

# SERVICE MANUAL

TapeChek Model 4100  
Betacam SP  
Cassette Cleaner/Evaluator



Research  
Technology,  
International

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## Repair/Return Procedure

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The Tapechek 4100 Betacam SP Evaluator/Cleaner is a professional unit for the high speed processing of large and small Betacam plus Betacam SP (metal) cassettes. This machine is built to the highest standards of quality and performance. It runs the tape at 25 times NTSC play speed which translates to 120 inches per second. At these high speeds, a great deal of dust, loose oxide and debris can accumulate in the machine which can cause some types of failures. TO PREVENT MOST MACHINE PROBLEMS, CLEAN THE MACHINE MECHANISMS REGULARLY! Do not, however, use flammable or corrosive solvents.

The machine is fully warranted, when new (check your warranty statement) to be free of manufacturing defects and to perform properly. If problems are found during the warranty period, they will be handled according to the warranty. After the warranty period, RTI and its service dealers will assist, at a reasonable charge, with parts and labor to address problems if they arise. Telephone assistance is available, at no charge, to answer your questions.

In many cases the repairs can be done on location by simple replacement of a part or assembly. However, sometimes the repair requires a critical adjustment or the trained eye of our factory technicians. In these cases, the machine should be returned to RTI or one of its service dealers to be repaired. Please note the following:

### Important

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Call RTI or Service Dealer for assistance before attempting any repairs to the machine. Our trained personnel can, in many cases, diagnose the problem on the phone! Call for a Return Authorization Number before shipping unit to the factory.

**If factory repair/return of your unit is required, you must send the unit back in its carton with original shipping materials, etc. to prevent shipping damage!**

# SAFETY PRECAUTIONS

- 1. Read these warnings, the installation instructions, and the operating instructions before using the model 4100. These precautions are for your own safety.**
2. Follow all warnings and instructions marked on the product and in the manual.
3. Do not use this product in or near water, it may cause electrical shock.
4. Unplug this product from the power source before opening the case.
5. Do not place this product on an unstable cart, stand, or table. It may fall, causing personal injury.
6. Slots or openings in the cabinets are provided for ventilation. These openings must not be blocked to insure proper operation.
7. Do not allow anything to rest on the power cord. Do not locate this product where people can step on the power cord or trip on it.
8. If an extension cord is used with this product, be sure that the total ampere ratings of all the loads plugged into the extension cord do not exceed the ampere rating of the extension cord.
9. Never push objects of any kind into the openings of electronic equipment as they may contact dangerous voltages, causing a risk of electrical shock or fire. Never spill liquid of any kind on this product or use flammable solvents to clean the mechanisms..
- 10. Save the shipping container and packing materials. In case unit ever requires factory service, you must use these materials to assure proper packing.**

# GENERAL DESCRIPTION

Your TapeChek 4100 Cleaner/Evaluator will process your NTSC Betacam and Betacam SP tape cassettes at 25 times normal playing speed (slightly higher for PAL tapes). The Pro Line units accept both small and large Betacam/Betacam SP cassettes.

## CLEANING

The machine uses two sapphire burnishing posts and three cleaning tissue stations which have vacuum assistance. The burnishers polish the tape thoroughly in forward and reverse directions. There are two cleaning tissues on the oxide (metal) side of the tape and one cleaning tissue on the back side of the tape. A vacuum system helps to transfer the loose debris from the videotape into the fibers of the cleaning tissue for more effective dropout removal. Since most videotape dropouts are due to dust, dirt and surface contaminants, you will find that the TapeChek 4100 cleaning system will substantially reduce the number of dropouts in your videotapes. Older, more heavily used tapes will show an even greater dropout removal.

## DETECTION

In addition to the cleaning and polishing systems, the TapeChek 4100 employs a very sensitive defect detection system. This is an optical defect detection system that will not alter or affect pre-recorded tapes. The videotape is inspected by a CCD(charge coupled device) sensor which is capable of detecting wrinkles, creases and edge damage. Unlike other defect detection systems, the CCD detector is very sensitive to longitudinal creases, a common form of tape damage. There are 64 elements, grouped into three channels: Upper, Center, Lower.

Sometimes the defect will only appear in one of the channels, however, a crease all the way across the tape will count once in the Upper channel, once in the Center channel and once

in the Lower channel. However, it will only be counted as one defect in the total. Rather than counting individual fluctuations in light reflected from the tape, the machine counts the number of seconds of videotape that contain defects. This produces a more meaningful defect report and display. For example, a continuous edge damage might consist of 92 little variations in the tape over a one second length of videotape. If the machine reported a defect count of 92, one would think that the tape is totally bad and unusable. But this is not the case since only one second of videotape was actually affected by the damage.

## SWITCHES/DISPLAYS

The back lighted LCD display offers many different displays and operator messages. There are three keyboards or "switch clusters" on the front panel of the machine. The upper switch cluster has the switches relating to tape transport functions, such as Stop, Automatic, Forward, Reverse, etc. The main power switch for the machine is also located here. After the operator carefully inserts the cassette in the loading slot (centering a small cassette between the raised guides), the operator will typically push the AUTO switch to start the automatic evaluating and cleaning cycle. (See Operating Instructions Section).

## AUTOMATIC OPERATION

After the tape is run to its end, the machine will gently stop and automatically reverse. It is during the reverse cycle that the defect detector inspects the tape for physical damage. Of course, the tape is cleaned and polished during the forward and the reverse modes. After the automatic cycle is finished, the machine will eject the tape. It is then possible to receive a printed report of the tape inspection if the unit is equipped with the optional printer.

## TAPE CONDITION

The right hand keyboard shows the "A", "B", and "C" tape condition lights. The factory settings are such that a tape which has 0, 1 or 2 defects is considered an "A" tape, 3 through 9 defects are considered a "B" tape, and ten or more defects is indicated as a "C" tape condition. By pressing the SET-UP key the operator may change the values for the "A", "B", and "C" tape condition.

## SMART ELECTRONICS

The TapeChek 4100 is a fully automatic machine with sensors to detect cassette size, erase protection tabs, and many other machine functions. The POWER switch on the front panel is actually under microprocessor control

as is the rest of the Pro Line machine. Therefore, if the POWER switch is turned off while a cassette is in the machine, instead of turning off immediately, the machine will eject the cassette and then power down. Since the entire machine is microprocessor controlled, it is very gentle to the tape and monitors tape tension and speed continuously during the evaluation and cleaning cycle. Also, if a cassette is inserted incorrectly, the machine will automatically eject the cassette so that the operator can try again. If a tape is loaded and will not run, it is possible that one of the cleaning tissues has been exhausted and needs to be replaced. In this cases a message is shown on the display panel.

## MACHINE SPECIFICATIONS

### TAPE TRANSPORT SYSTEM:

25 times NTSC Betacam tape speed (approximately 120 ips.)

- Capstanless dual-motor spindle drive
- Metallic leader sensing system
- Tape accumulators prevent excess tape tension and provide gentle tape handling.
- Tape speed and tension are constantly monitored by microprocessor electronics.
- Infra-red detection systems for cassette size and loading sensors.
- DISPLAY AND SWITCHES:-Six lighted transport key switches
- LCD display (2 line by 16 char.) provides operator messages and tape data. Adjustable back light control.
- Three LED "Tape Condition" indicators.
- Tape data input keys and numeric keypad.

### TAPE CLEANING SYSTEM:

Two sapphire burnishing stations.

- Three vacuum-assisted cleaning systems.
- Automatic tissue advance in Forward and Rewind.

DETECTION SYSTEM:

Optical defect sensing system, using CCD line array and associated electronics. Detects longitudinal and transverse creases, wrinkles, and other physical defects.

- Three-channel system identifies the area of tape containing damage.
- location and number of defects are reported on the display and by the optional printer.

OPERATOR CONTROLS:

Three Switch clusters contain switches for the tape transport system, display and data entry systems, and the option printer system.

ELECTRONICS:

- Microprocessor based control system with ROM and battery backup RAM memory devices. Digital electronics control all motors, the transport system, defect detection, keyboard, and displays. The memory stores defect data and information. DIAGNOSTICS SYSTEM:-The status of all sensors and mechanisms in the Pro Line machine is monitored and displayed on special diagnostic displays seen on the LCD module.

PRINTER OPTION:

This optional electronics package and 20 column printer produces a printed report of the tape inspection on special thermal printing paper. (To prevent printhead damage only use paper specified by RTI.)

ERASE OPTIONS:

There are two erase options available for the Pro Line machines. One designed for oxide videotape and the other designed for oxide and metal Betacam videotape. The full width of the videotape is erased when this function is selected by the operator. Cassettes with erase protection tabs activated will not be erased by the 4100. The display will indicate "Erase Protected".

POWER:

117 VAC,3 Amp., 60 Hz. Standard

- 220, 240 VAC; 50Hz. Special Order

DIMENSIONS AND WEIGHT

- W x 13" H x 20" D.
- pounds.

# OPERATOR CONTROLS

## TAPECHEK 4100 EVALUATOR/CLEANER

The following is a description of the push button controls and keys on the front panel of the TapeChek 4100 Betacam unit.

### TRANSPORT PANEL SWITCHES:

#### POWER

This Power switch turns ON and OFF the main power. When this switch is depressed, it lights up and the main power is turned on to the machine. If a video cassette is loaded into the machine at the time the power switch is turned off, the machine will automatically go through a cassette eject cycle before the power is turned off. This condition will be indicated to the operator by a series of beeps at the time the power switch is depressed.

#### EJECT:

The Eject key initiates the eject sequence that removes the cassette from the machine.

#### STOP:

Depressing this switch will stop the tape from moving in either the forward or rewind directions and Eject the tape if in the Erase mode.

#### AUTO:

The Auto key initiates the automatic inspection and cleaning of the videotape. In the auto mode the tape is run forward to the end of the tape and is then automatically rewound back to the beginning. At the end of the auto cycle, the videotape is ejected from the machine. At this time a printed report can be obtained from the optional printer system. If the auto switch (like other switches) is depressed during the loading cycle, the switch light will blink. After the loading cycle is complete, the Auto and Forward lights will light constantly, indicating that the Auto mode has begun.

REW Depressing this switch will start the tape in the rewind mode. The tape will move in high speed rewind until the beginning leader is detected. At this point the tape will stop.

FWD The forward switch will start the videotape moving in fast forward. It will continue until the tail leader is detected or another switch is depressed.

## MEMBRANE KEYBOARDS

The following descriptions are for the keys on the right-hand keypad located under the LCD Display. This display shows defect and tape length information as well as various messages and diagnostics.

ERASE This Erase switch is used to initiate the erase function on cassettes that are not erase protected. To initiate the optional erase function, the operator depresses the ERASE key followed immediately by the AUTO switch, followed again by the ERASE key. If this sequence of 3 commands is made within 3 seconds, the machine will go into the ERASE mode. Since the erase function is tied to the auto function, the operator is insured that the entire videotape will be erased.

RESET The reset key clears all of the defect data and tape information from the memory of the TapeChek 4100 machine. It also clears information such as Tape # and Operator # from the memory. The Date is retained until the power is turned off.

CLEAR This key is used to clear incorrect data when entering the Date, Operator # or Tape #. It does not clear the memory in the machine of other data, such as defect locations, etc.

DISPLAY The display key changes the information shown on the LCD display. Pressing the display key will sequence the operator through the various displays available on the TapeChek 4100. (See Page 11 - 14 in the Operator Manual )

" "

This key is not used for normal machine operation.

" "

This key is not used for normal machine operation. Depressing this key will indicate the version of software in the machine.

#### TAPE CONDITION LED'S

The "A", "B" and "C" tape condition LED's are illuminated based on the total number of defects found in the tape. The default parameters for these are: up to 2 defects, up to 9 defects, and 10 defects or more for the "A", "B" and "C", respectively. These parameter values may be changed by using the SET-UP key and entering new 2-digit parameters.

The following descriptions are for the data entry keys on the left-hand key panel for the machine.

#### "0-9" KEYS

This numeric keypad is for the entry of Date, Tape #, etc.

#### TAPE #

This key is pressed, followed by number keys (up to 8 digits), to input the number of the cassette being cleaned. The display shows the data entry and the clear key may be used to start over if a mistake is made. Depressing other keys will get out of the Tape # entry mode.

#### DATE

Depress this key followed by numbers (6 digits) to enter the date of tape cleaning and evaluation. Like the Tape # and Operator #, the Date appears on the printed reports.

#### OPER #

The operator key allows the entry of the operator number, if applicable. 4 digits.

#### SET-UP

This key is used to alter the defect values for the "A","B" and "C" tape condition lights. This key is also used (after entering six 9's in the date) for diagnostic displays, see page 13.

#### " X "

This key is used when the display is in the "Defect Location" mode to sequence through the machine memory of defect locations.

#### " Y "

The "Y" key sequences through the defect locations in reverse order.

## Displays

The diagnostic displays built in to the Tapechek 4100 have been carefully designed to assist our factory trained service technicians in diagnosing problems that may, from time to time, arise with the machine. There are two basic types of displays in this category: 1) Status and warning messages and 2) Coded diagnostic readouts.

### STATUS MESSAGES

```
*** WAIT ***  
NOT READY
```

This message is the first display to be seen flashing as the machine is turned ON. This wait message indicates that the machine is initializing the various mechanisms in the unit. It will cycle the carrier, spindle motors, cleaner assembly and others as necessary.

```
TAPECHEK Proline  
READY -- LOAD TAPE
```

The machine is now ready to accept a tape cassette. The operator may now load a tape. If a small cassette, carefully center the cassette and push into the loading slot. The motorized loading system will pull in the tape and lower the carrier.

```
*** WAIT ***  
TAPE LOADING
```

The tape is being loaded into the mechanism. You may press the AUTO, FWD or REV keys while the tape is loading. This display **flashes** until the tape threading is complete.

```
READY    LENGTH  
TO RUN   0:00
```

The tape has been loaded into the machine and the machine is in the Idle mode (neither AUTO, FWD or REV has been selected).

```
FORWARD/CLEANING  
>>>>>-- 2:30
```

The machine is running the tape in the AUTO forward direction and is counting the tape length. In the manual FWD mode, the length counts downward.

```
REWIND/CLEANING  
---<<< 13:45
```

The machine is running the tape in the reverse direction in the manual REV mode. The tape is being cleaned and polished also.

```
PLEASE WAIT  
TAPE EJECTING
```

This display **flashes** during the Eject cycle. When the Eject is complete, the normal display will appear. The machine will not allow

transport keys to work but you can select a printout during this cycle.

DEFECTS LENGTH
013 26:34

This is the normal display during the AUTO reverse mode when defect inspection is actually occurring. To see individual channel defect counts, press the DISPLAY key.

OTHER DEFECT DISPLAYS ARE DESCRIBED IN THE OPERATOR'S MANUAL...

UP CEN LOW TOT
12 09 11 012

This display shows the defect counts in individual channels. The operator may switch back to the Total Defects/Length display at any time during the rewind cycle or after the tape has been ejected.

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### ERROR MESSAGES

***TISSUE LOW*** CHANGE ROLL
---------------------------------

This (along with the beeper) warns the operator that at least one of the tissue rolls has been exhausted. The machine will complete the current run of tape but will not allow another tape to be run until the new tissue roll has been loaded. See inside cabinet lid for directions.

**WARNING TAPE** ERASE PROTECTED
-------------------------------------

This message warns the operator that the cassette erase protect tab has been pushed in. The machine will go into the AUTO mode but will not erase the tape. Under these circumstances, this display is seen during the forward AUTO mode until the machine starts to rewind the tape.

The following diagnostic displays are available to verify the status of the various machine sensors and to verify what the microprocessor is calling for at any given time.

To see these displays, **enter all 9's in the Date and press SET-UP.**

#### DIAGNOSTIC DISPLAY #1

MACHINE SENSOR READOUTS indicate the state of the various sensors in the tape transport mechanism. When an individual letter is capitalized, it means that function is "true"; when letter is small, it means that function is "false".

AiO LuD SIo Elrt  
eeeDiple HsL TuD

First line:

- "AIo" - Threading Arm In
- "AiO" - Threading Arm Out
  
- "LUd" - Cassette Lift Up
- "LuD" - Cassette Lift Down
  
- "SIo" - Spindles In
- "SiO" - Spindles Out
  
- "EIRT" - Leader Sensor Right and Out of Tissue
- "ELrt" - Leader Sensor Left and Not Out of Tissue

Second line:

- "E--" - Large special recognition opening (in Digital, SX and other formats)
- "--M" - Small cassette, metal tape, Erase OK
- "-S-" - Small cassette, oxide, Erase OK
  
- "DiPle" - Cassette fully In, Cassette Present,  
Small Cassette Size, set for Digital cassettes
- "DipLZ" - Digital, Cassette Not Fully In, Not Present,  
Mechanism set for Large Size, Not erase protected
  
- "HLL" - Hub Size Large
- "HsL" - Hub Size Small
  
- "TuD" - Tissue Mechanism Down
- "TUd" - Tissue Mechanism Up

## DIAGNOSTIC DISPLAY #2

94 41 42 6B CC 0  
LRCOiET 58 12:26

For diagnosing problems in the tape transport mechanism, this display helps the service technician. The meaning of the above sample information is as follows:

- "94" - MACHINE MODE; Indicates AUTO FWD, AUTO REW, REWIND, MANUAL FWD, etc. in code numbers.
- "41" - Actual TAPE SPEED; in code numbers.
- "42" - SPEED being called for by microprocessor ; in code numbers.
- "6B" - LEFT MOTOR POWER; Indicates amount of power being called for by the microprocessor. "10" represents an idle condition, "FD" indicates almost maximum power.
- "CC" - RIGHT MOTOR POWER; same as above, but for the right hand spindle motor.
- "0" - CASSETTE SIZE; small or large.
  - "0" - Small Cassette, Small Hubs
  - "1" - Small Cassette, Large Hubs
  - "2" - Large Cassette, Small Hubs
  - "3" - Large Cassette, Large Hubs
- "58" - TAPE TENSION; "58" typical in FWD, "35" typical in REV
- "12:26" - - Normal TAPE LENGTH display(not used for diagnostics)
  
- “LRCOIET” - These are diagnostic codes for factory use.

# Mechanical Adjustments

## GENERAL

The TapeChek 4100 transports the videotape at approximately 120 ips. The machine also has many mechanisms which are operated by 11 different motors. We have tried to design the product with assemblies to be self-adjusting where possible, but, obviously, some parts of the machine do require adjustment if new parts or assemblies are installed.

In general, anything in the threading path of the videotape that touches the tape should be perpendicular to the transport panel. The exceptions to this rule are the crown threading arm rollers and the tape tach timing assembly. The operating tape path height is 1.145" from the bottom edge of tape to the top of the transport panel.

## CASSETTE CARRIER

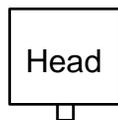
The carrier should be aligned with the opening in the front panel of the machine. If it is not, cassette may not load properly. To adjust the carrier height, up and down, so that it matches the opening of the front panel, the entire transport panel is raised and lowered by moving its mounting brackets on the left and right sides of the bottom part of the cabinet. This adjustment is made when the carrier lift assembly is in its full "up" position.

The left/right position of the carrier is determined by 2 small brackets which have black plastic rollers that ride on the sides of the carrier assembly. The carrier brackets are adjusted left and right so that when the cassette is lowered onto the transport panel, the cassette is in alignment with the cone shaped support pins and other sensors on the transport panel. Using just the bottom half of a Betacam cassette shell will show when the carrier is in alignment with the transport mechanism.

The carrier floor is adjustable by its four mounting screws to the carrier arms. This adjusts the position of the carrier floor (and the cassette) toward the front or back of the machine. These four screws also allow you to adjust the height of the carrier floor when the carrier is in the down position. In the down position the carrier floor should drop away from the video cassette and leave approximately a 1/16" gap between a small cassette shell bottom and the carrier floor so that the cassette is solely resting on the support posts of the transport panel.

## MAGNETIC HEADS (Optional)

The face of the magnetic heads should be square to the panel as measured with a triangle or other square block. This is also true for the tape guide post next to the moveable erase head. Also, the head should be adjusted so that the wrap of the tape is sufficient to cover the black area of the face of the head.



### Tape Wrap

The angle of the tape going into the head should also be approximately equal to the angle of the tape leaving the head. This is adjusted by the mounting screws for the head itself. It is normal for the

tape to move up and down slightly on the head without effecting erasure. The heads are built over-size to accommodate this.

## TENSION SENSOR

The tension sensor, arm and pin, is connected to a potentiometer and pushes against a leaf spring. This assembly measures the tension of the tape as it runs through the mechanism. The pin that touches the tape must be perpendicular to the transport panel. With the machine in the diagnostic(display #2) mode, the front panel readout for the tension sensor should be "00" or "01" when the tension arm is at its rest position. If not, the set screw that connects the arm to the potentiometer shaft should be loosened and the shaft of the potentiometer changed to achieve the "01" reading on the display.

The spring should be adjusted so there is a slight pressure against the arm at the rest position and that there is a force of 45 grams at the middle of the arm's travel when measured at the tape guide pin. The squareness of the threading arm pin can be most easily adjusted with .010" thick washers on the three mounting support spacers that mount the tension potentiometer assembly to the panel.

## THREADING ARMS

The threading arms are spring loaded so that the arm wheels should be pressing lightly against the transport panel at all times. It is most desirable that both wheels on the threading arms be in contact with the panel. However, this may not be true when the tape is threaded and the tape tension pulls on the threading arm slightly. It is normal for the rear wheel to lift off the panel slightly and touch the underside of the threading arm guide plate.

## THREADING ARM ROLLERS

The blocks of metal that hold the threading roller should be close to perpendicular to the transport panel, however, there may be slight variations to this as the roller was adjusted for proper tape travel. The angle of the threading

arm roller is adjusted by tilting the pulley mounting block fore and aft and then securing the two 4-40 screws that hold the block to the arm. When adjusting the angle of the roller left or right, the adjustment is made by carefully bending the vertical member of the threading arm so that the tape travels in the middle of the roller or touches either flange lightly.

Under no circumstances should the tape press against the flanges of the roller hard enough to buckle or deform the tape. You will find that tilting the mounting block for and aft will adjust the position of the tape on the roller when a tape is going in the forward direction; and in the reverse direction, angling the arm left or right will affect the tape travel.

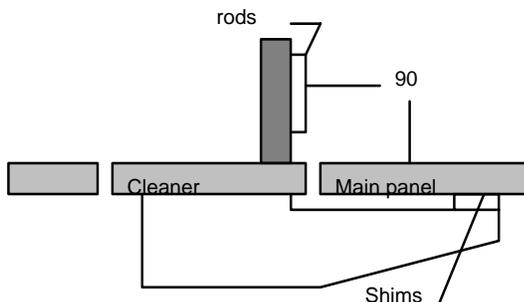
### THREADING ARM SWITCHES

In addition to the rollers, the "in" and "out" microswitches should be adjusted to switch approximately 3/16" prior to the arm reaching either its "out" position or its "home" position. The threading arm is connected to the threading motor via a clutch(set to slip at 11 oz.), and the threading motor will continue to run for a brief period after the arm "in" and arm "out" microswitches actually switch.

### TAPE BACKUP SUPPORT BLOCK EFFECTS DEFECT DETECTION

The black support block with the sapphire support rods also needs to be square to the transport panel. Remove the detector to check the rods for squareness(90° to the panel.) The machine automatically brings the detector backup block into position when tape is not threaded. It is very important that the rods that support the tape at the detector be perpendicular to the transport panel.

The following sketch shows the moveable cleaner and the tape back-up support block with the sapphire rods.



This adjustment is made by adding or removing shim washers from the pivot bracket of the moveable cleaner assembly underneath the transport panel.

### CASSETTE HEIGHT

The height of the cassette is determined by the 6 support posts on the transport panel. These hexagonal posts are fixed and not adjustable. For proper operation of the 4100 machine, it is imperative that the cassette be in contact with these support posts, not the carrier floor. NOTE: The large cassette has a total of six support posts. Obviously, because of variations in the large cassette housing it is not totally flat and, therefore, if four of the six posts touch the cassette, that is sufficient to support the cassette.

## SPINDLE HEIGHT

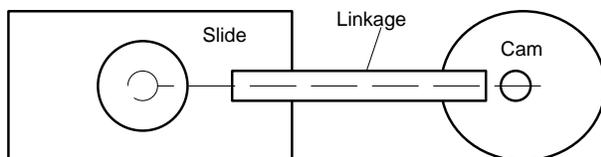
The spindles of the machine that drive the reels inside the cassette should be at .990 inches above the transport panel. This measurement is made from the top of the spindle flange down to the top of the transport panel. The spindle should be at this height, plus/minus .004 inches.

## CASSETTE PLUNGER SENSORS

There are five plunger-type microswitch sensors underneath the cassette. These sensors sense large/small reel hubs, metal/oxide tape and the erase tabs for small and large cassettes. For proper operation, these microswitches should switch approximately 1/32" prior to the cassette coming down on its support hex post. Also, check for the free action of the plunger. The plunger should not be sticky and should return to its full upright position easily. **DO NOT LUBRICATE THE PLUNGERS**, that causes them to stick due to the tight fit in the tube. Clean, dry plungers are desired.

## SPINDLE MOVERS

The spindles are moved to accommodate the large cassette via a gear motor and cam arrangement with a straight arm linkage. The cam has a detente and two microswitches to stop the cam at the appropriate position for the two sizes of cassettes. The arms of the microswitch may have to be bent slightly (when installing a replacement switch) so that the switch operates reliably in the detente of the cam.

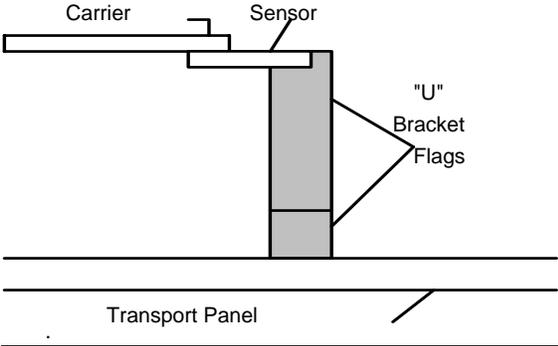


The linkage should be in a straight line from the pivot point of the cam to the spindle slide in the "in" and "out" positions (180° apart). Check that both spindle cams are in the same relative position. If they are not, the timing belt may have to be adjusted. This is accomplished by removing the bearing roller that rides on the timing belt, cause slack in the belt and manually rotate the right-hand spindle until the proper orientation is achieved. Then reattach the timing belt bearing roller. **WARNING:** Keep your hands and clothing out of the slides when they are operating.

## CARRIER LIFT ASSEMBLY

The carrier is moved up and down by a gear motor with gears and linkage arms underneath panel. The rotating arm is connected to the carrier via round linkages that are covered by a spring. When the carrier is in the "down" position, the spring extends to add further down pressure, holding the cassette in place. The rotating linkage should be approximately vertical when the carrier is in the up position and straight down when the carrier is in the down position. The carrier lift motor is turned "on" and "off" via two optical sensors on the back edge of the carrier floor. A tall "U" shaped bracket interrupts the two optical sensor beams and causes the carrier to stop in the up and down position, respectively. Once the "flags" of this "U" shaped bracket are trimmed to the proper the height at the

factory, further adjustment should not be required. However, if a new carrier floor has been installed, try to position it at the same height as the old one, otherwise, one might need to shim the "U" bracket up or down slightly with shim washers to have the carrier lift mechanism stop in the full up and full down position.



Side View of Carrier Up/Down Sensors

**CAUTION:** Keep hands and clothing away from the carrier lift gears to prevent injury.

## THREADING ARM GUIDE PLATES

When the threading arms are in the out position, the threading arm wheels go underneath a guide plate. This plate should be within approximately .005" to the height of the ball bearing wheels. This is a very small gap (the thickness of a couple of pieces of paper) and, therefore, **dirt on the threading arm wheels and transport panel can cause the threading arm to be sticky** and not go underneath the guide plate smoothly. The panel and ball bearing wheels should be cleaned on a regular basis to prevent this problem.

## CLEANER LIFT MOTOR ASSEMBLY

The movable cleaner assembly is moved up and down via a gear motor and a wire rope linkage. When the cleaner comes up to the upright position, it should stretch the spring on the wire rope so that there is approximately a 1 lb. pressure holding the moveable assembly up against the transport panel in the up position. The lift motor bracket can be loosened and moved toward the front or back of the machine to change the stretch of the spring and, hence, the engagement force. Since the tape back-up support for the detector is on the cleaner assembly, it is very important that the cleaner comes up firmly.

## TAPE BURNISHER SYSTEM

The burnisher posts are made of very hard sapphire. The edges are very sharp to polish the tape surface. These edges should be checked on a weekly basis for nicks, cracks, or imperfections. Run a card or the back of the finger nail along the edges to detect any roughness. Replace burnisher immediately if defective. Exercise care not to cut yourself on the sharp edges. **Do not run tape over a defective burnisher post! Severe tape damage may result.**

# DEFECT DETECTOR OPERATION

SEE SECTION IN OPERATOR'S MANUAL FOR  
LASER DEFECT DETECTOR OPERATION AND SETUP.

# ELECTRONICS

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## THEORY OF OPERATION

### POWER-UP SEQUENCE

By observing the power-up sequence of the TC 4100, one can usually determine if any problems exist with the motors or sensors. The following sequence should occur after first turning on the main power switch on the front panel:

#### Power-up Check

- 1) The cleaner lift if up, will drop to its "down" position.
- 2) Threading arms, if out, will move to their "in" home position.
- 3) Carrier lift, if down, will now cycle to its "up" position and stop.
- 4) Cassette loading rollers will turn (trying to un-load a cassette) for approx. 4 seconds.
- 5) The spindle slides will now cycle to the "large" position and back to the "small" position.
- 6) The cleaner lift will return the cleaner module to its "up" position. The cleaner stays up, to facilitate the changing of the cleaning tissues, unless the machine is threading a tape.

### TAPE LOADING SEQUENCE

The insertion of a cassette in the loading slot should cause the following sequence of events:

- 1) As the tape is loaded an infra-red sensor in the carrier is blocked, signaling the presence of a cassette.
- 2) At the back end of the carrier are two sensors that determine whether the cassette is loaded partially (one photocell blocked) or all the way (2 blocked).
- 3) Once the loading rollers have shut off, the cassette size is determined by two photocells that look for the presence of a large cassette. If the spindles are not at the correct position

for the cassette, the spindle-mover motor slides them to the proper position. The reel spindle position is sensed by two microswitches in the spindle-mover cam notches.

4) The cleaner lift motor now drops the moveable cleaner to its "down" position. Two microswitches sense the lift motor cam position.

5) The carrier lift is now turned on to lower the cassette carrier to its "down" position. If the "carrier-down" optical interrupter sensor does not become blocked, the carrier continues to cycle until it gets this signal. If this happens, something is preventing the carrier from going down fully.

6) When the carrier is down, the cassette is now sitting on the locating pins (hex posts.) Microswitches, actuated by plungers through the panel, now read the reel hub size, metal/oxide tabs and the erase protection tabs on small and large cassettes.

7) The threading arm motors (Bi-directional) now move the threading arms, and tape, to their "out" position. The motors continue to be powered in the outward direction, forcing the arms against the outer limit stops (with the help of slipping clutches) until both arm-out microswitches are tripped.

8) The final step is for the cleaner to lift to its "up" running position.

The machine is now loaded and ready to run the tape. It will wait for a transport key command by the operator to run FWD, etc. . Due to the smart electronics, however, the machine will accept a transport command during the loading process. Normally the operator presses AUTO which will cause the tape to run forward and rewind back to the beginning.

# CIRCUIT BOARD REPLACEMENT

WARNING, WARNING, WARNING, MAKE SURE THE MACHINE IS DISCONNECTED FROM THE MAIN POWER SOURCE BEFORE REMOVING OR REPLACING ANY CIRCUIT BOARD OR WIRING IN THE MACHINE.

## CIRCUIT BOARD REPLACEMENT

There are 10 circuit boards in the TapeChek 4100 in addition to the defect detector. Needless to say, these circuit boards should be handled carefully during removal or installation. Of particular concern are the wire connections and connectors going to the circuit boards. Under no circumstances should one remove a connector by pulling on the wire, but rather pull on the body of the connector shell to remove the connector. You will notice three common types of connectors and cable systems used in the 4100 machine. These are:

- (1) Flat wire connectors which carry anywhere from 10 to 40 wires.
- (2) Amp brand MATE-N-LOK™ connectors, these are white nylon shells with metal contacts that crimp onto the individual wires inside the connector. A special extraction tool is required to remove the terminals from the Amp connector shell.
- (3) Insulation displacement connectors. These connectors are either red or orange in color. The wire is pressed into the terminal in the back of the connector without stripping off the insulation of the wire. A special tool is required to make these wire terminations.

As stated before, always be very careful to remove the connectors from the circuit board before trying to replace the board with a new one. Most of the electrical connectors on these circuit boards are keyed so they only plug in

one way. Be careful to align the keyways before inserting a connector into its socket or look for color-coding of the plugs.

## FRONT PANEL CIRCUIT BOARDS

There are three circuit boards on the front panel of the machine as follows:

Machine Transport keyboard (Power, Stop, Eject, Etc.)

This circuit board is mounted with six screws into 1" long metal standoffs. Note that one of these screws goes through the mounting heatsink tab of a device in the upper left corner of the board. To remove the board, remove these 6 screws and lock washers (if present).

## Membrane switch keyboards

On the front panel there are two membrane switch keyboards which are fastened with four nuts. These boards also have "H" shaped metal supports to keep the board from flexing as they keypad is pressed. When replacing this "H" support on the back of a new circuit board, make sure that the "H" is aligned so that the horizontal member rests on the insulating mylar strip. Severe shortcircuits could occur otherwise. To replace the board merely remove the elastic stopnuts, washers, and metal "H" supports. When installing the new board, repeat the procedure and tighten the elastic stopnuts so that they are snug.

**DO NOT OVERTIGHTEN THE ELASTIC STOPNUTS ON THE FOUR MOUNTING STUDS.**

## MAIN CIRCUIT BOARDS

There are three circuit boards in the base of the cabinet. One is the Microprocessor Board that has the microprocessor, RAM, and other digital integrated circuits. The other two boards are mounted together as a unit. These boards are the Power Board and the Printer Interface Board.

### Microprocessor board

This circuit board is held in place on four hex standoffs with four 6-32 x 1/4" screws. When replacing this circuit board, do be careful of the wires that are run underneath the circuit board. No not pinch these wires when putting the new Microprocessor Board in place. The four mounting screws should be tightened so they are very snug, but do not overtighten.

### Power Board/Printer Board Assembly

The Power Board is held in place to the bottom of the cabinet via 6 screws into standoffs in the base of the cabinet. Two of these are at either end of the metal heatsink. One of these screws (in the front right corner) is threaded into a nylon hex spacer. Be very careful not to overtighten the screw into this nylon spacer.

The aluminum heatsink of the Power Board is attached to the side of the machine via two 6/32 hex nuts.

The Printer Interface Board is held in place by four 6-32 nuts. The board fits very snugly on these special hex standoffs and care should be taken when removing and installing the circuit board. When tightening the four small nuts, be careful not to damage nearby connectors or foils of the circuit board.

## CIRCUIT BOARDS BELOW PANEL

Under the transport panel, there are 2 circuit boards: the Erase Board and the Sensor Board

### Erase Board

The Erase Board has one RCA phono type connector and two Amp connectors. This board is held in place to two 10/32 screws coming through the transport panel. These two 10/32 screws, like most screws in the pro-line machine require a hex allen wrench.

### Sensor board

The leader sensor circuits plus wiring for other sensors/microswitches are located on this board. The black sensor board is mounted to the reinforcing rib underneath the transport panel of the machine. All of the connectors are keyed in some way and only fit based on connector or wire length in one location. This is true except for two small 4-pin red connectors that go to the spindle motor tachs. Note which connector is plugged into which socket before unplugging these wires. Then replace the connectors in the new circuit boards as they were in the old one. Once again, do not overtighten the 4 screws that mount this board to the hex metal standoffs.

## CIRCUIT BOARDS ABOVE PANEL

There are more circuit boards located on top of the transport panel.

### Tach wheel circuit board

The Tach Wheel circuit Board is mounted with three screws to the top of the transport panel (on later units). One of these screws is also used to adjust the tilt of the tach wheel in order to align it with the video tape path. Before removing this board, notice that there are fixed

spacers under two of the mounting screws, and a stack of spring washers under the third mounting screw.

Before removing the board, turn the screw going through the spring washers clockwise and count the revolutions of your screwdriver until the screw stops turning. Mark this down so that the new circuit board can be adjusted to that same adjustment point. Also note the number and orientation of the spring washers so you can duplicate that when installing the new circuit board.

## CARRIER BOARDS

### Upper carrier circuit board

The Upper Carrier circuit Board contains the phototransistors that sense the presents of the cassette in the loading slot and carrier. It is screwed in place with four mounting screws to the 1/4" square horizontal carrier bars.

### Lower carrier circuit boards

**Beta, Betacam, and Betacam SP** are Trademarks of SONY Corporation.

**Tapechek** is a registered Trademark of Research Technology International Company.

The TAPECHEK 4100 is a professional machine built to the highest standards. RTI maintains a staff of service technicians at the factory as well as many qualified service dealers throughout the world. We recommend that you contact RTI of your dealer if you notice a problem that is not addressed in this manual - before attempting any repairs on your own. Our address is:

**RESEARCH TECHNOLOGY INTERNATIONAL COMPANY  
4700 CHASE AVENUE  
LINCOLNWOOD, ILLINOIS, U.S.A.**

**Phone: 708 677-3000    Toll Free: 1-800-323-7520  
Fax: 708 677-1311**

Underneath the floor of the carrier, there are three circuit boards containing LED's for the carrier cassette sensors as well as two opto-interrupters for the carrier up/down sensing. To replace these boards, raise the transport panel to its upright position and detach the metal "E" rings that secure the spring linkage arms to the rotating carrier lift arms. Take care not to drop washers or "E" rings down onto the circuit boards. With the carrier linkage arms detached, lower the transport panel so you may raise the carrier assembly for easy access to the bottom carrier circuit boards. The bottom carrier circuit boards are attached with 4-40 elastic stop nuts and three nylon washers between the circuit boards and metal carrier floor. Make sure to duplicate this arrangement of hardware when installing the new circuit boards. Also be very careful not to break the wires at the point where they are soldered to the circuit board. This might happen if the wires are bent at sharp angles Route the wires through the cable clamps as the old boards were mounted.

# TAPECHEK 4100

## APPENDIX

- A) Primary Service Parts list
- B) Electrical diagrams

# Appendix A

## Service Parts list

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Part Number	Description
<b>4100 Circuit Boards</b>	
TA 2997-1	Power Board
TA 2970	Sensor Board
TA 2786	Erase Board
TA 5450C	Microprocessor Board
TA 2794	Tach Wheel Board
TA 2906-3	Transport Keyboard
TA 2427-1	Display Board
TK 2428-1	Left Membrane Keyboard
TK 2425-1	Right Membrane Keyboard
TA2960-1	Lower Carrier Board,      Left
TA 2968-1	"      "      "      Center
TA 2964-1	"      "      "      Right
TA 2900-2	Upper Carrier board.
<b>Motors</b>	
TM 2832	Motor, Spindle drive
TM 2828	Motor, gear 187:1
TM2828-H	Motor, gear 187:1 Heavy duty (carrier lift)
TM2334	Motor, gear, Thread arms
DM3523-1	Motor, tissue drive, 10 RPH, 24V.
<b>Misc. Mechanical Parts</b>	
TB 2841	Belt, timing, spindle mover
TR 2871	Roller, cassette loading
TR 2108-18	Roller, Tape, 1/2" Crowned
TV 2942-1	Vacuum Pump, Air, 120 VAC
TV 2942-2	Vacuum Pump, Air, 220 VAC, 50 HZ

Service parts list continued.....

Misc. electronic parts.

EI 6204	IC, Motor controller UDN 2953
EI 6206	IC, UDN 2950z
EI 3048	Interrupter, opto
EI 3048-1	Interrupter, opto new, Tach board
EL 5313	Lamp, Detector 6 vdc.
ER 3017	Regulator, 78H05 5 Amp. 5v.
ER 6119	Regulator, LM338, Adj. 5 Amp.
DS 3093	Switch, micro, lo-torque
ES 5059	Switch, PB mom. Transport key
ES 5059-1	Switch cap for above
ES 5022	Switch, micro, Subminiature
ES 5022-1	Switch, micro, gold contact
ET 3054-1	Transistor, TMOS FET
ET 3061	Transistor, MTM 4N50