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# 609 #

# 2166

## PAPER TAPE READER

### TECHNICAL MANUAL

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# 2166

## PAPER TAPE READER

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TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 51 CONSISTING OF THE FOLLOWING:

Page No.	Change No.	Page No.	Change No.
Title Page.....			
A Page.....			
i thru vi.....			
1-0 & 1-2.....			
2-1 & 2-2.....			
3-1 thru 3-10.....			
4-1 thru 4-4.....			
5-1 & 5-2 .....			
6-1 thru 6-18.....			
7-1 & 7-2.....			
8-1 thru 8-5.....			

\*The asterisk indicates pages changed, added, or deleted by the current change

# TABLE of CONTENTS

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
SECTION I DESCRIPTION		
1.1	General .....	1-1
SECTION II SPECIFICATIONS		
2.1	General .....	2-1
2.2	Contacts .....	2-1
2.3	Electromagnetic Drive .....	2-2
2.4	Mechanical .....	2-2
SECTION III PRINCIPLES OF OPERATION		
3.1	Drive Mechanism .....	3-1
3.2	Sensing Mechanism .....	3-1
3.3	Mechanical Operation .....	3-2
3.4	Electromagnet .....	3-3
3.5	Adjustable Resistor .....	3-4
3.6	Arc-Suppression Network .....	3-4
3.7	Interrupter Switch .....	3-5
3.8	Tape Hold-Down Arm Switch .....	3-7
3.9	Starwheel Sensing Contacts .....	3-7
SECTION IV INSTALLATION		
4.1	Mounting Data .....	4-1
4.2	Loading Tape .....	4-1

## TABLE of CONTENTS(CONT'D)

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
SECTION V LUBRICATION		
5.1	Lubrication .....	5-1
5.1.1	Grease .....	5-1
5.1.2	Oil .....	5-1
SECTION VI ADJUSTMENTS		
6.1	Starwheel Sensing Head .....	6-1
6.2	Sprocket Shaft and Detent Arm .....	6-2
6.3	Detent Arm Spring Adjustment .....	6-3
6.4	Armature Gap Clearance .....	6-3
6.5	Armature Travel Adjustment .....	6-4
6.6	Feed Pawl Adjustment .....	6-6
6.7	Feed Pawl Tension .....	6-7
6.8	Pawl Depressor Adjustment .....	6-8
6.9	Armature Spring Tension .....	6-9
6.10	Interrupter Switch .....	6-10
6.11	Interrupter Switch Blade Tension .....	6-11
6.12	Interrupter Switch Gap Adjustment .....	6-12
6.13	Interrupter Switch Card Tension .....	6-13
6.14	Starwheel Arm Clearance from Drum .....	6-14
6.15	Starwheel Arm Spring Tension .....	6-15
6.16	Starwheel Contact Screws .....	6-16
6.17	Series Adjustable Resistors .....	6-18

**TABLE of CONTENTS(CONT'D)**

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
	SECTION VII TOOL LIST	
7.1	Introduction .....	7-1
	SECTION VIII ENGINEERING DRAWINGS	
8.1	Introduction .....	8-1

**LIST of TABLES**

<u>Table</u>	<u>Title</u>	<u>Page</u>
	SECTION VI ADJUSTMENTS	
6-1	Residual Shims .....	6-4
	SECTION VII TOOL LIST	
7-1	Tool List .....	7-1

## LIST of ILLUSTRATIONS

<u>Figure</u>	<u>Title</u>	<u>Page</u>
SECTION III PRINCIPLES OF OPERATION		
3-1	Sensing Mechanism Diagram .....	3-2
3-2	Mechanical Operation Diagram .....	3-3
3-3	Arc-Suppression Network Schematic Diagram SI Connected for Self-stepping Operation .....	3-5
3-4	Paper Tape Reader Schematic Diagram SI Connected for Data Contact Protection .....	3-6
3-5	One-Shot Schematic Diagram SI Connected for Generating a Data Strobe Pulse .....	3-8
3-6	Sensing Contacts Diagram .....	3-9
SECTION IV INSTALLATION		
4-1	Mounting Data Diagram .....	4-2
4-2	Loading Paper Tape .....	4-3
SECTION V LUBRICATION		
5-1	Lubrication Chart .....	5-1
SECTION VI ADJUSTMENTS		
6-1	Starwheel Sensing Head Adjustment .....	6-1
6-2	Sprocket Shaft and Detent Arm .....	6-2
6-3	Detent Arm and Starwheel Position Adjustment .....	6-3
6-4	Armature Gap Clearance Adjustment .....	6-4
6-5	Armature Travel Adjustment .....	6-5

## LIST of ILLUSTRATIONS(CONT'D)

<u>Figure</u>	<u>Title</u>	<u>Page</u>
6-6	Feed Pawl Adjustment .....	6-6
6-7	Magnet and Feed Pawl .....	6-7
6-8	Feed Pawl Tension Adjustment .....	6-7
6-9	Depressor Adjustment .....	6-8
6-10	Depressor Pawl Alignment .....	6-9
6-11	Armature Spring Tension Check .....	6-10
6-12	Armature Spring Tension Adjustment .....	6-10
6-13	Armature Adjustment .....	6-11
6-14	Interrupter Switch Blade Tension Adjustment.....	6-12
6-15	"B" Switch Adjustment .....	6-13
6-16	"C" Switch Engaged/Disengaged .....	6-13
6-17	Interrupter Switch Tension Adjustment .....	6-14
6-18	Starwheel Arm Clearance .....	6-14
6-19	Starwheel Arm Adjustment .....	6-15
6-20	Starwheel Arm Spring Tension Adjustment .....	6-15
6-21	Starwheel Contacts Adjustment .....	6-17
6-22	Contact Wire and Contact Screw Gap Adjustment .....	6-17

### SECTION VIII ENGINEERING DRAWINGS

8-1	Paper Tape Reader Assembly Drawing .....	8-2
8-2	Paper Tape Reader Head Assembly Drawing .....	8-3
8-3	Paper Tape Reader Harness Drawing .....	8-4
8-4	Paper Tape Reader Schematic Wiring Drawing .....	8-5

## **SECTION I DESCRIPTION**

### 1.1 GENERAL

The Paper Tape Reader Model 2166 is used for extracting data stored on punched paper or mylar tape. It presents this data in the form of contact closures to other equipment.

The Model 2166 reads up to eight channel punched paper tape unidirectionally at speeds up to 30 characters per second. Sensing of the punched holes is accomplished by the use of eight starwheels. When a starwheel enters a hole, an arm carrying the starwheel closes the switch. An additional switch is provided on the tape hold-down arm. When tape is loaded into the unit, this switch is open. This switch is closed when paper tape is installed between the starwheel arm and sprocket drum.

The stepping of the Paper Tape Reader is accomplished by an electromagnet. Stepping of the tape occurs on the spring return stroke of the electromagnetic. The interrupter switch provides for self-stepping, starwheel contact protection, or timing function.

## NOTES

## SECTION II SPECIFICATIONS

### 2.1 GENERAL

Number of Tape Channels: 5, 6, 7, or 8

Data Hole Size: 0.072" diameter on 0.100" centers (EIA Proposed Standards RS-227)

Feed Hole Size: 0.046" diameter

Reading Speed: Variable from 0 - 30 characters per second, unidirectional

Tape Widths: 11/16 inch, 7/8 inch, and 1 inch

Connections: 24 pin Amphenol connector, with mating connector supplied

### 2.2 CONTACTS

(1) Starwheel Sensing Switches:

- (a) Eight Form "A" (normally open) bifurcated contacts, (one side common), each consisting of two eutectic silver wires, plus one stainless steel wire for minimizing bounce.
- (b) Contact bounce less than two milliseconds.
- (c) Maximum contact rating is three amperes steady state.
- (d) For switching under load, current affects life as follows:

CURRENT (ampere)	LIFE (no. of switching operations)
0.035	200,000,000
0.100	100,000,000
0.500	20,000,000
1.000	5,000,000

(2) Tape Hold Down Switch:

Form "A" contact consisting of one eutectic silver wire and one stainless steel wire.

(3) Interrupter Switch:

(a) One switch, consisting of Form "B" (normally closed) bifurcated heavy duty contacts. Current rating is three amperes switching resistive loads.

(b) Switch bounce less than two milliseconds.

2.3 ELECTROMAGNETIC DRIVE

Power Requirements: 24, 48, or 90 VDC

Pull-In Time: Nominally set at 14 milliseconds

Drop-Out Time: Nominally 14 milliseconds

Arc Suppression: Diode, resistor network across each electromagnet

Voltage and Power Adjustments: Adjustable resistor in series with each electromagnet

2.4 MECHANICAL

(1) Size:

(a) 3-1/2 inches high by 6-3/4 inches wide

(b) Extends 2-5/8 inches front of panel, and 2-1/2 inches rear of panel

(2) Weight:

2-1/2 pounds

## **SECTION III**

### **PRINCIPLES of OPERATION**

#### **3.1 DRIVE MECHANISM**

A unique cross-coupled pawl system, driven by an electromagnet, is employed for stepping of the tape in one direction. The stepping of the tape occurs on the spring return stroke of the electromagnet.

An interrupter switch is actuated by an extension of the electromagnet armature. When the armature pulls in, and at the point when the pawl locates in under the next tooth on the ratchet, the interrupter switch is opened, and remains open until after the electromagnet is de-energized and has advanced the tape. The function of the interrupter switch is:

- (1) Provides a means for continuous self-stepping of the tape when placed in series with the magnet coil.
- (2) Provides the electrical interlock signal to connected equipment.
- (3) Protects the make and break of the starwheel sensing contacts.

#### **3.2 SENSING MECHANISM**

Sensing of the punched holes is accomplished by the use of starwheels. See Figure 3-1. When a starwheel enters a hole, an arm carrying the starwheel closes a switch. A switch is also provided on the tape hold-down arm. When tape is being loaded into the unit, this switch is open.

An advantage of the starwheel sensing over all other methods of hole sensing is that the sensing switch remains closed when a series of holes is sensed. Only when a no-hole condition is sensed is the starwheel raised and the sensing switch opened. Thus, a single tape channel can control the pull-in, holding, and drop-out sequence of a relay or other responsive device.

If interruption is desired, the sensing switch common may be wired in series with the interrupter switch.

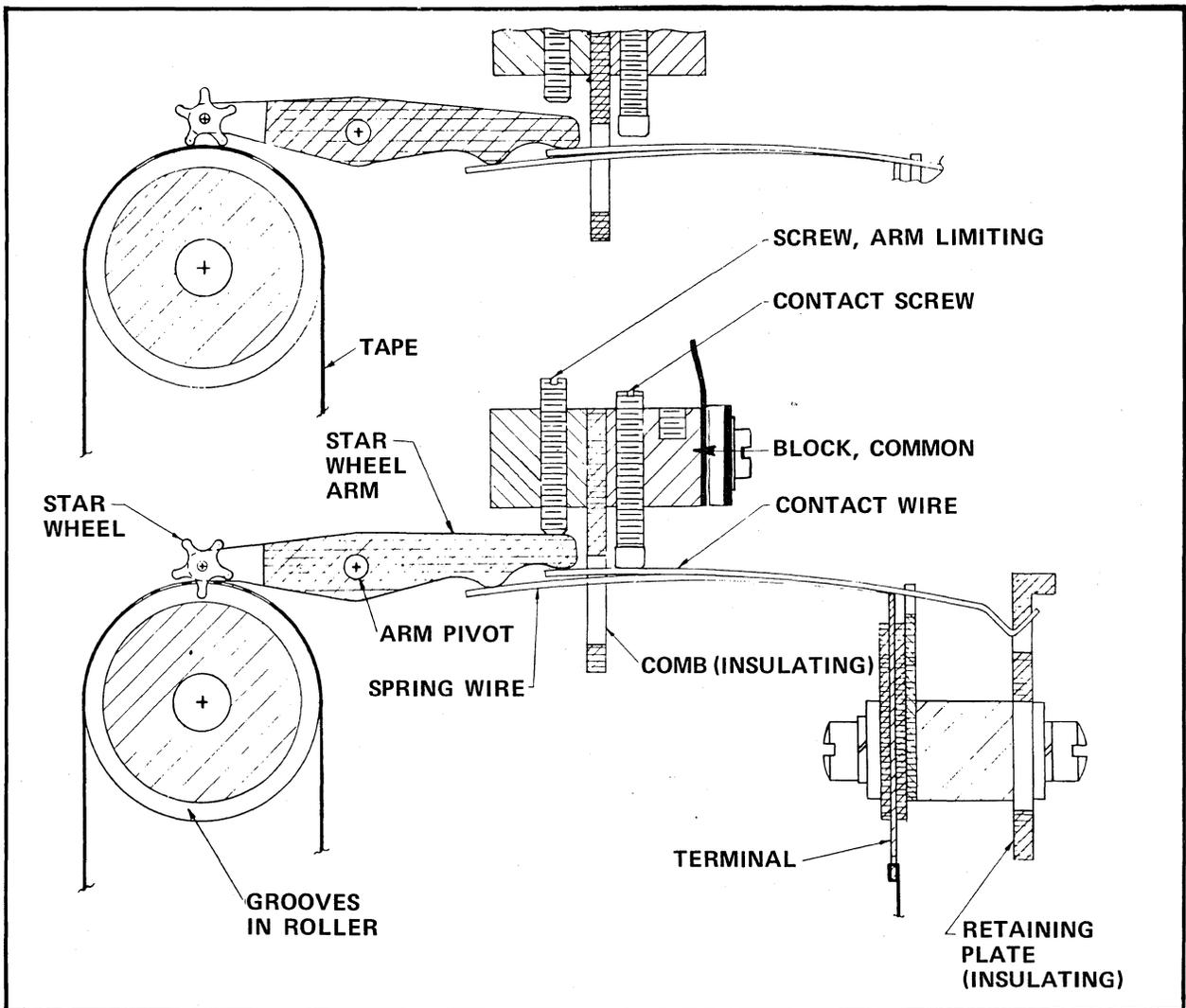


Figure 3-1 Sensing Mechanism Diagram

### 3.3 MECHANICAL OPERATION

When starwheel (1) senses hole in paper tape (2), the starwheel arm (3) is rocked counterclockwise under the urging of contact wires (4) which limit on lower surface of contact screw (5). See Figure 3-2. Electrical circuit is thus completed from common block (6) to terminal (7). The spring wire (8) urges starwheel arm (3) against arm limiting screw to reduce bounce. Drive

shaft (9) extends rearward through panel and carries unidirectional ratchet (10). Energization of coil (11) attracts armature arm (12) and engages pawl blade (13) under next tooth. Pawl depressor (14) disengages opposing pawl blade (15). Tip (16) of armature moves card (17) to open interrupter switch contacts (18).

Under de-energization of coil (11), pawl blade (13) steps shaft (9) under urging of spring (19). Interrupter switch (18) recloses (near end of armature return) one to two milliseconds after sensing switches have achieved new positions.

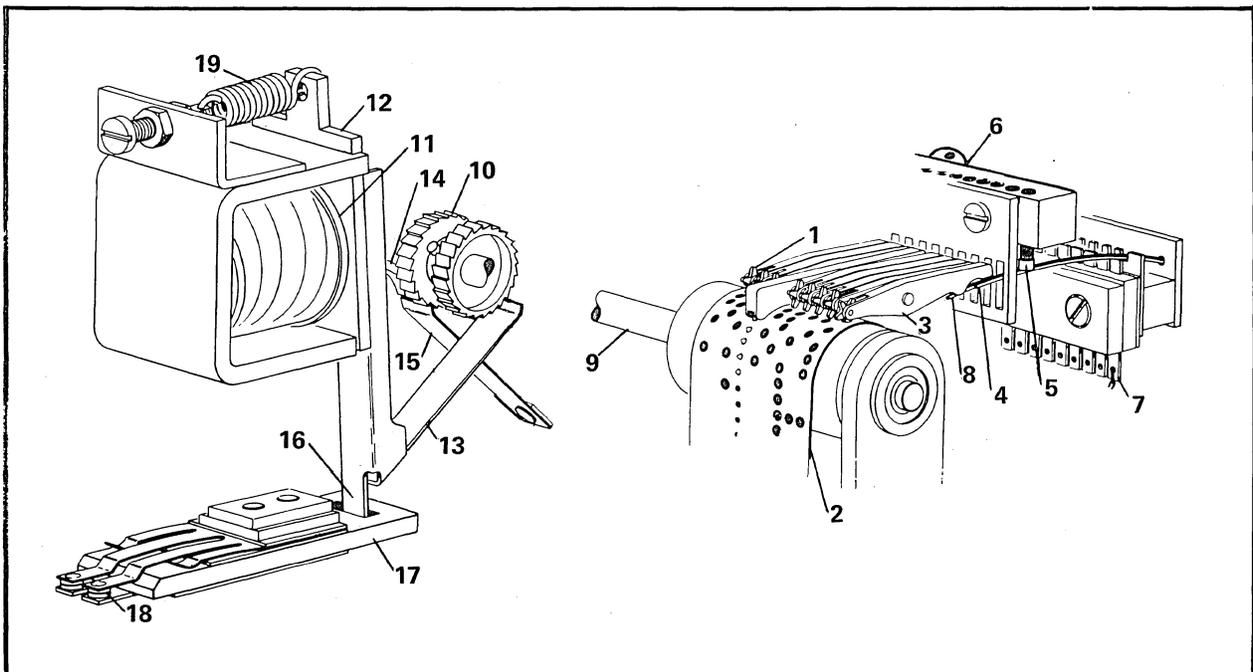


Figure 3-2 Mechanical Operation Diagram

#### 3.4 ELECTROMAGNET

The function of the electromagnet is to translate electrical energy into mechanical motion and store this energy in a spring. When the coil voltage is removed, the spring action advances the paper tape.

### 3.5 ADJUSTABLE RESISTOR

The adjustable resistor in series with the electromagnet provides the following functions:

- (1) Provides adjustment for other than standard coil voltages (24, 48, or 90 VDC) which may be available in the user's system. This adjustment is nominally  $\pm 25\%$ . Thus, a 24 VDC reader can accommodate 18 VDC to 30 VDC by simple adjustment. If specified, this adjustment can be made at the factory prior to shipment.
- (2) Provides additional power dissipation. Therefore, the electromagnet coil can sustain continuous applied power without damage from over-heating.
- (3) Provides adjustment for increasing or decreasing pull-in time for electromagnets.

### 3.6 ARC-SUPPRESSION NETWORK

The diode-resistor network across the electromagnet coil L1 provides protection for the interrupter switch S1. See Figure 3-3.

The diode acts as a polarity sensitive switch. When positive voltage is applied to terminal 11, the diode prevents current from flowing through its associated resistor. When the voltage is removed from the electromagnet coil L1, the collapsing magnetic field induces a large voltage of opposite polarity in the coil. The diode now acts as a closed switch and allows this induced voltage to be dissipated through resistor R3 and the electromagnet coil L1, thus protecting the interrupter switch S1. Were this diode-resistor network eliminated, the induced voltage would damage the interrupter switch S1, or in the case of solid-state drivers, would damage the junction

of the driving transistors.

**NOTE**

When the coil L1 voltage is applied, it is essential that the polarity indicated in Figure 3-3 be positive (+) voltage applied to terminal 11. If polarity is not observed, the result will be an increase in power consumption and the protection intended in the design of the diode resistor network will be absent.

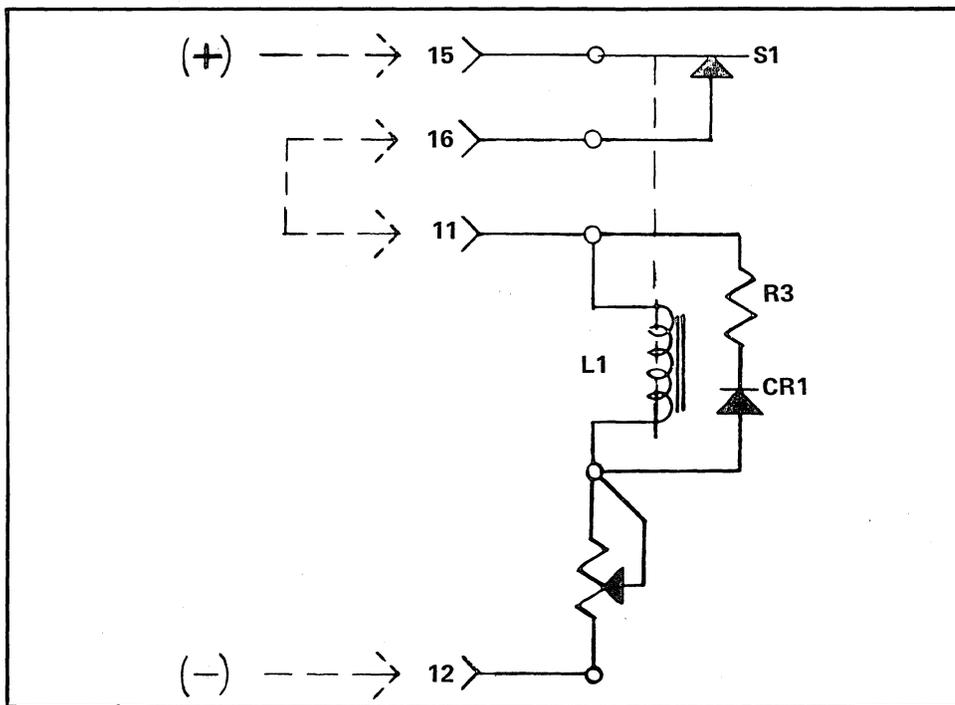


Figure 3-3 Arc-Suppression Network Schematic Diagram  
S1 Connected for Self-stepping Operation

3.7 INTERRUPTER SWITCH

The interrupter switch opens between 12 and 15 milliseconds after voltage is applied to the coil and closes approximately 16 milliseconds after the applied voltage has been removed.

The interrupter switch is opened prior to the advance of the tape and remains open for approximately one to two milliseconds after the starwheel contacts have achieved their new positions. The interrupter switch then closes. If the reader is connected as shown in Figure 3-4, the starwheel contacts will open and close only during the time the interrupter switch is open, and will never switch a live load. Thus, all inrush currents and kick-back voltages due to inductive loads are switched by the heavy duty contacts of the interrupter switch. These contacts were designed to handle this type of load.

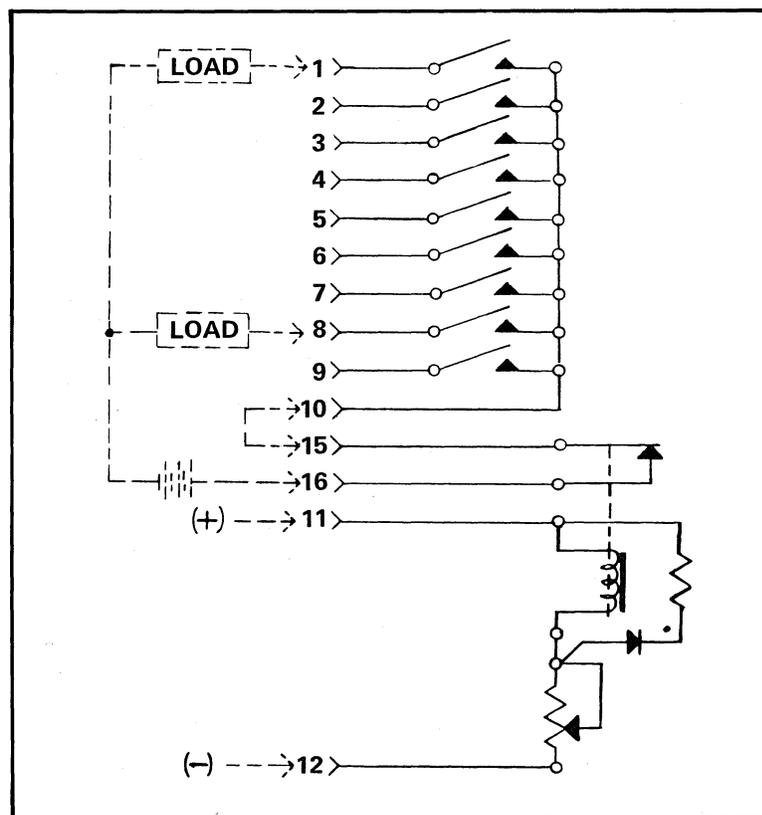


Figure 3-4 Paper Tape Reader Schematic Diagram

S1 Connected for Data Contact Protection

If the starwheel contacts are required to operate into solid state logic, and if contact bounce becomes a problem, the interrupter switch can be used

to activate a "one-shot" as shown in Figure 3-5. An extremely fast rise time pulse of any desired duration, depending on the one-shot, can be achieved even though a hard contact reader is used.

### 3.8 TAPE HOLD-DOWN ARM SWITCH

The tape hold-down arm insures the engagement of the feed holes in the tape with the sprocket wheel. The tape hold-down arm contact is closed when the starwheel arms are in the operation position. The starwheel arms are lifted by the loading knob when loading tape. If the loading knob is not returned to its operate position after loading, the starwheels will not be in position to read the tape, and the tape hold-down switch will be open to indicate this condition.

### 3.9 STARWHEEL SENSING CONTACTS

The starwheel sensing mechanism provides flexibility not achievable with any other type of sensing device. See Figure 3-6. When a series of holes are sensed, the starwheel contact remains closed. This feature is useful in programming control, eliminating the need for holding circuit for relays.

If this feature is not desired, connect the paper tape reader as shown in Figure 3-4, and the interrupter switch will momentarily open the circuit during each tape advance.

The data contacts should not be connected directly to intergrated circuits because the current drain through the contacts is too small to insure reliable operation. 35 ma. should be the minimum value of the current that is carried by the data contacts.

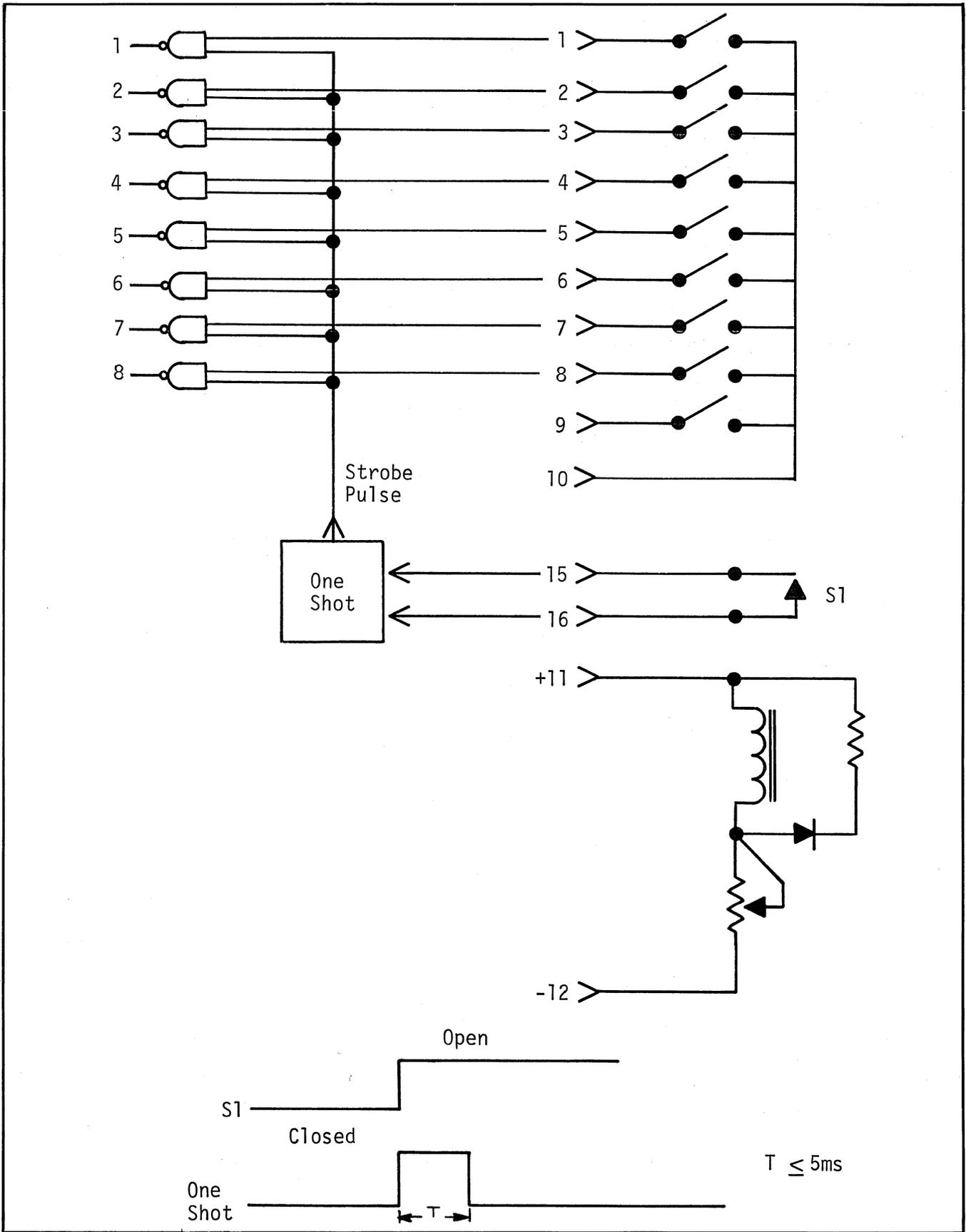


Figure 3-5 One-Shot Schematic Diagram

S1 Connected for Generating a Data Strobe Pulse

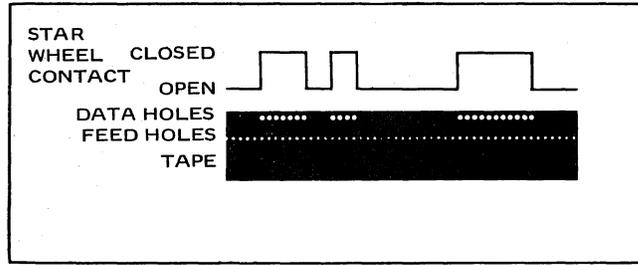


Figure 3-6 Sensing Contacts Diagram

## NOTES

## **SECTION IV INSTALLATION**

### I.1 MOUNTING DATA

Mounting data for Model 2166 Paper Tape Reader is shown in Figure 4-1.

### I.2 LOADING TAPE

In order to load the Paper Tape Reader, rotate loading knob counterclockwise to lift starwheel arms away from the sprocket shaft. See Figure 4-2. Insert tape between starwheel arms and sprocket shaft, limiting paper tape against rear flange on sprocket shaft. Engage tape on sprocket pins. Rotate loading knob clockwise to lower starwheel arms to sensing position.

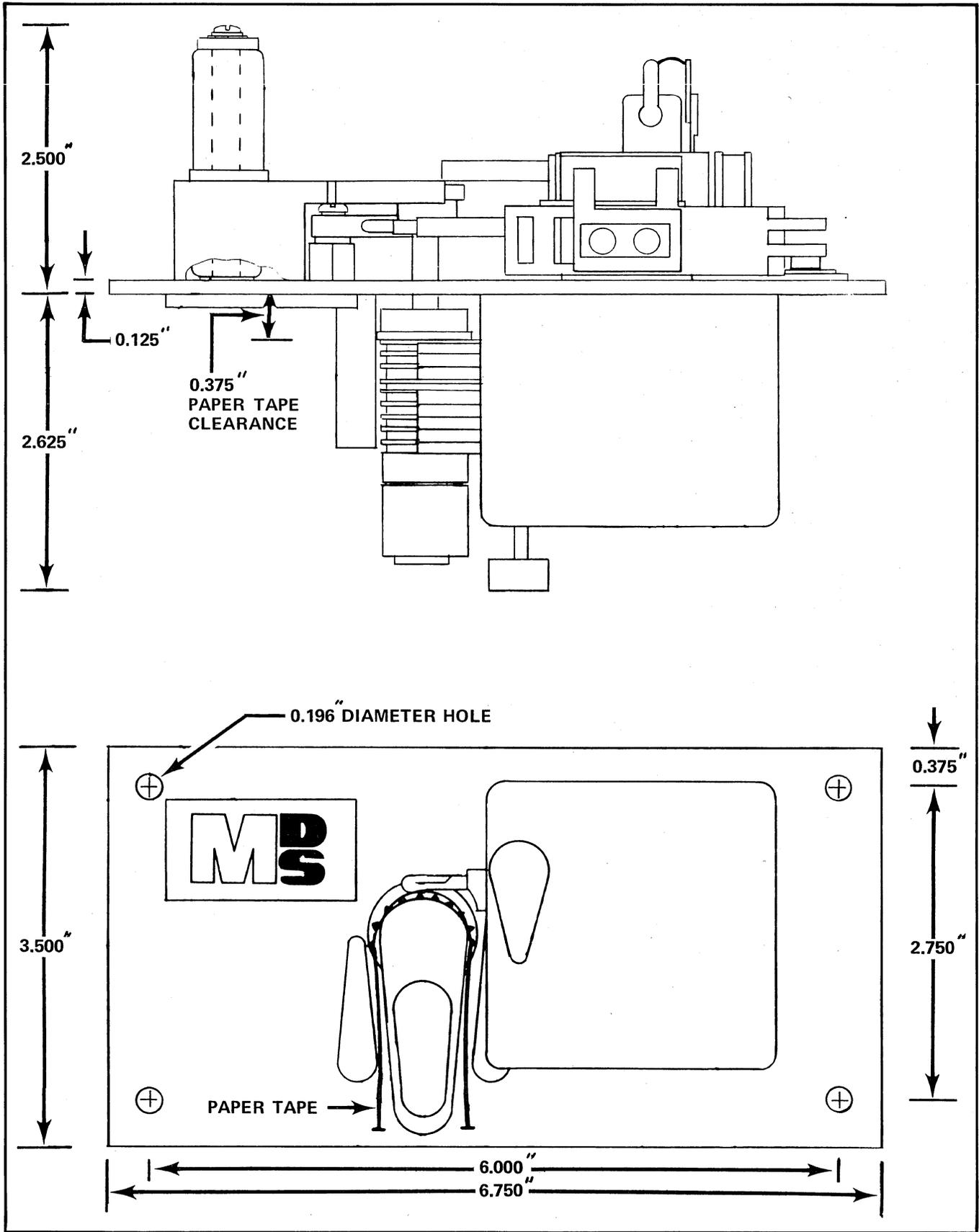


Figure 4-1 Mounting Data Diagram

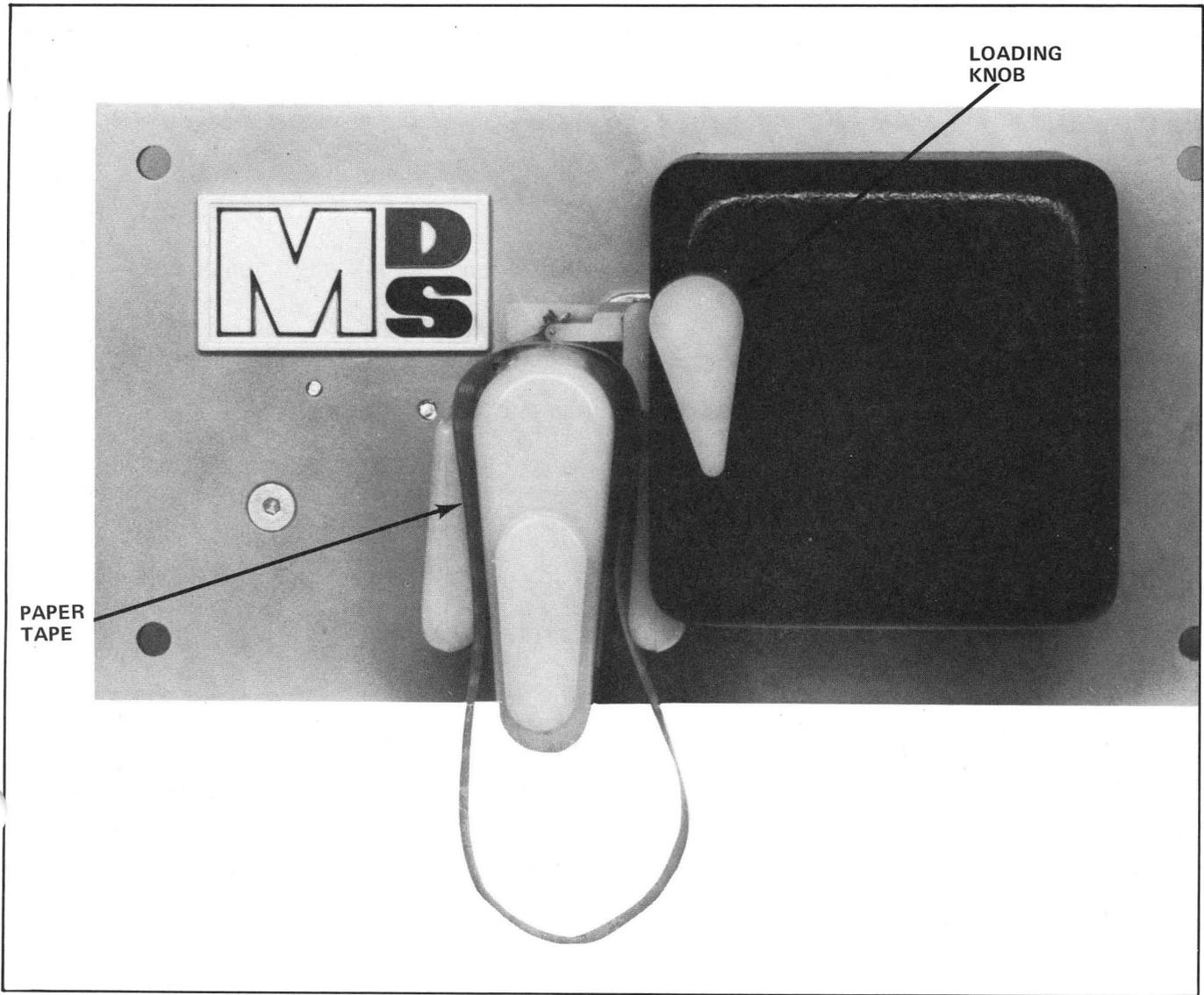


Figure 4-2 Loading Paper Tape

NOTES

## SECTION V LUBRICATION

### 5.1 LUBRICATION

The Paper Tape Reader Model 2166 should be lubricated every three months.

#### 5.1.1 GREASE

The following should be greased with number 102050 and grease lightly at the specified locations. See Figure 5-1.

- (1) Armature at pivot point (7).
- (2) Detent roller (6).
- (3) Drive pawl tips at ratchet (4).
- (4) Pawl depressor tips (3).
- (5) Spring at anchor points of armature and screw (8).
- (6) Interrupter switch card at cam end (1).
- (7) Interrupter switch card at pressure finger (2).

#### 5.1.2 OIL

The following should be oiled with oil number 102049 and place one drop at the specified location. See Figure 5-1.

Detent Arm pivot on Eccentric Post (5).

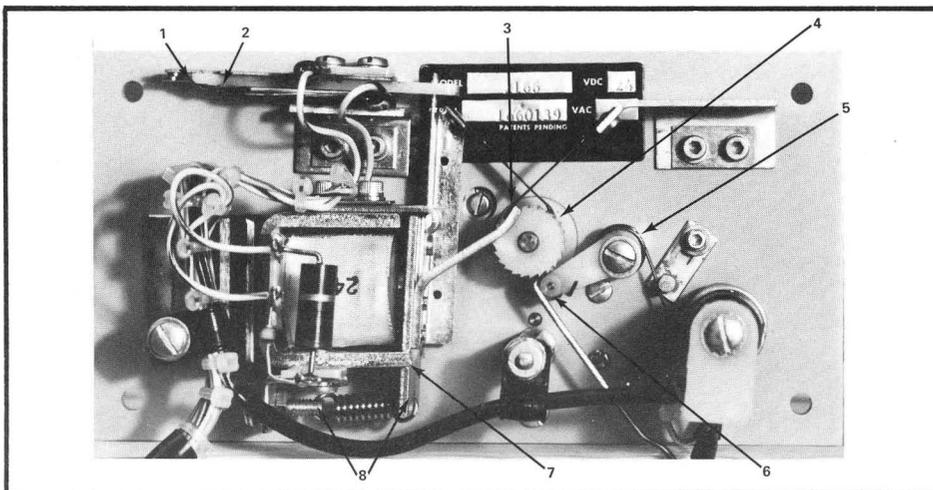


Figure 5-1 Lubrication Chart

## NOTES

## SECTION VI ADJUSTMENTS

### 6.1 STARWHEEL SENSING HEAD

- (1) To check or adjust the sensing head, remove knob and cover using 0.050" hex driver and 5/64" hex driver (see Table 7-1).
- (2) Position the starwheel sensing head so that the upper edge of the plate is visually parallel to the upper edge of the main panel. See Figure 6-1.

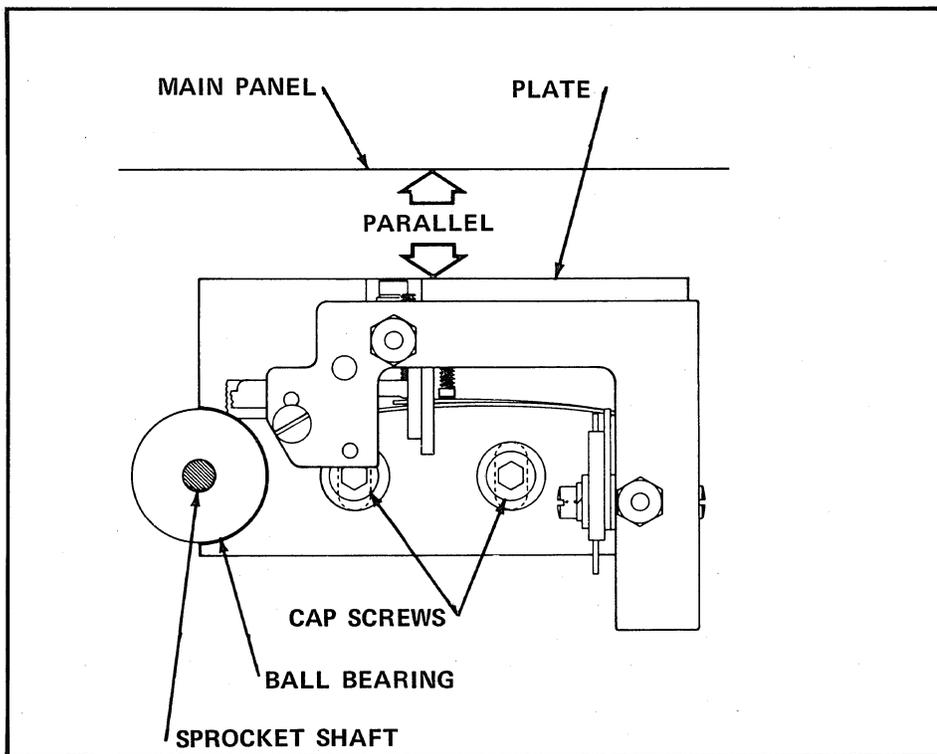


Figure 6-1 Starwheel Sensing Head Adjustment

- (3) To adjust the position of the sensing head, loosen the two socket head cap screws sufficiently to rotate the sensing head clockwise or counter-clockwise. Maintain slight pressure to the left to keep the head assembly against the outside diameter of the sprocket shaft ball bearing. This is required to maintain starwheel alignment with the sprocket

shaft assembly.

- (4) Tighten the two cap screws securely.

## 6.2 SPROCKET SHAFT AND DETENT ARM

### NOTE

The detent arm prevents rotation of the sprocket during energization of the drive magnet. See Figure 6-2.

- (1) Install punched tape over sprocket drum.

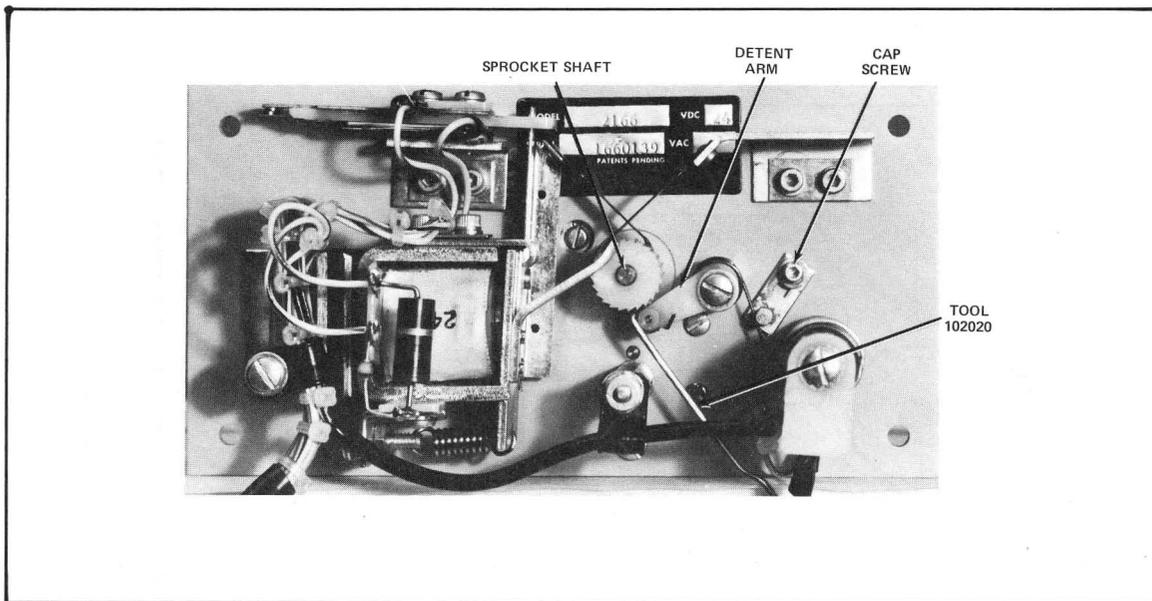


Figure 6-2 Sprocket Shaft and Detent Arm

- (2) Position the detent arm so that the starwheel straddles the area between the holes with an equal distance from the two points of the starwheel riding the tape to the preceding and following hole edges. See Figure 6-3.
- (3) To adjust the detent arm, loosen the flat head screw and rotate the eccentric so that the sprocket shaft is positioned for correct tape hole alignment with the starwheels. Securely tighten flat head screw. See

Figure 6-3.

**NOTE**

To keep the pawls temporarily disengaged when making this adjustment, loosen socket head magnet lock screws of the magnet assembly and position magnet so that its pawl is disengaged from ratchet and its opposing pawl is out of engagement.

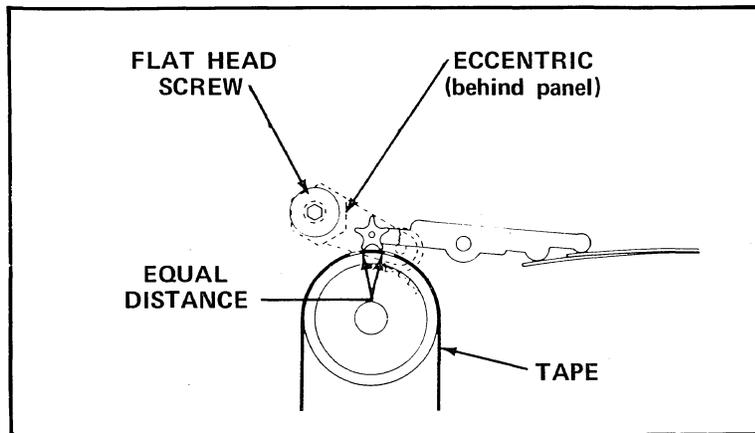


Figure 6-3 Detent Arm and Starwheel Position Adjustment

i.3 DETENT ARM SPRING ADJUSTMENT

- (1) Check tension of the detent arm spring. See Figure 6-2. Using spring scale (see Table 7-1), the tension required to start moving the detent arm away from the ratchet is 12 ounces ( $\pm 1/2$  ounce).
- (2) To adjust detent arm spring tension, loosen socket head cap screw and reposition spring post assembly and tighten cap screw. See Figure 6-2.
- (3) Repeat step (1).

i.4 ARMATURE GAP CLEARANCE

- (1) The correct air gap clearance is established by assembling a 0.013" (nominal) residual shim between the armature limit and magnet housing. See Figure 6-4. With the armature manually energized, the air gap

should be checked with both a 0.003" and 0.005" feeler gauge. The 0.003" gauge should pass freely between the core and the armature. The 0.005" gauge should be tight.

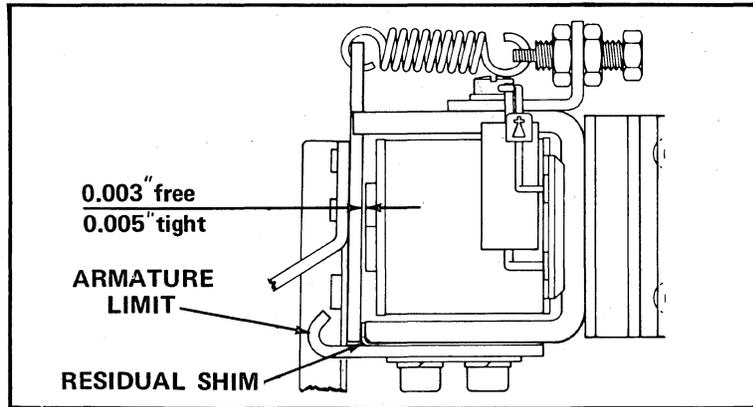


Figure 6-4 Armature Gap Clearance Adjustment

- (2) To adjust air gap clearance, change the residual shim to obtain the 0.004" minimum and 0.006" maximum. Residual shims are available in the following thicknesses as shown in Table 6-1.

Table 6-1 Residual Shims

SIZE	PART NUMBER
0.005"	119114-1
0.007"	119114-2
0.010"	119114-3
0.013"	119114-4
0.003"	119114-5

- (3) If shim is changed readjust armature travel. See paragraph 6.5, (3).

## 6.5 ARMATURE TRAVEL ADJUSTMENT

- (1) Check clearance between the armature and the residual shim determines

the stroke or travel of the armature.

**NOTE**

Excessive clearance would effect pick time of the armature during energization of the coil. Insufficient clearance, in addition to effecting pick time, may limit travel of the armature and thus prevent normal stepping.

- (2) In order to have sufficient travel to pick the ratchet tooth and operate the interrupter switch with the required safety factor, the clearance between the armature and residual shim is set at 0.062". This is measured with 0.062" round gauge (see Table 7-1). See Figure 6-5.

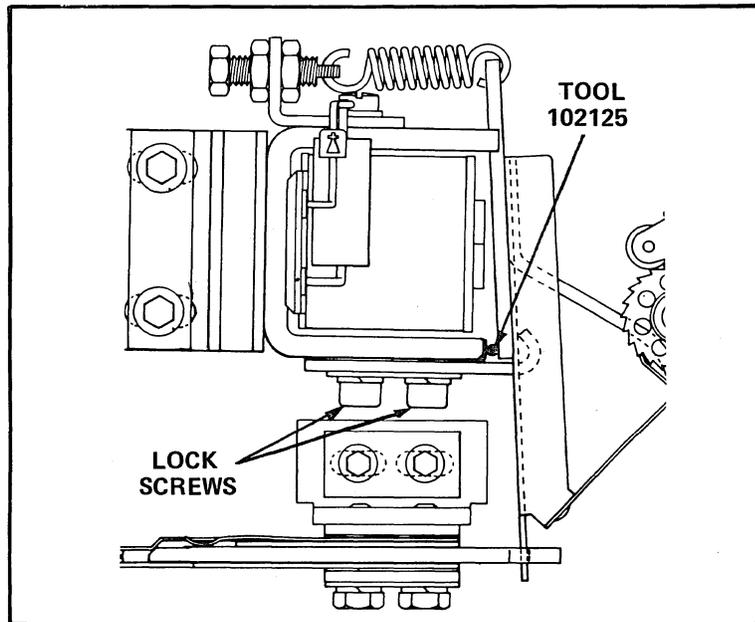


Figure 6-5 Armature Travel Adjustment

- (3) If necessary to change or correct this adjustment, loosen the two lock screws under coil which assemble the armature limit and residual shim to the magnet housing. Insert the 0.062" round gauge (see Table 7-1) between the armature and the shim and press the armature limit against

the armature, closing up all clearances.

- (4) Tighten the two lock screws and remove the 0.062" round gauge (see Table 7-1).

#### 6.6 FEED PAWL ADJUSTMENT

- (1) Check position of feed pawls in relation to the ratchet. The pawls should lay into the third notch of the ratchet from the bottom center position.
- (2) The pawl must be adjusted so that it butts against the ratchet tooth. It must also be free to re-engage with the tooth when displaced from the root of the ratchet tooth. See Figure 6-6.

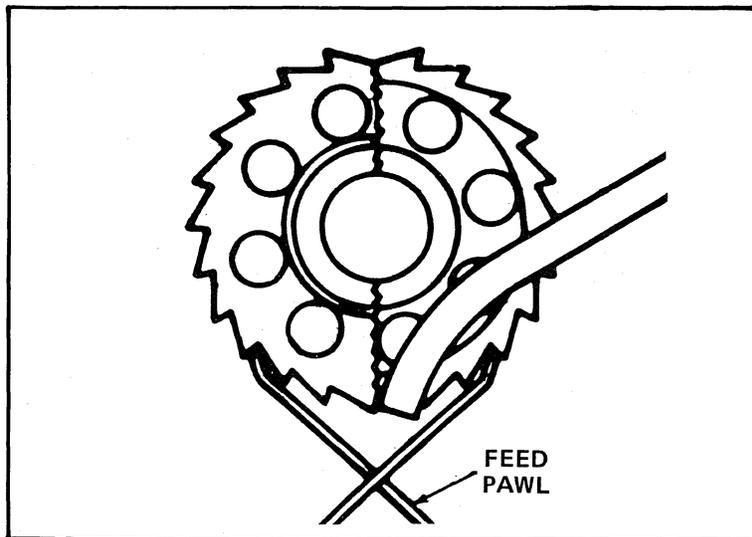


Figure 6-6 Feed Pawl Adjustment

- (3) To reposition the pawl in relation to the ratchet, it is necessary to reposition the magnet assembly. Two lock screws secure the magnet assembly housing to the main plate. By loosening these screws, the assembly can be adjusted into the correct position. See Figure 6-7.

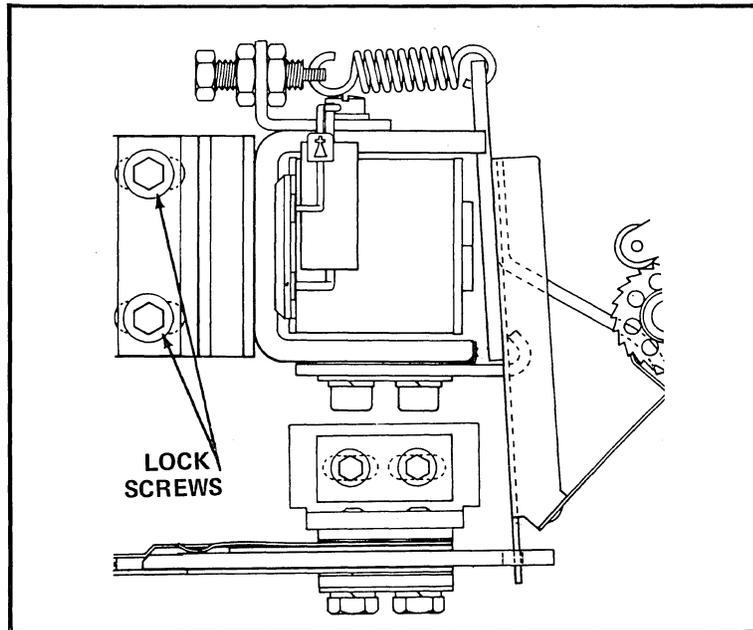


Figure 6-7 Magnet and Feed Pawl

.7 FEED PAWL TENSION

- (1) The blade tension of the feed pawl against the ratchet is 95 grams. See Figure 6-8. This is measured at the tip of the pawl and is the gram tension required to start moving pawl away from the ratchet. Use 50 - 250 gram gauge (see Table 7-1).

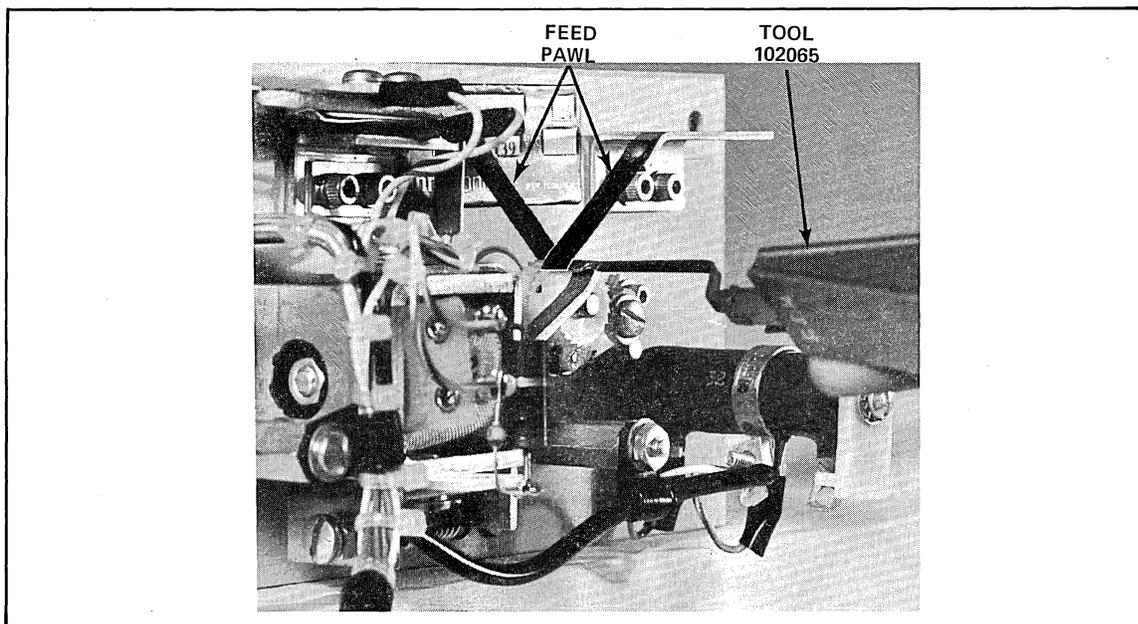


Figure 6-8 Feed Pawl Tension Adjustment

- (2) The tension can be increased by forming the pawl slightly at its base where it is assembled to the armature extension. Use bender (number 102038, see Table 7-1).

#### 6.8 PAWL DEPRESSOR ADJUSTMENT

- (1) The pawl depressor operates the opposing pawl out of engagement during energization of the armature so that the ratchet can rotate during de-energization. See Figure 6-9. The tip of the opposing pawl should clear the ratchet by approximately 0.010 and re-engage after the first third of the tooth is passed the tip of the pawl during the rotation of the sprocket shaft assembly. Use 0.010" flat gauge and two benders (see Table 7-1).

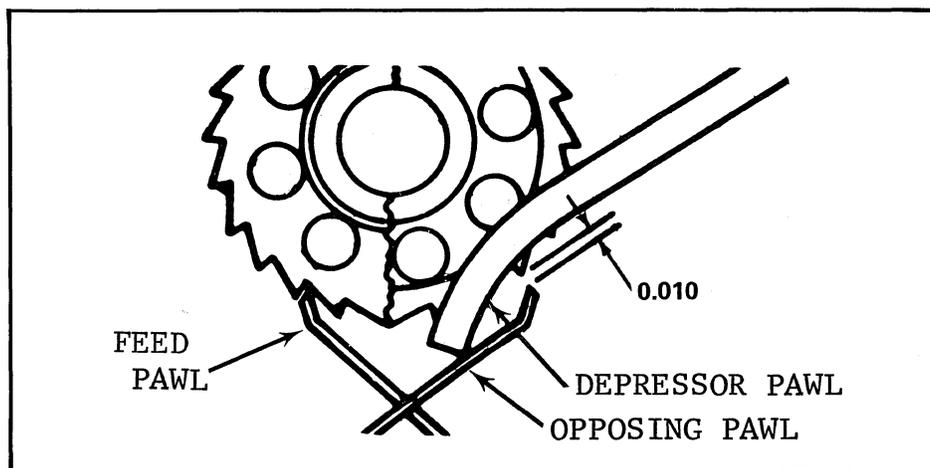


Figure 6-9 Depressor Adjustment

- (2) If adjustment is required, loosen the two cap screws. See Figure 6-10.
- (3) Repeat step (1) and tighten the two cap screws.

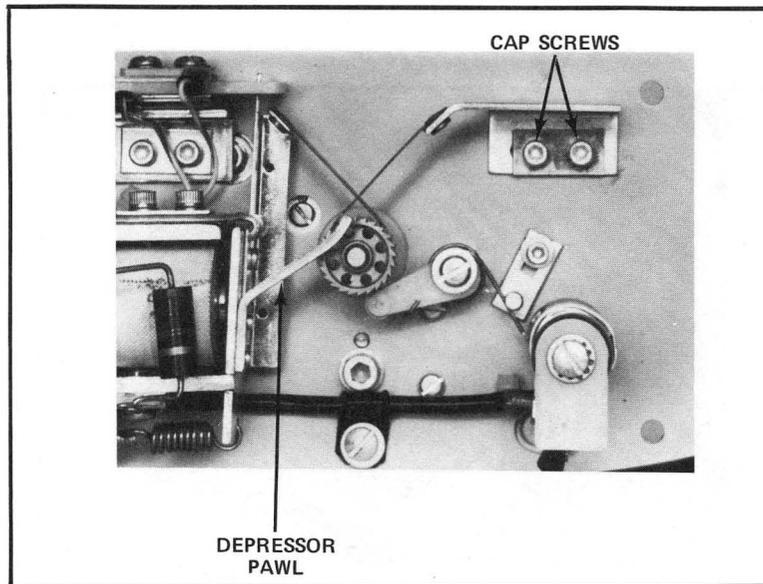


Figure 6-10 Depressor Pawl Alignment

## 6.9 ARMATURE SPRING TENSION

### **NOTE**

The armature spring is the driving force which advances the sprocket and tape upon de-energization of the magnet.

- (1) The armature spring tension is 420 grams. See Figure 6-11. This measurement is made at the tip of the armature extension and is measured at the point where the armature starts to move. Use 0 - 650 gram gauge (see Table 7-1).
- (2) To adjust, loosen the lock nut of the armature spring post and increase or decrease tension by turning adjustment nut as required. See Figure 6-12.
- (3) Secure lock nut after assuring adjustment is correct.

### **NOTE**

Assure that spring loop is perpendicular to end of armature so that spring tension is not creating side pressure in spring hole.

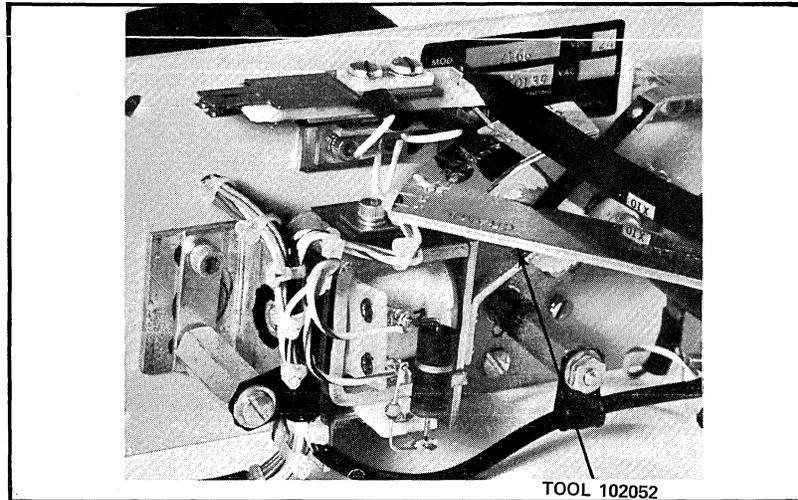


Figure 6-11 Armature Spring Tension Check

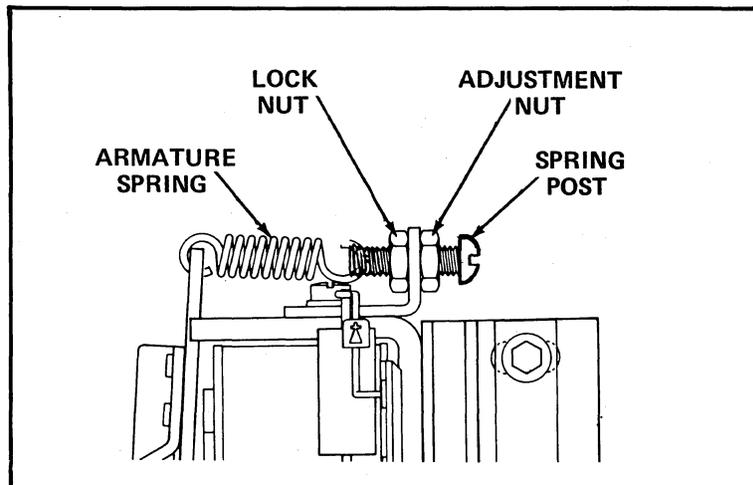


Figure 6-12 Armature Spring Tension Adjustment

## 6.10 INTERRUPTER SWITCH

### **NOTE**

The interrupter switch is designed to transfer at the point where the feed pawl engages with the next ratchet tooth during attraction of the armature. This assures that the circuit to the coil, during self interrupt, will not be broken before the armature has fully energized.

- (1) To adjust, loosen two socket head mounting screws. See Figure 6-13. With ohm meter or buzzer connected across the interrupter terminals, manually operate armature. Adjust switch to break at point where the feed pawl snaps into next tooth.
- (2) Tighten the two socket head screws.
- (3) To check the interrupter switch remake timing, manually operate the interrupter switch card. See Figure 6-13. This will partially operate the armature and open the interrupter switch.

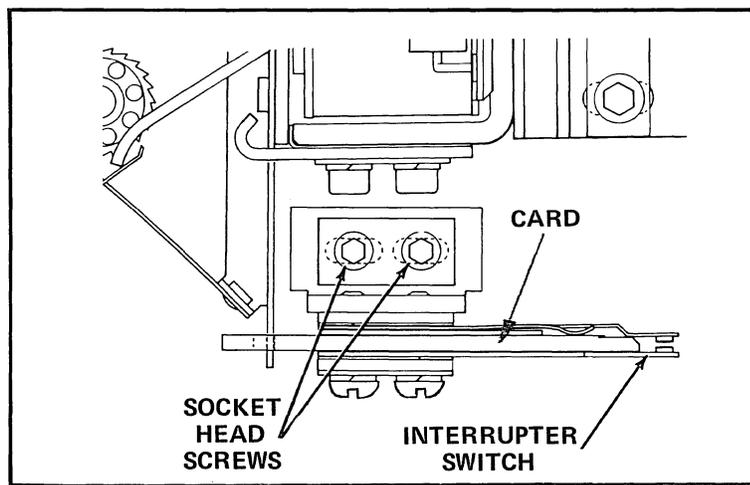


Figure 6-13 Armature Adjustment

**NOTE**

The release of the card will result in the switch re-making which should occur within the last one quarter tooth of the ratchet. This assures that the interrupter will not re-make before the sprocket shaft has been stepped.

.11 INTERRUPTER SWITCH BLADE TENSION

- (1) Check interrupter switch blade tension at contact. Check each blade individually. The contact should not break at 25 grams but should break at 35 grams. Use 10 - 80 gram gauge (see Table 7-1). See Figure

6-14.

- (2) To adjust, loosen the two pan head mounting screws sufficiently to permit forming of switch blades as required to obtain proper tension. Use bender (number 102038) and contact adjustment screw driver (see Table 7-1). Securely tighten the two screws. See Figure 6-14.
- (3) Repeat step (1).

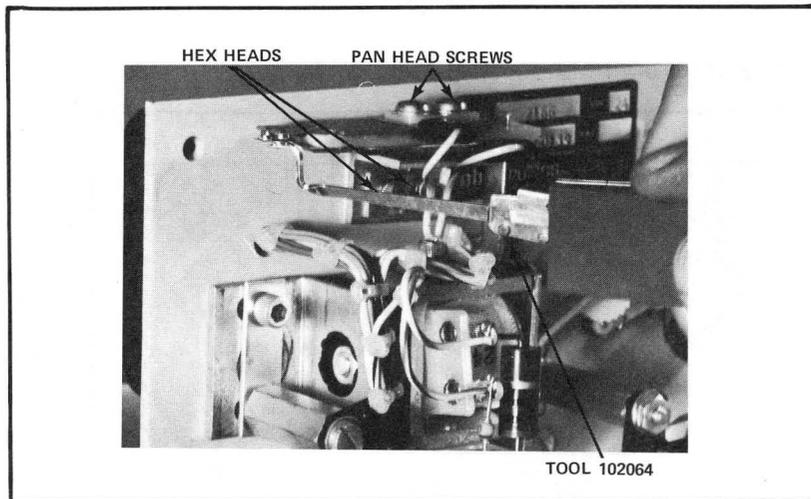


Figure 6-14 Interrupter Switch Blade Tension Adjustment

## 6.12 INTERRUPTER SWITCH GAP ADJUSTMENT

### **NOTE**

Standard paper tape readers are equipped with "B" type switch which consists of a common and normally closed contact. The "C" type switch which consists of a common, a normally open and a normally closed contact, are available as an option.

- (1) Check "B" type switch gap with card fully engaged between interrupter contacts. Gap should be 0.018" - 0.020". See Figure 6-15 Use 0.020" round gauge (see Table 7-1).

- (2) Check "C" type switch gap with card engaged. Gap should be 0.020". With card disengaged gap should be 0.015". See Figure 6-16. Use 0.020" round gauge (see Table 7-1).

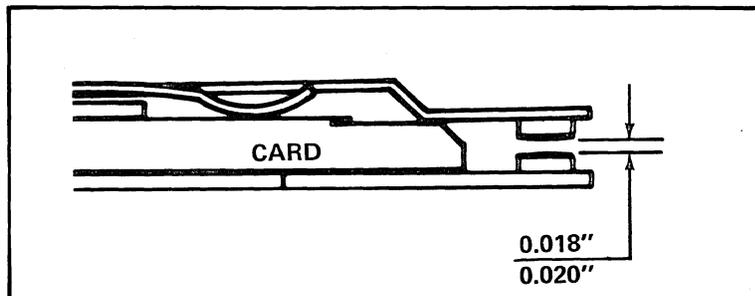


Figure 6-15 "B" Switch Adjustment

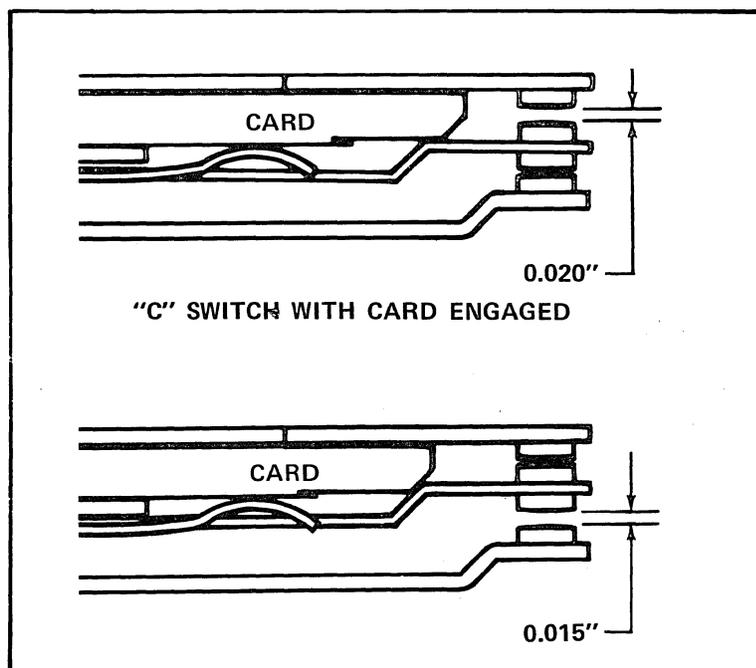


Figure 6-16 "C" Switch Engaged/Disengaged

### 5.13 INTERRUPTER SWITCH CARD TENSION

- (1) Remove armature spring. See Figure 6-12.
- (2) Free slide tension of the interrupter switch card should be 56 - 70 grams. Use 10 - 80 gram gauge (see Table 7-1).

- (3) Bend the friction fingers against the card for free slide tension. See Figure 6-17. Use bender (number 102038, see Table 7-1).
- (4) Replace armature spring. See Figure 6-12.

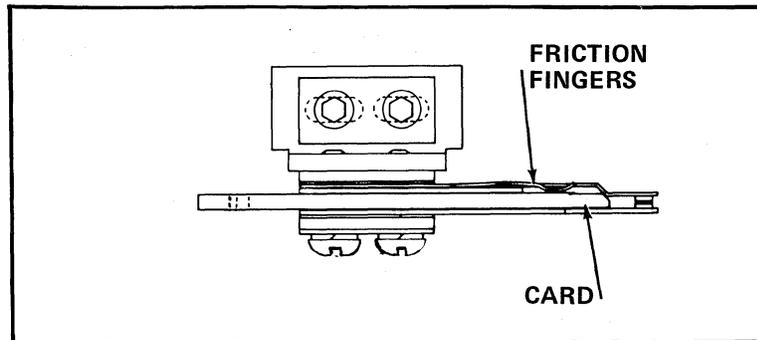


Figure 6-17 Interrupter Switch Tension Adjustment

#### 6.14 STARWHEEL ARM CLEARANCE FROM DRUM

- (1) The starwheel arms are adjusted to provide 0.006 inch clearance between the arm and sprocket drum. With a 0.004 inch tape passing under the arm, no wear of the tape or the arm will occur. This also provides for acceptance of splicing patches, thus eliminating inaccuracies in reading. See Figure 6-18.

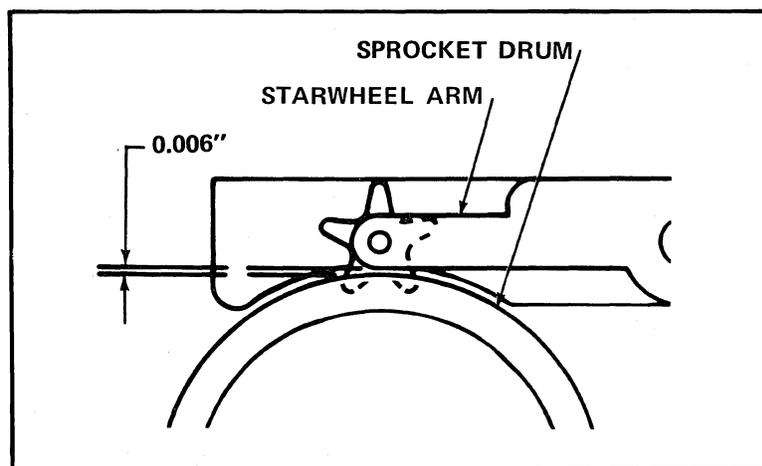


Figure 6-18 Starwheel Arm Clearance

- (2) The down position of the starwheel is controlled by the limit screw. By adjusting the two end position arms 1 and 8 then aligning the center

arms 2 through 7, the clearance can be equalized. Use 0.035" hex driver (see Table 7-1). See Figure 6-19.

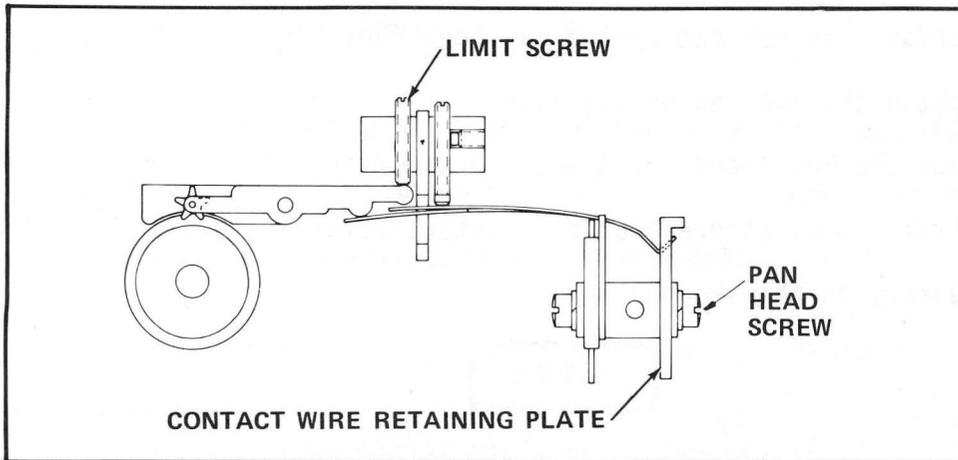


Figure 6-19 Starwheel Arm Adjustment

#### 6.15 STARWHEEL ARM SPRING TENSION

(1) The starwheel arm spring tension is obtained by raising or lowering the contact wire retaining plate. See Figure 6-19. The retaining plate is adjusted so that 25 grams applied under the starwheel arm at the pivot of the starwheel will not break continuity between the common input and the starwheel contact wire. Applying 30 - 35 grams at the same point will raise the starwheel arm and break the circuit. See Figure 6-20.

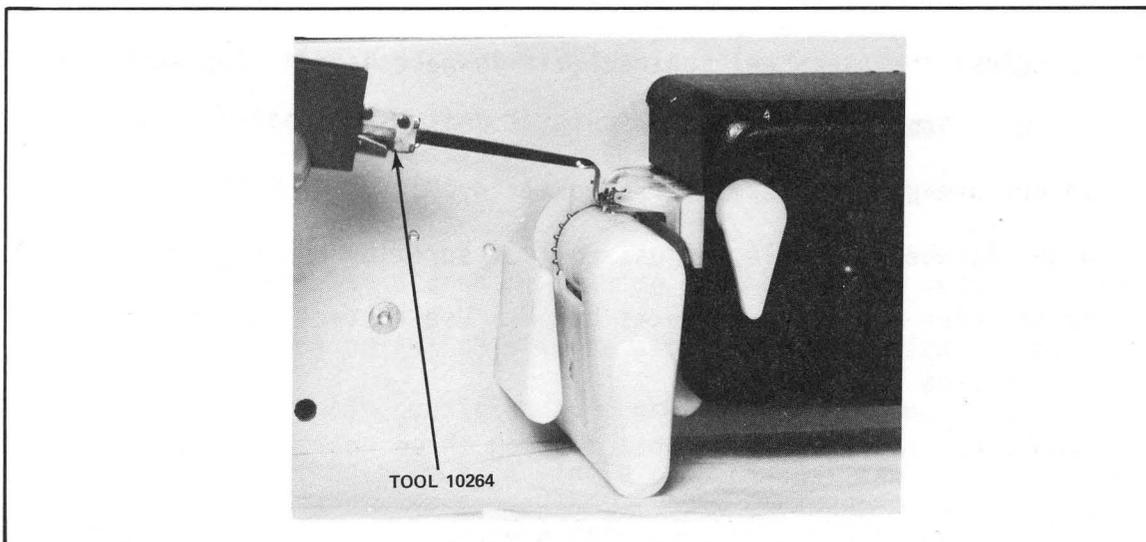


Figure 6-20 Starwheel Arm Spring Tension Adjustment

- (2) To change spring tension, loosen the two pan head screws. A slight change in the position of the retainer plate will greatly increase or decrease the contact spring tension. See Figure 6-19.
- (3) Tighten the two pan head screws.
- (4) Check the No. 1 and No. 8 positions for specified tension. If adjustment is made, assure that the contact retaining plate is positioned squarely in the sensing head.

**NOTE**

If the retaining plate is tilted, the contact wires will twist and not lay evenly in the sensing head. This can cause a cross-over of the contact wires with their stainless steel spring wires.

#### 6.16 STARWHEEL CONTACT SCREWS

**NOTE**

The starwheel contact screws act as the common electrical contact for each of the eight starwheel arms as well as the tape hold-down arm.

- (1) To adjust the starwheel contacts, it is necessary to loosen the lock screws. See Figure 6-21.
- (2) Insert pre-punched tape over sprocket drum.
- (3) With starwheel in hole, adjust contact screw by backing off until buzzer or meter indicates contacts break. Use contact adjustment screw driver (see Table 7-1).
- (4) Remake contact then turn contact screw three quarters turn more. See Figure 6-21.

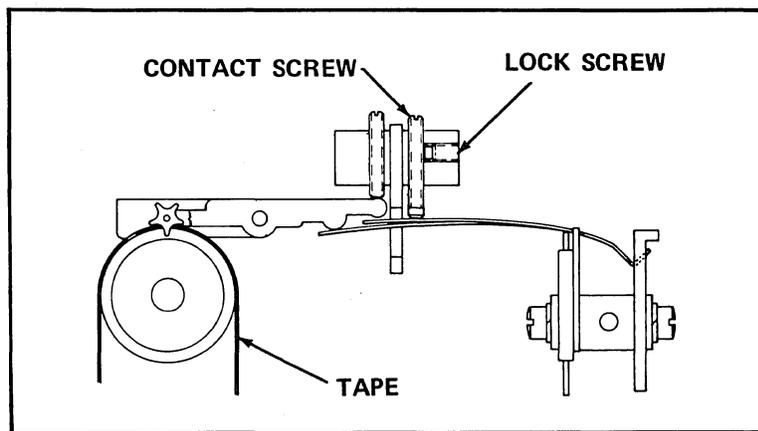


Figure 6-21 Starwheel Contacts Adjustment

- (5) Advance tape to no-hole position and check for gap between contact wire and contact screw. Gap should be 0.015" - 0.020". Use 0.020" round gauge (see Table 7-1). See Figure 6-22.

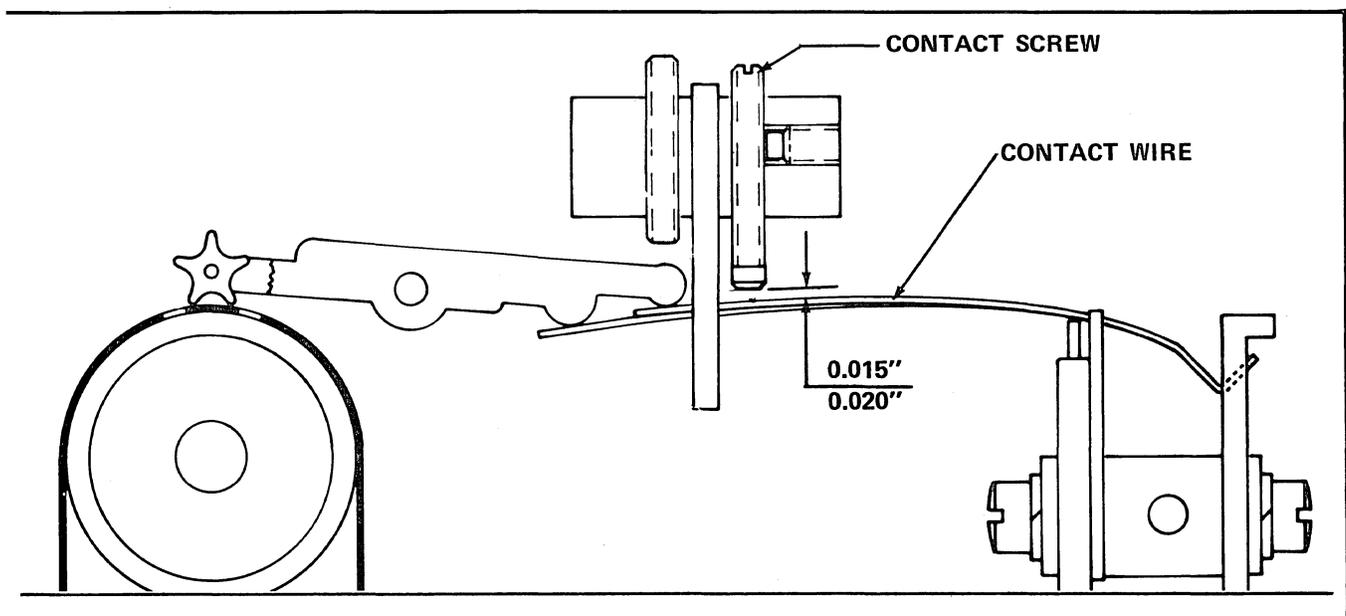


Figure 6-22 Contact Wire and Contact Screw Gap Adjustment

**NOTE**

If gap is insufficient, the starwheel arm tension is probably excessive causing unnecessary flexing of the starwheel contact wires and rechecking will be necessary.

(6) Tighten the lock screw.

#### 6.17 SERIES ADJUSTABLE RESISTORS

The adjustable resistor is in series with the magnet coil to limit the current flowing through the coil. The resistor reduces the power flowing to the coil making the coil continuous duty.

The series resistor should be adjusted so that pull-in time of the coils is 12 - 16 milliseconds. The drop-out time is 12 - 16 milliseconds and is a product of the armature gap, spring tension, tape drag and the resistor-diode across the magnet coil.

## SECTION VII TOOL LIST

### 7.1 INTRODUCTION

This section contains the list of tools for the Model 2166 Paper Tape Reader.

Table 7-1 Tool List

PART NUMBER	DESCRIPTION
102010	Burnisher, Contact
102018	Screw Driver, Contact Adjustment
102020	Spring Scale, 0 - 36 ounces
102038	Bender
102041	Bender
102042	Hex Driver 0.035" (Starwheel Limit)
102043	Hex Driver 0.050"
102045	Hex Driver 5/64" (Detent Eccentric)
102047	Hex Driver 7/64" (Interrupter Switch)
102048	Hex Driver 9/64" (Magnet Adjustment)
102049	Oil, 1/2 Pint Can
102050	Grease (Tube, 4 ounces)
102052	Gram Gauge, 0 - 650 grams
102064	Gram Gauge, 10 - 80 grams
102065	Gram Gauge, 50 - 250 grams
102066	Round Gauge 0.020"
102075	Flat Gauge 0.010"
102125	Round Gauge 0.062"

NOTES

## **SECTION VIII ENGINEERING DRAWINGS**

### 8-1 INTRODUCTION

This section contains the engineering drawings for the Model 2166 Paper Tape Reader.

Figure 8-1 Paper Tape Reader Assembly Drawing

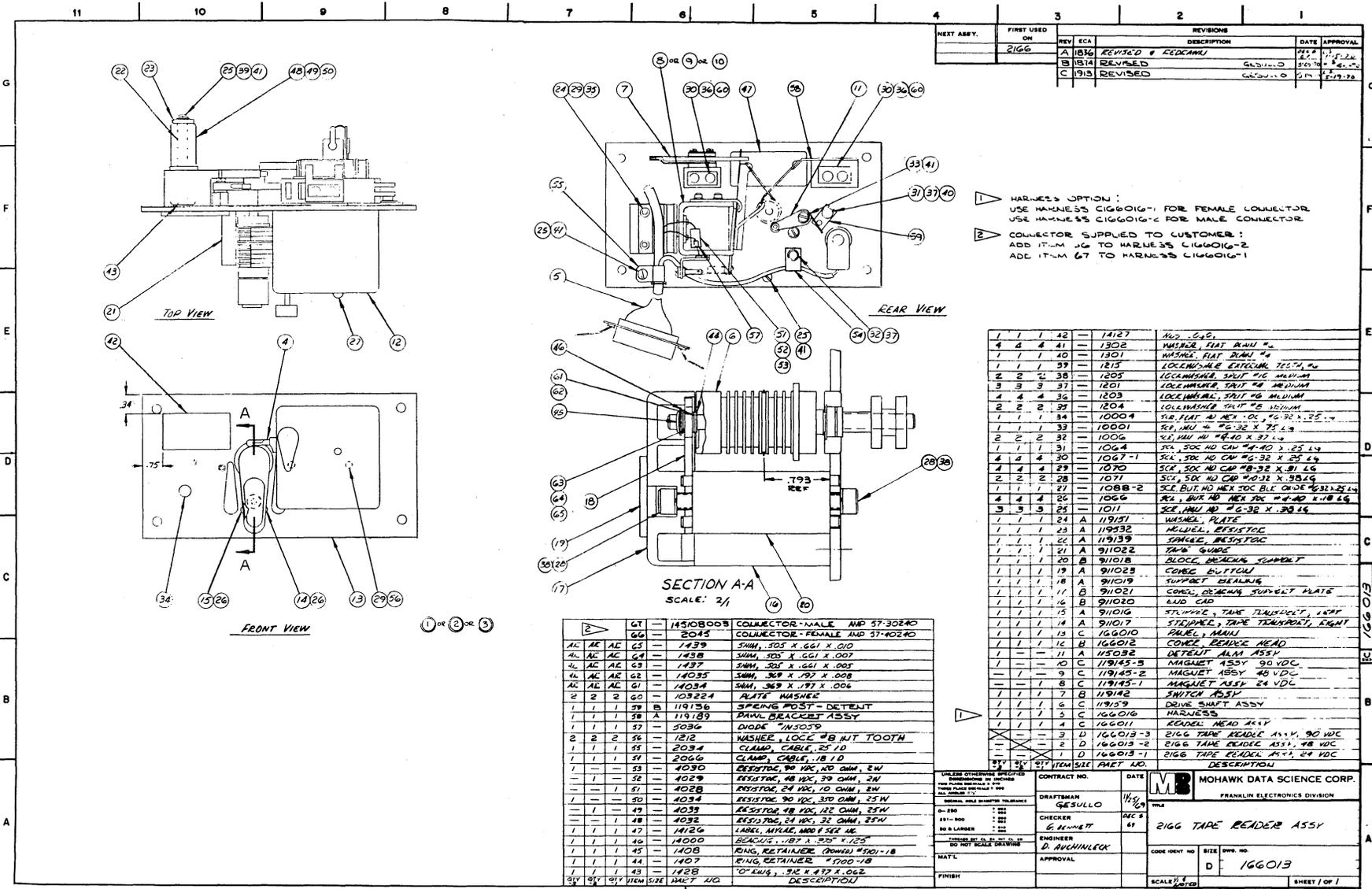
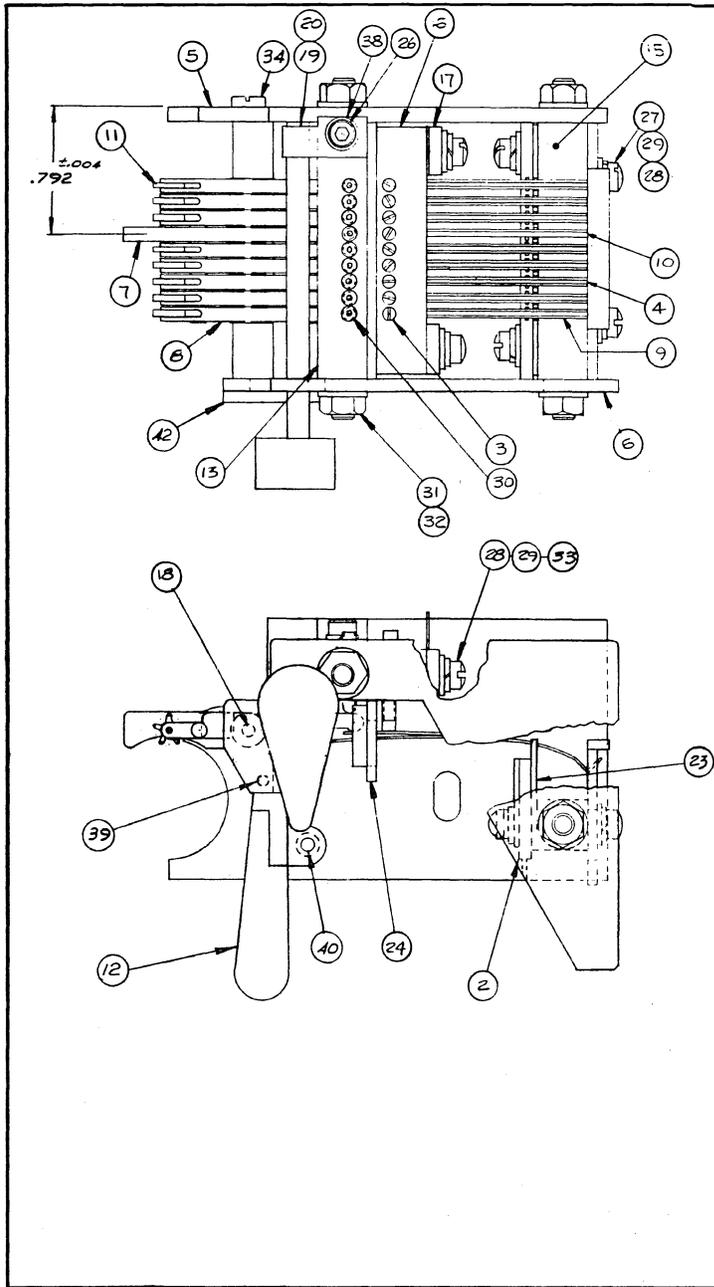
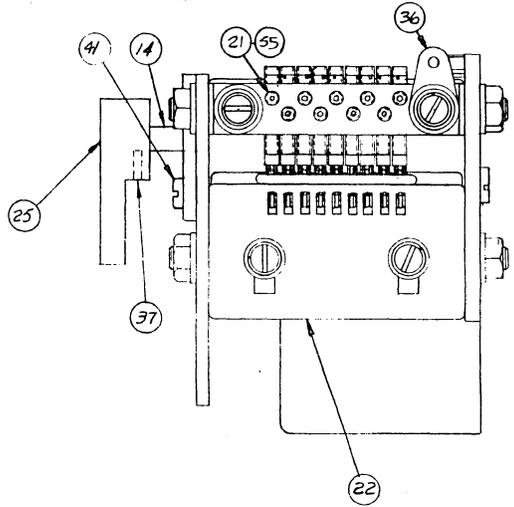


Figure 8-2 Paper Tape Reader Head Assembly Drawing



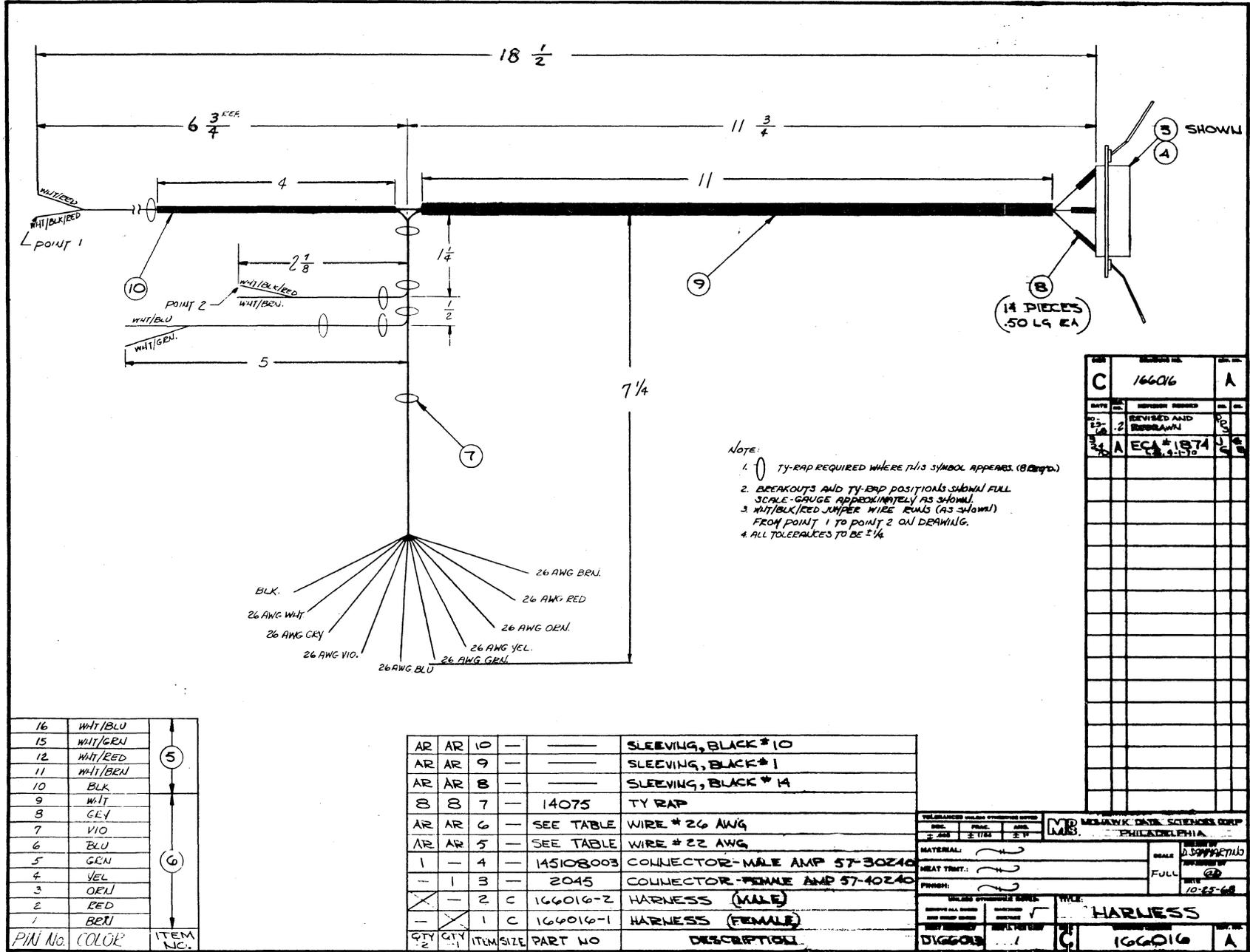
QTY	ITEM	SIZE	PART NO	DESCRIPTION	QTY	ITEM	SIZE	PART NO	DESCRIPTION
1	C		166011	READER HEAD ASSY	1	23	A	119032	PLATE, WIRE LOCATOR
1	2	B	119124	TERMINAL BLOCK ASSY	1	34	A	119079	PLATE, WIRE GUIDE
9	3	A	119117	CONTACT ASSY	1	25	A	911053	KNOB, STAR WHL CAM
8	4	A	153235	CONTACT WIRE	1	26	-	1202	WASHER, LOCK, SPLIT #3
1	5	B	911011	PLATE, READ HEAD	4	27	-	1056	SCR, FL HD #4-40 X .38 LG
1	6	C	040012512	PLATE, END SUPPORT	6	28	-	1201	WASHER, LOCK, SPLIT #4
1	7	B	911025	HOLD DOWN ARM	6	29	-	1301	WASHER, FLAT #4
8	8	B	119111	ARM, PIVOT-STAR WHEEL	9	30	-	10044	SCR, SET #2-56 X .50 LG
17	9	A	119049-1	CONTACT WIRE	4	31	-	1103	NUT, HEX #6-32
1	10	A	119049-2	CONTACT WIRE	4	32	-	1207	WASHER, LOCK NUT TOOTH #6
8	11	A	119011	STARWHEEL	2	33	-	1059	SCR, FL HD #4-40 X .75 LG
1	12	A	911045	PIVOT BLOCK ASSY	1	34	-	10090	SCR, PAN HD #4 X .81 TYPE "B"
1	13	A	119078	BAR, ADJ SCR SUPPORT	9	35	-	1060	SCR, SET #3-48 X .12 LG.
1	14	A	911051	CAM, STAR WHL PIVOT	1	36	-	2077	SOLDER LUG
1	15	A	119083	BAR, SPACER-END SPT	1	37	-	1058	SCR, SET #4-40 X .38 LG.
1	16	A	119080	BLOCK, CONT ADJUSTING	1	38	-	1061	SCR, SCH CAP #3-48 X .17 LG.
2	17	A	119081	SPACER, INSULATING	7	39	A	911029-1	ARM PIVOT - TAPE SW.
1	18	A	119053	SHAFT, PIVOT	1	40	-	1035	SCR, FLAT HD #4-40 X .25
1	19	A	119116	SPRING, DETENT	1	41	-	1012	SCR, PAN HD #2-52 X .30 LG.
1	20	A	119147	BRACKET, CAM LIMITING	1	42	A	911031	COVER-BACKUP PLATE
9	21	A	119115	PLUG, SCREW LOCK					
1	22	A	119023	PLATE, CONT ADJUSTING					



DATE	REV.	REVISION RECORD	BY	CHK.
	A	ECA 1836	J. G.	12/28/59
	B	ECA 1943	J. G.	12/28/59

TOLERANCES UNLESS OTHERWISE SPECIFIED			MCHAMWK DATA SCIENCES CORP PHILADELPHIA	
DEC.	FRACTIONAL	ANG.		
± .008	± 1/64	± 1°		
MATERIAL:			SCALE	DRAWN BY
HEAT TRMT:			9/1	G250110
FINISH:			DATE	APPROVED BY
UNLESS OTHERWISE NOTED:				
REMOVE ALL BURS AND SHARP EDGES	MACHINED SURFACE	<input checked="" type="checkbox"/>	TITLE	
NEXT ASSEMBLY		REQ'D. PER UNIT	READER HEAD ASSY	
	1		DRAWING NUMBER	REV. NO.
			C 166011	B

Figure 8-3 Paper Tape Reader Harness Drawing



NOTE:  
 1. ( ) TY-RAP REQUIRED WHERE THIS SYMBOL APPEARS. (SEE DRAWING)  
 2. BREAKOUTS AND TY-RAP POSITIONS SHOWN FULL SCALE - GAUGE APPROXIMATELY AS SHOWN.  
 3. WHT/BLK/RED JUMPER WIRE RUNS (AS SHOWN) FROM POINT 1 TO POINT 2 ON DRAWING.  
 4. ALL TOLERANCES TO BE ± 1/4

16	WHT/BLU	5	
15	WHT/GRN		
12	WHT/RED		
11	WHT/BRN		
10	BLK		
9	WHT		
8	CRY		
7	VIO		
6	BLU		6
5	GRN		
4	YEL		
3	OEN		
2	RED		
1	BRN		
PIN No.	COLOR		ITEM No.

AR	AR	10	—	—	SLEEVING, BLACK #10
AR	AR	9	—	—	SLEEVING, BLACK #1
AR	AR	8	—	—	SLEEVING, BLACK #14
8	8	7	—	14075	TY RAP
AR	AR	6	—	SEE TABLE	WIRE # 26 AWG
AR	AR	5	—	SEE TABLE	WIRE # 22 AWG
1	—	4	—	145108003	CONNECTOR - MALE AMP 57-30240
—	1	3	—	2045	CONNECTOR - FEMALE AMP 57-40240
—	—	2	C	166016-2	HARNESS (MALE)
—	—	1	C	166016-1	HARNESS (FEMALE)
QTY	QTY	ITEM	SIZE	PART NO	DESCRIPTION

MATERIALS			MILWAUKEE DATA SCIENCES CORP. PHILADELPHIA		
DATE	REVISED AND DRAWN	DATE	SCALE	REVISED BY	DATE
10-25-68	ECI # 1574	10-25-68	1/8"	ECI	10-25-68
MATERIAL: <i>WHT/BLK/RED</i>			TITLE: <b>HARNESS</b>		
HEAT TREAT: <i>—</i>			DRAWN BY: <i>—</i>		
FINISH: <i>—</i>			CHECKED BY: <i>—</i>		
DIGGER			C 166016 A		

Figure 8-4 Paper Tape Reader Schematic Wiring Diagram

