
Deluxe TV Tape Recorder, Type TR-22D

- Fully transistorized for dependable performance
- Built-in Automatic Timing Correction
- Plug-in Color ATC accessory available



Deluxe TV Tape Recorder, Type TR-22D

This deluxe, transistorized tv tape recorder maintains a high measure of excellence in producing trouble-free, error-proof tape recordings and in obtaining high-quality reproduction from recorded tapes—both color and monochrome.

This new TR-22D model is designed for added facility in color taping operations. Accessory color modules merely plug into the space provided for them. Tape handling has been improved to increase color tape life. A number of technical innovations are included to fortify the reliability and repeatability of producing color tapes. The result is a machine on which good color tapes can be produced time after time—by semi-technical personnel.

Completely self-contained in a modern compact console, the TR-22D is functionally designed for utmost ease of operation. Included in the basic recorder are such quality features as automatic timing corrector (for monochrome operation), tape lifter, a tape motion sensor, and latest-design transistorized audio, picture and waveform monitors.

The TR-22D will accept a number of deluxe accessories that may be housed within the compact console. These accessories include automatic timing corrector (for color operation), dropout compensator, and electronic splicer. They are all transistorized, all modularized, all designed to plug into the spaces provided for them.

Description

Color Advantages

The TR-22D is designed to the exacting standards of color tv. It can be used for color taping by merely plugging in color ATC modules. This accessory fits into the planned space in the basic console. Addition of color ATC permits making and playing of color tapes with the same kind of reliability and repeatability experienced in monochrome taping.

A new headwheel servo system includes four high-performance modes of operation—tone wheel, switchlock, pixlock, and linelock. The fourth mode, linelock, is particularly valuable in playing color tapes. It will handle tapes made with a more than normal range of timing errors, thereby increasing the playability of color tapes from outside sources.

Transistorized for Reliability

The advanced circuitry of the TR-22D uses semiconductors to perform all circuit functions necessary to the recording and playing back of television tape. Use of long life transistors and other solid state components makes possible significant savings in size, weight, and power consumption. Transistor circuits provide reliability over long periods of time, reduce maintenance, and give dependable performance.

Stabilized for Uniform Quality

Uniform picture quality is a result of stabilized circuits in the

TR-22D. These circuits function to correct themselves, holding a high-level of performance over long periods of operation. They compensate for changes that may occur with component aging. Operators are freed from constant attention and frequent "touch-up" of controls.

Fully Instrumented Operation

Another significant contribution is a unique signalling system which indicates faulty operation during recording or playback. A series of indicator lights point out operational modes, warn operators of potential trouble, and help technicians quickly pinpoint and correct malfunctions, should they occur.

Automatic Timing Corrector

Transistorized circuits to provide electronic compensation for geometric distortions which may occur in some recorded tapes are built into the TR-22D. These distortions (skewing, quadrature or jitter) occur as timing delay errors and are virtually eliminated after passing through ATC. Serving as a continuous monitoring device, ATC automatically compensates for time delay errors, thereby assuring best possible playback quality.

Easy Handling Tape Path

The TR-22D is easier than ever to thread. This is made possible by using cone-shaped guide posts and a newly styled headwheel cover which

provides increased access to the video headwheel and audio heads.

A tape lifter is included in the tape path to remove the tape from the master erase head whenever the machine is in the wind mode. This device is air activated and is comprised of a sapphire rod on which the tape rides. Use of the tape lifter results in longer tape life, less tape scratching and also longer life for the master erase head.

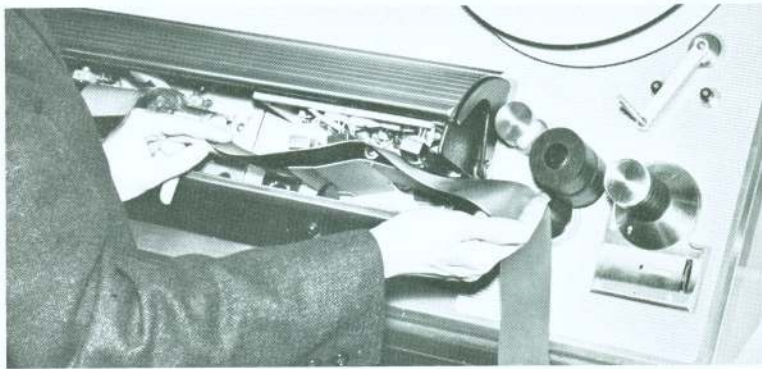
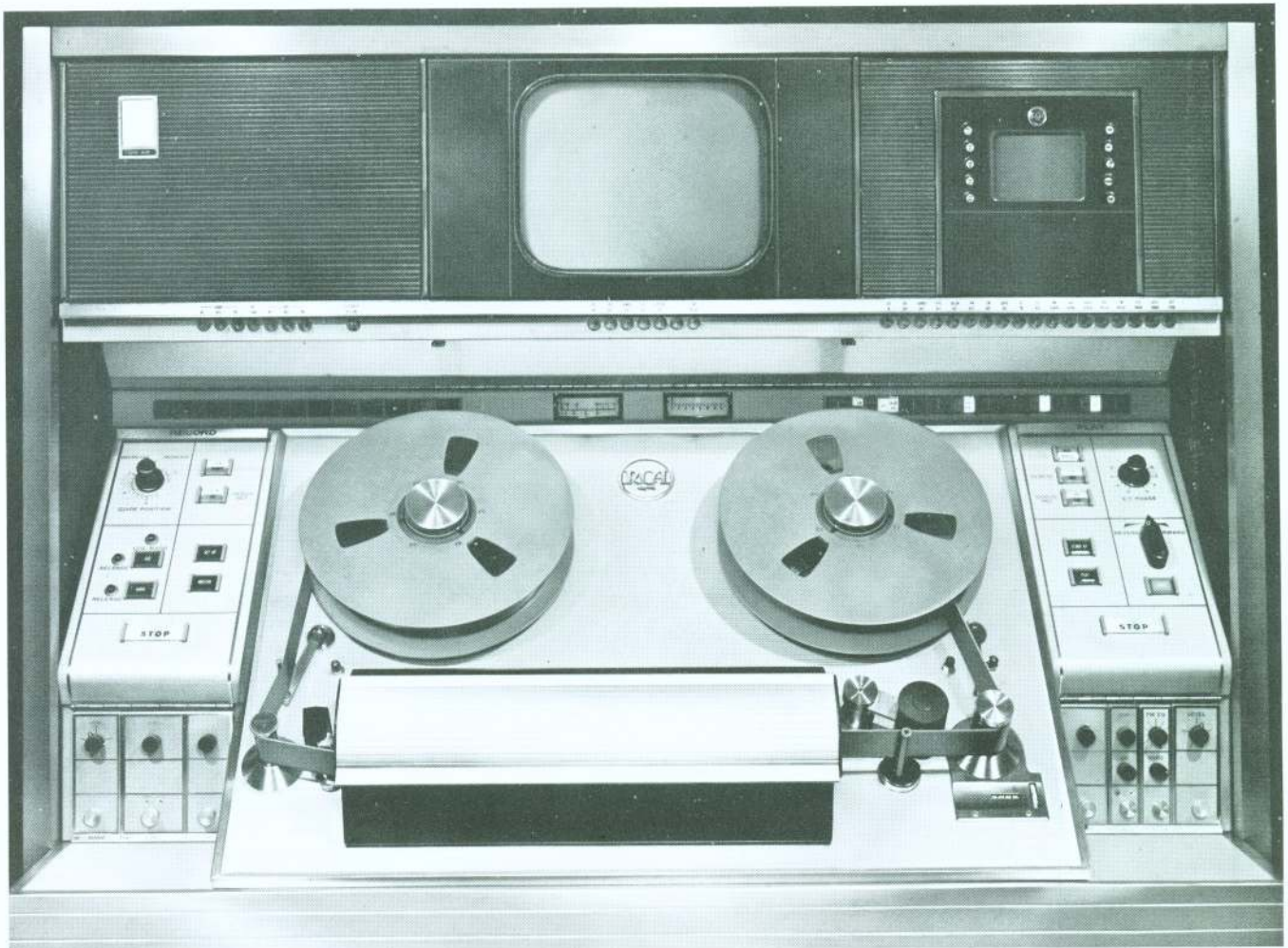
Switchable Standards

In recognition of the increasing importance of international exchanges of television programs, the TR-22D is available in two basic models: (1) a 525-line machine, and (2) a switchable standards machine for 525/625/405 or 819-line operation. In the latter model, either 405 or 819 line operation may be specified as the third standard.

To change from one standard to another, an operator merely moves a selector switch to the desired position. This master switch changes all machine circuitry—i.e., monitors and CRO—to the desired standard.

Built-In Two-Speed Operation

Circuits to permit choice of operating speeds—7½ or 15 inches per second—are built into the TR-22D. By switchover to half-speed recording (7½ ips), substantial savings in tv tape stock can be realized. Use of a narrow track headwheel assem-

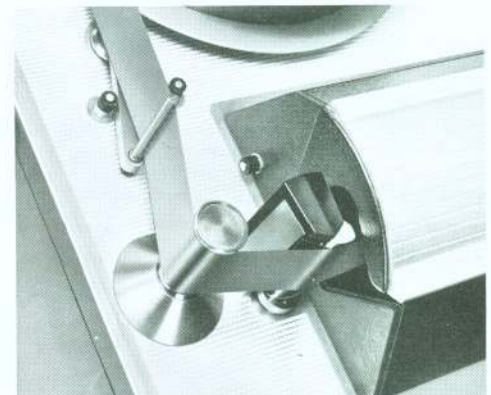


EASY THREADING FOR QUICK-ACTION TAPE HANDLING . . . Headwheel cover slides back against tape deck for easy threading . . . from natural, comfortable position. This expedites tape handling, splicing and editing.

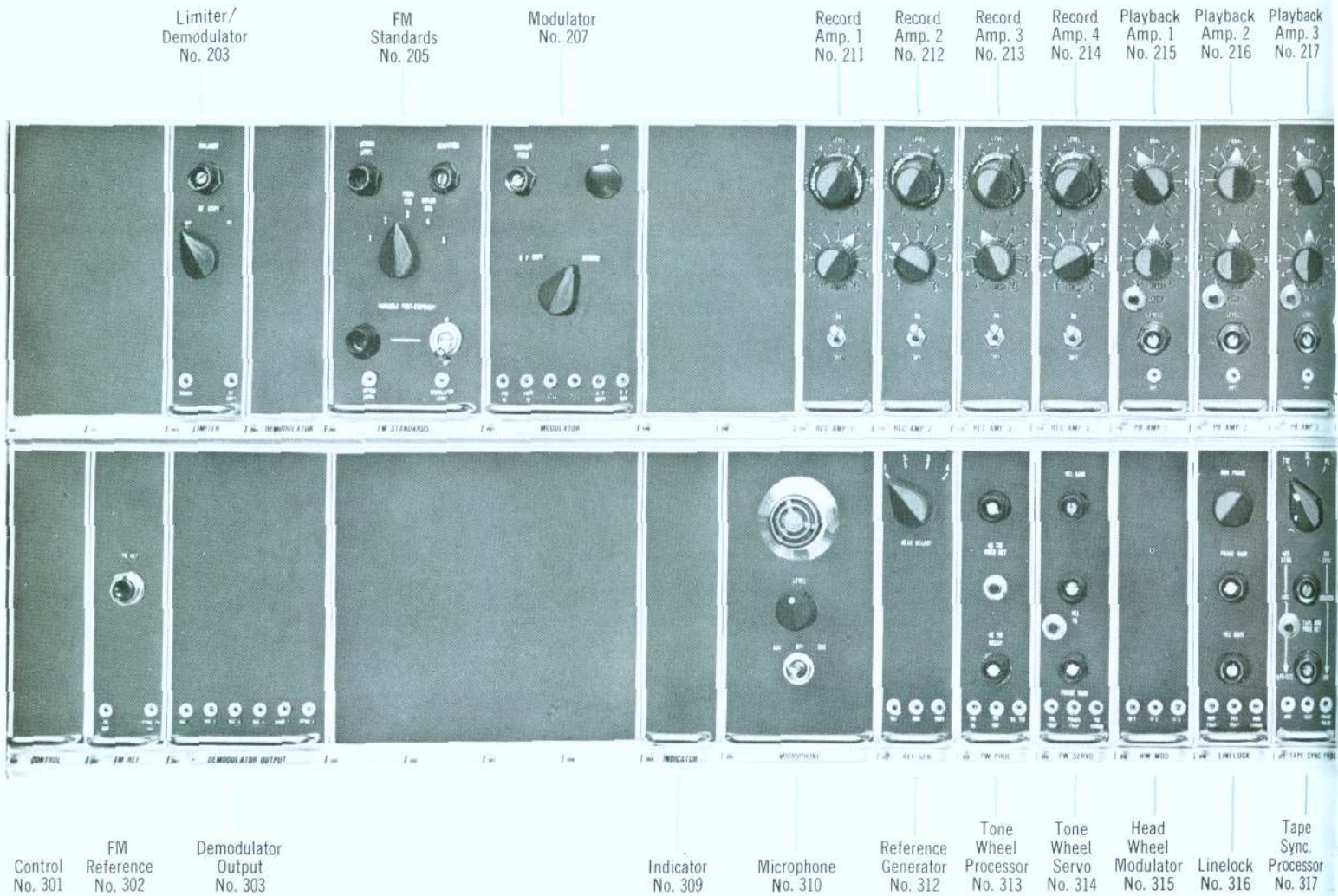


SWITCHABLE TV LINE STANDARDS FOR WORLD-WIDE USE . . . The TR-22D is available in a switchable standards model which provides instantaneous switchover from 525 to 625 to optional 405 or 819 tv line standards.

CONTROL CENTER . . . All operating functions of the TR-22D are centered at this modern tape deck—functionally styled to make operations easy and to encourage consistently high quality pictures with minimum effort. Recording and playback controls are built on separate panels arranged at either end of the tape deck to reduce the possibility of human errors. This is the quality control center—the “business” end of the TR-22D recorder.



TAPE LIFTER AND CONE-SHAPED GUIDE . . . increase tape life and wear on erase head at same time reducing tape dropouts.



TR-22D Module Bank

Limiter/Demodulator—No. 203

FM signal is converted to push-pull, passed through several stages until overall limiting characteristic of at least 55 db is achieved. Contains demodulator and output filter circuits.

FM Standards—No. 205

Video input is pre-emphasized to make a standard recording. A five-position switch selects proper pre-emphasis for monochrome, color, or special standards. Post-emphasis for playback is also provided.

Modulator—No. 207

Clamps pre-emphasized video at the sync-tip level to modulate a capacity-diode-controlled heterodyne type modulator. Circuitry included for copy facility.

Record Amplifier 1—No. 211

Output from record delay amplifier No. 1 is increased in level to a value sufficient for recording on tape.

Record Amplifier 2—No. 212

Output from record delay amplifier No. 2 is increased in level to a value sufficient for recording on tape.

Record Amplifier 3—No. 213

Output from record delay amplifier No. 3 is increased in level to a value sufficient for recording on tape.

Record Amplifier 4—No. 214

Output from record delay amplifier No. 4 is increased in level to a value sufficient for recording on tape.

Playback Amplifier 1—No. 215

Gain circuit and equalizer amplifier for correcting variations of frequency response in Channel No. 1.

Playback Amplifier 2—No. 216

Gain circuit and equalizer amplifier for correcting variations of frequency response in Channel No. 2.

Playback Amplifier 3—No. 217

Gain circuit and equalizer amplifier for correcting variations of frequency response in Channel No. 3.

Playback Amplifier 4—No. 218

Gain circuit and equalizer amplifier for correcting variations of frequency response in Channel No. 4.

Guide Servo—No. 221

Control position of the guide to produce skew-free pictures. Functions in automatic, manual, record, and record-set modes of operation.

Delay/Output—No. 223

Delay video is time modulated line-by-line in the variable delay line. Output line drivers provide time corrected video signals for monitoring and processing.

ATC Error Detector—No. 225

Generates error signal which is amplified (non-linearly) and fed to two phase splitters. Four error outputs drive the variable delay line.

ATC Reference—No. 226

Contains AFC which may be locked to local sync signal or tape sync signal. ATC trapezoid is generated from ATC pulse. A clamp sync separator provides a time corrector sync output to the processing amplifier.

Horizontal AFC—No. 227

Tape sync from the demodulator output is used to control the frequency and phase of a multi-vibrator. This, in combination with other circuits, generates a new horizontal sync, front porch, and blanking.

Vertical Advance—No. 228

Special circuitry counts the number of pulses in a field, to determine very accurately the position for regenerated vertical blanking. Includes 3-position standards switch in switchable standards model.

Sync Logic—No. 230

Generates horizontal and vertical blanking; combines them into composite blanking. Combines tape sync and regenerated horizontal sync into composite regenerated sync. Generates a start pulse which phases the counting of the vertical advance circuitry.

Playback
Amp. 4
No. 218

Guide
Servo
No. 221

ATC Output
No. 223

ATC Error
Detector
No. 225

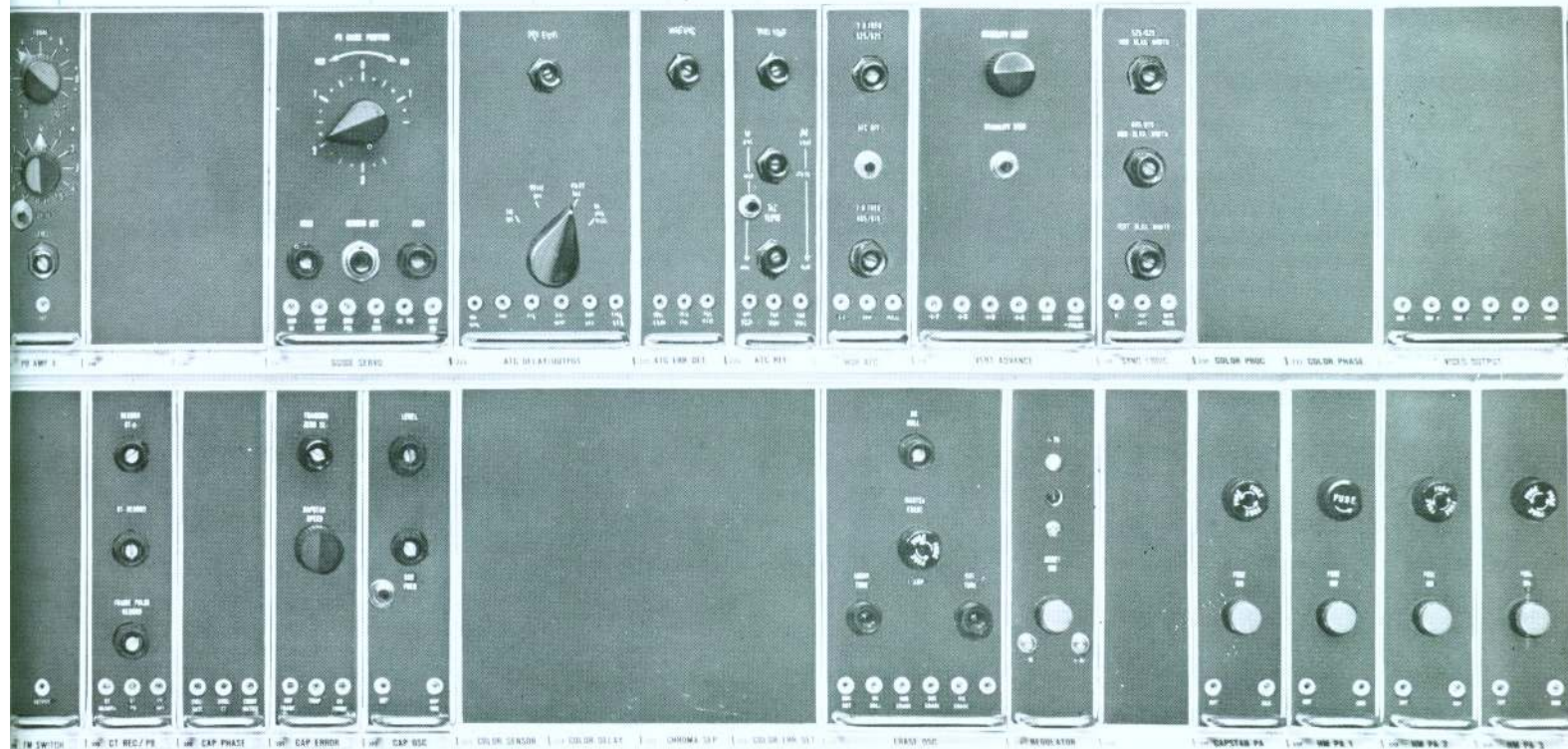
ATC
Reference
No. 226

Horizontal
AFC
No. 227

Vertical
Advance
No. 228

Sync.
Logic
No. 230

Video
Output
No. 233



FM
Switch
No. 318

Control
Track
Record/
Playback
No. 319

Capstan
Phase
No. 320

Capstan
Error
Detector
No. 321

Capstan
Oscillator
No. 322

Erase
Oscillator
No. 327

Regulator
No. 329

Capstan
PA
No. 331

Head Wheel
Motor
PA 1
No. 332

Head Wheel
Motor
PA 2
No. 333

Head Wheel
Motor
PA 3
No. 334

Description of Functions

Video Output—No. 233

Two sending-end-terminated line drivers distribute video within the machine. Three sending-end-terminated line drivers provide outputs from the machine.

Control—No. 301

Part of control system. Provides inhibit logic and time delays.

FM Reference—No. 302

Provides two reference frequencies keyed in from crystal oscillators. References are introduced on alternate vertical blanking intervals and represent precise sync-tip and peak-white frequencies.

Demodulator Output—No. 303

Separates tape sync from the tape signal. Provides line drivers to feed unprocessed video to monitoring circuits and to processing amplifier.

Indicator—No. 309

Senses machine performance and lights trouble indicator in the event of malfunction.

Microphone—No. 310

Houses microphone and mike-cable reel, with microphone amplifying circuits. Permits operator to record on either audio or cue tracks.

Reference Generator—No. 312

Processes local sync to produce horizontal-rate reference, field-rate reference and frame-rate reference.

Tonewheel Processor—No. 313

Shapes the tonewheel pulse and also provides 960-cycle switcher drive.

Tonewheel Servo—No. 314

Derives error signal controlling the headwheel motor in the tonewheel mode of operation.

Headwheel Modulator—No. 315

Amplitude-modulates the headwheel motor-drive sine waves. Gives wide-band three-phase output.

Linelock—No. 316

Provides line-by-line lock-up in the Pixlock mode.

Tape Sync Processor—No. 317

Processes tape sync to produce horizontal-rate reference, field-rate reference and frame-rate reference.

FM Switch—No. 318

Switches between heads during playback, connecting the head scanning the tape to the output.

Control Track Record/Playback—No. 319

The 240-cycle control track signal is amplified, filtered to produce a clean 240-cycle sine wave, clipped, and shaped into a pulse.

Capstan Phase—No. 320

The preceding pulse feeds a chain of binary counters which divide the pulse frequency by eight to produce a 30-cycle output pulse.

Capstan Error Detector—No. 321

A phase detector which compares incoming pulse to the local frame pulse and produces a d-c voltage proportional to the magnitude of the phase error.

Capstan Oscillator—No. 322

D-c error voltage controls the frequency of the oscillator which supplies the drive frequency for the capstan motor. Tape speed is thereby synchronized to local reference.

Erase Oscillator—No. 327

Supplies 87.5 kc erase and bias current to the audio and cue heads.

Regulator—No. 329

Provides regulated voltages to operate the transistor circuitry of the machine.

Capstan PA—No. 331

Power amplifier for the capstan motor.

Headwheel Motor PA 1—No. 332

Power amplifier for one of the three phases required by the headwheel motor.

Headwheel Motor PA 2—No. 333

Power amplifier for one of the three phases required by the headwheel motor.

Headwheel Motor PA 3—No. 334

Power amplifier for one of the three phases required by the headwheel motor.

bly (in place of the headwheel normally supplied) permits twice as many tracks to be recorded on the same length of tape—with full tape interchangeability with other machines, when operated at 15 ips.

Test and Set-Up Aids

Precision performance is standard with a TR-22D. All circuits, controls and monitors are fully instrumented so that technical personnel find it easy to maintain consistent quality. Complete checkout of recording or playback functions is at the operator's fingertips. A seven-position switcher permits monitoring of audio and cue channel information. The 14-inch picture monitor includes a 7-position switcher for checking picture information at various points in the recorder. Through a 20-position switcher, waveforms at key points in the TR-22D may be monitored.

Mode indicators show at a glance the mode of operation being employed while fault indicating lights point out to the operator areas which may be possible sources of circuit malfunction. A multi-meter used in conjunction with a 24-position module test switcher permits rapid checking of pertinent a-c and d-c voltages.

The Recording Process

The recording process centers at the tape deck and operational area. Before the tape gets to the headwheel, it passes over the master erase head which removes all previously recorded information. This clean tape then passes between the vacuum guide and headwheel where the FM modulated video signal is recorded. The tape next passes over the control track head where a 240-cycle signal is recorded. This signal will be used during playback to make sure that the video heads scan along their respective recorded tracks. A 30-cycle frame pulse superimposed on the control track is used to determine where the tape may be conveniently spliced.

Note: When operating with 50 cycle power, the control track frequency is 250 cycles, and the frame pulse rate is 25 cycles.

A program audio track is recorded along one edge of the tape, the area first having been erased by a separate erase head which is a little wider than the following record head. A simultaneous playback head, after

the record head, allows operator to monitor the audio signal as it is being recorded.

On the other edge of the tape, the cue channel record head provides a means for recording cue information. This can be in the form of voice, tone or digital information. A special feature of the program and cue channel is that recording can be done independently of video recording; in other words, sound may be dubbed in while playing back or previewing the video signal.

This cue channel is of such high quality it can be used as a second program channel if desired.

Time-tested features of RCA's TV Tape Recorders are now standard in the TR-22D. These include electronic quadrature adjustment, continuously variable winding speed, separate guide position control for record and play, air lubricated tape guides, brake release switch, magnetic tone wheel, master erase head, simultaneous audio playback and complete cue facilities.

MAJOR ACCESSORIES

The complement of production accessories available for the TR-22D includes an Electronic Splicer, a Dropout Compensator, and Color ATC. The recorder is pre-wired to accept all of these by merely plugging them in the module spaces provided for them.

Electronic Splicing

Splicing of TV tape, electronically, is achieved in the TR-22D by inserting accessory plug-in modules into pre-wired receptacles. With the splicer installed, program segments in color or monochrome can be added to or inserted in recorded material without mechanically cutting the tape. The splicer operates at tape speeds of 7½ or 15 inches per second. The splicer modules afford easy access to all components. When any module is removed, a by-pass circuit automatically returns the recorder to normal operation. Other

features of the splicer include switchable standards and pushbutton electronic setup procedure.

Dropout Compensator

The TR-22D is also pre-wired for insertion of a plug-in Dropout Compensator module. The purpose of this accessory is to eliminate video dropouts caused by tape imperfections. This preserves picture quality and prolongs the life of tapes. For color or monochrome operation, the device employs a delay line principle which inserts previous line video in the space occupied by the dropout.

Color ATC

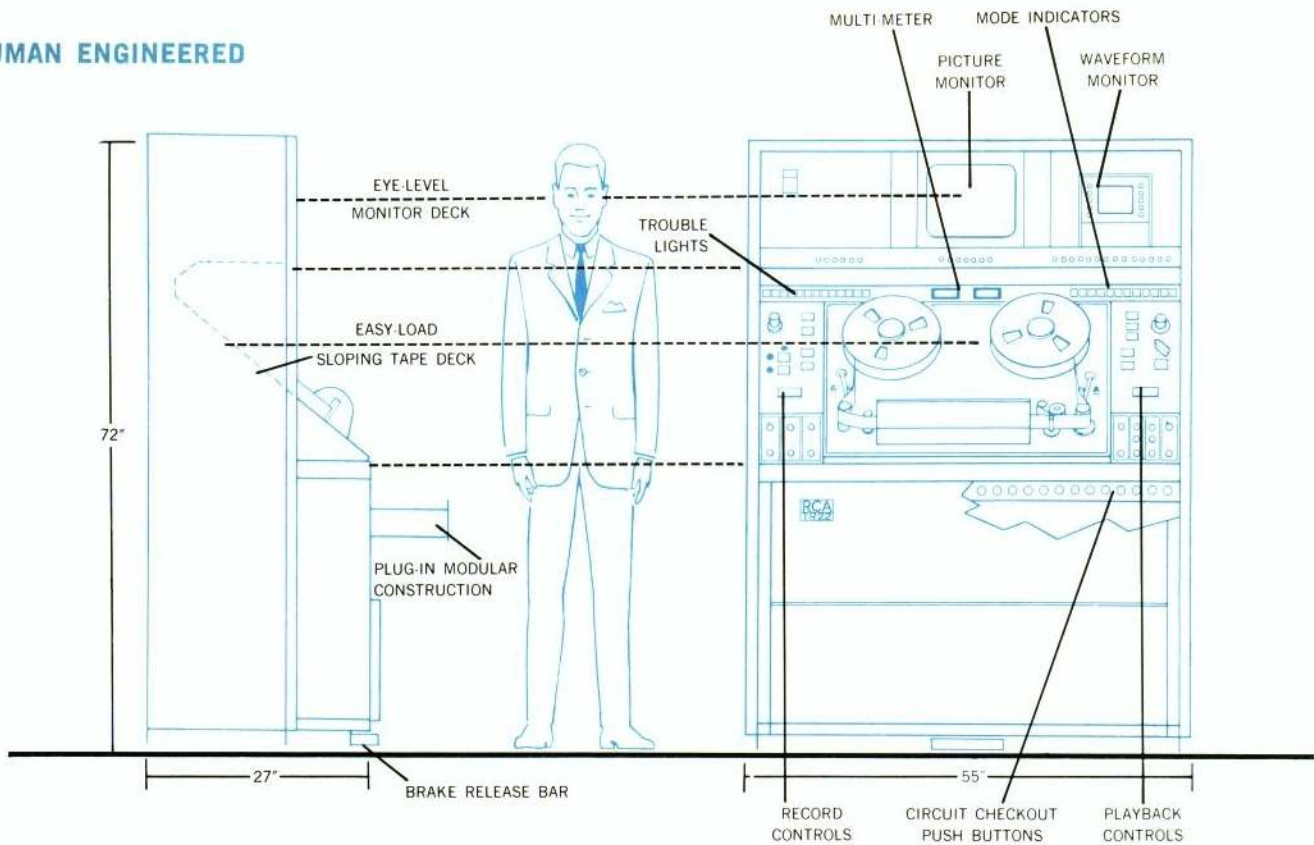
Insertion of the plug-in color ATC modules converts the monochrome TR-22D for color without further modification. Color playbacks then become an automatic operation, with the color ATC circuits offering precise stabilization and a high order of color performance.

COMPLETE LIST OF ACCESSORIES

(supplied complete—order by MI-number)

Automatic Timing Corrector (color).....	ES-43581
Electronic Splicing Accessory.....	MI-40695-A
Dropout Compensator	MI-43309
Video Pre-Amplifier Module (spare).....	MI-40603-A
Remote Control Panel (mode).....	MI-40691-A
Remote Control Panel (signal).....	MI-40692-A
Narrow Track (7½-15) Headwheel Panel Assembly (air bearing).....	MI-40799
Headwheel Panel Assembly (air bearing).....	MI-40790-A
Tape Splicer (15 IPS) including Tape Developer.....	MI-40772
Tape Splicer (7½ IPS) including Tape Developer.....	MI-40748
Splicer Table	MI-40592
Dolly Assembly	MI-40668

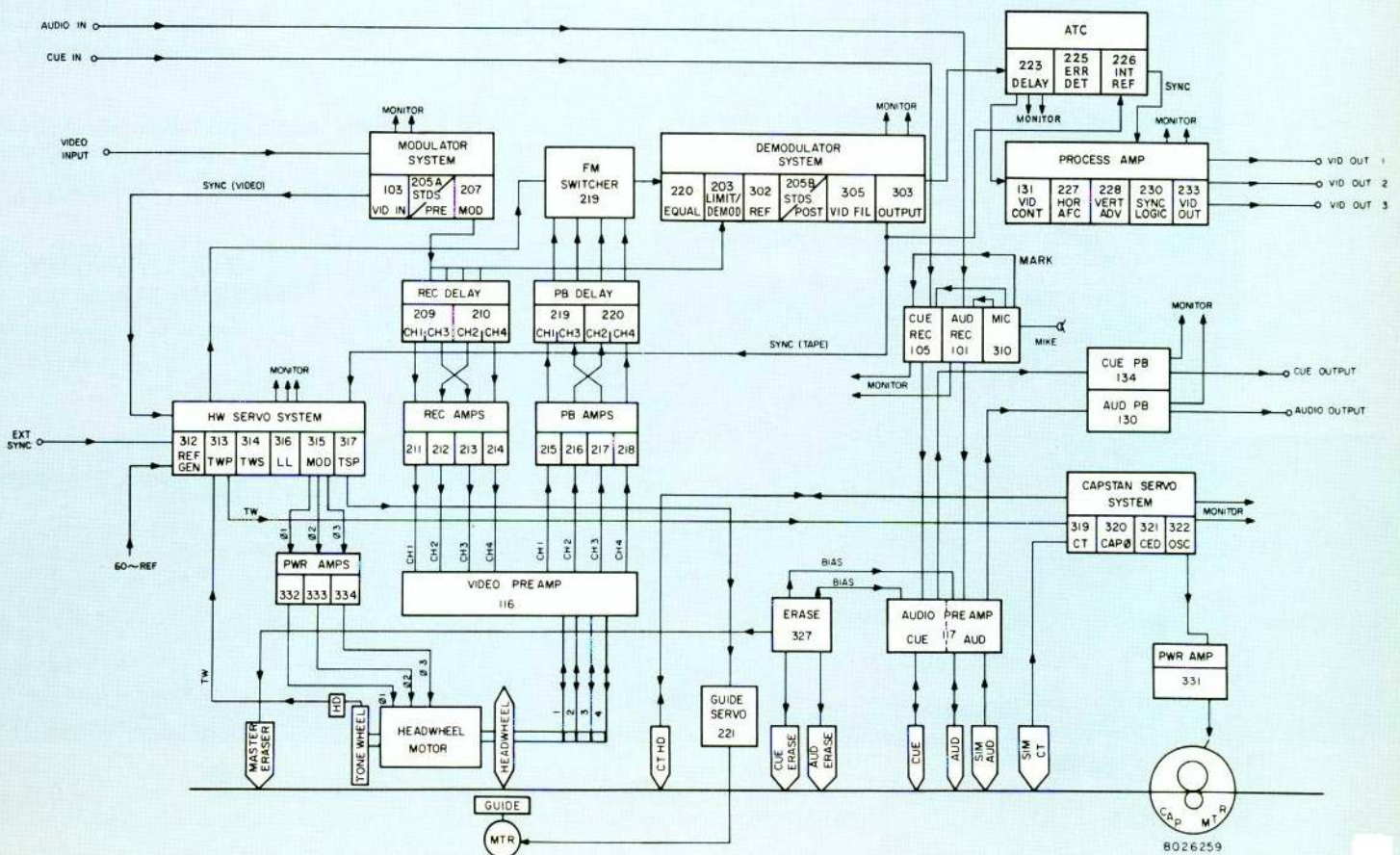
HUMAN ENGINEERED



Among the human engineering features introduced in the TR-22D are a 45-degree angle tape deck set waist-high for ease in loading reels and threading tape. Recording and playback controls have been separated to minimize errors. Monitoring facilities are located at eye

and ear levels with the pushbuttons controlling their functions located immediately below each of the monitors. Also a series of warning lights, which operate continuously, prevent faulty recording. These features simplify the making and playing of quality color tv tapes.

FUNCTIONAL DIAGRAM



Specifications

General

Recording Medium.....	Magnetic tape 2" wide	
	50 Field	60 Field
Tape Speed	15.6 in. (39.7 cm)	15 in. (38.2 cm)
Picture-Sound Separation	14.8 frames sound leading	18.5 frames sound leading
Recording Time	92 min. on a 14 in. reel (7200 ft.)	96 min. on a 14 in. reel (7200 ft.)
Rewind Time	Approx. 5 min. for 7200 ft. reel	Approx. 4 min. for 7200 ft. reel
Recording Time Reference.....	To incoming video signal or an external reference	
Playback Time Reference.....	To the power line or to an external reference	
Stopping Time.....	Less than .2 seconds from Record or Play mode	
Start Time for Stabilized Picture and Sound (tone wheel mode).....	Less than 5 seconds from Stop, less than 3 seconds from Setup or Standby (Pix Lock mode).....	
Tape Interchangeability.....	Tapes made on any machine may be played back on any other machine providing they are made in accordance with all applicable proposed SMPTE recommended practices and proposed ASA standards.	
Tape Timer.....	Accumulated time measured in minutes and seconds. Accuracy within 3 seconds per hour	
Horizontal Displacement of Vertical Aligned Picture Elements.....	Not to exceed .02 microseconds at junction points	
RF Limiting.....	Sufficient to allow RF signal level into the demodulator to be 55 db below nominal before video signal is affected by a 10 percent reduction in level.	

Signal Levels

Input Signal Requirements:

VIDEO.....	Input signal level may be between .5 volt p/p and 1.4 volts p/p composite signal; signal may be looped through or terminated in 75 ohms.
AUDIO.....	Line input level between 0 and 36 dbm, 600 ohm balanced or unbalanced (Recorder may be wired for 150 ohm balanced or unbalanced or 5000 ohm bridging).
CUE.....	Same as Audio above
SYNC.....	Negative polarity 3 to 5 volts p/p
COLOR SUBCARRIER.....	1.5 to 2.5 volts p/p bridging or 75 ohm terminated
RF COPY.....	1 volt p/p nominal 75 ohm terminated

Output Signal Availability:

VIDEO (Monochrome or Color)	Three Line Outputs: one composite or non-composite
	Two Monitor Outputs: composite
	Video Level: .5 to 1 volt p/p; Sync Level: .2 to .4 volt p/p
	Pedestal Level: $\pm 20\%$ of video level
	Burst Level: .2 to .4 volt (color only)
	Chroma Level: $\pm 20\%$ of nominal (color only)

AUDIO.....	One Line output: ± 18 dbm maximum into 150/600 ohms balanced or unbalanced line
	One Monitor output: $+40$ dbm maximum level into 8/16 ohm load (10 watts)
CUE.....	Same as Audio above
SYNC.....	3.5 to 5 volts p/p standard EIA sync signal
RF COPY.....	1 volt p/p level, 75 ohms terminated

Electrical

Power Requirements	60 cycle.....117 volt a-c $\pm 10\%$ single phase 2 kw
	50 cycle.....234 volt $\pm 10\%$ single phase 2 kw
Frequency Response:	Video Channel.....Monochrome—405/525 ± 1.5 db
	30 cycles to 4 mc; 625/819 ± 1.5 db 25 cycles to 4.5 mc; -3 db at 5 mc
	Audio Channel.....(at 15 ips) ± 2 db, 50 to 15,000 cycles
	(at 7½ ips) ± 2 db, 60 to 10,000 cycles
	Cue Channel*.....(at 15 ips) ± 2 db, 50-10,000 cps
	(at 7½ ips) ± 3 db, 60-10,000 cps
Signal-to-Noise Ratio:	Video.....On an interchangeable tape basis; 4 db pre-emphasis
	405/525 line.....Better than 40 db (37 db at 7½ ips)
	625/809 line.....Better than 37 db (34 db at 7½ ips)
	Audio.....Better than 55 db, measured overall between a recorded level corresponding to 3% total rms distortion at 1000 cycles per second and noise present when playing back an erased unmodulated tape
	Cue.....Better than 34 db, measured overall between a reference 5% record level and the noise present when playing back an erased, unmodulated tape
	Transient Response.....Rise time less than 0.15 μ sec. overshoot less than 12% on 0.062 μ sec. sine-squared window test pattern
	Ambient Temperature and Humidity.....Between 35° and 110° F. (0° to 45° C) at 20 to 90% relative humidity
	Picture Jitter.....With recorder in pixlock mode using air bearing headwheel assembly, picture jitter should not exceed $\pm .07$ microseconds
	Wow and Flutter.....0.5 to 250 cps range
	(15 ips) 0.15% or less RMS
	(7½ ips) 0.25% or less RMS

Mechanical

Transport.....	Centrally located at 45° angle and at a reel height of 48" (112 cm)
Dimensions: Width (overall) 55" (140 cm), Width (Less End Panel) 53" (134 cm), Height 71¼" (181 cm), Depth 26½" (67 cm)	
Shipping Information: Width 61¼" (155.5 cm), Depth 35" (88.8 cm), Height 84" (213 cm), Volume 125 ft. ³ (3.75 M ³), Gross Weight 1560 lbs. (708 kg)	

* Includes 36 db notch at 240 or 250 cps, automatically switchable for 50 or 60 cycle standards.

Ordering Information

The Type TR-22D TV Tape Recorder is available for operation on 525, 625, 405 and 819 line tv standards.

Two basic models are available:

- (1) a 525 line machine
- (2) a switchable machine for 525/625/405 or (optional 819) line operation

They may be ordered as follows:

- 525 line, 60 cycles, specify ES-43560
- 525/625/405 line, 50 cycles, specify ES-43561-405
- 525/625/819 line, 50 cycles, specify ES-43561-819

All models include the following equipment complement:

- 1 TV Tape Recorder (Console Mounted) complete
- 1 Headwheel Panel Assembly (Air-bearing)
- 2 End Panels
- 1 Kit of Maintenance Materials
- 1 Monochrome Video Alignment Tape