CURRICULUM MODULE
3/4” U-matic Videotape

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I. Physical Characteristics

U-matic is what is known as “helical scan” videotape. In a helical scan system, the video signal information is written in tracks that run across the surface of the tape at an angle; in the case of U-matic, as seen here:

As can be seen in the diagram, the audio signal on a U-matic tape is recorded at the bottom of the tape (when the tape is oriented as it is during playback.). Space is allocated at the top of the tape for control track and time code information. Note that the video tracks are separated by narrow “guard bands,” blank spaces which are designed to prevent interference or “cross-talk” between adjoining video tracks. (Azimuth recording, which does not require guard bands and thus allows for video information to be stored more densely on the tape—and thus for smaller tape and cassettes—had been demonstrated prior to the creation of U-matic, but was not utilized because of the difficulty in mass-producing azimuth equipment at the time.¹)
U-matic cassettes come in two sizes. The more common, standard, size, is roughly 8 5/8” x 5 3/8” x 1 3/16” and small cassettes are 7 1/4” x 4 5/8” x 1 3/16”. The smaller size, known officially as U-matic S, was developed specifically for use in compact record decks by television news crews. The first portable U-matic S deck (the Sony VO-3800) was introduced in 1974. Early top-load U-matic decks accept the smaller cassettes only with special adapters. Later, front-load decks accept both formats. U-matic S tapes generally had record times of no more than 20 minutes, though 30-minute S tapes were also used.

Inside the record and playback decks, the tape is pulled from the cassette to wrap around the drum containing the record heads, in a shape roughly that of a “U”:
Record protection for a U-matic cassette is accomplished by the removal of a small, round, red button located on the tape’s underside:

There were three basic variants of U-matic videocassettes and decks. The initial U-matic tapes had a potential resolution of 250 lines. In 1974, a higher-resolution variant was introduced, which became known as “high-band” U-matic; the earlier version then became known as “low-band.” Finally, in 1986, U-matic SP, the highest-resolution variant, was introduced to the market.

Additionally, in 1974, “KCA” tape was introduced, with a sturdier binder system that could support freeze-frame playback on decks that allowed for it. Prevent non-KCA tapes from being put into still-frame mode, a hole was put on the bottom of all KCA cassettes:
II. Format History

a. Summary

U-matic videotape, also known colloquially as “three-quarter-inch” or simply “three-quarter,” (and more formally as SMPTE Helical Scan Type E) was the first truly successful videocassette format, developed primarily by Sony, in conjunction with two other firms, and introduced in 1971. Initially intended for the consumer market, it instead achieved wide popularity in corporate and institutional applications, and starting in the mid-1970s, as a format for television newsgathering. It was largely supplanted in broadcast applications by Betacam during the mid-1980s and in other applications by the early 1990s. U-matic tapes and record decks were also used for digital audio mastering in the early days of compact discs.

b. Development

Throughout the late 1960s, companies around the world were working to develop video recording formats for home use. Few ever made it past the introductory phase, and the two formats to achieve wide adoption—Sony’s ½” open reel AV and CV formats—did so without penetrating the consumer market. By January, 1970, so many unsuccessful “consumer” formats had been announced with great fanfare, only to fail, that Broadcast Management/Engineering magazine could sardonically refer to “a special kind of tradition—a prominent manufacturer start[ing] production of a low-cost video tape recorder ‘for the home.’ A few may end up in somebody’s living room for a weekend, but the main customers for these ‘home’ units turn out to be school systems, industrial
This article, interestingly, went on to describe Sony’s latest prototype demonstration, a cassette tape format that would eventually become U-matic—and the article’s prediction that “home” formats eventually succeed in institutional applications would prove to be especially true for U-matic.

According to Sony’s official corporate history, U-matic had its genesis in a desire by executives that the company create a videotape system that could use a cassette the size of a hardcover book. They hoped that a video cassette could emulate the success of Philips’ audio cassette system, introduced in 1962. By 1969, the Sony development team was ready to display a prototype, a cassette recorder that utilized 3/4”-wide tape. The system used a series of pins attached to a rotating ring to pull tape from the cassette and wrap it around a rotating drum on which the record and playback heads were held. The fact that the tape wrapped around the drum in the shape of a “U” led to the format’s being named “U-matic.”

The prototype was demonstrated publicly late that year. Before a production model was introduced, however, Sony took a radical step: the company shared technical information with Matsushita Electric (Panasonic) and JVC (Japan Victor Corporation), who went on to cooperate in the format’s further development. According to one history of the company, “A proliferation of incompatible formats, [Sony] feared, could cause consumers to recoil in confusion or even to embrace an inferior system simply because one large company was promoting it.”

(In fact, U-matic was known for a time in Japan as the “3-C” format due to the three company’s cooperative efforts. Matsushita and JVC also signed licensing agreements to manufacture U-matic equipment in 1970—a critical
step allowing for more rapid market penetration. In October, 1971, Sony announced another cross-licensing agreement with 3M, allowing 3M to manufacture U-matic equipment and Sony to manufacture 3M’s “High Energy” tape. U-matic was formally launched in 1971.

d. Institutional/corporate use

During the first year of U-matic’s production, Sony’s promotion of its new format was somewhat schizophrenic. On one hand, the company directed advertisements at the educational and business markets in 1972, calling U-matic “a revolutionary new means of communication,” likening it—audaciously—to the invention of the printing press, and declaring that it made the blackboard “obsolete.” Sony also held professional demonstrations called “The U-matic Videocassette Showcase,” at hotels in Chicago and Los Angeles, aimed directly at businesses and institutions. These efforts did succeed. An early adopter of the system was the Ford Motor Company, who bought nearly 4,000 3/4” decks for dealer communications in August, 1972. Ford produced 26 videocassette titles to “educate and motivate salesmen and win over potential car buyers...show off the latest Ford models and demonstrate features not found on competitive makes.” (In this case, the technology would appear not to have revolutionized the company’s communications, but instead simply to have been a direct replacement for the 16mm films that had served the same purpose for decades.)

That same year, however, U-matic was being discussed in the popular press as a competitor to Cartrivision, a cartridge format sold in combination with a color television by Sears for $1,350 and by Admiral for $1,700. (In comparison, Sony’s VP-1000 play-only deck sold for $995 and its VP-1600 record-capable deck for $1,395. In Los
Angeles, Federated-Magnetic TVI advertised the VO-1600 alongside quadraphonic receivers, reel-to-reel audiotaape decks, and other high-end consumer audio equipment. And in Chicago, Polk Brothers, a furniture retailer, and Carson, Pirie, Scott & Co., a department store, both announced demonstrations of the U-matic player by a “factory-trained Sony Representative” (though not actually advertising the machines for sale)—alongside images of Sony TVs that the stores were actually selling. U-matic never made serious inroads into the consumer market, however; it is unclear how many (if any) decks were sold for home use, but the numbers were small if not nonexistent.

By 1974, though, U-matic had established its dominance in the non-broadcast AV field: “The U-matic has become so widespread in industrial and business communications,” wrote Broadcast Management/Engineering, “that tape is a new vernacular in broad reaches of American industry.” The cassettes and decks were relatively compact, very easy to use, rugged, and reliable. In the words of author James Lardner, “Decisively rejected by the market for which it had been intended, the U-matic became a stunning success just the same.”

e. Electronic News Gathering

In the early 1970s, broadcasters at both the local and network level used 16mm film almost exclusively for covering events in the field. The only videotape format to give images of sufficient quality and stability for broadcast was 2” quad, and the prohibitive size of 2” machines—and of the tape reels themselves—limited the use of videotape to the studio, or to remote events for which careful preparation was possible. Though 16mm provided high-quality images from relatively lightweight and portable equipment, it had serious drawbacks. The most serious were its cost, and the time
required for processing. The need for film to be developed necessarily meant a delay in getting footage of events on the air (hence the once-common announcer’s refrain, “...film at 11”—teasing coverage of events for which images would not be available for broadcast until the late news.)

The first key development that made it possible to use U-matic tapes for broadcast was the introduction in 1973 of an advanced, digital time base corrector that could stabilize the helical signal sufficiently for broadcast. The second was Sony’s introduction in 1974 of “high-band” U-matic decks, which provided 50% greater bandwidth than the original decks had. Television networks and affiliates, eager to speed up news production and eliminate the heavy costs of 16mm film processing, quickly embraced the new technology. No doubt Sony’s introduction in 1975 of a complete U-matic editing system, combining record and playback decks, an electronic controller, and a stable synch source, also played a role.

CBS, which had been the earliest network adopter of videotape back in 1956, was also an early adopter of videotape for electronic news gathering, beginning experimental trials in 1971 and 1972. The network used Sony U-matic 3800 record decks and its R-400 editing controller for coverage of President Nixon’s June 1974 trip to Moscow—a choice that quickly proved U-matic’s worth as a newsgathering format. NBC had begun using Sony VO-3800 decks at its affiliate in Washington, WRC, also as early as 1972. James Kitchell, General Manager of News Services for the network, said at the time, “Sony may not have planned exactly this application of their U-matic....but at the moment it is in our view the tape system with the best combination of quality and portability.” KMOX-TV, St. Louis, as of September 15, 1974, became the first station in the United States to
abandon film for newsgathering completely, in favor of U-matic videotape.19 And when Broadcast Management/Engineering ran a survey article on electronic news gathering in March, 1975, all stations described in the article were using Sony U-matic equipment. According to the SMPTE Journal Progress Committee Report for 1975, 400 stations “of all types” made the switch to electronic news gathering during the year.20 Sony won an Emmy for the U-matic system in 1976,21 and announced the formation of the Sony Broadcast division at the National Association of Broadcasters show that same year.

**f. Audio mastering**

One of U-matic’s lesser known uses is audio mastering. During the early days of digital audio recording and compact discs, U-matic recorders and tape were a very common master format. The reason for using U-matic had to do with the needs of digital audio recording. Pulse Code Modulation recording, or PCM recording, requires a very high bandwidth—much higher than that of analog audio recording. Videotape recorders, however, are capable of recording sufficient bandwidth to handle this kind of audio. Sony developed a special PCM adaptor—the PCM-1600 that converted the audio signal into a “pseudo” video signal, laying down the audio information in the same physical layout as the video information on a U-matic tape. The video image, if played back on a monitor, resembles a vibrating checkerboard pattern.

**g. Successors/obsolescence**

In April, 1975, Sony launched its new Betamax videotape recorders in Japan. There the Betamax sold for $788.00, compared to $1297.00 for a comparable U-matic deck. Tapes were also less expensive by 45-55 percent, depending on length.22 The tapes took advantage of azimuth recording, which took allowed for the elimination of the
guard band that separated recording tracks and thus allowed for smaller cassettes and decks. It was not, however, until the third quarter of 1977 that sales of Betamax decks exceeded those of U-matic decks.

In the broadcast realm, Sony introduced a high-quality 1/2” cassette format, nearly identical in physical structure to Betamax, in 1981: Betacam. Its image quality, and the fact that its small size allowed for cameras that integrated recording in a single unit, rapidly led to Betacam’s dominance in the broadcast realm, and hastened the demise of U-matic as a viable format.
II. Preservation issues

The problems archivists face in preserving U-matic videotape start with sheer numbers. The wide success of U-matic during the 1970s and 1980s mean that any institution holding audiovisual materials is likely to have at least some U-matic tapes, and probably more. For example, the 2005 PrestoSpace report on preservation issues found that European audiovisual archives considered U-matic reformatting to their top priority (and claimed to have a total of 700,000 tapes in their collections.25 ) The BBC archive contains 61,000 U-matic tapes that date from 1982-1988—roughly 4% of the total number of items in the archive, but nearly all of the news material for the bulk of the 1980s.

One critical issue facing archives that hold U-matic tapes is the increasing unavailability of usable decks, technicians to repair them, and expertise to calibrate and maintain them. Though many different models of U-matic playback and record decks were produced, the most technically advanced are the Sony broadcast models, with model names beginning with “BVU.” The BVU-950 and –9850 are particularly recommended.

U-matic tapes face typical issues that plague other magnetic tape formats, such as sticky shed. They also appear to face a condition similar to sticky shed in its manifestations during playback, but that is not alleviated by tape baking as sticky shed often is. Unfortunately, magnetic media including U-matic has yet to build a body of scientific research that can further quantify this type of problem.
III. Primary documents
1 TAPE CASSETTE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to tape cassettes, and more particularly to tape cassettes adapted for easy and certain attachment to tape apparatus at a proper position thereof.

2. Description of the Prior Art

The use of tape cassettes is extending steadily in magnetic tape apparatus for recording and reproducing. Such apparatus will hereinafter be referred to simply as magnetic tape apparatus. There has recently been proposed cassette-type magnetic tape apparatus not only of the type employing a fixed magnetic head but also of the type using a rotary magnetic head as in the case of magnetic video tape apparatus. The tape cassette has merits such as protection of the tape and simplification of loading of the tape on the apparatus. In order to bring out such merits effectively, the tape cassette is required to be easily loaded in position on the magnetic tape apparatus without fail. This is especially true of magnetic tape apparatus for video use because the tape is drawn from the cassette and directed around a cylindrical drum incorporating a rotary magnetic head therein for helical scanning of the tape by the rotary magnetic head.

It is one object of this invention to provide a tape cassette which is arranged to be properly and surely attached to tape apparatus for use in cooperation therewith.

It is another object of this invention to provide a tape cassette having an improved housing to assure attachment to magnetic tape apparatus.

Other objects, features and advantages of this invention will become apparent from the following description taken in conjunction with the accompanying drawings.

SUMMARY OF THE INVENTION

The tape cassette of the present invention has a housing provided with a cutout portion in at least one of walls thereof for engagement with one part of a magnetic tape apparatus to assure attachment of the tape cassette to the apparatus at a proper position thereof. The tape cassette has a housing provided with a slot in the bottom wall thereof for engagement with one part of a magnetic tape apparatus to assure attachment of the tape cassette to a proper position of the apparatus to ensure correct attachment of the cassette.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 and 2 are perspective views showing one example of a tape cassette of this invention;
FIG. 3 is a plan view, partly in cross-section, showing the tape cassette exemplified in FIGS. 1 and 2; and
FIGS. 5 and 6 are cross-sectional views taken on the lines A--A' and B--B' in FIG. 3, respectively.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to FIGS. 1 and 2, a description will be given first of the tape cassette of this invention as applied to magnetic tape apparatus for video signals. The cassette comprises a housing 1 that consists of substantially parallel top and bottom walls 2 and 3 and a side wall 4 connecting them with each other. The side wall 4 has an opening 5 therein for drawing out a magnetic tape 6 from the housing 1, and a lid 7 is provided for the opening 5. The lid 7 is biased by a spring 8 to cover the opening 5 normally and is locked by a locking means 9. Guide pins 10, 11, and 11' position the tape 6 and facilitate its travel when the tape 6 is drawn from the cassette and loaded on the apparatus. A display window 12 of a counter is provided for indicating the amount of the tape incorporated in the cassette and the number of uses of the cassette, or the like. An aperture 13 is provided for counting the apparatus to drive the counter. While in use, the tape 6 is drawn from the housing 1 and loaded on a drum incorporating a rotary magnetic head therein, so that the bottom wall 3 has formed therein an opening 14 in which a tape extraction means, such as a pin provided in the apparatus for drawing out the tape 6 from the cassette, engages the tape 6. Further, the bottom wall 3 has apertures 15 and 16 to provide driving access for reels housed in the cassette. The wall 3 also includes means 17 to prevent accidental erasure and apertures 18 and 19 for fixing the position of the cassette when it is mounted on the apparatus.

Referring now to FIGS. 3 to 6, a pair of reels 20 and 21 having the magnetic tape 6 wound thereon are disposed in a predetermined spaced relation to each other in the cassette housing 1. As will be apparent from FIG. 3, the reels 20 and 21 have cavities 27 and 28 to receive reel shafts of the apparatus and central apertures 22 and 23 formed in their upper end faces respectively, which apertures receive engaging shafts 24 and 25 projecting from the top wall 2 of the housing 1. The reels 20 and 21 are disposed in the housing 1 in a manner to be rotatable relative to the latter.

The supply reel 20 has a flange 26a of a large diameter formed at its lower end and a flange 26b of a small diameter at its upper end. The take-up reel 21 has a flange 26b only at the upper end thereof equal in diameter to the flange 26a of the supply reel 20. The flange 26a overlies the flange 26b when viewed from above.

On the inside of the bottom wall 3 of the housing 1 a raised portion 26a is formed at a position corresponding to the take-up reel 21 and the raised portion 26a is covered with a low-friction material 36 such as, for example, a Teflon sheet or the like to provide a flat surface, which serves as a lower flange of the take-up reel and facilitates smooth traveling of the tape. The cavities 27 and 28 of the reels 20 and 21 receive reel shafts of the apparatus which are inserted through the apertures 15 and 16 formed in the bottom wall 3 of the housing 1, and the reels 20 and 21 are driven by the reel shafts. Small apertures 28 and 29 are formed in the bottoms of the cavities 27 and 28 wherein engaging pins 30 and 31 project from the reel shafts in order to couple the reels with the reel shafts when the reel shafts are inserted into the cavities 27 and 28. In this case, it is preferred for stable driving of the reels that the bottoms 27a and 28a of the cavities 27 and 28 is at a position more than 1/2 of the height of the reels as depicted in FIG. 5.

A tape guide pin 31 from the magnetic tape apparatus 3 is inserted into the opening 14 formed in the bottom wall 3 of the cassette housing 1. The opening 14 is formed in the side wall 4 of the housing 1 corresponding to the opening 14 as previously described. The mag-
nic tape 6 wound on the supply reel 20 in the housing 1 is drawn out therefrom through the opening 5 across the guide pin 10, guided across the opening 14 along the front side wall of the housing 1 and then introduced again into the cassette housing 1 across the guide pins 11 and 11', thereafter being wound on the take-up reel 21.

When the magnetic tape apparatus is in its recording or reproducing condition, the magnetic tape 6 is drawn out by the tape guide pins 31 forwardly of the cassette housing 1 through the opening 5 and, at the same time, guided by the tape guide pins 10, 11, and 11' to be directed around a predetermined peripheral portion of a rotary magnetic head drum.

In the present invention, the bottom wall 3 of the cassette housing 1 has a slot 32 formed therein and extending from the front of the housing 1 in a direction in which the cassette is urged to slide when it is mounted on the cassette holder of the apparatus. The slot 32 is spread out at the front portion of the housing 1 to provide a substantially V-shaped cut-out 33a. In this case, it is preferred that the cut-out 33a is formed at a position corresponding to the opening 14 between the reeds 20 and 21 in the housing 1 and that the cut-out 32a at one end of the slot 32 is contiguous with the opening 14. Further, it is preferred that although the distance between the reeds 20 and 21 in the housing 1 and that the cut-out 32 at one end of the slot 32 is contiguous with the opening 14.

On the cassette receiving portion of the cassette holder apparatus which receives the bottom wall 3 of the cassette housing 1, a projection is formed for engagement with slot 32 of the bottom wall 3 of the cassette housing 1 when the housing is in its correct loaded position. The cassette holder of the apparatus is designed so that the cassette housing 1, after being mounted on the cassette holder, is brought down onto the base 22 to be engaged therewith. It is preferred that one of the reed shafts, for example the take-up reel shaft, be adapted to be moved in accordance with the size of the cassette housing being employed. In this case, if the slot 32 is not formed at the center between the opposing side walls of the cassette housing 1 but at a position further to the right or left than the center, the slot 32 would not receive the projection of the apparatus to ensure avoidance of faulty loading of the cassette when the cassette is loaded in the wrong direction.

When the tape cassette of this invention is loaded in the cassette holder of the magnetic tape apparatus, the cassette is slid onto the cassette holder from the front of the apparatus, which allows the slot 32 formed on the bottom wall of the cassette housing to be engaged with the projection projecting from the cassette receiving portion of the cassette holder and be guided to bring the tape cassette to a predetermined position on the cassette holder and retain the cassette thereon. In this case, even if the tape cassette is in a little cut out position to the right or left when it is loaded on the cassette holder, the V-shaped cut-out 33a contiguous to the slot 32 always aligns with the projection of the cassette holder and guides it into engagement with the slot 32, thus ensuring that the tape cassette is loaded at the predetermined position. Accordingly, the tape cassette can be loaded on the apparatus by one hand without accurately ascertaining the position of the projection of the cassette holder.

As has been described in the foregoing, the present invention enables easy, accurate and rapid loading of tape cassettes of different sizes on the magnetic tape apparatus.

Although the present invention has been described as being applied to the tape cassette for video signal recording and reproducing apparatus, the invention is applicable to other tape cassettes for use with magnetic tape apparatus.

Further, in the foregoing the slot is formed in the bottom wall of the cassette housing, but when this invention is applied to tape cassettes different in height from the aforementioned cassette, the slot may be formed on the side walls of the cassette housing for facilitating the loading thereof.

It will be apparent that many modifications and variations may be effected without departing from the scope of the novel concepts of this invention.

What is claimed is:

1. A tape cassette for holding a tape and being used for supplying the tape to a tape apparatus for recording or reproducing or both, said cassette comprising:
   A. A reel having said tape wound thereon; and
   B. A housing formed by walls for containing said reel therein, said housing having an opening permitting the passage therethrough of said tape and one of said walls having a cut-out formed at the peripheral portion thereof and a slot extending from said cut-out for engagement with a portion of said apparatus thereby to guide said cassette to a predetermined position, said cut-out involving a portion of the margin of said one wall and becoming gradually narrower toward said slot from said margin.

2. A tape cassette according to claim 1 in which said slot extends in the direction of movement of said cassette to be loaded to said apparatus.

3. A tape cassette according to claim 2 in which said cut-out is substantially delta-shaped, one side of said delta-shaped cut-out being at said margin and one apex opposing said one side being contiguous to said slot.

4. A tape cassette for holding a tape and being used for supplying the tape to a tape apparatus for recording or reproducing or both, said cassette comprising:
   A. A reel having said tape wound thereon; and
   B. A housing formed by walls for containing said reel therein, said housing having an opening permitting the passage therethrough of said tape and one of said walls having a cut-out formed at a peripheral portion thereof and a slot extending from said cut-out for engagement with a portion of said apparatus thereby to guide said cassette to a predetermined position, and in which said walls of the housing are constituted by top, bottom, side and back walls, said opening is located in said side wall and said cut-out and slot are formed in said bottom wall.

5. A tape cassette according to claim 4 in which said cut-out and slot extend across said bottom wall to one edge thereof from the opposing edge.

6. A tape cassette according to claim 4 in which said cassette contains a supply reel and a take-up reel spaced from each other on the inside of said bottom wall and said slot is provided between said supply and take-up reels.

7. A tape cassette according to claim 6 in which said slot is spaced by a predetermined distance from one of said supply and take-up reels regardless of the size of said cassette.

** * * * **
Draft American National Standard
Dimensions and Location of Records for
3/4-in Type A Helical-Scan Video Tape
Cassette Recording

1. Scope
This standard specifies the location of the edges for the video, audio and tracking-control records and the mechanical separation of the simultaneously recorded information of the video and audio records, as recorded on a 3/4-in Type A helical-scan video tape recording cassette system, operating at a tape speed of 95.3 mm/s (3.752 in/s).

2. Definitions
2.1 Transverse. Pertaining to dimensions perpendicular to the direction of tape travel.
2.2 Longitudinal. Pertaining to dimensions parallel to the direction of tape travel.
2.3 Downstream. Pertaining to locations on the tape longitudinally displaced from a given reference point in the direction of tape travel.
2.4 Upstream. Pertaining to locations on the tape longitudinally displaced from a given reference point in the direction opposite tape travel.
2.5 Trailing Edge of Video Track. The upstream edge of the video track.
2.6 Transverse Reference Line. An imaginary line on the magnetically recorded tape perpendicular to the reference edge and passing through the trailing edge of the video track at its highest point (trailing edge at the end of the video track).

The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights.

By publication of this standard, no position is taken with respect to the validity of this claim or any patent rights in connection therewith. The patent holder has, however, filed a statement of willingness to grant a license under these rights on reasonable and non-discriminatory terms and conditions to applicants desiring to obtain such a license. Details may be obtained from the publisher.

No representation or warranty is made or implied that this is the only license that may be required to avoid infringement in the use of this standard.

3. General Specifications
3.1 Dimensions. Metric dimensions are primary.
3.2 Measurement Conditions. The dimensions shall be measured with no transverse or longitudinal tension applied to the tape.
3.3 Measurement Environment. The temperature shall be (20 ± 2°C) (68 ± 4°F) with a relative humidity of 50 ± 5 percent.
3.4 Magnetic Coating. With the direction of tape travel as shown in Fig. 1, the magnetic coating is on the surface facing the observer.
3.5 Tape Speed. The tape speed shall be 95.3 mm/s (3.752 in/s).
3.6 Video Writing Speed. The video writing speed shall be 10.26 m/s (404 in/s).

3.7 Video Head Drum Diameter. The video head drum diameter shall be 110.00 ± 0.01 mm (4.3307 ± 0.0004 in).

4. Dimensions
The transverse and longitudinal dimensions shall be as specified in Fig. 1 and Table 1.

Table 1
<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Millimeters</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Audio No. 1 width</td>
<td>0.80 ± 0.05</td>
<td>0.0315 ± 0.0020</td>
</tr>
<tr>
<td>B. Audio No. 2 width</td>
<td>0.80 ± 0.05</td>
<td>0.0315 ± 0.0020</td>
</tr>
<tr>
<td>C. Video area lower limit</td>
<td>2.90 ± 0.05</td>
<td>0.1142 ± 0.0009</td>
</tr>
<tr>
<td>D. Video area upper limit</td>
<td>18.20 max</td>
<td>0.7165 max</td>
</tr>
<tr>
<td>E. Control track width</td>
<td>0.60 nom</td>
<td>0.0236 nom</td>
</tr>
<tr>
<td>F. Control track reference</td>
<td>18.40 ± 0.28</td>
<td>0.7244 ± 0.0110</td>
</tr>
</tbody>
</table>

*See Section 7.2.*

Fig. 1
Track Configuration and Dimensions from Magnetio-Sensitive Side
5. Audio- and Control-Head Position

The distance (c) on the tape pattern from the end of the 180° arc of a video head to the audio and control head position is 74.0 mm (2.913 in), as shown in Fig. 1.

6. Audio Record Displacement

Program audio or other information which is time coincident with video information recorded at a point, b, of any video track shall be recorded on Audio No. 2 at a distance, I, downstream from that point (c). (See Fig. 1.)

7. Video Head Switching

7.1 The switching position between the two heads during playback shall be between the 5th and 8th horizontal lines before the leading edge of the vertical sync signal, as shown in Fig. 3.

7.2 When the address track (Dimension f) is used, the video head switching position ahead of the vertical sync signal shall be between 0.5 and 2.0 horizontal lines. (See Fig. 5.)

7.3 The f output of both video heads shall extend past the switching point by approximately 3 horizontal lines to provide ~ 3 horizontal lines of overlap.

8. Tape Back-Tension

The tape back-tension in the record mode shall be 0.030 ± 0.009 N (0.67 ± 0.2 lbs) when measured at the entrance of the drum, as shown in Fig. 3. A full-slip-out cassette (60 minutes) shall be inserted in the recorder and the tape threaded past the entrance guide post. Tension shall be measured with a suitable spring balance as the tape is pulled off the reel at normal tape speed. The mutual ratio of tension between the maximum tape back diameter of 118 mm (4.64 in) and the minimum tape back diameter of 86 mm (3.39 in) on a 60 minute cassette shall be 3:1.

NOTE: In addition to this standard, there are available the following documents relating to Type A half-inch video tape recording.


Fig. 3

Tape Path and Guidance

Fig. 3

Switching Position of Two Video Heads
Out in the field, we’re way ahead of the field.

A pretty dramatic statement, we’ll admit. But Sony Broadcast has dramatic equipment to back it up.

What would you say to a professional U-matic color video-cassette recorder, and a broadcast-quality 3-tube ENG color camera, at a combined weight of under 40 pounds.

And that includes little things like camera head, and viewfinder, and lens, and video cassette, and even rechargeable battery!

Surprised? You shouldn’t be. After all, portable Sony equipment has been leading the ENG revolution for years.

And combining our BVU-50 recorder with our BVP-300 camera gives you one of the most advanced news gathering and field production teams we’ve ever fielded.

Look, first, at our BVP-300 camera.

It’s a state-of-the-art 3-tube color camera in a completely self-contained package. A camera that combines broadcast-quality pictures with the ENG advantages of extremely small size, light weight, and low power consumption.

Three Plumbicon® or Sabicon® pickup tubes provide the exact pickup system that suits your needs. Extra sensitivity lets you bring your stories to light...even if you have just 2 footcandles to work with. And automatic controls make setup a snap.

Next, look at our BVU-50 recorder.

It saves space and weight by having record-only circuitry. Yet a unique video confidence head system lets you know you’re getting adequate RF signal on the tape. Framing servo insures proper frame orientation. And professional picture quality makes the BVU-50 equal to any ENG or EFP situation.

Now look at them both together. And see how far ahead of the field Sony Broadcast really is.

Your BVU-50/BVP-300 system will operate for up to 74 minutes on a single BP-90 NiCd battery.

You can start and stop the recorder by the camera trigger.

At the end of each shooting sequence, the BVU-50 automatically backs the tape for clean scene-to-scene transitions. You get continuous usable video for the full length of your recording tape.

While you’re recording, you can monitor all VTR warning functions in both camera viewfinder and earphone.

And while you’re in standby mode, the BVU-50 head drum rotates at slower speed, reducing power consumption by two-thirds.

In short, you get an ENG/EFP package that gives you the size, weight, and convenience you’d normally expect from 16mm film equipment. Yet retains all the economic and electronic advantages of video.

Advantages that can keep you way ahead of the game.

For more information, write Sony Broadcast, 9 West 57th Street, New York, N.Y. 10019. Or call us direct. In New York, our number is (213) 371-5800. In Chicago, we’re at (312) 792-3600. And in Los Angeles, at (213) 537-4300.

SONY

BROADCAST

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We've lightened your load.

Our new portable video cassette recorder/player makes eyewitnessing the news easier than ever before.

JVC has done two things to improve your ENG capability: we've made the gear lighter and we've lowered its rental cost.

Our brand-new CR-4400U Color Portable Camera Servo 1/4" U-VCR weighs only 24.5 pounds, complete with rechargeable battery and standard 20-minute videocassette setup. And it sits as lightly on your shoulder with the CR-4400U at your side, you'll get to record top-quality color video, with a S/N ratio of better than 45 dB. There's a full-function keyboard, including pause/still and audio dub. Other JVC features include audio mixing and multi-purpose meter to read audio, battery, video and servo levels. Our exclusive auto assemble editing function enables you to get smooth, glitch-free edits between scenes, and can be operated by camera trigger or remote switch. With back-up time to full speed at less than 0.2 second, you're always ready to shoot. And you can shoot 50% longer, too, since the CR-4400U requires 50% less power than most other decks.

JVC's unique patented dubbing switch is provided to facilitate quality tape transfers. For playback through regular TV sets, an optional RF converter can be plugged right into the deck. The CR-4400U operates on AC as well with its companion AA-P44U Power Adaptor, which also functions as a battery charger.

But the best way for you to find out how this light-weight, low cost portable video-cassette system can add to your news-gathering ability is to get yourself a hands-on demonstration. Call your JVC dealer, or send us the coupon below.

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1) CR-4400U Portable Color 1/4" Video Cassette Recorder/Player
3) GC-4800U Portable Color Camera
4) CR-4800U Full Editing 1/4" Video Cassette Recorder/Player
5) I'd like a demonstration

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JVC
JVC INDUSTRIES, INC.
Think you've heard everything?

The world thought so, too. Then Thomas Edison invented a tiny thing called a phonograph. Suddenly sounds could not only be produced. They could be reproduced. And for 100 years, we've been reproducing sounds just about the way Tom did when his music went round and round.

But not any more.

Sony has perfected a new kind of audio recording system for professional use. It's called PCM, which stands for Pulse Code Modulation. And it's part of the digital audio revolution—such a great improvement over conventional analog recording techniques, it's been called the best thing since night baseball.

It's here right now.

We've taken those last important steps toward making digital audio a practical reality. And the 2-track PCM-1600 were exhibiting at this fall's AES conference isn't just the most advanced professional digital equipment to come to the marketplace. It's an idea whose time has come.

The perfect master.

Used as a Studio Master, the Sony PCM-1600 gives you true digital mastery of audio. Substantially better audio quality than is possible through even the best analog technology. It lets you record separate takes and assemble them. Make generation after generation of lacquers with no sound degeneration. And distribute any number of digital masters to, say, foreign affiliates...giving France the same quality you gave England.

And you still haven't heard the best about the PCM-1600.

First, it uses a standard videotape recorder. The same kind of recorder already familiar to broadcasters across the nation. To edit, or to perform a digital-to-digital dub, you use a standard Sony video editing console—and do it all electronically.

Second, some very impressive numbers. Dynamic range greater than 90 dB. Harmonic distortion less than 0.05%. Wow and flutter so low it can't be measured. And absolutely no hint of hiss.

Third, we've solved the problem of dropouts. By introducing an error-correcting code technique originally developed for computers, we've given our PCM-1600 fail-safe signal reproduction. The kind computer applications take for granted.

And finally, Sony PCM equipment is ready to live up to the Sony name. It's rugged, Reliable. Designed to take anything professionals dish out. And once producers and artists hear the difference, conventional analog recording systems just don't sound good enough.

Now you've heard everything.

Unless, of course, you haven't heard our PCM-1600 in action. In that case, we'll be glad to demonstrate...and even take your order now for fall and winter deliveries.

If you think you can wait, see our PCM exhibit at the 51st AES Convention, Waldorf Astoria, New York, November 3-6. Have a good look around.

Then have a good listen.
INTERVIEW: Chris Lacinak (conducted via e-mail).

What are some of the typical physical defects encountered in U-Matic tapes? What's the most common problem?

The most common physical defect with U-matic tape is a degradation of the media which results in the combination of high stiction/friction, low adhesion and low cohesion in transport. With polyester tape of the U-matic era (and particularly the late 70s to mid 80s) this set of symptoms would be identified generally as sticky shed. The common treatment of sticky shed is to remove moisture through methods such as baking, dehydration, incubation, vacuum, and exposure to desiccants. Unique to U-matic is the number of tapes that exhibit these symptoms, yet fail to respond to usual methods of treatment.

Are there specific visual defects or issues that should be looked for when inspecting tapes?

Not particular to U-matic. You would use the same inspection process as with other videocassette based media.

What advice can you give when it comes to setting priorities for remastering?

It is assumed that we are setting aside value of content and rights issues and focusing solely on the technical aspects (which is not all that representative of reality, but...). Speaking to specific brands and model numbers, the reality is that there are exceptions to every generalization. The end result depends heavily on the combination of media...
quality, storage history and care and handling. Even if there are issues, the threat is less that there is an issue with the tape itself that will cause permanent loss. The real threat is lack of expertise in identifying the fact that there is an issue or improper treatment of degraded media. In the case of U-matics degraded media is less of a prioritization issue than it is a workflow issue. Therefore my tendency for technical prioritization would probably lean toward obsolescence. That would most likely place 1630 (Audio mastering format) at the forefront followed by Low Band, High Band and SP. Thanks to players that playback all three variants there isn't necessarily more emphasis on one than the other.

I would add that the very nature of analog systems is inconsistent. They take alignment and calibration to maintain consistency of quality. Generally speaking, the older the technology the greater the inconsistency. I bring this up for two reasons. 1. With digital technology today people are used to consistency. The concept of calibration and alignment is not present in their minds. It is important that calibration and alignment are performed upon playback in order to achieve integrity and a faithful reproduction, although not nearly widely practiced as it should. Those that are bypassing this step are not recognizing an inherent part of analog systems. 2. Whether it is valid or not, many people expect U-matic to look bad because it is an older format. This expectation can cause a lack of consideration for the integrity of the reproduction and an acceptance of quality that is far less than preservation. The combination of poor practices on the reproduction side and low expectation on the viewing side is dangerous to the goal of
For remastering purposes, what are the important factors to consider when choosing a deck?

1. Serviceability - Did the unit have significant market saturation? Does the model share parts with other models from the manufacturer, which would make it more likely to find parts for the machine? Are there technicians who have the expertise and the tools to repair the unit? Tools to perform transport/mechanical and electrical calibration for many of these decks are obsolete and difficult or impossible to find. The net effect of this is that the machines can not be "brought up to spec" with any level of certainty.

2. The ability reproduce the largest number of format variants and features (i.e. Audio Noise reduction, time code, etc.).

3. Transport stability

4. Types and quality of inputs and outputs (XLR vs. RCA for audio, whether it has a ref/sync input, Dub out, etc.)

5. Obviously the condition of the deck upon purchase is always a critical factor. Heads, belts, pinch rollers must all be in optimal condition.

Are there decks or characteristics of decks that should be avoided?

As opposed to talking about all the decks that should be avoided I would summarize by saying that I highly recommend, in order of preference, the Sony BVU-950 and the 9850.

What kind of regular maintenance should be performed on a U-Matic deck?
By regular I am assuming that we are talking about things that an operator would do as opposed to a technician:

--demagnetize and clean the transport

--Verify the integrity of the reproduction system by playing back a reference test tape

*How would you characterize the situation as far as maintenance at this point are parts and technicians relatively easy to come by?*

Technician’s tools and parts for these machines are becoming obsolete. It is becoming harder to find technicians with the expertise and tools to repair U-Matic decks.

*With decks becoming more plentiful and cheap as they’re being discarded by post houses, etc., do you advise that people stockpile them if they have space?*

As one part of a multi-tiered approach to combating obsolescence I suggest that there be a coordinated and strategic effort utilizing pooling of resources to acquire and maintain not only material items such as decks, manuals and technician tools, but also the knowledge base of the user community and technicians that thrived in the height of U-matic’s existence.

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1 According to Cusumano, Mylonadis and Rosenbloom, citing a Japanese-language source, Sony wanted to use an azimuth recording system but because its corporate partners Matsushita and JVC were not ready to manufacture this sophisticated design, Sony proceeded with the U-matic’s guard-band design—necessitating a larger cassette and playback deck, which contributed the format’s failure in the consumer market. Michael A Cusumano., Yiorgos Mylnadis, Richard S. Rosenbloom. “Strategic Maneuvering and Mass-Market Dynamics: The Triumph of VHS over Beta.” *The Business History Review*, Vol. 66, No. 1, (Spring 1992) pp. 51-94.
2 A note on spelling: Though it has appeared in variant spellings in magazines and other publications, Sony has always used the spelling “U-matic,” with a hyphen and lower-case “m.”


13 Advertisement in the Chicago Tribune, August 7, 1972.


15 Fast Forward, p.73.


17 “CBS Gave the ENG Wagon An Early Push; Other Nets Soon Joined,” Broadcast Management/Engineering, January 1975.


23 Cusumano, Mylonadis, and Rosenbloom.
