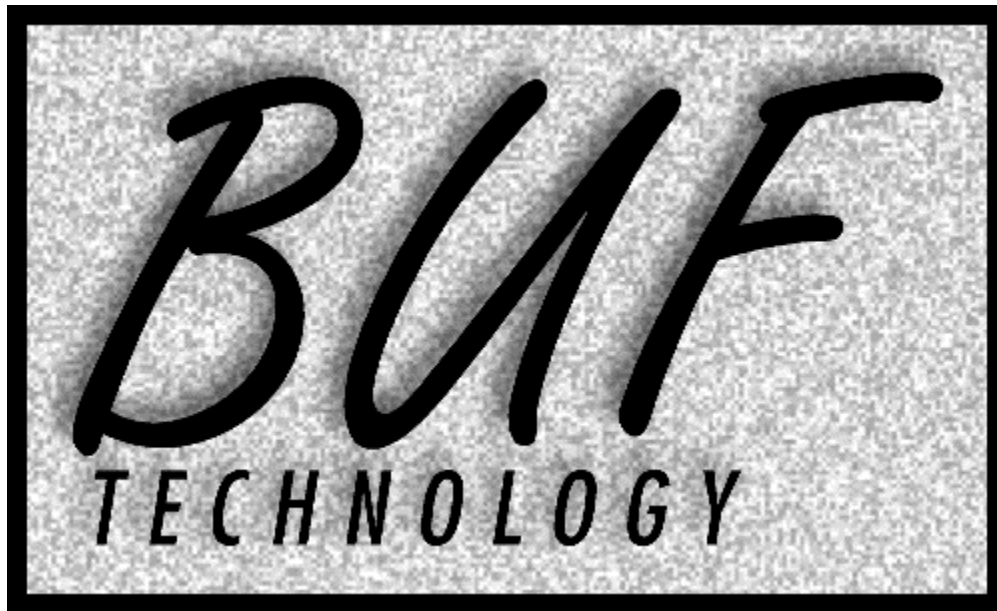




High Definition Replay System

INSTRUCTION MANUAL

VERSION: 150106

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INTRODUCTION

FCC RADIO FREQUENCY INTERFERENCE STATEMENT

This device complies with part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

Changes or modifications not expressly approved by BUF Technology could void the user's authority to operate this equipment. Shielded cables must be used with this equipment to maintain compliance with FCC regulations.

WARRANTY STATEMENT

BUF Technology warrants that the equipment it manufactures is free from defects in materials and workmanship. Equipment that has been operated within its ratings and has not been subjected to mechanical or other abuse or modification and has failed because of such defects, will, at the option of BUF Technology, be repaired or replaced if it is returned, freight pre-paid, to BUF Technology within two years from the date of shipment. Equipment that fails under conditions other than described herein will be repaired at the price of parts and labor in effect at the time of repair.

The disk drive used in the Sport-HD Replay System is not warranted by BUF Technology. Please refer to the respective disk drive manufacturer for warranty information. When Sport-HD is disconnected from its power supply, power should not be reapplied for at least five (5) seconds. Failure to follow this procedure results in "short cycling" of the power and could cause permanent damage to the disk drive. Although it is safe to remove and install the disk cartridge while power is on, this should never be done during recording as the disk will likely become unreadable (lose all recordings) and require reformatting.

This warranty is in lieu of all other warranties, express or implied, including, but not limited to, any implied warranty of merchantability or fitness for a particular purpose. BUF Technology is not liable for any consequential damages.

OVERVIEW

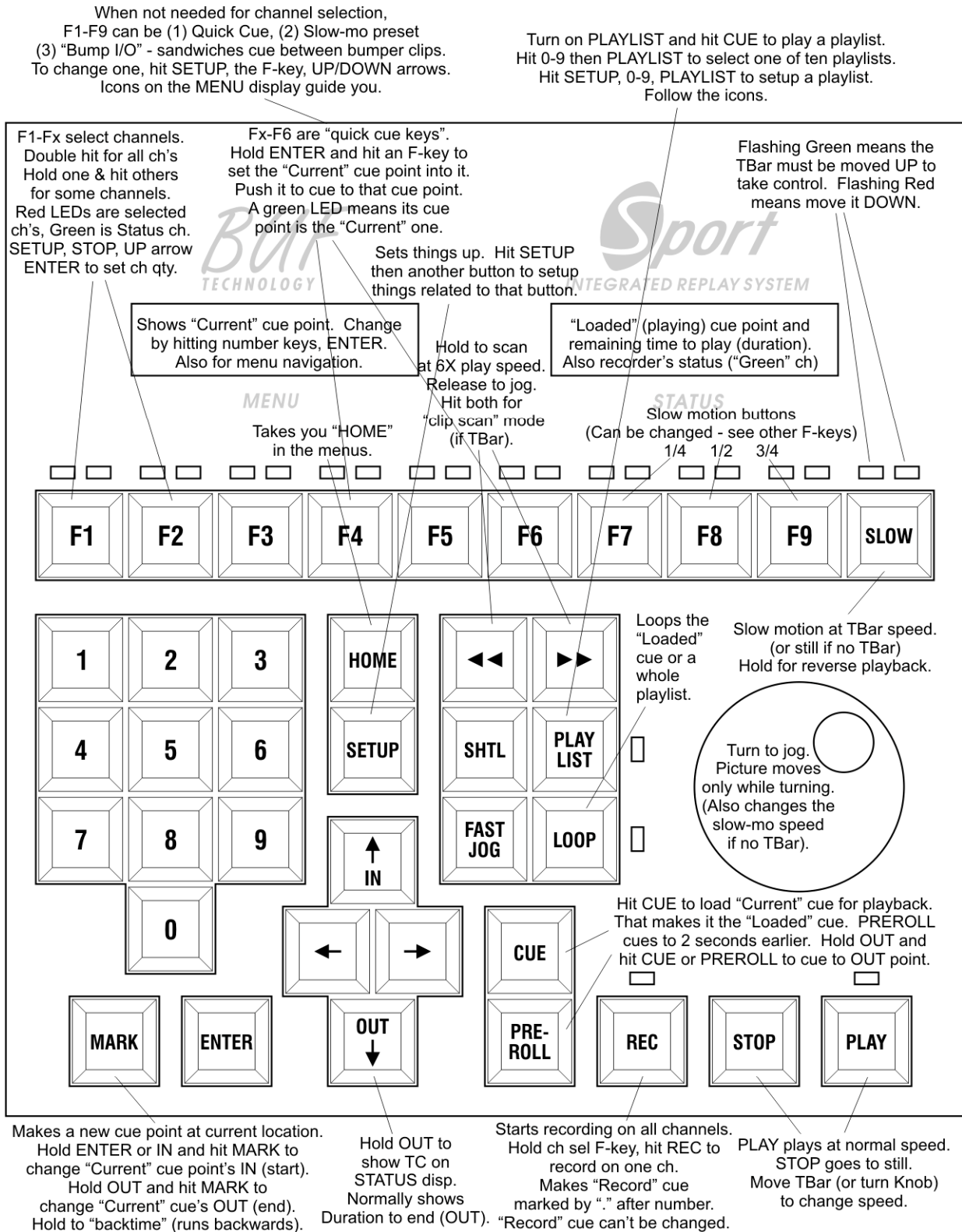
The Sport-HD Replay System is a multi channel replay system consisting of a Sport-EX control panel with TBar and one to six separate RM-HD Replay Recorder hard disk replay recorders. Separate single channel HD video servers are used, so record and playback operations are separate and cannot occur simultaneously (recording must stop when in playback mode). One HDSDI input and output are provided per channel which carry eight channels of embedded digital audio in addition to the video signal. Two channels of analog audio are provided which replace the first two embedded channels if used. Power is supplied to each RM-HD Replay Recorder by a 12VDC, 3A (minimum) converter. Power to the Sport-EX controller is provided by the first RM-HD in the system.

All recording and playback operations are controlled by the operator via the SPORT-EX control panel. Channels can be selected together, independently, and/or in any combination. Memory for up to 1000 cue points allows instant cueing of any or all channels to the same point in time. Each cue point references the clip from which it is made, and timecode within the clip that may begin at zeros or the time of day when recorded. A clip is created automatically when recording begins using the next available cue point number. When a cue point is manually marked, it remembers the clip that is playing or recording, which is recalled each time the cue point is used. Clip names are handled transparently to the operator, however a cue point that denotes a recorded clip is indicated by a period (.) after its number, and can be deleted, but not changed. Ten playlists of up to 100 cue points can be programmed and played with seamless cut edits. Cue points or entire playlists can be looped indefinitely.

**SPORT-EX CONTROL PANEL**

QUICK REFERENCE

To best learn Sport-HD, feed channels with test sources (tape, off air, or DVD), and outputs to monitors. Don't use static pictures for testing, the more motion the better. Start with displays, F1-Fx, REC, MARK, CUE, PLAY, SLOW, KNOB, SCAN (◀◀, ▶▶). Play with it until you are comfortable, then move on to PLAYLIST, LOOP, BUMP I/O.



INSTALLATION

1. Install the RM-HD1 and/or RM-HD2 SPORT-HD Replay Recorders in a 19 inch rack using standard mounting methods. The rear of the units may be secured if desired using separately purchased rack ears (recommended only in high shock applications).
2. Connect HDSDI IN of each channel to a feed from a camera, CCU, aux buss, or input selection router.
3. Connect HDSDI OUT of each channel to a video switcher, distribution system, and/or monitor.
4. Connect SD video reference to REF input (use standard bi-level SD blackburst - tri-level HD sync is not recommended). Reference is optional and needed only if the production switcher requires timed signals.
5. Optionally, connect up to 2 channels of line level balanced analog audio inputs and outputs to the XLR audio connectors (+4 professional levels, not -10 consumer levels). An additional six embedded audio channels (3-8) may be fed to the HDSDI input. All eight audio channels are embedded on the HDSDI output signal. External audio embedding and disembedding equipment can be used to access the digital audio channels.
6. Using the 15 foot (5 meter) RJ45 cable, connect the PANEL connector of the first (CH-1) RM-HD unit to the AUX-E connector on the TBar. Using a short RJ45 cable, connect the AUX connector on the TBar to the main control panel RJ45 connector. In applications where the control panel must be located farther than a 15 foot cable will allow, an extension system is available that allows up to 1000 meters of distance.
7. Using a short RJ45 cable, connect the PANEL connector of each successive RM-HD unit to the previous channel's NEXT connector. This is how the channels are assigned to the control system.
8. If time of day timecode is available and desired, connect it to the TC connector on the Sport-EX TBar.
9. Connect the 12VDC, 3A (minimum) power supply to the power input of each RM-HD and apply mains power. The displays of the control panel should light up and the lamps on each RM-HD disk should light. After about 25 seconds (if disk is erased), all channels should be finished booting and recording/playback should be possible. Timecode will replace NO RESPONSE on the STATUS display. The time required for this process will become longer as more video is recorded on the disk, and can take up to several minutes.
10. Press SETUP, STOP, UP arrow to CHANNEL QTY, ENTER. Type the number of channels on the keypad (1-6), ENTER. F1 through up to F6, depending on the number of channels, are channel select keys.
11. Double-tap a channel select F-key to control all channels. Select a single channel with a single tap. Hold one and press others to select some channels. The red LED above channel select keys indicate the channels being controlled. The green LED above one indicates which channel is shown on the STATUS display. (If only one channel is used, no F-keys are used for channel selection, and F1 will be available for other functions.)
12. Select the type of HDSDI signal that is to be used on each channel as follows: Select one or more channels. Press SETUP, REC, use the UP and DOWN arrows to INPUT VIDEO SEL, press ENTER, UP and DOWN arrows to input type (INTERLACE, PROGRESSIVE), press ENTER. Also set the frame rate (field rate if interlaced): DOWN arrow to TV STANDARD SEL, enter, UP and DOWN arrows to the frame (or field) rate (59.94, 50, or nonstandard 60). These must both be set correctly or recordings will not cue or playback.
13. Optionally, enter the time of day and date using the menu (if timecode is applied, only the date is relevant): Press SETUP, REC, UP/DOWN arrows to SET TIME OF DAY, ENTER, and enter the time of day (HHMMSS) in 24 hour format (add 12 to hours for PM, 00 for 12AM), ENTER, enter date (YYMMDD), ENTER, HOME. Enter zeros if clips are to begin at zero.
14. Make a test recording: Press REC, wait at least five seconds, press CUE, the STATUS display should read CUED. Press PLAY, all channels should play back the recorded video. When the disk is erased and/or when the unit is first powered up, it may be necessary to try the first recording a second time (make a test recording!). If CUED does not appear and/or video does not play back on any channels, check the HDSDI type and rate (step 12) and check input/output signals by inserting a BNC barrel between the input and output cables in place of the suspect RM-HD to see if input HDSDI feeds through to the output monitoring. If it checks OK and you are sure the HDSDI is the same format as set in step 12, the disk may be bad or may need formatting.

WARNING: Whenever power is disconnected from an RM-HD, always wait at least 5 seconds before reapplying power. Failure to follow this procedure results in "short cycling" the disk drive power and, on rare occasions, could cause permanent damage to the disk drive. Avoid applying unreliable power that is susceptible to repeated interruptions or "brown outs". The disk drive is not covered under the Sport-HD warranty.

BASIC OPERATION

1. To select a channel for control, press its F-key (F1 for ch-1, etc.). Double-tap the F-key to select all channels. Hold the F-key and tap others to select some channels. The red LED lights above channels selected for control, the green LED lights above the status channel (the channel shown on the STATUS display).
2. Press REC to start recording. A cue point is automatically created. Always records on an unused part of the disk(s) so existing material cannot accidentally be recorded over. All channels are automatically selected.
Note: When first powered up, double-tap the STOP key to enter pass-through mode and check that input video is passed through to the output. Then do a test recording and cue it. If it is unsuccessful, try a second time.
3. Stop recording and scan back at 6 times normal speed using the reverse scan (◀◀) key. The forward scan key (▶▶) scans forward. Hold for scan, release for still. Turn the knob to fine tune the position (jog mode).
4. Press PLAY to playback at normal speed (play mode) or press F7, F8, or F9 to playback in slo-mo at ¼, ½, or ¾ normal speed. Use the TBar to adjust slo-mo speed; the knob for jog.
No button pushes are needed to change between play, slo-mo, and jog modes. TBar all the way up is play mode, move down for slo-mo, bottom is still. Then just turn the knob for jog, TBar back up to return to slo-mo.
5. During recording or playback, press MARK to create a new cue point. Cue points are marked via the status channel TC. For better accuracy, *hold down* MARK to back-time the cue point by the amount of time it is held.
6. Press CUE to cue playback to the location that MARK was hit, or press PREROLL to cue 2 seconds earlier. If multiple channels are selected, they will all cue to the same point in time.
7. To select any cue point, BUT NOT cue playback, enter the cue number on the keypad and press ENTER. To select any cue point, AND instantly cue playback, enter the cue number on the keypad and press CUE. This is the *current* cue. It shows on the MENU display and can be changed with the LEFT/RIGHT arrow keys.
8. To change the IN point (beginning) of an existing cue (the *current* cue), hold ENTER (or IN) and press MARK.
9. To change the *current* cue's OUT point (end), hold the OUT key and press MARK. Normal or slo-mo playback will pause exactly at the OUT point. To resume playback, press PLAY or a slo-mo key. Playback will again stop at the end of the recording. To cue to the OUT point, hold OUT and press CUE. Hold OUT and press PREROLL to cue 2 seconds before the OUT point.
10. Hold ENTER and hit F1-F6* to store a quick cue. Anytime a quick cue key is hit, playback is instantly cued.
11. Clip scan: To quickly scan a loaded clip from IN to OUT, press both scan keys (◀◀ & ▶▶) together. As the TBar is moved, playback continually cues to the point proportional to the TBar position. End the clip scan mode by using any playback or record function (example: turn knob to enter jog mode).
12. The STATUS display shows the time remaining before the OUT point. Slo-mo speed is taken into account so the display shows the actual time it will take to finish playing. Hold IN or OUT to show timecode.
13. Hold ENTER and press PLAYLIST to add the *current* cue to the end of the *current* playlist. To *edit*, press SETUP, PLAYLIST. Use the arrow and number keys to insert cues anywhere in the playlist. Also cues can be deleted or pauses (STL) can be inserted (the display shows which keys to use). Press HOME when done.
14. To *play* a playlist, press PLAYLIST, CUE, then PLAY. As playback reaches the OUT point of each cue in the list, it cuts cleanly to the IN point of the next cue. While playing a playlist, the STATUS display shows the time remaining in the entire list (or until the next pause), and is adjusted for slo-mo speed. A pause (STL) stops playback, and shows a still frame at the OUT point of the playing cue, press PLAY to still frame at the IN point of the next cue. Then PLAY again to resume playback. Slow motion can also be used during playlist playback.
15. There are ten playlists. To select a different playlist, press a keypad number (0-9) immediately before using the PLAYLIST key. To add the *current* cue to *any* playlist, hold its keypad number (0-9) and press PLAYLIST (adds cue to that playlist, but does not change the *current* playlist). Each playlist holds up to 100 cues.
Note: Changing the *current* playlist affects both the next playlist that will be *cued*, and the next playlist that will be *edited* (this is a change from earlier versions to simplify operation).

* If 2 or more channels are configured, F1-Fx select channels and are not available for other functions.

COLD BOOT

If the Sport-EX controller is acting strangely or not communicating with the connected channels, normal operation might be restored by performing a COLD BOOT. See COLD BOOT near the end of this manual for directions.

OPERATION

SELECTING CHANNELS

To select a channel for control, press its F-key (F1 for ch-1, F2 for ch-2, etc.). Double-tap the F-key to select all channels. Hold the F-key and tap others to select some channels. The red LED lights above channels selected for control, the green LED lights above the status channel (the channel shown on the STATUS display). All transport and other functions apply to the selected channels and do not affect unselected ones.

When the REC key is pressed to begin recording, ALL CHANNELS are selected automatically.

To record on fewer than all channels (e.g. one channel), hold a channel select F-key (and optionally select others), then hit REC while still holding the first channel select key.

To set the total number of channels in the system:

SETUP, STOP, UP arrow to CHANNEL QTY, ENTER, total number of channels on the keypad (1-6), ENTER.

RECORDING

To record, simply press REC. To stop recording and enter the playback mode, press any playback related key such as STOP, CUE, PREROLL, or reverse scan (◀◀). It is not necessary to press STOP to end a recording (however this can be enabled optionally, see the RECORD SETTINGS, REC END MODE menu setting).

When REC is pressed, all channels are selected and begin recording. To record on fewer than all channels, hold a channel select key while hitting REC (see SELECTING CHANNELS). A cue point is automatically created that memorizes the name and length of the recording. It is identified by a 3-digit number followed by a period "." (the period indicates it is a *record cue point*). Recording occurs on unused parts of all disks; existing material cannot accidentally be recorded over.

To check the remaining record time, press SETUP, REC. "FREE=" and the approximate amount of available record time for the selected channel is displayed (program content can vary the actual record time somewhat). If SET TIME OF DAY is shown, then current time of day is shown instead; hit DOWN ARROW to show free space. Additional record time can be obtained at the expense of lower picture quality by changing the compression rate, see RECORD SETTINGS, COMPRESSION (SD CHANNELS ONLY).

PLAYBACK

Press PLAY for normal speed playback. Press F7 to play in slow motion at $\frac{1}{4}$, F8 to play at $\frac{1}{2}$, or F9 to play at $\frac{3}{4}$ normal speed (to change these default speeds, see SLO-MO SPEED PRESET KEYS). Move the TBar to vary playback speed between zero (still) at bottom, and 100% normal speed at top. When speed is set by keystroke (PLAY, STOP, F7-F9), the TBar must be moved to that speed before it will take control. A flashing SLOW key LED indicates this, green for up, red for down. Once the TBar takes control, the green LED lights continuously if in slow motion playback, or the PLAY key LED lights if at 100% speed.

It is not necessary to press any keys to change between variable play (slow motion) and jog modes:

When playback is at still, simply turn the knob to jog or raise the TBar from the bottom to begin playing in slow motion. In jog, playback moves relative to the amount the knob is turned and stops when the knob is stopped.

The FAST JOG key enters the fast jog mode which is identical to jog, but picture movement is much faster (the knob operates with much greater sensitivity), allowing you to quickly move through more material.

Hold the HOME key while jogging for SLOW JOG, which allows moving very slowly to an exact frame.

REVERSE PLAYBACK

Press and hold down the SLOW key to play in reverse at the current TBar speed. Release the SLOW key to resume the forward playback direction. The TBar controls reverse speed the same as forward. The red LED above the SLOW key indicates reverse play, green indicates forward. To smoothly reverse playback direction, move the TBar to the bottom (still), then press and hold the SLOW key, move the TBar up - speed increases in reverse. Then move the TBar back to the bottom and release the SLOW key, move the TBar up. If the SLOW key is held or released only when the TBar is down at still, smooth playback direction changes are possible.

PLAYBACK WITHOUT TBAR

Playback behavior is somewhat different if a TBar is not connected: Press SLOW to begin slow motion playback paused, or press a speed preset key (F7-F9 by default) to start at another speed, use the knob to vary the playback speed from 0% to 100%. Press STOP to enter the jog mode. Reverse playback is not possible without the TBar.

CUE POINTS

A cue point is a memory location that stores a particular point of recorded material, allowing this location to be recalled at any time. For speed reasons, cue points are referenced numerically, from zero to 999.

When a cue point is created, it includes the currently playing timecode, called the IN point, and the clip filename from which it is being made. When a cue point is used, the stored filename is loaded automatically for playback.

The cue point also contains another timecode number called the OUT point. The *duration* of the cue point (how long it will play) is found by subtracting the OUT point from the IN point. The OUT point is important if the cue point is looped or used in a playlist. It is also handy to pause playback at a certain point, and is frame accurate. When playing at normal or slow motion speeds, playback goes to still when the OUT point is reached. Playback can be resumed to the end of the clip by pressing PLAY or entering slow motion. The OUT point is ignored when in jog mode, allowing jogging beyond the OUT point.

The duration of a cue point is normally shown on the MENU display because it is useful information. The OUT point can be observed by holding the OUT key.

CREATING AND TRIMMING CUE POINTS

A new cue point is created by pressing the MARK key. Cue points are created sequentially from 000 to 999. To change, or *trim*, a cue point's beginning (IN point) to the current position, hold ENTER and hit MARK. Often, the IN isn't exactly where you want it, so hit CUE and turn the knob to jog to the perfect point, then hold ENTER and hit MARK.

To set or change a cue point's OUT point (end) to the current position, hold OUT and hit MARK. You can trim a cue point after entering it into a playlist and the trimmed cue point is inherently fixed in the playlist too (because the playlist simply contains a reference to the cue point's number).

MARK BACKTIMING

A unique feature of Sport replay systems is *variable mark backtiming (VMBT)*. VMBT is a fast and effective way to move a cue point back in time while it is being marked. It saves valuable time and effort, often eliminating the need to tweak cue points entirely.

The process is simple, just hold the MARK key down for the length of time it took to decide the button should be hit. During the time MARK is held, the marked point effectively runs backwards. The idea being that an operator can't evaluate that something is "worthy of replay" until after it has begun to occur, and the timing of this evaluation period tends to vary.

So rather than attempting to guess when something is about to happen, or more likely "mark and tweak later", just hit the button when sure, then hold it down until the timing "feels right". The human brain has an amazing ability to judge timing relationships, resulting in surprisingly close or perfect cue point marks the first try. If tweaking a cue point is still needed, it is likely closer than it would have been without VMBT, or with the older fixed-duration "reaction time" setting with which video editors may be familiar.

While the MARK key is being held, the length of time being subtracted is shown, followed by the 'M' indicator, on the STATUS display. VMBT also works in shuttle, and counts backwards at the speed in effect, allowing more accurate backtimed marks when making a sequence of cue points from previously recorded long clips. VMBT works anytime MARK is used, including when marking OUT points.

VIEWING AND USING CUE POINTS

The cue point shown on the MENU display is called the *current* cue point.

The CUE key cues playback to the *current* cue point's IN point.

The PREROLL key cues playback to 2 seconds before the IN point (or the beginning of the clip).

Hold OUT and hit CUE to cue to the *current* cue's OUT point.

Hold OUT and hit PREROLL to cue 2 seconds before the OUT point. (The last 2 seconds can then be played.)

To make a cue point *current* without affecting playback, enter its number on the keypad and hit ENTER.

To make a cue point *current* and cue playback, enter its number on the keypad and hit CUE.

The RIGHT/LEFT arrow keys change the *current* cue to the next/previous cue point.

Hold IN and hit the RIGHT/LEFT arrow keys to also cue playback to the next/previous cue point.

Manual on-the-fly playlist:

Make any cue point *current*, then hold HOME & hit CUE to cut playback to the new cue point without stopping.

DELETING CUE POINTS

Cue points can be deleted in various ways, see the RECORD SETTINGS menu. DELETE CLIPS deletes a specified range of cue points and erases the recorded clips included in that range ("record" cue points, marked with a period after the number). DELETE NON-PL CLIPS does the same, but skips cue points and clips that are used in playlists. CLEAR CUES NO DELETE deletes a range of cue points, but not the clips - it does not erase any recorded material. ERASE ALL VIDEO and FORMAT DISK!!! delete all cue point memory, playlists, and recorded clips.

NOTE: Deleted material cannot be recovered! See RECORD SETTINGS for more information on deleting.

A cue point always retains its original number and is not renumbered to fill deleted ones. Instead, deleted cue points are displayed with a "deleted" mark 'd' after its number. There are a couple of reasons for this. First, clips are named with cue point numbers and cannot be renamed, so a cue point that designates a recorded clip must remain available. The second reason is so that any external notes referencing cue points by number remain valid after deleting lower numbered cue points. Cue points marked as deleted can be reused, except when they denote recorded clips. The last used cue point can be made *current* by hitting 999, ENTER. An attempt to cue to a higher cue point (number, CUE) has no effect, unless a clip that is named with that number exists on any channel. In this case, the cue point is marked as a record cue (with a period), and cue points below it are marked with a period if a clip exists, or a "delete" mark (d) if not. If the clip exists on the status channel, its record start (IN) and duration are assigned and the clip is cued. This mechanism allows selected clips to be preserved indefinitely, like ones used in BUMP I/O keys.

PREROLL

PREROLL cues to the location 2 seconds before the IN point, or to the beginning of the clip if the IN point is within the first 2 seconds. The preroll time can be changed by pressing SETUP, PREROLL and entering a different time.

FUNCTION KEYS (F-KEYS)

Each of the function keys F1-F9 that are not used to select channels serve any of three purposes: Slo-mo Speed Preset, Quick Cue, or Bump I/O. A Slo-mo Speed Preset key plays in slow motion at a preset speed (then the TBar can be used to vary the speed). A Quick Cue key cues playback instantly to any cue point. A Bump I/O key sandwiches the *current* cue point between pre-designated IN and OUT bumper clips. By default, F1-F6 are Quick Cue keys and F7-F9 are slow motion speed preset keys. To change a key's function, press SETUP, the F-key, then the UP/DOWN arrow keys.

SLO-MO SPEED PRESET KEYS

To change the speed of a Slo-mo Speed Preset F-key, press SETUP, the Slo-mo Speed Preset F-key, the speed in percent of normal, then ENTER. Press HOME when done.

QUICK CUE KEYS

The *current* cue point (the one showing on the MENU display) can be assigned to a Quick Cue F-key at any time by holding the ENTER key while pressing a Quick Cue F-key. Alternately, press SETUP, the Quick Cue F-key, the cue point number on the keypad, then press ENTER. Press HOME when done.

The green LED lights above any Quick Cue keys that are assigned to the *current* cue point.

BUMP I/O (TBAR REQUIRED)

Bumper clips are typically animations that include a sponsor or team logo and let the audience know when a replay is coming and when it's finished. Any cue points can be used, even as simple as a camera zoom into and/or out of a sign. Just record the material and mark two cue points, then assign the bumpers:

Press SETUP, the Bump I/O F-key, the IN bumper cue point number on the keypad, then press ENTER, then the OUT bumper cue point, then ENTER (ENTER toggles between the IN and OUT bumpers). Press HOME when done. Bumper clips must be at least 3 seconds in length.

Any cue points can be set as the IN and OUT bumper clips. A Bump I/O key automatically cues the IN bumper clip, delays, then plays it at normal speed, then cuts to the currently selected cue point and plays it at the speed set on the TBar, then at its OUT point, playback cuts to the OUT bumper, which again plays at normal speed. Speed can be changed with the TBar while the clip is being played. The OUT bumper transition can be forced early (before the currently playing cue point's OUT point), by hitting the RIGHT arrow key. "i" and "o" icons on the STATUS display indicate when the IN and OUT bumpers are playing. When done, playback still frames at the OUT bumper's OUT point.

The delay to roll of the IN bumper can be adjusted, or can be set to require a manual PLAY keystroke after cueing by using the BUMP AUTO START item in the OPERATIONAL PREFERENCES menu.

NOTE: Bumper clips and cue points used with bumper clips must be at least 3 seconds long to work reliably.

SCAN

The reverse scan (◀◀) and forward scan (▶▶) keys scan playback while being held, and pause the picture when released. While paused, turning the knob allows fine adjustment of picture position (jog), or lifting the TBar from the bottom begins slow motion playback. The default scan speeds are 6 times normal speed. To change the scan speed, press SETUP, the scan key to change, turn the knob until the desired speed is shown, then press ENTER.

CLIP SCAN

To enter "Clip Scan" mode, tap both scan keys (◀◀ & ▶▶) together. While in clip scan mode, playback continually cues to the point in the last cued clip relative to the TBar position. This allows clips of any length to be scanned quickly from heads (bottom = IN point) to tails (top = OUT point). Any other transport key (STOP, PLAY, SHTL, etc.) exits the clip scan mode. Also, turning the knob exits the clip scan mode and enters jog (still).

SHUTTLE

To shuttle quickly through material, press the SHTL key and use the TBar (or knob if no TBar). Near the middle is still, up from middle shuttles forward, down from middle shuttles in reverse. Speed response uses a logarithmic scale providing a natural feel for both fast and slow speeds. While in the still range, the knob can be used to jog without leaving the shuttle mode. The SHTL key sets shuttle speed to still and the SLOW key LEDs indicate the direction the lever must be moved to gain control. A second use of the SHTL key (SHTL when already in shuttle still) sets shuttle speed to the current position of the TBar. As in other modes, the MARK key can be used to mark cue points while in shuttle.

ERASING RECORDED MATERIAL

Press SETUP, REC and use the UP and DOWN arrows to select: DELETE CLIPS to delete entire recordings (material contained in record cue points). DELETE NON-PL CLIPS to delete clips not used in any playlists. CLEAR CUES NO DELETE to erase ranges of cue point memory without deleting the underlying recorded material from disk. ERASE ALL VIDEO to delete all recorded material, cue points, and playlists. This should be used occasionally to prevent possible disk fragmentation. FORMAT DISK!!! to delete all recorded material or to prepare a new hard disk for recording. Press ENTER once the desired action is displayed.

NOTE: Deleted material cannot be recovered! See RECORD SETTINGS for more information on deleting.

PLAYLISTS

Sport has memory for up to ten playlists each containing up to 100 steps which can be assigned cue points or stills. When played, as the OUT point of each step's cue point is reached, a seamless cut is made to the cue point of the following step while motion continues. Cue points must have a duration of at least 3 seconds for playlists to operate properly. While playlist mode is enabled (PLAYLIST LED lit), the MENU display shows the *current* playlist number, the current step and cue point, and the next step and cue point. The STATUS display shows the actual time, adjusted for slo-mo speed, that it will take for the playlist to finish playing to the next still (STL) or end. If looping is enabled while playing a playlist, the entire playlist is looped.

PLAYLIST SETUP (EDIT)

To create or edit a playlist, press SETUP, the number of the playlist (0-9), then PLAYLIST. If the number is skipped, the last used playlist is edited. The MENU display shows the playlist number and a playlist step with its cue point. To add a cue point to the list, enter its number on the keypad and press RIGHT arrow. The next step is then shown, so a sequence of cue points can be added. (If ENTER is used instead of RIGHT arrow, the cue point is added, but the step is not incremented, so subsequent cue points are added in reverse order). Press ENTER without numbers to add the *current* cue point to the list. The RIGHT and LEFT arrow keys change the displayed step. While holding the zero (0) key, the RIGHT and LEFT arrow keys change the step by 10. If the cue point is END, every new point you enter is added to the end of the list. If not at END, an entry is inserted at the current step and other steps are rippled up to make room. Press the DOWN arrow to program a still (STL) at the current step. To delete the current step and ripple all higher steps down, press the UP arrow key. (Reminders of the UP and DOWN arrow key functions are shown with icons on the display).

QUICK PLAYLIST CREATION

A shortcut method allows cue points to be added quickly to the end of playlists: Hold the ENTER key and press the PLAYLIST button to add the *current* cue point (the one on the MENU display) to the end of the *current* playlist (the one last selected by pressing a keypad number 0-9, then PLAYLIST). To add the *current* cue point to *any* playlist, hold the keypad number of the desired playlist (0-9) and press PLAYLIST (this does not change the *current* playlist). This allows separate playlists to be created for different purposes, such as special playlists for key athletes or types of plays.

PLAYLIST PLAYBACK

To quickly play the *current* playlist, press PLAYLIST, CUE, PLAY. When done, hit PLAYLIST to exit the mode.

To prepare *any* playlist for playback as the *current* playlist, press the number of the playlist (0-9), then PLAYLIST. The PLAYLIST LED lights. When lit, turn the playlist mode off by again pressing PLAYLIST. Press CUE to cue playback to the first step (the step 00 cue point). Press PLAY or a slo-mo key to begin playlist playback. When a still (STL) step is reached, the OUT point of the playing cue is frozen until PLAY or a slo-mo key is pressed, which freezes on the first frame of the next step. Press PLAY or a slo-mo key again to continue playing.

Playback speed can be varied while a playlist is playing. Move the TBar or hit SLOW or F7-F9 to vary speed on the fly (F9 and turn the knob if no TBar). This allows playing some events more slowly than others and allows the playback time to be extended. (Slo-mo speeds cannot be programmed into playlist steps, only changed manually.) The STATUS display is continually updated to show the actual amount of time it will take to finish playing the playlist at the speed in effect at each moment (or time until the next STL if any are programmed).

Sometimes there is not enough time to finish playing a playlist. To speed things along, press the RIGHT arrow key partway through some or all playlist steps. The current step ends early and a switch is made to the next step as though the end of the current step was reached (thus reducing the overall playback time).

If stopped, the RIGHT/LEFT arrow keys change the current step, or a step number can be entered followed by ENTER. Hold the IN or OUT key while using LEFT/RIGHT arrows to cue to each IN or OUT point in a playlist.

Note that the same playlist is used for *playback* and *setup* (changed from earlier versions for simplicity).

LOOPING

Looping is enabled by pressing the LOOP key so that the LOOP LED lights. When on, playback will continuously loop between the last used cue point's IN and OUT points. If the playlist mode is enabled, the entire playlist will loop forever. Cue points must have a duration of at least 1 second for looping to operate properly.

STATUS DISPLAY

The STATUS display always shows the current status of the replay recorder regardless of what is being done in the menu system. Also, all transport keys (PLAY, STOP, CUE, SLO-MO, etc.) are always active. The bottom line of the STATUS display always shows the record or playback status. When in slow motion mode, the speed reads out in percent of normal speed, when in scan or shuttle, the display reads in multiples of normal speed. The top line shows timecode and the cue point last cued with CUE or PREROLL or created with REC (playing or recording).

REMAINING TIME DISPLAY

The top line of the STATUS display shows the time remaining in either the current clip (time until OUT point), or if playlist mode is enabled, the time remaining until the end of the playlist or the next still step. The format of the remaining time is -HH:MM:SS:FF, where the - sign indicates playback is before the OUT point (or playlist STL or END), HH is hours, MM is minutes, SS is seconds, and FF is frames. If playback is after the OUT point, the time after is shown preceded by a + sign.

REMAINING TIME IN SLO-MO

If playback is in slow motion and not stopped, the approximate remaining time is shown scaled for the current playback speed. As speed is changed (by turning the knob or using speed preset keys), the remaining time is adjusted on the fly to represent the actual time that playback will continue at that speed. If more than one hour of recorded material remains, the speed calculation is not used. When the remaining time is scaled for speed, it is preceded by a 'v' to indicate that variable play speed is taken into account.

TIMECODE POSITION DISPLAY

The actual timecode being played is displayed in lieu of remaining time when the OUT key is held down.

MENU DISPLAY

The MENU display is used for various purposes depending on the panel's mode. Press HOME and turn PLAYLIST off to return to normal display mode.

HOME DISPLAY

The MENU display normally shows the "current" cue point number and IN point timecode on the top line and its duration on the bottom line. The OUT point timecode can be viewed instead of duration by holding the OUT key. To change to a different cue point, simply enter the cue point number on the keypad and press ENTER. If you press CUE or PREROLL instead of ENTER, it has the same effect as pressing ENTER, then CUE or PREROLL (playback immediately cues to the newly entered cue point). The RIGHT and LEFT arrow keys change to the next or previous cue point. If IN or OUT is held while the RIGHT or LEFT arrow is used, playback cues to each new cue point. This allows quick browsing of successive cue points.

PLAYLIST DISPLAY

The PLAYLIST button toggles the playlist mode on and off. If a number key (0-9) is pressed before PLAYLIST, that playlist is selected for playback. While playlist mode is enabled (PLAYLIST LED lit), the MENU display shows the playlist number and the current and next steps and cue points. To see the IN point and duration for the current step's cue point, press and turn off PLAYLIST. Note that turning PLAYLIST off just before reaching the end of a playlist step will cause playback to pause at the OUT point of the current step.

CUSTOMIZATION

MENUS

The MENU display is also used for navigating SETUP menus. Setup menus are entered by pressing SETUP followed by another key. Press HOME when done with a setup menu.

The setup menus are:

KEY PRESSED AFTER SETUP	MENU	MENU ITEMS
MARK	PERSONALITY MENU ITEMS	SAVE PERSONALITY RECALL PERSONALITY REGISTER RECALL DEFAULTS CALC VS. PHONE STYLE NUMERIC KEYPAD
PLAY	DDR SETUP ITEMS	EXTERNAL REF SET INPUT LEVELS (SD CHANNELS ONLY) EXT DDR CONTROL (NATIVE/ODETICS) EXT DDR SOFTWARE UPDATE
REC	RECORD SETTINGS (SHOWS DISK SPACE)	INPUT VIDEO SEL SET TIME OF DAY COMPRESSION (SD CHANNELS ONLY) TV STANDARD SEL DELETE CLIPS DELETE NON-PL CLIPS CLEAR CUES NO DELETE ERASE ALL VIDEO FORMAT DISK!!! REC END MODE MAXIMUM RECORD DURATION
STOP	OPERATIONAL PREFERENCES	CHANNEL QUANTITY RECUE WHEN PLAY BUMP AUTO START START CLIPS W 0000 KNOB SENSITIVITY JOG MAX SPEED JOG SENSITIVITY
SCAN (◀◀ & ▶▶)	SCANNING SPEEDS	SCANNING SPEEDS
PLAYLIST	PLAYLIST SETUP MENU	PLAYLIST SETUP MENU
CUE	CUE POINTS	KNOB SCROLLS THROUGH CUE POINTS
PREROLL	SET PREROLL	IN SECONDS & FRAMES
F1-F9	F-KEYS SETUP MENU	FUNCTION KEYS (F-KEYS)
ENTER	MISC MENU ITEMS	VERSION AND TEST LED BRIGHTNESS MENU & STATUS DISPLAY ANGLES INITIALIZE UNIT

PERSONALITY MENU ITEMS

All user configuration settings are stored in permanent memory and remain safe even after extended periods without power (at least 10 years). Settings can be stored in any of five personality registers for later recall, allowing different users to personalize the panel to their preferences. Press SETUP, MARK to enter the PERSONALITY MENU ITEMS menu. Use the UP and DOWN arrows to choose a selection and select it with the ENTER key.

SAVE PERSONALITY

After selecting this item, enter a register number on the keypad (0-4), then press ENTER. You can then name the register by turning the knob to change a character and using the RIGHT and LEFT arrow keys to change the character position. Press ENTER when done. The personality remains protected unless the unit is initialized (see MISC MENU ITEMS, INITIALIZE UNIT).

RECALL PERSONALITY REGISTER

To recall a previously stored personality, enter the register number (0-4) on the keypad (names of registers are shown as you press different keypad keys), then press ENTER. The settings that were in effect when the register was saved are recalled. A register's data integrity can be trusted if its name appears (other than DEF).

RECALL DEFAULTS

Recalls the factory default settings. Saved personality registers are not altered.

CALC VS. PHONE STYLE NUMERIC KEYPAD

The numeric keypad is arranged telephone style. The panel can be changed to calculator style by changing this menu item. This setting is stored separately from personality data and can only be changed using this menu.

After changing the style, it is necessary to physically swap the keycaps between the 1-2-3 and 7-8-9 keys.

DDR SETUP ITEMS

Press SETUP, PLAY to enter the DDR SETUP ITEMS menu. Use the UP and DOWN arrows to choose a selection and select it with the ENTER key. This menu changes video server related settings.

EXTERNAL REF

Enables or disables external video timing reference and facilitates subcarrier and horizontal phase adjustments. For HD channels, anytime external reference video is applied, genlock occurs irrespective of this setting. The subcarrier adjustment has no meaning for HD channels, but H phase operates as expected.

If reference video is not supplied to the REF connector of SD channels, this setting **MUST** be disabled or serious random picture breakup and timing disturbances will occur during playback. If external reference is not required or applied, select DISABLED and press ENTER to enable internal "free run" reference.

Video timing can be adjusted only in playback mode. In the record and EE (input check - double-tap STOP) modes, input video is fed directly to the outputs without processing and the input to output delay is fixed and not affected by timing adjustments. To adjust timing, record a short clip of color bars (at least three seconds), press CUE, turn on LOOP, and press PLAY to continually play the signal.

If external "blackburst" video reference is applied to the REF connector, select ENABLED in this menu and press ENTER. The UP arrow selects SUBCARRIER for adjustment, the DOWN arrow selects HORIZONTAL. The knob adjusts the selected phase. Phase adjustments affect the outputs as the knob is turned, but the new values are not stored in memory until ENTER is pressed. HOME cancels the adjustment process without saving and restores the original timing. HD "tri-level" reference is not recommended even for HD channels.

SET INPUT LEVELS (SD CHANNELS ONLY)

Allows adjustment of the input video processing levels. The UP and DOWN arrows select which adjustment to make, the knob adjusts the level. Unlike most other adjustments, the results are saved as soon as the adjustments are made (the ENTER key need not be used). The input adjustments should be done while in the input check mode (double-tap the STOP key). Adjustments are for BRIGHTNESS (black level), CONTRAST (like gain, but counteracts with black), SATURATION, and HUE. This adjustment does not affect the SDI input.

EXT DDR CONTROL (NATIVE/ODETICS)

The Sport replay system can be controlled in three different ways, by Sport's control panel and two different types of remote control.

The default setting is PANEL CONTROL. Sport is controlled locally by its control panel. The 9-pin 'D' REMOTE connector must remain disconnected from other equipment when using the panel to control the system.

REMOTE NATIVE and REMOTE ODETICS enable the internal video disk recorder to be controlled via the 9-pin 'D' REMOTE connector. "Native" and "Odetics" refer to two different remote control protocols, the former is a proprietary FFV protocol, the latter refers to the protocol originally developed by Odetics Broadcast Corporation and later adopted by many video server manufacturers. In Odetics mode, Sport can be controlled by the BUF Technology "Spot" Server Management System, and all Spot's powerful features are supported. Both these protocols and the 9-pin 'D' pinout are compatible with the "Sony" VTR Remote Control Protocol. The 9-pin 'D' REMOTE connector must remain disconnected from other equipment in all other modes.

The remaining settings set the system up for control by another Sport replay system or a Sport-EX controller via the AUX RJ45 connector. AUX REMOTE CH 1 - AUX REMOTE CH 6 assigns one of six addresses that specifies which F-key on a Sport-EX panel selects that channel. If using a Sport for control, the internal channel

is selected with F1, the others are offset by 1 (F2 controls a Sport set to AUX REMOTE CH 1, etc.). Except for a controlling Sport's internal recorder, which is always channel 1, other SD channels appear after HD channels in the address chain, so if there are any HD recorders being controlled, the first external SD Sport should be set to the next address following the HD channels. The 9-pin 'D' REMOTE connector on all Sports must remain disconnected from other equipment.

EXT DDR SOFTWARE UPDATE

This menu prepares selected recorder channels to receive updated firmware data. A data upload mode is initiated and control is temporarily released to the REMOTE connector(s). A personal computer running terminal software sends the firmware data using the "XMODEM" protocol. To connect the computer to the recorder's REMOTE connector, a serial (RS-232) to RS-422 or USB to RS-422 adapter is used. When the update is finished, the recorder(s) must be power cycled before normal operation is possible. Use VERSION AND TEST to check the new firmware version.

RECORD SETTINGS

Press SETUP, REC to enter the RECORD SETTINGS menu. Use the UP and DOWN arrows to choose a selection and select it with the ENTER key. While in this menu (unless showing SET TIME OF DAY), the available FREE recording time is shown on the MENU display top line (time is approximate and affected by picture content).

INPUT VIDEO SEL

HD: PROGRESSIVE HD, INTERLACED HD, or STANDARD DEF

SD: COMPOSITE, Y/C (S-VIDEO), or SDI DIGITAL VID

Selects the type of video to be recorded or played. This must match the input format or recordings will not succeed, even though it may appear so when recording. Make sure TV STANDARD SEL is set correctly also. For HD channels, these settings must match recorded clips in order to cue them for playback.

SET TIME OF DAY

Sets the current time of day and date. When enabled (nonzero time), clips are created with IN points at the time of day recording starts. Once set, replay channels keep track of time of day even through power interruptions. If a timecode signal is applied to the TBar TC input, time of day is automatically set.

COMPRESSION (SD CHANNELS ONLY)

Sets the amount of data compression used for recording from 4:1 to 20:1 (default is 5:1). The best picture quality is achieved at 4:1, with no noticeable signal degradation. At 20:1, the picture quality is poor, but the available record time is significantly increased. A compression rate of about 6:1 provides a good compromise between quality and record capacity and is similar to DV compression. As the compression rate is changed, the display shows the approximate amount of available record time taking into account the compression shown. The new setting is not put into effect until the ENTER key is used and a new recording is started.

TV STANDARD SEL

59.94 (SD=NTSC), 50 (SD = PAL), 60 (NON STD)

Selects the television frame rate standard (field rate for interlaced) to be used for recording (typically 59.94 in North and South America, 50 elsewhere). This must match the format of the input video signal for recordings to succeed. The 60FPS mode is included to accommodate record and playback of these non-standard formats, but should not normally be used as this rate is rarely, if ever, broadcast. This setting must match recorded clips in order to cue them for playback. For HD channels, INPUT VIDEO SEL must match as well. If clips are recorded in the non-standard 60FPS mode, they will not cue when TV STANDARD SEL is set to 59.94.

DELETE CLIPS

Permanently erases recorded clips from all selected channels. Clips defined by record cue points (ones marked with periods) that fall within the range entered are deleted. Deleted material cannot be recovered! If material in these recordings is used in cue points outside of this range, it will be erased regardless, and those cue points will be marked as deleted. Deleted cue points are indicated with a small 'd', but are not removed so any external documentation of higher cue points that you may be keeping will still refer to the correct cue point numbers. Deleted cue points are removed if there are no other higher numbered cue points.

DELETE NON-PL CLIPS

Same as DELETE CLIPS, except does not delete clips that are used in any playlists.

CLEAR CUES NO DELETE

Clears all cue points in the specified range, but does not delete any recorded clips. Existing clips are skipped by subsequent recordings and cue points and as they are used (cued), their IN and OUT points are restored.

ERASE ALL VIDEO

Deletes all recorded clips, cue points, and playlists. This cannot be undone!

FORMAT DISK!!!

Formats a disk for recording. This menu item allows a new disk to be formatted for use. Once formatted, power must be removed (always for at least 5 seconds), then restored. Format will erase any material that may exist on the disk and erases all cue points and playlists. You will be asked to hold the REC key and press MARK to confirm before formatting begins.

REC END MODE

The default is ANY XPORT KEY. Any playback related key such as STOP, CUE, or reverse scan (◀◀) stops recording and begins playback mode. For long term and other critical recording applications with infrequent record/playback changes, the ONLY STOP KEY setting stops recording only when the STOP key is pressed.

MAXIMUM RECORD DURATION

Sets the maximum length of time that a clip will record. If set to zero (default), recording continues until disk is filled. This is useful for applications where long term unattended recording is desired, especially when some remaining disk space is needed.

OPERATIONAL PREFERENCES

Press SETUP, STOP to enter the OPERATIONAL PREFERENCES menu. Use the UP and DOWN arrows to choose a selection and select it with the ENTER key.

CHANNEL QUANTITY

Sets the number of replay channels being controlled. When only one channel is used, the F1 key is not needed to select channels, so is available for other F-key features (see FUNCTION KEYS (F-KEYS)).

RECUE WHEN PLAY

When enabled, if playing at normal or slow motion speeds, the CUE key causes a clean cut to the *current* cue (the one on the MENU display) without stopping. Normally, the CUE key stops playback and cues to a still. This works like a manual playlist step, continuing to the new cue point at the current speed. When playing, enter any cue point number on the keypad then hit CUE to switch to the next cue, then repeat as desired. If disabled (default), this feature can be used by holding HOME when hitting CUE (while playing, enter cue number, ENTER, hold HOME, hit CUE).

BUMP AUTO START

When disabled, requires manual playing of the IN bumper clip after using a Bump I/O key. For more information see BUMP I/O. Default is ENABLED. When enabled, a second part of this menu allows changing the IN bumper delay, which delays at still after cueing the IN bumper before playing. Default is 10 frames delay.

START CLIPS W 0000

When disabled (default) clip filenames use the format 'CLIP0xxx', when enabled, the format is '00000xxx', where xxx is the clip number. Allows access to clips recorded with earlier firmware.

KNOB SENSITIVITY

Reduces the overall sensitivity of the knob by two or four fold. If you feel the knob is too sensitive in all modes, use this item to reduce it's sensitivity.

JOG MAX SPEED

Sets the maximum playback speed in jog mode from zero to 500% normal speed. Change using the knob and hit ENTER. The default is 500%. This setting does not affect the fast jog mode.

JOG SENSITIVITY

Adjusts the speed the knob must be turned in the jog mode to reach the JOG MAX SPEED. This setting affects the fast jog mode also. Default is 10 units (units are arbitrary).

SCANNING SPEEDS

By default, the scan keys (◀◀&▶▶) scan playback at 6 times normal speed. To change the speed of either key, press SETUP, the scan key, turn the knob until the desired speed is shown, then press ENTER.

PLAYLIST SETUP MENU

See PLAYLIST SETUP (EDIT) in the OPERATION, PLAYLISTS section.

CUE POINTS

Press SETUP, CUE to enter the CUE POINTS menu. While in this menu, you can scroll through all cue points using the knob.

SET PREROLL

Press SETUP, PREROLL to change the preroll time. The PREROLL key operates identically to the CUE key except it cues to a point earlier than the IN or OUT point being cued. 2 seconds is the default, but the preroll advance can be changed in 1 frame increments to any amount of time up to 99 seconds.

F-KEYS SETUP MENU

See FUNCTION KEYS (F-KEYS) in the OPERATION section.

MISC MENU ITEMS

Press SETUP, ENTER to enter the MISC MENU ITEMS menu. Use the UP and DOWN arrows to choose a selection and select it with the ENTER key.

VERSION AND TEST

Displays software version dates and performs a self test. First, the version dates of the selected video server are shown, press any key to show the control panel firmware version. All 24 LED indicators light and the keyboard can be tested by checking that keystrokes show on the STATUS display. Move the TBar up and down and observe the TBar readings from 1 to 4095. Turn the knob to end the keyboard test. If a PROM FAILED! message appears, the program PROM needs replacement. The unused stack space (MEM FREE:) is also displayed and should be a non-zero number, if not, please call the factory. The firmware version of the first HD recorder's I/O board is checked and will produce an error message if not up to date. Please contact the factory if HD recorders need updating.

LED BRIGHTNESS

Adjusts the brightness of the 24 LED indicators. Turn the knob until the desired LED brightness is reached, then press any key.

MENU & STATUS DISPLAY ANGLES

Adjusts display contrasts to optimize for viewing angle.

INITIALIZE UNIT

This menu item clears all PERSONALITY REGS which is NOT RECOMMENDED unless absolutely necessary. Memory reset without erasing personality data can be done using the COLD BOOT function (see COLD BOOT).

COLD BOOT

In rare instances, especially during heavy ESD (electrostatic discharge) events like lightning storms or dry weather in carpeted environments, panel memory data can become corrupted. This can cause various symptoms including garbage (random characters) displayed in menu settings, keyboard problems, strange slow motion speeds, other settings that are out of normal range, and/or complete failure to communicate with recorder channels. There are hardware circuits in the panel designed to prevent errant RAM writes whenever power is below a certain voltage level, but there is no way to completely protect against ESD induced problems.

A COLD BOOT restores all system memory to the factory default condition except the personality registers.

A COLD BOOT also erases all cue points and playlists, which are not saved in personality registers.

To perform a COLD BOOT: Disconnect AC power from the power supply for at least 5 seconds. Hold down the MARK and PLAY keys while applying power and continue holding until characters appear on the displays.

Previously saved personality registers can be recalled after a COLD BOOT to restore custom settings.

A personality register must be saved before data corruption occurs and can be trusted as long as the saved name appears (any name other than DEF). See PERSONALITY MENU ITEMS.

SPECIFICATIONS

VIDEO

Standards:	SMPTE 274M (1080I/29.97), SMPTE 296M (720P/59.94)
Input:	HDSDI (1) BNC 75 OHM
Output:	HDSDI (1) BNC 75 OHM
Supported Resolutions:	1920 x 1080I/29.97 1280 x 720P/59.94 1920 x 1080I/25 1280 x 720P/50
Compression:	JPEG-2000
Bit Rate:	Maximum supported by disk, up to 100Mbit/S
Reference Input:	SD blackburst - tri-level sync is not recommended (ref not required)

AUDIO

Embedded input:	6 channels embedded on HDSDI input (channels 3-8, 1-2 not used)
Embedded output:	All 8 channels embedded on HDSDI output
Analog	2 channels balanced (channels 1-2), +4 dBu nominal line level
Resolution:	24 bits
Sampling Rate:	48 KHz

CONTROL RESOLUTION

Knob resolution:	256 PPR minimum, 2 pulse direction change hysteresis
TBar resolution:	12 bits (4095 steps), 2 step direction change hysteresis

DISK DRIVE

Interface Type	SATA - 2.5" form factor cartridge with mini-USB
Capacity	500G standard or optional 750G, 1T, or SSD

POWER

Voltage:	12VDC +/- 20%
Peak Current:	3A Maximum (required for disk spin-up)
Power, Operating:	14W typical per channel, 6W typical for Sport-EX controller

ENVIRONMENT

Operating:	0-35 Degrees C, 10-90% Relative Humidity (non-condensing)
Storage:	0-70 Degrees C, 10-90% Relative Humidity (non-condensing)

DIMENSIONS/WEIGHT

SPORT-EX Control Panel:	9.75"W x 8.1"D x 3.7"H / 6 lbs
RM-HD1 (Single Recorder):	1RU 1.7"H x 8.4"W x 9.5"D (including connectors) / 5 lbs
RM-HD2 (Dual Recorder):	1RU 1.7"H x 16.8"W x 9.5"D (including connectors) / 10 lbs

