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**REDACTRON MODEL 100  
CASSETTE TRANSPORT**



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Figure 1 – Model 100 Magnetic Tape Cassette Transport

## INTRODUCTION

The Redactron Model 100 (Figure 1) is a unique magnetic tape cassette transport. It offers high reliability and computer-quality performance in a compact, low cost cassette transport. Complex mechanical mechanisms (which have historically plagued cassette transports) have been reduced to a minimum in the Model 100. The problem of providing high-level performance from the transport was relegated to the associated electronics package; the premise being that complex electronics is far more reliable than complex mechanics.

The Model 100 is available in the two configurations defined in Table 1. As described, it is available as a mechanical only unit, or as a unit with local electronics.

TABLE 1

**MODEL 100** Tape Cassette Transport (Mechanical Unit Only)  
**MODEL 110** Tape Cassette Transport (with Local Electronics)

### OPTIONS

**OPTION 180** MOS Controller  
**OPTION 181** MOS Controller Mounted on P.C. Card with Clock, Switch Filters, MOS Clock Drivers.

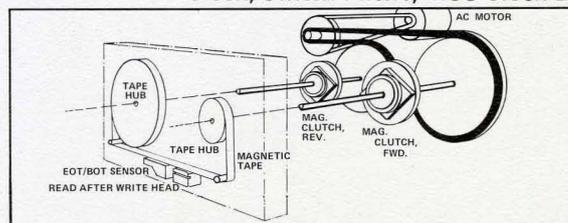


Figure 2 – Transport, Simplified View

## OPERATION

**MECHANICAL TRANSPORT** — The transport consists of a minimum amount of components (see Figure 2). A continuously rotating motor drives two hub pulleys in opposite directions as shown. Two magnetic clutches are provided, one on each hub shaft, to couple or decouple the rotating shafts from their respective tape hubs. After the tape cassette is loaded onto the transport, activating one clutch or the other will move tape in the forward or reverse direction. The tape path through the transport includes an EOT/BOT sensor and a read-after-write tape head. The transport also includes switches for the following functions: Rewind, Write Enable, and Cassette-In-Place.

**TAPE CASSETTE** — The Model 100 uses a modified "Norelco-type" cassette having a replaceable Write Allow tab and large hubs. Each cassette contains 200 feet of 0.7 mil computer-grade tape with a reflective leader at each end. Since the transport is equipped with a read-after-write head, highly reliable operation is assured even if the tape is dirty or creased.

**LOCAL ELECTRONICS** — The local electronics board contains circuitry for the following functions: tape drive, read/write amplification, and leader detection. The tape drive circuitry provides the proper drive signals for the forward/reverse clutches and brakes, in response to forward/reverse run commands. The read amplifier shapes and amplifies the read signal to provide a digital output signal have a sharp rise and fall time.

The write amplifier provides amplification and gating of the write data in addition to creating the read threshold voltage level. The leader detection circuitry indicates when the beginning-of-tape (BOT) or end-of-tape (EOT) reflective leader is being detected.

**OPTIONAL CONTROLLER BOARD** — The optional controller board consists of a single printed circuit board on which is mounted a custom MOS circuit and associated components. The MOS circuit is approximately equal to 65 TTL chips. The Controller performs all the basic functions required for the reading and writing of data, including tape motion control. The Controller contains the basic control module with associated filters and inverters, and a clock generator circuit. A unique method was devised to record and then recover data from tape, using the very basic transport previously described. This method, called Ratio Detection,\* allows for wide speed variation, both long and short term. The following paragraphs describe the method used for recording and recovering data.

\*Patent No. 3720927

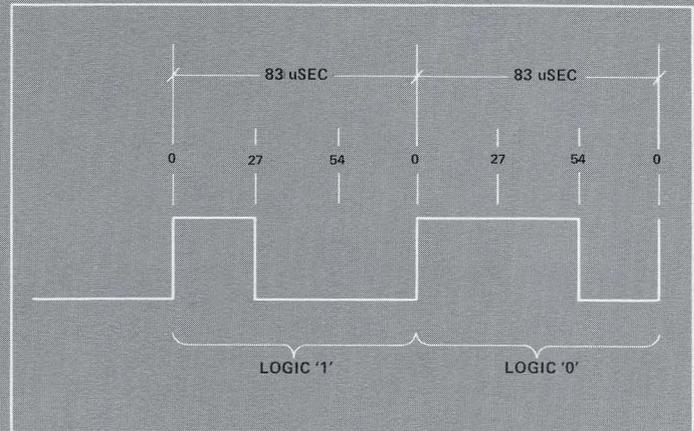


Figure 3 — Recording Technique

**RECORDING TECHNIQUE**—As shown in Figure 3, each logic bit on tape requires the space normally allotted for three flux reversals (83 microseconds). Each bit commences with a positive-going flux change. If a logic "1" bit is to be recorded, the next flux change, which is negative going, occurs at the first allowable position, in this case 27 microseconds after the positive-going change which defined the beginning of the bit. If a logic "0" bit is to be recorded, the negative-going flux change occurs at the second allowable position, in this case 54 microseconds after the beginning of the bit. Each subsequent bit which follows is recorded in the same 27-54-83 microsecond pattern as described above. A final one bit must be recorded to define the completion of a data block. (Automatically done in the MOS controller chip).

The write function can be performed only in the forward direction. This function is defined by issuing the Forward and Read commands. If the Busy signal is off, and a Write-Enable tab is inserted in the cassette, the Forward command causes the tape to move. When the tape is up to speed and at least 3 inches past the tape leader, Write OK is generated to indicate that writing of data may begin (see Figure 4).

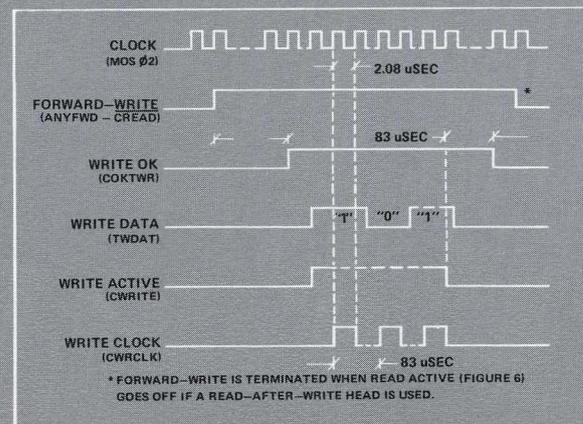


Figure 4 — Write Function Timing

When Write Data is available, the Write Active signal must be turned on to activate the write timer. As soon as Write Active appears, the Controller generates Write Clock signals every 83 microseconds. Write Data is strobed into a buffer by the Write Clock. When Write Clock goes off, it indicates that new data may be presented on the Write Data line. The new data must be ready for transfer less than 80 microseconds after Write Clock goes off. The coding of the data bit into the buffer controls the writing of the data transition. If the Write Data is a ONE bit, the transition occurs approximately 27 microseconds after the transition defining the start of a bit-cell (proportionately early in the cell). If the Write Data is a ZERO bit, the transition occurs approximately 54 microseconds after that transition (proportionately late in the cell).

When the last Write Data bit is transferred, the Write Active signal must be turned off within 80 microseconds so that the transition defining the beginning of a bit-cell does not occur. The Forward Command is also turned off at this time unless a read-after-write head is being used in which case the command is terminated when Read Active goes off. Writing must be done on a block by block basis, and a new forward-write command may be given only after the Busy signal goes off.

When the Write Active signal is terminated, the Controller generates a final ONE bit defining the completion of the block. This last ONE bit is never read when moving forward because there is no subsequent start-of-bit-cell transition to cause it to be strobed. Also, when reading in reverse, the first transition detected is inhibited and the next transition defines the beginning of the bit-cell.

The Busy signal is maintained for 17 milliseconds after the Forward Command is removed. This prevents the start of any new command until the tape comes to a complete halt. It also insures a sufficiently large interrecord gap to allow the tape to come up to speed for reading the block in reverse.

**DATA RECOVERY** – After amplification and peak detection, the read signal resembles the waveform shown in Figure 5. It should be noted that this waveform is shown with an exaggerated amount of both long and short term speed variations to

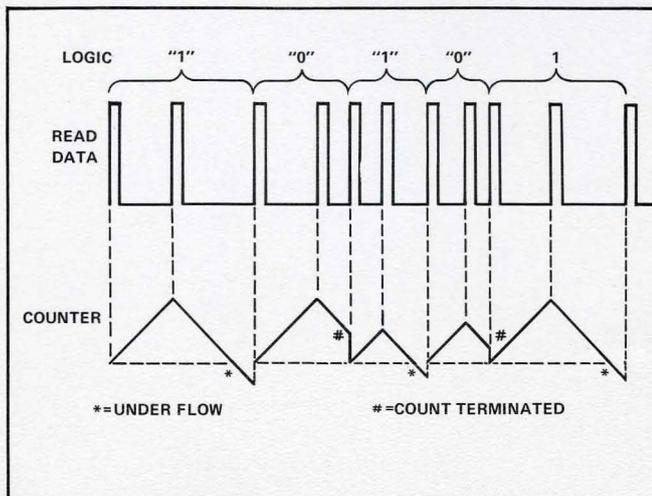


Figure 5 – Data Recovery

illustrate the effectiveness of Redactron's data recovery method.

A counter is employed to "count up" during the period between the first and second pulses. At the leading edge of the second pulse, the counter is reversed and allowed to "count down" at the same rate. If the counter counts down to the underflow condition or zero before the leading edge of the third pulse, the bit being read is interpreted as a logic "1". If the counter does not reach the underflow condition before the leading edge of the third pulse, the count is terminated and the bit being read is interpreted as a logic "0". The process repeats itself for all data bits being read.

The normal forward-read function is defined by issuing the Forward and Read commands. The Busy signal must be off before any motion command can be given. The Forward command causes the tape to move, and when data is detected, the Read Active signal is generated (see Figure 6). Read Active stays on during the entire read operation. Approximately 1 millisecond after the last bit is read, Read Active goes off, signalling the end of a read operation.

Read Active going off indicates that the Read and Forward commands can be terminated. When continuous block reading is taking place, the forward-read function can be terminated at any block, but only at the time when Read Active goes off. If reinstatement of the Forward or Read command is made within 2 milliseconds, the Controller will not stop the transport. If reinstatement is made after 2 milliseconds, the Controller stops the transport, causing a total post-stop delay of 17 milliseconds.

Data is transferred synchronously. It is stored on tape based on a "proportional cell" technique where the bit, a zero or a one, is written proportionately closer to the end or to the beginning of the cell respectively. A 9-bit, up-down counter is incremented at the clock frequency as the beginning of each bit-cell is detected. This continues until the transition defining the data bit occurs, at which point the counter starts to decrement at the same clock frequency. If the counter passes through zero before the next transition, the data bit stored in the cell is considered to be a ONE, if not, it is a ZERO. This data (Read Data) is presented along with a Read

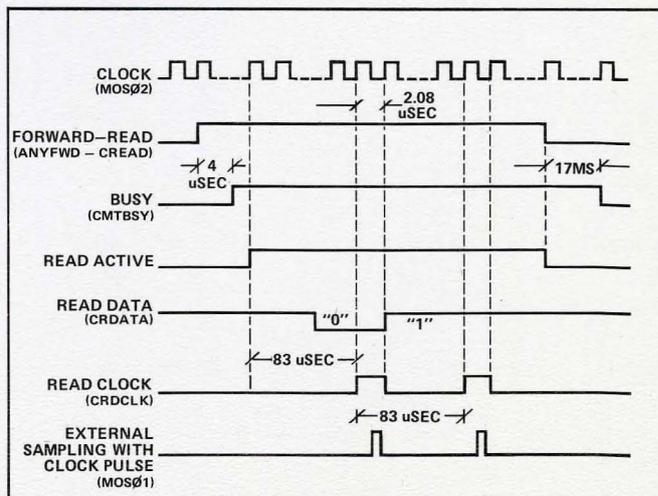


Figure 6 – Read Function Timing

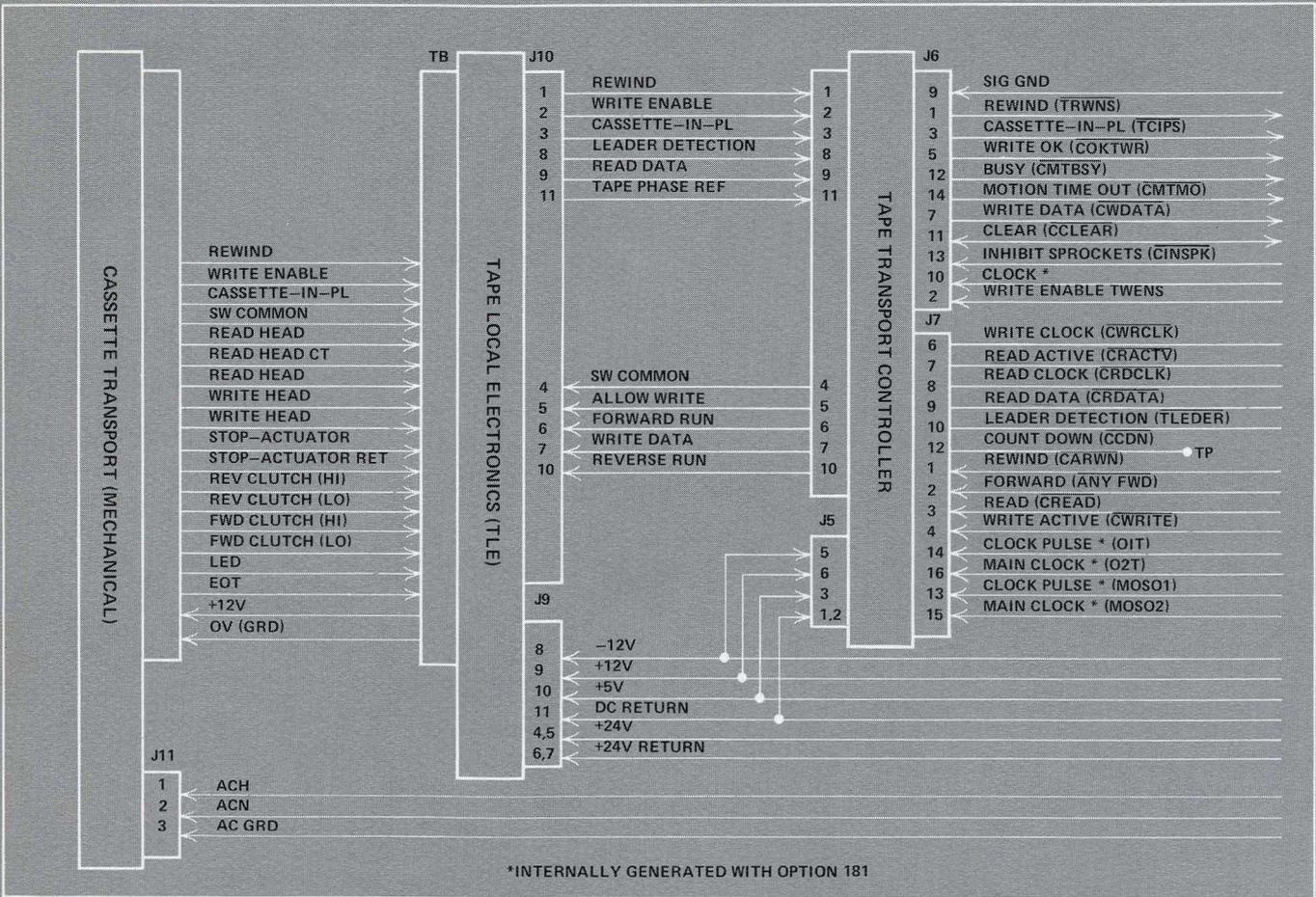


Figure 8 - Interface Connections

Clock signal which is one cycle long. The external detection must gate a Clock Pulse with the Read Data at this time to strobe the signal.

**TAPE MOTION CONTROL** - Tape motion is essentially controlled by the Forward, Rewind and Read commands. The Clear signal should be applied after power turn-on for a minimum of 10 Clock periods to assure proper reset of the logic. The Busy signal is generated whenever the transport is performing a function, or if the tape cassette is not loaded.

A Rewind command may be issued either externally or by actuation of the Rewind switch. The rewind operation is automatically terminated by detection of the tape leader. The external rewind signal should be turned off as the Busy signal appears. Busy is generated when rewinding begins, and lasts until the rewind operation has been completed.

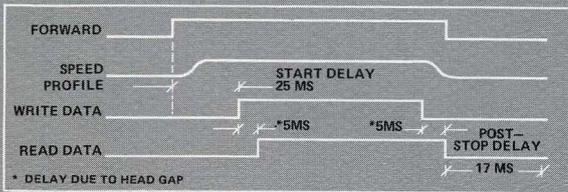


Figure 7 - Tape Motion Control

Figure 7 illustrates the timing requirements for starting and stopping tape motion. Before writing, a delay time of 25

milliseconds is necessary to assure that the tape is up to speed. Also, when stopping, a delay of 17 milliseconds is necessary before a new command may be issued.

**INTERFACE CONSIDERATIONS**

Signal and pin number designations for all interface connections are shown in Figure 8. The illustration shows a complete unit including the mechanical transport, local electronics, and optional controller. Power requirements as well as signal levels are listed under Basic Specifications.

The necessary clock pulses (required for Option 180) are shown in Figure 9. When Option 181 is chosen, these pulses are internally generated.

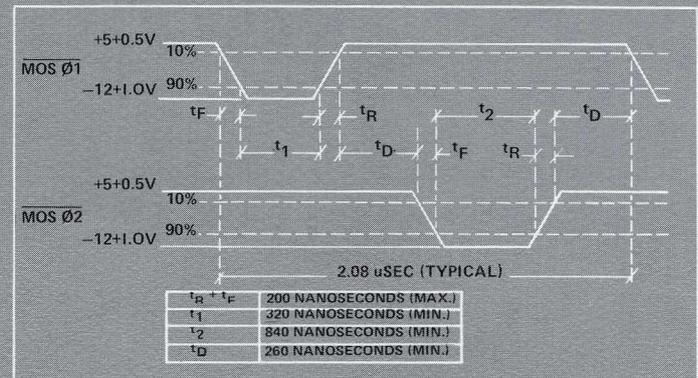


Figure 9 - Clock Pulse Requirements

## INSTALLATION

Figures 10 and 11 provide all information necessary for the proper mounting of both the controller board and the cassette transport. Figure 10 illustrates the physical dimensions of the controller board, as well as the mounting holes and connector requirements. Figure 11 shows the physical dimensions of the cassette transport which can be mounted in any rack-type panel meeting the requirements of the outline drawing.

## SPECIFICATIONS

### Cassette Drive

This is a spindle driven (reel-to-reel) cassette transport designed specifically for minimum cost and long life. A read-after-write (RAW) head is supplied.

### Start-Stop Characteristics

Start Time to "up-to-speed" is 25 ms.

Distance to up-to-speed .6 in. + 10%

Stop Time to stop is 12 ms.

Distance to stop is .25 in. + 10%

### Mechanical Interface (i.e., without Electronics)

#### Clutch Control Signals

Forward Run: 24 volts; 120 ma.

Reverse Run: 24 volts; 120 ma.

Stop Actuator: 24 volts; 150 ma.

#### Detection Signals

Cassette-in-Place (Contact Closure)

Leader Detected (Photocell)

Write Enable (Contact Closure)

Rewind Switch (Contact Closure)

#### Head Signals

Read-After-Write Head Signals

Read Head (3 connections)

Write Head (2 connections)

### Electrical Interface (i.e., with Electronics)

#### Interface Voltage Levels

Logic 0 is 0.0 volts (+ .4, -0)

Logic 1 is +5.0 volts (+0 -2.2)

All input signals are the equivalent of one TTL load.

All output logic signals will drive the equivalent of 3 TTL loads.

All switches should be driven at 50 ma. 50 volts max.

#### Input commands

Forward Run: Logic 0 is on; Logic 1 is off

Reverse Run: Logic 0 is on; Logic 1 is off

#### Output Control Signals

Cassette-in-Place: Switch Contact; closed when not operated.

Leader Detected: Logic 1 is on; Logic 0 is off.

Write Enable: Switch Contact; closed when not operated.

Rewind Switch (local switch): Switch Contact; open when switch not operated.

#### Connector

Two connectors are used, plus the AC power connector

Signals: 16 pin Dual in-Line Plug

Power: Standard .156" center PC edge connector

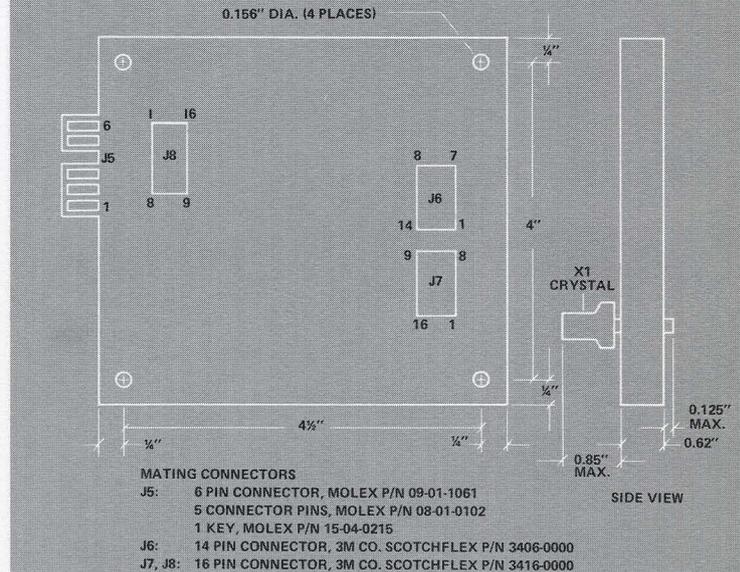
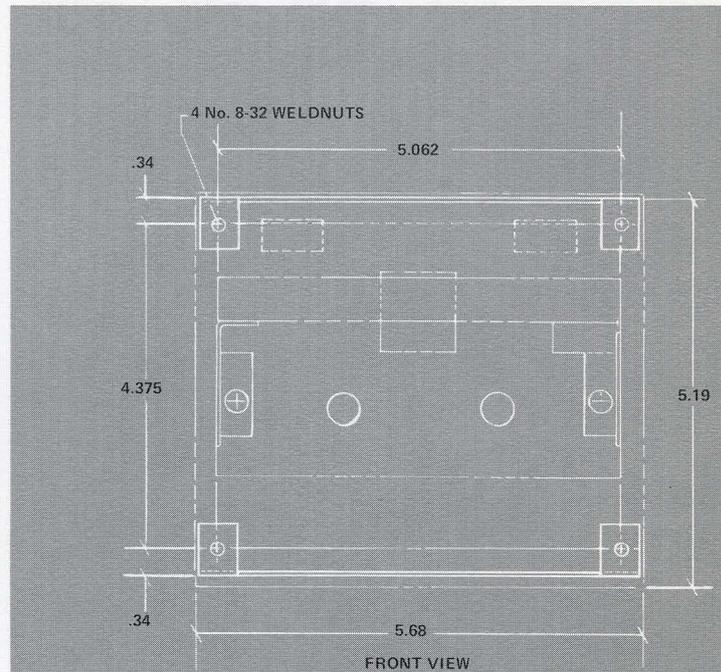
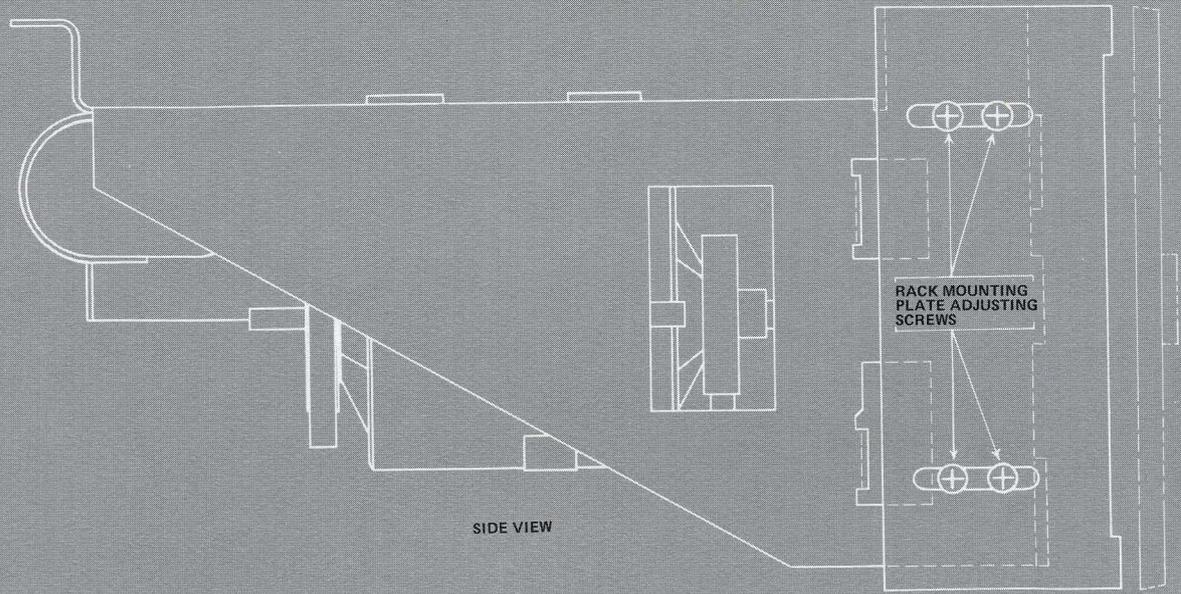


Figure 10— Controller Dimensions





Mating Connectors

J9: DC Connector, MOLEX P/N 09-01-1121

J10: Signal Connector, AUGAT P/N 2P16-1

J11: AC Connector, AMP. P/N 1-480305-0

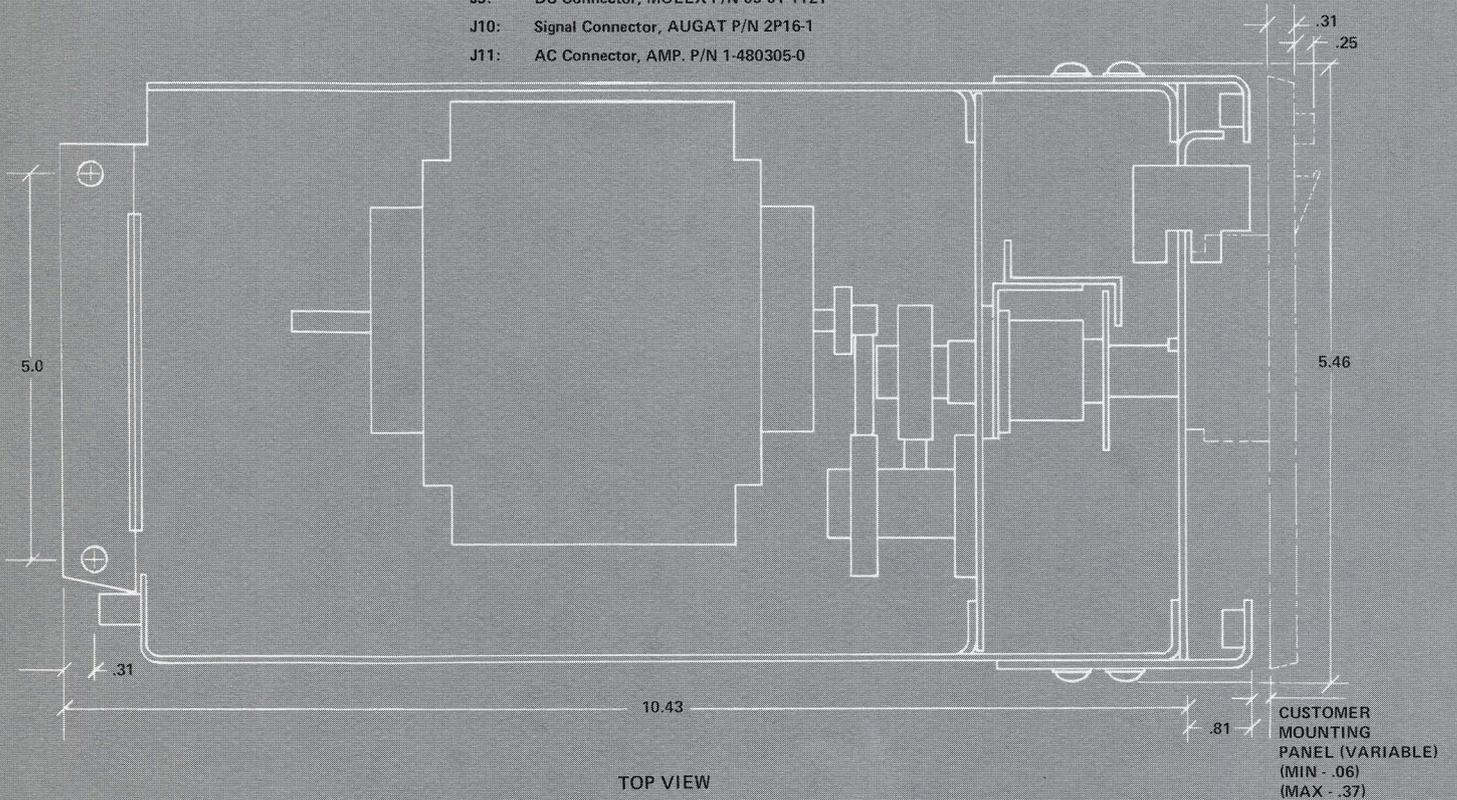


Figure 11 – Outline Dimensions

### Tape Speed

Constant spindle speeds cause tape velocity to vary depending on the reel diameter.

Average tape velocity is 31 ips.

Max. speed approximately 38 ips  
(at end of tape).

Min. speed approximately 24 ips  
(at beginning of tape).

Max. deviation (bit to bit) +15%  
(forward read or write)

Rewind: 85 seconds for full 200 foot reel.

### Head

#### Read-After-Write Head

Separation between read and write  
head: .150" +.005

Write width: .120" (across tape)

Read width: .085" (across tape)

### Record Mode

430 bpi max. average

Max. density is approximately

555 bpi at beginning of tape.

Min. density approximately

350 bpi at end of tape.

Transfer rate

8333 or 12000 bps depending  
on recording scheme.

### Tape Capacity

Completely written tape stores  
125,000 eight-bit bytes.

### Cassette

Norelco cassette modified as follows:

1.2" Diam hub liner

200 feet per reel

Computer grade .7 mil tape  
(need not be certified perfect  
with read-after-write head.)

Pressure pad is .140" by 5/16"

ID of hubs held to .307 +001

Rotating corner roller

Replaceable "Write Enable" button

Reflective Leader at Beginning/  
End of tape

### Environmental Conditions

The environmental limits are for the  
mechanism only. Actual limits are  
defined by the magnetic tape used  
in the system.

Temperature:

Storage: -40° C to 65° C

Operating: -0° C to 55° C

Humidity:

Storage: 0% to 95% at 40 C,  
without condensation

Operating: 10% to 95% at 40° C  
without condensation

### Power Requirements

AC Power (via 3 conductor plug)

115 volts +10 volts; 60 hz  
+5 hz, @ 1.2 amp.

230 volts +20 volts; 50 hz  
+5 hz (option) @.6 amp.

DC Power (Option - Dependent)

Solenoids: 24 volts +3  
volts; 300 ma.

Electronics:

+12 volts +.6 volts; 175ma.

-12 volts +.6 volts; 50 ma.

+5 volts +.5 volts; 200 ma.

### Equipment Size

Height so as to fit in 5¼" high rack  
mount.

Width less than 5¾".

Depth behind front panel less  
than 12"

Clearance from top and bottom  
behind front panel

1/16" minimum.

Weight: 8½ pounds (approx.)

