to be input.

When the sync source is a VIDEO or PULSE signal

Regenerating is also possible using a video or pulse signal in sync with the input time code as the sync source. Procedures in operating the keys are the same as for the previous time code used for the sync source.

In this procedure, it is necessary that the difference between sync signal and time code be within ±1/2 frame for correct regenerating and this method is very effective at video production since most time codes of such recordings are generated in sync with the video signal.

When the sync source and time code becomes offset more than ±1/2 frame, such phenomenons as insertion of a time code with the same frame address or a missing frame address will result. Before this occurs, a continuous time

code in sync with the sync source beyond that point can be output by pressing the REGEN key (16) again to exit the regenerate mode. The frame mode of the time code under regeneration will be followed.

Examples of regeneration

In most cases of video editing, work is started by initially producing a working tape from the master tape but in the dubbing process, the time code is not directly recorded but by regenerating it through the above procedure, time code deterioration due to repeated copying can be prevented.

When sync source is interrupted

When the sync source is interrupted, the following two conditions will result, in the same way as at external sync generating, depending on the rear panel DIP switch (30) [SA: 7] setting.

SA: 7 at OFF: The RUN LED and REGEN LED will be extinguished and the EXT LED will blink; and the generator will be stopped at HOLD.

SA: 7 at ON: When sync source is interrupted, each LED for RUN, EXT SYNC and REGEN will blink slowly to indicate the enable state of each mode. When the sync source subsequently returns to normal, regeneration will start again.

Reverse direction regenerating

In the Model 4010, regenerating is possible even though the input time code direction is in reverse. However, it must be noted that if regenerating is interrupted during reverse direction regeneration, the positive direction time code will be output from that instant. If jam sync is enabled, the reverse direction is maintained after the jam caused by interrupted regenerating.

Jam sync regeneration

The jam enable mode is entered by pressing the JAM key (18) during regeneration. If the sync source is interrupted while in this condition, it will enter into jam sync operation (Refer to "Jam sync generate" for details).

When internal sync generation starts in jam sync, the REGEN LED is extinguished, the EXT LED start blinking slowly, and the blinking JAM LED will change to a constant light. After switching to internal sync, a continuation of the address immediately before switching will be successively output in the same format as the time code under regeneration.

When the rear panel DIP switch (30) [SA: 6] is set to ON, it will simply go to external sync generation without reverting to the former regenerating mode even though the sync source returns to the previous signal while in jam sync.

7. TIME CODE READER

The time code reader in the Model 4010 have the following features.

- It can read time data and user bits for the various formats of FILM, EBU and SMPTE. For SMPTE, the drop frame and non-drop frame can both be read.
- It can read time codes in speeds of 1/50 ∿ 100 times.
- It can read levels within MIN 10mV ∿ MAX 30V (p-p).
- It can output a frame tach pulse and direction signal from the time code that is input.

Operating method and the display

The reader display and operation of the keys are as follows.

- Time data of the time code that is read will be shown on the display by pressing the RDR TIME key (7) but if the generator frame mode is on display, it will change to reader frame mode display when RDR TIME key (7) is pressed. In addition, if the reader frame mode is on display when the RDR TIME key (7) is pressed, time data of the time code that is read will be shown on the display.
- The user bit of the time code that is read will be shown on the display by pressing the SHIFT key (6), then the RDR TIME (RDR UB) key (7).
- The input time code frame mode will be indicated by pressing the SHIFT key (6) → CLEAR key (FRAME) (11) → RDR TIME key (7) or RDR TIME key (7) → SHIFT key (6) → CLEAR key (FRAME) (11). If the display is already in the frame mode, the reader frame mode will be displayed by pressing the RDR TIME key (7) only, or when either RDR TIME or RDR UB is on display, by pressing the SHIFT key (6), then the CLEAR (FRAME) key (11).
- If the tenth bit of the input time code is "1", the DF indicator will be lit to indicate that it is a drop frame (at display of RDR TIME or RDR UB).

  In the same way, 29.97DF will be displayed if in the frame mode display.
- When the display is showing the frame mode, CF will be shown in the last two digits, such as 25CF, 29.97DFCF, 30CF, to indicate that a color flag exists if the eleventh bit of the input time code is "1".

(*) The relationship between the input time code and the display are as follows.

The time code on display will always coincide with the frame presently being read in. In other words, the display will always be for the frame next (the drop condition will be accurately reproduced in the drop frame mode) to which all 80 bits have been established.

Frame tach pulse and direction signal function

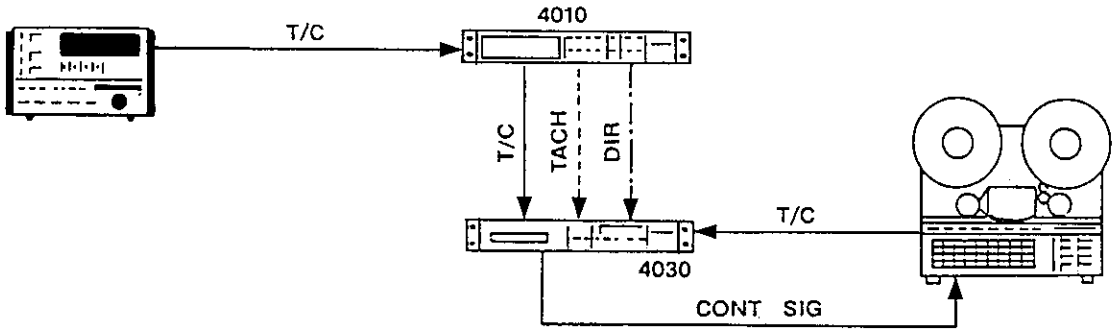
The Model 4010 can output from the ACCESSORY connector the frame tach pulse and direction signal corresponding to the time code input to the reader.

The frame tach pulse having a width about 200μsec. will continue to be output as long as a readable time code is applied to the input. The pulse at the output from the ACCESSORY connector is 5V, zero volt at the border between frames (the clock transition point between bit 79 and bit zero) and return to 5V 200μsec. later. This pulse can be input to the external sync signal input connector of a video deck, etc., as the sync signal (High level will be 3.0V and low level 0.4V when terminated by 75Ω.).

The direction signal is normally high level, and will be low level (both are TTL levels) when reading the reverse direction time code.

As the readable frequency range is wide, the 4010 can be inserted between the master equipment when inter-connecting with the 4030 Synchronizer, and by supplying the time code only from the master, the frame tach pulse and direction signal can be output from ACCESSORY 1 to the 4030. Due to this feature, good tracking of the slave can be expected if the master machine can output the time code in any mode of tape transporting.

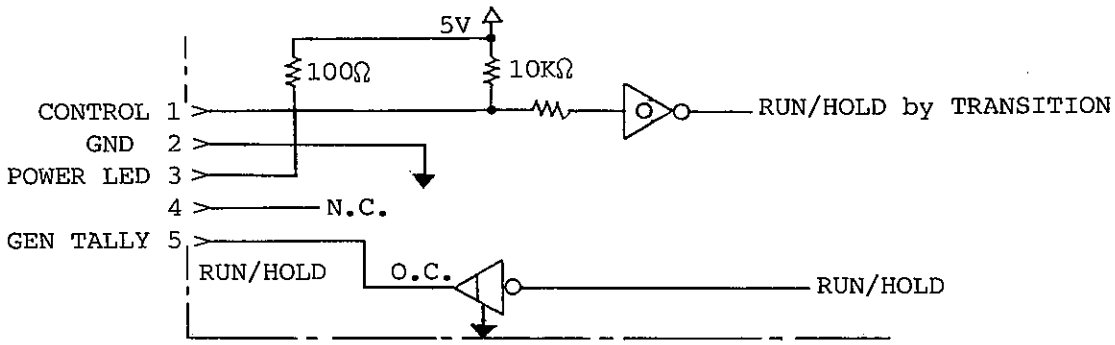
An example of inter-connections is shown below.



8. ACCESSORIES

1. Remote connector

The generator run/hold can be controlled externally through this connector. The remote connector pin assignment and the 4010 internal signal flow are shown below.



* The run/hold condition will change each time the control input level changes (transition interval is MIN 900μsec.).
  Tally output is the open collector type (300mA MAX) will be OFF during generator run and always ON in other modes (hold/run enable).

2. EVENT 1, 2 of ACCESSORY 1

Two event outputs - EVENT 1 at pin 2 and EVENT 2 at pin 4 - are available at the ACCESSORY 1, 8 pin DIN connector. Either outputs are the open collector type (300mA MAX) and their output timing are as follows:

At EVENT 1, when the MEM 1 content and the reader time coincide, EVENT 1 will be ON for 100msec. from the zero bit position of that frame.
In the same way, EVENT 2 will be ON by effect of the MEM 2 content.
EVENT 2 will be output under the above condition even though MEM 2 is used for the JAM memory.

3. Event preroll function (Software Ver. 2.0 and later)

Event preroll is the function of issuing the event output at a given length of time prior to the time indicated by the event memory. The memory for this preroll time is called "Event preroll memory (EPM)." There are two EPM's - one for MEM 1 and another one for MEM 2.
The event output time, for example, for Event 1 is -

[Event 1 output time] = [MEM 1] - [EPM 1]

If the setting is MEM 1=10 minutes and EPM=1 second, then Event 1 will be output on 9 minutes 59 seconds.

As EPM will be "0" at switch on of power, unless a value other than "0" is stored, then -

[Event output time] = [MEM]

Write/read of the EPM can be done in the same way as for MEM, etc. The EPM can be specified by the following keys:

EPM 1 = [SHIFT][JAM]
EPM 2 = [SHIFT][FORCE JAM]

Maximum time which can be stored in the EPM is -
59 seconds 29 frames

and it will be an error if an attempt is made to store a higher value.

9. COMMUNICATION (33)

1. General outline

The purpose of this interface circuit is in connecting a computer to the 4010 to control its operation externally or output the status of the 4010.

Although an interface circuit and connectors are provided as standard components, the communication cable is separately sold as an optional item.

The interface signals are electrically compatible with the EIA RS-232C specifications but although the connector is not of the regular D sub type, and uses the DIN standard 8P connector, it can be connected to a computer with the RS-232C connector by using the special cable (Model 8740) for interconnection between it and the DIN connector.

2. Hardware specifications

2.1 Electrical specifications

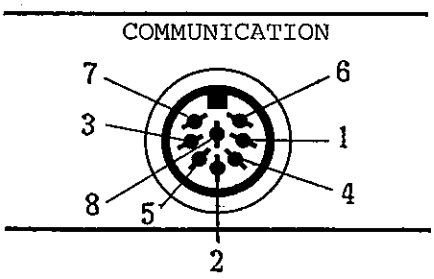
Standard	EIA RS-232C
Synchronization	Asynchronous
Communication speed (bps)	9600 or 4800
Start bit length	1 bit
Character length	8 bit
Parity bit	Odd parity
Stop bit length	1 bit
Signal level	HI +5 ∿ +12V, LO -5 ∿ -12V
Logic polarity	TXD, RXD (low true) RTS, CRS, DSR, DTR high true
Communication type	Full duplex
Equipment definition	Data terminal (DTE)

2.2 Signal line specification

An 8 pin DIN standard connector indicated "COMMUNICATION" is provided on the 4010 rear panel.

Pin assignments

Pin No.	Name of signal
1	SGD (signal common)
2	$\overline{\text{TXD}}$
3	$\overline{\text{RXD}}$
4	RTS
5	CTS
6	DSR
7	DTR
8	No connection
Shell	GRD (Protective ground)



$\overline{TXD}$ Data output from 4010

$\overline{RXD}$ Data input to 4010

RTS This signal normally urges the recipient to prepare receiving data but it is fixed at HIGH in the 4010.

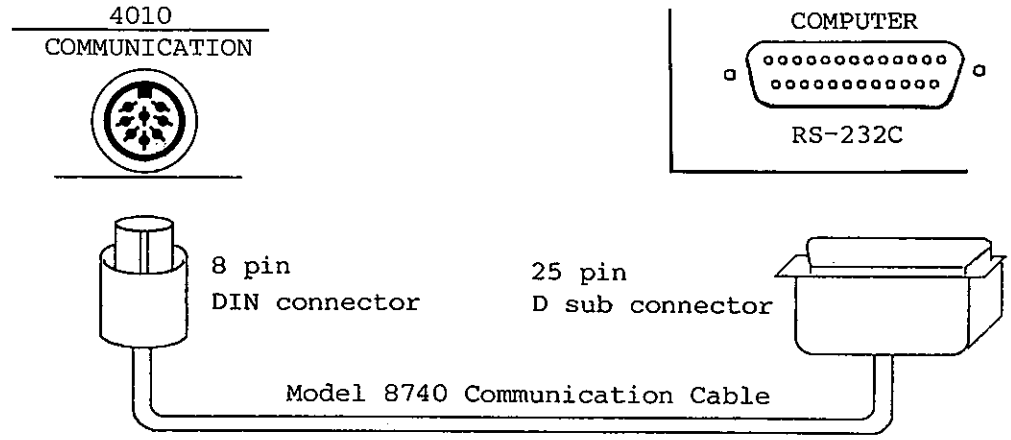
CTS This signal from the recipient acknowledges to the 4010 that it is ready to receive data from the 4010.

DSR This signal acknowledges to the 4010 that the recipient is ready to send and receive data.

DTR This signal is to notify DCE that DTE is ready to send and receive data but in the 4010, it goes to LOW only when it cannot receive data. See Item 2.3 or details on DTE and DCE.

2.3 Method of connection

The 4010 is connected to a computer through an RS-232C interface using the cable (Model 8740) shown below but it must be noted that the pin assignments must be changed in accordance to the interface specification of the computer.



There are two different formats of the RS-232C interface. They are called -

Data terminal definition DTE (Data Terminal Equipment) ..... A

Modem definition DCE (Data Communication Equipment) ... B

NOTE: Format of the 4010 is DTE. As the communication cable pin assignments at the computer side are different for DTE and DCE, this format should first be confirmed by referring to the computer manual.

2.3.1 Connection to DTE

If the computer side is the DTE format, the Model 8740 cable can be used without making any changes in pin assignment. Pin assignments of this cable are as follows:

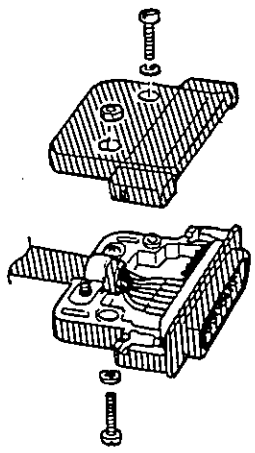
4010 (DTE) 8 pin DIN connector		Connection	Computer (DTE) 25 pin D sub connector	
Signal	Pin No.		Pin No.	Signal
SGD	1		7	SGD
$\overline{TXD}$	2		2	$\overline{TXD}$
$\overline{RXD}$	3		3	$\overline{RXD}$
RTS	4		4	RTS
CTS	5		5	CTS
DSR	6		6	DSR
DTR	7		20	DTR
-	8		8	CARDET
GRD	Shell		1	GRD

Other pins not used.

2.3.2 Connection to DCE

If the computer side is of the DCE format, pin assignments inside the 25 pin connector must be changed as follows:

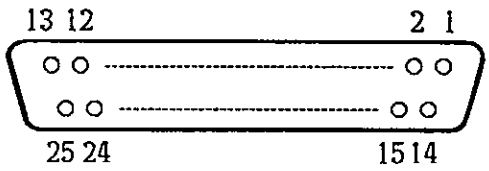
4010 (DTE) 8 pin DIN connector		Connection	Computer (DCE) 25 pin D sub connector	
Signal	Pin No.		Pin No.	Signal
SGD	1		7	SGD
$\overline{TXD}$	2		2	$\overline{TXD}$
$\overline{RXD}$	3		3	$\overline{RXD}$
RTS	4		4	RTS
CTS	5		5	CTS
DSR	6		6	DSR
DTR	7		20	DTR
-	8		8	CARDET
GRD	Shell		1	GRD



Remove the connector shell and exchange pin assignments between:

Pins 2 and 3
" 4 and 5
" 6 and 20

Pin locations seen from the solder pin side are as shown below.



2.4 Setup of the communication mode

Communication speed in the 4010 is setup by the rear panel DIP switches before power on. If switch #1 is set to up position, the speed will be 4800 bps and 9600 bps if set to down position.

In the computer, it is necessary to match the following item with those of the 4010.

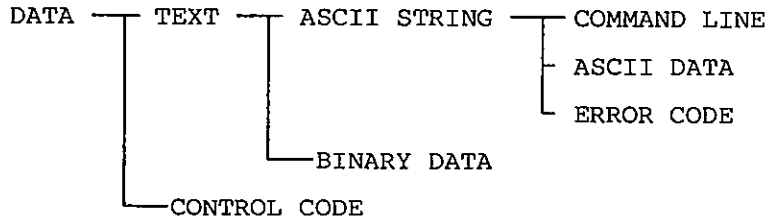
Communication speed	Selectable to 4800 or 9600 bps
Character length	8 bits
Parity	Odd number parity
Stop bit	1 bit

3. Method of communication

3.1 Communication data

3.1.1 Types of data

Data are sent and received in 8 bit units. One set of 8 bits is called a character. A string of information comprised of characters is called a text. Data are classified as follows:



In the ASCII string, a control code is added to indicate the end code (called 'delimiter').

Control codes other than delimiter are often inserted at random locations in the ASCII string.

Binary data are always sent and received when the number of transmitting characters are clear. Control codes cannot be inserted in binary data.

3.1.2 Character set

Characters used for data are as follows:

1) ASCII letter codes 32 (20H) ∿ 126 (7EH)
   Used for ASCII strings.
2) 8 bit binary 0 ∿ 255 (0FFH)
   Used for binary data.
3) ASCII control codes 0 ∿ 31 (1FH) and 127 (7FH)
   Used for control codes.

The function of each code are as follows:

ASCII control codes				Functions in the 4010	
10	(0AH)	LF	Line feed	Used as the ASCII string terminator. See 3.1.3.	
13	(0DH)	CR	Carriage Return		
17	(11H)	DC1	Device control 1	XON character	Explanation in Item 3.2.2
19	(13H)	DC3	" " 3	XOFF "	

4) Not defined ASCII codes

The 4010 will never transmit characters as ASCII strings or control codes other than defined in above items 1) and 3).

If the 4010 receives an undefined code other than when receiving binary data, it will ignore it. In other words, the condition will be as if those characters were not sent at all.

3.1.3 Delimiter (ASCII string terminator)

The 4010 will send CR LF as the delimiter.

The 4010 will accept any of the following as the delimiter:

CR, LF, CR LF, LF CR

3.2 Busy control

During communication, there is the possibility of the receiving end taking too long a time to process incoming data and more data could be sent before the processing is completed. When such a situation occurs, it will cause data drop out and result in serious errors (called overrun error).

To prevent this, when such a situation (busy condition) is foreseen, it becomes necessary to request from the receiving side to the transmitting side, to temporarily cut data transmission. This is called 'busy control'. In the 4010, two methods of busy control are available and both methods are always in function but either one only need be supported at the computer side.

3.2.1 Hardware hand-shake

Signal names (DTR, etc.) which appear in this item 3.2.1 shall be for that in the 4010 side.

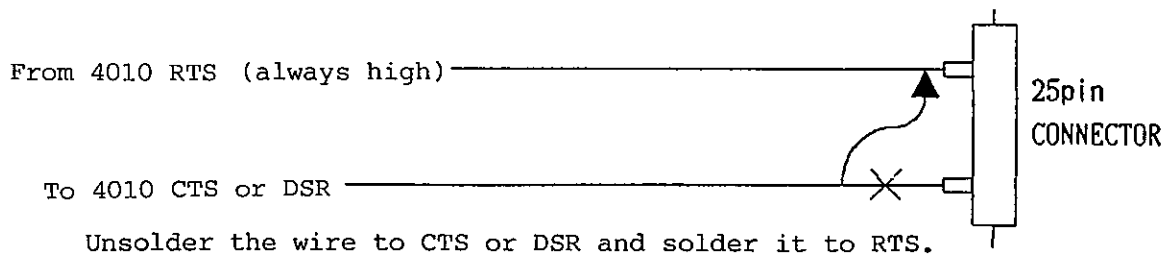
When the 4010 can receive data, the DTR signal is set to HIGH and when not able to receive it (busy state), this signal is set to LOW. Only when this signal is at HIGH will the computer transmit data to the 4010.

When either the CTS signal or DSR signal is at LOW, the 4010 will not transmit any data. Therefore, when the computer is in the busy state, it is only a matter of setting either one of these signals to LOW. Only when both CTS and DSR are at high will the 4010 transmit data.

When the computer is not to use this function, it is necessary to maintain both CTS and DSR at HIGH.

In the case when only one of either CTS or DSR is to be used, the other signal must be maintained at HIGH.

If these signals cannot be maintained at HIGH by the computer interface, change the wiring at the connector as shown in the schematic.



Unsolder the wire to CTS or DSR and solder it to RTS.

3.2.2 XON/XOFF

The other method of busy control is called XON/XOFF. When the data receiving side enters the busy state, it transmits a specific character called XOFF to the data sending side. When the data sending side receives this character, it interrupts the data transmission. When the data receiving side ceases to be busy and is able to receive data, it sends a signal named XON to the data transmitting side. Upon receiving this XON character, the sending side resumes the interrupted data transmission.

For XON, the ASCII character DC1 code (11H), and for XOFF, the DC3 code (13H) is used.

When the 4010 is commanded to interrupt transmission by either one of the above two methods, the 4010 will interrupt the transmission. However, there is the possibility of a maximum of two characters being sent after receiving the interrupt command.

The 4010 will not send data when a sending permission is not issued by both the above two methods.

Both methods (Items 3.2.1 and 3.2.2) are simultaneously enforced when the 4010 requests the other equipment to interrupt data transmission.

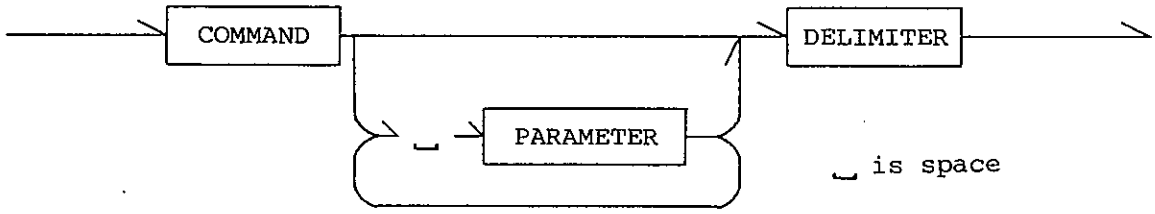
Sending and receiving of the XON/XOFF code itself shall not be obstructed by the transmission permission/refusal codes.

It shall be declared permissible to insert XON/XOFF at any point in the ASCII code test. It cannot be inserted in binary data.

3.3 Command processing

3.3.1 Command line format

This is the command format externally sent to the 4010.
The command line will consist of the commmand only or the command and the parameters.



3.3.2 Response of the 4010 (the command echo back)

In the 4010, the command echo back will be ON when the command line is opened and is in the initial state immediately after entering the remote mode but ECHO back can be switched OFF by the ECHO command (Refer to item 3.3.6). After this, the 4010 will correctly receive the command and if it can execute it, the first three letters of the command line received, will be returned.

If the command cannot be correctly received regardless to whether echo back is ON or OFF, the following error code is returned and enter in the new command accepting mode. BSY, RER, and CER are returned after the command line is terminated but PER, OER and FER are immediately returned at the instant these errors occur.

Also, at the instant the 4010 receives a command, if it is in the state same as if it had already received this command, an error code will not be returned.

Error code	Meaning	
DER	DATA ERROR	Illegal text or parameter
BSY	BUSY	Unable to process the command
RER	REMOTE MODE ERROR	Not in remote mode*
CER	COMMAND ERROR	Command not defined
PER	PARITY ERROR	Parity error
FER	FRAMING ERROR	Framing error
OER	OVER RUN ERROR	See item 3.2

* See item 3.3.3.

NOTE: On occasion, when a command line is sent to the 4010 from outside, an error code is occasionally returned when the 4010 cannot keep up with the processing. This has been corrected from version 2.0 and after but may also occur when a continuous command line is automatically sent by the computer program at 9,600 bauds.
Should this happen, please process so that "the computer confirms the command echo back and, if an error occurs, send again the command line previously sent."

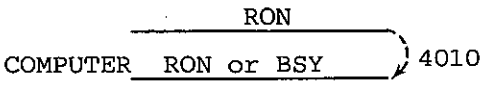
3.3.3 Remote mode

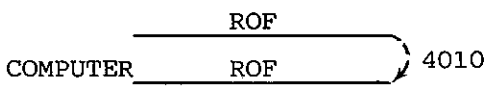
To avoid confusion in operation between the 4010 panel buttons and the computer, it is designed so that if the present operation is by the 4010, the computer control will be inactive, or vice versa. The condition of external control operation is called the 'remote mode.'

First, the computer requests the 4010 to enter remote mode by sending the RON command. Then, if the 4010 is able to enter remote mode, this is informed by returning "RON." Upon receiving this, the computer proceeds to the next operation.

Once it enters the remote mode, operation by the 4010 panel buttons cannot be done until the remote mode off command (ROF) is applied from outside.

When the 4010 receives RON and it cannot go to the remote mode (for instance, when it is editing data), it returns, not RON, but BSY.



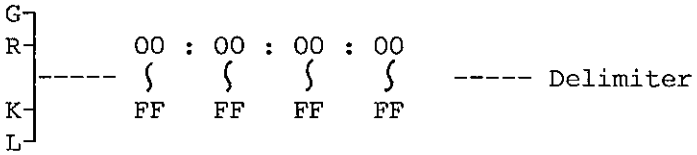


If a command other than RON is sent when the 4010 is not in the remote mode, these command will not be accepted and RER is returned.

The remote mode will be cancelled if the CLEAR button on the 4010 is pressed.

3.3.4 Time data

ASCII data within the command line or the time data as a parameter is entered as follows:



G = Generator time
R = Reader time
K = Generator User Bits
L = Reader User Bits

Data without a header (G, R, T, U) is called [TIME].

3.3.5 Letters to be used

Both capital letters and small letters will be accepted in the command line. Outputs will all be in capital letters.

3.3.6 List of commands

	Command	Parameter(1)
Remote mode	RON	None
	ROF	None
Data transfer	TFR	i, j
	DON	b, r
	DOF	None
	STA	x_1
Display mode	DSP	
Control	RUN	a
	CLO	a
	REG	a
	EXT	a
	JAM	a
	FJM	a
Mode control	GMD	x_1, x_2

*(1) Parameters

a = 0, 1
b = 0, 1
i = G, R, K, L, M, J, C, P, Q
j = G, R, K, L, M, J, C, P, Q
k = G, R, K, L, M, J, N, O, P, Q
r = G, R, K, L, M, J, P, Q
x = Parameter original to each command. For the content, refer to explanation on each command.

G: Generator time	K: Generator UB
R: Reader time	L: Reader UB
M: MEM1	N: Generator frame mode
J: MEM2	O: Reader frame mode
C: COMMUNICATION	P: Event preroll memory for MEM1
	Q: " " " " MEM2

RON	Remote function will be ON. All operation will be through the COMMUN connector. The 4010 front panel controls will be ineffective except for CLEAR. When it enters the remote mode after correctly receiving this command, the 4010 display indicator will change to blinking (which indicator among the four will blink depends on condition of the display immediately before receiving RON. After this, it will change depending on the DSP command. Refer to explanation on DSP.) This condition will not change until a ROF command is accepted or the 4010 CLEAR key is pressed.
ROF	Remote function will be cancelled. All operations can now be done from the 4010. In this state, when a command other than RON is received, RER is returned. This state will not change until RON is received.
TFR i, j	Time data of i is transferred to j. When i=C, or in other words, when data is transferred to the 4010 through the communication line, data must be contained in the command line as follows: TFR C,j [time]
DON b,r1 DON b,r1,r2 DON b,r1,r2,r3 DON b,r1,r2,r3,r4	Requests transmitting of time data to the 4010. One set of time data specified by r1 ∿ r4 is sent once when b=0. When b=1, it goes to the continuous transmitting mode and thereafter, the specified time data is repeatedly sent sequentially. The continuous transmitting mode is cancelled by the DOF command. The continuous transmitting mode will be in effect even after the remote mode is cancelled by the ROF command. r1 ∿ r4 are optional combinations(maximum 4 letters) of one letter each from among G, R, K, L, M, J, P or Q. A data consisting of a format with a header is sent from the 4010. When another command is sent to the 4010 while it is transmitting in the continuous mode, it will be processed after one set of data, shown below, are sent.

Computer → 4010	4010 → computer
DON␣1, G, R, K[delimiter]	DON[CR LF] G[time][CR LF] R[time][CR LF] K[time][CR LF]
RUN␣0[delimiter]	G[time][CR LF] R[time][CR LF] K[time][CR LF] RUN[CR LF]
DOF[delimiter]	G[time][CR LF] R[time][CR LF] K[time][CR LF] DOF[CR LF]

DOF

Cancels the continuous transmission established by DON.

STA x_1

x_1 is one number from 0 to 3 and is the requesting command for information such as RDR frame mode, GEN status, etc.
It will be requesting information, on the reader (RDR) when X=0,1 and, on the generator (GEN) when X=2,3.
After the command echo back, the 4010 sends eight 0 and 1 with periods between each number.
Example:

STA␣1[delimiter] →
← STA[CR LF]
← 1.0.0.0.0.1.0.0[CR LF]

x and meaning of the information sent in response are given in List 1.

Bit \ x_1	Information on RDR		Information on GEN	
	0	1	2	3
1	Code input	CF bit	GEN OUT	Sync source
2	0	27 bit	EXT ENA	" "
3	Direction	43 bit	EXT ON	0
4	0	58 bit	COLOR ENA	REGEN ENA
5	0	59 bit	COLOR ON	REGEN ON
6	Frame mode	0	Frame mode	0
7	Frame mode	0	Frame mode	JAM ENA
8	Frame mode	0	Frame mode	JAM INT

List 1

Zero will always be sent for "0" in List 1. The meaning of 0 and 1 of each bit are shown in List 2.

Information	1	0	Remarks
Code input	Yes	No	Readable time code input → 1
Direction	Forward	Reverse	0 if no input
GEN output	Yes	No	Time code actually output → 1
EXT ENA	ENA	DIS	Selects external sync (regardless to input)
EXT ON	EXT	Others	External sync mode and input is normal → 1
COLOR ENA	ENA	DIS	Selects color frame lock (regardless to input)
COLOR ON	COL	Others	Color frame lock and input is normal → 1
REGEN ENA	ENA	DIS	Selects regen mode (regardless to operating mode)
REGEN ON	On REG	Others	Operating in regen mode
JAM ENA	ENA	DIS	Jam sync mode (regardless to operating condition)
JAM ON	On JAM	Others	At INTERNAL during jam sync → 1

List 2

When x_1=0 or 2, the frame mode represented by bit 6 through 8 will be coded as shown in List 3.

bit 6	0	0	0	0	1	1	1	1
bit 7	0	0	1	1	0	0	1	1
bit 8	0	1	0	1	0	1	0	1
Frame mode				nd	df	30	25	24

List 3

When X=3, sync source type represented by bits 1 and 2 are given in List 4.

	<table><tr><td>bit 1 bit 2</td><td>0 0</td><td>0 1</td><td>1 0</td><td>1 1</td></tr><tr><td>Sync source</td><td>VIDEO</td><td>TIME CODE</td><td>1 PULSE/ FRAME</td><td>2 PULSE/ FRAME</td></tr></table> List 4
DSP k	The command for putting the data indicated by k on the main unit display. Depending on the data on display, the state of on or off of the four LED's (blinking indicates the remote mode) will be as follows: <table><tr><td rowspan="2">k</td><td rowspan="2">Type of data</td><td colspan="4">Display indicator LED</td></tr><tr><td colspan="2">RDR</td><td colspan="2">GEN</td></tr><tr><td></td><td></td><td>TIME</td><td>UB</td><td>TIME</td><td>UB</td></tr><tr><td>G</td><td>Generator time</td><td>-</td><td>-</td><td>*</td><td>-</td></tr><tr><td>R</td><td>Reader time</td><td>*</td><td>-</td><td>-</td><td>-</td></tr><tr><td>M</td><td>MEM 1</td><td>*</td><td>*</td><td>*</td><td>*</td></tr><tr><td>P</td><td>Event preroll memory for MEM 1</td><td>*</td><td>*</td><td>*</td><td>*</td></tr><tr><td>J</td><td>MEM 2</td><td>*</td><td>*</td><td>*</td><td>*</td></tr><tr><td>Q</td><td>Event preroll memory for MEM 2</td><td>*</td><td>*</td><td>*</td><td>*</td></tr><tr><td>K</td><td>Generator user bit</td><td>-</td><td>-</td><td>-</td><td>*</td></tr><tr><td>L</td><td>Reader user bit</td><td>-</td><td>*</td><td>-</td><td>-</td></tr><tr><td>N</td><td>Generator frame mode</td><td>-</td><td>-</td><td>*</td><td>*</td></tr><tr><td>O</td><td>Reader frame mode</td><td>*</td><td>*</td><td>-</td><td>-</td></tr></table>*: Blink -: Extinguished
RUN a	The generator run hold command. The RUN or RUN ENABLE mode is entered by a=1, and HOLD by a=0.
CLO a	The COLOR LOCK command. It will enter LOCK or LOCK ENABLE by a=1, and be cancelled by a=0.
REG a	The regenerate command. It will enter REGEN or REGEN ENABLE by a=1, and be cancelled by a=0.
EXT a	Internal or external of sync source is selected. It will be external by a=1 and internal by a=0.
JAM a	Selection of JAM SYNC function. It will be ENABLE by a=1 and DISABLE by a=0.
FJM a	It will switch from external sync to internal sync by a=1, and switch from internal sync to external sync by a=0.
ECO a	a=0 command echo back OFF a=1 " " " ON

GMD x_1,x_2

Various settings necessary for generator operation is carried out. The values of x_1, x_2 and content of the setting are as follows:

	x_1	x_2	Content of setting
Sync source	C	0	Time code
		1	Priority on time code, auto switching with video
		2	Priority on time code, auto switching with X1 pulse
		3	Priority on time code, auto switch-switching with X2 pulse
	S	0	Video
		1	Priority on video, auto switching switching with time code
	P	0	X1 pulse
		1	X2 pulse
		2	Priority on X1 pulse, auto switching with time code
		3	Priority on X2 pulse, auto switch-
Jam sync	H	0	Jam sync source, X'tal
		1	Jam sync source, hold data
	J	0	Jam auto return, ineffective
		1	Jam auto return, effective
Ext sync	R	0	HOLD by sync source loss at external sync
		1	RUN ENABLE by sync source loss at external sync
Regen.	B	0	UB at regenerate, reader UB
		1	UB at regenerate, generator UB
MEM	M	0	Memory 2. jam memory ineffective
		1	Memory 2, Jam memory effective
Frame mode	G	0	Generator frame mode 24
		1	Generator frame mode 25
		2	Generator frame mode 30
		3	Generator frame mode 29.97df
		4	Generator frame mode 29.97nd
59 bit	E	0	Phase correction OFF
		1	Phase correction ON
Pulse I/F generate	I	1	Pulse I/F mode, X1 pulse
		2	Pulse I/F mode, X2 pulse

10. SPECIFICATIONS

Time code input	
Level	10mV ∿ 30V p-p
Impedance	20KΩ unbalanced, RCA pin connector
Readable range	20bps ∿ 260Kbps
Video input	
Format	Composite video - NTSC, PAL, SECAM
Level	0.5V ∿ 2V p-p
Impedance	10KΩ unbalanced, BNC connector
Pulse input	
Level	0.5V ∿ 30V p-p (At input of 30Hz square wave)
Input waveform	Sine wave, square wave, pulse (Pulse width 1μSEC. min.)
Readable range	0.5Hz ∿ 500KHz (At input of sine wave)
Time code output	
Format	SMPTE, EBU, FILM
Level	Adjustable 0.1V ∿ 10V p-p
Rise time	25μSEC.
Remote connector	External remote control input - 5 pin DIN connector
Accessory 1	Event control output, etc. - 8 pin DIN connector
Communication buss	RS-232C, 8 pin DIN connector
Accessory 2	Data output - 30 pin flat cable connector
Power	120V AC, 60Hz, 12W 220/240V AC, 50Hz, 12W
Physical dimensions	482(W) x 48(H) x 250(D) mm
Weight	3.3kg

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