



**TEN YEARS WORTH  
OF IMPROVEMENTS  
ARE PACKED INSIDE  
THIS MACHINE.**

**3M**

The original ITC Premium Series of tape cartridge machines was introduced in 1970. To say it caught on quickly would be an understatement.

Over the next ten years, the Premium Series became the standard of the broadcast industry throughout the world, outselling its nearest two competitors combined. Over 35,000 Premium Cart Machines were purchased, over 50,000 Premium Decks. In fact, three out of every five broadcast cart machines around the world are ITC machines.

What made the Premium Series so popular was an unmatched level of features, performance specs and reliability within the mid-price range. And those same attributes are still there, along with over ten years worth of improvements, in the Delta Series, the new generation of mid-priced ITC machines.

1983



1973



## Delta I Single Deck Reproducer



The Delta I was designed for use with size A or AA tape cartridges.

The unit is much smaller than previous cart machines. So three machines can now fit into a rack where two used to fit.

The Delta I is packed with improvements. High-speed recue is standard. NE5500 Series amplifiers are used, along with an exclusive ITC playback head. There's a toroidal power transformer. And a digital cue tone detector.

The half-inch tool plate aluminum deck is still there, with the air-damped solenoid design pioneered by ITC. So is the chain-and-sprocket pressure roller assembly.

And we've gone to a modular series design. That means you can add a Delta IV Recording Amplifier to any single or triple deck to make a play/record combination.

### ITC Reproduce Head

This patented head, pioneered in ITC's Series 99 results in unusually flat response and extended life.



### Precision CNC Milled, Tool Plate Aluminum Deck

The aluminum alloy deck offers the rigidity of steel with the weight advantages of aluminum. It provides a stable reference surface for motor, solenoid, and head block mounting. Unique criss-cross azimuth adjusting arms provide the fine adjustment of head azimuth, zenith and height on the true center pivot head block. Locking nuts secure position after each adjustment. Head mounting straps allow easy head replacement. And the complete head mounting block is removable for ease of service. Plug-in head cables make program and cue channel calibration and testing easy. And the metal deck is brushed and anodized for long life.



Delta I  
Rear View



### DC Brushless Servo Motor

The motor is precision manufactured for extremely low wow and flutter. Selectable speeds are 3¾, 7½ and 15 ips, with high-speed recue running at 22.5 ips.

### Delta Series Servo Motor

At the heart of any cartridge machine is its motor. Traditional designs have used hysteresis-synchronous motors with high wow and flutter, heat and radiated magnetic field. These motors were usually limited to one speed because they were referenced to the power line frequency.

In contrast, The Delta Series utilizes a unique, brushless DC servo motor, phase locked to a precision crystal reference. Among other things, this provides for extremely low wow and flutter. Wow and flutter are some of the most audible types of distortion. You can hear it even through inexpensive AM radio receivers.

One reason we can produce machines with such low wow and flutter is that our servo motor uses an averaging tachometer. Most tachometers use a toothed ring attached to the motor, rotating at the same speed with a single point detector. These tachs determine motor speed by counting the teeth on the ring. Unfortunately, this has been a rather troublesome part of conventional servo motor design, because any eccentricity in the gear circumference or tooth irregularities will cause instantaneous errors, which will, in turn, cause the electronic driver circuit to make false current adjustments, actually injecting wow and flutter into the motor.

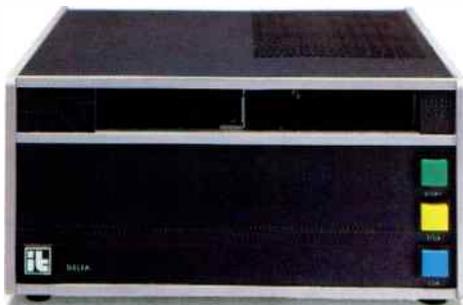
Our averaging tachometer is a unique design that automatically compensates for tachometer ring eccentricity which induces flutter. The averaging tachometer produces a stable, steady signal input to the phase-locked loop motor controller to ensure extremely accurate speed control. Included in the tachometer design is a second pickup coil, wired out of phase, which serves to reduce extraneous hum fields.

The Delta Series Servo Motor also generates far less heat—less than one watt, compared to 23 watts from conventional hysteresis-synchronous motors. This reduction of heat will significantly improve the life of the motor bearings.

Most importantly, the Delta motor is a powerful high torque motor reducing the effective cart-generated wow and flutter. Due to the power of this motor, stall protection is included to prevent motor damage.

### Delta II Wide Play Reproducer

Twice as wide as Delta I to accommodate all sized cartridges. The Delta II is also compatible with the Delta IV Recorder.



## Delta III Triple-Deck Reproducer

Like the Delta I, the Delta III is designed for use with size A or AA tape cartridges.

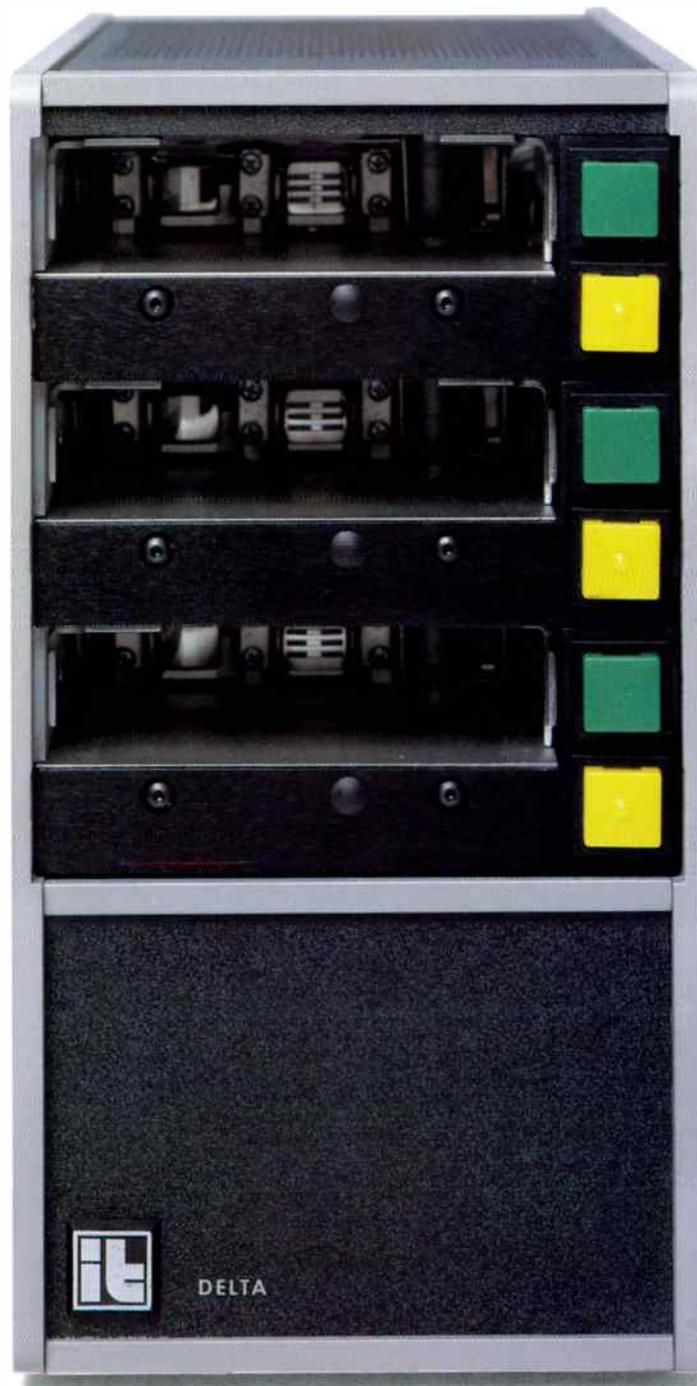
It features three independent reproduce decks. When combined with a Delta IV Recorder, the lower deck is the record deck. Each deck can be removed for service or alignment without affecting the performance

of the other decks.

Since the Delta III is the same width as the Delta I, three units, or nine decks, can now fit into a standard 19-inch equipment rack.

Historically, triple deck machines have suffered from many drawbacks. They are bulky,

mechanically unstable, difficult to maintain and generally lower in audio quality than single deck machines. In contrast, the Delta III has been designed as a high performance, highly reliable and easily maintainable machine at substantially less cost than three single deck Delta machines.



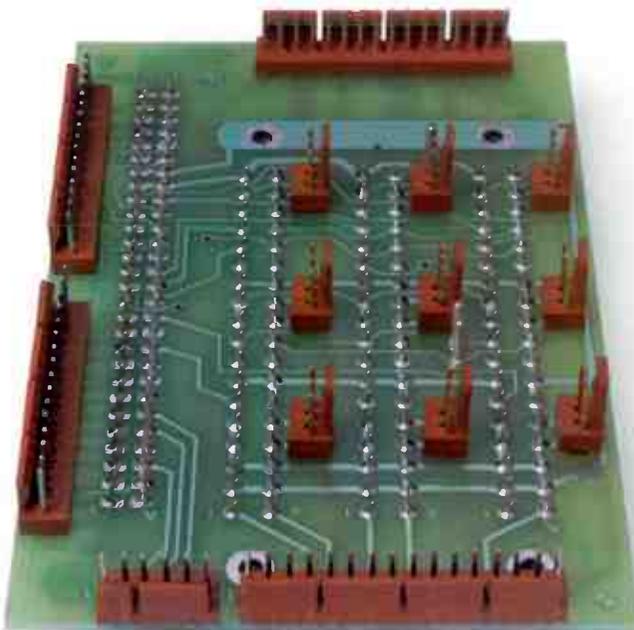
### Capstan Drive Motor Assembly

Unlike previous triple-deck motors, this motor is set within a unique, single-piece casting that uses just two ball bearings. As a result, bearing noise and failure are greatly reduced. The 10mm, non-magnetic, stainless steel shaft is centerless ground and vapor honed to optimize the tape driving surface. All of these features help solve many problems common to triple deck motors, such as bearing misalignment, wow and flutter, and phase instability. Selectable speeds are 3¾, 7½, and 15 ips.



### Rear View of a Delta III Deck

Each deck is easily removed for maintenance with the turn of one front panel screw. There is only one component connector per deck, and as part of the deck assembly, it disconnects as the deck is removed. Interchangeable decks do not leave remaining decks out of service. The precision milled tool plate deck is warp resistant.



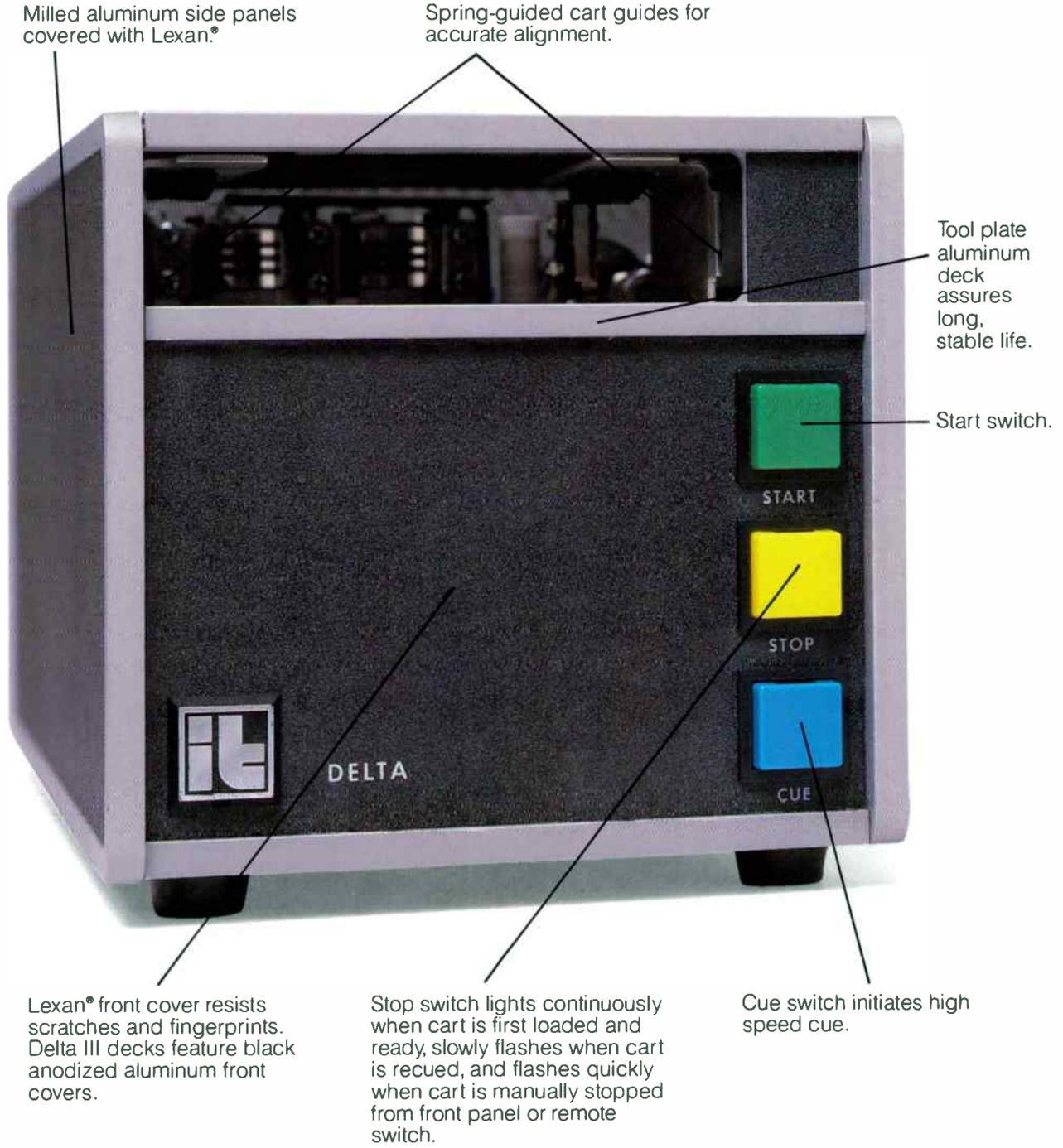
### Delta III Interconnect Board

Dramatically reduces messy wiring by providing a central connection point for PC Cards and Cabling.



### Delta III Rear View

XLR-type audio connectors are used. All remote connections are brought in through connectors with signal paths compatible with the Delta I and Delta IV.



Milled aluminum side panels covered with Lexan®

Spring-guided cart guides for accurate alignment.

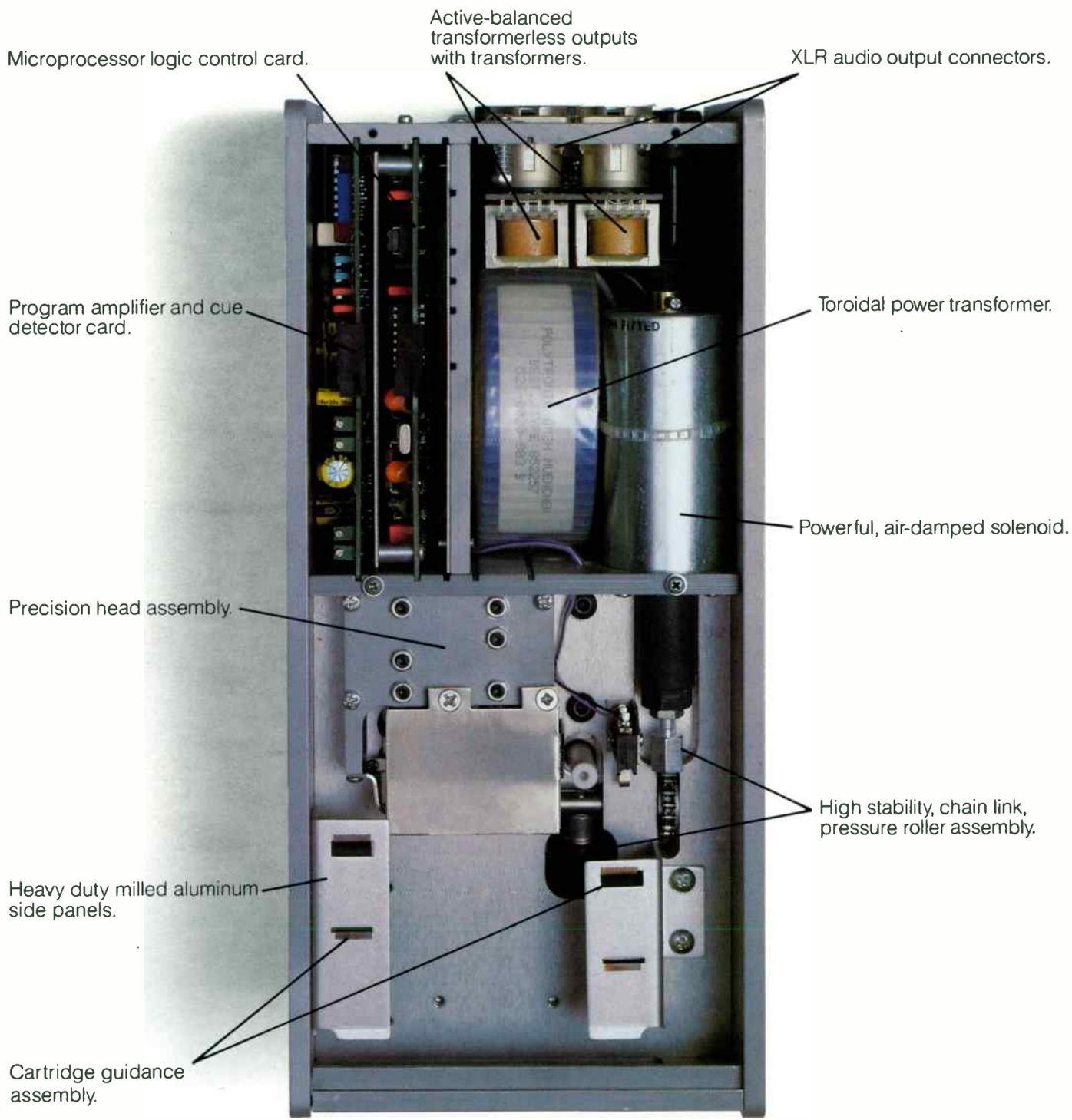
Tool plate aluminum deck assures long, stable life.

Start switch.

Lexan® front cover resists scratches and fingerprints. Delta III decks feature black anodized aluminum front covers.

Stop switch lights continuously when cart is first loaded and ready, slowly flashes when cart is recued, and flashes quickly when cart is manually stopped from front panel or remote switch.

Cue switch initiates high speed cue.



# Delta IV Recording Amplifier

The Delta IV may be combined with any Delta Reproducer to make a fully compatible recorder/reproducer combination.

Like the rest of the Delta Series, the Delta IV is built with high quality components, such as the NE5500 Series amplifiers, electrolytic and film capacitors, and metal film resistors.

Balanced audio inputs are switchable between 600 ohms, 150 ohms or 20k ohms, and may be used with or without audio input transformers.

The Delta IV accepts audio input levels up to +18 dBm without the use of external pads. The amplifier design easily accommodates higher recording levels for improved signal-to-noise ratios. Record amplifier distortion

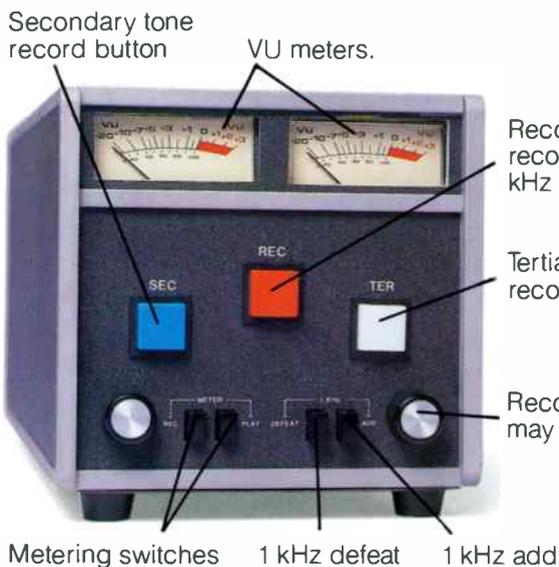
is less than 0.5% THD and I.M. distortion is significantly reduced. Group delay compensation is incorporated to eliminate phase delays caused by inductive and capacitive components, improving transient response.

Program and bias signals are mixed actively, using slow rate operational amplifiers, instead of program/bias mixing transformers.

Metering functions are calibrated independently using high quality, multi-turn potentiometers. Meters automatically display program playback output level when not in the record mode. A level internal slide switch allows the front panel meters to be used for setup adjustments of record bias, cue bias, and cue play level.

Bias amplifiers are independently adjustable for left program, right program, and cue channels. A crystal-referenced bias generator maintains a frequency of 119.3 kHz  $\pm$  .05%. Bias ramp on and off is carefully controlled to insure pop-free recordings. The high bias frequency, plus the active mixing of program material and bias, reduce I.M. distortion.

A microprocessor controls all logic functions in the recording amplifier and interfaces with the reproducer microprocessor. Since recorder and reproducer microprocessors are identical, they may be interchanged to aid with servicing. Components include CMOS, TTL, and low power Schottky integrated circuit.

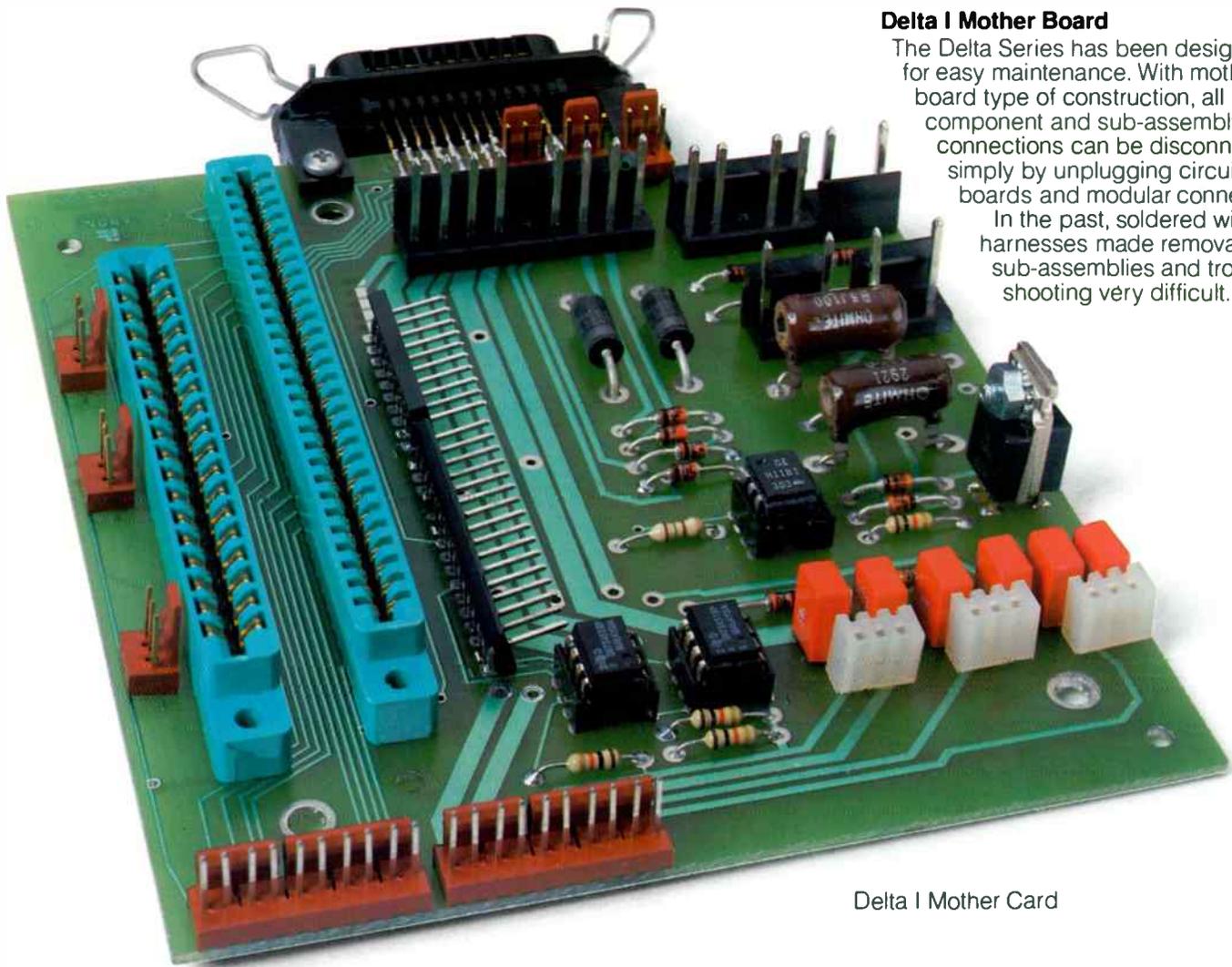


Delta III/Delta IV Recorder/Reproducer Combination (Record/Reproduce on bottom deck only)



Delta I/Delta IV Recorder/Reproducer Combination





### Delta I Mother Board

The Delta Series has been designed for easy maintenance. With mother board type of construction, all component and sub-assembly connections can be disconnected simply by unplugging circuit boards and modular connectors. In the past, soldered wire harnesses made removal of sub-assemblies and troubleshooting very difficult.

Delta I Mother Card



### Toroidal Power Transformer

The Delta Series incorporates a new innovation in domestically made cartridge machines, the toroidal power transformer, distinguishable by its doughnut shape. The magnetic core is made of spirally wound magnetic steel, and the primaries and secondaries are wound through the center and

around the core.

This design has several advantages over conventional transformers. The first is reduced stray magnetic field.

Conventional transformers suffer from significant stray field and designers have had to resort to complex shielding to cancel the stray field at the head. In a toroidal transformer, the field is confined to the core, and very little stray field is emitted—typically one-tenth of a conventional transformer stray field—minimizing the need for

bulky and expensive shielding.

Reduced heat is another advantage. A conventional transformer made to be electrically “quiet” is inefficient, and can be a significant source of heat in a machine. Toroids are far more efficient for the same electrical load. Thus, less heat is produced. This helps lengthen the life of heat sensitive components within the machine.

Generally, a toroidal transformer is considerably smaller than a conventional transformer, making smaller machines possible.

# Electronic Quality

Common, interchangeable printed circuit cards are used throughout the Delta Series to reduce your need to maintain a large parts inventory while making on-site maintenance easier and faster than ever before. The program reproduce amplifier/cue detector p.c. card is common to all Delta Reproducers, as is the reproduce logic p.c. card. And the same microprocessor

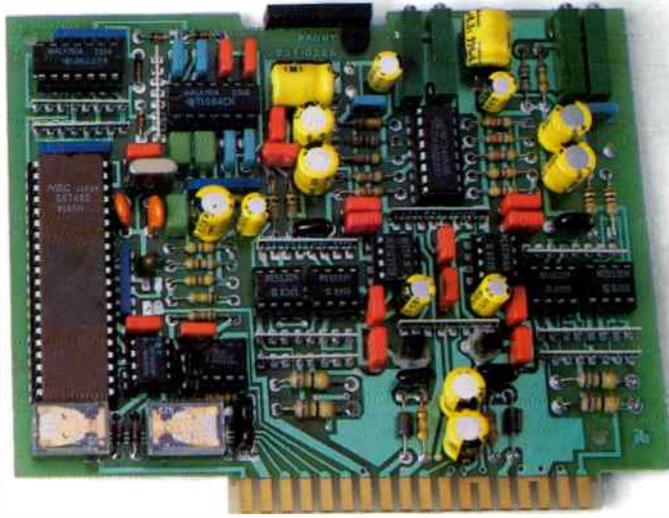
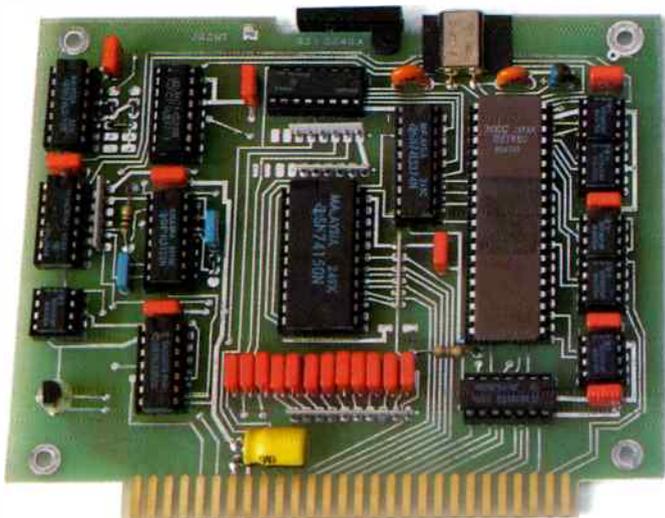
software is used for single-deck, triple-deck and record amplifier logic, reducing the need for costly backup components.

The mother board/daughter board concept is also used throughout. Most active components are located on removable printed circuit boards for ease of service. Transistors and integrated circuits are socketed for ease of service. A full set

of extender p.c. cards are available for servicing.

Machine logic is user definable for all features requiring user interface, or for custom applications.

The Delta proves that good electronic design reliability can go hand in hand. All printed circuit boards are made of G10/FR4 glass epoxy with solder-resist masking. And all components are overrated for their applications.



## Microprocessor Logic

A lot of products, these days, are made with microprocessors that serve no purpose. They're simply marketing gimmicks.

But this is not the case with the Delta Series. Microprocessors make our units more accurate, more reliable, more servicable, more compact, more efficient and more affordable. Best of all, the powerful microprocessor allows inclusion of many features not practical with conventional designs.

They're more accurate because they use digital logic, which means that component drift cannot affect machine operation.

For the same reasons, they're more reliable.

And since you can afford to replace the entire microprocessor, troubleshooting is easy. No more searching for individual components to replace, or faulty discrete circuitry.

Without unnecessary components or discrete circuitry, they're more compact and they require less power.

And they're not only less expensive to run, less expensive to service, and cheaper in terms of reliability, they're actually inexpensive to buy, feature for feature.

## Microprocessor Cue Detection

The Delta Series employs a microprocessor which handles the bulk of the cue detection responsibilities. The circuit is a unique approach to this critical area in cart machine design.

The cue channel signal from the head is amplified, equalized and band-split before being converted to square waves. The resultant four signals are routed to independent ports on the microprocessor. In a proprietary process the microprocessor compares the frequency of each of the signals simultaneously to that of a reference-crystal oscillator.

This makes possible a simple design which, compared to conventional LC or PLL circuits is more accurate, more repeatable and far less susceptible to component drift or misadjustment. In fact, no adjustment is ever required.

## Audio Quality

High performance components are the standard throughout the Delta Series. NE5500 Series operational amplifiers are used for transparent audio and exceptionally low noise. There's extensive use of electrolytic and

monolithic capacitors, as well as metal film resistors. Logic circuits are CMOS, TTL, and low power Schottky.

The electronically balanced output circuitry can be used with or without output transformers. Audio output level is continuously

variable from  $-18$  dBm to  $+18$  dBm. Amplifier distortion is typically less than 0.5% THD at 0 dBm. I.M. distortion is significantly reduced. Audio output impedance is strappable for 150 ohm or 600 ohm loads.

## User Options

The Delta Series offers many opportunities to tailor our equipment to your needs.

- Audio output transformers are standard, providing high isolation. Or you can order a transformerless audio output card to use the electronically balanced audio amplifiers.
- The audio output impedance is factory set to operate into 600 ohm loads. But it may be changed to 150 ohms by moving a strap.
- The audio output level is continuously variable from  $-18$  dBm to  $+18$  dBm, with the amplifier clipping level at  $+20$  dBm. Reproducer equalization is

factory adjusted to meet 1975 NAB standards. It can be set to 1964 NAB standards or CCIR equalization by readjustment.

- End of message tones mute the audio and initiate high-speed recue. This is factory set to occur with the secondary tone, but may be jumpered to use the tertiary tone. A new feature allows either, neither, or both tones to be used at the end of message. High-speed recue may be defeated, if so desired.
- Audio input impedance is normally factory set at 20k ohms bridging. By moving a jumper, it can be changed to 150 ohms or

600 ohms balanced terminating, or to transformerless, electronically balanced bridging input at 20k ohms.

- The audio input level range is from  $-18$  dBm to  $+18$  dBm. Two range control straps in the recording amplifier input circuitry are used to select a nominal input level of  $-6$  dBm or  $+6$  dBm.
- A repeat play lock-out feature can be engaged with a strap change. This prevents the operator from inadvertently playing the same cart twice in a row.
- And the capstan motor speed, normally  $7\frac{1}{2}$  ips, may be changed to  $3\frac{3}{4}$  ips or 15 ips with a strap change.



### Mounting the Delta Series

All units in the Delta Series may be tabletop-mounted or rack-mounted. ITC now makes a universal rack mount designed to accommodate all Delta Series machines, as well as the PD-II, the ESL-IV, and all Series 99 machines.

## Delta Series Features

### MECHANICAL

- Compact size— $\frac{1}{3}$  rack width, 12" deep (D I, II, IV)  
13" deep (D III)  
Height 5 $\frac{1}{2}$ " (D I, II, IV) 10 $\frac{1}{2}$ " (D III)
- Modular construction
- Styling similar to Series 99—neutral colors
- $\frac{1}{2}$ " deck assembly—tool plate aluminum—anodized
- New headblock—stable, compact, allows precision adjustment
- Improved cart guides
- Solenoid electronically controlled
- Capstan motor—D.C. Servo, brushless with ball bearings on magnetic, vapor-honed, stainless steel motor shafts.  
Crystal referenced—can be strapped for 3 $\frac{3}{4}$ , 7 $\frac{1}{2}$ , 15 ips
- XLR-type connectors for audio inputs and outputs
- Vinyl-clad and polycarbonate surfaces for lasting finish and ease of cleaning
- Universal rack mounting
- On D III, all three decks are removable
- Extensive use of mumetal shielding
- Long-life, high quality switches—bifurcated wiping contacts
- All front panel switches illuminated, using five-volt, long-life bulbs

### ELECTRICAL

- Toroidal power transformer
- Extended life, open face, cylindrical heads
- Common p.c. cards for D I, II and III
- Microprocessor control
- State-of-the-art audio using TLO Series and 5500 Series (5532, 34) op-amps
- Electronically balanced input/output. Can be used with or without transformers (input can be bridging)
- Hi-speed recue standard on D I and II
- Full three-cue tone operation standard
- Either 150 Hz or 8 kHz cue detectors can be strapped to initiate hi-speed cue
- Audio muting
- Non-repeat indicator with repeat play lockout
- Flashing record lamp for record set with 1 kHz cue disabled
- D IV front panel controls and indicators:
  1. Normal record (input) metering
  2. Program play (output) metering
  3. 1 kHz defeat (electronically latched)
  4. 1 kHz add (timed tone)
  5. Front panel actuation of test metering mode:
    - a. cue play/cue bias
    - b. program bias
- ICs and transistors socketed
- Solder mask on all printed circuits
- All power supplies regulated
- Full remote controls including lamps
- Detachable line cord
- Strappable level ranges
- Cart cueing standard (Cue switch mutes unless held depressed)
- D IV is universal recording amplifier for use with D I, D II, and bottom deck of D III
- Motor and control electronics (servo) are one assembly—eliminates field matching
- High frequency crystal reference bias (120 kHz)
- Auxiliary start pulse

## Delta Specifications

1. Power Specification
  - A. 105 to 132 VAC or 210 to 264 VAC
  - B. 50/60 Hz
  - C. Power Consumption
    1. Delta I—50 VA Typical; 65 VA Maximum
    2. Delta II—50 VA Typical; 65 VA Maximum
    3. Delta III—120 VA Typical; 135 VA Maximum
    4. Delta IV—5 VA Typical; 10 VA Maximum
  - D. Line Conditioning with EMI Filter
2. Tape Speed
  - A. 7 $\frac{1}{2}$  ips, (19 cm/s) standard; 3 $\frac{3}{4}$  ips (9.5 cm/s); 15 ips (38 cm/s) strappable
  - B. High speed recue—22.5 ips (57 cm/s), nominal
3. Capstan Motor
  - A. Direct drive capstan (10.0 mm diameter capstan shaft)
  - B. Brushless DC servo motor
  - C. Electrolyzed stainless steel shaft, non-magnetic
  - D. Permanently lubricated ball bearings
4. Record/Play Wow and Flutter
  - A. Record/Play maximum 0.15% DIN WTD at 7.5 ips
  - B. Play maximum 0.12% DIN WTD at 7.5 ips
 Tape cartridge length 2 $\frac{1}{2}$  minutes
5. Speed Accuracy
 

Better than  $\pm 0.2\%$
6. Audio Output Configuration and Audio Impedance
  - A. Transformer coupled
 

Strappable for 150 ohm or 600 ohm (load impedance) operation (source impedance is 50 ohms or 275 ohms respectively)
  - B. Transformerless output
 

(Source impedance is 75 ohms as factory supplied for 600 ohm load; only for electronically balanced output, no transformers)
7. Audio Output Level
 

+18 dBm before clip, w/XFMR, 600 ohm  
+20 dBm before clip XFMR-less, 600 ohm
8. Distortion
 

Reproduce Amplifier: 0.5% or less THD.  
System Distortion: 1.5% or less THD; 0.5% or less 2nd and 3rd harmonic distortion  
Referenced to 250 nWb/m, 1kHz on ScotchCart
9. Noise
  - A. S/N—Measured with bias/no signal; virgin "ScotchCart" tape at 7.5 ips
 

Mono	Stereo
58 dB	56 dB
(or better)	(or better)
  - B. Hum & Noise—No tape running
 

Mono	Stereo
60 dB	58 dB
(or better)	(or better)
  - C. Squelch Noise—70 dB or better
  - D. Reference level of measurements 250 nWb/m at 1 kHz recorded signal
10. Cross Talk
 

Measured at 1 kHz—50 dB min. separation between program channels
11. Frequency Response
  - A.  $\pm 2.0$  dB from 50 Hz —16 kHz
  - B. R/P 0 dB reference; 250 nWb/m at 1 kHz (ScotchCart tape)

12. Equalization
- 1975 NAB cartridge machine standard—adjustable for CCIR (pot. adjustment)
  - Customer option/component reloading in field 7.5 ips only—1964 NAB equalization
  - Fixed low frequency equalization; adjustable high frequency equalization
13. Head Configuration—NAB, Mono/Stereo
14. Cue Signals
- NAB primary cue 1 kHz
  - NAB secondary cue 150 Hz
  - NAB tertiary cue 8 kHz
  - Open collector sinking signal (ground switching) available upon sensing secondary or tertiary cue tones maximum volts 25V, maximum current 200 ma, saturation volts 0.7V at 200 ma
  - Cue detect open relay contacts; closure upon sensing secondary or tertiary cue tones
- Secondary and Tertiary cue detect normally open relay SPDT\*
- \*Contact ratings—1A at 25V DC, 0.5A at 100V AC (resistive). Not to be used with inductive loads
15. Logging Signals
- Not internal to machine
  - Cue audio input and cue audio output available for external use
- Cue Audio Input—Source impedance: 10K ohms or less  
Volts in: .5V ± .25V RMS @ 3.5 kHz\*
- Cue Audio Output—Load impedance: 47K ohms or greater  
Volts out: 500 mv nominal @ 1 kHz, 150 Hz, 3.5 kHz, \* 8 kHz
- \*—10 dBm referenced to 0 dBm @ 160 nWb/m
16. Audio Input Level
- 18 dBm to +18 dBm
  - 2 range control straps on record amp: —6 dBm/+6 dBm center-range
  - Front panel potentiometer range: 0 to at least +12 dB—referenced to each strap
17. Audio Input Configuration
- Input XFMR is normally supplied for 20K ohm balanced bridging
  - Strappable for 600 ohms or 150 ohms terminating
  - Electronically balanced bridging 20K ohms
18. Metering (DIV)/Function Switches
- Front panel switch selection for monitoring (left to right positions on front panel)
    - Meter Rec—monitor input level to recorder—switches automatically to "Meter Play" (monitor output level from playback) when machine is not set to record
    - Meter Play—monitor output level
    - 1 kHz Defeat—prevents the 1 kHz tone from automatically being recorded on the cue track when recording. This mode is indicated when the record set lamp flashes.
    - 1 kHz Add—Places a 1 kHz tone on the tape for a duration of 0.625 seconds when the playback is in the run mode. It is not necessary to hold the 1 kHz record button depressed for the duration of the tone.
  - Internal Meter Switch—Two position slide switch on record amp/meter board—activates only when meter rec and meter play buttons are in "out" position
    - Cue play/cue bias—slide switch in the "left" position for cue functions and record bias; Cue Play—Left Meter Cue Bias—Right Meter
    - Record Bias—Slide switch in the "right" position for program bias functions Left Program Bias—Left Meter Right Program Bias—Right Meter
19. Bias Amplifier  
119.3 kHz Bias Frequency, crystal referenced
20. Tape Capacity
- NAB sizes A and AA (Delta I and Delta III)
  - NAB sizes A, AA, B and C (Delta II)
21. Start Time  
Typically 100 milliseconds  
(Timing dependent upon solenoid air damp adjustment)
22. Stop Time
- Audio squelch stop time typically 2 msec—Tape stop time typically less than 100 msec
  - Tape travel varies according to:
    - Type of cartridge
    - Length of tape
23. Ambient operating temperature range  
10-50 degrees C (50 degrees to 122 degrees F)
24. Manual and Remote Controls
- All front panel indicators and controls (except program bias and cue track metering)
  - Play remotes available via play remote connector
  - Record remote functions (except metering) available via record remote connector
25. External Connectors
- XLR audio connectors
  - Jones remote connectors
  - Interconnect between play unit and recorder to carry audio and microprocessor control lines
  - Plug-in line cord
26. Mounting
- Table top standard
  - Rack mount (optional rack mount hardware)
27. Dimensions
- | A.        | Width              | Depth | Height             |
|-----------|--------------------|-------|--------------------|
| Delta I   | 5 $\frac{5}{8}$ "  | 12"   | 5 $\frac{1}{4}$ "  |
| Delta II  | 11 $\frac{1}{8}$ " | 12"   | 5 $\frac{1}{4}$ "  |
| Delta III | 5 $\frac{5}{8}$ "  | 13"   | 10 $\frac{1}{2}$ " |
| Delta IV  | 5 $\frac{5}{8}$ "  | 12"   | 5 $\frac{1}{4}$ "  |
- \*Add  $\frac{1}{3}$ " for feet.  
All machines require 3 $\frac{1}{2}$ " additional depth at rear for interconnection.
- Single height rack assembly (for use with the Delta I, II, and IV): requires 7" vertical height
  - Double height rack assembly (for use with all machines): requires 12 $\frac{1}{4}$ " vertical height.
28. Weight (typical)
- Delta I—15 lbs; 6.75 kg
  - Delta II—20 lbs; 9.0 kg
  - Delta III—31 lbs; 13.95 kg
  - Delta IV—8 lbs; 3.6 kg
  - Total shipping weight (including connectors, instruction book, etc.) less than 50 lbs; 22.5 kg

All ITC Equipment is covered by one or more of the following patents: 3,801,043; 3,800,323; 3,809,329; 3,869,719; 3,833,925; 3,932,887; 3,942,189; 4,105,934; 4,040,114; 4,142,221; 4,221,316; 4,101,937; D248,393; 4,153,918; 4,219,167; 4,096,533; D255,793; 4,158,868; 4,978,709; 4,193,103; 4,271,440.



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